June 2015

South Shore of Staten Island Coastal Storm Risk Management Draft Environmental Impact Statement

Prepared For:
US Army Corps of Engineers
New York District

South Shore of Staten Island Coastal Storm Risk Management Project
Draft Environmental Impact Statement

EXECUTIVE SUMMARY

Proposed Action: Construction of a Line of Protection (LOP) consisting of a buried seawall/armored levee along a majority of the Fort Wadsworth – Oakwood Beach reach (approximately 80%) serving as the first line of defense against severe coastal surge flooding and wave forces. The remainder of the LOP would consist of a T-Type vertical floodwall, levee and in the Oakwood Beach area - a mosaic of habitats (tidal wetlands, maritime forest/scrub-shrub habitat, low marsh and high marsh acres of living shoreline). In addition, construct interior drainage areas, which would include tide gates, sluice gates, stormwater outfall structures, road raisings, and excavated ponds.

Location of Action: The Project area is located on the eastern side of the south shoreline of Staten Island, in Richmond County, New York, and encompasses a reach approximately 5.3 miles long from Fort Wadsworth to Oakwood Beach. The principal neighborhoods along the Project area from east to west are South Beach, Midland Beach, New Dorp Beach, and Oakwood Beach.

Type of Statement: Draft Environmental Impact Statement (EIS)

Lead Agency: U.S. Army Corps of Engineers, New York District.

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Executive Summary

The United States Army Corps of Engineers (USACE), New York District (District), is the lead Federal agency for the South Shore of Staten Island Coastal Storm Risk Management Project (hereafter referred to as "Project"). The primary goal of the Project is to manage the risk of damages from coastal storm flooding. The Project area is located in the Borough of Staten Island, Richmond County, New York (Figure ES-1), and generally extends along the shoreline from Fort Wadsworth (near the Verrazano Narrows Bridge) to Oakwood Beach (near New York City's [NYC] Great Kills Park). The New York State Department of Environmental Conservation (NYSDEC) is the non-Federal partner for this study in cooperation with the New York City Department of Environmental Protection (NYCDEP), and New York City Department of Parks and Recreation (NYCDPR).

This Draft Environmental Impact Statement (EIS) presents the results of the USACE's evaluation of various alternatives intended to manage damages caused by storm events, and assesses the environmental impacts of the selected Project. This Draft EIS fulfills the requirements of the National Environmental Policy Act of 1969 (NEPA) and is in accordance with the President's Council on Environmental Quality (CEQ) Rules and Regulations for implementing NEPA (Title 40, Code of Federal Regulations [CFR], Sections 1500-1508), the USACE's *Procedures for Implementing NEPA* (Engineering Resolution [ER] 200-2-2), and other applicable Federal and state environmental laws.

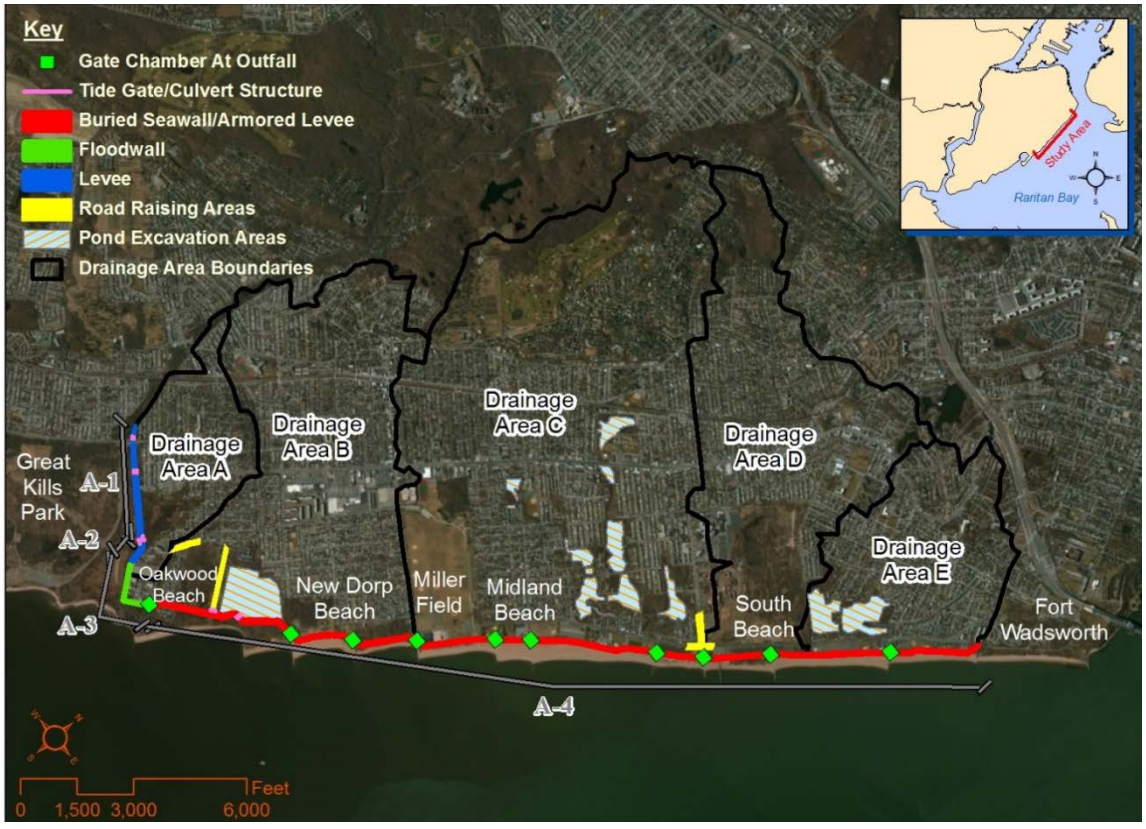

Figure ES-1. Project Area and National Economic Development (NED) Plan Overview

Flooding in the Project area can result from either high storm surges from the Bay or interior precipitation runoff that cannot be conveyed out to the Bay by the existing interior drainage system. Much of the study area is protected from storm surge until floodwaters rise above Father Capodanno Boulevard or other local topographic features, such as dunes or levees. As such, the existing structures and landforms manage risk associated with bay flooding/high frequency storm events, but after the waters rise above the crest, large low-lying portions of inland areas become inundated from the Bay, combining with flooding already caused by rainfall runoff.

The USACE's proposed plan, known as the National Economic Development Plan (NED) Plan, is the coastal storm risk management plan that reasonably maximizes net excess benefits and is the baseline against which other locally-preferred plans are compared. The NED Plan is consistent with all requirements contained in *The Disaster Relief Appropriations Act of 2013* (Public Law 113-2), which would provide authorization for construction (USACE 2015). Public Law 113-2 also provides the authority for 100% Federal funding for the completion of costal storm risk management on-going feasibility studies as of October 29-30, 2012 (Hurricane Sandy). Figure ES-1 provides an overview of the National Economic Development (NED) Plan.

The NED Plan includes a Line of Protection (LOP) that would consist of a buried seawall/armored levee along a majority of the Fort Wadsworth – Oakwood Beach reach (approximately 80%) serving as the first line of defense against severe coastal surge flooding and wave forces. The remainder of the LOP would consist of a T-Type vertical floodwall, levee and in the Oakwood Beach area - a mosaic of habitats (tidal wetlands, maritime forest/scrub-shrub habitat, low marsh and high marsh acres of living shoreline). The LOP would also include a closure structure at Hylan Boulevard, drainage control structures for existing stormwater outfalls, tide gate structures, vehicle and pedestrian access structures, and demolition of the existing boardwalk. The LOP would be split into four reaches as follows:

- Reach A-1: Earthen Levee; 2,800 feet in length;
- Reach A-2: Earthen Levee; 600 feet in length;
- Reach A-3: Vertical Floodwall; 1,800 feet in length;
- Reach A-4: Buried Seawall; 22,700 feet in length.

The NED Plan also provides for interior flood control, consisting of tide gates, sluice gates, stormwater outfall structures, road raisings, and 10 excavated ponds. The NED Plan for interior flood control is consistent with, and complements, the proposed project described in the Bluebelt Generic EIS, which the NYCDEP completed on November 4, 2013.

A summary of the potential environmental impacts associated with the NED Plan follows. Construction would occur over about a 3-4 year time period (nominally mid-2016 through 2019). The USACE would implement best management practices in the design, construction, and operation of the NED Plan to avoid and minimize environmental impacts to the extent practicable. Throughout Chapter 4 of the Draft EIS, measures that would be taken to avoid and minimize impacts are discussed, as appropriate, for each resource.

Geology, Topography, and Soils. Construction activities would disturb approximately 243 acres (LOP: 51 acres; excavated ponds: 188 acres; road raisings: 4 acres). Impacts on geology, topography, and soils are expected to be minimal.

Water Resources. Construction activities may cause a temporary, short-term increase in suspended sediment and turbidity in surface waters adjacent to the Project. Long-term improvement of interior drainages would positively affect the surrounding areas by controlling and containing large volumes of stormwater runoff that would otherwise flood developed areas. The NED Plan is expected to result in improved water quality in the watershed. In addition, pond excavation would create new and deepen existing surface water habitats

Vegetation (Uplands). Construction would require only minor tree clearing and site grading. With mitigation measures (such as native vegetation planting and tree replacements) in place, no significant adverse impacts to trees or vegetation would be expected as a result of construction. Because many of the Project areas support invasive species, it is possible that construction in upland areas could be beneficial due to the removal of invasive species and subsequent replanting with native vegetation. Similarly, pond excavation may result in beneficial impacts due to the removal of invasive species such as common reed.

Wetlands. The net impacts would be as follows: a loss of 10.9 acres of freshwater wetlands and construction of 46 acres of tidal wetlands. Taken as a whole, the construction of 46 acres of tidal wetlands versus the loss of 10.9 acres of freshwater wetlands would produce a net significant positive impact on wetland habitats and the quality of wetlands in the Project area.

Wildlife. Construction activities would disturb habitats and cause birds and other wildlife to avoid areas undergoing construction. Disruptions to wildlife would be temporary and short in duration across the Project construction areas. The USACE would have a process in-place for the rescue of wildlife, including fish, as may be necessary to avoid impacts or as may be required during the Project construction process.

Socioeconomics. Construction activities would not produce new development or increase development density within the Project area. Construction requirements are expected to be met by workers within, or near, the Project area, so in-migration of workers is not expected. While construction activities would result in a positive contribution to the overall economy and incomes, the impact is expected to be small.

Environmental Justice. The analysis in this EIS supports the conclusion that there would be no high and adverse impacts to any groups in the population from construction activities, and thus, no environmental justice impacts.

Cultural. The NED Plan would have adverse effects on the setting and viewshed of the National Register of Historic Places (NRHP)-listed Miller Army Airfield Historic District and will also entail the demolition of the World War II fire tower. Coordination regarding minimization and/or mitigation of potential impacts is ongoing.

Land Use and Zoning. Construction associated with the NED Plan would take place on

Bluebelt lands, City or state parklands, and some private land. Any potential disruptions around ponds, raised roads, and along the LOP due to construction would be temporary and short in duration and would not result in any short-term or long-term land use changes. Construction would not conflict with local zoning or public policies and would not displace any existing uses. Additionally, the NED Plan does not involve any rezonings, new residential or commercial development, or an increase in development density within the Project area.

Recreation. Recreational activities that occur along the beachfront and within Miller Park would sustain short-term, direct impacts during Project construction activities, as well as long-term, direct impacts (for example, required relocation of buildings or portions of fields). Several baseball fields would be temporarily impacted by construction, as would one soccer field. To the extent practicable, access to the beaches would be maintained throughout construction. The Project could also require the relocation and reconstruction of some park facilities, potentially including comfort stations, concessions, and recreational components such as playgrounds or athletic fields. In addition, parking areas used by people seeking recreation in the Project area may be temporarily closed to the public, to serve as construction staging areas. Specific impacts to facilities will be identified during the refined design of the Project, and in collaboration with NYCDPR. Due to the linear nature of much of the Project, these impacts would be essentially mobile, moving along the LOP as each activity is completed.

Aesthetics and Scenic Resources. Increased traffic, the presence of construction equipment, and the actual construction activities would create short-term, direct adverse impacts to aesthetics and scenic resources.

Coastal Zone Management. As detailed in Appendix D, the NED Plan would be consistent with the State Coastal policies and the Local Waterfront Revitalization Program (LWRP) policies.

Hazardous, Toxic, and Radioactive Wastes. Construction activities would involve the disturbance of soil and groundwater in areas where prior uses, regulatory database searches, and testing have indicated a potential for the presence of hazardous materials in the soil and/or groundwater. The USACE would continue to closely coordinate with the National Park Service (NPS) to ensure that there are no cross-connecting impacts between the NED Plan construction and NPS' ongoing cleanup of radioactive contamination within Great Kills Park.

Transportation. Construction activities would have short-term minor adverse effects on transportation and traffic. These effects would be primarily due to worker commutes, and delivery of equipment and materials to and from the construction sites and staging areas. In addition, road closures or detours to accommodate utility system work may be expected. Although the effects would be minor, contractors would route and schedule construction vehicles to minimize conflicts with other traffic, and strategically locate staging areas to minimize traffic impacts. Typically, construction activities and associated traffic would be conducted during normal business hours; however, construction would proceed during evening hours at certain locations where traffic or road-use restrictions would affect the schedule.

The NED Plan would require both street closures and sidewalk closures during some project phases. All closures would be subject to Department of Transportation (DOT) approval under a street and sidewalk construction permit, and a traffic management plan would be submitted to DOT for review and approval. Closures would be temporary and diversions would be provided. Any sidewalk closures would incorporate the appropriate pedestrian protection measures, and sidewalks would be restored as part of street reconstruction. These effects would be less than significant.

Air Quality. Emissions would be associated with non-road construction equipment working on the site and on-road trucks moving on public roads to and from the construction site. Emissions from these two source categories are primarily generated from diesel engines. Fugitive dust on the worksite can potentially be generated due to trucks and equipment moving on unpaved surfaces.

Noise. Short-term moderate effects would be expected due to heavy construction activities such as pile driving and use of construction equipment during revetment activities. Increases in noise would be temporary, and subside as construction progresses to subsequent segments of the project. In addition, a noise mitigation plan would be developed and submitted for approval prior to the start of work and implemented to minimize intrusive noise into nearby areas.

If the NED Plan is not implemented, no additional Federal actions would be taken to provide for coastal storm risk management. The No Action (without-project) Alternative future conditions for the south shore of Staten Island have been identified as follows:

- Flooding and wave impacts during future storm events;
- Continued erosion of unprotected bay front shorelines; and
- Continued development and fill of low-lying storage areas.

It is expected that future storms would continue to cause damages in the Project area. Although coastal risk management from small storm events is provided by local topographic features and landforms, future large storm events would cause extensive damages to the area. Because no major changes to the shorefront are expected, the existing level of coastal risk protection would be less effective as sea level changes and severe storm surges become more frequent.

The No-Action (without project) Alternative fails to meet any of the objectives or needs of a coastal storm risk management plan, but it provides the base against which project benefits are measured. Failure to provide the Project area with additional storm damage and erosion control measures may lead to potential loss of life, physical and environmental damage, municipal infrastructure damage and harm to economic activity within the Project area. The No-Action Alternative would be implemented if Project costs for coastal storm risk management were to exceed project benefits, thus indicating that risk management measures are not in the Federal interest under current NED guidelines. The USACE has calculated that the equivalent annual damages for the No-Action Alternative would be $23,254,000.

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Appendices

ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
APE	Area of Potential Effect
BA	Biological Assessment
BCR	benefit-cost ratio
BMP	Best Management Practice
CAA	Clean Air Act
CEA	Critical Environmental Area
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMP	Coastal Management Program
CO_2	carbon dioxide
CWA	Clean Water Act
cy	cubic yards
dB-A	decibel, A-weighted
District	United States Army Corps of Engineers, New York District
DO	dissolved oxygen
DOHMH	Department of Health and Mental Hygiene
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FDR	Franklin Delano Roosevelt
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FO	Fort Wadsworth to Oakwood Beach series of alternatives
FM	Fort Wadsworth to Miller Field series of alternatives
Ft	feet
FWCA	Fish and Wildlife Coordination Act
HRE	Hudson-Raritan estuary
GEIS	Generic Environmental Impact Statement
GHG	greenhouse gas
GIS	geographic information system
GMP	General Management Plan
HABS	Historic American Buildings Survey
HDP	Harbor Deepening Project
HTRW	Hazardous, Toxic and Radioactive Wastes
IPCNYS	Invasive Plant Council of New York State
Ldn	day-night noise level
LER	lands, easements, and rights-of-way
LOP	Line of Protection
LPP	Locally-Preferred Plan
LWRP	Local Waterfront Revitalization Program

mg/l	milligrams per liter
MHW	mean high water
ml	milliliter
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MTA	Metropolitan Transit Authority
NAAQS	National Ambient Air Quality Standard
NACCS	North Atlantic Coast Comprehensive Study
NACP	Northern Atlantic Coastal Plain
NAVD88	North American Vertical Datum of 1988
NEA	Northern Ecological Associates, Inc.
NED	National Economic Development
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGVD29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NMFS	National marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOx	oxides of nitrogen
NPS	National Park Service
NRA	National Recreation Area
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NYC	New York City
NYCDEP	New York City Department of Environmental Protection
NYCDCP	New York City Department of City Planning
NYCDP	New York City Department of Planning
NYCDPR	New York City Department of Parks and Recreation
NYCPC	New York City Planning Commission
NYNHP	New York Natural Heritage Program
NYRCR	New York Rising Community Reconstruction
NYSDEC	New York State Department of Environmental Conservation
NYSDOS	New York State Department of State
NYSECL	New York State Environmental Conservation Law
NYSHCR	New York State Homes and Community Renewal
OPRHP	Office of Parks, Recreation, and Historic Preservation
PAL	Planning Aid Letter
PM	particulate matter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
ppt	parts per thousand
PPV	peak particle velocity
RONA	Record of Non-Applicability
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SIRR	Special Initiative for Rebuilding and Resiliency
SO_2	sulfur dioxide

SPDES	Stormwater Pollutant Discharge Elimination System
SWPPP	Stormwater Pollution Prevention Plan
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compound
WPA	Works Progress Administration
WWTP	Wastewater Treatment Plant

1.0 PURPOSE AND NEED OF ACTION

1.1 INTRODUCTION

The United States Army Corps of Engineers (USACE), New York District (District), is the lead Federal agency for the South Shore of Staten Island Coastal Storm Risk Management Project (hereafter referred to as "Project"). The primary goal of the Project is to manage the risk of damages from hurricane and storm surge flooding. The Project area is located in the Borough of Staten Island, Richmond County, New York (Figure 1-1), and generally extends along the shoreline from Fort Wadsworth (near the Verrazano Narrows Bridge) to Oakwood Beach (near New York City's [NYC] Great Kills Park). The New York State Department of Environmental Conservation (NYSDEC) is the non-Federal partner for this study in cooperation with the New York City Department of Environmental Protection (NYCDEP), and New York City Department of Parks and Recreation (NYCDPR).

Source: USACE 2015

Figure 1-1. Project Area

The Project area represents a flood-prone, high risk area because of its low-lying topography and low capacity storm sewers. Flooding has been a problem in this area since at least the late 1800s, when Richmond County became one of the five boroughs of New York City and

residential development accelerated. Despite several previous beach erosion control and storm damage protection projects implemented along the south shore of Staten Island, properties and inland areas continue to be susceptible to damages as a result of periodic, severe extratropical storms, nor'easters, and hurricanes. Storm-related property and infrastructure damages have resulted from wave action, tidal inundation, and storm surges. Additionally, tidal surges during storms also have blocked critical storm drainage systems that drain inland areas, causing flooding in inland areas by temporarily impounding stormwater runoff (USACE 2015).

During coastal storm events, homes and other properties in the communities flood quickly creating a significant life safety risk. The resulting damages to the properties and potential loss of life exemplify the need for improved risk management (USACE 2015).

A primary mission of the USACE is to develop engineering solutions that will manage damages caused by storm events. Accordingly, the USACE is proposing the construction of new coastal storm risk management measures in the Project area. If coastal storm risk management measures are implemented, the study area may avoid future damages and loss of life (USACE 2015).

This Draft Environmental Impact Statement (EIS) presents the results of the USACE's evaluation of various alternatives intended to manage damages caused by storm events, and assesses the environmental impacts of the selected Project. This Draft EIS fulfills the requirements of the National Environmental Policy Act of 1969 (NEPA) and is in accordance with the President's Council on Environmental Quality (CEQ) Rules and Regulations for implementing NEPA (Title 40, Code of Federal Regulations [CFR], Sections 1500-1508), the USACE's *Procedures for Implementing NEPA* (Engineering Resolution [ER] 200-2-2), and other applicable Federal and state environmental laws.

1.2 PROJECT AUTHORIZATION

The Federal government authorized the study of the problem and potential solutions along the south shoreline of Staten Island via a United States House of Representatives Committee on Public Works and Transportation resolution dated May 13, 1993. This resolution states:

> "The Secretary of the Army, acting through the Chief of Engineers, is requested to review the report of the Chief of Engineers on the Staten Island Coast from Fort Wadsworth to Arthur Kill, New York, published as House Document 181, Eighty-ninth Congress, First Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of beach erosion control, storm damage reduction and related purposes on the South Shore of Staten Island, New York, particularly in and adjacent to the communities of New Dorp Beach, Oakwood Beach, and Annadale Beach, New York."

Therefore, in 1994, the USACE began the Federally-funded reconnaissance level study to examine whether previously recommended, but not constructed, shore and hurricane protection measures along the 13 miles of shoreline along the south shore of Staten Island (from Fort Wadsworth to Tottenville) were justified for Federal participation and funding. This reconnaissance study examined current field conditions along the shoreline from Fort

Wadsworth to Tottenville, as well as historical shoreline changes and storm damage reports, and the causative agents of ongoing erosion. In addition, the reconnaissance study considered a range of alternatives to improve the existing situation and the cost-effectiveness associated with these alternative plans of improvement. Federal interest was determined to exist based on the preliminary evaluation of the benefits, costs, and environmental effects of the specific measures studied, and on the extent of support by local officials and interested parties.

The results of the USACE's *South Shore of Staten Island Beach Erosion Control and Storm Damage Protection Reconnaissance Study* (USACE 1995) (Reconnaissance Study) concluded that there was Federal interest in finding solutions to beach erosion and storm damages occurring along the south shore of Staten Island. The NYSDEC, NYCDEP, and the NYCDPR indicated their support and willingness to share the costs of the feasibility study, and became non-Federal sponsors of the next phase of study. Following the Reconnaissance Study and the signing of the Feasibility Cost Sharing Agreement (FCSA) by the USACE and the non-Federal sponsors, the Project entered into the feasibility phase.

Based on a preliminary screening of potential plans during the initial phase of the feasibility study, the USACE determined that: (1) the 5.3-mile-long shoreline from Fort Wadsworth to Oakwood Beach was the most susceptible to storm damages; and (2) coastal risk management measures for the 7.7-mile-long shoreline from Great Kills Harbor to Tottenville were not economically viable (USACE 2015). As a result, the USACE eliminated the 7.7-mile-long shoreline from Great Kills Harbor to Tottenville from the feasibility study and concentrated on developing coastal storm risk management alternatives on the area from Fort Wadsworth to Oakwood Beach. This 5.3-mile-long area comprises the Project area (see Figure 1-1).

In the aftermath of Hurricane Sandy (October 29-30, 2012), there has been renewed interest in considering possible coastal storm risk management measures from Great Kills Harbor to Tottenville. In order to allow work to proceed on coastal protection from Fort Wadsworth to Oakwood Beach, the USACE decided that risk management measures for Great Kills Harbor to Tottenville would be reconsidered as part of a Phase II.[1] A second interim study to address the Great Kills to Tottenville reach is currently under coordination with NYSDEC and NYC. As a result, the feasibility study was split into two phases:

- Phase I – Fort Wadsworth to Oakwood Beach
- Phase II – Great Kills to Tottenville

[1] The area from Great Kills Harbor to Tottenville does not have a hydrological connection to the area from Fort Wadsworth to Oakwood Beach, meaning that coastal storm risk management measures in each area can be developed independently. Chapter 4 of this EIS considers the potential cumulative impacts of coastal risk management measures from Great Kills Harbor to Tottenville.

Phase I is the subject of this EIS. Because the Phase I and Phase II areas do not have a hydrological connection, decisions and implementation of decisions related to Phase I can be made independently, and would not prejudice any future proposals or decisions related to Phase II. The USACE is currently evaluating whether to propose any Federal risk management measures for Great Kills Harbor to Tottenville. Phase 2 of the South Shore of Staten Island Coastal Risk Management Project is considered in the cumulative impact analysis in this EIS (see Section 4.23). Subsequent studies (see Chapter 2) further refined and narrowed the range of reasonable alternatives that would provide coastal storm risk management measures along the 5.3-mile shoreline of Staten Island from Fort Wadsworth to Oakwood Beach. As described in Chapter 2, the USACE determined that a line of protection (LOP) with an interior drainage system would provide the optimum solution.

Line of Protection (LOP)

LOP generally refers to structural methods that serve as a barrier to water flow. Section 2.3.2 discusses these structural measures.

The preferred LOP measures for Phase I were originally identified prior to Hurricane Sandy (October 29-30, 2012). In November 2014, the USACE completed a post-Hurricane Sandy interim feasibility study *(South Shore of Staten Island, New York Coastal Storm Risk Management, Draft Interim Feasibility Study for Fort Wadsworth to Oakwood Beach* [USACE 2015]). That interim feasibility study was prepared in compliance with the applicable requirements of *The Disaster Relief Appropriations Act of 2013* (Public Law 113-2). Specifically, that interim feasibility report fulfills the requirements necessary to demonstrate that the Project is economically justified, technically feasible, and environmentally acceptable, and that the National Economic Development (NED) Plan incorporates resiliency, sustainability, and consistency with the North Atlantic Coast Comprehensive Study (NACCS).

As a result of that interim feasibility study, the USACE shifted the LOP landward near Oakwood Beach and New Dorp Beach. The alignment modification effectively reduces the minimum design crest/top of wall elevations along adjacent sections of the LOP (see Section 2.4.3 for a more detailed discussion of post-Hurricane Sandy enhancements). Details on the alternatives considered in this EIS are provided in Chapter 2.0. The USACE's NED Plan (see Section 2.5) is consistent with all requirements contained in *The Disaster Relief Appropriations Act of 2013* (Public Law 113-2), which would provide authorization for construction (USACE 2015). Public Law 113-2 also provides the authority for 100% Federal funding for the completion of costal storm risk management on-going feasibility studies as of October 29-30, 2012 (Hurricane Sandy).

1.3 PREVIOUSLY AUTHORIZED AND/OR CONSTRUCTED PROJECTS

Federal, local, and cooperative beach erosion control, flood control, and hurricane protection studies have been conducted over a long period of time within, and in the vicinity of, the Project area. Some of the studies resulted in the construction of protection measures, whereas some of the studies did not progress to the implementation phase. This section provides a brief overview of past projects along the south shore of Staten Island.

Since 1935, two Federal projects and two State/City project have been completed along the study area. Three of these were beach fill projects and are shown in Table 1-1. The fourth project was constructed in 1999 near the Oakwood Beach Waste Water Treatment Plant (WWTP) and is described at the bottom of this section. The beach fill projects contributed to a total of 2,880,000 cubic yards of fill placed along 15,600 feet (50%) of the shoreline (USACE 2015).

Table 1-1. Reported Fill Volumes Placed Since 1935				
Location	**Fill Quantity (cubic yards)**	**Project Length (feet)**	**Year**	**Work Performed By**
South Beach	1,000,000	7,500	1937	U.S. Government
Midland Beach	1,880,000	8,100	1955	State and City
Total	**2,880,000**	**15,600**	-	-

Source: USACE 2015.

From 1936 to 1937, the Federal government built six timber and rock groins, constructed a timber bulkhead, and placed an estimated 1,000,000 cubic yards of hydraulic fill at South Beach. The total cost of the construction was approximately $1,000,000 (USACE 2015).

The State and City placed about 1,880,000 cubic yards of fill between New Creek and Miller Field in 1955 at a cost of about $745,000. The cost of additional work performed by private interests at this time is not known, but it is estimated to be several hundred thousand dollars. The material, which consists of medium grained sand, was placed along the shore and has helped it remain stable. The beaches provide a measure of risk management against tidal flooding as well as a recreational area. Two concrete storm sewer outfalls that extend through the fill have acted as groins, helping to further stabilize the beach (USACE 2015).

The District constructed a project in 1999 to manage risk in the Oakwood Beach area from Raritan Bay and Lower New York Bay (Bay) flooding. The project consisted of two earthen levee segments, one tide gate structure, underground storm water storage, and road raising. The first levee segment is located south of the WWTP and east of Oakwood Creek. It has a top elevation of 10 feet National Geodetic Vertical Datum of 1929 (NGVD29). The second levee segment is located north of the WWTP and runs northward and westward. It is a raised road system with a top elevation that varies between 7.9 feet NGVD29 to 8.4 feet NGVD 1929. The project also consisted of: (1) a new tide gate; (2) the raising of an access road at the northwestern area of the WWTP property; and (3) underground storm runoff storage. The project was based on a 10-year period of analysis and provides risk management against a 15-year coastal storm (6.7% chance of occurring in any given year) (USACE 2015).

After Hurricane Sandy (October 29-30, 2012) USACE awarded two repair contracts authorized under the *Flood Control and Coastal Emergencies Act* (Public Law 84-99) that were completed in Fall 2013 to repair the levee and tide gate from damages inflicted by Hurricane Sandy (USACE 2015).

As part of other post-Sandy efforts, NYC initiated short term dune improvements as part of its Special Initiative for Rebuilding and Resiliency (SIRR) that included beach nourishment and dune construction along the study area in attempt to decrease future losses from coastal storm events. This program was completed in October 2013. Location and quantities of beach fill are unknown (USACE 2015).

National Geodetic Vertical Datum of 1929 (NGVD29)

The Sea Level Datum of 1929 was the vertical control datum established for vertical control surveying in the United States by the General Adjustment of 1929. The datum was used to measure elevation (altitude) above, and depression (depth) below, mean sea level. It was renamed the National Geodetic Vertical Datum of 1929 (NGVD29) in 1973. Although NGVD29 has been superseded by the North American Vertical Datum of 1988 (NAVD88), many cities and USACE projects with established data continued to use the older datum**.** The District has prepared this EIS and the interim feasibility study based on references to NGVD29. The project datum will be updated to NAVD 1988 after the feasibility phase because NAVD88 is more compatible with newer surveying techniques such as Global Positioning Systems and is also more accurate. The conversion from NGVD29 to NAVD88 in New York City is accomplished by subtracting 1.1 feet from the original NGVD29 elevation value.

Continued development within the Project area may exacerbate flooding levels. To combat the consequences of development, the Staten Island Bluebelt Program has been acquiring local property for the preservation of wetlands and introduction of new natural storage areas for stormwater conveyance. The Staten Island Bluebelt Program was introduced to incorporate Best Management Practices (BMPs) and other plans and actions to provide stormwater management, and to decrease flood hazards and increase water quality (USACE 2015). Section 2.2 of this EIS provides more details regarding the Bluebelt Program.

In addition, the City of New York has constructed a significant number of outfall structures to discharge stormwater runoff from streets and residential/commercial properties. Several of the outfall structures have been repaired and replaced over the past 50 years (USACE 2015). The Bluebelt Program is also proposing additional stormwater improvements (see Section 2.2).

1.4 DESCRIPTION OF THE PROBLEM AND CAUSES

Flooding in the Project area can result from either high storm surges from the Bay or interior precipitation runoff that cannot be conveyed out to the Bay by the existing interior drainage system. Much of the study area is protected from storm surge until floodwaters rise above Father Capodanno Boulevard or other local topographic features, such as dunes or levees. As such, the existing structures and landforms provide risk management from bay flooding for high frequency storm events, but after the waters rise above the crest, large low-lying portions of inland areas become inundated from the Bay, combining with flooding already caused by rainfall runoff (USACE 2015).

Throughout the Project reach of Staten Island, more frequent localized flooding has been reported due to interior runoff which becomes trapped by high tides or storm surges or is restricted by the capacity of the storm drainage system. The storm drainage system can convey flows only when the tides in Raritan and Lower New York Bay are below the interior flood elevations. When runoff and high tides occur at the same time, the runoff is unable to flow to the Bay. This situation results in flooding from the landward side of Father Capodanno

Boulevard and is distinguished from storm surge flooding that results from elevated storm surges in Raritan and Lower New York Bay (USACE 2015).

Historic Storm Damage

Over the past 60 years, more than 90 hurricanes, tropical storms, or extratropical storms have significantly impacted the New York City area, often causing storm surges more than 4 feet in elevation (USACE 2015). The storms that wielded the most damage along the south shore of Staten Island include:

- Hurricane of November 25, 1950;
- Extratropical storm of November 6–7, 1953;
- Hurricane Donna, September 12, 1960;
- Nor-easter of March 6–8, 1962;
- Storm of January 23, 1966;
- Storm of November 11, 1977;
- Nor'easter of December 11–12, 1992;
- Storm of March 1993; and,
- Hurricane Sandy, October 29–30, 2012

Of these storms, Hurricane Sandy, the Nor'easter of December 1992, and Hurricane Donna were especially damaging and are discussed below.

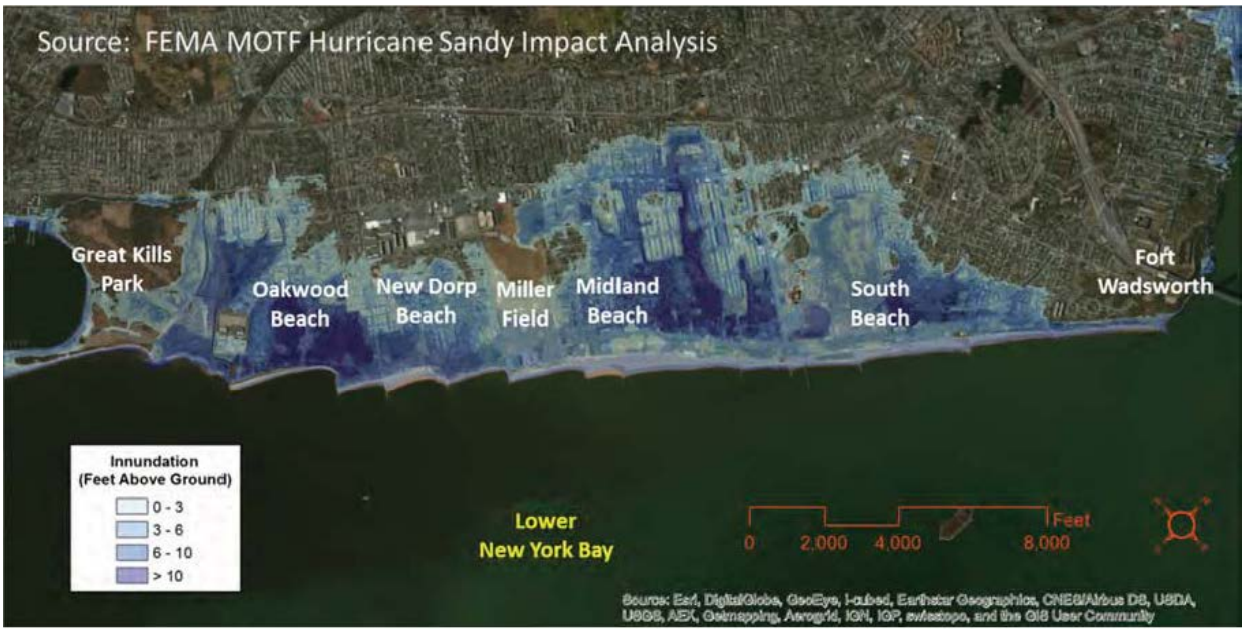
Hurricane Sandy (October 29–30, 2012). Hurricane Sandy, one of the largest Atlantic hurricanes to reach the United States on record, resulted in great devastation along the New York coast and inland New York. Fourteen counties, including Richmond County, were declared as Federal disaster areas. Sixty New Yorkers died, including 23 in Staten Island and 10 in the neighborhood of Midland Beach alone. Most deaths resulted from drowning in areas where waters rose rapidly as a result of the storm surge. The storm damaged or destroyed as many as 300,000 housing units, affected or closed over 2,000 miles of roads, produced catastrophic flooding in subways and tunnels, and damaged major power transmission systems. This destruction came in the wake of Hurricane Irene and Tropical Storm Lee, both of which had damaged New York only one year prior to Hurricane Sandy, and was particularly devastating to an economy just recovering from the recent financial crisis (New York State Homes and Community Renewal [NYSHCR] 2013).

Hurricane Sandy generated record storm surges in the study area. During Sandy the maximum water level at The Battery, New York peaked at 12.4 feet NGVD29, exceeding the previous record by over four feet. High water marks and storm tide gauges deployed by the USGS show that maximum water levels in the study area during Sandy reached somewhere between 13 and 16 feet NGVD29 (USACE 2015). An overview of the extent and magnitude of flooding in the study area is shown in Figure 1-2.

In Richmond County, more than 11,369 owner-occupied homes were damaged by Hurricane Sandy, and 2,575 rental properties suffered substantial damage or were destroyed, according to FEMA's housing damage estimates (NYSHCR 2013). Many homes in the highest risk locations

on the east and south shores of Staten Island were not only flooded, but also severely damaged, shifted from foundations, or completely destroyed.

Staten Island's position in the New York Bight—a right angled funnel of land on either side of Lower New York Bay—increased the extent of the storm surge. As the storm surge came ashore, the narrowing of land compressed the rising water from the sides, leading to even greater storm surge in force and height. As a result, peak storm tides in the waterways off Staten Island were roughly five feet higher than the Lower Manhattan Battery (New York Rising Community Reconstruction [NYRCR] 2014, NYC 2013).



Source: USACE 2015.

Figure 1-2. Hurricane Sandy Flood Inundation

Within the Project area, flooding associated with Hurricane Sandy was attributable to five primary factors:

1. Development of wetlands and low lying areas: Development in wetlands and areas that would have served as natural drainage reduced the ability for the landscape to absorb storm and flood waters, increasing the vulnerability of homes and infrastructure;
2. Inadequate stormwater management: Storm drain systems are inadequate or nonexistent in many areas. Flooding from stormwater, either through surge or backwater inundation, was exacerbated at high tide when tide gates in existing outfalls were closed to prevent tidal water from flowing back into the system;
3. Inadequate coastal flood protection: Discontinuous natural and manmade coastal protection systems along the shoreline of the community exposed coastal areas to storm surges;
4. The confluence of unique circumstances described above: a large storm making landfall during a spring tide on a northwesterly path through the New York Bight; and

5. Sea level change: Storm surge and stormwater impacts were amplified by the approximate 1.5-foot rise in sea level that has occurred since 1821 (NYRCR 2014).

As discussed in this EIS, these factors were all considerations in developing the Project to manage the risk of damages from hurricane and storm surge flooding.

A total of 121,000 electric customers on Staten Island, or about 70% of customers on the Island, were without power following Hurricane Sandy due to substation damage and downed overhead lines, affecting residential customers, businesses and the two hospitals on the east and south shores. Electric outages persisted for weeks and, in some cases months, in the areas most impacted by Hurricane Sandy on the Island. The Oakwood Beach WWTP, serving nearly 250,000 residents on Staten Island, was completely inundated, damaging many of the facility's electrical equipment (NYRCR 2014) which contributed to $3.4M in FEMA flood claims.

As of October 15, 2013, approximately $8 billion in National Flood Insurance Program (NFIP) payments have been made to policy holders to account for the damages from Hurricane Sandy (USACE 2015).

December 1992 Nor'easter. During this storm, flood levels ranged from 8.4 to 10.6 feet NGVD29 between Fort Wadsworth and Miller Field. Nearly 2,000 structures within this area are at ground elevations at or below the average elevation of floodwaters recorded during this event. The December 1992 storm caused the partial collapse of 22 bungalows at Cedar Grove Beach. Since that time, 26 bungalows at the western end of the beach have been demolished by New York City, and a dune was constructed in their place (USACE 2015).

At Oakwood Beach the earthen berm, located on New York City property, was breached in the 1992 storm. This occurred at Kissam Avenue, creating a breach in the dune up to 175 yards wide. In addition, prior to the completion of the USACE project in 1999, the Oakwood Beach area was open on its western flank to the low lands around the wastewater treatment plant and NYC's Great Kills Park. Large areas along Fox Lane and Kissam Avenue were flooded with depths up to 5 feet. Remedial action has been planned and implemented by local authorities to remove debris in the watercourse, repair the sewer system and reconstruct the dune. As previously described, a short-term plan of coastal risk management was implemented to protect Oakwood Beach residents from inundation from the western flanked area. As a result of this storm, 225 flood claims totaling almost $2 million were paid out from the NFIP (USACE 2015).

Hurricane Donna (September 12, 1960). Prior to Hurricane Donna, a park development at South Beach was completed between Miller Field and Fort Wadsworth, which included an artificially filled beach and promenade. In addition, Seaside Boulevard (Father Capodanno Boulevard) was raised from Miller Field to the vicinity of Burgher Avenue (approximately half of the distance to Fort Wadsworth). This work was very effective in protecting the many dwellings that are located on the extensive marshland, inshore of the beach (USACE 2015). However, during Hurricane Donna, which struck the New York City area on September 12, 1960 as a Category 4 hurricane, tidewaters and waves did break through under the boardwalk and across the old road, at the point where the new boulevard ended. Foam-capped breakers

reportedly soared 50 feet or more in the air between South Beach and Midland Beach. The beach was also breached at Sand Lane to the east and around the end of the boardwalk near Fort Wadsworth, inundating Seaside Boulevard up to a depth of 3 feet. In the community of Oakwood Beach, tide gates at a wastewater treatment plant flume at the south end of a protective sand dike failed to operate and tidewater began to flow into the streets. As the tide and wave action increased, the dike was flanked at the breach near the center. Twenty-five families were forced to leave the area when their homes were inundated (USACE 2015).

In New Dorp Beach, the grounds of the Seaside Nursing Home were flooded up to the steps of the main building, but damages were confined to clean-up operations. The streets of the residential area were flooded about 500 feet inland. From the Ocean Edge Colony, along New Dorp Lane to Cedar Grove Beach, residents and Fire Department crews reportedly pumped water from the streets. Cedar Grove Avenue was impassable due to flooding. Miller Field suffered damage when tidewater entered through the former New Dorp Avenue gate and flooded grounds, hangars and some buildings at the southeast end of the field (USACE 2015).

1.5 PROJECT AREA DESCRIPTION

As shown on Figure 1-1, the Project area is located on the eastern side of the south shoreline of Staten Island, New York, and encompasses a reach approximately 5.3 miles long from Fort Wadsworth to Oakwood Beach. The principal neighborhoods along the Project area from east to west are South Beach, Midland Beach, New Dorp Beach, and Oakwood Beach (see Figure 1-3). The Project area is bound inland by natural high ground approximately one mile from the shoreline. The Project area lies within the political boundary of the 11th Congressional District of New York.

Terrain in the Fort Wadsworth to Oakwood Beach portion of the Project area generally consists of a relatively wide, low beach intersected by a number of drainage system structures contained in groins. The shoreline is uneven or jagged as a result of localized sand erosion and accretion on either side of the groins. The shoreline in the Project area consists entirely of city-owned beaches and lands of the Gateway National Recreation Area (NRA) (see Figure 3-17 in Chapter 3), owned by the Federal government and administered by the National Park Service (NPS), at the northeast end of the Project area, Miller Field (a former Army airfield, currently a park with athletic fields) in the New Dorp Beach area, and NYC's Great Kills Park (an undeveloped natural area) southwest of Oakwood Beach. A long boardwalk and hard-surface promenade walkway extends approximately 2.75 miles along the beach from South Beach to Midland Beach, ending at Miller Field. In addition to these public parks and recreation areas, landward of the beaches are low-lying, densely developed, primarily residential properties, as well as commercial properties located primarily along Hylan Boulevard. In addition, the Project area contains several large, undeveloped tidal and freshwater wetlands. The Oakwood Beach WWTP is located approximately 0.25 mile from the shore in Oakwood Beach, along Oakwood Creek (USACE 2015). Staten Island contains approximately 5,300 acres of floodplain, including surface waters (NYSHCR 2013).

Historical data on shoreline changes for the Project area cover the time period 1836-1994 based on topographic sheets and aerial photographs obtained from the National Oceanic and

Atmospheric Administration (NOAA). Additional shoreline analysis was performed based on comparisons of beach profiles surveyed in March 1961, February 1995, and February 2000.

Based on an analysis of the shoreline changes since 1836, the beachfront along the study area can be generally classified as having been subject to mild erosion. Fill mechanically placed has resulted in incidents of shoreline advance. The mean high water shoreline data from historic maps, aerial photographs, and surveys were used to conduct a shoreline analysis. The results indicated that the rate of erosion over most large areas of the shoreline is low. Most areas have averaged less than one foot of shoreline loss annually during the most recent period of analysis. Historic fill projects may have impacted shoreline loss rates in this area.

Despite the overall mild shoreline changes, certain areas have experienced dramatic change as the shoreline reaches equilibrium adjacent to newly constructed coastal structures. The effect has been the development of headland-like features, with dramatic embayments. An example is Oakwood Beach, where the shoreline immediately west of coastal structures is seriously offset. Areas such as Fort Wadsworth have experienced minimal change, as they lie adjacent to land masses featuring elevated headlands consisting of more rocky material, helping to naturally strengthen the land against erosional forces.

Within this area, most of the residential and commercial structures, boardwalk, and roadways are at least 200 feet landward of the projected 50-year future shoreline location, and protective shoreline structures were considered stable and able to withstand such erosion.

Tidal flooding is a primary problem in the Fort Wadsworth to Oakwood Beach Project area. Topographic conditions and patterns of development between Fort Wadsworth and Oakwood Beach have made properties in this area particularly susceptible to flood damages. The floodplain between Fort Wadsworth and Oakwood Beach lies at a lower elevation (typically 4 to 8 feet NGVD29) than the shorefront area (which is typically 9 to 11 feet NGVD29) (USACE 2002). When tidal floodwaters overtop shorefront dunes or other shore protection structures, they quickly spread over the broad, densely developed, low-lying floodplain. During Hurricane Sandy, approximately 28,618 structures were within the storm surge area (NYSHCR 2013).

In addition, tidal surges during storms also have blocked critical storm drainage systems that rely on gravity to drain stormwater runoff from the inland areas, temporarily impounding water and causing flooding. Without the implementation of new storm protection measures, future large and moderate storm events are expected to cause extensive damages, increasing as the sea level rises and storm surges become more severe. Based on long-term trends measured at the Sandy Hook Gage, an increase of 0.013 feet per year is anticipated, resulting in a baseline increase of 0.7 feet over the 50-year period of analysis for the Project. As a result of sea level rise, more frequent and higher stages of flooding will result in the years ahead (USACE 2015).

Source: USACE 2015

Figure 1-3. Principal Neighborhoods along the Project Area

1.6 PLANNING OBJECTIVES

Planning objectives were identified based on the area's needs and opportunities, as well as the existing physical and environmental conditions present in the Project area. The planning objectives and constraints used during development of this Project include technical, economic, environmental, regional, social, and institutional considerations, and are discussed in greater detail in the USACE's Feasibility Study (USACE 2015). The planning objectives are to:

1. Manage the risk of damages from hurricane and storm surge flooding along the Project area.
2. Manage the risk to local residents' life and safety.

The USACE's process of developing and screening alternative plans is required to adhere to a set of four major criteria set forth in the *Principles and Guidelines* (U.S. Water Resources Council 1983) established pursuant to the Water Resources Planning Act of 1965 (USACE 2002). These criteria seek to ensure that the selected plans are: (1) complete, with regard to investments and actions necessary for full attainment of the plan; (2) effective, with regard to technical performance of the plan; (3) efficient, with regard to cost and environmental impact minimization; and, (4) acceptable, with regard to concerns of the involved parties.

In addition, key Federal objectives include maximizing the net benefits contributing to the National Economic Development (NED) account, and protecting the nation's environmental quality pursuant to national environmental statues, applicable executive orders, and other Federal planning requirements.

Therefore, the *Principles and Guidelines* require that plans must be formulated to maximize NED benefits while providing a complete, effective, efficient, and acceptable plan. The alternative that reasonably maximizes net benefits generally becomes the NED plan. The NED plan normally serves as the limit on Federal expenditures on a beach erosion control and/or storm damage protection plan, to the exclusion of more costly plans. However, in the event the non-Federal sponsor(s) prefer additional erosion control and/or storm damage protection that exceeds the NED plan allowance, the planning process does allow a more costly plan to be selected, provided the non-Federal sponsor(s) agree to pay the difference in cost (USACE 2002). However, the Locally Preferred Plan (LPP) must also be technically feasible, environmentally acceptable, and economically justified to be eligible for Federal interest and cost-share funding.

In addition, Public Law 113-2, *The Disaster Relief Appropriations Act of 2013*, requires that the USACE developed a plan that: (1) is resilient (e.g., able to adapt to changing conditions and withstand, and rapidly recover from disruption due to emergencies); (2) is sustainable (e.g., able to continue without interruption or diminution); (3) integrates sea-level change; and (4) provides a robust risk management system (USACE 2015).

Where Project activities are proposed for NPS lands, the USACE will strive for consistency with NPS policies (2006 NPS Management Policies) and the Gateway National Recreation Area General Management Plan (2014).

1.7 PUBLIC REVIEW AND COMMENT

In accordance with the NEPA, a scoping meeting was held locally on October 3, 2001, to introduce the *South Shore of Staten Island Beach Erosion Control and Storm Damage Reduction Study* and to solicit public and agency comments on the study to date. The purpose of this scoping effort was to identify public and agency concerns, agency requirements, environmental issues, and alternative solutions for inclusion in the plan development process and in this EIS.

The scoping meeting was designed to solicit comments from the public as well as Federal, state, county, and local agencies. The scoping meeting was open to the public and held at the New Dorp High School. Public notices were published in two local newspapers and postcards announcing the meeting were sent directly to mailing list participants (developed from previous

scoping efforts) and interested Federal, state, county, and local agencies and government representatives. Oral and written comments and questions were recorded at the meeting and comment cards were provided to attendees for submission by mail.

Since 2001, USACE has coordinated extensively with stakeholders to refine the project. In addition, there were funding delays, pre-Hurricane Sandy. This 2015 Draft EIS has been filed with the United States Environmental Protection Agency (USEPA). A formal notice indicating that the Draft EIS is available was published in the Federal Register, and the document has been mailed to individuals and organizations on the mailing list prepared during the scoping process (Appendix E). In accordance with the CEQ regulations implementing NEPA, the public has 45 days from the date of issuance to comment on this Draft EIS. The USACE is planning to hold one public meeting in the New Dorp Beach area during the 45-day public comment period. The location, date, and time for that meeting will be announced in local media. The USACE will review and use the comments received during the public comment period to prepare a Final EIS for the Project.

1.8 PERMITS, APPROVALS, AND REGULATORY REQUIREMENTS

As the lead Federal agency for the Project, the USACE has certain obligations under Federal environmental statutes and regulations, including Section 7 of the Endangered Species Act (ESA); Section 106 of the National Historic Preservation Act (NHPA); Sections 401, 402, and 404 of the Clean Water Act (CWA); and the Clean Air Act (CAA). All major permits, approvals, concurrences, and consultations required for the Project under these statutes and regulations are identified in Table 1-2, along with the current status of Project compliance with them. In addition to compliance with Federal environmental statutes and regulations, there will be a need for State and local approvals, including potentially the taking of a parkland for non-park use (i.e., parkland alienation).

Table 1-2. Compliance with Environmental Statutes

Federal Statutes	Compliance Status
Clean Air Act, as amended	Ongoing
Clean Water Act of 1977, as amended	Ongoing
Coastal Zone Management Act of 1972, as amended	Ongoing
Endangered Species Act of 1973, as amended	Ongoing
Fish and Wildlife Coordination Act, as amended	Ongoing
Marine Mammal Protection Act of 1972, as amended	Ongoing
National Historic Preservation Act of 1966, as amended	Ongoing
National Environmental Policy Act of 1969, as amended	Ongoing
Rivers and Harbors Appropriation Act of 1899, as amended	Ongoing
Executive Orders, Memorandum, etc.	
Executive Order 11988, Floodplain Management	Ongoing
Executive Order 11990, Protection of Wetlands	Ongoing
Executive Order 12989, Environmental Justice in Minority and Low-Income Populations	Ongoing
Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks	Ongoing
Executive Order 11593, Cultural Resources	Ongoing
Local Land Use Plans	Ongoing
2006 NPS Management Policies and Gateway National Recreation Area General Management Plan (NPS 2014)	Ongoing

1 Ongoing— Some requirements and permits of the statute or executive order remain to be met.

2.0 ALTERNATIVES

2.1 INTRODUCTION

To provide a basis for selection of the final plan and design (*i.e.,* the NED Plan), the USACE evaluated an array of alternatives. The alternatives considered included both structural and non-structural methods of solving the stated issues and problems along the south shore of Staten Island. Structural measures consist of constructed barriers that protect areas of development, and include levees, floodwalls, seawalls, and constructed beaches. Non-structural measures do not involve these large constructed features, and instead, consisted of modifications to individual buildings such as raising them above the flood level, acquisition and removal of buildings from the floodplain, implementing zoning restrictions to prevent future development in the floodplain, or implementing flood warning systems (USACE 2015).

The USACE presented a preliminary analysis of alternatives in its Reconnaissance Study (USACE 1995), and then documented increasingly detailed studies in its *Draft Preliminary Alternatives (P-7) Report* (USACE 2002) and its *Line of Protection & Interior Drainage Alternatives Report* (USACE 2003a, USACE 2004). Following Hurricane Sandy, the USACE reviewed the preliminary analyses and produced the *South Shore of Staten Island, New York Coastal Storm Risk Management, Draft Interim Feasibility Study for Fort Wadsworth to Oakwood Beach* (USACE 2015).

The post-Hurricane Sandy project proposed: (1) a smaller interim study area, deferring the reaches west of Oakwood Beach to a second phase; (2) a sensitivity analysis to identify the net benefits before and after Hurricane Sandy rebuilding efforts; and (3) discussion about the continued use of the original stage-frequency curves, ultimately settling on using the stage-frequency curves from FEMA's forthcoming New York City (NYC) coastal Flood Insurance Study (FIS) (USACE 2015). This EIS analyzes the potential impacts of this approach.

Throughout this investigation, the USACE has worked closely with the non-Federal partners and stakeholders (NYSDEC, NYCDEP, NYCDPR) to: (1) describe the range of potential Federal participation in coastal storm risk management on the south shore of Staten Island; and (2) explain the roles and responsibilities of the USACE and the non-Federal partner in project planning and implementation. Furthermore, there has been extensive coordination with local stakeholders through formal and informal meetings. Any potential future implementation of a Federal coastal storm risk management project in the study area would require support from non-Federal interests and a commitment to working with the USACE to address storm damage along the south shore of Staten Island (USACE 2015).

This chapter summarizes the study of alternatives that the USACE performed as it explored solutions to the storm damage protection concerns in the Project area, including:

1) The No-Action Alternative;

2) A variety of non-structural measures including the acquisition of properties in the 10-year floodplain, the flood proofing of structures in the 25-year floodplain, and changes in zoning;
3) A variety of structural alternatives for the LOP, including: beach nourishment and/or dune restoration, sea wall construction, levees and/or floodwalls, and elevation of a road and promenade; and,
4) Several alternatives for interior flood control measures, which must be provided to drain areas behind the LOP to ensure flood damage protection.

A discussion of the No-Action Alternative is presented in Section 2.2. An introduction to the different types of non-structural and structural measures available is provided in Section 2.3, and the specific alternatives that were evaluated for this Project are presented in Section 2.4. Section 2.5 describes the NED Plan, with sub-section 2.5.1 describing details on the LOP, and sub-section 2.5.2 describing interior flood control. Section 2.6 describes measures to avoid and minimize potential environmental impacts.

2.2 NO-ACTION ALTERNATIVE

The No-Action (without-project) Alternative means that no additional Federal actions would be taken to provide for coastal storm risk management. The without-project future conditions for the south shore of Staten Island have been identified as follows:

- Flooding and wave impacts during future storm events;
- Continued erosion of unprotected bay front shorelines; and
- Continued development and fill of low-lying storage areas (USACE 2015).

It is expected that future storms would continue to cause damages in the Project area. Although coastal risk management from small storm events is provided by local topographic features and landforms, future large storm events would cause extensive damages to the area. Because no major changes to the shorefront are expected, the existing level of coastal risk protection would be less effective as sea level changes and severe storm surges become more frequent (USACE 2015).

It is assumed that no new drainage outfalls would be constructed along the shoreline, and that the existing drainage structures would continue to be maintained by the City. The Section 103 project is being deactivated and the tide gate will be removed and replaced as part of the National Economic Development (NED) Plan. It is also assumed that the beach profile and layout shape would be maintained over the long term and that beach alignments would not significantly alter current conditions (USACE 2015).

Storm tide inundation is expected to increase over time, in direct relation to the anticipated rise in sea level. Based on long-term trends measured at the Sandy Hook Gage, an increase of 0.013 feet per year is anticipated, resulting in a baseline increase of 0.7 feet over the 50-year period of analysis for the project. As a result of sea level rise, more frequent and higher stages of flooding would result in the years ahead (USACE 2015).

It is expected that continued development would occur in the floodplain, subject to local floodplain management ordinances. Small residences would continue to be displaced by larger new homes and townhouses, and vacant areas would come under increasing pressure to be developed as the local population continues to increase. The rapid rate of development that is being experienced in the Project area, particularly in shorefront neighborhoods, coincides with an increasing amount of fill in the floodplain as new construction is elevated above the base flood elevation. Much of the currently vacant land in the Project area is under considerable development pressure, with some areas already zoned for residential development. The combination of new development and fill would reduce the natural storage available to attenuate flood depths from interior runoff. Consequently, increases in interior flood stages are expected to accompany continued development and fill in the floodplain (USACE 2015).

In addition to the loss of natural flood storage areas, the inventory of properties vulnerable to flood damage would increase as the low-lying areas continue to be developed. As a conservative assumption, the analysis has not included the increased inventory estimated with future development when calculating the future flood damage values (USACE 2015).

It is possible that locally funded flood control improvements would be implemented in certain areas within the Project area, but these would likely be piecemeal and would not provide as comprehensive a solution as is needed for the southern shore of Staten Island. The NYCDEP's Staten Island Bluebelt Program incorporates plans and actions to provide stormwater management to decrease flood hazards and increase water quality both inside and outside the Project area. NYCDEP is proposing amended drainage plans comprised of a network of storm sewers, BMPs, and Bluebelt wetlands. The primary drainage plan objective of the Bluebelt Program is to provide City streets with storm sewers that flow via gravity to proposed BMPs and outfalls to the Lower Bay for discharge.

One of the mitigating activities important to the level of development within the Project area is the acquisition of local property for the preservation of wetlands and introduction of new natural storage areas for stormwater conveyance. Under the Mid-Island Bluebelt Program that encompasses the study area, NYCDEP proposed to acquire approximately 204 acres of wetland property (note: this area includes mapped but unbuilt streets). As of spring 2015, approximately 129 of those acres have been vested in the City of New York. The acquisition of land and introduction of other stormwater BMPs is being done in accordance with NYCDEP's Bluebelt Program. The NED Plan presented in this EIS is consistent with, and complements, NYCDEP's Bluebelt Program (USACE 2015).

The No-Action (without project) Alternative fails to meet any of the objectives or needs of a coastal storm risk management plan, but it provides the base against which project benefits are measured. Failure to provide the Project area with additional storm damage and erosion control measures may lead to potential loss of life, physical and environmental damage, municipal infrastructure damage and harm to economic activity within the Project area. Under this scenario, all natural forces and manmade conditions currently in effect would continue. Additionally, this plan would be implemented if project costs for coastal storm risk management plan were to exceed project benefits, thus indicating that risk management measures are not in the Federal interest under current NED guidelines. The USACE has

calculated that the equivalent annual damages for the No-Action Alternative would be $23,254,000 (USACE 2015).

2.3 INTRODUCTION TO NON-STRUCTURAL, STRUCTURAL, AND INTERIOR FLOOD CONTROL MEASURES

2.3.1 Non-Structural Measures

Three basic types of non-structural alternatives for storm damage protection were evaluated by the USACE, consisting of: (1) acquisition of all or selected structures within the 10-year floodplain; (2) zoning; and (3) retrofit/floodproofing selected structures within the 25-year floodplain, as described in this section.

Acquisition: Permanent evacuation of existing areas subject to erosion and/or inundation involves the acquisition of this land and its structures either by purchase or by exercising the powers of eminent domain. Following this action, all development in these areas is either demolished or relocated (USACE 2015).

Zoning: Through proper land use regulation, floodplains can be managed to ensure that their use is compatible with the severity of the flood hazard. Several means of regulation are available, including zoning ordinances, subdivision regulations, and building and housing codes. Although such controls can be effective in reducing future potential losses in other, less developed areas, zoning is ineffective in limiting or controlling the development that already exists. It should be noted that zoning is a local issue and is not within the jurisdiction of the Federal government. However, any Federal project will have a floodplain management plan component which includes requirements on the use of flood prone lands (USACE 2015).

Retrofit/Floodproofing: Floodproofing is a body of techniques for reducing the risk of flood damages through modifications both to structures and their contents. It involves keeping water out, as well as reducing the effects of water entry. Such modifications can be applied by an individual or as part of a collective action, either when buildings are under construction or by retrofitting existing structures. Floodproofing, including physically elevating structures, can significantly reduce damages, but still requires that residents be evacuated during a flood (USACE 2015).

2.3.2 Structural Measures

Five general types of structural alternatives for storm damage protection were evaluated by the USACE, consisting of: (1) levees and/or floodwalls; (2) beach fill; (3) beach fill with structures; (4) shore stabilization; and (5) channelization. All of these structural measures can also be considered a LOP, serving as a barrier to water flow. The following text provides an introduction to these structural measures.

Levees and/or Floodwalls: Levees and floodwalls are intended to provide flood risk management against coastal and riverine flooding in the absence of waves. These structures can be cost-effective measures against tidal flooding when placed landward of direct wave exposure.

Used in this manner, levees and floodwalls provide flood risk management to interior structures. Although levees and floodwalls provide a cost-effective means to manage the risk of flooding in low-lying areas, runoff trapped behind the structure may cause flood related damages because the structure may not allow for the interior drainage area to discharge local stormwater runoff.

Raising existing roads and thoroughfares can also act as a levee-like risk management measure and prevent tidal storm surges from entering low-lying areas. Road raising entails modifying existing roads (and associated infrastructure) that run parallel to the shoreline so that they function as a barrier and protect properties from wave action and tide/surge-induced flooding. The elevation of roads must also consider the raising of associated structures as necessary, including manholes and utility valve boxes, hydrants, light and power poles, roadside landscaping, and sidewalks. In addition, raising adjacent structures such as buildings, driveway access, intersections with and other roads, and bus shelters would need to be considered with this alternative.

Levee

A levee is typically a trapezoidal-shaped earthen structure designed to function as a barrier against flooding in the absence of waves. Although levees are not effective in conditions of direct wave exposure, levees can be constructed landward of direct wave exposure to connect or "tie back" a shoreline structure, such as a seawall, to a designated point of high ground landward of the shore. Levees also can be constructed between developed areas and interior drainages (such as tidal channels) or wetland areas that are subject to flooding, to protect development adjacent to these areas. Materials used to construct the levees may vary, and some levees have in impermeable core or a sheetpile "cutoff" to prevent seepage of floodwater through the levee.

Floodwalls are often used in conjunction with levees, and serve the same purpose as levees. Floodwalls, which are typically narrower and less massive than levees, may be used in shorter segments where a lack of available space makes construction of a levee infeasible.

Beach Fill: Beach fill involves the placement of sand on an eroding shoreline to restore its form and to provide adequate coastal storm risk management. A beach fill design typically includes a berm backed by a dune, and both elements combine to prevent erosion, wave attack and inundation damages to leeward areas. Compared to floodwalls and levees, beach nourishment represents a "soft," more natural method for reducing storm damages. Beach nourishment requires a long-term commitment to offset long-term shoreline erosion, and may be costly along highly eroded shorelines. Federal participation in periodic nourishment would be limited to a period of 50 years from completion of project construction.

Beach Fill with Structures: Structures such as groins are used to retard beach erosion, increase the longevity of beach fill, and maintain a wide beach for risk management purposes and recreation. Groins placed perpendicular to the shore at the ends of a beach nourishment project would reduce erosion rates and would minimize the potential impact of sand migration into any nearby tidal wetlands. These structures would reduce erosion and long-term renourishment requirements.

Shore Stabilization: Shore stabilization measures offer both flooding and erosion control for shorefront structures, and reduce flooding of low-lying interior areas. Structure types include bulkheads, seawalls, and revetments. Shore stabilization measures limit landward movement of the shoreline and minimize overtopping floodwaters. In combination with beach nourishment in highly erosive areas, or without beach nourishment for relatively stable shorelines, these structures can provide long-term storm coastal risk management. Costs can be high, depending on the extent and severity of existing shoreline problems.

Channelization: Channelization usually is a desirable choice if the flooding is due to interior drainage rather than storm tides. For purposes of this Project, channelizing creeks would not be effective, as the controlling water surface is due to the storm surge in the Raritan and Lower New York Bay. In Staten Island, the creeks are mostly piped where they discharge to the Bay and flow may be limited by the piping rather than the open channel portions.

2.3.3 Interior Flood Control and Drainage Measures

Interior flood control and drainage measures must be a component of any comprehensive storm damage protection plan that involves the establishment of structural barriers, such as levees or floodwalls, between the stormy oceanfront shoreline and interior areas. If interior flood control and drainage measures were not implemented with such a plan, the developed interior areas that the structural barriers seek to protect would be at risk of flooding from interior stormwater runoff that becomes trapped behind the barriers. This effect could occur during severe storms as well as the more common heavy rain events.

Interior drainage alternatives include non-structural as well as structural measures. The non-structural measures described in the previous section, such as land acquisition and floodproofing, are also applicable as non-structural measures for interior flood risk management. Structural measures (also called hydraulic structures) for interior flood control and interior drainage include gravity outlets, ponding, pressure outlets, pumping, and levees, as described in the following paragraphs.

Gravity outlets are generally defined as drainage systems that rely on gravity to convey stormwater, and include structures such as open swales or ditches, and gravity-fed drainage pipes or storm sewer systems that convey stormwater through a barrier or structural LOP (e.g., seawall or levee). Gravity outlets function well when the existing land elevation or grade landward of the barrier/LOP is higher than the target area for discharge (i.e., the water level in the bay or receiving water). Accordingly, gravity outlet systems along shorelines function best during weather events that yield high rainfall with low tides, when there is sufficient head (i.e., based on elevation difference between the flooded interior area and the bay receiving waters) for gravity exchange of stormwater. Conversely, gravity outlets are ineffective during high tide events when the tailwater (bay) elevations are higher than the floodwater (interior area) elevations, effectively blocking gravity discharge[2]. Similarly, gravity outlets do not function well with

[2] When gravity outlets are used, they are usually integrated with tide gates or other measures to allow flow only in one direction, preventing backflow from the bay into interior areas during high tide/storm surge periods.

large, low-lying natural flood storage areas such as freshwater wetlands, where elevations between the flooded interior area and the bay receiving waters are so similar that even a moderate tide can prevent gravity discharge (USACE 2003a). However, gravity outlets can be used in combination with ponding (described below) to increase the success of storm damage control during these periods of ineffectiveness.

Ponding, or storing stormwater runoff in low-lying, undeveloped areas, can be effective as a means of reducing interior flooding, especially when used in combination with gravity outlets. Ponding is the most effective when the system is designed so that floodwaters can be discharged through gravity outlets, as long as low tailwaters (i.e., the water level in the bay or receiving water) permit. Then, as high tides or storm surges raise the tailwater and block the outward flow through the gravity outlets, runoff is diverted into ponds or low-lying areas. This combined use with gravity outlets minimizes the size of the pond required, compared to diverting all stormwater runoff into ponds. Natural low-lying areas should be considered for this purpose as much as possible because excavating ponds to increase runoff storage volume can be cost prohibitive (USACE 2003a).

Pressure outlets can be used instead of gravity outlets when there is not enough head to allow gravity outlets to function, and if a sizable portion of the drainage area is higher than the top of the LOP. With sufficient head between the higher ground and the maximum tailwater, runoff can be diverted directly into the bay through pressure conduits. Diversion effectively reduces the amount of runoff reaching the LOP that would otherwise have to be handled by ponding or pumping.

Pumping entails using submersible or other types of pumps to reduce the volume of water landward of the LOP when gravity outlets are blocked and floodwaters exceed the existing flood storage capacity landward of the LOP. Pumping can be used to reduce the water volume in a ponding area or it can be used to handle the peak runoff. Although modern submersible pumps have become less costly than older-style pumps for this purpose, pumping is usually the most costly alternative with regard to construction, operation, and maintenance.

Interior levees can be useful in large, low lying, natural flood storage areas where further lowering of the interior water levels is not cost justified. In these areas, interior levees can provide additional flood protection by serving as a barrier between the vulnerable developed areas and the natural flood storage area. Interior levee heights are typically low, because the maximum water surface elevations in interior areas are lower than those of exterior tide levels.

2.4 ALTERNATIVES CONSIDERED

During the process of exploring the range of solutions to storm damage in the Project area, the USACE performed a multi-tiered analysis of alternatives. This section describes that process which led to the NED Plan that is presented in Section 2.5.1 for the Line of Protection and Section 2.5.2 for Interior Flood Control.

2.4.1 Initial Alternatives Analysis

An array of initial alternatives was identified through the examination of previous studies, new concepts, and public suggestions. These plans include combinations of the flood risk management measures described in Section 2.3 to manage the local coastal flood risk. The preliminary costs, benefits, and impacts of each preliminary alternative were examined to determine which alternative should be considered for a more detailed analysis and which should be eliminated from further evaluation. Some of the principal items considered during the screening process, other than economic implications, were life safety issues, implementation constraints, engineering feasibility, environmental impact, and social consequences (USACE 2015). A detailed list of initial alternatives and their potential as a solution may be found in Table 2-1.

The preliminary designs for the initial alternatives were developed to a level of detail that would allow preliminary cost estimates, benefit-cost analysis, and a basic assessment of environmental and social impacts to be completed. Among the alternatives, one of the variables considered was the level of protection provided, based on either 10-, 25-, or 100-year floodplains/storm protection level (USACE 2015).

In accordance with the USACE's review criteria and procedures (explained in Section 1.6) the costs of the selected plan must be justified based on the results of benefit-cost analyses, with the goal of achieving the maximum net excess benefits. In general, the USACE found that structural measures have greater net benefits than non-structural measures. However, based on evaluation, the USACE acknowledges that using structural protection measures such as levees, floodwalls, and beach nourishment could potentially have greater impacts on the environment than the non-structural measures (USACE 2015). Structural measures may require placement of fill in wetlands, wildlife habitat, or public and private lands, and may result in aesthetic impacts. In addition, interior flood control and drainage measures, which must accompany any hard structure LOP, could have adverse effects on environmental and cultural resources (USACE 2015).

In contrast, potential adverse environmental impacts would generally be reduced if only non-structural measures (such as floodproofing and acquisition) were implemented in the Project area. Non-structural measures would tend to occur on already developed lands, which often contain limited or no significant environmental resources. There may be impacts to cultural resources should any of the structures proposed for non-structural measures be determined historic properties eligible for the National Register of Historic Places (NRHP).

Acquisition and removal of structures from the floodplain would achieve an ideal flood damage prevention situation, by removing all potentially damageable structures from the floodplain. As shown on Table 2-1, the acquisition and floodproofing alternatives (FM 2, FM 3, FO4, FO5, and FO6) were not economically feasible and were screened out. Additionally, alternatives that only achieved partial protection, such as the Seawall from Fort Wadsworth to Miller Field Only (FM 1) and the Road Raising from Fort Wadsworth to Miller Field Only (FM 4) were screened out. Lastly, the USACE determined that Alternative FO3B would not be economically feasible, and that alternative was also screened out (USACE 2015).

Table 2-1. Initial Level of Protection Alternatives				
Alternative	**Description**	**Benefits**	**Constraints**	**Recommendation**
FM4	Road Raising (Fort Wadsworth to Miller Field Only)	• Doesn't create potential public safety issues (as opposed to seawall alternative) • Access routes remain open during flood event • No wetland disturbance	• 49 structures require raising • Miller Field to Oakwood Beach remains unprotected • Major traffic delays may result during construction • Additional costs incurred for relocation of utilities • Creates additional interior drainage cost for handling runoff between the road and the shoreline	Low net benefits compared to Alternative covering full project reach: **Screened out**
FO1	Beachfill, Seawall	• Access routes remain open during flood events • No private property would be directly impacted • Increased beach area may provide recreation opportunities	• Bay bottom shoreline disturbance • High cost • Requires continued beach renourishment	**Further Development and Evaluation**
FO2	Levee, Floodwall, Buried Seawall/Armored Levee	• Access routes remain open during flood events • No significant environmental impacts identified • No private property would be directly impacted	• Possible public safety issues	Locally preferred variation available. See raised promenade variation, FO2A
FO2A	Levee, Floodwall, Buried Seawall/Armored Levee (with Raised Promenade)	• Access routes remain open during flood events • No significant environmental impacts identified • No private property would be directly impacted	• Possible public safety issues	**Further Development and Evaluation**
FM1	Seawall (Fort Wadsworth to Miller field Only)	• Access routes remain open during flood events • No significant environmental impacts identified • No private property would be directly impacted	• Possible public safety problems	Low net benefits compared to Alternative covering full project reach: **Screened out**
FM2	Floodproofing: 25 year Floodplain	• Lots for any acquired structures • No wetland disturbance • No additional maintenance requirements	• Miller Field to Oakwood Beach remains unprotected • Access routes would not remain open during flood event • No coastal risk reduction outside of 25 year floodplain • Not cost-justified based on storm risk management benefits	Not economically feasible: **Screened out**

Table 2-1. Initial Level of Protection Alternatives (con't)				
Alternative	**Description**	**Benefits**	**Constraints**	**Recommendation**
FM3	Acquisition: 10 year Floodplain	• Additional open space created • Would permanently eliminate potential for future losses to level of coastal risk management • May permanently eliminate need for future emergency response and recovery resources • No wetland disturbance	• Miller Field to Oakwood Beach remains unprotected • Homeowners would have to relocate • No coastal risk management outside of 10 year floodplain • Access routes would not remain open during flood event • No cost-justified based on storm risk management benefits	Not economically feasible: **Screened out**
FO3	Raised Road, Buried Seawall/Armored Levee, Levees and Floodwalls	• Access routes remain open during flood events • No private property would be directly impacted • No significant environmental impacts • Does not create potential public safety issues	• 49 structures require raising • Major traffic delays may result during construction • Additional costs incurred for relocation of utilities • Creates additional interior drainage cost for handling runoff between the road and the shoreline	**Further Development and Evaluation**
FO3A	Raised Road, Raised Promenade, Buried Seawall/Armored Levee	• Access routes remain open during flood events • No private property would be directly impacted • No significant environmental impacts • Does not create potential public safety issues	• 49 structures require raising • Major traffic delays may result during construction • Additional costs incurred for relocation of utilities • Creates additional interior drainage cost for handling runoff between the road and the shoreline	**Further Development and Evaluation**
FO3B	Road median Floodwall, Raised Road, Raised Promenade, Buried Seawall/Armored Levee	• Access routes remain open during flood events • No private property would be directly impacted • No significant environmental impacts • Does not create potential public safety issues	• 49 structures require raising • Major traffic delays may result during construction • Additional costs incurred for relocation of utilities • Creates additional interior drainage cost for handling runoff between the road and shoreline	Not economically feasible: **Screened out**

Table 2-1. Initial Level of Protection Alternatives (con't)				
Alternative	**Description**	**Benefits**	**Constraints**	**Recommendation**
FO4	Floodproofing: 25 year Floodplain	• No wetland disturbance • Lots for any acquired structures would become open space • No additional maintenance requirements	• Access routes would not remain open during flood event • Temporary inconvenience to homeowners during construction phase or relocation for structures to be acquired • No coastal risk management outside of 25 year floodplain • Not economically justified based on storm risk management benefits	Not Economically feasible: **Screened out**
FO5	Acquisition: 10 year Floodplain	• No wetland disturbance • Creation of open space • Would permanently eliminate potential for future losses to level of risk management • May permanently eliminate need for future emergency response and recovery resources	• Homeowners would have to relocate • No coastal risk management outside of 10 year floodplain • Access routes would not remain open during flood event • Not cost-justified based on storm risk management benefits	Not Economically feasible: **Screened out**
FO6	Acquisition: Wave Zone	• No wetland disturbance • Creation of open space • Would permanently eliminate potential for future losses to level of risk management • Permanently eliminates need for future emergency response and recovery resources	• Only provides coastal risk management for structures susceptible to wave effects • Homeowners would have to permanently relocate • No risk management outside of wave zone • Access routes would not remain open during flood event • Not cost justified based on storm risk management benefits	Not Economically feasible: **Screened out**

Source: USACE 2015

Based on the USACE's analysis, the list of initial alternatives was reduced to four (4) alternatives for further detailed study and development. These four alternatives (shown in Table 2-2) resulted in a favorable benefit-cost ratio (BCR) (i.e., BCR greater than 1.0).

Table 2-2. Line of Protection Alternatives

Alternative	Description
Alternative #1	Alternative #1, (formerly FO1), included a combination of beach fill and seawalls, new floodwalls and raising of the existing levees near Oakwood Beach.
Alternative #2	Alternative #2, (formerly FO3), included road raising, a buried seawall/armored levee, levees and floodwalls. This alternative focused on raising the road along the entire beachfront reach.
Alternative #3	Alternative #3, (formerly FO3A), included a combination of road raising, promenade raising, a buried seawall/armored levee, levees and floodwalls. This alternative focused on a road raising for 75% of the beachfront reach and includes a raised promenade along the remaining beachfront reach.
Alternative #4	Alternative #4, (formerly FO2A), included varying lengths of floodwalls, levees and a buried seawall/armored levee (with raised promenade).

Source: USACE 2015

2.4.2 Second Tier Analysis for Line of Protection Alternatives

The four LOP alternatives presented in Table 2-2 were all designed to protect against the 100-year storm event. These four LOP alternatives are described below.

Alternative #1

This alternative included a dune and a protective fronting beach berm. The beach along the Project area has been mostly stable over the last 20 to 30 years. With this alternative the minimum existing height and width of the beach would have to increase to reduce damage to the dune and property landward of the dune during a coastal storm event. The incorporation of a larger beach berm would help attenuate wave energy because of its increased height and may reduce the risk from tidal-surge flooding because of the increased cross sectional area.

The beach expansion, however, may disrupt the present balance and stability of the existing beach-front. Historically, when requiring a wider beach to be maintained, the erosion rates along the beach will increase significantly. The increased erosion rates will drive higher annual beach renourishment costs and may lead to an increase in vulnerability to flood damages throughout the course of the erosion/renourishment cycle (USACE 2015).

Alternative #2

This alternative focused on raising Father Capodanno Boulevard along its entire length and specifically included:

- Road raising along Father Capodanno Boulevard;
- Buried seawall/armored levee from Miller Field to Oakwood Beach; and
- Levees and floodwall at Oakwood Beach.

Road raising: With this alternative Father Capodanno Boulevard (currently at an average existing elevation of +10.0 feet NGVD29) would be raised by roughly 5 feet to an elevation of +15.0 feet NGVD29, for a distance of approximately 14,000 feet. Two vehicular turnarounds feeding off Father Capodanno Boulevard, as well as approximately 49 adjacent structures, two bus shelters, and one monument would also be raised to maintain road access. The alternative includes fill, new pavement, and sidewalks, plus necessary manhole and valve box raising, catch basin raising, light and power pole raising, tree, and hydrant raising. A temporary bypass constructed just south of Father Capodanno Boulevard would have to be utilized in sections between major intersecting thoroughfares while the road raising is accomplished in sections. Impacts to individual properties from Road Raising is discussed in Section 4.13 Transportation.

Buried Seawall/Armored Levee: Average existing elevations along the shoreline at the LOP range from +7.0 to +10.0 feet NGVD29. Continuing in a westerly direction, this alternative consists of 6,800 feet of buried stone seawall/armored levee with a crest elevation of +17.0 feet NGVD29 and terminates at the existing dune at the eastern end of Oakwood Beach. There is enough space for the above buried seawall/armored levee alignment without encroaching on the existing beach front. At the time this alternative was initially considered, NYC Department of Parks and Recreation indicated that the future without-project condition for the Cedar Grove Beach area would include the removal of existing structures by the City. Since then, most of these structures have already been removed, either through actions of the City or as a result of Hurricane Sandy.

Levees and Floodwall: From this point westerly along the shore and northerly near the mouth of Oakwood Creek, the tieback includes the following:

- 700 feet of new levee plus 700 feet of raising the existing levee (currently at elevation +10.0 feet NGVD29) at the Oakwood Beach WWTP vicinity to an elevation of +15.0 feet NGVD29;
- 650 feet of sheet pile floodwall at an elevation of +14.0 feet NGVD29 along the Treatment Plant embankment; and
- 2,830 feet of levee north of the WWTP at an elevation of +13.0 feet NGVD29, with a tide gate structure across Oakwood Creek. This levee ties into existing high ground.

An existing nature walk, west of the promenade terminus at Miller Field, could be relocated to the crest of the buried seawall/armored levee and extended to Oakwood Beach (USACE 2015).

<u>Alternative #3</u>

This alternative is a slight variation of Alternative #2 and includes:

- A partial road raising along Father Capodanno Boulevard;
- Raising of existing promenade;

- Buried Seawall/armored levee from Miller Field to Oakwood Beach; and
- Levees and floodwall at Oakwood Beach.

Road Raising and Raised Promenade: This alternative is the same as the road raising for Alternative #2, except that the existing promenade (5,700 feet) would be raised in place of a portion of Father Capodanno Boulevard (6,000 feet). Under this alternative, the promenade (at an average existing elevation of +10.0 feet NGVD29) would be raised by roughly 5 feet to an elevation of +17.0 feet NGVD29. A temporary bypass constructed just south of Father Capodanno Boulevard would have to be utilized in sections between major intersecting thoroughfares while the road raising is accomplished in sections. Six ramp systems would be included to maintain pedestrian and vehicular access up and over the raised promenade.

Buried Seawall/Armored Levee: This section is identical to the layout described for Alternative #2.

Levees and Floodwall: This section is identical to the layout described for Alternative #2 (USACE 2015).

Alternative #4

This alternative incorporates:

- Buried seawall/armored levee (with a raised promenade); and
- Levees and floodwalls.

Buried Seawall/Armored Levee (with a Raised Promenade): This alignment begins at the eastern end of the Project area (Fort Wadsworth) with approximately 22,705 feet of buried stone seawall/armored levee with a paved walkway and/or bicycle path crest and with a crest elevation of +17.0 feet NGVD29 and transitions to a floodwall at the Oakwood Beach WWTP.

Levees and Floodwalls: From the eastern end of the Oakwood Beach WWTP heading west and then north, this alternative includes the following:

- 1,826 feet of T-type floodwall supported on piles, generally at an elevation of +14.0 feet NGVD29, tying into the levee north of the WWTP; and
- 615 feet of levee tying into the proposed tide gate chamber at the Oakwood Beach Waste Water Treatment Plant vicinity, followed by 2,815 feet of levee tying into Hylan Boulevard— all to an elevation of +15.0 feet NGVD29 (USACE 2015).

Although Alternative #4 for the LOP does not include road raising, the analysis for interior flood control considers road raising as part of the overall plan.

All four alternatives were structural solutions that would manage the risk to buildings, life-safety, and infrastructure, such as roads and utilities and other local assets behind the LOP. Details of the economic findings for each alternative may be found in USACE 2015.

Alternative #1 included a combination of beach fill (with periodic re-nourishment), buried seawall, levees, and floodwalls acting as a LOP from future coastal storm events. Pre-Sandy investigations indicated that this alternative did not maximize net excess benefits. It was therefore eliminated from further consideration (USACE 2015).

Alternatives #2 and #3 featured road raising along Father Capodanno Boulevard. Alternative #2 included raising the entire roadway (14,000 feet) and Alternative #3 included raising a portion of the roadway (8,000 feet) along with a 6,000 foot promenade raising instead of the roadway (USACE 2015).

Father Capodanno Boulevard is a busy arterial thoroughfare between the residential areas of Midland Beach and South Beach, providing access to two hospitals (Staten Island University Hospital and South Beach Psychiatric Hospital), and ultimately connecting to the Verrazano Narrows Bridge. The thoroughfare is important for commuters and local residents, and also provides access to the recreational amenities in this project reach (USACE 2015).

With Alternative #2 and Alternative #3, the road raising construction work, involving the closure of individual lanes and sometimes whole sections of the route, would also necessitate the relocation of utilities. Along with utility relocations, grading and structure setbacks would need to be adjusted in order to tie into the elevated roadway. The design height would be limited by those factors as well as increased costs and may not have provided a set of design options that would have afforded the level of risk management warranted by the critical nature of the project.

Alternative #4 features a floodwall, levees and a buried seawall/armored levee (with a raised promenade) and was found to have the highest Net Excess Benefits of the four alternatives. The plan was locally supported because it incorporates a raised promenade for recreational use. This modification improves the overall aesthetics of the Project and does not incorporate the disadvantages of pursuing road raising of Father Capodanno Boulevard. Thus, Alternative #4 is the Tentatively Selected Plan (USACE 2015).

2.4.3 Post-Hurricane Sandy Updates

The Tentatively Selected Plan was originally identified prior to Hurricane Sandy. Following Hurricane Sandy, the USACE incorporated post-Hurricane Sandy considerations into the optimization process. They are:

- ☐ Updated stage frequency curves from FEMA's forthcoming coastal Flood Insurance Study for New York City;
- ☐ Changes in the alignment of the LOP and design section types based on post-Sandy site conditions; and
- ☐ Recent update in technical guidance related to I-Type floodwall design (USACE 2015).

The alignment of the LOP was initially defined as part of the reconnaissance level study and subsequent meetings with the City of New York, the State of New York, and the USACE. Following Hurricane Sandy and additional meetings with the City of New York, the State of New York, and the NPS, the alignment was shifted landward in some areas to increase protective

buffer between the Bay and LOP. These changes would allow for a more homogenous LOP, lower structure crest elevations, and potentially lower maintenance costs. The alignment modification complements the NYC Bluebelt Program (USACE 2015).

In addition, the design section along the perimeter of the WWTP at Oakwood Beach was changed from a I-Type floodwall to a T-Type concrete floodwall supported on concrete piles utilizing current USACE engineering guidance. The T-Type floodwall design in the Oakwood beach area is more robust than the original design and therefore more costly; however, implementing a management measure with a thin footprint is necessitated by physical site constraints along the perimeter of the Oakwood Beach WWTP (USACE 2015).

2.4.4 Alternatives Analysis for Interior Flood Control

Interior flood control and drainage facilities considered for the Project included the general types described in Section 2.3.3. While the LOP defends against flood water originating from exterior sources, interior drainage facilities are intended to alleviate flooding that may subsequently occur from interior runoff. The determination of interior drainage facilities was conducted using the guidance from Engineer Manual 1110-2-1413 (Hydrologic Analysis of Interior Areas). The strategy outlined under this guidance follows the premise that interior flood control measures are planned and evaluated separately from the LOP, and should provide adequate drainage at least equal to that of the existing local storm drainage infrastructure during low exterior stages without the LOP in place.

Interior drainage facility planning is based on the "minimum facilities" concept. Minimum interior drainage facilities are defined as "the measures required to provide interior drainage relief such that during low exterior stages (gravity conditions), the local storm drainage system will function essentially as it did without the LOP in-place to accommodate the flows from the stormwater system design storm. Minimum facilities may also include higher storm water design standards than accommodated by the local stormwater system if these higher standards are mandated by validly promulgated Federal, state or local regulations. If, for example, a community has to modify an existing storm water system to meet current State standards, the minimum facilities for the LOP should accommodate the current standard. With the LOP in-place, interior flooding will occur when storm events exceed the minimum facility under both gravity and blocked conditions (USACE 2015).

The minimum facility plan is the starting point against which additional interior drainage facilities are compared. Because the minimum facility may be inadequate in preventing all interior flood damages (for example, when storm events exceed the minimum facility under both gravity and blocked conditions), benefits accrued from additional interior facilities are derived from the reduction in the residual flooding and damages which would have remained under the minimum facility condition. Selection of the appropriate solution must be based on maximizing project net benefits. Measures to solve residual interior flooding may include larger capacity outlets, diversion structures, pressure conduits, excavated detention storage, ponding areas, pumping plants and nonstructural solutions. For an alternative to be justified and become a component of the NED Plan, it must be implementable and reasonably maximize benefits versus the additional cost required for its construction, operation, and maintenance (USACE 2015).

For the interior drainage analyses for the Project, the area landward of the LOP was subdivided into five interior drainage areas (Areas A, B, C, D, and E as shown on Figure 2-1), separated by high ground.

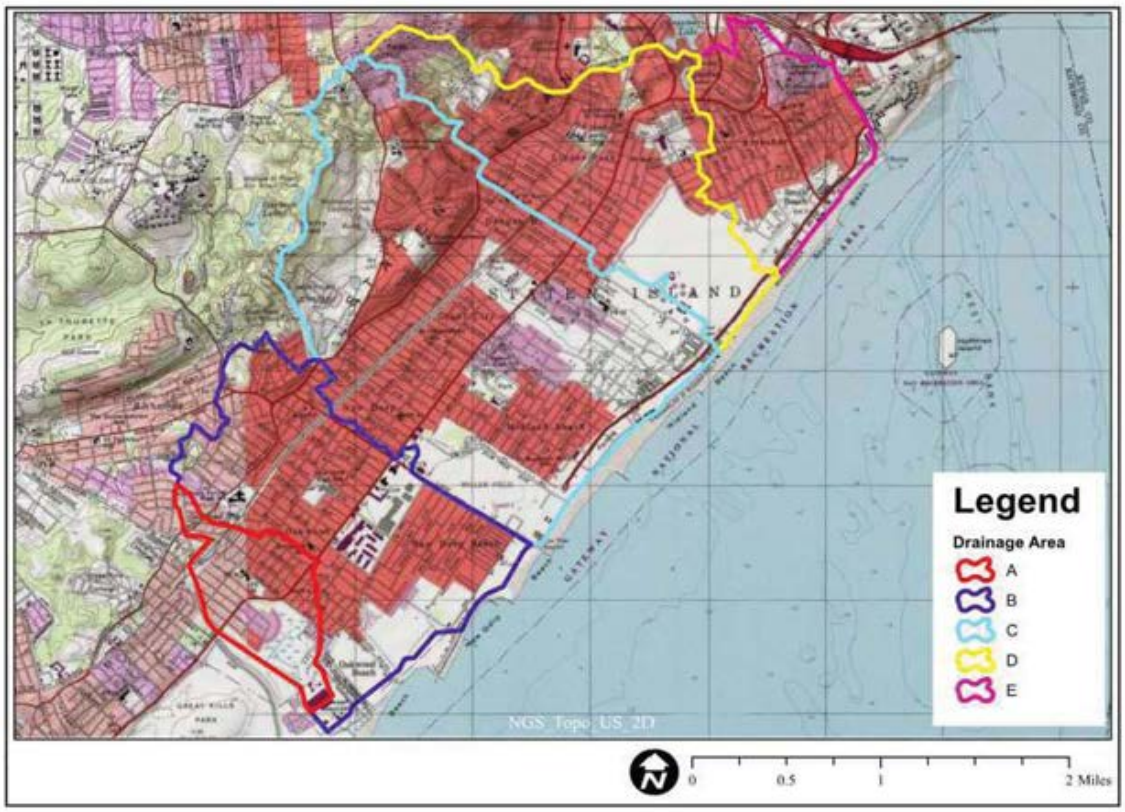


Figure 2-1. Interior Drainage Areas

Table 2-3 identifies the interior drainage alternatives that were considered for the five interior drainage areas. Following Table 2-3, a narrative for each interior drainage area discusses how these alternatives were considered by the USACE.

Table 2-3. Interior Drainage Alternatives	
Drainage Area	**List of Alternatives**
A	Minimum Facility
	DEC Conceptual Plan*
B	DEC Conceptual Plan*^
	DEC Conceptual Plan + Pond #2
	Interior Levees
C	Minimum Facility
	1500 cfs Pump Station
	900 cfs Pump Station with Two Excavated Ponds
	Non-Structural
	DEP Blue-Belt Plan (Midland Beach)*
	Seven Excavated Ponds
	Four Excavated Ponds
	Two Excavated Ponds
D	Minimum Facility
E	Minimum Facility
	DEP Blue-Belt Plan (Midland Beach)*
	1800 cfs Pump Station
	Two Excavated Ponds
	600 cfs Pump Station with Two Excavated Ponds
	Non-Structural

Source: USACE 2015
cfs—cubic feet per second
* - Also known as "Sponsor Identified Plan"
^ - Is also defined as the "Minimum Facility"

Oakwood Creek – Drainage Area A

In the case of Drainage Area A, the proposed LOP would trap a majority of the interior flooding. The minimum facility for this area consists of the 17.19 acres of currently available natural flood storage that is to be preserved by NYC in conjunction with a proposed tide gate structure with three 5-foot by 5-foot sluice gates that would allow Oakwood Creek to flow through the LOP. The gates are designed to permit backflow at low (non-damaging) exterior elevations. Ditches would be constructed along the landward side of the levees, floodwall, and buried seawall/armored levee system to direct runoff toward the creek and tide gate structure. The real estate required for Drainage Area A has been, or is slated to be, acquired (for Bluebelt purposes).

The proposed tide gate structure is a stand-alone structure supported on piles that spans the width of Oakwood Creek. The total length of the structure is approximately 22.75 feet, with a top width of approximately 16 feet and a top elevation of 18 feet NGVD29. Concrete head and wing walls would connect the structure to the earthen levee on either side. The three 5-foot x 5-foot stainless steel slide gates would be housed in the structure. These gates would be equipped with both electrical and backup manual operation to control flow.

The interior water surface elevation landward of the proposed LOP with the minimum facility is 7.1 feet NGVD29 for the 100-year storm event, which shows a reduction in interior flooding

elevations compared to the 100-year coastal storm surge stillwater elevations from the forthcoming FEMA coastal Flood Insurance Study (USACE 2015). The screening of alternatives in this area used the water surface elevation of the 2-year storm surge with 100-year rainfall condition and the 100-year storm surge with 2-year rainfall condition, whichever is more restrictive. The minimum facility described above resulted in interior water levels that were below the first level of significant damages in this drainage area and no nuisance flooding (flooding of streets or lawns), hence no further screening of additional facilities was warranted. Therefore the minimum facility was determined to be the selected interior drainage alternative for Drainage Area A (see Figure 2-2) (USACE 2015).

Source: USACE 2015

Figure 2-2. Minimum Facility Plan for Interior Drainage Area A

Oakwood to New Dorp Beach – Drainage Area B

In the case of Drainage Area B, the excess runoff is blocked by an existing dune. The proposed LOP would be located somewhat landward of the existing dune because the post-Sandy availability of acquired real-estate affords a more cost effective alignment for the buried seawall/armored levee. The realignment reduces reach length of the buried seawall by over 1,000 feet and reduces the wave heights at the LOP during a coastal storm. The new alignment, however, decreases the natural flood storage volume and therefore would cause an increase in interior flood stages compared to the existing conditions. In order to meet the minimum facility

requirement of not inducing flooding, an excavated pond (see Figure 2-3) providing 204,000 cubic yards of additional storage is required. The proposed excavation essentially offsets the storage lost by relocating the LOP landward.

The minimum facility for Drainage Area B includes a tide gate on pond to control the inflow to and outflow from the drainage area. It would be constructed to elevation 20.5 NGVD29 with the same features as the tide gate in Area A, but with slight variations in dimension. New chambers containing flap and sluice gate would also be added at the existing Ebitts Street, New Dorp Lane, and Tysens Lane outfalls. The minimum facility would also include a road raising along Mill Road to an elevation of approximately 7.1 feet NGVD29 and Kissam Avenue to an elevation of approximately 7.1 feet NGVD29. The Mill Road raising would disallow the spillover of floodwater from Drainage Area A to Drainage Area B, while the Kissam Avenue road raising would provide vehicle access to the buried seawall/armored levee during storm events (USACE 2015).

Source: USACE 2015

Figure 2-3. Minimum Facility Plan for Interior Drainage Area B

The non-Federal Sponsors have identified a plan that proposes additional excavation to create permanent ponds and wetlands within the properties identified for acquisition. The additional excavation and drainage features allow additional flow from the existing outfall to be directed to these ponding and wetland areas. The additional excavation would take place below 3 feet

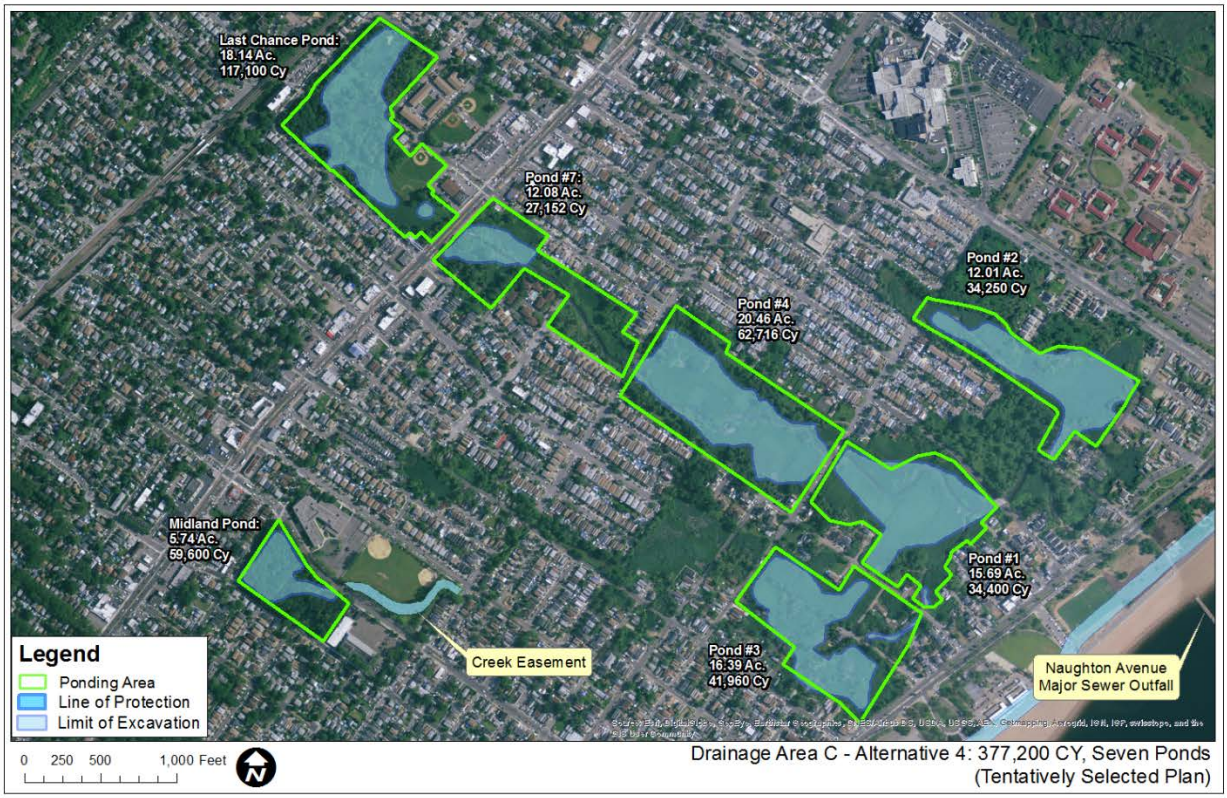
NGVD29 and thus will not provide significant effective flood storage because the excavation would be below the predicted water table. The additional excavation is a cost that does not provide relief from flood related damages. The alternative considered beyond the Minimum Facility is not cost justified based on a reduction in storm damages and therefore not included as a Project cost.

New Dorp Beach to Midland Beach – Drainage Area C

In Drainage Area C, the excess runoff is blocked by an existing barrier, formed by Father Capodanno Boulevard, which has a minimum elevation of 10.1 feet NGVD29 for this area. The minimum facility for Drainage Area C includes four new gate chambers (Greeley, Midland, Naughton and Seaview Avenues) below the proposed LOP and the acquisition and preservation of the currently available freshwater wetland areas for a total natural storage area of 120.44 acres. The proposed property acquisitions are consistent with the properties identified as part of the Bluebelt plan. A section of Seaview Avenue would be raised to an elevation of +10 feet NGVD29 in the area of Quincy Avenue to Father Capodanno Blvd to prevent potential overland flow from the adjacent interior Drainage Area D into Drainage Area C for all frequency events. Ditches or drains would be constructed along the landward side of the buried seawall/armored levee system to direct runoff toward all outlets. The water surface elevation landward of the LOP with the minimum facility is 6.36 feet for the 100-year event, which shows a reduction in interior flooding elevations, compared to the 100-year coastal storm surge stillwater elevations from the forthcoming FEMA coastal Flood Insurance Study (USACE 2015).

The screening of alternatives in this area used the water surface elevation of the 2-year storm surge with 100-year rainfall condition and the 100-year storm surge with 2-year rainfall condition, whichever is more restrictive. In addition to the minimum facility, eight alternatives were developed and analyzed with different combinations of pumps and ponds. Each alternative assumes acquisition of the same properties as the minimum facility plan. Some of the plans were eliminated from consideration based on preliminary evaluations. For instance, the evaluation of pump stations initially considered pump station sizes ranging from 600 cubic feet per second (cfs) to 1500 cfs. That analysis identified that the optimum pump station size would be 1500 cfs (USACE 2015).

Because Drainage Area C has such high annual damages with the minimum facilities, a relatively high number of alternatives were considered (see the Draft Interim Interior Drainage Appendix to USACE 2015 for additional details). An analysis indicated that the cost of the four of the most viable Alternatives range from about $17 million to $39 million. The highest net benefits in excess of costs would occur with Alternative 4, which includes seven excavated ponds located along Seaview Avenue, Father Capodanno Boulevard, Midland Avenue and Hylan Boulevard to provide 377,200 cubic yards of additional storage (USACE 2015). The proposed ponds in Drainage Area C are consistent with one of the ponds proposed for the Bluebelt Program. Figure 2-4 shows the interior drainage facilities for Alternative 4 for Drainage Area C.



Source: USACE 2015

Figure 2-4. Alternative 4 Facilities for Interior Drainage Area C

Midland Beach to South Beach – Drainage Area D

In Drainage Area D, excess runoff is blocked by an existing barrier formed by Father Capodanno Boulevard, which has a minimum elevation through the LOP of approximately 9.6 feet NGVD29 for this area. The minimum facility plan for Drainage Area D includes the replacement of one existing gate chamber (Quintard Street/Raritan Avenue) below the proposed LOP and 30.76 acres of available natural flood storage area that must be preserved by NYC Parks. The water surface elevation landward of the proposed LOP with the minimum facility is 9.78 feet NGVD29 for the 100-year event, which is slightly lower than the coastal surge elevations from the forthcoming FEMA Flood insurance Study (USACE 2015).

The minimum facility provided interior water levels that were below the first level of significant damage in this drainage area except for a small number of structures that are only impacted by very infrequent storms (i.e. storms with a return period greater than 50 years). Therefore no further screening of additional alternative facilities was warranted, and the minimum facility was determined to be the selected interior drainage alternative for Drainage Area D (see Figure 2-5) (USACE 2015).

Source: USACE 2015

Figure 2-5. Minimum Facility Plan for Interior Drainage Area D

South Beach – Drainage Area E

In Drainage Area E, excess runoff is blocked by an existing barrier formed by Father Capodanno Boulevard, which has an average elevation of 10.0 feet NGVD29 for this area. The minimum facility plan for Drainage Area E (see Figure 2-6) includes one new gate chamber at Sand Lane below the planned Line of Protection and the acquisition and preservation of 46.7 acres of available natural storage. It is assumed that this land acquisition would be accomplished with the use of flowage easements (USACE 2015). The 46.7 acres of available natural storage is all within the area to be acquired for the South Beach Bluebelt. The Bluebelt drainage plan for this area requires a new ocean outfall at McLaughlin Street.

The screening of alternatives in this area used the water surface elevation of the 2-year storm surge with 100-year rainfall condition and the 100-year storm surge with 2-year rainfall condition, whichever is more restrictive. The minimum facilities condition allowed for high level of damages in the drainage area, so a number of alternatives were examined (see the Draft Interim Interior Drainage Appendix to USACE 2015 for additional details). In addition to the minimum facility, five alternatives were developed and analyzed for Drainage Area E. These alternatives considered with different combinations of pumps, ponds and non-structural

measures. Each alternative assumes acquisition of the same properties as the minimum facility plan. Some of the plans were eliminated from consideration based on preliminary evaluations. For instance, the evaluation of the 1800 cfs pump stations was identified as having annual costs that exceed the annual damages with minimum facility and was eliminated from consideration (USACE 2015). The USACE determined that Alternative 2 (two ponds with 227,720 cubic yards of storage) was the optimum plan for Drainage Area E. Alternative 2 is similar to the Bluebelt Program for this area, with the exception that the Bluebelt Program would provide slightly more storage within a single pond. However, the USACE determined that Alternative 2 had the higher net excess benefits between the two (USACE 2015).

Source: USACE 2015

Figure 2-6. Alternative 2 Facilities for Interior Drainage Area E

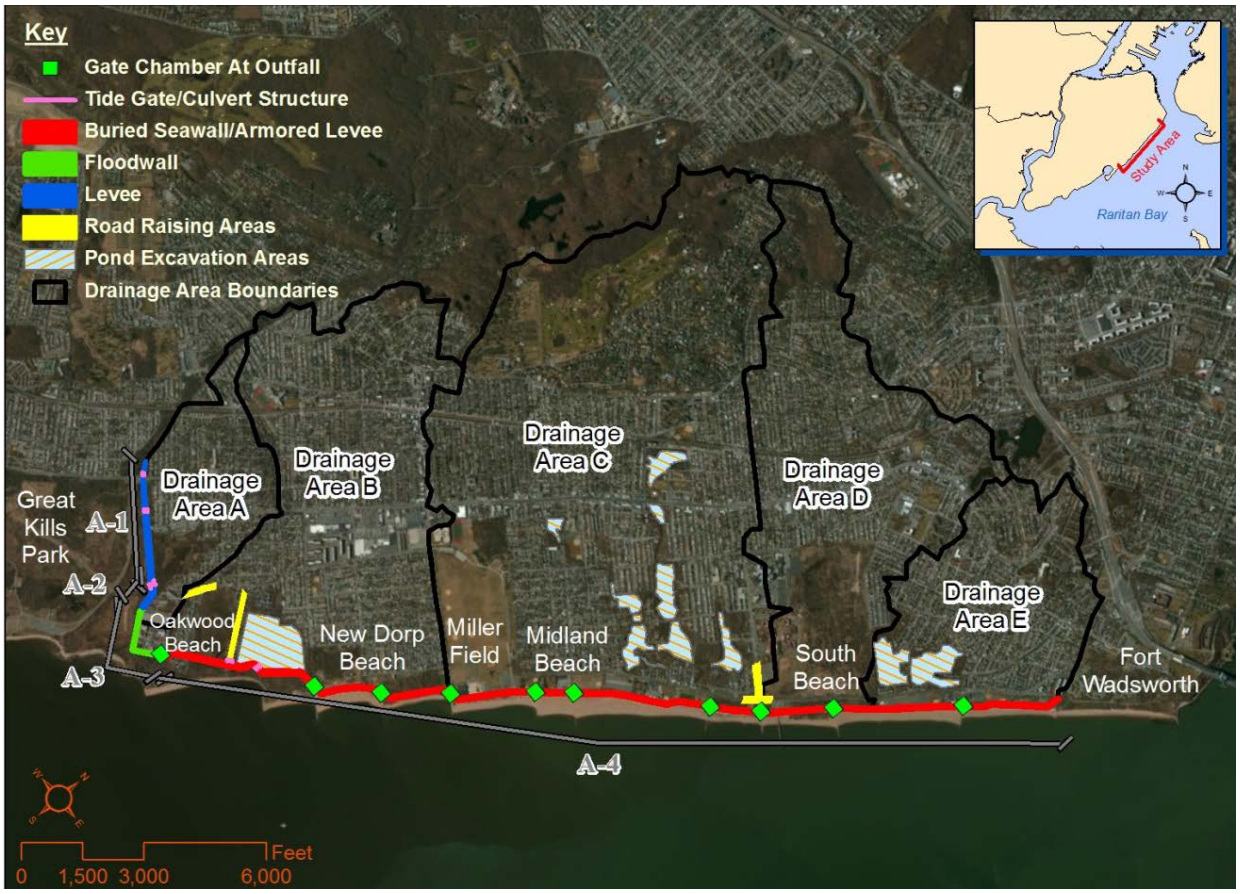
2.5 NATIONAL ECONOMIC DEVELOPMENT PLAN FOR THE SOUTH SHORE OF STATEN ISLAND COASTAL STORM RISK MANAGEMENT PROJECT

Overview

This section introduces the NED Plan for the South Shore of Staten Island Coastal Storm Risk Management Project. The NED Plan is the coastal storm risk management plan that reasonably maximizes net excess benefits and is the baseline against which other locally-preferred plans are compared. Normally, the Federal share of the NED Plan is the limit of Federal expenditures on any more costly plan. Although the NED Plan forms the basis for establishing the Federal share of a project cost, the planning process recognizes that the non-Federal partners may have additional desires for coastal storm risk management and erosion control that may differ from that provided by the NED Plan. A LPP may be recommended, but must also be technically feasible, environmentally acceptable, and economically justified to be eligible for Federal interest and cost-share funding (USACE 2015).

The NED Plan is selected based on the design level that produces the greatest Net Excess Benefits, and is the plan the USACE must recommend unless there is an overriding reason for choosing another plan. Such reasons may include local support for another Alternative, which must also be demonstrated to be economically justified. In a case where an Alternative is recommended in place of the NED Plan, the Federal Sponsor's share of the cost of construction of the LPP will be based on their share of the cost in the NED plan, with the local non-Federal Sponsors contributing the balance.

The NED Plan is based on feasibility-level design information, which represents the best available information for analyzing potential environmental impacts in this EIS. The Plans and Specifications Phase of design would be conducted once the Feasibility Report is approved. The Plans and Specifications Phase of design will be based on 100 percent design, which will be coordinated with the non-Federal sponsor and local stakeholders. Additionally, the 100 percent design (including the closure structure) will undergo Value Engineering. The NED Plan incorporates the optimum design height for the Tentatively Selected LOP Plan and Tentatively Selected Interior Drainage Plan. The NED Plan meets the needs of *The Disaster Relief Appropriations Act of 2013* (Public Law 113-2). Figure 2-7 provides an overview of the NED Plan.



Source: USACE 2015

Figure 2-7. NED Plan Overview

2.5.1 Line of Protection

As described below, the NED Plan includes a LOP that would consist of a buried seawall/armored levee along a majority of the reach (approximately 80%) serving as the first line of defense against severe coastal surge flooding and wave forces. The remainder of the LOP would consist of a T-Type vertical floodwall, and levee. The LOP would also include a stoplog closure structure at Hylan Boulevard, drainage control structures for existing stormwater outfalls, tide gate structures, vehicle and pedestrian access structures, and demolition of the existing boardwalk. The LOP would be split into four reaches as follows:

- Reach A-1: Earthen Levee; 2,800 feet in length; crest elevation 18 feet NGVD29;
- Reach A-2: Earthen Levee; 600 feet in length; crest elevation 18 feet NGVD29;
- Reach A-3: Vertical Floodwall; 1,800 feet in length; crest elevation 20.5 feet NGVD29;
- Reach A-4: Buried Seawall; 22,700 feet in length; crest elevation 20.5 feet NGVD29 (USACE 2015).

Figure 2-8 provides an overview of the LOP. More detailed figures for the overall Project area are contained in Chapter 3. Detailed plan view drawings are available in Appendix A.

Source: USACE 2015

Figure 2-8. Overview of Line of Protection

Starting in Oakwood Beach in Reach A-1, the levee would tie in to high ground on the landward side of Hylan Boulevard. A stoplog structure, which would only need to be closed across the road during severe storm events, is proposed at Hylan Boulevard. The levee would continue east from Hylan Boulevard through Oakwood Beach parallel to Buffalo Street until the LOP would cross over Oakwood Creek. A tide gate structure is proposed at this location. The total length of Reach A-1 would be 2,800 feet (USACE 2015). As part of the integrated approach for the Oakwood Beach area, the NED Plan has been designed to improve the functionality of the tidal wetlands (see Section 4.3.2 of this EIS). Reach A-2, which would also be a levee, would begin on the eastern side of Oakwood Creek and extend approximately 600 feet to the Oakwood Beach WWTP (USACE 2015).

In Reach A-3, the LOP would transition to a vertical floodwall surrounding two sides of the Oakwood Beach WWTP. The total length of Reach A-3 would be 1,800 feet (USACE 2015). The WWTP is currently subject to interior flooding when storm elevations reach the micro-strainer building at 10.6 NAVD. During Hurricane Sandy, storm surge elevations were reported as 13.1 NAVD near the WWTP. The NED LOP is designed to manage flooding from storm surges up to 14.5 NAVD. The buried seawalls, levees and floodwalls will reduce the probability of flooding (under current sea level conditions) from approximately 5% per year to below 0.4% per year. Areas behind the LOP may sometimes be flooded from interior runoff, seepage or other sources of inflow. Because the WWTP is at a higher elevation than adjacent areas, runoff is directed away from the WWTP and will pond in the lower lying areas when high stages block the stormwater outfalls. At the WWTP, an additional source of flooding is overflow from the

wastewater process during high storm tides. The solution to address the overflow of the wastewater under high surge conditions would be the construction of an effluent pump. The USACE has evaluated the vulnerability of the WWTP, and the storm damages that would remain with the LOP in-place. The USACE has determined that the construction of an effluent pump to maintain discharge capacity against storm flood elevations for purposes of storm damage reduction would not be incrementally supported, based upon the cost of the pump and the reduced damages to the WWTP. It is recognized that an effluent pump would provide additional benefits beyond what the USACE can consider for storm damage reduction benefits, and that the construction of an effluent pump, if constructed by others, would complement the NED Plan.

Reach A-4 would extend 22,700 feet from Oakwood Beach to Fort Wadsworth. In previous alternatives, Reach 4 consisted of a mixture of exposed armor stone revetments, buried seawalls, and vertical steel sheet pile flood walls. The structure was revised to a continuous buried seawall. The alignment of the buried seawall through Oakwood Beach deviates from previously developed alternatives, extending across a portion of the Fox Beach neighborhood that is being environmental restored as part of the Bluebelt Plan. The alignment continues across the marshes of Oakwood Beach and past Kissam Ave. The alignment in this marshy area is landward of New York City's sanitary sewer trunk line to the WWTP. A service road is proposed along the seaward edge of the buried seawall to facilitate access to the trunk line. A bend in the alignment occurs at the eastern end of Oakwood Beach to accommodate a second proposed tide gate structure. From Midland Beach to Fort Wadsworth the alignment would generally follow the footprint of the existing promenade and FDR Boardwalk. There are a few exceptions (most noticeable at the eastern end of the Project area where the beach narrows) where the alignment would shift landward to maintain a protective buffer between the shoreline and LOP. The LOP would tie in to high ground at Fort Wadsworth (USACE 2015).

Miller Field Sub-alternatives. At Miller Field, the NED Plan for the buried seawall follows the alignment of the existing sand dunes on the landward edge of the beach berm and seaward of existing Miller Army Air Field Historic District (which consists largely of the Double Seaplane Hangar- Building #38). This alignment was selected to minimize the buried seawall footprint and crest height and impacts to the historic district. The buried seawall would be located landward of the active littoral zone and would be covered with sand and planted with native dune grasses to mimic the appearance of existing dunes. In the analysis of the impacts at Miller Field, this is referred to as the "NED Plan (Seaward)." Additionally, if the NED Plan (Seaward) is constructed, the recently constructed multi-use path at Miller Field would be impacted and the USACE would provide a functional equivalent pathway (in the form of a promenade on top of the buried sea wall or a promenade at ground level behind the buried seawall). This EIS discusses any notable environmental differences between these two promenade locations.

During consultation, the NPS identified the following concerns/issues with the proposed NED Plan alignment at Miller Field:

- Removal of the World War II era fire tower;
- Impacts to character and setting of the Historic District;
- Reduction in park user's viewshed and use of the beach;

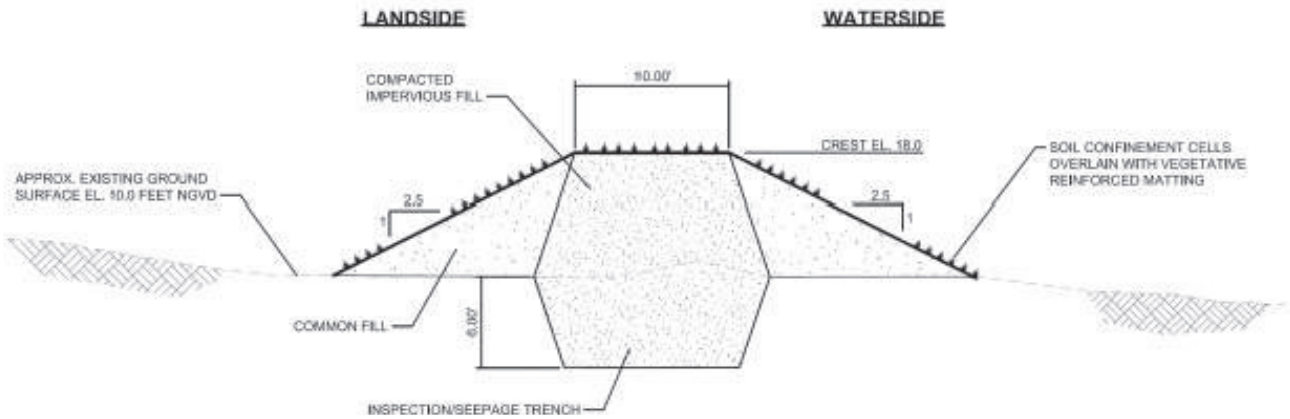
- Loss of beach habitat for birds and other biota.

In response to NPS concerns and ideas, the USACE developed two sub-alternative alignments for the buried seawall at Miller Field, and this EIS analyzes the environmental differences among the NED Plan (Seaward) and these two sub-alternatives. The alignment of Sub-alternative 1 would be 70 feet landward (west) of Hangar 38 and would avoid impacts to the fire tower, the existing dunes, and habitats supported by the existing dunes. However, this landward alignment could impact some recreational resources (ball fields and a trail) at Miller Field. In the analysis of the impacts at Miller Field, this is referred to as "Sub-alternative 1 (Landward)."

The alignment of Sub-alternative 2 would be through the east bay of Hangar 38 (seaward hangar), and would also avoid impacts to the fire tower and existing dunes. The outside façades and roof slabs of the east bay hangar would be removed to expose the structural framing and truss members. Sub-alternative 2 is intended to accommodate the buried seawall yet maintain some sense of the historic hangar (Moffatt and Nichol 2015). In the analysis of the impacts at Miller Field, this is referred to as "Sub-alternative 2 (Through)." Appendix A contains the plan sheets for the sub-alternatives.

Levee

The levee proposed for Reach A-1 and Reach A-2 would tie in the LOP to high ground. The levee would have a crest elevation of 18 feet NGVD29. The levee would consist of compacted impervious fill that would extend a minimum of 6 feet below the existing ground surface to prevent seepage. Common fill would be placed at a 2.5:1 (H:V) slope (e.g., a height of 2.5 for every 1 of vertical) to stabilize the core and provide a solid basis for vegetation. The proposed design would have a crest width of 10-feet; however, the A-2 levee section to the east of the proposed tide gate structure would be increased to 15-foot wide to permit maintenance vehicle access to the tide gates. Figure 2-9 presents a typical section of the levee in Reach A-1 and Reach A-2 (USACE 2015).



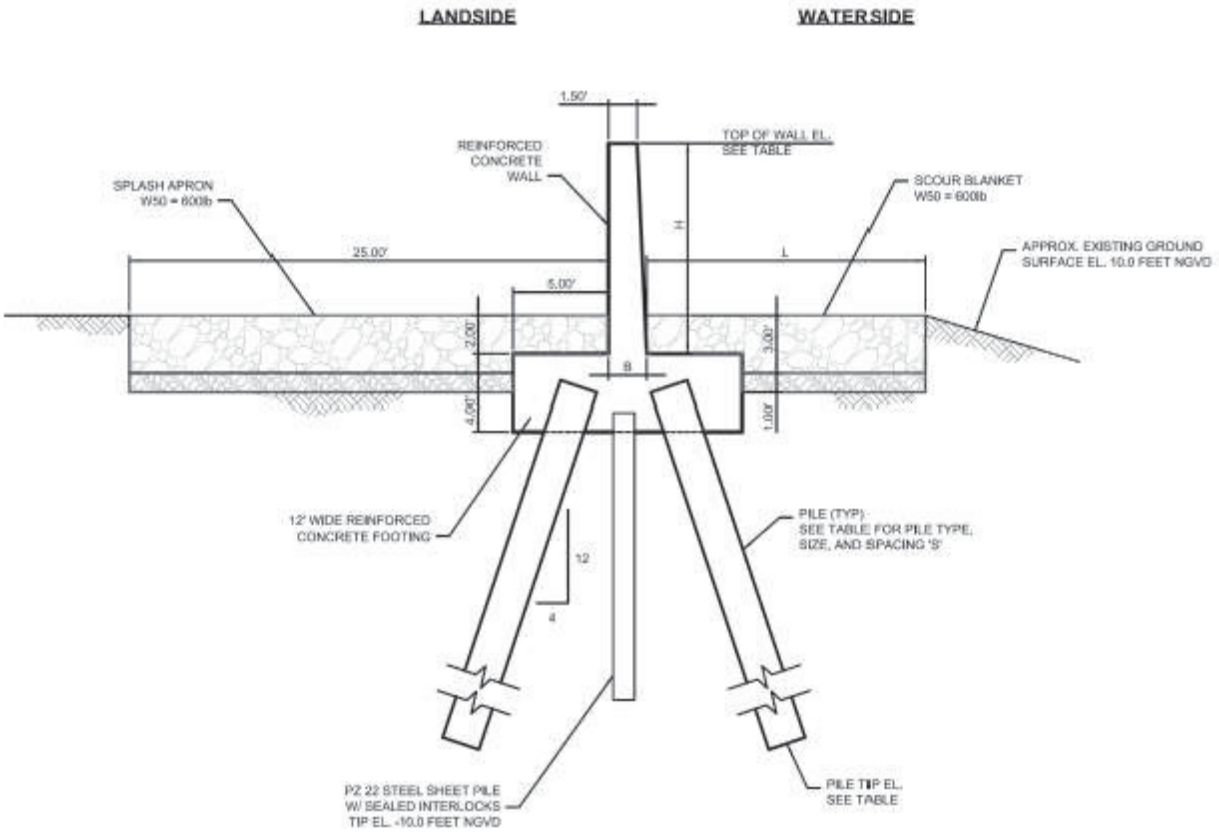
Source: USACE 2015

Figure 2-9. Typical Section of Levee in Reach A-1 and Reach A-2.

Floodwall

A reinforced concrete floodwall would be used for Reach A-3 where a reduced footprint would be necessary to minimize impacts to the Oakwood Beach WWTP. The floodwall design would consist of a pile-supported T-wall with a top wall elevation of 20.5 feet NGVD29 (USACE 2015).

The floodwall footing would be designed to accommodate localized jet scour by defining a 3-foot thick base that would be set 2 feet below grade. In addition, a rock blanket would extend 15 feet on the seaward side of the floodwall to address wave scour, and a rock splash apron would extend 25 feet landward from the concrete footing to provide adequate overtopping jet scour protection. A vertical steel sheet pile wall would be included beneath the wall to prevent seepage below the footing. Figure 2-10 presents a typical section of the floodwall for Reach A-3 (USACE 2015).



Source: USACE 2015

Figure 2-10. Typical Section of Floodwall in Reach A-3.

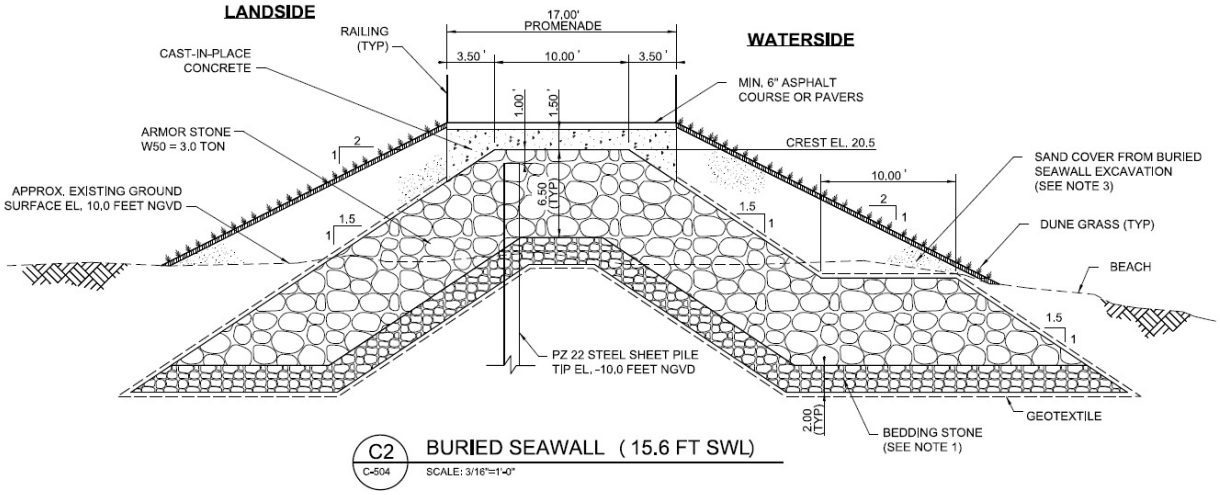
Buried Seawall

A buried seawall would be used for Reach A-4, which spans the majority of the LOP from Fort Wadsworth to Oakwood Beach. The crest elevation of the buried seawall would be 20.5 feet NGVD29. The buried seawall would be located on the existing dune system or landward of the existing dune system. No components or elements of the project would be located or would

be constructed seaward of the existing dune system. The buried seawall would consist of a trapezoidal-shaped core structure with a 10-foot wide crest and a side slope of 1.5 H:V. The core would be constructed with two-stone thickness armor stone and bedding stone layers. A 10-foot wide scour apron would be incorporated into the seaside structure toe. The entire core structure would be covered with backfill, with compacted fill placed on the seaward face and landward face to support grass and other native beach vegetation. Geotextile fabric would be placed underneath the bedding layer to reduce settlement, and around the core structure to minimize loss of fill through the voids. The backfill would be placed on 2:1 (H:V) side slopes with dune grass plantings to provide additional stabilization of the seaward face during less intense storm events. A vertical steel sheet pile wall would be installed in the interior of the structure to prevent seepage (USACE 2015).

The buried seawall would incorporate a promenade, replacing the continuous at-grade paved and pile-supported promenade from Miller Field to Oakwood Beach. Roller compacted concrete would be constructed atop the crest to create a 17-foot wide paved promenade. From Miller Field to Fort Wadsworth, the buried seawall would provide for a 38-foot width boardwalk atop the proposed seawall. The boardwalk would be a functional equivalent to the existing boardwalk. Public access points are provided as discussed under "Pedestrian and Vehicular Access" below.

Figure 2-11 presents a typical section of the buried seawall for Reach A-4 (USACE 2015).



Source: USACE 2015

Figure 2-11. Typical Section of Buried Seawall in Reach A-4.

Stoplog Structure

At Hylan Boulevard, a stoplog closure gate closure structure would be used to close the roadway as needed to prevent flooding from severe storm events. The structure, which would be

approximately 106 feet long and 4 to 4.5 feet high, would be supported by a concrete foundation (consisting of a series of footings located within the roadway adjacent to each lane of traffic, along with footings located in the center median and each side of the Hylan Boulevard). During a flood event, removable posts would be installed within the roadway and the stoplogs would be installed within the frame/guide. Nine spans would allow the stoplog structure to be staged and tested, precluding a full closure of Hylan Boulevard prior to actual use (USACE 2015).

Based on a feasibility-level design, the stoplog closure structure maximized the average annual net benefits, and has been included in the NED Plan. However, during the Plans and Specifications Phase conducted once the Feasibility Report is approved, design refinements will be conducted for all plan elements based on tasks such as new topographic surveys, utility survey and geotechnical data. These surveys/analyses will allow the USACE to more definitely determine what the appropriate closure structure will be recommended for construction. The Plans and Specifications Phase of design will be based on 100 percent design, which will be coordinated with the non-Federal sponsor and local stakeholders. Additionally, the 100 percent design (including the closure structure) will undergo Value Engineering. During this required review, an alternate closure structure may be identified and incorporated into the final design.

Tide Gates and Stormwater Outfalls

Existing stormwater outfalls, consisting of single and double concrete box culverts, would pass beneath the Buried Seawall at nine locations. At these locations, the sheet pile seepage wall would terminate at either side of the existing culverts and the buried seawall rock structure would be constructed around the culverts and proposed drainage outfall control structures (USACE 2015).

Tide gate structures with reinforced concrete wing walls are proposed at two locations along the LOP in the vicinity of Oakwood Beach. Aside from increases in wall height and thickness, the basic design of the proposed tide gate structures would be consistent with the design of the existing tide gate structure located to the east of the Oakwood Beach WWTP. The tide gate structures would not be designed for vehicular loading (USACE 2015).

Pedestrian and Vehicular Access

Three types of access points would be provided along the LOP: maintenance vehicle access, combined truck and pedestrian access, and pedestrian access. Maintenance vehicle access would be provided at one location on Reach A-2 and at four locations along Reach A-4 (between New Dorp Beach and Oakwood Beach) to provide vehicular access to the tide gate and stormwater outfall structures. Earthen ramps are proposed to provide vehicular access to the tide gate and stormwater outfall structures. These ramp sections would be designed to allow maintenance vehicles to access the sluice gates in the drainage structures from above (USACE 2015).

An additional nine earthen ramps are proposed between Oakwood Beach and South Beach. These ramps would be designed for both pedestrian and vehicular access and meet the 1:12 maximum slope required by *Americans with Disabilities Act* (ADA) guidelines. The ramps would be strategically located to provide beach access from existing roads and access paths. Pedestrian access points, spaced approximately every 500 feet, would be located along the

Buried Seawall between Midland Beach and South Beach. Each access point would be comprised of 10-foot wide reinforced concrete stairs on both the landward and seaward sides of the buried seawall to provide access to the promenade and the beach (USACE 2015).

The buried seawall crest elevation would exceed the existing deck elevation for the Ocean Breeze fishing pier. The pier segments nearest to the promenade would need to be reconstructed to ramp up to the promenade at a 1:12 maximum slope required by ADA guidelines (USACE 2015).

Fill Material

Fill material for the seawall cover would come from excavations of the seawall foundation. Fill material for the levee would be brought in from outside the Project area. The estimated fill quantity is 230,000 cubic yards. Appendix B provides additional information related to fill requirements associated with the NED Plan.

2.5.2 Interior Flood Control

This section provides a brief description of the NED Plan for Interior Flood Control associated with the proposed LOP for Fort Wadsworth to Oakwood Beach. The NED Plan for Interior Flood Control is consistent with, and complements, the proposed project described in the Bluebelt GEIS, which the NYCDEP completed on November 4, 2013.

The NED Plan for Interior Flood Control consists of minimum facility plans and the alternatives described in Section 2.4.4 which would result in the highest net excess benefits. The interior drainage areas would include tide gates, sluice gates, stormwater outfall structures, road raisings, and excavated ponds. The tide gates, sluice gates, and outfall chambers are part of the LOP design described in Section 2.5.1. As described in Section 2.4.4, and shown in Figure 2-12, the NED Plan for interior flood control is divided into five drainage areas. The interior drainage measures utilized in each of drainage areas include:

Drainage Area A: Minimum Facility

Natural Storage: 17.19 acres
Tide Gate
- Length: 22.75 feet along levee alignment
- Height: 18 feet NGVD29 crest elevation
- Width: 16 feet wide
- Features: 3 @ 5-foot by 5-foot sluice gates, wingwalls, pre-engineered bridge on top of the tide gate

Drainage Area B: Minimum Facility

Natural Storage: 81.23 acres
Excavated Pond: 1 Pond
- Volume: 204,000 cubic yards
- Area: 40.7 acres
- Invert: 2.5 feet and 2.65 feet NGVD29

Tide Gate

Length:	22.75 feet along levee alignment
Height:	20.5 feet NGVD29 crest elevation
Width:	16 feet wide
Features:	3 @ 5-foot by 5-foot sluice gates, wingwalls, pre-engineered bridge on top of the tide gate
Road Raising	Kissam Ave. to 7.1 feet NGVD29, Mill Rd. to 7.1 feet NGVD29
Length:	1,730 linear feet @ Kissam Avenue & 630 linear feet @ Mill Road
Width:	30 feet @ Kissam Avenue & 60 feet @ Mill Road
Height:	3 feet @ Kissam Avenue & 1 foot @ Mill Road
Outlets:	Ebbits Street, New Dorp Lane, Tysens Lane Gate Chambers

Drainage Area C: Alternative 4

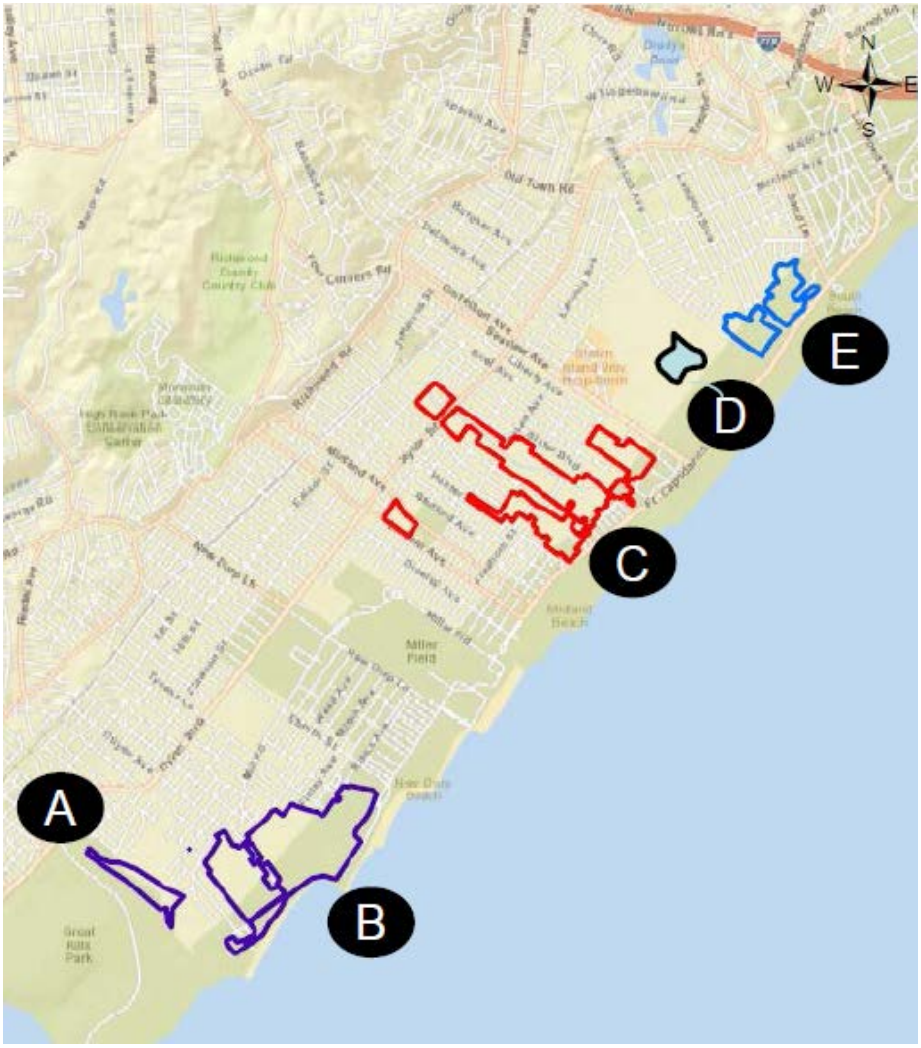
Natural Storage:	120.44 acres
Excavated Ponds:	7 Ponds
Volume:	377,200 cubic yards
Area:	42.2 acres
Invert:	2 feet NGVD29
Road Raising	Seaview Ave. & Father Capodanno Blvd. to 10 ft. NGVD29
Length:	820 linear feet @ Seaview Ave & 300 linear feet @ Father Capodanno Blvd.
Width:	90 feet @ Seaview Ave & 60 feet @ Father Capodanno Blvd.
Avg. Height:	1 foot for both
Outlets:	Greely Avenue, Midland Avenue, Naughton Avenue, Seaview Avenue Gate Chambers

Drainage Area D: Minimum Facility

Natural Storage:	30.76 acres
Outlets:	Quintard Street Gate Chamber

Drainage Area E: Alternative 2

Natural Storage:	46.7 acres
Excavated Ponds:	2 Ponds
Volume:	222,720 cubic yards
Area:	34.0 acres
Invert:	2 feet NGVD29
Outlets:	Sand Lane Gate Chamber, Quincy Ave. Chamber (USACE 2015).



Source: USACE 2015

Figure 2-12. NED Plan for Interior Flood Control

Ponds

Drainage Areas B, C, and E include ponds excavated to at least 2 feet NGVD29. The proposed side slopes would be 2.5:1 or 3:1, and the maximum depth would be established by setting the pond bottom elevation to 2 feet NGVD29, which is near the approximate groundwater elevation. However, the final configuration of the ponds would not be fully established until the field work (soil borings and topographic/utility survey) has been completed. The final location, area, volume, and configuration of these ponds would be established within the minimum facility footprint after field data (i.e. topographical survey and boring data) is acquired. Details on the pond locations and specifications are shown on the Draft Interim Interior Drainage Appendix to USACE 2015.

Road Raisings

Seaview Avenue, Mill Road and Kissam Avenue would be raised to control the spillover of interior stormwater collections between adjacent drainage areas. The road raising along Mill Road and Kissam Avenue would be implemented as part of the NED Plan for Drainage Area B, and the road raising along Seaview Avenue as part of the NED Plan for Drainage Area C. Specific locations of road raisings are identified in the Draft Interim Interior Drainage Appendix to USACE 2015.

In summary, some residual street flooding would still occur during a 100-year storm event in low-lying areas under all selected interior drainage alternatives in the Project area. All interior drainage structures would be located within or adjacent to the natural flood storage areas, which are mostly freshwater wetlands (USACE 2015).

2.6 IMPACT AVOIDANCE AND MINIMIZATION

The USACE would implement BMPs in the design, construction, and operation of the NED Plan to avoid and minimize environmental impacts to the extent practicable. However, as discussed in Section 4.20, some impacts are unavoidable. For example, the NED Plan would have unavoidable adverse impacts to cultural resources, vegetation, trees, and some wildlife habitats. These impacts are directly related to the specific locations for the proposed LOP and ponds, which need to be sited along the coast and stream channels within the watershed, and sized according to the drainage area in order to achieve the stormwater management and flood reduction objectives of the NED Plan. Throughout Chapter 4, measures that would be taken to avoid and minimize impacts are discussed, as appropriate, for each resource.

2.7 RELATIONSHIP BETWEEN THIS EIS AND THE NYCDEP BLUEBELT GEIS

Both this EIS and the Bluebelt GEIS evaluate interior flood control plans for the south shore of Staten Island. While there are both similarities and differences in these plans, the plans are nonetheless consistent and complementary. For example, in this EIS, the excavated pond proposed for Drainage Area B generally corresponds, in location, to "BMP OB-2" proposed for Oakwood Beach, as described in Chapter 3.1 of the Bluebelt GEIS. As an example of a difference, in the Bluebelt GEIS, NYCDEP proposed and analyzed additional excavation at Oakwood Beach which the USACE considered, but decided not to analyze in this EIS because it would "not provide significant effective flood storage." The fact that there are differences between the two plans and the two documents is largely a function of differences in the statutory mission of the USACE and NYCDEP, as well as differences in regulatory requirements.

Table 2-4 presents the current overlap between the Bluebelt and USACE interior drainage areas and features. As shown in that table, the locations of all the proposed ponds generally correspond to Bluebelt BMPs except for one. The one exception is the water body labeled Pond #3 on Figure 2-4. In the Bluebelt plan, that pond is divided into two: BMPs NC-9 and NC-10. BMP NC-10 has its own new outfall into the Raritan Bay.

Table 2-4. Overlap of USACE and Bluebelt Interior Drainage Areas and Features			
USACE Drainage Area	**USACE Designation**	**Bluebelt Watershed**	**Bluebelt Designation**
A	Natural Flood Storage	Oakwood Beach	BMP OB-3
B	Drainage Area B Pond	Oakwood Beach	BMP OB-2
C	Pond #1	Oakwood Beach	BMP NC-17
C	Pond #2	New Creek	BMP NC-18
C	Pond #3	New Creek	BMP NC-9, NC-10
C	Pond #4	New Creek	BMP NC-16
C	Last Chance Pond	New Creek	BMP NC-11
C	Midland Pond	New Creek	BMP NC-6
C	Pond #7	New Creek	BMP NC-13
E	One of two ponds	South Beach	BMP SBE-1A
E	One of two ponds	South Beach	BMP SBE-1B

3.0 AFFECTED ENVIRONMENT

In accordance with the Council on Environmental Quality regulations, the affected environment is "interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14). Descriptions of the affected environment provide a comparison for understanding the potential direct, indirect, and cumulative impacts of the National Economic Development (NED) Plan and the No-Action Alternative (Chapter 4). The level of detail for the affected environment discussions varies with each resource based on the likelihood of a potential impact and to ensure inclusion of relevant issues. For some resources (such as Geology, Topography, and Soils [Section 3.1]), an overview of the affected environment is presented, followed by a more detailed description of the areas identified in Figure 3-1). As shown in Figure 3-1, those three areas are:

- Oakwood Beach, which is comprised of Drainage Areas A and B;
- New Creek, which is comprised of Drainage Area C; and
- South Beach, which is comprised of Drainage Areas D and E.

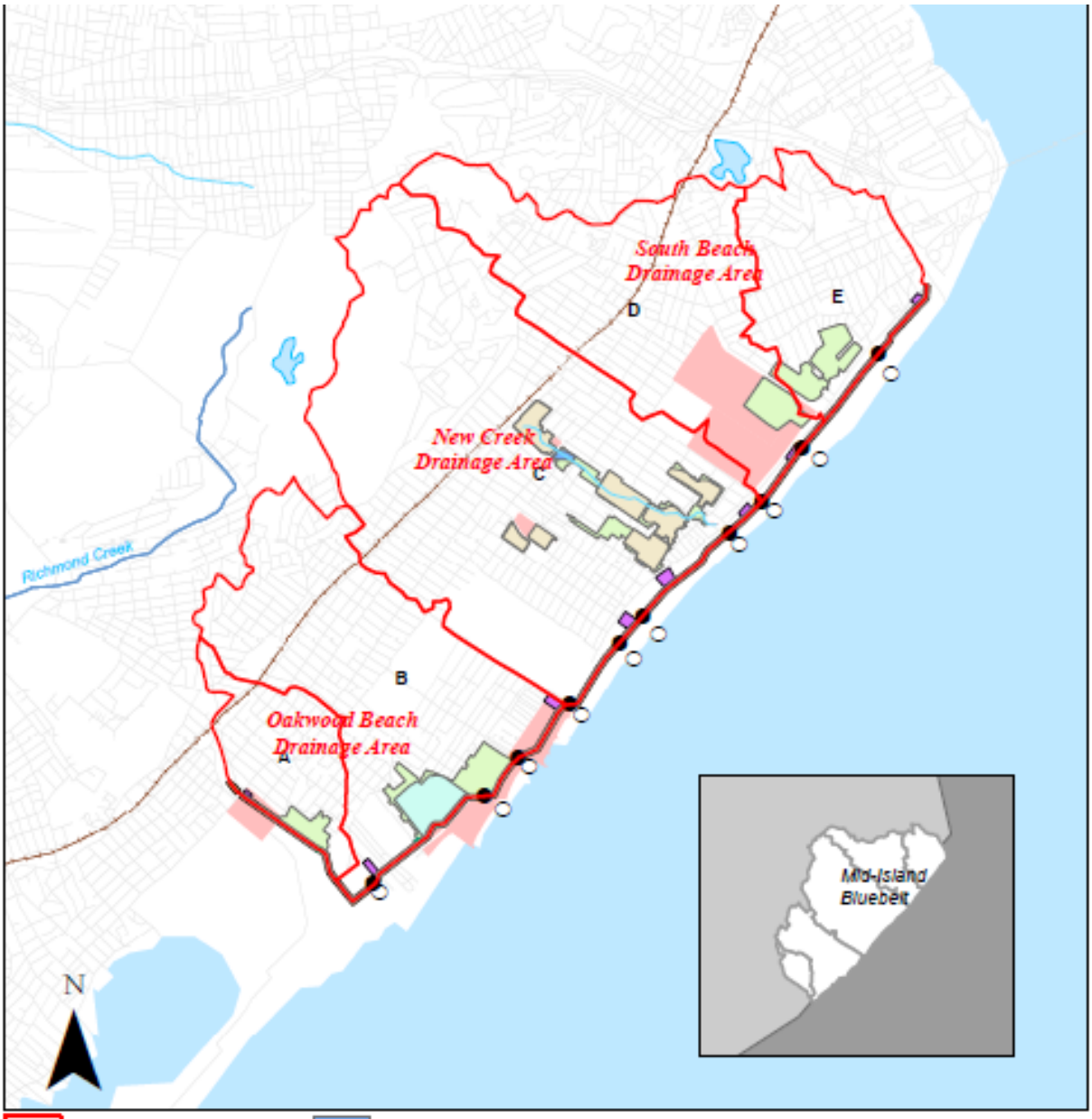
This approach provides a greater level of detail for the overall Project area. For other resources, the description of the affected environment can be adequately presented for the overall Project area (see, for example, Socioeconomics and Environmental Justice [Section 3.6]).

3.1 GEOLOGY, TOPOGRAPHY, AND SOILS

Overview. The overall Project area lies within the Atlantic Coastal Plain Province. This region is characterized by low topographic relief and extends along the eastern margin of the United States. The topography of the Project area is nearly level with elevations ranging from sea level to almost 100 feet above sea level (USACE 2015).

There are four types of bedrock existing within or adjacent to the Project area. The predominant and oldest bedrock unit is serpentinite and consists of the serpentine minerals antigorite, chrysotile, and lizardite. The remaining three types of bedrock include the Stockton Formation consisting of sandstones and arkoses; the Lockatong Formation consisting of siltstones and shales; and the Passaic Formation consisting of shale, siltstone, sandstone, and conglomerate (Benimoff and Ohan 2003). The surficial deposits within the Project area consist primarily of glacial outwash deposits from the most recent (Wisconsin) glaciations (Benimoff and Ohan 2003).

The main soil type within the Project area consists of Beaches. The Beaches unit is composed of very deep to deep bedrock and poorly drained areas adjacent to the Atlantic Ocean. Beaches are not considered a true soil because they typically do not support vegetation, and are constantly reworked by wave and wind action (U.S. Department of Agriculture, Natural Resources Conservation Service [USDA/NRCS] 2014).



Source: NYCDEP 2013

Figure 3-1. Oakwood Beach, New Creek, and South Beach Areas

These sands contain abundant magnetite and comparatively little garnet (Northern Ecological Associates, Inc. [NEA] 2002). The general characteristics of these sands are very different from other sands in the region. These sands are less rounded and poorly sorted, and contain abundant feldspar and rock fragments suggesting that the materials were derived mostly from the rivers draining the Newark Basin region (i.e., the Passaic, Hackensack, and Raritan rivers) (NEA 2002).

According to the USGS topographic map, slopes generally range from 0 to 10 percent within Richmond County. The topography is generally flat, though the elevation varies slightly in the central part of the county. According to the USDA/NRCS New York City Reconnaissance Soil Survey, there are no prime farmlands or farmlands of statewide importance in the Project area (NYSHCR 2013). The beach unit in the Project area is likely to contain heavy mineral sands common to the south shore of Staten Island.

Oakwood Beach (Drainage Areas A and B). The Oakwood Beach area is generally bounded by NYC's Great Kills Park in the Gateway NRA to the west; by Cotter Avenue to the north; by New Dorp Lane to the east; and by the Lower Bay to the south (see Figure 3-2). The area covers approximately 1,329 acres. The topography of the area conveys stormwater flows from the northeast to the southwest and ultimately to the Lower Bay via three stream branches. The West Branch originates along the Willowbrook Parkway in the hillier upper watershed and flows south into Great Kills Park, where a stream channel and storm sewer converge. This channel flows east and then south to eventually reach the Lower Bay below the Oakwood Beach WWTP (NYCDEP 2013).

Another drainage system is the East Branch, which begins in Great Kills Park. This stream flows south and west to a tide gate that is situated immediately south of the Oakwood Beach WWTP. Lastly, there is a smaller branch in the center of the watershed draining a wide channel that originates at Hylan Boulevard. This man-made channel runs along the mapped but unbuilt bed of Adelaide Avenue before turning west into the unbuilt bed of Falcon Avenue. This stream then turns south to connect with the West Branch near the WWTP. Much of the lower area is at a very low elevation—within five feet or less of sea level. This low-lying area is primarily in the vicinity of Mill Road, Fox Lane, Kissam Avenue, and the adjacent streets (NYCDEP 2013).

New Creek (Drainage Area C). The New Creek area is located northeast and adjacent to the Oakwood Beach area. The New Creek area is generally bounded by Miller Field and New Dorp Lane to the west, the northern boundary extends through and incorporates portions of the Richmond County Country Club, parallels Ocean Terrace, and extends eastward across Reeds Basket Willow Swamp Park. Seaview and Burgher Avenues generally form the eastern boundary and the Lower Bay is the southern boundary (see Figure 3-3). The New Creek area occupies about 2,248 acres (NYCDEP 2013).

The inland area's higher elevations, rolling topography, steep slopes, woodlands and freshwater ponds contrast sharply with the flat relief and common reed-dominated marshes of the lower watershed (below Hylan Boulevard) which are just above sea level. The inland area is characterized by the steep topography of the Staten Island terminal moraine. Thus, it does not

Note: "Proposed BMP Site" and "Proposed Lower Bay Outfall" refer to the Bluebelt GEIS. Additionally, NYCDEP is no longer planning to build BMP OB-1 because the neighborhood it would have served is being bought out and emptied.
Source: NYCDEP 2013.

Figure 3-2. Oakwood Beach Area (Drainage Areas A and B)

Note: "Proposed BMP Site" and "Proposed Lower Bay Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-3. New Creek Area (Drainage Area C)

suffer as much from street or property flooding, but the steep-sloped hillsides do create high stream velocities and erosion. Streams in the inland part of the watershed extend as open water courses across and out from open spaces such as St. Francis Seminary and Reeds Basket Willow Swamp Park, but become piped once they enter the lower area (generally at either Richmond Road or Hylan Boulevard). Approximately 750 acres of the lower area drains directly into the three streams channels: the Main Channel which originates at Last Chance Pond; the West Branch which originates at the Boundary Avenue wetlands; and the East Branch which originates at the southern end of Dongan Hills Avenue. There are several miles of stream channels that meander between streets and homes, which is one cause of local flooding due to undersized and sediment laden channels. The balance of the lower area is served by storm sewers that drain to the main trunk sewers and ultimately to the Lower Bay via tide-gate controlled outfalls (NYCDEP 2013).

South Beach (Drainage Areas D and E). The South Beach area is the easternmost of the three areas. It is east of and adjacent to the New Creek area and is generally bounded by Medford, Fingerboard, Narrows Roads, and the Staten Island Expressway to the north, Fort Wadsworth to the east, Burgher and Seaview Avenues to the west, and Lower Bay to the south (see Figure 3-4). The area covers about 1,267 acres. The topography of the watershed causes stormwater to flow from north to south. The inland topography is characterized by Staten Island's terminal moraine, with elevations well over 100 feet above sea level. There are no remaining open stream corridors in the inland part of the watershed, though remnant channels exist in a few locations. Existing surface water features of the upper area are Brady's Pond and Cameron's Lake. Brady's Pond is privately owned while Cameron's Lake is NYCDEP Bluebelt property. Also in the upper area is Whitney Woods, which is a small, wooded site, located west of Cameron's Lake, where stormwater collects. The lower area is generally flat and at very low elevation—within five feet or less of sea level (NYCDEP 2013).

3.2 WATER RESOURCES

This section provides a description of the regional hydrology and groundwater resources, surface water, and tidal influences and floodplains in the Project area.

3.2.1 Regional Hydrogeology and Groundwater Resources

The Project area is located directly above the Northern Atlantic Coastal Plain (NACP) aquifer system, which consists of the Magothy aquifer and the underlying Lloyd aquifer. The two aquifers are separated by the Raritan confining unit (clay) and consist primarily of sand with gravel being more prevalent in the Magothy aquifer (USEPA 2014a).

The primary source of available groundwater extraction in the Project area is the Magothy aquifer, and the primary source of recharge is through precipitation and infiltration. The Magothy aquifer is primarily composed of quartz and feldspar and also contains water under unconfined conditions (USEPA 2014a). There are no sole source aquifers in Richmond County (NYSHCR 2013).

Note: "Proposed BMP Site" and "Proposed Lower Bay Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-4. South Beach Area (Drainage Areas D and E)

The chemical quality of the water in the Magothy aquifer is suitable for most uses, including human consumption. The groundwater is low in dissolved solids (generally less than 150 milligrams per liter (mg/l), with calcium and bicarbonate as the dominant ions in solution. Other solids, in smaller amounts, include sodium, potassium, magnesium sulfate, and chloride. Historically, no significant quantities of heavy metals, pesticides, organics or coliform bacteria have been found in the artesian aquifers. Except for specific parameters (e.g. iron) and contamination incidents, water quality in the artesian groundwater system meets or exceeds Federal and State drinking water standards (EPA 2014a). However, groundwater on Staten Island has not been used for public supply since 1970. Richmond County is connected to the New York City municipal water supply, which comes from reservoirs to the north in the Croton and Catskill/Delaware Watersheds (NYSHCR 2013).

Oakwood Beach (Drainage Areas A and B). In support of the Bluebelt GEIS process, in order to describe groundwater conditions in the Oakwood Beach area, monitoring wells were installed along Fox Lane between Mill Lane and Cedar Grove Avenue, at the end of Kissam Avenue, and near the intersection of Riga and Dugdale Streets. Groundwater elevations at each well were averaged for the spring, summer, and fall monitoring periods (all in 2010). Groundwater monitoring results indicate that the water table is not far from surface elevations in the downstream section of the Oakwood Beach watershed. Water table elevations are highest during the wet period in April and May. The summer and fall water table elevations are fairly similar, with July observations slightly lower or about equal to October and November elevations. In general, spring water table elevations average about 0.5 feet higher than at the same well in the summer and fall (NYCDEP 2013).

New Creek (Drainage Area C). In support of the Bluebelt GEIS process, groundwater monitoring wells were installed along Dongan Hills Avenue, Seaview Avenue, Freeborn Street, Graham Boulevard, and at Last Chance Pond. In general, results of the groundwater monitoring indicate that the water table in the lower watershed is not far below ground surface elevations. Water table elevations are highest during the wet period in the spring (i.e., April and May). Summer and fall water table elevations are fairly similar, with July observations slightly lower than October and November elevations. In general, spring water table elevations were about 0.75-1.0 feet higher than at the same well in the summer and fall (NYCDEP 2013).

South Beach (Drainage Areas D and E). In support of the Bluebelt GEIS process, groundwater monitoring wells were installed along the Quintard Street right-of-way, at the end of Quincy Avenue near Sand Lane, and at the end of McLaughlin Street. In general, results of the groundwater monitoring indicate that the water table in the lower watershed is not far below the ground surface elevations. Water table elevations are highest during the wet period in April and May. The summer and fall water table elevations are fairly similar, with July observations slightly lower than October to November elevations. In general, spring water table elevations averaged about 0.75 feet higher than summer and fall measurements (NYCDEP 2013).

For all three areas, groundwater elevations were found to fall between typical low- and high-tide elevations, which is consistent with the assumption that the low tide elevation sets the minimum water table elevation. However, no correlation was found between the tide elevation at the time of measurement and the groundwater elevation. This finding indicates that while the sea level

controls the broader water table elevation, individual tidal cycles do not impact the movement of groundwater in the wetland areas of the watersheds (NYCDEP 2013).

3.2.2 Surface Water

Oakwood and New Creeks are the only identified (named) surface waters in the Project area. However, there are numerous wetlands and interior drainages throughout Staten Island. The drainage from creeks is conveyed mostly through pipes where it discharges into the Lower New York Bay/Raritan Bay. The slow subsidence of floodwaters during and after storms may be more a result of the limited capacity of these pipes than the limited capacity of open-channel portions of the creeks. Oakwood Creek is an important creek because many of the local sewers discharge into a branch of the creek and the flow is ultimately discharged via the open creek channel into the Lower New York Bay/Raritan Bay (USACE 2003a). Additionally, there are 10 drainage outfalls throughout the Project area (USACE 2003a). There are no Wild and Scenic Rivers within Richmond County, as designated by the U.S. Department of the Interior (NYSHCR 2013).

Oakwood Beach (Drainage Areas A and B). The inland watershed of the Oakwood Beach area includes drainage along the mapped, but not built, Willowbrook Parkway right-of-way. For most of this length, the right-of-way is between 200 and 300 feet in width. It is largely undeveloped, and crossed only by Amboy Road/Savoy Street and the Staten Island Railroad (the rail crossing is elevated). There are several surface water features along this right-of-way, among them two ponds in the northern portion, one at Park Street and the other at Thomas Street. The first pond receives street runoff from the intersection of Park Street and Maplewood Avenue. After especially heavy rains, when the pond very occasionally spills over its banks, the overflow drains into a catch basin at the intersection of Riedel Avenue and Park Street. A field inspection in support of the Bluebelt GEIS process found no evidence of this overflow occurring on a regular basis. The second pond, which is mostly open water without much emergent vegetation, receives street runoff from the intersection of Thomas Street and Combs Avenue (NYCDEP 2013).

The lower portion of the Oakwood Beach watershed, below Hylan Boulevard, is at a very low elevation, especially in the vicinity of Mill Road, Fox Lane, Kissam Avenue and other adjacent streets. Runoff within the lower watershed flows south into the Lower Bay via three branches of the Oakwood Beach drainage system. Discharge from East Branch is regulated by a tide gate, maintained by the City, thereby preventing inland flooding along the East Branch during high tide events. There are no tidal gates controlling the middle or west branch outlets. When high tide and large intensity storms occur simultaneously, water in the channels of Oakwood Beach Creek backs up, typically causing flooding (NYCDEP 2013).

Modeling shows that under 10-year storm conditions, portions of the Oakwood Beach lower watershed would flood, particularly at Kissam and Fox Avenues. Although the elevation of water at Tysens Lane does not exceed the street elevation under the modeled 10-year storm event, field reconnaissance associated with the Bluebelt GEIS has observed surging sewers in this area (NYCDEP 2013).

New Creek (Drainage Area C). In the upper watershed, a small creek originates in a forested area just north of the Richmond County Country Club. Referred to on some maps as Moravian Brook, it flows through the Richmond County Country Club and Moravian Cemetery before entering a culvert under Richmond Road. Here the creek drains into an existing trunk storm sewer that ultimately discharges to the Lower Bay via the existing Greeley Avenue ocean outfall. The creek drains approximately 450 acres that include forested open space, a golf course and low density residential uses. Runoff is conveyed via overland flow throughout this sub-drainage area of the inland part of the watershed (NYCDEP 2013).

The Reeds Basket Willow Swamp Park in the northwest portion of the watershed is characterized by very steep slopes (46 percent grade at some locations) and is surrounded by residential properties. Runoff from streets and surrounding residences flows overland to small channels in the park. Stormwater enters the storm sewer on an unbuilt section of Woodale Avenue between Hillview Place and Dalemere Road. This sewer discharges to Lower Bay via the Seaview Avenue trunk sewer and outfall (NYCDEP 2013).

Priory Pond is an approximately 0.6-acre freshwater pond, located south of Saint Francis Seminary and to the west of Todt Hill Road. The pond is owned and managed by the NYSDEC as a conservation area and is part of the St. Francis Woodlands. In support of the Bluebelt GEIS process, a field investigation at the pond and its environs revealed no inlet structures, erosion, gullies, or overland flow entering into the pond. A weir at the southwest side of the pond provides the outlet from the pond, and field investigations of the pond in summer 2010 found no outflow from the pond and the channel below the weir was dry. This suggests that the pond is groundwater-fed and not directly reliant on stormwater flow (NYCDEP 2013).

Approximately half of the lower watershed (generally southeast of Richmond Road), drains overland to the three branches of New Creek (the Main Channel and the East and West Branches), while the other half drains directly to existing trunk sewers and outfalls to Lower Bay. All three channels of New Creek are fed by street runoff, either localized or from existing storm sewer outfalls. Under existing conditions, because of the prevailing flat topography of the lower watershed, surcharging at the Naughton Avenue trunk sewer can lead to flooding across the lower watershed. During the peak stage of the 10-year storm event, the flood water surface elevations are nearly level throughout the lower watershed as a result of the closing of the tide gate. When the tide gate is closed, floodwaters cannot discharge through the outfall to Lower Bay and the lower watershed floods with continuous upstream runoff. Because the lower watershed has a level grade, erosion is not a concern (NYCDEP 2013).

South Beach (Drainage Areas D and E). The upper watershed is characterized by three separate hydrologic features: Brady's Pond, Cameron's Lake and Whitney Woods. Brady's Pond is at the top of the watershed and has a water surface elevation of approximately 94 feet. Brady's Pond has a total drainage area of 55 acres. Water levels in the pond are controlled by a privately maintained outlet at Windmere Road and Delphine Terrace. The water surface elevation in the pond is generally constant during extended dry weather, which suggests that the water level in the pond is dependent on groundwater inflow. Presently, private owners swim in Brady's Pond and treat the waters with chemicals that discourage algal growth during the summer months based on a permit authorization from NYSDEC. Overflow from Brady's Pond

is controlled via an existing weir and culvert located at the intersection of Windermere Road and Delphine Terrace. This flow feeds Cameron's Lake (immediately to the south) (NYCDEP 2013).

Cameron's Lake is hydraulically below Brady's Pond. The water surface elevation of Cameron's Lake is approximately 88 feet. Flow from the lake discharges to an existing storm sewer in Clove Road. As with Brady's Pond, Cameron's Lake does not dry up during periods of low rainfall, so it is assumed that there is significant groundwater inflow. Six bathymetry readings of Cameron's Lake indicate a maximum depth of 4.5 feet in the middle of the lake. The remaining readings show a depth of four feet at various locations (NYCDEP 2013).

At Whitney Woods, water currently collects on the property at the stub end of Woodlawn Avenue due to the local topography before feeding an existing storm sewer grate at the end of Whitney Avenue. The existing grate is subject to clogging by leaves and other debris, which exacerbates localized pooling of water. The watershed of Whitney Woods is approximately 9.3 acres (NYCDEP 2013).

The lower South Beach watershed is situated generally in the vicinity of Olympia Boulevard and McLaughlin Street. A large open water pond is the main hydrologic feature of the lower watershed. Under existing conditions, the 10-year design storm indicates that street flooding occurs (NYCDEP 2013).

3.2.3 Water Quality

Overview. Under existing conditions, pollutants that enter the local waterways in turn flow to the Lower Bay. These pollutants can include organic matter, which can increase the biochemical oxygen demand (BOD) within the water column and reduce the dissolved oxygen (DO) concentrations. This can then stress natural communities. Organic matter can also cause an increase in coliform bacteria, and nutrients. Although nutrients such as nitrogen and phosphorus are essential to the growth of phytoplankton and act as a base for supporting higher tropic levels, in excess concentrations these nutrients can result in a condition known as eutrophication. This can result in phytoplankton blooms, including nuisance algal forms, which further depresses DO levels in water bodies. With large stormwater runoff volumes that are not attenuated in any way, as under current conditions, more of these pollutants coming from rooftops, lawns, roadway surfaces and other urban areas are transported directly to local streams and ultimately to the Lower Bay. There are also the erosive forces of unmanaged runoff which leads to sedimentation in local waterbodies (NYCDEP 2013).

Oakwood Beach (Drainage Areas A and B). Many water bodies in the Oakwood Beach area are small, and as a result, many are not classified by NYSDEC. For unclassified streams and ponds there are no legally mandated water quality goals. In the inland part of the watershed, there are no classified water bodies. In the lower Watershed, all three branches of Oakwood Beach Creek are classified as I/C or C (NYSDEC water quality standard ratings are defined in the text box). In general, activities in these designated waters cannot degrade water quality, introduce new contaminants or reduce flow or oxygen concentrations to a level that impairs the designated functions. The Lower Bay is classified as SB.

New Creek (Drainage Area C). In the inland part of the watershed, the ponds at the Richmond County Country Club and Reeds Basket are either unclassified or listed as Class B water bodies by the NYSDEC. Under existing conditions, there are no known water quality issues in the surface water bodies of the inland watershed. The streams in the lower watershed are small and, as a result, many are not classified for water quality standards or goals. The Main Channel and the East and West Branches of New Creek are classified as I/C or C. The Lower Bay is classified as SB. Activities proposed within these designated water bodies cannot degrade water quality, introduce new contaminants or diminish flows or oxygen concentrations such that it impairs or compromises the function or intended use of the water body.

NYSDEC Water Quality Standard Ratings

Class B waters - primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Class C waters - best usage is fishing. These waters shall be suitable for fish propagation and survival.

Class SA waters - shellfishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Class SB waters - primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Class SC waters - best usage is fishing. These waters shall be suitable for fish propagation and survival.

Class I waters - best usages are secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

South Beach (Drainage Areas D and E). Surface waters in the inland part of the watershed include Brady's Pond, Cameron's Lake, and Whitney Woods. NYSDEC classifies Brady's Pond and Cameron's Lake as Class B waterbodies. The Lower Bay is classified as SB. The surface water that collects in Whitney Woods is not classified by the State. Under existing conditions, water quality issues at Brady's Pond include algal blooms that can lead to low dissolved oxygen counts in addition to the impacts on aesthetics and recreational uses. As discussed above, water supply to Brady's Pond is most likely dependent on groundwater discharges since water levels do not fluctuate seasonally or with periods of low rainfall and the quality of the water is swimmable.

3.2.4 Tidal Influences and Floodplains

Overview. The tides along the south shore of Staten Island are semi-diurnal (two similar high tides and two similar low tides per day) and have a mean range varying from approximately 4.3 feet to 6.3 feet Tidal currents along the south shore of Staten Island are generally weak and do not exceed 1.0 knot. The shape of Lower New York Bay helps to restrict highly oblique waves from impacting the south shore of Staten Island and limits the longshore wave-driven currents (USACE 1995, NPS 2014).

The shorelines along southeastern Staten Island have generally been mildly erosional, which indicate that the rate of erosion over most large areas of the shoreline is low, averaging less than 1 foot per year of shoreline loss). However, in the segment in the Great Kills Park/Oakwood Beach area, shoreline recession has been as high as 20 feet per year (USACE 1995, USACE 2015). Within the Gateway NRA, most park sites are experiencing a long-term negative sediment budget (NPS 2014).

Based on the USACE's study of sediment transport dynamics in the Project area, a nodal point exists somewhere between South Beach and Midland Beach. East of this nodal point, the direction of sediment (beach sand) transport is eastward toward the Narrows, and west of this nodal point, the direction of sediment transport is westward (USACE 1995).

East of the nodal point, between South Beach and Fort Wadsworth, erosion is mild, losing approximately 10,600 cubic yards of sand per year (yd^3/yr) in an easterly direction. Similarly, west of the nodal point, between Midland Beach and Great Kills Park, erosion is also mild, losing approximately 10,300 yd^3/yr in a westerly direction. The erosion rate is more than three times higher at Great Kills Park to Crookes Point, losing approximately 36,400 yd^3/yr (USACE 1995). Data from the period between 1961 and 1995 indicate that the total volumetric change of beach sediment along the south shoreline of Staten Island was low, but was highly variable, depending on location among the beaches. For example, South Beach lost nearly 400,000 yd^3, while Midland Beach showed accretion (USACE 1995, NPS 2014).

Executive Order 11988 requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Figures 3-5**,** 3-6, and 3-7 present the 100-year floodplain (area with a 1 percent chance of being inundated within any given year) and the 500-year floodplain (area with a 0.2 percent of being inundated within any given year) boundaries for the Project area. As shown on those figures, much of the coastal Project area is within the 100-year floodplain, which extends north to Hylan Boulevard and Mill Road (NYCDEP 2013). Standing water in the streets and slumping of soil and pavement in these coastal, low lying areas is evidence of frequent local flooding. Based on an examination of the Flood Insurance Rate Maps (FIRMs) for the Project area, the 100-year flood elevation varies based on location from 10 feet to 11 NGVD29 (6.8 feet to 7.8 feet Staten Island Datum) in the coastal parts of the Project area. FEMA has not calculated 100-year flood elevations for the inland Project areas, indicating that there are no known major storm flooding issues in the inland areas. Much of the lower watershed is within the 100-year floodplain, which extends north to Hylan Boulevard and Mill Road (NYCDEP 2013).

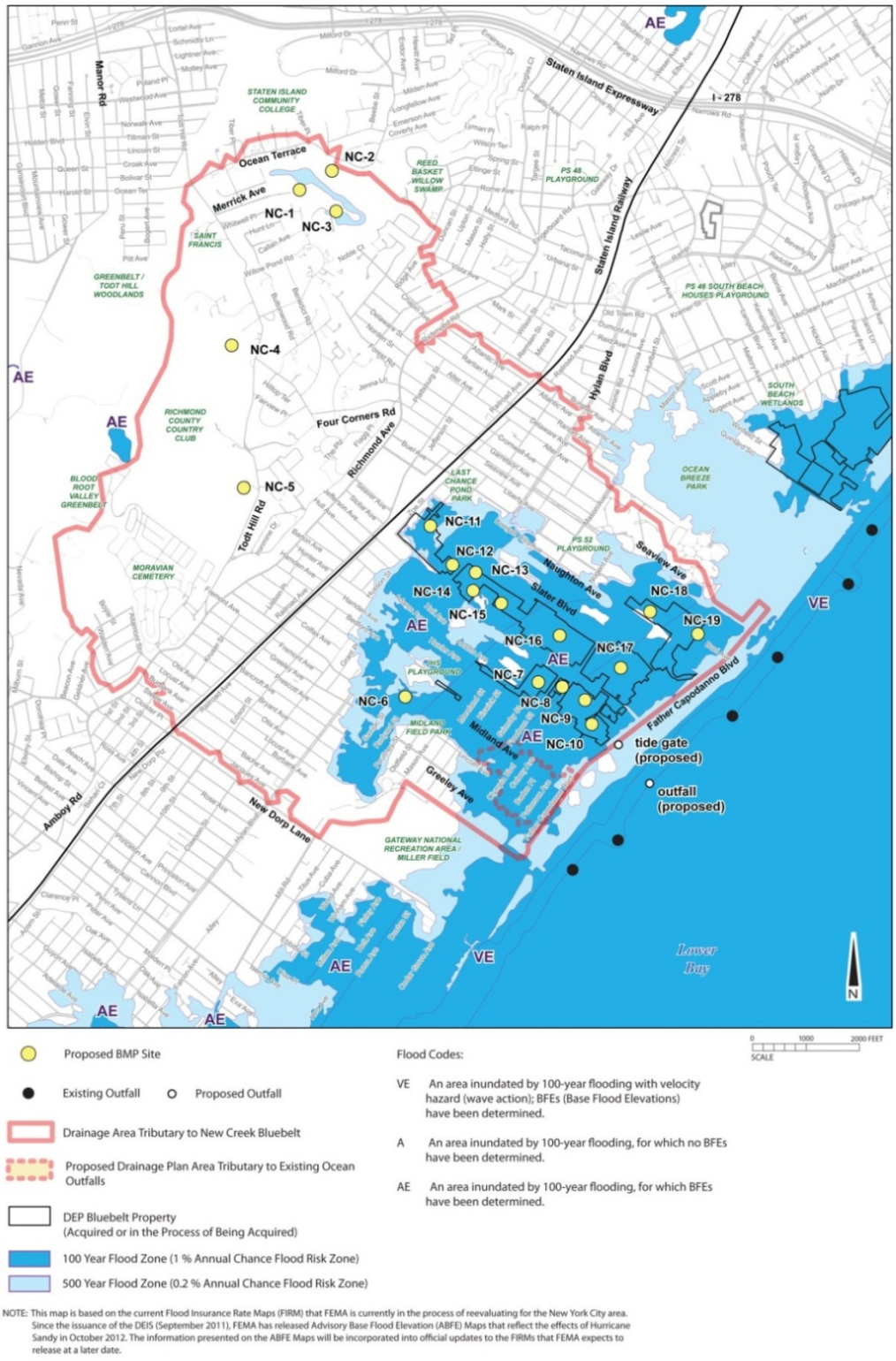
3.2.5 Wastewater

In Richmond County, the NYCDEP operates two wastewater treatment plants. The Oakwood Beach WWTP receives liquid wastes from the southern section of Richmond County. The Port Richmond WWTP receives liquid wastes from the northern section of Richmond County. Treated wastewater is discharged into local water bodies. The NYCDEP maintains the waste water collection (sewer) systems.

In most areas of the county, sanitary and industrial wastewater, rainwater and street runoff are collected in the same sewers and then conveyed together to the treatment plants. This is known as a combined sewer system. Sometimes, during heavy rain and snow storms, combined sewers receive higher than normal flows that cannot be handled by the treatment plants. When this occurs, a mix of excess stormwater and untreated waste water discharges directly into the waterways at certain outfalls. Separate collection systems for sanitary waste and stormwater are

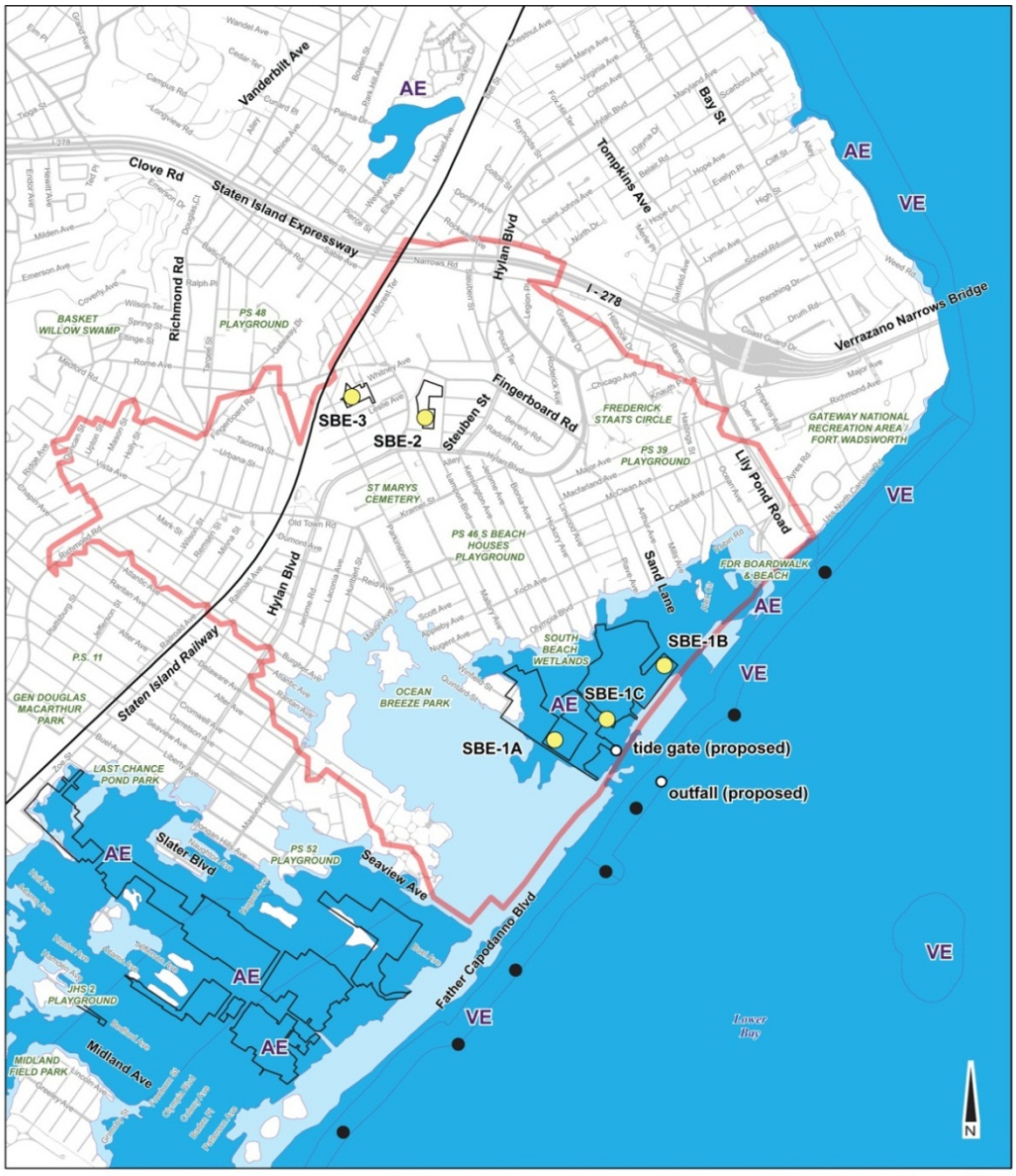
Note: "Proposed BMP Site" and "Proposed Outfall" refer to the Bluebelt GEIS. Additionally, NYCDEP is no longer planning to build BMP OB-1 because the neighborhood it would have served is being bought out and emptied.
Source: NYCDEP 2013

Figure 3-5. Oakwood Beach Area Floodplains (Drainage Areas A and B)



Note: "Proposed BMP Site" and "Proposed Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-6. New Creek Area Floodplains (Drainage Areas C)



Note: "Proposed BMP Site" and "Proposed Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-7. South Beach Area Floodplains (Drainage Areas D and E)

found in some neighborhoods in the southern part of the county with the wastewater directed to wastewater treatment plants, while stormwater is channeled directly to local water bodies (NYSHCR 2013).

3.3 VEGETATION (UPLANDS AND WETLANDS)

Staten Island is located within the Eastern Deciduous Forest Biome. This biome is characterized by forest cover of a mixture of broad leaved deciduous trees, with evergreens, particularly pines, predominant in some sections. Within the Eastern Deciduous Forest Biome, Staten Island is located in the vegetated subdivision designated the Oak-Chestnut Forest Region (Braun 1950).

The majority of the land along the south shore of Staten Island consists of developed residential land and the remaining land is characterized by commercial development, forests, meadows, beaches, ponds, creeks, and wetlands. In addition, open lands have been preserved in several locations along the shoreline in the form of developed parks with large parking areas, boardwalks, and promenades that parallel the beach.

An analysis of changes in Staten Island's flora indicates that 40 percent of known indigenous species for that area are not currently found on Staten Island and that the proportion of non-native species has increased from 19 percent to 33 percent of the flora (USFWS 1997). More recent studies associated with the Bluebelt GEIS confirm these trends (NYCDEP 2013). The Invasive Plant Council of New York State (IPCNYS) created a list of the 26 most invasive species in New York (IPCNYS 2015). Although this list does not have legal status, it is generally considered the best reference for invasive plants in the state. Of the species on the list, common reed (*Phragmites australis*), black locust (*Robinia pseudoacacia*), porcelain berry (*Ampelopsis brevipedunculata*), Japanese knotweed (*Polygonum cuspidatum*), multiflora rose (*Rosa multiflora*), purple loosestrife (*Lythrum salicaria*), and Japanese honeysuckle (*Lonicera japonica*) occur in the vicinity of the Project area. In addition, tree of heaven (*Alianthus altissima*), a rapidly growing and prolific seed producing deciduous tree native to central China, is scattered throughout the Project area. *Alianthus* trees also produce toxins that prevent the establishment of other plant species (Plant Conservation Alliance 1999).

State and Federally-listed endangered, threatened, and rare plant species and communities of special concern are discussed in Section 3.5. The following subsections provide a site-specific description of upland and wetland vegetation present in the Project area.

3.3.1 Uplands

Vegetated upland areas located in the interior drainage features of the Project area can be characterized as isolated islands of habitat distributed amongst developed residential and commercial lands, and areas developed for recreational use. The majority of upland vegetation in these areas consists of non-native species that are commonly found in highly disturbed areas. Upland herbaceous areas are dominated with species of goldenrod (*Solidago* spp.), common reed, common ragweed (*Ambrosia artemisiifolia*), common mugwort (*Artemisia vulgaris*), poison ivy (*Toxicodendron radicans*), and various grasses, legumes, and forbs. Upland scrub-shrub areas are dominated with species of honeysuckle (*Lonicera* spp.) multiflora rose, Japanese

Knotweed, common pokeweed (*Phytolacca americana*), winged sumac (*Rhus copallina*), and black locust. Upland forest areas are dominated by oaks (*Quercus* spp.), sassafras (*Sassafras albidum*), and black cherry (*Prunus serotina*) in relatively undisturbed areas. Black locust and tree of heaven dominate highly disturbed areas that have reverted to forest. In addition, several vines including poison ivy, porcelain berry, and Japanese honeysuckle form nearly impenetrable barriers in upland areas immediately adjacent to wetlands (NYCDEP 2013). Mulberry trees (*Morus rubra*) are a prevalent native tree species in the Uplands west of Richmond Road, particularly in Drainage Areas C and D.

Upland vegetation in the Project area includes maintained lawns and planted trees and shrubs associated with the boardwalk, promenade, and recreational parks adjacent to the beach at South Beach, Midland Beach, and Miller Field. Dominant vegetation commonly found along the coastal areas includes American beachgrass (*Ammophila breviligulata*), seaside goldenrod (*Solidago sempervirens*) sandbur (*Cenchrus* spp.), and beachheather (*Hudsonia* spp.) (NYCDEP 2013).

3.3.2 Wetlands

Overview. Wetlands in the Project area are both State-regulated and Federally-regulated, generally with differing regulations. Wetlands have been mapped in the Project area by both the NYSDEC and the USFWS (via the National Wetland Inventory [NWI]). The specific wetlands for the Oakwood Beach area (Drainage Area A and Drainage Area B), New Creek area (Drainage Area C), and South Beach area (Drainage Area D and Drainage Area E) are described below. The size and quality of wetlands have been altered as a result of development and continuing development pressure in the Project area.

Wetland boundaries were field delineated in 2003 and verified in 2009 as part of the USACE's planning for this Project (USACE 2009). The complete Wetland Delineation Report is contained in Appendix C. The purpose of the delineation was to determine the presence and extent of areas within the Study Area that meet the criteria for wetland identification and other Waters of the United States, as established by USACE guidelines. Areas identified and delineated are potentially jurisdictional and regulated pursuant to Section 404 of the Clean Water Act (CWA). In addition, NYSDEC regulates freshwater wetlands greater than 12.4 acres under the New York State Environmental Conservation Law, Article 24 (Freshwater Wetlands) and also regulates tidal wetlands under Article 25 (Tidal Wetlands). Executive Order 11990 directs Federal agencies to action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands…"

A total of 1,099 acres were surveyed in the Project area. In 2003, a total of 18 wetlands were identified and delineated. In 2009, the boundaries of the 18 previously identified wetlands were verified or updated and 12 additional wetlands were identified in an expanded survey area. A total of 30 wetlands occur within the Project survey limits. The majority of these wetlands are well defined emergent wetlands dominated by common reed. A total of approximately 300 acres of wetlands have been field delineated in the Project area (USACE 2009). The Project area contains both tidal wetlands and freshwater wetlands, as explained below.

Tidal Wetlands. Tidal wetlands are the areas where the land meets the sea. These areas are periodically flooded by seawater during high or spring tides or, are affected by the cyclic changes in water levels caused by the tidal cycle. Salt marshes and mud flats are some typical types of tidal wetlands found along the south shore of Staten Island. Tidal wetlands are classified by the amount of water covering the area at high and low tides and the type of vegetation. New York State uses specific categories and codes to describe and represent different types of coastal, tidal and fresh water wetlands. Within the Project area, tidal wetlands are only found in the Oakwood Beach area (Drainage Area A and Drainage Area B).

Freshwater Wetlands. Freshwater wetlands include inland marshes and wet meadows dominated by herbaceous plants, swamps dominated by shrubs, and wooded swamps dominated by trees. Within the Project area, freshwater wetlands are found in the Oakwood Beach area (Drainage Area A and Drainage Area B), New Creek area (Drainage Area C), and South Beach area (Drainage Area D and Drainage Area E). A summary of the wetlands in these areas follows.

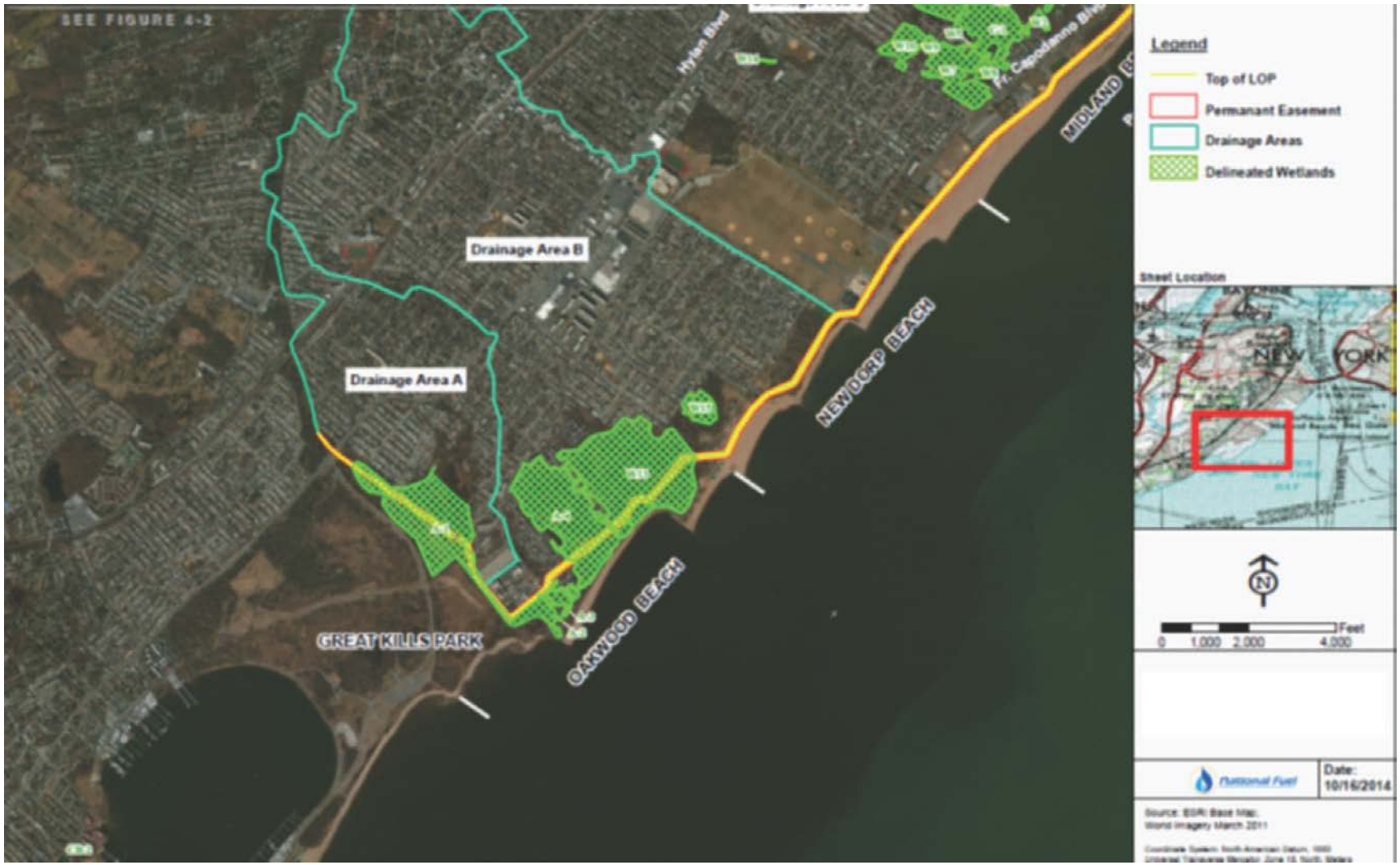
Oakwood Beach (Drainage Areas A and B). Figure 3-8 shows the delineated wetlands within the Oakwood Beach watershed that may be affected by the Project. The estuarine wetlands in the Oakwood Beach area are hydrologically connected by Oakwood Creek and are identified as a complex of several wetland types. Specifically, these wetlands consist of: estuarine, intertidal, persistent emergent, common reed-dominated, irregularly flooded wetlands; and, palustrine, forested, broad-leaved deciduous, temporarily flooded and seasonal tidal wetland components (USACE 2009). Estuarine intertidal wetlands are mapped along the shoreline and within the bay (NYCDEP 2013). Within Drainage Area A and Drainage Area B, there are approximately 166.62 acres of delineated wetlands (USACE 2009). More detailed wetland maps for Drainage Area A and Drainage Area B are presented in Appendix C.

New Creek (Drainage Area C). Figure 3-9 shows the delineated wetlands within the New Creek watershed that may be affected by the Project. As shown on Figure 3-9, wetlands are found throughout the watershed including palustrine wetlands of the upper watershed and emergent, common-reed dominated wetlands of the lower watershed. These are hydrologically connected by a series of streams that flow throughout the wetland complexes (USACE 2009). Historically much of the lower watershed was a tidal marsh connected to the Lower Bay. However, filling, development, and alterations in hydro logy have greatly modified those wetlands and eliminated the tidal wetlands, replacing them with freshwater wetlands supported by runoff from the upper watershed (NYCDEP 2013).

Last Chance Pond is a Class I wetland with approximately 62 percent of the wetland is characterized as a deciduous swamp, 25 percent as an emergent marsh, and 13 percent with floating and submergent vegetation (NYCDEP 2013). Within

NYSDEC Wetlands Classification

The NY state regulatory program classifies its wetlands into four classes (see 6 NYCRR Section 664). Class I wetlands are the highest quality of wetlands. A Class I wetland would be defined as such, for example, due to its large size, variety of cover types, or because it supports important or rare plant communities. A Class IV wetland, which would be at the other end of the spectrum, is not as valuable a wetland, and would be identified as such, for example, due to its smaller sizes, monotypic vegetative stands, or low value cover types.



Source: USACE 2009

Figure 3-8. Delineated Wetlands in Drainage Areas A and B

Source: USACE 2009

Figure 3-9. Delineated Wetlands in Drainage Areas C, D, and E

Drainage Area C, there are approximately 84.16 acres of delineated wetlands, all of which are considered freshwater wetlands (USACE 2009). More detailed wetland maps for Drainage Area C are presented in Appendix C.

Wetland NA-9 covers most of the Lower Watershed. It is a common reed-dominated marsh that contains the three branches of the New Creek drainage system. Despite the historical impacts of filling and other hydrologic alterations to this system, it is a Class I wetland and recognized for providing flood control pollutant removal, and important ecological habitat for raptors and fish. Approximately 89 percent of the wetland is identified as common reed dominated emergent marsh and 11 percent is open water. The wetlands are subject to brush fires when the common reed has dried out, particularly in the late winter and early spring (NYCDEP 2013).

South Beach (Drainage Areas D and E). Figure 3-9 also shows the delineated wetlands within the South Beach watershed that may be affected by the Project. The wetlands identified in the South Beach area consist of a larger complex of palustrine, narrow-leaved emergent, semi-permanently flooded wetlands with smaller associated palustrine, broad-leaved deciduous forested, seasonally flooded/saturated and palustrine, unconsolidated bottom, permanently flooded components (USACE 2009). Within Drainage Area D and Drainage Area E, there are approximately 45.73 acres of delineated wetlands, all of which are considered freshwater wetlands (USACE 2009). More detailed wetland maps for Drainage Area D and Drainage Area E are presented in Appendix C.

The wetland in Drainage Area E is a NYSDEC-designated Class I wetland due to its important natural habitats and flood control features in an otherwise urban setting. Approximately 49 percent of this wetland is identified as emergent marsh, 38 percent as wet meadow, and 13 percent as open water. According to the NYSDEC wetland designation report, this wetland was documented as resident habitat for State-listed threatened or endangered animal species (NYCDEP 2013).

3.4 WILDLIFE

In connection with the New York and New Jersey Harbor Deeping Project and other work in the area, the USACE has conducted a variety of studies related to aquatic life offshore of Staten Island, including the Lower Bay. These studies include: (1) 2013 Migratory Finfish Report (USACE 2014a); (2) Aquatic Biological Survey Report 2010 (USACE 2011a); (3) Aquatic Biological Survey Report 2011 (USACE 2012); (4) Benthic Recovery Monitoring Report (USACE 2011b); (5) Benthic Monitoring Program (USACE 2006); and (6) Ambrose Obstruction Biological Sampling Report (USACE 2010). These studies, which provide relevant and current information regarding aquatic life in the Project area, are included, as appropriate, in the descriptions that follow.

3.4.1 Benthic Resources

Benthos can be described as the complex community of plants and animals that live on or in the bottom sediments of oceans, streams, and wetlands. The benthic community in the Harbor consists of a wide variety of small aquatic invertebrates which live burrowed into or in contact

with the bottom, such as worms, mollusks, and amphipods. Benthic invertebrate communities play an important role in the Harbor and are an essential part of the marine food web, as they cycle nutrients from the sediment and water column to higher trophic level (USACE 2011b).

In 2006, benthic resource samples collected in the Lower Bay included: annelids (52 percent), arthropods (21 percent), mollusks (21 percent) and other (6 percent). Blue mussel (*Mytilus edulis*) dominated the catches, accounting for 41 percent of the total catch. Amphipods (Gammaridae), Polychaetes (*Nephtys* sp. and *Magelona* sp.) and northern dwarf tellin (*Tellina Agilis*) also contributed significantly to the catches in this area. Overall, the benthic community living in the sediments of the Lower Bay exhibited moderate levels of organism abundance, high community diversity, and high evenness relative to the other areas sampled in the New York/New Jersey offshore area (USACE 2006).

Benthic samples in 2009 were generally typical of the coastal Mid-Atlantic region and were similar to the 2006 study (USACE 2010). Despite urbanization, the Harbor remains a productive estuary, and supports fairly diverse communities of benthic invertebrates (USACE 2011b).

3.4.2 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The regulations further clarify EFH by defining "waters" to include aquatic areas that are used by fish (either currently or historically) and their associated physical, chemical, and biological properties; "substrate" to include sediment, hard bottom, and structures underlying the water; and, areas used for "spawning, breeding, feeding, and growth to maturity" to cover a species' full life cycle. Prey species are defined as being a food source for one or more designated fish species, and the presence of adequate prey is one of the biological properties that can make a habitat essential. Like many estuarine systems, Raritan Bay supports a diverse assemblage of fish and shellfish. The National Marine Fisheries Service (NMFS), USACE, USFWS, and the Marine Science Research Center have conducted a variety of surveys throughout Raritan Bay. The following sub-sections discuss the finfish and shellfish in the Project area.

Finfish. The finfish assemblage (species occurrence and relative abundance) within the Harbor is a dynamic community consisting of many resident and migratory fish species typical of coastal estuaries and inshore waterways along the Middle Atlantic Bight. The Lower Bay is part of the Hudson-Raritan estuary that provides spawning habitats, migratory pathways, along with nursery and foraging areas for many fish species. Table 3-1 presents a summary of the EFH designated finfish species by life stage occurring in the Project area as determined by the NMFS. Nine (9) species of finfish were categorized as important non-EFH species: alewife (*Alosa pseudoharengus*), American eel (*Anguilla rostrata),* American shad (*Alosa sapidissima*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), blueback herring (*Alosa aestivalis*), rainbow smelt (*Osmerus mordax),* shortnose sturgeon *(Acipenser brevirostrum),* and striped bass (*Morone saxatilis*).

In 2011, a migratory finfish survey (USACE 2013) was conducted to investigate timing and spatial distribution of seasonal movements of migratory fish in the New York/New Jersey Harbor. American shad, blueback herring, alewife, striped bass, and Atlantic menhaden were selected as target species for this program because they spawn in freshwater (except menhaden), are important as forage (shad, blueback herring, alewife, menhaden), or are a major predator in the Harbor (striped bass). During spring and fall, migratory finfish species gain access to upstream freshwater spawning/nursery habitat through the New York/New Jersey Harbor and the Hudson-Raritan Estuary. Migratory fish may be potentially vulnerable to habitat disturbance because their migratory behavior concentrates them through relatively small areas over short periods of time. A total of 58 species were collected. The analysis of the 2011 data is consistent with previous studies that migratory finfish use the New York/New Jersey Harbor during spring and fall migration periods (USACE 2013).

Table 3-1. Federally-designated Essential Fish Habitat Species in Project Area.

Species	Eggs	Larvae	Neonate/ Early Juveniles	Juveniles	Adults	Spawning Adults
Atlantic herring (*Clupea harengus*)		M,S		M,S	M,S	
Atlantic mackerel (*Scomber scombrus*)	M,S	M,S		M,S	M,S	
Black sea bass (*Centropristus striata*)	M,S	M,S		M,S	M,S	
Bluefish (*Pomatomus saltatrix*)				M,S	M,S	
Butterfish (*Peprilus triacanthus*)	M,S	M,S		M,S	M,S	
Red hake *(Urophycis chuss*)		M,S		M,S	M,S	
Scup (*Stenotomus chrysops*)	M,S	M,S		M,S	M,S	
Summer flounder (*Paralicthys dentatus*)		M,S		M,S	M,S	
Windowpane (*Scopthalmus aquosus*)	S	M,S		M,S	M,S	M,S
Winter flounder (*Pseudopleuronectes americanus*)	M,S	M,S		M,S	M,S	M,S
Clearnose skate (*Raja eglanteria*)				X	X	
Little skate (*Leucoraja erinacea*)				X	X	
Winter skate (*Leucoraja ocellata*)				X	X	
Cobia (*Rachycentron canadum*)	X	X		X	X	
King mackerel (*Scomberomorus cavalla*)	X	X		X	X	
Spanish mackerel (*Scomberomorus maculatus*)	X	X		X	X	
Dusky shark (*Carcharhinus obscurus*)			X	X		
Sand tiger shark (*Odontaspis taurus*)			X		X	
Sandbar shark (*Carcharinus plumbeus*)			X		X	

Source: USACE 2012.
Legend: S = Includes the seawater salinity zone (salinity > 25.0 percent)
M = Includes mixing water / brackish salinity zone (0.5 percent < salinity < 25.0 percent)
F = Includes tidal freshwater salinity zone (0.0 percent < salinity < 0.5 percent)
X = Designated EFH but no salinity zone specified

Shellfish. Anthropogenic impacts such as sewage pollution, harbor dredging, and industrial pollution from the New York metropolitan area have contributed to the decline of the shellfish beds in the Project area. In addition to pollution, predation and competition for suitable habitat are other causes of decline in the shellfish seeding beds. Recent improvements to water quality have resulted in the opening of some areas of Raritan Bay for either direct shellfish harvest or "relay and depuration" (harvested shellfish are placed into tanks of cleaned waters to purge

themselves of contaminants before being sold or consumed). In general, as water quality has improved, more harvesting, particularly under the relay/depuration program, has taken place in Raritan Bay (USEPA 2007).

Raritan Bay and Sandy Hook Bay support several shellfish that are commercially or recreationally fished, including the American lobster, American oyster (*Crassostrea virginica*), bay scallop (*Argopencten irradiens*), blue crab, blue mussel, hardshell clam (or quahog) (*Mercenaria mercenaria*), horseshoe crab (*Limulus polyphemus*), and softshell clam (*Mya arenaria*) (MacKenzie 1990b, USFWS 1992). In 2010, two shellfish species (American lobster and blue crab) were collected during the bottom trawl survey (USACE 2011a). A list of common shellfish species found in the nearshore waters of the south shore of Staten Island is provided in Table 3-2.

Table 3-2. Common Shellfish Species Found in the South Shore Staten Island Nearshore Area.

Common Name	Scientific Name
American Oyster	*Crassostrea virginica*
Blue Crab	*Callinectes sapidus*
Blue Mussel	*Mytilus edulis*
Hardshell Clam	*Mercenaria mercenaria*
Horseshoe Crab	*Limulus polyphemus*
Softshell Clam	*Mya arenaria*

Source: MacKenzie 1990b, USFWS 1992, USACE 2011a.

3.4.3 Reptiles and Amphibians

Site-specific studies and surveys describing the diversity and abundance of amphibians and reptiles within the Project area were not conducted. However, the New York State Amphibian and Reptile Atlas Project, sponsored by NYSDEC, has recorded several reptile and amphibian species as occurring in or near the Project area. Species of frogs and toads such as the green frog (*Rana clamitans melanota*), spring peeper (*Acris crucifer*), bull frog (*Rana catesbeiana*), and Fowler's toad (*Bufo fowleri*) have been common to the area and have been found inhabiting fresh and brackish water wetlands (NYSDEC 2003b). The northern redback (*Plethodon c. cinereus*), northern red (*Pseudotriton r. ruber*), and northern two-lined (*Eurycea bislineata*) salamanders have been recorded in the vicinity of the Fort Wadsworth to Oakwood Beach Project area (NYSDEC 2003b). Common snakes such as the eastern garter snake (*Thamnophis sirtalis sirtalis*), northern rinkneck snake (*Diadophis punctatus edwardsii*), and northern brown snake (*Storeria d. dekayi*) have been found inhabiting vegetated upland and wetland areas in the Fort Wadsworth to Oakwood Beach Project area (USACE 1976, NYSDEC 2003b). Diamondback terrapins (*Malaclemys terrapin*) are common to Great Kills Harbor. In addition, the common snapping turtle (*Chelydra s. serpentina*), painted turtle (*Chrysemys picta*), and eastern box turtle (*Terrapene c. carolina*) may occur in the Project area (NYCDEP 2013).

3.4.4 Birds

The coastal habitats of the Lower Bay and Raritan Bay, including tidal flats and subtidal bottoms, provide important habitat for various bird species. Previous investigations, including

the *Atlas of Breeding Birds in New York State* (Andrle and Carroll 1988, NYSDEC 2004a), have listed 67 waterfowl and shorebird species, and 84 upland bird species as either observed or expected to occur along the south shore of Staten Island (National Audubon Society 1995, USFWS 1997). Of these 151 species, it is estimated that 60 utilize the south shore of Staten Island for breeding. The following is a brief summary of the species likely to be found utilizing the bay and terrestrial habitats in the Fort Wadsworth to Oakwood Beach area.

The nearshore open waters at Great Kills Harbor and Raritan Bay provide habitat for common species of waterfowl such as the Canada goose (*Branta canadensis*), American black duck (*Anas rubripes*), mallard (*Anas platyrhynchos*), green-winged teal (*Anas crecca*), blue winged teal (*Anas discors*), and gadwall (*Anas strepera*) (USFWS 1997, Andrle and Carrol 1988, NYSDEC 2004a). The nearshore waters in the Fort Wadsworth to Oakwood Beach Project area provide forage for some species of shorebirds and gulls such as the spotted sandpiper (*Actitis macularia*), sanderling (*Calidris alba*), and laughing gull (*Larus atricilla*) (Andrle and Carroll 1988). Several species of wading birds may occur in the area including the glossy ibis (*Plegadis falcinellus*), great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), and black-crowned night heron (*Nycticorax nycticorax*) (Andrle and Carroll 1988, NYSDEC 2004a).

The yellow warbler (*Dendroica petechia*), American robin (*Turdus migratorius*), gray catbird (*Dumetella carolinensis*), common yellowthroat (*Geothlypis trichas*), and song sparrow (*Melospiza melodia*) are common breeders within scrub-shrub and wetland habitats (Andrle and Carroll 1988, NYSDEC 2004a). Other common bird species known to utilize the habitats within the Fort Wadsworth to Oakwood Beach Project area include the American crow (*Corvus brachyrhynchos*), red-winged blackbird (*Agelaius phoeniceus*), mourning dove (*Zenaida macroura*), killdeer (*Charadrius vociferous*), Northern flicker (*Colaptes auratus*), willow flycatcher (*Empidonax traillii*), American goldfinch (*Carduelis tristis*), Eastern phoebe (*Sayornis phoebe*), bank swallow (*Riparia riparia*), and blue jay (*Cyanocitta cristata*) (Bull 1974, Andrle and Carroll 1988, NYSDEC 2004a). The American kestrel (*Falco sparverius*) may breed at the Fort Wadsworth to Oakwood Beach Project area (Andrle and Carroll 1988, NYSDEC 2004). Feral wild turkeys are very common on the South Shore, particularly near Seaview Avenue between the beach and Hylan Boulevard in Drainage Area C.

3.4.5 Mammals

Site-specific studies and surveys describing the diversity and abundance of mammals within the Fort Wadsworth to Oakwood Beach Project area were not conducted for this Project. However, terrestrial species most likely to occur in the Fort Wadsworth to Oakwood Beach area are habitat generalists tolerant of urban development, including the eastern gray squirrel (*Sciurus carolinensis*), deer (*Cervidae*), eastern cottontail (*Sylvilagus floridanus*), eastern chipmunk (*Tamias striatus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), muskrat (*Ondatra zibethicus*), white-footed mouse (*Peromyscus leucopus*), and introduced species such as the house mouse (*Mus musculus*) and Norway rat (*Rattus norvegicus*) (USACE 1995, USFWS 1997, NYCDEP 2013). Wild deer are common in the uplands of Drainage Areas C and D, west of Richmond Road.

The most commonly observed marine mammal in the New York Harbor and Raritan Bay is the harbor seal (*Phoca vitulina*) (NYCDEP 2013). Although its occurrence is less frequent, the grey seal (*Halichoerus grypus*) has also been observed in these waters (USFWS 1997, NYCDEP 2013). Occasional records of cetaceans (whales, dolphins, and porpoises) in the New York Harbor and Raritan Bay are generally of single individuals that are likely unhealthy and/or lost (USFWS 1997). These species of marine mammals are protected under the Marine Mammal Protection Act of 1972, as amended 1994.

3.5 THREATENED AND ENDANGERED SPECIES AND COMMUNITIES OF CONCERN

3.5.1 Threatened and Endangered Species

Section 7 of the ESA requires a Federal agency to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of Federally-listed endangered and threatened species, or result in the destruction or adverse modification of designated critical habitat of the Federally-listed species. In addition, State-listed endangered and threatened animal species are fully protected under the New York State Environmental Conservation Law (NYSECL) Section 11-0535 and New York plant species are listed and protected under NYSECL Section 9-1503. The following sections discuss the Federal and State species of concern identified by these agencies for the Project area. The discussion is divided into Federal and State sub-sections. In instances in which a species is both Federally-protected and State-protected (or a species of State concern), the species is discussed in the Federal sub-section, and only listed in the State table (Table 3-4).

Federally-Protected Species

A review of that data from the USFWS and NMFS found that two maritime protected species, the shortnose sturgeon (*Acipenser brevirostrum)* and the Atlantic sturgeon (*Acipenser oxyrhynchus)*, are listed for the Lower Bay (NMFS 2014a, USFWS 2014a). There are also four species of Federally threatened or endangered sea turtles that may be found seasonally. NMFS also lists several species of whales that occur seasonally in the offshore waters of New York, but concludes that the depths near the inshore waters are too shallow to be occupied by any of the listed whales (NYCDEP 2013). Table 3-3 lists the Federally-protected species along with their potential to occur in the Project area. The species are discussed below.

Shortnose sturgeon is a Federally-endangered anadromous fish, meaning it spends most of its life in brackish or salt water and migrates into freshwater to spawn. Shortnose sturgeon can be found throughout the Hudson River system. These fish spawn, develop, and overwinter well upriver of the Tappan Zee Bridge, and prefer colder, deeper waters for all life stages. Shortnose sturgeon use the lower Hudson River when traveling to or from the upriver spawning, nursery and overwintering areas. However, the Hudson River below Tappan Zee is not considered optimal shortnose sturgeon habitat (Bain 2004). Although the sturgeon may transit the bay in the spawning season, it would not be expected in the near shore shallow waters of the Lower Bay (NYCDEP 2013).

Atlantic sturgeon is also an anadromous fish that may grow to 14 feet, weigh as much as 800 pounds, and live to 60 years of age. Atlantic sturgeon can also be found throughout the Hudson River system and surrounding coastal waters. Atlantic sturgeon are similar in appearance to shortnose sturgeon, but can be distinguished by their larger size, smaller mouth, different snout shape, and scutes. The New York Bight population segment of Atlantic sturgeon is listed as endangered. Males migrate into freshwater during March and April, one month before females. They do not school together but meander singly. Females begin spawning as soon as they reach spawning grounds. Females lay 1 million to 2-1/2 million eggs in flowing water up to 60 feet deep. Both males and females may remain in the river until late fall before migrating back to the Atlantic. After hatching, the young tend to remain in their natal areas up to five years before beginning their journey to the ocean. Immature Atlantic sturgeon may also wander in and out of the Atlantic coastline. Today, less than 90 percent of the historic population of Atlantic sturgeon survives. Primary causes for the decline include overfishing, damming of rivers, and degradation or loss of habitat (NMFS 2014b).

Marine Turtles

Four species of marine turtles, all Federally-listed, can be found seasonally in New York waters typically between May 1 and November 30 when the waters are warm. Marine turtle occurrences in the Harbor Estuary are typically as small juveniles. Nesting sites for marine turtles are typically in sandy habitats with sparse or moderate vegetation cover (NYCDEP 2013).

Kemp's ridley sea turtle (*Lepidochelys kempii*) is a Federally-listed endangered species that is the most abundant Federally-listed sea turtle that enters the Harbor Estuary. This species typically occurs as a juvenile within the Lower Bay (NMFS 2009). Females reach sexual maturity at about six years or older (NYSDEC 2011). Nesting is restricted to a stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (NYSDEC 2011). In the northeast, this species remains briefly in open ocean waters, and retreats to harbors and estuarine waters in the summer months (NMFS 2009). Although Kemp's ridley sea turtles have been recorded near Sandy Hook (USFWS 1997), this species is pelagic in nature, and would be expected only in the deeper waters of the Lower Bay (NYCDEP 2013).

Loggerhead sea turtle (*Caretta caretta*) is Federally-listed threatened turtle that, with the Kemp's ridley sea turtle, is one of the most abundant Federally-listed sea turtles that enters the Harbor Estuary. In the northeast, this species remains briefly in open ocean waters, and retreats to harbors and estuarine waters in the summer months (NMFS 2009). This species reaches sexual maturity at about 10 to 15 years of age with most nesting occurring at beaches off of the Gulf of Mexico, southeastern United States, and Caribbean waters (NYSDEC 2011). Loggerhead turtles have been recorded near Sandy Hook (USFWS 1997). Nesting is uncommon in New York (NYCDEP 2013).

Green sea turtle (*Chelonia mydas*) is a Federally-listed threatened turtle that occasionally, when the waters are warm enough (June through October), occurs within the Harbor Estuary (NMFS 2009). This species prefers shallow waters of shoals, lagoons, estuaries, bays, and inlets with submerged aquatic vegetation. Nesting occurs is tropical waters that remain above 68 degrees Fahrenheit during the winter months (NYSDEC 2011). In the northeast, this species remains briefly in open ocean waters, and retreats to harbors and estuarine waters in the summer months

(NMFS 2009). It would be unlikely for this species to use the project sites for nesting due to the cold climate and waters of New York. In addition, submerged aquatic vegetation beds are not present in the Project area (NYCDEP 2013).

Leatherback sea turtle (*Dermochelys coriacea*) is a Federally-listed endangered turtle that is usually restricted to warmer waters with higher salinity levels offshore, and would less likely be found inshore. Nesting takes place from the Caribbean up to mid-Atlantic coast waters, typically on high energy, coarse sand beaches that are subject to erosion and adjacent to deep waters (NYCDEP 2013).

Marine Mammals

The Federally-listed endangered North Atlantic right whale (*Eubalaena glacialis*) and the humpback whale (*Megaptera novaeanglia*) occur in the offshore waters of New York on a seasonal basis (NMFS 2009). North Atlantic right whales occur from September 1 to March 31 and humpback whales occur from February to April and September to November. The Federally-endangered fin (*Balaenoptera physalus*) and sperm (*Physter macrocephalus*) whales are also seasonally present, but typically in deep offshore waters (NMFS 2009). Sightings of these species within New York/New Jersey Harbor are relatively rare (USFWS 1997). Although marine mammals are known to occur in the waters of the New York Bight, and occasionally come into New York/New Jersey Harbor, they are extremely unlikely in the waters in the Project area (NMFS 2009).

Birds

Piping plovers *(Charadrius melodus)* are small shorebirds listed as threatened under the ESA. Any piping plovers in the Project area would be part of the Atlantic Coast population, one of three population segments listed in the country. No critical habitat has been identified or proposed for this population (NPS 2014).

Rufa Red Knots *(Calidris canutus rufa)* are small shorebirds listed as threatened under the ESA. The red knot's range includes 40 U.S. states and 2 territories, and 27 countries and jurisdictions. The primary threats to the red knot are habitat loss across its range due to sea level rise, some shoreline projects, and Arctic warming; reduced food availability and timing mismatches throughout the birds' annual migratory cycle; and potential increases in predation on the Arctic breeding grounds. In 2015, the Service will announce a decision on whether and to what extent critical habitat may be designated (79 FR 73706). At the time of publication of this draft EIS in June 2015; critical habitat had not yet been designated.

Table 3-3. Federally-Protected Species Potentially Occurring in Project Area

Species	Source	Status	Habitat	Observed or Potential to Occur
Marine Species				
Shortnose Sturgeon	USFWS, NMFS	E	Found throughout Hudson River system	Not Expected
Atlantic Sturgeon	USFWS, NMFS	E	Found throughout Hudson River system	Not Expected
Kemp's ridley sea turtle	NMFS	E	Open ocean waters; retreats to harbors and estuarine waters in summer months	Not Expected
Loggerhead sea turtle	NMFS	T	In the northeast, remains briefly in open ocean waters; retreats to harbors and estuarine waters in summer months	Not Expected
Green sea turtle	NMFS	T	Prefers shallow waters of shoals, lagoons, estuaries, bays, and inlets with submerged aquatic vegetation	Not Expected
Leatherback sea turtle	NMFS	E	Usually restricted to warmer waters with higher salinity levels offshore; less likely to be found inshore	Not Expected
North Atlantic right whale	NMFS	E	Offshore waters of New York on a seasonal basis, from September 1 to March 31	Not Expected
Humpback whale	NMFS	E	Offshore waters of New York on a seasonal basis, from February to April and September to November.	Not Expected
Fin whale	NMFS	E	Seasonally present, but typically in deep offshore waters	Not Expected
Sperm whale	NMFS	E	Seasonally present, but typically in deep offshore waters	Not Expected
Birds				
Piping Plover	USFWS	T	Coastlines	Potential to occur
Rufa Red Knot[a]	USFWS	T	Coastlines	Potential to occur

Notes: (E) Endangered; (T) threatened.
[a] The Rufa Red Knot was listed as Threatened by the USFWS on December 11, 2014 (79 FR 73706). The final rule became effective on January 12, 2015.
Source: NMFS 2014, USFWS 2014, NPS 2014.

State Species of Concern

Table 3-4 lists State species of concern, along with their potential to occur in the Project area. The Breeding Bird Atlas lists four State-protected species for the area. Two State-listed "exploitably vulnerable" plants, the royal fern and cinnamon fern, and one State-listed "special concern" species, the Cooper's hawk, were observed during 2009-2010 field studies conducted in support of the Bluebelt GEIS (NYCDEP 2013). Database results furnished by NYCDPR indicate that three State-listed plant species have been recorded within the Oakwood Beach area (NYCDEP 2013). In addition, one State-listed plant species was identified during the literature review. In addition to those shown on Table 3-4, there are 15 State-listed species including dragonflies, damselflies, amphibians, and plants which are historically known to occur in the Project area (NYCDEP 2013). State species of concern are discussed below. Previous discussions of Federal species of concern are not repeated.

Osprey (*Pandion haliaetus*) is not a protected species, but is listed by the State as a species of special concern. In New York, osprey can be found along the coastline, and on lakes and rivers, but there are two main breeding populations, one on Long Island and the other in the Adirondack Mountains. The female lays one to four, but usually three, eggs in the spring in a large nest of sticks constructed at the top of a dead tree, but nesting platforms and other human-made platforms are also commonly used. The nest is often used year after year and tends to grow in size over time as more material is added before each nesting season. The young fledge at about eight weeks of age and remain in the vicinity of the nest for about two months. Osprey are typically in New York State from April to September and would have the potential to be found in the Project area (NYCDEP 2013).

Northern harrier (*Circus cyaneus***)** is a State-listed threatened species. Northern harriers breed in marshes, grasslands, meadows and cultivated fields. Breeding in coastal areas is preferred, but inland areas are also used when coastal habitats are limited. Nests are weakly built of sticks and grass on the ground either in dense vegetation or in a slightly elevated area. The clutch averages 5 eggs. The young fledge in 30 to 41 days and remain near the nest, dependent on their parents for 3 to 4 weeks. Northern Harriers occur in New York throughout the year. During the breeding season, the best time to see Northern Harriers is May through June. Based on the information provided in the Breeding Bird Atlas (none were observed during the spring or fall 2009/2010 field investigations for the Bluebelt GEIS) this species is potentially in the Project area (NYCDEP 2013).

Cooper's hawk (*Accipiter cooperii***)** is listed by the State as a special concern species. Cooper's hawks are found in woodland settings and travel through dense tree canopies at high speeds in pursuit of other birds. Although this species is more often in woodlands, in an urban setting it can be found in parks, neighborhoods, fields, yards, and within trees along busy tree-lined streets. The diet of the Cooper's hawks is mostly of medium-sized birds such as European starling, mourning dove, rock pigeon, American robin, northern flicker, and quail, pheasants, grouse, and chickens. Occasionally, Cooper's hawks rob nests and also eat chipmunks, mice, squirrels, and bats. Cooper's hawks nests are often built in pines, oaks, Douglas-firs, beeches, spruces, among other species found in dense woods. Cooper's hawks are known to occur in

southern New York year around. Cooper's hawk has been observed in the Project area during fall 2009 and spring 2010 site investigations for the Bluebelt GEIS (NYCDEP 2013).

Peregrine falcon (*Falco peregrinus***)** is a State-protected species (endangered) and is ranked "S3B" by NYNHP, indicating that there are typically 21 to 100 breeding occurrences or limited breeding acreage in the State. In 1999, the USFWS removed the Peregrine falcon from the Federally-protected threatened and endangered species list. Peregrine falcons often nest on ledges or holes on the faces of rocky cliffs, but will nest on human-made structures such as bridges and tall buildings, especially near or in urban areas. In the New York City area, wintering birds frequent buildings and open areas with plentiful prey in more natural settings. Peregrine falcon diets primarily consist of birds, ranging from songbirds to small geese, and also bats and other small mammals. The current Peregrine falcon range within the State includes the Adirondacks, the New York City area, and the Hudson Valley. A Peregrine falcon was observed flying overhead of the Project area during the Spring 2010 site investigation for the Bluebelt GEIS, and has been reported by NYSDEC in the vicinity of the South Beach area. No Peregrine falcons were observed nesting and foraging at any of the BMP sites proposed in the Bluebelt GEIS (NYCDEP 2013).

Whip-poor-will (*Caprimulgus vociferus***)** is a State-listed special concern species that is potentially in the Oakwood Beach watershed based on the Breeding Bird Atlas (none were observed during the spring/fall 2009/2010 field investigations in support of the Bluebelt GEIS). It is named for its distinctive call and is more commonly heard than seen. During the day the whip-poor will roosts on the low limbs of trees where it is well camouflaged. Whip-poor-will is potentially in the Mid-Island watersheds based on the Breeding Bird Atlas. However, it was not observed during the field investigations and given the types of habitats typically used by this species, it is not expected in the Project area (NYCDEP 2013).

Northern cricket frog (*Acris crepitans*) is a State-endangered species that inhabits the edges of sunny marshes, marshy ponds. NYNHP records indicate that the last species noted within the three watersheds was in 1967, with the last recorded sighting at Reeds Basket Willow Swamp in 1897. Therefore, it is not likely that this species is present in the Project area (NYCDEP 2013).

Table 3-4. State Species of Concern Potentially Occurring in Project Area

Species	Source	Status	Habitat	Observed or Potential to Occur
Marine Species				
Shortnose Sturgeon	NYSDEC	E	Found throughout Hudson River system	Not Expected
Atlantic Sturgeon	NYSDEC	E	Found throughout Hudson River system	Not Expected
Kemp's ridley sea turtle	NYSDEC	E	Open ocean waters; retreats to harbors and estuarine waters in summer months	Not Expected
Loggerhead sea turtle	NYSDEC	T	In the northeast, remains briefly in open ocean waters; retreats to harbors and estuarine waters in summer months	Not Expected
Green sea turtle	NYSDEC	T	Prefers shallow waters of shoals, lagoons, estuaries, bays, and inlets with submerged aquatic vegetation	Not Expected
Leatherback sea turtle	NYSDEC	E	Usually restricted to warmer waters with higher salinity levels offshore; less likely to be found inshore	Not Expected
North Atlantic right whale	NYSDEC	E	Offshore waters of New York on a seasonal basis, from September 1 to March 31	Not Expected
Humpback whale	NYSDEC	E	offshore waters of New York on a seasonal basis, from February to April and September to November.	Not Expected
Fin whale	NYSDEC	E	Seasonally present, but typically in deep offshore waters	Not Expected
Sperm whale	NYSDEC	E	Seasonally present, but typically in deep offshore waters	Not Expected
Amphibians				
Northern Cricket frog	NYSDEC	E	Inhabits the edges of sunny marshes, marshy ponds	Not Expected
Birds				
Osprey	Breeding Bird Atlas	SC	Coastlines; lakes; rivers; dead trees; human-made structures	Potential to occur
Coopers Hawk	Observed	SC	Coastlines; lakes; rivers; dead trees; human-made structures	Observed in Project area
Northern Harrier	Breeding Bird Atlas	T	Coastal marshes, grasslands, meadows and cultivated fields	Potential to occur
Peregrine Falcon	Breeding Bird Atlas and Field observations	E	Nests on ledges of rocky cliffs; human-made structure; wetlands for foraging	Potential for flyover or foraging
Whip-poor-will	Breeding Bird Atlas	SC	Roosts on the low limbs of trees where it is well camouflaged.	Not Expected
Piping Plover	NYSDEC	E	Coastlines	Potential to occur

Table 3-4. State Species of Concern Potentially Occurring in Project Area (con't)				
Species	**Source**	**Status**	**Habitat**	**Observed or Potential to Occur**
Plants				
Slender Blue Iris	NYCDPR	T	Fresh and Brackish marsh of coastal areas	Observed in Project area
Northern Gamma Grass	Literature Review	T	Moist places such as ditches, depressions, swales, and the edges of salt marshes	Potential to occur
Turks-caps-Lilly	NYCDPR	EV	Wet meadows; woods	Observed in Project area
Royal Fern	Recent Observations	EV	Emergent wetlands, red-maple hardwood swamp, shrub-dominated wetlands; areas with low common reed coverage	Observed in Project area
Slender Blue Flag	NYCDPR	T	Marshes (fresh, brackish, salt)	Observed in Project area
Green Milkweed	NYNHP	T	Upland slopes of serpentine or calcerous rock, grasslands, mowed golf course, sands; old pasture; alkaline soils; cedar glades	Potential to occur
Jacob's Ladder	NYNHP	E	Rich woods, moist soil of open woods, roadsides, thickets, or moist to dry upland woods	Potential to occur
Lowland Fragile Fern	NYNHP	E	Rich, open woods, borders, and thickets	Potential to occur
Cinnamon Fern	Observed	EV	Swamps, stream banks, and shores with subacid soils	Observed in Project area
Spinulose Wood Fern	Observed	EV	Moist or wet woods, swamps	Observed in Project area
Slender Rose Gentian	NYCDPR	E	Salt and brackish	Potential to occur
Hop Sedge	Data and literature review	T	Coastal Sands	Potential to occur
Fringed boneset	Data and literature review	E	Coastal Sand and meadows	Potential to occur
Neelepod Rush	Data and literature review	E	Coastal Sand and meadows	Potential to occur
Seaside knotweed	Data and literature review	R	Sandy beaches and shores	Potential to occur
Globose Flatsedge	Data and literature review	E	Sandy coastal plains	Potential to occur
Butterfly Milkweed	Data and literature review	EV	Dry fields/banks	Potential to occur
Nodding Ladies Tresses	NYCDPR	EV	Wet meadows and swamps	Potential to occur

Notes: (E) Endangered; (T) threatened: (SC) Species of Concern; (EV) Exploitably Vulnerable; (R) Rare. Observed = observed during 2009/2010 surveys for Bluebelt GEIS process.
Source: NYCDEP 2013.

3.5.2 Natural Areas and Communities of Special Concern or Management

There are no NYSDEC designated Critical Environmental Area (CEA) or Unique Geologic Features in Richmond County (NYSHCR 2013). However, the USFWS lists the Raritan Bay – Sandy Hook Bay as a Significant Habitat Complex of the New York Bight Watershed (USFWS 1997). Significant Habitat Complexes are identified by the USFWS to aid in the identification, description, distribution, and population status of key marine, coastal, and terrestrial species occurring within the near-coastal waters, coastal lands, and uplands of the New York Bight watershed (NYCDEP 2013). Additionally, NYNHP records indicate that the following notable ecological communities occur in the Project area:

Serpentine Barrens. The NYNHP has identified the Serpentine Barrens as in the vicinity of the South Beach area. The serpentine barrens is described as a grass-savanna community that occurs on shallow soils over outcrops of serpentine bedrock. In New York this community is known to occur on Staten Island, where the remnants are relatively disturbed. Serpentine barrens are dominated by little bluestem (*Schizachyrium scoparium*), panic grasses (such as *Panicum virgatum* and *P. philadelphicum*), Indian grass (*Sorghastrum nutans*), and poverty-grass (*Danthonia spicata*). Characteristic forbs include heath aster (*Aster ericoides*), calico aster (*A lateriflorus*), small white snakeroot (*Eupatorium aromaticum*), old-field cinquefoil (*Potentilla simplex*), and green milkweed (*Asclepias viridiflora*). Trees and shrubs are scattered in the barrens. Characteristic woody plants are gray birch, black oak, sassafras, quaking aspen (*Populus tremuloides*), bayberry (*Myrica pensylvanica*), shining sumac, sawbrier, arrowwood, and blueberries. A characteristic butterfly is the arogos skipper (*Atrytone arogos arogos*) (Edinger et. al 2002, NYCDEP 2013).

Oak-Hill Tulip Forest. The NYNHP has identified the Oak-Tulip Tree Forest within Reed's Basket Willow Swamp Park, but not at other locations in the Project area (NYCDEP 2013). The Oak-Tulip Tree Forest community has been described as a "mesophytic hardwood forest community that occurs on moist, well-drained sites in southeastern New York (Edinger et. al. 2002). The dominant trees include a mix of oaks and tulip trees, American beech (*Fagus grandifolia),* black birch (*Betula lenta*), and red maple (*Acer rubrum*). The subcanopy often includes flowering dogwood (*Cornus florida*), and common understory associates include witch hazel (*Hamamelis*), sassafras (*Sassafras albidum*), and lowbush blueberries. The herb layer is moderate to sparse and may include New York fern (*Thelytris noveboracensis*), white wood aster (*Eurybia divaricata*), and Solomon's plume (*Maianthemum racemosum*)." NYNHP identifies the Oak-Tulip Tree Forest as a special concern vegetative community (NYSDEC Natural Heritage Program, 2009). It should be noted that Edinger et. al. (2002) lists the Staten Island Greenbelt as an example of the oak-tulip tree community type.

3.6 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

This section discusses the socioeconomic setting in the Fort Wadsworth to Oakwood Beach area, including a characterization of population and race, economy and income, and housing. Pertinent to these topics, an introductory overview of the history of Staten Island's growth is provided in the following two paragraphs.

Between 1990 and 2010, the population of Staten Island (Richmond County) increased by 89,753, to a total of 468,730 people, as documented in the 2010 U.S. Census (US Census Bureau [USCB] 2010). This represents a 23.6 percent population increase, and made Richmond County one of the fastest growing counties in New York State during the past decade, and the fastest growing borough of New York City (USCB 2010). Although Staten Island's population is only about 5.7 percent of a total of more than 8.2 million people living in New York City (which includes the five boroughs of Manhattan, Bronx, Brooklyn, Queens, and Staten Island), the rate of population growth on Staten Island during the past decade almost doubled the average among the rest of the city (USCB 2010),

Staten Island has outpaced the rate of growth of the other four boroughs of New York City for more than 50 years. Population growth on Staten Island increased dramatically after the Verrazano Narrows Bridge was opened in 1964, providing direct access between Staten Island and the rest of the city (Staten Island Growth Management Task Force 2003).

3.6.1 Demographic Characterization

A large majority (64 percent) of the population on Staten Island is characterized as white non-Hispanic, the highest percentage of white population among the five boroughs of New York City. People of Hispanic origin make up about 17.3 percent of the island's population. Other race categories of the Staten Island population include: black/African American (about 9.5 percent), and Asian or Pacific Islander (about 7.4 percent), and American Indian/Alaska native or non-Hispanic of some other race (less than 1 percent each). About 22.7 percent of the population is under the age of 18, and 13.7 percent is over 65 (USCB 2010).

3.6.2 Economy and Income

Between 2008 and 2012, the average number of households in Staten Island was 163,675. The median household income was $73,496. Approximately 11.3 percent of the population was below the poverty level (USCB 2010).

3.6.3 Housing

In 2013, there were approximately 178,057 housing units on Staten Island (USCB 2010). Within the Oakwood Beach area there are approximately 7,630 housing units; within the New Creek area there are approximately 13,900 housing units; and within the South Beach area there are approximately 8,954 housing units (NYSDEP 2013). The home ownership rate is 69.1 percent and the median value of owner-occupied housing units is $449,400 (USCB 2010).

3.6.4 Environmental Justice and Protection of Children

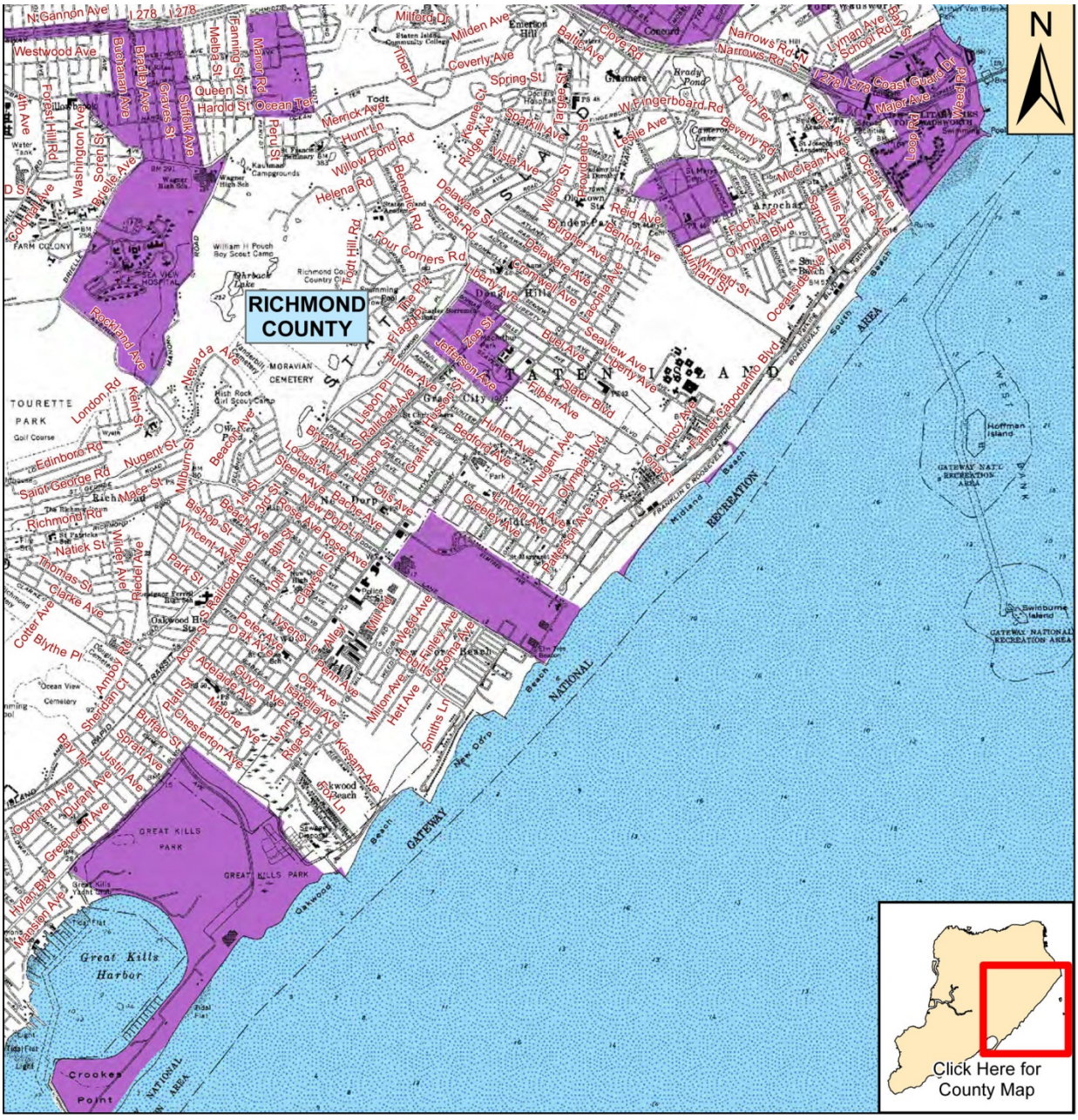
The USEPA has defined "environmental justice" as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA 2005). Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," signed in February 1994, directs

Federal agencies to address environmental and human health conditions in minority and low-income communities. The evaluation of impacts to environmental justice is dependent upon determining if there would be disproportionately high and adverse impacts from the proposed action on any low-income or minority group in the affected community.

The USACE used information from NYSDEC to identify minority and low-income populations in the Project area. "Minority" refers to people who classified themselves in the 2010 Census as Black or African American, Asian or Pacific Islander, American Indian or Alaskan Native, Hispanic of any race or origin, or other non-White races. Environmental justice guidance defines "low-income" using statistical poverty thresholds from the U.S. Census Bureau.

Within the Project area, there are several potential environmental justice areas in the Oakwood Beach area. One area, around the Fresh Kills Landfill, is located on the western edge of Oakwood Beach. A second area is located near New Dorp Lane. These areas are shown on the NYSDEC's mapped Environmental Justice Areas map (Figure 3-10). The primary goal of the Project is to manage the risk of damages from hurricane and storm surge flooding. This goal applies to all individuals in the Project area.

Under Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks," issued on April 21, 1997, to the extent permitted by law and appropriate, and consistent with the agency's mission, each Federal agency: (a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. The primary goal of the Project is to manage the risk of damages from hurricane and storm surge flooding. This goal applies to all individuals in the Project area.



Source: NYSHCR 2013

Figure 3-10. Potential Environmental Justice Areas within the Project Area

3.7 CULTURAL RESOURCES

As a Federal agency, the USACE has certain responsibilities for the identification, protection and preservation of cultural resources that may be located within the Area of Potential Effect (APE) associated with the proposed Project. Current statutes and regulations governing the identification, protection, and preservation of these resources include the NHPA; NEPA; Executive Order 11593; and the regulations implementing Section 106 of the NHPA (36 CFR Part 800, Protection of Historic Properties, August 2004). Significant cultural resources include any material remains of human activity eligible for inclusion on the NRHP. The APE for this undertaking includes all areas directly impacted by activities required to construct project features as well as construction access and staging areas and, as required, environmental mitigation measures. The APE also includes viewsheds and landscapes adjacent to the LOP.

Much of the project's APE has been subject to cultural resource surveys by the USACE or by others. A reconnaissance report was prepared for this study in 1995 which was a summary of cultural resources work conducted to date in the project vicinity, a brief overview of historic map research and recommendations for further work (Rakos 1995). This work summarized and updated a previous study undertaken for the project (Lipson, *et al*. 1978.). The USACE conducted archaeological investigations at Oakwood Beach in 1995 (Rakos 1996). A Phase I survey of the entire south shore of Staten Island Project area was completed for the USACE in 2005 (Panamerican Consultants, Inc. [Panamerican] 2005). This work included archaeological testing and an historic architectural survey. The only historic structures identified in the APE are at Miller Field, detailed below. The resulting report recommended further archaeological investigations in selected locations along the proposed project alignment and within interior drainage features as testing had not been conducted within those locations. These investigations will be undertaken as the project proceeds. All work was coordinated with the (New York State Office of Parks, Recreation, and Historic Preservation (OPRHP), which is the State Historic Preservation Office (SHPO) for New York.

Proposed interior drainage features and ponding areas are largely parcels contained in the NYCDEP Staten Island Bluebelt program. Since the USACE's 2005 survey NYCDEP undertook cultural resources studies as part of the Bluebelt GEIS and identified several locations where archaeological testing was recommended (Historical Perspectives 2011a, 2011b and 2011c).

Archaeological Sites

Archaeological sites previously recorded in the vicinity of the project area were largely documented in the late 19th and early 20th centuries although a few have come to light through more recent cultural resource management studies. No sites were documented in the APE itself. The "Arrochar" site, near the northern end of the APE, yielded both Native American and early European materials. The Walton-Stillwell house site (northwest of the present intersection of Drury Lane and Ocean Avenue) also indicated occupation by Native American populations as well as evidence of the 17-th century European habitation. At Oakwood Beach the Oakwood/Lake's Mill site a shell midden and lithic finds were reported. Testing by the USACE

at Oakwood Beach identified a Native American site (Rakos 1996). This site was later destroyed by a private development project. A number of finds were documented in the vicinity of Great Kills including *Sites #A-085-01-0162* through *0165*, described respectively as a campsite at Crooke's Point, isolated fluted point northwest of Great Kills Harbor, a camp and shell midden and what was possibly Contact Period site (John Milner Associates 1978). These sites are south of the APE.

The presence of prehistoric sites along the south shore of Staten Island is affected by the topography and physiography of the area. As revealed by various historic maps extensive areas of salt marsh formerly extended along the shoreline adjacent to much of the project area. During the latter portion of the prehistoric period, areas of salt marsh would not have provided favorable environments for prehistoric settlement. Similarly, beach areas, although undoubtedly visited and utilized by Native Americans would not have represented likely areas for settlement or long-term occupation. Marsh areas could however contain deeply buried evidence of early prehistoric utilization. The potential for deeply buried sites was corroborated by a geomorphological study conducted for the USACE's New York and New Jersey Harbor Navigation Project (Geoarchaeological Research Associates 2014). While this study's APE was offshore, it suggested that the south shore of Staten Island is moderately sensitive for now inundated or deeply buried shoreline sites.

At New Dorp Beach, the remains of several concrete structures were encountered and the 2005 report recommended a Phase II field and documentary investigation to define specific structural features and to make direct linkages with the documented structures from the shoreline inland to Cedar Grove Avenue. These remains are likely from the St. John's Guild Hospital (also known as the Seaside Hospital) built in 1881, closed in the 1960s, but extant until 1988. The 2005 report includes sketch plans and photographs of the concrete structural remains, which consist of disarticulated elements of the foundation walls with sections of concrete flooring. These features have clearly had been broken up and scattered by storms. Since 2005, there have been many other severe storms to hit the area including Hurricane Sandy which disturbed these remains even further. Similar structural elements were noted in this vicinity in a previous survey of the area and were determined not significant (Site numbers *AO95-01-0129*, *AO85-01-0153* and *AO85-01-0154*) (John Milner & Associates 1978). Forty-two shovel tests were excavated in 2005 in and around these remains, of which just two had more than two strata, and only 11 others had more than one soil layer. Almost three quarters of the tests yielded artifacts which consisted largely of building materials, although a few ceramic sherds were encountered as were fragments of bottle glass. The datable material was largely 20th century, with some 19th century artifact fragments as well as modern debris. The lack of structural integrity and lack of documented stratigraphy suggest that further field work would not yield any significant information.

Emergency protective berms constructed in this area by NYCDPR following Hurricane Sandy have likely further diminished or destroyed the integrity of any resource present. Further, a letter from the OPRHP to NYCDPR as part of the Cedar Grove Beach work states, "I understand that you are currently concerned about the location of the former Seaside Hospital. The OPRHP has no concerns regarding this location" (Mackey 2011). The current proposed alignment of the LOP in this location has shifted landwards. This shift may also impact remains associated with the original site of Britton Cottage. The cottage is now located in Historic Richmondtown.

Historic Architectural Resources, Landscapes and Viewsheds

An architectural reconnaissance was conducted for all buildings and structures in and immediately adjacent to the project area (Panamerican 2005). The purpose was to identify historic properties or districts that might be eligible for listing on the NRHP. The study also served to identify and evaluate potential impacts to cultural resources associated with the various protection measures. The architectural field investigation focused on the exteriors of structures and involved photographic documentation of buildings 50 years old or older, as well as general streetscapes and viewsheds along the project route. Basic data gathered for selected structures included location, function, and age of construction. Other pertinent information collected in the field focused on building materials, architectural features and details, visible exterior modifications, integrity, associated outbuildings and landscape features. Few potentially eligible of NRHP-listed properties were noted.

The FDR Boardwalk, which once followed the entire South/Midland Beach shoreline between Miller Field and Fort Wadsworth, was constructed between 1935 and 1938 by FDR's Works Progress Administration (WPA). While the entire length of the walkway is still designated as the FDR boardwalk, its southern half (south of Seaview Avenue) actually consists of a modern, at-grade asphalt and pavement promenade. North of Seaview Avenue, the walkway is composed of a traditional wood boardwalk, although the original 1935 construction has been replaced in-kind. This structure was determined not eligible for the NRHP.

Both the 1995 and 2005 reports recommended a NRHP evaluation of the Cedar Grove Beach Club community. The bungalow community at Cedar Grove was later determined eligible for the NRHP by the New York SHPO in 2011 in connection with a NYCDPR proposal to remove most of these structures. Mitigation measures associated with the proposed removal were being developed and the structures were to be removed by NYCDPR before the USACE's construction was initiated (AECOM 2011). Since that time, the structures were all severely impacted by Hurricane Sandy. Just two of the structures remain and they are slated for demolition by NYCDPR.

Miller Army Airfield National Register Historic District (Miller Field)

The Miller Army Airfield Historic District is the only NRHP-eligible or listed resource identified within the APE. This property is part of the Gateway NRA. The historic district, which was listed on the NRHP in 1980, consists of 3.05 acres including "seaplane hangar No. 38, and the Elm Tree Light and their immediate surroundings' (NPS 1976). The exact boundaries of the district are not defined but include the concrete apron to the northeast of Hangar 38. Miller Field contained a total of 38 structures when completed, 24 of which survived when the NPS acquired the 180-acre tract. A landplane hangar built as part of the original plan was too deteriorated to save and it was demolished. Several former residential structures from the base are extant but not considered eligible for the NRHP and are not included in the historic district. Miller Field was the subject of a Historic Sites Report (HSR) which contains extensive information on the history of the airfield and its construction as well as its later usage (Unrau and Powell 1981). Hangar 38 was documented in the Historic American Building Survey in 1978 (HABS 1978).

The airfield property occupies a portion of the former Vanderbilt Estate, a 350-acre "gentleman's farm" established by Cornelius Vanderbilt in 1836. When the U.S. Army acquired the land in 1919, numerous changes were made in order to adapt the property to airfield use. The Army initially utilized existing buildings, however the requirements of military use led to the eventual demolition of all structures associated with the Vanderbilt family, including the family mansion (Baugher-Perlin and Bluefeld 1980).

Because its location was particularly well suited to both land and sea planes, Miller Field was authorized in 1917 as an Aero Coast Defense Station. Its mission was to assist the Coast Artillery in defending New York Harbor. When completed in 1921, it was the only Air Service Coast Defense Station on the east coast and was the only one of seven proposed to be built that was actually constructed (Unrau and Powell 1981; Historic Miller Field 2007). Over time, the airfield served a number of different purposes, including functioning as an Army Airfield, a training base, a Coast Guard Artillery gun site, a Nike Missile Repair Depot, a U.S. Army Special Forces Base, and a temporary prisoner-of-war camp (Historic Miller Field 2007). It is significant for its testing and servicing of early American aircraft.

The seaplane hangar, Building 38, was constructed by the United States Army 1920-1921. Access to the sea was via a concrete ramp. At the same time a landplane hangar, Building 33, was built and other ancillary strictures were constructed to support the aviation mission. Building 38, or Hangar 38, is a double seaplane hangar, comprised of a steel frame structure with stuccoed tile curtain walls. The hangars have gambrel roofs, supported by open steel trusses and covered with tarred gypsum slabs.

Hangar 38 had a concrete paved surface between it and the ramp to the sea which, according to the HSR "leads directly into the water extending out about 200 feet beyond mean low tide, the entire ramp being 400 feet long and 40 feet wide "(Unrau and Powell 1981). The ramp was severely damaged in 1924 and was gone by 1935 after extensive renovations by the WPA (Unrau and Powell 1981). The extant concrete apron to the northeast of Hangar 38 once connected it to the Quartermaster Storehouse and landplane hangar, both no longer standing. The apron between the hangars was improved by the WPA in 1935-36 (Unrau and Powell 1981). The NRHP nomination does not directly refer to the concrete apron but mentions the area "immediately surrounding" the hangar. The New York SHPO has determined the concrete apron eligible as a contributing element of the historic district.

The Elm Tree Light was built in 1939 by the Coast Guard to replace earlier aids to navigation, including a large elm tree that stood at the end of New Dorp Lane in the 18th century and served as a guide to mariners (NPS 1976; Unrau and Powell 1981). This "octagonal concrete beacon tower" supported the light on a flat roof surrounded by an iron railing (NPS 1976). The structure decreases in diameter as it rises from the ground to the beacon. As per the GMP, the significance of the Elm Tree Light "lies with its direct association with the early lighthouse service (NPS 2014). The Elm Tree Light was documented to HABS standards (HABS 1978).

Adjacent to, but not included in, the historic district is a 1943 concrete fire control tower. This structure is also owned by the NPS but was not addressed in their Final General Management

Plan/Generic Environmental Impact Statement (NPS 2014). It was built to serve as a "base end station", which aided locating offshore targets through triangulation and worked in concert with stations at Fort Wadsworth on Staten Island and Fort Hamilton in Brooklyn (Historic Miller Field 2007). This structure was not included in the NRHP Nomination Form as a contributing element to the historic district (NPS 1976). As per the 2005 USACE study, due to the structure's lack of integrity, it was neither an individually eligible resource, nor a contributing element to the historic district; however further study was recommended (Panamerican 2005). The tower was documented to HABS standards (HABS 1978). At this time no determination of eligibility for the fire tower has been made.

Studies of the Miller Field property as a whole have noted that the grounds have the potential for archaeological resources due to the long historical occupation of the area. Native American resources may be encountered, as well as remains from Colonial period farmsteads. There may also be elements remaining from the Vanderbilt Estate although the heart of the estate, including the mansion, was inland of the APE. Limited testing conducted in association with a park road improvement project identified evidence of the demolition of the Vanderbilt buildings but no *in situ* evidence of the period of occupation was identified (Mueller and Linck 1991).

The concrete ramp that once provided seaplanes access to the sea from Hangar 38 is not visible on the surface as a beach and dune have developed over the site. It is not clear how much of the ramp, if any of it, remains buried. The NRHP nomination form indicates that the ramp is not extant (NPS 1976). A recent archaeological survey conducted for the NPS identified what may be the original concrete ramp below the 1939 concrete apron (Dukes 2012).

A stone jetty was built in 1924 at the northern end of the airfield to help maintain the sand on the beach. There are no visible remains of this jetty on the ground surface but elements of it may remain.

Fort Wadsworth National Register Historic District

The Fort Wadsworth National Register Historic District lies immediately adjacent to the northern terminus of the LOP and within the project's APE. The property contains nationally significant historic structures representing military history and coastal defense systems from the late 18th-century through the Cold War. The contributing structures to the historic district are largely sited to the north and east of the APE in locations that provided commanding view of the Narrows and Upper Bay, the entryway to New York Harbor, which the defenses were designed to protect. These structures, and the history of Fort Wadsworth, have been discussed in a number of reports and publications and will not be detailed here. The concern for this project is the proposed seawall and its potential impact on the setting of the historic district and in particular the LOP obscuring historic viewsheds from the property. Fort Wadsworth is sited on a great promontory rising to over 100-feet above sea level. The "unrestricted view of New York Harbor" is identified as one of the important aspects of the fort in the National Register nomination form (Hunter Research 1995; NPS n.d.b,.1995, 2014). Listed separately on the NRHP, but contributing resources to the historic district, are twelve Endicott Era batteries, built between 1895 and 1904 (NPS 1985). Two of them, Batteries Ayers and Richmond, are the historic

structures nearest to LOP. These resources are separated from the LOP by modern housing built both within the historic district and outside its boundaries.

3.8 LAND USE AND ZONING

Overview. Overdevelopment and inappropriate development has increasingly become one of the most significant issues on Staten Island. Over the last two decades, the island's population grew by 23.6 percent, making it one of the fastest growing counties in New York. The addition of 89,753 people between 1990 and 2010 was accompanied by approximately 36,930 new housing units, an increase of almost 26.5 percent (NYCDEP 2013). The Borough of Staten Island has established zoning for residential, commercial, and manufacturing districts in the Project area. There are four different residential zoning districts, four commercial districts, and one manufacturing zoning district in the Project area (see Table 3-5). All of the residential zoning districts permit community facilities and open uses which serve the residents of these districts or which provide benefits to the specific residential environment (NYCPC 2003).

Table 3-5. Staten Island Zoning Districts in the Project Area.

District	Use Category	Example Uses
Residential		
R1-2	Single family detached residence district	Designed to provide a suitable open character for single-family detached dwellings at low densities.
R3-1	Detached and semi-detached residence district	Designed to provide for single- or two-family detached or semi-detached dwellings.
R3-2	General residence district	Designed to provide for all types of residential buildings, with specific standards for density, open space, and spacing of buildings.
R3-A	Detached residence district	Designed to provide for single- or two-family detached dwellings on zoning lots of specified lot widths, including zero lot line buildings.
Commercial		
C1-1	Local retail district	Provides local shopping, including a wide range of retail stores and service oriented businesses.
C1-2	Local retail district	Provides a wide range of essential local services not involving regular shopping (such as post offices, doctor's offices, and hair salons).
C3	Waterfront recreation district	Designed to support the waterfront recreational activities such as pleasure boating and fishing, by permitting rental, servicing, and storage of boats in appropriate waterfront areas.
C4-1	General commercial district	Major and secondary shopping centers, providing for occasional family shopping needs and essential services for business establishments, including large stores generating considerable traffic.
Manufacturing		
M3-1	Heavy manufacturing	Accommodates essential heavy industrial uses; excludes new residential or community facilities.

Sources: NYCPC 2003.

As discussed in Section 2.2 of this EIS, the NYCDEP has an ongoing program to purchase wetland properties for inclusion into the Bluebelt system. Other publicly and privately owned wetland areas are also incorporated into the system. These properties include NYC parkland, New York State wetland preserves, Designated Open Space, and other City-owned properties. Approximately 204 acres of the Project area will be, or is already, owned by the NYCDEP Bluebelt Program (USACE 2015). No areas of Richmond County are in the Coastal Barrier

Resources Area (NYSHCR 2013). Land use in the Project area consists primarily of residential, commercial, and recreational areas. A more detailed discussion of land use follows.

Oakwood Beach (Drainage Areas A and B). The Oakwood Beach area, which is approximately 1,329-acres, is developed and urbanized. As shown in Table 3-6 and Figure 3-11, land use in the Oakwood Beach area is comprised of residential (46.7 percent), open space (8.7 percent), commercial (5.2 percent) and developed roadbed (20.9 percent).

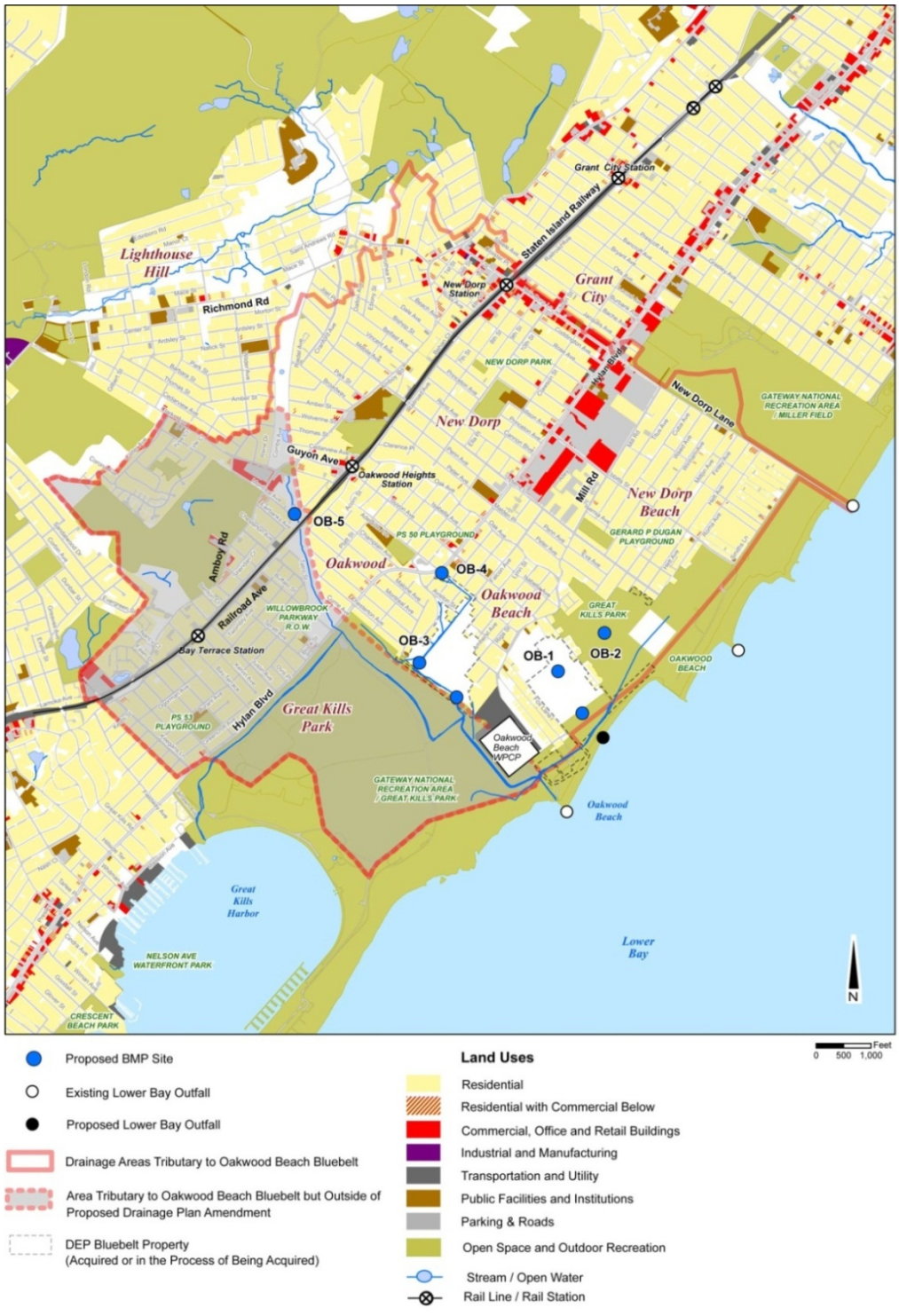
Table 3-6. Land Use in the Oakwood Beach Area

Land Use	Acres	Percentage of total land
Residential	621.2	46.7
Road bed/sidewalks	278.8	20.9
Open Space*	113.4	8.7
Vacant**	93.3	7.0
Commercial	68.7	5.2
Public facilities/institutional	40.9	3.1
Transportation/utility	27.8	2.1
Mixed residential/commercial	10.1	0.8
Other (industrial, parking, etc.)	75.1	5.5
Total Area	**1,329.3**	**100.0**

Notes: * Open Space includes City parkland and NYSDEC property.
**Vacant land includes Bluebelt property which totals about 42 acres.
Source: NYCDEP 2013

Residential uses are predominantly single-family detached homes, although there are also some two family homes and multi-family apartment buildings in the area. Commercial uses include restaurants, food markets, small offices and a larger commercial center at the intersection of Hylan Boulevard and New Dorp Lane. Public facilities and institutional uses, including places of worship and public and private schools, comprise a small portion of the area.

Major access roads within the area include Hylan Boulevard and Amboy Road, which run east to west, and New Dorp Lane, which runs north to south. The Staten Island Railway, a rail service operated by the Metropolitan Transit Authority (MTA), parallels Amboy Road and offers transit service between Tottenville and St. George. Transit stations in the area are located in the New Dorp and Oakwood Heights communities. In addition, the Oakwood Beach WWTP is located in the southwest portion of the area. Most of the area's vacant land is located in the blocks south of Hylan Boulevard, east of Tysens Lane, north of Mill Road and west of New Dorp Lane. This vacant land is a combination of abandoned commercial properties and undeveloped land. Some of these vacant parcels also have development constraints due to freshwater wetlands that are regulated by NYSDEC and the USACE. NYCDEP Bluebelt property totals about 61 acres. Great Kills Park, the City parkland under the jurisdiction of NYCDPR, comprises much of the open space in the area. The park is about 315 acres in size.



Note: "Proposed BMP Site" and "Proposed Lower Bay Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-11. Land Use for the Oakwood Beach Area

Zoning for the Oakwood Beach area is shown in Figure 3-12. As shown in Figure 3-12, the Oakwood Beach area contains a mix of lower-density residential zoning districts including R3-1, R3-2, R3X and R2, with a commercial zoning district (C4-1) and a manufacturing zoning district (M3-1).

New Creek (Drainage Area C). The New Creek area, which is approximately 2,248-acres, is developed and urbanized. As shown in Table 3-6 and Figure 3-13, land use in the New Creek area is comprised of residential (42 percent), open space (16.2 percent), public facility (3 percent), commercial (6.2 percent) and developed roadbed (17.5 percent).

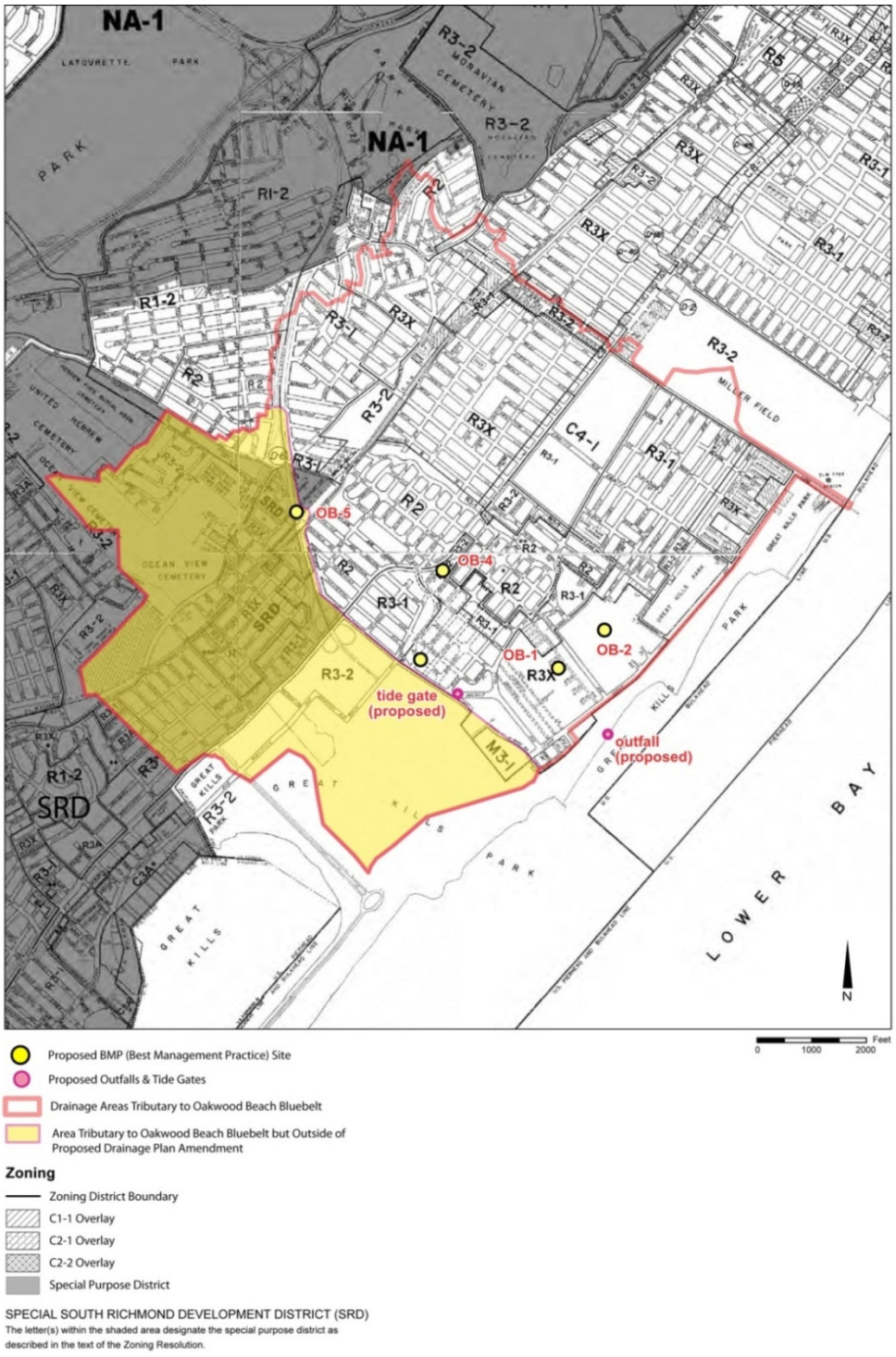
Table 3-7. Land Use in the New Creek Area

Land Use	Acres	Percentage of total land
Residential	943.7	42.0
Road bed/sidewalks	394.5	17.5
Open Space*	363.6	16.2
Vacant**	165.9	7.4
Commercial	139.3	6.2
Public facilities/institutional	67.0	3.0
Transportation/utility	24.1	1.1
Mixed residential/commercial	9.6	0.4
Other (industrial, parking, etc.)	140.2	6.2
Total Area	**2,247.9**	**100.0**

Notes: * Open Space includes City parkland and NYSDEC property.
**Vacant land includes Bluebelt property which totals about 107 acres.
Source: NYCDEP 2013

Residential uses are predominantly single-family detached homes, although there are also some two-family homes and multi-family apartment buildings in the area. Commercial uses include restaurants, food markets, small offices and a larger commercial center along Hylan Boulevard. Public facilities and institutional uses, including places of worship and public and private schools, comprise a small portion of the area and include the Staten Island University Hospital, located east of Seaview Avenue. Major access roads within the area include Hylan Boulevard and Richmond Avenue which run east to west, and Todt Hill Road and Seaview Avenue, which run north to south. The Staten Island Railway line, a rail service operated by the MTA, runs parallel to Richmond Avenue and offers transit service between Tottenville and St. George. Transit stations within the area are located in the Dongan Hills, Jefferson Avenue and Grant City communities.

Larger open spaces in the area include the Richmond County Country Club (a golf course on NYSDEC-owned land), St. Francis Woodlands (also NYSDEC land) and the Reeds Basket Willow Swamp Park (NYCDPR land), all of which are located in the upper area, north of Richmond Avenue. Smaller City parks such as Last Chance Pond and Midland Field Park are located south of Richmond Avenue. The Lower Bay waterfront/shoreline is also parkland that is

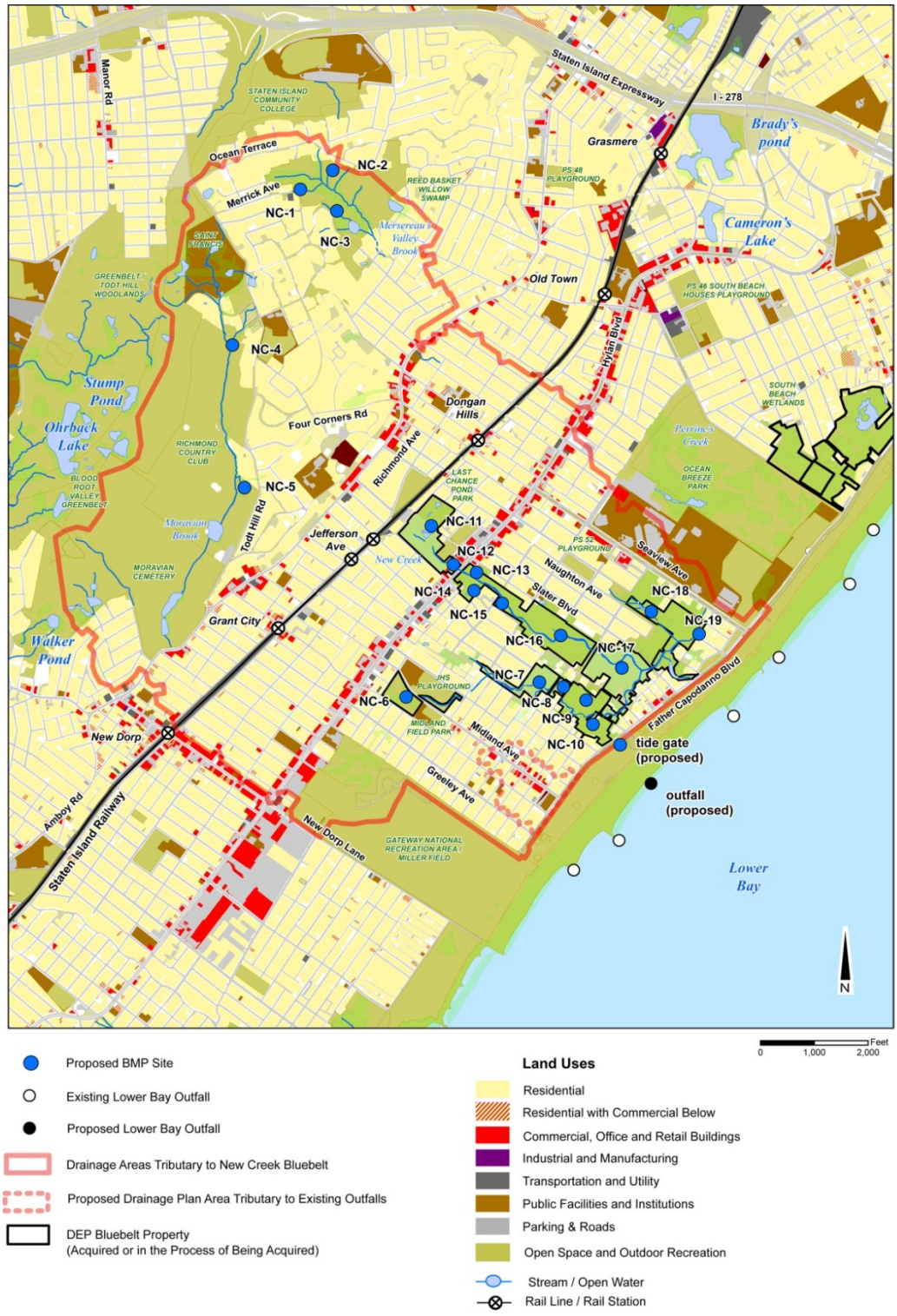


Note: "Proposed BMP Site" and "Proposed Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-12. Zoning for the Oakwood Beach Area

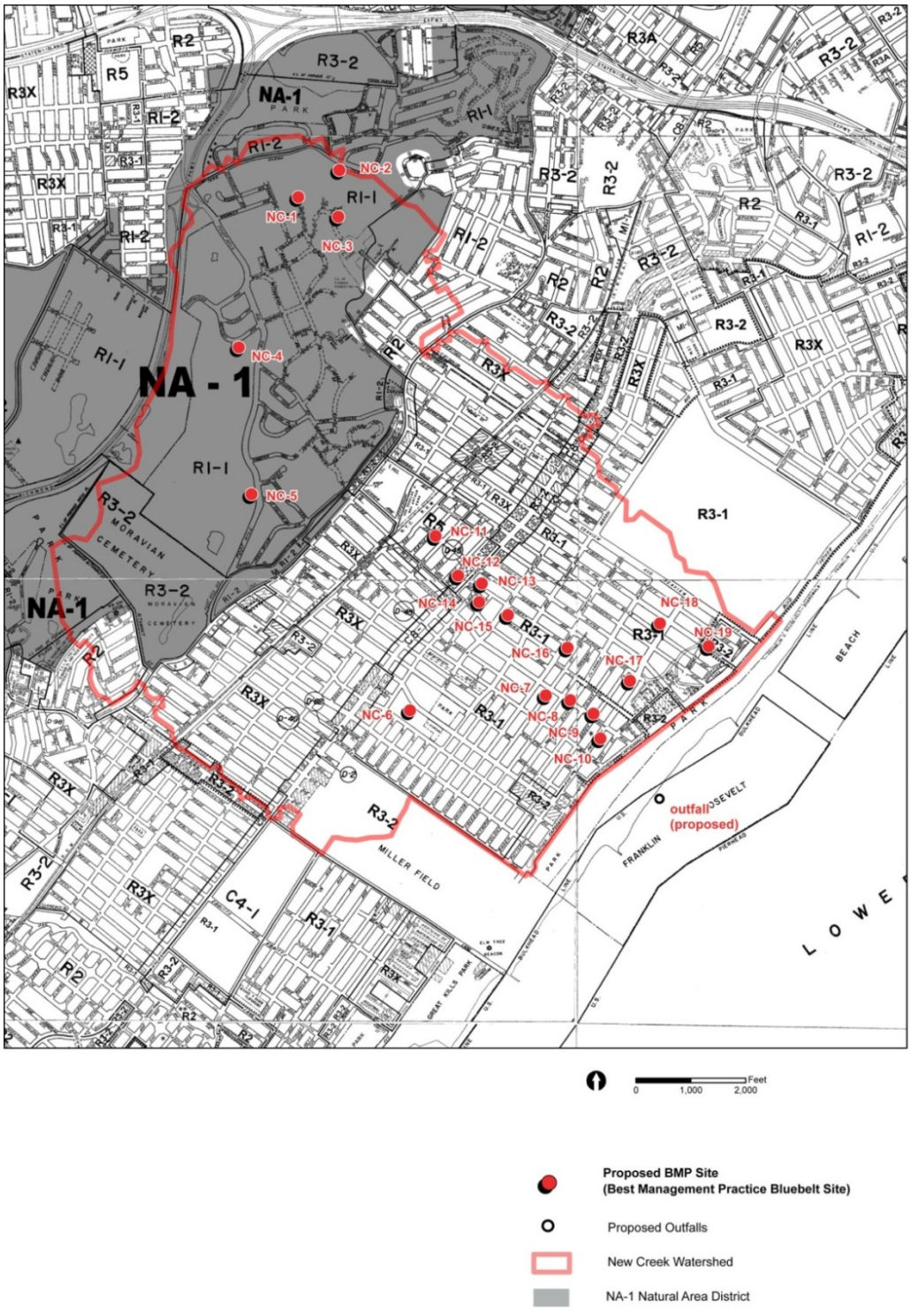
part of the Franklin Delano Roosevelt (FDR) Boardwalk and Beach Park which extends along Staten Island's south shore. Only about 7 percent of the land use in the area is vacant. The majority of this vacant land is freshwater wetlands in the lower area where development is regulated by NYSDEC and the USACE. Some of this land is NYCDEP-owned, and has been acquired (or is to be acquired) for the purposes of the proposed project.

Zoning for the New Creek area is shown in Figure 3-14. As shown in Figure 3-14, the New Creek area contains a mix of lower density residential zoning districts including R1-1, R3-1, R3-2, R3X and R5 with one commercial zoning district, C8-1.



Note: "Proposed BMP Site" and "Proposed Lower Bay Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-13. Zoning for the New Creek Area



Note: "Proposed BMP Site" and "Proposed Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-14. Zoning for the New Creek Area

South Beach (Drainage Areas D and E). The South Beach area, which is approximately 1,266-acres, is mostly developed and urbanized. As shown in Table 3-8 and Figure 3-15, land use in the South Beach area consists of residential (42.3 percent), open space (10.8 percent), public facility (2.5 percent), commercial (6.8 percent) and developed roadbed (20.1 percent).

Table 3-8. Land Use in the South Beach Area

Land Use	Acres	Percentage of total land
Residential	535.4	42.3
Road bed/sidewalks	255.7	20.1
Open Space*	136.2	10.8
Vacant**	118.9	9.4
Commercial	85.7	6.8
Public facilities/institutional	31.4	2.5
Transportation/utility	16.7	1.3
Mixed residential/commercial	8.3	0.7
Other (industrial, parking, etc.)	78.1	6.1
Total Area	**1,266.4**	**100.0**

Notes: * Open Space includes City parkland and NYSDEC property.
**Vacant land includes Bluebelt property which totals about 56 acres.
Source: NYCDEP 2013

Residential uses are predominantly single-family detached homes, although there are also some two-family homes and multi-family apartment buildings in the area. Single-family homes on larger lots are more common north of Hylan Boulevard in the area of steeper slopes and higher elevations.

The wide streets and major access roads include Hylan Boulevard and Fingerboard Road. In addition to the streets, another important transportation use crossing the study area and running generally parallel to Hylan Boulevard is the Staten Island Railway line, a rail service operated by the MTA that offers transit service between Tottenville and St. George. Rail stations are located in the Old Town and Grasmere communities. Commercial uses are concentrated along the major east-west streets and are oriented towards providing local goods and services. Larger open spaces in the area include Ocean Breeze Park in the lower area (this a natural area park with some active uses) and Brady's Pond in the northern area (also primarily a natural area park). The Lower Bay waterfront/shoreline is also parkland that is part of the FDR Boardwalk and Beach Park, which is a large, waterfront park extended along Staten Island's south shore.

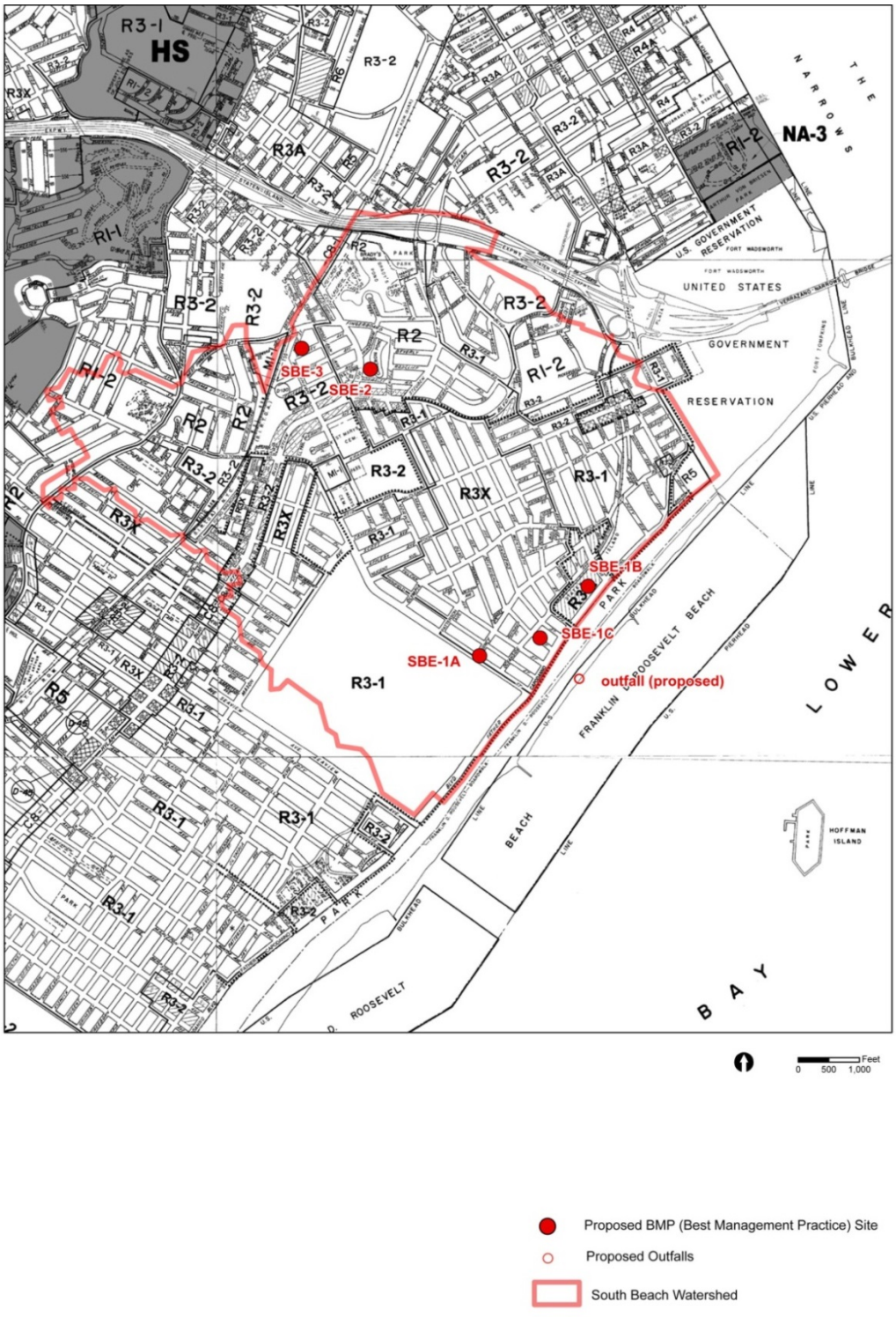
Public facilities and institutional uses, including places of worship and public and private schools, comprise a small portion of the area land use. Only about 7 percent of the land use is vacant. The majority of this vacant land is freshwater wetlands in the lower area where development is regulated by the NYSDEC and USACE. Some of this land is also NYCDEP land that has been acquired (or to be acquired) for the purposes of implementing the proposed project.

Zoning for the South Beach area is shown in Figure 3-16. As shown in Figure 3-16, the South Beach area contains a mix of lower density residential zoning districts, including R1-2, R3-1,

R3-2, R3X, R2, and R5 zoning districts, a commercial zoning district, C8-1, and commercial overlay districts mapped along Hylan Boulevard and Richmond Avenue.

Note: "Proposed BMP Site" and "Proposed Lower Bay Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-15. Land Use for the South Beach Area



Note: "Proposed BMP Site" and "Proposed Outfall" refer to the Bluebelt GEIS.
Source: NYCDEP 2013

Figure 3-16. Zoning for the South Beach Area

3.9 RECREATION

Overview. Recreational areas within or in the vicinity of the Project area include Gateway NRA (Figure 3-17), NYC's Great Kills Park, and city-owned public beaches and undeveloped wetlands in areas further inland. These recreational areas range from relatively undeveloped areas of beach and tidal marshland along the shoreline, accessed by pedestrian and bicycle trails and roads, to developed areas with playgrounds, picnic areas, boathouses, bath houses, public parking, tennis and basketball courts, and observation areas. Recreational opportunities associated with these areas include swimming, sunning, picnicking, hiking, biking, fishing and boating (USACE 2015). In addition, Raritan Bay is used for both commercial and recreational fishing for numerous finfish and shellfish species.

Recreational opportunities within the Project area are primarily centered around the Gateway NRA which extends approximately 7 miles in length along the shore. The Gateway NRA contains several beaches with associated boardwalks and promenades, and includes additional recreational opportunities at Miller Park and Fort Wadsworth.

Source: NPS 2014.

Figure 3-17. Gateway National Recreation Area (Staten Island Unit)

South Beach and Midland Beach are the predominant beaches utilized by the public and contain extensive parking areas, and restroom and concession facilities. Recreational activities associated with these beaches include: strolling and jogging along the boardwalk at South Beach and the promenade at Midland Beach, swimming, sunning, picnicking, and fishing. Unimproved parkland and shorefront along New Dorp Beach and Oakwood Beach is lightly utilized.

Fort Wadsworth is part of the Gateway NRA. The fort abuts the northeast end of South Beach and extends northeast along the shore for a distance of approximately 3,200 feet, and provides the terminus for the Verrazano-Narrows Bridge. Fort Wadsworth is one of the oldest military installations in the United States. Tourists frequently take self-guided and ranger-led tours of the historic facility.

Miller Field, also part of the Gateway NRA, once served as the only Air Service Coast Defense Station on the east coast of the United States. Miller Field has been converted to a series of athletic fields and picnic areas. Visitors can view the remaining aircraft hangars and a WWII Coast Artillery Tower that still stand at Miller Field.

The Staten Island Greenway is a conceptual plan for a 50-mile bike path and recreational trail around the perimeter of Staten Island, which would link the numerous separate pedestrian and bike paths throughout the island. Two segments of this proposed Greenway would be located within the Fort Wadsworth to Oakwood Beach Project area. One segment would link the 3 miles between Fort Wadsworth and Miller Field, and a second segment would continue from Miller Field approximately 1.5 miles to NYC's Great Kills Park (NYCDCP 2014).

Oakwood Beach (Drainage Areas A and B). NYC's Great Kills Park is the largest park in the vicinity of the Project area with over 300 acres. Great Kills Park is almost entirely a natural area comprised of freshwater wetlands and shoreline along Lower Bay. Great Kills Park is part of the Gateway NRA and includes open space where visitors can enjoy many recreational amenities or explore wildlife. Great Kills Park offers a seasonal swimming beach, kayaking, hiking, biking, boating, and fishing.

New Creek (Drainage Area C). Reeds Basket Willow Swamp Park is a large natural area park that occupies about 48 acres. It is part of the larger 2,800-acre Staten Island Greenbelt and is located in the headwaters of the New Creek watershed. Reeds Basket Willow Swamp Park is primarily a natural area park with large areas of forested wetlands, a pond and contributing streams. The FDR Boardwalk and Beach Park is a large waterfront open space that fronts Lower Bay and is the one of the largest beachfront parks on Staten Island's South Shore. It is an important recreational resource and includes a 2.5-mile boardwalk, ballfields, playgrounds, basketball courts and a roller hockey rink, in addition to memorials and statues. There is also a pier for year-round fishing and the park provides one of three public swimming beaches on the South Shore. The St. Francis Woodlands is a 27-acre natural area park owned by NYSDEC and adjacent to the St. Francis Seminary. It is located in the upper watershed, just west of Reeds Basket Willow Swamp Park, and is also considered part of the larger 2,800-acre Staten Island Greenbelt. The St. Francis Woodlands is primarily a natural area open space, with large areas of steep sloped woodlands and a pond (Priory Pond), which is at the headwaters of the stream that flows south into the Richmond County Country Club. The St. Francis Woodlands includes trails that connect to the larger Greenbelt trails. The Richmond County Country Club is a golf club that operates on land that is leased by the NYSDEC to the golf course operator. The parcel also contains a wooded buffer area and trails, along the west side of the park, that are part of the Greenbelt, but its primary purpose is active recreation.

South Beach (Drainage Areas D and E). Ocean Breeze Park is a large natural area park covering about 137 acres located west of Quintard Street. The park provides a variety of coastal natural features including coastal shrub and woodland vegetation, grasses and freshwater wetlands. There are extensive hiking trails across the park. Although primarily a natural area preserve with public trails, an indoor athletic facility, and an equestrian facility covering approximately 10 acres is currently under construction on the south end of the park (fronting on Father Capodanno Boulevard). The FDR Boardwalk and Beach Park is a large waterfront open space that fronts Lower Bay and is one of the largest beachfront parks located on Staten Island's South Shore. It is an important recreational resource and includes a 2.5-mile boardwalk, ballfields, playgrounds, basketball courts and a roller hockey rink, in addition to memorials and statues. There is also a pier for year-round fishing and the park provides one of the City's three swimming beaches on the South Shore.

3.10 AESTHETICS AND SCENIC RESOURCES

Overview. The southern portion of Staten Island has undergone extensive development, particularly within the last 30 years, as the metropolitan area associated with New York City has expanded due to economic and demographic growth. Such development in the Project area is largely residential, as discussed in Sections 3.6 (Socioeconomics and Environmental Justice) and 3.8 (Land Use and Zoning), and consists of various types of residential housing and commercial structures. In response to this relatively rapid development, there has been a recent move to protect older residential neighborhoods in the southern portion of Staten Island through the establishment of five Uniform Land Use Review Procedure applications. These applications have been created to prevent or limit "out-of-context overdevelopment" by controlling the type and amount of development in southern Staten Island (Molinari 2004), and would, in part, serve to preserve the visual and aesthetic character of existing neighborhoods.

The aesthetic qualities of the Project area have been influenced by its largely residential backdrop, and by waterfront property along the Lower Bay, which has been retained, protected, and enhanced through a variety of measures. The residential backdrop for the Project area is associated with the communities of South Beach, Midland Beach, New Dorp and New Dorp Beach, and Oakwood and Oakwood Beach. Waterfront property consists of both developed and undeveloped areas adjacent to Father Capodanno Boulevard, the Franklin D. Roosevelt Boardwalk and its associated promenade, recreational areas such as Miller Field, and existing beach land and shoreline along the Lower Bay.

Scenic resources associated with the Project area are derived from waterfront vistas of the south shore of Staten Island. These scenic resources include beach land along the shoreline of the Project area, including South, Graham, Midland, New Dorp, Cedar Grove, and Oakwood beaches. From vantage points along the beaches and shoreline, the Franklin D. Roosevelt Boardwalk and its associated promenade, and Father Capodanno Boulevard, a variety of natural and scenic vistas may be appreciated. Exterior views from Fort Wadsworth to Oakwood Beach include natural scenic resources such as the lower New York Bay, a variety of seashore, beach, grassland, forest, and tidal wetland settings, and migratory birds and butterflies. These visual resources are associated with the outlet of the Narrows, the Gravesend and Lower bays, and

southern portions of Gateway NRA, including Great Kills Park (NYRCR 2014). Exterior views from these same vantage points also include cultural and manmade scenic resources associated with recreational and commercial activities within these same areas, including fishing, boating, and swimming/sunbathing, as well as cultural or manmade scenic resources associated with the Verrazano-Narrows Bridge, the Ocean Breeze fishing pier, offshore portions of Gateway NRA (Hoffman and Swinburne islands), and the Staten Island, Coney Island, West Bank, Romer Shoal, and Old Orchard Shoal lighthouses (NYRCR 2014).

Oakwood Beach (Drainage Areas A and B). The proposed interior flood control and drainage measures would be sited in the lower coastal plain of the Oakwood Beach watershed where there is little topographical relief. As shown on Figure 2-3, the excavated pond proposed for Oakwood Beach would be bordered by the Lower Bay shoreline of Great Kills Park to the south, residential areas to the north and east, and Great Kills Park to the west. The site has no formal public access (e.g. trails) and there are limited public views are from the adjoining streets (e.g. Kissam Avenue, Mill Pond, Fox Lane). Views from the street and adjacent private properties are limited because of the flat topography, the absence of public vantage points and the thick common reed vegetation at the street edges, which can grow up to and above average eye level (i.e., equal to or greater than five feet above grade). The proposed site is visually dominated by common reed emergent wetlands with some partially visible channels, creeks and open water habitats. Large stands of common reed obscure much of the street level public view into the area. Transitional areas between the common reed stands and adjacent sidewalks or residential properties are often characterized by southern hardwood trees comprised of elms, maples and birch, with canopy heights ranging from 10 to 30 feet. The proposed tide gate structure and sluice gates would be located seaward of a sandy beach. Public views of the shoreline are open along the beach. The views are primarily of a sandy beach, the waters of the Lower Bay to the south, and a low berm or dune to the north (NYCDEP 2013).

New Creek (Drainage Area C). Seven excavated ponds associated with the TSP are proposed along Seaview Avenue, Father Capodanno Boulevard, Midland Avenue and Hylan Boulevard as shown in Figure 2-4. The sites for the five easternmost proposed ponds are generally flat, dominated by common reed marsh with some isolated stands of woodlands, narrow stream channels and some open water ponds, the majority of which are not visible to the public from the adjoining streets except at street crossings. In the interior portions of these proposed interior flood control locations, where the elevation increases slightly, there are wooded hummocks; however, these features too are generally not visually prominent from either the public or private vantage points, particularly when compared with the thick stands of the tall common reed that can obscure public views into these sites from adjacent streets. In most cases, the proposed interior flood control site edges are bordered by single-family homes. Private views from residential homes are also generally limited to the edges of the proposed interior flood control sites. Limitations on views from the local street and adjacent private properties are due to the flat topography, the absence of public vantage points and the thick common reed vegetation at the street edges that can grow up to and above the average eye level (i.e., equal to or greater than five feet above grade) (NYCDEP 2013).

The westernmost proposed pond (labelled as Midland Pond on Figure 2-4) would occupy approximately three acres of a city park property, bounded by Boundary and Midland Avenues

to the north, Lincoln Avenue to the west, and a city school property to the south. The most evident visual feature of this site is its mature woodland of large trees that creates a full and high tree canopy (20-30 feet), comprised primarily of red maple with a variety of oaks including some with trunks as large as 50 inches in diameter. Running from east to west across the property is a narrow stream. Although the stream is a secondary visual feature of the site, it forms a corridor about 5 to 10 feet wide that is visible from the sidewalk. There are also some visible piles of fill and downed trees. This property, although under the jurisdiction of NYCDPR, is enclosed by a tall fence and is not publicly accessible, although it is visually accessible to pedestrians from the surrounding public streets and sidewalks. There are also private views to the site from across the bordering streets (NYCDEP 2013).

The northernmost proposed pond (Last Chance Pond on Figure 2-4) would be located within NYCDPR's Last Chance Pond Park, which occupies about 3.9 acres, as well as within about 4.9 acres in NYCDEP Bluebelt property. The site is primarily visible to the public from the surrounding adjacent public streets (there are no sidewalks fronting the property). While there is informal access to the site (i.e., the site is open and there are no physical barriers to public access), there is no formal trail system. There is a public seating area and memorial (recently installed by NYCDEP) that fronts the site on the Stobe Avenue side (near the end of Husson Street and within the Bluebelt portion of the property). Outside of the interior flood control site, the visual setting is comprised of residential houses, including some multi-family housing immediately to the north, from which there are views to the site. The most defining visual characteristic of this site from the public views is its wooded wetlands. There are some limited open waters (small ponds) on the interior of the site, but these ponds are generally not visible from the neighboring streets. The woodland composition includes red maple hardwood swamp/emergent marsh that is more common on the interior, albeit screened by the wooded and shrub layers at the site perimeter. Directly along the street edges, the vegetation resembles a successional southern hardwood community that is dominated by non-native and successional upland species in the canopy, shrub, and herbaceous strata. On the southerly portion of the site is an area of common reed marsh that has few trees (NYCDEP 2013).

South Beach (Drainage Areas D and E). The proposed interior flood control and drainage measures would be sited in the lower coastal plain of the South Beach watershed where there is little topographical relief and at an elevation just above or at sea level. As shown on Figure 2-6, two excavated ponds are proposed along McLaughlin Street. It is a coastal site, albeit just inland and separated from the beach by Father Capodanno Boulevard. The site is primarily an emergent wetland that is visually dominated by dense stands of common reed that can reach heights of six to eight feet and obscuring much of the street level public view into these sites. Bordering much of the site to the north and east are low-density residential structures; Ocean Breeze Park and its public trails are adjacent and to the west (portions of the parkland extend into the site, but no trails). There are limited public sidewalks around the perimeter of the site, and private views into the site are generally limited to the edges of the proposed interior flood control sites. The limited views from the street and adjacent private properties are due to the flat topography, the absence of public vantage points and the thick common reed vegetation at the street edges that can grow up to and above the average eye level (i.e., equal to or greater than five feet above grade) (NYCDEP 2013).

3.11 COASTAL ZONE MANAGEMENT

The Project area is located within a state-designated coastal zone management area. Therefore, development projects must be evaluated for consistency with NYSDOS Coastal Management Plan (CMP (NYS 2006). There are a total of 44 NYSDOS CMP State Coastal Policies, which are grouped together to address issues related to development, fish and wildlife resources, flooding and erosion hazards, general issues, public access, recreation, historic and scenic resources, agricultural lands, energy and ice management, and water and air resources in state-designated coastal zone areas (NYSDOS 2006). Of these 44 State Coastal Policies, some may be applicable to the proposed Project. The State Coastal Policies are discussed in greater detail in Appendix D.

In addition to consistency requirements associated with the NYSDOS CMP State Coastal Policies, New York City has developed a Local Waterfront Revitalization Program (LWRP) for the New York City coastal zone management area, which has been approved by State and Federal regulatory authorities (NYCDCP 2011). Therefore, development projects must also be evaluated for consistency with New York City's LWRP. New York City's LWRP incorporates the 44 State Coastal Policies with local waterfront management policies into 10 broad policies that provide additional guidance to address issues related to residential and commercial redevelopment, water-dependent and industrial uses, commercial and recreational boating, coastal ecological systems, water quality, flooding and erosion, solid waste and hazardous substances, public access, scenic resources, and historical and cultural resources in state designated coastal zone areas. Of these 10 LWRP policies, some may be applicable to the proposed Project. The LWRP policies are discussed in greater detail in Appendix D.

3.12 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES

An assessment of documented Hazardous, Toxic, and Radioactive Waste (HTRW) sites in the Project area was conducted by reviewing recent state and Federal data sources. No HTRW sites or New York State-listed Inactive Hazardous Waste Disposal Sites have been identified within the Project area (USEPA 2014b).

In support of this Project, the USACE also conducted a Phase I Environmental Site Assessment on available parcels of land along the coast to identify any recognized environmental conditions (REC) that may have an adverse environmental impact upon the subject properties (USACE 2003b). The USACE conducted a thorough historical and municipal records search (Federal, State, and local), reviewed database listings, and conducted a site reconnaissance of the Project area. The findings of that investigation indicate that contaminated soils, surface water, and groundwater may be present throughout the Project area caused by known or potential historical fill, miscellaneous dumping activities, and past or present operations within or surrounding the properties and drainage areas of the study area. Findings also revealed that known or unknown active or abandoned underground storm sewer, sanitary sewer, and natural gas conduit may exist throughout all properties of the study area. In addition, record sources and previous site investigations have revealed that abandoned storm sewer and sanitary conduit extends into the Lower New York Bay, Great Kills Harbor, and the Raritan Bay from the southeastern shoreline (USACE 2003b).

Additionally, in conjunction with preparing the Bluebelt GEIS, Phase I and Phase II Environmental Site Assessments were conducted to reveal the potential for contamination at interior flood control sites (NYCDEP 2013). A discussion of the potentially applicable results of those assessments follows.

Oakwood Beach (Drainage Areas A and B)

- Proposed site for the excavated pond in Drainage Area B: historical uses and the regulatory databases have indicated the need for site testing to identify any potential impacts on soil and groundwater conditions; and
- Proposed sites of tide gates: historical uses and the regulatory databases have indicated the need for site testing to identify any potential impacts on soil and groundwater conditions (NYCDEP 2013).

New Creek (Drainage Area C)

- Proposed sites for the 7 excavated ponds in Drainage Area C: historical uses, site observations, and the regulatory databases have indicated the need for site testing to identify any potential impacts on soil and groundwater conditions; several of the sites have either a moderate or high potential for site contamination; and
- Proposed site of tide gate: historical uses and the regulatory databases have indicated the need for site testing to identify any potential impacts on soil and groundwater conditions (NYCDEP 2013).

South Beach (Drainage Areas D and E)

- Proposed site for the excavated pond in Drainage Area E: Phase II testing associated with the Bluebelt GEIS has identified a high potential for soil and groundwater contamination; and
- Proposed sites of tide gates: historical uses and the regulatory databases have indicated a moderate potential for soil and groundwater contamination (NYCDEP 2013).

In addition to these studies, there has been recent discovery of radiological contamination in a portion of the Great Kills Park, adjacent to NYC Park's property and the tie-off to the proposed LOP. In 2010, sections of Great Kills Park were closed to visitation due to health and safety concerns following the discovery of radium. This section of the park remains closed today. These radium sources, found buried more than a foot below the ground's surface, have been removed; however, since then, additional areas exhibiting above-background radiation readings have been identified within the footprint of the historical landfill at this Great Kills Park site. Investigation into the source of the radium contamination is ongoing; based on current information, the radioactive contamination was brought to the site with the waste fill material. The extent of the waste fill material along the park's southeastern boundary has not yet been fully delineated. Radium present in these items has probably leaked over time, resulting in contamination of the soil directly surrounding the sources. To ensure public safety, the NPS initiated a wider investigation into the extent of radium at the site in the form of a *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA, or Superfund) process in 2010. The goals of this CERCLA process are to determine the nature and

extent of the contamination, evaluate and select an option for cleanup, and return the park to a condition unencumbered by contamination. As they are identified, the sources of radium are removed from the site for proper storage and disposal at an out-of state facility. As of 2010 when the CERCLA process was initiated, the NPS (with technical assistance from the USACE) had removed radioactive sources and surrounding contaminated soil from the five locations with the highest radiation readings. The radiation at these sites averaged 4.12 milliroentgens per hour (mR/h) and dropped to 0.46 mR/h 3 feet away. Background radiation for this area is 0.02 mR/h (NPS 2014). The NPS is currently further investigating the footprint of the former landfill area. The current steps for the CERCLA project are:

- Remedial Investigation 2015-2017;
- Feasibility Study 2018;
- Proposed Plan;
- Record of Decision;
- Remedial Design/Remedial Action.

3.13 TRANSPORTATION

Overview. In general, the Project area is geographically linked to surrounding neighborhoods and population centers through a network of local roads and highways. The majority of roads in the Project area are identified as local streets or avenues, which primarily function to provide access to abutting residential and commercial properties and serve as easements for various public utilities.

Major interstates provide convenient access from New Jersey and Brooklyn to the Project area. From the north, Route 440 crosses from New Jersey via the Bayonne Bridge to connect with the Staten Island Expressway (Interstate 278), which is under NYSDOT's jurisdiction. The northern end of Hylan Boulevard, which runs northeast and southwest along the northern edge of the Project area, intersects the Staten Island Expressway. In the northwest part of Staten Island, the Goethals Bridge provides access from New Jersey's Union County and also connects with the Staten Island Expressway. To the southwest, the Outerbridge Crossing provides access from New Jersey's Middlesex County, where the Garden State Parkway and the New Jersey Turnpike connect to the Outerbridge Crossing via Route 440. The Verrazano Narrows Bridge provides access to Brooklyn and is located at the easternmost point of Staten Island. In 2008, about 190,000 vehicles used the bridge per day on average (NYSDOT 2009).

The average annual daily traffic (AADT) is the average number of vehicles traveling along a roadway each day. Level of Service (LOS) is a measure of the operational conditions on a roadway or at an intersection. LOS ranges from A to F, with "A" representing the best operating conditions (free flow, little delay) and "F" the worst (congestion, long delays). LOS A, B, or C are typically considered good operating conditions. Table 3-9 outlines the routes in the Project area, their AADT, and their estimated existing LOS. Notably, some of the nearby roadways are already congested during peak traffic periods (i.e. LOS D, E, or F). Parking is available in Staten Island at four municipal facilities by hourly, daily, or monthly permitted parking.

Table 3-9. Existing AADT and LOS on Nearby Roadways

Roadway	Average Annual Daily Traffic (AADT) [vpd]	One-Way Peak Hour Volume (V) [vph]	Volume to Capacity Ratio (V/C)	Estimated Existing Level of Service (LOS)
Staten Island Expressway	182,676	4,932	2.90	F
Father Capodanno Boulevard	24,886	896	0.53	D
Hylan Boulevard	40,322	2,177	1.28	F
Seaview Avenue	11,334	612	0.36	C
New Dorp Lane	11,533	1,246	0.73	E
Mill Road	7,604	821	0.48	D

Source: NYSDOT 2014a, ITE 2003.

The Project area is also served by various forms of mass transportation. Three New York City Transit bus routes operate separately along Hylan Boulevard and Father Capodanno Boulevard. Some of the bus routes are all-day, two-way service routes; other routes provide express service during rush hours (NYC Transit Authority 2014). The Metropolitan Transportation Authority's Staten Island Railway provides 24-hour rail service in the Project area, between Tottenville to the south and St. George to the north (Metropolitan Transit Authority [MTA] 2014). In addition, the Staten Island Ferry links northern Staten Island with Manhattan. The ferry transports approximately 70,000 pedestrians per day (Staten Island Ferry 2014).

Oakwood Beach (Drainage Areas A and B). . The major east and west collector roads through the area are Amboy Road to the north and Hylan Boulevard through the center. The southern portion of the area is served by Old Mill Road which functions as a collector road as well. Guyon Avenue is one of the few roads that run north and south. Guyon connects Amboy Road on the north with Old Mill Road on the south and intersects with Hylan Boulevard along the way. The major collector roads are more heavily traveled and carry larger volumes of traffic during the morning, afternoon and evening peak traffic hours. The remaining streets in the area are primarily local residential streets, some of which dead-end or are interrupted by the mapped, but unbuilt, segment of the Willowbrook Parkway, or the large open spaces of the area including the Gateway NRA, NYC's Great Kills Park, or the Oceanview Cemetery (NYCDEP 2013).

The Staten Island Railway which runs east and west across the area also interrupts the street grid at certain locations. For the most part, however, the street grid is complete in the upper portion of the Oakwood Beach area (i.e., Hylan Boulevard and above), while certain street segments in the lower portion of the Oakwood Beach area remain incomplete. These street segments have not been completed because of the presence of freshwater wetlands and streams that have restricted development of these properties, thus largely eliminating the need for a local access road. In addition, these wetlands have also impeded the construction of roads, due to physical and regulatory constraints faces when building through wetlands. Currently, these wetlands have been or are in the process of being acquired by NYCDEP under the Bluebelt program (NYCDEP 2013).

There are few on-street parking restrictions in this area. Most parking needs are met off-street in residential driveways, although some denser areas of residential development do use on-street parking to address local parking needs. Another exception is along the commercial corridors,

such as Hylan Boulevard, where on-street parking is metered or time-restricted along certain segments (NYCDEP 2013).

The Oakwood Beach area is served by both rail and bus service. Rail service is provided by the Staten Island Railway and there is one stop in the study area, Grant City, Oakwood Heights. Bus service is also provided along the major roads such as Amboy Road, Hylan Boulevard and Mill Road (NYCDEP 2013).

Sidewalks and formal crosswalks are provided throughout much of the Oakwood Beach area although there are segments of streets where no sidewalks are provided. With the exception of the major commercial corridors in the area, like Hylan Boulevard, pedestrian traffic is generally light (NYCDEP 2013).

New Creek (Drainage Area C). The major east and west collector roads in the New Creek area are Ocean Terrace at the northern end, Amboy Road/Richmond Road and Hylan Boulevard through the center, and Father Capodanno Boulevard which run along the southern portion and provide access to the waterfront beaches. North/south collector roads include: Todt Hill Road which intersects with Ocean Terrace on the north and Richmond Hill Road on the south; Midland Avenue which extends between Richmond Avenue on the north and Father Capodanno Boulevard on the south and Seaview Avenue which also extends between Richmond Avenue on the north and Father Capodanno Boulevard on the south. These major collector roads are more heavily traveled and carry larger volumes of traffic during the morning, afternoon and evening peak hours (NYCDEP 2013).

The other streets in the New Creek area are generally local residential streets some of which dead end or are interrupted by large open spaces such as Richmond County Country Club, Reeds Basket Willow Swamp Park and Miller Field (part of the Gateway NRA). The Staten Island Railway also runs east/west across the New Creek area and interrupts the street grid at certain locations. However, for the most part the street grid is complete in the upper portion of the New Creek area (Hylan Boulevard and above), with a number of quiet and lightly traveled residential streets in and around the Todt Hill neighborhood. Segments of the street grid in the lower portion of the New Creek area have not been completed. These street segments have not been completed because of freshwater wetlands and streams that have restricted development of these properties, thus largely eliminating the need for a local access road. In addition, these wetlands have also impeded the construction of roads, due to physical and regulatory constraints faces when building through wetlands. Currently, these wetlands have been or are in the process of being acquired by NYCDEP under the Bluebelt program. The incomplete street grid in the lower New Creek area is generally associated with the mapped, but unbuilt streets that are occupied by streams, wetlands and floodplains. The lower area is also characterized by quiet, lightly traveled, and narrow residential streets (NYCDEP 2013).

There are few on-street parking restrictions in this area. Most parking needs are met off-street in residential driveways, although some denser areas of residential development do use on-street parking to address local parking needs. Another exception is along the commercial corridors, such as Hylan Boulevard, where on-street parking is metered or time-restricted along certain segments (NYCDEP 2013).

The New Creek area is served by both rail and bus service. Rail service is provided by the Staten Island Railway and there are three stops in the area: Grant City, Jefferson Avenue and Dongan Hills. Bus service is also provided along the major roads such as Richmond Avenue, Midland Avenue, Lincoln Avenue, Seaview Avenue, New Drop Lane and Hylan Boulevard (NYCDEP 2013).

Sidewalks and formal crosswalks are provided throughout much of the area, although there are segments of streets where no sidewalks are provided. With the exception of the major commercial corridors in the New Creek area, like Hylan Boulevard, pedestrian traffic is generally light (NYCDEP 2013).

South Beach (Drainage Areas D and E). The major collector east/west collector roads through the South Beach area are Hylan Boulevard across the northern portion, and Father Capodanno Boulevard along the southern portion, which provides access to the waterfront beaches. The Staten Island Expressway extends along the northern border of the South Beach area and is accessible from Hylan Boulevard. There are a few important north/south oriented collector roads including: Quintard Street which extends between an intersection with Hylan Boulevard on the north to Patterson Avenue on the south; Sand Lane which extends between Hylan Boulevard on the north and Father Capodanno Boulevard on the south; and Lily Pond Road which extends between the Staten Island Expressway on the north and Father Capodanno Boulevard on the south. These major collector roads are more heavily traveled and carry larger volumes of traffic during the morning, afternoon and evening peak traffic hours than at other times of the day (NYCDEP 2013).

The other streets in the South Beach area are generally local residential streets some of which dead end and are interrupted by local open spaces and waterbodies such as Brady's Pond and Cameron's Lake in the northern portion of the area. The road network around the ponds is characterized by quiet and lightly traveled residential streets. Ocean Breeze Park similarly interrupts many streets in the southern portion of the South Beach area. The Staten Island Railway also runs east/west across the area and interrupts the street grid at certain locations. With few exceptions, the street grid is complete in the upper portion of the South Beach area (i.e., Hylan Boulevard and above). Segments of the street grid in the lower portion of the South Beach area have not been completed. One of the principal reasons these street segments have not been completed is the presence of freshwater wetlands that have restricted development of these properties, thus largely eliminating the need for the local access roadways. In addition, these wetlands have also impeded the construction of the street network, given both the physical and regulatory constraints of building roads through these wetlands, particularly in the absence of any compelling need for the road (NYCDEP 2013).

There are generally few on-street parking restrictions in this area. Most parking needs are met off-street in residential driveways although some areas of denser residential development do use on-street parking to meet local parking needs. Another exception is along the commercial corridors, such as Hylan Boulevard, where the on-street parking is metered or time restricted along certain segments (NYCDEP 2013).

The South Beach area is served by both rail and bus service. Rail service is provided by the Staten Island Railway and there are two stops in the study area, Old Town Station and Grasmere Station. Bus service is also provided along the major roads such as McLean Avenue, Olympia Boulevard, Steuben Street, Clove Road, Richmond Road and Hylan Boulevard (NYCDEP 2013).

Sidewalks and formal crosswalks are provided throughout much of the South Beach area, although there are segments of streets where no sidewalks are provided. With the exception of the major commercial corridors in the area, like Hylan Boulevard, pedestrian traffic is generally light (NYCDEP 2013).

3.14 NAVIGATION

The Ambrose Channel starts at the narrows where it connects to the Anchorage Channel in the Upper Bay and extends thru the Lower Bay to the Atlantic Ocean between Rockaway peninsula, NY and Sandy Hook, NJ. The depth of the Ambrose Channel has recently been deepened to approximately 53 feet at the width of 2,000 feet (USACE 2004) as part of the NY/NJ Harbor Deepening Project (HDP). Ambrose Channel is located approximately 2.6 nautical miles offshore from the project area. The Chapel Hill North navigational channel is located approximately 3.5 nautical miles offshore from Oakwood Beach, and connects with the Ambrose Channel. The Chapel Hill North navigational channel and the Ambrose navigational channel are both Federal navigation channels.

3.15 AIR QUALITY

Emissions from Federal actions are regulated under 40 CFR §93 Subpart B General Conformity. The Project area is located in the southern part of Staten Island, Richmond County, New York, and is part of the New York City Metropolitan Area. Richmond County has been designated with the following attainment status with respect to the National Ambient Air Quality Standards (NAAQS) for criteria pollutants: marginal nonattainment area for the 2008 8-hour ozone standard and a maintenance area for the 2006 particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$) standard (40 CFR §81.333). Oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) are precursors for ozone and sulfur dioxide (SO_2) is a precursor pollutant for $PM_{2.5}$. Richmond County is in attainment of the NAAQS for all other criteria pollutants.

3.16 NOISE

Sound is a physical phenomenon consisting of vibrations that travel through a medium, such as air, and are sensed by the human ear. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Human response to noise varies depending on the type and characteristics of the noise distance between the noise source and the receptor, receptor sensitivity, and time of day. Noise is often generated by activities essential to a community's *quality of life*, such as construction or vehicular traffic.

Sound varies by both intensity and frequency. Sound pressure level, described in decibels (dB), is used to quantify sound intensity. The dB is a logarithmic unit that expresses the ratio of a

sound pressure level to a standard reference level. Hertz are used to quantify sound frequency. The human ear responds differently to different frequencies. "A-weighing", measured in A-weighted decibels (dBA), approximates a frequency response expressing the perception of sound by humans. Sounds encountered in daily life and their dBA levels are provided in Table 3-10.

Table 3-10. Common Sounds and Their Levels

Outdoor	Sound Level (dBA)	Indoor
Motorcycle	100	Subway train
Tractor	90	Garbage disposal
Noisy restaurant	85	Blender
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Source: Harris 1998.

The dBA noise metric describes steady noise levels, although very few noises are, in fact, constant. Therefore, A-weighted Day-night Sound Level has been developed. Day-night Sound Level (DNL) is defined as the average sound energy in a 24-hour period with a 10-dB penalty added to the nighttime levels (10 p.m. to 7 a.m.). DNL is a useful descriptor for noise because: (1) it averages ongoing yet intermittent noise, and (2) it measures total sound energy over a 24-hour period. In addition, Equivalent Sound Level (L_{eq}) is often used to describe the overall noise environment. L_{eq} is the average sound level in dB.

The Noise Control Act of 1972 (PL 92-574) directs Federal agencies to comply with applicable Federal, state, and local noise control regulations. In 1974, the USEPA provided information suggesting continuous and long-term noise levels in excess of DNL 65 dBA are normally unacceptable for noise-sensitive land uses such as residences, schools, churches, and hospitals. NYCDEP maintains an extensive noise ordinance (Local Law 113) which limits noise in order to maintain public health, comfort, convenience, safety, welfare and the prosperity of the people of the city. Construction noise is specifically addressed with not-to-exceed (L_{max}) levels, limited hours, and a noise mitigation plan. A summary of the Law is as follows:

- No sound (including impulse sounds) shall exceed 80 dBA at a distance of 50 or more feet (§24-228 DEP);
- Construction may occur between 7:00 a.m. and 6:00 p.m. Monday – Friday (§24-222 DEP);
- Work may take place after hour and on weekends only with authorization from the Departments of Buildings and Transportation (§24-223 DEP);
- A Noise Mitigation Plan for each construction site must be in place before construction begins (§24-219-222 DEP).

Residential and recreational land uses are the most sensitive to noise within the immediate vicinity of construction work. Existing sources of noise near the proposed site include local and interstate traffic, high-altitude aircraft overflights, boat and harbor noise, and natural noises such as

leaves rustling and bird vocalizations. Existing noise levels (L_{eq} and DNL) were estimated for the surrounding areas using the techniques specified in the American National Standard *Quantities and Procedures for Description and Measurement of Environmental Sound Part 3: Short-term measurements with an observer present.* Table 3-11 outlines the land use category and the estimated background noise levels for nearby noise sensitive areas (ANSI 2013).

Table 3-11. Estimated Background Noise Levels at Nearby Noise Sensitive Areas

Closest Noise Sensitive Area (NSA)				Estimated Existing Sound Levels (dBA)			
						L_{eq}	
Activity	Distance to NSA [ft(m)]	Direction	Location	Land Use Category	DNL	daytime	nighttime
Residential				Urban and Noisy Suburban Residential	57	55	49
Revetment	0		Cedar Grove Beach Place				
Revetment	50 (15)	North	Grayson Street				
Revetment	110 (34)	Northwest	Father Capodanno Boulevard				
Sheetpile Walls	410 (125)	Northwest	Block Father Capodanno Boulevard				
Church							
Revetment	670 (204)	North	Cedar Grove Avenue				
Hospital							
Sheetpile Walls	1,270 (387)	Northwest	Seaview Avenue				
School							
Sheetpile Walls	645 (197)	Northwest	Sand Lane				
Revetment	1,300 (396)	North	Olympia Boulevard				

Source: ANSI 2013.

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter discusses the potential environmental consequences for both the National Economic Development (NED) Plan and the No-Action Alternative. For the NED Plan, the potential environmental consequences associated with both construction and long-term operations are presented for the various resource areas (Sections 4.1 through 4.17). For the No-Action Alternative, the potential environmental consequences associated with not implementing the NED Plan are presented in Section 4.18. Section 4.19 presents a summary comparison of the NED Plan and the No-Action Alternative. Additionally, this chapter discusses unavoidable adverse effects and considerations that offset adverse effects (Section 4.20); the relationship between short-term uses of the environment and long-term productivity (Section 4.21); irreversible and irretrievable commitment of resources (Section 4.22); and cumulative impacts (Section 4.23).

4.1 GEOLOGY, TOPOGRAPHY, AND SOILS

Impacts on geology, topography, and soils from constructing the LOP in the Project area are expected to be minimal. No impacts on geology would occur because bedrock elevations would be below the depth of proposed structure foundations and pond excavation depths. As shown in Table 4-1, the proposed LOP would occupy approximately 52.8 acres. Ditches would be constructed along the landward side of the levees, floodwall, and buried seawall/armored levee system to direct runoff toward creeks, outfalls, and tide gate structures. Soil erosion and sedimentation would be minimized during construction through the use of a soil erosion and sediment control plan. In addition, erosion is expected to be minimal during construction because the surrounding topography is generally flat, reducing stormwater runoff capability. Only clean material would be used for LOP construction. There are no prime farmlands or farmlands of statewide importance in the Project area.

Table 4-1. Estimated Land Area of LOP

	Length of LOP (feet)	Width of LOP (feet)	Disturbed Area (Square Feet)	Disturbed Area (Acres)	Crest Elevation
Reach 1	2,800	85	238,000	5.5	+18 feet NGVD29
Reach 2	600	85	51,000	1.2	+18 feet NGVD29
Reach 3	1,800	3	77,400 (Note 1)	1.8	+20.5 feet NGVD29
Reach 4	22,700	85	1,929,500	44.3	+20.5 feet NGVD29 (Note 2)
Total	**27,900**	**varies**	**2,295,900**	**52.8**	**Varies**

Note 1: the disturbed area for Reach 3 includes a 25-foot splash apron and a 15-foot scour blanket.
Note 2: the finished elevation of the buried seawall (Reach 4) would be 2 feet higher than the crest elevation.

The LOP would be constructed parallel to the shoreline and would reduce the drift and deposition of sand inland. A prevailing east to west littoral drift of sand is a known pattern on the south shore of Staten Island. However, the LOP is not expected to significantly alter or interrupt these littoral drift patterns. Topography would be permanently impacted by placement

of the LOP to a crest elevation of +18.0 to +20.5 feet NGVD29. These permanent impacts would be offset by the significant benefit of stabilizing the shoreline and providing coastal storm risk management.

The interior drainage facilities would include tide gates, sluice gates, stormwater outfall structures, natural storage ponds, excavated ponds, and road raisings. Because the tide gates, sluice gates, and outfall structures are part of the LOP design, those impacts are included in the discussion of the LOP above. As such, the analysis below focuses on the potential impacts of excavated ponds and road raisings within the drainage areas.

Within Drainage Area B (see Figure 2-3), two excavated ponds would be located east and west of Kissam Avenue, on the landward side of the LOP. Excavation to a depth of 2.5 feet NGVD29 would occur within approximately 41.6 acres. As part of the interior drainage facilities, Mill Road and Kissam Avenue would also be raised.

Within Drainage Area C (see Figure 2-4), 7 excavated ponds would be required. Excavation to a depth of 2 feet NGVD29 would occur within approximately 99.81 acres. A section of Seaview Avenue would also be raised in the area of Quincy Avenue to Father Capodanno Blvd.

Within Drainage Area E (see Figure 2-5), two excavated ponds would be located along McLaughlin Street. Excavation to a depth of 2 feet NGVD29 would occur within approximately 46.69 acres.

As shown in Table 4-2, the proposed excavation of ponds would occupy approximately 187.2 acres. Road raisings could disturb approximately 4.1 acres. Soil disturbances would generally occur within the footprints of the existing roads, although it is possible that road widths could increase slightly as a result of road raising.

Table 4-2. Estimated Land Area for Excavated Ponds and Road Raisings

	Area of Excavated Ponds[1] (acres)	Length of Road Raising[2] (feet)	Area of Road Raising[3] (acres)
Drainage Area A	0	0	0
Drainage Area B	40.7	2,360	2.0
Drainage Area C	99.81	1,120	2.1
Drainage Area D	0	0	0
Drainage Area E	46.69	0	0
Total	**187.2**	**3,480**	**4.1**

[1] Pond excavations would occur within these acreage estimates, but would not necessarily disturb the full acreages presented.
[2] Road raising would generally not change the disturbed linear footprint of the existing road.
[3] Road raising would generally not change the disturbed area of the existing road.

The first step in excavating any pond would be to mark the project site and identify the clearing limits as per the final designs; this marking may be modified in the field based on observed conditions and decisions that may avoid the removal of important trees or stands of vegetation, where feasible. Work activities and clearing limits would be identified and no soils outside these limits would be disturbed.

All construction activities would be performed in accordance with NYSDEC technical standards for erosion and sediment control and must be implemented in accordance with an approved Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would comply with the NYSDEC Stormwater Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity. The SWPPP would include a soil, erosion, and sediment control plan in conformance with NYSDEC's "Standard and Specifications for Erosion and Sediment Control" that, at a minimum, would include, but not be limited to: construction limiting fencing, staked straw bales, reinforced silt fences, sediment traps with filters, sediment filters, portable sediment tanks, storm drain inlet protections, and sandbags, as necessary. No stockpiling of excavated material that would cause erosion would be permitted. With the implementation of these control measures, the NED Plan would not contribute runoff pollutants.

All excavated soil would be handled and managed in accordance with applicable City, State, and Federal regulations. Excavated soils would be tested for contamination and re-used within the Project area (such as for road raising and grading) to the extent practicable. Some soils would be transported out of the Project area.

Miller Field Sub-alternatives. At Miller Field, there would be no notable differences in impacts to geology, topography, or soils, with the exception that locating the promenade at ground level behind the buried seawall would disturb soils that would be avoided if the promenade were located on top of the buried seawall.

4.2 WATER RESOURCES

4.2.1 Regional Hydrogeology and Groundwater Resources

The NED Plan would not change the total volume of groundwater available, or the quality or usability of groundwater supplies. The Project would alter stormwater runoff patterns and involve the excavation of ponding areas for the purpose of managing storm-related runoff. Although proposed ponding and drainage storage areas would generally be located in low-lying landscape positions where water already tends to collect, the excavation of ponding areas would further concentrate larger volumes of stormwater runoff in selected locations. As a result of the creation and deepening of ponding areas, these areas would collect larger volumes of stormwater runoff than other areas, possibly altering the locations of, or volumes of water received by, other nearby groundwater recharge zones. However, because groundwater flows relatively unimpeded through the large sand and gravel aquifers that underlie the Project area, these minor, localized changes to recharge zone locations are not anticipated to significantly affect regional hydrogeology and groundwater.

The proposed ponds could require excavation below the groundwater table. Therefore, groundwater inflow to the proposed ponds is expected, but would only be expected to consume a small fraction of the proposed storage capacity. If field data gathered during final design indicate that a higher rate of inflow may occur at a proposed pond, then the hydraulic structures may need to be upsized during final design for the purposes of enlarging the low-flow orifices. The soils surrounding the proposed ponds may also need to be amended as well to reduce the

hydraulic conductivity. Flow rates during final design would be determined using test pits and soil borings and monitoring of groundwater movement would also be conducted during the dewatering and construction of the proposed ponds. Therefore, the proposed BMPs would not result in potential significant adverse impacts on groundwater flows (NYCDEP 2013).

Groundwater that would inflow to the proposed ponds would become surface water. In studies associated with the Bluebelt GEIS, this inflow was determined to be minimal and the proposed ponds were determined to result in no significant adverse impacts on the groundwater table. A lowered water table can lead to the consolidation of soils and ground subsidence, which on large scales can cause damage to property and infrastructure. Based on available data about the types of soils in the watershed and the anticipated minor changes in the groundwater table, potential ground subsidence in the immediate vicinity of the proposed ponds was calculated to be at most 0.4 inches, which would not cause any damage to neighboring structures. Therefore, the NED Plan would not result in potential significant adverse impacts on groundwater volumes, the groundwater table, or land subsidence (NYCDEP 2013).

Certain construction activities, including pond excavations in areas of shallow groundwater, are expected to require dewatering activities so that work can be performed without groundwater inundating the work area. Discharge points for the residual water from the dewatering operations may be a City sanitary line or local surface waters, both of which would require permit approvals from NYCDEP and NYSDEC, respectively.

The type of dewatering technique employed would be dependent upon the amount of groundwater needing to be pumped and the location of the proposed construction activity. Typically, the contractor would install a series of well points and pumpouts. In low-pump rate situations, a single line would be placed in the trench. Contractors would be required to convey pumped-out residual water through settling devices, such as sediment traps or portable sediment tanks, prior to discharge. Sediment tanks allow suspended solids to settle out before discharge. The captured sediments from the bottom of the tanks would be regularly removed by the contractor.

Discharge of dewatered effluents would be required to meet specific requirements, such as a maximum turbidity standard. This standard would be, in part, based on existing turbidity of the receiving pond or stream. Dewatering activities would also be subject to the requirements of the SPDES discharge permit for temporary dewatering activities that would involve direct discharges to surface waters. If dewatering into New York City sewers were proposed, a Sewer Discharge Permit must be issued by NYCDEP prior to the start of any dewatering activities at the site. In this case, groundwater sampling to determine compatibility within NYCDEP Sewer Discharge Criteria would need to be performed in areas where dewatering is expected. Data would be submitted to NYCDEP for review and approval.

4.2.2 Surface Water

The construction activities associated with the NED Plan may cause a temporary, short-term increase in suspended sediment and turbidity in surface waters adjacent to the Project. However, the suspended sediments and turbidity are expected to settle quickly out of the water column, and therefore no long-term adverse impacts to surface water quality are expected.

Long-term improvement of interior drainages (i.e., tide/slide gates and construction of new drainage ponds) would positively affect the surrounding areas by controlling and containing large volumes of stormwater runoff that would otherwise flood developed areas. In addition, ponds would also serve to detain or retain the impurities commonly associated with stormwater runoff, such as petroleum based liquids in runoff from paved areas, and sediment-laden waters in runoff from unstable soil areas. In addition, pond excavation would create new and deepen existing surface water habitats.

Best management practices for erosion control would be utilized where necessary to prevent runoff from upland construction activities from entering the tidal creeks and the Raritan and Lower New York Bay. With the exception of Oakwood Creek area, tide gates in the Project area would be designed to drain flooded freshwater wetlands from Lower New York Bay storm surges and interior runoffs. Tidal gates at Oakwood Creek would be designed to permit backflow at low (non-damaging) elevations of the Lower New York Bay, which allows intermixing of fresh and salt water in the area's wetlands (USACE 2015). A draft Section 404(b)(1) Guidelines Evaluation has been completed and is provided as Appendix B of this EIS.

4.2.3 Water Quality

The NED Plan is expected to result in improved water quality in the watershed compared to the No-Action (without-project) Alternative. This conclusion is supported by a literature review and data collected for the Bluebelt GEIS. In the future without the NED Plan, runoff would not be collected and directed to the proposed ponds. In contrast, proposed ponds function as wetlands that provide physical, chemical, and biological treatment of pollutants contained within runoff; flow rates into wetlands are attenuated, allowing sediment and organic debris to settle. During this process, nutrients undergo both chemical and biological transformation in a wetland. Nitrogen can be naturally altered into forms that are more favorable to uptake by wetland plants and phosphorus is readily precipitated out of water in many of its chemical forms, depending on the pH of the water and is also utilized by plants. Proposed ponds can also reduce fecal coliform concentrations by detaining water, allowing for die-off of microorganisms (NYCDEP 2013).

In addition, analyses of ponds previously constructed and operating on Staten Island (in the South Richmond Bluebelt) shows general water quality improvement resulting from ponds. Data from a 2003 water quality study of three Staten Island ponds installed in the South Richmond Bluebelt (including two extended detention wetlands and one wetland retrofit pond) show that extended detention wetlands are performing as a typical stormwater wetland, achieving good pollutant removal efficiencies. In addition, in the Richmond Creek watershed of South Richmond, it has been found that outlet stilling basins and other velocity attenuating structures can provide a 10 to 20 percent pollutant removal efficiency that is attributable to velocity

reductions that allow sediment and other debris present in the water to settle instead of being transported downstream. This would help reduce nutrient loads from adjacent properties such as ball fields or lawns from directly entering the Lower Bay, thereby improving the water quality over the existing conditions. Therefore, the NED Plan would not result in potential significant adverse impacts to water quality (NYCDEP 2013).

4.2.4 Tidal Influences and Floodplains

The LOP and interior drainage facilities would not alter the existing tidal fluctuation or tidal ranges at the Project area. Construction of the NED Plan would limit the inland extent of storm surges, provide long-term shoreline erosion protection, and reduce tidal flooding of the local communities, especially during storm events. The NED Plan would be consistent with Executive Order 11988, which requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

Effects of Sea Level Rise

New York City has an extensive coastal zone with billions of dollars of private and public investments, making sea level rise an important long-term planning issue. The potential impacts of sea level rise on the City were a major focus of the City's PlaNYC report (NYC 2013), which recommended preparation of a comprehensive climate change adaptation study and examination of climate change resiliency options. Warming global temperatures are considered extremely likely over the coming decades and through the course of the next century. It is anticipated that this warming will be at a faster rate than past trends which will have the effect of increasing the rate of global sea level rise. Given the long-term nature of sea level rise effects and the variables intrinsic to predicting global carbon emissions, global climate conditions, and the resulting effects on sea level, there are ranges in sea level rise projections that take into account various scenarios (NYCDEP 2013).

In February 2009, the City's Panel on Climate Change released its report "*Climate Risk Information*" which was prepared with the assistance of the Mayor's Office of Long Term Sustainability (NYC 2009). That report presents sea level rise projections that take into account the predicted ranges of both global climate change and local land subsidence. The central range of these projections are sea level increases of 2 to 5 inches by the 2020's, 7 to 12 inches by the 2050's, and 12 to 23 inches by the 2080's.[3] Impacts of sea level rise as identified in the report include the risk of increased coastal flooding and precipitation. A report released by the *New York State Sea Level Rise Task Force— Report to the Legislature* (December 31, 2010) accepts similar sea level rise projections.

The current guidance (ER 1100-2-8162) from USACE states that proposed alternatives should be formulated and evaluated for a range of possible future local relative sea level change rates. The

[3] Extreme ranges presented in the report that assume rapid ice melt yielded projections of sea level increases of 5 to 10 inches by the 2020's, 19 to 29 inches by the 2050's, and 41 to 55 inches by the 2080's.

relative sea level change rates shall consider as a minimum a low rate based on an extrapolation of the historic rate, and intermediate (Curve 1) and high (Curve III) rates which include future acceleration of the eustatic sea level change rate. These rates of change for this Project correspond to an increase in sea levels of 0.7 feet, 1.1 feet, and 2.6 feet over 50 years for the low, medium and high rates. The historic rate, 0.7 feet over 50 years, is being used as the basis of design for the flood protection structures (USACE 2015).

The NED Plan represents the type of infrastructure design and investment for the City that would be responsive to climate change. The NED Plan design crest is only predicted to be overtopped by surge during the most restrictive combination of storm event and sea level change studied. Only the 500-year + the "high" rate of sea level change would overtop the minimum design crest elevation of 18 feet NGVD29. The NED Plan would also meet the overtopping requirements in the event of a 100-year storm in year 2069 for the low, intermediate, and high predictions of sea level change. Beyond the 50-year period-of-analysis, the robust design of the NED Plan may support the added loads of structural expansion or adaptation to meet the needs of future sea level change (USACE 2015). Additionally, the proposed ponds are designed to maximize stormwater management effectiveness in an existing low-lying developed coastal area where the street and property grades are essentially fixed and cannot be modified. In sum, the NED Plan would manage flood levels during storm events and operation of the proposed ponds would not be impacted by sea level rise. Therefore, the NED Plan would not result in any significant adverse impacts on hydrology in the Project area.

4.2.5 Stormwater

The NED Plan would not introduce any new development or any significant new impervious surface coverage that would generate runoff. Rather, this Project would improve local stormwater management with the implementation of the proposed ponds, thereby providing flood volume and velocity control along with enhanced ecological conditions through the protection and restoration of wetlands (NYCDEP 2013).

Combined with the sewer proposals presented in the Bluebelt GEIS, the resultant drainage plan would provide a storm sewer system that integrates the existing water bodies and stormwater features to create a comprehensive drainage system, with stormwater conveyance and detention. Based on modelling associated with this Project, the NED Plan would lower water surface elevations in the low-lying areas, to a level that provides positive drainage to the ponds and wetlands, thereby reducing local street flooding (USACE 2015). Reductions in street flooding would thus reduce events where sanitary sewers are impacted by street flooding. Therefore, the NED Plan would not result in potential significant adverse impacts to stormwater management infrastructure.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in impacts to water resources among the NED Plan (Seaward) and the two sub-alternatives.

4.3 VEGETATION (UPLANDS AND WETLANDS)

4.3.1 Uplands

Implementation of the NED Plan would potentially impact up to approximately 52.8 acres of vegetation along the LOP, and up to approximately 187.2 acres of vegetation within the interior drainage areas of the Project area. Construction of the LOP and most proposed ponds would require only minor tree clearing and site grading. Excavation at pond sites NC-6 and NC-11 in Drainage Area C (see Figure 2-4) would require the greatest amount of tree clearing and site grading. Approximately 200 tress could be impacted by the Project construction. To avoid indirect and unintended injury or damage to trees that are proposed to remain after construction, the following protection measures would be applied during staging and construction:

- Pre-construction surveys for any protected threatened and endangered plant species and the identification of species for plant rescue and relocation;
- Clearing and grading limits would be clearly marked prior to construction;
- Trees to remain after construction would be protected by barricades consisting of sturdy wood posts and rails at a distance of at least 10 feet from the trunk of each tree. This would prevent vehicles and equipment from damaging the tree trunks or compacting the soil over the root system;
- To protect against root damage, pests and diseases, roots would be cleanly cut during excavation near trees. Exposed roots would also be kept moist. When feasible, there would be a compensatory trimming of the tree canopy to balance the root loss;
- Any trees destroyed would be replaced in accordance with the NYC Tree Valuation Protocol (NYCDPR 2009);
- As the final stage in construction, all areas would be restored in accordance with the proposed design and diverse planting program including the planting of native herbaceous, shrub and tree species; In addition, the NED Plan would follow all NYCDPR tree protection measures, as required for work in City parkland.
- The USACE will conduct a tree survey of existing conditions prior to construction and then again after the project is built. Mitigation will be accomplished by planting at a ratio of two new trees for every tree destroyed. Within NYC property, restitution requirements for removal of street trees or trees within park property are dictated by Local Law 3 of 2010 and associated NYCDPR rules and valuation methodology.

The entire above-grade portion of the seawall from Fort Wadsworth to Miller Field would be covered with material excavated to accommodate the structure foundation. This material, primarily sand with some clay, silts, and topsoil, would support grass and other native beach vegetation. The material cover is used to visually integrate the buried seawall with surrounding topography and to protect the public from climbing and/or falling on the uneven rock surface. Geotextile fabric is placed underneath the bedding layer to reduce settlement and around the core structure to minimize loss of fill through the voids. The material cover would be placed on 2:1 side slopes. A mix of native dune vegetation would be planted on both the seaward and landward slopes; however, no planting would be done on the landward slope of the LOP in reaches where the boardwalk is located and would cover/shade out vegetation. To address the use of native

plants, the USACE would consider the use of local nurseries such as the Staten Island-based Greenbelt Native Plant Center.

With regard to the area between New Dorp Beach and Oakwood Beach, the USFWS has requested burial of the area of exposed seawall to allow for movement of terrestrial species, such as turtles, that traverse the wetlands. Although the USACE had originally planned to leave the seawall exposed because of phrag rhizomes (invasive plants) in the excavated material, the USACE has now decided to implement the USFWS request and would cover the seawall with material excavated from the area. The USACE will perform monitoring and phrag control (via herbicide) in the area.

Under Executive Order 13112, Federal agencies whose actions may affect the status of invasive species shall not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless the agency had determined and made public its determination that benefits of such action clearly outweigh the potential harm caused by invasive species.

Consistent with Executive Order 13112, the USACE would use general invasive plant species control measures, such as requiring contractors to clean equipment prior to beginning of work in the Project area and avoiding the use of hay bales and other materials that potentially contain weed seeds for erosion control. Some invasive vegetation could be impacted as a result of construction of the NED Plan; however land disturbance and removal of invasive vegetation would be unlikely to accelerate the spread of invasive species because non-native invasive species are already the dominant component of vegetative cover types within the Project area. Because many of the Project areas support invasive species, it is possible that construction in upland areas could be beneficial due to the removal of invasive species and subsequent replanting with native vegetation. Similarly, pond excavation may result in beneficial impacts due to the removal of invasive species such as common reed.

Although existing roads and parking areas would be used to the greatest extent possible for access and staging during construction, temporary impacts to upland vegetation may occur in areas used for haul roads and temporary workspaces. Following construction, these areas would be stabilized and revegetated with native plant species. With the measures identified in this section in place, the NED Plan would not result in potential significant adverse impacts to trees or vegetation during construction.

Miller Field Sub-alternatives. The current dunes at Miller Field, which are not manmade, are actively managed by NPS. While the NPS has encouraged natural dune development, the dunes have benefited from groins and up drift nourishment. Since Hurricane Sandy, windblown sand has been slowly augmenting the dune elevation. Recent planting by the NPS have aimed at restoring native vegetation as well as dune stabilization. Under the NED Plan (Seaward), the existing dune habitat at Miller Field would be disturbed; however this habitat would reestablish after construction is complete. In addition, at the request of the USFWS, the USACE would also plant appropriate species on the slopes, which would result in a continuous line of dune habitat and the creation of approximately 21 acres of dune habitat. USACE will work with the NPS to develop an appropriate species list for planting at Miller Field.

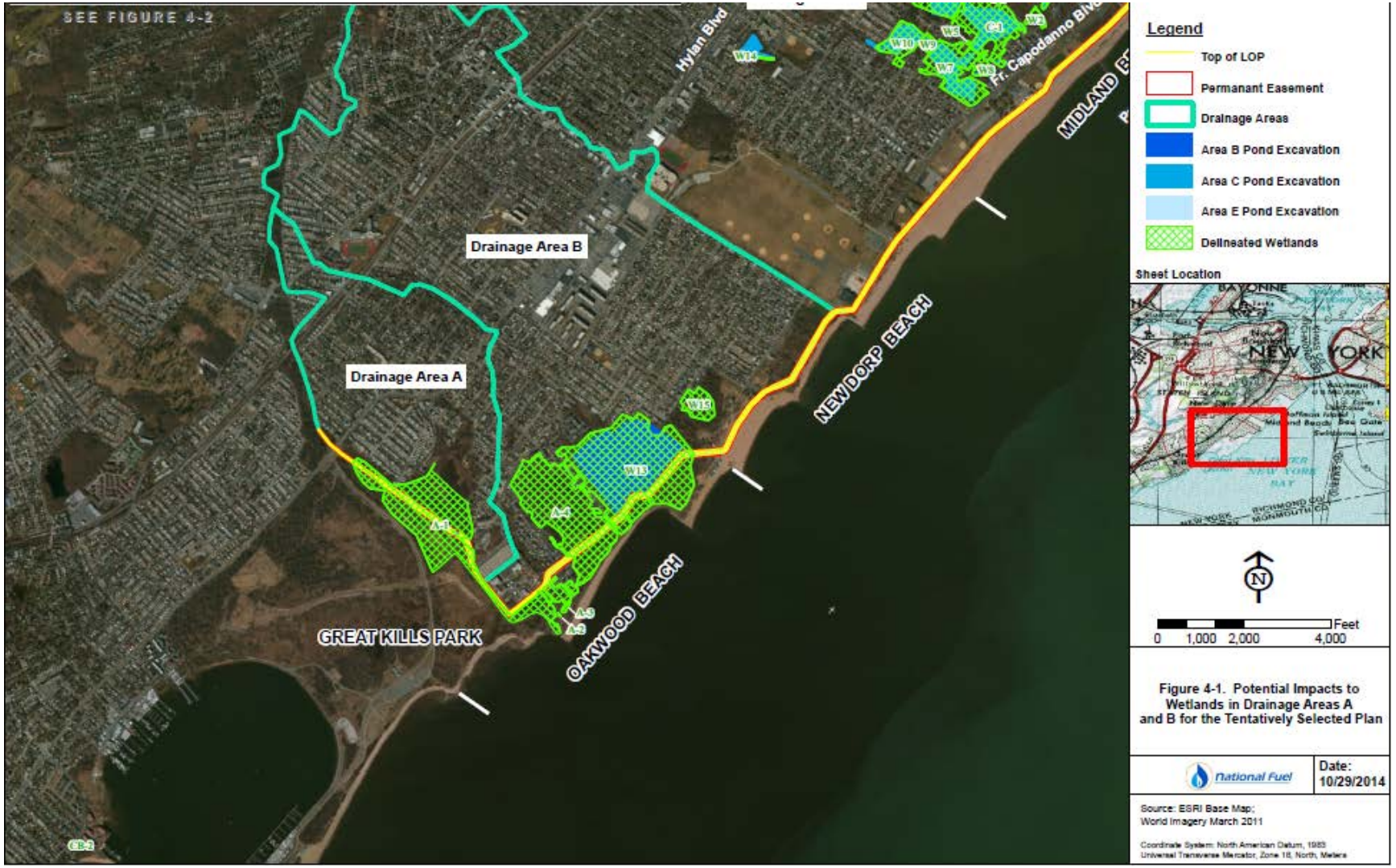
Additionally, if the NED Plan (Seaward) is constructed, the recently constructed multi-use path would be impacted and the USACE would provide a functional equivalent pathway (in the form of a promenade on top of the buried sea wall or a promenade at ground level behind the buried seawall. A promenade on top of the buried seawall would not impact the vegetated dune on the slopes of the seawall. A promenade at ground level behind the buried seawall would have similar impacts as the recently completed multi-use path. If the LOP is constructed landward of the hangar (Sub-alternative 1 [Landward]) or through the hangar (Sub-alternative 2 [Through]), the existing dune habitat at Miller Field would not be disturbed.

4.3.2 Wetlands

Under Executive Order 11990, Federal agencies are directed to "take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands…" A primary objective of the NED Plan is to use existing freshwater wetlands and their adjacent areas to improve stormwater management, manage flooding and erosion, and improve the overall ecological value of the watershed. To that end, the NED Plan would improve and diversify wetland habitats, transforming some existing common reed dominated wetlands into a variety of open water and emergent periodically inundated wetlands along with upland buffer areas. While construction of the LOP and tide gates along the south shore of Staten Island could impact some freshwater wetlands, the Project would create tidal wetlands as well. This section addresses each of these impacts.

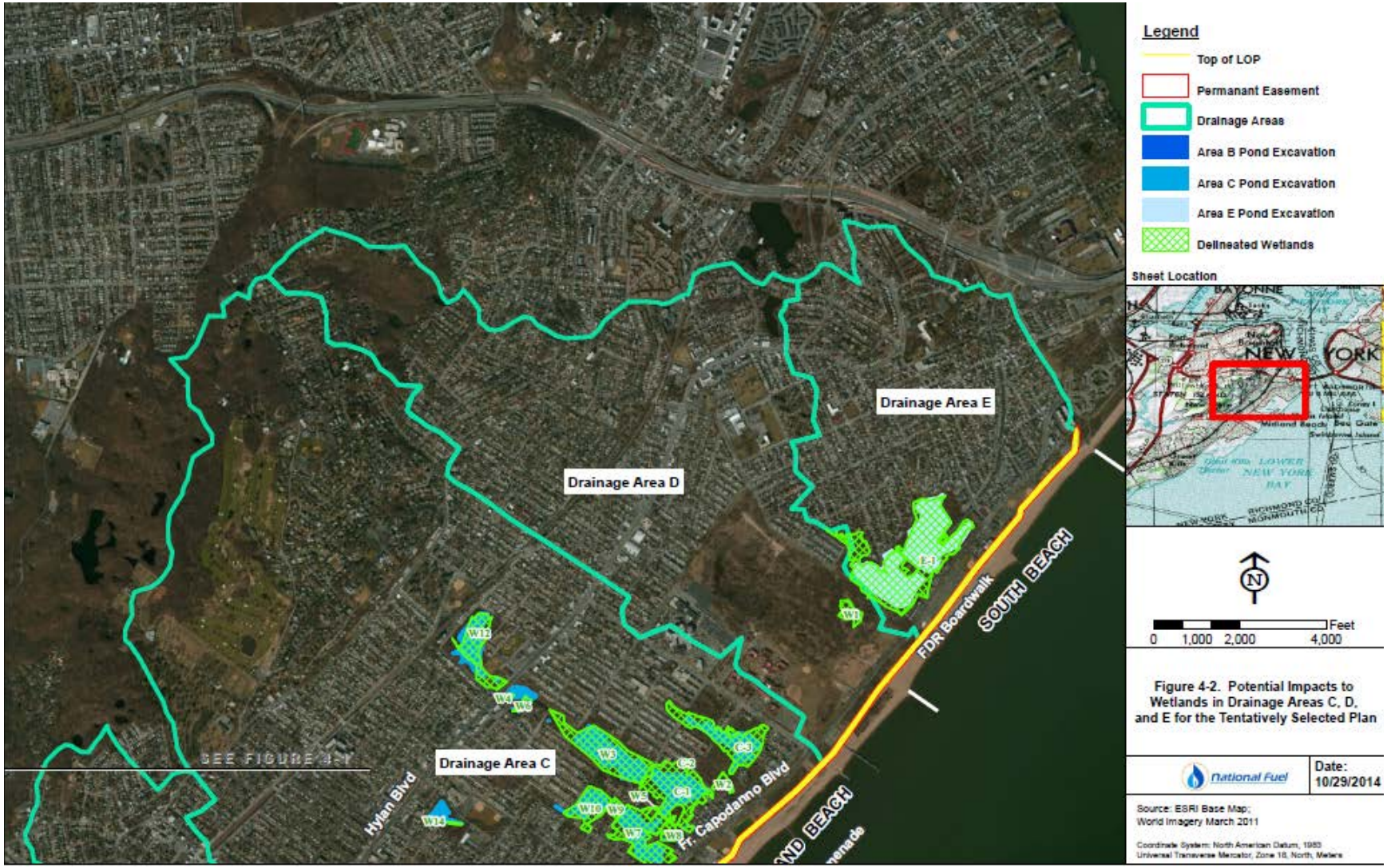
As described in Section 3.2.3, wetland boundaries were field delineated in 2003 and verified in 2009 as part of the USACE's planning for this Project. The complete Wetlands Delineation Report is contained in Appendix C. In order to calculate potential impacts to both tidal and freshwater wetlands, the USACE overlaid the NED Plan atop the delineated wetlands in the Project area (see Figures 4-1 and 4-2). Using geographic information system (GIS) mapping, the USACE determined the potential wetland acreages that could be impacted for each Project component/feature.

As shown in Figures 4-1 and 4-2, construction of the LOP would impact freshwater wetlands. The LOP would potentially impact a total of 10.9 acres of freshwater wetlands, all located at southern end of the LOP in the Oakwood Beach area. In addition, two types of land use easements associated with the LOP coincide with freshwater wetlands, including: (1) 5.6 acres in permanent easements, which would facilitate the construction, operation, maintenance, patrol, and repair and replacement of the LOP and dune; and (2) 12.2 acres in temporary easements, which would allow temporary access in, over, and across the land during construction. In total, up to 28.7 acres of freshwater wetlands could be impacted: 10.9 acres would be permanently impacted by placement of fill for the LOP; 5.6 acres would be temporarily impacted during construction and most would be restored and continue to be wetlands following construction, but would be encumbered by permanent easements for the LOP; and the remaining 12.2 acres could be temporarily impacted by use for construction workspace during construction but will be restored to wetlands following construction. Impacts on freshwater wetlands would be minimized in final design.



Source: USACE 2009, USACE 2015

Figure 4-1. Potential Impacts to Wetlands in Drainage Areas A and B for the NED Plan



Source: USACE 2009, USACE 2015

Figure 4-2. Potential Impacts to Wetlands in Drainage Areas C, D, and E for the NED Plan

Construction associated with the NED Project would involve substantial activities within and adjacent to freshwater wetlands. Measures typically used in USACE projects to minimize disturbance to wetlands during construction include the following:

- Sediment and erosion control practices (described above) would be part of the contract requirements, including specific techniques and methods to control sedimentation and erosion, such as snow fencing and silt fence/surface water collectors;
- Flagging and marking the edge of wetlands so that construction activities do not inadvertently extend into wetlands not intended for construction or restoration;
- Construction limit fencing would be used to avoid wetland encroachments during construction activities. The fencing would be equipped with signs reading "Protected Wetlands— Construction Prohibited Beyond This Point." The fencing and straw bales would be maintained for the duration of work in a stretch of the LOP or at a pond location;
- For construction segments with more intensive construction activities (such as along roads adjacent to wetlands), a reinforced silt fence with a surface water collector would be used, if necessary. After construction is complete, the fence would be removed; the trap rock could remain, since it would provide a quality well-drained shoulder for the road.

The NED Plan would require State and Federal agencies to issue certifications and/or concurrences for construction activities in and adjacent to freshwater wetlands. Therefore, it is expected that additional protection measures would be developed during the course of Project implementation and permitting, which would be incorporated into construction specifications and implemented during construction.

The shorelines along the southeastern shore of Staten Island have generally been mildly erosional, which indicate that the rate of erosion over most large areas of the shoreline is low, averaging less than 1 foot per year of shoreline loss. However, the segment near the Oakwood Beach area is at a much lower elevation (within 5 feet or less of sea level), and shoreline recession has been as high as 20 feet per year. Physical properties of the area seaward of the LOP in Oakwood Beach include poorly drained, organic and erosive soils (USACE 2015).

As part of the integrated approach for the Oakwood Beach area, the USACE considered increasing human and ecosystem community resilience as part of the overall solution to manage risk. To inhibit erosion, attenuate wave energy that can cause scour to the Project area, and to reduce sedimentation through the creek and tide gate into the freshwater wetland, the NED Plan has been designed to preserve the functional effectiveness of tidal exchange. This would facilitate wetland drainage and enable the tidal wetlands seaward of the LOP to help filter sediments so they are not brought into the freshwater wetlands (see Figure 4-3). In addition, the NED plan will utilize sand excavated during construction of the foundation for the LOP.

The existing channel would be relocated from along the inside toe of the existing natural berm to a central location within the site. The mouth of the existing channel would be widened from 22

feet (at elevation 2.0 feet NGVD29) to 30 feet wide. Widening the channel mouth and relocating the channel itself would allow for proper flooding and draining of the proposed marsh. The channel would be extended into the upper portion of the site to allow drainage from runoff from the scrub-shrub and maritime forest. The channel would also branch off and would connect with the proposed tide gate under the proposed access road that would run parallel to the LOP (USACE 2015).

As shown on Figure 4-4, the proposed measures along the coastline include constructing approximately 46 acres of tidal wetlands on the seaward side of the proposed revetment. Approximately 10.1 acres of maritime forest/scrub-shrub habitat would also be planted along the front of the revetment, while 12.9 acres of low marsh and 6 acres of high marsh acres of living shoreline are proposed in the shallow waters adjacent to the existing beachfront. Further, 17 acres of dune grass is proposed to be planted. These measures include multiple habitats that would provide environmental and public benefits to the Oakwood Beach area (USACE 2015).

With respect to interior drainage areas, approximately 90% of the excavation of proposed ponds would occur mostly within wetlands; however, some upland areas would be excavated and elevations lowered. It is possible that the resulting elevations from excavation in uplands could support/develop wetland or open water conditions if wetland hydrology became newly present, inviting volunteer hydrophytic/wetland plants to establish and hydric soils to form. The net result would be to expand open water (low-flow channels and ponds) and create permanent pool (emergent wetlands) habitats. These features have the hydrologic objective of storing and detaining stormwater that periodically inundates wetlands with runoff during storm events. In addition, as part of the Bluebelt Program, the NYCDEP intends to plant the flood storage areas or BMPs with wetland plants. The Bluebelt Program will replace low quality wetlands dominated by *Phragmites* with diverse wetland plantings and other features to enhance wildlife habitat.

Table 4-3 summarizes the potential impacts to wetlands associated with the LOP and interior ponding areas. As shown in that table, the net impacts to wetlands would be as follows: a loss of 10.9 acres of freshwater wetlands and construction of 46 acres of tidal wetlands. Taken as a whole, the construction of 46 acres of tidal wetlands versus the loss of 10.9 acres of freshwater wetlands would produce a net significant positive impact on wetland habitats and the quality of wetlands in the Project area. Given this net significant positive impact, no mitigation measures are proposed for the loss of 10.9 acres of freshwater wetlands.

Note: the area outlined in black represents the marsh and tidal wetlands area

Figure 4-3. Location of Tidal Wetlands at Oakwood Beach

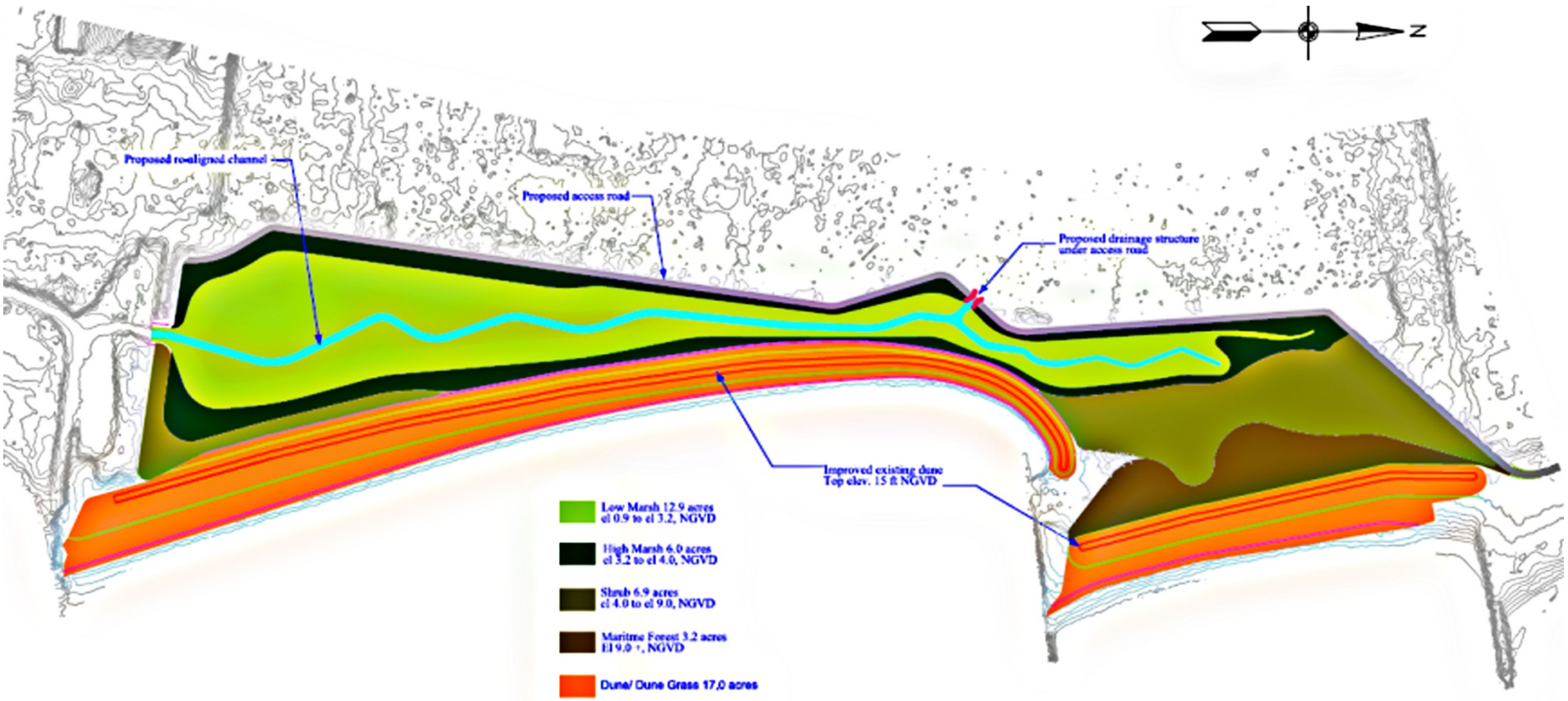


Figure 4-4. Features of Tidal Wetlands at Oakwood Beach

Table 4-3. Summary of Wetlands Impacts

	LOP	Interior Ponding Areas
Oakwood Beach	• Loss of 10.9 acres of freshwater wetlands (note 1) • Construction of 46 acres of tidal wetlands	No change to wetlands (note 2)
New Creek	0	No change to wetlands (note 2)
South Beach	0	No change to wetlands (note 2)
Total	• Loss of 10.9 acres of freshwater wetlands (note 1) • Construction of 46 acres of tidal wetlands	No change to wetlands (note 2)

Note 1: Based on permanent impacts associated with the LOP. Impacts of permanent easements (5.6 acres) and temporary easements (12.2 acres) on freshwater wetlands are not included in this value.

Note 2: Proposed ponding locations for the NED Plan are generally the same as the BMPs presented in the Bluebelt GEIS. In the Bluebelt GEIS, NYCDEP determined that the BMPs would create freshwater wetlands. It has not been determined whether the Bluebelt Program would be implemented prior to, or after, the NED Plan. Consequently, the USACE does not take any credit for the creation of any freshwater wetlands that could be created by interior ponds, as these may result from actions associated with the Bluebelt Program.

As part of its regulatory responsibilities under the Fish and Wildlife Coordination Act (see Section 4.4.2), the USFWS has reviewed the proposed action (see USFWS 2015) and has provided the following position with respect to wetlands:

> … nearly all of the wetlands to be excavated and/or filled consist of a monoculture of the invasive common reed which is of limited ecological value. The removal of invasive non-native vegetation, the seeding and planting of native wetland vegetation and the creation of emergent wetland in the excavated wetlands would improve the ecological value of those habitats. Additionally, the enhancement of 18.9 acres of tidal wetlands at Oakwood Beach will also improve the ecological value of those wetlands. Finally, the excavation, grading and planting of 11.34 acres of uplands converted into freshwater wetlands could also be accredited towards and attain the 1:1 mitigation ratio described in the Service's 2006 FWCAR. Provided the wetland enhancements function as designed/intended, the proposed action would result in no net loss of wetland acreage and in a net increase in wetland functional values. As such, the Service concludes, provided the Service-recommended measures are implemented, that the proposed action will not have significant adverse impacts on fish and wildlife resources in the project area.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in impacts to wetlands among the NED Plan (Seaward) and the two sub-alternatives.

4.3.3 Erosion and Sediment Transfer

The beach along the South Shoreline of Staten Island is a buffer between the LOP structures (earthen levee, concrete vertical floodwall, and buried seawall) and Raritan Bay, dissipating wave energy and insulating the LOP structures from short and long-term changes in shoreline position. The alignment of the LOP structures was selected so the structures are set back and elevated, minimizing their exposure to storm induced water levels and waves except during infrequent extreme events (i.e. 25-year event and greater). The with-project coastal impacts are expected to be minor for the LOP structures.

Beach erosion is not anticipated to affect the performance of the structures or the sediment transport processes that may affect the stability of beaches in or adjacent to the Project area until it reaches a minimum beach width. A minimum beach width threshold of 75 feet (measured from mean high water (MHW) was determined based on analysis of the impact of LOP structures on storm induced beach change using a validated SBEACH model.

Because the long-term sediment budget for the project area indicates that the beach is relatively stable, it is not anticipated over the project period of analysis (50-years) for the beach to erode below the minimum 75-foot threshold. The long-term beach erosion rate may be affected by climate variability, including increasing sea level rise and frequency/duration of coastal storm events. If the long-term beach erosion accelerated such that the minimum beach width of 75 feet was reached, beach maintenance/restoration activities may be evaluated. The implementation of beach maintenance/restoration as a future project adaptation would be based on a future decision document that would evaluate and record the changed metrological and oceanographic conditions.

4.4 WILDLIFE

Overview. As is the case throughout the region, Staten Island has lost much of its historic freshwater and tidal wetlands and the Project area is no exception. Therefore, the preservation of remaining wetlands under the NED Plan, coupled with the construction of tidal wetlands, provides an opportunity to protect and reinvigorate important natural resources habitats in the Project area. To achieve the goal of habitat enhancements, natural features have been designed into the Project for the purposes of providing ecological diversity in addition to (and in support of) the functions of stormwater management and flood control. The objective of these diverse design elements is to enhance the overall habitat complexity and ecological values in the Project area.

Most wildlife in the Project area is accustomed to human presence and activity, due to the dense urban nature of Staten Island. However, construction activities would disturb habitats and cause birds and other wildlife to avoid areas undergoing construction. The NED Plan would be implemented over approximately 3-4 years, in phases across the Project area. Disruptions to wildlife would be temporary and short in duration across the Project construction areas. Once constructed, the Project would provide diversified habitats. The USACE would have a process in-place for the rescue of wildlife, including fish, as may be necessary to avoid impacts or as may be required during the Project construction process. The NED Plan would also implement best management practices (BMPs) during construction activities to avoid impacts to wildlife. Therefore, the NED Plan would not result in potential significant adverse impacts to wildlife during construction.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in impacts to wildlife resources among the NED Plan (Seaward) and the two sub-alternatives.

4.4.1 Benthic Resources

Construction activities in the Project area would impose a one-time, temporary, and short-term negative impact, and long-term beneficial impacts on the existing benthic resources at the nearshore waters. Mortality of benthic resources would be anticipated as a result of habitat loss associated with the LOP, including the construction of seawalls and levees. In addition, the anticipated slight increase in suspended sediment may cause a temporary displacement of food sources for the motile benthic organisms and may have the potential to cover the openings of dwellings of adjacent benthic organisms (i.e., polychaeate worms, ghost crabs, and clams). However, the increased sedimentation would be minor and settle quickly out of the water column. Some existing benthic organisms have the ability to burrow through sand and would not be impacted from the slight increase in sedimentation caused by the Project. Additionally, motile epifaunal organisms, such as crabs, would relocate to nearby unaffected areas for food and also experience minimal impacts from the increase in sedimentation and turbidity.

The excavation of ponds would have positive impacts for the overall health of the marine benthic community. New drainage ponds would reduce storm water runoff and further act as detention bins for surface toxins normally released through outfalls during storm events. Although there would be a decrease in freshwater input to the system resulting from runoff reduction, it is unlikely that this would alter local salinity levels significantly.

4.4.2 Essential Fish Habitat

The following sub-section discusses the potential impacts to the finfish and shellfish in the Project area.

Finfish and Shellfish

Construction activities associated with the LOP would impose minimal impact on the existing finfish and shellfish resources in the nearshore waters of the Project area. Should impacts to finfish and shellfish occur, they would be temporary and localized and would impose a one-time, short-term impact that would be limited to the footprint of the slide and tide gates implemented within the Project area.

The placement of slide and tide gates within the Project area may cause direct mortality (burial) to existing finfish and shellfish at the footprint of the construction area. This type of direct impact would be expected to be primarily limited to egg and larval stages of windowpane, flounder, blue crab, horseshoe crab, larval stage flounder, and juvenile windowpane and flounder. The placement of slide and tide gates may also bury existing benthic macroinvertebrates and cause a temporary shortage of available food sources. However, the impacts from the slide and tide gates would be spatially limited and localized, and fish and mobile shellfish species would be expected to relocate to adjacent, unaffected areas for foraging purposes.

Additionally, an increase in turbidity and sedimentation may result from these temporary, short-term nearshore construction activities. Increases in turbidity could affect the settling rate of shellfish ova and larvae, and can cause gill abrasion to fish species that may temporarily affect oxygen uptake (Uncles et al. 1998).

Upland construction (i.e., pond excavation and road raising) may cause a temporary increase in sedimentation and turbidity of the nearshore Project area. However, proper erosion control measures and best management practices, such as straw bales and silt fences, would be implemented to prevent runoff from entering the bay during upland construction. Should erosion and runoff occur, the sediment would settle quickly out of the water column, causing minimal impact to marine biota in the Project area.

Long-term, the Project would widen and improve the overall hydrologic functions of the watershed streams and would improve water quality over the No-Action Alternative condition, thus improving aquatic habitats with the addition of stormwater that would be filtered by the proposed ponds. In the absence of the Project, hydrology and water quality conditions are expected to further decline.

Additionally, the constructed tidal creek in Drainage Area B would facilitate wetland drainage and, because it is tidal influenced, would allow passage of anadromous and diadromous fish. Anadromous fish, such as river herring, can use freshwater pond, such as those found along the east and south shore of Staten Island for spawning. Populations of these fish are in decline, and these ponds provide of potential for habitat restoration. Diadromous fish, such as American eel, might also be able to use these ponds. The Fish and Wildlife Coordination Act (FWCA) (16 USC 662(a)) provides that whenever the waters of any stream or other body of water are proposed to be impounded, diverted, deepened or otherwise controlled or modified, the USACE shall consult with the USFWS, the NMFS (as appropriate), and the agency administering the wildlife resources of the state. The consultation shall consider conservation of wildlife resources with the objective of preventing loss of and damages to such resources, as well as providing for development and improvement in connection with such water resource development. Any reports and recommendations of the wildlife agencies shall be included in authorization documents for construction or for modification of projects (16 USC 662(b)). Upon completion of the ongoing consultation between the USACE and USFWS/NMFS, the USFWS would provide a FWCA 2(b) report that would provide a Fish and Wildlife Coordination Act 2(b) Report. The USFWS has provided a draft Fish and Wildlife Coordination Act 2(b) Report (see Appendix G) to the USACE which concluded that, "with incorporation of the recommended mitigation measures, the proposed action will not significantly impact fish and wildlife resources in the project area" (USFWS 2006). On March 27, 2015, the USFWS provided a Draft Planning Aid Letter (PAL) (USFWS 2015), which was intended as a supplement and update to the Fish and Wildlife Coordination Act Section 2(b) Report dated January of 2006.

4.4.3 Reptiles and Amphibians

Construction of the proposed LOP may cause mortality of individuals of less mobile species of reptiles and amphibians that reside in or pass through upland and intertidal habitats of the Project

area. Pond excavation may have similar effects. More mobile species would be temporarily displaced from work areas, escaping to nearby undisturbed areas. Moreover, the presence of construction machinery and human disturbance may deter some species from utilizing the Project area. Following construction, reptile and amphibian species are expected to resume their normal habits consistent with post-construction habitat availability in and within the vicinity of the Project area.

The installation of 27,900-foot linear levee/floodwall/buried seawall would result in long-term disruptions of terrestrial migration patterns of reptiles and amphibians. In contrast, buried seawalls and levees are not expected to significantly restrict movements of reptiles and amphibians because they would have moderate slopes (2:1 and 2.5:1 side slopes, respectively).

The excavation of ponds would result in the disruption and possible mortality of reptiles and amphibians who encounter large construction equipment used for excavation. However, these same flood storage areas are expected to provide long-term benefits to reptile and amphibian species that favor flooded wetlands because shallow *Phragmites*-dominated wetlands and uplands would be converted to deeper wetlands. Examples of species that would benefit include the bull frog, Fowler's toad, northern water snake, and common snapping turtle.

4.4.4 Birds

Implementation of the NED Plan could have minor short-term impacts on area bird populations. Temporary short-term impacts may occur during construction, as the presence of construction machinery and human disturbance may deter some species from utilizing the Project area or disrupt nesting. Following construction, bird species are expected to resume their normal habits consistent with post-construction habitat availability in and within the vicinity of the Project area.

The excavation of ponds is expected to provide long-term benefits to bird species that favor wetlands that are flooded for longer durations (e.g., waterfowl and wading birds). Another improvement to the quality of these habitats would be the presence of a greater abundance of native wetland plants, most of which serve as better sources of food and cover for wildlife.

4.4.5 Mammals

Construction of the LOP and pond excavation could have minor short-term impacts on terrestrial mammal populations occurring in the area. During construction, the clearing and grading of work areas would result in the temporary disturbance of habitat and possible mortality of individuals of less mobile, burrowing, and/or denning species of mammals. Construction activities may also cause the temporary and permanent displacement of more mobile species due to increased human activity and habitat alterations. Following construction, mammals are expected to resume their normal habits consistent with post-construction habitat availability in and within the vicinity of the Project area.

Long-term effects of the NED Plan would include changes to vegetation cover types once construction is complete. Vegetation changes would result in a loss of habitat for mammals that utilize *Phragmites* habitat and an increase in habitat for species that favor wetlands that are flooded for longer durations (e.g., muskrat).

The installation of 27,900-foot linear levee/floodwall/buried seawall would result in long-term disruptions of terrestrial migration patterns of small and medium-sized mammals. In contrast, buried seawalls and levees are not expected to significantly restrict movements of these mammals because they would have moderate slopes (2:1 and 2.5:1 side slopes, respectively).

4.5 THREATENED AND ENDANGERED SPECIES AND COMMUNITIES OF CONCERN

4.5.1 Threatened and Endangered Species

With respect to the marine-related species, the shortnose sturgeon is not expected in the Project area or within watershed streams. Although it may use Lower Bay in some way during the migratory seasons, given the limited nearshore area that would be directly impacted by the NED Plan, no significant adverse impacts on this species would be expected. Similarly, the placement of slide and tide gates within the Project area would not result in a significant adverse impact on Kemp's ridley sea turtles, loggerhead sea turtles, green sea turtles, or leatherback sea turtles, as all four species are not likely to occur in the vicinity of the proposed sites. Similarly, no significant adverse impacts are expected on marine mammals. As discussed below, the USACE would continue to consult with the USFWS, NMFS, and NYSDEC with regard to any potential impacts to threatened and endangered species.

Because osprey, northern harrier, Coopers hawk, Peregrine falcon, and Piping plover have the potential to nest, forage or flyover the lower watershed Project areas, the USACE would consult with the USFWS and NYSDEC to determine the need for pre-construction surveys to be conducted for these species. Based on agency consultation, the USACE would take appropriate measures to avoid adverse impacts to these species during construction and operation of the NED Plan.

With respect to protected plant species, the USACE would consult with NYSDEC to determine the need for pre-construction surveys. If protected species are identified, the USACE would explore the possibility of refining the Project design to avoid these species or their habitats and, with respect to plants, plant salvage may also be implemented as a technique for relocating plants to avoid impacts.

Consultation. The USACE is required to consult with the USFWS and/or the NMFS, and the appropriate state agency, to determine whether any Federally-listed, State-listed, proposed species, or critical or proposed critical habitat may occur in the Project area, and to determine the proposed action's potential effects on these species or critical habitats. If the proposed action would adversely affect a listed species or critical habitat, the USACE must report its findings to the USFWS and NMFS in a Biological Assessment (BA). As discussed below, consultation between the USACE and USFWS, NMFS, and NYSDEC is ongoing.

To comply with the requirements of Section 7 of the ESA, USACE has conducted informal consultations with the USFWS and NMFS regarding the presence of Federally-listed or proposed listed endangered and threatened species and their critical habitat in the vicinity of the Project area. In addition, USACE has contacted the New York Natural Heritage Program (NYNHP) (USACE 2014b) and has reviewed their database regarding State-listed endangered and threatened species potentially occurring in the Project area. In 2006, the USFWS submitted a Draft Fish and Wildlife Coordination Act 2(b) Report (USFWS 2006) to the USACE which concluded that, "with incorporation of the recommended mitigation measures, the proposed action will not significantly impact fish and wildlife resources in the project area" (see Appendix G). The USACE sent letters to the USFWS and NMFS in October 2014 stating that the Project will not likely adversely affect Atlantic Sturgeon (USACE 2014c, USACE 2014d).

On March 27, 2015, the USFWS provided a Draft PAL (USFWS 2015), which provided additional details related to the red knot. The Draft PAL stated that,

> … there are records of red knot presence on the mudflats at Great Kills Park, located adjacent to the project area to the south, during the months of May and August in past years. The most recent sighting (one red knot) at Great Kills Park was in August of 2013. The project site does provide suitable red knot foraging habitat along the lower New York Bay/Atlantic Ocean shoreline. As such, it is likely that the red knot does frequent the project site during the spring and fall migrations.

The USFWS requested that Section 7 consultation shall be conducted and documented in a separate document and will be contingent upon the USFWS's receipt of an ESA determination and assessment by the USACE.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in impacts to threatened and endangered species among the NED Plan (Seaward) and the two sub-alternatives.

4.5.2 Natural Areas and Communities of Special Concern or Management

The USACE anticipates that implementation of the NED Plan would have no effect on the ability of the Project area to continue to play an important role as part of the USFWS's Raritan Bay – Sandy Hook Bay Significant Habitat Complex. The USACE does not expect any impacts to either the Serpentine Barrens in the vicinity of the South Beach area, or the Oak-Tulip Tree Forest within Reed's Basket Willow Swamp Park.

4.6 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

4.6.1 Demographic Characterization

Construction activities would not be expected to produce new development or increase development density within the Project area. Consequently, no impacts to the demographic

characteristics of the south shore of Staten Island are expected. Once construction is completed, the LOP and interior drainage areas would enhance coastal storm risk management and natural resources, but should not affect demographics in the Project area.

4.6.2 Economy and Income

Construction activities would occur over about a 3-4 year time period (nominally mid-2016 through 2019) and the Project is estimated to cost approximately $492 million. Based on the relatively large number of households in the Project area (163,675), and the relatively high median household income ($73,496), construction activities would only result in a small positive contribution to the overall economy and incomes. Construction requirements are expected to be met by workers within, or near, the Project area, so in-migration of workers is not expected. Once construction is completed, the NED Plan would enhance coastal storm risk management and natural resources in the Project area. This could result in a positive impact on the economy and incomes in the Project area, but would not be expected to contribute any additional growth pressure or result in potential significant adverse impacts to growth inducing characteristics.

4.6.3 Housing

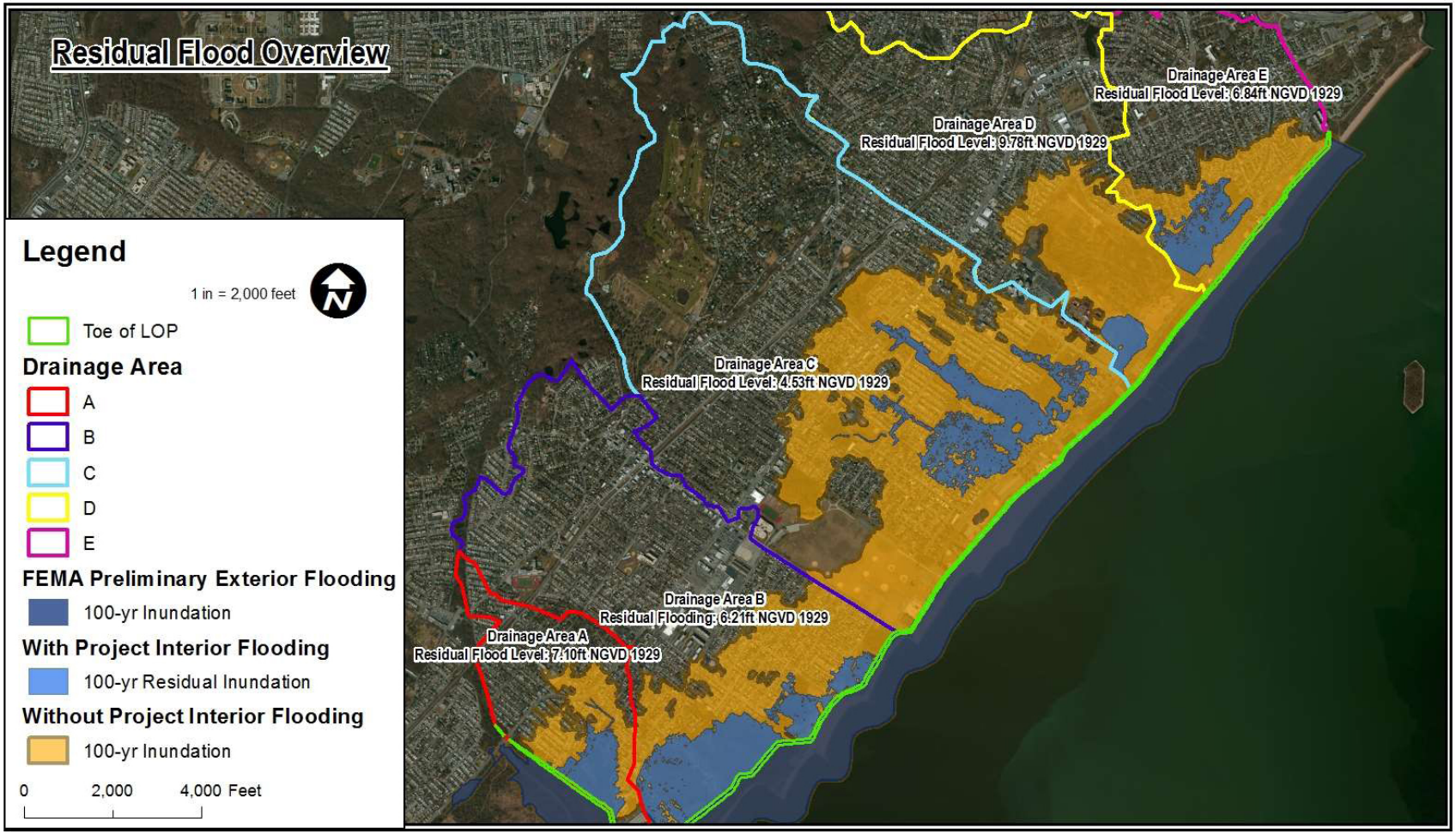
Because construction activities would not produce new development or increase development density within the Project area, housing would not be significantly affected. Once construction is completed, the NED Plan would enhance coastal storm risk management and natural resources in the Project area. However, it would not eliminate all flooding behind the LOP. Local property owners would still experience road closures during high frequency events (e.g. 2-year or 10-year events) and the first floor of many homes may still flood during events as frequent as the 10-year event. The damages resulting from these types of flooding could not offset the cost of introducing flood control measures to negate them. In other words, other flood control measures were not deemed cost-effective and thus, could not be considered for the Project (USACE 2015). That said, the NED Plan would manage flooding impacts throughout the Project area, which would be positive for housing. Figure 4-5 provides an overview of flooding in the Project area both with, and without, the NED Plan. USACE is anticipating that the non-Federal sponsor will seek FEMA accreditation under CFR 44-65.10 in order to incorporate the significant risk management measures (i.e. Armored Levee System) into the effective FIRMS.

4.6.4 Environmental Justice and Protection of Children

The fundamental purpose of the Project is to enhance coastal storm risk management. The evaluation of impacts to environmental justice is dependent upon determining if there would be disproportionately high and adverse impacts from the proposed action on any low-income or minority group in the affected community. If there are no high and adverse impacts to *any* groups in the population, then there would not be any disproportionately high and adverse impacts on any low-income or minority groups. The analysis in this EIS supports the conclusion that there would be no high and adverse impacts to any groups in the population, and thus, no environmental justice impacts. By reducing the risk of damages from hurricane and storm surge

flooding, implementation of the NED Plan would result in positive impacts to all individuals in the Project area. This conclusion is also applicable to the protection of children.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in socioeconomic or environmental justice impacts among the NED Plan (Seaward) and the two sub-alternatives.



Source: USACE 2015

Figure 4-5. Overview of Potential Flooding in Project Area, With and Without the NED Plan.

4.7 CULTURAL RESOURCES

Studies by the USACE and others have identified National Register of Historic Places listed or eligible properties within the APE that have the potential to be impacted by the project alternatives. Miller Army Airfield and Fort Wadsworth are NRHP-listed historic districts; both discussed below. The WWII fire tower at Miller Field is potentially eligible for the NRHP. There is the potential to encounter deeply buried Native American sites along sections of the LOP. Areas not previously surveyed for archaeological resources have a moderate potential to yield significant sites. Additional investigations and mitigation would be undertaken as per the Programmatic Agreement (see "Section 106 Coordination," below) and would be conducted as the project proceeds.

Recommended work includes the excavation of deep borings in selected locations to test for the presence of early landforms buried under marsh or organic soils. The 2005 report (Panamerican 2005) indicated that the need for borings is contingent on the construction technique proposed. If open trenching is proposed, then borings are recommended; however, if pile driving is the proposed construction method, then no borings would be excavated. Borings would serve to determine if any significant resources or sensitive landforms are present. If such resources are identified then construction impacts would be determined and mitigation measures developed.

The USACE would undertake no further studies of the bungalow community at Cedar Grove and no additional shovel testing would be conducted there. The USACE would undertake no further work in connection with the structural remains on the beach at New Dorp, pending SHPO concurrence. However, the alignment in the New Dorp area, as now proposed, has shifted landwards. Testing of the new alignment will be undertaken. The alignment in the Oakwood Beach vicinity has also been moved landward from the alignment studied in 2005 so this location would also be surveyed. The stop-log structure proposed at Hylan Boulevard is a new element to the project and would be investigated as well.

Archaeological testing of high ground adjacent to proposed ponding areas and pump stations was recommended in the 2005 cultural resources report (Panamerican 2005). Since that time, more detailed work was undertaken in association with the NYCDEP Bluebelt Program. The USACE will use the cultural resources recommendations provided for the Bluebelt on any project actions that overlap with the Bluebelt Program. Interior drainage features not included in the Bluebelt Program would be subject to a cultural resources survey by the USACE.

Fort Wadsworth Historic District

The NED plan will have no direct impact to the Fort Wadsworth Historic District.

Fort Wadsworth sits on a high promontory with great vistas to the north and east, towards the Narrows and Lower Bay, and was located there to protect the entryway to New York Harbor. These views are cited as contributing to the historic district's NRHP eligibility. The LOP, which ties into high ground immediately south of Fort Wadsworth, is not within the historic viewshed of the Fort (for plans, please see Appendix A, Sheet C-110; for photographs, see Appendix G,

USACE Consultation Letter to NPS, dated 8 May 2015, Attachment 1). There will be a partial obstruction of the view from the southeast corner of the property at the bend on the USS North Carolina/Ayers Road where the seawall ties in to high ground near the Drury Avenue Extension. The view to the beach is already obstructed here by the existing boardwalk and modern apartment buildings adjacent to the historic district. The seawall and tie-off, the top of which would be five feet higher than the current boardwalk would further obscure this view, however, the view here is largely the viewshed from the modern housing constructed within the historic district. Batteries Ayers and Richmond, the contributing resources closest to the LOP and those that are oriented towards the south rather than the Narrows, are located on high ground. Views from them along the beach are largely obscured by modern intrusions. The view out to sea from these defenses remains obscured only by trees growing on the embankments of the batteries themselves. Views from higher ground and from the historic defenses that are oriented towards the south shore would not be impacted by the seawall construction as the views to the beach are already obscured by the modern housing within the historic district. The seawall within the viewshed of modern housing located within the historic district would not have an adverse effect on the historic district. None of the viewsheds associated with the district's contributing historic resources would be adversely affected by construction of the proposed alignment.

Miller Army Airfield Historic District

The three alternatives proposed for the LOP at Miller Field, seaward (the NED Plan), landward or through Hangar 38, would all have varying adverse effects on the NRHP-listed Miller Army Airfield Historic District (see Appendix A for plan sheets of the NED Plan and the sub-alternatives). The USACE would continue to work with the NPS and NY SHPO to minimize and/or mitigate for impacts to the historic district. The USACE would also evaluate the NRHP-eligibility of the 1943 fire control tower as there has been no determination of eligibility for this structure.

NED Plan (Seaward)

The LOP constructed seaward of the Miller Army Airfield Historic District would be immediately adjacent to, as well as cut through a portion of, the historic district [Figures 4-6, 4-6(a), 4-7 and 4-7(a)]. The seaward alignment would however protect the district from future coastal storm damage.

There are no direct impacts anticipated to the historic district's contributing structures; Hangar 38, the Elm Tree Light or concrete apron. Construction of the seawall would occur within 15 to 20 feet of the hangar and Elm Tree Light however vibration control measures would be implemented to ensure that vibration from construction would be limited. In general, USACE construction specifications require an upper limit of 0.5 peak particle velocity (PPV) in the vicinity of historic structures. Seismographs would be placed on site to monitor vibration during the construction period. A pre- and post-construction survey of the structures may be undertaken to document

Figure 4-6. Hangar 38 and Elm Tree Light (the concrete tower to the right) at Miller Field.

Figure 4-6a. Hangar 38 and Elm Tree Light at Miller Field with rendering of NED Plan behind, and wrapping around, the hangar before continuing along the beach.

Figure 4-7. Hangar 38 and Fire Tower at Miller Field.

Figure 4-7a. Hangar 38 at Miller Field. The NED plan would remove the fire tower and create a barrier between the seaplane hangar and the sea.

conditions both before and following activities in site. This approach has been employed successfully on numerous USACE projects involving construction near historic structures.

Hangar 38, now separated from the sea by the lack of a ramp connecting it to the water and by the presence of the existing dune and beach, would be further disconnected from its original setting by the construction of the seawall. The seawall wraps around the hangar's south side, adjacent to the Elm Tree Light, adversely affecting the historic district by closing off the open feel and setting of the former airfield.

The seawall will rise to a height of 22.5 feet NGVD29, which is a further eight to ten feet above the existing dune. The view at ground level from the hangar to the sea would be obstructed completely which is an adverse effect on the historic district. The 55-foot high Elm Tree Light, once an aid to navigation, would remain clearly visible from the sea and views from the light to the sea would also remain unobstructed. The WWII fire tower would be demolished. If the structure is determined eligible for the NRHP its removal would have an adverse effect on the structure and mitigation measures would be required. The seaplane ramp may be encountered as the LOP cuts through the former alignment to the sea. Remains of the 1924 jetty may also be encountered. An archeological investigation would be conducted to determine if the ramp or jetty remain within the LOP.

Miller Field Sub-alternatives

Sub-alternative 1 (Landward). The landward alignment is proposed immediately adjacent to western boundary of the historic district. The area landward of Hangar 38 was not the focus of the seaplane hangar but was the focus of the former landplane hangar (Building 33) and its operations and contribution to aviation history. Building 33 was demolished in 1976 and its airfield and runways were removed to create park facilities including ball fields. The focus and connection of Hangar 38 with sea would remain with the landward option. The focus of the Elm Tree Light was also to the sea and it too would remain without impact. The overall feel of the open former airfield, now recreation areas, would be adversely impacted by a seawall constructed landward of the historic district. The alignment would likely skirt the apron thereby avoiding direct impacts to it although the seawall would separate the apron from the former airfield it once served. Mitigation measures for these impacts would be developed with the NPS.

As with the No-Action alternative, locating the LOP landward of Miller Field Historic District would leave it vulnerable to further coastal storm damage. It is not anticipated that wave damage would be increased due to the presence of the barrier. Waves arriving at the buried seawall would be limited in energy due to the depths fronting the seawall. The waves breaking on the seawall would have their energy dissipated upon breaking and would not have energy to do damage to the hangar upon retreat. The landward alignment would not impact the WWII fire tower. An archaeological survey of the landward alignment would be required.

Sub-alternative 2 (Through). Sub-alternative 2, constructing the seawall through Hangar 38, would likely require a dismantling of most of the seaward half of Hangar 38 to allow construction to proceed safely. This section of hangar would have to be reconstructed following

construction. The crest of the buried seawall, including two feet for sand cover and/or promenade placement, is 22.5 feet NGVD29. The footprint width is approximately70 feet, of which 20 feet is below existing grade. In order to accommodate the buried seawall through the center line of the east bay hangar, most of the intermediate support columns on the north and south sides of the building would have to be removed. Extensive modifications to the two main support spans on the north and south side of the building would have to be performed. The construction of the buried seawall may require removal of approximately 95 feet of existing floor slab to facilitate structure toe installation. The floor slab removal and associated excavation may affect the stability of the existing building foundation, necessitating extensive modifications. Although the crest elevation of the buried seawall is approximately seven feet lower than the lowest roof truss member, the low clearance would pose significant and very costly construction techniques to lift and place the 3- ton armor stones onto the outer layer of the buried seawall. Maintenance of the buried seawall would also face these access issues and elevated repair costs. Furthermore, placing the buried seawall through the structure does not protect the building's foundations on the east side of the east bay hangar from localized scour caused by receding floodwaters. Shallow concrete footers support the east bay hangar. If the concrete footer becomes compromised so does the stability of the hangar.

This option would cause the most direct damage to the original fabric of Hangar 38 and would most alter the original purpose of the structure, to house and repair seaplanes, with the insertion of a seawall through its large open expanse. The feeling of the historic interior would be lost. This alternative would also require the Elm Tree Light to be dismantled and it would cross the entire concrete apron. The alterative through the hangar would have direct adverse impacts to the Hangar 38, the Elm Tree Light and the concrete apron. This option, as with the other alternatives, would also impact the setting. The eligibility of the historic district would be compromised with this alternative.

Section 106 Coordination and Mitigation. All previous USACE cultural resources studies were coordinated with the NY SHPO (see Appendix G). No response was supplied by the NY SHPO in 2005 because they concurred with Phase I report recommendations and had no comments (Mackey 2009).

The USACE has drafted a Programmatic Agreement (PA) (see Appendix F) which stipulates the actions the USACE will take with regard to cultural resources as the Project proceeds. The Programmatic Agreement will be used to ensure that the USACE satisfies its responsibilities under Section 106 of the NHPA and other applicable laws and regulations. The Draft PA has been provided to the Advisory Council on Historic Preservation (ACHP), the NPS, the Delaware Nation, the Delaware Tribe of Indians, the Stockbridge- Munsee and the New York City Landmarks Preservation Commission for their review and participation. The tribes were provided a copy of the Phase I survey report prepared for the USACE by Panamerican Consultants, Inc. in 2005. The NY SHPO and NPS have provided comments on the Draft PA which have been incorporated into the document contained in Appendix F. The ACHP has opted to not participate in the agreement document. NYCLPC concurred with the recommendations of the 2005 report and the direction the USACE would take on future studies as per the Draft PA. They request being informed of the studies as they are undertaken. The Delaware Tribe

concurred with the Phase I recommendations for deep testing. The Delaware Nation indicated that the USACE should continue with the project as planned (see Appendix G).

The Staten Island Historical Society, Staten Island Museum, Staten Island Historian, Preservation League of Staten Island and the Harbor Defense Museum of Fort Hamilton were also contacted by the USACE. Mr. Barnett Shepherd, Executive Director, Preservation League of Staten Island, called the USACE archaeologist and indicated an interest in the early settlement at New Dorp and the Huguenot Oak, the forerunner of the Elm Tree Light (Barnett Shepherd, personal communication 14 November 2014).

The draft Programmatic Agreement is available for public review as Appendix F of this Draft EIS and will serve as the USACE's Section 106 public coordination. The final Programmatic Agreement will incorporate comments received on the draft document, as appropriate.

Cultural resources mitigation includes excavation of borings/deep testing in selected locations as per the Draft PA. Estimates for this work include costs to study a site should one be encountered through the borings/deep testing. Such work would require that considerable logistical issues be addressed due to working in a deep, and likely wet, site. Cultural resources mitigation estimates include testing of areas where the alignment has shifted, staging areas and ponding areas as per the Draft PA. Should a site be encountered through testing additional study or archaeological mitigation may be needed. The cost for potential archaeological mitigation is included in the estimate. The mitigation cost includes costs to mitigate for adverse effects to the Miller Army Airfield Historic District. These measures have yet to be determined but are being developed in coordination with NPS and the NY SHPO.

4.8 LAND USE AND ZONING

The NED Plan would preserve existing open space, including wetlands and buffer areas, for habitats and stormwater management. The proposed LOP and all ponds would be compatible with adjacent land uses and activities. Implementation of the Project would provide a stormwater management plan for the Project area and would enhance natural resources through habitat restoration and protection.

The Project would complement NYCDEP's Bluebelt Program, which proposes amended drainage plans comprised of a network of storm sewers, BMPs, and Bluebelt wetlands. One of the mitigating activities important to the level of development within the Project area is the acquisition of local property for the preservation of wetlands and introduction of new natural storage areas for stormwater conveyance. Approximately 204 acres of the Project area will be or is already owned by the NYCDEP Bluebelt Program (NYCDEP 2013). These properties lie mostly within the Federal Emergency Management Agencies designated Special Flood Hazard Area and are barred from future development. The acquisition of land and introduction of other stormwater BMPs may help balance out the increases in stormwater damages from the anticipated development and fill in the Project area.

Construction associated with the NED Plan would take place on Bluebelt lands, City or state parklands, and some private land. Any potential disruptions around ponds, raised roads, and along the LOP due to construction would be temporary and short in duration and would not result in any short-term or long-term land use changes. Construction would not conflict with local zoning or public policies and would not displace any existing uses. Additionally, the NED Plan does not involve any rezonings, new residential or commercial development, or an increase in development density within the Project area.

The total required lands, easements, and rights-of-way (LER) required in support of the Project would be approximately 417.01 acres. Of this total, approximately 374.71 acres would be permanent easements and approximately 42.30 acres would be temporary easements. Overall, the Project would impact 670 parcels, currently affecting 268 private owners and 402 public owners (USACE 2015). Permanent easements and temporary easements are discussed below.

Permanent Easements. Permanent easements consist of flowage easements and flood protection levee easements. Flowage easements within the Project area would impact approximately 250.4 acres (impacting 556 parcels; 214 private and 342 publicly-owned) within the Project area. Under a flowage easement, portions of land would be subjected to permanent inundation and/or occasional flooding. Flowage easements would create restrictions on these properties (such as preventing construction of structures for human habitation and limiting excavation or the placement of fill on the land) without the approval of the USACE. Flowage easements would serve as a means to maintain open space within the Project area. Flood protection levee easements would be required for the construction, operation and maintenance of the LOP. These easements would affect approximately 124.31 acres (impacting 124 parcels; 42 privately-owned and 82 publicly-owned) (USACE 2015).

Temporary Easements**.** Temporary easements would be required for staging/work area purposes. Temporary easements would affect approximately 42.30 acres (impacting 56 parcels; 6 private and 50 public owners). The required temporary work areas are typically adjacent to land to be acquired for construction of the LOP and typically affect the same ownerships. Temporary work area easements would be required for two-year durations (USACE 2015).

If not for the presence of freshwater wetlands and the otherwise limited supply of vacant land in the Project area, historical development pressure would be expected to continue in the future regardless of the NED Plan. In addition to the regulatory restrictions that limit development in these wetlands, many of the wetland acres are also preserved as City or state open space or Bluebelt properties which would also preclude their development. While the NED Plan would enhance natural resources in the Project area and would preserve wetlands for stormwater management, these actions are not expected to contribute any additional growth pressure.

Miller Field Sub-alternatives. At Miller Field, there would be no notable differences in land use and zoning impacts among the NED Plan (Seaward) and the two sub-alternatives. Although it has not yet been determined as to the legal authority and instrument that would be utilized with regard to any actions that would take place on NPS lands, the USACE and NPS are working closely to make this determination.

4.9 RECREATION

Visitors to the south shore of Staten Island use a substantial portion of the Project area specifically for recreational purposes. Implementation of the NED Plan would provide an opportunity to maintain and preserve the Project area's many existing parks and other recreational facilities for the foreseeable future. The NED Plan also allows for the possibility that the protective measures could enhance recreational opportunities. For example, portions of the LOP would be designed with a promenade on top for access to the beach and local recreation areas.

Figure 4-8 depicts parks and recreational facilities in the Project area. As evidenced by that figure, many recreational opportunities exist in improved and unimproved parklands in the Project area. Recreational activities that occur along the beachfront (including the beach, boardwalk, and promenade) and within Miller Park (see "Miller Field Sub-alternatives" below) would sustain short-term, direct impacts during Project construction activities, as well as long-term, direct impacts (for example, required relocation of buildings or portions of fields). To the extent practicable, access to the beaches would be maintained throughout construction. The Project could also require the relocation and reconstruction of some park facilities, potentially including comfort stations, concessions, and recreational components such as playgrounds or athletic fields. Specific impacts to facilities will be identified during the refined design of the Project, and in collaboration with NYCDPR. Short-term, indirect impacts include construction noise and the temporary limitations on access to the beach. In addition, parking areas used by people seeking recreation in the Project area may be temporarily closed to the public, to serve as construction staging areas. The USACE will be in close coordination with NYCDPR during the Plans and Specification Phase and during construction to minimize any potential impacts. Upon the completion of Project construction, recreational uses and activities are expected to resume.

Due to the linear nature of much of the Project, these areas of increased construction noise and reduced access would be essentially mobile, moving along the LOP as each activity is completed. Accordingly, the duration of increased noise and reduced access in any one location would be short-term, compared to the entire construction timeframe.

The buried seawall would incorporate a promenade, replacing the continuous at-grade paved and pile-supported promenade from Miller Field to Oakwood Beach. Roller compacted concrete would be constructed atop the crest to create a 17-foot wide paved promenade. From Miller Field to Fort Wadsworth, the buried seawall would provide for a 38-foot width boardwalk atop the proposed seawall. The boardwalk would be a functional equivalent to the existing boardwalk. Public access points would be provided, as discussed below.

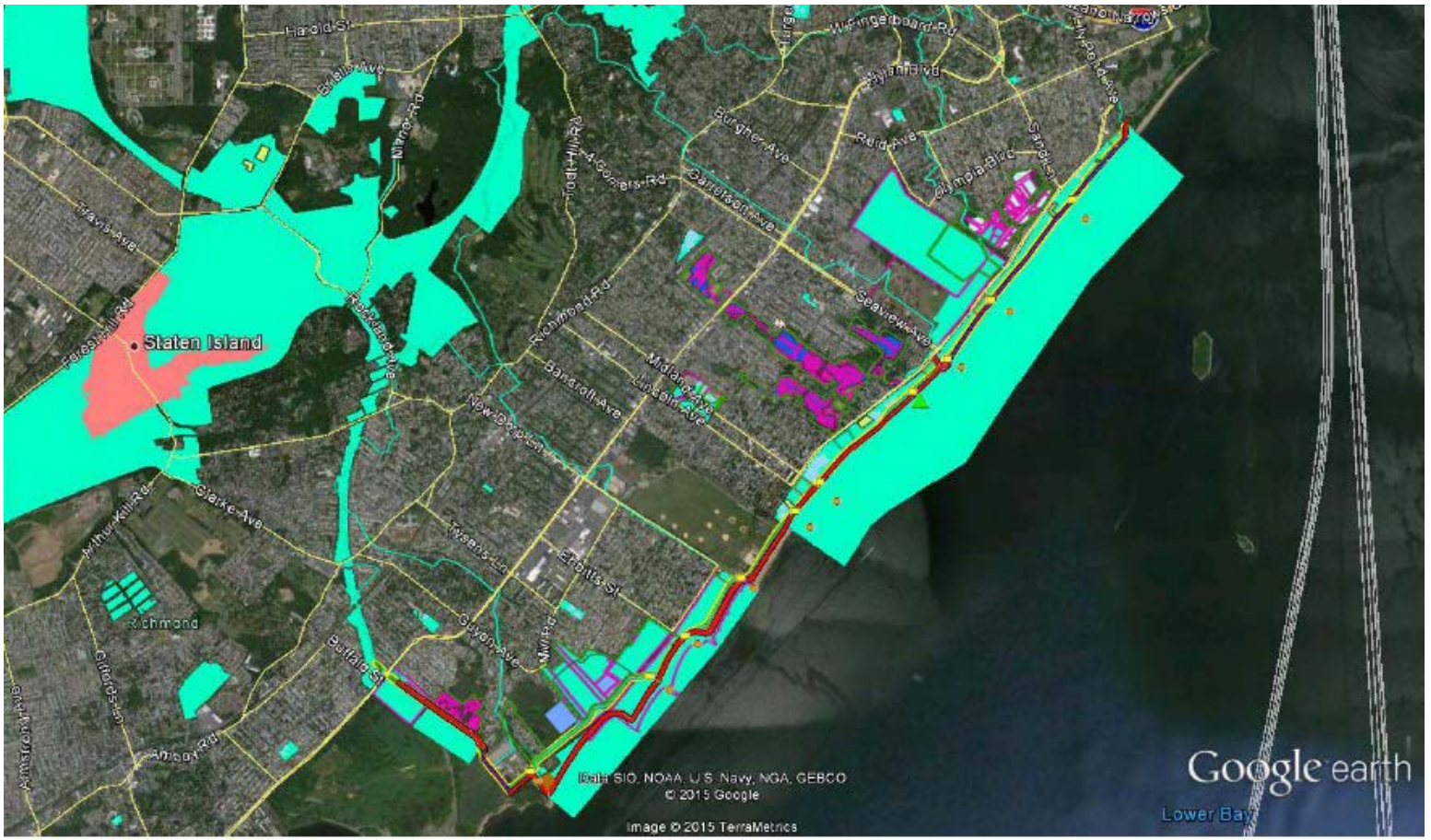


Figure 4-8. Parks and Recreational Facilities in the Project Area.

Fourteen (14) earthen ramps are proposed between Oakwood Beach and South Beach. These ramps would be designed for both pedestrian and vehicular access and meet the 1:12 maximum slope required by ADA guidelines. The ramps would be strategically located to provide beach access from existing roads and access paths. Pedestrian access points, spaced approximately every 500 feet, would be located along the Buried Seawall between Midland Beach and South Beach. There would be a total of 27 access points for pedestrians along the promenade. Each access point would be comprised of 10-foot wide reinforced concrete stairs on both the landward and seaward sides of the buried seawall to provide access to the promenade and the beach (USACE 2015). Each access point would provide a way to traverse both the seaward and landward slopes of the buried seawall/levee.

As discussed in Section 4.3.3, beach erosion is not anticipated to affect the performance of the structures or the sediment transport processes that may affect the stability of beaches in or adjacent to the project area until it reaches a minimum beach width. Because the long-term sediment budget indicates that the Project area beach is relatively stable, adverse erosional impacts to the recreational resources associated with the beach are not expected.

Most of the proposed interior drainage facilities are located in areas that are not used extensively for active recreation. Pond creation and deepening are proposed are open, undeveloped areas that are likely used for passive recreation activities such as bird watching and nature observation and active recreation activities such as jogging, walking, and off-road bicycling. Excavating ponds would infringe upon land-based passive and active recreation use during both construction and long-term operation of the ponds. However, these areas were selected for this purpose (ponds) because of their present low landscape position and elevations, in comparison to surrounding areas. These areas are already the first areas to be inundated with water during rain events and therefore, would not be the most highly utilized recreation areas available. Active and passive recreation would be able to resume following construction in the areas surrounding the new and deeper ponds.

The Lower Bay is classified SB, which is a marine water designation that also calls for recreational uses, such as swimming and boating. Once the NED Plan is implemented, improved water quality (Section 4.2.3) could enhance recreational use and the recreational value of the Lower Bay.

During the Plans and Specifications Phase of the Project, refined design of Project components that interface with park and recreational facilities will be developed in collaboration with NYCDPR. That interface will also refine the number, location, and design of pedestrian and vehicular access points across the buried seawall.

Miller Field Sub-alternatives. Seawall construction under the NED Plan (Seaward) could impact the recently constructed multi-use path; however, the USACE would replace it with a functional equivalent in the form of a promenade. The location of the promenade on top of, or behind, the seawall would have differing impacts on recreation. A seawall topped with a heavily-trafficked promenade through the middle of the vegetated dune community may create an enforcement issue for the NPS. Alternatively, the visitor experience behind the dune may be

different than what visitors currently experience, or would experience on lands adjacent to NPS lands. For Sub-alternative 1 (Landward), locating the buried seawall landward of Hangar 38 at Miller Field could result in a loss of some recreational fields and a trail currently occupying that area. For all sub-alternatives, beach access would be maintained and impacts to recreation would be minimal. Under any alternative, there would likely be no noticeable impact to sea breezes or the microclimate.

4.10 AESTHETICS AND SCENIC RESOURCES

The NED Plan is expected to have a variety of effects on aesthetics and scenic resources within interior and exterior views of this portion of the Project from surrounding natural and cultural landscapes, depending on the structural characteristics and location of each element of the LOP. The proposed LOP would blend with the surrounding natural and cultural landscapes, which are composed of existing linear features such as Father Capodanno Boulevard, the existing raised promenade and/or boardwalk, and the existing shoreline, including existing dunes. The entire core structure would be covered with backfill, with compacted fill placed on the seaward face and landward face to support grass and other native beach vegetation (USACE 2015).

The crest elevation of the buried seawall would be 20.5 feet NGVD29, with a finished elevation that would be 2 feet higher, meaning that the final height would be 22.5 feet NGVD29. Because the Boardwalk has a height of 17 feet NGVD29, the finished height of the LOP would be 5.5 feet higher than the existing raised promenade and wooden boardwalk. Consequently, the buried seawall would change the surrounding landscape and terrain. Earthen ramps proposed between Oakwood Beach and South Beach would be designed for both pedestrian and vehicular access. Each access point would be comprised of 10-foot wide reinforced concrete stairs on both the landward and seaward sides of the buried seawall to provide access to the promenade and the beach (USACE 2015).

Other portions of the LOP would also be higher than the existing landscape (for example, the promenade at Midland Beach is at ground level and the wetland areas of Oakwood Beach are undeveloped). These elements of the LOP would become more visually prominent within interior and exterior views of the Project area. In particular, in the Midland Beach area, interior views along portions of the LOP would be partially blocked, particularly from ground-level indoor and outdoor views of residences adjacent to and behind (on the landward side of) the proposed LOP. To minimize visual and aesthetic impacts, the proposed LOP would utilize shapes and vegetation cover types which already exist within the surrounding natural and cultural landscapes. These shapes and vegetation types include existing linear features such as Father Capodanno Boulevard, the existing raised promenade and/or boardwalk, and the existing shoreline, including existing dunes.

A portion of the proposed LOP would be aligned perpendicular to the shoreline, placed against the backdrop of the existing Oakwood Beach WWTP, and aligned such that they would visually tie into existing levees and high ground. Although the alignment and placement of this new landscape feature would result in low levels of change in the surrounding natural and cultural

landscapes, this new landscape feature would not attract undue visual attention within the limited interior and exterior views of this portion of the proposed LOP along the Project area.

To summarize, the various elements of the NED Plan would result in some long-term, direct and indirect impacts on aesthetics and scenic resources within interior views from adjacent residential areas, and exterior views from vantage points within Raritan Bay and the Gateway NRA. The various elements of the LOP would result in a continuous linear landscape feature that is consistent with existing natural and cultural landscape features and terrain in the Project area, including linear features such as Father Capodanno Boulevard, the existing raised promenade and boardwalk, existing dunes and levees, and the shoreline. Minor impacts would be partially mitigated by the utilization of materials, colors, and vegetation cover to the maximum extent possible so that the NED Plan either blends with, or appears consistent with, the surrounding natural and cultural landscapes and terrain. Therefore, the NED Plan would have no significant adverse effects on aesthetics and scenic resources within the Project area.

The flood storage areas and interior drainage behind the LOP are not expected to have long-term, direct or indirect beneficial or negative impacts on aesthetics and scenic resources within interior views of this portion of the Project from surrounding residential areas. The elements of the NED Plan include the preservation of existing property owned by the NYCDPR for flood storage areas, the acquisition of additional undeveloped private property for flood storage areas, the installation of tide/slide gate structures, raising sections of existing roads, the construction of new ponds, and modifications to existing ponds (USACE 2015).

All of the proposed flood storage areas are located within areas that are currently undeveloped or have been previously set aside for preservation by the NYCDPR (USACE 2015). These proposed flood storage areas are generally characterized as open, natural areas covered with grasses, shrubs, and wetland vegetation, and containing occasional (storm event or seasonal) surface water ponding. Modifications to these areas to increase flood storage capacity, including excavation of existing low-lying areas for larger existing ponds or for new ponds, would result in landscape features and vegetation cover types that would remove many acres of *Phragmites* and create vistas different from existing conditions. The aesthetic appeal of wetlands may vary, and is a largely subjective quality, but some landscapes may be enhanced by their presence (USACE 2015).

Additionally, the proposed new tide/slide gate structures would be minor new landscape features that would not attract undue visual attention within interior views, and the proposed raising of various road sections within these interior drainage areas would result in minor changes to existing landscape features that also would not attract undue visual attention within interior views. Figures 4-9 through 4-15 depict many of the interior ponding areas within the Project area.

Source: NYCDEP 2013

Figure 4-9. Aerial View of Proposed Excavated Pond in Drainage Area B of Oakwood Beach Area

Source: NYCDEP 2013

Figure 4-10. Aerial View of Proposed Excavated Pond #1 in Drainage Area C of New Creek Area

Source: NYCDEP 2013

Figure 4-11. View of Site for Pond #1 in Drainage Area C of New Creek Area, Looking North from Father Capodanno Boulevard

Source: NYCDEP 2013

Figure 4-12. Pond #7 Site in Drainage Area C of New Creek Area, Looking South from Hylan Boulevard

Source: NYCDEP 2013

Figure 4-13. Pond Site in Drainage Area E of South Beach Area, Looking North from the End of Crestwater Court

Source: NYCDEP 2013

Figure 4-14. View of Pond Site in Drainage Area E of South Beach Area, Looking Northeast to Verrazano Bridge

Source: NYCDEP 2013

Figure 4-15. Aerial View of Pond Sites in Drainage Area E of South Beach Area, Looking West

Miller Field Sub-alternatives. Seawall construction under the NED Plan (Seaward) could impact the recently constructed multi-use path; however, the USACE would replace it with a functional equivalent in the form of a promenade. The location of the promenade on top of, or behind, the seawall would have differing impacts on aesthetics and scenic resources. The visitor experience and scenery behind the dune may be different than what visitors currently experience, or would experience on lands adjacent to NPS lands.

Under the NED Plan, the seawall would rise to a height of 22.5 feet NGVD29, which is a further eight to ten feet above the existing dune (see Figure 4-16). The view at ground level from the hangar to the sea would be obstructed completely which would have an adverse visual effect on the historic district. The 55-foot high Elm Tree Light, once an aid to navigation, would remain clearly visible from the sea and views from the light to the sea would also remain unobstructed.

Sub-alternative 2 (Through) would cause the most direct impacts to the original aesthetics of Hangar 38 and would most alter the original purpose of the structure. The aesthetics feeling of the historic interior would be lost. This alternative would also require the Elm Tree Light to be dismantled. Sub-alternative 3 (Landward) would have the least impact to aesthetics and scenic resources, as the location of the buried seawall would be furthest from the unique aesthetic and scenic resources of Miller Field.

Figure 4-16. Dune at Miller Field with Fire Tower in Background

With regard to aesthetics at Fort Wadsworth, views would not be impacted except for a partial obstruction of the view from the southeast corner of the property at the bend on the USS North Carolina/Ayers Road where the seawall runs inland to tie in at high ground near the Drury Avenue Extension (see Figure 4-17). The view to the beach is already obstructed here by the existing boardwalk and modern apartment buildings. The seawall and tie-off, the top of which would be five feet higher than the current boardwalk, would however further obscure this view. Views from higher ground that are oriented towards to the south shore would not be impacted by the seawall construction as the views to the beach are already obscured by the modern housing.

Figure 4-17. View of Boardwalk Beginning from Fort Wadsworth

With regard to aesthetics at Great Kills, the floodwall and levee would be aligned such that they would visually tie into the existing landscape. Due to the generally low-lying nature of that area (see Figure 4-18), the alignment and placement of the LOP would result in a minor change in the surrounding natural landscape.

Figure 4-18. Great Kills Shoreline

4.11 COASTAL ZONE MANAGEMENT

Because the NED Plan is located within a state-designated coastal zone management area that is associated with New York City, this portion of the Project must be evaluated to determine its consistency with NYSDOS CMP State Coastal Policies. Because New York City has developed an LWRP that has been approved by state and Federal regulatory agencies, the NED Plan must also be evaluated to determine its consistency with New York City's LWRP policies. As indicated in Section 3.11, State Coastal policies and LWRP policies may be applicable to the NED Plan. Determinations for the consistency of the NED Plan with the State Coastal policies and the LWRP policies are presented in Appendix D.

Pursuant to 15 CFR Part 930.34(b), the USACE must notify the NYSDOS CMP of project consistency with State Coastal Policies at least 90 days prior to project implementation. The USACE would coordinate and consult with the NYSDOS CMP and other agencies to ensure that the NED Plan would be consistent with NYSDOS' State Coastal Policies, and would have no undue adverse effects on New York State coastal zone resources. Similarly, the USACE must notify the NYSDCP of project consistency with the LWRP, and would coordinate and consult with the NYSDCP to ensure that the NED Plan would be consistent with New York City's LWRP policies, and would have no undue adverse effects on the coastal zone resources associated with New York City.

Miller Field Sub-alternatives. The NED Plan (Seaward) and the two sub-alternatives would be consistent with NYSDOS CMP State Coastal Policies and NYC's LWRP policies and there would be no notable differences among the alternatives.

4.12 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES

The NED Plan would involve the disturbance of soil and groundwater in areas where prior uses, regulatory database searches, and testing have indicated a potential for the presence of hazardous materials in the soil and/or groundwater. At some Project locations, this conclusion is based on Phase II testing. In other Project locations, additional site testing may be necessary. At all sites where contaminated soil or groundwater might be disturbed, the USACE would implement a Construction Health and Safety Program (CHASP) and Remedial Action Plan (RAP). In addition, all excavated soil would need to be handled and managed in accordance with all applicable City, state, and Federal regulations. A more detailed analysis of potential contamination in the areas of the proposed ponds follows.

Oakwood Beach (Drainage Areas A and B). Regulatory databases identified a closed-status spill involving illegal dumping of soil and construction/demolition debris on Hett Avenue (potentially at or adjacent to the proposed site of the pond to be excavated in Drainage Area B). A large golf course, which may use or historically has used pesticides, was shown on historical Sanborn maps approximately 1,100 feet north of the proposed site of the pond (potentially upgradient), and regulatory databases identified an active-status gasoline spill with impact to groundwater approximately 2,800 feet north of the proposed site of the proposed pond. However, based on its distance from the proposed site of the proposed pond, this facility is not likely to have significantly impacted this proposed location. Based on the findings, the proposed location for the pond in Drainage Area B has a moderate potential for contamination (NYCDEP 2013).

As discussed in Section 3.12, there is an ongoing CERCLA process associated with remediating radium contamination at the Great Kills Park, which is adjacent to the tie-off to the proposed LOP. The goals of that process are to determine the nature and extent of the contamination, evaluate and select an option for cleanup, and return the park to a condition unencumbered by contamination. If any contamination extends beyond the NPS property, it would be remediated as part of the ongoing CERCLA process. The USACE is conducting on-going coordination with the NPS to ensure that, prior to construction of the recommended coastal storm risk management plan, either no contamination exists in the Project construction footprint or all contamination has been removed from the Project footprint by the responsible party. Additional information regarding the on-going assessment at Great Kills Park may be found at: http://www.nps.gov/gate/learn/management/environmental-investigations.htm.

The NED Plan for Reach 1 calls for a vertical flood wall around the Oakwood WWTP and then an earthen levee extending up to Hylan Blvd. The construction footprint of Reach 1 could overlap with the eastern boundary of the Great Kills Park CERCLA project. As discussed in Section 3.12, the extent of contamination along the park's southeastern boundary has not yet been fully delineated. To the extent practicable, the NPS will consider prioritizing the

investigation and clean up along the eastern boundary. However, the CERCLA process will still take several years to complete. The NPS, the District, and NYC will continue to coordinate closely on the cleanup at Great Kills Park.

New Creek (Drainage Area C). Based on a review of historical uses, site observations, regulatory databases, and some site testing, all of the proposed pond locations in the New Creek area have a moderate to high potential for contamination. In general, contamination sources include prior uses and/or prior filling, dumping, or spills, either directly in the proposed pond areas or in the vicinity (NYCDEP 2013).

South Beach (Drainage Areas D and E). Based on a review of historical uses, site observations, regulatory databases, and some site testing, the two proposed pond locations in the South Beach area have a high potential for contamination. In general, contamination sources include prior uses and/or prior filling, dumping, or spills, either directly in the proposed pond areas or in the vicinity (NYCDEP 2013).

Construction activities under the NED Plan would generate minimal solid waste. Asphalt from the street raisings would be removed and disposed of or reused. Cut trees and vegetation would be mulched and may be reused to the extent practicable. The contractor would be responsible for transporting and disposing of construction period solid waste according to all applicable Federal, state and City regulations, and would also be required to keep the work area free of debris. Vegetative waste, including logs and shrubs, would be recycled or disposed of in accordance with Federal, state and City regulations. Therefore, the NED Plan would not result in potential significant adverse impacts to solid waste and sanitation services during construction.

If any dewatering is necessary during construction and discharge to sanitary sewers is proposed, the residual water would need to meet NYCDEP standards for discharge to a City sanitary line and pretreatment would need to be performed as necessary. If residual water is proposed to be discharged to a stream or waterway, it would need to meet NYSDEC SPDES and National Pollutant Discharge Elimination System standards for such discharges. In addition, any previously dumped materials would need to be handled and disposed of in accordance with all applicable regulations. With these measures in place, the NED Plan would not result in potential significant adverse impacts due to hazardous materials during construction.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in hazardous, toxic, or radioactive waste impacts among the NED Plan (Seaward) and the two sub-alternatives.

4.13 TRANSPORTATION

Construction activities would have short-term minor adverse effects on transportation and traffic. These effects would be primarily due to worker commutes, and delivery of equipment and materials to and from the construction sites and staging areas. In addition, road closures or detours to accommodate utility system work may be expected. Although the effects would be minor, contractors would route and schedule construction vehicles to minimize conflicts with other traffic, and strategically locate staging areas to minimize traffic impacts.

Worker Commutes. Commuting construction workers would generate a small increase in traffic during peak traffic periods, and throughout the day. On the average workday, the following numbers of construction workers would be expected:

- Pond excavation: approximately 20 to 25 individuals (NYCDEP 2013);
- Road work: approximately 15 to 25 individuals (Tetra Tech 2014);
- LOP construction: approximately 50 individuals (Tetra Tech 2014).

Construction activities associated with pond excavations, road raisings, and the LOP would overlap, and a maximum of 100 worker vehicles would typically commute between 6:00-7:00 a.m. and 3:00-4:00 p.m. before the afternoon peak traffic period. Additional vehicles would constitute a minor increase in the existing AADT on nearby roadways and would not change the LOS on any nearby segment or intersection (Table 3-9). This minor increase would be temporary and end with the construction phase. These effects would be minor.

Parking. The project area primarily consists of low-density residential land use with off-street driveway parking and ample on-street parking. Construction workers would use on-street parking in the vicinity of the daily construction activities. These effects would be minor, and would move from one area to another as construction progressed.

Trucks. In addition to the workers, there would be trucking activity associated with the delivery and removal of soils, and the delivery of materials for the LOP construction. On the average workday, the following numbers of truck trips would be expected:

- Pond excavation: approximately 15 to 20 trucks per day (NYCDEP 2013);
- Road work: approximately 10 to 15 trucks per day (Tetra Tech 2014);
- LOP construction: approximately 15 to 25 trucks per day (Tetra Tech 2014).

The number of truck trips would vary depending upon the level of construction and would typically be dispersed between 7:30 a.m.- 3:30 p.m.; however, a maximum of approximately 60 trucks per day would be dispersed at the highest level of construction. All trucks would use designated routes as their primary means of ingress and egress within each watershed while avoiding local neighborhoods. Truck traffic would be slightly higher on Sand Lane, Seaview Avenue, Mill Road, and New Dorp Lane. The additional vehicles would constitute a minor increase in the existing AADT on nearby roadways and would not change the LOS on any nearby segment or intersection (Table 3-9). The increase would be temporary and end with the construction phase. These effects would be minor.

Typically, construction activities and associated traffic would be conducted during normal business hours; however, construction would proceed during evening hours at certain locations where traffic or road-use restrictions would affect the schedule. Equipment would not be fixed in one location for long durations, but would progress along the construction right-of-way. Increased construction traffic would be temporary, and would subside at any particular location as construction progresses to subsequent segments of the project.

The NED Plan would require both street closures and sidewalk closures during some project phases. All closures would be subject to DOT approval under a street and sidewalk construction permit, and a traffic management plan would be submitted to DOT for review and approval. Closures would be temporary and diversions would be provided. Any sidewalk closures would incorporate the appropriate pedestrian protection measures, and sidewalks would be restored as part of street reconstruction. These effects would be less than significant.

Road Raisings. The NED Plan includes road raising for three roads: Seaview Avenue (at Father Capodanno Boulevard), Kissam Avenue, and Mill Road. Specific locations for road raisings are noted in Figure 4-19.

Seaview Avenue. Based on the original survey conducted for this analysis, the maximum road raising to obtain elevation +10.0 feet NGVD29 at Seaview Avenue is approximately 2.5 feet and 1.5 feet along Father Capodanno Boulevard. Final geometry/ roadway elevations will be established during the design phase. Seaview Avenue is to be raised to control the spillover of interior water between Interior Drainage Areas C and D. Father Capodanno Boulevard is to be raised to meet the new crest elevation at Seaview Avenue. Along Father Capodanno Boulevard there should be no issue with raising the intersection of Father Capodanno Boulevard/Seaview Avenue up to 1.5 feet or tying back into higher ground east and west of the intersection. On Seaview Avenue there may be some issue with grading down from elevation 10+/- NGVD29 to the homes located on the west side of the road between Quincy Avenue and Oceanside Avenue which are generally between elevation +7 feet NGVD29 and +8 feet NGVD29 based on the two foot contours. This would make the driveway slope at least 10 to 15 percent. Additional survey would be needed for the design in the design phase. The eastside should have no issues with grading. The roadway transition onto Quincy and Oceanside Avenues may also impact a few structures on the north side of the road. Additionally, some raising/adjustment of hydrants, valves, inlets, and manholes may be required.

Mill Road and Kissam Avenue**.** The Mill Road raising will disallow the spillover of floodwater from Interior Drainage Area A to Interior Drainage Area B up to the 100-year event used in this interim feasibility study whereas the Kissam Avenue road raising provides vehicle access to the buried seawall/armored levee during storm events where the surrounding roadways will be inundated. Intermittent culverts and drainage structures will be utilized to convey the flow through Kissam Avenue towards the tide gate. New gate chambers are to be added at the existing Ebbits Street, New Dorp Lane, and Tysens Lane outfalls. With the proposed acquisition of most of the properties surrounding these two areas, the impact of these two road raisings is limited. No private properties are expected to be impacted by the raising of these roads.

During the Plans and Specifications Phase of the Project, individual properties will be identified that may/will be affected by road-raising activities. Affected owners will be notified and a public meeting scheduled to discuss the design the design and construction of road raising details. This public meeting will give individuals an opportunity to express any concerns or provide additional information that may determine if design modifications/refinements are required. This public meeting will occur after the non-federal sponsor and local stakeholders have had the opportunity

to review and approve the design details and will be conducted in coordination/cooperation with the NYCDOT.

Figure 4-19. Road Raising Locations.

Based on the current design, no private properties are expected to be impacted for the Mill Road and Kissam Avenue road raising and only minimal impact to homes for the Seaview Road raising. Further refinement of the design and properties affected will be determined after the appropriate surveys are conducted during the Plans and Specifications Phase of the Project. NYCDOT will be requested to be actively involved in the design coordination of the road raisings at Mill Road, Kissam Avenue, Seaview Avenue and Father Capodanno Boulevard.

Closure Structure at Hylan Boulevard. Traffic safety would not be affected because of the presence of a closure structure (whether a stoplog or alternate closure structure) while not in operation. However, in the event that an extreme coastal storm event is projected to make landfall near Staten Island, Hylan Boulevard will need to be closed so that a closure structure can be installed in order to close off the study area from high storm surge levels. The closure structure will form a barrier of consistent elevation along the Line of Protection. NYC Office of Emergency Management evacuation strategies call for facilitating evacuation prior to the onset of hazards which would likely be prior to the installation of the closure structure. Also Hylan Boulevard is not a part of the Staten Island hurricane evacuation route as of January 2015. Any additional emergency provisions or communication systems would be implemented as part of the Local Flood Risk Management Plan, which is a part of the non-Federal sponsor responsibility. The USACE would coordinate with police and fire departments, as necessary, to ensure any closure structure would not interfere with their operations.

Following construction, it is not expected that the NED Plan would result in impacts on traffic conditions for a number of reasons, including that the site access is maintained to all existing privately held properties, where necessary. The Project area is also largely built-out under the current zoning and there is little remaining developable land. No additional large development is expected in the Project area that would generate a large traffic demand on local streets. Finally, acquisition of the remaining vacant land by NYCDEP under the Bluebelt program would preserve these lands for Bluebelt purposes which generate no traffic and eliminates additional traffic demands that might otherwise occur on these properties under development densities allowed under the current zoning.

There would be no ongoing or long-term changes in traffic or transportation resources due to the NED Plan. During normal "non-flood" conditions, traffic volumes and patterns would be comparable to existing conditions. Notably, during flood events, Staten Island experiences delays to all modes of motorized transportation as well as pedestrian and bicycle paths (NYC.Gov 2013). The NED Plan would provide an increase in protection to low lying areas such as the “bowl” topography area along Frank Capodanno Boulevard which can retain water and create delays. The NED Plan would have incremental long-term beneficial effects due to the decrease in service interruptions during these events.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in transportation impacts among the NED Plan (Seaward) and the two sub-alternatives.

4.14 NAVIGATION

The short- and long-term impacts of establishing the LOP and interior drainage plan would be negligible because these Project components are generally located landward of the normal high tide line and intertidal areas, and accordingly, would not interfere with any recreational or commercial boat traffic or navigational aids.

4.15 AIR QUALITY

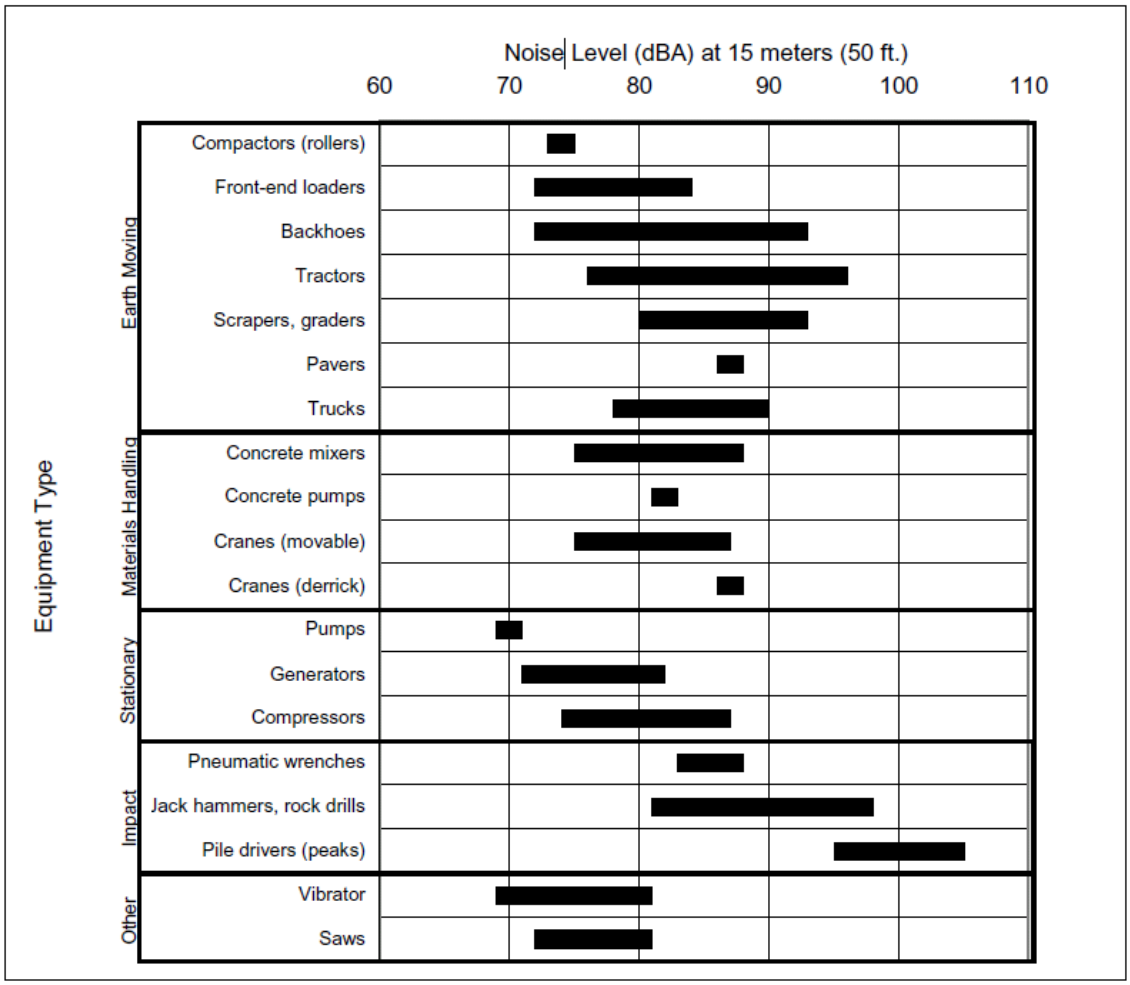
Emissions from the NED Plan would be associated with non-road construction equipment working on the site and on-road trucks moving on public roads to and from the construction site. Emissions from these two source categories are primarily generated from diesel engines, with emissions that include NO_x, VOCs, SO_2, $PM_{2.5}$, and CO. Fugitive dust on the worksite can potentially be generated due to trucks and equipment moving on unpaved surfaces. Fugitive dust is made up of particulate matter (PM) and can contain $PM_{2.5}$. Appendix H contains the General Conformity analyses and determination, which is a Record of Non-Applicability (RONA), for the NED plan.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in air quality impacts among the NED Plan (Seaward) and the two sub-alternatives.

4.16 NOISE

Short-term moderate effects would be expected. Short-term increases in noise would be due to heavy construction activities such as pile driving and use of construction equipment during revetment activities. The NED Plan would not create any permanent or long-term sources of noise. Construction noise would be intermittent, occurring at different times at various sites in the project area. Construction noise levels would depend on the type, amount, and location of construction activities. The typical noise levels from construction equipment are presented in Figure 4-20.

Figure 4-20. Typical Noise Levels From Construction Equipment



Source: USEPA 1971.
dBA = A-weighted decibels

Figure 4-21 shows nearby noise sensitive receptors, and Table 4-4 outlines the estimated noise levels from typical construction activities. There are some nearby noise sensitive receptors and areas that would experience appreciable amounts of noise from heavy equipment. Equipment would not be fixed in one site for long durations, but would progress along the construction right-of-way. Increases in noise would be temporary, and subside as construction progresses to subsequent segments of the project. Accordingly, the duration of increased noise in any one area would be short-term, compared to the entire construction timeframe. Although construction noise would be temporary, given the excessive amount of noise on some nearby receptors, this impact would be moderate. In addition to construction equipment, limited truck and worker traffic may be audible at some nearby locations having minor adverse effects.

Table 4-4. Short-Term Effects from Construction Noise

Receptor	Land Use	Distance to Work Zone [feet]	Average Construction Equipment Level [dBA]	Loud Construction Equipment Level [dBA]	Very Loud Construction Equipment Level [dBA]	Impact Pile Driver Level [dBA]
1	Residence	0	91.5	95.6	103.6	115.2
2	Residence	110	70.7	74.8	82.7	81.5[a]
3	School	1300	49.3	53.4	61.3	73.0
4	Residence	50	77.6	81.7	89.6	101.3
5	Church	670	55	59.1	67.0	78.7
6	Residence	565	56.5	60.6	68.5	80.2
7	Residence	535	57.0	61.1	69	80.7
8	Residence	410	59.3	63.4	71.3	83.0
9	Residence	425	59.0	63.1	71.0	82.7
10	Hospital	1270	49.5	53.6	61.5	73.2
11	Residence	980	51.7	55.8	63.7	75.4
12	Residence	700	54.6	58.7	66.7	78.3
13	School	645	55.3	59.5	67.4	79.1
14	Commercial	50	77.6	81.7	89.6	101.3
15	Residences	530	57.1	61.2	69.1	80.8
16	Residence	415	59.2	63.3	71.2	82.9
17	Residence	35	80.4	84.5	92.4	104.1
18	Residence	10	91.5	95.6	103.6	115.2

[a] Although Impact Pile Driver is 101.3 dBA at 50 feet, this NSA is closer to activities using very loud construction equipment which measures 89.6 dBA at 50 feet.

Sources: FHWA 2011.

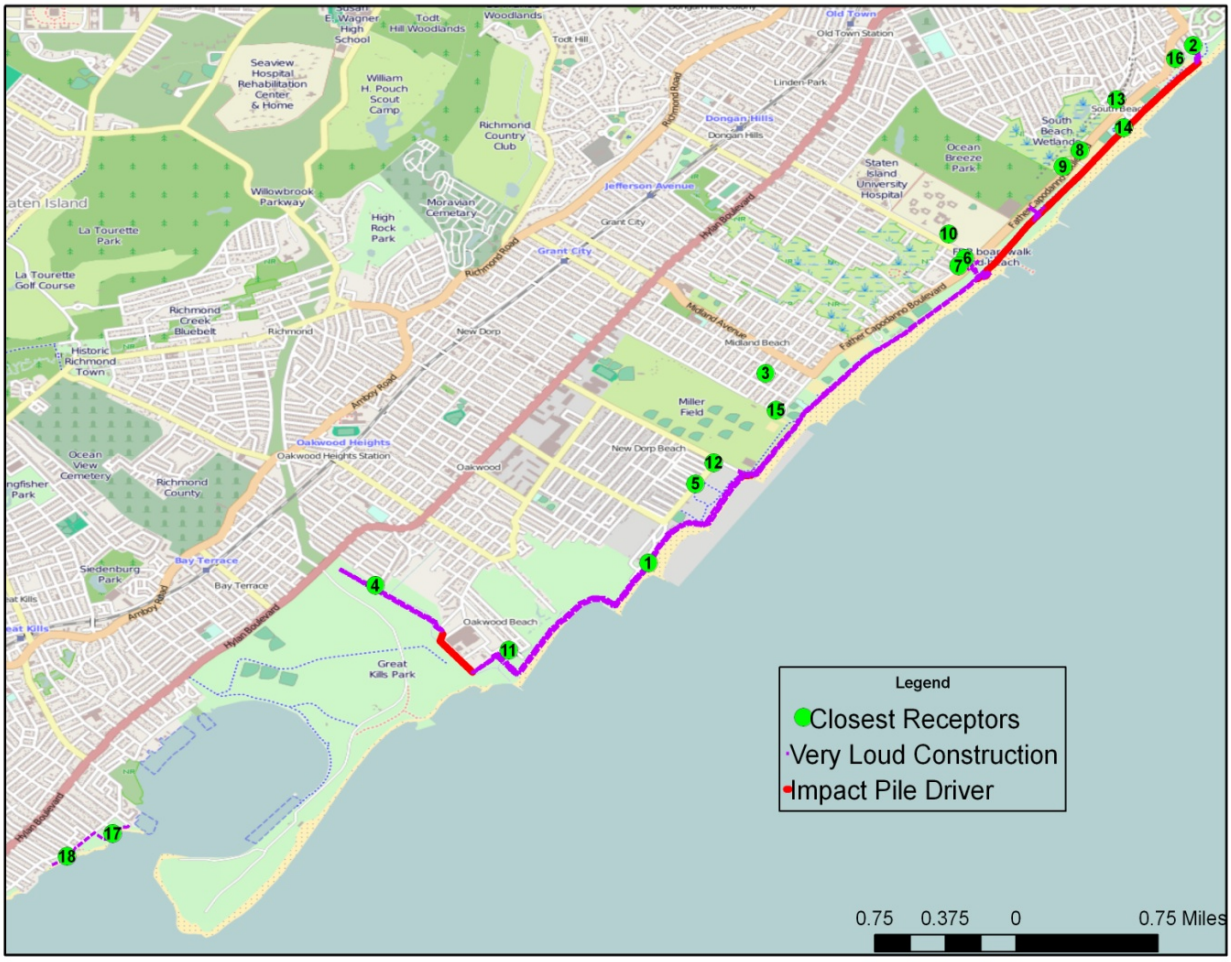


Figure 4-21. Closest Noise Sensitive Areas to Loud Construction Noise

In accordance with DEP §24-222, construction activities would be limited to weekdays between the hours of 7:00 a.m. and 6:00 p.m. without a special permit. In addition, a noise mitigation plan would be developed and submitted for approval prior to the start of work and implemented to minimize intrusive noise into nearby areas. The noise mitigation plan would include such restrictions as specifying sites for noise generating equipment and avoiding unnecessary late night and weekend construction activities, and would be developed to address nearby schools, hospitals, and houses of worship. A copy of the plan would be kept at the project site for compliance review by the USACE, NYCDEP, and the New York City Department of Buildings. Pursuant to DEP §24-222, after hours work could be authorized provided that the noise mitigation plan is updated by the contractor and submitted to DEP for review and approval.

There would be no new permanent sources of noise associated with the NED Plan and no long-term increases in the overall noise environment. Long-term incremental benefits to the noise environment may include less disruption to traffic, and a possible decrease in noise associated

with heavy equipment during rebuilding efforts after storm events with the implementation of the NED Plan. These effects would be negligible.

Vibrations generated by construction activities can be perceptible and in some cases potentially damaging to structures. No blasting is proposed; however, pile driving for the LOP would be necessary. Vibration levels are a function of the source strength, the distance between the equipment and the structure, characteristics of the transmitting equipment, and the receiver structure condition. It is expected that impact pile driving activities within approximately 27 feet of a residential structure could cause minor cosmetic damage such as window and plaster cracking. During pile driving activities, monitoring may be used to determine if vibration levels are potentially damaging to nearby structures.

Miller Field Sub-alternatives. At Miller Field, there would be no differences in noise impacts among the NED Plan (Seaward) and the two sub-alternatives.

4.17 SUMMARY OF CONSTRUCTION IMPACTS OF THE NED PLAN

This section summarizes the potential construction impacts associated with the NED Plan. Construction would occur over about a 3-4 year time period (nominally mid-2016 through 2019), and would consist of constructing an approximately 5.3-mile long LOP (consisting of a buried seawall, a vertical floodwall, and earthen levee) and interior flood control measures (such as tide gates, sluice gates, stormwater outfall structures, road raisings, and excavated ponds). This section is based on more detailed information contained in Sections 4.1 through 4.16 of this EIS.

Geology, Topography, and Soils. Construction activities would disturb approximately 243 acres (LOP: 51 acres; excavated ponds: 188 acres; road raisings: 4 acres). Impacts on geology, topography, and soils from construction activities are expected to be minimal.

Water Resources. Construction activities would not change the total volume of groundwater available, or the quality or usability of groundwater supplies. Construction activities may cause a temporary, short-term increase in suspended sediment and turbidity in surface waters adjacent to the Project. However, the suspended sediments and turbidity are expected to settle quickly out of the water column, and therefore no long-term adverse impacts to surface water quality are expected. Any discharge of dewatered effluents would be subject to the requirements of the SPDES discharge permit.

Vegetation (Uplands and Wetlands). Construction activities would potentially impact up to approximately 51 acres of vegetation along the LOP and approximately 188 acres of vegetation within the interior drainage areas. Construction would require only minor tree clearing and site grading. With mitigation measures (such as native vegetation planting and tree replacements) in place, no significant adverse impacts to trees or vegetation would be expected as a result of construction. With respect to wetlands, the net impacts would be as follows: a loss of 10.9 acres of freshwater wetlands and construction of 46 acres of tidal wetlands. Taken as a whole, the construction of 46 acres of tidal wetlands versus the loss of 10.9 acres of freshwater wetlands would produce a net significant positive impact on wetland habitats and the quality of wetlands

in the Project area. Given this net significant positive impact, no mitigation measures are proposed for the loss of 10.9 acres of freshwater wetlands.

Wildlife. Construction activities would disturb habitats and cause birds and other wildlife to avoid areas undergoing construction. Disruptions to wildlife would be temporary and short in duration across the Project construction areas. The USACE would have a process in-place for the rescue of wildlife, including fish, as may be necessary to avoid impacts or as may be required during the Project construction process. The NED Plan would also implement BMPs during construction activities to avoid impacts to wildlife. Therefore, the NED Plan would not result in potential significant adverse impacts to wildlife during construction.

Socioeconomics. Construction activities would not produce new development or increase development density within the Project area. Construction requirements are expected to be met by workers within, or near, the Project area, so in-migration of workers is not expected. While construction activities would result in a positive contribution to the overall economy and incomes, the impact is expected to be small.

Environmental Justice. The analysis in this EIS supports the conclusion that there would be no high and adverse impacts to any groups in the population from construction activities, and thus, no environmental justice impacts.

Cultural. The three sub-alternatives Miller Field (seaward, landward, or through Hangar 38), would all have varying adverse effects on the NRHP-listed Miller Army Airfield Historic District, including the potential demolition of the WWII fire tower and Elm Tree Light, and alteration of Hangar 38.

Land Use and Zoning. Construction associated with the NED Plan would take place on Bluebelt lands, City or state parklands, and some private land. Any potential disruptions around ponds, raised roads, and along the LOP due to construction would be temporary and short in duration and would not result in any short-term or long-term land use changes. Construction would not conflict with local zoning or public policies and would not displace any existing uses. Additionally, the NED Plan does not involve any rezonings, new residential or commercial development, or an increase in development density within the Project area.

Recreation. Recreational activities that occur along the beachfront and within Miller Park would sustain short-term, direct impacts during Project construction activities, as well as long-term, direct impacts (for example, required relocation of buildings or portions of fields). Several baseball fields would be temporarily impacted by construction, as would one soccer field. To the extent practicable, access to the beaches would be maintained throughout construction. The Project could also require the relocation and reconstruction of some park facilities, potentially including comfort stations, concessions, and recreational components such as playgrounds or athletic fields. In addition, parking areas used by people seeking recreation in the Project area may be temporarily closed to the public, to serve as construction staging areas. Specific impacts to facilities will be identified during the refined design of the Project, and in collaboration with

NYCDPR. Due to the linear nature of much of the Project, these impacts would be essentially mobile, moving along the LOP as each activity is completed.

Aesthetics and Scenic Resources. Increased traffic, the presence of construction equipment, and the actual construction activities would create short-term, direct adverse impacts to aesthetics and scenic resources. Due to the linear nature of much of the Project, these impacts would be essentially mobile, moving along the LOP as each activity is completed. At Miller Field, the view at ground level from the hangar to the sea could be obstructed and demolition of the WWII fire tower, Elm Tree Light, and alteration of Hangar 38 could change the visual character of the area.

Coastal Zone Management. As detailed in Appendix D, the NED Plan would be consistent with the State Coastal policies and the LWRP policies.

Hazardous, Toxic, and Radioactive Wastes. Construction activities would involve the disturbance of soil and groundwater in areas where prior uses, regulatory database searches, and testing have indicated a potential for the presence of hazardous materials in the soil and/or groundwater. At all sites where contaminated soil or groundwater might be disturbed, the USACE would implement a CHASP and RAP. In addition, all excavated soil would need to be handled and managed in accordance with all applicable City, state, and Federal regulations. Construction activities would generate minimal solid waste. Asphalt from the street raisings would be removed and disposed of or reused. Cut trees and vegetation would be mulched and may be reused to the extent practicable. The USACE would continue to closely coordinate with the NPS to ensure that there are no cross-connecting impacts between the NED Plan construction and the CERCLA cleanup of radioactive contamination at Great Kills Park.

Transportation. Construction activities would have short-term minor adverse effects on transportation and traffic. These effects would be primarily due to worker commutes, and delivery of equipment and materials to and from the construction sites and staging areas. In addition, road closures or detours to accommodate utility system work may be expected. Although the effects would be minor, contractors would route and schedule construction vehicles to minimize conflicts with other traffic, and strategically locate staging areas to minimize traffic impacts. Typically, construction activities and associated traffic would be conducted during normal business hours; however, construction would proceed during evening hours at certain locations where traffic or road-use restrictions would affect the schedule. Equipment would not be fixed in one location for long durations, but would progress along the construction right-of-way. Increased construction traffic would be temporary, and would subside at any particular location as construction progresses to subsequent segments of the project.

The NED Plan would require both street closures and sidewalk closures during some project phases. All closures would be subject to DOT approval under a street and sidewalk construction permit, and a traffic management plan would be submitted to DOT for review and approval. Closures would be temporary and diversions would be provided. Any sidewalk closures would incorporate the appropriate pedestrian protection measures, and sidewalks would be restored as part of street reconstruction. These effects would be less than significant.

Air Quality. Emissions would be associated with non-road construction equipment working on the site and on-road trucks moving on public roads to and from the construction site. Emissions from these two source categories are primarily generated from diesel engines, with emissions that include NOx, VOCs, SO2, PM2.5, and CO. Fugitive dust on the worksite can potentially be generated due to trucks and equipment moving on unpaved surfaces.

Noise. Short-term moderate effects would be expected. Short-term increases in noise would be due to heavy construction activities such as pile driving and use of construction equipment during revetment activities. Increases in noise would be temporary, and subside as construction progresses to subsequent segments of the project. Although construction noise would be temporary, given the excessive amount of noise on some nearby receptors, this impact would be moderate. In addition to construction equipment, limited truck and worker traffic may be audible at some nearby locations having minor adverse effects. In accordance with DEP §24-222, construction activities would be limited to weekdays between the hours of 7:00 a.m. and 6:00 p.m. without a special permit. In addition, a noise mitigation plan would be developed and submitted for approval prior to the start of work and implemented to minimize intrusive noise into nearby areas. The noise mitigation plan would include such restrictions as specifying sites for noise generating equipment and avoiding unnecessary late night and weekend construction activities, and would be developed to address nearby schools, hospitals, and houses of worship.

4.18 POTENTIAL IMPACTS OF THE NO-ACTION ALTERNATIVE

As discussed in Section 2.2, the No-Action (without-project) Alternative means that no additional Federal actions would be taken to provide for coastal storm risk management. Storm tide inundation is expected to increase over time, in direct relation to the anticipated rise in sea level. As a result of sea level rise, more frequent and higher stages of flooding would result in the years ahead (USACE 2015). If implemented, the Bluebelt Program would improve stormwater management and provide improved interior drainage.

The No-Action (without project) Alternative fails to meet any of the objectives or needs of a coastal storm risk management plan, but it provides the base against which project benefits are measured. Failure to provide the Project area with additional storm damage and erosion control measures may lead to potential loss of life, physical and environmental damage, municipal infrastructure damage and harm to economic activity within the Project area. The No-Action Alternative would be implemented if Project costs for coastal storm risk management were to exceed project benefits, thus indicating that risk management measures are not in the Federal interest under current NED guidelines. The USACE has calculated that the equivalent annual damages for the No-Action Alternative would be $23,254,000 (USACE 2015). A discussion of the potential environmental impacts of the No-Action Alternative follows.

Geology, Topography, and Soils. Under the No-Action Alternative, the impacts of the NED Plan (disturbance of approximately 52.8 acres of soils for the LOP and approximately 4.1 acres for road raisings) would not occur. If the Bluebelt Program were implemented under the No-

Action Alternative, pond excavations could disturb similar quantities of land in interior drainage areas as the NED Plan.

Water Resources. Under the No-Action Alternative, the same volume of stormwater would be generated in the watersheds as under existing conditions, but there would not be an interior flood control system to better manage stormwater flows. Street runoff would remain uncontrolled and stream banks would continue to erode. In that case, the No-Action Alternative would continue to contribute to degraded local water quality, erosion, and sedimentation impacts on wetlands. If implemented, the Bluebelt Program could reduce some of these impacts.

Vegetation and Wetlands. If implemented, the Bluebelt Program would disturb interior vegetation and tree clearing would occur. Potential beneficial removal of invasive species and subsequent replanting with native vegetation could occur. The Bluebelt Program could create a total of 21.9 acres of freshwater wetlands. No tidal wetlands would be created.

Wildlife. If implemented, the Bluebelt Program would benefit wildlife in a similar manner as the NED plan. Better control of runoff would reduce erosion and sedimentation, improving aquatic habitats and water quality. Avian and water-dependent species would have improved habitats associated with the proposed ponds.

Threatened and Endangered Species and Communities of Concern. The No-Action Alternative would not impact threatened and endangered species and communities of concern.

Socioeconomics and Environmental Justice. Under the No-Action Alternative, coastal storm risk management would not significantly improve and potential housing impacts from storms would continue. There would be no beneficial socioeconomic or environmental justice impacts. If implemented, the Bluebelt Program would improve stormwater systems and interior drainage, but not significantly manage flood risks.

Cultural Resources. The No-Action Alternative would not impact cultural resources. At Miller Field, the No-Action alternative would leave the historic district in its present condition. Hangar 38 would remain separated from the sea by the existing dune and beach however the vistas to the sea and sense of open space of the former airfield would remain. The historic district, particularly Hangar 38, would remain vulnerable to coastal storm damage. The No-Action alternative would have no effect on the Fort Wadsworth Historic District.

Land Use and Zoning. The No-Action Alternative would not result in any changes to land use in the Project area. Open space would continue to be managed as parkland under the jurisdiction of NYCDPR or NYSDEC. Bluebelt properties would continue to be City-owned vacant land managed by NYCDEP and would provide drainage in the Project area.

Recreation. The No-Action Alternative would not significantly impact recreation.

Aesthetics and Visual. Under the No-Action condition, the larger extended detention wetlands would remain as primarily large stands of common reed marshes that provide no unique or

valuable visual landscapes or views. If implemented, the Bluebelt Program would produce similar impacts as the NED Plan. In that case, the dense common reed that currently limits public views into these wetlands would be removed and views from local streets into the landscaping of the proposed ponds would be opened. The ponds are designed to provide diverse plantings and the Bluebelt program would provide ongoing maintenance to ensure plant diversity, establishment, and growth.

Coastal Zone Management. The No-Action Alternative would be consistent with the State CMP and New York City's LWRP policies, and would have no undue adverse effects on the coastal zone resources associated with New York City.

Hazardous, Toxic, and Radioactive Materials. Under the No-Action Alternative, areas determined to have the potential to contain hazardous materials remain undisturbed. Under the NED Plan, these locations would be tested in accordance with NYCDEP protocols prior to construction. If contaminated materials are found, they would be removed and disposed of in accordance with all City, State, and Federal regulations. If the Bluebelt Program were implemented, these positive impacts could also be realized.

Transportation. The No-Action Alternative would not impact transportation in the Project area.

Air Quality. The No-Action Alternative would not impact air quality in the Project area.

Noise. The No-Action Alternative would not change the existing noise impacts in the Project area.

4.19 SUMMARY COMPARISON OF THE NED PLAN AND THE NO-ACTION ALTERNATIVE

This section presents a summary comparison (Table 4-5) of the No-Action Alternative and the NED Plan. The summary comparison is presented for each of the resources addressed in this EIS.

Table 4-5. Summary Comparison of the No-Action Alternative and the NED Plan

	No-Action Alternative	NED Plan
Geology, Topography, Soils	Land disturbance for Bluebelt Program, if implemented, would be similar to pond excavations of NED Plan.	Land disturbance: 52.8 acres for LOP, 187.2 acres for pond excavation, and 4.1 acres for road raisings.
Water Resources	If implemented, amended drainage plans associated with Bluebelt Program could improve stormwater flows and achieve water quality benefits similar to NED Plan.	Beneficial impacts to water resources, including reduced sediment and other pollutant loadings, and improved water quality in stream channels and receiving waterbodies, including the Lower Bay.
Vegetation and Wetlands	If implemented, Bluebelt Program could result in benefits similar to NED Plan. Bluebelt Program would create 21.9 acres of freshwater wetlands. No tidal wetlands would be created.	Potential beneficial removal of invasive species and subsequent replanting with native vegetation. Decrease of 10.9 acres in freshwater wetlands and construction of 46 acres of tidal wetlands.
Wildlife	If Bluebelt Program implemented, potential benefits would be similar to NED Plan.	Improved habitats could benefit wildlife, including avian and water-dependent species.
T&E Species	No change from current status.	No additional impacts.
Socioeconomics and Environmental Justice	Coastal storm risk management would not improve and potential housing impacts from storms would continue. There would be no beneficial environmental justice impacts.	Coastal storm risk management would improve and potential housing impacts from storms would decrease considerably. NED Plan would result in positive impacts to all individuals in the Project area.
Cultural Resources	No change from current status.	The three sub-alternatives Miller Field would all have varying adverse effects on the NRHP-listed Miller Army Airfield Historic District, including the potential demolition of the WWII fire tower and Elm Tree Light, and alteration of Hangar 38.
Land Use and Zoning	No changes to land use. If implemented, Bluebelt Program would be compatible with land uses.	NED Plan would preserve existing open space for habitats and stormwater management. NED Plan compatible with land uses.
Recreation	No change from current status.	NED Plan would maintain, protect, and preserve existing parks and other recreational facilities.
Aesthetics and Visual	No impacts from LOP. If implemented, Bluebelt Program would produce similar interior impacts as NED Plan.	LOP would blend with surrounding landscapes. Excavation would result in increased open water/vegetation views. Miller Field views to sea could be obstructed and demolition of the fire tower, Elm Tree Light, and alteration of Hangar 38 could change the visual character.
Coastal Zone Mgmt.	Consistent with State CMP and NYC's LWRP policies.	Consistent with State CMP and NYC's LWRP policies.
Hazardous, Toxic, Radioactive Material	If Bluebelt Program implemented, positive impacts similar to NED Plan could result.	Any hazardous materials discovered through construction would be removed and disposed of in accordance with all regulations.
Transportation	No change from current status.	Minimal construction traffic impacts. Road raisings would require street closures and traffic flows would be temporarily affected.
Air Quality	No change from current status.	No change from current status.
Noise	Localized temporary noise increases typical of construction if Bluebelt Program implemented.	Localized temporary noise increases typical of construction. No blasting required. Pile driving vibrations would be monitored.

4.20 Unavoidable Adverse Effects and Considerations that Offset Adverse Effects

As described in Section 4.1, the NED Plan would disturb approximately 52.8 acres for the LOP and approximately 187.2 acres for pond excavation. Additionally, as described in Sections 4.3 and 4.4, the NED Plan would have unavoidable adverse impacts to cultural resources, vegetation, trees, and some wildlife habitats. These impacts are directly related to the specific locations for the proposed LOP and ponds, which need to be sited along the coast and stream channels within the watershed, and sized according to the drainage area in order to achieve the stormwater management, flood reduction objectives of the NED Plan. Therefore, these adverse impacts associated with the NED Plan are unavoidable. The NED plan would also adversely impact the Miller Army Airfield Historic District. Mitigation measures for unavoidable impacts are being developed with the NY SHPO, NPS, Tribes and other interested parties and stipulated in a Programmatic Agreement.

4.21 Relationship Between Short-Term Uses of the Environment and Enhancement of Long-Term Productivity

As described in Sections 4.1 through 4.16, the NED Plan would provide long-term coastal storm risk management in the Project area. Failure to provide the Project area with additional storm damage and erosion control measures may lead to potential loss of life, physical and environmental damage, municipal infrastructure damage and harm to economic activity within the Project area. Any short-term negative impacts associated with construction of the NED Plan would be minor compared to the long-term benefits.

4.22 Irreversible and Irretrievable Commitment of Resources

There are several resources, both natural and built, that would be expended in the construction and operation of the NED Plan. These resources include the land area used for the LOP and ponds; materials used for construction; energy in the form of gas and electricity consumed during construction and routine maintenance activities; and the human effort (time and labor) required to develop, construct, and maintain various Project components. These resources are considered irretrievably committed because their reuse for some purpose other than the project would be highly unlikely. This commitment of resources and materials has been weighed against the public purpose and need for the NED Plan and would provide various social, environmental and economic benefits.

4.23 Cumulative Impacts

The CEQ regulations (40 CFR 1508.7) that implement NEPA define cumulative impact as the "impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." The

District based the cumulative impact analysis for this EIS on the NED Plan and other activities in the surrounding region with the potential to contribute to cumulative environmental impacts.

4.23.1 Methodology

As discussed below, the methodology used in this EIS to estimate cumulative impacts was divided into two stages: (1) identification of reasonably foreseeable future actions; and (2) estimation of cumulative impacts.

Stage 1 - Identification of Reasonably Foreseeable Future Actions. In this stage, reasonably foreseeable future actions were identified and examined to determine which ones needed to be included in the cumulative impact analyses. Section 4.21.2 discusses the reasonably foreseeable future actions included in this cumulative impact assessment.

Stage 2 - Estimation of Cumulative Impacts. During this stage, impact indicators for the proposed action were added to the baseline values and the values for the reasonably foreseeable future actions for the purpose of estimating the cumulative impacts. The aggregate effects were used to estimate the cumulative impacts on each resource area. The degree of the impacts was largely determined using the same impact measures described in Sections 4.1 through 4.16 of the EIS. Section 4.22.3 presents the results of Stage 2 of this cumulative impact assessment.

4.23.2 Actions Considered in Cumulative Analysis

Past, present, and reasonably foreseeable future actions that occur within the Project area that may contribute to cumulative impacts are described as follows:

- **NYCDEP's Bluebelt GEIS Actions**: As explained in Chapter 2, NYCDEP's Staten Island Bluebelt Program incorporates plans and actions to provide stormwater management to decrease flood hazards and increase water quality both inside and outside the Project area. NYCDEP is proposing amended drainage plans comprised of a network of storm sewers, Best Management Practices (BMPs), and Bluebelt wetlands. The primary drainage plan objective of the Bluebelt Program is to provide City streets with storm sewers that flow via gravity to proposed BMPs and outfalls to the Lower Bay for discharge. Approximately 204 acres of the Project area will be or is already owned by the NYCDEP Bluebelt Program.

- **New York State Division of Housing and Community Renewal (NYSHCR) Community Development Block Grant Program Disaster Recovery Actions** (hereafter, this will be referred to as the NYSHCR Block Grant Program): In response to Hurricane Sandy, Hurricane Irene and Tropical Storm Lee, New York State has developed a storm recovery plan to help define how the State will effectively use any available funding to recover and rebuild, and just as importantly, to stimulate economic growth in every affected community through a community-driven planning process. As part of that NYSHCR Block Grant Program, the State has established three housing programs for providing assistance to New York State residents whose homes were

damaged or destroyed by Hurricane Sandy, Hurricane Irene, and Tropical Storm Lee. These programs are: Recreate NY Home 1-4 Unit Rehabilitation Program, NY Rising Recovery Program for 5+ Unit Residential Properties, and the NY Rising Residential Housing Buyout and Acquisition Program.

- **Staten Island Living Breakwaters Project**. The "Living Breakwaters" Project was conceived for the U.S. Department of Housing and Urban Development-sponsored Rebuild by Design competition, which was intended to address the structural and social vulnerabilities exposed by Hurricane Sandy. New York State has been allocated $60 million of HUD Community Development Block Grant- Disaster Recovery funds to implement the first phase of the Living Breakwaters Project. This first phase is to be located along the Tottenville shoreline of the South Shore of Staten Island. The overarching goal of the Living Breakwaters Project is to reduce risk to the shoreline community in Tottenville by implementing strategies that would primarily address wave action and reverse long-term erosion while secondarily enhancing ecosystems and interfacing with the community through educational programs. The key component of the Living Breakwaters Project is the ecologically enhanced breakwater system. Breakwaters would reduce wave heights, promote calm water and reverse shoreline erosion. The location of the breakwaters could encourage sedimentation, which would serve to replenish the protective beaches along the shore. The proposed breakwaters would span an approximately 13,000 linear foot stretch along the Tottenville shoreline of Staten Island and would be located to optimize wave height reduction, likely within one-half mile of the existing shoreline.

- **New York Rising Community Reconstruction Program.** In April 2013, NYCRC announced th**is** $650+ million planning and implementation process to provide rebuilding and resiliency assistance to communities severely damaged by Hurricane Irene, Tropical Storm Lee, and Hurricane Sandy. The Plan includes a menu of short term, "shovel-ready" projects; medium-term projects that can be implemented within 2-5 years; and long term actions. Some of the key initiatives include: planting and stabilizing existing temporary dunes for added erosion protection; stormwater management improvements complementary of the Bluebelt Program; and improving the emergency response capacity of existing municipal agencies (NYRCR 2014).

- **Phase 2 of the South Shore of Staten Island Coastal Risk Management Project**: As explained in Chapter 1, this EIS focuses on coastal risk management from Fort Wadsworth to Oakwood Beach, which can be considered the first phase of the USACE's long-term plan for coastal risk management along the south shore. In the future, it is possible that the USACE may propose a second phase of coastal risk management along the south shore. Phase 2 is likely to cover the area from Great Kills to Tottenville. That area was not included in this EIS because: (1) there is not currently a proposal that has been developed for coastal risk management in that area; (2) the area from Fort Wadsworth to Oakwood Beach is hydrologically disconnected from the Great Kills to Tottenville area; (3) the Fort Wadsworth to Oakwood Beach area is much more susceptible to devastating damage from flooding than the Great Kills to Tottenville area

(for example, Hurricane Sandy damages were significantly greater in the Fort Wadsworth to Oakwood Beach area compared to the Great Kills to Tottenville area); and (4) decisions and implementation of decisions for the Fort Wadsworth to Oakwood Beach area can be made independently and would not prejudice any future proposals or decisions related to the Great Kills to Tottenville area.

- **Forest Restoration and Fire Management in Oakwood Beach-Great Kills Park.** The NYCDPR is the lead agency for the review of this project, which is a forest restoration and fire management pilot project for a 2-acre open space in Great Kills Park. The project involves the restoration of a wetland and adjacent forest area to enhance ecosystem value and lower fuel vegetation structure. The NYCDPR determined that this project would not have a significant impact on the environment (NYCDPR 2015). This project does not overlap the two proposed ponds in Drainage Area B.

4.23.3 Potential Cumulative Impacts

This section presents the results of this cumulative impact assessment.

Geology, Topography, and Soils. The actions associated with NYCDEP's Bluebelt GEIS would not change the impacts presented in this EIS, as the interior flood control actions of both projects are complementary and consistent. Although there are some differences between the two proposals (for example: [1] the Bluebelt GEIS includes stormwater sewers; [2] two outfalls proposed in the Bluebelt GEIS were not included in this EIS proposal because the USACE determined they were not cost-effective for inclusion in the Coastal Storm Risk Management Program; and [3] some interior drainage ponds are different in terms of excavation depth, etc), those differences are not meaningful in terms of cumulative impacts. The NYSHCR Block Grant Program would likely result in a cumulative reduction in impacts to soils as a result of the buyout and acquisition of damaged homes. As part of this program, some properties would be backfilled and graded following removal of any structures (NYSHCR 2013). The Living Breakwaters Project would not impact geography, topography, or soils. Dune restoration associated with the New York Rising Community Reconstruction Program could produce positive impacts to soils in the Project area. If Federal interest in Phase 2 of the South Shore of Staten Island Coastal Risk Management Project was determined to exist, potential impacts from Phase 2 are unknown; nonetheless, cumulative impacts would be minor due to the fact that the impacts would not occur within the same watershed.

Water Resources. The actions associated with NYCDEP's Bluebelt GEIS would not change the impacts presented in this EIS, as the interior flood control actions of both projects are complementary and consistent. Under the NYSHCR Block Grant Program, removing existing residential buildings and converting the land to open space would decrease the amount of runoff going into the local stormwater system. Creating open space and replacing existing solid surfaces, such as building foundations and associated solid surfaces such as driveways and patios, will enable rainwater to percolate into the ground at a faster rate, thereby reducing the amount of stormwater run-off into the local stormwater corridor system, but likely increase stormwater runoff into the groundwater recharge basins (NYSHCR 2013). The Living

Breakwaters Project could impact water resources in the general area by providing approximately 28 acres of a combination of exposed, intertidal and subtidal reef habitat. Any stormwater management improvements associated with the New York Rising Community Reconstruction Program could produce positive impacts to water resources in the Project area. If Federal interest in Phase 2 of the South Shore of Staten Island Coastal Risk Management Project was determined to exist, potential impacts from Phase 2 are unknown. Although the impacts would not occur within the same watershed, overall pollutant loadings should be reduced and there would be water quality benefits in stream channels and receiving waterbodies, including the Lower Bay.

Vegetation and Wetlands. The actions associated with NYCDEP's Bluebelt GEIS would not significantly change the impacts presented in this EIS, as the interior flood control actions of both projects are complementary and consistent. However, the actions associated with the Bluebelt GEIS in the Oakwood Beach drainage area would create 10.2 acres of wetlands, as that action proposes greater amounts of excavation than the USACE's Project. Overall, the Bluebelt Program would create a total of 21.9 acres of freshwater wetlands in the three drainage areas. Under the NYSHCR Block Grant Program, potential buyout areas would occur in low elevation areas located near or adjacent to coastal open space and wetlands. Depending on participation, the buyout program could significantly increase the amount of open space in the affected areas, consistent with NYC planning goals to create open space and lower density in flood-prone areas. Under this program, residential buildings would be purchased and demolished, and open space with native vegetation would be created and remain in perpetuity. These open spaces would act as a buffer against future flood hazards and potentially reduce the impact of future storms (NYSHCR 2013). The potential impacts of the Living Breakwaters Project on vegetation and wetlands are unknown. Any dune restoration efforts associated with the New York Rising Community Reconstruction Program could produce positive impacts to vegetation in the Project area. If Federal interest in Phase 2 of the South Shore of Staten Island Coastal Risk Management Project was determined to exist, potential impacts from Phase 2 are unknown. Because any potential impacts would not occur within the same watershed, cumulative impacts would not be expected.

Wildlife. The actions associated with NYCDEP's Bluebelt GEIS or the New York Rising Community Reconstruction Program would not change the impacts presented in this EIS, as the actions of these projects are complementary and consistent. The Living Breakwaters Project would foster ecological resiliency by providing a structural habitat for a diversity of species, including finfish, lobsters, and shellfish. The breakwaters would provide approximately 28 acres of a combination of exposed, intertidal and subtidal reef habitat, and through the incorporation of "reef streets" (pockets of complexity within the structure), would further increase biological recruitment and shelter filter-feeding organisms. The Living Breakwaters Project would also provide an opportunity for oyster restoration in Raritan Bay. Under the NYSHCR Block Grant Program, open space with native vegetation would be created and remain in perpetuity. These open spaces would produce a positive impact on wildlife (NYSHCR 2013). If Federal interest in Phase 2 of the South Shore of Staten Island Coastal Risk Management Project was determined to exist, potential impacts from Phase 2 are unknown.

Threatened and Endangered Species and Communities of Concern. The actions associated with NYCDEP's Bluebelt GEIS, New York Rising Community Reconstruction Program, and the NYSHCR Block Grant Program would produce positive cumulative impacts on habitats on Staten Island, which could have a positive cumulative impact on any habitats of threatened and endangered species. The potential impacts of the Living Breakwaters Project on the habitats of threatened and endangered species are unknown. If Federal interest in Phase 2 of the South Shore of Staten Island Coastal Risk Management Project was determined to exist, potential impacts from Phase 2 are unknown.

Socioeconomics and Environmental Justice. All of the actions considered could produce positive cumulative socioeconomic impacts on Staten Island by reducing flooding, which is disruptive to socioeconomic conditions.

Cultural. Cumulative impacts on cultural resources would not be expected as a result of the actions.

Land Use and Zoning. The actions associated with NYCDEP's Bluebelt GEIS or the New York Rising Community Reconstruction Program would not change the impacts presented in this EIS, actions of these projects are complementary and consistent. Under the NYSHCR Block Grant Program, open space would be created and remain in perpetuity (NYSHCR 2013). The potential impacts of the Living Breakwaters Project on land use and zoning are unknown. If Federal interest in Phase 2 of the South Shore of Staten Island Coastal Risk Management Project was determined to exist, potential impacts from Phase 2 are unknown.

Recreation. The cumulative impacts from all actions would be positive on recreation as a result of more open space and improved water quality in the Project area.

Aesthetics and Visual. The actions associated with NYCDEP's Bluebelt GEIS or the New York Rising Community Reconstruction Program would not change the impacts presented in this EIS, as the actions of these projects are complementary and consistent. Under the NYSHCR Block Grant Program, open space would be created and remain in perpetuity (NYSHCR 2013). The potential impacts of the Living Breakwaters Project on aesthetics and visual resources are unknown. If Federal interest in Phase 2 of the South Shore of Staten Island Coastal Risk Management Project was determined to exist, potential impacts from Phase 2 are unknown. .

Coastal Zone Management. The cumulative impacts from all actions are expected to be consistent with New York City's LWRP policies, and would have no undue adverse effects on the coastal zone resources associated with New York City.

Hazardous, Toxic, and Radioactive Materials. The cumulative impacts from all actions would be positive. Any contaminated materials found would be removed and disposed of in accordance with all City, State, and Federal regulations.

Transportation. The cumulative impacts from all actions would not be expected to significantly impact transportation in the Project area.

Air Quality. The cumulative impacts from all actions would not be expected to significantly impact air quality in the Project area. Potential impacts during construction would be temporary. Long-term, the creation of open space and improved habitats would be positive for air quality.

Noise. The cumulative impacts from all actions would not be expected to significantly impact noise in the Project area. Potential impacts during construction would be temporary. Long-term, the creation of open space would reduce current noise impacts in the area.

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