APPENDIX I

ENVIRONMENTAL IMPACTS SUPPORT DOCUMENT

US Army Corps
of Engineers
New York District

Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay

Draft Hurricane Sandy General Reevaluation Report
And
Environmental Impact Statement

Volume III: Environmental Appendix I

June 17, 2016

Environmental Appendix I:
Atlantic Coast of New York
East Rockaway Inlet to Rockaway Inlet and Jamaica Bay

Draft Hurricane Sandy General Reevaluation Report
and Environmental Impact Statement

1.0 INTRODUCTION

This Environmental Appendix I supports the Draft Hurricane Sandy General Reevaluation Report/Environmental Impact Statement (HSGRR/EIS), which examines coastal storm risk management (CSRM) problems and opportunities for the East Rockaway Inlet to Rockaway Inlet and Jamaica Bay study area. The area was devastated by the impacts of Hurricane Sandy in 2012, and the HSGRR/EIS analyzes potential environmental impacts of a Proposed Action, and Action Alternative, and the No-Action Alternative. Consistent with current U.S. Army Corps of Engineers (USACE) planning guidance, the study team identified and screened alternatives to address CSRM, and is presenting a tentatively selected plan (TSP).

2.0 ORGANIZATION OF THE ENVIRONMENTAL APPENDIX

This Environmental Appendix consists of the following Chapters:

- Chapter 1: Introduction to the Environmental Appendix I.
- Chapter 2: Organization of the Environmental Appendix I.
- Chapter 3: Summary Description of Analyzed Actions.
- Chapter 4: Affected Environment
- Chapter 5: Environmental Impacts
- Chapter 6: Cumulative Impacts
- Chapter 7: Summary of Potential Impacts
- Chapter 8: Irreversible and Irretrievable Commitment of Resources
- Chapter 9: Short- and Long-Term Productivity of the Environment
- Chapter 10: Unavoidable Adverse Environmental Impacts
- Chapter 11: References

In addition to the chapters in the Environmental Appendix I, several stand-alone files are referenced, which are included with the submittal as separate files. These files are listed by file name and are described below. This Environmental Appendix is presented in a single zip file: "HSGRR Enviro Appendix 17Jun16 1 of 1.zip."

- MFR3_draft_09_03_14_ANocera.docx. This report documents the process used to further evaluate and recommend suitable ecological restoration projects from the inventory of measures. Those ecological restoration projects carried forward within the context of this Reformulation Study are those which can be incorporated into living shorelines and/or provide required mitigation within Jamaica Bay to offset potential unavoidable impacts to waters and wetlands, threatened and endangered species, and/or water quality. A rapid assessment tool was developed to provide a means to measure or evaluate the structure, composition, and function of an ecosystem operating within the bounds of natural or historic range of conditions as documented through a reference data set. The ecological assessment presented herein provides an index of ecological integrity based on metrics of biotic and abiotic condition, size, and landscape context. This report outlines this ecological assessment tool, as well as detail how it was applied within the context of this Reformulation Study and assumptions which were made. This report is also known as ARCADIS MFR 3.

- MFR8_Ecovaluation_12111415.pdf. The objective of this report is to provide a holistic or comprehensive evaluation of required compensatory mitigation for each of the alternative alignments that fully accounts for ecological services and functions, and provide recommendations for mitigation projects to offset these impacts. This report is also known as ARCADIS MFR 8.

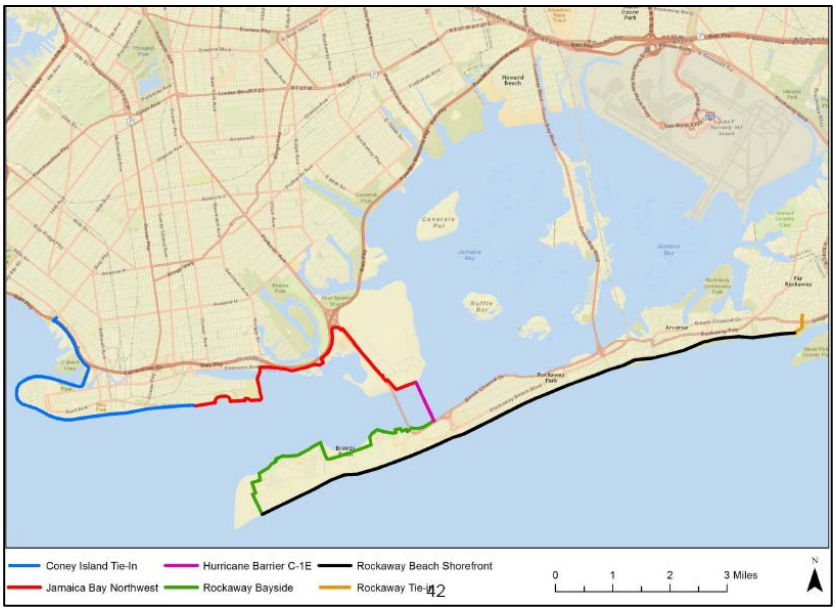
- Rockaway-EFH-061716.docx. The objective of this EFH assessment is to describe the potential adverse effects to designated EFH for federally-managed fisheries species within the project site. It will also describe the conservation measures proposed to avoid, minimize or otherwise offset potential adverse effects to designated EFH resulting from the recommended plan.
- Depiction Of Environmental Consequences – This file contains maps depicting impact footprints.
- APPENDIX P – Emissions Estimates
- APPENDIX P – Draft Statement of Conformity

3.0 SUMMARY DESCRIPTION OF ANALYZED ACTIONS

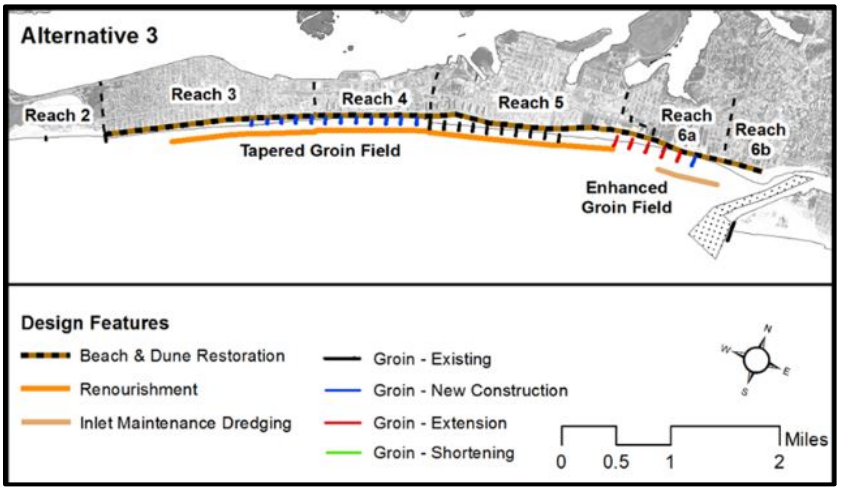
The actions analyzed are defined briefly as follows, and are defined more fully in the HSGRR/EIS.

3.1 Proposed Action – Storm Surge Barrier Plan Alternative

The Storm Surge Barrier Plan Alternative consists of six Coastal Storm Risk Management Units (CSRMU): Atlantic Ocean Shorefront (also identified as "Rockaway Beach Shorefront" in the following figure), Rockaway Eastern tie-in, Coney Island tie-in, Rockaway bayside barrier, Jamaica Bay northwest interior barrier, Hurricane Inlet barrier). Analyses conducted to date support the current Tier 1 decision to construct a composite seawall and associated beach restoration with increased erosion control at the Atlantic Ocean shorefront along the Rockaway peninsula (shown in black in the figure). Associated tie-ins, also shown on the figure, include a tie-in at the eastern end of the Rockaway peninsula, a Rockaway Bayside tie-in, a western tie-in at Coney Island, and a tie-in along the Jamaica Bay northwest interior.

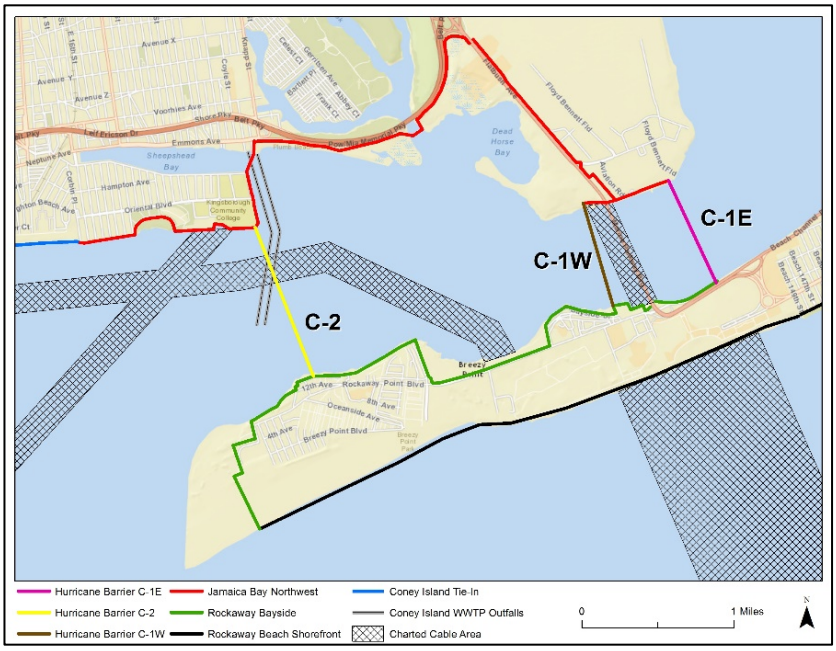


The Atlantic Ocean Shorefront CSRMU has been developed to a higher level of detail than other components of the alternative plans because of its significance as the primary CSRMU feature addressing ocean side wave attack and wave run up on the Rockaway peninsula and because substantial analyses have been performed just prior to and immediately following Hurricane Sandy, which had not been performed for other CSRMUs. The general approach to developing this CSRMU was to evaluate erosion control alternatives in combination with a single beach restoration plan to select the most cost effective renourishment approach prior to the evaluation of alternatives for coastal storm risk management. The most cost effective erosion control alternative is beach restoration with increased erosion control. A composite seawall was selected as the best coastal storm risk management alternative. The composite seawall protects against erosion and wave attack and also limits storm surge inundation and cross-peninsula flooding.



On the Rockaway peninsula, the preferred alignment ties in to the Rockaway Bayside CSRMU, which continues west along the Rockaway peninsula and around Breezy Point, tying into Reach 1 of the Rockaway Shorefront CSRMU.

In addition, the Proposed Action includes a Storm Surge Barrier. Three alternative alignments for the hurricane barrier across Rockaway Inlet of the Storm Surge Barrier Plan (C-1, C-2, and C-3) were assessed. The C-3 alignment was screened out from the more detailed analysis based on relatively higher construction costs and O&M costs due to its longer in-water footprint, while providing the same level of benefits as alignments C-1 and C-2. In addition, alignment C-3 required a complicated tie-in to Breezy Point. Alignment C-2 and two alternative alignments for C-1 (C-1E and C-1W) were evaluated for impacts to tidal amplitude and velocities in Jamaica Bay for various tide gate configurations and hurricane barrier alignments.



Alignment C-1E with 1,100 linear feet of gate opening and alignment C-2 with 1,700 linear feet of gate opening were identified as having the least hydrodynamic impacts to the bay. It was determined that alignment C-1E would be preferred over alignment C-1W. Advantages of Storm Surge Barrier Alignment C-1E over alignment C-1W include the likelihood that C-1E would:

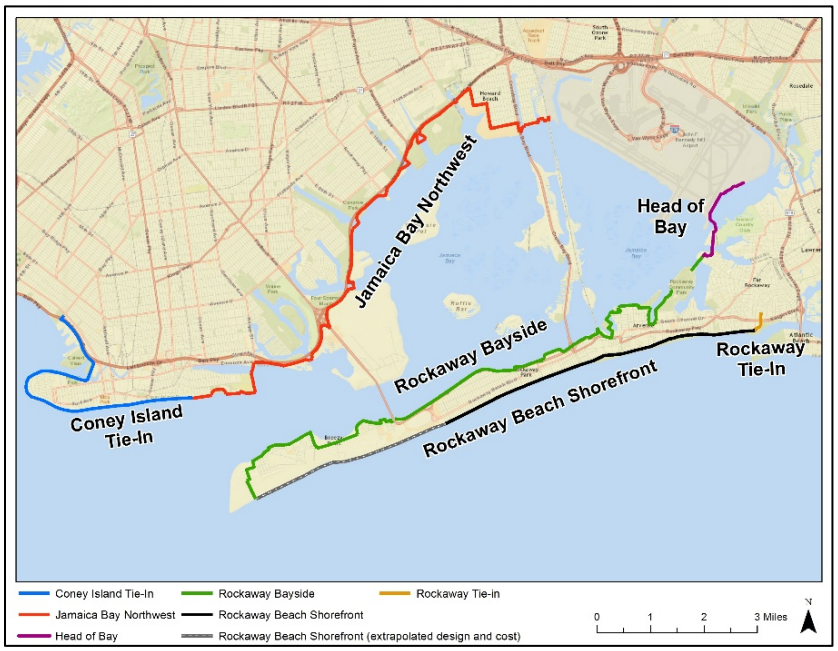
- Result in less scour at the Gil Hodges Memorial Bridge;
- Result in less real estate and aesthetic impacts to the Roxbury Community where alignment C-1W would tie in;
- Be located in a more stable channel location; and
- Avoid potential impacts to submerged cables.

However, as a part of the Tier 2 analysis additional water quality investigations, public outreach, and agency coordination will be will be performed as required to finalize the Storm Surge Barrier alignment (tie-ins) and design. The Tier 2 decision to construct the final and refined Storm Surge Barrier design will be made in the future based on additional investigations conducted for that purpose.

The Proposed Action **would** achieve the objectives of coastal storm risk management: reducing future flood risk, supporting long-term sustainability of the coastal ecosystem and communities, and reducing the economic costs and risks associated with large-scale flood and storm events.

3.2 Action Alternative – Perimeter Barrier Plan

The Perimeter Barrier Plan consists of four common CSRMUs (Atlantic Ocean shorefront unit, the Rockaway eastern tie-in unit, the Coney Island tie-in unit, and longer extent of Jamaica Bay northwest interior barrier unit) and two geographically discrete CSRMUs (Head-of-Bay and Rockaway Bayside). The Perimeter Barrier Plan does not include a Storm Surge Barrier. Additionally, although the Jamaica Bay northwest interior barrier unit is common to both actions, the linear extent of this unit extends approximately 6 miles northwest under the Perimeter Barrier Plan. These common CSRMUs are required for full functionality of each alternative plan, regardless of whether the plan provides a Perimeter Barrier or a Storm Surge Barrier.



The Perimeter Barrier Plan creates a nearly 44-mile contiguous barrier along the Jamaica Bay interior, with the exception of JFK Airport (JFK Airport already has infrastructure providing coastal storm risk management). The Jamaica Bay Interior Barrier Alternative Plan would avert inundation at a stillwater elevation of 11 feet for communities surrounding the Bay. Eleven feet is generally equivalent to the stillwater elevation for a storm event with 1% probability of annual occurrence in 2070 including mid-range sea level rise. The community at Broad Channel, which is effectively within Jamaica Bay—as opposed to being a community on the fringe of Jamaica Bay—would not benefit from the Perimeter Barrier Plan.

The Perimeter Barrier Plan would require 13 tributary flood gates (Sheepshead Bay, Gerritsen Inlet, Mill Basin, Paerdegat Basin, Fresh Creek, Hendrix Basin, Spring Creek, Shellbank Creek,

Hawtree Basin, Head-of-Bay, Negro Bar Channel, Norton Basin and Barbados Basin) and five roadway flood gates across Rockaway Parkway at Canarsie Pier, Pennsylvania Avenue, Hendrix Street, Fountain Avenue, and the Edgemere landfill service road. Additionally, a railroad floodgate would be required at 104th Street for the Long Island Railroad.

The Action Alternative **would** achieve the objectives of coastal storm risk management.

3.3 No-Action Alternative

Under the No-Action alternative, none of the coastal storm risk management measures described for the action alternatives would be constructed. Selection of the No-Action Alternative would leave the Rockaway Peninsula, Jamaica Bay, and Coney Island unprotected from future extreme weather events.

The No-Action Alternative **would not** meet the objectives of coastal storm risk management.

4.0 AFFECTED ENVIRONMENT

The purpose of this section is to provide a brief summary of the affected environmental resources within the Area of Potential Impact (API) for the Proposed Action and Alternatives. A separate subsection is provided under the affected environmental resource topic where the API is unique for the Rockaway peninsula or Jamaica Bay.

4.1 Geologic Setting

The study area consists of the Atlantic Coast of New York City between East Rockaway Inlet and Rockaway Inlet, and the water and lands within and surrounding Jamaica Bay, New York. The coastal area, which is approximately 10 miles in length, is a peninsula located entirely within the Borough of Queens, New York City. This peninsula, generally referred to as the Rockaways, separates the Atlantic Ocean from Jamaica Bay immediately to the north. The greater portion of Jamaica Bay lies in Kings County and Queens County, which are also boroughs of New York City, and a section at the eastern end, known as Head of Bay, lies in the southwestern portion of Nassau County, New York.

4.1.1 Geology

Both the Rockaway API and the Jamaica Bay API lie within the Atlantic Coastal Plain Physiographic Province of the U.S. and includes geological deposits and regional aquifers that are bounded to the south by the Atlantic Ocean and the north by Long Island Sound.

Long Island was formed primarily by Pleistocene-age glaciations including the Wisconsin Ice Age and Laurentide Ice Sheet, which retreated approximately 10,000 years ago. Two advances of the Wisconsin ice sheet during the Upper Pleistocene Epoch of the Quaternary Period caused the island to be blanketed with glacial till, ice-contact stratified drift, outwash deposits, and other deposits composed of clay, silt, sand, gravel, and boulders. The terminal moraines and the north shore of Long Island are composed primarily of stratified glacial drift with some till. The area between the moraines and the south shore of Long Island is primarily covered by outwash deposits. Central and South Long Island are of glaciofluvial origin. These Pleistocene deposits lie atop gently dipping, metamorphic, Paleozoic or Precambrian-age rocks (Misut and Monti 1999; US Dept Interior, NPS, October 2015).

The undifferentiated igneous and metamorphic bedrock of Paleozoic or Precambrian age that underlies the Cretaceous sediments was eroded to a nearly flat or broadly undulating plain before the overlying Cretaceous-age sediments were deposited; the rock surface was later eroded by Pleistocene glaciation in north-northwestern Queens County near the East River and slopes southward at about eighty (80) feet per mile (USEPA 1983a; USEPA 1983b). This dipping bedrock surface and the depositional environment of the overlying sediments resulted in a series of southdipping, unconsolidated, morainal and outwash accumulations associated with the continental glaciers.

The Raritan Formation, consisting of the Lloyd Sand Member and an unnamed clay member, directly overlies the igneous and metamorphic bedrock. Overlying the Raritan Formation is the Magothy Formation and Matawan Group (undifferentiated), the Jameco Gravel, the Gardiners Clay, and upper Pleistocene deposits. Rockaway Peninsula and Coney Island consist of Holocene fluvial deposits. There are four primary water-bearing formations on Long Island: the Upper Glacial, Jameco, Magothy, and Lloyd aquifers. Figure 4.1-1 shows the location of a regional, north-south trending geologic cross-section published by Cartwright, and Figure 4.1-2 shows a cross-section depicting the stratigraphic sequence (Cartwright, 2002). A simplified bedrock geological map of the API and larger area is presented in Figure 4.1-3 (Columbia University, 2008). A larger scale map of bedrock in the region is presented in Figure 4.1-4 (USGS, 2013).

Figure 4.1-1. Location of Kings, Queens, and Nassau Counties, NY (Aerial of A-A' Cross-section)(Cartwright, 2002)

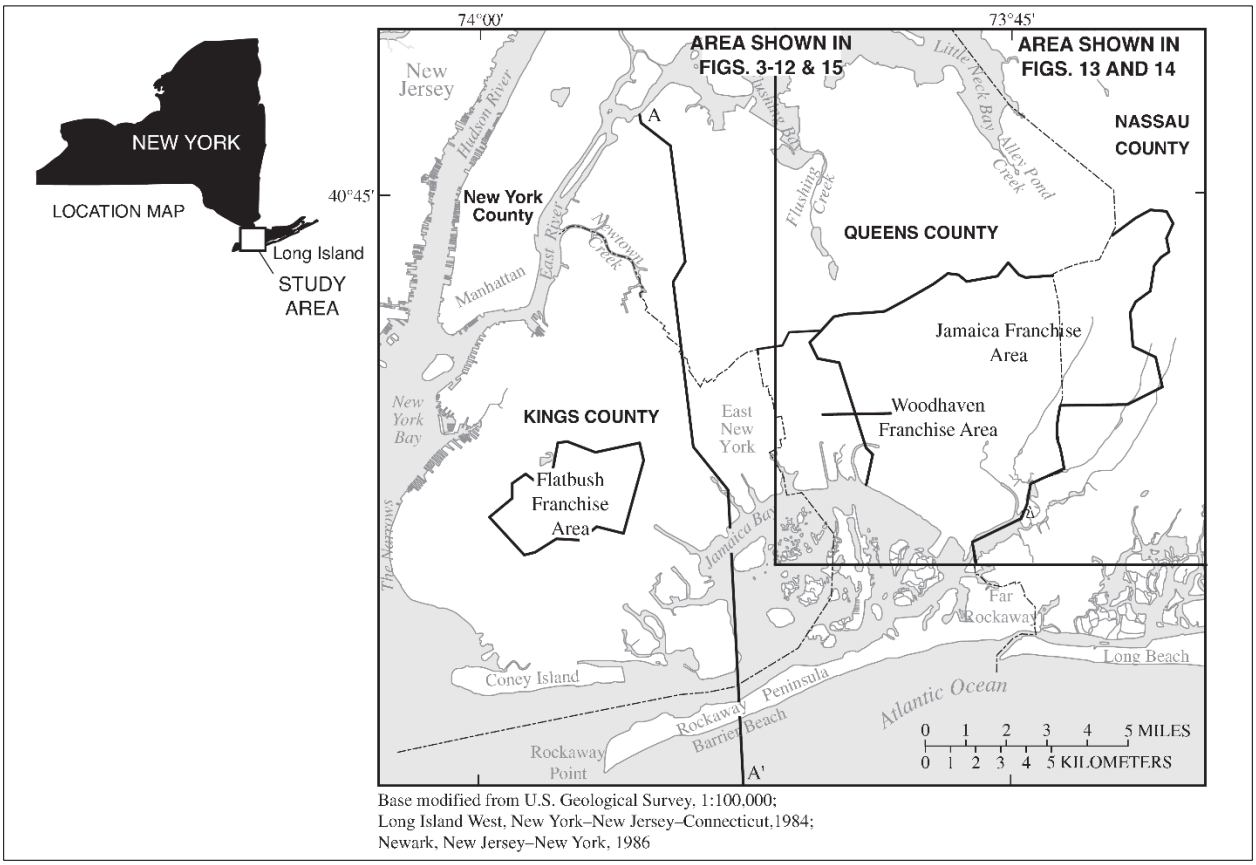


Figure 4.1-2. Hydrogeologic Cross-section A-A' through Kings and Queens Counties, NY (Cartwright, 2002)

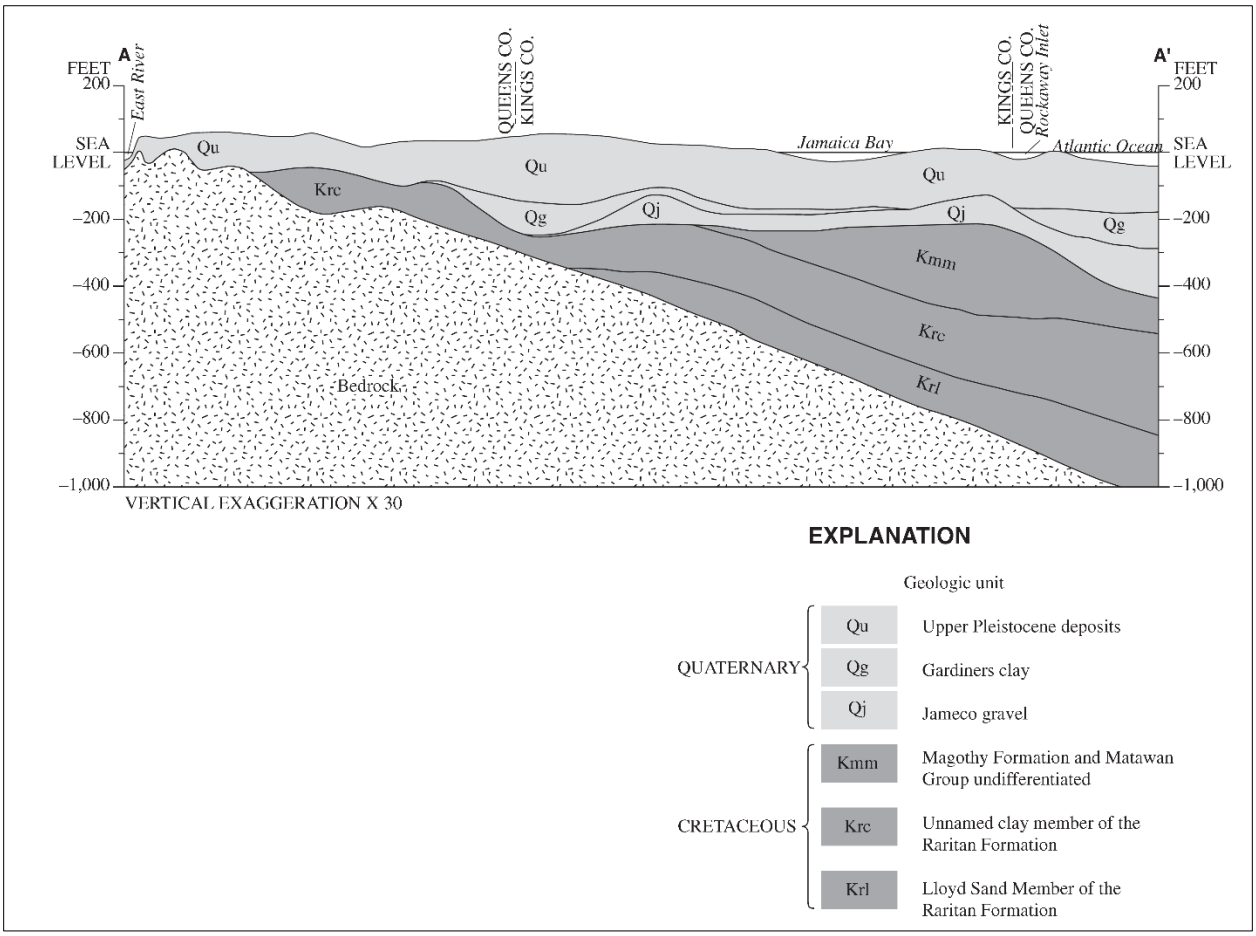


Figure 4.1-3. Bedrock Geology At and in Vicinity of the API

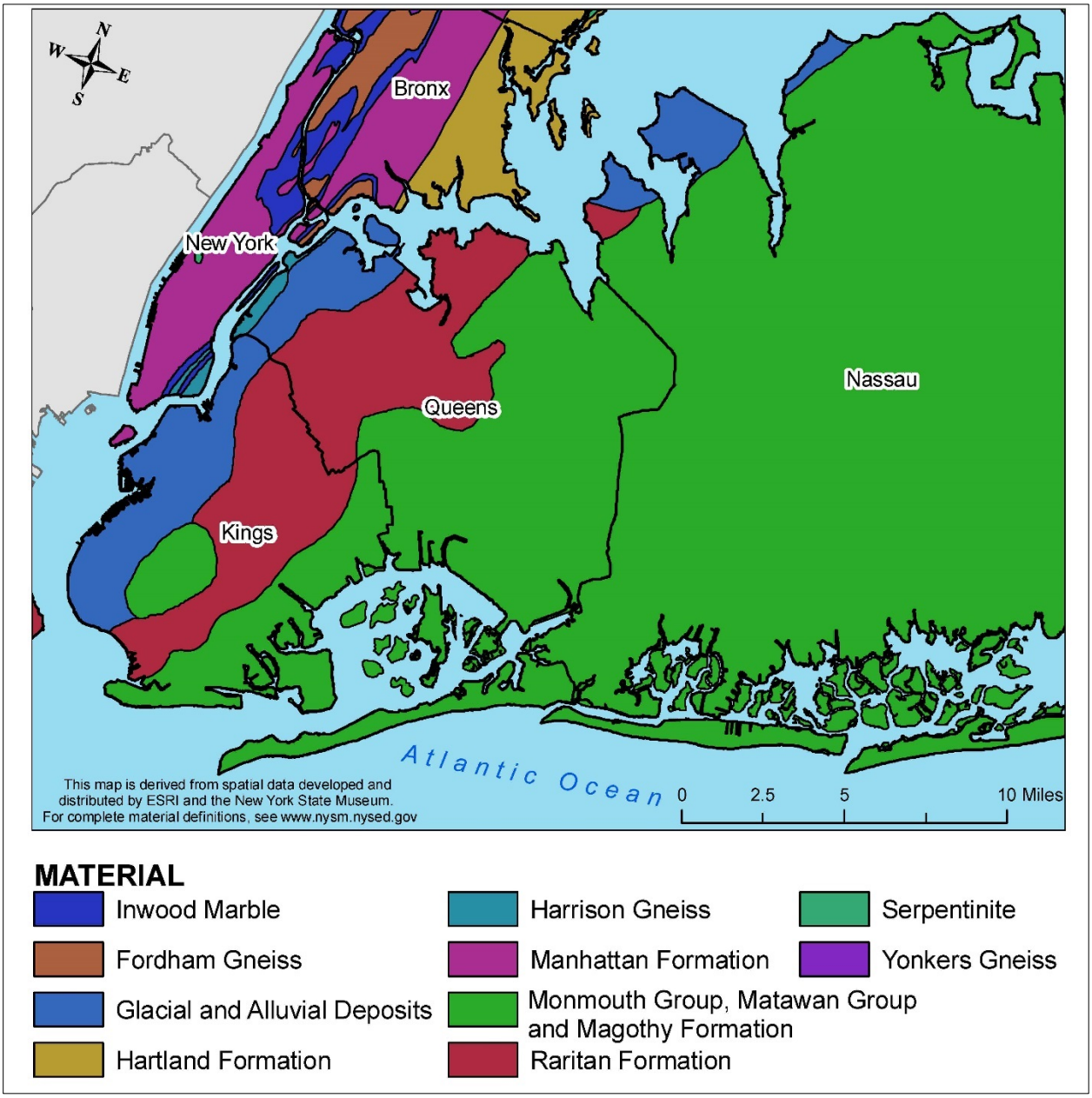
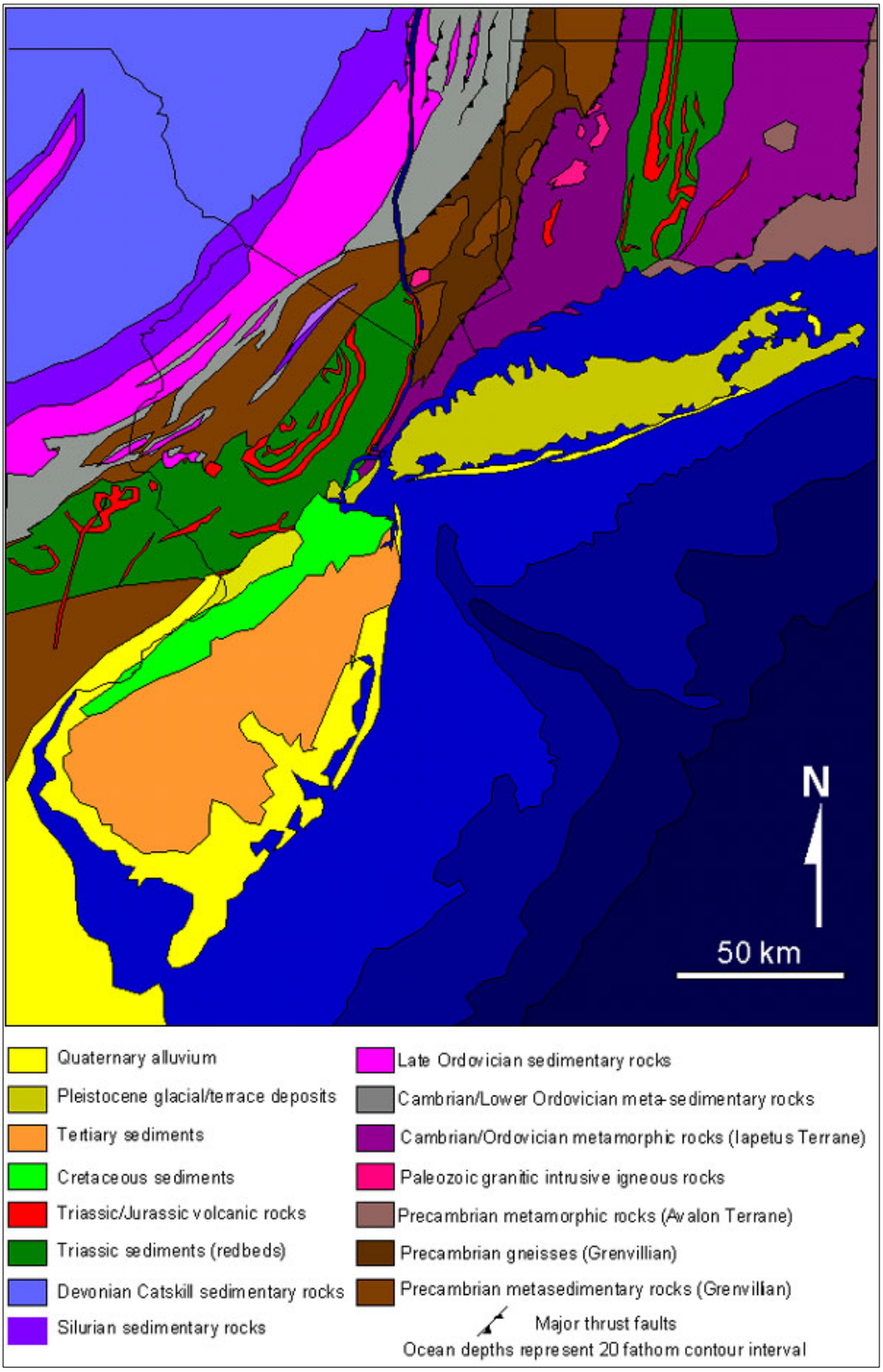


Figure 4.1-4. Geological Map of the New York City Region



Source: USGS, 2013.

4.1.2 Soils

4.1.2.1 Rockaway

The soils on the Rockaway peninsula are formed in a mantle of eolian and marine washed sand (USDA, 2001). These landforms are highly dynamic and can change readily with each coastal storm. Some areas have also been affected by human activities such as hydraulic filling or dredging to control erosion from hurricanes and nor'easters, and to maintain depth in nearby shipping channels. Soils found on the eolian and marine deposits within these portions of the park include Hooksan and Jamaica. On less stable landscapes the miscellaneous land units, Dune land and Beaches, are common. Soils formed in dredge filled areas include Bigapple, Fortress, and Barren. Verrazano soils are found where loamy fill has been placed over sandy materials. Soils within the Rockaway API are predominantly classified as Urban land-Verrazano and Urban land-Flatbush complexes, with 0-3% slopes and a sandy substratum, Hooksan-Dune land complex, and beaches. Soils along the perimeter of the Rockaway API are typically mucky peats susceptible to subsidence (USDA, 2016a). Figure 4.1-5 depicts the USDA soil classifications within the Rockaway API.

Prime Farmland. The USDA Farmlands Protection Policy Act is intended to minimize the impact Federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses (http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/fppa/). It assures that to the extent possible federal programs are administered to be compatible with state, local units of government, and private programs and policies to protect farmland. Federal agencies are required to develop and review their policies and procedures to implement the FPPA every two years. Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978. Based on the USDA soil survey farmland classification map (Figure 4.1-6), none of the soils within the Rockaway API are classified as prime farmland (USDA, 2016a). Therefore, the Farmlands Protection Policy Act does not apply to the proposed Project.

Figure 4.1-5. USDA Soil Classification Map - Rockaway

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Barren sand, 0 to 3 percent slopes
- Beaches
- Bigapple fine sand, 0 to 3 percent slopes
- Bigapple fine sand, 25 to 35 percent slopes
- Bigapple fine sand, 3 to 8 percent slopes
- Bigapple fine sand, 8 to 15 percent slopes
- Bigapple sandy loam, 0 to 3 percent slopes
- Bigapple-Blown-out land complex, 0 to 3 percent slopes
- Breeze loamy sand, 0 to 3 percent slopes
- Breeze loamy sand, 3 to 8 percent slopes
- Fortress sand, 0 to 3 percent slopes
- Freshkills sandy loam, 0 to 8 percent slopes
- Freshkills sandy loam, 15 to 35 percent slopes
- Hooksan fine sand, 0 to 3 percent slopes
- Hooksan fine sand, 3 to 8 percent slopes
- Hooksan-Dune land complex, 0 to 3 percent slopes
- Hooksan-Dune land complex, 3 to 8 percent slopes
- Hooksan-Dune land complex, 8 to 15 percent slopes
- Hooksan-Verrazano-Urban land complex, 0 to 8 percent slopes
- Ipswich mucky peat, 0 to 2 percent slopes, very frequently flooded
- Ipswich-Pawcatuck complex, 0 to 1 percent slopes, very frequently flooded
- Jamaica sand, 0 to 3 percent slopes, frequently ponded
- Ladyliberty fine sandy loam, 0 to 3 percent slopes
- Laguardia-Greenbelt complex, 0 to 3 percent slopes
- Laguardia-Urban land complex, 0 to 3 percent slopes
- Marinepark-Verrazano complex, 0 to 3 percent slopes
- Matunuck mucky peat, 0 to 2 percent slopes, very frequently flooded
- Oil-waste land
- Riverhead sandy loam, 0 to 3 percent slopes
- Riverhead sandy loam, 3 to 8 percent slopes
- Sandyhook mucky fine sand, 0 to 2 percent slopes, very frequently flooded
- Secaucus artifactual fine sandy loam, 0 to 3 percent slopes
- Udipsamments, wet substratum
- Urban land
- Urban land, outwash substratum, 0 to 3 percent slopes
- Urban land, reclaimed substratum, 0 to 3 percent slopes
- Urban land, sandy substratum, 0 to 3 percent slopes
- Urban land, tidal marsh substratum, 0 to 3 percent slopes
- Urban land-Bigapple, non-dredge material complex, 0 to 3 percent slopes
- Urban land-Bigapple, non-dredge material complex, 0 to 3 percent slopes, low impervious surface
- Urban land-Flatbush complex, 0 to 3 percent slopes
- Urban land-Flatbush complex, 0 to 3 percent slopes, low impervious surface
- Urban land-Flatbush complex, 3 to 8 percent slopes
- Urban land-Riverhead complex, 0 to 3 percent slopes
- Urban land-Riverhead complex, 3 to 8 percent slopes
- Urban land-Udipsamments, wet substratum complex
- Urban land-Verrazano complex, 0 to 3 percent slopes
- Urban land-Verrazano complex, 0 to 3 percent slopes, low impervious surface
- Urban land-Verrazano complex, 3 to 8 percent slopes, low impervious surface
- Verrazano sandy loam, 0 to 3 percent slopes
- Water
- Not rated or not available

Soil Rating Lines

- Barren sand, 0 to 3 percent slopes
- Beaches
- Bigapple fine sand, 0 to 3 percent slopes
- Bigapple fine sand, 25 to 35 percent slopes
- Bigapple fine sand, 3 to 8 percent slopes
- Bigapple fine sand, 8 to 15 percent slopes
- Bigapple sandy loam, 0 to 3 percent slopes
- Bigapple-Blown-out land complex, 0 to 3 percent slopes
- Breeze loamy sand, 0 to 3 percent slopes
- Breeze loamy sand, 3 to 8 percent slopes
- Fortress sand, 0 to 3 percent slopes
- Freshkills sandy loam, 0 to 8 percent slopes
- Freshkills sandy loam, 15 to 35 percent slopes
- Hooksan fine sand, 0 to 3 percent slopes
- Hooksan fine sand, 3 to 8 percent slopes
- Hooksan-Dune land complex, 0 to 3 percent slopes
- Hooksan-Dune land complex, 3 to 8 percent slopes
- Hooksan-Dune land complex, 8 to 15 percent slopes
- Hooksan-Verrazano-Urban land complex, 0 to 8 percent slopes
- Ipswich mucky peat, 0 to 2 percent slopes, very frequently flooded
- Ipswich-Pawcatuck complex, 0 to 1 percent slopes, very frequently flooded
- Jamaica sand, 0 to 3 percent slopes, frequently ponded
- Ladyliberty fine sandy loam, 0 to 3 percent slopes
- Laguardia-Greenbelt complex, 0 to 3 percent slopes
- Laguardia-Urban land complex, 0 to 3 percent slopes
- Marinepark-Verrazano complex, 0 to 3 percent slopes
- Matunuck mucky peat, 0 to 2 percent slopes, very frequently flooded
- Oil-waste land
- Riverhead sandy loam, 0 to 3 percent slopes
- Riverhead sandy loam, 3 to 8 percent slopes
- Sandyhook mucky fine sand, 0 to 2 percent slopes, very frequently flooded
- Secaucus artifactual fine sandy loam, 0 to 3 percent slopes
- Udipsamments, wet substratum
- Urban land
- Urban land, outwash substratum, 0 to 3 percent slopes
- Urban land, reclaimed substratum, 0 to 3 percent slopes
- Urban land, sandy substratum, 0 to 3 percent slopes
- Urban land, tidal marsh substratum, 0 to 3 percent slopes
- Urban land-Bigapple, non-dredge material complex, 0 to 3 percent slopes
- Urban land-Bigapple, non-dredge material complex, 0 to 3 percent slopes, low impervious surface
- Urban land-Flatbush complex, 0 to 3 percent slopes
- Urban land-Flatbush complex, 0 to 3 percent slopes, low impervious surface
- Urban land-Flatbush complex, 3 to 8 percent slopes
- Urban land-Riverhead complex, 0 to 3 percent slopes
- Urban land-Riverhead complex, 3 to 8 percent slopes
- Urban land-Udipsamments, wet substratum complex
- Urban land-Verrazano complex, 0 to 3 percent slopes

Figure 4.1-6. USDA Farmland Soil Classification Map - Rockaway

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

4.1.2.2 Jamaica Bay

Jamaica Bay has a long history of alterations by extensive dredging, filling, and development in and around the bay (USFWS, 1997; USDA, 2001). Over sixty years ago, West Pond and East Pond and other islands within Jamaica Bay were created on the filled lands from Rulers Bar Hassock (USDA, 2001). The area was covered with fill material that consisted of natural and human materials, including rubble, fly ash, etc. (NPS, 2014a). For example, Floyd Bennett Field in the Jamaica Bay Unit was constructed on saltmarsh now covered by dredged materials, rubble, fly ash, and wastes and in some cases paved to create space for runways, hangars, and historically for the railroad across Jamaica Bay. The Fountain Avenue and Pennsylvania Avenue former landfills occupy space on the northern edge of Jamaica Bay. Each is about 80 feet high and covers 100 acres of former saltmarsh habitat (NPS, 2013).

Soils and sediments in Jamaica Bay are underlain by poorly drained glacial outwash soils in the Ipswich series, including organic materials that have accumulated since the retreat of the glaciers (USDA, 2001; US Dept Interior, 2015). Benthic soils in western Jamaica Bay are more likely fine to medium sands while sediment of the eastern and northern portions of the bay are silty and muddy, fine sand (USFWS 1997; NYCDEP 2011; US Dept Interior, 2015). The remainder of soils within the Jamaica Bay API are predominantly classified as Urban land-Flatbush, -Verrazano, and -Riverhead complexes with 0-3% slopes and a tidal marsh or outwash substratum, Bigapple fine sand with 0-3% slope (USDA, 2016b). Figure 4.1-7 depicts the USDA soil classifications within the Jamaica Bay API.

However, given Jamaica Bay is one of the most urbanized estuaries in North America, the project area has had a long history of anthropogenic disturbances which include extensive dredging, filling, and development in and around the bay (USFWS 1997; USDA 2001; GNRA 2015). In many locations, the topography of the region has been altered by development and cut and fill activities which have created many new, man-made topographic features. Within the bay, many areas within the bay have been used historically as a borrow source for urban development (further discussed in Section 3.2.2). On land, native soils have primarily been excavated, covered with fill material, compressed, or covered by impervious surfaces. Historically, significant salt marsh areas throughout the Bay project area have been filled to support construction of Floyd Bennett Field, John F. Kennedy (JFK) Airport, and/or the Fountain Avenue and Pennsylvania Avenue former landfills. Dead Horse Bay is also a historic landfill. The New York Soil and Water Conservation District have mapped the soils surrounding the bay as almost entirely categorized anthropogenic fill.

Prime Farmland. A review of prime farmland occurrence in the Jamaica Bay area was performed. Figure 4.1-8 depicts the farmland soil locations within the Jamaica Bay API. While the Sudsbury sandy loam and Riverhead loamy coarse sand soils at are classified as prime farmland, the proposed action would not prevent these soils from potential agricultural use. Therefore the Farmlands Protection Policy Act does not apply to the proposed Project.

Figure 4.1-7. USDA Soil Classification Map - Jamaica Bay

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Dystric Eutrudepts
- Coarse-loamy, mixed, active, hyperthermic Oxyaquic Eutrudepts
- Coarse-loamy, mixed, active, mesic Dystric Eutrudepts
- Coarse-loamy, mixed, active, nonacid, mesic Aquic Udorthents
- Coarse-loamy, mixed, active, nonacid, mesic Typic Endoaquents
- Coarse-loamy, mixed, mesic Typic Dystrochrepts
- Coarse-loamy, mixed, superactive, mesic Typic Dystrudepts
- Dysic, thermic Typic Udifolists
- Euic, mesic Typic Sulfihemists
- Loamy-skeletal, mixed, superactive, nonacid, mesic Oxyaquic Udorthents
- Loamy-skeletal, mixed, superactive, nonacid, mesic Typic Udorthents
- Mixed, mesic Aquic Udipsamments
- Mixed, mesic Typic Psammaquents
- Mixed, mesic Typic Udipsamments
- Mixed, mesic Udipsamments
- Sandy or sandy-skeletal, mixed, euic, mesic Terric Sulfihemists
- Sandy, mixed, mesic Aquic Dystric Eutrudepts
- Sandy, mixed, mesic Aquic Dystrochrepts
- Sandy, mixed, mesic Haplic Sulfaquents
- Sandy, mixed, mesic Histic Sulfaquents
- Sandy, siliceous, mesic Aeric Haplaquods
- Sandy-skeletal, mixed, hyperthermic Typic Udorthents
- Sandy-skeletal, mixed, mesic Oxyaquic Udorthents
- Wassents
- Not rated or not available

Soil Rating Lines

- Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Dystric Eutrudepts
- Coarse-loamy, mixed, active, hyperthermic Oxyaquic Eutrudepts
- Coarse-loamy, mixed, active, mesic Dystric Eutrudepts
- Coarse-loamy, mixed, active, nonacid, mesic Aquic Udorthents
- Coarse-loamy, mixed, active, nonacid, mesic Typic Endoaquents
- Coarse-loamy, mixed, mesic Typic Dystrochrepts
- Coarse-loamy, mixed, superactive, mesic Typic Dystrudepts
- Dysic, thermic Typic Udifolists
- Euic, mesic Typic Sulfihemists
- Loamy-skeletal, mixed, superactive, nonacid, mesic Oxyaquic Udorthents
- Loamy-skeletal, mixed, superactive, nonacid, mesic Typic Udorthents
- Mixed, mesic Aquic Udipsamments
- Mixed, mesic Typic Psammaquents
- Mixed, mesic Typic Udipsamments
- Mixed, mesic Udipsamments
- Sandy or sandy-skeletal, mixed, euic, mesic Terric Sulfihemists
- Sandy, mixed, mesic Aquic Dystric Eutrudepts
- Sandy, mixed, mesic Aquic Dystrochrepts
- Sandy, mixed, mesic Haplic Sulfaquents
- Sandy, mixed, mesic Histic Sulfaquents
- Sandy, siliceous, mesic Aeric Haplaquods
- Sandy-skeletal, mixed, hyperthermic Typic Udorthents
- Sandy-skeletal, mixed, mesic Oxyaquic Udorthents
- Wassents
- Not rated or not available

Soil Rating Points

- Coarse-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Dystric Eutrudepts
- Coarse-loamy, mixed, active, hyperthermic Oxyaquic Eutrudepts
- Coarse-loamy, mixed, active, mesic Dystric Eutrudepts
- Coarse-loamy, mixed, active, nonacid, mesic Aquic Udorthents
- Coarse-loamy, mixed, active, nonacid, mesic Typic Endoaquents
- Coarse-loamy, mixed, mesic Typic Dystrochrepts
- Coarse-loamy, mixed, superactive, mesic Typic Dystrudepts
- Dysic, thermic Typic Udifolists
- Euic, mesic Typic Sulfihemists
- Loamy-skeletal, mixed, superactive, nonacid, mesic Oxyaquic Udorthents
- Loamy-skeletal, mixed, superactive, nonacid, mesic Typic Udorthents
- Mixed, mesic Aquic Udipsamments
- Mixed, mesic Typic Psammaquents
- Mixed, mesic Typic Udipsamments
- Mixed, mesic Udipsamments
- Sandy or sandy-skeletal, mixed, euic, mesic Terric Sulfihemists
- Sandy, mixed, mesic Aquic Dystric Eutrudepts
- Sandy, mixed, mesic Aquic Dystrochrepts
- Sandy, mixed, mesic Haplic Sulfaquents
- Sandy, mixed, mesic Histic Sulfaquents
- Sandy, siliceous, mesic Aeric Haplaquods
- Sandy-skeletal, mixed, hyperthermic Typic Udorthents
- Sandy-skeletal, mixed, mesic Oxyaquic Udorthents
- Wassents
- Not rated or not available

Water Features

- Streams and Canals

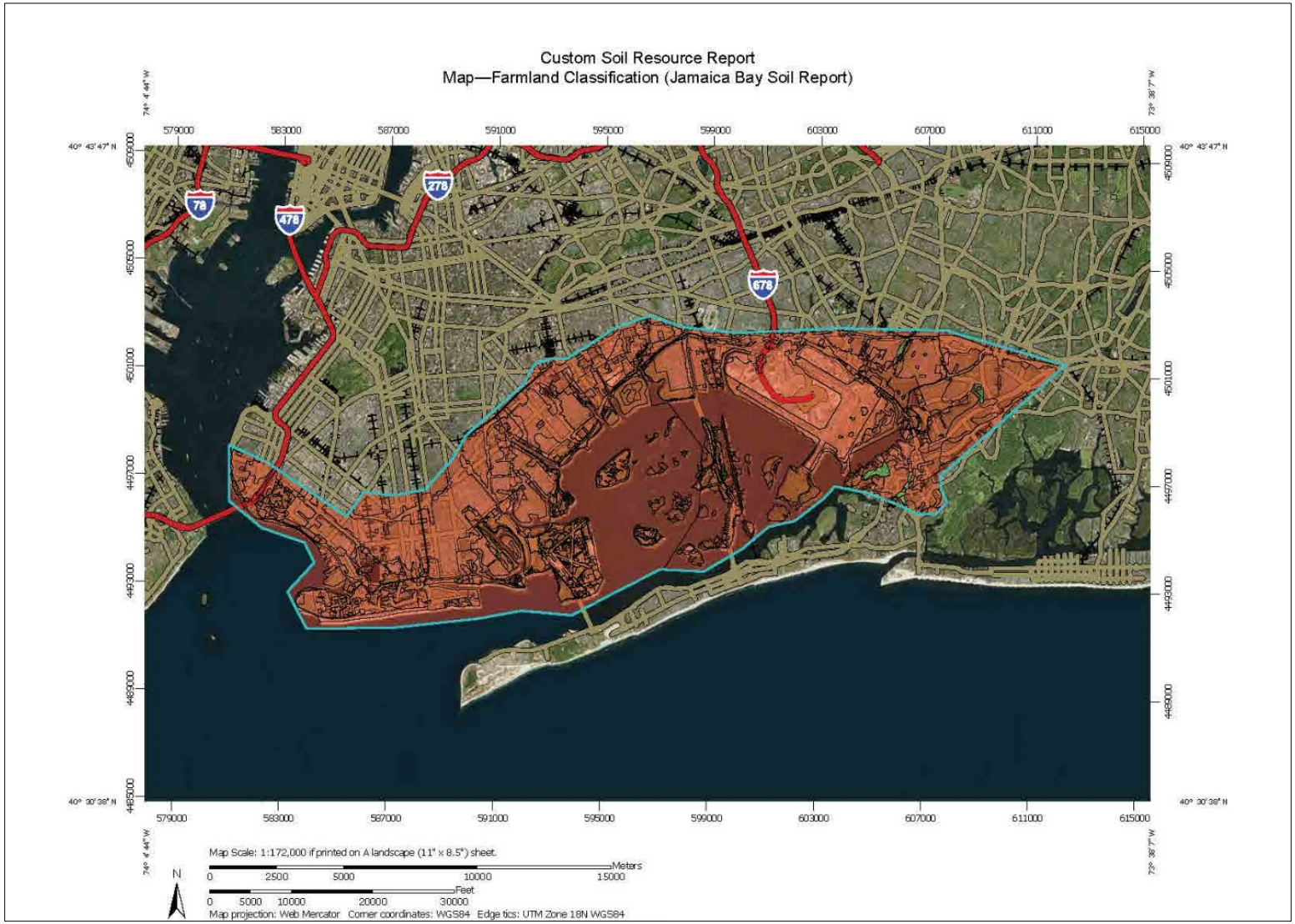
Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

Figure 4.1-8. USDA Farmland Soil Classification Map - Jamaica Bay



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Lines

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Soil Rating Points

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Water Features

4.1.3 Topography

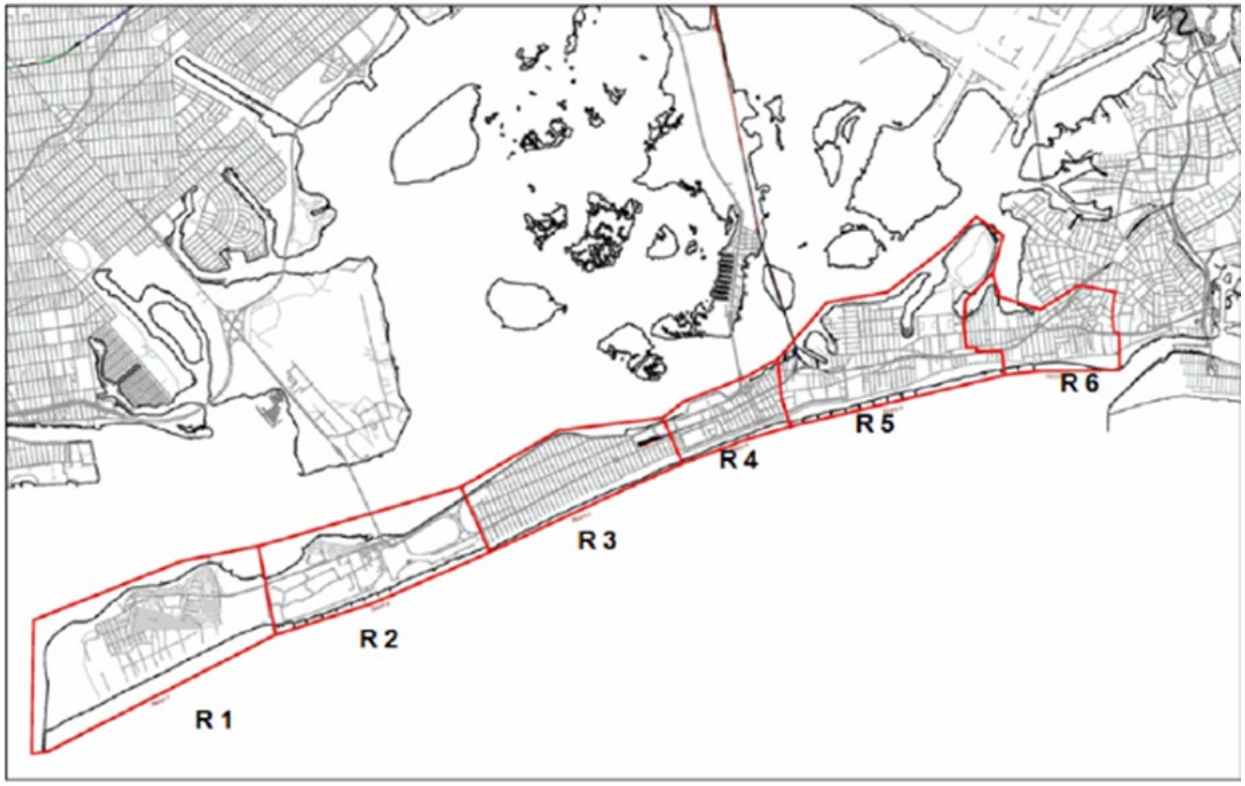
The last erosional period, which may have been during late Pliocene time, generated many of the topographic features of Long Island, including the ancestral Long Island Sound and erosional scouring of a deep north-south channel in Queens County as having been incised by an ancestral Hudson River system (Cartwright, 2002). During the Quaternary, Pleistocene glacial episodes and the resulting changes in sea level caused alternating periods of deposition and erosion that reworked the surficial sediments. The last major features to be formed on Long Island are the glacial moraines, which were emplaced during the Wisconsinan glacial stage, and outwash that was deposited south of the moraines by glacial meltwater.

4.1.3.1 Rockaway

In 1835, Rockaway Point was located near the present east boundary of Jacob Riis Park (FEMA, 2013). East Rockaway Inlet was located 20,000 feet east of its present position, near Long Beach, New York. South of Rockaway Point, a large shoal had formed which was to provide the material for extending this point nearly four miles to the east during the next 100 years. The shoreline generally receded between 1835 and 1878 while, at the same time, Rockaway Point extended two miles westward. Jacob Riis Park acquired its present shoreline during this period. Between 1878 and 1927, the shoreline of the Rockaways advanced a small amount. Rockaway Point grew rapidly until 1902, but from 1902 to 1927, its westward expansion was only half its previous rate. From 1927 to 2007, the shoreline of the Rockaways has been stable. Nearly 12 million cubic yards of sand have been artificially placed east of Rockaway Point since that time (FEMA, 2013).

The communities located on the Rockaway peninsula from west to east include Breezy Point, Roxbury, Neponsit, Belle Harbor, Rockaway Park, Seaside, Hammel, Arverne, Edgemere and Far Rockaway. The former Fort Tilden Military Reservation and the Jacob Riis Park (part of the Gateway National Recreation Area) are located in the western half of the peninsula between Breezy Point and Neponsit. The characteristics of nearly all of the communities on the Rockaway peninsula are similar. Ground elevations rarely exceed 10 feet above mean sea level (msl), except within the existing dune field. Elevations along the Jamaica Bay shoreline side of the peninsula generally range from 5 feet above msl, increasing to 10 feet above msl further south toward the Atlantic coast (USGS, 2016, based on topographic maps dated 2013). An estimated 7,900 residential and commercial structures on the peninsula fall within the FEMA regulated 100-year floodplain. Division of the Rockaway API into reaches does not imply separable projects or construction areas.

Figure 4.1-9. Rockaway Atlantic Shoreline Reaches



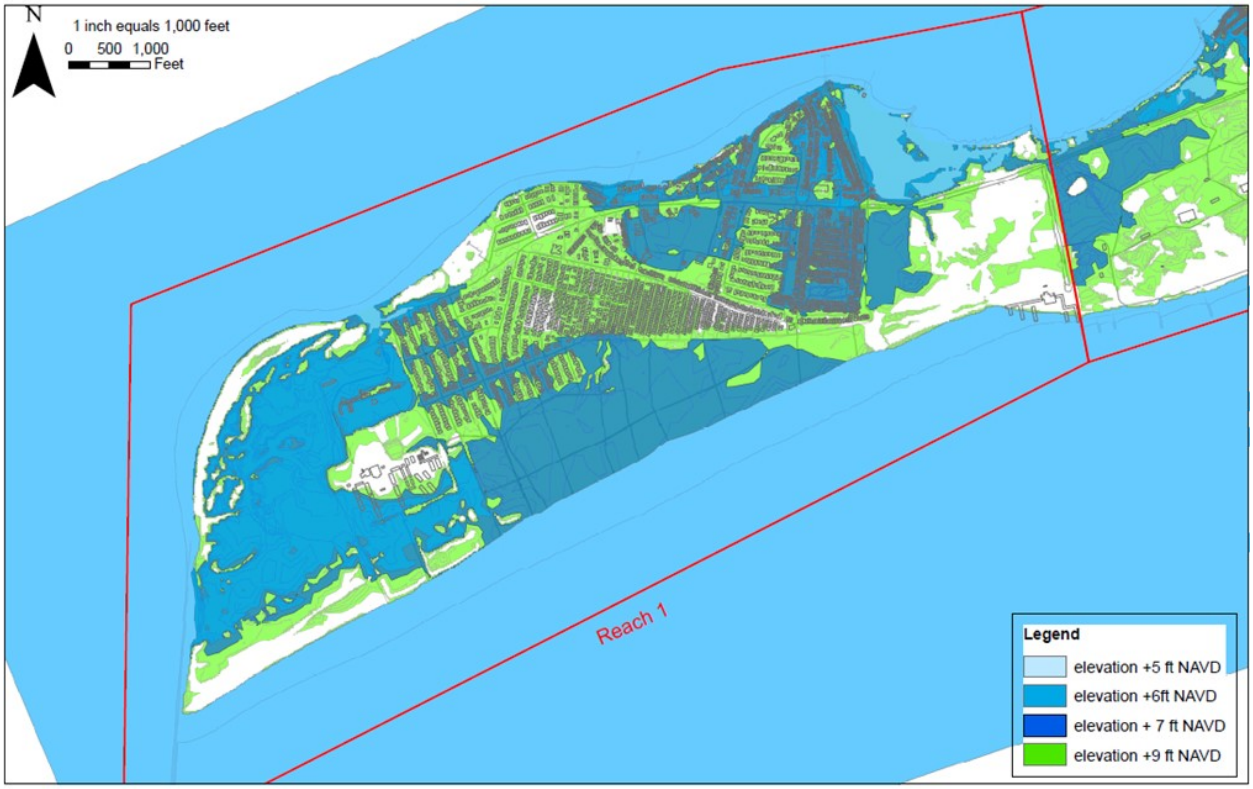
Reach 1: Rockaway Point to Beach 193rd Street

Reach 1 contains the area between Rockaway Point and Beach 193rd Street (Figure 4.1-10). This reach consists of the Breezy Point and Rockaway Point communities. These communities consist mostly of private properties ranging from year round residences to seasonal vacation houses. Commercial development in the area is minimal. Structures sit on piles of varying depths in the area. Most residents have closed up their original crawl spaces between the main floors. Some residents utilize the space for storage and other damageable utilities.

The ocean-side beach of Breezy Point is wide. The beach has no established dune which results in the vulnerability of the area to tidal inundation from both the ocean and bay. Reach 1 consists of low-lying accretion areas with large buildings. The developments are subject to flooding both from the bay and the ocean due to its low ground elevations.

Figure 4.1-10 presents the buildings with potential flooding at different surge heights. In this reach, the surge levels are nearly the same on the Atlantic Ocean and Jamaica Bay ides of the peninsula. As shown, the entire reach is vulnerable to inundation at a +9 feet NAVD elevation.

Figure 4.1-10. Atlantic Shoreline Reach #1



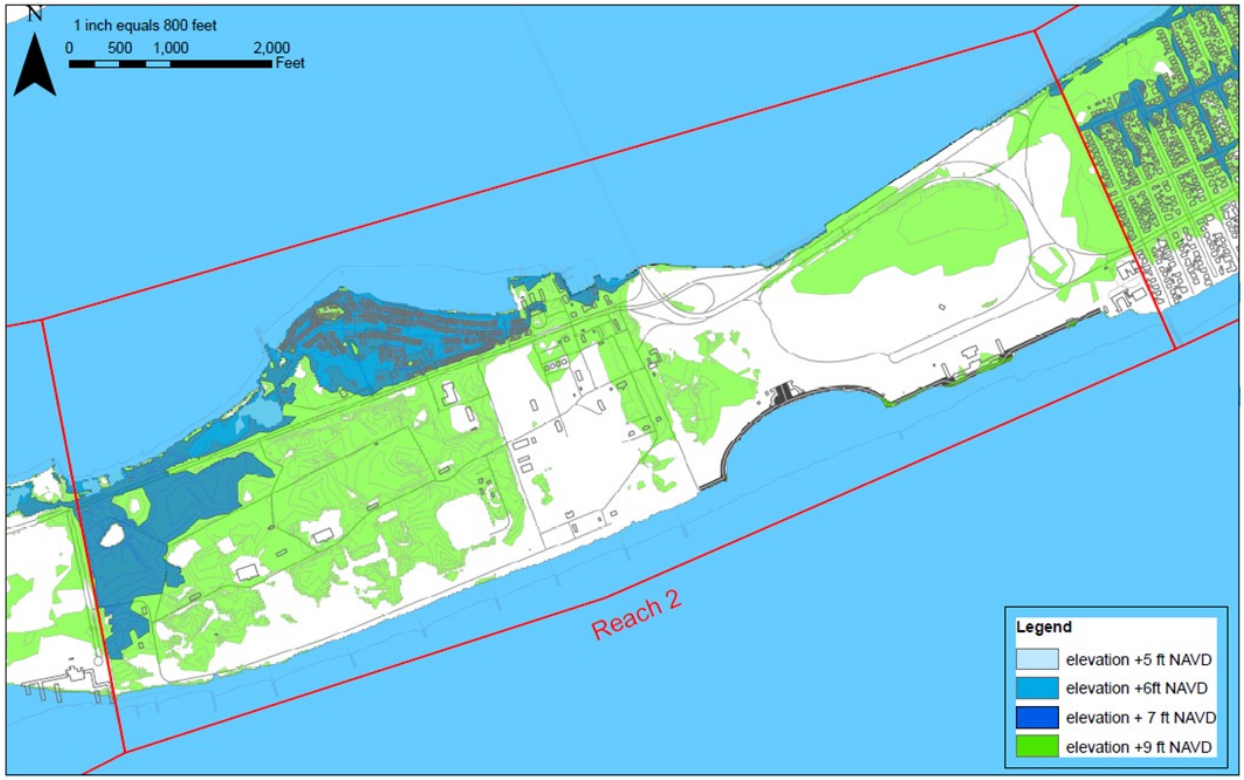
Reach 2: Beach 193rd Street to Beach 149th Street

Reach 2 includes the former Fort Tilden and Jacob Riis Park areas, and the community of Roxbury along the Jamaica Bay shoreline (Figure 4.1-11). The reach has some of the highest ground elevations along the Rockaway peninsula.

As shown in Figure 4.1-11, the shoreline contains a number of groins. These groins and the continued sediment supply from the east have resulted in the ocean-front shoreline being relatively stable. The east of the area has limited development. Most of the bay shoreline has a continuous wall which addresses low wave height, high frequency bayside flooding.

Reach 2 sits on a relatively high area. This reach, which supports recreational areas with limited shorefront development, has vulnerability to erosion, wave attack, and inundation. The community of Roxbury along the Jamaica Bay shoreline is susceptible to flooding from the bay where buildings are flooded at elevation +6feet NAVD, also shown in Figure 4.1-11.

Figure 4.1-11. Atlantic Shoreline Reach #2



Reach 3: Beach 149th Street to Beach 109th Street

Reach 3 is a heavily developed area from ocean to bay (Figure 4.1-12). Ground elevations at the ocean end of the streets are about 10 to 11 feet NAVD with evidence of relict dunes. Landward of Reach 3, ground elevations drop to 5 to 6 feet NAVD along the bay shoreline. The reach has received sand fill from the existing, authorized project.

A retaining wall with a top elevation of approximately 3 to 4 feet above grade (roughly +10ft NAVD) protects the bay shoreline. The wall provides significant a degree of protection to the low lying areas of the reach.

Reach 3 contains densely developed areas on the shoreline. The existing authorized project includes this reach as part of its footprint. The reach has experienced low to moderate erosion. Significant infrastructure is at risk to ocean-side wave attack and flooding. The existing retaining wall along the bayside functions as a flood wall and reduces the risk of flooding along the bayside.

Figure 4.1-12 shows the areas of the reach that would be flooded at different elevations in the absence of the retaining wall. The figure also illustrates the potential for flooding on the reach where the surge runs across the island and ponds behind the existing floodwall.

Figure 4.1-12. Atlantic Shoreline Reach #3

Reach 4: Beach 109th Street to Beach 86th Street

Reach 4 is a heavily developed area, similar to Reach 3 (Figure 4.1-13). As part of the existing, authorized project, the reach has required a relatively large volume of material. The shore-front area contains several deteriorated wood pile groins. The Jamaica Bay shoreline is hardened with a low bulkhead at elevations near +6ft NAVD.

Surfers consider this area as a highly desirable surfing location. A surfing beach has been designated in this reach.

Erosion in the area persists despite wood pile groins. Severe erosion losses have required the reach to receive large volumes of beach fill material. Inundation from Jamaica Bay is not as extensive as other reaches due to this bulkhead. Significant infrastructure is still at risk. Figure 4.1-13 illustrates the developments impacted under different storm surge heights.

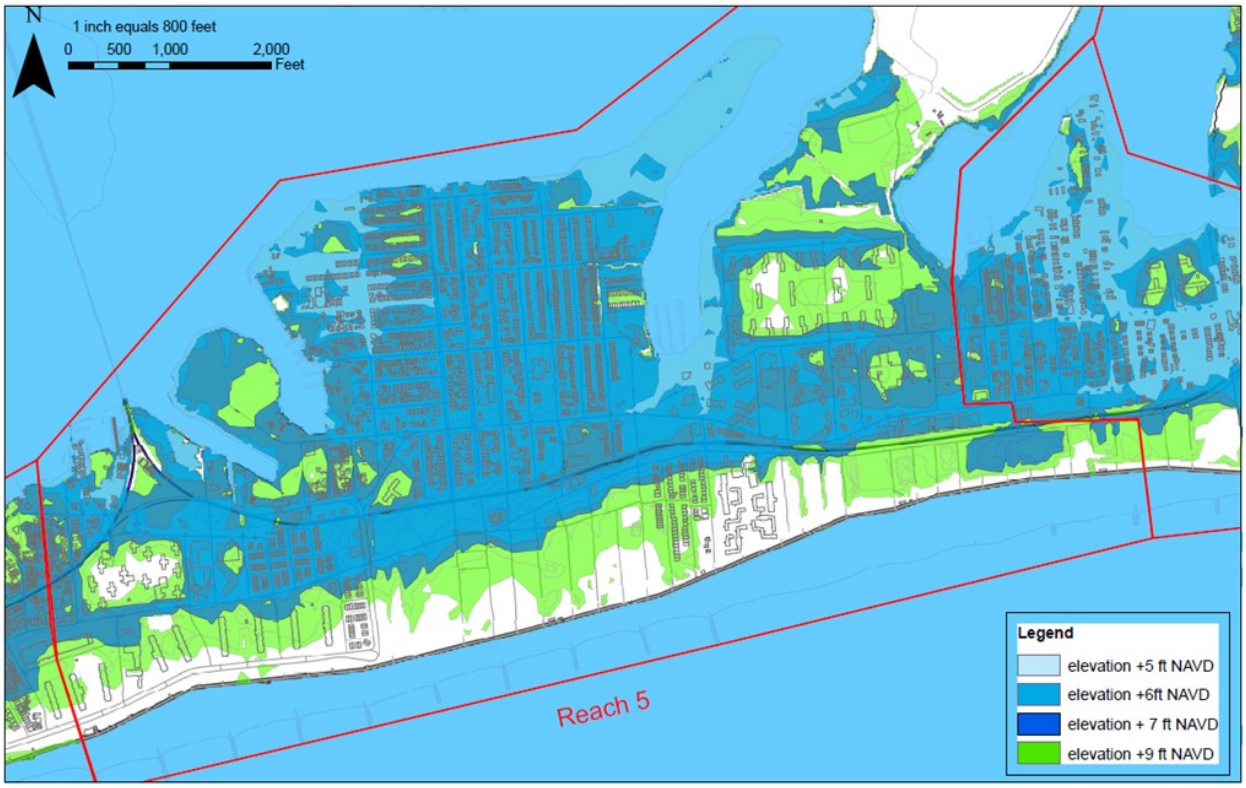
Figure 4.1-13. Atlantic Shoreline Reach #4

Reach 5: Beach 86th Street to Beach 42nd Street

Reach 5 consist of some developed areas near the ocean side of the peninsula (Figure 4.1-14). The developed areas sit at a higher elevation that Reaches 3 and 4. The reach has been relatively stable due to existing stone groins and its high elevations. Much of the development is at higher elevations compared to developed areas in Reaches 3 and 4, which results in the structures being less susceptible to storm damages. Also, the irregular shoreline of the area makes the design of line of protection measures very complex and costly.

The Arverne community in Reach 5 has low ground elevations ranging from 4.5 feet to 6 feet NAVD. The low elevations make the area susceptible to inundation. Figure 4.1-14 shows the developments impacted under different surge heights. Almost half of the reach gets submerged at a surge height of +6 feet NAVD.

Figure 4.1-14. Atlantic Shoreline Reach #5



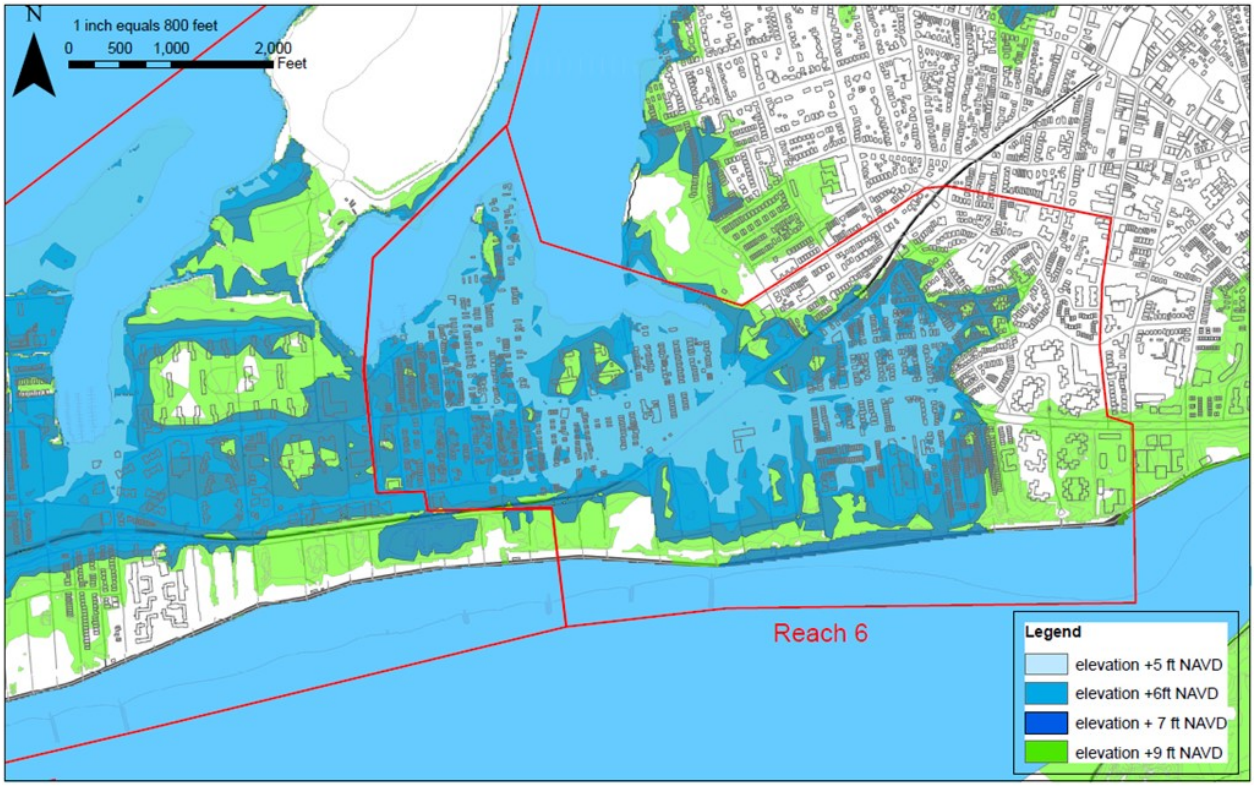
Reach 6: Beach 42nd Street to Beach 9th Street

Reach 6 is located in the immediate vicinity of the inlet (Figure 4.1-15). The reach includes a heavily developed shoreline with some undeveloped shore front parcels. It experiences extremely high erosion rates and receives large amount of beach fill from the existing authorized project. The Jamaica Bay shoreline in this area is very irregular and low-lying, almost similar to Reach 5.

At times, the ocean shoreline has receded to and landward of the boardwalk. The area has required large amounts of fill placement as part of the existing authorized project. The reach also receives the dredge material from East Rockaway Inlet.

Figure 4.1-15 shows the developments impacted by different storm surge heights. As shown, most of the area gets affected by water depths as low as +5 feet NAVD. Also, portions of the main access road within this area get flooded by low water depths.

Figure 4.1-15. Atlantic Shoreline Reach #6



4.1.3.2 Jamaica Bay

Within Jamaica Bay, it has been estimated that 150 million cubic yards of material have been dredged (FEMA, 2013). The most common use for dredged material has been for fill purposes in land reclamation projects. Originally, almost all of the area surrounding Jamaica Bay, except the barrier beach to the south, was marshland (FEMA, 2013)

The topography of the Jamaica Bay varies among the natural and man-made physiographic features within the API, including the numerous basins and creeks that fringe the interior periphery of the bay; several man-made landfills and residential/commercial infilled developments along the interior periphery of the bay; and numerous salt marsh islands and island bars located within the interior of the bay (Figure 4.1-16). Accordingly, elevations vary on account of these features. The grades of the salt marsh islands and island bars vary from sea level to as high as 22 feet above msl at Ruffle Bar and Little Egg Marsh. Inland landfills rise rapidly from the shoreline to approximately 40 feet above msl, while residential/commercial areas are lower than the landfills, ranging from sea level at their shoreline to approximately 20 feet msl inland (USGS, 2016, topographic maps dated 2013).

Figure 4.1-16. Jamaica Bay Topography

Source: http://ngmdb.usgs.gov/maps/TopoView/

4.1.4 Seismic Activity

The majority of significant earthquakes around the world are associated with tectonic subduction zones, where one crustal plate is overriding another (e.g., the Japanese islands), where tectonic plates are sliding past each other (such as in California), or where tectonic plates are converging (e.g., the Indian Sub-Continent). Unlike these highly active tectonic regions, the east coast of the United States is a passive tectonic plate boundary located on the "trailing edge" of the North American continental plate, which is relatively seismically quiet (FERC, 2013). Earthquakes that do occur on the east coast of the United States area largely due to trailing edge tectonics and residual stress release from past orogenic (mountain building) events. Earthquake hypocenters generally are concentrated in older bedrock terranes, such as the crystalline bedrock beneath the coastal plain and post-glacial sediments south of New York City (Sykes et al., 2008). According to the USGS Earthquake Hazards Program, New York City is located well within the North American plate, far from the plate boundary located approximately 2,000 miles east in the Atlantic Ocean.

A number of low magnitude events have been recorded in the vicinity of the Rockaway Project area since the 18th century. The largest recorded earthquake occurred in 1884 in Brooklyn, New York, approximately 6.6 miles west of the Rockaway Project area. This earthquake is estimated to have been a magnitude 5.5 event on the Richter scale resulting in Modified Mercalli Intensity

(MMI) VII damage in the New York City area (NYC Natural Hazard Mitigation Plan, 2009; USGS, 2010). An event such as this today would cause considerable damage to poorly built structures but negligible damage to buildings of good design and construction. The most recent significant earthquake in the New York City area was a magnitude 1.6 event that occurred on July 8, 2014 near Newark, approximately 15 miles to the northwest of the study area, and a magnitude 2.3 earthquake on June 6, 2010 in Brownville, New Jersey, approximately 20 miles west of the study area (USGS, 2016).

The USGS National Earthquake Hazard Reduction Program has developed a series of maps that depict the estimated probability that certain levels of ground-shaking, expressed as acceleration due to gravity, will occur within a given period of time (http://www.nehrp.gov/). To make such estimations, the USGS takes into account the past seismic history of an area. The maps are used to create and update design provisions in building codes in the United States. We assessed the probability for ground-shaking during an earthquake to occur within the Rockaway API and Jamaica Bay API using these maps.

Both the Rockaway API and Jamaica Bay API are located in an area where the peak horizontal ground acceleration (PGA) is 4 percent of gravity or less with a 10 percent probability of exceedance in 50 years (USGS 2016 4% gravity 10% prob 50 years.pdf; based on USGS 2008 data). At a 10 percent probability, the frequency of exceedance (return time) for a given horizontal ground acceleration is once every 500 years. For reference, a PGA between 3.9-9.2 percent of gravity would result in very light potential damage and moderate perceived ground shaking. PGAs less than 3.9 percent of gravity would result in no potential damage and light perceived shaking, as shown in Table 4.1-1 (USGS, 2016).

Table 4.1-1. Approximate Relationship between MMI and PGA

MMI	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< .17	Not Felt	None
II	.17–1.4	Weak	None
III	.17–1.4	Weak	None
IV	1.4–3.9	Light	None
V	3.9–9.2	Moderate	Very Light
VI	9.2-18	Strong	Light
VII	18–34	Very Strong	Moderate
VIII	34–65	Severe	Moderate to Heavy
IX	65–124	Violent	Heavy
X	> 124	Extreme	Very Heavy
XI	> 124	Extreme	Very Heavy
XII	> 124	Extreme	Very Heavy

Based on the USGS National Seismic Hazard Map, both the Rockaway API and Jamaica Bay API are within the 4-5%g peak acceleration area (where %g is peak acceleration expressed as a percent of gravity) as depicted on Figure 4.1-17 (Seismic-Hazard Maps for the Conterminous

United States, 2014; http://pubs.usgs.gov/sim/3325/). Based on the USGS Simplified 2014 Hazard Map, this correlates to a lower hazard area, as depicted on Figure 4.1-18 (USGS, 2014; http://earthquake.usgs.gov/hazards/products/conterminous/2014/HazardMap2014_lg.jpg). Based on seismic activity from 1974-2014, earthquakes up to a magnitude 4.9 have occurred north of the API, as depicted on Figure 4.1-19 (USGS 2014, Central and Eastern U.S. Hazards and Seismic Map; http://earthquake.usgs.gov/hazards/products/urban/images/ceus-seis-haz.pdf).

Figure 4.1-17. Seismic Hazard Map for the Conterminous U.S., 2014

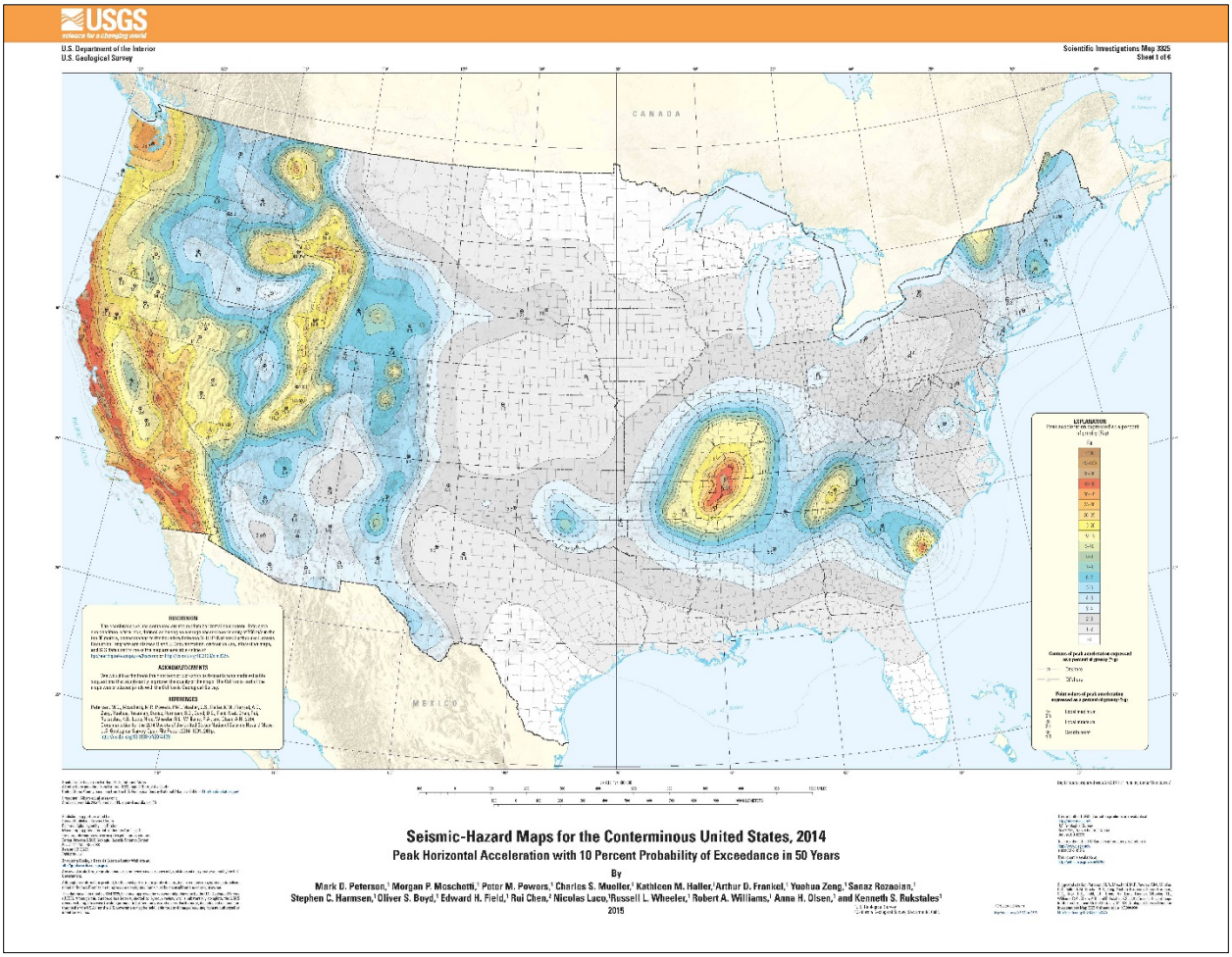


Figure 4.1-18. Simplified 2014 Hazard Map

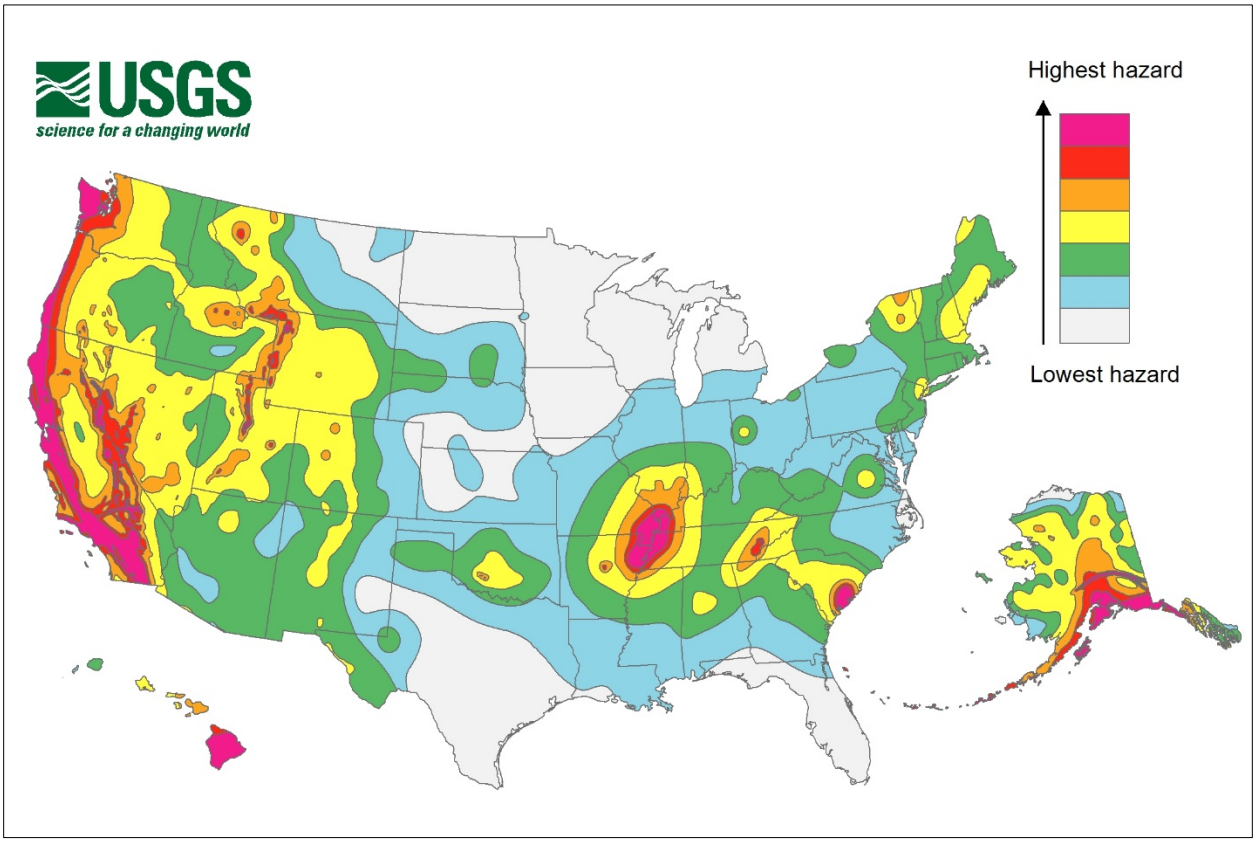


Figure 4.1-19. Central and Eastern U.S. Earthquake Locations (1974-2014)

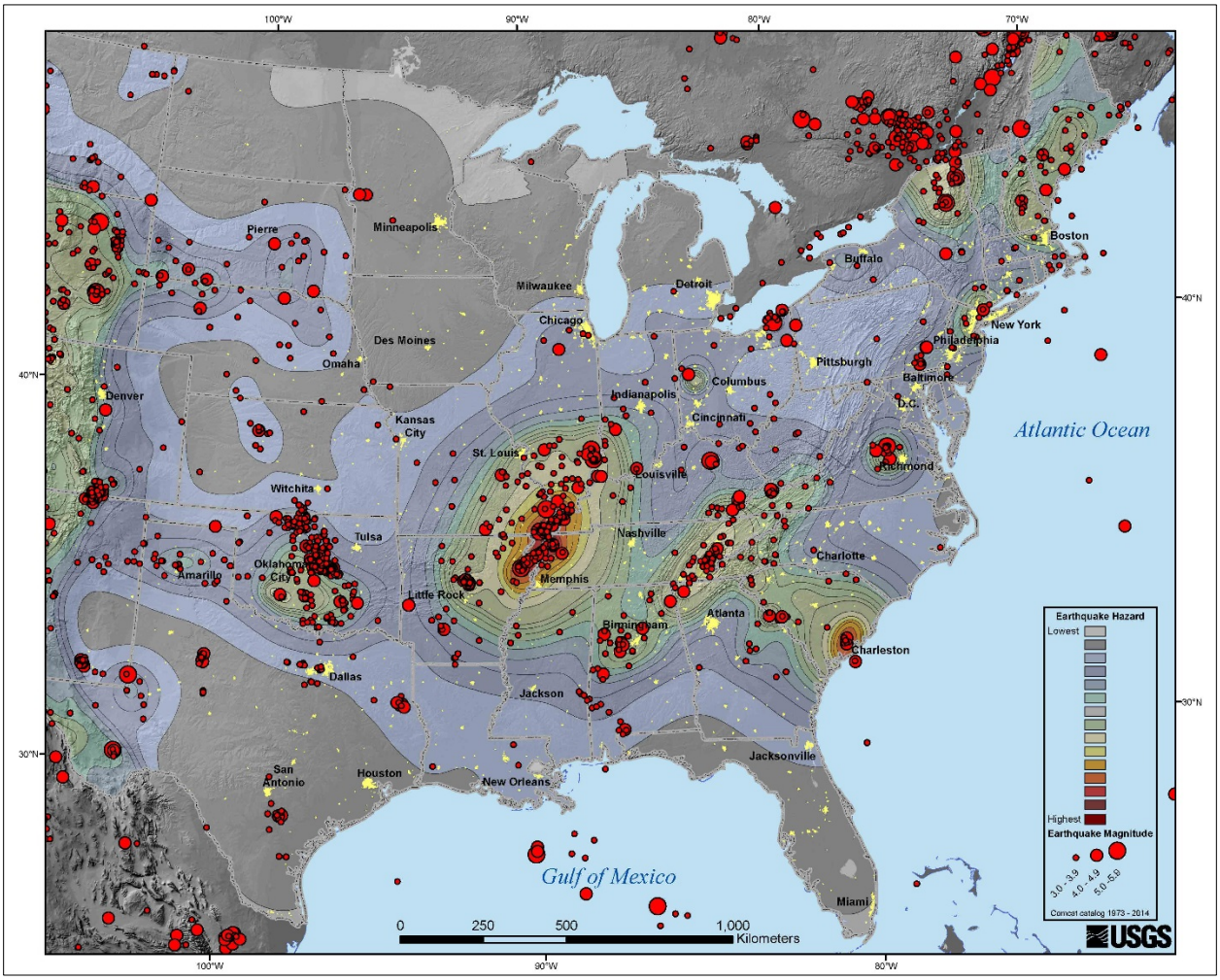
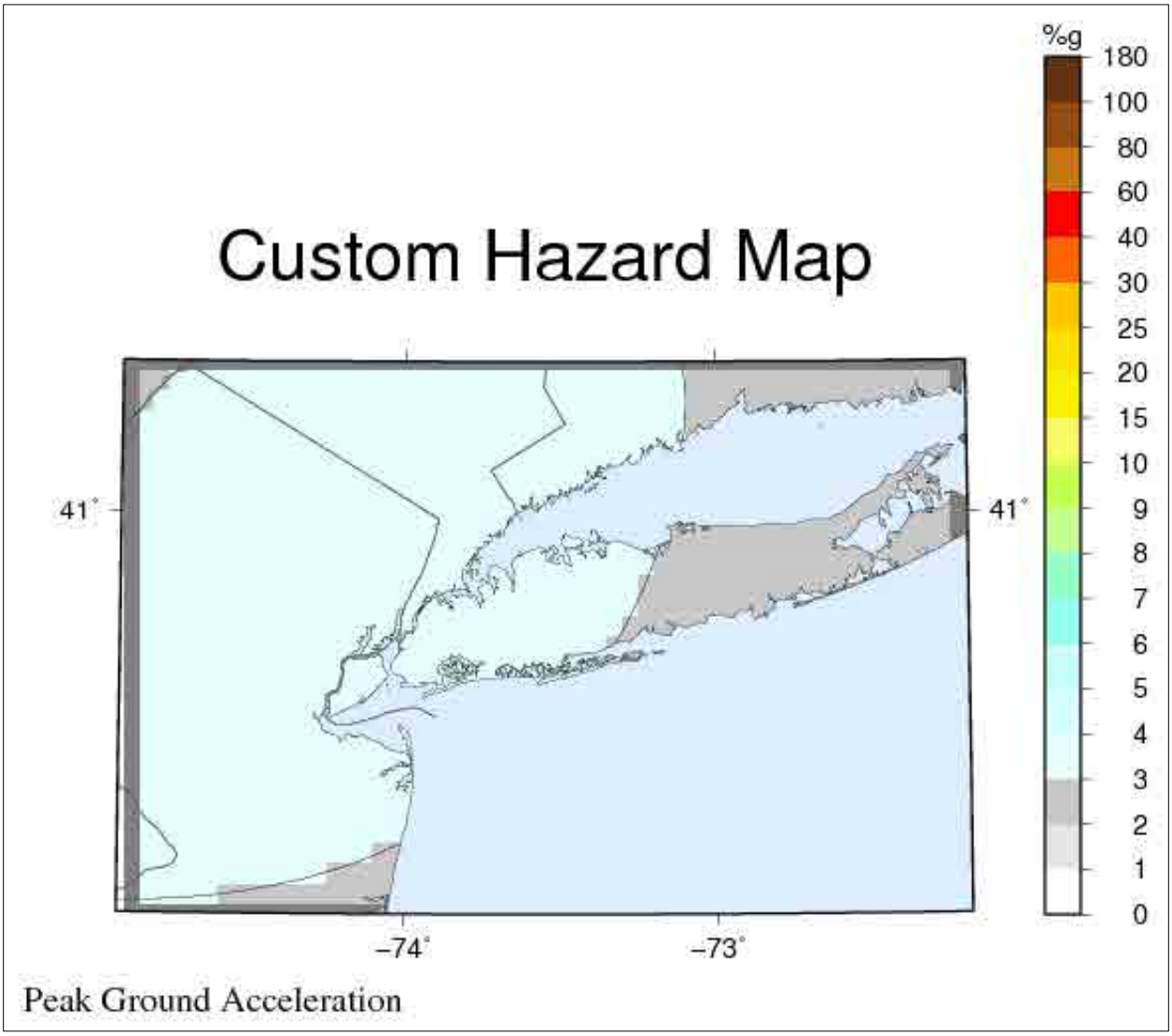


Figure 4.1-20. Peak Ground Acceleration



4.1.5 Bedrock Faults

A review of the USGS Quaternary Fault and Fold Database did not identify any active faults in the vicinity of the proposed Rockaway API or Jamaica Bay API. This database describes faults and associated folds in the United States that are believed to be sources of earthquakes greater than magnitude 6 in the past 1.6 million years (USGS, 2006).

As discussed above, earthquake hypocenters in the region are concentrated in older bedrock terrains buried beneath thick deposits of younger sediments of the coastal plain and post-glacial sediments. Evidence of faulting in these younger sediments is generally missing (Sykes et al., 2008).

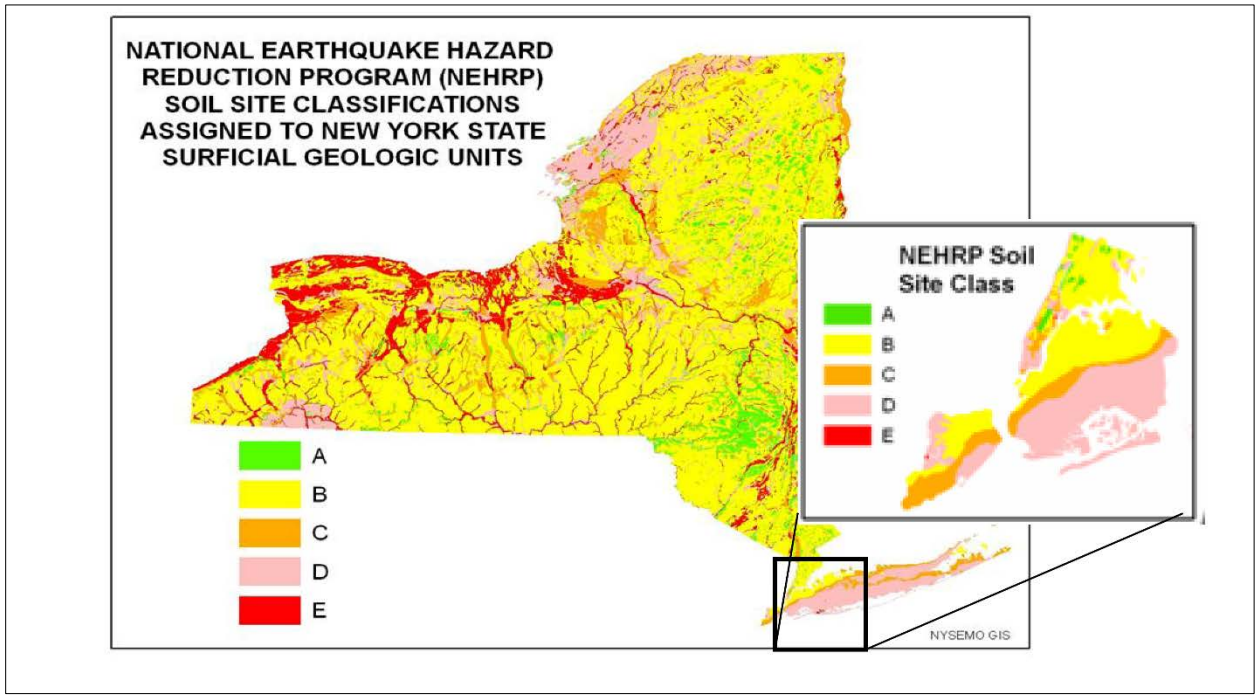
No bedrock faults within either API were identified on the USGS Fault Source Map, depicted in Figure 4.1-21 (USGS, 2014; http://earthquake.usgs.gov/hazards/qfaults/map/hazfault2014.html).

Figure 4.1-21. USGS 2014 Fault Line Map

Soil type can have an impact on the severity of an earthquake at a given location. Seismic waves propagate out from the earthquake epicenter and travel outward through the bedrock up into the soil layers. As the waves move into the soils, how stiff or soft the soil is affects the wave speed and velocity. Generally, in a stiff or hard soil, the wave will travel at a higher velocity. With soft soils, the wave will slow, traveling at lower velocities. With slower waves, the seismic energy is modified, resulting in waves with greater amplitude. This amplification results in greater earthquake damage.

The National Earthquake Hazard Reduction Program (NEHRP) soil-classification system describes how soils affect seismic waves. Class A soils (shown in green) tend to reduce ground motions, whereas Class E soils (shown in red) tend to further amplify and magnify seismic waves. As shown in Figure 4.1-22, the study area has a variety of NEHRP soil site classes ranging from hard rock to soft soil. Most of New York City is classified as Class B (rock) and Class D (soft to medium clays or sands) (NYCNHMP, 2009).

Figure 4.1-22. NEHRP Soil Site Classes



Reduces Ground Motion	
A	Very hard rock (e.g., granite, gneisses; and most of the Adirondack Mountains)
B	Rock (sedimentary) or firm ground
C	Stiff Clay
D	Soft to medium clays or sands
E	Soft soil (including fill, loose sand, waterfront, lake bed clays)
Amplifies Ground Motion	

(From NYCNHMP, 2009)

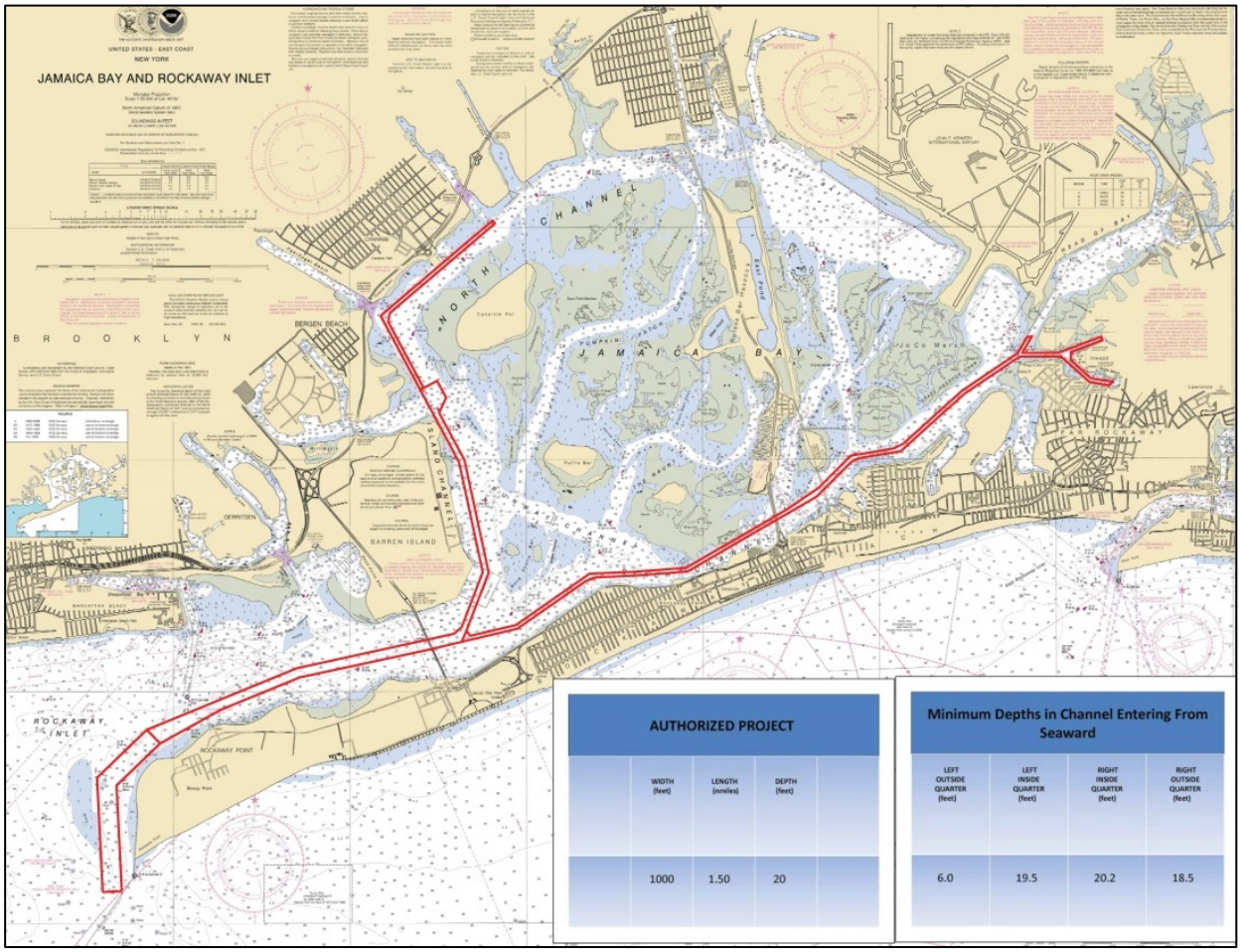
4.2 Sediments

4.2.1 Bathymetry

Jamaica Bay bathymetry and the anthropomorphic changes over time has been well documented (USACE 2010, Nordenson, et. al. 2014; Seavit et al. 2014). The mean depth of Jamaica Bay is approximately 13 feet with dredged channels reaching 30 to 50 feet deep (NYCDEP 2007). Dredging and filling of Jamaica Bay over the past century has significantly altered the bathymetry of Jamaica Bay. Currently, USACE only dredges the federally authorized and maintained Jamaica Bay Federal Channel in Rockaway Inlet approximately every two years. The Federal Channel is at the eastern entrance channel to Jamaica Bay and is dredged to an authorized depth of approximately 20 feet and width of 1000 feet. Figure 4.2-1 includes a map of the federal navigation projects within Jamaica Bay. The interior bay channels have an authorized depth of approximately 12 feet, however many of these channels are significantly deeper and

therefore, maintenance dredging is unnecessary. These navigational channels within the Bay are used by the NYCDEP sludge barges serving the municipal waste water treatment plants and dredging is infrequent due to the lack of sediment input from former tributaries and the narrow, modified morphology of the tributaries.

Figure 4.2-1. Jamaica Bay and Rockaway Inlet Federal Navigation Channels



Jamaica Bay also has numerous deep borrow pits. Borrow pits, exceeding forty feet in depth in some locations, are located at the bayside margins of both Floyd Bennett Field and JFK Airport.

Other borrow pits include the Norton Basin and Little Basin Borrow Pits; as well as offshore borrow areas that include East Rockaway Inlet Rockaway Emergency Contract 1C Borrow Area, and USACE Borrow Areas A-West and A-East. Dredge material from these pits served to fill low lying land and support airport construction at both sites. However due to the lack of sediment input from former tributaries and the sheltered nature of the Bay, these borrow pits have not silted in over time.

Historic dredging has increased the overall water volume within Jamaica Bay (NYCDEP 2007), and has had consequences on both the rate of flushing and sediment budget (NYCDEP 2007). The rate of flushing for an urbanized estuary is critical factor to consider as it reduces concentrations of pollutants and raises valuable oxygen levels (NPS 2015). In addition, the historic filling operations, hardening of shorelines, and eradication of natural habitats have also altered historic flow patterns and flushing time within the Bay. The effect of this historic dredging is discussed below.

4.2.2 Sediments Transport and Quality

With respect to sediments within the Atlantic Shoreline project area, sediment modelling was completed to support the Erosion Control Alternative Analysis (USACE 2015). A seven-cell sediment budget was completed for without project condition based upon historical data and anticipated SLC. The net annual longshore sediment transport rates are similar to historical conditions, and increase from east to west along Rockaway Beach peaking in Reach 3. The steady increase in net annual longshore transport rate creates a sediment deficit in Reaches 3, 4, 5, and 6a. The overall trend in longshore sediment transport is driven by the alongshore variability in the wave conditions. shows the alongshore variability in the net annual longshore sediment transport problems. The primary difference between the without project condition and historical conditions sediment budgets is that there is no beach fill in the without project condition to offset the sediment deficit created by the overarching trend longshore sediment transport. Note that a total 15.6 million cubic yards of beachfill were placed along Rockaway Beach from 1975-2010.Table 4.2-2. Seven Cell Without Project Future Conditions Sediment Budget Shoreline Changes shows the corresponding shoreline change rates based on the seven-cell without project condition sediment budget. The most striking cell is Reach 4, which is predicted to erode by 17.5 ft/yr. This erosion hotspot is caused by 1) overarching trend in longshore sediment transport along eastern Rockaway Beach, 2) sediment impoundment of updrift groin field in Reach 5.

Figure 4.2-2. Sediment Transport Pathways at Rockaway Beach (USACE 2015)

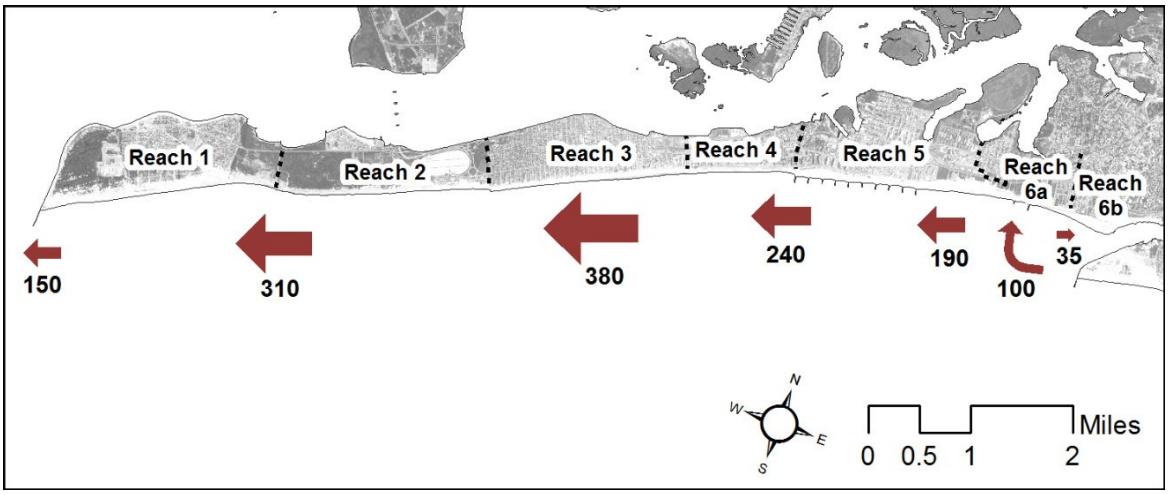


Table 4.2-1. Seven Cell Without Project Future Conditions Sediment Budget Shoreline Changes

Reach	Shoreline Change (ft/yr)
1	+9
2	+4.4
3	-3.2
4	-17.5
5	-3.8
6a	-5.3
6b	+9.4

With respect to sediments within the Bay project area, movement is restricted due to the narrow restriction of Rockaway Inlet and little to no sediment input from the watershed (due to the urbanized land uses). At the entrance to Rockaway Inlet, the prevailing currents slow as they enter the mouth of the Bay and turn to the east to again slow. This continual slowing of water movement reduces sediment transport throughout the Bay project area. Consequently, sediments at the mouth of the Bay are primarily coarse sands and the remainder of the Bay is finer silt sediments.

Historically, prior to pollution regulations, large quantities of chemicals, including heavy metals, pesticides, polychlorinated biphenyl (PCB), dichlorodiphenyltrichloroethane (DDT), and dioxin, were discharged into waters of Jamaica Bay. Contaminations adhere to organic compounds and settle into sediments; now found to exceed acceptable levels throughout the Bay (Steinberg et al. 2004). In addition to these “legacy” chemicals, chemicals from modern sources (i.e, Wastewater Treatment Plants [WWTPs] discharges, combined sewer overflows [CSOs], non-point source discharges, chemical and oil spills) are also known to adversely affect Bay sediments.

Many of these chemicals, which are readily absorbed in the fat cells of animals, can accumulate to dangerous levels. Currently, all regions of the Hudson-Raritan Estuary (HRE), including Jamaica Bay, have consumption advisories in some fish and shellfish species (NYSDOH 2016, NJDEP 2013). Moreover, the recent rates of decline in contaminants will be difficult to match in the future since current non-point sources of these chemicals and metals (e.g., overland runoff, atmospheric deposition) will not be as easy to control as point sources (Steinberg et al. 2004).

4.3 Surface Water

Jamaica Bay's watershed and surface waters are well documented (USACE 2010, NYCDEP 2007), and are dominated by the 36-square mile water body which historically captured water and sediment from a watershed approximately 142 square miles. Eight natural tributaries remain and which discharge directly into Jamaica Bay: Sheepshead Bay, Paerdegat Basin, Fresh Creek, Hendrix Creek, Spring Creek, Shellbank Basin, Bergen Basin, and Thurston Basin.

Jamaica Bay has been greatly influenced by the anthropogenic activities to the extent that tributaries in the traditional sense, now consist of receiving basins, sewersheds, and canals. The sources of water in Jamaica Bay are the WWTPs, CSOs, storm sewers, groundwater, precipitation, and tidal exchange through Rockaway Inlet. The most important hydrologic input to the bay remains the semidiurnal tides. However, contributions from natural tributaries, now mostly filled or diverted by urbanized development, have been replaced in importance through outflows from WWTPs, CSOs, and stormwater runoff and which will be discussed further below.

The mean tidal range along the Atlantic Shorefront project area is 4.5 feet (ft) and the spring tidal range reaches 5.4 ft. The Mean High Water (MHW) level and Mean Low Water (MLW) level relative to NAVD88 are +1.5 ft and - 3.0 ft, respectively for the Atlantic Coast of the Island. With respect to the Bay, the MHW level and MLW level relative to NAVD88 within the Bay are +2.4 and -3.07 respectively. Tidal elevations are further discussed in MFR 2 (Arcadis 2015b).

4.3.1 Water Levels

For the purposes of the Reformulation Study, major storms have been identified to be those which produce surge tide and wave conditions similar to the 100-year base flood elevation (BFE), as defined by Federal Emergency Management Agency (FEMA), with additional consideration of projected sea-level change (SLC). FEMA recently released Preliminary Flood Insurance Rate Maps (FIRMs) in the New York City portion of the study area, which included consideration of stillwater elevations and wave conditions. Though these maps are not yet the effective FIRMs in New York City, they are believed to be the best available information for defining 100-year flood elevations. The portions of the study area in Nassau County were assessed using the Nassau County 2009 Flood Insurance Study (FIS) 100-year effective BFE data. These data were released in 2009 by FEMA (FEMA 2009) and include consideration of still water levels and wave action throughout Nassau County. Figure 4 shows the preliminary FIRMs for New York City and the effective BFEs in Nassau County.

Note that, in subsequent phases of the Reformulation Study, major storms may be defined as flood elevations which are different than the 100-year elevation defined by FEMA. The final determination of major storms will be reach-dependent and informed by economic analysis. For purposes of the Reformulation Study to date, the FEMA 100-year elevations are used as baseline data to define risks in the study area.

SLC was considered in the preliminary screening based on the guidance in the most recent Engineer Regulation (ER) 1100-2-8162 (USACE 2013e), which is the successor to Engineer Circular (EC) 1165-2-212 (USACE 2011). Per ER 1100-2-8162:

Planning studies and engineering designs over the project life cycle, for both existing and proposed projects, will consider alternatives that are formulated and evaluated for the entire range of possible future rates of SLC, represented here by three scenarios of "low," "intermediate," and "high" SLC. These alternatives will include structural, nonstructural, nature based or natural solutions, or combinations of these solutions. Alternatives should be evaluated using "low," "intermediate," and "high" rates of future SLC for both "with" and "without" project conditions.

ER 1100-2-8162 considers the historic rate of SLC as the low rate. The intermediate and high rates are computed from the modified National Research Council (NRC) Curve I and III respectively, considering both the most recent Intergovernmental Panel on Climate Change (IPCC) projections and modified NRC projections with the local rate of vertical land movement added.

For the purposes of the Reformulation Study, the year of construction is assumed to be 2020, with a design life of 50 years. Figure X illustrates the USACE SLC curves for 2010 to 2100 at The Battery, New York (NY). The intermediate SLC rate is considered for this phase of the study. Hence, a SLC of 1.3 feet in 2070, as compared to the 1992 sea level values, or slightly greater than one foot as compared to the 2014 sea level value, is added to the FEMA preliminary FIRM 100-year elevations to define future risk levels.

With the addition of SLC to the current floodplain, the floodplain for the region expands in area and depth. Regions currently in the floodplain are at risk of higher flood depths during storm events (e.g., a BFE of 13 feet can become a BFE of 14 feet). Similarly, the floodplain will extend further inland, increasing the number of assets at risk of flooding. Water surface elevations were examined in the modeling described in MFR #7 (Arcadis 2015x). The ADCIRC model developed as part of the USACE North Atlantic Coast Comprehensive Study (NACCS) was the basis of the model setup for this analysis. Model simulations were completed with tidal forcing only (e.g., local winds were not imposed) for a 53 day period from June 13 through August 5, 2013.

4.3.2 Tidal Currents

With respect to the Atlantic Shoreline, tidal currents are generally weak. Currents at Jones Inlet and East Rockaway Inlet have respective average maximum velocities of 3.1 and 2.3 knots at flood tide, and 2.6 and 2.2 knots at ebb tides.

Rockaway Inlet is the only tidal inlet to Jamaica Bay with high currents at its narrowest point which is 0.63 miles with an average depth of 23 feet (USFWS 1997). At the entrance to Rockaway Inlet, the prevailing currents slow as they enter the mouth of the Bay and turn to the east and again slow which significantly reducing tidal exchange. Tides in Jamaica Bay are semi-diurnal and average 5 feet. Dredging has deepened the mean depth of the bay from approximately 3 feet in the past to 13 feet now, which has increased the residence time of water from 11 days to an average of 33 days but varying by depth and location (USFWS 1997). The maximum tidal current speeds in North Channel at Canarsie Pier are 0.5 knots (0.84 ft/s) flood and 0.7 knots (0.84 ft/s) ebb (USACE 2005). MFR 7 presented USGS observations of flow speeds at the USGS Rockaway Inlet gage that are generally 1.0 knots or less during neap tide periods and 1.7 knots or less during spring tide periods. Tidal currents and exchange within Jamaica Bay have been modeled as part of this Reformulation Study, and are discussed in detail in MFR 7 (Arcadis 2016b).

4.3.3 Wind and Wave Climate

Wind speed/direction data for the Atlantic Shoreline project area were available from the US Naval Oceanographic Office (1970). Annual percent-occurrence statistics for wind direction/speed data were separated into eight direction bands as shown in Table 4.3-1. Annual Percentage of Wind Direction by Speed (USACE 2015)and previously presented as part of Atlantic Coast of Long Island Jones Inlet to East Rockaway Inlet Long Beach Island, New York Hurricane Sandy Limited Reevalation Report Volume 1. Main Report and Environmental Assessment (USACE 2015). As shown in, predominant wind directions along the Atlantic Shoreline are from the south, southwest, and west Table 4.3-1, which occur approximately 18, 16 and 17 percent of the time, respectively. Winds from the south and southeast contribute the most to littoral transport in the study area and account for nearly 26 percent of all wind occurrences. Wind speeds are typically less than 27 knots, accounting for approximately 95 percent of all observations. The dominant wind speed range is from 7 to 16 knots, which occurs nearly 49 percent of the time. Wind speeds exceeding 27 knots (strong breeze) are less frequent with a total occurrence percentage of approximately 5 percent.

Table 4.3-1. Annual Percentage of Wind Direction by Speed (USACE 2015)

Wind Speed		Direction									
Knots	Description	Ind.	North	NE	East	SE	South	SW	West	NW	Total
0-6	Calm	3.2	2.3	1.8	2.4	2.9	4.8	3.9	2.9	2.0	26.2
7-16	Gentle Breeze		4.1	4.1	4.2	4.2	9.7	8.8	7.9	5.8	48.8

17-27	Fresh Breeze		2.0	2.2	1.3	1.0	2.7	2.8	4.5	3.7	20.2
28-40	Strong Breeze		0.5	0.7	0.2	0.1	0.3	0.4	1.3	0.9	4.4
>40	Gale			0.1			0.0		0.1	0.1	0.3
Total		3.2	8.9	8.9	8.1	8.2	17.5	15.9	16.7	12.5	99.9

The direction of wave approach to the Atlantic Shoreline project area is primarily from the south and southeast. For the Atlantic Coast of Long Island Jones Inlet to East Rockaway Inlet Long Beach Island Project, a wave height-frequency curve was developed to obtain storm wave conditions (USACE 1995). Breaking wave heights were calculated for the 10, 25, 50, 100 and 500-year return periods. The results of these calculations indicate that the deep-water wave height for a storm having a 100-year return period would be 21 ft. (USACE 2015).

Wind speed/direction data for the Bay project area were available from recorded wind data at the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) for JFK Airport. Data is available beginning in the early half of the 20th century to the present. Based on the wind speed-direction occurrence, normal winds are predominantly from south clockwise to northwest quadrant, with stronger winds predominantly from west and northwest. The mean speed and peak gusts over the time period available, is presented in Table 4.3-1. Average monthly wind speeds range from 10 to 14 mph and the maximum wind gust reached 71 mph and peak wind gusts from 47 to 71 mph with a prevailing direction from south.

Due to the length and orientation of Rockaway Inlet, the Bay project area is largely sheltered from ocean waves. The majority of waves in the bay are locally generated due to wind/water surface interaction or produced by vessels navigating the interior channels. The wind climate varies from calm and light to potentially dangerous winds of a winter nor'easter or a late summer hurricane. The wind, waves, and currents have significant bearing on the sustainability of the marsh within the bay. To varying degrees, the stability of the vegetative cover and the conservation of sediment depend on these coastal processes. The wave climate may be considerably different from year to year, resulting in very different erosion rates from year to year.

4.3.4 Tributaries

4.3.5 Water Quality

For the Atlantic Shoreline Project Area, water quality is influenced by ebbing waters from East Rockaway Inlet to the east and from semi-diurnal tidal fluctuations characteristic of the Atlantic coast. Three miles of the Atlantic coastline along New York State are subject to shellfish water quality impairments from combined sewer overflows (NYSDEC 1998). However, the affected area is situated well outside the Project Area, along the westernmost portion of Long Island where Lower New York Bay meets the Atlantic Ocean.

Recent water quality data collected from coastal stations at Far Rockaway and Atlantic Beach, as part of the USEPA helicopter-monitoring program, show that overall bacteriological water quality is very good. Geometric mean densities (1989 through 1998) of fecal coliform and enterococci are well below acceptable federal guidelines for primary contact recreational uses (USEPA 1999b). In addition, the New York City and Nassau County Public Health Departments report good overall water quality in the Project Area (Jacobs 1999, Luke 1999).

With respect to the Bay project area, the bay continues to be threatened by poor water quality. Almost the entire watershed is urbanized such that the bay receives pollution from point and non-point sources around the bay, such as the CSOs, runoff from the roads and the airport, leachate from landfills, windblown trash, and other sources. Specifically, 240–340 million gallons per day of treated sewage effluent flow into Jamaica Bay from four WWTPs (GNRA 2013). This continues to be a major source of pollution, including treatment byproducts such as chlorine, and heavy metals and other contaminants that are not eliminated by water treatment facilities (NPCA 2007a). In addition, large rain events can overwhelm the sewer system capacity, resulting in untreated wastewater and raw sewage. Other sources within the Bay include landfill leaching, runoff from JFK Airport, as well as atmospheric deposition (NPCA 2007, USACE and PA 2009).

The water quality in Jamaica Bay has been extensively studied and characterized, as it is a critical component to the Jamaica Bay Watershed Protection Plan (NYCDEP 2007). While nitrogen and phosphorus are characteristically limiting nutrients in estuarine ecosystems, their quantities within Jamaica Bay are exaggerated by WWTP inputs. As such, nutrient loading can lead to eutrophication. High nitrogen levels can also decrease root production in salt marsh plants, and in turn decrease their ability to accumulate organic material and hold sediments within tidal marshes. High nitrogen levels also increase microbial decomposition, reducing the accumulation of organic matter and limiting the ability of saltmarshes to maintain an elevation that keeps pace with sea level change (SLC) (Rafferty, Castagna, and Adamo 2010).

High nutrient levels are also a major contributor to low DO levels in Jamaica Bay. DO ranges from 3.5 to 18.5 milligrams per liter (mg/L), sometimes falling below the 5.0 mg/L threshold specified by state water quality standards for waters suitable for recreation and fishing. Long periods of low DO can harm or kill larval fish and shellfish, and lead to odor problems from production of H2S gas in oxygen-deficient sediments. High concentrations of DO in the water column can also indicate poor water quality, and typically occur when algal blooms near the surface create very high to supersaturated DO concentrations as a byproduct of photosynthesis. While there is high year-to-year variability in measured DO concentrations, long-term monitoring suggests DO levels are trending toward improvement (NYCDEP 2007).

The NYSDEC assigns classifications to all of the waterbodies within its jurisdiction. These classifications are assigned such that “the discharge of sewage, industrial waste or other wastes shall not cause impairment of the best usages of the receiving water as specified by the water classification at the location of the discharge and at other locations that may be affected by such

discharge." Three of the classifications developed by NYSDEC apply to waters within Jamaica Bay: Class SB, Class SC and Class 1.

- Class SB – includes the open waters of Jamaica Bay, Shellbank Creek, Gerritsen Creek, Mills Basin, and East Basin (NYSDEC 2011). The best usages of Class SB waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish and wildlife propagation and survival.

- Class SC – Motts Basin (NYSDEC 2011). The best usage of Class SC waters is fishing. These waters shall be suitable for fish, shellfish and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

- Class 1 - Hendrix Street Canal, Fresh Creek, Hendrix Creek, Spring Creek, Paerdegat Basin, Bergen Basin, Sheepshead Basin, and Thurston Basin (NYCDEC 2011). Impairment is due to nitrogen levels, oxygen demand, and presence of pathogens. The best usages of Class I waters are secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. In addition, the water quality shall be suitable for primary contact recreation, although other factors may limit the use for this purpose.

4.4 Geomorphology

4.5 Air Quality

4.6 Groundwater Resources

4.6.1 Regulatory Overview

Safe Drinking Water Act and Clean Water Act. 40 CFR 149 of the Safe Drinking Water Act deals with Environmental Protection Agency regulations on sole source aquifers. 40 CFR 133 of the Clean Water Act deals with the secondary treatment regulations and 1977 amendments of the Clean Water Act deal with conventional pollutants and nonconventional pollutants. In this instance conventional pollutants (i.e. Sec 304.(a) (4)) deals with conventional pollutants such as biological oxygen demand, suspended solids, fecal coliform, and pH levels. Groundwater is regulated under various New York State Department of Environmental Conservation and New York City Department of Environmental Protection statutes and requirements, including but not limited to New York State Department of Environmental Conservation Part 701: Classifications-Surface Waters and Groundwaters, New York Environmental Conservation Law §15-1528 and the New York State Water Well Driller Registration Law.

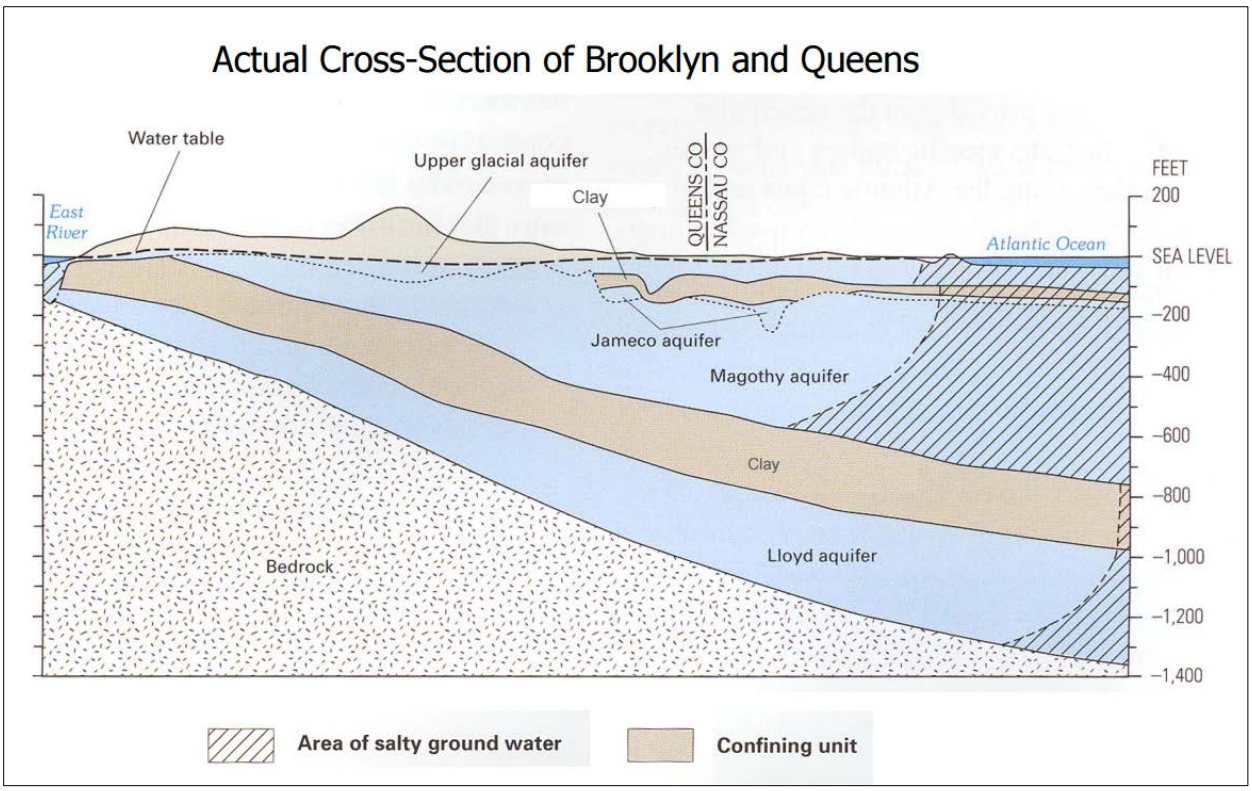
4.6.2 Hydrology (Physical Characteristics of Groundwater Underlying the API's)

The Rockaway API and Jamaica Bay API are located within the Atlantic Coastal Plain Physiographic Province of the U.S. and includes geological deposits and regional aquifers that are bounded to the south by the Atlantic Ocean and the north by Long Island Sound (Cartwright, 2002; NYSDEC, 2016, http://www.dec.ny.gov/lands/36183.html; USGS, 2016, State of the

Aquifer, http://ny.water.usgs.gov/projects/SOTA/index.html). The Raritan Formation, consisting of the Lloyd Sand Member and an unnamed clay member, directly overlies the igneous and metamorphic bedrock. Overlying the Raritan Formation is the Magothy Formation and Matawan Group (undifferentiated), the Jameco Gravel, the Gardiners Clay, and upper Pleistocene deposits. Rockaway Peninsula and Coney Island consist of Holocene fluvial deposits (Cartwright, 2002).

There are four relevant water bearing formations on Long Island: The Upper Glacial, Jameco, Magothy, and Lloyd aquifers (Cartwright, 2002) (Figure 4.6-1). Each of the aquifers located in Queens County are of high transmissivity (except where they thin or pinch out), with hydraulic conductivity values ranging from approximately 20 – 300 feet/minute (ft/min). Using the unit thicknesses below Jamaica Bay, wells completed in the Jameco, Magothy, and Llyod aquifers are expected to have specific capacities ranging from 44 - 135 gallons per minute per foot (gpm/ft) of drawdown (Misut and Monti 1999).

Figure 4.6-1. Aquifers within the APIs



Source: http://www.nyc.gov/html/dep/pdf/gwsaquifer.pdf

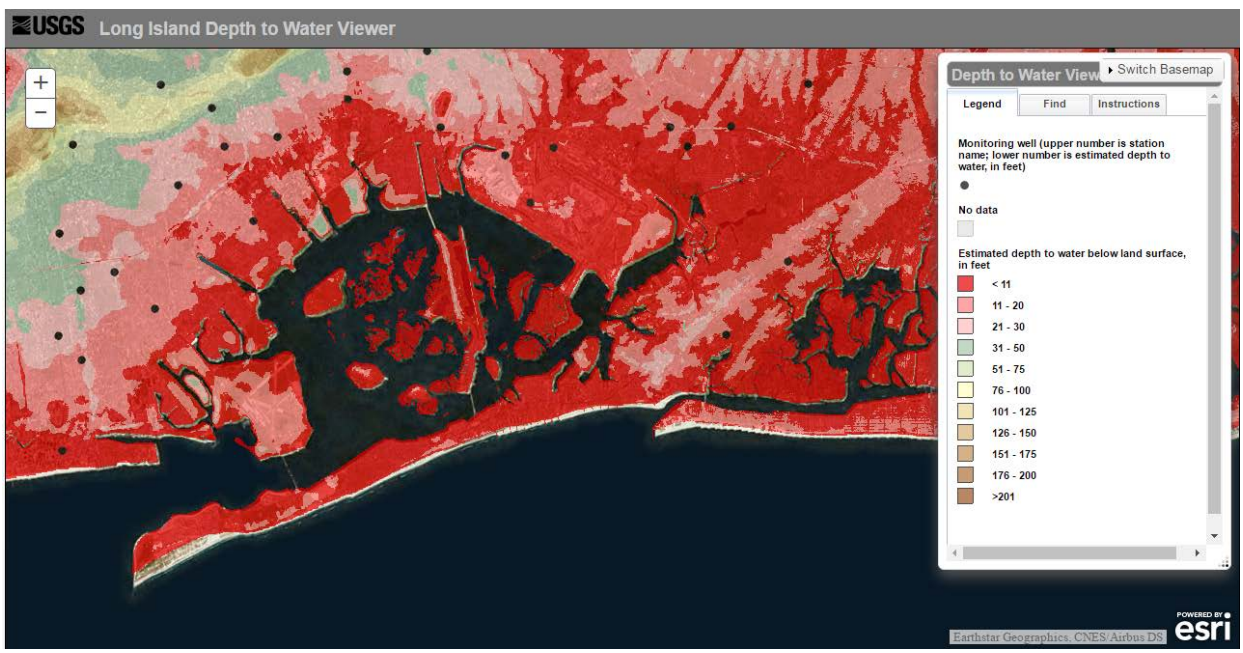
The upper Pleistocene glacial deposits represent the uppermost water-bearing unit and are in contact with saline surface water; therefore, they do not represent a reliable source of freshwater. This conclusion is supported by the U.S. Geological Survey (2002), Barlow (2003, in USGS (n.d.) and NYCDEP 2015).

The combined Jameco-Magothy aquifer is reported to be confined to semi-confined below Jamaica Bay; however, chloride concentrations are reported to exceed approximately 3,000 milligrams per liter (mg/L) immediately adjacent to Jamaica Bay on all sides, indicating that a saltwater wedge exists in this aquifer below West Pond. This aquifer is the largest of the formations and holds the most water, much of which is hundreds of years old. Coarse sand and gravel within this formation enhances its water bearing capabilities.

Groundwater in the Lloyd aquifer underlying Jamaica Bay and as far south as Rockaway Island has a low salinity (chloride concentrations of 120 mg/L (0.12 g/L) (or less) and nitrate ranging from below the limit of detection to 0.72 mg/L (Cartwright, 2002). The relatively low salinity in the Lloyd aquifer underlying Jamaica Bay is supported by the position of the saltwater wedge. The Lloyd aquifer is made of fine to coarse quartzose sand and gravel interbedded with layers of clay and contains the oldest water, some of which has been in the aquifer system for more than 5,000 years.

Depth to groundwater in both the Rockaway API and Jamaica Bay API range from less than 11 feet to 20 feet below ground surface, as depicted on Figure 4.6-2 (USGS, 2016, Long Island Depth to Water Viewer, http://ny.water.usgs.gov/maps/li-dtw10/).

Figure 4.6-2. Estimated Depth to Groundwater



4.6.2.1 Contaminated Groundwater

Groundwater quality in Kings and Queens Counties, New York is deteriorated due to the lowering of groundwater levels and other factors associated with urbanization and development. In addition to the encroachment of salt water from the surrounding tidewater in response to

excessive drawdown, other sources of contamination include road salts, leaking sewers, and toxic spills at the land surface (US EPA, 1983). The portion of the Upper Glacial aquifer underlying the Rockaway Peninsula has historically been subject to saltwater intrusion (Buxton and Shernoff, 1999). This has resulted in high levels of chloride in the groundwater, particularly in nearshore areas. Chloride contamination can also be attributed to inland surface sources, especially in northwest Queens County, where saltwater intrusion is unlikely. High concentrations of nitrate in groundwater indicate contamination from surface sources, such as fertilizers, landfills, leachate from cesspools and septic tanks, and leaky sewer lines (US EPA, 1983).

As part of the Transco Rockaway Pipeline EIS (FERC, 2014), groundwater samples collected from one existing and five new groundwater monitoring wells near Floyd Bennett Field were analyzed for VOCs, PAHs, PCBs, priority pollutant metals, and mercury (FERC, 2014). None of these compounds were detected at concentrations above the NYSDEC's Technical and Operational Guidance (TOGS) thresholds for the GA Water Classification (i.e., source of drinking water (groundwater)). NYSDEC's TOG Series 1.1.1 for Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations outline measures of purity or quality of groundwater in relation to its reasonable or necessary use.

4.6.3 Sole Source Aquifers

The EPA defines a sole or principal source aquifer (SSA) as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. EPA guidelines require that SSAs can have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend upon the aquifer for drinking water (US EPA, 2010). The NYSDEC believes that all of the Primary Water Supply Aquifers in New York State would qualify for designation as Sole Source Aquifers (http://www.dec.ny.gov/lands/36151.html). However, there is no direct technical relationship between the designation of "Sole Source" aquifers and Primary and Principal Aquifers.

There are no NYSDEC-designated Principal aquifers in the Rockaway or Jamaica Bay APIs (http://www.dec.ny.gov/docs/water_pdf/primary.pdf). However, it appears the NYSDEC has designated all of the aquifers underlying Long Island as Primary aquifers (http://www.dec.ny.gov/lands/36183.html).

The portion of the Long Island aquifer system underlying the Rockaway API is not currently used as a public source of drinking water. As part of the Water for the Future Program, a number of projects are being implemented to supplement New York City's water supply, including reactivation of the groundwater supply system in southeastern Queens County. Completion of the upgrades and repairs, and subsequent start-up of the groundwater supply system, is required to be finished before 2020 (NYCDEP, 2011a). The recharge zone for this system, which includes all of Kings and Queens Counties, is designated as the Brooklyn Queens SSA (EPA, 2016;

http://www.dec.ny.gov/docs/water_pdf/ssa.pdf; https://www.epa.gov/dwssa/map-sole-source-aquifer-locations).

4.6.4 Municipal Drinking Water Use Within the APIs

4.6.4.1 Rockaway

The New York City Department of Environmental Protection provides potable water throughout the Rockaway API. The following information regarding the potable water distribution system is from the New York City 2015 Drinking Water Supply and Quality Report published by the NYC Environmental Protection (http://www.nyc.gov/html/dep/pdf/wsstate15.pdf).

The New York City Water Supply System provides approximately one billion gallons of safe drinking water daily to more than 8.5 million residents throughout the New York City Distribution Area, including Queens County, as depicted on Figure 4.6-3. In all, the New York City Water Supply System provides nearly half the population of New York State with high-quality drinking water.

New York City's surface water is supplied from a network of 19 reservoirs and three controlled lakes in a nearly 2,000-squaremile watershed, roughly the size of the State of Delaware, which extends 125 miles north and west of New York City. The New York City Water Supply System, Public Water System Identification Number (PWSID) NY7003493, consists of three individual water supplies: the Catskill/Delaware supply, located in Delaware, Greene, Schoharie, Sullivan, and Ulster Counties; the Croton supply, New York City's original upstate supply, in Putnam, Westchester, and Dutchess Counties; and a groundwater supply in southeastern Queens.

In 2015, New York City received a blend of drinking water from the Catskill/Delaware and Croton supplies, with the Catskill/Delaware supplying approximately 94 percent of the water, and approximately 6 percent supplied by Croton. Water from the groundwater supply was not fed into distribution in 2015.

The Catskill-Delaware supply is treated at the Catskill-Delaware Ultraviolet Water Treatment Facility which came online in October 2013. In May 2015, the Croton filtration plant was commissioned and provides another source of drinking water to the City's residents. The Croton Watershed supplies the filtration plant with an average of 100 million gallons per day and the new plant can treat up to 290 million gallons per day. The New York City Department of Environmental Protection disinfects its water with ultraviolet light (UV) and chlorine (elemental or sodium hypochlorite) as a secondary disinfectant. UV treatment is a disinfection process that works by passing the water by special lamps that emit UV light, which can inactivate harmful microorganisms. Chlorine is a common disinfectant added to kill germs and stop bacteria from growing on pipes. The water is also treated with food grade phosphoric acid, sodium hydroxide, and low level of fluoride. The treatment measures that provide water safe for public consumption also render the water unsafe for aquatic use, particularly chlorine.

Between 1887 and 1996, the privately owned Jamaica Water Supply Company (JWS) operated a group of wells that served the communities of southeastern Queens and portions of Nassau County (NYCDEP, 2016, http://www.nyc.gov/html/dep/html/drinking_water/groundwater.shtml#geology). In 1996, New York City purchased the Queens portion of the JWS and took responsibility for the delivery of drinking water to those communities served by the groundwater wells. After acquiring the JWS wells, the NYCDEP renamed the group of wells the Groundwater Supply System. Located in southeastern Queens, the groundwater supply system consists of 68 supply wells at 44 well stations and several water storage tanks. Most of the system has not operated in more than 12 years, but the groundwater system did provide water to a limited portion of the city's distribution system in Queens until 2007. When online, residents within the service area received groundwater or a mix of ground and surface waters depending on demand and supply availability.

Figure 4.6-3. New York City Water System Service Area

4.6.4.2 Jamaica Bay

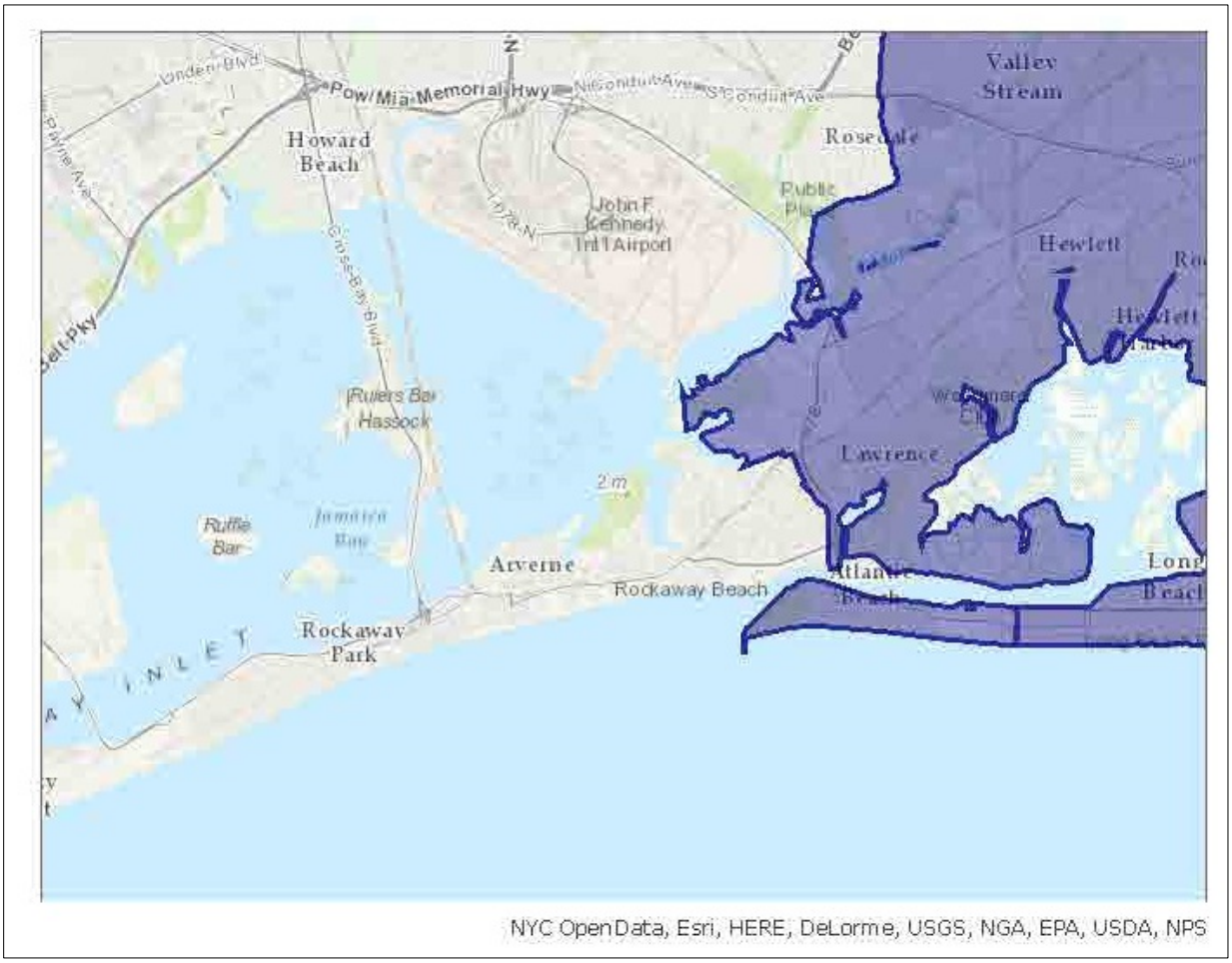
Portions of the Jamaica Bay API are located in Kings County, Queens County, and Nassau County. The portions located in Kings and Queens Counties receive potable water supplied by the New York City Water Supply System, as previously described for the Rockaway API.

However, the eastern portion of the Jamaica Bay API that is located in southwestern Nassau County, as depicted in Figure 4.6-4 (USGS, 2016, Long Island Water District, http://ny.water.usgs.gov/projects/SOTA/interactive.html), receives potable water supplied by Long Island American Water, a wholly owned subsidiary of American Water (Long Island American Water, 2016). Long Island America Water serves approximately 220,000 people in the majority of southwestern Nassau County. In 2011, the most recent year available, the total average household use was approximately 102,140 gallons of water per day.

Groundwater is the source of the drinking water supply (Long Island American Water, 2016). It is drawn from 162 wells located in the aquifer system beneath the land surface throughout southwestern Nassau County. The aquifers are water-bearing geologic deposits of sand and clay that absorb and store about 45 percent of the rain and snow that fall on Long Island. Long Island American Water has wells in the Upper Glacial, Jameco, Magothy, and Lloyd aquifers. The wells range in depth from about 30 feet to 1,100 feet, averaging 500 feet. Not all wells are operating at the same time, which means that the provided water is a blend of treated water from different well locations (an integrated system).

Soils in this area have a naturally high iron and mineral content. The water dissolves these naturally occurring minerals, and while they are not health hazards, they can cause discolored water. Bacteriological pollutants are not usually present in wells at the average depth of 500 feet and, consequently, water directly from the well is drinkable. However, water treatment is required to protect the water in the distribution system and to minimize discolored water conditions. Treatment consists of chlorination, pH adjustment (lime), filtration, sodium silicate to stabilize (sequester) iron not removed by filtration, and air strippers to remove volatile organics at one location (not specified).

Figure 4.6-4. Long Island American Water Service Area within the Jamaica Bay API



Note: Purple shaded area receives water from Long Island American Water.

Source: USGS Long Island Water District Map (http://ny.water.usgs.gov/projects/SOTA/interactive.html)

4.7 Aquatic And Terrestrial Environments

Coastal communities within both project areas generally occur along an ecological continuum dependent upon tidal influence, and described further in MFR 8. The critical tidal elevations that help define these habitats include mean lower low water (MLLW), MHW, and mean higher high water (MHHW) as discussed in Section 3.2.4). More localized benchmarks are discussed in detail in MFR 7.

Initial impact assessments as described in MFR 8 is based upon the classification of twelve distinct habitat types that were identified and mapped throughout the project areas. They represent the range of conditions and habitat quality observed throughout Jamaica Bay, including both native habitats and those resulting from long-term anthropogenic disturbances. Specifically, the Shoreline project area consists of oceanfront beach habitat with isolated dune

habitats. Most of the project area is devoid of vegetation and is significantly impacted from human use of the area for recreational activities and significant development that abuts the upper beach zone in most of the Project area. The Bay Project area consists of all twelve habitat types, and is one of the most diverse estuaries remaining in the HRE. While many native communities can be found through Jamaica Bay, it is also characterized by dense urban development that has altered and/or created new habitats indicative of the historic anthropogenic disturbance.

A brief habitat summary for each habitat type is provided below, and additional habitat and plant community descriptions can be referenced in MFR 2 & 8 (Arcadis 2015b and 2016c).

4.7.1 Subtidal Bottom

Subtidal bottom are all open water areas below the mean low low water (MLLW) line (i.e., -3.1' North American Vertical Datum of 1998 [NAVD 88]). This habitat type represents a significant area throughout Jamaica Bay, as well as a significant variation of water depths (both naturally occurring and anthropogenic). Specific to this habitat type, historic anthropogenic disturbances have commonly altered this habitat and its connection to adjacent intertidal and upland habitats. In addition, managed navigation channels occur throughout the bay as described above in Section 3.2.2 to support commerce within the bay.

4.7.2 Oyster Reefs

Oyster reefs provide vertical and horizontal complexity to the subtidal bottom habitats to promote habitat use by diverse communities of fish and other aquatic organisms. The structural complexity of an oyster reef provides habitat and refuge to many small aquatic organisms. In turn, these reefs provide feeding, as well as breeding and nursery habitats, for finfish as well as larger crustaceans. In addition, oysters are an important prey source for gastropods, whelks, sea stars, crabs, and boring sponges. Finally, they also provide foraging habitats for many shorebirds throughout the bay. This habitat complexity also is important to wave attenuation that has led to significant loss of intertidal wetlands throughout Jamaica Bay.

Oyster reefs also provide ecological enhancement through their ability to filter significant particulates within the water column. By filtering particulate material from the water column, oysters are able to lower excess nutrients in an urban watershed, as well as improving water clarity. In turn, these water quality improvements can directly influence other species such as eelgrass beds (Cerco and Noel 2007).

Significant oyster populations historically occurred throughout Jamaica Bay, as well as greater HRE. They have been considered a historically important keystone species by providing both ecological functions and a significant economic resource (USACE 2009). However, by the early 20th Century, poor water quality conditions and incidence of human-transferable diseases resulted in significant population declines (MacKensie 1992). This loss of oyster beds has permanently altered habitat structure of sub-tidal bottoms and the functioning of the estuaries benthic ecosystem.

Today no known oyster reefs occur within Jamaica Bay or the HRE. However, scattered live oysters can be found in certain areas and indicating the presence of isolated populations. In addition, multiple oyster reef restoration efforts have been historically undertaken within Jamaica Bay.

4.7.3 Hardened Shoreline

Throughout the bay, many natural shorelines have been replaced with hardened structures such as bulkheads, revetments, or rip rap. These hardened structures have interrupted the naturally occurring ecological continuum, and caused an unnatural transition from upland areas (i.e., usually impervious surfaces associated with urban areas) immediately into deep subtidal area. These shorelines provide limited habitats and services to a suite of resources identified as critical to the Jamaica Bay ecosystem.

4.7.4 Mudflats

Mudflats are broad, shallow areas which are un-vegetated and exposed twice daily (i.e., diurnal) at or near low tide. This habitat provides a crucial ecological transition between intertidal wetlands and subtidal bottom areas, as well as provide services related to shoreline protection, water quality improvement, fisheries resources, and habitat and food sources for migratory and resident animals. Tidal mudflats support a wide diversity of both terrestrial and aquatic life.

4.7.5 Intertidal Wetlands - Native

Intertidal wetlands are vegetated areas tidally influenced and connected to open waters that are inundated or saturated by surface- or ground-water frequently enough to support vegetation that thrives in wet soil conditions. Intertidal wetlands for purposes of this EIS include both low and native high salt marsh communities. The low salt marsh community generally occurs between mean low and mean high water, and is inundated twice daily by normal high tides. Low marsh communities are typically dominated by saltmarsh cordgrass (Spartina alterniflora). The native high marsh community occurs between MHW and the MHHW, which is only occasionally flooded during major storms or during extreme (i.e., spring) high tides. High marsh vegetation is dominated by salt marsh hay (Spartina patens) with saltgrass (Distichlis spicata) and/or marsh elder (Iva frutescens) occasionally mixed throughout.

Wetland loss at Jamaica Bay has been occurring for decades, with a measured loss of vegetated marsh islands of 63% (1,471 acres) from 1951 to 2003 (2,347 acres to 876 acres). During this time of wetland loss, the rate of marsh loss has increased from 17 acres lost per year from 1951 - 1974 to 33 acres lost per year from 1989 – 2003 (NPS 2007).

Many contributing factors to this historical wetland loss have been identified: sea level rise; alternations in the bay's sediment budget; erosion due to changes in wind energy; effects of contaminants; changes in hydrologic connectivity; or excessive consumption of marsh grasses by waterfowl (Steinberg et al. 2004). In the end, the significant wetland losses throughout Jamaica Bay cannot be attributed to one factor and likely a complex function of many factors combined.

4.7.6 Non-Native Wetlands

In addition to the significant wetland losses throughout Jamaica Bay, much of the native high marsh salt marsh community has been invaded by common reed throughout Jamaica Bay. Given the expansive monotypical stands of common reed, as well as the reduced level of services and functions that this community affords to the Jamaica Bay ecosystem, non-native intertidal wetlands have been defined as a separate habitat type. Common reed can cover many acres, and effectively outcompete native species that historically occurred throughout the high marsh. Through development of these expansive monotypical communities, this species also significantly reduce hydrologic complexity by altering and/or limiting intertidal channels and pools. Finally, these large monotypical stands also raise the elevation of these historic marsh communities by trapping sediment as well as the annual decomposition of the significant above ground biomass produced by this species.

4.7.7 Marsh Islands

Given their complex role within Jamaica Bay, marsh islands are also identified as a distinct habitat type. While these marsh islands are primarily composed of intertidal wetlands, they also include relatively smaller patches of upland maritime forest and scrubland. Ecologically, these marsh islands are at the heart of the Jamaica Bay ecosystem. It is their ecological habitat complexity that differentiates them from perimeter wetlands. The assemblage of marsh islands in the center of Jamaica Bay provides the most significant habitat to the majority of wildlife resources within the Back Bay and for all trophic levels of the bay food web. They are protected from a comparable level of anthropogenic disturbances impacting perimeter wetlands due to their remote location. In turn, significant ecological diversity can be found throughout the year utilizing these marsh islands.

As noted above in Section 6.5, rates of wetland loss within Jamaica Bay have been significant over the last 100 years. A great deal of this wetland loss has been directly from the loss of marsh island habitat. However, it is important to note that numerous initiatives, including beneficial use of dredged material from the NYNJ Harbor Deepening Project have been implemented to restore Jamaica Bay's marsh islands. To date more than 155 acres of marsh island have been restored (USACE 2016), however the potential for long term net loss vegetated wetlands in the Jamaica ay Planning Reach remains a likely outcome of the FWOP.

4.7.8 Beaches and Dunes

Beach and dune habitats are the most dynamic of the upland communities described within Jamaica Bay and found within both project areas. While they are described together herein, they are delineated as separate habitat types for purpose of habitat mapping. They are continually modified by wind and waves, and stabilized by plant communities. When the beaches and dunes are altered, this also changes the inland forest and shrubland habitats; bringing them either closer to the shore or pushing them inland. These habitat types are some of the most vulnerable to future coastal storm erosion

Beach and dune habitats are the most dynamic of the upland communities described within Jamaica Bay and found within both project areas. They are continually modified by wind and waves, and stabilized by plant communities. Beaches are the narrow strip of shoreline in immediate contact with water and consisting of unconsolidated sediments (i.e., sand), and characteristically unvegetated. The Atlantic Shoreline project area is almost exclusively beaches. Within the Bay project area, the largest beaches are primarily found near the inlet due to sediment dynamics found within the bay. However, there are a number of natural beaches, as well as beaches that formed in absence of degraded wetlands, throughout the inland perimeter of the bay.

Dunes are typically reinforced sand mounds located along the back edge of a beach which break waves and keep floodwaters from inundating. In many cases, dunes provide a sediment source for beach recovery after a storm passes. Characteristic species include beachgrass (Ammophila breviligulata), dusty miller (Artemisia stelleriana), beach pea (Lathyrus japonicus), sedge (Carex spp.), seaside goldenrod (Solidago sempervirens), and sand-rose. Stabilized dunes include beach heather (Hudsonia tomentosa), bearberry (Arctostaphylos uva-ursi), beach pinweed (Lechea maritime), jointweed (Polygonella articulate), bayberry (Myrica pensylvanica), and beach-plum (Prunus maritima).

4.7.9 Maritime and Coastal Forest and Shrubland

Historically, a mosaic of the maritime forests/shrubland/grassland habitats was a large component of the undisturbed Jamaica Bay complex. They supported and therefore increased the value of the wetland and aquatic habitats by providing cover, alternate food sources and breeding habitats to many of the species that characteristically inhabit adjacent salt marshes, mudflats and shallow water habitats. They additionally act as a buffer area for the salt marsh communities. This benefit is integral to a full functioning integrated estuarine system, adding to the benefits of the adjacent habitats and increasing overall connectivity between and among similar habitats and multiple habitats used by the same species. Unfortunately, these maritime forests and grasslands, with beach and dune complexes, are now the rarest habitat type and often the subject of long-term restoration goals throughout the bay. They provide a critical resource for migratory passerine bird species, as well as other resident and migratory birds, mammals, and sensitive insect species. MFR #2 provides a summary of many of the different plant community types of upland habitats

4.7.10 Ruderal Uplands

As Jamaica Bay remains one of the most urban estuaries throughout North America, many upland habitats (which are not yet impervious surfaces) have been modified by historic and current anthropogenic disturbances. Ruderal upland habitats found extensively throughout the Project Area represent upland areas that are (1) dominated by invasive species, (2) managed as lawns or landscape features, and/or (3) disturbed soil and/or rock and gravel.

4.7.11 Urban

Finally, a great deal of area within the Project Area has been paved with impervious surface due to urban development. This urban habitat type is inclusive of the following, and not necessarily limited to: roads; paved trails; recreational courts; commercial and residential buildings; parking lots; and laydown yards. This habitat type is assumed to provide little to no services or functions to the Jamaica Bay ecosystem.

4.8 Aquatic And Terrestrial Wildlife

Aquatic and terrestrial wildlife species likely to be present in Jamaica Bay, Breezy Point and Rockaway Beaches are discussed below. Federal and state listed threatened and endangered species and species of concern are specifically discussed in Section 3.5

4.8.1 Invertebrate and Benthic Resources

Terrestrial and marine invertebrates have many important functions as key lower food web components in the Jamaica Bay coastal and marine ecosystems. Terrestrial and benthic invertebrates serve as food resources for birds, mammals, and fish (Waldman 2008). Blue crab (Callinectes sapidus) and American lobster (Homarus americanus) are food resources for predatory fish and birds (Bain et al 2007; Waldman 2008; USACE 2009), and commonly found in subtidal bottom and oyster reef habitats. Horseshoe crab (Limulus polyphemus), and specifically the large quantities of horseshoe crab eggs produced during spawning, are key food resources for fish, reptiles, and migrating shorebirds like the red knot (Botton et al 2006). Horseshoe crabs utilize multiple habitats along the shoreline from subtidal bottoms, into intertidal mudflats, and along sandy beaches. Oysters (Crassostrea virginica) filter particulate matter from the water column, enhance subtidal habitats like eelgrass beds, and function as food resources for fish and birds. In addition, oyster reefs provide spatially complex substrate that facilitate the presence and functioning of other coastal ecosystems (Rodney et al. 2007, Bain et al. 2007; Waldman 2008; USACE 2009). Clams (for example softshell, Mya arenaria, and quahog, Mercenaria mercenaria) are important food resources for other food web components and also perform water quality functions (USFWS 1997a). Blue mussels (Mytilus edulis) are found in intertidal shallows along the shorelines attached to hard substrates, while ribbed mussels (Geukensia demissa) are found in soft sediments and have an important mutualism with cordgrass species. Both mussel species are important food resources for fish and birds and as filter-feeders they improve water quality (Bain et al. 2007; Waldman 2008; USACE 2009; NYC Department of Environmental Protection 2014).

Benthic data assemblages have been historically collected in Jamaica Bay to assess water body condition using a benthic index of biotic integrity (B-IBI). The B-IBI evaluates existing conditions by measuring field measures that when combined can effectively describe benthic assemblages (Weisberg et al. 1998). This quantitative method is further discussed in MFR #3 (Arcadis 2014). Data used to support the B-IBI were collected as part of the EPA's Regional Environmental Monitoring and Assessment Program (REMAP), specifically dataset's from the

Sediment Quality of the NY/NJ Harbor System (Weisberg et. al. 1998) and the 5-Year Revisit (Adams et. al. 2003). Data used specific to Jamaica Bay B-IBI analysis included sample locations within the designated reach boundaries, as well as within 2000 feet of a shoreline. This inclusion buffer provided the best representation for the data currently available in the different delineated reaches. Additional benthic community data was collected in the summer of 2015 at 30 site specific locations, inclusive of known highly impacted to subtidal mudflats within the Jamaica Bay reaches. Results of the field sampling event and B-IBI analysis, which incorporates the REMAP data, is included in MFR #8. A list of species collected as part of the 2015 field event, is included as Table 4.8-1.

Table 4.8-1. Benthic Organisms Identified as Part of 2015 Field Event

Taxon			Common Name
Nematoda			round worm
Hoplonemertea			
	Monostilifera		ribbon worm
Tubificida			tube worm
Ariciida			
	Orbiniidae		
		Leitoscoloplos sp.	orbiniid worm
	Paraonidae		
		Lavinsenia gracilis	paraonid worm
Capitellida			
	Capitellidae		
		Capitella capitata cplx.	thread worm
		Heteromastus filiformis	thread worm
		Mediomastus ambiseta	thread worm
	Maldanidae		bamboo worm
Cirratulida			
	Cirratulidae		
		Tharyx acutus	fringed worm
Phyllodocida			
	Glyceridae		
		Glycera dibranchiata	blood worm
	Goniadidae		
		Glycinde solitaria	blood worm
	Nereididae		
		Alitta succinea	clam worm
		Neanthes arenaceodentata	clam worm
	Phyllodocidae		
		Hypereteone sp.	paddle worm
		Hypereteone heteropoda	paddle worm

	Syllidae		
		Syllides verrilli	syllid worm
Sabellida			
	Sabellidae		
		Manayunkia speciosa	fan worm
Spionida			
	Spionidae		
		Dipolydora socialis	mud worm
		Polydora cornuta	mud worm
		Scolelepis texana	mud worm
		Spio filicornis	mud worm
		Streblospio benedicti	mud worm
Terebellida			
	Pectinariidae		
		Pectinaria gouldii	trumpet worm
Carditoida			
	Crassatellidae		
		Crassinella lunulata	crassinella clam
Myoida			
	Myidae		
		Mya arenaria	soft-shell clam
Mytiloida			
	Mytilidae		
		Geukensia demissa	ribbed mussel
		Mytilus edulis	blue mussel
Venerioda			
	Tellinidae		
		Macoma balthica	macomid clam
	Veneriidae		
		Gemma gemma	gem clam
		Mercenaria mercenaria	hard clam
		Turtonia minuta	turton clam
Ellobioidea			
	Ellobiidae		
		Melampus bidentatus	salt-marsh snail
Heterostropha			
	Pyramidellidae		
		Boonea bisuturalis	odostome snail
Littorinimorpha			
	Assimininеidae		
		Assiminea succinea	assiminea snail
	Hydrobidae		
		Ecrobia truncata	hydrobe snail
Mesogastropoda			
	Calyptaeidae		

		Crepidula fornicata	slipper snail
Neogastropoda			
	Nassariidae		
		Ilyanassa obsoleta	mud snail
	Hydrobidae		
		Ecrobia truncata	hydrobid snail
Amphipoda			
	Ampeliscidae		
		Ampelisca abdita	side swimmer
		Ampelisca vadorum	side swimmer
	Corophiidae		
		Macrocorophium insidiosum	tube maker
		Monocorophium acherusicum	tube maker
	Gammaridae		
		Gammarus mucronatus	side swimmer
		Gammarus sp.	side swimmer
	Haustoridae		
		Haustorius canadensis	side swimmer
		Neohaustorius schmitzi	side swimmer
	Hyalidae		
		Ptilohyale plumulosa	side swimmer
	Lysianassidae		
		Lysianopsis alba	side swimmer
	Maeridae		
		Elasmopus levis	side swimmer
	Melitidae		
		Melita nitida	side swimmer
Caprellida			
	Caprellidae		
		Paracaprella tenuis	skeleton shrimp
Decapoda			
	Crangonidae		
		Crangon septemspinosa	sand shrimp
	Ocypodidae		
		Uca spp.	unknown fiddler crab
	Paguridae		
		Pagurus longicarpus	hermit crab
	Palaemonidae		
		Palaemonetes pugio	grass shrimp
		Palaemonetes vulgaris	grass shrimp
	Xanthidae		
		Dyspanopeus sayi	mud crab
Isopoda			
	Idoteidae		

		Edotea triloba	isopod
Tanaidacea			
	Leptocheliidae		
		Leptochelia rapax	taenid shrimp
Xiphosura			
	Limulidae		
		Limulus polyphemus	horse-shoe crab
Diptera			
	Canacidae		
		Canace sp.	beach fly
	Ceratopogonidae		
		Culicoides sp.	sand fly
	Chironomidae		midge
	Dolichopodidae		long-legged fly
	Ephydridae		shore fly

With respect to the Atlantic Shoreline project area, the primary shellfish with important commercial or recreational value in the near shore portion of the Project area are the, hardshell clam [Quahog], softshell clam, bay scallop (Argopencten irradiens), American lobster, and blue crab (MacKenzie 1990). Surf clam (Spisula solidissima), razor clam (Ensis directus) and tellin (Tellina agillis) occur in the vicinity of the offshore borrow area. Surveys conducted by the USACE in 2003 and by the NYSDEC in 2012 indicate that the borrow area itself contains very small, to no, localized populations of surf clam. It is the intent of the USACE to conduct another survey in the borrow area prior to the utilization of the borrow area.

4.8.2 Finfish

Primary fish species of the Atlantic Shoreline project area include black sea bass (Centropristis striata), summer flounder (Paralichthys dentatus), winter flounder (Pseudopleuronectes americanus), weakfish (Cynosion regalis), bluefish (Pomatomus saltatrix), scup (Stenotomus chrysops), striped bass (Morone saxatillis), and Atlantic mackerel (Scomber scombrus). In addition, other common species in near shore waters include tautog (Tautoga onitis), northern puffer (Sphoeroides maculates), windowpane (Scophthalmus aquosus) and American eel (Anguilla rostrata). A number of migrant anadromous and catadromous species are found throughout the project area. Common migrant species include the Atlantic sturgeon (Acipenser oxyhinchus), blueback herring (Alosa aestivalis), alewife (Alosa pseudoharengus), American shad (Alosa sapidissima), Atlantic silverside (Menidia menidia), striped bass, and American eel (Woodhead 1992).

Jamaica Bay habitats are also highly productive and support a large number of fish species that serve as key resources for other Bay ecosystem components. Forage fish (Fundulus sp.) are important middle food web components and function as food resources for birds and predatory fish including resident (e.g., flounder sp.) and anadromous (e.g., shad, herring, Atlantic sturgeon,

striped bass) species (USFWS 1997b; Waldman 2008; USACE 2009). The waters and sediments of Jamaica Bay are a highly productive and regionally significant habitat for finfish, shellfish, and wildlife. Winter flounder was the most important commercial and recreational fish to use the bay in great numbers during all life stages; the bay is also believed to be a significant breeding area for this species. Forage fish species with high abundances, including Atlantic silverside (Menidia menidia), bay anchovy (Anchoa mitchilli), mummichog (Fundulus heteroclitus), Atlantic menhaden (Brevoortia tyrannus), and striped killifish (Fundulus majalis), form a prey base for other fish and birds that use the area. Both the nearshore and offshore waters of the project area support seasonally abundant populations of many recreational and commercial finfish (USFWS 1989, 1995, USACE 1995). Some of the other common species found in surveys and recreational landings include scup, bluefish, windowpane, tautog, weakfish, black sea bass, summer flounder, American eel, and searobin (Prionotus spp.). Anadromous species that use the area include blueback herring, Atlantic sturgeon, alewife, American shad, striped bass, and Atlantic mackerel (Scomber scombrus).

4.8.3 Reptiles and Amphibians

The diamondback terrapin (*Malaclemys terrapin*) are medium sized turtle species that inhabit brackish waters of estuaries, tidal creeks, and salt marshes along the northeastern coast of North America. Unfortunately its populations are declining throughout their range (Waldman 2008; USACE 2009). Diamondback terrapin use habitats within Jamaica Bay for nesting and feeding.

Other amphibians and reptiles species that may potentially be present in the project are include Fowler's toad (Bufo woodhousii fowleri), spring peeper (Pseudacris crucifer), gray treefrog (Hyla versicolor), green frog (Rana clamitans), spotted salamander, redback salamander (Plethodon cinereus), northern brown snake (Storeria d. dekayi), smooth green snake (Opheodrys vernalis), eastern hognose snake (Heterodon platirhinos), eastern milk snake (Lampropeltis triangulum triangulum), northern black racer (Coluber c. constrictor), snapping turtle (Chelydra serpentina), eastern painted turtle (Chrysemys p. picta), and eastern box turtle (Terrapene c. carolina).

Five species of threatened and endangered marine turtles have habitat ranges that overlap with the near shore coastal waters of the Project area during summer and early fall. Species include the Federally-listed Kemp’s ridley (Lepidochelys kempii, endangered), leatherback (Dermochelys coriacea, endangered), green (Chelonia mydas, threatened), loggerhead (Caretta caretta, threatened), and hawksbill (Eretmochelys imbricata, endangered). The most common are Kemps ridley that prefer coastal areas, and leatherbacks, which commonly found nearby in offshore Long Island waters (NYS DEC 2016a), while the hawksbill is considered to be the rarest encountered in NY waters (NYS DEC 2016b). Sea turtles may utilize coastal resources in the Project vicinity for foraging. However, nesting is unlikely to occur along beaches in the Project area, as breeding grounds for all species are located in warmer waters to the south.

4.8.4 Birds

Several different groups of bird species use both the Atlantic Shoreline and Jamaica Bay project areas. Wading birds (herons, stilts), seabirds (terns, cormorants), waterfowl (ducks, geese), shorebirds (plovers, sandpipers), passerines (terrestrial songbirds) and raptors are dependent upon the different types of coastal and upland habitats found in these areas (Waldman 2008, USACE 2009, NYC Audubon 2015). Both resident and migratory bird species use Jamaica Bay (including Floyd Bennet Field, Gateway National Wildlife Refuge), Rockaway Beaches and Breezy Point.

A wide diversity of bird species is likely to occur within, and in the vicinity of, the Project area. The most common species in the project area are habitat generalists that are tolerant of development and that utilize beach habitat along the shoreline and deepwater habitats. Common species include herring gull (Larus argentatus), greater black-backed gull (Larus marinus), American crow (Corvus brachyrhynchos), American robin (Turdus migratorius), barn swallow (Hirundo rustica), black-bellied plover (Pluvialis squatarola), black scoter (Melanitta nigra), bufflehead (Bucephala albeola), common grackle (Quiscalus quiscula), common yellowthroat (Geothlypis trichas), double-crested cormorant (Phalacrocorax auritus), European starling (Sturnus vulgaris), gray catbird (Dumetella carolinensis), mourning dove (Zenaida macroura), rock dove/pigeon (Columba livia), sanderling (Calidris alba), song sparrow (Milospiza melodia), house sparrow (Passer domesticus), house finch (Carpodacus mexicanus), and tree swallow (Iridoprocne bicolor) [USACE 1998, 2003, USFWS 1992]. Permanent avian residents of the surrounding area include various species of gulls, crows, pigeons, and sparrows, which are commonly associated with developed areas and areas of high human activity (USFWS 1992, USACE 1998, 2003). Migratory bird species of conservation concern that are likely to be found breeding, foraging or migrating through the project area are listed in Table 4.8-2.

Table 4.8-2. Migratory Birds of Conservation Concern Potentially Present at Proposed Project Locations

Species Name	Common Name
Haematopus palliatus	American Oystercatcher
Botaurus lentiginosus	American Bittern
Haliaeetus leucocephalus	Bald Eagle
Rynchops niger	Black Skimmer
Coccyzus erythropthalmus	Black-billed Cuckoo
Vermivora pinus	Blue-winged Warbler
Wilsonia canadensis	Canada Warbler
Dendroica cerulea	Cerulean Warbler
Passerella iliaca	Fox Sparrow
Gelochelidon nilotica	Gull-billed Tern
Podiceps auritus	Horned Grebe
Limosa haemastica	Hudsonian Godwit
Ixobrychus exilis	Least Bittern

Species Name	Common Name
Sterna antillarum	Least Tern
Lanius ludovicianus	Loggerhead Shrike
Limosa fedoa	Marbled Godwit
Falco peregrinus	Peregrine Falcon
Podilymbus podiceps	Pied-billed Grebe
Dendroica discolor	Prairie Warbler
Calidris maritima	Purple Sandpiper
Calidris canutus rufa	Red Knot
Euphagus carolinus	Rusty Blackbird
Ammodramus caudacutus	Saltmarsh Sparrow
Ammodramus maritimus	Seaside Sparrow
Asio flammeus	Short-eared Owl
Egretta thula	Snowy Egret
Bartramia longicauda	Upland Sandpiper
Empidonax traillii	Willow Flycatcher
Hylocichla mustelina	Wood Thrush
Helmitheros vermivorum	Worm Eating Warbler

4.8.5 Mammals

Although mammals are a less visible component of Jamaica Bay ecosystem, the project areas serves as important habitat for many species. Bat species like hoary bat (Lasiurus cinereus), red bat (Lasiurus borealis), little brown bat, (Myotis lucifugus), and silver-haired bat (Lasionycteris noctivagans) may be present (Waldman 2008) in upland habitats adjacent to Jamaica Bay. Other terrestrial mammals in the Jamaica Bay, Rockaway Beach, and Breezy Point areas include opossum (Didelphis virginiana), black-tailed jackrabbit (Lepus californicus) escaped from JFK Airport cargo, eastern cottontail rabbit (Sylvilagus floridanus), eastern chipmunk (Tamias striatus - introduced), gray squirrel (Sciurus carolinensis), white-footed mouse (Peromyscus leucopus), meadow vole (Microtus pennsylvanicus), muskrat (Ondatra zibethicus), and house mouse (Mus musculus).

Nearshore coastal areas serve as habitat for several marine mammals. Federally listed cetaceans that may occur in the Project areas include the endangered North Atlantic right whale (Eubalaena glacialis); the endangered humpback whale (Megaptera novaeangliae); and the endangered fin whale (Balaenoptera physalus) (USACE 2015). Non-listed cetacean species with nearshore coastal New York water habitats include finback (Balaenoptera physalus), minke (B. acutorostrata), and pilot (Globicephala melaena) whales as well as several dolphin species, including common (Delphinus delphis), bottle-nosed (Tursiops truncatus), white-sided (Lagenorhynchus acutus), and striped (Stenella coerulealba), and harbor porpoise (Phocoena phocoena) (Edinger et. al. 2014). Other marine mammals that are found in coastal waters include seals. Harbor seals, the most abundant seal species found within NY waters, frequently winter in nearshore waters of the Project area and can be found basking on sand bars, rocks, or remote

beaches (NYS DEC 2016c). Although not as frequent, grey seal (Halichoerus grypus) habitat also overlaps with the Project area.

4.9 Threatened and Endangered Species/Communities

4.9.1 Federal Species

A search of USFWS IPaC was conducted in April to determine the federal list of threatened, endangered, species of concern, and critical habitat that are located within the project area. A formal consultation with U.S. Fish and Wildlife and/or NOAA National Marine Fisheries Service (NMFS) has not been initiated at this time. A complete list based upon this database search is included as Table 4.9-1.

The federally-listed threatened piping plover (Charadrius melodus) and threatened seabeach amaranth (Amaranthus pumilus) (plant) have been identified within the project areas.

Seasonal avian surveys conducted by NYSDEC over an interval of three years (1998 through 2000) identified one pair of piping plovers nesting on the beach between Beach 19th and Beach 40th Streets. During the same 3-year time period, the beaches west from Beach 41st to Beach 72nd streets were found to support from 9 to 12 nesting pairs of piping plover per season (NYSDEC unpublished information).

Although not documented as occurring in the Project Area, the USFWS (1993) noted that the roseate tern is found along the sand or sand/cobble beaches of the Atlantic coast.

In addition, the Atlantic Shoreline project area supports one of the largest sea beach amaranth populations in New York State (Young 2000). During field surveys conducted by NYSDEC biologists in 2000, 26 sea beach amaranth plants were identified on the beach between Beach 22nd and Beach 39th Streets (Young 2000). A larger population of approximately 2,000 plants was also identified further west, between Beach 44th and Beach 66th streets. Seabeach amaranth is an annual plant that prefers beach habitats, and is subject to competitive exclusion by beach grass and other vegetation.

Some federally-listed endangered whales, sea turtles and Atlantic sturgeon may occur in the project area, periodically and seasonally. Formal consultation with NOAA NMFS has been initiated.

Table 4.9-1. Federal and New York State Listed Species of Concern as Identified through IPaC and NYDEC

Scientific Name	Common Name	Federally Listed	NY-listed (county)
Molluscs			
None			
Insects			
Enallagma minusculum	Little Bluet		T
Pontia protodice	Checkered White		SC
Fish			

Scientific Name	Common Name	Federally Listed	NY-listed (county)
Acipenser oxyrinchus oxyrinchus	Atlantic Sturgeon (New York Bight distinct population)	E	
Amphibians			
Scaphiopus h. holbrookii	Eastern Spadefoot		SC
Ambystoma maculatum	Spotted Salamander		SC
Birds			
Gavia immer	Common Loon		SC
Podilymbus podiceps	Pied-billed Grebe		T
Botaurus lentiginosus	American Bittern		SC
Ixobrychus exilis	Least Bittern		T
Haliaeetus leucocephalus	Bald Eagle		T
Accipiter cooperii	Cooper's Hawk		SC
Accipter striatus	sharp-shinned hawk		SC
Buteo lineatus	Red-shouldered Hawk		SC
Circus cyaneus	northern harrier		T
Falco peregrinus	Peregrine Falcon		E
Pandion haliaetus	osprey		SC
Bartramia longicauda	upland sandpiper		T
Rynchops niger	black skimmer		SC
Sterna antillarum	least tern		T
Sterna hirundo	common tern		T
Asio flammeus	short-eared owl		E
Eremophila alpestris	horned lark		SC
Ammodramus maritimus	seaside sparrow		SC
Ammodramus savannarum	grasshopper sparrow		SC
Charadrius melodus	Piping Plover	T	E
Calidris canutus rufa	Red Knot	T	
Sterna dougallii dougallii	Roseate Tern	E	E
Reptiles			
Malaclemys t. terrapin	Diamondback Terrapin		SC
Terrapene c. carolina	eastern box turtle		SC
Eretmochelys imbricata	Hawksbill Sea Turtle	E	E
Dermochelys coriacea	Leatherback Sea Turtle	E	E
Chelonia mydas	Green sea turtle	T	T
Caretta caretta	Loggerhead sea turtle	T	T
Lepidochelys kempii	Atlantic (=Kemp's) ridley sea turtle	E	T
Mammals			
Myotis septentrionalis	Northern Long-eared Bat	T	T
Eubalaena glacialis	North Atlantic right	E	E

Scientific Name	Common Name	Federally Listed	NY-listed (county)
	whale		
Megaptera novaeangliae	Humpback whale	E	E
Balaenoptera physalus	Fin whale	E	E
Physeter catodon	Sperm whale	E	E
Balaenoptera borealis	Sei whale	E	E
Balaenoptera musculus	Blue whale	E	E
Phocoena phocoena	Harbor porpoise		SC
Flowering Plants			
Agalinis acuta	Sandplain Gerardia	E	
Amaranthus pumilus	Seabeach Amaranth	T	
Cuscuta pentagona	Field-dodder		E
Cuscuta polygonorum	Smartweed-dodder		E
Cyperus schweinitzii	Schweinitz's flatsedge		R
Pinus virginiana	Virginia Pine		E
Cyperus houghtonii	Houghton's umbrella-sedge		R
Eleocharis obtusa var. ovata	Blunt spikerush		R
Asclepias purpurascens	Purple milkweed		T
Bidens laevis	Smooth bur-marigold		R
Quercus phellos	Willow oak		E
Lythrum lineare	Saltmarsh loosestrife		E
Rumex hastatulus	Heart-winged sorrell		T
Potentilla anserina ssp. pacifica (= P. a. ssp. egedii)	Silverweed		R
E=endangered, T=threatened, SC=species of concern, R=Rare			

4.9.2 Migratory Birds

Migratory birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by USFWS.

An IPaC search identified the following species of migratory birds which could potentially be affected by activities in this location: America bittern (*Botaurus lentiginosus*, breeding), American oystercatcher (*Haematopus palliates*, year round), bald eagle (*Halianeetus leucocephalus*, year round), black skimmer (*Rynchops niger*, breeding), black-billed cuckoo (*Coccyzus erythropthalmus*, breeding), blue-winged warbler (*Vermivora pinus*, breeding), Canada warbler (*Wilsonia canadensis*, breeding), Cerulean warbler (*Dendroica cerulean*, breeding), fox sparrow (*Passerella illiaca*, wintering), gull-billed tern (*Gelochelidon nilotica*, breeding), horned grebe (*Podiceps auritus*, wintering), Hudsonian godwit (*Limosa haemastica*, migrating), least bittern (*Ixobrychus exilis*, breeding), least tern (*Sterna antillarum*, breeding),

loggerhead shrike (*Lanius ludovicianus*, year round), marbled godwit (*Limosa fedoa*, wintering), peregrine falcom (*Falco peregrinus*, wintering), pied-billed grebe (*Podilymbus podiceps*, year round), prairie warbler (*Dendroica discolor*, breeding), purple sandpiper (*Calidris maritima*, wintering), red knot (wintering), rusty blackbird (*Euphagus carolinus*, wintering), saltmarsh sparrow (*Ammodramus caudacutus*, breeding), seaside sparrow (*Ammodramus maritimus*, year round), short-eared owl (*Asio flammeus*, wintering), snowy egret (*Egretta thula*, breeding), upland sandpiper (*Bartramia longicauda*, breeding), willow flycatcher (*Empidonax traillii*, breeding), wood thrush (*Hylocichla mustelina*, breeding), worm eating warbler (*Helmitheros vermivorum*, breeding).

4.9.3 Critical Habitat

No federally designated critical habitat is found within or near the proposed project area.

Jamaica Bay and Breezy Point have been designated Significant Coastal Fish and Wildlife Habitat by the New York State Department of State (NYSDOS), Division of Coastal Resources. Jamaica Bay, Breezy Point, and Rockaway Beaches have also been designated globally Important Bird Areas by Audubon New York.

4.9.4 State Species of Concern

A review of New York State listed threatened, endangered, and rare species and species of concern in Nassau, Queens, and Kings Counties was conducted using the NYDEC website (http://www.dec.ny.gov/animals/7494.html, accessed April 6, 2016). These species are listed in Table 4.9-1.

The state-listed endangered least tern is known to occur in the same type of habitat as the piping plover and roseate tern (see Section 3.5.1) (USACE 1993). Least terns are known to nest in areas in the vicinity of Beach 45th Street and westward along the beach (USFWS 1999). The transient endangered peregrine falcon also occurs occasionally within Jamaica Bay project areas (USFWS 1993). Other state-listed threatened species that occur in the general area include the northern harrier (Circus cyaneus), osprey (Pandion haliaetus), and common tern (Sterna hirundo).

In addition, the piping plover (state endangered), peregrine falcon (state endangered), roseate tern (state endangered), and the bald eagle (state threatened) are present in the Project Area as discussed in Section 3.5.1.

Two species of state-listed plants are known to occur in the vicinity of the Project Area (Young 2000). Sea beach knotweed (Polygonum glaucum, state status: rare) and dune sandspur (Cenchrus tribuliodes, state status: threatened) have been observed by NYSDEC biologists in the same type of habitat along the East Rockaway beaches as the federally-listed sea beach amaranth (Young 2000).

4.10 Special Management Areas

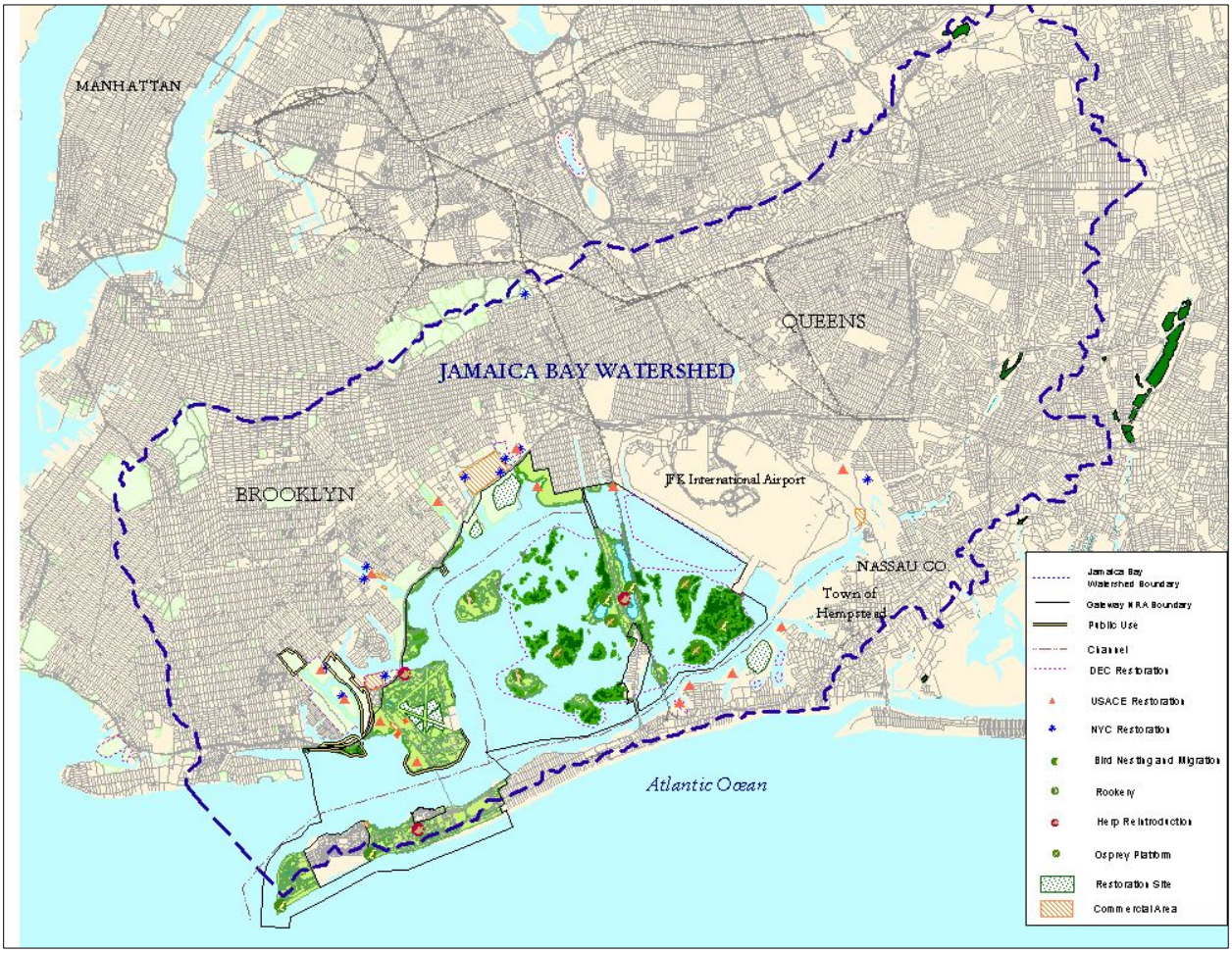
This section describes the special management areas whose uses are regulated by one or more federal or state agency. This section does not describe the individual recreation areas located in many of these special management areas; recreational areas are described in detail in 13.0. A discussion of "standard" zoning regulations is presented in Section 12.2. Additionally, historic districts are described in detail in Section 0.

4.10.1 Gateway National Recreation Area

The Jamaica Bay Unit is one of the largest expanses of open space in the region, consisting of over 19,000 acres of land, bay, and ocean waters within the densely populated and urban areas of Brooklyn and Queens, New York. This entire Jamaica Bay Unit is located within the Jamaica Bay watershed (Figure 4.10-1). The Jamaica Bay watershed is located at the southwestern tip of Long Island. It falls within the broader Atlantic Ocean/Long Island Sound watershed, which consists of approximately 91,000 acres (142 square miles) and includes portions of Brooklyn, Queens, and Nassau County, New York. This watershed is one of seventeen watersheds within the state of New York. Jamaica Bay itself encompasses approximately 13,000 acres ranging from brackish to saline conditions with an average depth of 13 feet and a tidal range of about 4.9 feet. The center of the bay is dominated by sub-tidal open water and extensive low-lying islands composed of saltmarsh, tidal flats, mudflats, and adjacent uplands.

The following sections identify the individual Gateway National Recreation Area parks that fall within either API.

Figure 4.10-1. Jamaica Bay Watershed



Source: http://www.ciesin.org/jamaicabay/photogallery/mailing_lg.jpg

4.10.1.1 Rockaway

The Gateway National Recreation Area parks located within the Rockaway API include Fort Tilden, Jacob Riis Park, and Breezy Point Tip (Figure 4.10-2).

Figure 4.10-2. Gateway National Recreation Area - Special Management Areas

Source: http://www.ciesin.org/jamaicabay/photogallery/jb_resources2.jpg

4.10.1.2 Jamaica Bay

The Gateway National Recreation Area parks located within the Jamaica Bay API include Jamaica Bay Wildlife Refuge, Floyd Bennett Field, Plumb Beach, Bergen Beach, Canarsie Pier, and the Frank Charles Memorial Park (Figure 4.12-2).

4.10.2 NYC Waterfront Revitalization Program (WRP)

The New York City Waterfront Revitalization Program (WRP) is the city's principal coastal zone management tool. It establishes the City's policies for development and use of the waterfront. Most City, State and Federal discretionary actions in the Coastal Zone must be reviewed for consistency with these policies.

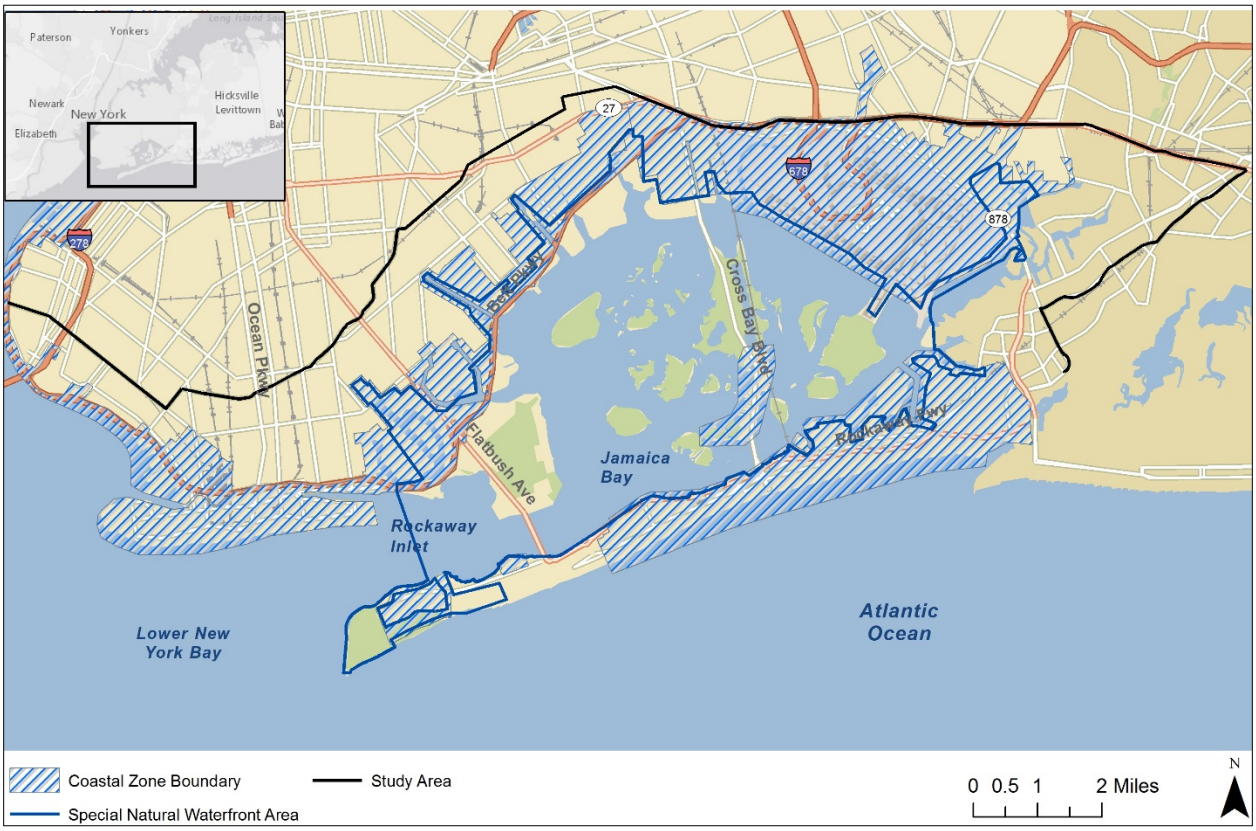
On February 3, 2016, the NYS Secretary of State approved the revisions to the NYC Waterfront Revitalization Program. This set of policies and maps should be used for consistency review of all local and state actions. However, until the revisions to the Waterfront Revitalization Program

(WRP) are approved by the US Secretary of Commerce, the 2002 WRP should be used for all federal actions that require consistency review.

Although the New York City WRP policies are intended to be used to evaluate proposed actions to promote activities appropriate to various waterfront locations, evaluating the consistency of existing land use with those policies can be used to anticipate future waterfront conditions. Ten policies are included in the Program: (1) residential and commercial redevelopment; (2) water-dependent and industrial uses; (3) commercial and recreational boating; (4) coastal ecological systems; (5) water quality; (6) flooding and erosion; (7) solid waste and hazardous substances; (8) public access; (9) scenic resources; and (10) historical and cultural resources.

As originally mapped and adopted in 1982, the coastal zone boundary defines the geographic scope of the WRP (Figure 4.10-3).

Figure 4.10-3. NYC Waterfront Revitalization Program, Coastal Zone Boundary, and Special Natural Waterfront Areas



4.10.3 Coastal Zone Boundary

As originally mapped and adopted in 1982, the coastal zone boundary defines the geographic scope of the WRP. Pursuant to federal statute, the boundary encompasses all land and water of direct and significant impact on coastal waters. The Coastal Zone Boundary is depicted in Figure 4.10-3.

The coastal zone boundary extends seaward to the Westchester and Nassau County and New Jersey boundaries, and to the three-mile territorial limit in the Atlantic. The boundary extends landward to encompass the following coastal features:

- Significant Maritime and Industrial Areas
- Significant Coastal Fish and Wildlife Habitats
- Special Natural Waterfront Areas (e.g. Jamaica Bay)
- Staten Island Bluebelts
- Tidal and Freshwater Wetlands
- Coastal Floodplains and Flood Hazard Areas
- Erosion Hazard Areas
- Coastal Barrier Resources Act Areas
- Steep Slopes
- Parks and Beaches
- Visual Access and Views of Coastal Waters and the Harbor
- Historic, Archaeological, and Cultural Sites Closely Associated with the Coast
- Special Zoning Districts.

In developed areas devoid of these features, the coastal zone boundary is generally defined as the nearest legally mapped street at least 300 feet landward of the Mean High Tide Line. In undeveloped areas devoid of these features, the landward boundary is delineated at the legally mapped street nearest to the first major man-made physical barrier. Exceptions to these guidelines include City Island, Broad Channel Island, and the Rockaway Peninsula which are included within the coastal zone in their entirety. Federal lands and facilities are excluded from the coastal zone and consistency review in accordance with federal legislation. However, should the federal government dispose of any coastal property, it would be included in the coastal zone.

4.10.4 NYC Special Natural Waterfront Area

Jamaica Bay is a NYC-designated Special Natural Waterfront Area (SNWA) (Figure 4.10-3). A SNWA is a large area with concentrations of important coastal ecosystem features such as wetlands, habitats and buffer areas, many of which are regulated under other programs. *The New Waterfront Revitalization Program* (New York City Department of City Planning [NYCDCP] 1999b) defines SNWAs as coastal areas with special characteristics identified in New York City's Comprehensive Waterfront Plan that "have particular natural habitat features that should be considered in connection with any waterfront activity." It further directs that "activities that protect and restore these features would be consistent with waterfront policy for these areas." Accordingly, the WRP encourages public investment within the SNWA to focus on habitat protection and improvement and discourages activities that interfere with the habitat functions of the area. Acquisition of sites for habitat protection is presumed consistent with the goals of this policy. Similarly, fragmentation or loss of habitat areas within an SNWA should be avoided.

4.10.5 Coastal Barrier Resources Act Areas

In the 1970s and 1980s, Congress recognized that certain actions and programs of the Federal Government have historically subsidized and encouraged development on coastal barriers, resulting in the loss of natural resources; threats to human life, health, and property; and the expenditure of millions of tax dollars each year (USFWS, 2016). To remove the federal incentive to develop these areas, the Coastal Barrier Resources Act (CBRA) of 1982 designated relatively undeveloped coastal barriers along the Atlantic and Gulf coasts as part of the John H. Chafee Coastal Barrier Resources System (CBRS), and made these areas ineligible for most new federal expenditures and financial assistance. CBRA encourages the conservation of hurricane prone, biologically rich coastal barriers by restricting federal expenditures that encourage development, such as federal flood insurance. Areas within the CBRS can be developed provided that private developers or other non-federal parties bear the full cost.

Section 6 of the Coastal Barrier Resources Act (CBRA; 16 U.S.C. § 3505) prohibits new Federal expenditures or financial assistance within System units of the CBRS. However, federal expenditures are allowable within the CBRS if the project meets any one of the exceptions listed below (from 16 U.S.C. § 3505(a)(1)-(5)):

- Any use or facility necessary for the exploration, extraction, or transportation of energy resources which can be carried out only on, in, or adjacent to a coastal water area because the use or facility requires access to the coastal water body.
- The maintenance or construction of improvements of existing federal navigation channels (including the Intracoastal Waterway) and related structures (such as jetties), including the disposal of dredge materials related to such maintenance or construction. A federal navigation channel or a related structure is an existing channel or structure, respectively, if it was authorized before the date on which the relevant System unit or portion of the System unit was included within the CBRS.
- The maintenance, replacement, reconstruction, or repair, but not the expansion, of publicly owned or publicly operated roads, structures, or facilities that are essential links in a larger network or system.
- Military activities essential to national security.
- The construction, operation, maintenance, and rehabilitation of Coast Guard facilities and access thereto.

Additionally, a federal expenditure is allowable within the CBRS, if it meets any of the following exceptions (16 U.S.C. § 3505(a)(6)) **and** is also consistent with the three purposes of the CBRA (e.g. to minimize [1] the loss of human life, [2] wasteful expenditure of Federal revenues, and [3] the damage to fish, wildlife, and other natural resources associated with coastal barriers).:

- Projects for the study, management, protection, and enhancement of fish and wildlife resources and habitats, including acquisition of fish and wildlife habitats, and related lands, stabilization projects for fish and wildlife habitats, and recreational projects.
- Establishment, operation, and maintenance of air and water navigation aids and devices, and for access thereto.
- Projects under the Land and Water Conservation Fund Act of 1965 (16 U.S.C. § 460l-4 through 11) and the Coastal Zone Management Act of 1972 (16 U.S.C. § 1451 et seq.).
- Scientific research, including aeronautical, atmospheric, space, geologic, marine, fish and wildlife, and other research, development, and applications.
- Assistance for emergency actions essential to the saving of lives and the protection of property and the public health and safety, if such actions are performed pursuant to sections 5170a, 5170b, and 5192 of title 42 and section 1362 of the National Flood Insurance Act of 1968 (42 U.S.C. § 4103) and are limited to actions that are necessary to alleviate the emergency.
- Maintenance, replacement, reconstruction, or repair, but not the expansion (except with respect to U.S. route 1 in the Florida Keys), of publicly owned or publicly operated roads, structures, and facilities.
- Nonstructural projects for shoreline stabilization that are designed to mimic, enhance, or restore a natural stabilization system.

The western portion of the Rockaway peninsula and all of Jamaica Bay are located within the designated CBRA (Unit NY-60P) (Figure 4.10-4 and Figure 4.10-5). The eastern portion of Rockaway peninsula is located in a CBRS Unit Buffer Zone, which represents the area immediately adjacent to a CBRS boundary. USFWS should be contacted to obtain an official USFWS CBRS property determination for this eastern portion of the Rockaway peninsula (process described here: http://www.fws.gov/ecological-services/habitat-conservation/cbra/Determinations.html).

Figure 4.10-4. Coastal Barrier Resource System Area (1 of 2)

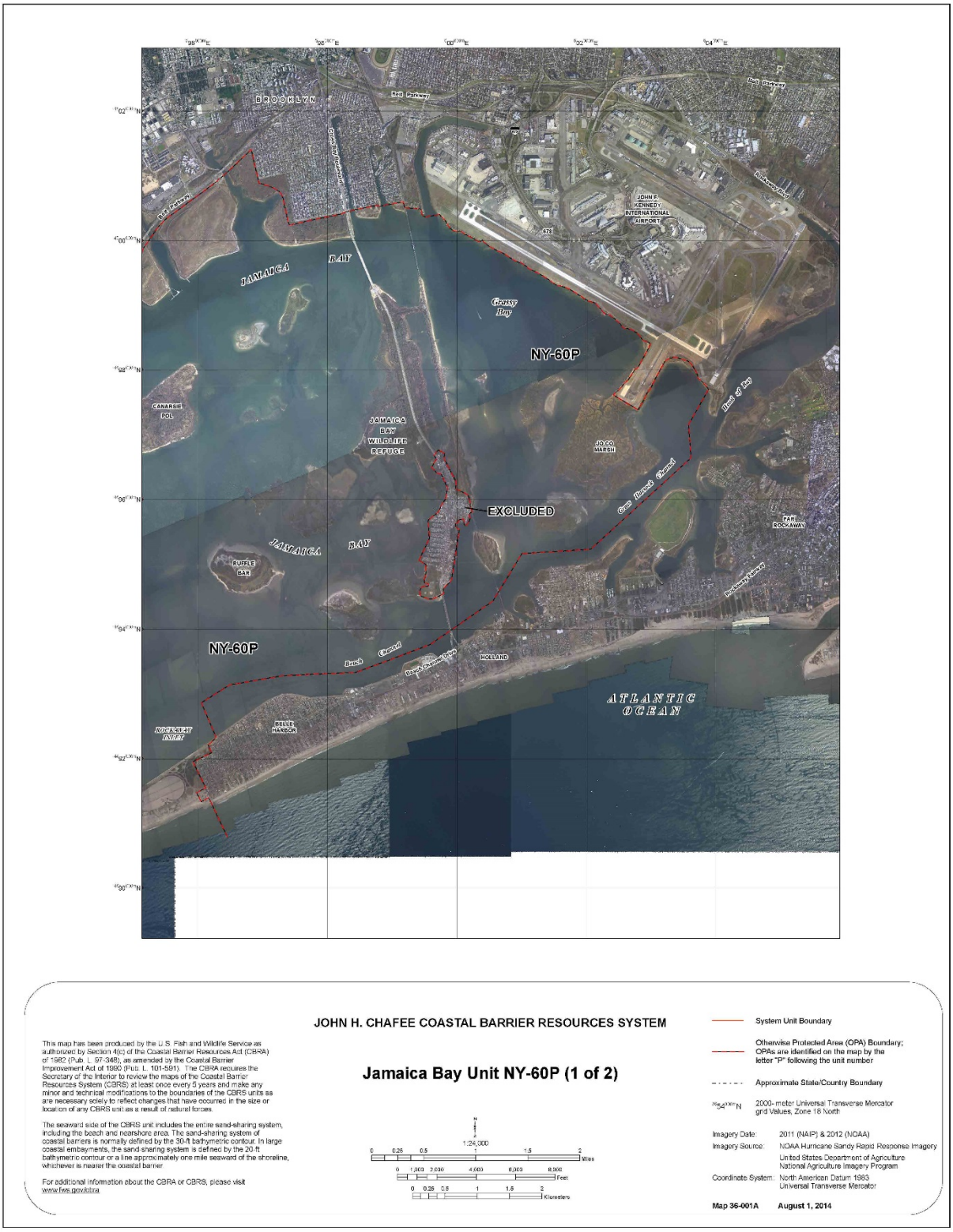
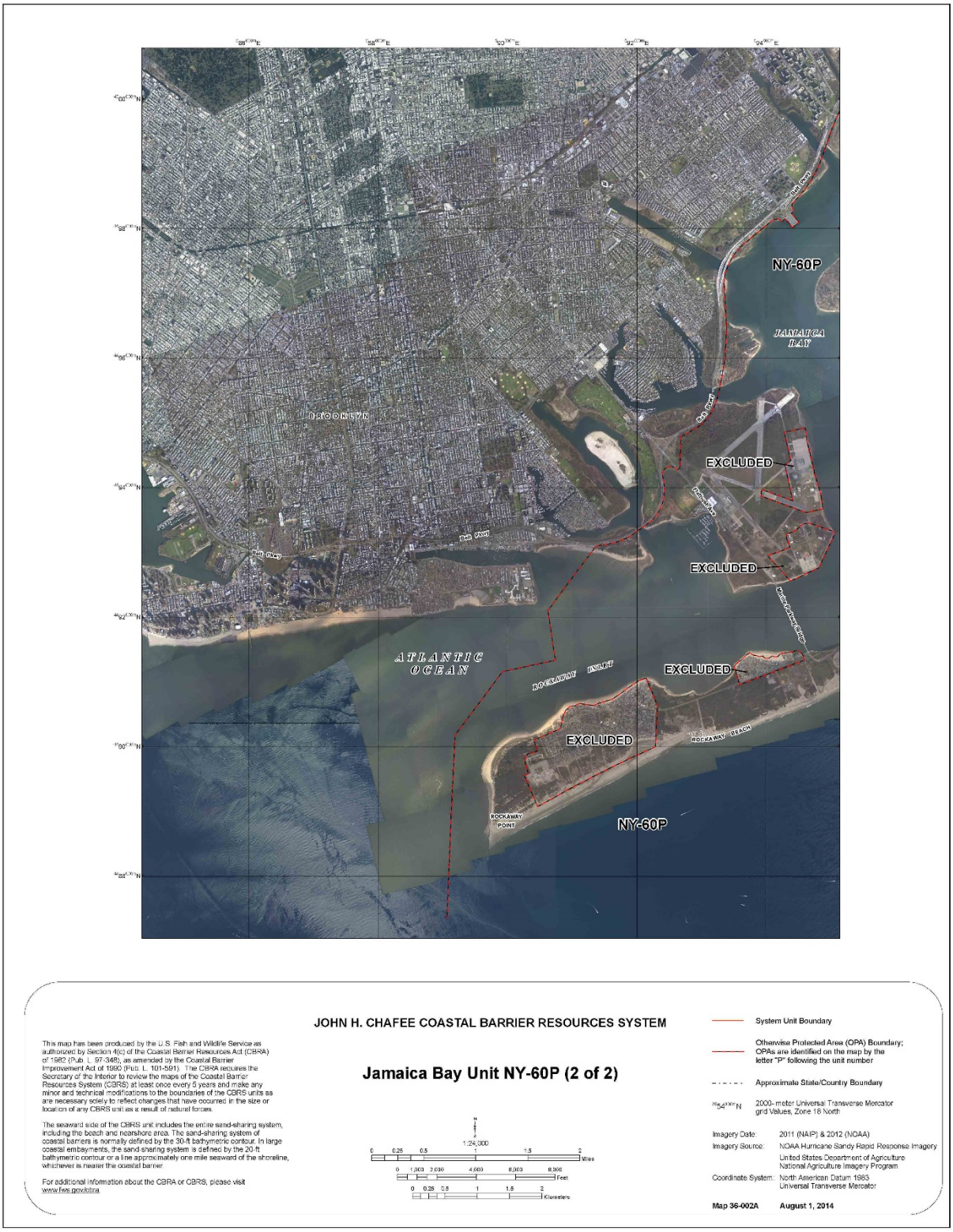


Figure 4.10-5. Coastal Barrier Resources System Area (2 of 2)



4.10.5.1 New York State Natural Heritage Program

The New York State Natural Heritage Program, in conjunction with The Nature Conservancy, recognizes two Priority Sites for Biodiversity within the Jamaica Bay and Breezy Point habitat complex: Breezy Point Tip (B2 - very high biodiversity significance) and Fountain Avenue Landfill (B3 - high biodiversity significance).

4.10.5.2 New York State Department of State Significant Coastal Fish and Wildlife Habitats

Jamaica Bay and Breezy Point Tip have been designated as Significant Coastal Fish and Wildlife Habitats by the New York State Department of State (NY Department of State, Planning and Development, 2016) (Figure 4.10-6).

Figure 4.10-6. NYS Dept. State Significant Coastal Fish and Wildlife Habitats

Notes: Green shaded area indicates Significant Coastal Fish and Wildlife Habitats

Source: NY Department of State, Planning and Development, 2016.

4.10.5.3 NYC Planning Special Purpose Districts

In additional to standard zoning, the NYC Planning Commission has designating special zoning districts to achieve specific planning and urban design objectives in defined areas with unique characteristics (NYC Planning, 2016, http://www1.nyc.gov/site/planning/zoning/districts-tools/special-purpose-districts.page). Special districts respond to specific conditions; each special district designated by the Commission stipulates zoning requirements and/or zoning incentives tailored to distinctive qualities that may not lend themselves to generalized zoning and standard development.

Rockaway API

No NYC-designated special purpose districts were identified within the Rockaway API (NYC Planning, 2016).

Jamaica Bay API

Within the Jamaica Bay API, the NYC Planning-designated special purpose districts are located to the west of Marine Parkway Bridge and include the following areas (Figure 4.10-7):

- Sheepshead Bay District (the Sheepshead Bay district was identified to protect and strengthen that neighborhood's waterfront recreation and commercial character. New commercial projects and residential development must meet conditions that will support the tourist-related activities along the waterfront. Provision for widened sidewalks, landscaping, useable open space, height limitations, and additional parking.)
- Ocean Parkway District (the Ocean Parkway Special District encompasses a band of streets east and west of the parkway extending from Prospect Park in the north to Brighton Beach on the south. The purpose of the Special District is to enhance the character and quality of this broad landscaped parkway, a designated Scenic Landmark.)
- Coney Island District (the Special Coney Island District (CI) was created as part of a comprehensive, long-range plan to re-establish famed Coney Island as a year-round, open entertainment and amusement destination. Outside of the entertainment area, the district fosters neighborhood amenities and new housing opportunities, including affordable housing through the Inclusionary Housing designated areas Program.)
- Coney Island Mixed Use District (the Special Coney Island Mixed Use District (CO) was established to stabilize existing residential development and protect the industries within an area, zoned M1-2, north of Neptune Avenue. The district allows existing residential buildings to be improved and enlarged, and new residential infill housing to be developed if adjacent to an existing residence or community facility. Certain manufacturing uses and most commercial uses are allowed as-of-right on lots adjacent to existing commercial and manufacturing uses, and along certain streets that allow commercial uses.)
- Bay Ridge District (the Special Bay Ridge District (BR) maintains the neighborhood's existing scale in conjunction with contextual and lower-density zoning districts mapped throughout the district. Beyond the underlying district controls, the neighborhood streetscape is preserved by limitations on the maximum permitted floor area ratio (FAR) and the height of community facilities, which is limited to 32 feet in contextual zoning districts.)

Development in the special use districts requires consultation with the NYC Planning Commission.

Figure 4.10-7. NYC Planning Special Use Districts

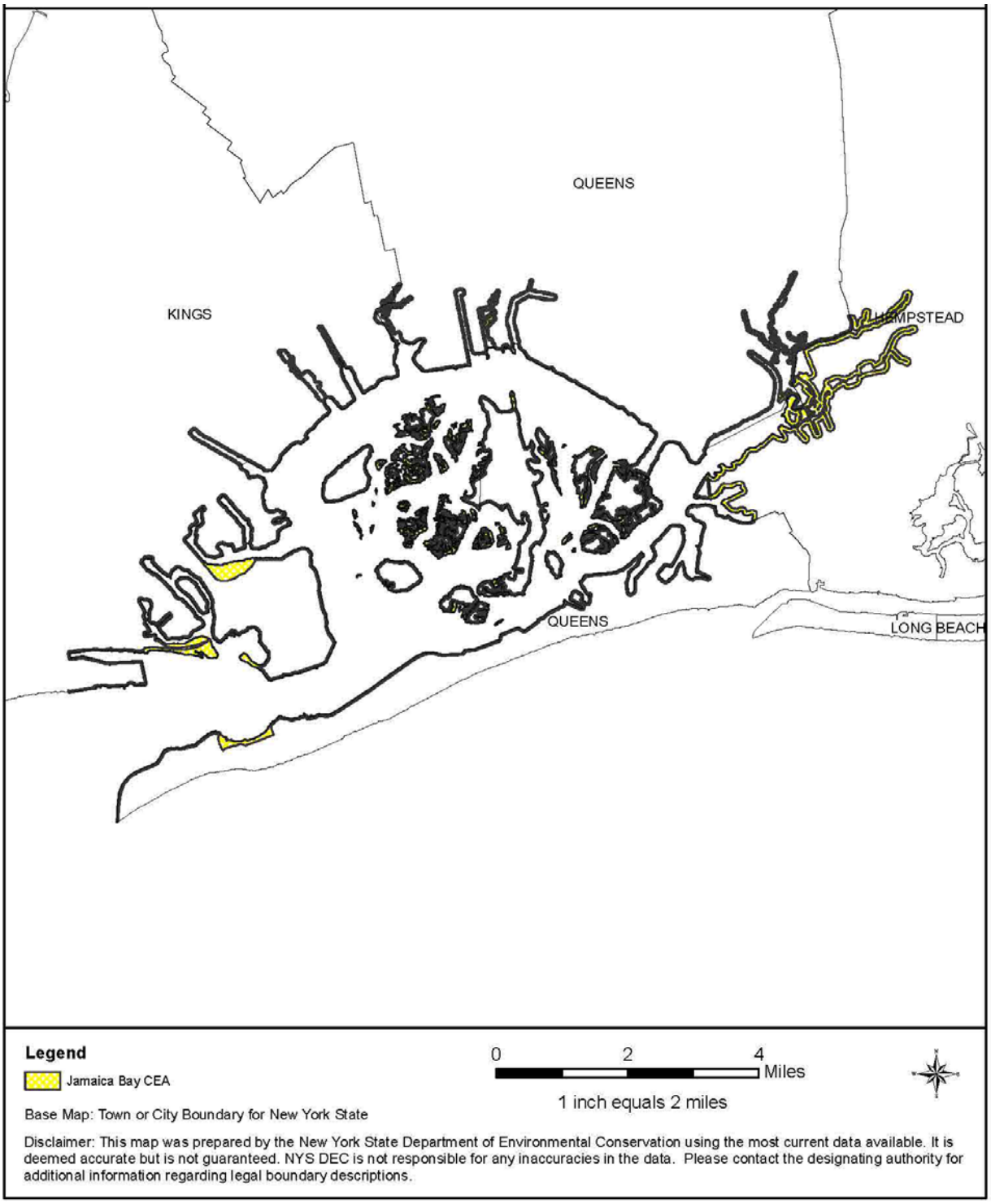
Source: NYC Planning, 2016.

4.10.5.4 NYSDEC Critical Environmental Area

Jamaica Bay is recognized by the NYSDEC under the State Environmental Quality Review Act as a Critical Environmental Area (CEA) (NYSDEC, 1990). The NYSDEC states that Jamaica Bay and its tributaries, tidal wetlands, and regulated adjacent areas are considered to be a CEA. The tributaries leading into Jamaica Bay (e.g. Gerritsen Creek) and their tidal wetlands and regulated adjacent areas are considered as part of this CEA. The NYSDEC defines a CEA as having "exceptional or unique character." The distinct characteristics associated with Jamaica

Bay are: 1) a natural setting (e.g., fish and wildlife habitat, forest and vegetation, open space and areas of important aesthetic or scenic quality) and 2) an inherent ecological, geological or hydrological sensitivity to change that may be adversely affected by any change.

Figure 4.10-8. NYSDEC Critical Environmental Area



Source: NYSDEC, 1990.

4.10.5.5 New York/New Jersey Harbor Estuary Program

The New York/New Jersey Harbor Estuary Program (HEP) has also recognized the importance of the Jamaica Bay watershed. In the HEP Habitat Workgroup 2001 Status Report (NY-NJ HEP 2001), HEP targeted Jamaica Bay, along with the Arthur Kill and the Hackensack Meadowlands, as one of the three watershed areas "of primary concern and ecological importance" (in Gerristen Creek EA 2003).

4.11 Land Use and Zoning

This section describes the State or Local land use and zoning regulations applicable the study area. A discussion of Special Management Areas is presented in 11.0.

4.11.1 Rockaway

Land use within the Rockaway API varies. The current land use is largely an artifact of historical urbanization, but future use is controlled by zoning, public policy, and land use regulations intended to promote activities appropriate to neighborhood character and the community. Existing land use and future changes based on zoning, known land use proposals, and current consistency with relevant land use policies are presented below. Existing land use within the Rockaway API is represented graphically in Figure 4.11-1. Existing zoning within the Rockaway API is represented graphically in Figure 4.11-2.

Figure 4.11-1. Existing land use within the Rockaway API and Jamaica Bay API

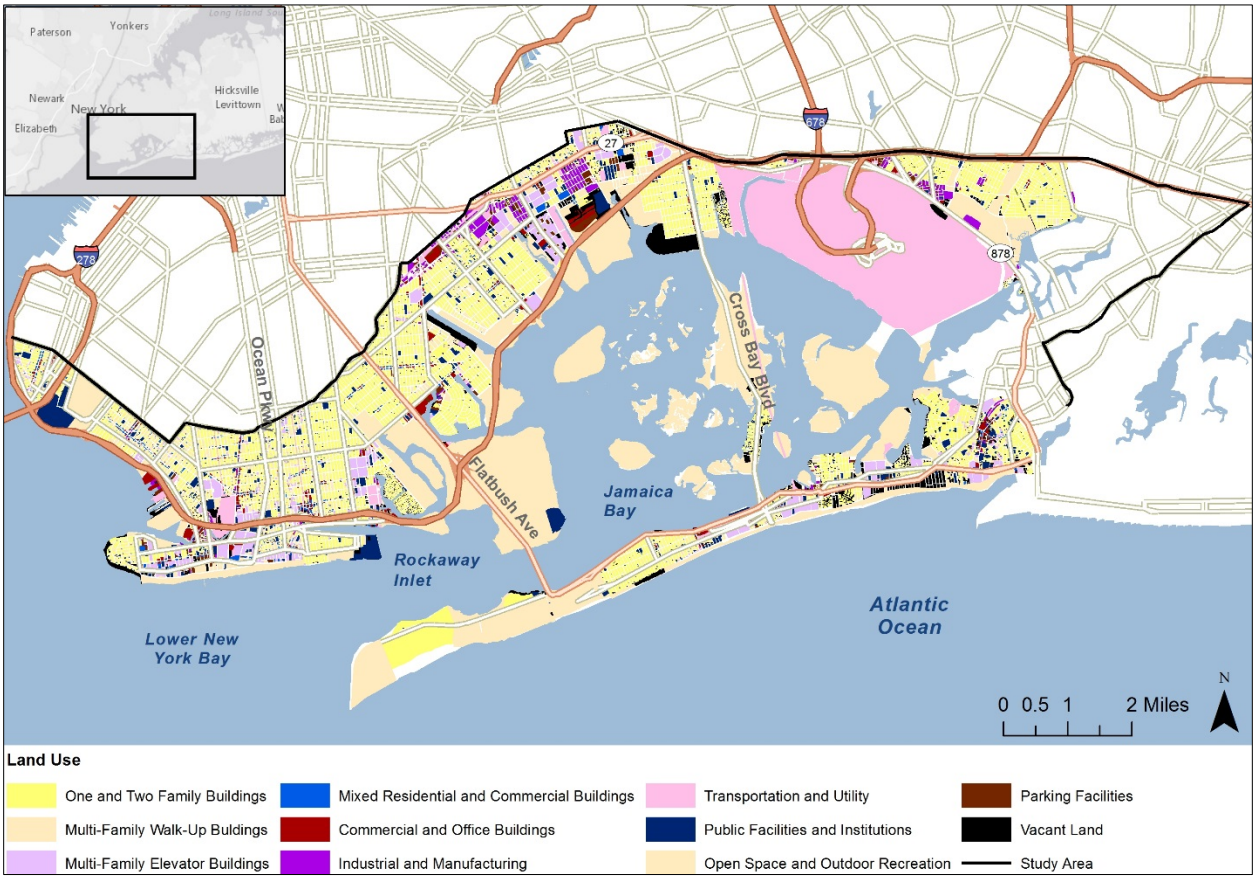
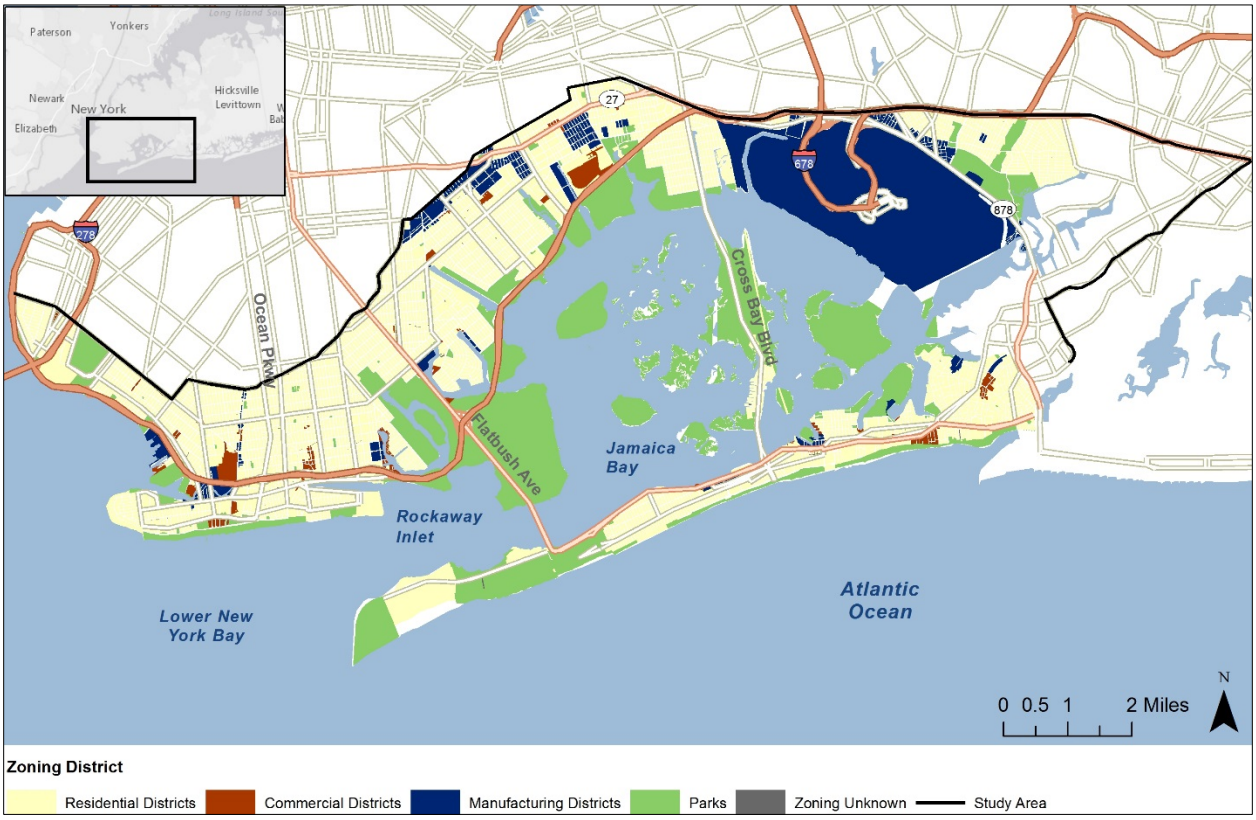


Figure 4.11-2. Existing zoning within the Rockaway API and Jamaica Bay API



4.11.1.1 Land Use

The Rockaway API is approximately 4,200 acres in land area. The area overall is extensively developed, with the predominant land used for residential use, open space, and outdoor recreation. Table 4.11-1 summarizes the area and percentages of the 11 land use categories defined by NYCDCP present in the Rockaway API. Open space and outdoor recreation accounts for the largest percentage of the land use within the Rockaway API due to the presence of the Jamaica Bay Unit of the Gateway National Recreation Area (GNRA), which includes Breezy Point Tip, Fort Tilden, and Jacob Riis Park. GNRA property within the watershed is characterized as open space on the land use map (Figure 4.11-1). The Rockaway API also contains numerous city parks managed by the NYC Department of Parks and Recreation, most notably the Rockaways Beach and Boardwalk, which covers approximately 304 acres on the Atlantic Ocean facing side of the Rockaway peninsula. It extends approximately 7 miles from the boundary of the Jacob Riis Park to the eastern end of the peninsula.

Table 4.11-1. Land Use Categories and Areas in the Rockaway API

Land Use	Acres	Percentage
Open Space and Outdoor Recreation	1596	38%
One & Two Family Buildings	1365	33%
Vacant Land	332	8%
Multi-Family Elevator Buildings	273	7%
Public Facilities and Institutions	193	5%
Multi-Family Walk-Up Buldings	143	3%
Transportation and Utility	126	3%
Commercial and Office Buildings	73	2%
Industrial and Manufacturing	27	1%
Mixed Residential and Commercial Buildings	26	1%
Parking Facilities	34	1%

4.11.2 Zoning

The Zoning Resolution of the City of New York regulates the size of buildings and properties, the density of populations, and the locations that trades, industries, and other activities are allowed within the City limits. The Resolution divides the City into districts, defining residential, commercial, and manufacturing districts with use, bulk, and other controls. Residential districts are defined by the allowable density of housing, lot widths, and setbacks, with a higher number generally indicating a higher allowable density (e.g., single-family detached residential districts include R1 and R2, whereas R8 and R10 allow apartment buildings). Commercial Districts are divided primarily by usage type, such that local retail districts (C1) are distinguished from more regional commerce (C8). Manufacturing districts are divided based on the impact of uses on sensitive neighboring districts to ensure that heavy manufacturing (M3) is buffered from

residential areas by lighter manufacturing zones (M1 and M2) that have higher performance levels and fewer objectionable influences.

Figure 4.11-2 presents zoning within the Rockaway API, which is primarily comprised of residential zoning districts at approximately 58%. The residential areas of the Rockaway API are characterized primarily by low density housing (one- and two-family homes) which account for approximately 33% percent of the land area. In contrast, medium and high density housing account for only 3% of the land area. Park zones account for 33% of the land area, mostly accounted for by the federally designated NPS property of the GNRA Jamaica Bay Unit. Manufacturing zones account for 3% of the area, while commercial zones account for the smallest percentage of the Rockaway API at approximately 2%.

4.11.3 Jamaica Bay

Land use within the Jamaica Bay API varies. The current land use is largely an artifact of historical urbanization, but future use is controlled by zoning, public policy, and land use regulations intended to promote activities appropriate to neighborhood character and the community. Existing land use and future changes based on zoning, known land use proposals, and current consistency with relevant land use policies are presented below. Existing land use within the Jamaica Bay API is represented graphically in Figure 4.11-1. Existing zoning within the Jamaica Bay API is represented graphically in Figure 4.11-2.

4.11.3.1 Land Use

The Jamaica Bay API is approximately 22,000 acres in land area. The area overall is extensively developed, with the predominant land used for open space and outdoor recreation, transportation and utility, and residential—comprised mostly of one- and two- family homes. Table 4.11-2 summarizes the area and percentages of the 11 land use categories defined by NYCDCP present in the Jamaica Bay API. Open space and outdoor recreation accounts for the largest percentage of the Jamaica Bay API due to the presence of the Jamaica Bay Unit of the Gateway National Recreation Area (GNRA), which within the Jamaica Bay API includes the Jamaica Bay Wildlife Refuge, Floyd Bennett Field, Canarsie Pier, Dead Horse Bay, Plumb Beach, and Bergen Beach. GNRA property within the watershed is characterized as open space on the land use map (Figure 4.11-1). The Jamaica Bay API also contains numerous city parks managed by the NYC Department of Parks and Recreation and one state park managed by the NYSDEC. The relatively large percentage of land use under the transportation and utility category is primarily due to the presence of the JFK Airport, which is almost 5,000 acres in size.

Table 4.11-2. Land Use Categories and Areas in Jamaica Bay API

Land Use	Acres	Percentage
Open Space and Outdoor Recreation	7,095	33%
Transportation and Utility	4,939	23%
One & Two Family Buildings	4,662	22%
Multi-Family Elevator Buildings	909	4%

Multi-Family Walk-Up Buldings	900	4%
Public Facilities and Institutions	878	4%
Commercial and Office Buildings	570	3%
Vacant Land	719	3%
Industrial and Manufacturing	371	2%
Mixed Residential and Commercial Buildings	286	1%
Parking Facilities	278	1%

4.11.3.2 Zoning

The Zoning Resolution of the City of New York regulates the size of buildings and properties, the density of populations, and the locations that trades, industries, and other activities are allowed within the City limits. The Resolution divides the City into districts, defining residential, commercial, and manufacturing districts with use, bulk, and other controls. Residential districts are defined by the allowable density of housing, lot widths, and setbacks, with a higher number generally indicating a higher allowable density (e.g., single-family detached residential districts include R1 and R2, whereas R8 and R10 allow apartment buildings). Commercial Districts are divided primarily by usage type, such that local retail districts (C1) are distinguished from more regional commerce (C8). Manufacturing districts are divided based on the impact of uses on sensitive neighboring districts to ensure that heavy manufacturing (M3) is buffered from residential areas by lighter manufacturing zones (M1 and M2) that have higher performance levels and fewer objectionable influences.

Figure 4.11-2 presents zoning within the Jamaica Bay API, which is primarily comprised of residential zoning districts at approximately 40%. As mentioned above, the residential areas of the Jamaica Bay API are characterized primarily by low density housing (one- and two-family homes) which account for approximately 22% percent of the land area. In contrast, medium and high density housing account for only 8% of the land area. Park zones account for 33% of the land area, mostly accounted for by the federally designated NPS property of the GNRA Jamaica Bay Unit that occupies much of the area adjacent to the shoreline of Jamaica Bay. Except for Bayswater State Park on Norton Basin and the GNRA lands, the remainder of the designated parklands in the area of the Bay is City-owned. Manufacturing zones account for 15% of the area, while commercial zones account for the smallest percentage of the Jamaica Bay API at approximately 2%.

Zoning in the portion of the Jamaica Bay API located in Nassau County is regulated and administered by the Nassau County Economic Development Office and the Planning Commission (Nassau County, 2016).

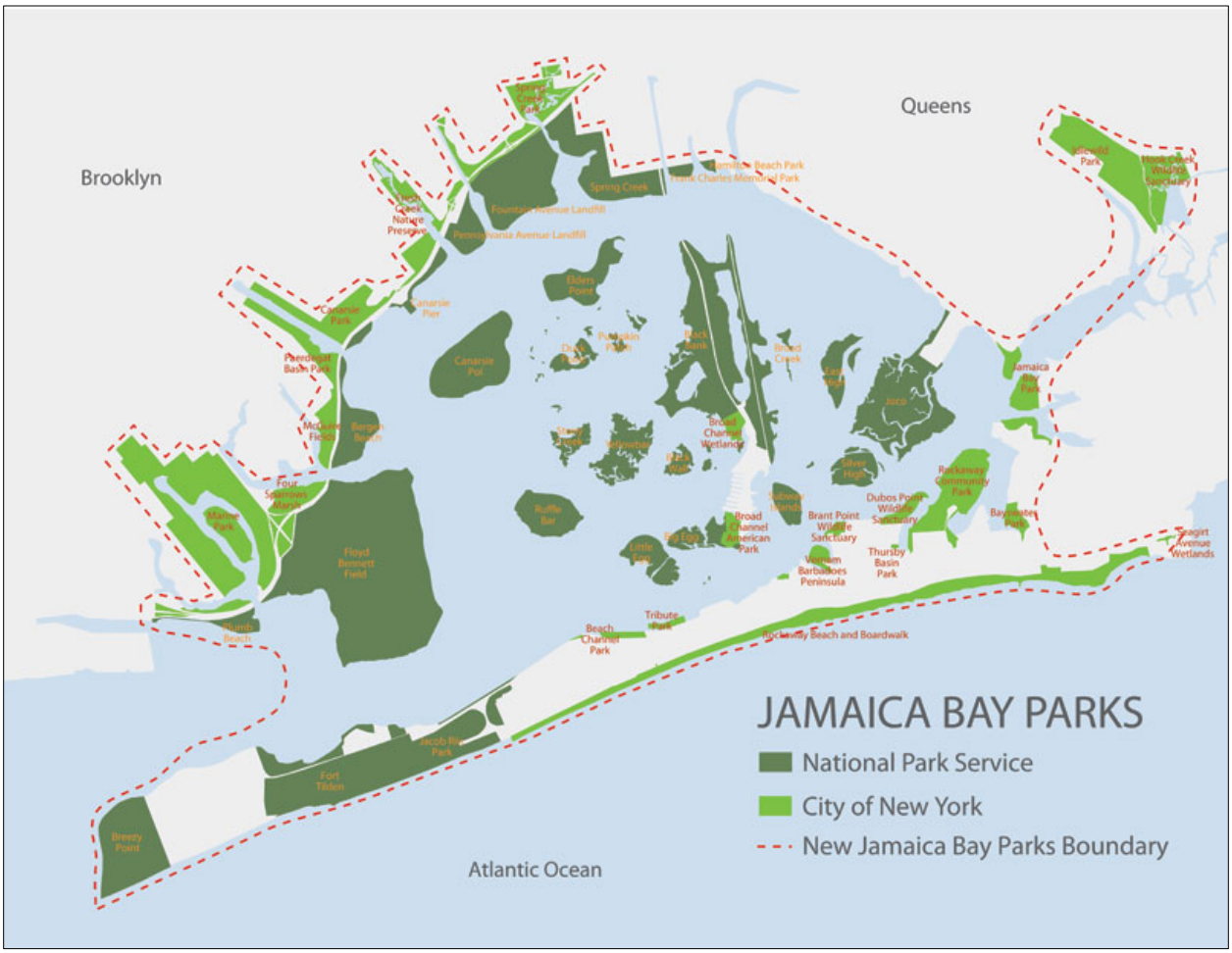
4.12 Recreation

This section describes public recreation areas. Many of these recreational areas also have cultural and historical significance, described in Section 18.0; aesthetic significance, described in Section 21.0; and are within Special Management Areas, described in Section 11.0.

4.12.1 Rockaway

The major recreational areas within the Rockaway API are located within the Jamaica Bay Parks Boundary, and are managed by federal and NYC agencies (Figure 4.12-1). The following sections describe these recreational areas in detail.

Figure 4.12-1. Recreational Areas in Rockaway API and Jamaica Bay API



Source: New York City Department of Parks and Recreation, 2016

4.12.1.1 Rockaway Beach and Boardwalk

Rockaway Beach and Boardwalk covers approximately 304 acres on the Atlantic Ocean facing side of the Rockaway peninsula. It extends approximately 7 miles from the boundary of the

Jacob Riis Park to the eastern end of the peninsula bordering Nassau County. It is owned by New York City and managed by the NYC Department of Parks and Recreation.

Approximately 7.7 million visits are made by approximately 1.5 million people to Rockaway Beach annually (in National Economic Development (NED) Recreation Benefit for Rockaway Beach, NY, 2015). A summary of the method of travel that visitors used to access Rockaway Beach is provided in Table 4.12-1 (NED, 2015).

Table 4.12-1. Rockaway Beach Annual Visitation Data

METHOD OF TRAVEL	VISITS	AVERAGE # OF VISITS FROM SURVEY (conducted June-August 2105)	# OF VISITORS
WALK/BIKE	557,172	12.85	43,360
CAR	4,735,962	5.72	827,965
BUS/SUBWAY	2,445,366	4.05	603,794
TOTAL	7,738,500		1,475,119

Those visitors who walk or bike to the beach and live close to the beach visit substantially more frequently than those that drive or take the subway/bus (NED, 2015). These visitors make up 3 percent of visitors and 7.2 percent of visits, which is reasonable, given the larger number of potential visitors who can drive or take the bus/subway to Rockaway Beach compared to those that are within walking or biking distance (NED, 2015).

Beach attendance under the without-project condition (No Action Alternative) is estimated using responses from the survey regarding expected beach attendance if Rockaway Beach is not maintained against erosion resulting in a beach width approximately half to the existing beach width (NED, 2015). Table 4.12-2 summarizes these data.

Table 4.12-2. Rockaway Beach Predicted Visitation Without Proposed Action

METHOD OF TRAVEL	VISITS	AVERAGE # OF VISITS	# OF VISITORS
WALK/BIKE	397,364	10.91	36,422
CAR	1,891,235	4.86	389,143
BUS/SUBWAY	937,389	3.45	271,707
TOTAL	3,225,988		697,272

The without-project condition of not maintaining Rockaway Beach against erosion results in a substantial number of existing beach goers not willing to visit (NED, 2015). The without-project future condition assumes the lack of beach maintenance against erosion. Rockaway Beach would continue to experience erosion at a rate of about 10 feet per year. Based on responses to beach surveys completed in the summer of 2015, it is estimated that a 50% reduction in beach width would reduce the annual number of visits to Rockaway Beach by 4,512,512 visits. Beach visitors arriving by walking or biking have the highest percentage continuing to visit under the

without project condition at 84 percent. More than 50 percent of visitors arriving by car or subway/bus are not willing to visit Rockaway Beach under the without-project condition. Those willing to visit under the without-project condition slightly reduce their number of beach visits compared with their existing beach visits. The number of visits not taking place under the without-project condition at Rockaway Beach is 4,512,512. Some of these visits will likely take place at alternative beaches such as Long Beach, Jones Beach and Coney Island (NED, 2015).

Rockaway Beach and Boardwalk is also home to the 79-acre Rockaway Beach-Arverne Shorebird Preserve, which is part of the "Forever Wild" program operated by NYC Parks and Recreation (New York City Department of Parks and Recreation, 2016). Every summer in the Arverne neighborhood of Rockaway Beach, an area between B44th and B57th Streets is cordoned off to limit disturbance to breeding piping plovers. As noted in Section 4.15, other species benefiting from this protection are least terns, oystercatchers - and an endangered plant, sea beach amaranth.

4.12.1.2 Gateway National Recreation Area Park – Rockaway Parks

The Gateway National Recreation Area, established in 1972, consists of three administrative units: Sandy Hook, New Jersey; Jamaica Bay, New York, and Staten Island, New York City (National Park Service, 2016) (Figure 4.12-2). Approximately 10 million people visit the Gateway National Recreation Area annually (New York Harbor Parks, 2016). The Jamaica Bay Unit parks that are located in the Rockaway API include Breezy Point Tip, Fort Tilden, and Jacob Riis Park. The specific number of visitors to these individual Gateway National Recreation Area parks within the Rockaway API was not available (Mabbett, 2016).

Breezy Point Tip

Breezy Point Tip is an isolated peninsula beach fronting Jamaica Bay (NPS, 2016, http://www.nyharborparks.org/visit/brpo.html). It is approximately 319 acres. It is one of the least disturbed natural areas of the Gateway National Recreation Area. It is a popular beach-front scenic and fishing area (striped bass, blue fish and summer flounder). It features over two hundred acres of ocean-front beach, bay shoreline, sand dunes, marshes and coastal grasslands all within New York City. The Breezy Point Tip area includes sand dunes, saltmarshes, brackish marshes, and grasslands that offer habitat for many threatened and endangered bird species (NPS, 2013).

Throughout the summer the sand dunes of Breezy Point serve as an important nesting area for the threatened Piping Plover. Also found at the beach are the Roseate Tern, Least Tern, Common Tern, Black Skimmer, and the American Oystercatcher. In the spring and fall the Breezy Point Tip serves as a stop-over for migrating shorebirds (NPS, 2016).

Fort Tilden

Fort Tilden encompasses approximately 475 acres (including the adjacent West Beach) and includes reclaimed habitats including natural beaches, a freshwater pond, a maritime forest

(NPS, 2013). The site also includes historic Fort Tilden, established in 1917 and now home to the Rockaway Theatre Company and the Rockaway Artist Alliance. Fort Tilden was also used as a Nike Missile Launch Site. In October 2012, Hurricane Sandy destroyed the dunes at Fort Tilden and exposed old seawalls and other debris (Student Conservation Association, 2016). Fort Tilden is described as “one of the best places on New York Harbor” to observe hawks during the fall migration (New York Harbor Parks, 2016). Fort Tilden offers “spectacular views of Jamaica Bay, New York Harbor, and the Manhattan skyline” (NPS, 2013).

Jacob Riis Park.

Jacob Riis Park is named in honor of Jacob Riis, the famed New York City journalist and photographer who documented the plight of the poor and working class in the city's tenements. The park was designed by Park Commissioner Robert Moses in 1936 and constructed on the site of one of the first US naval air stations. Moses envisioned Jacob Riis Park as a park for poor immigrants, accessible by public transportation, and close to New York City. Jacob Riis Park was transferred to the control of the National Park Service in 1972.

Jacob Riis Park is a cultural landscape that includes beaches for swimming and sunbathing, basketball courts, paddle tennis, playgrounds, a golf course, a historic bathhouse, and a mile-long cement boardwalk (NPS, 2013). It is approximately 269 acres. Dubbed "The People's Beach," Jacob Riis Park is known for its Art Deco bathhouse, which was constructed in 1932, and which was severely damaged during Hurricane Sandy.

Figure 4.12-2. Gateway National Park

Source: National Park Service, Gateway National Park

4.12.1.3 Other Recreational Areas

The Rockaway API includes a number of other recreational areas, many also having local environmental and cultural significance. These areas include the 33-acre Dubos Point Wildlife Sanctuary (New York City Department of Parks and Recreation, 2016), which is one of the "Forever Wild" nature preserves managed by the NYC Department of Parks and Recreation. Other recreational parks (not part of the "Forever Wild" program) managed by NYC Department of Parks and Recreation include:

- 195-acre Rockaways Community Park
- 15.5-acre Jamaica Bay Park
- 3.3-acre Marine Park/Beach Channel Park
- 16-acre Broad Channel American Park
- 21-acre Vernam Barbadoes Peninsula (Terrapeninsula Preserve)
- 4.3-acre Brant Point Wildlife Sanctuary, and
- 22-acre Michaelis-Bayswater Park (based on GIS data layer from Chris McGarry and http://www.nycgovparks.org/park-features/parks-list?boro=Q). The New York State Office of Parks, Recreation and Historic Preservation manages the 17-acre Bayswater Point State Park (http://parks.ny.gov/parks/86/details.aspx), while the NYSDEC manages the 11-acre Norton Basin (http://www.dec.ny.gov/outdoor/48692.html).

A map of these recreational areas, as well as those managed by the National Park Service, is presented in Figure 4.12-1.

4.12.2 Jamaica Bay

The major recreational areas in Jamaica Bay include Gateway National Recreation Area parks and New York City parks.

4.12.2.1 Gateway National Recreation Area – Jamaica Bay Parks

The Jamaica Bay Unit of the Gateway National Recreation Area includes the following areas:: Jamaica Bay Wildlife Refuge, Floyd Bennett Field, Plumb Beach, Bergen Beach, Canarsie Pier, and the Frank Charles Memorial Park. The specific number of visitors to these individual Gateway National Recreation Area areas within the Jamaica Bay API was not available (Mabbett, 2016). Additional detail about these parks is provided in the following sections.

Jamaica Bay Wildlife Refuge

The Jamaica Bay Wildlife refuge encompasses approximately 9,000 acres that include a portion of the bay itself, several islands, two brackish ponds (East Pond and West Pond –now breached), trails, and a visitor center. The refuge is composed of saltmarsh, natural inlets, grassy hassocks, sand dunes, small beaches, and upland habitats (NPS, 2015).

The area now known as Jamaica Bay Wildlife Refuge was established in the 1950s and was owned and managed by New York City (NPS, 2015). Robert Moses, former Commissioner of the New York City Parks Department (1934-1960), with aid from the U.S. Fish and Wildlife Service, surveyed Jamaica Bay in 1951 to further plans for a bird sanctuary and park with breeding ponds in the bay. In 1954, the New York City Parks Department partnered with the New York State Conservation Department to establish Jamaica Bay Bird Sanctuary. East and West Ponds were constructed in 1954 to provide attractive feeding habitat and freshwater plants for birds in Jamaica Bay. West Pond was created in the center of the refuge when dikes were built on the west side of Rulers Bar Hassock.

The Jamaica Bay Wildlife Refuge is located along the Atlantic flyway and is a significant bird sanctuary with sightings of over 300 species of songbirds, shorebirds, and waterfowl over the last 30 years (NPS, 2015). Shoals, bars, and mud flats provide habitat for a number of small mammals, reptiles, and amphibians. The Jamaica Bay Wildlife Refuge is the only wildlife refuge in the National Park System, and is also home to an impressive array of native reptiles, amphibians, small mammals, over 60 species of butterflies and one of the largest populations of horseshoe crabs in the Northeast (New York Harbor Parks, 2016). The refuge provides opportunities for recreation, scenic vistas, birding, visitor orientation, environmental education, national recreation area maintenance, and ranger operations. West Pond is one of the few places within the greater New York City metropolitan area that visitors can easily access the refuge (NPS, 2015).

The most prominent manmade features of the Jamaica Bay Wildlife refuge, East and West Ponds, are located east and west of the Cross Bay Boulevard, respectively. The majority of this island is located in Queens (Queens County), New York, but the extreme western edge, including a portion of West Pond, is located in Brooklyn (Kings County). Facilities in the study area include trails around West Pond, a visitor center, gardens, and viewing areas with benches. The West Pond area within the refuge contains an assemblage of coastal ecosystems that includes estuary, bay, and maritime uplands.

Habitats that comprise these ecosystems, so rare in such a highly developed area, support a rich biota that includes migratory birds, marine finfish, and shellfish; plant communities; and rare, threatened, and endangered species. These features provide opportunities to restore, study, enhance, and experience coastal habitats and ecosystem processes.

West Pond was approximately 44 acres and approximately 3 to 4 feet deep prior to Hurricane Sandy. West Pond was breached during Hurricane Sandy, allowing waters from Jamaica Bay to flow unabated into the pond thereby changing habitat conditions in and around the pond. The east and west banks of the breach continue to erode with tidal and storm activity.

Floyd Bennett Field

Once an important New York City airport, Floyd Bennett Field is now dedicated to aviation history, sports, and outdoor recreation (New York Harbor Parks, 2016). Floyd Bennett Field is approximately 1,115 acres.

Named for naval aviator and Brooklyn resident Floyd Bennett, the first person to fly over the North Pole, the old airport was a point of departure for other record-breaking flights of famous aviators including Amelia Earhart and Howard Hughes. The site opened in 1931 as New York's first municipal airport and was converted to a Naval Air Station in 1941. It was then the most active airport in the United States during World War II. Now, Floyd Bennett Field is home to the Historic Aircraft Restoration Project (HARP), which restores and maintains a wide variety of aircraft and gives visitors the opportunity to view these airplanes.

Floyd Bennett Field has a variety of nature programs that include urban camping, ecology walks, astronomy and gardening events and kayak trips, which launch from the Seaplane Ramp into Jamaica Bay.

Ranger-led walks through the wild North Forty highlight the site's unique, sensitive ecology and give visitors the opportunity to get as close as possible to amazing flora and fauna without causing harm. Bird lovers especially appreciate the wild grassland areas; these uncut sections provide a variety of rare species with essential native habitat. Additionally, the Floyd Bennett Field Garden Association runs Brooklyn's largest community garden, where members plant and tend their own plots.

Other park recreational activities include horseback riding at Jamaica Bay Riding Academy, golf and mini golf, archery, biking, softball, and fishing. Visitors also make use of the Jamaica Bay Greenway, a multi-use pathway adjacent to Floyd Bennett Field for walking, jogging, or biking.

4.12.2.2 Plumb Beach

Located at the mouth of Jamaica Bay, Plumb Beach is a beach along the north shore of Rockaway Inlet, in the New York City borough of Brooklyn. It is a stretch of shoreline, tidal mudflats, low saltmarsh areas, a tidal lagoon, a dune system, and woodland thickets at the entrance to Gerritsen Creek adjacent to the Belt Parkway. Originally an island, the creek separating it from the land was filled in the 1930s. New York City acquired the federal property for park purposes in 1924, but leased it to a contracting company, which parceled and rented the land. Since 1972 it has been a part of Gateway National Recreation Area, though the parking lot and greenway that provide primary access to the shore are the responsibility of the New York City Department of Parks and Recreation and the New York City Department of Transportation.

In the past, Plumb Beach was one of the best locations to observe the mating ritual of horseshoe crabs (USGS, 2015). Horseshoe crabs migrate up and down the Atlantic coast, but return to their site of birth to mate on the beach during the highest tides of the full moon in the spring (typically late May to earliest June). Unfortunately, horse crab populations are becoming severely

threatened throughout the region. A move in the early 1990s to replenish sand to Plumb Beach severely disrupted the habitat conditions for the horseshoe crabs, and they abandoned use of the beach.

The environment is not completely natural, having been totally modified during the construction of the Belt Parkway, and land filling in and around Sheepshead Bay (USGS, 2015). The shore dunes are essentially the borough's only line of defense against catastrophic flooding of a major storm or hurricane.

Plumb Beach experiences strong winds that draw many windsurfers and kite boarders (SCA, 2016, http://sandy.thesca.org/jamaica-bay-ny). The beach's exposed location led the site to suffer massive storm damage during Hurricane Sandy in October 2014, and Plumb Beach was closed to the public until extensive restoration and reconstruction was completed.

4.12.2.3 Canarsie Pier

In the 19th century, Canarsie Pier was a center for commercial fishing (New York Harbor Parks, 2016). By the early 1900's, the waterfront also became a popular recreation area with a yacht club, summer bungalows, and a floating bath house. The area was rumored to house some of the most raucous establishments in the city, filled with colorful characters. However, by 1920 urban pollution from the rapidly expanding population made the fish unfit for consumption. The City of New York built the 600-foot pier that exists today as a commercial dock, but the goal of turning Jamaica Bay into a seaport never reached fruition. The National Park Service took control of this site in 1973, and pollution management over the past three decades has improved the water quality of Jamaica Bay holistically.

Today, the pier is known to locals as a prime location to catch blue fish and fluke. Surrounded by protected shoreline and salt marshes, the beautiful natural backdrop is also an ideal spot for picnicking and outdoor recreation.

Canarsie Pier offers several recreational opportunities. There is a kayak launch from which many ranger-led Canarsie Pol paddle trips embark and the sheltered coast next to the pier offers a safe space for the park's summer kayak tryouts. Seasonal kite flying activities, youth group paddling, fishing and a summer concert series also take place.

Bergen Beach

Bergen Beach on the north shore of Jamaica Bay (not to be confused with the bordering neighborhood of the same name) is also nearby and within the unit's boundary, supporting the Jamaica Bay Riding Academy concession (horses). Bergen Beach was originally an island later connected to the Brooklyn mainland by landfill.

Frank Charles Memorial Park

Frank Charles Memorial Park and Hamilton Beach were originally created as municipal parks and include playgrounds and ball fields along with shoreline access for fishing, as well as some sensitive marshlands (NPS, 2013).

The Frank Charles Memorial Park offers public beachfront as well as playgrounds and athletic fields. Frank Charles Park was one of the first sites to reopen after Hurricane Sandy (SCA, 2016, http://sandy.thesca.org/jamaica-bay-ny).

4.12.2.4 Coney Island

Coney Island is an approximately 442-acre area peninsula located in the southwestern portion of Kings County and abuts the Lower Bay. Coney Island has a mix of residential and recreational uses. The residential portion of the peninsula is a community of 60,000 people in its western part, with Sea Gate to its west, Brighton Beach and Manhattan Beach to its east, the Atlantic Ocean/Lower Bay to the south, and Gravesend to the north.

Coney Island has been a popular recreational spot about the time of the American Revolution (USGS, 2015). In its early days Coney Island was a privately owned hog farm. Its cedar forest was stripped away for fence and firewood by the growing community around Gravesend Bay (pickled red cedar stumps still sometimes was up on the beach even though the forests are long gone). Other barrier islands likely existed further offshore and to the east about the time of European contact. Much of the Coney Island coast has been artificially modified since development has taken place.

Coney Island first prospered as a resort when Ocean Parkway was completed, connecting the beach with the East River ferry docks just before the Civil War (USGS, 2015). Its sand dunes gave way to boardwalks, beginning the long history of storm damage along the water front. Its earthy attractions, cheap motels, and steady Sunday morning traffic gave it its reputation as "Sodom by the Sea." Coney Island later became a high risk experiment by New York City's Urban Development Corporation in the construction of a great densely spaced, urban high rise complex during the 1950s to 1960s. Coney Island became one of the most densely populated shore front areas in North America.

Coney Island’s recreational attractions include three miles of beach and boardwalk, and its famous amusement parks, including the wooden Cyclone roller coaster which has operated continuously since 1927 (USGS, 2015). The two newest parks, Luna Park and Scream Zone, opened in 2010 and 2011, respectively (NYSOSC, 2014). The Brooklyn Cyclones, a minor-league baseball team, play 32 home games a year at nearby MCU Park. The New York Aquarium, which suffered an estimated $65 million in damages during Hurricane Sandy in October 2012, remains a draw. A $157 million shark exhibit is scheduled to open in 2016 (NYSOSC, 2014). Approximately 12.8 million people visited Coney Island in 2010, compared to 4.2 million in 2009 (NYSOSC, 2011).

Coney Island maintains a broad sandy beach from West 37th Street at Sea Gate, through the central Coney Island area and Brighton Beach, to the beginning of the community of Manhattan Beach, a distance of approximately 2.5 miles. The beach is continuous, and is served for its entire length by the broad Riegelmann Boardwalk.

Coney Island beach is no longer a natural feature (USGS, 2015). Its natural sand supply has been cut off by the construction of the Breezy Point jetty. To maintain the beach, sand must be pumped in occasionally from offshore sand reservoirs (USGS, 2015). The beach is groomed and replenished on a regular basis by the city. The position of the beach and lack of significant obstructions means virtually the entire beach is in sunlight all day. The beach is open to all without restriction, and there is no charge for use. The beach area is divided into "bays", areas of beach delineated by rock jetties, which moderate erosion and the force of ocean waves.

4.12.2.5 Other Recreational Areas

The Jamaica Bay API also includes many parks owned by New York City and managed by the NYC Department of Parks and Recreation, including, but not limited to:

- 180-acre Idlewild Park Preserve, including 111-acre Hook Creek park
- 18-acre Coney Island Boat Basin
- 77-acre Calvert Vaux Park
- 8-acre Bensonhurst Park
- 41-acre Belt Parkway/Shore Parkway
- 9.9-acre Sheepshead Bay Piers/Shore Boulevard
- 40-acre Manhattan Beach Park
- 572-acre Marine Park
- 57-acre Four Sparrow Marsh
- 77-acre Joseph T. McGuire Park
- 107-acre Paerdegat Basin Park
- 40-acre Fresh Creek Park
- 90-acre Spring Creek Park and Addition
- 16-acre Broad Channel American Park
- Hook Creek Park/Wildlife Sanctuary
- Tucker Place
- John J. Carty Park
- Dyker Beach Park
- Bensonhurst Park

4.13 Navigation

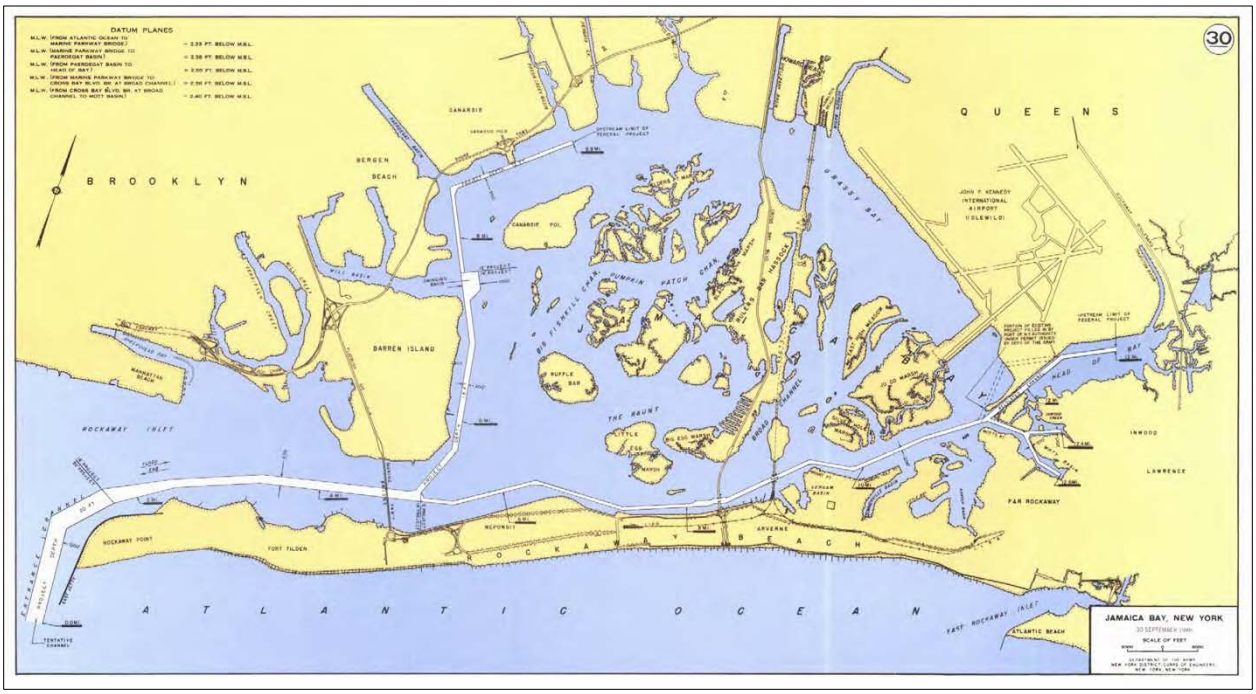
Most of Jamaica Bay is a shallow body of water, primarily navigable only by shallow draft vessels (USACE, 2005). Water depths around the marsh islands typically range from 2-6 feet. Over the last century, the various entities, including USACE dredged a number of channels through Jamaica Bay. Rockaway Inlet connects Jamaica Bay to the New York Harbor at the

southwest corner of the bay. Rockaway Inlet is the only entrance into the bay from the Atlantic Ocean/New York Harbor. At the mouth of Jamaica Bay, Rockaway Inlet branches into three channels: Beach Channel running to the east, Island Channel running northwest, and two unnamed channels running north. These channels vary in depth from 20-40 feet. On the west side of the bay, the larger channels fork into smaller channels that run through and around the various marsh islands. These smaller channels include Big Channel, Big Fishkill Channel, Pumpkin Patch Channel, Black Wall Channel, and Horse Channel; these channels are typically 10-16 feet deep. Elders Point is accessible by Pumpkin Patch Channel, which runs to the north of the island, and Yellow Bar is accessible by Horse Channel to the west, Black Wall Channel to the east, and Pumpkin Patch Channel to the north (USACE, 2005).

4.13.1 Federal channel

The NOAA chart "Jamaica Bay and Rockaway Inlet" (chart 12350; 1:20,000 scale) depicts the federal navigation channel within this area (NOAA, 2016). As previously described, deep water channels extend from the Rockaway Inlet east into Jamaica Bay, continuing along the southern and northern portions of Jamaica Bay until reaching the far eastern extent of Jamaica Bay at Bergen Basin, Head of Bay, and Far Rockaway (Figure 4.13-1).

Figure 4.13-1. Jamaica Bay and Rockaway Inlet - Federal Navigation Channel



Source: USACE, Jamaica Bay March Islands, Integrated Ecosystem Restoration Report, EA and FONSI, December 2005 (*NOAA chart 12350 is 12 MB too large to insert*)

According to the USACE, domestic commercial vessels made approximately 1,002 upbound (entered Jamaica Bay) and downbound (exited Jamaica Bay) trips in 2013, as summarized in Table 4.13-1 (USACE, 2013). Based on this report, no trips were made by non-domestic vessels into Jamaica Bay.

Commercial vessels primarily transport bulk fuel to several privately operated bulk fuel storage terminals located in basins at the eastern end of Jamaica Bay. Commercial vessels also transport sand and gravel to several aggregate facilities at the eastern end of Jamaica Bay and north of Coney Island. A list of Wharf and Dock Facilities is presented in 4.19.1.

Table 4.13-1. Trips and Drafts of Vessels, CY 2013

Trips and Drafts of Vessels, 2013 (draft in feet)												
Draft (feet)	Upbound						Downbound					
	Self-Propelled Vessels				Non-Self Propelled Vessels		Self-Propelled Vessels				Non-Self Propelled Vessels	
	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker	Total	Dry Cargo	Tanker	Tow or Tug	Dry Cargo	Tanker
15	2	-	-	-	-	2	-	-	-	-	-	-
13	1	-	-	-	-	1	-	-	-	-	-	-
≤12	510	-	1	123	133	253	489	-	1	123	133	232
TOTAL	513	-	1	123	133	253	489	-	1	123	133	232
TOTAL UPBOUND and DOWNBOUND TRIPS = 1,002												

Source: USACE, 2013.

4.13.2 Recreational Channel

Recreational vessels include motor, sail, and paddle boats. Recreational traffic includes vessels traveling to and from many private and one municipally-owned marinas offering permanent storage (slips or moorings), as well as transient (temporary) storage associated with restaurants located along the shoreline of Jamaica Bay and Rockaway peninsula. A list of recreational marinas is presented in Table 4.14-6. Recreational vessels are not restricted from traveling within Jamaica Bay or along the Atlantic coastline of the Rockaway peninsula. Mabbett requested recreational vessel traffic counts from the USCG in April 2016, but a response has not been received to date.

4.14 Infrastructure

4.14.1 Airports

John F. Kennedy (JFK) International Airport is a 5,000-acre major international airport located in Queens, New York City. The airport is 12 miles southeast of lower Manhattan and is located within the Jamaica Bay API. Over 70 airlines operate from the airport and have destinations in all six inhabited continents. It is operated by the Port Authority of NY & NJ (Port Authority of NY and NJ, 2016).

JFK International Airport is accessible via Route 678 by car, or via the MTA subway and buses and the Long Island Railroad which connect to the JFK AirTrain system, which makes several stops throughout the airport and is operated by the Port Authority of NY & NJ (Port Authority of NY and NJ, 2016).

4.14.2 Roads, Trains, Ferries

In October 2012, Hurricane Sandy came ashore in the New York area, resulting in damage from wind and flooding from rain, overflowed rivers, and storm surge, which in some areas exceeded 13 feet (NPS, 2013). Damage to transportation-related structures from Sandy within the Jamaica Bay Unit of the Gateway National Recreation Area included:

- Jamaica Bay Wildlife Refuge East and West Ponds were breached, and the West Pond remains breached, resulting in damage to trails and a subway route.
- All of Fort Tilden was flooded from both the ocean and bay side, damaging transportation infrastructure.
- The Shore Road and fisherman's parking lot were covered in sand.
- At Jacob Riis Park, winds covered much of the park north of the beach in sand.
- Bicycle and pedestrian paths were damaged.

4.14.2.1 Rockaway

Roads. The Rockaway peninsula is accessible from roadways on the eastern end of the peninsula and two bridges crossing over Jamaica Bay from the north. From the north, the primary roadways leading to and from the Rockaway Peninsula include Flatbush Avenue, which crosses over the Marine Parkway Memorial Bridge (Gil Hodges Bridge), and Cross Bay Boulevard, which crosses over the Cross Bay Veterans Memorial Bridge.

Marine Parkway-Gil Hodges Bridge is a vertical-lift bridge connecting Rockaway Peninsula to Flatbush Avenue, Floyd Bennett Field, Belt Parkway, and Marine Park. While the center span is only 55 feet above mean high water (MHW), its lift gates can be raised to a height of 150 feet above MHW. Based on design considerations, it is assumed that the clearance required for construction, assuming a gate structure would be transported upright, is no more than 45 to 50 feet, such that barges would be able to pass beneath the center span (preferably at low tide) (page 63 in Arcadis MFR 6, 2016).

The Cross Bay Veterans Memorial Bridge is a high-level fixed bridge connecting Cross Bay Boulevard from Broad Channel in Jamaica Bay to the Rockaway Peninsula. Similar to the Marine Parkway-Gil Hodges Memorial Bridge, the clearance below is 55 feet above MHW. Based on design considerations, it is assumed that the clearance required for construction, assuming a gate structure would be transported upright, is no more than 35 to 40 feet, such that barges would be able to pass beneath the center span (page 64 in Arcadis MFR 6, 2016).

From the east, the primary roadway is Rockaway Beach Boulevard, which extends west through the central portion of the peninsula to Jacob Riis Park. Beach Channel Drive on the southern

side of the peninsula extends west terminating at Breezy Point Tip. Shore Front Parkway (State Route 908L) is a 1.5-mile roadway that provides access to portions of Rockaway Beach on the northern side of the peninsula. The most recent annual average daily counts are summarized in Table 4.14-1 and visualized in Figure 4.14-1.

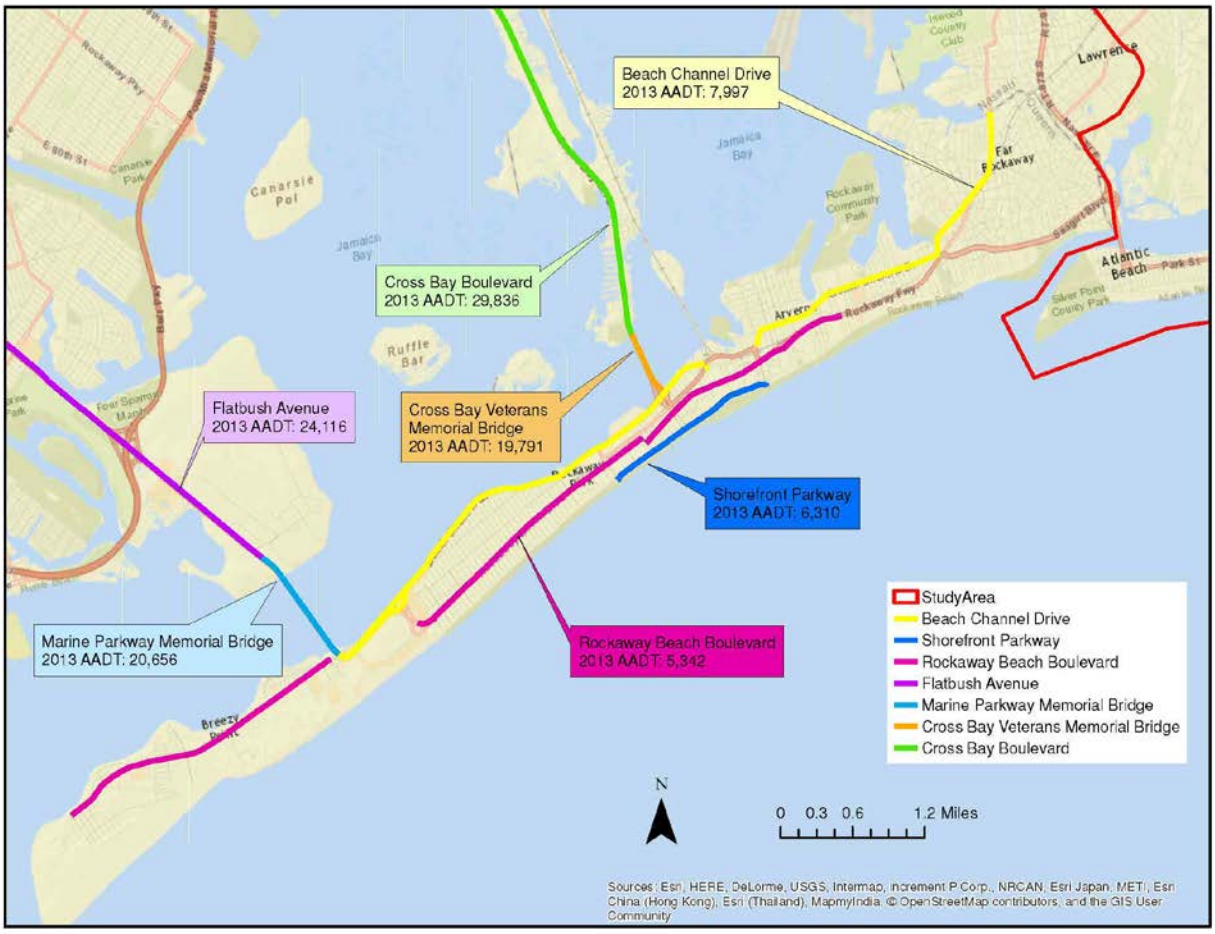
The New York City and New York State regulations regarding traffic, weight, and truck restrictions apply to roadways throughout the Rockaway API.

Table 4.14-1. Annual Average Daily Traffic Counts - Rockaway

Road	Number of Automobile Lanes	Annual average daily traffic counts (2013)
Flatbush Avenue	4	24,116
Marine Parkway Bridge (aka Gil Hodges Memorial Bridge)	4	20,656
Cross Bay Boulevard	4	29,836
Cross Bay Veterans Memorial Bridge	4	19,929
Rockaway Beach Boulevard	4	5,342
Beach Channel Drive	2	7,997
Shore Front Parkway (Route 908L)	2	6,310

Source: NYSDOT, 2013

Figure 4.14-1. Primary Roadways - Rockaway



Trains. The Rockaway Park Shuttle is a shuttle service of the New York City Subway operating in Queens. From the Cross Bay Veterans Memorial Bridge, it connects with the A train at Broad Channel station and is the latest iteration of the Rockaway Shuttle services that have been running in the Rockaway peninsula since 1956. This shuttle train provides service to the western part of the peninsula, with a terminus at Rockaway Park – Beach 116th Street, and to the eastern part with a terminus at Far Rockaway-Mott Avenue. The fully aboveground route operates on trackage that was originally part of the Long Island Rail Road's Far Rockaway Branch until the mid-1950s. The Long Island Rail Road extends into the eastern portion of the Rockaway peninsula at Far Rockaway, but this train does not connect with the New York City Subway stop at Far Rockaway-Mott Avenue.

Hurricane Sandy (October 29, 2012) severely disrupted transportation service to the area (NYSOSC, 2014). Subway service to the Rockaways, provided by the A line, was suspended for six months as crews performed cleanup and emergency repairs. Permanent repairs will be

needed, and the MTA estimates that the cost to restore the line to its pre-storm condition could total $650 million (NYSOSC, 2014).

Bus. The Queens Woodhaven Boulevard Bus Rapid Transit Corridor runs to and from the Rockaway Peninsula.

Ferry. The Rockaway Beach Ferry operates from Pier 11 in Wall Street, Manhattan to Jacob Riis Park Beach in Rockaway from May through September.

4.14.2.2 Jamaica Bay

Roads. The Jamaica Bay API is located in Kings, Queens, and Nassau Counties. Vehicles travel through this area via several key routes and bridges. Within the Jamaica Bay Unit of the Gateway National Recreation Area, the Belt Parkway and Flatbush Avenue provide access to Canarsie Pier and Floyd Bennett Field districts from the north, east, and west (NPS, 2013). Continuing across the Marine Parkway Bridge allows access to the Rockaway Peninsula. Belt Parkway and Woodhaven Boulevard provide access to the Jamaica Bay Wildlife Refuge from the north, east, and west. These routes connect to Cross Bay Boulevard, which extends across the Joseph Addabbo-North Channel Bridge into the Jamaica Bay Wildlife Refuge; annual average daily traffic counts are presented in Section 15.2.1. The primary roadways to and from Coney Island include Cropsey Avenue and Ocean Parkway. The most recent annual average daily counts are summarized in Table 4.14-2 and visualized in Figure 4.14-2, Figure 4.14-3, and Figure 4.14-4 (NYSDOT, 2013).

New York City, Nassau County, and New York State regulations regarding traffic, weight, and truck restrictions apply to roadways throughout the Jamaica Bay API.

Table 4.14-2. Annual Average Daily Traffic Counts - Jamaica Bay

Road	Number of Automobile Lanes	Annual average daily traffic counts (2013)
90-7C/Shore Parkway	6	166,108
NY27	6	33,066
Cropsey Avenue	4-6	31,367
908H/Ocean Parkway	6	39,908
Marine Parkway Memorial Bridge	4	20,656
Cross Bay Veterans Memorial Bridge	4	19,791

Trains. The New York City Subway provides transit services throughout Kings and Queens Counties. Within the Jamaica Bay API, the L line provides access to Canarsie Park. The New York City Subway also provides access from northern areas to Coney Island, including the Broadway Local N line, Broadway Express Q Line, the 6 Avenue Express D Line, the 6 Avenue Local F Line, and the B line.

Bus. Regional transit access to the districts of Jamaica Bay can be made via bus connections to subway stations at Flatbush Avenue, Rockaway Park/Beach 116th Street, Rockaway Parkway, and Broad Channel.

Ferries. There are no public ferry service landings within the Jamaica Bay API.

Figure 4.14-2. Primary Roadways - Jamaica Bay (western area)

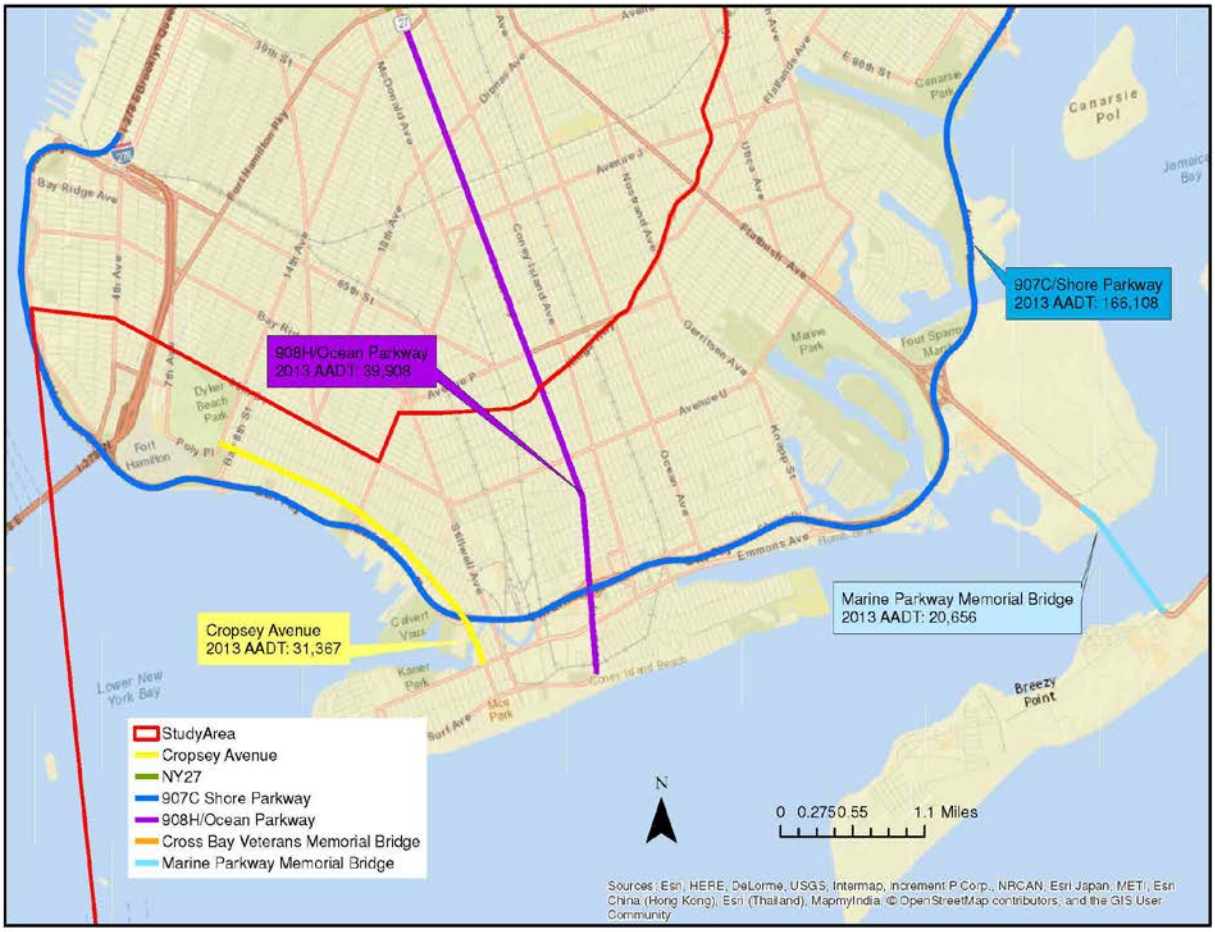
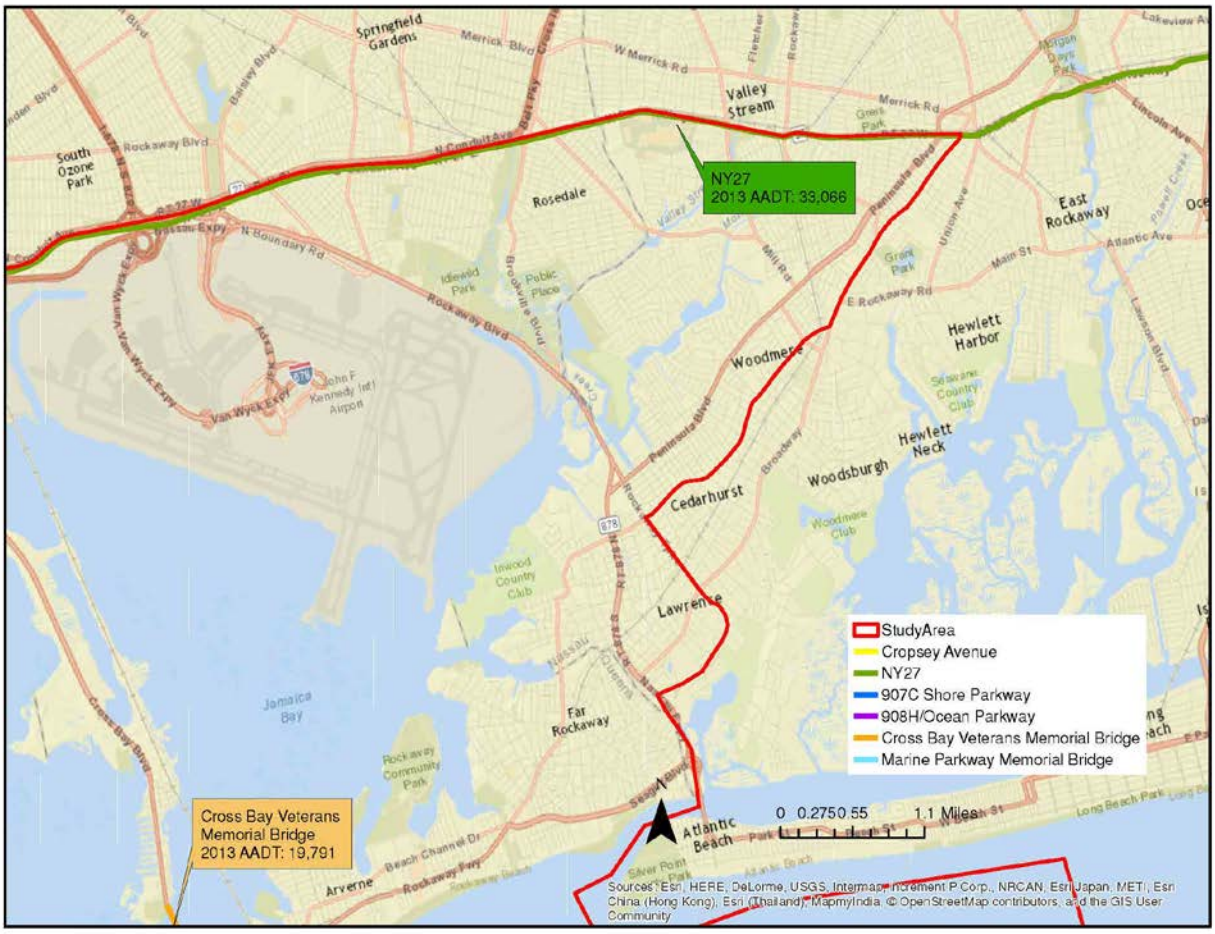


Figure 4.14-3. Primary Roadways - Jamaica Bay (central area)

Figure 4.14-4. Primary Roadways - Jamaica Bay (eastern area)



4.14.3 Wastewater Treatment

The NYCDEP has documented the wastewater treatment plants (WWTPs) that are the major source of freshwater in Jamaica Bay and their impact on water quality. The Waterbody/Watershed Facility Plan for Jamaica Bay and CSO tributaries is available at: http://www.hydroqual.com/projects/ltcp/wbws/jamaica_bay.htm (2011). The Long Term Control Plan outlined in the Facility Plan is designed to reduce CSO volume and pollutants discharged into Jamaica Bay improving dissolved oxygen levels and reducing fecal coliform levels. WWTPs and storm sewers are the largest source of fresh water to Jamaica Bay as natural flow has been greatly diminished due to urbanization. The Waterbody/Watershed Facility Plan identifies four WWTPs and auxiliary plants along with the CSOs that flow into Jamaica Bay: 26th Ward WWTP, Spring Creek Auxiliary WWTP, Jamaica WWTP, Rockaway WWTP, and the Coney Island WWTP. These plants collectively discharge approximately 258 million gal/day of treated effluent into the Bay.

The dry weather flow capacity from each of these WWTPs into Jamaica Bay is 110 million gal/day from the Rockaway WWTP, 85 million gal/day from the 26th Ward WWTP, 100 million

gal/day from the Jamaica WWTP, and 110 million gal/day from the Coney Island WWTP. The Spring Creek Auxiliary WWTP is designed to store 10-12 million gal/day before returning it to the 26th Ward WWTP. Other sources of freshwater include the Cedarhurst WWTP in Nassau County which treats 1 million gal/day and discharges into Mott Creek a tributary of Jamaica Bay.

In wet weather the capacity of these treatment plants is overwhelmed, and untreated runoff from 91,000 acres of land enters the Bay via 32 CSO outfalls (NYCDEP 2011). The Cedarhurst WWTP also discharges stormwater into the bay. Due to the nitrogen and phosphorus from the WWTPs, the Bay is eutrophic. Eutrophic systems are in a cycle where the highly enriched environment supports the growth of algae which reduces water clarity. The algae die and decompose requiring large amounts of oxygen. Fish and other aquatic life can die in the reduced levels of oxygen resulting in additional impairment or mortality (fish kills).

Known stormwater and CSO outfalls within the Jamaica Bay Northwest and Rockaway Peninsula project reaches are listed in Table 4.14-3 and 4.14-4, respectively. The outfall identifications listed in the tables are consistent with the naming convention from the New York City Department of Environmental Protection (NYCDEP) State Pollutant Discharge Elimination System (SPDES).

Table 4.14-3: Jamaica Bay Northwest SPDES Outfalls

SPDES Outfall ID	Location	Size	Receiving Water
CI-633	Rockaway Parkway	Unknown	Jamaica Bay
JAM-602	Shellbank Creek	Unknown	Shellbank Basin
JAM-117	Shellbank Creek	Unknown	Shellbank Basin
JAM-116	Charles Memorial Park	Unknown	Shellbank Basin
JAM-658	Hawtree Basin	Unknown	Hawtree Basin

Table 4.14-4: Rockaway Peninsula SPDES Outfalls

SPDES Outfall ID	Location	Size	Receiving Water
JAM-624	John F. Kennedy Airport	Unknown	Grassy Bay
ROC-003	Plant Bypass	72" Dia	Jamaica Bay
ROC-004	Seaside Avenue (Reg #D-11)	12" Dia	Jamaica Bay
ROC-005	Beach 102nd Street (Reg #D-10)	12" Dia	Jamaica Bay

SPDES Outfall ID	Location	Size	Receiving Water
ROC-006	Beach 101st Street (Reg #D-9)	8" Dia	Jamaica Bay
ROC-007	Beach 100th Street (Reg #D-8)	10" Dia	Jamaica Bay
ROC-008	Beach 99th Street (Reg #D-7)	12" Dia	Jamaica Bay
ROC-009	Beach 98th Street (Reg #D-6)	12" Dia	Jamaica Bay
ROC-010	Beach 97th Street (Reg #D-5)	12" Dia	Jamaica Bay
ROC-011	Beach 96th Street (Reg #D-4)	12" Dia	Jamaica Bay
ROC-012	Beach 94th Street (Reg #D-3)	10" Dia	Jamaica Bay
ROC-013	Beach 93rd Street (CSO)	12" Dia	Jamaica Bay
ROC-014	Beach 91st Street (Reg #D-2)	12" Dia	Jamaica Bay
ROC-015	Beach 88th Street (Reg #TG-1)	60" Dia	Jamaica Bay
ROC-016	Bayswater Avenue	60" Dia	Norton Basin
ROC-017	Beach 9th Street (Seagirt Ave. P.S.)	24" Dia	Bannister Creek
ROC-029	Beach 106 Street (Reg #1, 2)	72" Dia	Jamaica Bay
ROC-030	Beach 104th Street (Reg #D-12)	12" Dia	Jamaica Bay
ROC-031	Redfern Avenue (Nameoke P.S.)	11' X 4'6"	Mott Basin

Additional information and detailed mappings of the stormwater outfalls were requested from state and city agencies but were not available for this analysis. However, a desktop review of aerial photography and sparse mapping, as well as listings from other studies, were used to develop an allowance for utility impacts inclusive of stormwater and CSO outfalls. Additional work will need to be performed once topographic surveys (including subsurface utility surveys) are obtained in order to fully understand the subsurface assets within the project area.

4.14.4 Bridge, Pipeline, and Cable Crossings

In an effort to minimize impacts to utilities through the proposed CSRM alignments, a due diligence effort was made to identify all major utility crossings. Online mapping resources were reviewed to gather information where available. The National Pipeline Mapping System was reviewed, and no pipelines were found within the project corridor. Online mapping of fiber optics was accessed through Level 3 Communication's website as well as the Telecom Ramblings website. It appears that no fiber optic cables are located within the project corridor. Additionally, information requests were made to various public and private utility owners to gather any available mapping of subsurface utilities. In response to these requests, information was received from National Grid, which included mapping of their assets in the project area, particularly on Rockaway Peninsula. The majority of these assets were found to be local distribution pipelines located throughout the neighborhoods. No pipelines within the network

were found to cross the proposed alignment of the perimeter barrier. The maps did show two pipelines crossing from Barren Island to Rockaway Peninsula west of the Gil-Hodges Bridge. These lines are 26-inch and 12-inch steel pipelines and were installed in 2013 by directional drilling at a depth of 50 feet.

Although there are limited conflicts overland, cross charted submarine cable areas are known to occur within the Rockaway Inlet. Details of the submarine cables (e.g., depth and cable type) are unknown at this time and will require further investigation in future design phases.

Two vehicular bridges and potentially one subway/railroad bridge would have barges pass under during the construction. Considerations for the Marine Parkway-Gil Hodges Memorial Bridge and Cross Bay Veterans Memorial Bridge are discussed in MFR #6.

4.14.5 Wharf and Dock Facilities

This section describes wharf and dock facilities for commercial and recreational vessels. Commercial wharf and dock facilities include large commercial facilities engaged in receiving and storing bulk quantities of petroleum or aggregate (e.g. sand and gravel) materials.

4.14.5.1 Rockaway

The Rockaway API contains a number of wharf and dock facilities for commercial vessels and many private marinas for recreational vessels. All of these facilities and marinas are located on the inland Jamaica Bay side of the peninsula.

Commercial Facilities

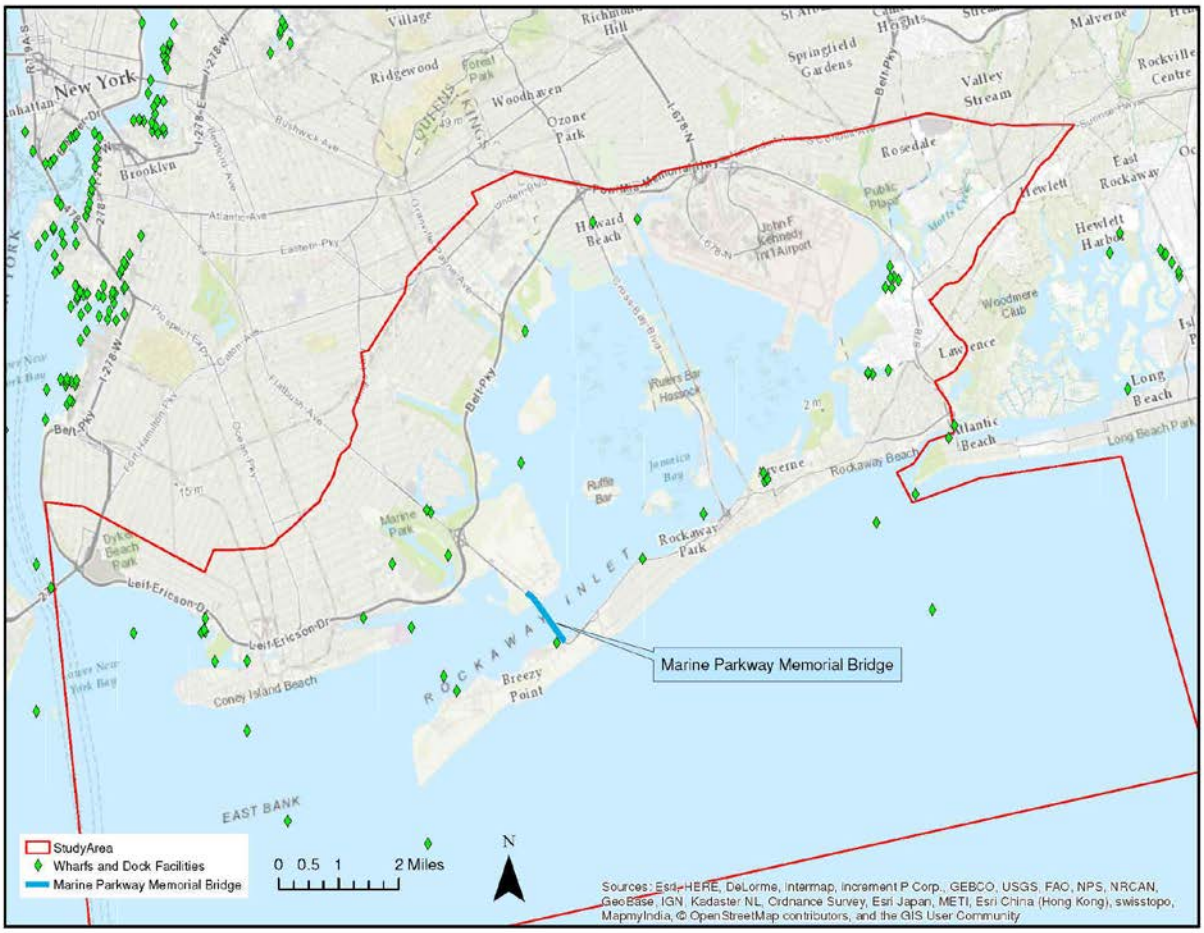
Commercial wharf and dock facilities are located east and west of Marine Parkway Bridge, as presented in Table 4.14-5. These facilities include bulk oil storage terminals and asphalt/concrete plants. The commercial vessel traffic previously described in Section 0 travel to and from these commercial facilities. The major commercial wharf and dock facilities identified throughout the study area by the U.S. Navigation Data Center (USNDC) are depicted on Figure 4.14-5 (USNDC, 2016).

Table 4.14-5. Commercial Wharf and Dock Facilities – Rockaway

West of Marine Parkway Bridge			
Name	Address	Use	Location
Breezy Point Landing	202-30 Rockaway Point Blvd	Occasional dock for a passenger ferry boat	Dead Horse Bay
US Coast Guard Rockaway Station Boat Basin	201 Rockaway Point Blvd	Mooring, fueling and repairing US Park Service and other government owned vessels	Dead Horse Bay
East of Marine Parkway Bridge			
Phoenix Marine Co., Rockaway Park, Beach Channel Drive Shoreline Protection	Beach Channel Drive	Receipt of construction equipment and materials	South Side of Rockaway Inlet and Beach Channel
Seaway Marine Corp.	72-46 Thursby Avenue	Equipped with large-scale boat	Vernam Basin

Docks		lifts for fishing boat repair	
Bay Terminals of the Rockaways Wharf	75-02 Amstel Blvd	Used for receipt of petroleum products by barge	Vernam Basin
Quadrozzi Concrete Corp. Arverne Dock	75-02 Amstel Blvd	Used for receipt of sand, gravel, and stone (up to 50,000 tons) by barge	Vernam Basin
Far Rockaway Station West Wharf/National Grid Generation LLC	1425 Bay 24th Street	Formerly used for receipt and storage of coal. Currently National Grid Far Rockaway Power Station.	Motts Basin
Nassau Ready Mix, Inwood Dock	1 Sheridan Blvd	Used for receipt of sand and gravel, and shipment of stone and fill dirt, all by barge	Motts Basin

Figure 4.14-5. Commercial Wharf and Dock Facilities



Source: USNDC, 2016.

Recreational Marinas

Recreational marinas are located east and west of Marine Parkway Bridge, as presented in Table 4.14-6. These marinas are used for permanent and transient vessel storage. These marinas are privately owned and operated. Based on a review of aerial imagery of the area, there are no residential homes with individual private docks for recreational vessels. Recreational marinas were identified through a Google search (Google, 2016).

Table 4.14-6. Recreational Marinas – Rockaway

Private Marinas East of Marina Parkway Bridge					
Name	Address	Telephone	Operated by	Vessel capacity	Location
Marina 59	59-14 Beach Channel Dr. Queens, NY 11692	(718) 945-4500	Beach Channel	200 (approx.)	Sommerville Basin
Inwood Marina	4 Pine Rd Inwood, NY 11096	Not available	North of Motts Basin	60 (approx.)	Motts Basin

4.14.5.2 Jamaica Bay

The Jamaica Bay API contains a number of commercial wharf and dock facilities and many recreational marinas. The majority of these facilities and marinas are located east of the Marine Parkway Bridge, though several commercial wharfs and marinas are also located to the west of the Marine Parkway Bridge along the southwestern shoreline of Brooklyn, Dead Horse Bay, Sheepshead Bay, and Plumb Beach Channel. Tables of these facilities and marinas are discussed in the following section.

Commercial Facilities

Commercial wharf and dock facilities are located east and west of Marine Parkway Bridge, as presented in Table 4.14-7. These facilities include bulk oil storage terminals and asphalt/concrete plants. The commercial vessel traffic previously described in Section 0 travels to and from these commercial facilities. The major commercial wharf and dock facilities identified throughout the study area by the USNDC are depicted on Figure 4.14-5 (USNDC, 2016).

Table 4.14-7. Commercial Wharf and Dock Facilities – Jamaica Bay

East of Marine Parkway Bridge			
Name	Address	Use	Location
Inwood Terminal Pier/Carbo Concord Oil	555 Doughty Blvd	Receipt and bulk storage of petroleum products by barge	Northwest of Doughty Boulevard
Inwood Terminal Pier/Global Companies LLC	464 Doughty Blvd	Receipt of petroleum products by barge	At south side of Elders Creek/Inwood

Seville Central Mix Dock	101 Johnson Road	Receipt of crushed stone	Between north and south arms of Motts Basin
Rason Asphalt Wharf	4 Johnson Road	Receipt of stone and gravel by barge	Between north and south arms of Motts Basin
Carbo Industries Wharf/Concord Terminal Corp.	1 Bay Blvd	Receipt and bulk storage of petroleum products by barge	At south side of inner end of north arm of Motts Basin
Motive Enterprises, LLC/Star Enterprise Long Island Sales Terminal Pier	74 East Avenue	Used for receipt and bulk storage of petroleum products by barge	Head of Bay
Jamaica Bay Oil Terminal/Lefferts Oil Terminal	160-21 Lefferts Blvd	Used for receipt and bulk storage of petroleum products by barge	Bergen Basin
New York City Police Harbor Unit Adam Bas Piers	157-158 Cross Bay Blvd	Mooring and fueling harbor-patrol and fire-department vessels	Shellbank Basin
26th Ward Water Pollution Control Plant Pier	Flatlands Avenue @ Hendrix Street	Receipt of sludge by barge	West side of entrance to Hendrix Creek
Hunter Fish Packing Co Wharf	2773 Flatbush Avenue	Receipt of fish and mooring for fishing boats	Mill Basin
Nicks Lobster Fish Market Wharf	2777 Flatbush Avenue	Receipt of lobsters and mooring for lobster-fishing boats	Mill Basin
West of Marine Parkway Bridge			
Municipal Piers Nos 1 thru 10	2232 Emmons Avenue	Mooring charter-fishing boats	North side of Sheepshead Bay
Quadrozzi Concrete Corp Coney Island Plant Wharf	3024 Cropsey Avenue	Receipt of crushed stone by barge and sand by truck	Gravesend Bay, Coney Island Creek
City of NY, Southwest Brooklyn Marine Transfer Station, Barge Slip	Bay 41st Street @ Gravesend Bay	Shipment of refuse by barge and mooring barges	Gravesend Bay
City of NY, Southwest Brooklyn Marine Transfer Station, Incinerator Wharf	between 25th Avenue extended and Bay 41st Street extended	Mooring barges	Gravesend Bay
Department of Sanitation Southwest Brooklyn Marine Transfer Stations	Bay 41st Street @ Gravesend Bay	Waste material, garbage, landfill, sewage sludge and waste water	Gravesend Bay

Bayside Fuel Oil Depot Corp Bensonhurst Term Pier	1776 Shore Parkway	Receipt of petroleum products by barge for local distribution	Gravesend Bay

Recreational Marinas

Recreational marinas are located east and west of Marine Parkway Bridge, as presented in Table 4.14-8. These marinas are used for permanent and transient vessel storage. The majority of marinas are privately owned and operated. One marina is owned and operated by NYC Department of Parks and Recreation. There are also hundreds of residential homes with individual private docks for one or two recreational vessels. Together, vessel traffic from these marina and private docks is expected to be significant, particularly during warmer periods in late spring through early fall.

Table 4.14-8. Recreational Marinas - Jamaica Bay

Name	Address	Telephone	Operated by	Vessel capacity	Location
Private Marinas West of Marine Parkway Bridge					
Venice Marina	3939 Emmons Ave, Brooklyn, NY 11235	(718) 646-9283	Venice Marina	150 (approx.)	Plumb Beach Channel
Gateway Marina	3260 Flatbush Ave. Brooklyn, NY 11234	(718) 252-8761	Gateway Marina	500	Dead Horse Bay
Marine Basin Marina	1900 Shore Parkway, Brooklyn, NY 11214	(718) 372-5700	Marine Basin Marina	200	North of Coney Island
Varuna Boat Club	2806 Emmons Ave, Brooklyn, NY 11235	(718) 646-1357	Varuna Boat Club	40 (approx.)	Sheepshead Bay
Miramar Yacht Club	3050 Emmons Ave, Brooklyn, NY 11235	(718) 646-9436	Miramar Yacht Club	30 (approx.)	Sheepshead Bay
Sheepshead Bay Yacht Club	3076 Emmons Ave, Brooklyn, NY 11235	(718) 891-0991	Sheepshead Bay Yacht Club	20 (approx.)	Sheepshead Bay
Brooklyn Yacht Club	3147 Voorhies Ave, Brooklyn, NY 11235	(718) 646-9420	Brooklyn Yacht Club	60 (approx.)	Plumb Beach Channel
Tamaqua Marina	84 Ebony Ct, Brooklyn, NY 11229	(718) 646-9212	Tamaqua Marina	50 (approx.)	Plum Beach Channel
Private Marinas East of Marine Parkway Bridge					
Sea Travelers	2875 Flatbush Ave. Brooklyn,	(718) 377-0216	Sea Travelers Marina Inc.	300	East Mill Basin

Marina Inc.	NY 11234				
Kings Plaza Marina	2565 Flatbush Ave., Brooklyn, NY 11234	(718) 344-3551	Kings Plaza Marina	150	East Mill Basin
Old Mill Yacht Club Inc.	Yacht Club 16315 Cross Bay Blvd, Queens, NY 11414	(718) 835-0454	Old Mill Yacht Club Inc.	20 (approx.)	Shellbank Basin
Diamond Point Yacht Club (Paerdegat Basin 3)	Westerly side of Paerdegat Avenue North, at foot of Paerdegat 12th Street	(718) 444-7700	Diamond Point Yacht Club, Inc.	24	Paerdegat Basin Park
Hudson River Yacht Club (Paerdegat Basin 1)	Foot of Avenue U & Bergen Avenue	(718) 251-9791	Hudson River Yacht Club	80	Paerdegat Basin Park
Midget Squadron Yacht Club (Paerdegat Basin 2)	Foot of Seaview Avenue & Paerdegat Avenue North	(718) 251-9823	Midget Squadron Yacht Club	75	Paerdegat Basin Park
Mill Basin (aka DiMeglio Marina)	Avenue Y & East 69th Street	(718) 241-5011	Donato DiMeglio	100	East Mill Basin
Paerdegat Squadron Yacht Club (Paerdegat Basin 5)	Paerdegat Avenue North, on northeast bank of basin between Paerdegat 11th Street and Seaview Avenue	(718) 241-4581	Paerdegat Squadron Yacht Club	20 (approx.)	Paerdegat Basin Park
Sebago Canoe Club (Paerdegat Basin 4)	Paerdegat Avenue North, on northeast bank of basin between Paerdegat 11th Street and Seaview Avenue	(718) 434-5785	Sebago Canoe Club, Inc.	4	Paerdegat Basin Park
Lil Cricket Too Marina	16345 Cross Bay Blvd,	(718) 845-7594	Lil Cricket Too Marina	40 (approx.)	Shellbank Basin

	Jamaica, NY 11414				
Sunset Marina	64 West 10th Road, Far Rockaway, NY 11693	(718) 474-3256	Sunset Marina	10 (approx.)	Sommerville Basin
Ebb-Tide Marina	370 Beach 85th St, Rockaway Beach, NY 11693	(718) 945-5883	Ebb-Tide Marina	20 (approx.)	Sommerville Basin
Inwood Marina	4 Pine Rd, Inwood, NY 11096	Not Available	Inwood Marina	60 (approx.)	Motts Basin
Municipal Marina West of Marine Parkway Bridge					
Sheepshead Bay	Emmons Avenue between Ocean Avenue & East 27th Street, Sheepshead Bay	(718) 478-0480	NYC Department of Parks and Recreation, Marine Division		Sheepshead Bay

4.15 Hazardous, Toxic, and Radioactive Waste (HTRW)

Mabbett conducted a review of publically available databases for selected federal- and state-regulated sites with hazardous, toxic, and radioactive waste (HTRW) for the Rockaway API and the Jamaica Bay API. The federal USEPA Superfund Information System contains several databases with information on existing Superfund sites, including the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), the National Priorities List (NPL), Resource Conservation and Recovery Act Information (RCRAinfo), and the Brownfields Management System. In addition, the NYSDEC has records of RCRA sites. In summary, RCRA sites were investigated with the EPA Clip N Ship Application. The NYSDEC Remediation Site Boundary layer was used to investigate Superfund, Brownfields and Voluntary Cleanup sites within the project area. The Department of Energy database was reviewed for radioactive waste sites (http://energy.gov/em/cleanup-sites).

The following sections describe the findings of the review and present figures showing the locations of regulated HTRW sites. An expanded discussion of individual landfills is provided in Section 17.0.

4.15.1 Rockaway

The following entries were found for Rockaway and are displayed in Figure 4.15-1:

- 47 inactive RCRA sites and 49 active sites (EPA, 2016). The generation and disposal of hazardous waste should not have an effect on the environment if in compliance with RCRA.
- 3 Brownfield Cleanup Sites shown in Table 4.15-1 (NYSDEC, 2016). Of those sites, two sites are active, none are closed and one is No Further Action Taken.
- 5 State Superfund Sites shown in Table 4.15-1 (NYSDEC, 2016). Three of those sites are "Registry" Sites and the remaining two are Non-Registry Sites.
- Three Voluntary Cleanup Sites shown in Table 4.15-1 (NYSDEC, 2016). One is active and the remaining two are closed.
- No radioactive waste sites were identified.

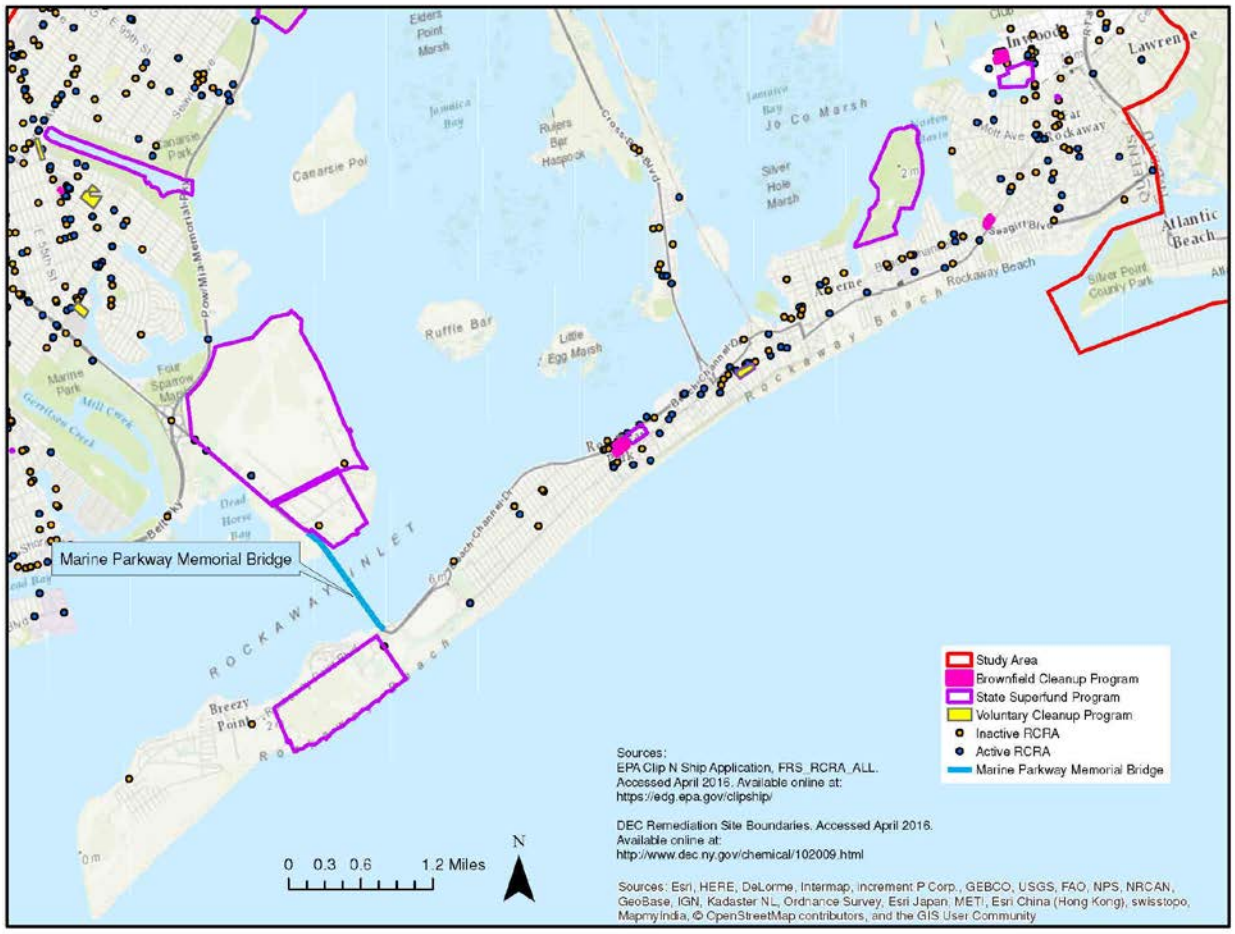
Table 4.15-1. HTRW Sites - Rockaway

Site Name	NYSDEC Site Class	Locality
Brownfield Cleanup Program		
34-11 Beach Channel Drive	A	Far Rockaway
CPB Site	A	Far Rockaway
Belle Harbor Shopping Center	N	Far Rockaway
State Superfund Program		
K - Rockaway Park MGP	2	Rockaway Park
London-French Dry-Cleaning Co.	4	Rockaway
Edgemere Landfill	4	Rockaway
Fort Tilden - Breezy Point	A	Rockaway
K - Far Rockaway MGP	A	Far Rockaway
Voluntary Cleanup Program		
Belle Harbor Shopping Center	A	Far Rockaway
Gas Drive Station, 112-01 Beach Channel	C	Rockaway Park
London French Cleaners/Dayton Plaza	C	Rockaway

Notes:

NYSDEC "Registry" Site Classes		NYSDEC "Non-Registry" Site Classes	
1	Contamination constitutes significant threat.	A	Active
2	Disposal of hazardous waste has been confirmed.	C	Closed
3	Contamination does not presently constitute serious threat.	P	Potential
4	Properly closed site, but requires continued management.	PR	Potential RCRA Corrective Action
5	Site has been properly closed and requires no further action.	N	No Further Action at this Time

Figure 4.15-1. Regulated HTRW Sites - Rockaway



4.15.2 Jamaica Bay

The following entries were found for Jamaica Bay and are displayed in Figure 4.15-2, Figure 4.15-3, and Figure 4.15-4:

- Nearly 1,000 inactive RCRA sites and nearly 700 active sites were found (EPA, 2016). The generation and disposal of hazardous waste should not have an effect on the environment if in compliance with RCRA.
- Ten Brownfield Cleanup Sites shown in Table 4.15-2 (NYSDEC, 2016). Of those sites, six sites are active, three are closed and one is no further action taken.
- Twenty four State Superfund Sites shown in Table 4.15-2 (NYSDEC, 2016). Nine of those sites are "Registry" Sites and the remaining 15 are Non-Registry Sites.
- Twelve Voluntary Cleanup Sites shown in Table 4.15-2 (NYSDEC, 2016). Just one site is no further action at this time, six are active and the remaining five are closed.
- No radioactive waste sites were identified.

Additionally, during preparation of the FERC EIS for the M&R facility, FERC received a comment from the NPS that a tar-like substance associated with an "old factory site" was located on the south shore of Floyd Bennet Field east of the Marine Parkway Bridge (FERC, 2013). No additional information about this site or actions taken was available in the file material.

Table 4.15-2. HTRW Sites - Jamaica Bay

Site Name	Site Class	Locality
Brownfield Cleanup Program		
Former Gateway French Dry Cleaners	A	Brooklyn
2002-2024 Cropsey Avenue Site	A	Brooklyn
Former Brighton Cleaners - Off-Site	A	Brooklyn
2103 Ralph Avenue	A	Brooklyn
175 Roger Avenue LLC - Off-Site	A	Inwood
Former Watermark Designs Facility	A	Brooklyn
Former Brighton Cleaners	C	Brooklyn
OFF-SITE Foundation for Torah Studies Project	C	Brooklyn
Foundation for Torah Studies Project	C	Brooklyn
175 Roger Avenue LLC	N	Inwood
State Superfund Program		
Quick and Clean Cleaners	2	Cedarhurst
175 Roger Avenue	2	Inwood
Peninsula Boulevard Investigation	2	Hewlett
Former Majestic Garment Cleaners	2	Brooklyn
Idlewild Construction Waste Landfill	3	New York City
Pennsylvania Avenue Landfill	4	Brooklyn
Fountain Avenue Landfill	4	Brooklyn
101 Green Acres Road Site	4	Valley Stream
K - Former Brooklyn Borough Gas Works	4	Brooklyn
Floyd Bennett Field	A	Brooklyn
Fort Hamilton	A	Brooklyn
K - Dangman Park MGP	A	Brooklyn
K - Inwood Holder	A	Inwood
Spring Creek (Emerald St.)	C	Brooklyn
Grove Cleaners	C	Hewlett
GLY Cleaners	N	Brooklyn
Watermark Designs DeWitt Ave	N	Brooklyn
491 Wortman Avenue	N	Brooklyn
Former Gateway French Cleaner	N	Brooklyn
525 - 535 Burnside Avenue	N	Inwood
Former Franklen Auto Garage	P	Brooklyn
Bragg Street – Avenue W GW	P	Brooklyn
Paerdegat Basin	P	Brooklyn
USCG Air Station Brooklyn	P	Brooklyn

Site Name	Site Class	Locality
Voluntary Cleanup Program		
Valley Stream S04 (LIRR)	A	Valley Stream
Harbor Estates Property	A	Brooklyn
LILCO - Edgemere Substation	A	Edgemere
American Drive In Cleaners	A	Hewlett
Kings Plaza Shopping Center/Marina	A	Brooklyn
Far Rockaway (Inwood) F03 (LIRR)	A	Inwood
Bayside Fuel Oil Corporation (1810 Shore	C	Brooklyn
Pep Boys Supercenter #349	C	Inwood
Duralab Property	C	Brooklyn
Bon Ton Cleaners	C	Brooklyn
S.& S. X-Ray Products, Inc.	C	Brooklyn
Bayside Fuel Oil Depot Corporation	N	Brooklyn

Notes:

NYSDEC "Registry" Site Classes		NYSDEC "Non-Registry" Site Classes	
1	Contamination constitutes significant threat.	A	Active
2	Disposal of hazardous waste has been confirmed.	C	Closed
3	Contamination does not presently constitute serious threat.	P	Potential
4	Properly closed site, but requires continued management.	PR	Potential RCRA Corrective Action
5	Site has been properly closed and requires no further action.	N	No Further Action at this Time

Figure 4.15-2. Regulated HTRW Sites - Jamaica Bay (Kings County area)

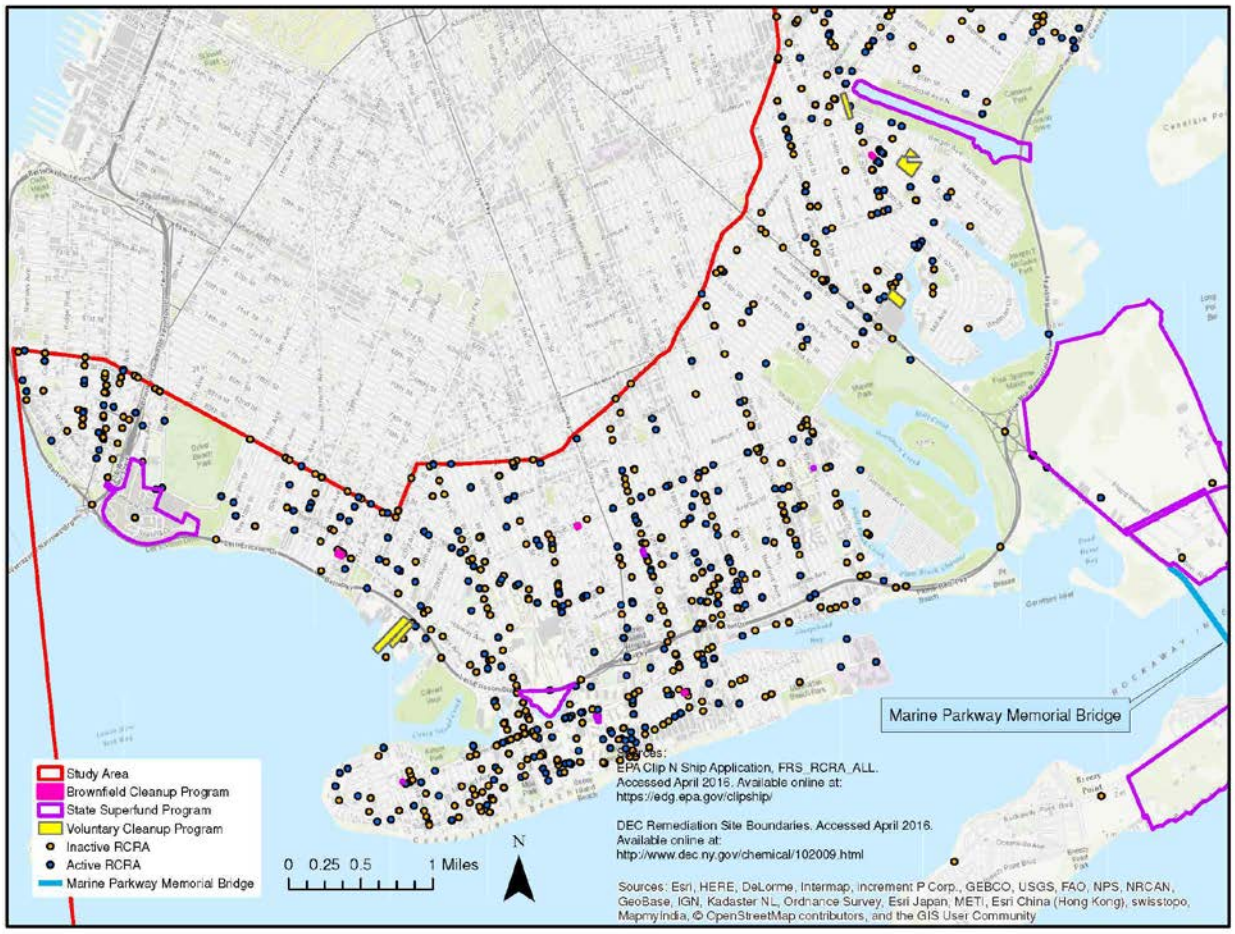


Figure 4.15-3. Regulated HTRW Sites - Jamaica Bay (Queens County area)

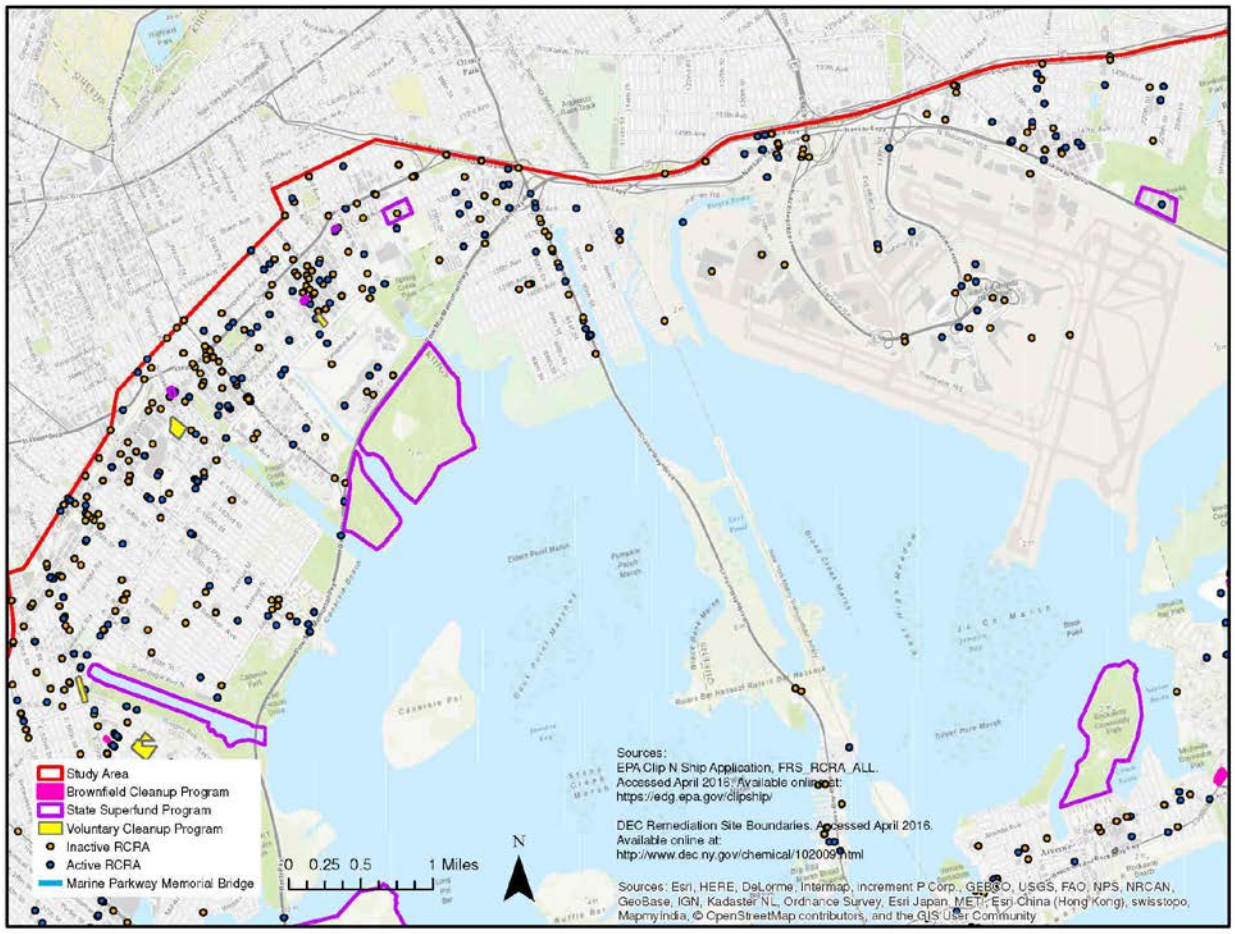
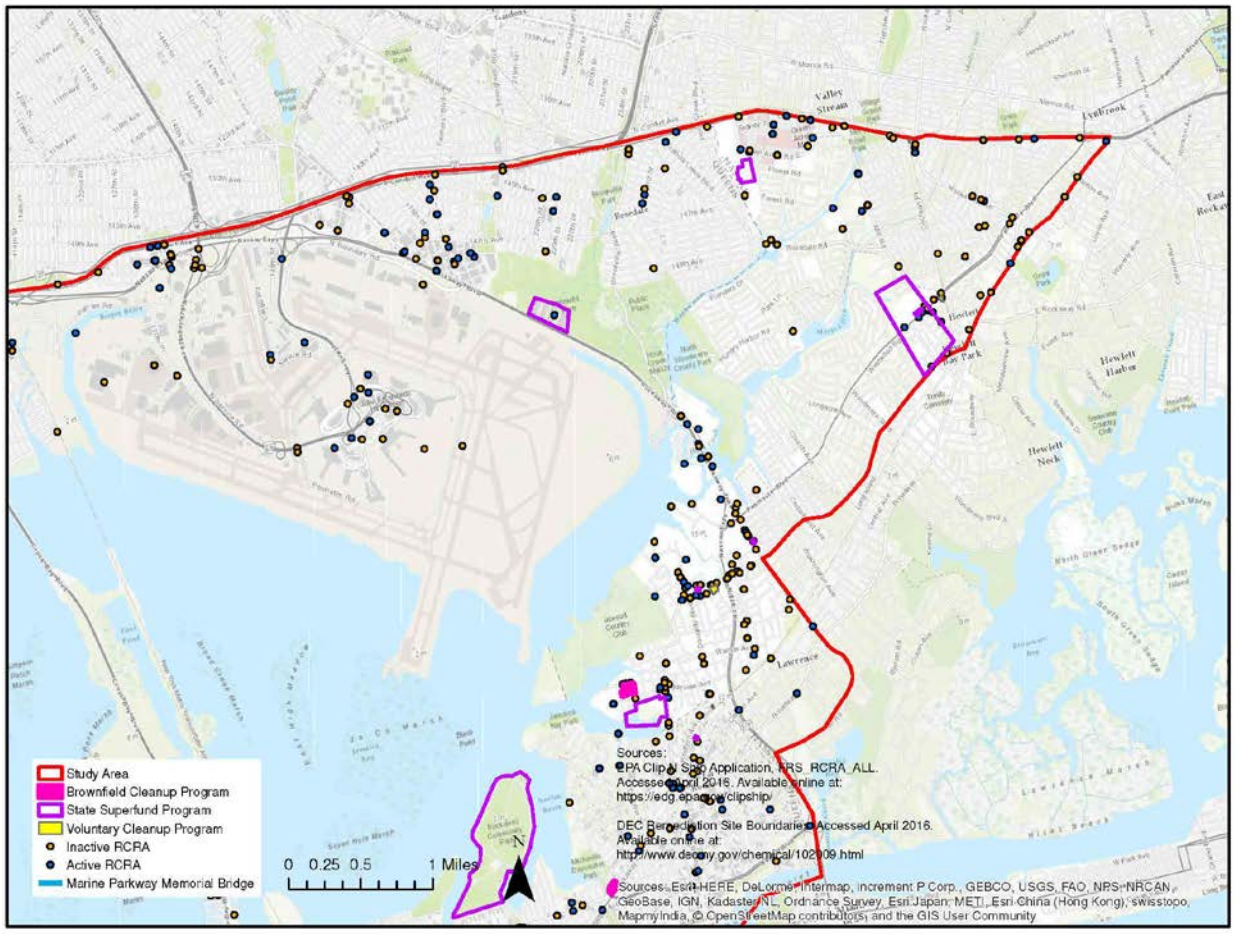


Figure 4.15-4. Regulated HTRW Sites - Jamaica Bay (Nassau County area)

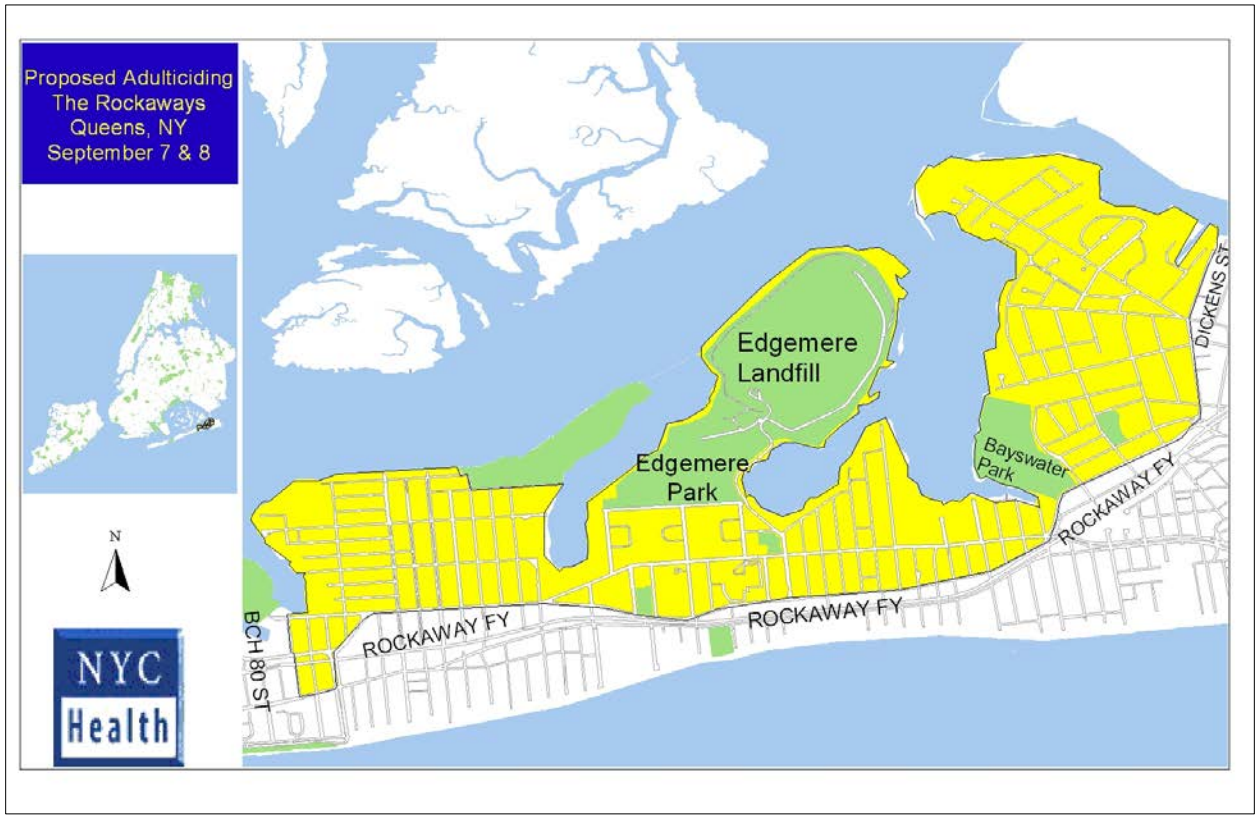


4.16 Landfills

4.16.1 Rockaway

The Rockaway API contains the former Edgemere Landfill. This former sanitary landfill operated from 1938-1991, was approximately 65 high, and covered approximately 173 acres (Freshkills Park Alliance, 2011) (Figure 4.16-1). It was capped in 1996 and has utilized flarings to control odors. The former Edgemere Landfill is now part of the Rockaway Community Park, an outdoor open space recreation area owned and operated by the NYC Department of Parks and Recreation (New York City Department of Parks and Recreation, 2016).

Figure 4.16-1. Former Edgemere Landfill



Source: New York City Health, 2007

4.16.2 Jamaica Bay

The Jamaica Bay API contains three landfills described in the following sections.

Fountain Avenue and Pennsylvania Avenue Landfills. The former Fountain Avenue and Pennsylvania Avenue landfills are located in the Canarsie Pier Coastal Area (NPS, 2013) (Figure 4.16-2). Each is about 80 feet high, and covers over 100 acres of former salt marsh. The Fountain Avenue Landfill opened in 1956, filling up with residential trash, construction debris, and asbestos incinerator ash. In its last year of operation, 1985, an average of 8,200 tons of trash arrived there each day — some 40 percent of the city's refuse. It covered approximately 297 acres. It was capped in 2006 and planted with native vegetation, including grasses, shrubs and trees (NYCDEP, 2010). The Pennsylvania Avenue Landfill was open from 1956 to 1980 and covered approximately 110 acres. In its later years, it was primarily a dump for debris from construction and demolition (New York Times, 2009). It was capped in 2005 and also planted with native vegetation, including grasses, shrubs and trees (NYCDEP, 2010). Both sites are listed as Class 2 Inactive Hazardous Waste Sites, which means that beneath their surfaces lie unknown quantities of hazardous wastes.

Figure 4.16-2. Former Fountain Avenue and Pennsylvania Avenue Landfills

Source: https://static01.nyt.com/images/2009/09/07/nyregion/07landfill.map.jpg

Barren Island. From circa 1850 to 1936, Barren Island was a former dumping ground for carcasses of dead animals and household waste from Manhattan, Brooklyn, and the Bronx (Baltimore Sun, 2000; Liboiron, 2013). The vestigial name, Dead Horse Inlet, in Jamaica Bay, still marks the location of the pier. According to Liboiron, land filling was used to unite the island with mainland Brooklyn in 1926 for what became and is now Floyd Bennett Field (Liboiron, 2013). In 1926, Barren Island was buried and the spaces between it and the surrounding islands were filled to create New York City's first municipal airport, Floyd Bennett Field, which opened in 1927 (New York Times, 1999). Six million cubic yards of sand were pumped from Jamaica Bay, raising the resulting peninsula to 16 feet above the high tide mark. "Dry fill," or garbage free from organic material (or mostly free), was also added. Residents of Barren Island continued to live and work on Barren Island amidst the air traffic. However, in 1936, infamous urban planner Robert Moses evicted the entire island population to make way for the Marine Parkway Bridge. The cottages and remaining infrastructure were bulldozed to the

ground. The landfill, the uppermost layer comprised of people's homes, was capped. In the 1950s, the east shore of the cap burst, exposing the waste to the ocean tides (Liboiron, 2013). In 1972, Floyd Bennett Field became part of the Gateway National Recreation Area.

4.17 Cultural Resources

"Cultural resources" is an umbrella term for many heritage-related resources, including prehistoric and historic archaeological sites, buildings, structures, districts, or certain objects. Cultural resources are discussed in terms of archaeological resources, architectural resources, or resources of traditional cultural significance.

Federal cultural resources laws applicable to this project include the National Historic Preservation Act (NHPA), the Archaeological and Historic Preservation Act (1974), the American Indian Religious Freedom Act (1978), the Archaeological Resources Protection Act (1979), and the Native American Graves Protection and Repatriation Act (1990).

The National Register of Historic Places (NRHP) is the official list of the properties in the United States that are significant in terms of prehistory, history, architecture, or engineering. The NRHP is administered by the National Park Service.

Generally, resources must be more than 50 years old to be considered eligible for the NRHP. To meet the evaluation criteria for eligibility to the NRHP, a property needs to be significant under one or more NRHP evaluation criteria (36 CFR Part 60.4), and retain historic integrity expressive of the significance. More recent structures might be eligible for listing in the NRHP if they are of exceptional importance or if they have the potential to gain significance in the future per special NRHP considerations.

The New York City landmarks law gives the New York City Landmarks Preservation Commission (NYCLPC) authority to designate City landmarks, Interior landmarks, Scenic landmarks, and Historic Districts, and to regulate any construction, reconstruction, alteration, or demolition of them. Projects that might physically affect City landmarks or are within landmark Historic Districts require review by NYCLPC. Archaeological resources also are considered by the NYCLPC. Criteria for City landmarks are different from NRHP evaluation criteria, and consider properties 30 years of age or older that meet certain criteria, compared to the NRHP evaluation of properties of at least 50 years of age or older.

Section 106 of the NHPA requires a Federal agency official to take into account the effects of its undertaking on historic properties, and afford the Advisory Council on Historic Preservation (ACHP), an independent Federal agency, an opportunity to comment. This is done in accordance with the regulations of the ACHP implementing Section 106 process, 36 CFR Part 800. Additionally, consultation with the New York State Historic Preservation Office (NYSHPO) and consulting parties including local governments is required regarding the identification and evaluation of potentially affected historic properties, determination of potential effects of an

undertaking on historic properties, and resolution of any adverse effects. Under the Section 106 process, the City of New York would also be a consulting party for the proposed project.

The Section 106 review requires an assessment of the potential impact of an undertaking on historic properties that are within the proposed project's Area of Potential Effect (APE). The APE is defined as the geographic area(s) "within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist."

The APEs are based on location of each proposed project element (represented in Figure 4.17-1. Area of Potential Effects for Proposed Action) and the areal extent over which construction and operation of the element would reasonably be expected to occur. In general, the APEs for each project element are considered to be within or immediately adjacent to the element, because construction and operation of each element is not anticipated to require disturbing the ground surface beyond the immediate "footprint" of the element. A description of the APEs are provided in Section 4.17-2.

4.17.1 Historical Context

The following information for the Cultural Resources sections were excerpted from *Phase 1A Cultural Resource Documentary Study For Gerritsen's Creek Ecosystem Restoration, Borough of Brooklyn, Kings County, New York* (2002). This information was reported in the USACE Gerritsen's Creek Environmental Assessment (2003).

The following information pertains to the area encompassing both the Rockaway and Jamaica Bay projects.

Native American and Early European History. Roughly 5,000 to 6,000 years ago (circa 3,000 to 4,000 B.C.), the Atlantic shoreline lay some 25 miles to the east; by around A.D. 500 to 1000, less than 1,500 years ago, the coastline began to roughly resemble that of the present day, and Jamaica Bay and its neighboring drainages will have been largely tidal (Hunter and Damon, 2002).

Native American occupation of the Lower Hudson Valley and Long Island is likely to have followed on soon after the retreat of the last glacier, although clear cut evidence of such activity during the Paleo-Indian (circa 10,000-8,000 B.C) and Archaic (circa 8,000-2,000 B.C.) periods is generally sparse (Hunter and Damon, 2002).

Throughout the Late Woodland period, circa AD 1000-1600, camp sites and shell middens were a common feature within the tidal landscape of southern Long Island and evidence of Native American occupation of this period has been recorded all around the periphery of Jamaica Bay (Hunter and Damon, 2002). Further inland on Long Island, a few larger sites, probably permanent base camps, have also been identified, including one locus in Flatlands with an Iroquois style longhouse considered to be a ceremonial center and meeting house. Both longhouses and smaller round houses have been noted on Late Woodland period sites on Long Island. The majority of the documented sites were noted in the late nineteenth and early twentieth centuries, in particular as a

result of the work of Reginald Bolton (1920, 1922, 1934), with several subsequent studies confirming their existence (Hunter and Damon, 2002).

Towards the end of the Late Woodland period, continuing into the seventh century when contact with Europeans was occurring on a regular basis, the Native American population of Long Island began to come more clearly into focus as a part of recorded history (Hunter and Damon, 2002). The Brooklyn area was inhabited by a group known as the Canarsie (or Canarsee), a branch of the Algonquian-speaking Lenape, a series of loose-knit and semi-sedentary tribes spread across much of the area between the Delaware and Lower Hudson Rivers and extending east into Long Island (Hunter and Damon, 2002).

The Jamaica Bay area supported villages of Canarsie and Rockaway American Indians, who engaged in cultivation, fishing, gathering shellfish, and possibly the manufacture of wampum from the seashells (Hunter and Damon, 2002). In the seventh century, the Canarsie participated in a complex of web of trading relationships involving the Lenape, other Native American peoples further to the west and north, the Dutch and eventually the English. The two key commodities traded by the Canarsie for European goods were furs and wampum (polished shell beads used for jewelry and as currency), the latter being of particular importance in view of the abundance of shellfish in and around Jamaica Bay. The general area (southern Long Island) was settled by the Dutch in the 1630s and 1640s (Hunter and Damon, 2002). In the 1630s and 1640s, however, the Canarsie began to lose their hold over land in southern Long Island, ceding property to Dutch farmer-settlers. By century's end, their numbers, probably never more than a few thousand, were severely reduced as a result of disease, conflict (notably Kieft's War of 1643-46) and the general dislocation visited upon them by Europeans. Over the course of the eighteenth century, the surviving Canarsie moved west and out of the Hudson Valley altogether.

A detailed and more expansive history of the transition from American Indians to European occupancy is available in *Jamaica Bay: A History, Gateway National Recreation Area, New York--New Jersey* (Black, 1981), as well as the *Cultural Resources Baseline Study, Jamaica Bay Ecosystems Restoration Project, Kings, Queens and Nassau Counties, New York* (Panamerican, July 2003).

19th and 20th Century History. The section provides a summary of development in the Rockaway and Jamaica Bay areas during the 19th and early 20th centuries.

Rockaway

Although a part of Queens, Rockaway was settled by Europeans separately and earlier than other areas around Jamaica Bay (NYCDEP, 2011). In 1833, the Rockaway Association purchased most of the oceanfront property on the Richard Cornell homestead to construct an oceanfront resort called the Marine Hotel in Far Rockaway. Transportation to and from Rockaway originally consisted of horses and horse-drawn carriages, but by the mid-1880s, railroad access was provided, terminating at the present Far Rockaway station of the Long Island Railroad. Land values increased and business expanded rapidly as a consequence, and the population of Far

Rockaway was large enough to apply for incorporation in 1888. On July 1, 1897, the Village of Rockaway Park was incorporated into the City of Greater New York. Streets were graded and sections of Rockaway Park, Belle Harbor, and Neponsit began to be developed. Completion of the Cross Bay Bridge in 1925, further development of the beach and boardwalk in 1930, the opening of the Marine Parkway Bridge in 1937, and improvements to the railroad services in 1941 all made Rockaway more accessible, encouraging population growth, development, and urbanization (NYCDEP, 2011).

In the second half of the nineteenth century, the Rockaway Peninsula developed as a popular seaside resort for the growing middle-class New Yorkers, who filled its seaside bungalows and amusement parks (Structures of Coastal Resilience [SRC], 2014). Transportation access to the oceanfront beaches became an issue. Ferry service and deepened navigational channels were established by the Canarsie Railroad Line, and by 1887 a cross-bay train trestle was constructed by the New York, Woodhaven, and Rockaway Railroad. This line was sold in 1886 to the Long Island Railroad, which renamed it the New York and Rockaway Beach Railway. It was purchased in 1955 by the City of New York, reconstructed, and incorporated into the city's subway service as the IND Rockaway Line; it now carries the Metropolitan Transportation Authority's A and S trains across Jamaica Bay. The trestle pilings caused some obstruction of the bay's creeks and waterways, as did the development of the Flynn Cross-Bay Roadway (now the Cross Bay Boulevard) traversing the bay. Yet the Canarsie Line, the train trestle, and the Cross Bay Boulevard led to the transformed perception of the bay itself as an enjoyable place of recreation. Many believed that the waters of the bay were healthier and safer for swimming than the Atlantic beachfront of the Rockaway Peninsula (SCR, 2014).

Fort Tilden was established in 1917 and provided a coastal location from which to defend New York City and the harbor from sea and air attacks during World War I through the Cold War era, when a Nike Missile Launch Site was installed. Fort Tilden was decommissioned in 1967 and in 1974 was transferred to the National Park Service and became part of the Gateway National Recreation Area (NPS, 2014).

Jamaica Bay

A review of historical maps shows that the area of Brooklyn adjacent to Jamaica Bay was largely undeveloped marshland until the turn of the 20th century (NYCDEP, 2011). The neighborhoods of East New York and Flatbush were the closest developed areas of Brooklyn to Jamaica Bay, although limited development had occurred in Canarsie Landing and Bergen Beach on high ground that extended into the marshes of Jamaica Bay. Brooklyn was originally inhabited by the Lenape, American Indians who planted corn and tobacco and fished in the rivers. The Dutch settled in Manhattan in the early 1600s, and subsequently founded five villages on Long Island: Bushwick, Brooklyn, Flatbush, Flatlands, and New Utrecht. A sixth village, Gravesend, was founded in 1643 by an Englishwoman. The British captured the Dutch territory in 1674, and incorporated the six villages into Kings County, which is now part of New York City. A 1698

census counted 2,017 people in Kings County, about half of whom were Dutch (NYCDEP, 2011).

Brooklyn quickly became an important commercial port, in part due to the supply of foods grown on Long Island to New York City (NYCDEP, 2011). The Navy opened a shipyard on Wallabout Bay in 1801, and Robert Fulton began a steam-ferry service across the East River in 1814. The Village of Brooklyn was incorporated in 1816, roughly encompassing what is now known as Brooklyn Heights. By 1860, 40 percent of Brooklyn's wage earners worked in Manhattan, and ferries carried more than 32 million passengers a year. The intense pressure on ferry service led to the construction of the Brooklyn Bridge, which opened in 1883, spawning a surge in population and development. The City of Brooklyn, created in 1834, expanded to accommodate the new population, eventually encompassing all of Kings County. Brooklyn was incorporated into the City of New York in 1898 (NYCDEP, 2011).

The early 20th century saw a vast expansion in the population and urbanization of Brooklyn (NYCDEP, 2011). New bridges, trolley lines, elevated railroads, and subway lines went further into the borough. Each expansion opened new settlement and development areas. The rural character of Brooklyn quickly vanished. By the 1930s, the tributary waterbodies had been dredged, straightened, and armored, and by about 1960, most of the shoreline area was developed and expanded around Jamaica Bay (NYCDEP, 2011).

In Queens, as in Brooklyn, expansion of mass transportation system influenced growth and urbanization in Queens dramatically (NYCDEP, 2011). By 1915, most of Queens came within reach of the New York City subway. The Interborough Rapid Transit service opened to Long Island City (1915), Astoria (1917), and Queensboro Plaza (1916). Another branch extended along Queens Boulevard and Roosevelt Avenue, reaching Corona (1917) and Flushing (1928). In southern Queens, the Brooklyn Rapid Transit Company built an elevated line along Liberty Avenue through Ozone Park and Woodhaven to Richmond Hill in 1915 and along Jamaica Avenue from the Brooklyn border through Woodhaven and Richmond Hill to Jamaica during 1917-1918 (NYCDEP, 2011).

These improvements in transportation promoted rapid growth (NYCDEP, 2011). During the 1920s, the population of Queens more than doubled, from 469,042 to 1,079,129. Farms and open areas were replaced with urban street grids aligned without regard to streams, marshes, and other waterbodies that would have to be buried or filled. While the Great Depression of the 1930s ended this boom, transportation improvements continued with new bridges (the Triborough Bridge in 1936 and the Bronx-Whitestone in 1939), roadways (the Interboro Parkway in 1935 and the Grand Central Parkway in 1936), and airports (LaGuardia Airport in 1939 and Idlewild in 1948) (NYCDEP, 2011).

Floyd Bennett Field was constructed in 1928-1931 on Barren Island and served as New York City's first municipal airport. It was sold by the City to the US Navy in 1941, and became the most active Naval Air Station in the US during World War II. In 1972, it was transferred to the

National Park Service and became part of the Gateway National Recreation Area (http://www.nyharborparks.org/visit/flbe.html).

Plumb Beach is located along the north shore of Rockaway Inlet in Brooklyn. It is a stretch of shoreline, tidal mudflats, low saltmarsh areas, a tidal lagoon, a dune system, and woodland thickets at the entrance to Gerritsen Creek adjacent to the Belt Parkway. Originally an island, the creek separating it from the land was filled in the 1930s. In 1924, New York City acquired the property for use as a park, but instead leased it to a contracting company, which parceled and rented the land. In 1972 it became part of Gateway National Recreation Area, though the parking lot and greenway that provide primary access to the shore are the responsibility of the New York City Department of Parks and Recreation and the New York City Department of Transportation.

The Marine Parkway-Gil Hodges Memorial Bridge was opened by the Marine Parkway Authority in 1937 to provide access to the Rockaway Peninsula, which previously could be reached only by ferry or by a circuitous route around the eastern end of Jamaica Bay (NYC MTA, 2016). The bridge is approximately 3,985 feet long, and is designed with a vertical lift-through truss. The land at both ends of the bridge is part of the Gateway National Recreation Area. In 1978, Gil Hodges' name was added to the bridge in honor of the Brooklyn Dodgers' great first baseman and Mets manager. Average daily traffic is approximately 20,000 vehicles.

4.17.2 Areas of Potential Effect

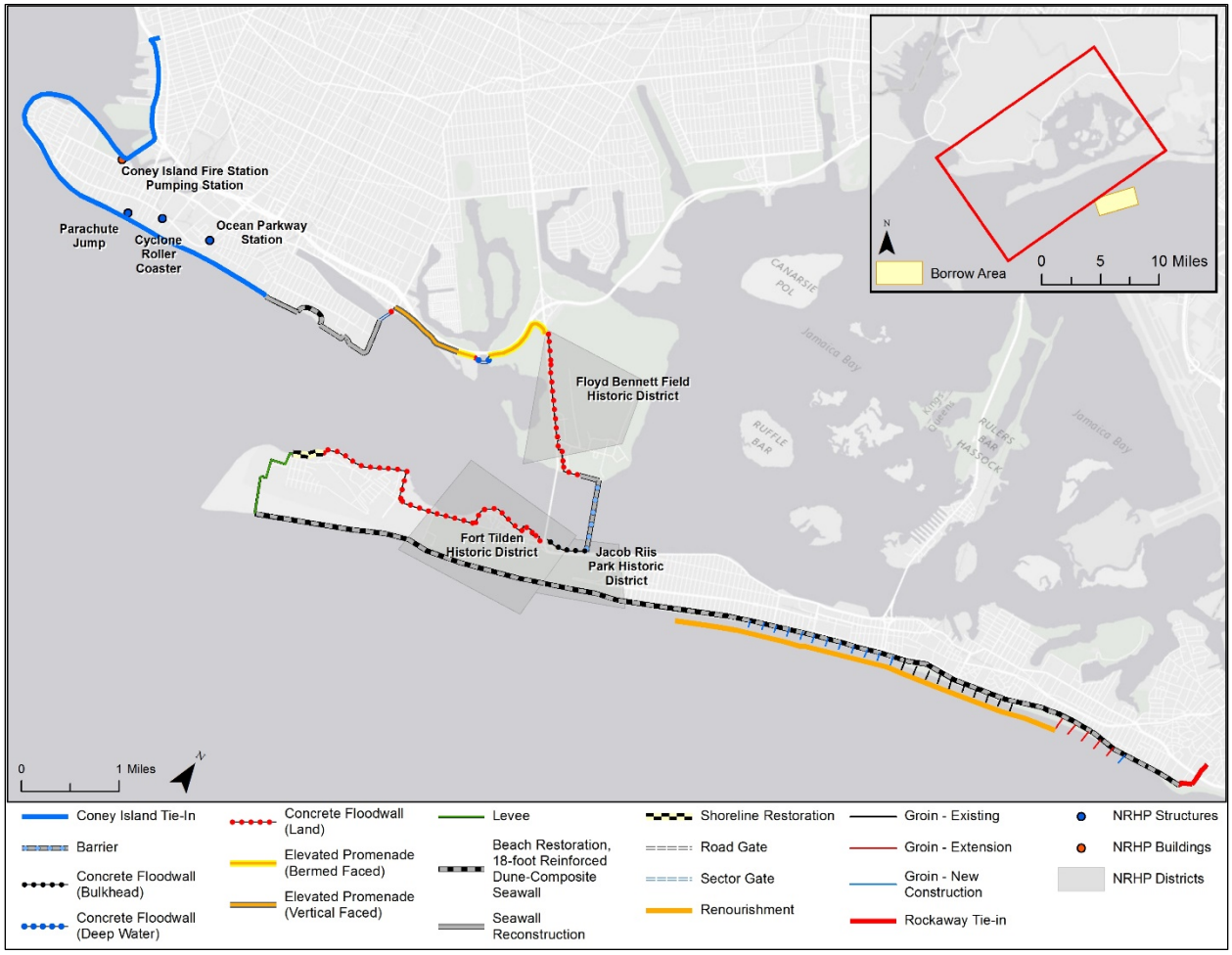
4.17.2.1 Rockaway

The APE for Rockaway consists of the ocean-side (Atlantic facing) onshore and immediate offshore areas, and the bay-side onshore and shoreline areas (facing Jamaica Bay). It also includes the proposed off-shore borrow area located in the Atlantic Ocean approximately two miles south of the Rockaway peninsula (Figure 4.17-1).

The proposed construction designs for the CSMRUs varies depending on the location within the APE. However, all of the onshore elements generally require installation of concrete and/or metal pilings to depths approximately 10 feet below ground surface, with above-ground elevations ranging from approximately 14 to 18 feet. The horizontal width of the elements ranges from approximately 40 to 120 feet wide. These proposed construction designs are provided in the Arcadis Memorandum for Record (December 14, 2015); the Moffatt & Nichol Formulation Memorandum (August 18, 2015); and the USACE Erosion Control Alternative Analysis (March 26, 2015).

Based on the proposed alignments and construction designs of the CSRMUs, the APE is limited to a relatively narrow strip within the Rockaway peninsula. However, the APE for the offshore borrow area is approximately 20 square miles.

Figure 4.17-1. Area of Potential Effects for Proposed Action



4.17.2.2 Jamaica Bay

The APE for Jamaica Bay includes the onshore and shoreline areas along the interior perimeter of Jamaica Bay extending west from the Long Island Railroad (near 104th Street) to Coney Island (Figure 4.17-1). The onshore areas extend inland up to the Belt Parkway from the Fountain Street Landfill to Plumb Beach Channel. On Coney Island, the APE is along the shoreline from Seawall Avenue to Corbin Place just east of Brighton Beach. The APE also includes the submerged seafloor areas where sector gates would cross the inlets of Sheepshead Bay, Plumb Beach Channel, Mill Basin, Paerdegat Basin, Fresh Creek, Hendrix Creek, Old Mill Creek, Shellbank Basin, and Hawtree Basin. Additionally, the APE includes the submerged seafloor spanning the Rockaway Inlet where the hurricane barrier would be constructed between Floyd Bennett Field and Rockaway, just east of the Gil Hodges Bridge.

As previously described under the Rockaway APE, the construction designs for CSMRUs within Jamaica Bay are similar to the Rockaway elements. However, the Jamaica Bay CSMRUs are generally not as wide as for Rockaway, primarily because the Jamaica Bay APE does not require

extensive buried seawalls as does the oceanside of Rockaway. The proposed construction designs for the Jamaica Bay CSMRUs are provided in the Arcadis Memorandum for Record.

Based on the proposed alignments and construction designs of the CSRMUs, the APE is limited to a relatively narrow strip within Jamaica Bay.

4.17.3 Previous Research

This section summarizes the findings of previous research investigations for cultural resources within or in close proximity to the APEs for Rockaway and Jamaica Bay, with a primary emphasis on historic properties—those that are listed or eligible for listing—on the NRHP, followed by a secondary focus on NYCLPC landmarks not on the NRHP list. This section also describes research findings for archaeological resources (pre-contact sites) and submerged sites within the APEs.

Large portions of both APEs are located within the Jamaica Bay Unit of the Gateway National Recreation Area. The NPS has reported that evidence of Paleo-Indian use in Gateway is sparse. Although manifestations of Paleo-Indian use of the general region are evident, no Paleo-Indian sites have been recorded (NPS, 2014). The NPS also reported that although manifestations of human occupation of northern New Jersey and the New York Harbor during the Archaic period have been recorded, no archeological sites dating definitively to this period have been recorded in Gateway. Several sites dating to the Woodland period have been identified within Gateway and are characterized by the presence of ceramic sherds (fragments), lithic artifacts, and shell middens indicative of the period. Several Contact period sites are known to have existed in the area around Gateway, but none have been recorded within Gateway (NPS, 2014). Contact period settlements typically include small amounts of European goods (metal kettles, glass beads, bottles, etc.) intermixed with larger amounts of indigenous-material cultural items.

4.17.3.1 Rockaway

Prior cultural resource assessments have been conducted for beach nourishment projects along sections of Rockaway (e.g. between Beach 19th Street and Beach 149th Street; Kopper, 1979) (USACE, 1979; USACE, 1993; Kopper, 1979). These prior studies concluded that no existing prehistoric or historic sites and no archaeological sites were present, and that, "…cultural resources reconnaissance surveys were deemed unnecessary considering the great erosive forces…" in those specific project areas (USACE, 1979; Kopper, 1979). The USACE has also determined for similar nourishment projects that sand placement should not have an adverse effect as long as it does not interfere with any features in historic districts.

Historic Districts Listed on the National Register

The NPS has identified the Fort Tilden, Jacob Riis Park, and the Far Rockaway Beach Bungalow Historic District (Beach 24th, 25th, and 26th Streets) as Historic Districts on the Rockaway Peninsula (Figure 4.17-1. Area of Potential Effects for Proposed Action). These districts are listed on the New York State Register of Historic Places (SRHP) and the NRHP.

Historic districts are defined by NPS as resources that possess a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

Fort Tilden and Jacob Riis Park are located within the Gateway National Recreation Area and are managed by the National Park Service.

Jacob Riis Park Historic District. The Jacob Riis Park Historic District, listed in 1981, is considered an "excellent, though greatly deteriorated, example of … municipal recreational planning the 1930s" (NPS, 2014) (Figure 18.2.1-2). Its historical significance derives from its association with New York City's Commissioner of Parks, Robert Moses, as well as it being a notable work of landscape architecture. The park was completed through the WPA (Works Progress Administration) and is associated with this important social and government program (NPS 1979b). The park landscape has lost much of its integrity and has not been well maintained (Olmsted Center for Landscape Preservation, 2002). In 2012, Hurricane Sandy resulted in heavy wind and water damage to Jacob Riis Park facilities, including flooding; broken windows; blown out walls, sand deposition in the bathhouse; missing ceramic tiles in the bathhouse; and sand and other debris deposited in structures and across the landscape. The brick courtyard wall was destroyed and heavy erosion is evident along the boardwalk (IMT 2012h).

The 220-acre Jacob Riis Park occupies a mile-long section of the Rockaway Peninsula and provides a variety of recreational activities. The park's three significant recreational buildings were constructed between 1932 and 1937.

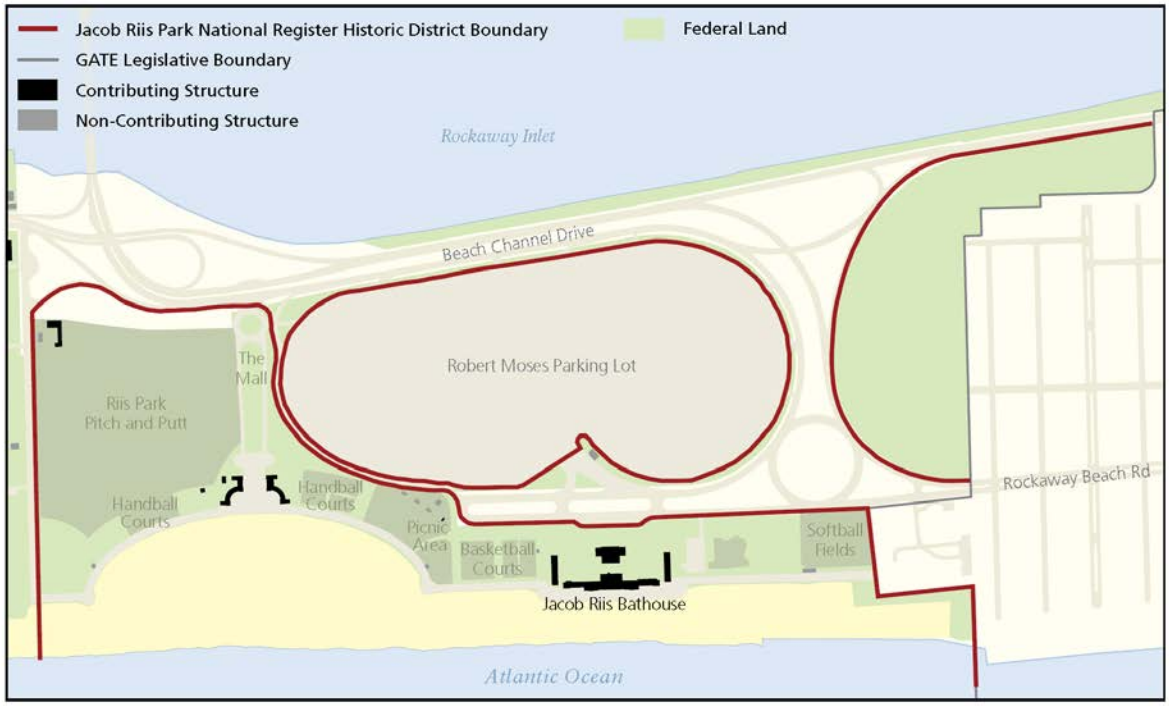
The original bathing pavilion—commonly known as the bathhouse—is the dominant feature of the park. The T-shaped, one-story brick masonry structure was completed in 1932. In 1936–37, it was enlarged by a long, two-story addition on the south side of the structure. The entrance to the bathhouse is located on the north wall. The front of the bathhouse is faced with a long arcade supported by pillars and topped with two octagonal turrets (NPS 1979b).

The mall focuses on a crescent-shaped extension of the boardwalk. The twin central mall buildings—constructed of brick and tile masonry—face each other at the southern end of the mall. Constructed in 1936–1937, both are two-story, square buildings, flanked by one- story wings, and connected to a rectangular, single-story wing to the south by a single- story, semicircular wing. Both have flat concrete roofs, concrete cornices, and concrete floors (NPS 1979b).

In addition, a broad promenade plaza adjacent to the original bathhouse was opened in 1932. During an expansion of the original park in 1936–1937, a continuous walkway (the length of the beach) was created, connecting all areas of the park. Both the promenade and boardwalk are considered integral elements of the park and contribute to its historic significance (Lane, Frenchman, and Associates 1992). Another striking feature of the park is the 72-acre parking lot located north of the bathhouse. With a 12,000–14,000 car capacity, it was believed to be the largest in the world at that time (NPS 1979b). The parking lot still retains its original integrity

and is a contributing element to the district. (Please refer to NPS 1979b; Lane, Frenchman, and Associates 1992; and the Olmsted Center for Landscape Preservation 2002 for greater detail on the Jacob Riis Park Historic District.)

Figure 4.17-2. Jacob Riis National Register Historic District



The Rockaway proposed CSRMU elements would be located on both the Atlantic-facing and Jamaica Bay-facing sides of the Jacob Riis Historic District. On the Atlantic side, the proposed buried seawall would be constructed along the beach, just inland of the shoreline. Based on the delineation of the historic district, the shoreline is within the historic district (see Figure 4.17-2). This element would not intersect with any of the historic structures present within the district. The element elevation would be approximately 18 feet NAVD88 and approximately 50 feet wide. This element may have an effect on resources buried in the shoreline as well as a visual effect on the Jacob Riis historic district. Jacob Riis Park has also been defined as a cultural landscape. The historic structures' relationship to the ocean is a significant characteristic of this landscape (NPS 2015b). On the Jamaica Bay side, the element would entail installation of a concrete floodwall in the same location as the existing bulkhead. However, the concrete floodwall would be completed at an elevation of approximately 15 feet NAVD88, which is several feet higher than the existing bulkhead.

Fort Tilden National Register Historic District. The following summary is excerpted from the NPS Gateway National Recreation Area General Management Plan (NPS, 2014). Fort Tilden Historic District is considered significant because of its role in the defense network designed to protect New York Harbor. It was determined eligible by the Keeper of the National Register of

Historic Places for its association with military history from 1916 to 1967. Contributing resources include the surviving Taft-era gun emplacements and associated structures from World Wars I and II, surviving features associated with the Nike-Ajax and Nike-Hercules missiles, and significant surviving operational, administrative, housing, wharf, and transportation components (NPS, 2014).

The parade ground at Fort Tilden was built around 1941 with assistance from the WPA. In order to construct it, 11 World War I cantonment buildings were destroyed. The parade ground is about 3 acres in size and was designed as the primary ceremonial area at the fort. The WPA placed a steel, 75-foot-high flagpole at the northeast corner of the parade ground near the main fort's entrance; the flagpole was lost during Hurricane Sandy in 2012. The flagpole was set in a cut stone with inscriptions of the installation, organization, and U.S. Army Coast Artillery insignia. Plans called for the parade ground to be seeded and landscaped. It was bound by tree-lined roadways and enclosed by structures to the west, north, and south. The parade ground contributes to the significance of the Fort Tilden Historic District.

The wharf area (Riis Landing) is located immediately to the northeast of the Fort Tilden post area. It consists of an area approximately 10 acres in size and was historically considered part of the post. It contained the "main dock, warehouses, maintenance facilities and administration buildings, with rail lines connecting from the main dock through the post area to the fortifications". Although the wharf area contained 19 buildings during the World War II period, only 8 structures remain today, and only pilings remain from the main dock. In the early 2000s, a new ferry dock and parking lot were constructed as part of the Riis Landing redevelopment project. The project included the adjoining complex of buildings once used as the U.S. Coast Guard Station Rockaway.

Figure 4.17-3. Fort Tilden National Register Historic District

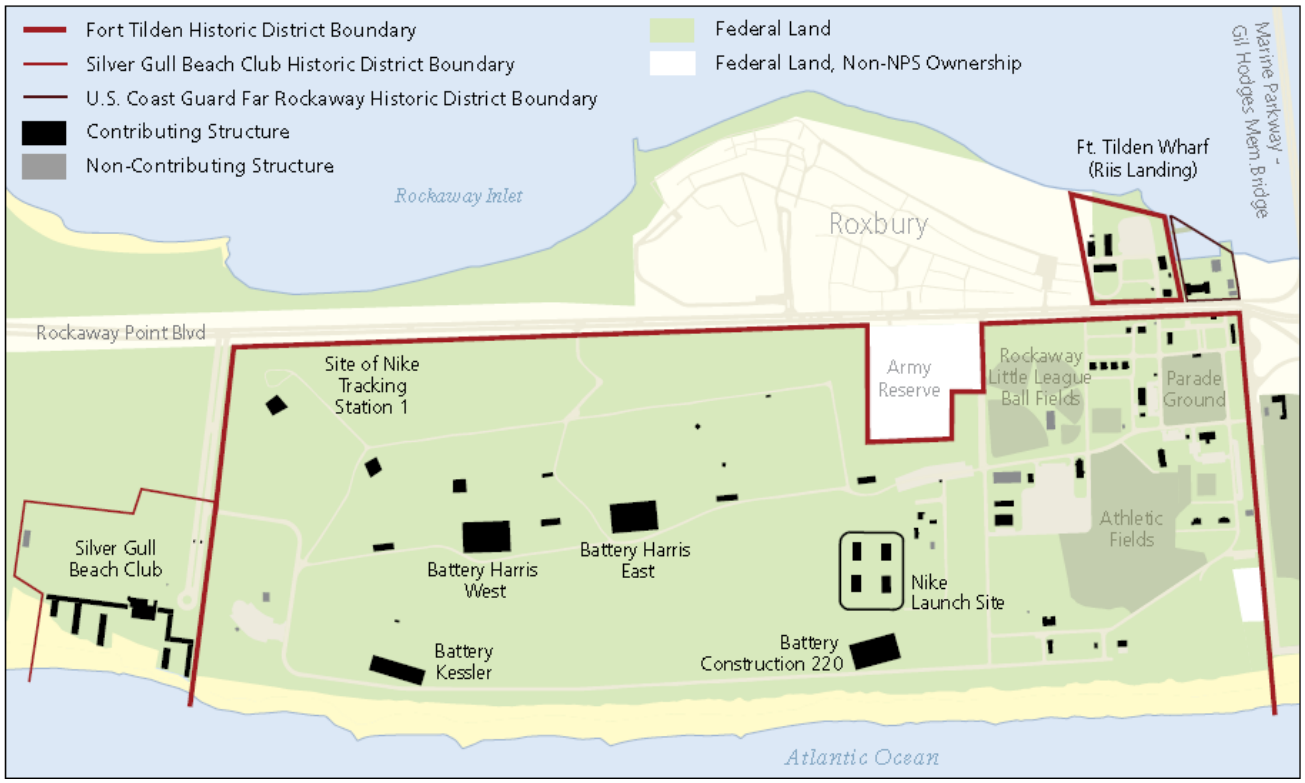


Figure 4.17-4. Nike Missile Launch Area at Fort Tilden, 1969

Source: https://www.nps.gov/gate/learn/historyculture/images/475nikephoto_1.gif

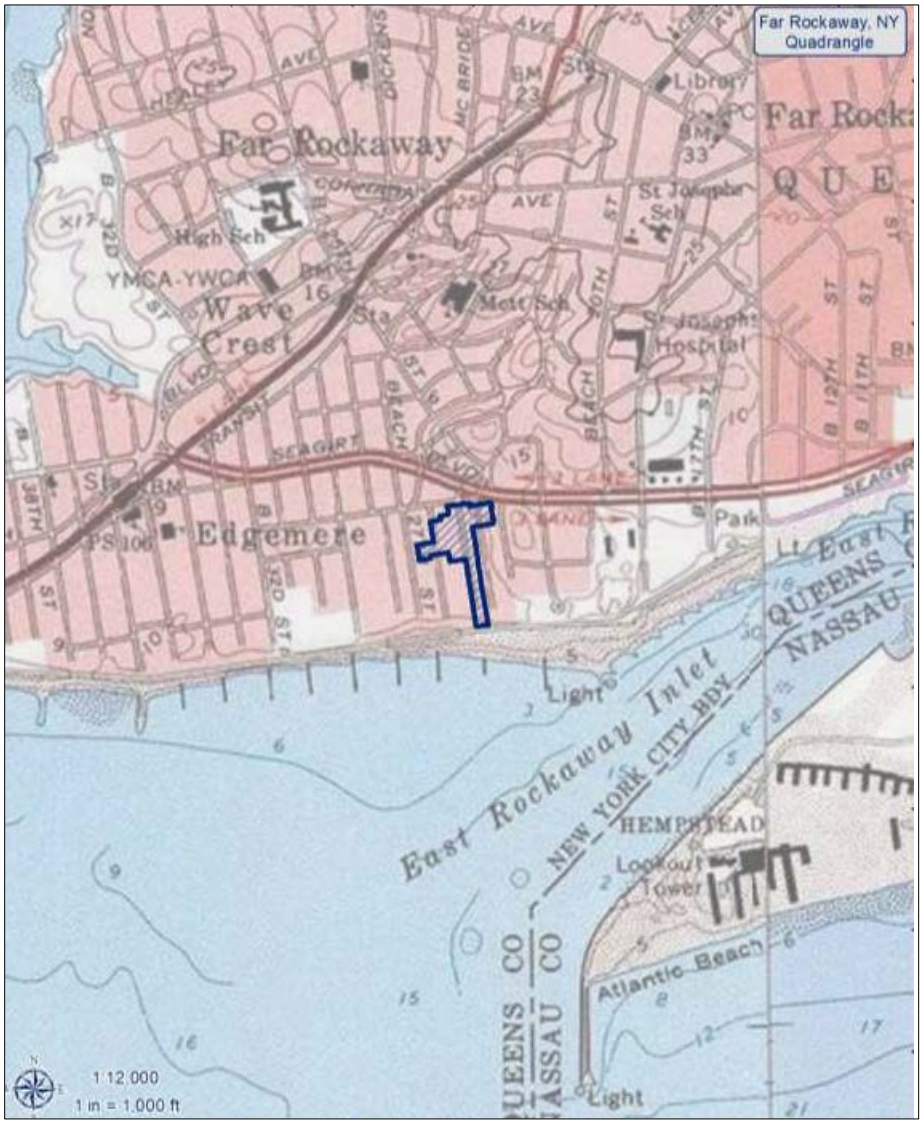
The Rockaway proposed CSRMU elements would be located on both the Atlantic-facing and Jamaica Bay-facing sides of the Fort Tilden Historic District. On the Atlantic side, the proposed buried seawall would be constructed along the beach, just inland of the shoreline. Based on the historic boundary, the shoreline is included within the historic district (see Figure 4.17-3). This element would not intersect with any of the historic structures present within the district. The element elevation would be approximately 18 feet NAVD88 and approximately 50 feet wide. On the Jamaica Bay side, the element would be constructed within the portion of the historic district represented by the Fort Tilden Wharf/Riis Landing (see Figure 4.17-3). The element would entail installation of a concrete floodwall constructed on shore and behind the current beachfront. The element elevation would be approximately 14.5-15 feet NAVD88, with the bottom of footings at -10 feet NAVD88, and at a width of approximately 40 feet.

Far Rockaway Beach Bungalow Historic District. The Far Rockaway Beach Bungalow Historic District is located along Beach 24th, 25th, and 26th Streets in Far Rockaway in Queens County. It was listed on the National Register of Historic Places in 2013 (NPS, 2013b). It includes summer beach bungalows near the oceanfront of Far Rockaway. They are smaller than the usual domestic bungalows of the 1920s. They were built in 1921 using pattern book designs incorporating uniform facades, compact interiors, integrated porches and exposed rafters. Their architect, Henry Hohauser, became better known in the 1930s as a designer of Art Deco hotels in Miami Beach. The district was hit by Hurricane Sandy in 2012, but survived without major damage.

Figure 4.17-5. Far Rockaway Beach Bungalow Historic District Homes

Source: https://www.nps.gov/nr/feature/places/13000499.htm

Figure 4.17-6. Far Rockaway Beach Bungalow Historic District Map



The Rockaway proposed CSRMU element in this area, a tie-in to Sea Girt Avenue, would be located on the Atlantic-facing side of the Rockaway peninsula. The element should not intersect with the historic district.

Other Historic Districts Eligible for the National Register

The Silver Gull Beach Club, the Breezy Point Surf Club, and the Far Rockaway Coast Guard Station have been determined eligible for the National Register by the New York State Historic Preservation Office (NPS, 2014).

Silver Gull Beach Club Historic District. The Silver Gull Beach Club Historic District is located on the Atlantic Ocean shorefront, immediately west of Fort Tilden, on the Rockaway Peninsula. It is located within the Gateway National Recreation Area and is managed and administered by the NPS. The historic district consists of approximately 7.5 acres of relatively

flat land surrounded on three sides by undeveloped coastal land covered with dense low brush. It is bordered on the south by the Atlantic Ocean, "where a wide sandy beach provides uninterrupted vistas to the east and west" (NPS, 2014).

The Silver Gull Beach Club Historic District is an oceanfront cabana complex containing a total of 15 contributing (1 site, 7 buildings, 7 structures) and 10 non-contributing (5 buildings and 5 structures) resources. The district's contributing resources include a large clubhouse, 4 court buildings, a pool court, an activity building, recreational facilities, and both paved and unpaved parking areas. The 12,000-square-foot, one-story clubhouse is the central building of the cabana complex. The Silver Gull Beach Club sustained substantial storm damage from Hurricane Sandy in 2012. Cabanas, the pool, and surrounding concrete were destroyed. Large sections of beaches were eroded, large amounts of sand were deposited in parking lots and roads, and buildings within the historic district were damaged (NPS, 2014).

The Silver Gull Beach Club Historic District is in its original location on the Atlantic Ocean and retains a high degree of integrity in terms of setting, design, materials, workmanship, feeling, and association. Only one major alteration—the removal of a set of second-floor cabanas from the clubhouse building—has occurred. "The club continues to serve its original function and it conveys a strong sense of feeling and association as a mid-twentieth-century oceanfront recreational resource" (NPS, 2014).

The Silver Gull Beach Club is significant at the local level in the areas of entertainment/recreation, social history, community planning and development, and architecture. Its period of significance is 1962–1963, the years the club was designed, constructed, and opened by its original owner the Atlantic Improvement Corporation (NPS, 2014).

Fifteen contributing structures are listed in the National Register nomination form for the Silver Gull Beach Club, including those related to transportation (roads/parking) and recreation (e.g., clubhouse, pools, cabanas) (NPS, 2014).

The Rockaway proposed CSRMU element in this area is a buried seawall. The current alignment of this element intersect with pavilions located along the shoreline. According to the historic district designation, the shoreline is also within the historic district. The element elevation would be approximately 18 feet NAVD88 and approximately 50 feet wide. The height of this proposed element may affect the east-west vistas that would be a part of the historic significance of the district.

Breezy Point Surf Club. The Breezy Point Surf Club is located on the western portion of the Rockaway peninsula, between Breezy Point Tip and the western side of the Breezy Point community. It is located within the Gateway National Recreation Area and is managed and administered by the NPS. It is an approximately 60-acre cabana complex in a coastal setting of relatively flat land facing the ocean on the Rockaway Peninsula. The historic district contains 69 contributing buildings, 11 contributing structures, and 1 contributing site; most of these were constructed between 1937 and 1962. The complex has two distinct sections of cabana courts

known as the Original Courts and the Ocean Courts, along with several pools and athletic courts. The district reflects a primarily recreational landscape that evolved from 1937 to 1963 in response to increased demand for memberships in the club (NPS, 2014).

The historic district retains a high degree of integrity in terms of its location (original), setting, design, materials, workmanship, feeling, and association. Although routine maintenance has occurred throughout the years, the majority of the original materials are intact and the workmanship of the buildings is still evident. The district retains a strong sense of its feeling and association as a large, recreational oceanfront resort built in the early to mid-19th century. Damage to the Breezy Point Surf Club from Hurricane Sandy in 2012 was not extensive (NPS, 2014).

The Breezy Point Surf Club Historic District is eligible for listing in the National Register at the local level in the areas of entertainment/recreation, social history, and architecture. The period of significance ranges from 1937, when the Club was established, and ends in 1963 when the layout of the cabana complex as it exists today was completed (NPS, 2014).

The National Register nomination form for Breezy Point Surf Club lists 79 contributing structures, including those related to transportation (roads/parking areas) and recreation (e.g., cabanas, boardwalks and walkways, pools, cabins, showers) (NPS, 2014).

The proposed CSRMU element in this area is a levee that would be constructed beyond the western boundary of the Breezy Point Surf Club. The element elevation would be approximately 14 feet NAVD88, with pilings at -6 feet NAVD88, and a sloped width of approximately 100 feet. The Atlantic-facing element would be a constructed seawall, which would not intersect with the district, if the district does not include the Atlantic shoreline. The Breezy Point Surf Club vista may be affected by the elements along the Atlantic shoreline and to the west of the historic district..

Far Rockaway Coast Guard Station Historic District. The Far Rockaway Coast Guard Station Historic District is located just east of the Fort Tilden wharf area (in the Fort Tilden Historic District) (NPS, 2014; see Figure 4.17-3). It is located within the Gateway National Recreation Area and is managed and administered by the NPS. The Coast Guard facility is considered historically and architecturally significant for its association with the history of lifesaving services and as a distinctive example of Colonial Revival institutional architecture. During the 19th and early 20th centuries, Far Rockaway was the site of numerous marine accidents and shipwrecks. An earlier lifesaving station—established by the New York Life Saving Benevolent Association—operated with volunteers at Far Rockaway as early as 1849. The current station's construction began in 1938 with WPA funds and continued through 1944. The facility was designed with a boat basin, piers, breakwaters, marine railways, and radio communications. Through the years some support facilities have been removed (e.g., boat shop), but the complex is believed to retain substantial integrity of its original construction period. In

2012, Hurricane Sandy resulted in moderate damage to the main building, boathouse, garages, and power house (NPS, 2014).

The proposed CSMRU element would consist of a land-based concrete floodwall, with an elevation of 14.5 feet NAVD88, and piles at least 10 feet below existing grade. The current alignment appears to intersect with the docks that extend into Jamaica Bay.

Landmark Structures

Landmark structures include buildings and sites and may be eligible for or listed on the National Register by the NPS and the NYC Landmark Preservation Commission. These landmark structures and sites include the Richard Cornell Burial Ground (1457 Greenport Road, Far Rockaway) (listed by the NYC Landmark Preservation Commission, http://www.neighborhoodpreservationcenter.org/db/bb_files/richard-cornell-graveyard.pdf), and NPS-designated structures including the Rockaway Courthouse (90-01 Beach Channel Drive), the Temple of Israel Synagogue (1-88 Beach 84th Street), US Post Office-Far Rockaway (1836 Mott Avenue), Trinity Chapel (1847 Mott Avenue), and the Russel Sage Memorial Church (1324 Beach 12th Street).

Local landmarks (not formally listed) include the Waterfront Tribute Park (9/11 memorial) at the corner of Beach 116th Street and Beach Channel Drive and American Airline Flight 587 Memorial (southern end of Beach 116th Street near the beachfront).

Based on the location of these landmark structures and the proposed alignment of Rockaway CSRMUs, none of these landmark structures are within the Rockaway APE.

4.17.3.2 Jamaica Bay

Prior cultural resource assessments have been conducted in the area of the Jamaica Bay APE (FERC, 2013; NPS, 2014; Bernstein, 2009). Documented sites in this vicinity of Barren Island include the Equendito Native American village site and the nineteenth century Rendering Plant on Dead Horse Bay. Bernstein indicated that the area around Barren Island had an “overall low sensitivity for intact prehistoric and historic period archaeological deposits…” but “The area of highest sensitivity for archaeological sites is near the southern end (the west side of Flat Bush Avenue near the entrance to Floyd Bennett Field), where historic maps indicate that former Barren Island was dry land and fill may not be as deep as elsewhere in the APE” (Bernstein, 2009). Bernstein also reported that undisturbed portions Barren Island, if they exist, would have a moderate to high sensitivity for the presence of prehistoric resources. However, it is likely that any prehistoric deposits are now very deeply buried beneath landfill (greater than 6 feet below sediment surface). Excavation about 6 feet was anticipated to have relatively low potential for impact to any prehistoric resources (Bernstein, 2009).

The Jamaica Bay APE includes two historic districts, which are described in the following sections.

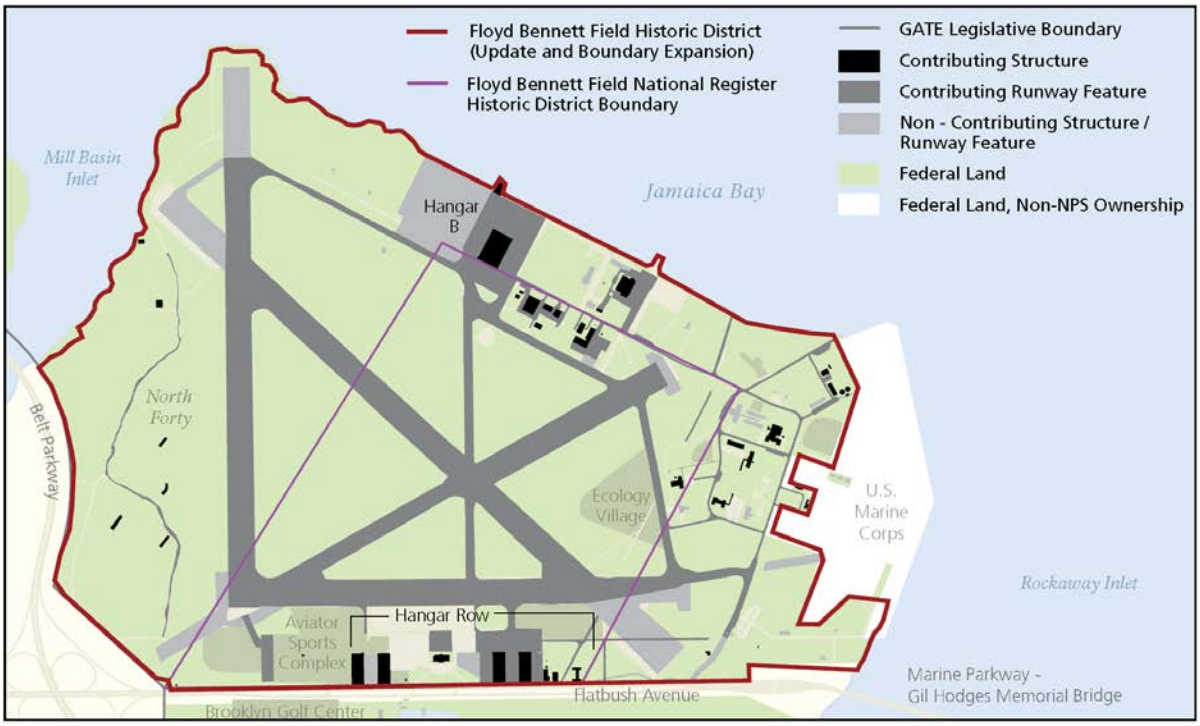
Historic Districts Listed on the National Register

Floyd Bennett Field Historic District. Floyd Bennett Field Historic District is located on Barren Island and is within the Gateway National Recreation Area and managed by the NPS. It was originally listed on the National Register in 1980 (Figure 4.17-7) (NPS, 2014). Its period of significance (1931–1941) was related to its involvement in the evolution of aviation history and municipal airport construction. According to the original National Register nomination, the original complex of steel frame and brick hangars and support building at Floyd Bennett Field still retains the "architectural design and historic cohesion of an early municipal airport" (NPS, 2014). A recent determination of eligibility expands the district's boundaries and period of significance. The revision to the period of significance ranges from 1928 to 1945 to incorporate important historical themes not addressed in the original documentation. The district's boundaries have been revised to include all lands east of Flatbush Avenue and south of the Shore Parkway, with the exception of the U.S. Department of Defense land used as a Marine Corps Reserve Center (NPS, 2014).

These expanded boundaries conform to federally owned lands administered by the NPS that are historically associated with Floyd Bennett Field and the Coast Guard Air Station Brooklyn. The expanded district is significant for its role in early aviation history. "In the 1930s it was the starting point and terminus for many record-breaking continental and intercontinental flights and important air races in the 'Golden Age' of U.S. aviation history". Its significance also lies in its role during World War II when the navy operated the field as Naval Air Station New York, one of the most vital "home front" navy installations, "ferrying more naval aircraft from regional assembly plants to the West Coast for deployment in the Pacific Theater than any other facility". The district is also significant for its architecture and engineering. Much of Floyd Bennett Field's original structure and setting— hangars, administration building, runways, and taxiways—is still evident and it is one of the few municipal airports that still reflects the pioneering of the aviation industry. Hangar B, the largest structure at the field, was completed in 1941 to house seaplanes and currently houses the Historic Aircraft Restoration Project volunteer group and numerous historic aircraft. Hangar B sustained roof damage and broken windows and is in need of stabilization as a result of Hurricane Sandy in 2012 (NPS, 2014).

The historic district's National Register significance lies not only in its association with aviation history and municipal airport construction but also in its association with individuals significant in early aviation (NPS, 2014). The former air terminal at Floyd Bennett Field is currently being used as the Ryan Visitor Center (NPS, 2014).

Figure 4.17-7. Floyd Bennett Field National Register Historic District



Source: NPS, 2014

The Jamaica Bay proposed CSRMU elements on Barren Island would extend in a north-south transect across the western side of the district. The longest element would be an on-land concrete floodwall, with an elevation of approximately 14.5-15 feet NAVD88, footings at -10 feet NAVD88, and a width of approximately 40 feet. On the northwestern portion of the district the element would be an elevated promenade at an elevation of approximately 15 feet NAVD88 and a width of approximately 95 feet. On the southern end of the district, a short segment of reconstructed seawall would be constructed at an elevation of approximately 18 feet NAVD88. This element would be connected to the hurricane barrier, which would span Rockaway Inlet and connect to the Rockaway peninsula near Jacob Riis Park.

Other Historic Districts Eligible for the National Register

The Gil Hodges Bridge has been determined by the SHPO to be National Register eligible (04701.014797, 08101.007322). The aforementioned hurricane barrier would have an elevation of approximately 16 feet NAVD88. The proposed alignment would be approximately 2,200 feet east of Gild Hodges Bridge. Accordingly, the hurricane barrier would have negligible visual or aesthetic impacts on the current viewshed from Gil Hodges Bridge. Viewsheds looking at/to the Gil Hodges Bridge would be affected.

Landmark Structures

Landmark structures include buildings and sites and may be eligible for or listed on the National Register by the NPS and the NYC Landmark Preservation Commission. These landmark structures and districts are listed below by county. However, based on the alignment of CSRMU elements within the Jamaica Bay APE, these landmarks are relatively far from the element. Therefore, construction and operation of the elements are not anticipated to adversely affect these landmark structures.

Kings County

- Landmark Buildings and Sites
    - All Saints' Memorial Church Complex
    - Beth El Jewish Center of Flatbush
    - Casemate Fort, Whiting Quadrangle
    - Hubbard House
    - Lott, Hendrick I., House
    - New Lots Reformed Church and Cemetery
    - Old Gravesend Cemetery (Site)
    - On Coney Island - Coney Island Fire Station Pumping Station
    - On Coney Island – The Jewish Center of Coney Island
    - On Coney Island – Manhattan Beach Jewish Center
    - Stoothoff-Baxter-Kouwenhaven House
    - West Bank Light Station
    - Wyckoff-Bennett Homestead
- Landmark Structures
    - Avenue U Station (Dual System BRT)
    - Bay Parkway Station (Dual System BRT)
    - Coney Island Yard Electric Motor Repair Shop
    - Coney Island Yard Gatehouse
    - On Coney Island - Cyclone Roller Coaster
    - On Coney Island - Ocean Parkway Station (Dual System BRT)
    - On Coney Island - Parachute Jump
    - Romer Shoal Light Station (located in Lower Bay approximately 4 miles south of Coney Island and 4 miles west of Breezy Point Tip)

Queens County

- Landmark Structures
    - Trans World Airlines Flight Center at JFK International Airport

Nassau County

- Landmark Buildings and Sites

- Rock Hall

4.17.4 Archeological Resources – both Rockaway and Jamaica Bay

The NPS has reported that archeological resources in the Jamaica Bay Unit of the Gateway National Recreation Area date primarily to later pre-contact (Woodland period) and historical periods (NPS, 2014). Cultural manifestations include both surface and subsurface materials. However, many of the archeological resources identified in earlier studies can no longer be located, due to a combination of inaccurate data records, natural processes (e.g., erosion), and landfilling throughout the region in the late 19th and 20th centuries (NPS, 2014).

4.17.4.1 Pre-Contact Archeological Sites

Most of the recorded pre-contact sites in Gateway were described as lithic scatters, lithic/ceramic scatters, campsites, or shell middens (NPS, 2014). Most of these remain undated or are believed to date to the Woodland period. Isolated finds believed to date to the Paleo-Indian period have also been recovered. The NPS has stated that the potential for encountering pre-contact archeological resources in the future is dependent on the original sensitivity and later historical use of the area (NPS, 2014).

Although the APEs for Rockaway and Jamaica Bay are relatively narrow, the APEs extend for several linear miles through Gateway. Accordingly, it is possible that pre-contact archeological sites are present in the APEs. Given the depth of the elements throughout the APE, it is anticipated that additional assessment for pre-contact archeological sites is warranted with the APEs. USACE will consult with the NPS, the NYSHPO, the Tribes, and other interested parties to develop a testing program as part of the Programmatic Agreement.

4.17.4.2 Historical Archaeological Sites

The potential for the discovery of additional in situ archeological resources in Gateway is influenced by a variety of natural and human factors (NPS, 2014). These include ancient and historical sea-level fluctuations, erosion and sediment transport due to tidal/wave action, and land filling/land-modification activities in the 19th and 20th centuries. All these factors affect the potential for the discovery of buried archeological resources, and their influence varies by geographic location. Although many natural coastal park areas have been buried beneath deep fill deposits, there are also areas where intact soils and archeological deposits have been recorded. For these reasons, the potential for the identification of intact archeological deposits in the park is strongly dependent on the types and effects of past and ongoing natural and human processes. The potential for discovery of archeological resources in each specific area of the park should be evaluated based on each area's unique set of circumstances.

Recent and comprehensive archeological assessments that considered the issue of the potential for archeological resources in Gateway included area-specific analyses of the sensitivity for such resources (NPS, 2014). These studies have included consideration of both natural and human impacts on specific park areas, and they have speculated on where the areas of highest potential

for archeological resources may be. For instance, in Fort Wadsworth (Staten Island Unit), high-potential areas include pre-contact sites on bluffs within 1,000 feet of the shoreline, 18th century structures, late 19th century batteries, pre-contact sites on bluffs and terraces in the southern and western portions of Fort Wadsworth, and others (NPS, 2014).

The sensitivity for archeological resources located within portions of Breezy Point Tip in the Jamaica Bay Unit stands in contrast to the high-sensitivity areas at Fort Wadsworth (NPS, 2014). In this second case, the recent formation of the landform and the lack of long-term historical occupation have created a situation in which the potential for archeological resources of any period is very low. The ability to predict to a limited extent the sensitivity of an area for the presence of archeological resources is an outcome of the patterned nature of human behavior. Such predictions have many uses, one of which is their use in project planning (NPS, 2014).

The depth of floodwalls, levees, and buried seawalls/dunes may have the potential to impact archaeological resources.

4.17.4.3 Submerged Archeological Resources (Shipwrecks and Submerged Sites)

Rockaway

The Rockaway beach nourishment and reformulation proposed action may obtain sediment from one or more off-shore borrow locations, as well as from onshore sources shipped overwater via barge to the site by one or more commercial aggregate suppliers (USACE, 2016). Accordingly, and pursuant to guidelines established by the National Historic Preservation Act of 1966 and the National Environmental Policy Act of 1969, potential impacts to any significant cultural resources in a proposed borrow area must be addressed.

Based on a borrow source investigation, USACE identified three suitable offshore borrow areas approximately 3 miles south of the Rockaway peninsula (USACE, 2016). The borrows are identified as Borrow Area A West, Borrow Area A East, and Borrow Area B West (Figure 4.17-8). The average dredging depth would be approximately 18 feet below the seafloor.

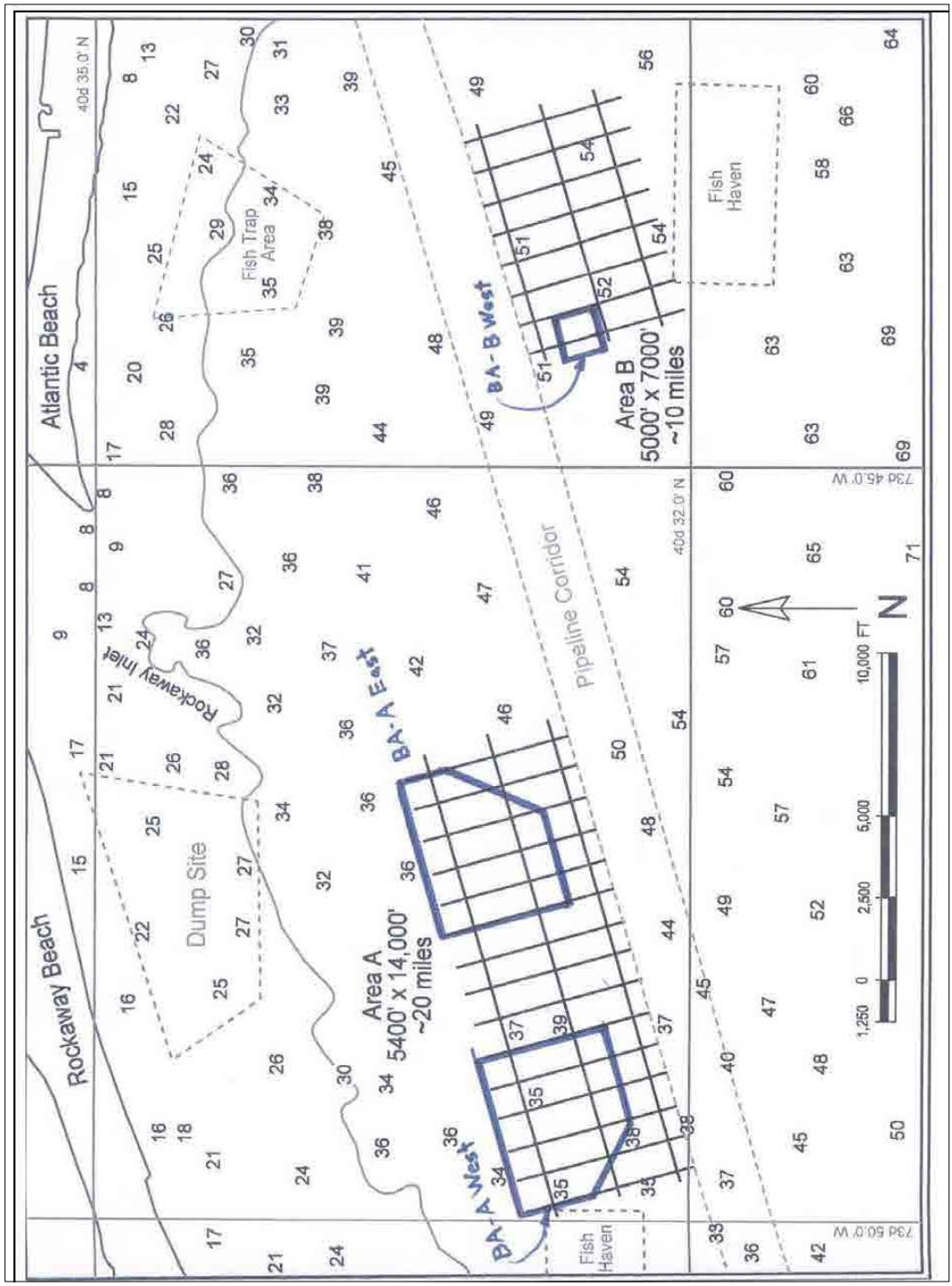
The area for Borrow Area A-West is roughly rectangular in shape approximately 4,800 feet from east to west, and 4,000 feet from north to south. Borrow Area A-East is roughly rectangular (5,000 feet in the alongshore direction by 4,000 feet in the on-offshore direction), and is approximately 1 mile east from Borrow Area A West. Borrow Area B-West is roughly a 1,200 by 1,200 feet box, and is approximately 4 miles west of Borrow Area A West (USACE, 2016).

Panamerican conducted a remote sensing survey at Borrow Area A-West and A-East in 2005 (Panamerican, 2005). Sixty-seven magnetic anomalies were recorded within the project area. Based on signal characteristics, three anomalies have the potential to represent significant cultural resources. Panamerican recommended avoidance of all three targets. If avoidance is not an option, additional archaeological investigations are recommended to identify the source of the magnetic anomalies. Additional work should consist of remote-sensing target refinement and diver assessment of the refined target location. Diver assessment should consist of a visual and

tactile investigation of the ocean bed at the center of highest gamma deviation for each. In the event that there is no source of magnetic deflection located directly on the ocean bed, sub-ocean bed investigations should be conducted with a probe or hydroprobe to a depth sufficient to either meet proposed project requirements or to locate and delineate the anomaly source. All targets should be assessed as to historical significance, relative to NRHP criteria. The remaining anomalies represent debris deposited for fish havens along and in the western edge of the project area, as well as a pipeline that parallels the southern project area boundary (Panamerican, 2005).

A remote sensing survey has not been conducted at Borrow Area B-West. If USACE plans to use this borrow area, a remote sensing survey will be conducted prior to dredging any material. USACE will share the results with the SHPO and provide recommendations for avoidance or additional investigation, as warranted.

Figure 4.17-8. Borrow Area Location Map



Source: Figure B-9 in USACE, 2016

Previous reports suggest there is the potential for shipwrecks in the general area off of the Rockaway peninsula (e.g. Engebretsen's shipwreck inventory on the Greater New York Harbor;

Engebretsen, 1982, as referenced in Panamerican Consultants, 2003; Panamerican Consultants, 2006). Based on an analysis of shipwrecks compiled by Riess and Pickman, Panamerican concluded, "Considering the amount of vessels wrecked off of Coney Island/Ambrose Channel (west of Borrow Area 2) and the number of vessels wrecked to the east of [Borrow Area 2], it can be inferred that the potential for wrecks off of Rockaway Beach remains high" (Panamerican Consultants, 2003). Additionally, Panamerican reported that a diver's guide to shipwrecks within the general area of Rockaway Beach lists seven wreck sites, including: *Princess Anne, Robert A. Snow, Cornelia Soule, Rascal, Black Warrior, Mistletoe,* and *Margaret* (in Daniel Berg's Wreck Valley Vol. II, 1990) (Panamerican Consultants, 2003). USACE has previously stated that "*twenty-three vessels were known to have been wrecked or stranded off Rockaway and Rockaway Beach. No wrecks have been located in the East Rockaway channel inlet itself. Because this inlet has been dredged in the past [prior to 1993], no resources will be impacted* (Kopper, 1979)" (referenced in Appendix L in USACE, 1993).

The Rockaway APE also includes creation of groins and lengthening of existing groins along the Atlantic Ocean shoreline, on the eastern portion of the Rockaway peninsula. Based on the preliminary construction design, constructing new or extending groins will require deepening of the seafloor up to 10-12 feet below existing grade, over a width of approximately 50 feet.

Jamaica Bay

A recent survey within the waters of Jamaica Bay, including waters under the jurisdiction of Gateway, found no significant magnetic anomalies or sonar targets that might indicate the presence of buried/submerged cultural resources (PBS&J, 2009, in NPS, 2014). However, the authors provided information on several shipwrecks that are known to be present in waters adjacent to lands managed by the NPS. These include the *Mistletoe*, the *Black Warrior*, the *Ajace*, and the *Cornelia Soule*, all of which sank, burned, or were grounded between 1859 and 1924. New York State also maintains a list of shipwrecks in Jamaica Bay. These submerged historic resources are also subject to disturbance from weather, development (construction of undersea utility lines, structures, etc.), and dredging activities (NPS, 2014).

Based on the Jamaica Bay APE, the hurricane barrier across Rockaway Inlet and the sector gates along the northwestern shoreline of Jamaica Bay are elements that have the potential to impact buried/submerged cultural resources. This is because these elements require driving piles at least 10 feet below the seafloor.

4.17.5 Native American Tribal Consultation

USACE will consult with Native American Tribes to solicit input regarding the TSP and for information about historical properties and archaeological resources within the Rockaway and Jamaica Bay APEs. The Native American Tribes to be consulted include the federally-recognized Shinnecock Indian Nation, Stockbridge-Munsee Band of Mohican Indians, Delaware Tribe of Indians, and Delaware Nation, as well as the NY State-recognized Ukecheug Indian

Nation. Although the Montauk Indian Nation is not federally- or state-recognized, they will be consulted as an interested stakeholder.

4.18 Socioeconomics/Demographics

The potential socioeconomic effects of construction and operation of the Projects include changes in population levels or local demographics, increased opportunities for employment, increased demand for housing and public services, transportation impacts, and an increase in government revenue associated with sales, payroll, and property taxes. These are discussed in Sections 4.9.1 through 4.9.6. Section 4.9.7 provides an analysis of Environmental Justice (EJ) for the Rockaway Project in accordance with CEQ guidelines (1997) for federal agency actions. Demographic and other population statistics for the Rockaway API and Jamaica Bay API are discussed by community district and/or county in the sections below.

The economic impact of the Gateway National Recreation Area (including the Jamaica Bay Unit) is applicable to both the Rockaway API and Jamaica Bay API. The NPS estimated the overall economic impact of the Gateway National Recreation Area (Yue, Mahoney, and Herbowicz, 2013, as cited in NPS 2013), but not for the individual parks. Accordingly, each API is anticipated to have a portion of the overall economic impacts, as summarized in the following table (from NPS, 2013).

Table 4.18-1. Spending, Economic and Payroll Impacts of the Gateway National Recreation Area on the Local Economy

Type of Visitation/Spending	Amounts
Public Use Data	
Recreation Visits	7,697,727
Overnight Stays	8,165
Visitor Spending	
All Visitors	$150,947,000
Non Local Visitors	$60,712,000
Impact of Non-Local Visitor Spending	
Jobs	668
Labor Income	$30,724,000
Value Added	$50,537,000

4.18.1 Rockaway

New York City is divided into 59 community districts for land use and other city planning (NYCDCP, 2016b). The Rockaway API is located in Queens Community District 14 (QCD14), which includes the neighborhoods of Arverne, Bayswater, Belle Harbor, Breezy Point, Broad Channel, Edgemere, Far Rockaway, Hammels, Neponsit, Rockaway Park, The Rockaways, Roxbury, Seaside, and Somerville (Figure 4.18-1). The following sections describe the

socioeconomic and demographic statistics available for QCD14 from the NYCDCP (NYCDCP, 2016b).

Figure 4.18-1. Queens Community District 14 (QCD14) - Rockaway

Source: NYCDCP, 2016 (http://maps.nyc.gov/doitt/nycitymap/?z=3&p=1050568,148940&c=GISBasic&s=f:COMMUNITY_DISTRICT,414)

4.18.1.1 Population and Employment

Population. The 2010-2012 population in QCD14 was 120,610 persons, which represents 7.8% increase since 2000 (NYCDCP, 2016b). The 2013 population in Queens was 2,296,175 (NYCDCP, 2016b).

Housing. The QCD14 has a total of 45,348 housing units, of which 5,306 units were vacant (NYCDCP, 2016b). This represented 11.7% vacancy rate, and an average rental vacancy rate of 5.5%. The average household size (i.e., average number of people per household) was 3.12 people (owner occupied) and 2.74 people (renter occupied). Median rent was $971 (NYCDCP, 2016b).

The Breezy Point neighborhood, located between Breezy Point Tip and Fort Tilden near the western end of the Rockaway peninsula, is a private cooperative established in 1961 that covers approximately 500 acres. The neighborhood is part of Queens Community District 14 (NYCDCP, 2016b). The community is run by the Breezy Point Cooperative, in which all residents pay the maintenance, security, and community-oriented costs involved with keeping the community private. There are approximately 2,800 single-family homes in the community (NYTimes, 1984). During Hurricane Sandy on October 29, 2012, most Breezy Point homes were damaged and destroyed by high water. In Breezy Point, Hurricane Sandy damaged or destroyed nearly 150 homes by fire due to downed utility lines (NYSOSC, 2014).

Income. The 2010-2012 estimated household income was $47,218 (median) and $65,943 (mean) (NYCDCP, 2016b).

Employment/Economic Activity. The 2010-2012 in labor force was 51,937 persons, representing 58.2% of the population 16 years and over (NYCDCP, 2016b). Approximately 38,095 eligible persons were not in the labor force. The majority of the labor force is employed in education services/health care/social assistance (33.1%), followed by professional/scientific/management/administrative/waste management (9.0%), transportation/warehousing/utilities (8.3%), retail (8.2%), public administration (7.3%), arts/recreation/food services (7.3%), construction (7.1%), finance/insurance/real estate (7.1%), and other non-public administration services (5.6%). Other industry categories each employ fewer than 5% of the labor force (NYCDCP, 2016b).

Social Characteristics. The 2010-2012 median age was 34.9 years. Languages spoken at home included English only (69.5%), Spanish 18.1%, other Indo-European (7.0%), Asian and Pacific Islander (2.0%), and "Other" (3.5%) (NYCDCP, 2016b). Ancestry is predominantly Irish (11.5%), West Indian (excluding Hispanic origin groups) (8.3%), Italian (6.0%), American (5.0%), German (3.7%), Polish (3.5%), Sub-Saharan African (3.2%), and Russian (2.7%) (NYCDCP, 2016b). Education attainment level was predominantly high school (27.4%), followed by some college (no degree) (18.2%), Bachelor's degree (14.5%), 9-12th grade (no diploma) (12.7%), less than 9th grade (10.2%), Graduate/Professional degree (9.2%), and Associate's degree (7.9%) (NYCDCP, 2016b).

4.18.2 Jamaica Bay

New York City is divided into 59 community districts for land use and other city planning (NYCDCP, 2016b). The portion of the Jamaica Bay API in Kings County is located in portions of Brooklyn Community Districts (BCD) 5, 10, 11, 13, 14, 15, 16, 17, and 18 (NYCDCP, 2016b)

(Figure 4.18-2). The portion in Queens County is located in Queens Community District (QCD) 10, 12 and 13. The remainder of the Jamaica Bay API is located in the southwestern portion of Nassau County.

Figure 4.18-2. Brooklyn (Kings County) and Queens Community Districts, and Nassau County - Jamaica Bay

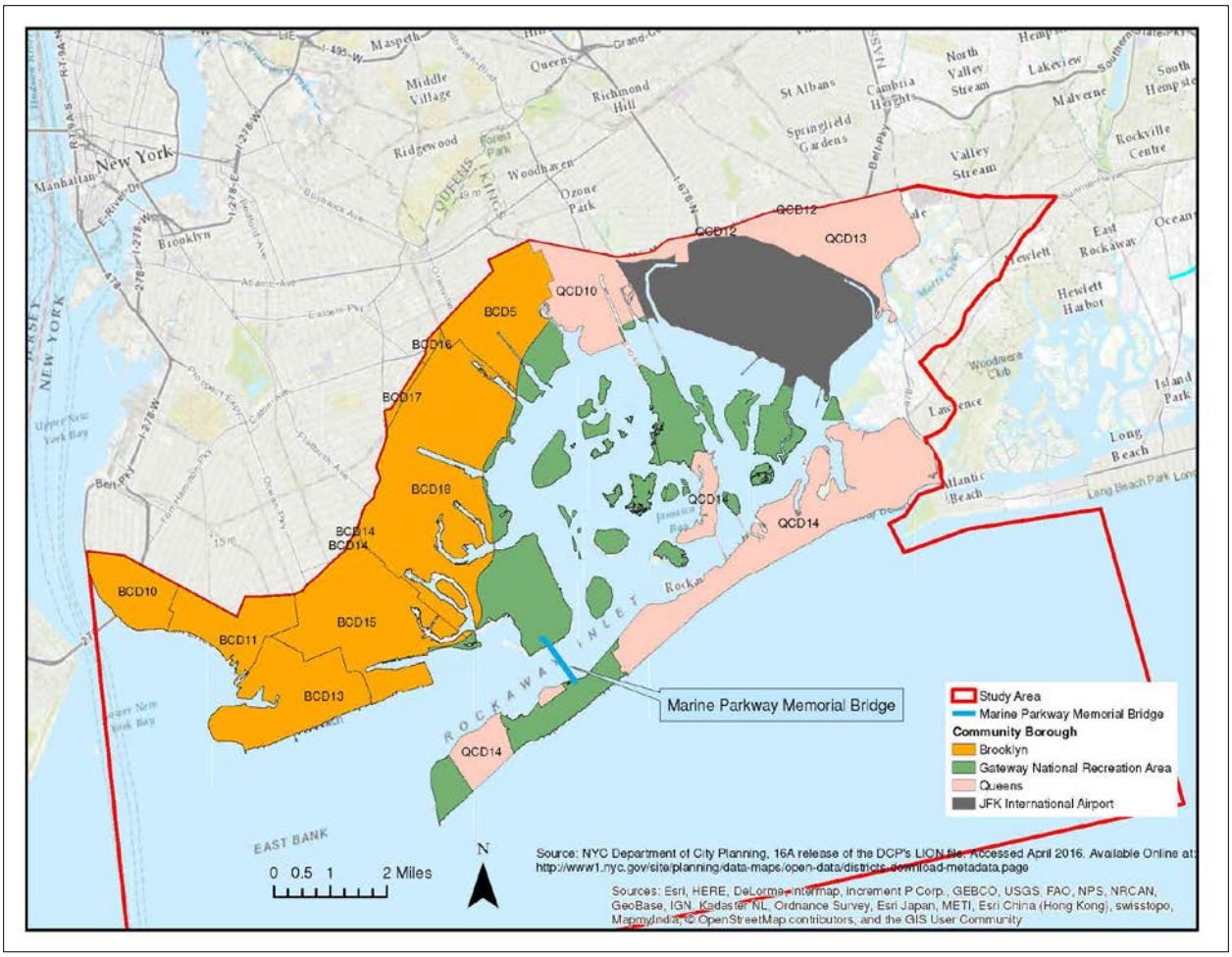


Table 4.18-2 provides a summary of select socioeconomic and demographic information for the communities located in vicinity of the Jamaica Bay API (NYCDCP, 2016b).

Table 4.18-2. Socioeconomic and Demographic Data - Jamaica Bay

Commun-ity District/ County	Population (2010) (a)	Population Growth (Percent Change 2000-2010) (a)	Population Density (persons/sq mile) (a)	Per Capita Income (b) ($)	Civilian Labor Force (b)	Unemploy-ment (b)	Top Three Labor Sectors (b, f)
BCD5	182,896	5.6%	32,660	15,109	59,243	7.1%	EH, RT, PS
BCD10	124,491	1.6%	31,123	29,465	66,234	5.6%	EH, AE, F
BCD11	181,981	5.7%	49,184	22,303	84,192	5.8%	EH, AE, RT
BCD13	104,278	-1.7%	33,638	21,615	45,300	6.8%	EH, RT, PS
BCD14	160,664	-4.8%	55,401	21,940	76,333	6.8%	EH, PS, TW
BCD15	159,650	-0.4%	33,968	26,669	66,792	5.6%	EH, PS, RT
BCD16	155,252	-6.3%	45,662	15,008	49,413	8.5%	EH, RT, TW
BCD17	155,252	-6.3%	45,662	21,202	68,996	8.1%	EH, RT, TW
BCD18	193,543	-0.6%	21,505	25,259	105,163	6.8%	EH, TW, RT
QCD10	122,396	-3.8%	20,065	24,056	69,774	7.0%	EH, RT, TW
QCD12	225,919	1.0%	23,533	20,996	119,178	9.8%	EH, RT, TW
QCD13	188,593	-3.9%	14,968	28,111	107,784	6.7%	EH, RT, TW
Nassau County	1,361,350 (c; 2015)	1.6% (c; 2010-2015)	3,005.19	42,949 (2010-2014)	699,702 (d; 2015)	4.3% (e; 2015)	--

Notes:
a - NYCDCP, 2016b
b - U.S. Census Bureau Economics, 2012
c - U.S. Census Bureau Quick Facts, 2016
d - U.S. Bureau of Labor Statistics, 2016. Civilian Labor Force
e - U.S. Bureau of Labor Statistics, 2016. Unemployment Rate
f - Sector Key:
AE = Arts, entertainment, recreation, accommodation, and food services
C = Construction
EH = Educational, health, and social assistance
F = Finance and Insurance, and real estate and rental and leasing
PS = Professional, scientific, management, administrative, and waste management services
RT = Retail trade
TW = Transportation, warehousing, and utilities

Housing. Table 4.18-3 summarizes select housing statistics for the communities located in vicinity of the Jamaica Bay API.

Table 4.18-3. Housing Characteristics - Jamaica Bay

Community District/ County	Owner Occupied (Percent) (a)	Renter Occupied (Percent) (a)	Vacant Housing Units (a)	Owner Vacancy Rate (Percent) (a)	Rental Vacancy Rate (Percent) (a)
BCD5	22.5%	77.5%	7,927	4.4%	8.0%
BCD10	38.8%	61.2%	3,417	1.8%	2.9%
BCD11	36.3%	63.7%	5,253	3.8%	4.1%
BCD13	29.3%	70.7%	4,048	1.6%	4.8%
BCD14	23.3%	76.7%	4,508	1.6%	4.8%
BCD15	46.7%	53.3%	4,977	2.4%	4.1%
BCD16	18.8%	81.2%	4,900	3.0%	5.0%
BCD17	33.9%	66.1%	5,214	1.0%	4.7%
BCD18	57.4%	42.6%	4,787	1.8%	3.1%
QCD10	64.1%	35.9%	2,300	0.5%	1.7%
QCD12	48.5%	51.5%	6,390	3.5%	3.2%
QCD13	72.3%	27.7%	3,368	1.1%	3.5%
Nassau County (b)	80.4%	19.6%	--	1.2%	4.4%
Notes: a U.S. Census Bureau Housing, 2012					
b NYS Comptroller, 2012					

4.19 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Population and Low-Income Populations (Executive Order, 1994), directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority population and low-income populations. When conducting NEPA evaluations, the USACE incorporates Environmental Justice (EJ) considerations into both the technical analyses and the public involvement in accordance with the USEPA and the Council on Environmental Quality guidance (CEQ, 1997).

The CEQ guidance defines “minority” as individual(s) who are members of the following population groups: American Indian or Alaskan native, Asian or Pacific Islander, Black, not of Hispanic origin, and Hispanic (CEQ, 1997). The Council defines these groups as minority populations for Environmental Justice considerations when either the minority population of the affected area exceeds 50% of the total population, or the percentage of minority population in the

affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis.

Low-income populations are identified using statistical poverty thresholds from the Bureau of the Census Current Population Reports, Series P-60 on Income and Poverty (US Census Bureau, 2015). In identifying low-income populations, a community may be considered either as a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect. The threshold for the 2014 census was an income of $12,071 for an individual and $24,230 for a family of four (U.S. Census Bureau, 2014a). This threshold is a weighted average based on family size and ages of the family members.

Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority Populations and Low Income Populations," issued in 1994, directs Federal and state agencies to incorporate environmental justice as part of their mission by identifying and addressing the effects of all programs, policies and activities on minority and low-income populations. The fundamental principles of EJ are as follows:

1. Ensure the full and fair participation by all potentially affected communities in the decision-making process;
2. Prevent the denial of, reduction in or significant delay in the receipt of benefits by minority and low-income populations; and
3. Avoid, minimize or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.

In addition to Executive Order 12898, the Environmental Justice analysis is being developed per requirements of "Department of Defense's Strategy on Environmental Justice" (March 24, 1995).

Per the above directives, EJ analyses identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of the project on minority and low-income populations. The methodology to accomplish this includes identifying low-income and minority populations within the study area, as well as community outreach activities such as stakeholder meetings with the affected population.

The population of New York is primarily Caucasian, representing 56.4-percent of the population in 2014 (US Census, 2014). The Hispanic minority population is numerically the largest minority and accounted for 18.7-percent of New York's population in 2014. The majority of the remaining minority population in the state is black. Table 4.19-1 shows the 2014-estimated population and the ethnic mix (as a percentage) for each of the three counties within the combined study area (Rockaway and Jamaica Bay). Table 4.19-2 shows the percentage of individuals below the poverty level in the three counties, New York, and the US.

Table 4.19-1. Percent Race by County

County	2014 Population Estimate	White[1]	Black	America n Indian	Asian	Hawaiian-Pacific Islander	Two or More Races	Hispanic
Kings	2,597,659	35.7%	33.4%	0.3%	11.8%	N	2.4%	19.5%
Queens	2,296,519	25.6%	18.4%	0.4%	25.0%	N	3.1%	28.0%
Nassau	1,338,841	62.1%	11.4%	N	8.7%	N	3.5%	16.1%
New York	19,228,524	56.4%	15.5%	0.4%	8.2%	N	2.9%	18.7%
US	310,899,910	62.0%	12.4%	0.8%	5.3%	0.2%	3.0%	17.4%

Notes: 1 - White alone, not Hispanic or Latino.

Source: U.S. Census Bureau, 2014.

Table 4.19-2. Percent of Population Below Poverty Level

Area	Percent Poverty
Kings	23.4
Queens	15.2
Nassau	6.4
New York	15.9
US	15.5

Source: U.S. Census Bureau, 2014a.

(From FERC, 2013 EIS) In addition to federal requirements, the NYSDEC established Commissioner's Policy 29 in 2003 to provide guidance on how to incorporate EJ into permit reviews, enforcement, grants, and public participation (NYSDEC, 2003). The NYSDEC identifies "Potential Environmental Justice Areas (PEJAs)" as census block groups meeting one or more of the following NYSDEC criteria in the 2000 U.S. Census (NYSDEC, 2016):

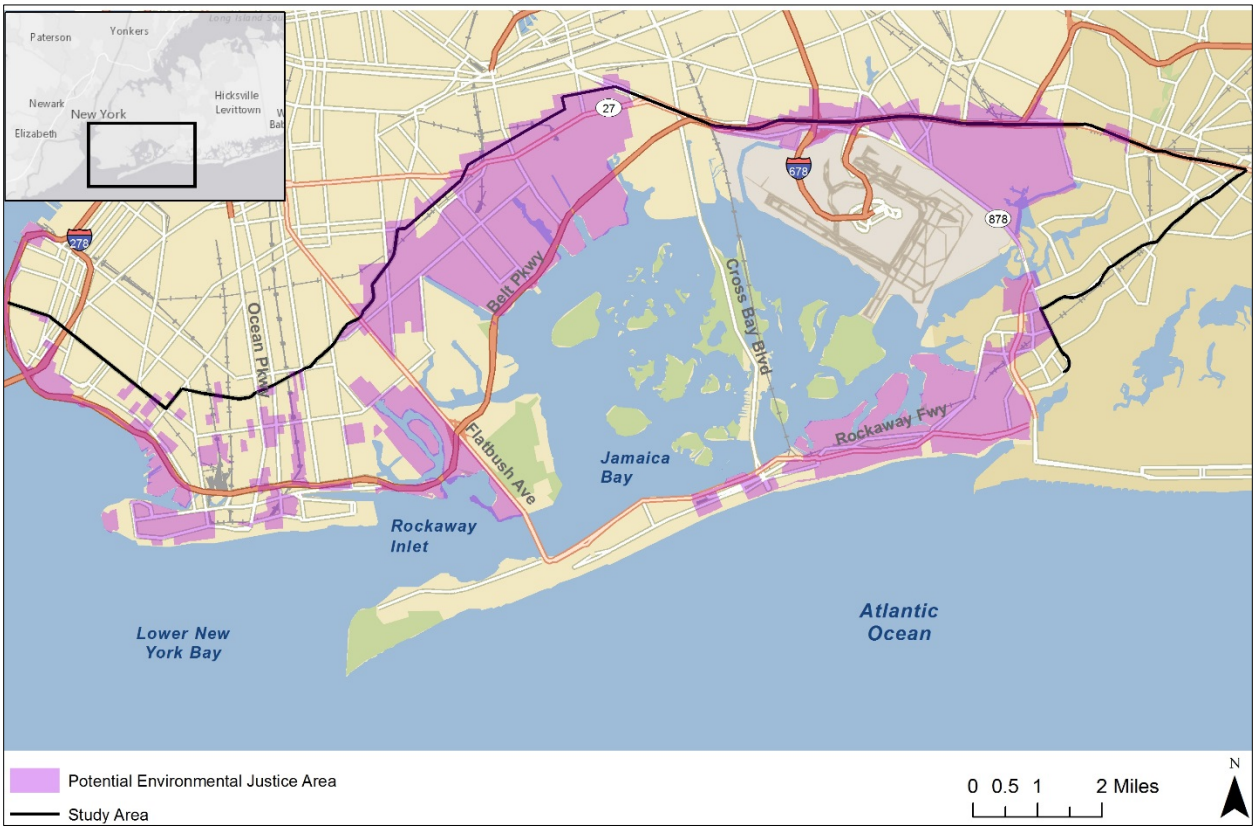
- 51.1% or more of the population are members of minority groups in an urban area;
- 33.8% or more of the population are members of minority groups in a rural area, or;
- 23.59% or more of the population in an urban or rural area have incomes below the federal poverty level.

The NYSDEC publishes county maps identifying PEJAs, including Kings, Queens, and Nassau counties (NYSDEC, 2016). The following section discusses the NYSDEC PEJAs for the Rockaway API and the Jamaica Bay API.

4.19.1 Rockaway

The Rockaway API contains several PEJAs identified by the NYSDEC (NYSDEC, 2016). Almost the entire area between the eastern end of the project and Beach 116th Street near the central portion of the peninsula is identified as a PEJA (Figure 4.19-1). There are no communities identified as a PEJA by the NYSDEC to the west of Beach 116th Street.

Figure 4.19-1. NYSDEC Potential Environmental Justice Areas - Rockaway

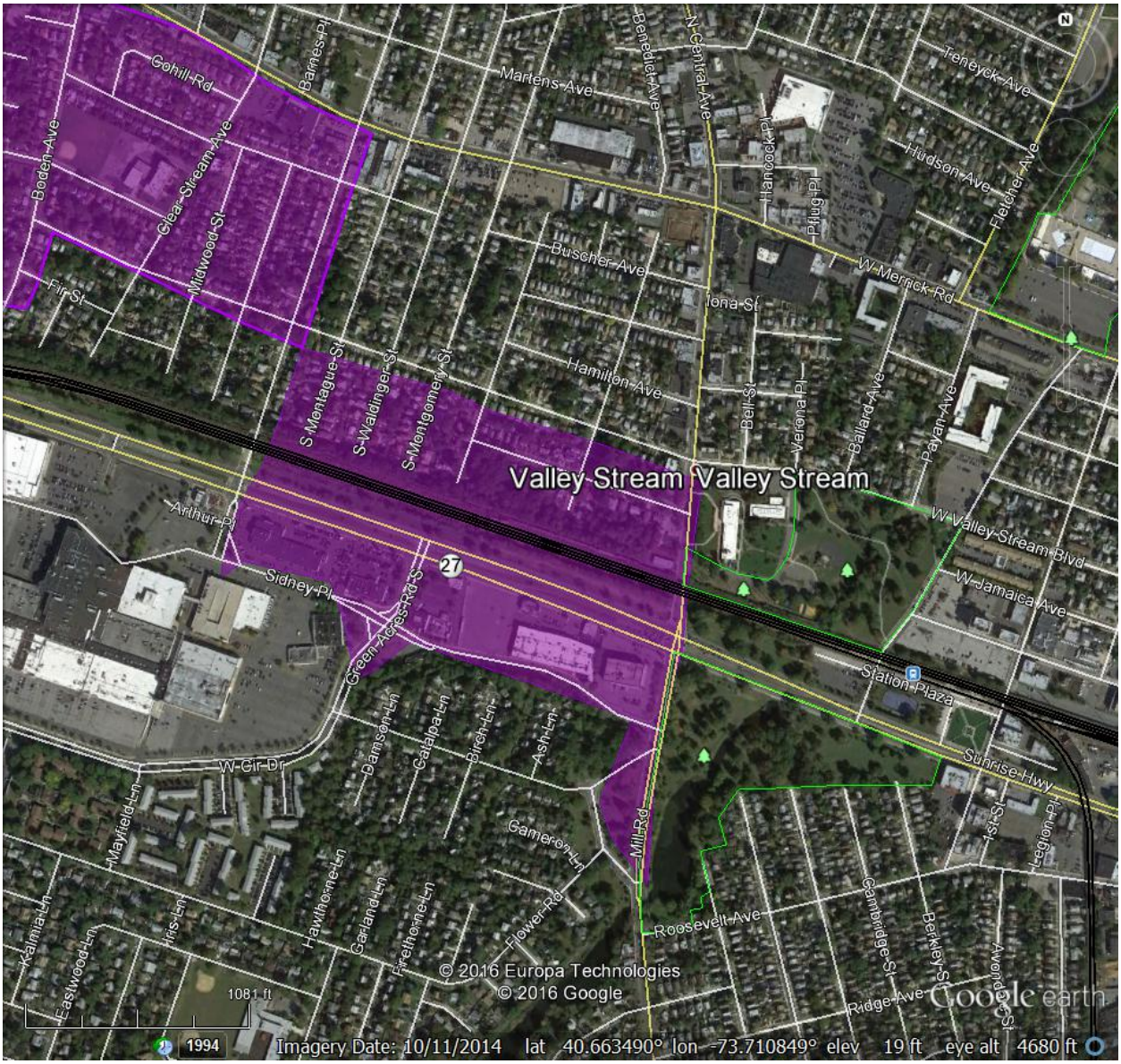


Source: NYSDEC, 2016. PEJA data layer available at http://www.dec.ny.gov/maps/pejalink.kmz

4.19.2 Jamaica Bay

The Jamaica Bay API located in portions of Kings, Queens, and Nassau Counties contains several PEJAs identified by the NYSDEC (NYSDEC, 2016). In Nassau County, a small PEJA is present the municipality of Hempstead, west of the Valley Stream neighborhood; however, the area south of Route 27 within the Jamaica Bay API appears to contain few if any residences (Figure 4.19-2). In Queens County, the majority of the Jamaica Bay API north and east of JFK airport is identified as a PEJA, while the neighborhoods west of JFK airport are not (Howard Beach, Lindenwood, Hamilton Beach) (Figure 4.19-3). Likewise, the majority of the Jamaica Bay API within Kings County is identified as a PEJA, including the communities surrounding the Gateway National Recreation Area, a large portion of Coney Island, and in and around the Fort Hamilton municipality (Figure 4.19-4).

Figure 4.19-2. NYSDEC Potential Environmental Justice Areas - Nassau County - Jamaica Bay



Notes: Purple-shaded area identified as an NYSDEC PEJA.

Source: NYSDEC, 2016. PEJA data layer available at http://www.dec.ny.gov/maps/pejalink.kmz

Figure 4.19-3. NYSDEC Potential Environmental Justice Areas - Queens County - Jamaica Bay

Notes: Purple-shaded area identified as an NYSDEC PEJA.

Source: NYSDEC, 2016. PEJA data layer available at http://www.dec.ny.gov/maps/pejalink.kmz

Figure 4.19-4. NYSDEC Potential Environmental Justice Areas - Kings County - Jamaica Bay

Notes: Purple-shaded area identified as an NYSDEC PEJA.

Source: NYSDEC, 2016. PEJA data layer available at http://www.dec.ny.gov/maps/pejalink.kmz

4.20 Aesthetics (Visual Resources)

Urban design and visual resources contribute to a pedestrian's experience of a public space by connecting the public realm to significant natural or built features. The features of visual resources include views of the distinct buildings or groups of buildings, and natural resources, and the features of urban design include the form, arrangement, bulk, and streetscape of the urban environment that defines a pedestrian's immediate environment. Street vistas are an important design consideration in New York because they provide visual relief, light and air, and extended views (NYCCWP, 1992). Visual corridors and panoramic views to the waterfront are a particularly important public amenity because of the water's aesthetic value.

Waterfront visual corridors are regulated under NYC Waterfront Zoning regulations, which apply to properties within waterfront blocks adjacent to or intersected by the shoreline (see Article VI, Special Regulations Applicable to Certain Areas; Chapter 2 – Special Regulations Applying in the Waterfront Area, Effective March 22, 2016; NYCDCP, 2016). These visual corridors are open areas that provide an unobstructed view from upland streets through a

waterfront zoning lot to the shoreline. Intended to extend existing views to the shore from the upland communities, visual corridors are required at regular intervals corresponding to the existing street grid, or spaced between 400 and 600 feet apart. Visual corridors, which are not required to be open to the public, may contain certain obstructions such as parking and trees (NYCDCP, 2016). Additionally, the regulations also address Waterfront Access Plans (WAPs), which allow for the modification of waterfront public access area requirements to address unique conditions in specific areas. The area must consist of at least a full block or four acres (174,240 sq. ft.) with 600 feet or more of shoreline. The area governed by a WAP must be entirely within the waterfront area. A WAP adapts waterfront zoning regulations governing public access and height and setback requirements to the specific conditions and planning goals for a defined area. It can be used, for instance, to ensure seamless continuity of shore public walkways to be developed over time by multiple property owners (NYCDCP, 2016).

For most developments on waterfront blocks, the Chairperson of the New York City Planning Commission must certify that the proposed development complies with requirements for public access and visual corridors (NYCDCP, 2016). Once certified, a maintenance and operation agreement with the NYC Department of Parks and Recreation must be filed and recorded before a building permit can be issued by the NYC Department of Buildings. The review procedure helps NYC enforce maintenance obligations and the public's right of access to these areas during required hours of operation and, for planning purposes, track the progress of waterfront development throughout the city (NYCDCP, 2016).

Additionally, the NYC Planning Commission has identified Special Scenic View Districts (NYC Zoning Resolution Chapter 113-00), which are intended to prevent obstruction of outstanding scenic views as seen from a public park, esplanade or mapped public place (NYC Planning, 2016). No buildings or structures are allowed to penetrate a scenic view plane except by special permit of the City Planning Commission. Based on a review of the NYC Planning Commission Special Scenic View Districts, no such districts are present in either the Rockaway API or the Jamaica Bay API (NYC Planning, 2016).

An adverse effect is found when a project would result in a change to the built environment's arrangement, appearance, or functionality such that the change would negatively affect a pedestrian's experience of the area. Important considerations in assessing the impact of a project on aesthetics are whether the project would obstruct important visual resources, whether such obstruction would be permanent, seasonal, or temporary, and whether the views that would be affected are unique or there are similar views that can be seen from other locations.

4.20.1 Rockaway

Waterfront and View Corridors. Aesthetics and scenic resources in the Rockaway APE are accessed primarily by boardwalks along the south shore, and encompass a view of the ocean and beach recreational facilities to the south and north from Fort Tilden, Jacob Riis Park, and Breezy Point Tip. The Atlantic shorefront beach extends to the east and west for approximately 11

miles, while the boardwalk covers approximately 4.5 miles of the Atlantic beachfront. Groins are visible along the majority of the Atlantic beachfront. The visible natural resources are primarily the Atlantic Ocean to the south, and Jamaica Bay to the north and west. Inland natural resources include the flora and fauna at Breezy Point Tip.

Public Parks and Culturally Significant Resources. As previously described in Section 13.0, public parks within the Rockaway APE include those managed by NPS (Fort Tilden, Jacob Riis, Breezy Point Tip) and several by the NYC Department of Parks and Recreation near the central and eastern ends of the Rockaway APE. These public parks provide views of natural areas and a respite from urban development. Additionally, as previously described in Section 0, landmark structures provide views of culturally significant resources.

4.20.2 Jamaica Bay

Waterfront and View Corridors. Waterfront and view corridors in the Jamaica Bay APE are accessed primarily from public parks located along the Gravesend Bay and Jamaica Bay shorelines extending from Kings County to Queens County. In Kings County, Coney Island provide important access to panoramic views of the Gravesend Bay and Lower Bay waterfronts and the entrance channel to Jamaica Bay. Waterfront views of Jamaica Bay are also accessible from the Gateway National Recreation Area parks located in Kings and Queens Counties. However, waterfront views from Nassau County are limited to areas near Head of Bay and Thurston Basin, adjacent to the east side of JFK airport.

Public Parks and Culturally Significant Resources. As previously described above and in 13.0, public parks within the Jamaica Bay APE provide scenic views of natural areas and a respite from urban development. Additionally, as previously described in Section 0, landmark structures provide views of culturally significant resources.

4.21 Noise

Sound is defined as a particular auditory effect produced by a given source, for example the sound of rain on a rooftop. Noise and sound share the same physical aspects, but noise is considered a disturbance while sound is defined as an auditory effect. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying. Noise can be intermittent or continuous, steady or impulsive, and can involve any number of sources and frequencies. It can be readily identifiable or generally nondescript. Human response to increased sound levels varies according to the source type, characteristics of the sound source, distance between source and receptor, receptor sensitivity, and time of day. How an individual responds to the sound source determines if the sound is viewed as music to one’s ears or as annoying noise. Affected receptors are specific (e.g., schools, churches, or hospitals) or broad areas (e.g., nature preserves or designated districts) in which occasional or persistent sensitivity to noise above ambient levels exists.

Noise Metrics. Although human response to noise varies, measurements can be calculated with instruments that record instantaneous sound levels in decibels. A-weighted decibel (dBA) is used to characterize sound levels that can be sensed by the human ear. "A-weighted" denotes the adjustment of the frequency range to what the average human ear can sense when experiencing an audible event. The threshold of audibility is generally within the range of 10 to 25 dBA for normal hearing. The threshold of pain occurs at the upper boundary of audibility, which is normally in the region of 135 dBA (USEPA, 1981). Table 4.21-1 compares common sounds and shows how they rank in terms of the effects of hearing. As shown, a whisper is normally 30 dBA and considered to be very quiet while an air conditioning unit 20 feet away is considered an intrusive noise at 60 dBA. Noise levels can become annoying at 80 dBA and very annoying at 90 dBA. To the human ear, a change in noise levels of 5 dBA is generally discernible while a change of 10 dBA is perceived by the human ear as either a doubling or halving of noise levels (USEPA, 1981).

Table 4.21-1. Common Sound Noise Levels and Effects

Noise Level (dBA)	Common Sounds	Effect
10	Just audible	Negligible
30	Soft whisper (15 feet)	Very quiet
50	Light auto traffic (100 feet)	Quiet
60	Air conditioning unit (20 feet)	Intrusive
70	Noisy restaurant or freeway traffic	Telephone use difficult
80	Alarm clock (2 feet)	Annoying
90	Heavy truck (50 feet) or city traffic	Very annoying, Hearing damage (8 hours)
100	Garbage truck	Very annoying
110	Pile drivers	Strained vocal effort
120	Jet takeoff (200 feet) or auto horn (3 feet)	Maximum vocal effort
140	Carrier deck jet operation	Painfully loud

Source: USEPA, 1981

Federal Regulations. Sound levels, resulting from multiple single events, are used to characterize noise effects from vehicle activity and are measured in Day-Night Average Sound Level (DNL). The DNL noise metric incorporates a "penalty" for nighttime noise events to account for increased annoyance. DNL is the energy-averaged sound level measured over a 24-hour period, with a 10-dBA penalty assigned to noise events occurring between 10:00 p.m. and 7:00 a.m. DNL values are obtained by averaging sound exposure levels over a given 24-hour period. DNL is the designated metric of the Federal government for measuring noise and its impacts on humans. According to the Federal Aviation Administration (FAA) and the U.S. Department of Housing and Urban Development (HUD) criteria, residential units and other noise-sensitive land uses are "clearly unacceptable" in areas where the noise exposure exceeds 75 dBA DNL, "normally unacceptable" in regions exposed to noise between 65 and 75 dBA DNL, and "normally acceptable" in areas exposed to noise of 65 dBA DNL or less (HUD, 1991). The Federal Interagency Committee on Noise developed land use compatibility guidelines for

noise in terms of DNL (FICON, 1992). For outdoor activities, the USEPA recommends 55 dBA DNL as the sound level below which there is no reason to suspect that the general population would be at risk from any of the effects of noise (USEPA, 1974).

State Regulations. On October 6, 2000, NYSDEC issued a program guidance document: *Assessing and Mitigating Noise Impacts* (revised February 2, 2001) (NYSDEC, 2001). The guidance document discusses noise generation and propagation, offers methodology for performing noise assessments, and suggests ways to evaluate whether increases in noise levels are environmentally significant. An increase in noise levels of 10 dBA is perceived by most individuals to be twice as loud. The guidance document recommends that for non-industrial settings, the noise level should not exceed existing ambient noise levels by more than 6 dBA at a given receptor; however, this limit should be used as a general guideline as opposed to a regulatory limit. For example, in rural settings with low existing ambient noise levels, an increase of more than 6 dBA could be deemed acceptable because the baseline ambient noise level is low. However, the addition of any new noise source in a non-industrial setting should not raise the noise level above a maximum of 65 dBA, as 65 dBA allows for undisturbed speech at a distance of approximately 3 feet (0.9 meters) and is considered the "upper end" non-industrial ambient limit. Ambient noise levels in industrial or commercial areas should not exceed 79 dBA (NYSDEC, 2001).

City Regulations. The New York City Noise Control Code (NYC Noise Code §24-232; NYC Local Law 113), which was revised in 2005 and went into effect in July 2007, regulates noise emissions in New York City (includes Kings and Queens Counties) (NYCLL, 2005). The code limits construction activities to weekdays between 7:00 a.m. and 6:00 p.m. The code also contains sound-level standards for various sources of ambient noise and construction noise, and prohibits unnecessary noise near hospitals, schools, and courthouses. The sound-level standards limit noise levels, as they would be measured in the interior of buildings, not outdoors. Table 4.21-2 provides the applicable limits for the interior of residential structures.

Additionally, the NYCDEP prescribes the methods, procedures, and technology to be used at construction sites to achieve noise mitigation (Title 15, Chapter 28: Citywide Construction Noise Mitigation; NYSDEP, 2007). This New York City rule also limits the use of onshore equipment to the hours of 7:00 A.M. to 6:00 P.M. on weekdays unless and after-hours work authorization is obtained, in which case the equipment may be used according to the permit specifications.

Furthermore, according to the City of New York Environmental Quality Review (CEQR) Manual – Chapter 19 "Noise," if a substantial stationary source noise generator is within approximately 1,500 feet of a receptor, and there is a direct line of sight between the receptor and the generator, further analysis may be needed (CEQR, 2014). If the noise from a stationary source at any receptor site would exceed 45 dBA, then a detailed analysis would be necessary. For impact evaluation, an increase of 3 dBA of the 1-hour equivalent sound level ($L_{eq[1]}$) above the existing background noise level during nighttime hours typically would be considered significant (CEQR Manual, 2014).

Table 4.21-2. New York City Noise Code - Maximum Noise Level (decibels) Inside Receiving Room

	Octave Band Frequency(HZ)								
Building Type	31.5	63	125	250	500	1,000	2,000	4,000	8,000
Mixed Use and Residential	70	61	53	46	40	36	34	33	32
Commercial	74	64	56	50	45	41	39	38	37

Source: New York City Local Laws (NYCLL, 2005). New York City Noise Code §24-232.

Construction Sound Levels. Demolition and construction work can cause an increase in sound that is well above the ambient level. A variety of sounds are emitted from loaders, trucks, saws, and other work equipment. Table 4.21-3 lists noise levels associated with common types of construction equipment. Construction equipment usually exceeds the ambient sound levels by 20 to 25 dBA in an urban environment and up to 30 to 35 dBA in a quiet suburban area. However, the New York City Noise Control Code also provides noise limits for specific construction equipment within the city (Table 4.21-3). Guidance on quieter available construction equipment and quieter construction procedures are provided in the NYCDEP Notice of Adoption of Rules for Citywide Construction Noise Mitigation (NYCDEP, 2007).

Table 4.21-3. Predicted Noise Levels for Construction Equipment

Construction Category and Equipment	Predicted Noise Level at 50 feet (dBA)	New York City Maximum Noise Levels at 50 Feet (dBA)
Clearing and Grading		
Bulldozer	80	85
Grader	80–93	85
Truck	83–94	84
Roller	73–75	85
Excavation		
Backhoe	72–93	80
Jackhammer	81–98	73
Construction		
Concrete mixer	74–88	85
Welding generator	71–82	73
Crane	75–87	85
Paver	86–88	85

Source: NYCDEP, 2007; USEPA, 1971

To predict how construction activities would potentially impact adjacent populations, construction noise, during daytime hours, at specified distances noise from the probable work areas was estimated in Table 4.21-4. These sound levels were predicted at 50-1,500 feet from the source of the noise. These sound levels were estimated by calculating the anticipated noise

from several pieces of equipment in use simultaneously and then estimating the decrease in noise levels at various distances from the source of the noise.

Table 4.21-4. Predicted Noise Levels from Construction Equipment over Distance

Distance from Construction Equipment (Feet)	Predicted Noise Level (dBA)
50	90 to 94
100	84 to 88
150	81 to 85
200	78 to 82
400	72 to 76
800	66 to 70
1,500	Less than 64

Source: USEPA, 1971

4.21.1 Existing Conditions

The most common human-caused sources of noise may be temporary, such as watercraft and airplanes, while others are more constant and typical of an urban environment. Typical noise sources heard throughout the combined study areas include:

Watercraft. Noise from motorized watercraft and other vessels in Jamaica Bay, as well as ship noise.

Vehicles. The busy thoroughfares, traffic patterns, and city streets surrounding the project area lands generate sounds such as honking, emergency vehicle sirens, road noise, road construction, and trains.

Aircraft. Commercial airplanes fly low over parts of the project area as they approach and depart from John F. Kennedy International Airport. This noise is particularly loud on the waters of Jamaica Bay and at the Jamaica Bay Wildlife Refuge. Commercial helicopter flights also fly low over several areas of park lands and impact the park experience. In addition, banner planes advertise along the beaches and impact the natural beach soundscape.

Airports and Development. As airports seek to enhance their services and facilities, the interface between national parks and airport areas increases.

Human Voices. The voices of people recreating and picnicking, as well as associated sounds of human use, including radios, can be heard throughout park areas and beaches. Popular recreation destinations like Jacob Riis Park tend to be crowded with visitors and this activity amplifies the sound of human voices.

4.21.1.1 Rockaway

Noise Sensitive Areas (NSA) are those that could be affected by noise levels above typical ambient conditions. NSAs can include single- and multi-family residences, parks managed by NPS or NYCDEC, schools, religious facilities, hospitals, etc.

Sound measurements have been collected near Fort Tilden during daytime hours on June 14, 2012, to determine the ambient A-weighted equivalent sound levels (i.e., L_{eq}) and unweighted octave-band SPLs (FERC, 2013). The sound measurements attempted to exclude "extraneous sound" such as a vehicle passing immediately by the sound measurement position. The measured ambient daytime equivalent sound level (L_d) was 42.3 dBA and the calculated day-night average sound level (L_{dn}) was 48.7 dBA (FERC, 2013).

In lieu of field measurements elsewhere within the Rockaway API, the noise levels can be approximated using existing land uses. The dominant land use in the Rockaway API is primarily residential housing, which has mean outdoor day-night sound levels range from 59 to 78 dBA (USEPA, 1978). In New York City, the primary source of noise in most areas is traffic (NYCPC, 2013). Average decibel levels in the region range between about 60 and 74 dBA, but can fluctuate from as low as about 55 dBA to as high as 84 dBA (NYCPC, 2012). Comparable sound levels are human conversation, 60–65 dBA; a heavy truck passing at 15 meters (80–90 dBA); or background noise in an office (50 dBA) (Cowan, 1994). Periodic loud noises, such as construction sounds, horns honking, road noise, trucks driving by, or low-level aircraft, are easily perceived above background noise levels. Human-caused noise is perceptible throughout most of the park lands in the Jamaica Bay Unit parks (NPS, 2013). However, the NPS has stated that, "…the quietest places where visitors can retreat from the noises of the urban surroundings include…Breezy Point Tip [and] Fort Tilden..." (NPS, 2013).

4.21.1.2 Jamaica Bay

Sound measurements have been collected near Floyd Bennett Field during daytime hours on June 14, 2012, to determine the ambient A-weighted equivalent sound levels (i.e., L_{eq}) and unweighted octave-band SPLs (FERC, 2013). The sound measurements attempted to exclude "extraneous sound" such as a vehicle passing immediately by the sound measurement position. The measured ambient daytime equivalent sound levels (L_d) ranged from 42.0-45.6 dBA and the calculated day-night average sound levels (L_{dn}) ranged from 48.4-52.0 dBA (FERC, 2013).

In lieu of field measurements elsewhere within the Jamaica Bay API, the noise levels can be approximated using existing land uses. The dominant land use in the Rockaway API is primarily residential housing, which has mean outdoor day-night sound levels range from 59 to 78 dBA (USEPA, 1978). Human-caused noise is perceptible throughout most of the park lands in the Jamaica Bay Unit parks (NPS, 2013). However, the NPS has stated that, "…the quietest places where visitors can retreat from the noises of the urban surroundings include…Jamaica Bay Wildlife Refuge, Bergen Beach, and Floyd Bennett Field's North Forty area." (NPS, 2013).

4.21.2 Vibration

Vibration refers to oscillatory movement in a solid object, such as the ground or a structure, measured as acceleration, velocity, or displacement. The New York City Department of Buildings (NYCDOB) established vibration level criterion for avoidance of architectural or structural damage to historic buildings in its Technical Policies and Procedures Notice No.

10/88. Under this notice, the peak particle velocity (PPV) from construction vibration is not permitted to exceed a vibration damage threshold criterion of 0.5 inches per second at historic buildings. This is the threshold level above which a building could experience architectural or structural damage. It is also consistent with the Federal Transit Administration's (FTA's) threshold for architectural damage to reinforced-concrete, steel, or timber buildings as referenced in Chapter 12, "Construction" of the FTA's *Transit Noise and Vibration Impact Assessment* guidance manual (FTA, 2006).

4.21.2.1 Rockaway

A vibration analysis program associated with pile driving near the Rockaway Boardwalk was performed during the summer of 2014 (Skanska, 2014). No other vibration studies were readily available in the Rockaway API. However, vibration levels along the Rockaway peninsula are anticipated to be similar to those measured at Floyd Bennett Field in Jamaica Bay (see Section 23.1.2).

4.21.2.2 Jamaica Bay

Ambient vibration levels were recently measured at three locations on Floyd Bennett Field (the southwest corner of Hangar 2; the southeast corner of Hangar 2; and at a point located 272 feet east of Hangar 2) (FERC, 2013). The study measured vibration as acceleration in dB referenced to 1 micro-inch per second and as peak particle velocity (PPV) in inches per second. Vibration levels measured as acceleration in dB are expressed across a spectrum of frequencies for the vibration. Frequency is the rate at which acceleration, velocity, or displacement fluctuates in a cycle over a given quantity of time, and is measured in Hz, where 1 Hz equals one cycle per second.

At all three locations, ambient vibrations were determined to be less than 50 dB at frequencies less than 1,000 Hz, which is below the human limit of perception for vibration (humans begin to detect vibrations at levels ranging from about 78 dB at 2 Hz to 120 dB at 500 Hz). The ambient vibrations measured by the study are also below the vibration damage threshold criterion of 0.5 inches per second for historic buildings (FERC, 2013). The vibrations measured at these locations were attributed to vehicle traffic along Flatbush Avenue and to vehicle and helicopter traffic at Floyd Bennett Field (FERC, 2013).

4.22 Floodplains

This entire italicized section is excerpted from FERC, 2013

Coastal flooding is caused by long and short wave surges that affect the shores of the open ocean, bays and tidally influenced rivers, streams, and inlets. The movement of coastal waters is influenced by the astronomic tide and meteorological forces such as northeasters and hurricanes. Hurricanes and northeasters have historically caused flooding in and around the study area. Inundation of low-lying coastal areas in the City of New York is primarily the result of storm surges, wave setup, and wave runup, which occur during hurricanes and northeasters.

The City of New York is built in a confined coastal location, which accounts for much of its natural protection against hurricanes. The strongest winds from a storm rarely reach New York since the New Jersey coast is on one side of the city and Long Island is on the other side. However, high storm surges can propagate within the New York Bight and cause severe flooding along the coastal portions of the city. Moreover, the cuplike topography of the area accounts for most of the dynamic effects, including resurgence, which cause the waters to oscillate to flood levels well after the storm has left the area.

Sections of Queens, Brooklyn, and Staten Island are exposed to direct ocean surges and waves. Coney Island and the Rockaway Peninsula are particularly vulnerable to wave damage. On Rockaway Peninsula and Jamaica Bay, the shoreline configuration has changed considerably over the past 50 years due to dredging and filling. These changes affect wave propagation, particularly in areas such as Rockaway Point at Rockaway Inlet, where the configuration of the point controls the direction of the incoming waves. Surge waves can also propagate through Long Island Sound. Consequently, a surge wave can propagate in the New York Bight, move into Hudson River and enter the East River from the south.

Jamaica Bay is affected by astronomical tides, storm surges from the Atlantic Ocean off New York Bay, wind-generated wave setups within the bay, and rainfall runoff from other areas (American Society of Engineering, 1964). The outer shoreline of the Rockaway Peninsula is subject to tidal fluctuations from the Atlantic Ocean. The Rockaway Peninsula can be a surge barriers to Jamaica Bay during small storm surges; however, a storm surge can almost entirely overtop and inundate the peninsula during larger surge events.

The most severe flooding conditions result from the overtopping of the peninsula. The low-lying areas of Brooklyn and Southern Queens including JFK Airport are directly affected by flooding from Jamaica Bay.

Detailed descriptions of coastal flood damage in and around the City of New York caused by the November 1950, November 1953, September 1960, and March 1962 storms are presented in Study Overview (Camp, Dresser and McKee, 1983).

The storm of November 1950 caused millions of dollars worth of damage and required evacuation of many parts of New York. Damage as a result of the flood occurred in parts of Queens, Jamaica Bay, Brooklyn, Rockaway Point, and Staten Island. Tides inundated portions of Staten Island for up to one mile inland.

During this flood, Rockaway Point beaches were severely eroded and the protective dunes were leveled. Homes along the ocean and bay were inundated by one to two feet of water. Wave crest heights ranged to an estimated 25 feet along the Atlantic Ocean.

There was a tide recorded (8.6 feet at Fort Hamilton, Brooklyn, New York) that resulted from the hurricane of September 1960. The City of New York experienced damage estimated at close to $20,000,000.

As a result of the March 1962 storm, the City of New York experienced damages totaling approximately $17,000,000. Portions of Coney Island and Rockaway Beach were inundated by one to two feet of water.

Almost all of the largest storms through the April 1962 to November 1992 period were either small tropical storms by the time they got to the Northeast or they passed to the east of New York City and had very little impacts in New York City, such as Gloria in 1985 (Category 2) and Agnes in 1972 (Category 1).

On December 12, 1992, the city sustained the most significant flood damage since the March 1962 storm. A peak wind gust of 67 mph was recorded at LaGuardia Airport. Commerce and transportation all but ceased as roads and subway tunnels became flooded. Peak tidal elevations were recorded 8.04 feet NAVD 1988, at the Battery, in Manhattan and 11.27 feet NAVD 1988 at Willets Point, in Queens. Over 3000 homes, citywide, sustained storm related damage. Estimates of storm related damage topped 750 million dollars.

Having earlier been downgraded to a tropical storm, Irene came ashore in Brooklyn on August 28, 2011 during the astronomical high tide. Peak winds were recorded at 58 mph at JFK International Airport. A peak tidal elevation of approximately 9.5 feet NAVD 1988 was recorded at the Battery. Heavy rain swept through the city with 6.87 inches of rain being reported in Central Park. Fearing damage to infrastructure and possible public safety issues, the city shut down the subway system and evacuated thousands of residents in low-lying coastal areas; however, only minor flooding was reported. The storm continued inland with extensive flood related damages to property and infrastructure, for areas upstate of the city, approximating 1.3 billion dollars.

Hurricane Sandy came ashore as an immense extratropical storm in Brigantine, New Jersey, on October 29, 2012 (NOAA, 2013). Being north and east of the storm track the city sustained extensive damage to property and infrastructure in each of the 5 boroughs. The astronomical tides in the city at the time of landfall were at their highest level (NOAA, 2013). A peak wind gust of 90 mph was recorded at Islip, in Long Island. At the entrance to New York Harbor, wave heights were recorded to 32.5 feet. Storm related tidal levels were approximately 11.28 feet NAVD 1988 at the Battery and 12.5 feet NAVD 1988 at Kings Point (NOAA, 2013). General tidal inundation elevations were 9 to 12 feet NAVD 1988 in Manhattan, 10 to 13 feet NAVD 1988 in Staten Island, 9 to 12 feet NAVD 1988 in Brooklyn, and 10 to 11 feet NAVD 1988 in Queens and the Bronx. Emergency responses were hampered; especially in Queens, where high winds and storm surge prevented fire response which resulted in the loss of approximately 122 structures. Extensive coastal flooding occurred in Staten Island, affecting the communities of Oakland Beach, New Dorp and Midland. In Manhattan, inundation occurred in the vicinity of the Battery, East Village and areas along and below Canal Street. Public infrastructure, citywide, was severely affected with all modes of public transportation ceasing operations due to storm conditions. Seven major subway tunnels were flooded, disrupting service for up to several weeks. Several highway tunnels were also flooded as well as the World

Trade Center site. Bridges and tunnels were closed. Extensive disruptions in electrical power occurred in Manhattan. Commerce was disrupted, on a nationwide basis, with a closure of the stock exchanges, lasting 2 days (NOAA, 2013). Storm related damages, including the City of New York, exceed 42 billion dollars (FEMA, 2013).

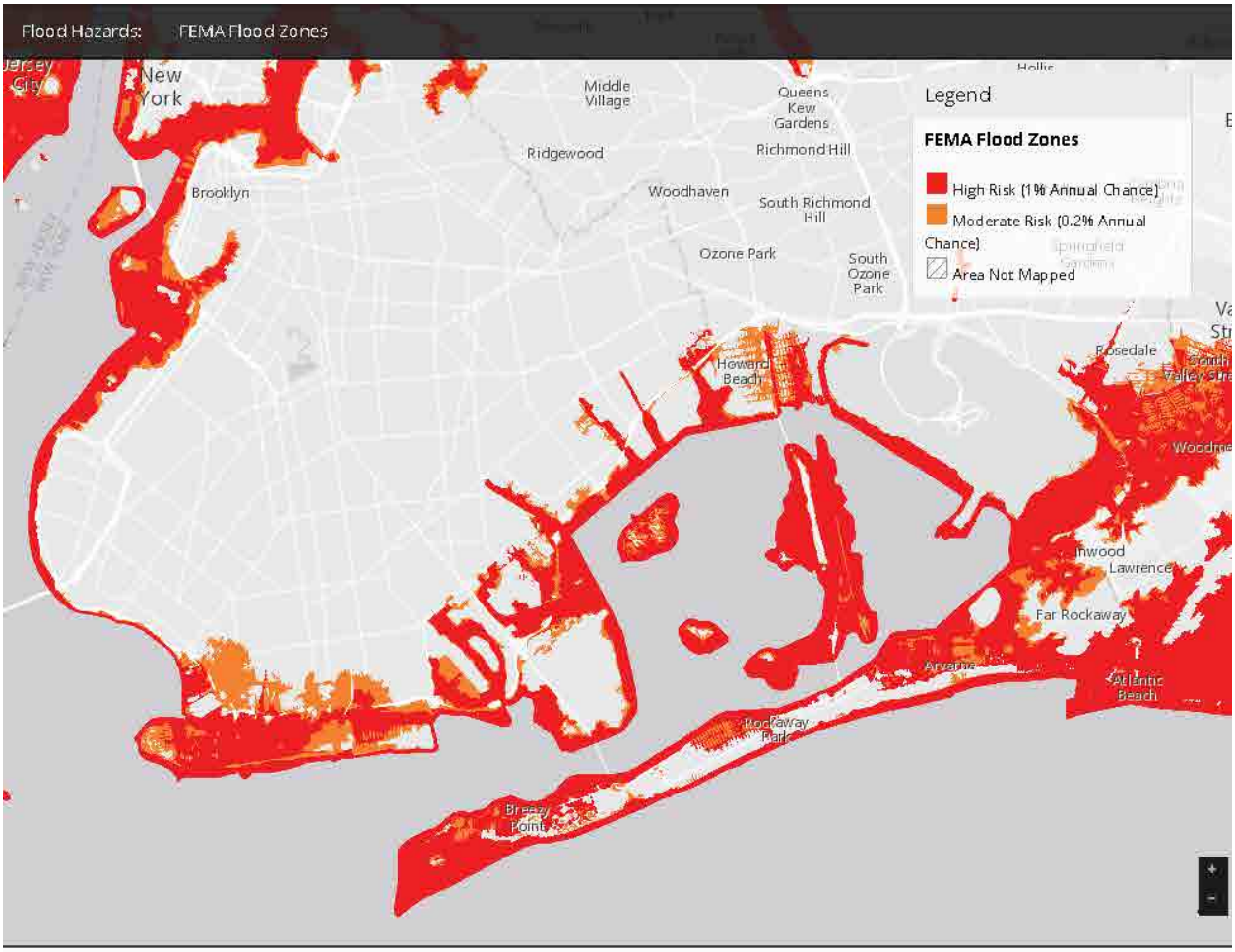
According to the NPS (NPS, 2014), flooding from storm surge, high tides, and wind during Hurricane Sandy occurred in the following locations in the Jamaica Bay Unit:

- Flooding damaged the Canarsie Pier shoreline and the structures on the pier.
- Some of the islands in Jamaica Bay (east islands and hassocks) were flooded.
- Jamaica Bay Wildlife Refuge East and West Ponds were breached, and the West Pond remains breached.
- Lower-elevation vegetative communities were flooded.
- All of Fort Tilden was flooded from both the ocean and bay side with enough force to diminish dunes by several feet on the beach side.
- In Fort Tilden, the Shore Road and fisherman's parking lot were covered in sand, and a significant portion of the road was reduced to rubble, indicative of high waves and strong winds from south to north.
- At Jacob Riis Park, coastal flooding removed a massive amount of beach, but winds also covered much of the park north of the beach in sand. Ocean waters flowed through the first floor of the bathhouse and protective dunes adjacent to it were destroyed.

FEMA Flood Zones mapped for the study area area are presented in Figure 4.22-1 (NOAA, 2016).

The USACE will initiate consultation with FEMA to assess what effects a surge barrier would have on National Flood Insurance Program (NFIP) requirements, participation rates, coverage areas, mapped flood hazard areas, and effects assocaited with implementing different proposed alternatives. (from USACE email from NYDOS, dated Thursday, April 14, 2016)

Figure 4.22-1. FEMA Flood Zones



5.0 ENVIRONMENTAL IMPACTS

Direct and indirect impacts are described in this Environmental Appendix I Chapter 5 and cumulative impacts are described in Environmental Appendix I Chapter 6, in accordance with CEQ regulations (40 CFR 1502.16). The significance of potential impacts from implementation of the Proposed Action, the Action Alternative, or the No-Action Alternative were analyzed for each resource area identified in Environmental Appendix I Chapter 4, Affected Environment. Potential effects on environmental resources are described qualitatively rather than quantitatively; however, for some resource areas, preliminary qualitative analyses are provided. Note that the terms "effect" and "impact" are used synonymously in the CEQ regulations (40 CFR §1508.8) and those terms are used interchangeably in this EIS.

The methodology employed to analyze impacts compares baseline conditions of each resource area (Environmental Appendix I Chapter 4) to changes that could reasonably be anticipated from implementation of the Proposed Action, the Action Alternative, and the No-Action Alternative. Impacts can be either adverse or beneficial. Adverse impacts are effects that causes an unfavorable result to the resource when compared to the existing conditions and beneficial impacts are those that lead to some improvement in the condition of the resource. Each resource area subsection below addresses potential impacts to the resource and assigns a qualitative magnitude identifier to the impacts. For the purpose of the impacts analysis, levels of significance of adverse impacts are classified as significant, minor, and no impact. Beneficial impacts are not further categorized as to the level of benefit.

- **Significant Impact.** An adverse impact is considered significant if implementation of an action would result in a substantial adverse change to the environmental resource analyzed.
- **Minor Impact.** An adverse impact is considered minor if implementation of an action would result in some effect to the environmental resource, but the effect would not be a substantial adverse effect.
- **No Impact.** A “no impact” or “negligible impact” conclusion is assigned where the environmental resource would not experience an adverse impact due to implementation of an action, or if an action’s impact would be negligible or unmeasurable compared to baseline conditions.
- **Beneficial.** An impact is considered beneficial where a positive effect on a resource can reasonably be expected when compared to existing conditions.

Impacts of the Proposed Action and Alternatives are discussed for each resource in terms of both direct and indirect impacts and the length of time impacts would occur. These parameters are defined as follows and the overlapping nature of the impacts is shown in the matrix below.

- **Direct Impact:** Direct impacts are caused by the action and occur at the same time and place.

- **Indirect Impact:** Indirect impacts are caused by the action, but manifest themselves later in time or farther removed in distance from the implementation of the action.
- **Short-Term Impact:** Impact effects would not exist five years past completion of the project construction phase.
- **Long-Term Impact:** Impact effects would extend beyond five years past completion of the project construction phase, including permanent impacts.

CEQ regulations dictate that mitigating measures be considered for significant adverse impacts.

	Direct Impact	Indirect Impact
Short-Term Impact	Direct impacts are typically short-term impacts, as they occur in the timeframe of the project construction phase.	Indirect impacts can be short-term when the effect occurs some distance from the area of project execution, but does not last more than five years.
Long-Term Impact	Direct impacts are long-term when project execution permanently affects a resource or the resource will not recover from the direct impact within five years of when the impact occurs.	Indirect impacts are typically long-term impacts, as they occur beyond the timeframe of the project construction phase.

No significant adverse impacts were identified through implementation of the impacts analysis methodology, except with regard to the No-Action Alternative. Where adverse impacts are determined to be minor, best management practices (BMPs) are proposed that would reduce the level of potential impact.

5.1 Geologic Setting

If an alternative would result in an increased geologic hazard or a change in the availability of a geologic resource, it could have an adverse significant impact. Such geologic and soil hazards would include, but not be limited to, seismic vibration, land subsidence, slope instability, or a reduction in the productive agricultural use of soils.

5.1.1 Impacts Common to Both Actions

Geology

In addition to the significance criteria previously described, an adverse geologic impact could occur if CSRMU elements altered bedrock conditions such that bedrock aquifer quality was compromised; bedrock competency to support existing or future building foundations was decreased; or caused an increase in seismic activity at levels capable of damaging buildings and at a frequency above predicted levels.

Under both alternatives, no impacts on geology are anticipated from implementation of the common CSRMU elements. The CSRMU seawall, floodwall, roadway gate, and floodgate

structural foundations would have a negligible impact on bedrock, and all other construction activities would occur above bedrock elevation.

Additionally, the project is located in an area with a low occurrence of seismic activity at frequencies damaging to buildings. Accordingly, naturally occurring seismic activity is not anticipated to have an adverse significant impact on the structural integrity of the constructed CSRMU elements. However, CSRMU elements will be designed by licensed engineers and incorporate industry-standard features to withstand current and projected future seismic activity for this area. Therefore, projected future seismic activity should not cause an adverse significant impact on the competency or function of the CSRMU elements.

Topography

Adverse minor long-term direct impacts to topography in the proposed project areas are anticipated from construction or extension of temporary and permanent near-shore and on-shore groins, walkovers, and access roads. The minor impacts on topography would exist for as long as built structures remain in place. Minor short-term direct adverse impacts on topography are anticipated from beach fill placement along the Coney Island tie-in and the Rockaway Beach Shorefront CSRMUs. Following proposed project activities, the topography in beach fill areas would be characteristically similar to natural beach/dune communities found along the Atlantic coast near Jamaica Bay.

Soils

Adverse minor direct short-term impacts to soils would occur due to such construction activities as clearing, grading, trench excavation, backfilling, and the movement of construction equipment within the project areas. Impacts include soil compaction and disturbance to and mixing of discrete soil strata. To reduce the impacts of construction on beach soils, BMPs would be implemented to control erosion and sedimentation during construction (e.g., installation of silt fences). Areas disturbed by construction activities (e.g., temporary access roads) would be restored at the end of project execution. Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could adversely affect soils. The effects of contamination are typically minor because of the low frequency and volumes of spills and leaks. Spill prevention and countermeasures BMPs would be implemented to minimize the potential for impacts associated with an inadvertent spill of hazardous materials.

None of the soils within the Rockaway peninsula are classified as prime farmland. The Sudsbury sandy loam and Riverhead loamy coarse sand soils north of Jamaica Bay are classified as prime farmland; however, neither action would not prevent these soils from potential agricultural use. Therefore, there would be no adverse significant impact on the agricultural use of soil.

Beneficial long-term direct impacts on soils would occur from built structures (e.g., groins, seawalls, floodwalls) that retain and capture littoral materials native to the beach communities and/or limit the effects of wave and storm surge erosion. Construction and extension of groins

and construction of seawalls and floodwalls would result in continued protection of upland soils from wave action and erosion that are anticipated from significant storms along project area shorelines, and would reduce the amount of renourishment fill required in the future. The groin and seawall structures would help slow the long-term beach erosion rate in the Project Area. Beneficial long-term direct impacts on soils would also occur due to beach renourishment actions, where beach sands are replenished at prescribed intervals over the project life cycle. The texture of the nourishment material to be used would be compatible with native sand material.

5.1.2 Proposed Action Impacts

Additional adverse minor long-term direct impacts to topography and adverse minor short-term direct impacts to soils would occur along the Rockaway Bayside and the Jamaica Bay Northwest segments of the Proposed Action. Impacts in these areas would be similar to those described for the common actions across the additional construction areas.

Additional beneficial long-term direct impacts would occur from built structures and beach renourishment, as described for the common project elements. No short- or long-term direct or indirect impacts to geology would occur from implantation of the additional unique aspects of the Proposed Action. However, it is noted that the construction details for Storm Surge Barrier CSRMU will be developed and finalized during the Tier 2 analysis. If the final design has the foundation secured to or directly on top of bedrock, potential impacts to bedrock, as well as from seismic activity, will be reevaluated as part of the Tier 2 analysis.

5.1.3 Action Alternative Impacts

Adverse minor long-term direct impacts to topography and minor short-term direct impacts to soils would occur along the Rockaway Bayside and the Jamaica Bay Northwest segments associated with the Action Alternative. Because the linear extent of construction activities would be substantially broader in the Jamaica Bay Northwest and Rockaway Bayside segments, impacts would be more extensive compared to those described for the common project elements. Soil compaction issues would be more extensive in areas where Type B and D vertical living shorelines would be constructed, including extensive temporary access roads. Additional, and more extensive, beneficial long-term direct impacts would occur from built structures and beach renourishment, as described for the common project elements, and from construction of vertical living shorelines which would enhance soil retention and natural development. No short- or long-term direct or indirect impacts to geology would occur from implantation of the additional unique aspects of the Action Alternative.

5.1.4 No-Action Alternative Impacts

Adverse significant long-term direct impacts to area topography and soils, but no short- or long-term direct or indirect impacts to geology are anticipated from implementation of the No-Action Alternative. Not implementing the proposed coastal protective measures would allow continued

beach sand and upland soil erosion from continued costal wave action and future extreme weather events.

5.2 Bathymetry and Sediments

If an alternative would result in an increased sedimentation and consequently reduce open water depths, it could have an adverse significant impact. Impacts would include, but not be limited to, effects on wetlands and marshes and impacts on navigation channels.

5.2.1 Impacts Common to Both Action Alternatives

Bathymetry

Construction of groins in the Rockaway Shorefront segment will have a net long-term benefit on the shoreline by stabilizing erosion and minimizing the long-term requirements for beach renourishment. However, construction of groins could have minor long-term effects by causing enhanced erosion on the down current side due to the modified sand transport. In addition, some sand would be expected to be diverted offshore as longshore currents flow into deeper around the groins.

Construction of seawalls and/or bulkheads in portions of the Jamaica Bay Northwest segment shared by both alternatives would also have minor long-term adverse impacts on bathymetry, as they are generally recommended where a similar structure is already present. Additional scouring at the toe of the structural measures could result from amplified wave energy and increased erosion and sediment transport associated with these hardened structures.

Short-term direct adverse impacts to bathymetry in Jamaica Bay could occur due to construction activities where increased sediment generation could affect depth of the water column. These effects would be minor and short-term, limited to the period of construction. Implementation of BMPs to control sedimentation and erosion and the large extent of Jamaica Bay compared to the construction footprint would minimize adverse impacts on the overall bathymetry of Jamaica Bay.

Sediments

The project would have beneficial long-term direct impacts on sediment budgets along the Rockaway Shorefront segment from implementation of the common project elements. Sediment budgets with and without implementation of Rockaway Shoreline and Jamaica Bay renourishment projects were analyzed quantitatively in *Erosion Control Alternative Analysis* (USACE 2015). With or without project implementation, east reaches along Rockaway Peninsula experience loss of sand and western reaches experience sand accretion. Based on results of the GENESIS-T modeling, sediment budgets calculated for Action Alternatives would result in a 29,000 cubic yards (cy) per year (yr) increase in renourishment quantities, not accounting for sea level rise. If the intermediate and high sea level change predictions are applied, renourishment quantities would increase by an additional 20,000 and 84,000 cy/yr respectively.

No short- or long-term direct or indirect adverse impacts to sediment quality would occur from implementation of the common project elements. FERC summarized publicly available databases in the EPA's Envirofacts Data Warehouse in the *Final EIS for Rockaway Delivery Lateral Project and the Northeast Connector Project* (FERC 2014) to identify known contaminated soils or sediments in the vicinity of proposed Transco Rockaway Project facilities. This project is used as a reference given its proximity to common project elements. The review identified one EPA-regulated facility (New York City Fire Department Engine Company 329) within 0.5 mile of the Rockaway Project. Additionally, FERC received a comment from NPS that a tar-like substance associated with an old factory site is located off the south shore of Floyd Bennett Field east of the Marine Parkway Bridge. Neither site would be disturbed by construction of the common project elements.

Beach nourishment is not expected to have an adverse impact on sediment quality, as all imported sands will be brought from dredge areas that have been tested for grain size, compatibility, and potential toxicity. Surface sediment samples analyzed in conjunction with pipeline planning (FERC, 2014) indicated elevated mercury levels in one surface sediment sample at one offshore location (0.22 ppm, where the Class A threshold is 0.17); however, subsurface samples collected between 1 and 7 feet below grade showed mercury levels ranging from 0.034 to 0.037 ppm, indicating dredged sediments would be well within acceptable NYSDEC parameters (FERC, 2014).

5.2.2 Proposed Action Impacts

Bathymetry

Minor long-term indirect adverse impacts to bathymetry are anticipated from construction of gate structures across the inlet and potential scouring due to increased velocities. Modeling detailed in ENV-1 MFR7 with respect to the Storm Surge Barrier noted the increased flow speeds:

- Based on engineering judgement, each of the modeled hurricane barrier scenarios have reasonable flow speeds through the gates, with the likely exception of 1E-400. Flow speeds and current patterns for any recommended hurricane barrier alternative should be studied in more detail using ship handling simulations with realistic flow fields to develop safe passing procedures, as well as appropriate classes of vessels, flow speeds and directions for safe passage.
- Hydrodynamic modeling to date has assumed a fixed bottom elevation, which could change with increased velocities. Therefore, additional hydrodynamic and sediment modeling is required to further refine understanding of long-term effects on increased flows through the inlet gate structure and potential design considerations to address potential scouring.

While additional modeling is necessary, the potential effect of scouring of sediment resulting in changes in bathymetry, which could affect the depth of the water column near the inlet gate, is

expected to be negligible. Substrate size of bed material within proximity to the gate would be expected to change due to increased velocities.

Sediments

Based upon completed hydrodynamic modeling (ENV-1 MFR7), an inlet gate structure is not expected at this time to have a long-term adverse effect on the sediment budget within Jamaica Bay. However, further refinement of the hydrodynamic models, and potential additional sediment modeling, is required to appropriately support engineering design and address potential scouring. Specifically, an increased velocity through the gate could have an effect on sediment movement and bathymetry and will need to be evaluated further during engineering design.

Minor short-term adverse impacts could result from in-water construction activities as described above, and implementation of BMPs is expected to control sedimentation and erosion.

Minor short-term direct adverse impacts on sediment quality could result from disturbance of a tar-like substance associated with an old factory site located off the south shore of Floyd Bennett Field. This site would potentially be disturbed by construction of the hurricane barrier where it ties into Barren Island. Therefore, sediment testing will be required during a feasibility study to appropriately inform engineering design and develop appropriate methods for isolation and potential disposal of contaminated sediments. It is anticipated that the amount of disturbed sediment would be minimized by implementation of BMPs.

Minor short-term adverse impacts on sediment quality could also result from other areas of in-water construction where contaminated sediments occur but are currently not delineated. Short-term adverse impacts on flow patterns during or immediately following construction will have the potential to mobilize contaminated sediment. These adverse impacts would be short-term, as it is expected that sediments will quickly settle through use of BMPs (e.g., silt curtains, work at low tide out of the water) when water depths and velocities permit their use, but would have the potential to have adverse indirect effects on aquatic life (see Sections 5.7 and 5.8).

5.2.3 Action Alternative Impacts

Bathymetry

Construction of gates across the tributaries of Jamaica Bay would have the potential to increase flow velocities and, therefore, increase the likelihood of scour. Given the sensitivity of the existing hydrodynamic model and uncertainties associated with tributaries, the potential long-term impacts associated with tributary gates is unknown at this time.

Minor short-term direct adverse impacts to bathymetry would occur in Jamaica Bay because the linear extent of construction activities would be substantially broader in the Jamaica Bay Northwest and Rockaway Bayside segments and include multiple areas of in-water construction. Construction of seawalls and/or bulkheads would also have minor long-term adverse impacts on bathymetry, as they are generally recommended where a similar structure is already present.

Scouring at toe of the structural measure may result from amplified wave energy and increased erosion and sediment transport associated with these hardened structures.

Sediments

It is unknown at this time if the Action Alternative would have an adverse effect on the sediment budget within Jamaica Bay. Additional hydrodynamic modeling is required to address uncertainties associated with the tidal exchange in the tributaries. A constriction of flows in each tributary would have the potential to change water velocities and, therefore, sediment transport.

Minor short-term adverse impacts on sediment quality could result from areas of in-water construction where contaminated sediments have the potential to occur but are currently not delineated. It is anticipated future sediment sampling may be required, and that these construction impacts would be minimized by implementation of BMPs (e.g., silt curtains, work at low tide out of the water). A change in flow patterns during or following construction will also have the potential to mobilize contaminated sediment. These adverse impacts would be short-term as it is expected that sediments would quickly settle through use of BMPs.

Implementation of vertical living shorelines are not expected to substantially increase the benefits accrued from implementation of the common project elements.

Changes in sediment deposition to Jamaica Bay has been studied as a possible culprit for the documented disappearance of wetlands in the bay. Understanding the possible relationship between sediment transport and marsh losses informs an analysis of regional projects that may cumulatively affect Jamaica Bay. Changes in sediment input result from the following types of human undertakings (Gateway National Recreation Area, National Park Service, Jamaica Bay Watershed Protection Plan Advisory Committee, August 2, 2007):

- Hardening of the bay's perimeter from increased residential and commercial development, which reduce the overall sediment load to the bay.
- Channeling of overland flow through storm sewers and combined sewer overflows, which redistributed the sediment load to the bay.
- Changing the bay's physical contours by westward progression of the Rockaway Peninsula, which alters sediment transport and affects water circulation.
- Dredging of navigational channels may be acting as sediment sinks and the increased wave energy and sediment flushing time caused by a deeper average depth may affect sediment accretion.
- Altering Jamaica Bay's tributaries, basins, creeks, and canals until there is little or no freshwater flow other than that conveyed by the sewage treatment, water pollution control plants, and storm sewers.

Project elements potentially disrupt sediment transport in Jamaica Bay, including the Proposed Action.

5.2.4 No-Action Alternative Impacts

Within the Rockaways Shorefront segment, significant long-term direct adverse impacts to sediment budgets are anticipated from implementation of the No Action alternative. Beach-fill continues to be insufficient to offset the sediment deficit created by the overarching longshore sediment transport trend. The most striking cell in the study is Reach 4, which is predicted to erode by 17.5 feet per year, caused by an overarching trend in longshore sediment transport along eastern Rockaway Beach and sediment impoundment of up-drift from the groin field in Reach 5. Increases in sea level and possible increases in the intensity and frequency of storms would be expected to have significant adverse impacts on sediment budgets and the movement of sand. The No-Action Alternative would leave the coast vulnerable to the strong waves and storm surges associated with extreme weather events, resulting in flooding, overwash, breaching, and loss of sand from dunes and some upland areas. The resulting loss of sand would increase adverse impacts on bathymetry and sediment budgets.

Within the Jamaica Bay Northwest and Rockaway Bayside segment, implementation of the No-Action Alternative would have a significant increase in shoreline erosion and, in turn, adversely effecting bathymetry and sediment budgets. The No-Action Alternative would leave the bay shoreline vulnerable to the strong waves and storm surges associated with extreme weather events, resulting in flooding, overwash, breaching, and loss of wetlands and some upland areas. In turn, implementation of the No-Action Alternative could have an adverse effect on sediment quality by erosion of potentially contaminated soils along the shoreline.

5.3 Surface Water

Impacts to water resources would occur if an alternative reduced water availability to, or interfere with, the supply of existing users; adversely affected water quality or endangered public health by creating or worsening adverse health hazard conditions; or violated established laws or regulations that have been adopted to protect or manage area water resources.

5.3.1 Impacts Common to Both Action Alternatives

Water Levels

No short- or long-term direct or indirect adverse impacts on surface water levels would be realized from implementation of the common project elements. Overall, minor effects on water levels would be expected from implementation of the common project elements.

Tidal Currents

Proposed activities in the Rockaway Shorefront segment would have a direct long-term benefit on near shore tidal currents. Consistent with discussion of sediment budgets in Section 5.2.1, common elements of both projects are expected to benefit the shoreline by reducing shoreline erosion and in turn reducing long-term need for beach renourishment.

Wind and Wave Climate

Implementation of the common project elements will have a long term benefit by directly addressing anticipated wave climate, and preventing future shoreline erosion. Under implementation of the common project elements, tidal current flow speeds and directions within the Rockaway Shorefront and Jamaica Bay segments would not be measurably affected. Groins have the potential to alter wave climates, but would have a long-term benefit by reducing future beach renourishment requirements.

Tributaries

No short- or long-term direct or indirect adverse impacts to the majority of Jamaica Bay tributaries are anticipated from implementation of the common elements of the Action Alternatives.

A gate across Sheepshead Bay and Shellbank Creek is a common element of the Action Alternatives. Additional hydrodynamic modeling would be required to understand the sensitivity of impacts to flushing and circulation within the tributaries as a result of tidal gates.

Water Quality

Minor short-term direct adverse impacts to ocean waters would occur from disturbance of subsurface sediments during construction of groins, walkovers, living shorelines, bulkheads, sea walls, and excavation of sand off shore. Water quality would quickly return to baseline conditions after construction activities are completed. It is anticipated that these adverse construction impacts would be minimized by implementation of BMPs.

Minor direct short-term impacts to surface water quality would occur due to common construction activities such as clearing, grading, trench excavation, backfilling, and the movement of construction equipment used during execution of the common project elements. Water quality impacts to surface water would primarily be related to increases in turbidity and suspended solids as a result of increased erosion and sedimentation, which would cause a short-term reduction in oxygen levels. These adverse construction impacts would be minimized by implementation of BMPs (e.g., silt curtains, work at low tide out of the water).

Spills or leaks of fuels, lubricants, or coolant from construction equipment could adversely affect water quality; however, the effects of contamination are typically negligible because of the low frequency and volumes of spills and the use of spill prevention standard construction BMPs. Leaks and spill effects would be minimized by immediate implementation of spill control and countermeasure BMPs (e.g. good housekeeping, adsorbents, storage containers).

Periodic renourishment activities over the project life-cycle would cause impacts similar to those generated during initial construction; however, because of tidal and current influences and the relatively quick settling velocity of subsurface sediments, turbidity is expected to dissipate rapidly, both spatially and temporally (Naqvi and Pullen 1982). Adherence to USACE and the

New York State Section 404(b)(1) water-quality guidelines would further ensure minimal adverse water quality impacts.

The effect on water quality from a tide gate across both Sheepshead Bay and Shellbank Creek is unknown at this time. The USACE is working with the NYCDEP to refine existing water quality models to evaluate potential adverse effects.

5.3.2 Proposed Action Impacts

Water Levels

Hydrodynamic modeling (Arcadis 2016b) demonstrated that the two Storm Surge Barriers (C-1E & C-2) would only have a minor long-term impact on tidal levels throughout the bay. Specifically, all tide levels sampling locations are within 0.10 foot of the without project conditions tide levels, with the exception of an increase of 0.11 foot to MHW at Location 1 (Head of Bay) for both hurricane barrier scenarios.

Tidal Currents

Hydrodynamic modeling completed to date indicates that an inlet gate structure would have limited minor long-term effect on tidal currents. Specifically, the gate is anticipated to slightly increase flow velocities within the Rockaway Inlet. An increase in flow velocities could have an effect on sediment transport within the bay. As indicated in ENV-1 MFR 7, flow patterns and speeds, and potential effect on sediment transport, are being studied in more detail.

Wind and Wave Climate

No long-term direct or indirect adverse impacts on wind and wave climate are anticipated from implementation of the additional actions associated with the Proposed Action. As noted above, flow patterns and speeds, and potential effect on localized wave climates, are being studied in more detail.

Water Quality

Current hydrodynamic modeling indicates minor long-term adverse impacts to bay hydrodynamics. In turn, impacts of an inlet gate are assumed to also have minor long-term adverse impacts on water quality. However, it is recognized that further analysis is required to better understand potential long-term effects on water quality. Specifically, water quality impacts for the interior basins need additional analyses to understand sensitivity of impacts to flushing and circulation. With respect to the tidal inlets that already exhibit poor water quality due to their limited flushing. Refinement of the existing model is anticipated to address these uncertainties. Currently, the USACE is working with the NYCDEP to use existing water quality models to refine the evaluation of potential long-term effects on water quality within the bay. The NYCDEP is implementing a multiyear plan to address water quality in Jamaica Bay that will improve future water quality under the Proposed Action Alternatives (see Wastewater, Section 5.16).

5.3.3 Action Alternative Impacts

Water Levels

Hydrodynamic modeling (Arcadis 2016b) demonstrated that the two Storm Surge Barriers (C-1E & C-2) would only have a minor long-term impact on tidal levels throughout the bay. However, the effects of tide gates across individual tributaries has not been evaluated at this time. Additional modeling would be required to understand the potential effects of tributary gates on water levels in each of the affected tributaries.

Tidal Currents

The effects of tide gates across individual tributaries has not been evaluated at this time. Additional modeling would be required to understand the potential effects of tributary gates on tidal currents in each of the affected tributaries.

Wind and Wave Climate

The effects of tide gates across individual tributaries has not been evaluated at this time. Additional modeling would be required to understand the potential effects of tributary gates on wind and wave climate in each of the affected tributaries.

Water Quality

Current hydrodynamic modeling indicates minor long-term adverse impacts to bay hydrodynamics. However, the effects of tributary tidal gates have not been evaluated at this time. To date, it has been recognized that water quality impacts to the interior tidal basins need additional analyses to understand the sensitivity of impacts to water quality from flushing and circulation. Currently, the USACE is working with the NYCDEP to refine existing water quality models to refine the evaluation of potential long-term effects on water quality within the bay.

5.3.4 No-Action Alternative Impacts

No short- or long-term direct or indirect adverse impacts on tidal currents, wind and wave climate, tributaries, or water quality are anticipated from implementation of the No-Action Alternative. Baseline conditions would remain as described in Chapter 4. The NYCDEP is implementing a multiyear plan to address water quality in Jamaica Bay that will improve future water quality under the No-Action Alternative (see Wastewater, Section 5.16).

5.4 Air Quality

An alternative could have a significant air quality effect if it would result in substantially higher air pollutant emissions or cause established air quality standards to be exceeded. Particularly, adverse impacts would be significant if criteria emissions contribute to nonattainment in the region.

5.4.1 Impacts Common to Both Action Alternatives

Adverse minor short-term direct impacts on regional air quality are anticipated from implementation of the common project elements. Activities associated with the common project elements would temporarily emit emissions associated with operation of diesel fuel-powered equipment relating to dredging and seawall, groin, and floodwall construction activities. The localized emission increases from the diesel-powered equipment would occur primarily during the project's construction period.

5.4.2 Proposed Action Impacts

The Proposed Action will temporarily produce emissions associated with diesel-fueled equipment relating to dredging, beach sand placement, and related landside construction activities. The project is anticipated to be conducted from 2017 through 2019. The localized emission increases from the diesel-fueled equipment will last only during the project's construction period (and primarily only locally to where work is actually taking place at any point in time), and then end when the project is over. Therefore, any potential impacts will be temporary in nature. The TSP is anticipated to be the most efficient approach to coastal management for the study area, and thus is anticipated to generate the lowest pollutant emissions.

The Proposed action will take place in Queens, Kings, and Nassau Counties, New York and the General Conformity applicability trigger levels for 'moderate' ozone nonattainment areas are: 100 tons per year (any year of the project) for NO_x and 50 tons per year for VOC (40 CFR§93.153(b)(1)). For areas designated as 'maintenance' for $PM_{2.5}$, the applicability trigger levels are: 100 tons for direct $PM_{2.5}$, SO_2, and CO per year (40 CFR§93.153(b)(2)).

The General Conformity-related emissions associated with the project are estimated as part of the General Conformity Review and are summarized below, by calendar year below in Table 5-1. Emission calculations are provided as Appendix P.

Table 5-1: TSP General Conformity-Related Emissions per Calendar Year, tons

	Estimated Emissions, tons per year				
Pollutant	**2017**	**2018**	**2019**	**2020**	**2021**
NO_x	159.6	239.4	239.4	0.0	0.0
VOC	6.0	9.0	9.0	0.0	0.0
$PM_{2.5}$	8.3	12.5	12.5	0.0	0.0
SO_2	0.1	0.2	0.2	0.0	0.0
CO	20.8	31.2	31.2	0.0	0.0

The emission levels of NO_x exceed the ozone '*de minimis*' trigger levels for General Conformity; therefore, applicable NO_x emissions will need to be fully offset as part of the project. Because NO_x will be fully offset, by rule, the net NO_x emissions increase will be zero and therefore will produce no significant impacts.

A Statement of Conformity (SOC) will be utilized to ensure that the project meets the General Conformity requirements. The associated mitigation and tracking over the life of the project will be coordinated through the Regional Air Team (RAT) that consists of: EPA Region 2, NYSDEC, NJDEP, USACE New York District, and other agencies associated with the mitigation efforts associated with the Harbor Deepening Project and the Hurricane Sandy-related Authorized-But-Unconstructed (ABU) projects. This approach was successfully used to fully offset emissions from the Harbor Deepening Project, which covered a construction period from 2005 through 2016.

The mitigation options for NO_x include: use of available Surplus NOx Emission Offsets (SNEOs) generated by the Harbor Deepening Project, establishment of a Marine Vessel Engine Replacement Program (MVERP), the purchase of EPA Cross-State Air Pollution Rule (CSAPR) ozone season NO_x allowances, statutory exemption, State Implementation Plan accommodation and elongation of the construction schedule so as not to trigger GC. The final combination of the above options will be coordinated and tracked through the RAT. The draft SOC is provided as Appendix P. In meeting the General Conformity requirements, the project, by definition will not incur significant impacts.

Project emissions of VOC, $PM_{2.5}$, SO_2, and CO are all significantly below their respective trigger levels and therefore, by rule, are considered '*de minimis*' and will have only a temporary impact around the construction activities with no significant impacts.

5.4.3 Action Alternative Impacts

Adverse minor short-term direct impacts on regional air quality are anticipated from implementation of the unique elements of the Proposed Action in addition to the impacts from the common project elements. No long-term direct or indirect impacts on regional air quality would result.

5.4.4 No-Action Alternative Impacts

The No-Action scenario may result in greater pollutant emissions due to the repeated coastal management that would need to be conducted as individual projects or emergency actions (i.e., less efficient implementation). For example, additional mobilization and demobilization, emergency response conditions, and other elements associated with numerous individual projects would continue to be needed under the No-Action scenario, which could reduce the overall efficiency of protecting the coast, which may in turn lead to increases in pollutant emissions.

Further, from the pollutant perspective, there is the potential that not all of the individual projects would necessarily trigger General Conformity, resulting in no offsetting of construction

emissions associated with '*de minimis*' projects. In this scenario, the ongoing projects and activities associated with the No-Action would continue to be reviewed with respect to General Conformity applicability and there is the potential that individual projects might not be subject to the requirements of General Conformity and therefore not be fully offset. If this were the case, the FWOP could actually result in higher levels of emissions than implementing the Proposed Action.

While the No-Action scenario may result in higher overall emissions from the individual projects compared to the Proposed Action, as noted above, it is anticipated that it would not result in a significant change to air quality in the area.

5.5 Groundwater

If an alternative would result in a significant impact if it resulted in a reduction in the quantity or quality of water resources for existing or potential future use or if the demand exceeded the capacity of a potable water system that depends on the groundwater resource.

5.5.1 Impacts Common to Both Action Alternatives

No short- or long-term direct or indirect impacts on groundwater are anticipated from implementation of the common project elements. No activities associated with the Proposed Action or the Alternatives would involve penetration of groundwater aquifers or result in contaminant release that could reasonably reach groundwater resources.

5.5.2 Proposed Action Impacts

No short- or long-term direct or indirect impacts on groundwater are anticipated from implementation of the additional unique elements associated with the Proposed Action.

5.5.3 Action Alternative Impacts

No short- or long-term direct or indirect impacts on groundwater are anticipated from implementation of the additional unique elements associated with the Action Alternative.

5.5.4 No-Action Alternative Impacts

No short- or long-term direct or indirect impacts on groundwater are anticipated from implementation of the No-Action Alternative. Baseline conditions would remain as described in Chapter 4, Groundwater.

5.6 Aquatic and Terrestrial Environments

Based upon aquatic and terrestrial habitat types defined in ENV-1 MFR 8, Aquatic and Terrestrial Habitats, Table 5-2 Permanent and Temporary Habitat Impacts summarizes the temporary and permanent impacts based upon an area metric (i.e., acres) associated with the two Storm Surge Barrier alignments associated with the Proposed Action (i.e., C-2 and C-1E) and the Action Alternative (i.e., D). In addition, habitat maps for all areas within the limits of disturbance boundaries associated with the selected TSP are included in the attached stand-alone

file "Depiction of Environmental Consequences." Permanent impacts are assumed to be all areas within the Right-Of-Way, and all other areas within the limits of disturbance defined as temporary impacts. The following provides additional discussion of impacts to aquatic and terrestrial habitats.

Table 5-2. Summary Impacts Based upon Area Metric (Acres).

Habitat Types	Permanent Impacts			Temporary Impacts		
Alignment	**Alt. C-2**	**Alt. C-1E**	**Alt. D**	**Alt. C-2**	**Alt. C-1E**	**Alt. D**
Subtidal Bottom	37.7	34.6	45.1	0.1	1.2	13.0
Intertidal Mudflat	3.3	7.5	25.1	3.8	8.8	24.2
Intertidal Wetlands	0	0.0	9.4	0	0.1	7.0
Non-Native Wetlands	0	0.4	3.5	0	0.4	0.3
Beach	0	13.0	17.0	61.0	69.9	69.6
Dune	3.1	4.0	6.8	10.4	11.3	10.3
Maritime Forest/Shrubland	6.71	20.6	31.5	3.9	11.4	30.3
Ruderal	0.43	24.4	46.7	0.6	12.6	49.4
Rip Rap / Bulkhead	4.2	6.5	13.5	0.2	0.4	3.5
Urban	6.7	18.7	48.4	6.2	12.8	41.5

5.6.1 Impacts Common to Both Action Alternatives

Construction of buried sea walls and/or groins along the Atlantic Ocean Shorefront Planning Reach, as well as portions of the Jamaica Bay Northwest segments, shared by both Action Alternatives, would have short-term minor adverse impacts on beach habitats, aquatic habitat, and potentially associated dune habitats at each nourishment area. These aquatic and terrestrial habitats are likely to be recolonized from nearby communities and benthic aquatic habitats are expected to-establish to a similar community within a 1 to 2-year period (USACE 1995; USACE 2001). No permanent impacts associated with habitat structure and/or vegetation are anticipated in this segment, as the seawall will be buried with sand in an effort to restore the existing habitat type. In fact, the project will have a net long-term benefit on these habitats by stabilizing the shoreline, increasing sediment the sediment budget, and minimizing future renourishment activities necessary to support a healthy North Atlantic Upper Ocean Beach community.

Construction of bulkheads or seawalls in both the Rockaway Bayside and Jamaica Bay Northwest reaches would have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat. No long-term adverse impacts are anticipated given the previous hardening of the shoreline. Construction of floodwalls and/or levees associated with the Breezy Point portion of the Rockaway Bayside reach, as well as shared portions of the Jamaica Bay Northwest reach, would have a footprint and maintained easement area that would have both long-term minor adverse impacts to ruderal, urban, maritime forest,

dune and beach habitats. In addition, areas within the limits of disturbance would have short-term minor adverse impacts to these habitats.

Impacts to both ruderal and urban habitats will be negligible given the limited ecological functions provided in current condition. The location of recommended CSRM measures were planned to minimize adverse impacts to these natural habitats (i.e., maritime forest, dune, beach), and were strategically placed along the outer edge of habitats that currently border urban (i.e., developed) habitats in an effort to reduce habitat fragmentation. However, both short- and long-term adverse impacts are unavoidable. Short-term adverse impacts to vegetation are anticipated to occur from clearing all areas within the defined construction limits of disturbance. In addition, impacts to soils discussed in Section 5.1 Geologic Setting would cause a minor short-term indirect impact on vegetation in the affected areas. Impacts to surface water quality from increases in near shore turbidity and suspended solids as described in Section 5.3, Surface Water, could cause a minor short-term direct reduction in oxygen levels, resulting in a reduction in primary productivity and photosynthesis in freshwater plant communities in Jamaica Bay. Long-term adverse impacts are expected to those aquatic and terrestrial habitats that are lost within the permanent footprint of the proposed structures.

Mitigation discussed in HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements, is intended to offset unavoidable long-term adverse impacts to natural habitats affected by the Proposed Action.

5.6.2 Proposed Action Impacts

Construction of an inlet gate structure as a component of the Storm Surge Barrier will have both short- and long-term minor adverse impacts on aquatic habitats – primarily deep water subtidal bottom. Long-term adverse impacts will be realized from the footprint of the gate structure. Short-term adverse impacts will result from construction and potential to increase flow velocities, and therefore increased likelihood of scour. Refined modeling necessary to inform engineering design will provide additional information with respect to potential impacts on aquatic habitats. This modeling would be conducted prior to the Final Draft HSGRR/EIS.

It should be noted that the Proposed Action would have beneficial long-term direct impacts on native habitats throughout Jamaica Bay by protecting shorelines from future erosion associated with storm surges. Specifically, an inlet gate will protect and preserve marsh island habitats, which have been diminishing at an accelerated rate (see section HSGRR/EIS Section 2.3.8, Aquatic and Terrestrial Habitats).

Mitigation discussed in HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements, is intended to offset long-term adverse impacts to natural habitats affected by the Proposed Action.

5.6.3 Action Alternative Impacts

Given the large footprint of CSRM structures across Jamaica Bay associated with the Perimeter Plan, the Action Alternative would have both short-term and long-term adverse impacts to a range of habitat types, consistent with the Alternative elements discussed above.

Tidal gates across each tributary would have both short- and long-term minor adverse impacts to primarily deep water subtidal bottom habitat, as well as intertidal wetland habitats at a few locations. Long-term adverse impacts are anticipated to occur from the permanent footprint of the gate structures. However, as noted above, hydrodynamic modeling of individual tributary gates has not been performed to date. Therefore, it is unknown at this time if tidal gates across individual tributaries could have other direct long-term adverse impacts to terrestrial and aquatic habitats.

Construction of elevated promenades, floodwalls and/or levees would have a footprint and maintained easement area that would have a directly, long-term minor adverse impacts to ruderal, urban, intertidal wetlands, non-native wetlands, maritime forest, dune and beach habitats. In addition, the limits of disturbance associated with construction of each feature would also have a direct, short-term impact. Impacts to both ruderal and urban habitats will be negligible. The location of CSRM measures were planned to minimize adverse impacts to these natural habitats (i.e., maritime forest, wetlands, dune, beach), and strategically placed along the outer edge of habitats, where possible, in an effort to reduce habitat fragmentation. Clearing of vegetation is assumed to occur within the defined limits of disturbance. Impacts to soils are discussed in Section 5.1, Geologic Setting, and would cause a minor short-term indirect impact on vegetation in the affected areas. Impacts to surface water quality from increases in near shore turbidity and suspended solids as described in Section 5.3, Surface Water, could cause a minor short-term direct reduction in oxygen levels, resulting in a reduction in primary productivity and photosynthesis in freshwater plant communities in Jamaica Bay.

Construction of bulkheads and/or seawalls will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat and subtidal bottoms. No long-term adverse impacts are anticipated given the previous hardening of the shoreline.

Living shorelines will have a long-term beneficial impact on native shoreline habitats throughout the bay. Table 5-3 includes a summary of benefits from NNBFs within the Action Alternative based upon an area metric.

Table 5-3: Summary Benefits of NNBFs in the Jamaica Bay Planning Reach

	Area (Acreage)	
Habitat Types	**Existing**	**Alternative Action**
Subtidal Bottom	5.5	4.6
Intertidal Mudflat	13.2	12.1
Intertidal Wetlands	5.8	11.1
Non-Native Wetlands	0.6	0.0
Oyster Reef	0.0	2.1
Beach	2.8	2.2
Dune	0.9	2.6
Maritime Forest/Shrubland	2.4	42.2
Ruderal	62.3	14.6
Rip Rap / Bulkhead	0.0	0.1
Urban	8.9	8.2

5.6.4 No-Action Alternative Impacts

Significant long-term direct adverse impacts on both aquatic and terrestrial habitats are anticipated from a No-Action Alternative. Significant adverse impacts are anticipated from shoreline erosion and loss of natural habitats throughout the bay. Specifically, the marsh island habitats are eroding at an accelerated rate. In the absence of any human intervention, the marshes are projected to vanish by the year 2025 (USACE 2016). The loss of sensitive habitat would, in turn, have significant adverse impacts on aquatic and terrestrial wildlife.

5.7 Invertebrate and Benthic Resources

Significant adverse impacts to benthic species would result from degradation of areas suitable for recruitment and protection for benthic invertebrate species. Adverse impacts would result from loss of food sources, spawning beds, and shelter as a consequence of implementation of an action.

5.7.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts to benthic shellfish species would be realized from implementation of the common project elements. Constructed groins would create areas suitable for recruitment and protection for numerous shellfish species. Beneficial impacts to the benthic community include the increase in food source, spawning beds, and shelter in the project area (USACE, 2015, [Jones Inlet EA]). Construction and extension of groins would provide living spaces for the floral and faunal communities on which benthic species rely. In addition to creating living spaces and increasing food availability of the project area, the proposed Project would provide shelter from wave attacks for the existing and surrounding benthic communities. Some species, such as rockweeds (*Fucus* spp.), oysters, and barnacles (*Balanus* spp.) would flourish on the newly constructed groins (Carter 1989). Various floral species such as rockweed

and spongomorpha (*Spongomorpha* spp.), and faunal species such as barnacle, oyster, and blue mussel, are expected to move into the area and colonize living space on groins (USACE 1995). Rockweeds are known to support numerous organisms, including both autotrophs and heterotrophs. In addition, rockweeds provide shelter, moisture at low tide, and food especially for the sessile epifaunal and epiphytic groups (Oswald et al. 1984). Gastropods, bivalves, and crustaceans are all common inhabitants of rockweeds.

Minor short-term direct adverse impacts to benthic communities are anticipated from construction activities associated with the common project elements, including future periodic renourishment. Construction would cause increased sedimentation, resulting in the smothering of existing sessile benthic communities in the vicinity of construction areas. Some mortality of shellfish, and polychaetes is expected for individuals that cannot escape during the construction process. Motile shellfish species would be able to relocate temporarily outside of the immediate project area.

A short-term impact to the existing benthic habitat are anticipated from burial of the benthic floral and faunal community. Benthic resources would begin to recolonize the project area immediately following Project completion. Infaunal organisms are likely to recolonize the area from nearby communities and re-establish to a similar community within a 6.5-month period (USACE 1995, USACE 2001). Short-term adverse impacts would occur because of short-term changes to water quality during construction, including resuspension of sediments in the water column and changes to the quality or quantity of soft bottom substrates, as discussed in Section 5.3. Construction related increases in turbidity and suspended solids cause a short-term reduction in oxygen levels (Reilley et al. 1978, Courtenay et al., 1980). Impacts are expected to be minor, given the temporary nature of the disturbance and the availability of suitable adjacent habitat and given the large extent of the Atlantic Ocean and Jamaica Bay compared to the project construction footprint. Implementation of BMPs to control sedimentation and erosion during construction would further minimize adverse impacts on benthic invertebrate species. It is possible that the species composition of the benthic community that reestablishes would be slightly different than the pre-construction composition given disturbance and potential change in substrate type.

Minor, but recurring, short-term, direct adverse impacts on nearshore benthic communities would occur as a result of dredging sand from the borrow areas and occur at each nourishment. According to the NPS environmental documents prepared for previous borrow efforts indicate the adverse impacts are not significant (GMP/EIS, 2014). Minor long-term direct impact on benthic invertebrates particularly to the abundance and size structure of sand dollar (*Echinarachnius parma*) populations (USACE 2001), would be experienced due to displacement and/or mortality during dredging for borrow areas. Impacts to benthic communities in the borrow area are considered short-term and minor because benthic invertebrate species are expected to recolonize the borrow area within 2-2.5 years (USACE 2001).

5.7.2 Proposed Action Impacts

Construction of an inlet gate structure will have short- and long-term minor adverse impacts to primarily deep water subtidal bottom habitat that is used by some benthic species. Long-term adverse impacts will be realized from the footprint of the gate structure, which will permanently remove some benthic habitat; although the project site is already impacted because it is actively maintained as a navigation channel. In addition, most benthic species would recolonize nearby and the addition of a new hardened in-water structures can function as habitat for some benthic species. Short-term adverse impacts will result from the potential to increase flow velocities, and therefore increase likelihood of scour in benthic habitat proximate to this permanent feature.

The Proposed Action would have a beneficial long-term direct impacts on native habitats throughout Jamaica Bay by protecting shorelines from future erosion associated with storm surges. Specifically, an inlet gate will protect tidal marsh and intertidal wetland habitats, used by many benthic species, which have been diminishing at an accelerated rate. It is estimated that approximately 1,400 acres of tidal salt marsh have been lost from the marsh islands since 1924, which equates to a rate of 20 acres lost per year. From 1994 through 1999, an estimated 220 acres of salt marsh were lost at a rate of 47 acres per year.

5.7.3 Action Alternative Impacts

The Action Alternative would have beneficial and adverse short-term and long-term adverse impacts to habitats important for benthic populations, consistent with the common elements discussed above.

- Tidal gates across each tributary would have adverse short- and long-term minor adverse impacts to primarily deep water subtidal bottom habitat and intertidal wetland habitats, which are important habitats for benthic species in the Bay. Long-term adverse impacts are anticipated from the footprint of the gate structure. However, as noted above, hydrodynamic modeling has not been performed at this time for individual tributary gates. Therefore, it is unknown at this time if tidal gates across individual tributaries could have other direct long-term impacts to terrestrial and aquatic habitats
- Construction of elevated promenades, floodwalls and/or levees would have a footprint and maintained easement area that would have both short- and long-term minor adverse impacts to intertidal mudflats and wetlands, as well as non-native wetlands that are used by many benthic species. Impacts to surface water quality from increases in near shore turbidity and suspended solids as described in Section 5.3 could cause a minor short-term direct reduction in oxygen levels which could impact benthic species.
- Construction of bulkheads and/or seawalls will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat and subtidal bottoms. No long-term adverse impacts are anticipated; benthic species can recolonize the structures after completion. No change is anticipated in the extent of hardened shorelines; therefore, no long-term adverse impacts are expected for benthic resources.

- Living shorelines will have a long-term beneficial impact on native shoreline habitats throughout the bay, including intertidal wetlands which are important for many benthic species.

Mitigation discussed in HSGRR/EIS Section 3.5.1 is intended to offset long-term unavoidable adverse impacts to natural habitats affected by the Action Alternative.

5.7.4 No-Action Alternative Impacts

The No-Action Alternative will potentially have minor indirect adverse effects on the benthic species in the project area through the continued, on-going impacts to aquatic habitats from high energy storm events. Intertidal wetlands and mudflats that function as habitat for many invertebrate species would experience significant erosion. Storms will also temporary increase water turbidity and changes in water chemistry from high energy wave action caused by storms. These adverse impacts can reduce the quality and extent of subtidal bottom and oyster reef habitats that are important for benthic invertebrates. Climate change is expected in increase the frequency and intensity of storms that would continue to contribute to the damage and loss of these habitats over the long-term (reference).

5.8 Fin Fish

Significant adverse impacts to finfish would result if actions significantly degraded areas suitable for recruitment and protection for fish species. Adverse impacts would result from loss of food sources, spawning beds, and shelter as a consequence of implementation of an action.

5.8.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts to fish species are also anticipated from implementation of the common project elements. Constructed groins would create areas suitable for recruitment and protection for numerous fish species. Beneficial impacts to the fish community include the increase in food source, spawning beds, and shelter in the project area (USACE, 2015, [Jones Inlet EA]). Construction and extension of groins would provide living spaces for the food resource on which fish species rely. In addition to creating living spaces and increasing food availability of the project area, the proposed Project would provide shelter from wave attacks for the existing and surrounding fish communities.

There would be minor short-term direct adverse impacts on adult and juvenile life stages of nearshore fish during construction, as mobile fish would be temporarily displaced from foraging habitat as they retreat from the area in response to construction activities. Construction related increases in turbidity and suspended solids will cause a short-term reduction in oxygen levels and reduce visibility for feeding (Reilley et al. 1978, Courtenay et al., 1980). Impacts are expected to be minor, given the temporary nature of the disturbance and the availability of suitable adjacent habitat. Adult and juvenile life stages and their prey species would quickly reestablish themselves after completion of construction.

Additional minor short-term direct adverse impacts on nearshore fish communities would occur as a result of dredging sand from the borrow areas. According to the NPS environmental documents prepared for borrow efforts indicate the adverse impacts are not significant (GMP/EIS, 2014). Additional minor short-term direct impact on benthic feeding fish species (e.g., windowpane, summer and winter flounder) would be experienced, due to temporary displacement during dredging for borrow areas. Impacts are considered minor because benthic feeding fish species are expected to avoid construction areas and feed in the surrounding area; therefore, would not be adversely affected by the temporary localized reduction in available benthic food sources. There are expected to be no impacts to fish assemblages of finfish foraging habits in offshore borrow areas (USACE 2001). Because adverse effects to essential fish habitat would be minor, the essential fish habitat requirements of the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations would be satisfied.

Minor short-term direct adverse impacts on nearshore fish communities would be realized by less mobile life stages (eggs and larvae) of nearshore fish, e.g., Atlantic butterfish, red hake, windowpane flounder, winter flounder, summer flounder, and scup, if present at the time of construction activities. Impacts would occur because of short-term changes to water quality, including resuspension of sediments in the water column and changes to the quality or quantity of soft bottom substrates, as discussed in Section 5.3. Impacts to nearshore fish community assemblages are considered minor (USACE 2001), given the large extent of the Atlantic Ocean and Jamaica Bay compared to the project construction footprint, and there would be no impact to nearshore fish foraging habitats (USACE 2001). Implementation of BMPs to control sedimentation and erosion during construction would further minimize adverse impacts on eggs and larvae of nearshore fish species.

5.8.2 Proposed Action Impacts

Construction of an inlet gate structure will have minor adverse short- and long-term impacts to finfish populations that use deep water subtidal bottom habitat in the immediate project area. Long-term adverse impacts are anticipated from the footprint of the gate structure that will eliminate a small portion of subtidal bottom habitat for fish; however, impacts will be minor and fish species should easily re-establish in other, adjacent habitat. Short-term adverse impacts will result in slight changes to water conditions around the inlet gate because of the potential to increase flow velocities.

The Proposed Action would have a beneficial long-term direct impact on native habitats important to fish species throughout Jamaica Bay by protecting tidal marshes and intertidal wetlands from future erosion associated with storm surges. Tidal marshes and marsh islands are important nursery habitat for many fish species in the Bay. Tidal marshes have been diminishing at an accelerated rate. It is estimated that approximately 1,400 acres of tidal salt marsh have been lost from the marsh islands since 1924, which equates to a rate of 20 acres lost per year. From 1994 through 1999, an estimated 220 acres of salt marsh were lost at a rate of 47 acres per year.

5.8.3 Action Alternative Impacts

The Action Alternative would have beneficial and adverse short-term and long-term impacts to habitats important for fish populations, consistent with the common elements discussed above.

- Tidal gates across each tributary would have adverse short- and long-term minor impacts to primarily deep water subtidal bottom habitat and intertidal wetland habitats, which are important habitats for different life stages of many fish species in the Bay. Long-term, but minor, adverse impacts will be realized from the footprint of the gate structure, which will permanently remove a small amount of habitat for fish. Short-term adverse impacts will result from the potential to increase flow velocities, and therefore increase likelihood of scour proximate to this permanent feature and potentially alter the environment for fish using these areas.
- Construction of elevated promenades, floodwalls and/or levees would have a footprint and maintained easement area that would have both short- and long-term minor adverse impacts to intertidal wetlands and non-native wetlands that are used by many fish species. Construction impacts to surface water quality from increases in near shore turbidity and suspended solids as described in Section 5.3 could cause a minor short-term direct reduction in oxygen levels, resulting in a reduction in primary productivity and photosynthesis in freshwater plant communities in Jamaica Bay. This could cause adverse impacts to herbivorous fish and indirectly impact carnivorous fish. Mitigation discussed in HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements, is intended to offset long-term adverse impacts to natural habitats affected by the Proposed Action.
- Construction of bulkheads and/or seawalls will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat and subtidal bottoms. No long-term adverse impacts are anticipated given that fish species can temporarily vacate the area during construction and recolonize after completion. No change is anticipated in the extent of hardened shorelines; therefore, no long-term adverse impacts are expected for fish.
- Living shorelines will have a long-term benefit on native shoreline habitats throughout the bay, including intertidal wetlands which are important for many fish species.

Mitigation discussed in HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements, is intended to offset unavoidable adverse long-term impacts to natural habitats affected by the Action Alternative.

5.8.4 No-Action Alternative Impacts

The No-Action Alternative will potentially have minor indirect adverse effects on the fish species in the project area through the continued, on-going impacts to aquatic habitats from high energy storm events. Intertidal wetlands along the main shorelines of Jamaica Bay and marsh islands that function as important nursery habitat for many fish species would experience significant erosion. These adverse impacts can also reduce the quality and extent of subtidal bottom and oyster reef habitats that are important for fish. Climate change is expected to

increase the frequency and intensity of storms that would continue to contribute to the damage and loss of these habitats over the long-term.

5.9 Wildlife

The effect of an alternative on wildlife could be significant if it would disrupt or remove any endangered or threatened species or its designated critical habitat. The loss of a substantial number of individuals of any species (sensitive or non-sensitive species) that could affect the abundance or diversity of that species beyond normal variability could also be considered significant. Adverse impacts to wildlife would be considered significant if priority species or habitats could be adversely affected over relatively large areas and/or disturbance could cause reductions in population size or distribution of a priority species. A significant impact would result in a substantial loss of habitat function or the disruption of life history requirements of a species.

5.9.1 Reptiles and Amphibians

5.9.1.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts on herptiles (i.e., reptiles and amphibians) are anticipated from implementation of the common project elements. Construction of buried seawalls and floodwalls associated with the Rockaway Beach Shorefront CSRM segment, the limited Rockaway Bayside CSRM segment, and the limited Jamaica Bay Northwest CSRM segment would protect shoreline vegetation from physical degradation, likewise preserving reptile and amphibian habitat. Overall habitat within the intertidal zone would increase as the beach is widened with beach fill, and groin structures would reduce the rate of beach loss. The physical characteristics of the intertidal habitat will not be altered, because the grain size of fill material will be the same as that of project footprint native sand.

Minor short-term direct adverse impacts on reptiles and amphibians are anticipated from construction associated with the common project elements. Shoreline intertidal, subtidal, upper beach, and dune wildlife habitats would be impacted from construction activities such as clearing and grading for temporary access road construction. Wetland habitats would be impacted by temporary changes in surface water quality from increases in near shore turbidity and suspended solids, as described in Section 5.3, affecting freshwater-dependent and saltmarsh-dependent reptile and amphibian species. There would be a permanent loss of some small areas of terrestrial upper beach zone and dune communities, dominated by sand and beachgrass, from construction of permanent pedestrian access ramps and walkways and placement of sand barriers. In addition, these habitats would experience minor short-term direct adverse impacts from construction activities. However, these adverse impacts are expected to occur in a small footprint and will be mitigated (see HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements) through implementation of BMPs and the addition of new habitat in other strategic locations within Jamaica Bay.

Construction of bulkheads in both the Rockaway Bayside and Jamaica Bay Northwest will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat that may be used by turtle species. No long-term adverse impacts are anticipated given the previous hardening of the shoreline.

5.9.1.2 Proposed Action Impacts

Additional adverse and beneficial but minor impacts on herptiles would occur as a result of implementation of the additional unique elements of the Proposed Action. Impacts would be similar to those described for the common project elements based upon selected CSRM measure, but would extend across an expanded project footprint.

Construction of an inlet gate structure will have adverse short- and long-term minor impacts to upland habitats in the immediate project area that may be used by reptile and amphibian species. Some habitat will be permanently removed, although additional habitat with more ecological functional value will be created in other areas. Passage through Rockaway Inlet is not expected to deter sea turtles from continuing to utilize Jamaica Bay.

The Proposed Action would have a beneficial long-term direct impact on native habitats important for reptiles and amphibians including wetlands, mudflats, and upland habitats throughout Jamaica Bay by protecting shorelines from future erosion associated with storm surges.

5.9.1.3 Action Alternative Impacts

Additional adverse and beneficial but minor impacts on herptiles would occur as a result of implementation of the additional unique elements of the Action Alternative. Impacts would be similar to those described for the common project elements, but would extend across an expanded project footprint. The Action Alternative would have both short-term and long-term adverse impacts to habitats important for reptile and amphibian populations, consistent with the common project elements.

- Tidal gates across each tributary would have both short- and long-term minor adverse impacts to upland, mudflats, and intertidal wetland habitats, which are important habitats for some turtle species in the Bay. Long-term adverse impacts will be realized from the footprint of the gate structure, which will permanently remove a small amount of upland, wetland, mudflat, and shoreline habitat used by amphibians and reptiles. It is unknown at this time if the tidal gates would have additional adverse impacts to native habitats through modification of tributary hydrodynamics.
- Construction of elevated promenades, floodwalls and/or levees would have a footprint and maintained easement area that would have both short- and long-term minor adverse impacts to intertidal wetlands and non-native wetlands that are potentially used by reptiles and amphibian species. Impacts to surface water quality from increases in near shore turbidity and suspended solids as described in Section 5.3 could cause a minor short-term direct reduction in water quality which could impact reptile species.

- Construction of bulkheads and/or seawalls will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat and subtidal bottoms. No change is anticipated in the extent of hardened shorelines, therefore no long-term impacts are expected for reptiles and amphibians.
- Living shorelines will have a long-term benefit on native shoreline habitats throughout the bay, including intertidal wetlands, mudflats, and uplands, which are important for many reptile and amphibian species.

Mitigation discussed in HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements, is intended to offset long-term adverse impacts to natural habitats affected by the Action Alternative.

5.9.1.4 No-Action Alternative Impacts

The No-Action Alternative will potentially have minor indirect long-term adverse effects on the amphibian and reptile species through the continued, on-going impacts to their habitats from high energy storm events. Beach/dune systems, uplands, intertidal wetlands, mud flats, and marsh island habitats experience significant erosion, temporary increases in turbidity and changes in water levels and water chemistry from high energy wave action caused by storms. Erosion of buffer habitats like intertidal wetlands may also have indirect adverse impacts on maritime and coastal shrub and forest habitats. These adverse impacts can reduce the quality and extent of these habitats in Jamaica Bay, negatively impacting the reptiles and amphibian species that use them. Climate change is expected in increase the frequency and intensity of storms that would continue to contribute to the damage and loss of these habitats over the long-term.

5.9.2 Birds

5.9.2.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts on birds are anticipated from implementation of the common project elements. As discussed in Section 5.6, Aquatic and Terrestrial Habitats, vegetation stabilization and renourishment of Rockaway Beach would support healthy North Atlantic Upper Ocean Beach; benefiting bird species, particularly beach nesting birds like piping plover and roseate terns that use this habitat. Construction of seawalls and floodwalls associated with the Rockaway Beach Shorefront CSRM segment, the limited Rockaway Bayside CSRM segment, and the limited Jamaica Bay Northwest CSRM segment would protect shoreline vegetation from physical degradation, likewise preserving bird habitat. Overall habitat within the intertidal zone would increase as the beach is widened with beach fill, and groin structures would reduce the rate of beach loss. The physical characteristics of the intertidal habitat will not be altered because the grain size of fill material will be the same as that of project footprint native sand.

Minor adverse short-term direct impacts on birds are anticipated from construction associated with the common project elements. Shoreline intertidal, subtidal, upper beach, and dune wildlife habitats would be impacted due to such construction activities as clearing and grading for temporary access road construction. Aquatic habitats would be impacted by temporary changes

in surface water quality from increases in near shore turbidity and suspended solids as described in Section 5.8, affecting freshwater-dependent and saltmarsh-dependent bird species. There would be permanent loss of some small areas of terrestrial upper beach zone and dune communities, dominated by sand and beachgrass due to construction of permanent pedestrian access ramps and walkways and placement of sand barriers. In addition, these habitats would experience minor short-term direct adverse impacts from construction activities. However, these adverse impacts are expected to be over a small footprint and will be mitigated for (see HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements) through BMPs (specifically construction planned for times of the year outside key breeding and migration periods) and the addition of new habitat in other locations in the project area.

Construction of bulkheads in both the Rockaway Bayside and Jamaica Bay Northwest will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat that may be used by bird species. No long-term impacts are anticipated given that the extent of hardened shoreline will not change.

Placement of groins would result in small losses of intertidal beach and subtidal aquatic habitats used by birds that are located within groin footprints. However, these adverse impacts are expected to occur in a small footprint and will be mitigated (see HSGRR/EIS Section 5.3.1 Habitat Impacts and Mitigation Requirements) through implementation of BMPs (specifically construction planned for times of the year outside key breeding and migration periods) and the addition of new habitat in other locations in the project area. The addition of groins could be beneficial for some bird species, as groins create habitat for many benthic and fish species that are prey for shorebirds and raptors.

5.9.2.2 Proposed Action Impacts

Additional minor adverse and beneficial impacts on birds would occur as a result of implementation of the additional unique elements of the Proposed Action. Construction of an inlet gate structure will have adverse short- and long-term minor impacts to primarily some upland, intertidal wetland, beach, and mudflat habitat that could be utilized by birds directly adjacent to the construction area. These adverse impacts are expected to occur in a small footprint and will be mitigated (see HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements) through implementation of BMPs (specifically construction planned for times of the year outside key breeding and migration periods) and the addition of new habitat in other locations in the project area. Short-term adverse impacts to water quality and water conditions will result from the potential to increase flow velocities proximate to this permanent feature, although this is not expected to impact birds.

The Proposed Action would have a beneficial long-term direct impacts on native habitats important for birds including wetland, marsh island, beach, mudflat, and upland habitats throughout Jamaica Bay by protecting shorelines from future erosion associated with storm surges. Specifically, an inlet gate will protect marsh island habitats, used by many bird species,

which have been diminishing at an accelerated rate. It is estimated that approximately 1,400 acres of tidal salt marsh have been lost from the marsh islands since 1924. From 1994 and 1999, an estimated 220 acres of salt marsh were lost at a rate of 47 acres per year.

5.9.2.3 Action Alternative Impacts

Additional adverse and beneficial but minor impacts on wildlife would occur as a result of implementation of the additional unique elements of the Action Alternative. The Action Alternative would have short-term adverse and long-term beneficial impacts to habitats important for bird populations, consistent with the common elements discussed above.

- Tidal gates across each tributary would have both short- and long-term minor adverse impacts to intertidal wetland habitats, which are important habitats for bird species and their food resources in the Bay.
- Construction of elevated promenades, floodwalls and/or levees would have a footprint and maintained easement area that would have both short- and long-term minor adverse impacts to maritime forest, intertidal wetlands and mudflats, and non-native wetlands that are used by many bird species.
- Construction of bulkheads and/or seawalls will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat and subtidal bottoms. No long-term impacts are anticipated, as bird species are not likely to use these areas. No change is anticipated in the extent of hardened shorelines; therefore, no long-term adverse impacts are expected for birds.
- Living shorelines will have a long-term benefit on native shoreline habitats throughout the bay, including intertidal wetlands which are important for many bird species.

Mitigation discussed in HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements, is intended to offset long-term adverse impacts to natural habitats affected by the Action Alternative.

5.9.2.4 No-Action Alternative Impacts

The No-Action Alternative will potentially have indirect adverse effects on bird species through the continued, on-going loss of their habitats from high energy storm events. Beach/dune systems, intertidal wetlands, mud flats, and marsh island habitats experience significant erosion, temporary increases in turbidity and changes in water levels and water chemistry from high energy wave action caused by storms. Erosion of buffer habitats, like intertidal wetlands, may also have indirect adverse impacts on maritime and coastal shrub and forest habitats. These adverse impacts can reduce the quality and extent of these habitats in Jamaica Bay, negatively impacting the bird species that use them. Climate change is expected in increase the frequency and intensity of storms that would continue to contribute to the damage and loss of these habitats over the long-term.

5.9.3 Mammals

5.9.3.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts on birds are anticipated from implementation of the common project elements. As discussed in Section 5.6, Aquatic and Terrestrial Habitats, vegetation stabilization and renourishment of Rockaway Beach would support healthy North Atlantic Upper Ocean Beach; benefiting mammal species that use this habitat. Construction of seawalls and floodwalls associated with the Rockaway Beach Shorefront CSRM segment, the limited Rockaway Bayside CSRM segment, and the limited Jamaica Bay Northwest CSRM segment would protect shoreline vegetation from physical degradation, likewise preserving upland habitat used by mammals. Overall habitat within the intertidal zone would increase as the beach is widened with beach fill, and groin structures would reduce the rate of beach loss.

Minor short-term direct adverse impacts on mammals are anticipated from construction associated with the common project elements. Upper beach, and dune wildlife habitats would be impacted due to such construction activities as clearing and grading for temporary access road construction. Wetland habitats would be impacted by temporary changes in surface water quality from increases in near shore turbidity and suspended solids as described in Section 5.3, affecting freshwater-dependent and saltmarsh-dependent mammal species. There would be permanent loss of some small areas of terrestrial upper beach zone and dune communities, dominated by sand and beachgrass due to construction of permanent pedestrian access ramps and walkways and placement of sand barriers. In addition, these habitats would experience minor short-term direct adverse impacts from construction activities, however these impacts are expected to occur in a small footprint and will be mitigated (see HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements) through implementation of BMPs and the addition of new habitat in other locations in the project area.

Construction of bulkheads in both the Rockaway Bayside and Jamaica Bay Northwest segments will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat that may be used by mammal species. No long-term impacts are anticipated given that the extent of hardened shoreline will not change.

5.9.3.2 Proposed Action Impacts

Construction of an inlet gate structure will have short- and long-term minor adverse impacts to primarily some upland, intertidal wetland, beach, and mudflat habitat that could be utilized by mammals. These adverse impacts are expected to occur in a small footprint and will be mitigated (see HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements) through implementation of BMPs and the addition of new habitat in other locations in the project area. Short-term adverse impacts to water quality and water conditions will result from the potential to increase flow velocities proximate to this permanent feature, although this is not expected to impact mammals.

Additional beneficial and minor adverse impacts on wildlife would occur as a result of implementation of the additional unique elements of the Proposed Action. Impacts would be similar to those described for the common project elements, but would extend across an expanded project footprint.

The Proposed Action would have a beneficial long-term direct impacts on native habitats important for mammals including wetland, marsh island, beach, mudflat, and upland habitats throughout Jamaica Bay by protecting shorelines from future erosion associated with storm surges.

5.9.3.3 Action Alternative Impacts

Additional beneficial and minor adverse impacts on wildlife would occur as a result of implementation of the additional unique elements of the Action Alternative. Impacts would be similar to those described for the common project elements, but would extend across an expanded project footprint.

Given the increased footprint of activities across Jamaica Bay, the Action Alternative would have both short-term and long-term adverse impacts to habitats important for bird populations, consistent with the Alternative elements discussed above.

- Construction of elevated promenades, floodwalls and/or levees would have a footprint and maintained easement area that would have both short- and long-term minor adverse impacts to some upland, intertidal wetlands and non-native wetlands that are used by mammal species.
- Construction of bulkheads and/or seawalls will have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat. No long-term impacts are anticipated given that mammal species are not likely to use these areas. No change is anticipated in the extent of hardened shorelines; therefore, no long-term impacts are expected for birds.
- Living shorelines will have a long-term benefit on native shoreline habitats throughout the bay, including intertidal wetlands, beach, and uplands which are important for many mammal species.

Mitigation discussed in HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements, is intended to offset long-term adverse impacts to natural habitats affected by Action Alternative.

5.9.3.4 No-Action Alternative Impacts

The No-Action Alternative will potentially have indirect adverse effects on the mammal species through the continued, on-going adverse impacts to their habitats from high energy storm events. Beach/dune systems, intertidal wetlands, mud flats, and marsh island habitats experience significant erosion from high energy wave action caused by storms. Erosion of buffer habitats like intertidal wetlands may also have indirect adverse impacts on maritime and coastal shrub and forest habitats. These adverse impacts can reduce the quality and extent of these habitats in

Jamaica Bay, negatively impacting the mammals that use them. Climate change is expected in increase the frequency and intensity of storms that would continue to contribute to the damage and loss of these habitats over the long-term.

5.10 Special Management Areas

A significant impact could occur if elements of an alternative were not in compliance with development and management requirements established for a regulated Special Management Area. Additionally, impacts could be significant if the project resulted in the degradation of characteristic natural or man-made features of Special Management Areas.

5.10.1 Impacts Common to Both Action Alternatives

Beneficial short- and long-term direct impacts on special management areas are anticipated from implementation of the common project elements. Construction of shoreline protective measures such as groins, seawalls, and floodwalls would protect special management areas from physical degradation and negative effects of flooding. Special management areas that would realize protection from the common project elements include:

- NPS Gateway National Recreation Area (Portions of Fort Tilden and Jacob Riis Park, Breezy Point, Plumb Beach),
- Special Natural Waterfront Area (Portions of Fort Tilden and Jacob Riis Park, Breezy Point, Plumb Beach),
- Coastal Zone Boundary (Coney Island, portions of Jamaica Bay Northwest, portions of Rockaway Peninsula, and Rockaway Bayside),
- NYC Waterfront Revitalization Program (same areas as Coastal Zone Boundary).

Adverse minor short-term direct impacts on the special management areas listed above are anticipated from construction activities associated with the common project elements. Negligible short-term direct impacts during project construction are anticipated from disruption of access to the special management areas listed above. Negligible short-term indirect impacts are anticipated from construction noise and dust, slightly diminishing the visitor experience in the special management areas listed above. Construction BMPs would be implemented to reduce the severity of these impacts to negligible levels to the maximum extent possible. BMPs would include limiting construction hours to standard allowable hours, using noise suppressing mufflers on construction equipment, water tanker trucks for dust suppression, and covering trucks with tarps to prevent airborne dust.

5.10.2 Proposed Action Impacts

Beneficial short- and long-term direct impacts on special management areas are anticipated from implementation of the unique elements of the Proposed Action. Beneficial impacts associated with the unique Proposed Action elements would be similar to those described for the common project elements, but would be broader, particularly with construction of the hurricane barrier, which when closed during storm surge conditions, would further protect special management

areas throughout Jamaica Bay. Additional special management areas protected by the unique elements of the Proposed Action include:

- NPS Gateway National Recreation Area (Floyd Bennett Field)
- Special Natural Waterfront Area (all Rockaway Bayside portions and Jamaica Bay portions, e.g., Brooklyn Marine Park, Four Sparrow March, Grassy Bay),
- Coastal Zone Boundary (all Rockaway Bayside portions, Jamaica Bay portions inside the hurricane barrier, and JFK Airport),
- NYC Waterfront Revitalization Program (same areas as Coastal Zone Boundary),
- Vernam/Barbadoes Park,
- Brant Point Habitat Restoration Area,
- Dubos Point Habitat Restoration Area, and
- Bayswater State Park Habitat Restoration Area.

Minor short-term direct impacts on some special management areas are anticipated from construction activities associated with the Proposed Action. Negligible short-term direct impacts during project construction are anticipated from disruption of access to these additional special management areas potentially affected by the unique elements of the Proposed Action. Minor short-term indirect impacts are anticipated from construction noise and dust, slightly diminishing the visitor experience in the special management areas listed above.

5.10.3 Action Alternative Impacts

Beneficial short- and long-term direct impacts on special management areas are anticipated from implementation of the unique elements of the Action Alternative. Beneficial impacts associated with the unique Proposed Action elements would be similar to those described for the common project elements, but would be broader in scope and would further protect special management areas in Jamaica Bay. Additional special management areas protected by the unique elements of the Action Alternative are the same as those listed for the Proposed Action, with the exception of Floyd Bennett Field and JFK Airport. Implementation of the Action Alternative would leave these special management areas unprotected.

Adverse minor short-term direct impacts on some special management areas are anticipated from construction activities associated with the Action Alternative. Minor short-term direct impacts during project construction are anticipated from disruption of access to the additional special management areas potentially affected by the unique elements of the Action Alternative (see list under Section 5.10.2, above). Minor short-term indirect impacts are anticipated from construction noise and dust, slightly diminishing the visitor experience in the special management areas listed in Section 5.10.2, above.

5.10.4 No-Action Alternative Impacts

Adverse significant short- and long-term direct impacts on special management areas are anticipated from implementation of the No-Action Alternative. Not implementing the proposed coastal protective measures would leave all special management areas identified in Chapter 4,

Special Management Areas, vulnerable to degradation and destruction by future extreme weather events.

5.11 Protected Species

Impacts to protected species would be considered significant if a protected species or its critical habitat could be adversely affected or disturbance could cause reductions in population size or distribution. A significant impact would result in a substantial loss of habitat function or the disruption of life history requirements of a species, or plant population, which would make a species eligible for listing under the Federal ESA, or would limit the recovery of a listed species.

5.11.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts on federally and state listed threatened and endangered species are anticipated from implementation of the common project elements. As discussed in Section 5.6, Aquatic and Terrestrial Habitats, vegetation stabilization and renourishment of Rockaway Beach would support healthy North Atlantic Upper Ocean Beach; therefore, habitats for sandplain gerardia, seabeach amaranth, piping plover, red knot, roseate tern and other species that use this habitat would benefit for the 50-year life of the project. Construction of seawalls and floodwalls associated with the Rockaway Beach Shorefront CSRM segment, the limited Rockaway Bayside CSRM segment, and the limited Jamaica Bay Northwest CSRM segment would protect shoreline vegetation from physical degradation, likewise preserving habitat for these species. Overall habitat within the intertidal zone would increase as the beach is widened with beach fill and groin structures would reduce the rate of beach loss. The physical characteristics of the intertidal habitat will not be altered because the grain size of fill material will be the same as that of project footprint native sand. USACE is engaged with the USFWS to ensure the latest reasonable and prudent measures for piping plovers (USFWS 2014) and standard BMPs are incorporated into the projects' Plans and Specifications detailing specific conservation measures to be undertaken to minimize potential adverse effects to protected species under their jurisdiction.

Minor short-term direct impacts to threatened and endangered species are anticipated from construction associated with the common project elements. Shoreline intertidal, subtidal, upper beach, and dune wildlife habitats would be impacted due to such construction activities as clearing and grading for temporary access road construction. Wetland habitats would be impacted by changes in surface water quality from increases in near shore turbidity and suspended solids as described in Section 5.3, affecting freshwater-dependent and saltmarsh-dependent wildlife species. Terrestrial upper beach zone and dune communities, dominated by sand and beachgrass would experience minor short-term direct impacts due to construction of permanent pedestrian access ramps and walkways and placement of sand barriers. Placement of groins would result in small losses of intertidal beach and subtidal aquatic habitats located within groin footprints, although groins attract benthic invertebrates and fish species that are food resources for, roseate tern, red knot, and osprey.

These activities will likely have impacts on the beach foraging habitats of roseate tern, sandplain gerardia and seabeach amaranth and the nesting habitat of the piping plover and roseate tern at Breezy Point and Rockaway Beaches, and the beach foraging habitat for migrating red knots dependent on horseshoe crab reproduction on beaches in Jamaica Bay, Breezy Point, and Rockaway Beaches. Future surveys are necessary to better define habitat areas utilized by species of concern within the project study area. In addition, implementation of BMPs to limit construction activities during the breeding and migratory seasons and protect areas where seabeach amaranth populations are present should further minimize adverse impacts on these threatened and endangered species.

Negligible impacts on threatened and endangered aquatic species, such as sea turtles, Atlantic sturgeon and marine mammals are anticipated since those species under NOAAs jurisdiction are not susceptible to adverse effects from cutterhead dredge operations, and are also unlikely to utilize the project area.

USACE has prepared a Not Likely To Adversely Affect determination (NLAA; Appendix J) for NMFS' review for the Atlantic Shoreline Planning Reach of the project. Once an alternative has been selected for the Jamaica Bay Planning Reach of the project, USACE will reinitiate consultation with NMFS, as required and via pre-coordination and consultation with NMFS.

5.11.2 Proposed Action Impacts

Additional minor impacts on threatened and endangered species under FWS jurisdiction would occur as a result of implementation of the additional unique elements of the Proposed Action. Impacts would be similar to those described for the common project elements, but would extend across an expanded project footprint.

Construction of an inlet gate structure will have short- and long-term minor impacts to primarily some upland, intertidal wetland, beach, and mudflat habitat that could be utilized by threatened and endangered species listed in Chapter 4, Protected Species, directly adjacent to the construction area. These impacts are expected to be over a small footprint and will be mitigated for (see HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements) through BMPs and the addition of new habitat in other locations in the project area. Short-term impacts to water quality and water conditions will result from the potential to increase flow velocities proximate to this permanent feature although this is not expected to impact threatened and endangered plant and bird species.

The Proposed Action would have a beneficial long-term direct impacts on native habitats important for threatened and endangered species, specifically beach and dune shoreline habitat important for piping plover, roseate tern, red knot, and seabeach amaranth in Jamaica Bay by protecting shorelines from future erosion associated with storm surges.

5.11.3 Action Alternative Impacts

Additional minor impacts on federal and state listed threatened and endangered species would occur as a result of implementation of the additional unique elements of the Action Alternative. Impacts would be similar to those described for the common project elements, but would extend across an expanded project footprint. The Action Alternative would have both short-term and long-term adverse impacts to habitats important for threatened and endangered species populations, consistent with the common elements discussed above.

- Construction of elevated promenades, floodwalls and/or levees would have a footprint and maintained easement area that would have both short- and long-term minor impacts to intertidal wetlands and non-native wetlands. No long-term impacts are anticipated given that the threatened and endangered species listed in Table 4.9-1 are not likely to use these areas.
- Construction of bulkheads and/or seawalls will have short-term minor impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat and subtidal bottoms. No long-term impacts are anticipated, as the threatened and endangered species listed in Table 4.9-1 are not likely to use these areas. No change is anticipated in the extent of hardened shorelines; therefore, no long-term impacts are expected for birds.
- Living shorelines will have a long-term benefit on native shoreline habitats throughout the bay that may be used by some threatened and endangered species.

Mitigation discussed in HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements, is intended to offset long-term impacts to natural habitats affected by the Action Alternative.

5.11.4 No-Action Alternative Impacts

The No-Action Alternative will potentially have indirect adverse effects on threatened or endangered terrestrial and aquatic species through the continued, on-going impacts to their habitats from high energy storm events as discussed in Section 5.6, Aquatic and Terrestrial Habitats. These impacts can reduce the quality and extent of these habitats in Jamaica Bay, negatively impacting the aquatic and terrestrial species that use them. In particular beach/dune habitat important to seabeach amaranth and nesting and foraging piping plover, roseate tern, and red knot would be under increased threat of erosion. Climate change is expected in increase the frequency and intensity of storms that would continue to contribute to the damage and loss of these habitats over the long-term.

5.12 Land Use

An alternative could have a significant effect if it was not consistent with existing and documented future land use policies, and/or result in the loss of property value or use of existing or projected future development, including economic losses.

5.12.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts on land use would be realized by implementation of the common project elements. Construction of seawalls, groins, and floodwalls along with beach renourishment actions would serve to stabilize coastal land, protecting the land from the influence of winds, waves, currents, and sea-level changes. Stabilizing the land and protecting land resources from severe weather promotes current residential, recreational, and transportation land uses. Negligible long-term direct and indirect impacts on project area real estate are anticipated from implementation of the Proposed Action or the Action Alternative, relative to completed structure footprints and associated rights-of-way easements necessary for structure maintenance.

5.12.2 Proposed Action Impacts

Additional beneficial short- and long-term direct impacts on land use would be realized from implementation of the additional shore protection actions unique to the Proposed Action. Beneficial impacts associated with the unique Proposed Action elements would be similar to those described for the common project elements, but would be broader, particularly with construction of the hurricane barrier, which when closed during storm surge conditions, would further protect lands along the Jamaica Bay shoreline from physical degradation and negative effects of flooding.

Additional negligible long-term direct and indirect impacts on project area real estate are anticipated from implementation of the Proposed Action, as described for the common project elements.

5.12.3 Action Alternative Impacts

Additional beneficial short- and long-term direct impacts on land use would be realized from implementation of the additional shore protection actions unique to the Action alternative. Additional negligible long-term direct and indirect impacts on project area real estate are anticipated from implementation of the Action Alternative, as described for the common project elements. Land use protections afforded by the unique elements of the Action Alternative are the same as those listed for the Proposed Action, with the exception of Floyd Bennett Field, which is not protected under implementation of the Action Alternative, resulting in potential adverse minor short- and long-term effects.

5.12.4 No-Action Alternative Impacts

Significant long-term direct impacts on land use are anticipated from implementation of the No-Action Alternative. The No-Action Alternative would leave land along the coast and surrounding Jamaica Bay vulnerable to change and instability from strong waves and storm surge. Extreme storms have proven detrimental to residential developments and associated transportation corridors, in some cases making future residential use untenable. Under the No-Action Alternative, beaches would experience erosion and eventually be as much as half the

width of existing beaches, limiting recreational land use (NED Recreation Benefit for Rockaway Beach, NY, Undated).

5.13 Recreation

An alternative could have a significant impact on recreation resources if it reduced access to or prevented use of designated recreational areas. Additionally, an impact could be significant if actions associated with an alternative permanently degraded a key characteristic of a recreation resource that contributes to the resource's public appeal.

5.13.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts on recreation would be realized by implementation of the common project elements. Construction of seawalls, groins, and floodwalls along with beach renourishment actions would stabilize areas currently used for recreation, protecting recreational resources from the detrimental influence of winds, waves, currents, and sea-level changes. Long-term benefits to recreational resources described in Chapter 4, Recreation, generally result from:

- Additional areas available for sport fishing (i.e., additional groins),
- An increase in the size of recreational beach area (Rockaway),
- Improved access to comfort stations and lifeguard headquarters (Rockaway),
- Protection of beaches (Rockaway and Coney Island),
- Protection of the newly constructed Rockaway Boardwalk (NYC Parks EA, 2014),
- Protection of Coney Island recreational facilities, and
- Protection of parks (NPS, NYC, NYSDEC) throughout the study area.

The Rockaway and Coney Island CSRMUs are designed to maintain the beaches in the study area against erosion, to a width of approximately 200 feet of beach (NED Recreation Benefit for Rockaway Beach, NY, Undated). Maintaining the width of existing beaches would create an enhanced recreation experience relative to the future condition of the beach without maintenance, which would be reflected in an increase in visitation. The Rockaway Beach Attendance Study demonstrated that people would be more willing to visit Rockaway Beach if the beach restoration projects were implemented. Based on responses to beach surveys completed in the summer of 2015, it was estimated that a 50 percent reduction in beach width would reduce the annual number of visits to Rockaway Beach by 4,512,512 visits (NED Recreation Benefit for Rockaway Beach, NY, Undated). For example, the total annual Rockaway Beach project recreation benefits are $38.6 million dollars (NED Recreation Benefit Document, Undated). It is reasonable to assume that Coney Island beaches would benefit similarly.

Also need to mention something about the "living shoreline" approach and how it would include a walking path (I think). Also, will need to mention how the common actions will generally be protective of the "New *Jamaica Bay-Rockaway Parks* Combined Parklands Boundary" mentioned in this document: http://www.nycgovparks.org/pagefiles/71/Conceptual-Plan-Final-

Report.pdf and here: http://www.nycgovparks.org/facility/beaches/beach-recovery/rockaway-parks-master-plan

Negligible short-term direct impacts are anticipated from disruption of access to recreation resources during project construction (e.g., beaches, parks, historic sites). Additionally, negligible short-term indirect impacts are anticipated from construction noise and dust, slightly diminishing the recreational experience of visitors who visit recreation areas during active construction. BMPs would include limiting construction hours to standard allowable hours, using noise suppressing mufflers on construction equipment, water tanker trucks for dust suppression, and covering trucks with tarps to prevent airborne dust.

5.13.2 Proposed Action Impacts

Additional beneficial short- and long-term direct impacts on recreation would be realized from implementation of the additional shore protection actions unique to the Proposed Action. Beneficial impacts associated with the unique Proposed Action elements would be similar to those described for the common project elements, but would be broader, particularly with construction of the hurricane barrier, which when closed during storm surge conditions, would further protect recreation resources throughout Jamaica Bay from physical degradation and negative effects of flooding. In particular, the portions of Gateway National Recreation Area on Floyd Bennett Field would be protected by the hurricane barrier alternative, but not protected by implementation of the Action Alternative.

Additional negligible short-term direct and indirect impacts on recreation are anticipated from implementation of the Proposed Action, as described for the common project elements.

5.13.3 Action Alternative Impacts

Additional beneficial short- and long-term direct impacts on recreation would be realized from implementation of the additional shore protection actions unique to the Action Alternative. Additional negligible short-term direct and indirect impacts on recreation are anticipated from implementation of the Action Alternative, as described for the common project elements. Recreation area protections afforded by the unique elements of the Action Alternative are the same as those listed for the Proposed Action, with the exception of Floyd Bennett Field, which is not protected under implementation of the Action Alternative, resulting in potential minor short- and long-term adverse effects.

5.13.4 No-Action Alternative Impacts

Significant long-term direct impacts on recreation are anticipated from implementation of the No-Action Alternative. The No-Action Alternative would leave land along the coast and surrounding Jamaica Bay vulnerable to change and instability from strong waves and storm surge. Extreme storms would be detrimental to recreational resources. Under the No-Action Alternative, beaches would experience erosion and eventually be as much as half the width of existing beaches, limiting recreational land use. Implementation of the No-Action Alternative

would result in Rockaway Beach continuing to experience erosion at a rate of about 10 feet per year. Based on responses to beach surveys completed in the summer of 2015, it is estimated that a 50 percent reduction in beach width would reduce the annual number of visits to Rockaway Beach by 4,512,512 visits. Beach visits per year were interpolated between these two points based on survey responses (NED Recreation Benefit for Rockaway Beach, NY, Undated).

Additionally, the No-Action Alternative could result in similar significant adverse impacts on recreational resources as occurred during Hurricane Sandy in October 2012, which devastated the area, sweeping away the majority of the Rockaway boardwalk, and many of the adjacent recreational areas on Rockaway, Following Hurricane Sandy, more than $140 million was invested to repair and restore Rockaway Beach. As part of this work, intact sections of the boardwalk were repaired, damaged beach buildings were renovated with new boardwalk islands constructed around them, public restrooms and lifeguard stations were installed to replace destroyed facilities and interim shoreline protection measures were created. The No-Action Alternative will offer no protection of the recently constructed Rockaway Boardwalk (i.e. NYP Rockaway Boardwalk EA 2014).

Additionally, on Coney Island, the New York Aquarium suffered an estimated $65 million in damages during Hurricane Sandy in October 2012. The No-Action Alternative would not protect this or other recently opened recreational resources on Coney Island, nor recreational resources within Jamaica Bay Unit of the Gateway National Recreation Area (see Chapter 4, Recreation).

5.14 Navigation

An alternative could have a significant impact if it significantly reduced, impeded, or prevented the overwater navigation of commercial and recreational vessels. Additionally, an adverse impact could be considered significant if it caused rapid accretion of sediments in a navigation channel, causing more frequent need for channel dredging.

5.14.1 Impacts Common to Both Action Alternatives

No short- or long-term direct or indirect impacts on navigation are anticipated from implementation of the common project elements. With or without implementation of the Proposed Project or the Action Alternative, commercial or recreational vessel usage of Jamaica Bay, including the Federal Navigation Channel, would be maintained to support baseline conditions or future projected conditions.

5.14.2 Proposed Action Impacts

No short- or long-term direct or indirect impacts on navigation are anticipated from implementation of the Proposed Action. The constructed hurricane barrier would be closed during a storm event; however, no adverse impact on navigation is anticipated from the closed barrier, as navigation during a storm is unlikely. After construction of the hurricane barrier, the Rockaway Inlet channel would be narrower than under existing conditions; however, adverse impacts from this narrowing are considered negligible on navigation of both commercial and

recreational vessels. Vessels would have to become familiar with the new restricted opening and be more careful regarding safe passage through the barrier opening.

5.14.3 Action Alternative Impacts

No short- or long-term direct or indirect impacts on navigation are anticipated from implementation of the Action Alternative.

5.14.4 No-Action Alternative Impacts

No short- or long-term direct or indirect impacts on navigation are anticipated from implementation of the No-Action Alternative.

5.15 Infrastructure

An alternative could have a significant effect on infrastructure if it would increase demand on a given infrastructure beyond the infrastructure's capacity, requiring a substantial system expansion or upgrade. Additionally, an impact could be significant if it would result in substantial system deterioration over current infrastructure condition beyond normal "wear and tear."

5.15.1 Impacts Common to Both Action Alternatives

Minor short-term direct impacts on airports and wharf and dock facilities are anticipated from implementation of the common project elements. The common elements of the action alternatives do not protect these infrastructure components in Jamaica Bay, including JFK International Airport and commercial and recreational wharf and dock facilities as described in Chapter 4, Infrastructure.

No short- or long-term direct or indirect impacts on rail roads; wastewater treatment; and bridge, pipeline, and cable crossings are anticipated. None of these infrastructure components are in the construction foot print of the common project elements. The borrow areas are specifically designed to avoid the pipeline and cable structures buried offshore.

Negligible short-term direct impacts on roads and traffic are anticipated from implementation of the common project elements. Roadways used by construction crews and equipment to access project construction sites would experience negligible short-term direct impacts from increased traffic congestion and wear. Temporary disruption of traffic on local roadways and thoroughfares in the area may occur during delivery of stone rubble and other construction-related materials and equipment. The primary roads affected by construction in the common project elements include those that access Rockaway Peninsula:

- Flatbush Avenue,
- Marine Parkway Bridge (aka Gil Hodges Memorial Bridge),
- Cross Bay Boulevard,
- Cross Bay Veterans Memorial Bridge,
- Rockaway Beach Boulevard,

- Beach Channel Drive, and
- Shore Front Parkway (Route 908L).

5.15.2 Proposed Action Impacts

Additional negligible and minor impacts on infrastructure would occur as a result of implementation of the additional unique elements of the Proposed Action. Impacts would be similar to those described for the common project elements, but would extend across an expanded project footprint. In particular, construction of the hurricane barrier in the Jamaica Bay inlet would increase road and traffic impacts; however, because impacts would be limited to the construction period, impacts are still considered to be negligible. Additional roads that would be impacted by construction activity include:

- 90-7C/Shore Parkway,
- NY27,
- Cropsey Avenue, and
- 908H/Ocean Parkway.

Beneficial long-term direct impacts on infrastructure would occur as a result of implementation of the additional unique elements of the Proposed Action. Specifically, beneficial long-term direct impacts on airports and wharf and dock facilities are anticipated from implementation of the unique elements of the Proposed Action, in particular, construction and use of the hurricane barrier in Jamaica Bay would protect JFK International Airport and commercial and recreational wharf and dock facilities as described in Chapter 4, Infrastructure, from degradation by severe, destructive weather events, and allow them to be operational during such events and allow them to resume operations more quickly after such events.

5.15.3 Action Alternative Impacts

Additional negligible and minor impacts on infrastructure would occur as a result of implementation of the additional unique elements of the Action Alternative. Impacts would be similar to those described for the common project elements and the Proposed Action, but would extend across an expanded project footprint. In particular, construction of the extensive seawalls and floodgates along the perimeter of Jamaica Bay would increase road and traffic impacts; however, because impacts would be limited to the construction period, impacts are still considered to be negligible.

Beneficial long-term direct impacts on infrastructure would occur as a result of implementation of the additional unique elements of the Action Alternative. Specifically, beneficial long-term direct impacts on wharf and dock facilities are anticipated from implementation of the unique elements of the Proposed Action, in particular, construction and use of the hurricane barrier in Jamaica Bay would protect JFK International Airport and commercial and recreational wharf and dock facilities as described in Chapter 4, Infrastructure, from degradation by severe, destructive weather events and allow them to operational during or more quickly after such events.

5.15.4 No-Action Alternative Impacts

No short- or long-term direct or indirect impacts on infrastructure are anticipated from implementation of the No-Action Alternative. Baseline conditions would remain as described in Chapter 4, Infrastructure.

However, the No-Action Alternative would not prevent similar adverse significant impacts on waterfront infrastructure as occurred during Hurricane Sandy in October 2012. Although barges and other "floating" infrastructure played a key role in the city's recovery from Sandy, damage to "fixed" waterfront infrastructure was extensive. The storm damaged boardwalks, landings, and terminals (NYC, Sandy and Its Impacts, 2013 [Chapter 1 in NYC Special Initiative for Rebuilding and Resiliency (SIRR), download here: http://www.nyc.gov/html/sirr/downloads/pdf/final_report/Ch_1_SandyImpacts_FINAL_singles.pdf and the entire report here http://www.nyc.gov/html/sirr/html/report/report.shtml)

Additionally, the No-Action Alternative would not prevent adverse significant impacts on transportation infrastructure as occurred during Hurricane Sandy in 2012. For example, the storm tide swamped subways and tunnels well beyond the 100-year floodplain. Subway service to the Rockaways, provided by the A line, was suspended for six months as crews performed cleanup and emergency repairs. The MTA has estimated that the cost to restore the line to its pre-storm condition could total $650 million (NYSOSC, 2014). The No-Action Alternative could require similar expenditures in the event similar damage occurs to the MTA subways.

5.16 Wastewater Treatment

An alternative could have a significant effect if it influenced the functioning of known water treatment within the project area. The location of WWTPs as well as associated CSOs are detailed in Chapter 4, Wastewater.

5.16.1 Impacts Common to Both Action Alternatives

Common project elements cross two large effluent sewer lines spanning between the Coney Island Wastewater Treatment Plant and the diffuser located in Rockaway Inlet. Alternatives D and C-1 cross these effluent sewer lines near the entrance of Sheepshead Bay, while C-2 crosses these effluent sewer lines in Rockaway Inlet. An analysis to assess whether the effluent lines can be realigned or built over requires further evaluation as part of a future, and would influence a determination of effect.

The indirect impacts of wastewater treatment on water quality from a tide gate across both Sheepshead Bay and Shellbank Creek is unknown at this time. USACE is working with NYCDEP to refine existing water quality models to evaluate potential adverse effects.

5.16.2 Proposed Action Impacts

No short term or long term direct impacts on wastewater treatment are expected. Current hydrodynamic modeling indicates minor long-term impacts to bay hydrodynamics. In turn,

impacts of an inlet gate are assumed to also have minor long-term impacts on water quality and the contribution of wastewater treatment. However, it is recognized that further analysis is required to better understand potential long-term effects on water quality. Specifically, water quality impacts for the interior basins need additional analyses to understand sensitivity of impacts to flushing and circulation. With respect to these tidal inlets that already are challenged by poor water quality, their current condition is that of limited flushing. Therefore, refinement of existing model is anticipated to address these uncertainties. Currently USACE is working with NYCDEP to utilize existing water quality models to refine evaluation of potential long-term effect on water quality within the Action Alternative impacts

5.16.3 Action Alternative Impacts

Current hydrodynamic modeling indicates minor long-term impacts to bay hydrodynamics. However, the effects of tributary tidal gates have not been evaluated at this time. To date it has been recognized that water quality impacts and the contribution of wastewater treatment for the interior basins need additional analyses to understand sensitivity of impacts to flushing and circulation. Currently USACE is working with NYCDEP to refine existing water quality models to refine evaluation of potential long-term effect on water quality within the bay.

5.16.4 No-Action Alternative Impacts

Significant long-term direct impacts to area wastewater treatment would result from implementation of the No-Action Alternative. The No-Action Alternative would leave the WWTPs along the coast and surrounding Jamaica Bay vulnerable to strong waves and storm surge. Extreme storms have proven detrimental to WWTPs, particularly due to inundation which renders them inoperable and damages equipment.

5.17 Bridge, Pipeline, and Cable Crossing

An alternative could have a significant effect if it would result in altering the location of a pipeline or cable crossing. The location of bridge, pipeline, and cable crossings are detailed in Chapter 4, Infrastructure.

5.17.1 Impacts Common to Both Action Alternatives

Common project elements could potentially affect cross charted submarine cable areas that are known to occur within the Rockaway Inlet. Details of the submarine cables (e.g., depth and cable type) are unknown at this time and will require further investigation in future design phases.

No pipelines or fiber optic lines are known within the project area.

5.17.2 Proposed Action Impacts

With the exception of potential impacts to chartered submarine cable areas, there are no other short- or long-term direct or indirect impacts related to bridges, pipelines, and cable crossings

from implementation of the additional unique elements associated with the Proposed Action Alternative.

5.17.3 Action Alternative Impacts

There are no other short- or long-term direct or indirect impacts related to bridges, pipelines, and cable crossings from implementation of the additional unique elements associated with the Action Alternative.

5.17.4 No-Action Alternative Impacts

There are no other short- or long-term direct or indirect impacts related to bridges, pipelines, and cable crossings from implementation of the additional unique elements associated with the No-Action Alternative.

5.18 Hazardous, Toxic, and Radioactive Waste

An alternative could have a significant effect if it would result in a substantial increase in the generation of hazardous substances, increase the exposure of persons to hazardous or toxic substances, increase the presence of hazardous or toxic materials in the environment, or place substantial restrictions on property use due to hazardous waste, materials, or site remediation.

5.18.1 Impacts Common to Both Action Alternatives

Adverse minor short term direct impacts could occur during construction of the common CSRMUs. Operation of the construction vehicles would increase the likelihood for release of vehicle operating fluids (e.g., oil, diesel, gasoline, anti-freeze, etc.) in the work zones. However, releases would be immediately addressed by site safety spill prevention and control measures to minimize potential impacts.

5.18.2 Proposed Action Impacts

Adverse minor short-term direct impacts could result from disturbance of a tar-like substance associated with an old factory site located off the south shore of Floyd Bennett Field. This site would potentially be disturbed by construction of the hurricane barrier where it ties in to Floyd Bennett Field, and hazardous sediments would potentially be generated, depending on results of sediment testing during excavation in this area.

Any solid and hazardous materials needed to operate the Storm Surge Barrier would be managed in accordance with USACE solid and hazardous materials SOPs and applicable Federal, State, and NYC laws.

5.18.3 Action Alternative Impacts

No short- or long-term direct or indirect impacts related to HTRW are anticipated from implementation of the additional unique elements associated with the Action Alternative.

5.18.4 No-Action Alternative Impacts

No short- or long-term direct or indirect impacts related to HTRW are anticipated from implementation of the No-Action Alternative. Following Hurricane Sandy, New York DEP undertook a study to understand the impact of the storm on sites that store hazardous substances, in accordance with Local Law 26 of 1988, more commonly known as the NYC Right-to-Know Law. Of 367 facilities that had filed reports under Local Law 26, 46 facilities were severely affected by Sandy, but reported no spills and showed no evidence of spills. Only 11 facilities reported spills related to Hurricane Sandy, but the spills had been cleaned up by the facility prior to DEP inspection or spills were completely washed out by the storm. The DEP study concluded that Though the lack of evidence of contamination may indicate that the impacted businesses had secured these chemicals sufficiently prior to Sandy or adequately remediated their sites post-storm, it also may reflect the particular reality of Sandy, as the high volume of water may have diluted and washed away any spills that occurred (http://www.nyc.gov/html/sirr/downloads/pdf/final_report/Ch11.5_EnvironProtection_FINAL_singles.pdf).

5.19 Landfills

An alternative could have a significant impact on landfills if the action compromised the integrity of the landfill's engineered barrier, resulting in the potential exposure of wastes or leaching of waste material into the environment.

5.19.1 Impacts Common to Both Action Alternatives

No short- or long-term direct or indirect impacts on landfills are anticipated from implementation of the common project elements. No landfills were identified in areas that could be affected by project activities in the Rockaway Beach CSRMU, the Coney Island tie-in, the Jamaica Bay Northwest common segment (the short segment on the western side of Gil Hodges Bridge), or the Rockaway Bayside common segment.

5.19.2 Proposed Action Impacts

Beneficial long-term direct impacts on landfills are anticipated from implementation of the additional unique elements associated with the Proposed Action. Construction of the hurricane barrier in Jamaica Bay would protect the closed landfills in Jamaica Bay, including the former Edgemere, Fountain Avenue, Pennsylvania Avenue, and Barren Island Landfills. The Proposed Action would protect landfill caps from extreme weather events that could lead to the exposure of landfill contents, such as the event that occurred at the Barren Island landfill in the 1950s, when the east shore of the cap burst, exposing the buried waste.

5.19.3 Action Alternative Impacts

Adverse minor long-term direct impacts on landfills are anticipated from implementation of the additional unique elements associated with the Action Alternative. Construction of unique Action Alternative elements, such as vertical living shorelines along the Jamaica Bay Northwest unit would not provide protection for the former Fountain Avenue, Pennsylvania Avenue, and

Barren Island Landfills. These landfills would be vulnerable to future landfill cap degradation, as described for the common project elements.

Beneficial long-term direct impacts on landfills are anticipated from construction of floodwalls along the Rockaway Bayside CRSM unit would protect the former Edgemere landfill from future landfill cap degradation, as described for the common project elements.

5.19.4 No-Action Alternative Impacts

Adverse minor long-term direct impacts on landfills are anticipated from implementation of the No-Action Alternative. The former Edgemere, Fountain Avenue, Pennsylvania Avenue, and Barren Island Landfills would remain vulnerable to future landfill cap degradation, as described for the common project elements.

5.20 Cultural Resources

As described in the Affected Environment section, cultural resources have been identified within the Area of Potential Effect (APE) for Rockaway and Jamaica Bay. This section analyzes the potential for construction and operation of the individual CSRMU elements to adversely impact those cultural resources identified within the respective APE. In cases where previous research investigations for cultural resources was inadequate or unknown within the APE, USACE will make a recommendation and/or solicit input from other agencies and stakeholders, including Native American Tribes, to decide whether additional investigation is warranted in context to the design of the individual CSRMU element within the specific APE. (For reference, please refer to the map of CSRMU elements depicted in Figure 4.17-1 in the Affected Environment section.)

5.20.1 Impacts Common to Both Action Alternatives

Several CSRMU elements are common to both action alternatives. These elements are located along the Atlantic Ocean-facing side of Rockaway peninsula. The impact from these elements within this APE is described in the following subsections.

1. Groin construction and extensions

These elements require excavating potentially undisturbed sediments up to 10 feet below the seafloor. Based on previous investigations, the potential for buried/submerged cultural resources in this area is low. Accordingly, the potential for this element to adversely impact cultural resources is low. However, USACE will consider utilizing a cultural monitor during excavation for the groin footings to document the discovery of potential cultural resources.

2. Renourishment

USACE has previously determined that sand placement should not have an adverse effect as long as it does not interfere with any features in the historic districts. The renourishment element does not intersect with any historic districts or landmarks. Accordingly, renourishment will not have an adverse effect within the Rockaway APE.

3. Borrow Area Dredging

Panamerican conducted a remote sensing survey at Borrow Area A-West and A-East in 2005 (Panamerican, 2005). Sixty-seven magnetic anomalies were recorded within the project area. Based on signal characteristics, three anomalies have the potential to represent significant cultural resources. Panamerican recommended avoidance of all three targets. If avoidance is not an option, additional archaeological investigations are recommended to identify the source of the magnetic anomalies. Additional work should consist of remote-sensing target refinement and diver assessment of the refined target location. Diver assessment should consist of a visual and tactile investigation of the ocean bed at the center of highest gamma deviation for each. In the event that there is no source of magnetic deflection located directly on the ocean bed, sub-ocean bed investigations should be conducted with a probe or hydroprobe to a depth sufficient to either meet proposed project requirements or to locate and delineate the anomaly source. All targets should be assessed as to historical significance, relative to NRHP criteria. The remaining anomalies represent debris deposited for fish havens along and in the western edge of the project area, as well as a pipeline that parallels the southern project area boundary (Panamerican, 2005).

A remote sensing survey has not been conducted at Borrow Area B-West. If USACE plans to use this borrow area, a remote sensing survey will be conducted prior to dredging any material. USACE will share the results with the NYSHPO and provide recommendations for avoidance or additional investigation, as warranted.

4. Buried seawall, beach and dune restoration

The on-land portion of this element overlaps the southern boundaries of the historic districts at Jacob Riis Park, Fort Tilden, Silver Gulf Beach Club, and the Breezy Point Surf Club. The shoreline is a part of the historic district for Jacob Riis Park, Fort Tilden and the Silver Gulf Beach Club. Construction of elements along the beach has the potential to adversely affect the historic district. The proposed alignment for this element passes through the existing footprint of the Silver Gulf Beach Club pavilion. As such, alternative alignments for this element should be considered to avoid this impact.

Additionally, the CSRMU element requires installation of pilings up to 8 feet below NAVD88. Although the presence of buried cultural resources in the piling footprint is unknown, USACE will consider additional investigations, to include utilizing a cultural monitor during construction activities.

Furthermore, the CSRMU element is designed to reach an elevation of approximately 17-18 feet NAVD88, which is several feet higher than the current ground elevation. Therefore, this element has the potential to adversely impact the viewshed when looking out at the Atlantic Ocean from within the historic district.

5.20.2 Proposed Action Impacts

This section continues the analysis of potential impacts within the Rockaway and Jamaica Bay APEs relative to the remaining CSRMU elements that are unique to the Proposed Action. Only

CSRMUs that are likely to have the potential to adversely impact an identified cultural resource are included in the following sections.

1. Levee

This CSMRU element is proposed to be constructed around the western border of the Breezy Point neighborhood. The element surrounds the Breezy Point Surf Club historic district. However, the element does not intersect with any of the key/individual elements comprising the historic district. However, the levee requires installation of pilings up to -6 feet NAVD88. Although the presence of buried cultural resources in the piling footprint is low, USACE will consider additional investigations, to include utilizing a cultural monitor during construction activities.

The top of the levee will be at an elevation of approximately 14 feet NAVD88, which is higher than the current ground surface. Views of the Atlantic Ocean, Breezy Point Tip, and the New York Harbor would be obscured within the land side of the levee. This would also obscure the view of the historic district from outside of the levee. This would result in a long-term adverse impact. This impact is unavoidable because the levee height needs to extend above the anticipated 2070 high water level in order to provide coastal storm protection.

2. Concrete Floodwall (Land)

This CSRMU element would be constructed on the Jamaica Bay-side of the Rockaway peninsula. This element intersects the dock areas at the Riis Landing and U.S Coast Guard Far Rockaway historic district boundaries. This element would have long-term adverse impact on the historic district, though not directly on any of the contributing structures. USACE should consider an alternative alignment to avoid this impact.

3. Hurricane Barrier

The Hurricane Barrier is designed to span Rockaway Inlet on the eastern side of Gil Hodges Bridge. No impact to Gil Hodges Bridge is anticipated, as the barrier would be located approximately 2,200 feet east. Views of the Atlantic Ocean and Jamaica Bay from Gil Hodges Bridge would not be obstructed but the hurricane barrier. However, views of the bridge from points in the Bay would be obstructed..

Construction of the hurricane barrier will require installation of pilings several feet below the seafloor. Although the presence of buried cultural resources in the piling footprint is low, USACE will consider additional investigations, to include utilizing a cultural monitor during construction activities.

4. Seawall Reconstruction, Concrete Floodwall (land), Elevated Promenade

These CSRMU elements will be constructed on the southern and western portions of Barren Island and within the Floyd Bennett Field historic district. The elements will roughly align with Flatbush Avenue. The heights of these elements range from 14.5-18 feet NAVD88, obstructing views of the entirety of the historic district on either side of the element, including obstruction of

views of contributing structures from the western side of the elements. The footings will be advanced to approximately -10 feet NAVD88. Although the presence of buried cultural resources in the piling footprints is unknown, USACE will consider additional investigations, to include utilizing a cultural monitor during construction activities.

The elevated promenade will be constructed within or in very close proximity to the right of way for Belt Parkway. The right of way is anticipated to be heavily disturbed and with a very low potential for encountering cultural resources. Accordingly, USACE will consider using a cultural monitor to observe the construction of the elevated promenade in areas outside of the Belt Parkway right of way, where the potential to encounter cultural resources would be relatively higher.

5. Sector Gates

The Sector Gates will span the inlets to Sheepshead Bay and Plumb Beach Channel. The foundation of the sector gates will be placed on top of the seafloor. Additionally, footings will be advanced below the seafloor. Although the potential for the presence of buried cultural resources in the piling footprints is low, USACE will consider utilizing a cultural monitor during construction activities. However, if these channels are routinely dredged, the potential for cultural resources is further decreased, and the USACE would not provide a cultural monitor. Additional consultation with other stakeholders regarding dredging frequency and depth of these channels will be used to inform USACE's decision.

6. Dune Restoration

Dune restoration would occur along the concave on-land portion of Manhattan Beach on Coney Island. The element would be constructed using buried rubble to a height of approximately 18 feet NAVD88. Although the potential for the presence of buried cultural resources in the dune footprint is low, USACE will consider utilizing a cultural monitor during construction activities. However, if this area has been previously excavated and renourished, the potential for cultural resources is further decreased, and the USACE would not provide a cultural monitor. Additional consultation with other stakeholders regarding the history of subsurface excavation within Manhattan Beach will be used to inform USACE's decision.

7. Residual Risk Features

The residual risk features surrounding Jamaica Bay vary in the elements proposed and the affected environment. Jamaica Bay has been used extensively and has been continually recontoured. Based on previous documentary research and pedestrian survey, areas around Jamaica Bay are sensitive for potentially significant cultural resources. In particular, at Dead Horse Bay, Fresh Creek, Spring Creek and Motts Point, there are remains of historic period cultural landscapes embedded in the existing environment (Panamerican 2003). These and other areas have the potential for the discovery of prehistoric and historic period deposits. Additional investigations may be required depending upon the location and element recommended.

Summary

In general, the Proposed Action will provide beneficial long-term direct impacts on cultural resources by protecting these cultural resources from further degradation or destruction by anticipated coastal storm events; for example, Floyd Bennett Field Historic District, which would be protected by implementation of the hurricane barrier, but would not be protected by implementation of the Action Alternative.

A programmatic agreement will be executed to develop a process for identifying additional investigations as well as avoidance, minimization and mitigation efforts for adverse effects to historic properties. In addition, during construction, BMP for all CSRMU elements, to prevent potential impacts to undiscovered resources, all construction personnel would be instructed on procedures to follow in case previously unidentified archeological resources were uncovered during construction. The procedure would include:

- Cease work in the area of a discovery immediately.
- Contact the assigned USACE project cultural resources specialist.
- Consult with the New York State Historic Preservation Officer, in accordance with 36 CFR§ 800.13.
- Follow provisions outlined in the Native American Graves Protection and Repatriation Act (1990) in the unlikely event that human remains are discovered.

5.20.3 Action Alternative Impacts

Beneficial short- and long-term direct impacts on cultural resources are anticipated from implementation of additional protective measures associated with the unique elements of the Action Alternative. Long-term benefits are anticipated from protection of additional cultural resources from degradation or destruction by severe weather events. Cultural resource protections afforded by the unique elements of the Action Alternative are the same as those listed for the Proposed Action, with the exception of Floyd Bennett Field, which is not protected under implementation of the Action Alternative, resulting in potential adverse minor short- and long-term effects.

5.20.4 No-Action Alternative Impacts

Adverse significant short- and long-term direct impacts on cultural resources are anticipated from implementation of the No-Action Alternative. Not implementing the proposed coastal protective measures would leave cultural resources vulnerable to degradation and destruction by future extreme weather events.

5.21 Socioeconomics

An alternative could have a significant impact if it causes significant direct effects on the local economy and population, and related indirect effects on other socioeconomic resources. Socioeconomic impacts would be considered significant if the Proposed Action resulted in

measurably affected regional employment, earnings, or community resources, such as schools and public safety services (e.g., police, fire, and emergency response).

5.21.1 Impacts Common to Both Action Alternatives

Beneficial short-term and long-term direct and indirect impacts on socioeconomics would be realized by implementation of the common project elements. Benefits from common project elements include:

- Construction of seawalls, groins, and floodwalls and dredging for beach renourishment actions would provide employment for local construction workers.
- Secondary economic benefits would be realized through those construction workers spending earnings in the local economy.
- Construction material providers (e.g., stone rubble and other construction-related materials) and equipment rental vendors would also benefit financially from the construction activities.
- Construction of seawalls, groins, and floodwalls and beach renourishment actions would serve to stabilize coastal land, protecting the land from the influence of winds, waves, currents, and sea-level changes. Stabilization of recreational assets (e.g., Rockaway Beach and Gateway National Recreation Area) would increase spending by visitors in the surrounding community. Gateway National Recreation Area concessioners would also benefit the local economy through business spending and employment (GMP/EIS NPS, 2015).
- Land stabilization would improve residential and business property values, particularly on Rockaway Peninsula.

5.21.2 Proposed Action Impacts

Additional beneficial short- and long-term direct and indirect impacts on socioeconomics would be realized from implementation of the additional shore protection actions unique to the Proposed Action.

5.21.3 Action Alternative Impacts

Additional beneficial short- and long-term direct impacts on socioeconomics would be realized from implementation of the additional shore protection actions unique to the Action alternative.

5.21.4 No-Action Alternative Impacts

None of the socioeconomic benefits identified above for the action alternatives would be realized from implementation of the No-Action Alternative.

Adverse significant short- and long-term direct impacts on socioeconomics are anticipated from implementation of the No-Action Alternative. Impacts are considered significant because of the documented impacts from Hurricane Sandy to affected areas of the New York City metropolitan area. For example Hurricane Sandy caused such economic impacts as 43 deaths, 6,500 patients evacuated from hospitals and nursing homes, approximately 90,000 buildings damaged in the

inundation zone, 1.1 million New York City children unable to attend school for a week, close to 2 million people left without power, 11 million travelers affected daily, and $19 billion in overall damage (http://www.nyc.gov/html/sirr/downloads/pdf/final_report/Ch_1_SandyImpacts_FINAL_singles.pdf). The No-Action Alternative would leave residential, commercial, and recreation land use areas along the coast and surrounding Jamaica Bay vulnerable to similar future damages from extreme weather similar to what was experienced as a result of Hurricane Sandy.

Additionally, the local economy would suffer over the long term due to reduced property values, reduced visitor use of recreation areas, and loss of commercial revenue associated with the local economy. For example, the total annual Rockaway Beach project recreation benefits are $38.6 million dollars (NED Recreation Benefit Document, Undated). Additionally, long lasting service disruptions (healthcare, transportation, telecommunications, electricity, liquid fuels, water supply, wastewater treatment) would occur during future extreme weather events, such as were experienced during the Superstorm Sandy storm surge, which impacted communities within and outside of the storm surge inundation area (SIRR, 2013).

5.22 Demographics

An alternative could have a significant impact if it caused substantial adverse changes in specific population groups within a given geography. Adverse impacts would be would arise if an alternative's activities caused a disproportionate adverse environmental impacts on one demographic group over another demographic group, for example senior citizens are disproportionately affected.

5.22.1 Impacts Common to Both Action Alternatives

No short- or long-term direct or indirect impacts on regional demographics are anticipated from implementation of the common project elements. No activities associated with the Proposed Action or the Alternatives would create conditions that would affect the birth, death, migration, or immigration in the local a population. Additionally, specific demographic groups would not be negatively or positively affected, including age groups; occupational groups; gender groups; racially, ethnically or culturally distinctive groups; political groups; or value-based groups.

5.22.2 Proposed Action Impacts

No short- or long-term direct or indirect impacts on regional demographics are anticipated from implementation of the unique elements of the Proposed Action.

5.22.3 Action Alternative Impacts

No short- or long-term direct or indirect impacts on regional demographics are anticipated from implementation of the unique elements of the Action Alternative.

5.22.4 No-Action Alternative Impacts

No short- or long-term direct or indirect impacts on regional demographics are anticipated from implementation of the No-Action Alternative.

5.23 Environmental Justice

Race, poverty, and environmental justice issues would arise if activities associated with an alternative caused a disproportionate impact to low-income or minority populations. Disproportionate impacts could be related to human health effects or environmental effects.

5.23.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts on Potential Environmental Justice Areas (PEJAs) would be realized by implementation of the common project elements. Construction of seawalls, groins, and floodwalls along with beach renourishment actions as part of the Rockaway Beach CRSM unit, the Coney Island tie-in, the Jamaica Bay Northwest common segment, and the Rockaway Bayside common segment would stabilize residential areas defined as PEJAs. These PEJAs would be protected from the detrimental effects of winds, waves, currents, and sea-level changes. Adverse impacts from storm damage are felt more deeply by communities with high levels of poverty, because community residents have limited financial resources available for rebuilding structures and replacing damaged possessions. Conversely, benefits of property protection realized from the common project elements would be more beneficial to areas with higher levels of poverty (e.g., PEJAs).

5.23.2 Proposed Action Impacts

Beneficial short- and long-term direct impacts on PEJAs, in addition to those realized by implementation of the common project elements, would be realized from implementation of the additional shore protection actions unique to the Proposed Action.

5.23.3 Action Alternative Impacts

Beneficial short- and long-term direct impacts on PEJAs, in addition to those realized by implementation of the common project elements, would be realized from implementation of the additional shore protection actions unique to the Action Alternative.

5.23.4 No-Action Alternative Impacts

Adverse significant long-term direct impacts on PEJAs are anticipated from implementation of the No-Action Alternative. The No-Action Alternative would leave Rockaway Peninsula and Jamaica Bay PEJAs vulnerable to property damage from strong waves and storm surges associated with extreme weather events. Adverse impacts, as discussed in Section 5.23.1, above, from extreme storm damage are felt more deeply by communities with high levels of poverty.

5.24 Aesthetics

An alternative could significantly affect visual resources if it resulted in abrupt changes to the complexity of the landscape and skyline (i.e., in terms of vegetation, topography, or structures) when viewed from points readily accessible by the public. Adverse impacts would be significant if area residents and visitors would respond negatively to changes, concluding that changes degrade the viewshed from key observation points in the area.

5.24.1 Impacts Common to Both Action Alternatives

Beneficial long-term direct impacts on aesthetics would be realized by implementation of the common project elements. Construction of seawalls, groins, and floodwalls along with beach renourishment actions would stabilize areas currently frequented by residents and visitors seeking to connect with significant natural or built features, including area beaches, parks, and landmark structures and districts. Implementation of protective features and beach renourishment common to both action alternatives would protect the project area's natural and culturally significant resources from the detrimental influence of winds, waves, currents, and sea-level changes. As discussed under impacts to recreation, based on responses to beach surveys completed in the summer of 2015, it was estimated that a 50 percent reduction in beach width would reduce the annual number of visits to Rockaway Beach by 4,512,512 visits (NED Recreation Benefit for Rockaway Beach, NY, Undated).

Negligible short-term direct impacts to area aesthetics are anticipated from the presence in the viewshed of heavy equipment during project construction and from temporary increases in dust and exhaust from construction activities. Construction BMPs would be implemented to reduce the severity of these impacts to negligible levels to the maximum extent possible. BMPs would include limiting construction hours to standard allowable hours, using noise suppressing mufflers on construction equipment, water tanker trucks for dust suppression, and covering trucks with tarps to prevent airborne dust.

5.24.2 Proposed Action Impacts

Additional beneficial short- and long-term direct impacts on aesthetics would be realized from implementation of the additional shore protection actions unique to the Proposed Action. Additional negligible short-term direct and indirect impacts on aesthetics are anticipated from implementation of the Proposed Action, as described for the common project elements, because of the greater extent of the Proposed Action project footprint.

5.24.3 Action Alternative Impacts

Additional beneficial short- and long-term direct impacts on aesthetics would be realized from implementation of the additional shore protection actions unique to the Action Alternative. Construction of unique Action Alternative elements, such as vertical living shorelines along the Jamaica Bay Northwest unit would increase the aesthetics along stretches of shoreline, particularly where paths and trails make shoreline vistas accessible to the public. As a BMP,

landscape vegetation used in living shorelines should not grow to heights that would impair views of water features from key near-shore observation points.

Additional negligible short-term direct and indirect impacts are anticipated from implementation of the Action Alternative, as described for the common project elements, because of the greater extent of the Action Alternative project footprint.

5.24.4 No-Action Alternative Impacts

Adverse significant long-term direct impacts on aesthetics are anticipated from implementation of the No-Action Alternative. The No-Action Alternative would leave land along the coast and surrounding Jamaica Bay vulnerable to change and instability from strong waves and storm surge. Extreme storms would negatively alter the aesthetic landscape, including beaches, parks, and landmark structures and districts. Negative impacts to aesthetics would contribute to the loss in recreational beach visits, as described in Section 5.13, Recreation.

5.25 Floodplains

EO 11988 (Floodplain Management) requires Federal agencies to avoid "to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative." In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities" for:

- Acquiring, managing, and disposing of Federal lands and facilities;
- Providing Federally undertaken, financed, or assisted construction and improvements; and
- Conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

USACE ER 1165-2-26 contains the USACE's policy and guidance for implementing EO 11988. Per ER 1165-2-26, the USACE must first determine whether there are practicable alternatives to placing a proposed project in a floodplain. In addition, ER 1165-2-26 specifies that all reasonable factors should be taken into consideration when determining practicability. These factors are conservation, economics, visual elements, natural and beneficial values served by floodplains, impact of floods on human safety, locational advantage, the functional need for locating the development in the floodplain, historic values, fish and wildlife habitat values, endangered and threatened species, Federal and state designations of wild and scenic rivers, refuges, etc., and, in general, the needs and welfare of the people.

To assist in complying with EO 11988, the USACE has issued guidance (USACE ER 1165-2-26), as it pertains to planning, design, and construction of USACE projects. The Water

Resources Council Floodplain Management Guidelines for implementation of EO 11988, as referenced in USACE ER 1165-2-26, requires an eight-step process that agencies should carry out as part of their decision-making on projects that have potential impacts on, or are sited within, the floodplain. The eight steps reflect the decision-making process required in Section 2(a) of EO 11988.

5.25.1 Proposed Action Impacts

In order to demonstrate the Proposed Action complies with EO 11988 and to address related public safety concerns, the following documentation is provided. The existing floodplain management activities, including the National Flood Insurance Program-related actions and requirements are described in the following responses to the eight-step process. The conclusion that the TSP (Proposed Action) is the most practicable alternative to minimize both short- and long-term adverse impacts associated with modification and occupancy of the base floodplain is detailed in item 8, below.

1. *Determine if the proposed action is in the base floodplain.*

Yes, the Proposed Action lies within the base floodplain. The TSP encompasses portions of Kings, Queens, and Nassau counties. The entire project area lies in the base floodplain. The area currently has no hurricane flood protection systems. The TSP for the project area includes the construction of a Coastal Storm Management Units, including seawalls, floodwalls, levees, and hurricane barriers located within the base floodplain.

2. *If the action is in the base floodplain, identify and evaluate practicable alternatives to the action or to location of the action in base floodplain.*

Alternatives have been evaluated and not carried forward, as they were either not practicable or did not meet the goals of the Proposed Action. Coastal storm flood risks are addressed by the TSP. A coastal flood risk analysis followed the "Principles and Guidelines for Water and Related Land Resources," dated March 1983, including evaluation of contributions to NED and reducing potential life-safety risk. Plan formulation and screening of plans described in this Hurricane Sandy General Reevaluation Report/Environmental Impact Statement (HSGRR/EIS) is the basis for concluding there are no practicable alternatives to locating the proposed flood risk management plan in the base floodplain. The main Federal objective of reducing coastal flood risk cannot be achieved by alternatives outside the floodplain. All structural alternatives considered were located in the base floodplain.

Practicable non-structural alternatives like flood proofing, structure relocation, permanent evacuation, and instrumentation were considered. Flood proofing, structure relocation and permanent evacuation were removed from consideration because they were not viable for broad application across the project area and are not economically viable.

3. *State whether the proposed action would induce development in the base floodplain.*

The Proposed Action would not induce development in the base floodplain. The Proposed Action would occur in areas within the three counties that are highly urbanized and have substantial industrial investment. Urban development is located on the protected side of the proposed hurricane flood protection systems. Accordingly, the TSP would protect the urban development in the project area within the three counties. All three counties participate in the National Flood Insurance Program (NFIP) which specifies how cities that participate should manage floodplain development, particularly through zoning ordinances and building codes. No indication exists that these counties have any intention of opting out of the NFIP at any point in the future.

4. *Identify the impacts in the base floodplain of the proposed action and any induced development.*

Impacts within the base floodplain are presented in the HSGRR/EIS. Potential impacts on the base floodplain are described for the TSP. Impacts on fish and wildlife, cultural resources, recreation, and other floodplain resources are considered in the Environmental Impact Statement. Avoidance and minimization of impacts on existing floodplain resources has been considered in the development of the TSP. Most of the expected losses or impacts on existing floodplain resources are expected to be compensated by the benefits provided by the Proposed Action. Mitigation requirements for the TSP are described in the GRR/EIS. The TSP is not anticipated to induce any substantial new development within the base floodplain.

5. *Describe measures available to minimize adverse impacts on the natural and beneficial floodplain values.*

Avoidance and minimization efforts for all resources are described in the HSGRR/EIS. The TSP would permanently affect approximately 154 acres of habitat. Mitigation requirements for the Proposed Action would be satisfied by the combination of the construction of the Floyd Bennett Field Wetlands Habitat Creation project and the Elders Island project. These projects would provide a total of 247 acres of habitat, which is an increase of 93 acres more than existing conditions.

6. *Describe the effect of the above topics on any reevaluation of alternatives and on the final plan selection*

A re-evaluation of alternatives was not required because of considering the topics listed above. There are no remaining unmitigated adverse effects on natural and beneficial floodplain due to implementation of the TSP.

7. *Finding and Explanation*

EO 11988 requires Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The TSP does not support direct or indirect floodplain development within the base floodplain.

USACE will lead public outreach efforts to local communities starting with the Draft HSGRR/EIS scoping meeting, and will continue throughout the NEPA process. Public and agency reviews of the Draft HSGRR/EIS will be conducted and relevant public and agency comments will be considered in the Final HSGRR/EIS.

8. Critical Actions

The TSP is the most responsive to the planning objectives established in the Environmental Impact Statement and is consistent with the requirements of this Executive Order. The TSP is the most practicable alternative to minimize both short- and long-term adverse impacts associated with modification and occupancy of the base floodplain while maintaining the avoidance of direct and indirect development in the floodplain. The TSP also seeks to minimize impacts on health and human safety and, where possible, to preserve the natural and beneficial uses of the floodplain.

5.25.2 No-Action Alternative Impacts

No short- or long-term direct or indirect impacts on floodplains are anticipated from implementation of the No-Action Alternative.

6.0 CUMULATIVE IMPACTS

As defined by CEQ Regulations at 40 CFR Part 1508.7, cumulative impacts are those that "result from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions, without regard to the agency (Federal or non-Federal) or individual who undertakes such other actions." Cumulative impact analysis captures the effects that result from the Proposed Action in combination with the effects of other actions in the Proposed Action's region of influence (ROI). A cumulative impacts analysis is intended to give a better picture of the additive or total impacts a given resource may experience when the impacts of unrelated actions or events are added to the predicted impacts of the alternative being evaluated. Analysis of cumulative impacts considers how the Proposed Action affects sensitive resources directly or indirectly, and also what other effects have occurred, are occurring, or might occur to these resources from other, related or unrelated activities within the Proposed Action's ROI. The analysis of cumulative effects is an extension of the impacts analysis performed to determine the significance of direct and indirect, project-specific effects.

The TSP and the cumulative impacts of the proposed Action maybe revised at the Agency Decision Milestone (ADM) based on responses from public, policy, and technical reviews of this Draft HGRR/EIS, specifically for the alignment of the Storm Surge Barrier and residual risk features.

The first step in cumulative impacts analysis is identification of resources that could be impacted by the Proposed Action, as presented in Section 7.1 through 7.22 (Environmental Consequences). Resources deemed to have no impacts from the Proposed Action were eliminated from the cumulative impacts analysis; resource areas that would not experience impacts could not contribute cumulatively to regional effects. Based on the impacts analysis, resources with minor adverse impacts from the Proposed Action were considered for inclusion in the cumulative impacts analysis. The following resources were included in the cumulative impacts analysis, based on the conclusion that the Proposed Action would have a minor adverse impact on the resource and could contribute to cumulative regional impacts.

- Soils
- Sediments (bathymetry and sediment)
- Water Quality (surface and ocean)
- Vegetation (including invasive species and terrestrial habitat)
- Wetlands (including aquatic habitat)
- Fish
- Benthic Community
- Wildlife
- Protected Species and Critical Habitat

Secondly, the ROI for each resource under each alternative scenario was defined in order to evaluate cumulative impacts resulting from projects that are proposed or anticipated within the

foreseeable future. The ROI for all resources considered for the cumulative impacts analysis is defined as the "greater New York Metropolitan area" coastal and estuarine regions.

Thirdly, the relevant past, present, and reasonably foreseeable future actions in the ROI were researched. Regional projects were evaluated for inclusion in the analysis that could cumulatively affect each identified resource, considering both the magnitude and significance of the potential cumulative effects.

Representative projects were researched and considered in broad categories of regional projects. Dozens of regional projects were identified, and those with a potential to introduce cumulative impacts in conjunction with potential effects of the Proposed Action were included in the analysis.

Recent, on-going, and proposed actions planned over the next several years with a potential interaction with effects of the Proposed Action are described below. The project sub-headings are broad project classifications. Cumulative impacts for the resource areas identified in Table 7.2 are summarized in Section 7.23.8 Summary of Cumulative Impacts; the analysis concludes that all adverse cumulative impacts are less than significant. Beneficial cumulative impacts are also summarized in Section 7.23.8 Summary of Cumulative Impacts.

6.1 Special Aquatic Habitat Programs Including Wetlands

Changes in sediment deposition to Jamaica Bay have been studied as a possible cause of the documented disappearance of wetlands in the bay. Understanding the possible relationship between sediment transport and marsh losses informs an analysis of regional projects that may cumulatively affect Jamaica Bay. Changes in sediment input result from the following types of human undertakings (Gateway National Recreation Area, National Park Service, Jamaica Bay Watershed Protection Plan Advisory Committee, August 2, 2007):

- Hardening of the bay's perimeter from increased residential and commercial development, which reduce the overall sediment load to the bay.
- Channeling of overland flow through storm sewers and combined sewer overflows, which redistributed the sediment load to the bay.
- Changing the bay's physical contours by westward progression of the Rockaway Peninsula, which alters sediment transport and affects water circulation.
- Dredging of navigational channels may be acting as sediment sinks and the increased wave energy and sediment flushing time caused by a deeper average depth may affect sediment accretion.
- Altering Jamaica Bay's tributaries, basins, creeks, and canals until there is little or no freshwater flow other than that conveyed by the sewage treatment, water pollution control plants, and storm sewers.

Regional projects that lead to any of the above outcomes potentially disrupt sediment transport in Jamaica Bay, including the Proposed Action. Combined sewer overflow (CSO) projects are discussed in Section 17.23.5, Long Term Combined CSO Projects below. Regional programs are being implemented to restore degraded or diminished aquatic habitat, including wetlands. Regional projects are described in the following subsections.

6.1.1 Yellow Bar, Black Wall and Rulers Bar Marsh Island Restoration 2012

The Marsh Islands Complex is an integral part of Jamaica Bay, targeted for restoration by the U.S. Army Corps of Engineers, The Port Authority of New York and New Jersey, National Park Service (Gateway), New York State Department of Environmental Conservation, New York City Department of Environmental Protection, the National Resources Conservation Service and the New York/New Jersey Harbor Estuary Program. Restoring salt marshes and coastal wetlands in Jamaica Bay are a critical component of the Comprehensive Restoration Plan for the Hudson Raritan Estuary.

The U.S. Army Corps of Engineers, New York District awarded a contract on March 23,2012 to restore Black Wall and Rulers Bar Marsh Islands in Jamaica Bay, N.Y. The project was designed to beneficially use clean sand from the New York-New Jersey Harbor 50-foot deepening project to restore marsh habitat in Jamaica Bay.

Following completion of the placement of 375,000 cubic yards of Ambrose Channel sand that is being used to restore 42 acres of marsh at Yellow Bar Hassock Marsh Island, an additional 250,000 cubic yards of sand from the Ambrose Channel deepening project were beneficially used to restore 22 acres of marsh at the Black Wall and 12 acres of marsh at Rulers Bar.

Approximately 45.5 acres of salt marsh habitat were restored at Yellow Bar Hassock via placement of approximately 375,000 cubic yards of sand from Ambrose Channel. The 45.5 acres of marsh is comprised of approximately 13.1 acres of transplanted low marsh plant hummocks, 21,859 high marsh transition plants and 17,175 high marsh plants planted on 4.427 acres and 350 pounds of dispersed seed over 27.75 acres.

Ambrose Channel sand was also beneficially used in September and October 2012 to restore an additional 30 acres of marsh islands at Black Wall (155,000 cubic yards of sand, 20.5 acres) and Rulers Bar (95,000 cubic yards of sand – 9.8 acres).

6.1.2 Broad Channel's Sunset Cove Salt Marsh Restoration Project

The New York State Department of Environmental Conservation, the New York City Department of Environmental Protection with the local non-profit organizations EcoWatchers, Jamaica Bay Guardian and the American Littoral Society, completed a community-based planting effort to vegetate 30 new acres created at Black Wall and Rulers Bar. Plantings in June 2013 included a mixture of smooth cord grass or salt marsh cord grass (Spartina alterniflora), salt marsh cord grass, salt meadow cord grass or salt hay (Spartina patens), and spike grass (Distichis spicata). The marsh island restoration efforts are providing valuable data on the cause of problems and assisting to

identify optimum effective future restoration options. This program also has significant implications for the future success of restoration activities from beneficially using sand from the Operations and Maintenance (O&M) Program.

6.1.3 Oyster Reef Restoration Project for Thurston Basin

Oyster restoration has been proposed as a future action by New York City Department of Environmental Protection (DEP) for Thurston Basin, but is not yet funded. The head of Thurston Basin is three feet deep which is suitable for restoration of oyster reefs. Shallow parts of the Basin along Idlewild Park Preserve have the potential to offer opportunities for other aquatic habitat restoration. Oyster restoration in Thurston Basin can lead to a series of protective oyster reefs that can dissipate wave energy and slow tidal flows. Oyster restoration would also improve the habitat and health of both Thurston Basin, known as a top location for bird watching in New York State, as well as adjacent Idlewild Park Preserve. Oyster restoration in Thurston Basin is an effective and resilient project complimentary to the ongoing Hudson-Raritan Estuary projects such as the Jamaica Bay Oyster Bed Pilot project and the New York Harbor Schools Billion Oysters Project in addition to other projects initiated by NY/NJ Baykeeper.

6.1.4 NY & NJ Harbor Deepening Contract Marsh Restoration

The project includes construction of four marsh restoration projects. Two marsh restoration projects at Woodbridge, NJ and Elders Point East, Jamaica Bay, NY (2006-2007, 40 acres of wetlands) were constructed as mitigation for the channel deepening. In 2009 through 2012, the project was modified to include the restoration of two additional Jamaica Bay marsh islands (Elders West and Yellow Bar Hassock) through the beneficial reuse of dredged material. In 2010 with 100 percent non-federal sponsor funding, 339,235 cubic yards of sand was beneficially used for the restoration of Lincoln Park, New Jersey.

6.1.5 Hudson-Raritan Estuary (HRE) Comprehensive Restoration Plan

The Hudson Raritan Estuary (HRE) is within the boundaries of the Port District of New York and New Jersey, and includes 8 Planning Regions: 1) Jamaica Bay; 2) Lower Bay; 3) Lower Raritan River; 4) Arthur Kill/Kill Van Kull; 5) Newark Bay, Hackensack River and Passaic River; 6) Lower Hudson River; 7) Harlem River, East River, and Western Long Island Sound; and 8) Upper Bay. As a first step, the USACE, with participation of the regional stakeholders, has developed a Comprehensive Restoration Plan (CRP) that serves as a master plan and blueprint for future restoration in the HRE region. The CRP provides the framework for an estuary-wide ecological restoration program by utilizing restoration targets -Target Ecosystem Characteristics (TECs) developed by the region's stakeholders. The CRP Program goal is to develop a mosaic of habitats that provide society with renewed and increased benefits from the estuary environment. Each TEC is an important ecosystem property or feature that is of ecological and/or societal value including restoration of coastal wetlands, shellfish/oyster reefs, eelgrass beds, water bird islands, public access, maritime forest, tributary connections, shorelines and shallow habitat, fish crab and lobster habitat, reduction of contaminated sediments and improvement of enclosed and confined waters.

The CRP provides a strategic plan to achieve the TEC goals, identify potential restoration opportunities and mechanisms for implementation. The HRE Feasibility Study will recommend specific restoration projects throughout the HRE Study Area that advance the CRP goals and provide solutions for water resource problems.

6.1.6 Beach Front Restoration and Protection Measures

The USACE New York District plans and executes an overall ecosystem restoration program to provide a comprehensive approach for addressing problems associated with disturbed and degraded ecological resources. Restoration techniques include wetland creation and restoration, streambank stabilization, reclamation and treatment of contaminated waterways, flood damage prevention, shoreline and coastal protection, and coastal zone habitat modification projects also involving beach renourishment and nourishment (similar to the Proposed Action). Projects in USACE's overall program that were considered for potential cumulative impacts are described in the following subsections.

Regional projects affecting beach fronts include the beach renourishment and nourishment projects identified in Section 6.1.5, USACE Overall Program and Coastal Zone Habitat Modifications. Each of these projects includes dredging borrow materials from off-shore sources. Regional projects requiring borrow material are discussed in this section. Some projects may have completed initial construction activities, but are considered for cumulative impacts because of plans for future, periodic nourishment.

6.1.7 Rockaway Boardwalk Reconstruction Project

The New York City Department of Parks and Recreation and the NYC Economic Development Corporation have funded this project, which is designed to reconstruct the boardwalk between Beach 20th and Beach 126th Streets in a similar footprint.

Existing concrete foundations in the way of new construction are to be removed and new steel foundations would be spaced approximately 30 feet apart. The reconstructed boardwalk will not intrude on the seaward side of the mean high water spring elevation. The typical boardwalk surface would be designed to be 3.0 feet above the 100-year storm surge elevation. This new elevation would result in raising the new boardwalk sections from approximately 1.4 feet at the eastern portion of the site to approximately 8.0 feet to the west. The reconstruction would also incorporate a sand-retaining wall underneath the boardwalk that would prevent sand migration and help to protect the adjacent beach vegetation community. Between Beach 126th and Beach 149th Streets, the project includes providing structured access to the beach with stairs and ramps across new dunes. In addition, the project would maintain the five existing at-grade crossings through the existing dunes between Beach 9th and Beach 20th Streets.

6.1.8 Long Beach

This USACE project entails the construction of a beach berm, dune and groin system to reduce the potential for storm damage along approximately 35,000 linear feet of shoreline, including the

creation or rehabilitation of at least 22 groins and the addition of more than 4.7 million cubic yards of sand. Work is scheduled to begin spring 2016 and is the first of two contracts. Contract one includes 4 new groins and 18 groin rehabilitations. Contract two, including a dune, sand nourishment and construction of crossovers, is scheduled for late 2017.

6.1.9 The Westhampton Beach Project

The project is designed to provide beach fill, taper an existing groin field, and fill the compartments of the groins in the villages of Westhampton Dunes, Westhampton Beach, and Southhampton. Approximately 4,486,600 cubic yards of sand were placed along 21,460 linear feet of beach. The project is reportedly performing better than expected.

6.1.10 West of Shinnecock Project

Starting in 2004, approximately 450,000 cubic yards of sand were placed from the inlet channel on adjacent beaches. Approximately 40,000 to 60,000 cubic yards were placed just west of the inlet jetties to address severe erosion problems in front of the fishing cooperative. The remainder were placed further downdrift to accomplish sand bypassing around the inlet. The timing of future fill to address erosion west of the jetties is still uncertain.

6.1.11 Fire Island

In late December 2008, USACE initiated projects to resupply sand to the beaches from Fire Island to Montauk Point. This work consisted of two separate projects: Smith Point and Cupsogue County Parks, with 460,000 cubic yards of sand dredged from Moriches Islet and 11 communities from Saltaire to Davis Park, with millions of cubic yards of sand added to their beaches. Sand was imported from offshore borrow areas about a mile south of Fire Island.

6.1.12 Hurricane Sandy Coastal Restoration

USACE is carrying out near-term coastal restoration work at previously completed coastal storm risk reduction projects throughout the northeast that were impacted by Hurricane Sandy in October 2012. This involves the placement of millions of cubic yards of sand along beaches impacted by Hurricane Sandy in order to restore them. The USACE New York District manages projects in New York and in New Jersey north of Manasquan Inlet. (Work south of Manasquan Inlet is managed by the USACE Philadelphia District.) Coastal restoration work includes the following five projects in New York.

- Rockaway Beach – Placed approximately 3.5 million cubic yards of sand through two contracts to repair and restore this coastal storm risk management beach project.
- Coney Island - Placed approximately 600,000 cubic yards of sand to repair and restore this coastal storm risk management beach project.
- Gilgo Beach - Placed approximately 1.5 million cubic yards of sand to complete the repair of this coastal storm risk management beach that is part of dual-purpose navigation (Fire Island Inlet) and coastal storm risk management project and to bolster nearby municipal beaches using additional funds provided by the state of New York.

- West of Shinnecock Inlet - Placed approximately 450,000 cubic yards of sand to repair and restore this coastal storm risk management beach project.
- Westhampton – USACE awarded a construction contract for this work and expects to oversee the placement of roughly 1 million cubic yards of sand by the end of 2016 to repair and restore this coastal storm risk management beach project.

Projects in New Jersey include placement of 18 million cubic yards of sand, including the two projects below managed by New York District as well as work further south in New Jersey being managed by the Philadelphia District.

- Keansburg - Placed approximately 875,000 cubic yards of sand to repair and restore this coastal storm risk management beach project. The repair and restore work also included repairs to eroded levees, repairs to the damaged wingwall adjacent to the tide gate and removal of debris along the levees.
- Sea Bright to Manasquan (includes several communities along the Atlantic Coast of New Jersey) - Placed approximately 8 million cubic yards of sand through four contracts to repair and restore this previously constructed coastal storm risk management beach project.

6.1.13 NY & NJ Harbor Deepening Contract Areas

The project area is the main navigation channels in the Port of New York and New Jersey that support the container terminals. The non-federal sponsor is The Port Authority of New York & New Jersey. The authorized project provides 50-foot deep water access to the four container terminals by deepening Ambrose Channel from deep water in the Atlantic Ocean to the Verrazano-Narrows Bridge, the Anchorage Channel (from the Verrazano-Narrows Bridge to its confluence with the Port Jersey Channel), the Kill Van Kull Channel, the main Newark Bay Channel to Pt. Elizabeth and the Port Elizabeth and South Elizabeth tributary channels, the Arthur Kill Channel adjacent to the New York Container Terminal), and the Port Jersey. Also authorized but deferred is the deepening of the Bay Ridge channel to 50-foot deep to the South Brooklyn Marine Terminal. The project also facilitates the beneficial use of nearly all dredged material from the channel deepening project, including creating fishing reefs from blasted rock, creating marshes, capping the Historic Area Remediation Site, and capping existing impacted landfills and brownfields.

Twenty dredging contracts have been awarded with 19 physically complete and one underway. Two of the last three contracts removed accumulated shoals and debris (partially due to Hurricane Sandy) in previously deepened channel areas inside the Narrows to facilitate transition of the project from construction to operation. The last contract, which involves the removal of material in utility corridors and other shoals in the Anchorage and Port Jersey Channels, is underway and will be completed shortly following the abandonment of two existing water supply siphons within Anchorage Channel. This water siphon relocation construction work by the Port Authority of NY and NJ and the NYC Economic Development Corporation was severely impacted and delayed by Hurricane Sandy such that the utility corridor deepening contract is not expected to be completed until summer of 2016.

6.2 Long-Term Combined Sewer Overflow (CSO) Projects

Municipalities are concerned about CSOs because of their effect on water quality and recreational uses in local waterways. Water treatment plants are affected by heavy rain and snow storms when combined sewers receive higher than normal flows. Treatment plants are unable to handle flows that are more than twice design capacity and when this occurs, a mix of excess stormwater and untreated wastewater discharge directly into waterways at certain outfalls. The following subsections describe CSO projects evaluated for cumulative impacts.

6.2.1 Jamaica Bay CSO Upgrade Projects

New York City Department of Environmental Protection (DEP) prepared a 2014 update to the Jamaica Bay Watershed Protection Plan. The plan, first issued in 2007, focuses on water quality improvements, ecological restoration and enhancing valuable natural resources. The update outlines the numerous initiatives DEP has undertaken, along with state and federal partner agencies, environmental advocates, leading educational institutions and community groups, to protect one of the most bountiful wildlife habitats in the Northeastern Unites States. Recent NYCDEP projects include wastewater treatment plant upgrades, oyster and ribbed mussel pilot restoration projects, wetlands restoration, green infrastructure projects and mapping.

6.2.2 New York City CSO Control Plan

Recent NYCDEP construction projects have included upgrades in key wastewater treatment facilities, storm sewer expansions and the construction of several large CSO retention tanks to further mitigate this chronic source of pollution. Existing infrastructure developments have increased NYCDEP's standardized CSO capture rate from about 30% in 1980 to over 80% in 2015. Some of the most recent increases can be attributed to the implementation of additional CSO control measures such as the Spring Creek and Flushing Bay CSO Retention Facilities that came online in 2007, and the Paerdegat Basin and Alley Creek CSO Retention Facilities, which came online in 2010.

6.3 Community Development Plans

Community development plans in the ROI can have direct cumulative effects, but such projects are also known to induce associated development. For example, improved recreational opportunities at area beaches often bring commercial development designed to serve increased visitor traffic.

6.3.1 Replacement or Repair of the Gil Hodges Bridge

The Metropolitan Transportation Authority (MTA) includes a feasibility study repair or replacement of the Gil Hodges Bridge in the 2015 – 2019 Capital Program budget. The 2015 – 2019 Capital Program budget includes rehabilitation/repair of the bridge's underwater structure, which is programmed for major construction in 2018. The 2018 rehabilitation/repair action is considered in the cumulative impact analysis; however, future replacement of the bridge is not included in this cumulative impacts analysis because a feasibility study is programed for 2018 and

the outcome of the feasibility study is speculative at this point in time (i.e., future bridge replacement options are unknown at this time).

6.3.2 The Arverne Urban Renewal Area

The 308-acre Arverne Urban Renewal Area is bounded by Beach 32nd Street, Beach 81st Street, Rockaway Freeway, and the Rockaway Boardwalk. The project is to be developed in phases. Phase I, Water's Edge, was completed in the Spring of 2001 and consisted of the construction of 40 two-family homes on four infill sites between Beach 59th Street and Beach 62nd Street, south of Rockaway Beach Boulevard. In 2006, construction began on Phase II, which consists of 130 condominiums in the same area as Phase I. The area also contains two other projects. Arverne by the Sea is intended to produce 2,300 units, half of which will be affordable to households making no more than $92,170 for a family of four. An area adjacent to Arverne by the Sea, Arverne East, has the goal of building 1,600 units of middle-income units. Forty-three percent of the units will be reserved for households with incomes no greater than $92,170 for a family of four.

6.4 Summary of Cumulative Impacts

The minor adverse impacts of the TSP on the aforementioned resource areas would not increase to significant adverse impact levels when combined with past, present, or reasonably foreseeable future impacts from other regional projects. These minor impacts are primarily associated with construction of the TSP. Cumulative adverse impacts on recreation, wetlands, water quality, sediment transport, fish and wildlife, and essential fish habitat would remain minor and short-term. This is due to the coastal storm protections afforded by the TSP to regional projects that have or are planned to restore and/or protect coastal resources located within the study area. Accordingly, the minor adverse impacts associated primarily with construction of the TSP would be offset by the cumulative long-term beneficial impacts of the TSP on, and in combination with, restorative regional projects.

Under the Alternative Action, the long-term significant adverse impacts on coastal resources within Jamaica Bay would remain at these levels in context to other regional projects. Additionally, because the Alternative Action does not provide protections to the interior coastal resources within Jamaica Bay, the Alternative Action would potentially reverse any beneficial impacts generated by other regional projects in this area. Therefore, the Alternative Action would, on its own, result in cumulative adverse impacts on coastal resources within this area; these coastal resources include wetlands, wildlife and habitat…

Implementation of the Proposed Action is not expected to have a significant cumulative adverse impact on any of the resource areas evaluated in this EIS. Cumulative net positive impacts would be realized in the local socioeconomic environment and many resource areas where protection from coastal storm events is beneficial to the resource (e.g., vegetation, wildlife, recreation).

The Proposed Action would not significantly, cumulatively increase regional adverse impacts in the areas identified by the cumulative impact analysis methodology. Minor adverse and beneficial cumulative impacts are discussed in the following sections.

6.4.1 Soils

The Proposed Action would cumulatively contribute to beneficial long-term direct impacts that would occur from the resulting built structures (e.g., groins, seawalls, floodwalls) that retain and capture littoral materials native to the beach communities and/or limit the effects of wave and storm surge erosion. Construction and extension of groins and construction of seawalls and floodwalls under the Proposed Action and in conjunction with similar regional projects would result in continued protection of beach sands and upland soils from wave action and erosion that result from significant storm events. Cumulative beneficial long-term direct impacts on soils would occur as a result of the Proposed Action and similar regional projects due to beach renourishment actions, where beach sands are replenished at prescribed intervals over project life cycles.

Cumulative minor adverse direct short-term impacts to soils would occur as a result of implementation of the Proposed Action due to such construction activities as clearing, grading, trench excavation, backfilling, and the movement of construction equipment within the project areas. Soil compaction and disturbance to and mixing of discrete soil strata cumulative impacts would be reduced through implementation of BMPs to control erosion and sedimentation during construction (e.g., installation of silt fences). Cumulative impacts would be reduced further because areas disturbed by construction activities (e.g., temporary access roads) would be restored at the end of project execution.

6.4.2 Sediments (bathymetry and sediment)

The Proposed Action would contribute to minor adverse indirect long-term impacts on sediment budgets. Construction of seawalls and floodwalls reduces sediment deposition in Jamaica Bay. Hardening of the bay's perimeter and changing the bay's physical contours may reduce sediment deposition in the bay.

Construction of seawalls and/or bulkheads in portions of the Jamaica Bay Northwest segment would cumulatively contribute to minor long-term adverse impacts on bathymetry, as they are generally recommended where a similar structure is already present. Additional scouring at the toe of the structural measures could result from amplified wave energy and increased erosion and sediment transport associated with these hardened structures. Short-term direct adverse impacts to bathymetry in Jamaica Bay could occur due to construction activities where increased sediment generation could affect depth of the water column. These effects would be minor and short-term, limited to the period of construction. Implementation of BMPs to control sedimentation and erosion and the large extent of Jamaica Bay compared to the construction footprint would minimize adverse impacts on the overall bathymetry of Jamaica Bay.

6.4.3 Water Quality (surface and ocean)

Implementation of the Proposed Action would cumulatively contribute to long term benefits by directly addressing anticipated wave climate, and preventing future shoreline erosion. Groins have the potential to alter wave climates, but would have a long-term benefit by reducing future beach renourishment requirements.

The Proposed Action would cumulatively contribute to minor short-term direct adverse impacts to ocean waters due to disturbance of subsurface sediments during construction of groins, walkovers, living shorelines, bulkheads, sea walls, and dredging of sand from the offshore burrow area. Water quality would quickly return to baseline conditions after construction activities are completed. It is anticipated that these minor short-term direct adverse construction impacts would be further minimized by implementation of BMPs.

Minor direct short-term impacts to surface water quality would occur due to common construction activities such as clearing, grading, trench excavation, backfilling, and the movement of construction equipment used during execution of the common project elements. Water quality impacts to surface water would primarily be related to increases in turbidity and suspended solids as a result of increased erosion and sedimentation, which would cause a short-term reduction in oxygen levels. These adverse construction impacts would be minimized by implementation of BMPs (e.g., silt curtains, work at low tide out of the water).

6.4.4 Vegetation (including invasive species and terrestrial habitat)

The Proposed Action would contribute positive benefits to regional terrestrial habitats in conjunction with other similar projects listed above. Projects initiated in the ROI would benefit from the shoreline and inlet CSRM features of the Proposed Action, which would serve to impede extreme storm surges, such as those experienced during Hurricane Sandy, from destroying or impeding establishment of beach vegetation communities. Similarly, terrestrial habitats that are undergoing enhancement through regional project efforts along the shores of Coney Island, Jamaica Bay, and Rockaway Peninsula will be exposed to less risk from storm surges.

Construction of floodwalls and/or levees associated with the Breezy Point portion of the Rockaway Bayside reach, as well as shared portions of the Jamaica Bay Northwest reach, would have a footprint and maintained easement area that would have both long-term minor adverse impacts to ruderal, urban, maritime forest, dune and beach habitats. In addition, areas within the limits of disturbance would have short-term minor adverse impacts to these habitats.

6.4.5 Wetlands (including aquatic habitat)

The Proposed Action would contribute positive benefits to regional aquatic habitats in conjunction with other similar projects listed above. Projects initiated in the ROI would benefit from the shoreline and inlet CSRM features of the Proposed Action. For example, the Storm Surge Barrier would reduce the potential for extreme storm surges, such as those experienced during Hurricane Sandy, to destroy or impede establishment of restored marshes in Jamaica Bay.

Construction of buried sea walls and/or groins along the Rockaway Atlantic Ocean Shorefront, as well as portions of the Jamaica Bay Northwest segments, shared by both Action Alternatives, would have short-term minor adverse impacts on beach habitats, aquatic habitat, and potentially associated dune habitats at each nourishment area. These aquatic and terrestrial habitats are likely to be recolonized from nearby communities and benthic aquatic habitats are expected to-establish to a similar community within a 1 to 2-year period (USACE 1995). No permanent impacts associated with habitat structure and/or vegetation are anticipated in this segment, as the seawall will be buried with sand in an effort to restore the existing habitat type. In fact, the project will have a net long-term benefit on these habitats by stabilizing the shoreline, increasing sediment the sediment budget, and minimizing future renourishment activities necessary to support a healthy North Atlantic Upper Ocean Beach community.

Construction of bulkheads or seawalls in both the Rockaway Bayside and Jamaica Bay Northwest reaches would have short-term minor adverse impacts to existing hardened shorelines as well as adjacent intertidal mudflat habitat.

6.4.6 Fish

The Proposed Action would contribute positive benefits to regional fish species. Constructed groins would create areas suitable for recruitment and protection for numerous fish species. Construction and extension of groins would provide living spaces for the food resource on which fish species rely and would provide shelter from wave attacks for the existing and surrounding fish communities.

The Proposed Action would contribute to minor short-term direct adverse impacts on adult and juvenile life stages of nearshore fish during construction, as mobile fish would be temporarily displaced from foraging habitat as they retreat from the area in response to construction activities. Construction related increases in turbidity and suspended solids will cause a short-term reduction in oxygen levels and reduce visibility for feeding (Reilley et al. 1978, Courtenay et al., 1980). Impacts are expected to be minor, given the temporary nature of the disturbance and the availability of suitable adjacent habitat. Adult and juvenile life stages and their prey species would quickly reestablish themselves after completion of construction.

Additional minor short-term direct adverse impacts on nearshore fish communities would occur as a result of dredging sand from the borrow areas. According to the NPS environmental documents prepared for borrow efforts indicate the adverse impacts are not significant (GMP/EIS, 2014). Additional minor short-term direct impact on benthic feeding fish species (e.g., windowpane, summer and winter flounder) would be experienced, due to temporary displacement during dredging for borrow areas. Impacts are considered minor because benthic feeding fish species are expected to avoid construction areas and feed in the surrounding area; therefore, would not be adversely affected by the temporary localized reduction in available benthic food sources. Because adverse effects to essential fish habitat would be minor, the essential fish habitat requirements of

the Magnuson-Stevens Fishery Conservation and Management Act and implementing regulations would be satisfied.

Minor short-term direct adverse impacts on nearshore fish communities would be realized by less mobile life stages (eggs and larvae) of nearshore fish, e.g., Atlantic butterfish, red hake, windowpane flounder, winter flounder, summer flounder, and scup, if present at the time of construction activities. Impacts would occur because of short-term changes to water quality, including resuspension of sediments in the water column and changes to the quality or quantity of soft bottom substrates, as discussed in Section 7.3 Bathymetry and Sediments. Impacts are considered minor, given the large extent of the Atlantic Ocean and Jamaica Bay compared to the project construction footprint. Implementation of BMPs to control sedimentation and erosion during construction would further minimize adverse impacts on eggs and larvae of nearshore fish species.

Mitigation discussed in Section 5.3.1 Habitat Impacts and Mitigation Requirements is intended to offset long-term unavoidable adverse impacts to natural habitats affected by the Proposed Action.

6.4.7 Benthic Community

The Proposed Action would contribute positive benefits to regional benthic shellfish species. Constructed groins would create areas suitable for recruitment and protection for numerous shellfish species. Construction and extension of groins would provide living spaces for the floral and faunal communities on which benthic species rely and would provide shelter from wave attacks for the existing and surrounding benthic communities. Some species, such as rockweeds (Fucus spp.), oysters, and barnacles (Balanus spp.) would flourish on the newly constructed groins (Carter 1989). Various floral species such as rockweed and spongomorpha (Spongomorpha spp.), and faunal species such as barnacle, oyster, and blue mussel, are expected to move into the area and colonize living space on groins (USACE 1995). Rockweeds are known to support numerous organisms, including both autotrophs and heterotrophs. In addition, rockweeds provide shelter, moisture at low tide, and food especially for the sessile epifaunal and epiphytic groups (Oswald et al. 1984). Gastropods, bivalves, and crustaceans are all common inhabitants of rockweeds.

Minor short-term direct adverse impacts to benthic communities are anticipated from construction activities associated with the common project elements, including future periodic renourishment. Construction would cause increased sedimentation, resulting in the smothering of existing sessile benthic communities in the vicinity of construction areas. Some mortality of shellfish, and polychaetes is expected for individuals that cannot escape during the construction process. Motile shellfish species would be able to relocate temporarily outside of the immediate project area.

6.4.8 Wildlife

The Proposed Action would cumulatively contribute to the beneficial long-term direct and indirect impacts on protected species populations, as discussed in Sections 7.9, 7.10, and 7.11. Beach renourishment of Coney Island and Rockaway beaches associated with the Proposed Action would

support healthy North Atlantic Upper Ocean Beach communities; therefore, species that rely on that vegetation community would benefit for the Proposed Action and similar regional projects.

The Proposed Action would cumulatively contribute to short-term direct minor adverse impacts to the species discussed in Section 7 Environmental Consequences. The Proposed Action and similar regional actions may cause minor adverse impacts associated with short-term construction activities that may cause direct mortality of individuals or contribute indirectly to mortality of individuals due to temporary destruction of habitat on which a species relies.

6.4.9 Protected Species and Critical Habitat

The Proposed Action would cumulatively contribute to beneficial long-term direct impacts on federally and state listed threatened and endangered species. As discussed in Section 7.6 Aquatic and Terrestrial Environments, vegetation stabilization and renourishment of Rockaway Beach would support healthy North Atlantic Upper Ocean Beach; therefore, habitats for seabeach amaranth, piping plover, red knot, roseate tern and other species that use this habitat would benefit for the 50-year life of the project. Construction of seawalls and floodwalls associated with the Atlantic Ocean Shorefront Planning Reach, the limited Rockaway Bayside reach, and the limited Jamaica Bay Northwest reach would protect shoreline vegetation from physical degradation, likewise preserving habitat for these species. Overall habitat within the intertidal zone would increase as the beach is widened with beach fill and groin structures would reduce the rate of beach loss. The physical characteristics of the intertidal habitat will not be altered because the grain size of fill material will be the same as that of project footprint native sand. USACE is engaged with the USFWS to ensure the latest reasonable and prudent measures for Piping Plovers (USFWS 2014) and standard BMPs are incorporated into the projects' Plans and Specifications detailing specific conservation measures to be undertaken to minimize potential adverse effects to protected species under their jurisdiction.

The Proposed Action would cumulatively contribute to minor short-term direct impacts to threatened and endangered species. Shoreline intertidal, subtidal, upper beach, and dune wildlife habitats would be impacted due to such construction activities as clearing and grading for temporary access road construction. Wetland habitats would be impacted by changes in surface water quality from increases in near shore turbidity and suspended solids as described in Section 7.3 Surface Water, affecting freshwater-dependent and saltmarsh-dependent wildlife species. Terrestrial upper beach zone and dune communities, dominated by sand and beachgrass would experience minor short-term direct impacts due to construction of permanent pedestrian access ramps and walkways and placement of sand barriers. Placement of groins would result in small losses of intertidal beach and subtidal aquatic habitats located within groin footprints, although groins attract benthic invertebrates and fish species that are food resources for, roseate tern, red knot, and osprey.

These activities will likely have impacts on the beach habitats of seabeach amaranth and the nesting habitat of the piping plover and roseate tern at Breezy Point and Rockaway Beaches, and

the beach foraging habitat for migrating red knots dependent on horseshoe crab reproduction on beaches in Jamaica Bay, Breezy Point, and Rockaway Beaches. Implementation of BMPs to limit construction activities during the breeding and migratory seasons and protect areas where seabeach amaranth populations are present should further minimize adverse impacts on these threatened and endangered species.

Negligible impacts on threatened and endangered sea turtles and marine mammals are expected at the time of construction these mobile species would be able to retreat from the area in response to if these species are temporarily displaced; however, impacts are expected to be minor because construction activities would be constructed during "construction windows". Impacts are considered negligible, given the temporary nature of the disturbance, the availability of suitable adjacent habitat, and the large extent of the Atlantic Ocean and Jamaica Bay compared to the project construction footprint. Implementation of BMPs to control sedimentation and erosion during construction would further minimize adverse impacts on sea turtles. In accordance with the latest NMFS recommendations (NMFS 2014) , if hopper dredges are used in the inlets or offshore borrow area between mid-June and mid-November, NMFS-approved observers will be onboard the vessels to monitor the removal of the dredge material.

Dredging offshore areas has the potential to impact the Federally-listed species Atlantic Sturgeon habitat by removal/burial of benthic organisms and increased turbidity from dredging and construction activities. Hydraulic dredges can directly impact sturgeon and other fish by entrainment in the dredge. Dredging may also impact important habitat features of Atlantic sturgeon if these actions disturb benthic fauna. Alteration of rock substrate is not a concern as this does not occur in the project area. Indirect impacts to sturgeon from either mechanical or hydraulic dredging include the potential disturbance of benthic feeding areas, disruption of spawning migration, or detrimental physiological effects of re-suspension of sediments in spawning areas.

The USACE is consulting with NMFS to ensure the latest protective BMPs (NMFS 2014), if any for cutterhead dredges, are incorporated into the projects' Plans and Specifications detailing specific conservation measures to be undertaken to minimize potential adverse effects to protected aquatic species under their jurisdiction, thereby reducing the temporary water quality impacts and general disturbances resulting from in-water construction activities. Additionally, transient listed species are expected to avoid the project area during construction activities. A Not Likely to Adversely Affect (NLAA) determination has been prepared by USACE for the Atlantic Shoreline Planning Reach of the project for NMFS' review. The Jamaica Bay Planning Reach consultation has been deferred until such time an alternative is selected and sufficient information is available for analyses.

7.0 SUMMARY OF POTENTIAL IMPACTS

Table 6-1 provides a summary comparison of impacts related to the common project elements, the Proposed Action, Action Alternative, and the No-Action Alternative. Impacts are summarized by each resource area considered in the impact analysis.

Table 6-1. Potential Impacts from the Action Alternatives and the No-Action Alternative

Section	Section Title	Common Project Elements	Proposed Action Unique Elements	Action Alternative Unique Elements	No-Action Alternative
5.1	Geologic Setting	Minor long-term direct impacts to topography	Additional minor long-term direct impacts to topography	Additional minor long-term direct impacts to topography	Significant long-term direct impacts to area topography
		Minor direct short-term impacts to soils Beneficial long-term direct impacts on soils	Minor short-term direct impacts to soils	Minor short-term direct impacts to soils	Significant long-term direct impacts to area soils
		No impacts on geology	No short- or long-term direct or indirect impacts to geology	No short- or long-term direct or indirect impacts to geology	No short- or long-term direct or indirect impacts to geology
5.2	Bathy-metry and Sediments	Minor long-term indirect impacts to bathymetry	Adverse minor long-term indirect impacts to bathymetry	Minor adverse short-term direct impacts to bathymetry	No short- or long-term direct or indirect impacts on bathymetry
		Beneficial long-term direct impacts on sediment budgets	Beneficial long-term direct impacts on sediment budget	Beneficial long-term direct impacts on sediment budget	Adverse significant long-term direct impacts to sediment budgets
5.3	Surface Water	No short- or long-term direct or indirect impacts on water levels	Beneficial long-term direct impacts on water levels	No short- or long-term direct or indirect impacts on water levels	Adverse significant long-term direct impacts on water levels
		No short- or long-term direct or indirect impacts on tidal currents	No long-term direct impacts on tidal currents	No short- or long-term direct or indirect impacts on tidal currents	No short- or long-term direct or indirect impacts on tidal currents
		No short- or long-term direct or indirect impacts on the area wind and wave climate	No short- or long-term direct or indirect impacts on wind and wave climate	No short- or long-term direct or indirect impacts on the area wind and wave climate	No short- or long-term direct or indirect impacts on the area wind and wave climate

Section	Section Title	Common Project Elements	Proposed Action Unique Elements	Action Alternative Unique Elements	No-Action Alternative
		No short- or long-term direct or indirect impacts on Jamaica Bay tributaries	No long-term direct impacts on Jamaica Bay tributaries	No short- or long-term direct or indirect impacts on Jamaica Bay tributaries	No short- or long-term direct or indirect impacts on Jamaica Bay tributaries
		Adverse minor direct short-term impacts to surface water quality	No short- or long-term direct or indirect impacts on surface water quality	No short- or long-term direct or indirect impacts on surface water quality	No short- or long-term direct or indirect impacts on surface water quality
		Minor short-term direct impacts ocean water quality	No short- or long-term direct or indirect impacts on ocean water quality	No short- or long-term direct or indirect impacts on ocean water quality	No short- or long-term direct or indirect impacts on ocean water quality
5.4	Air Quality	No impacts on regional air quality	No impacts on regional air quality	No impacts on regional air quality	Adverse short- or long-term direct or indirect impacts on regional air quality
5.5	Ground-water	No short- or long-term direct or indirect impacts on groundwater	No short- or long-term direct or indirect impacts on groundwater	No short- or long-term direct or indirect impacts on groundwater	No short- or long-term direct or indirect impacts on groundwater
5.6	Aquatic and Terrestrial Environ-ments	Beneficial long-term direct impacts on aquatic and terrestrial environments	Short- and long-term minor adverse impacts to deep water subtidal bottom habitat	Beneficial long-term direct impacts on aquatic and terrestrial environments	Adverse significant long-term direct impacts on aquatic and terrestrial environments
5.7	Invert-ebrate and Benthic Resources	Beneficial long-term direct impacts to benthic shellfish Minor short-term direct adverse impacts to benthic communities	No short- or long-term direct or indirect impacts on open water habitat Beneficial long-term direct impacts on native habitats throughout Jamaica Bay	Bbeneficial and adverse short-term and long-term adverse impacts to benthic habitats	Minor indirect adverse effects on the benthic species

Section	Section Title	Common Project Elements	Proposed Action Unique Elements	Action Alternative Unique Elements	No-Action Alternative
5.8	Fin Fish	Beneficial long-term direct impacts to fish species Minor short-term direct adverse impacts on adult and juvenile life stages of nearshore fish Adverse minor short-term direct impacts on nearshore fish communities with less mobile life stages (eggs and larvae)	Beneficial long-term direct impacts to fish species Minor adverse short- and long-term impacts to finfish populations that use deep water subtidal bottom habitat	Beneficial long-term direct impacts to fish species Minor short-term direct adverse impacts on adult and juvenile life stages of nearshore fish	Minor indirect adverse effects on the fish species
5.9	Wildlife	Beneficial long-term direct impacts on wildlife Adverse minor short-term direct impacts on wildlife from construction	Beneficial long-term direct impacts on wildlife Adverse minor short-term direct impacts on wildlife from construction	Beneficial long-term direct impacts on wildlife Adverse minor short-term direct impacts on wildlife from construction	Minor indirect long-term adverse effects on wildlife
5.10	Special Manage-ment Areas	Beneficial short- and long-term direct impacts on special management areas Adverse minor short-term direct impacts on the special management areas from construction	Beneficial short- and long-term direct impacts on special management areas Adverse minor short-term direct impacts on the special management areas from construction	Beneficial short- and long-term direct impacts on special management areas Adverse minor short-term direct impacts on the special management areas from construction	Adverse significant short- and long-term direct impacts on special management areas

Section	Section Title	Common Project Elements	Proposed Action Unique Elements	Action Alternative Unique Elements	No-Action Alternative
5.11	Protected Species	Beneficial long-term direct and indirect impacts on protected species populations Adverse minor or negligible short-term direct impacts on protected species individuals and their habitats from construction	Beneficial long-term direct and indirect impacts on protected species populations Adverse minor short-term direct or negligible impacts on protected species individuals and their habitats from construction	Beneficial long-term direct and indirect impacts on protected species populations Adverse minor short-term direct or negligible impacts on protected species individuals and their habitats from construction	Significant adverse long-term direct and indirect impacts on protected species No short-term direct or indirect impacts on protected species
5.12	Land Use	Beneficial long-term direct impacts on land use	Beneficial short- and long-term direct impacts on land use	Beneficial short- and long-term direct impacts on land use Adverse minor short- and long-term effects to Floyd Bennett Field	Significant long-term direct impacts on land use
5.13	Recreation	Beneficial long-term direct impacts on recreation Negligible short-term direct impacts from disruption of access to recreation resources during project construction	Beneficial long-term direct impacts on recreation Negligible short-term direct impacts from disruption of access to recreation resources during project construction	Beneficial long-term direct impacts on recreation Negligible short-term direct impacts from disruption of access to recreation resources during project construction Adverse minor short- and long-term effects to Floyd Bennett Field	Significant long-term direct impacts on recreation
5.14	Navigation	No short- or long-term direct or indirect impacts on navigation	No short- or long-term direct or indirect impacts on navigation	No short- or long-term direct or indirect impacts on navigation	No short- or long-term direct or indirect impacts on navigation
5.15	Infra-structure	Minor short-term direct impacts on airports	Minor short-term direct impacts on airports Beneficial long-term direct impacts on airports	Minor short-term direct impacts on airports	Minor adverse short-term on airports

Section	Section Title	Common Project Elements	Proposed Action Unique Elements	Action Alternative Unique Elements	No-Action Alternative
		Minor short-term direct impacts on wharf and dock facilities	Minor short-term direct impacts on wharf and dock facilities Beneficial long-term direct impacts on wharf and dock facilities	No short- or long-term direct or indirect impacts on wharf and dock facilities	Minor adverse short-term on wharf and dock facilities
		No short- or long-term direct or indirect impacts on rail roads	No short- or long-term direct or indirect impacts on rail roads	No short- or long-term direct or indirect impacts on rail roads	No short- or long-term direct or indirect impacts on rail roads
		Negligible short-term direct impacts on roads and traffic	Negligible short-term direct impacts on roads and traffic	Negligible short-term direct impacts on roads and traffic	Minor adverse roads and traffic
5.16	Waste-water Treatment	No short- or long-term direct or indirect impacts on wastewater treatment	No short- or long-term direct or indirect impacts on wastewater treatment	No short- or long-term direct or indirect impacts on wastewater treatment	No short- or long-term direct or indirect impacts on wastewater treatment
5.17	Bridge, Pipeline, and Cable Crossing	No short- or long-term direct or indirect impacts on bridge, pipeline, and cable crossings	No short- or long-term direct or indirect impacts on bridge, pipeline, and cable crossings	No short- or long-term direct or indirect impacts on bridge, pipeline, and cable crossing	No short- or long-term direct or indirect impacts on bridge, pipeline, and cable crossing
5.18	Hazardous, Toxic, and Radioactiv e Waste (HTRW)	Adverse minor short term direct impacts during construction	Adverse minor short term direct impacts during construction	Adverse minor short term direct impacts during construction	No short- or long-term direct or indirect impacts
5.19	Landfills	No short- or long-term direct or indirect impacts on landfills	Beneficial long-term direct impacts on landfills	Adverse minor long-term direct impacts on landfills in Jamaica Bay Beneficial long-term direct impacts on landfills along the Rockaway Bayside	Adverse minor long-term direct impacts on landfills

Section	Section Title	Common Project Elements	Proposed Action Unique Elements	Action Alternative Unique Elements	No-Action Alternative
5.20	Cultural Resources	Beneficial short- and long-term direct impacts on cultural resources	Beneficial short- and long-term direct impacts on cultural resources	Beneficial short- and long-term direct impacts on cultural resources Adverse minor short- and long-term effects at Floyd Bennett Field	Adverse significant short- and long-term direct impacts on cultural resources
5.21	Socio-economics	Beneficial short-term and long-term direct and indirect impacts on socioeconomics	Beneficial short-term and long-term direct and indirect impacts on socioeconomics	Beneficial short-term and long-term direct and indirect impacts on socioeconomics	Adverse significant short- and long-term direct impacts on socioeconomics
5.22	Demo-graphics	No short- or long-term direct or indirect impacts on regional demographics	No short- or long-term direct or indirect impacts on regional demographics	No short- or long-term direct or indirect impacts on regional demographics	No short- or long-term direct or indirect impacts on regional demographics
5.23	Race, Poverty, and Environ-mental Justice	Beneficial long-term direct impacts on Potential Environmental Justice Areas (PEJAs)	Beneficial long-term direct impacts on PEJAs	Beneficial long-term direct impacts on PEJAs	Adverse significant long-term direct impacts on PEJAs
5.24	Aesthetics	Beneficial long-term direct impacts on aesthetics Negligible short-term direct impacts to area aesthetics from heavy equipment during project construction	Beneficial long-term direct impacts on aesthetics Negligible short-term direct impacts to area aesthetics from heavy equipment during project construction	Beneficial long-term direct impacts on aesthetics Negligible short-term direct impacts to area aesthetics from heavy equipment during project construction	Adverse significant long-term direct impacts on aesthetics
5.25	Coastal Zone and Floodplain Manage-ment				

8.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

National Environmental Policy Act Section 101 2(c)(iv) requires a detailed statement on any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented. Irreversible and irretrievable resource commitments are related to the use of non-renewable resources and the effects that the use of those resources have on future generations. Irreversible commitments of resources are those that cannot be reversed except over an extremely long period of time. These irreversible effects primarily result from destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural site).

There are a number of resources, both natural and built, that would be expended in the construction and operation of the proposed actions. These resources include the materials used in construction; energy in the form of fuel and electricity consumed during construction; and the human effort (i.e., time and labor) required to develop, construct, and operate various components of the proposed actions. The resources are considered irretrievably committed because their reuse for some purpose other than the proposed actions would be highly unlikely.

The Project consists of construction of bulkheads, seawalls, living shorelines, gates, sand placement and groin construction in the Project Area. Sand removed from the borrow areas will be permanently utilized for this project, however the sand volume is a small fraction of the available sand offshore. Impacts to the benthic community would not be irreversible, as benthic communities would reestablish with cessation of placement activities. Rock for groin construction will be barged or trucked in from out of area quarries. The land use and aesthetic changes, and conversion of soils, loss of habitats associated with construction of the project features would render their use for other purposes infeasible, at least in the near term.

These commitments of land resources, energy, and materials are weighed against the public purpose and benefits of the proposed actions benefits in providing reduced vulnerability to major storms over the long term in a way that is sustainable, both for the natural coastal ecosystem and for the communities protected. No other irreversible or irretrievable commitment of resources will occur as a result of this project.

9.0 SHORT- AND LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

Pursuant to National Environmental Policy Act (NEPA) regulations (40 CFR 1502.16) an Environmental Impact Statement must consider the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. This chapter describes how the Proposed Action would affect the short-term use and the long-term productivity of the environment.

In reference to the Proposed Action, "short-term" refers to the temporary phase of construction of the proposed project and effects in the first five years, while "long-term" refers to the operational life of the proposed project (beyond 5 years) and including permanent effects. Chapter 5 of this EIS evaluates the short-term and long-term effects that could result from the Proposed Action.

Construction of the Proposed Action would result in short-term construction-related impacts such as increased turbidity, interference with local traffic and circulation, limited air emissions, increase in ambient noise levels, dust generation, disturbance of wildlife through temporary habitat disturbance, increased storm runoff, and disturbance of recreational and other public facilities. These impacts would be temporary and would occur only during construction, and are not expected to alter the long-term productivity of the natural environment.

It is anticipated that implementation of the Action Alternatives would not result in any impacts that would narrow the range of future beneficial uses of the environment because it would not pose any long-term risks to health, safety, or the general welfare of the public communities. The Proposed Action's benefits the long-term productivity of the Region's human and natural environmental uses by providing coastal storm risk management. It would reduce vulnerability to major storms over time in a way that is sustainable over the long term, both for the natural coastal ecosystem and for the communities it protects. The additive damages to homes, businesses, the area's recreational resources, and its economy would be reduced by the proposed project. These long-term beneficial effects of the Proposed Action would outweigh the mitigatable short-term impacts to the environment resulting primarily from project construction.

10.0 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

This chapter describes any potentially significant adverse environmental impacts as required by the National Environmental Policy Act. The analysis presented in this EIS has identified the potential for adverse environmental impacts and mitigation measures that would be implemented to either avoid or minimize these impacts have been identified. The adverse impacts that remain after implementing mitigation measures are considered to be unavoidable.

A summary of all impacts and mitigation measures is located in Section X of this EIS. This section describes the unavoidable adverse effects caused by the Proposed Action and Action Alternatives that would remain after applying the proposed mitigation measures (see HSGRR/EIS Section 5.3.1, Habitat Impacts and Mitigation Requirements). Where feasible, suggested mitigation measures are proposed to be incorporated into the Project planning and design to substantially eliminate the adverse impacts. In other cases, adverse impacts can be reduced but not eliminated and are therefore determined to be unavoidable.

Most unavoidable adverse impacts would occur during the construction phase of the Proposed Action or Alternative Actions and would be temporary. Unavoidable adverse effects related to Proposed Action and Action Alternatives construction would last only as long as the construction period, and would include the following:

- Soil compaction and erosion.
- Changes in land use from existing use to the Proposed Action Alternatives.
- Increased turbidity and sedimentation would be expected to affect water quality as a result of construction activities.
- Disturbance or loss of aquatic (subtidal bottom, intertidal wetland, mudflat) and terrestrial (shoreline, beach/dune, upland) habitats due to placement of structures and beach nourishment.
- Disturbance, displacement, and loss of some species of wildlife.
- Disturbance to fish, wildlife, and humans due to increase in traffic and noise from construction activities.
- Negligible short-term direct impacts are anticipated from disruption of access to recreation resources and special management areas during project construction. Negligible short-term indirect impacts are anticipated from construction noise and dust, slightly diminishing the recreational experience of visitors including special management areas during active construction.
- Roadways used by construction crews and equipment to access project construction sites would experience negligible short-term direct impacts from increased traffic and wear. Temporary disruption of traffic on local roadways and thoroughfares in the area may occur during delivery of construction materials and equipment.

- Minor short-term direct impacts on HTRW could result from disturbance of a tar-like substance associated with an old factory site located off the south shore of Floyd Bennett Field.
- Short term impacts to area aesthetics from the presence of construction equipment in the viewshed. The addition to the visual landscape of floodwalls or inlet barrier and extension of the groins.

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12.0 List of Preparers

Anderson, Bruce, Starcrest Consulting Group
B.S., Civil Engineering, Texas Tech University
Years of Experience: 25

Brighton, Nancy, U.S. Army Corps of Engineers, New York District
M.A., Anthropology, New York University
B.A., Archaeological Studies, Boston University

Years of Experience: 24

Cotta, Brooke, Mabbett & Associates, Inc.
B.S., Worcester Polytechnic Institute
Years of Experience: 2

Diamantides, Jerry, DMA
B.A. / M.A., Hunter College, City University of New York Ph. D., University of Rhode Island
Years of Experience: 40

Gallo, Jenine, U.S. Army Corps of Engineers, New York District
B.S. Marine Biology, Cedar Crest College
M.S. Marine Ecology
Years of Experience: 25

Gilmour, Richard, Arcadis
B.A. Anthropology/Sociology, Ramapo College of New Jersey M.C.R.P., City and Regional Planning, The Ohio State University
Years of Experience: 32

Glucksman, Andrew - Mabbett & Associates, Inc.
M.S., Clemson University
B.S., University of Rhode Island
Years of Experience: 14

Lockerd, Joe – Mabbett & Associates, Inc.
M.S., University of Arkansas
B.S., University of Arkansas
A.A., Casper College
Years of Experience: 30

McGarry, Christopher S., DMA
B.S., Illinois State University
M.S., University of Illinois at Urbana-Champaign
Years of Experience: 22

McGarry, Michael, David Miller & Associates
B.S., Natural Resources, Cornell University
Years of Experience: 27

Morrison Emily, Arcadis
PhD, Michigan State University
M.S., University of Kentucky
B.A., Clark University
Years of Experience: 4

Partridge, Douglas, Arcadis
M.S., Plant Ecology, University of Michigan BA, Biology and Philosophy, Kenyon College
Years of Experience: 16

Ray, Joseph, Starcrest Consulting Group
M.P.H., Environmental Management, University of Oklahoma Health Sciences Center
B.S., Microbiology, The University of Oklahoma
Years of Experience: 35

Roberts, Hugh, Arcadis
B.S. Civil Engineering, Notre Dame
M.S. Civil Engineering, Notre Dame
Years of Experience: 11

Schulze, Mike, Arcadis
B.S. Environmental Studies, Ohio Northern University
Years of Experience: 17

Smith, Robert, Biologist, U.S. Army Corps of Engineers, New York District

Vannicola, Vinicio, DMA
B.A., Virginia Polytechnic Institute
M.B.A., Darden School of Business, University of Virginia
Years of Experience: 30