A. INTRODUCTION

This chapter has been prepared to examine the potential impacts of the proposed actions' reasonable worst-case development scenario (RWCDS) on terrestrial and aquatic natural resources[1] and floodplains near the project sites (Sites A and B). (See Chapter 1, "Project Description," for details of the RWCDS.)

Specifically, the chapter:

- Describes the regulatory programs that protect floodplains, wildlife, threatened or endangered species, aquatic resources, or other natural resources within the project sites (Sites A and B);
- Describes the current condition of the floodplain and natural resources within the project sites, including water and sediment quality, and biological resources, including aquatic biota, terrestrial biota, and threatened or endangered species and species of special concern.
- Assesses future floodplain, water quality, and natural resources conditions in the future without the proposed actions;
- Assesses the potential impacts of the proposed actions on floodplain, water quality, and natural resources; and, finally
- Discusses the measures that would be developed, as necessary, to mitigate and/or reduce any of the proposed actions' potential significant adverse effects on water quality and natural resources.

PRINCIPAL CONCLUSIONS

The proposed actions would not cause any significant adverse impacts on terrestrial plant communities or wildlife, or on floodplains, wetlands, water quality, or aquatic biota in the East River and Newtown Creek. Potential benefits to natural resources that would result from the proposed actions include improved habitat for birds and other wildlife within the waterfront park and other open space areas. During final design of the project, stormwater management measures to reduce the amount and rate of stormwater generated within Site A (e.g., porous pavement, bioswales, etc.) will be considered.

[1] Natural resources are defined as "plant and animal species and any area capable of providing habitat for plant and animal species or capable of functioning to support ecological systems and maintain the City's environmental balance" (*City Environmental Quality Review (CEQR) Manual*, City of New York, 2001).

B. METHODOLOGY

OVERVIEW

This section presents the methodology used in this chapter to describe natural resources within the project sites under existing and future conditions, and to assess potential impacts on these resources from the proposed actions under the RWCDS.

Because the proposed actions would not affect the surrounding terrestrial resources or the floodplain either directly or indirectly during construction or operation of the RWCDS, the study area is limited to the boundaries of the project sites and their immediate vicinity. An exception was made for the identification of threatened or endangered species, which were evaluated for a distance of at least 0.5 miles from the project sites. The study area for water quality and aquatic resources included two water bodies: the overall aquatic resources within the East River and the East River waterfront portion of Site A; and the overall aquatic resources within Newtown Creek and the Newtown Creek waterfront portion of Site B.

The analysis of potential impacts on natural resources and floodplains from the proposed actions under the RWCDS considered the potential effects for full development of Site A in accordance with the new zoning district controls. The analysis also assumed that Site B would be redeveloped to the maximum FAR in accordance with the newly established special zoning district. Sites A and B would be constructed in one phase that would be initiated in late 2009 and completed by 2017.

EXISTING CONDITIONS

Existing conditions for floodplain, water quality, and natural resources within the study area were summarized from:

- Existing information identified in literature and obtained from governmental and non-governmental agencies, such as the New York City Department of Environmental Protection (NYCDEP) Harbor Water Quality Survey (NYCDEP 2007a and b); New York City Department of Sanitation (DSNY) Final Environmental Impact Statement (FEIS) for the New York City Comprehensive Solid Waste Management Plan (DSNY 2005); U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory maps and federally listed threatened or endangered species for Queens County, New York; U.S. Environmental Protection Agency (EPA) National Sediment Quality Survey Database, 1980-1999 (EPA 2001); New York/New Jersey Harbor Estuary Program; EPA Regional Environmental Monitoring and Assessment Program (R-EMAP); Federal Emergency Management Agency (FEMA) flood insurance rate maps; and U.S. Army Corps of Engineers (USACE) studies conducted as part of the New York and New Jersey Harbor Navigation Project.
- On-site observations.
- Responses to requests for information on rare, threatened, or endangered species in the vicinity of the project sites. These requests were submitted to the National Marine Fisheries Service (NMFS) and the New York Natural Heritage Program (NYNHP), a joint venture of the New York State Department of Environmental Conservation (NYSDEC) and the Nature Conservancy (TNC). NYSDEC maintains the NYNHP files. The NYNHP database is updated continuously to incorporate new records and changes in the status of rare plants or animals. In addition to the State program, the USFWS maintains information for federally

listed threatened or endangered freshwater and terrestrial plants and animals, and the NMFS does the same for federally listed threatened or endangered marine organisms.

- Results of sediment sampling conducted along the East River shoreline within Site A and results of soil and groundwater testing conducted as part of the Phase II environmental site assessment (ESA) conducted for Site A (TRC 2007a).
- Results of a geotechnical feasibility study conducted within Site A (TRC 2007b).

THE FUTURE WITHOUT THE PROPOSED ACTIONS

FLOODPLAINS AND TERRESTRIAL RESOURCES

In the future without the proposed actions, Sites A and B, which comprise the study area for the groundwater, floodplains and terrestrial resources, would remain under their current conditions with the exception of the wetlands mitigation that will occur within Site A without the proposed actions, in compliance with the USACE (issued February 2004) and NYSDEC (issued February 2003) permits authorizing the in-water and shoreline activities associated with the development of Stages 2, 3, and 4 of the Queens West project (see Chapter 1, section C, "Project Background," for a discussion of the Queens West project).

WATER QUALITY AND AQUATIC RESOURCES

The assessment of water quality and aquatic resources for the future without the proposed actions considered ongoing and proposed projects in the vicinity of the project sites, including:

- Water quality and sediment quality improvements expected to occur as a result of regional and local programs;
- Habitat enhancement or restoration activities associated with the New York/New Jersey Harbor Estuary Program (HEP) or Hudson-Raritan Estuary Ecosystem Restoration Project (HRE);
- Water quality improvements in the East River and Newtown Creek resulting from New York City projects. These include the development of the Waterbody/Watershed Facility Plan for Newtown Creek to address combined sewer overflow (CSO) discharges, a Drainage Basin Specific Long-Term Control Plan (LTCP) for Newtown Creek, and the City-wide LTCP that will be developed in compliance with the EPA's CSO Control Policy, and as specified in the Consent Order signed by NYSDEC and the City in 2005 (NYSDEC Case No. CO2-20000107-8); and
- Results of landside (sewer system) modeling, using the InfoWorks hydraulic model, discussed in detail below under "Assessment of Impacts from the Proposed Actions," and presented in detail in **Appendix 11.2**. Under the future condition without the proposed actions, the InfoWorks model developed for the Bowery Bay Water Pollution Control Plant (WPCP) was adjusted to account for the NYCDEP-projected increase in dry weather flow of 120 mgd for the 2017 build year, as well as infrastructure/facility changes planned by NYCDEP, and permitted wet-weather operation of the Bowery Bay WPCP.

ASSESSMENT OF IMPACTS FROM THE PROPOSED ACTIONS

With the proposed actions, stormwater discharged to the East River could affect the East River's water quality and aquatic habitats. Specifically, additional discharges to the combined sewer system generated by the proposed actions have the potential to adversely affect the volume and

frequency of CSOs to the East River and Newtown Creek, and subsequently, water quality of the East River and Newtown Creek, and are considered in the context of the City-wide LTCP and other requirements of the 2005 Consent Order to control pollutant discharges from CSOs.

Potential impacts on the floodplain, wetlands, aquatic, and terrestrial resources from the proposed actions were assessed by considering the following:

- The existing water quality and natural resources within the study area;
- Temporary impacts on water quality and aquatic organisms during construction of any in-water components, such as stormwater outfalls, modification to existing CSO outfalls, and shoreline modifications (i.e., removal of existing riprap/bulkhead and replacement with engineered riprap) associated with development of the two waterfront park areas (Sites A and B). In-water construction of these project elements has the potential to result in the following:
  - Temporary increases in suspended sediment and release of contaminants during sediment disturbance; and
  - Temporary loss of fish breeding, nursery, or foraging habitat, or Essential Fish Habitat (EFH) identified by the NMFS, from temporary water quality changes;
- Temporary impacts on water quality and aquatic biota from the discharge of stormwater during construction of the upland components of the proposed actions;
- Temporary impacts on water quality and aquatic biota from the possible discharge of groundwater recovered during dewatering;
- Results of landside (sewer system) modeling, using the InfoWorks hydraulic model, conducted to assess the potential effects on the municipal combined sewer system and Bowery Bay WPCP from the discharge of sanitary sewage generated by the proposed actions. The InfoWorks hydraulic model includes components for hydrology (rainfall-runoff) and hydraulics (pipe flow), and was used to determine runoff flows, water surface elevations, and flows within sewers. For hydrology, InfoWorks uses recorded rainfall information.[1] Sewer conditions were evaluated for CSOs. The results of the model simulations were used to estimate the total annual overflow volumes and frequencies by CSO outfall in the low-level portion of the Bowery Bay WPCP drainage, where the project sites are located, for the 2017 future with and without the proposed actions conditions. (**Appendix 11.2** presents a detailed discussion of the methods employed and results of the modeling.) The analysis evaluated potential impacts on the Bowery Bay WPCP from increased sewage flow resulting from the proposed actions, from the NYCDEP projection of a future dry weather sewage flow of 120 mgd in 2017 without the proposed actions, and a separate stormwater system in place within the project sites. The separate stormwater system that would be developed as part of the proposed actions would divert an estimated 26 million gallons of stormwater annually from the combined sewer system. Instead, this volume of stormwater would be directed to a separate stormwater management system that comprises catch basins, stormwater best management practices, storm sewers, and new stormwater outfalls to the East River and Newtown Creek.

[1] NYCDEP has adopted the calendar year 1988 hourly precipitation measured at JFK Airport as the "standard" rainfall record associated with average hydraulic/CSO conditions, for use in hydrologic modeling conducted for various NYCDEP projects (e.g., CSO Long-Term Control Plan).

- Long-term impacts on the East River and Newtown Creek water quality and aquatic biota due to potential changes in CSOs projected through the landside (sewer system) modeling. Temporary impacts on terrestrial resources associated with land clearing, grading, and other upland activities associated with construction of the proposed actions;
- Potential beneficial aquatic habitat improvements from the development of the waterfront open space in Sites A and B by replacement of existing concrete construction debris riprap and sheetpile bulkhead with engineered riprap;
- Potential long-term beneficial impacts on plants and wildlife from the proposed landscaping within the waterfront open space areas, open space areas developed along the southern side of 54th Avenue, and open space areas developed in Site B.

C. REGULATORY CONTEXT

In-water activities associated with the proposed actions—such as pier/pile repair or replacement, construction of an esplanade extension and marina, discharge of stormwater, and activities within the New York State Coastal Zone—must comply with Federal and State legislation and regulatory programs that pertain to activities in coastal areas, surface waters, floodplains, wetlands, and the protection of species of special concern.

FEDERAL

CLEAN WATER ACT (33 USC §§ 1251 TO 1387)

The objective of the Clean Water Act, also known as the Federal Water Pollution Control Act, is to restore and maintain the chemical, physical, and biological integrity of U.S. waters. It regulates point sources of water pollution, such as discharges of municipal sewage and industrial wastewater, the discharge of dredged or fill material into navigable waters and other waters of the United States, and non-point source pollution, such as runoff from streets, agricultural fields, construction sites, and mining that enter water bodies from other than the end of a pipe.

Under Section 401 of the Act, any applicant for a Federal permit or license for an activity that may result in a discharge to navigable waters must provide to the Federal agency issuing a permit a certificate, either from the state where the discharge would occur or from an interstate water pollution control agency, that the discharge would comply with Sections 301, 302, 303, 306, 307, and 316 (b) of the Clean Water Act. Applicants for discharges to navigable waters in New York must obtain a Water Quality Certification from NYSDEC.

Section 404 of the Act requires authorization from the Secretary of the Army, acting through USACE, for the permanent or temporary discharge of dredged or fill material into navigable waters and other waters of the United States. Waters of the United States is defined in 33 CFR 328.3 and includes wetlands, mudflats, and sandflats that meet the specified requirements in addition to streams and rivers that meet the specified requirements. Activities authorized under Section 404 must comply with Section 401 of the Act.

RIVERS AND HARBORS ACT OF 1899

Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the Secretary of the Army, acting through USACE, for the construction of any structure in or over any navigable water of the United States, the excavation from or deposition of material in these waters, or any obstruction or alteration in navigable water of the United States. The purpose of this Act is to

protect navigation and navigable channels. Any structures placed in navigable waters, such as pilings, piers, or bridge abutments up to the mean high water line, are regulated pursuant to this Act. USACE must evaluate the probable impacts, including cumulative impacts of the proposed activity on the public interest (benefits of the proposed activity versus potential detriments).

MAGNUSON-STEVENS ACT (16 USC §§ 1801 TO 1883)

Section 305(b)(2)-(4) of the Magnuson-Stevens Act outlines the process for the NMFS and the Regional Fishery Management Councils (in this case, the Mid-Atlantic Fishery Management Council) to comment on activities proposed by Federal agencies (issuing permits or funding projects) that may adversely impact areas designated as EFH. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 USC §1802(10)).

Adverse impacts on EFH, as defined in 50 CFR 600.910(A), include any impact that reduces the quality and/or quantity of EFH. Adverse impacts may include:

- Direct impacts, such as physical disruption or the release of contaminants;
- Indirect impacts, such as the loss of prey or reduction in the fecundity (number of offspring produced) of a managed species; and
- Site-specific or habitat-wide impacts that may include individual, cumulative, or synergetic consequences of a Federal action.

ENDANGERED SPECIES ACT OF 1973 (16 USC §§ 1531 TO 1544)

The Endangered Species Act of 1973 recognizes that endangered species of wildlife and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the nation and its people. The Act prohibits the importation, exportation, taking, possession, and other activities involving illegally taken species covered under the Act, and interstate or foreign commercial activities. The Act also provides for the protection of critical habitats on which endangered or threatened species depend for survival.

FISH AND WILDLIFE COORDINATION ACT (PL 85-624; 16 USC 661-667D)

The Fish and Wildlife Coordination Act entrusts the Secretary of the Interior with providing assistance to, and cooperation with, Federal, State, and public or private agencies and organizations to ensure that wildlife conservation receives equal consideration and coordination with other water-resource development programs. These programs can include the control (such as a diversion), modification (such as channel deepening), or impoundment (dam) of a body of water.

NEW YORK

PROTECTION OF WATERS, ARTICLE 15, TITLE 5, ECL, IMPLEMENTING REGULATIONS 6 NYCRR PART 608.

NYSDEC is responsible for administering Protection of Waters regulations to prevent undesirable activities on surface waters (rivers, streams, lakes, and ponds). The Protection of Waters Permit Program regulates five different categories of activities: disturbance of stream beds or banks of a protected stream or other watercourse; construction, reconstruction, or repair

of dams and other impoundment structures; construction, reconstruction, or expansion of docking and mooring facilities; excavation or placement of fill in navigable waters and their adjacent and contiguous wetlands; and Water Quality Certification for placing fill or other activities that result in a discharge to waters of the United States in accordance with Section 401 of the Clean Water Act.

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES) (N.Y. ENVIRONMENTAL CONSERVATION LAW [ECL] ARTICLE 3, TITLE 3; ARTICLE 15; ARTICLE 17, TITLES 3, 5, 7, AND 8; ARTICLE 21; ARTICLE 70, TITLE 1; ARTICLE 71, TITLE 19; IMPLEMENTING REGULATIONS 6 NYCRR ARTICLES 2 AND 3)

Title 8 of Article 17, ECL, Water Pollution Control, authorized the creation of the State Pollutant Discharge Elimination System (SPDES) to regulate discharges to the State's waters. Activities requiring a SPDES permit include point source discharges of wastewater into surface or groundwaters of the State, including the intake and discharge of water for cooling purposes, constructing or operating a disposal system (sewage treatment plant), discharge of stormwater, and construction activities that disturb 1 or more acres.

TIDAL WETLANDS ACT, ARTICLE 25, ECL, IMPLEMENTING REGULATIONS 6 NYCRR PART 661.

Tidal wetlands regulations apply anywhere tidal inundation occurs on a daily, monthly, or intermittent basis. In New York, tidal wetlands occur along the saltwater shore, bays, inlets, canals, and estuaries of Long Island, New York City, and Westchester County, and the tidal waters of the Hudson River up to the salt line. NYSDEC administers the tidal wetlands regulatory program and the mapping of the State's tidal wetlands. A permit is required for almost any activity that would alter wetlands or the adjacent areas (up to 300 feet inland from wetland boundary or up to 150 feet inland within New York City).

FLOODPLAIN MANAGEMENT CRITERIA FOR STATE PROJECTS (6 NYCRR 502)

Under 6 NYCRR 502, all State agencies are to ensure that the use of State lands and the siting, construction, administration, and disposition of State-owned and State-financed projects involving any change to improved or unimproved real estate are conducted in ways that would minimize flood hazards and losses. Projects are to consider alternative sites on which the project could be located outside the 100-year floodplain. Projects to be located within the floodplain are to be designed and constructed consistent with the need to minimize flood damage within the 100-year floodplain and include adequate drainage to reduce exposure to flood hazards. All public utilities and facilities associated with the project are to be located and constructed to minimize or eliminate flood damage. The regulations specify that for nonresidential structures, the lowest floor should be elevated or flood-proofed to not less than 1 foot above the base flood level so that below this elevation the structure, together with associated utility and sanitary facilities, is watertight, with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. No project may be undertaken unless the cumulative effect of the proposed project and existing developments would not cause material flood damage to the existing developments.

ENDANGERED AND THREATENED SPECIES OF FISH AND WILDLIFE; SPECIES OF SPECIAL CONCERN (ECL, SECTIONS 11-0535[1]-[2], 11-0536[2], [4], IMPLEMENTING REGULATIONS 6 NYCRR PART 182)

The Endangered and Threatened Species of Fish and Wildlife, Species of Special Concern Regulations prohibit the taking, import, transport, possession, or selling of any endangered or threatened species of fish or wildlife, or any hide, or other part of these species as listed in 6 NYCRR §182.6.

D. EXISTING CONDITIONS

This section describes existing natural resource conditions within the terrestrial and water quality and aquatic resources study areas.

GEOLOGICAL CONDITIONS

The surface topography of the project sites varies from 1 to 10 feet above mean sea level and generally slopes down to the west toward the East River. The project sites are underlain by historic fill of unknown origin consisting of varying amounts of construction debris and soil. Fill thickness varies from 10 to 58 feet under Site A. Under the northern portion of the Site A, the fill contains a layer of cobbles and boulders up to 42 feet thick. Within the eastern portion of Site A, fill is underlain by variably thick highly compressible organic silt (recent river deposits) with an average thickness of 15 feet. Below the fill and organic silt layers are residual, alluvial, and/or glacial soils. Gneiss/schist bedrock of the Fordham Gneiss Formation is encountered between 38 to 77 feet below the current land surface (TRC 2007b).

Analysis of soil samples collected from within Site A indicate elevated levels (i.e., above NYSDEC Brownfield Program Track 1 Restricted Residential use Soil Cleanup Objectives (SCOs)) of metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, and selenium) but not of volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), pesticides, or semivolatile organic compounds (SVOCs). Soil conditions within Site A do not suggest significant impacts have resulted from current or past historical site operations (TRC 2007a).

The lower East River primarily has a hard, rock bottom consisting of gravel, cobble, rocks, and boulders covered with a shallow layer of sediment.

GROUNDWATER

The depth to groundwater across the site generally varies between 7 to 14 feet below the existing ground surface, with the shallower depths closer to the East River. Within the large mounded areas, depth to groundwater is approximately 28 feet below the surface (TRC 2007b). Groundwater generally flows in a westerly direction toward the East River (TRC 2007a). Analysis of groundwater samples collected from within Site A indicate that concentrations of VOCs are generally below the New State Ambient Water Quality Standards and Guidance Values for Class GA fresh groundwater (Chapter X, Division of Water Resources, Part 701), the most likely groundwater classification that NYSDEC would assign to the project sites. Concentrations of VOCs only exceeded Class GA standards at wells located near an active fuel oil underground storage tank (UST). No PCBs or pesticides were detected in groundwater samples, and SVOCs are also generally below Class GA standards.

All groundwater samples had concentrations of metals above Class GA standards, with iron, magnesium, manganese, and sodium the metals most frequently in exceedance. Elevated levels of these metals are most likely due to intrusion of brackish water from the East River. Other metals reported at concentrations exceeding Class GA standards include antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, and thallium. Concentrations of dissolved metals (antimony, thallium, iron, magnesium, manganese, and sodium) are also above Class GA standards. The concentrations of dissolved iron, magnesium, manganese, and sodium most likely reflect intrusion of brackish water from the East River. Groundwater quality in the study area does not suggest that significant impacts have resulted from current or past historical site operations (TRC 2007a).

The project sites are within the area designated for the Brooklyn Queens Sole Source Aquifer. However, groundwater is not used as a potable water supply in this part of Queens, and non-potable use is limited.

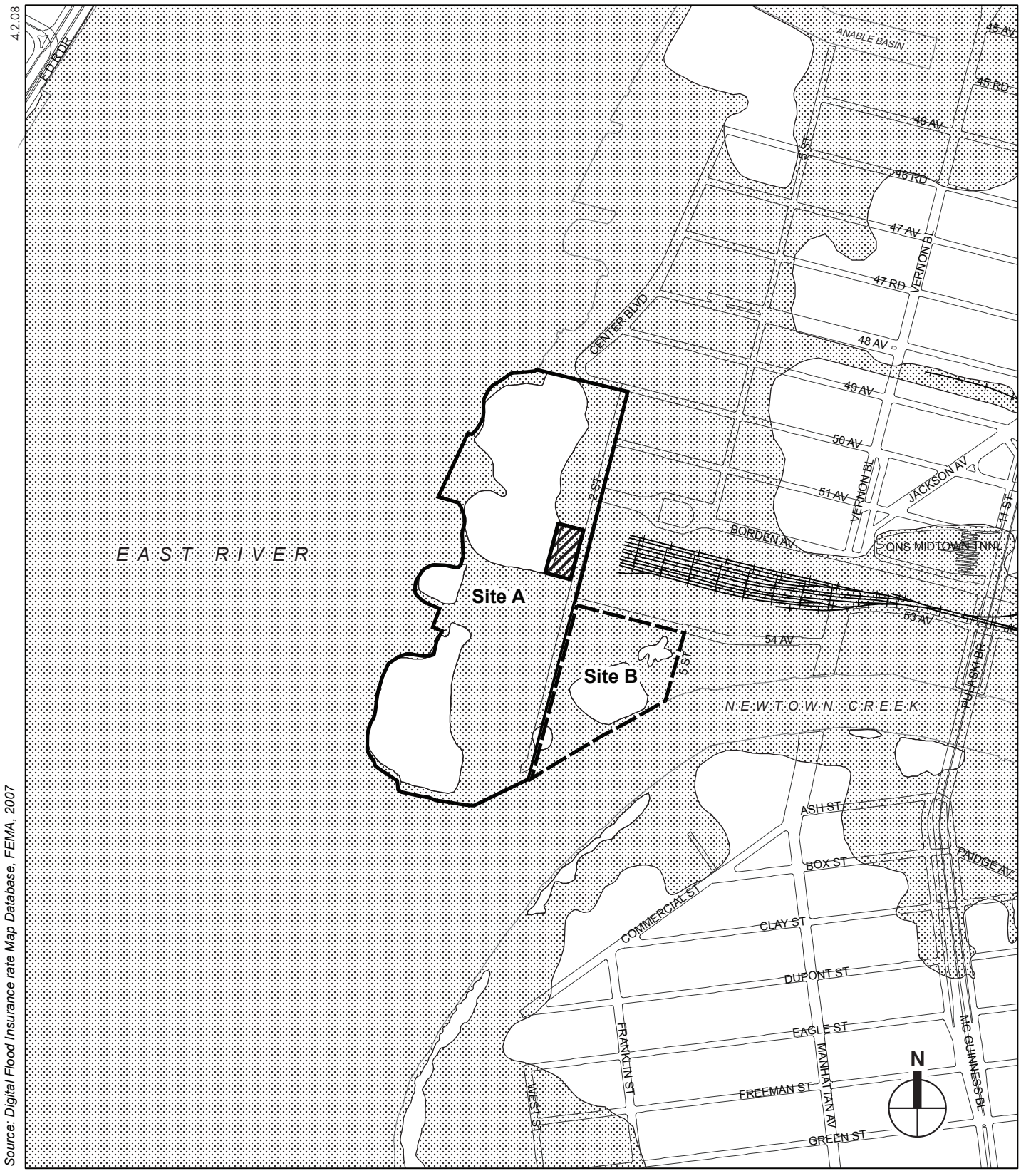
FLOODPLAINS AND WETLANDS

Figure 11-1 shows the 100-year floodplain boundary (i.e., the area with a 1 percent chance of flooding each year) within the project sites. As illustrated in the figure, the central and eastern portions of Site A, and much of Site B, are within the 100-year floodplain. The 100-year flood elevation is 10 feet above National Geodetic Vertical Datum (NGVD), which approximates mean sea level.

The entire shoreline within the project sites is engineered with bulkhead or riprap that limits the potential for tidal marsh plants or submerged aquatic vegetation. Shoreline elements found within the project sites include the following:

- Southern portion of Site A along Newtown Creek and the East River (the southern peninsula area from Newtown Creek to the location of the proposed extension of 55th Avenue)—steep slope stone fill containing concrete construction debris.
- Vicinity of the submerged float bridge—low-level, timber pile-supported concrete platform accessing the float bridge.
- Northern peninsula area (south of 54th Avenue)—steep slope stone fill containing concrete construction debris.
- At Water Taxi Beach—recently installed sheet pile bulkhead (approximately 300 linear feet).
- At the Water Taxi Beach pier—high-level concrete relieving platform that extends 25 feet offshore from a concrete cut-off wall and steel sheetpile bulkhead.
- At the Tennisport facility—recently installed sheet pile bulkhead protected by stone riprap at the toe.

The USFWS National Wetlands Inventory (see **Figure 11-2**) classifies the waters of the East River and Newtown Creek within the vicinity of the project sites as estuarine subtidal wetlands with unconsolidated bottom (E1UBL). Subtidal estuarine wetlands are continuously submerged areas with low energy and variable salinity, influenced and often enclosed by land. Unconsolidated bottoms have at least 25 percent cover of particles smaller than 6 or 7 centimeter (cm), and less than 30 percent vegetative cover. Because the waters within the project sites do not contain tidal wetland plants, USACE would likely regulate them as waters of the United States and would not be likely to classify portions of the study area as wetlands.

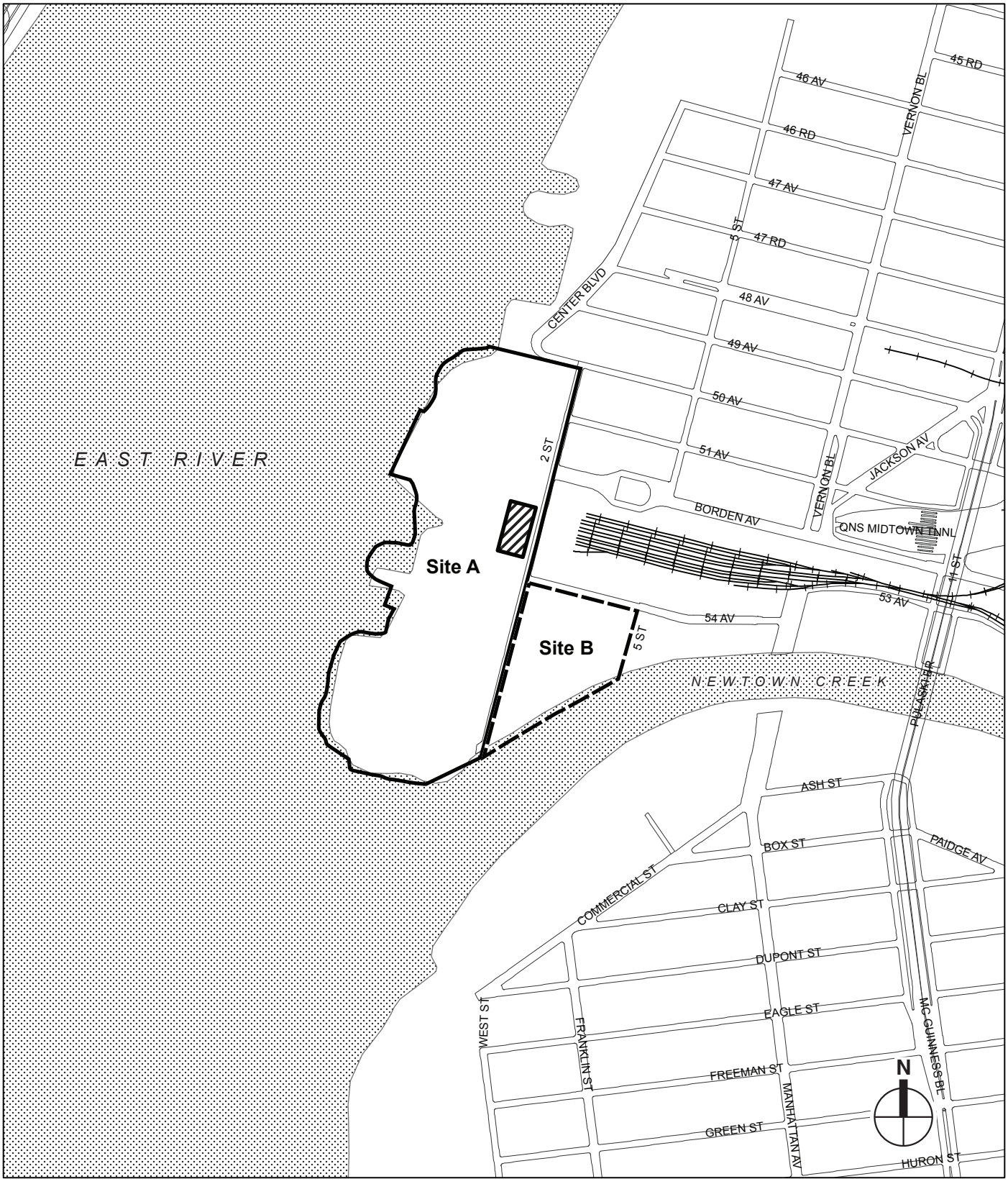


Source: Digital Flood Insurance rate Map Database, FEMA, 2007

FEMA Flood Hazard Areas

HUNTER'S POINT SOUTH REZONING AND RELATED ACTIONS

Figure 11-1



National Wetlands Inventory

HUNTER'S POINT SOUTH REZONING AND RELATED ACTIONS

Figure 11-2

NYSDEC designates the East River and Newtown Creek as littoral zone (shallow waters 6 feet or less in depth that are not included in other NYSDEC tidal wetland categories) (see **Figure 11-3**). However, NYSDEC regulations state that actual water depths determine whether or not an area is a littoral zone. Water depths along Newtown Creek within Site B range from 3 to 14 feet at mean lower low water (MLLW), and along the East River within Site A range from 3 to 18 feet at MLLW (NOAA 2007). These reported water depths suggest that water depths less than 6 feet at MLW occur along the shoreline of Sites A and B.

AQUATIC RESOURCES

SURFACE WATER RESOURCES IN THE STUDY AREA

The study area is located along the eastern shore of the East River, a tidal strait that connects New York Harbor with the western end of Long Island Sound. The East River's circulation and salinity structure are largely determined by conditions in the Upper Harbor and the sound. The river is approximately 16 miles long (26 kilometers [km]) and generally ranges from 600 to 4,000 feet wide (183 to 1,219 meters [m]). Water depth in the Federal navigation channel is maintained to 40 feet (12 meters below MLW) from the Battery to the former Brooklyn Navy Yard, and 35 feet (about 11 m) at MLW from that point to the Throgs Neck Bridge. In reality, the channel is much deeper in places than the maintained depth, reaching up to 100 feet deep (about 30 m) in areas just north of Hell Gate.

During the early flood cycle of the East River, Hudson River water flows in via the Battery, and during the entire flood cycle, Hudson River water enters through the Harlem River. The mean tidal range is considerable, approximately 4.3 feet (1.3 m) at the Battery, 5.1 feet (1.5 m) at Hell Gate east of the study area, and increasing to 7.2 feet (2.2 m) at Willets Point, the entrance to the Long Island Sound. The phase of the tide at Willets Point lags the Battery by about 3 hours. This phase difference, and the difference in resulting water elevations between the Battery and Willets Point, is chiefly responsible for the rapid tidal currents in this waterbody (Hazen and Sawyer 1983). Maximum current velocity measurements have been reported by several investigators. In 1994 and 1995, Blumberg et al. (1999) reported maximum velocities in the East River approaching 3.2 ft/sec at College Point, 6.0 ft/sec at Red Hook, and 1.6 ft/sec at the Battery. USACE reported velocities ranging from 2.0 to 7.9 ft/sec in the lower East River (USACE 1998) and average maximum velocities of 4.7 and 2.9 ft/sec at the Brooklyn Bridge and Hunts Point, respectively.

Sources of freshwater flow to the East River include the Bronx River, Westchester Creek, Hudson River, CSOs, and wastewater point sources (e.g., Newtown Creek and Red Hook wastewater treatment facilities). Regional surface water runoff also contributes to freshwater input.

WATER QUALITY

Title 6 of the NYCRR Part 703 includes surface water standards for each Use Class of New York surface waters. The lower East River near the study area is Use Classification I. The best usages for Class I waters are as secondary contact recreation and fishing. Water quality should be suitable for fish propagation and survival. Water quality standards for fecal and total coliform, DO, and pH for Use Classification I waters are as follows (there are no New York State standards for chlorophyll *a* or water clarity):

- Fecal coliform—Monthly geometric mean less than or equal to 2,000 colonies/100mL from 5 or more samples.

NYSDEC Tidal Wetlands

HUNTER'S POINT SOUTH REZONING AND RELATED ACTIONS

Figure 11-3

- Dissolved oxygen (DO)—Never less than 4 milligrams per liter (mg/L).
- pH—The normal range shall not be extended by more than 0.1 of a pH unit.

Newtown Creek is Use Classification SD, a classification reserved for water bodies that cannot meet the requirements for primary and secondary human contact and fish propagation. These waters should be suitable for fish survival. The NYSDEC saline surface water quality standards for Use Classification SD is that DO must never be less than 3 milligrams per liter (mg/L). No standards for coliform have been established for Use Classification SD waters.

The City of New York has monitored New York Harbor water quality for over 90 years through the Harbor Survey. NYCDEP evaluates surface water quality of four designated regions: Inner Harbor Area, upper East River-western Long Island Sound, Lower New York Bay-Raritan Bay, and Jamaica Bay (NYCDEP 2007a). The project sites are in the Inner Harbor Area, which includes the lower East River to the Battery. In 2003, NYCDEP began monitoring the East River tributaries, which includes Newtown Creek.

Temperature and salinity influence several physical and biological processes within the Harbor and the lower East River. Temperature has an effect on the spatial and seasonal distribution of aquatic species and affects oxygen solubility, respiration, and other temperature-dependent water column and sediment biological and chemical processes. Salinity fluctuates in response to tides and freshwater discharges. Salinity and temperature largely determine water density and can affect vertical stratification of the water column. Salinity is also an important habitat variable as most aquatic species have salinity tolerances within particular ranges.

Average temperatures within the Upper Bay range from about 3.7°C to 23.8°C (38.7°F to 74.8°F) (USACE 1999a). Within the Upper New York Harbor, higher salinity bottom waters tend to be somewhat warmer than the less saline surface waters during the winters months, with the opposite being true during the summer. Temperatures in the East River measured near the project sites during the Harbor Survey from 1995 to 2006 ranged from approximately 1.1 to 25.5°C (34 to 77.9°F). Temperatures in Newtown Creek measured near the project sites during the Harbor Survey from 2004 to 2006 Harbor Survey ranged from approximately 3.4 to 27.1°C (38.1 to 80.8°F) (NYCDEP 2007a).

Salinity varies spatially within the Harbor Estuary depending on the amount of freshwater flow. Within the New York-New Jersey Harbor Estuary system, average salinity values are highest in the Lower New York Harbor and Raritan Bay, and decrease moving up-estuary to the Upper New York Harbor, the lower Hudson River, and the lower East River. The Upper New York Harbor is partially stratified—higher salinity water originating from the Atlantic Ocean at the mouth of the estuary tends to remain near the bottom, while freshwater from the rivers draining to the estuary remains near the surface. Average salinity differences throughout the water column in the harbor are generally between 1 and 3 parts per thousand (ppt) (USACE 1999a). The swift tidal currents and limited freshwater inflow to the lower East River result in vertical mixing that prohibits the formation of large salinity gradients in this part of the river.

From 2004 to 2006, surface water and bottom water salinities recorded in the East River near the project sites ranged from 12.8 to 24.4 ppt and 13.6 to 24.9 ppt, respectively. Surface water and bottom water salinities recorded in Newtown Creek near the project sites ranged from 4.1 to 22.8 ppt and 13.8 to 24.1 ppt, respectively (NYCDEP 2005, 2006, 2007a and b). In Newtown Creek, bottom water salinity is generally slightly greater than surface water salinity due to periodic high freshwater flows in extremely wet years, which can occasionally create oligohaline conditions (salinity less than 5 ppt) for relatively short periods.

The results of recent Harbor Surveys (NYCDEP 2001, 2002, 2003, 2004, 2005, 2006, 2007a) show that the water quality of New York Harbor has improved significantly since the 1970s as a

result of measures undertaken by the City. These measures include infrastructure improvements, eliminating 99 percent of raw dry-weather sewage discharges, reducing illegal discharges, increasing the capture of wet-weather related floatables, and reducing the toxic metals loadings from industrial sources by 95 percent (NYCDEP 2002). The 1999 and 2000 IEC 305(b) reports also indicate that the year-round disinfection requirement for discharges to waters within its district (including New York Harbor) has contributed significantly to water quality improvements since the requirement went into effect in 1986 (IEC 2000, 2001).

As described in further detail below, survey data from a Harbor Survey station close to the study area, East 23rd Street (Station E2), indicate that the water quality in this part of the lower East River is generally good and meets the water quality requirements for Use Classification I waters (see **Table 11-1**), whereas the stations in Newtown Creek (Stations NC1, NC2, and NC3) indicate surface waters of poorer quality (see **Table 11-2**). Newtown Creek, and its tributaries, is considered impaired for its designated use (Use Classification SD saline surface water) because of low dissolved oxygen levels, primarily due to CSO and stormwater discharges. NYCDEP has conducted studies of Newtown Creek water and sediment quality since 1982. Newtown Creek was listed on the New York State 1998 Section 303(d) list as an impaired waterbody and was scheduled as a high priority for Total Maximum Daily Load (TMDL) development before the year 2005. The 303(d) list identifies waters that do not support appropriate uses and that require development of a TMDL or other restoration strategy to reduce the input of the specific pollutant(s) that restrict waterbody uses, in order to restore and protect such uses. However, the Draft 2006 Section 303(d) list of impaired waters includes Newtown Creek in the list of waters that are impaired but no longer requiring a TMDL. Newtown Creek was de-listed because other required control measures, resulting from the implementation of Consent Order signed by NYSDEC and the City in 2005, are expected to result in restoration of the waterbody.

Table 11-1
2004-2006 NYCDEP Water Quality Data for the East 23rd Street Sampling Station

Parameter	Top Waters			Bottom Waters		
	Low	High	Avg	Low	High	Avg
Fecal Coliform (per 100 mL)	2.0	1,660	113	NM		
Dissolved Oxygen (mg/L)	2.8	12.1	5.4	2.4	12.6	5.4
Secchi Transparency (ft)	2.0	9.0	4.8	NM		
Chlorophyll *a* (µg/L)	0.5	15.9	2.5	NM		

Notes: NM = not measured; E = estimated.
Source: NYCDEP 2007b.

Table 11-2
2004-2006 NYCDEP Water Quality Data for the Newtown Creek Sampling Stations

Parameter	Top Waters			Bottom Waters		
	Low	High	Avg	Low	High	Avg
Fecal Coliform (per 100 mL)	2.0	E 4,001	1,099.2	2.0	4,000	868.9
Dissolved Oxygen (mg/L)	0.06	13.8	4.21	0.02	10.5	2.7
Secchi Transparency (ft)	1.0	7.0	2.8	NM		
Chlorophyll *a* (µg/L)	0.4	211.6	34.3	NM		

Notes: NM = not measured; E = estimated. Sampling stations include NC1, NC2, and NC3.
Source: NYCDEP 2007b.

The 2005 Consent Order directed the City to develop and submit a Waterbody/Watershed Facility Plan for Newtown Creek to address CSO discharges by June 2007 and submittal of a Drainage Basin Specific LTCP for Newtown Creek by February 2016. The NYCDEP submitted the Waterbody/Watershed Facility Plan for Newtown Creek and the East River and Open Waters Waterbody/Watershed Facility Plan Report to address CSO discharges to the East River in June 2007. The Consent Order also establishes milestone dates for the design and construction of the in-stream aeration facilities, relief sewer/regulator modification design and construction, throttling facility design and construction, and the CSO storage facility design and construction. Most of these milestones are expected to be complete by the 2017 analysis year.

The presence of fecal coliform bacteria in surface waters indicates potential health impacts from human or animal waste, and elevated levels of coliform can result in the closing of bathing beaches and shellfish beds. According to the New York Harbor Water Quality Regional Summaries and data from the past five years (NYCDEP 2003, 2004, 2005, 2006, 2007a and b), the waters of the Inner Harbor Area, which includes the lower East River, meet the fecal coliform standard for Use Class I waters at most sampling locations. Temporary increases in fecal coliform concentrations may occur during wet weather due to increased fecal coliform loadings from CSOs that may occur following a rain event.

The project sites are located within the low-level drainage area of the Bowery Bay WPCP drainage, which contributes an estimated 34 percent of the dry weather flow for the Bowery Bay WPCP. In 2007, the dry weather flow treated at the Bowery Bay WPCP was 95 mgd on average, of which approximately 33 mgd, on average, can be attributed to the low level drainage area. The wet weather flow for the Bowery Bay WPCP low-level drainage is generally 3.4 mgd. Therefore, total flow (wet and dry weather flow) from the low-level drainage area was about 36 mgd on average in 2007. Total wet weather flow for the entire Bowery Bay WPCP drainage area was 11.32 mgd on average in 2006 and 9.25 mgd on average in 2007. There were 54 CSOs for the low level drainage area of the Bowery Bay WPCP in 2007, with 29 of these events occurring at the 5 CSO outfalls within the project sites.

While CSOs may result in temporary increases in fecal coliform concentration, overall, fecal coliform concentrations in this area have declined, significantly improving water quality from the early 1970s, when levels were well above 2,000 colonies/100 mL (NYCDEP 2001). From 2004 to 2006, fecal coliform concentrations from the East River station near the project sites peaked as high as 1,660 colonies/100 mL but generally remained below 200 colonies/100 ml (NYCDEP 2005, 2006, 2007a and b). From 2004 to 2006, the Newtown Creek stations near the project sites, however, had fecal coliform concentrations well above 2,000 colonies/100 mL, peaking as high as an estimated 4,000 colonies/100 mL on several sampling events (NYCDEP 2007b).

DO in the water column is necessary for respiration by all aerobic forms of life, including fish, invertebrates such as crabs and clams, and zooplankton. The bacterial breakdown of high organic loads from various sources can deplete DO to low levels. Persistently low DO can degrade habitat and cause a variety of sublethal or, in extreme cases, lethal effects. Consequently, DO is one of the most universal indicators of overall water quality in aquatic systems. DO summer concentrations in the Inner Harbor Area have increased over the past 30 years from an average of bottom water that was below 3 mg/L in 1970 to above 6 mg/L in 2006, a value fully supportive of ecological productivity (NYCDEP 2007). For the period from 2004 to 2006, the average DO concentration near the project sites at the East River station was 5.4 mg/L. During this same period, the average DO concentration for the Newtown Creek stations was 4.1 mg/L, with periods when the DO concentration was less than the DO standard for Use

Classification SD waters (i.e., DO never less than 3 mg/L). All pH levels in the New York Harbor Area are in attainment, with the average being 7.4 at the East 23rd Street station and 7.2 in Newtown Creek stations (NYCDEP 2005, 2006, 2007a and b).

High levels of nutrients can lead to excessive plant growth (a sign of eutrophication) and depletion of dissolved oxygen. Concentrations of the plant pigment chlorophyll-*a* in water can be used to estimate productivity and the abundance of phytoplankton. Chlorophyll-*a* concentrations greater than 20 micrograms per liter (µg/L) are considered suggestive of eutrophic conditions. From 2004 to 2006, concentrations at the East 23rd Street station averaged 2.5 µg/L and never exceeded 20 µg/L, while concentrations at the Newtown Creek stations averaged 34.3 µg/L and are suggestive of eutrophic conditions (NYCDEP 2007a and b). With NYCDEP implementing its program to reduce nitrogen loadings from wastewater treatment plants to the East River, upgrades implemented at four upper East River treatment plants have decreased nitrogen discharges from these plants by over 30,000 pounds per day since 1993. Upgrades to the Newtown Creek Water Pollution Control Plant (WPCP), which discharges to the East River downstream of the project sites, are expected to be completed in 2007.

Secchi transparency is a measure of the clarity of surface waters. Transparency greater than 5 feet (1.5 meters) indicates relatively clear water. Decreased clarity can be caused by high suspended solid concentrations or blooms of plankton. Secchi transparencies less than 3 feet (0.9 meters) may be considered indicative of poor water quality conditions. Average Secchi readings in the Inner Harbor area have remained relatively consistent since measurement of this parameter began in 1986, ranging between approximately 3.5 and 5.5 feet (1.1 to 1.8 meters). Average Secchi transparency recorded near the project sites from 2004 to 2006 at the East 23rd Street station was 4.8 feet (1.5 meters) (NYCDEP 2005, 2006, 2007a and b). Only three of the 68 measurements taken in 2004 through 2006 were less than 3 feet (0.9 meters), indicating that water quality in this area is infrequently impaired by reduced water transparency (NYCDEP 2005, 2006, 2007a). Average Secchi transparency from 2004 to 2006 at the Newtown Creek stations was 2.8 feet (0.85 meters) (NYCDEP 2007b) and is indicative of poor water quality conditions.

NYSDEC is leading a collaborative effort to reduce toxic chemicals in New York Harbor. This work is being done under the Contamination Assessment and Reduction Project (CARP). NYSDEC developed a comprehensive, multimedia contaminant identification and track-down program simultaneously with New Jersey and the CARP Work Group (a group of government, academic, and consultant experts). The States together with the work group are undertaking a variety of projects, including studies of Harbor water quality and tracking down contaminant sources in the surface water, groundwater, and wastewater of the Harbor. The overall goal of the initiative is to reduce the flow of contaminants to the Port of New York and New Jersey. The principal chemicals of concern include dioxins/furans, PCBs, polycyclic aromatic hydrocarbons (PAHs), metals (silver, mercury, cadmium, and lead), and pesticides (dieldrin and chlordane).

Two CARP sampling areas are near the study area: lower East River near the Brooklyn Navy Yard, and at the outfall of the Newtown Creek WPCP, just west of the study area. The average pesticide concentration from the lower East River was 0.00000022 mg/L for both dieldrin and chlordane. PCBs, PAHs, and metals (cadmium, mercury, and lead) were also reported in samples from the lower East River site (Litten 2003). Samples from the Newtown Creek WPCP contained measurable concentrations of pesticides (dieldrin, hexachlorobenzene, chlordane, and DDT), PCBs, PAHs, and metals (sliver, cadmium, mercury, and lead) (Litten 2003).

SEDIMENT QUALITY

Upper New York Bay has a complex distribution of sediments in the area because of variable currents and a high degree of sediment input from natural and human actions. Sediments in the Upper Bay vary from coarse sands and gravels in high-energy areas to fine-grained silts and clays in low-energy areas (USACE 1999a). The lower East River primarily has a hard, rock bottom consisting of gravel, cobble, rocks, and boulders covered with a shallow layer of sediment. The shallow sediment cover is affected by strong tidal currents in the river.

Typical of any urban watershed, New York Harbor Estuary sediments, including the East River, are contaminated due to a history of industrial uses in the area. Contaminants found throughout the New York Harbor Estuary include pesticides such as chlordane and DDT, metals such as mercury and copper, and various polycyclic aromatic hydrocarbons. Adams et al. (1998) found the mean sediment contaminant concentration for 50 of 59 chemicals measured to be statistically higher in the Harbor Estuary than other coastal areas on the East Coast. Within the New York Harbor Estuary, Adams et al. (1998) ranked Newark Bay as the most degraded area on the basis of sediment chemistry, toxicity, and benthic community, followed by the Upper Harbor, Jamaica Bay, Lower Harbor, western Long Island Sound, and the New York Bight Apex. Biological effects, identified based on the benthic invertebrate community, were found to be associated with the chemical contamination. While the sediments of the New York Harbor Estuary are contaminated, the levels of most sediment contaminants (e.g., dioxin, DDT, and mercury) have decreased on average by an order of magnitude over the past 30 years (Steinberg et al. 2002). Between 1993 and 1998, the percentage of sediment sampling locations with benthic macroinvertebrate communities considered impacted, or of degraded quality, decreased throughout the New York/New Jersey Harbor Estuary. Within the Upper Harbor, the percentage of benthic communities considered impacted decreased from 75 percent in 1993 to 48 percent in 1998 (Steinberg et al. 2004).

Litten (2003) reported the following concentrations of pesticides in sediment samples collected from the East River as part of CARP—dieldrin 0.0019 mg/kg, hexachlorobenzene 0.00085 mg/kg, heptachlor 0.000018 mg/kg, hexachlorocyclohexane (HCH), 0.00047 mg/kg, chlordane 0.017 mg/kg, and DDT 0.046 mg/kg. NYSDEC has established sediment quality threshold values for dredging activities, or riparian or in-water placement of dredged material for three of these pesticides (NYSDEC 2004): dieldrin, chlordane, and DDT. The dieldrin concentration falls into the classification of no appreciable contamination (no toxicity to aquatic life). The chlordane concentration falls into the classification of moderate contamination (chronic toxicity to aquatic life), and the DDT concentration falls into the classification of high contamination (acute toxicity to aquatic life). The CARP sediment sampling in Newtown Creek reported concentrations of pesticides that were generally higher than those for the East River—dieldrin 0.280 mg/kg, hexachlorobenzene 0.033 mg/kg, heptachlor 0.0021 mg/kg, hexachlorocyclohexane 0.0004 mg/kg, chlordane 1.6 mg/kg, and DDT 1.3 mg/kg (Litten 2003). The dieldrin concentration value falls into the NYSDEC (NYSDEC 2004) classification of moderate contamination (chronic toxicity to aquatic life); chlordane and DDT fall in the classification of high contamination (acute toxicity to aquatic life).

Bulk chemical analysis of the sediment samples collected in November and December 2006 along the shoreline of Site A (TRC 2007a) indicated that the levels of contamination were typical of other areas within New York Harbor. Similar to other sediment within the Harbor Estuary, the primarily medium to fine sand and silt sediment had elevated levels of some the following sediment contaminants for which NYSDEC has set sediment quality threshold values

for dredging, riparian, or inwater placement (NYSDEC 2004): arsenic, cadmium, copper, lead and mercury, total PAH, and PCBs (see **Table 11-3**). As presented in **Table 11-3**, the concentrations of arsenic and cadmium generally fall within the classification of moderate contamination (chronic toxicity to aquatic life). Concentrations of copper and mercury fall into the moderate and high contamination (acute toxicity to aquatic life) classifications, and lead, total PAH, and PCBs fall into the high contamination (acute toxicity to aquatic life) classification. None of the sediment samples collected along the shoreline of Site A exhibited evidence of petroleum contamination, except the southernmost sediment sample taken closest to Newtown Creek, where petroleum staining, odors, and elevated photoionization detector (PID) readings were found for the entire sediment core.

Table 11-3
Summary of Sediment Sampling Along Site A Shoreline, November 15-December 14, 2006

Compounds With NYSDEC Sediment Quality Threshold Values (TOGS 5.1.9)	Number Observations in which the Compound was Not Detected	Number of Observations in which the Compound was Detected	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Average Detected Concentration (mg/kg)
Arsenic	0	8	0.47 (1)	23.60 (2)	9.57 (2)
Cadmium	0	8	0.58 (1)	4.68 (2)	2.34 (2)
Copper	0	8	28.50 (1)	214 (3)	142.28 (2)
Lead	0	8	47.40 (2)	434 (3)	251.55 (3)
Mercury	0	8	0.15 (1)	2.40 (3)	1.12 (2)
Benzene	Not Analyzed				
Total BTEX	Not Analyzed				
Total PAH	0	8	1.69 (1)	264.68 (3)	49.39 (3)
Sum of DDT+DDD+DDE	Not Analyzed				
Mirex	Not Analyzed				
Chlordane	Not Analyzed				
Dieldrin	Not Analyzed				
PCBs (sum of aroclors)	0	8	33.10 (3)	79.70 (3)	48.78 (3)
2,3,7,8-TCDD (sum of toxic equivalency)	Not Analyzed				

Notes:
1 – TOGS 5.1.9 Class A Sediment Quality Threshold Value for dredging, riparian placement or in-water placement based on known or presumed impacts on aquatic organisms/ecosystem, no appreciable contamination level, no toxicity to aquatic life.
2 – TOGS 5.1.9 Class B Sediment Quality Threshold Value for dredging, riparian placement or in-water placement based on known or presumed impacts on aquatic organisms/ecosystem, moderate contamination (Chronic Toxicity to aquatic life). Dredging and riparian placement may be conducted with several restrictions.
3 – TOGS 5.1.9 Class C Sediment Quality Threshold Value for dredging, riparian placement or in-water placement based on known or presumed impacts on aquatic organisms/ecosystem, high contamination (Acute Toxicity to aquatic life). Dredged material is expected to be acutely toxic to aquatic biota and therefore, dredging and disposal requirements may be stringent
4 – Benzene, Total BTEX, Sum of DDT + DDD + DDE, Mirex, Chlordane, Dieldrin, and 2,3,7,8-TCDD were not analyzed.
5 – Total PAH was calculated by summing concentrations of all PAHs analyzed: 2-Chloronaphthalene, 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benxo(k)flouranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene, Pyrene
6 – PCBs (sum of aroclors) were calculated by summing concentrations of Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.
Sources: NYSDEC 2004.

AQUATIC BIOTA

The hydrodynamic and estuarine character of the East River, coupled with the numerous municipal and industrial discharges that have occurred in the river over many years, make this river a physically harsh environment; therefore, many of the species using the area must be

tolerant of highly variable conditions. The following sections provide a description of the aquatic biota found in the lower East River.

Primary Producers

Phytoplankton

Phytoplankton are microscopic plants whose movements within the system are largely governed by prevailing tides and currents. Light penetration, turbidity, and nutrient concentrations are important factors in determining phytoplankton productivity and biomass. While nutrient concentrations in most areas of New York Harbor are very high, rapid light attenuation has often limited the occurrence of phytoplankton blooms. Because of the strong currents and high rate of tidal exchange, planktonic organisms found in western Long Island Sound, the lower Hudson River, and Upper New York Harbor would also be expected to occur in the East River.

A recent survey of phytoplankton conducted from 1996 through 2003 on the East River to the west of the project sites in lower Manhattan (Pier 17 South Street Seaport), and the lower Hudson River, assessed the presence or absence of 29 taxa of phytoplankton along with various water quality parameters with respect to temporal distribution patterns (Levandowsky et al. 2004). While not a comprehensive survey of phytoplankton species, the study allowed investigators to discern relationships between the presence or absence of any of the 29 taxa evaluated and water quality parameters, such as temperature and salinity. Weekly plankton samples were collected with a 10-micron mesh from the upper meter of the water column. Using correspondence analysis (CCA), the study demonstrated that the lower Hudson River phytoplankton community is generally more structured (i.e., phytoplankton monitored exhibited consistent temporal and spatial distribution, possibly due to the stratified nature of the Hudson River) when compared with the phytoplankton community of the East River, which was more variable with respect to time and location (possibly due to the well-mixed nature of the East River).

In other surveys focusing on the East River, investigators collected 77 phytoplankton genera, several of which were represented by a number of different species. Diatoms are generally the most widely represented class of phytoplankton, accounting for over 90 percent of the different taxa collected in one 1983 survey; the green alga *Nannochloris* was the most abundant single taxa identified in this area (Hazen and Sawyer 1983). In a 1993 survey of New York Harbor, 29 taxa of phytoplankton were identified, with the diatom *Skeletonema costatum* and the green algae *Nannochloris atomus* determined to be the most abundant species at the monitored sites (Brosnan and O'Shea 1995). The average summer cell counts in that year ranged from 6,300 to 97,000 cells/mL. Resident times of phytoplankton species within New York Harbor are short, and species move quickly through the system. Investigators have suggested that the overall composition and relative abundance of phytoplankton taxa in the East River are more heavily influenced by the influx from waters of the sound and New York Harbor than by localized water quality conditions (Con Edison 1982).

Submerged Aquatic Vegetation and Benthic Marine Algae

Submerged aquatic vegetation (SAV) are vascular aquatic plants that are often found in shallow areas of estuaries. These organisms are important because they provide nursery and refuge habitat for fish. Benthic algae can be large multicellular algae that are important primary producers in the aquatic environment. They are often observed attached to rocks, jetties, pilings, and sandy or muddy bottoms (Hurley 1990). Since these organisms require sunlight as their primary source of energy, the limited light penetration of New York Harbor limits their

distribution to shallow areas. Light penetration, turbidity, and nutrient concentrations are all important factors in determining SAV and benthic algae productivity and biomass.

None of the studies reviewed as part of this assessment reported the presence of SAV in the lower East River. The extensively developed shoreline, swift currents, and steeply sloped engineered shorelines severely limit potential inhabitation of this area by SAV.

Common macro-algae known to occur within the East River include the Phaeophyte species *Fucus vesiculosus*, the Chlorophyte species *Ulva lactuca*, and *Enteromorpha* species (Perlmutter 1971). These species have a particular affinity for hard substrates within the photic zone and are frequent colonists of pilings, rocks, bulkheads, and other structures.

Zooplankton

Zooplankton—planktonic animals that include microscopic protozoans and rotifers less than 200 microns in size, copepods and invertebrate larvae between 200 microns and 2 millimeters in size, and amphipods, shrimp, fish larvae and jelly fish that are greater than 2 millimeters in size—are an integral component of aquatic food webs. They typically are the principal grazers on phytoplankton and detritus material, and are themselves consumed by organisms at higher trophic levels. The higher level consumers of zooplankton generally include forage fish, such as bay anchovy (*Anchoa mitchilli*), as well as commercially and recreationally important species, such as striped bass (*Morone saxatilis*) and white perch (*M. americana*) during their early life stages. Predacious zooplankton species can consume eggs and larvae and can have a detrimental effect on certain fish species.

Crustacean taxa are generally the most abundant group of zooplankton collected in New York Harbor. The most dominant species include the copepods *Acartia tonsa, Acartia hudsonica, Eurytemora affinis*, and *Temora longicornis*, with each species being prevalent in certain seasons (Stepien et al. 1981, Lonsdale and Cosper 1994, Perlmutter 1971, Lauer 1971, Hazen and Sawyer 1983). The data suggest that the copepods collected in the East River are extensions of populations present in Long Island Sound and New York Harbor.

Benthic Invertebrates

Invertebrate organisms that inhabit river bottom sediments and the surfaces of submerged objects (such as rocks, pilings, or debris) are commonly referred to as benthic invertebrates. These organisms are important to an ecosystem's energy flow because they convert detrital and suspended organic material into living tissue; moreover, they are also integral components of the diets of ecologically and commercially important fish and waterfowl species. Benthic invertebrates are also essential in promoting the exchange of nutrients between the sediment and water column. Benthic invertebrates include those specimens that can be retained on a 0.5-mm screen (defined as macroinvertebrates) as well as smaller forms, such as nematodes (a class of roundworm) and harpacticoid copepods (order of copepods that are primarily benthic), collectively called meiofauna. Some of these animals live on top of the substratum (epifauna) and some within the substratum (infauna). Substrate type (rocks, pilings, sediment grain size, etc.), salinity, and DO levels are important factors influencing benthic invertebrate communities; other factors include currents, reproductive success, larval distribution, wave action, predation, succession, and disturbance.

More than 100 benthic invertebrate taxa (mostly crustaceans or polychaete worms) have been identified in the East River (Coastal Environmental Services 1987). Within the portion of the Harbor Estuary comprising the Hudson River, East River, and Upper New York Harbor, common infaunal macroinvertebrates include oligochaete worms, polychaetes, gastropod and

bivalve mollusks, barnacles, cumaceans, amphipods, isopods, crabs, and shrimp. Epifauna include hydrozoans, sea anemones, flatworms, oligochaete worms, polychaetes, bivalves, barnacles, gammaridean and caprellid amphipods, isopods, tunicates, hermit crabs, rock crabs, grass shrimp, sand shrimp, blue crabs, mud dog whelks, mud crabs, horseshoe crabs, blue mussels, soft-shell clams, and nudibranchs (EA Engineering, Science, and Technology 1990, Able et al. 1995, NYCDPR 1994, PBS&J 1998).

Two separate but intermingled benthic invertebrate subcommunities have been identified in the East River on the basis of sediment hardness (Hazen and Sawyer 1983). The hard substrate community is characterized by organisms that are either firmly attached to rocks and other hard objects (e.g., mussels or barnacles) or that build or live in tubes. Other species of polychaetes and amphipods also occur on the hard bottom surfaces, and several species utilize the East River's hard bottoms and rapid currents by colonizing the abandoned tubes or shells of other species. The soft substrate community occurs in the more protected areas within the East River where detritus, clay, silt, and sand have accumulated in shallow, lower velocity areas near piers and pilings. Common soft substrate organisms include oligochaete worms, the soft-shelled clam *Mya arenaria*, and a variety of flatworms, nemerteans, polychaetes, and crustaceans (Hazen and Sawyer 1985).

In 2003, DSNY conducted field studies for the marine transfer station sites (MTS) as part of the environmental evaluation of the New York City Comprehensive Solid Waste Management Plan (DSNY 2005). *Streblospio benedicti* (oligochaete) was the most abundant infaunal macroinvertebrate collected in the bottom sediment of Newtown Creek near the Greenpoint MTS, with a density of 80,000 individuals per square meter. The dominant epifaunal macroinvertebrates included *Corophium insidiosum* (amphipods), *Molgula manhattensis* (sea grape), and *Polydora* species (polychaete worms), as well as hydrozoans, and mud and algal film. All of these organisms are tolerant of degraded environments.

Fish

As discussed earlier, New York City is located at the confluence of several major river and estuarine systems, all of which discharge to the New York Bight of the Atlantic Ocean. This convergence has resulted in a mix of habitats in the East River that supports marine fish, estuarine fish, anadromous fish (fish that migrate up rivers from the sea to breed in freshwater), and catadromous fish (fish that live in freshwater but migrate to marine waters to breed). **Table 11-4** lists fish that may be seasonally abundant in the East River and Newtown Creek. Despite the relatively low value of the East River and Newtown Creek as residential fish habitat, the waterway serves as a major migratory route from the Hudson River to the Long Island Sound. Harsh conditions within the lower East River, including its swift currents and lack of shoals and protected habitat, contribute to the limited utilization by fish at various times of the year. In addition, many species encountered in the East River are only seasonably abundant due to their natural migratory patterns or life history strategies. From 1999 through 2001, 64 species of finfish were collected during sampling conducted at the Charles Poletti Power Project ("Polettti") (Heimbuch et al. 2007), located on the East River across from Randalls Island, to the northeast of the project sites. Striped bass post-yolk-sac larvae collected at Poletti during this period are believed to have been transported from the lower Hudson River estuary into the East River and into western Long Island Sound (Dunning et al. 2006).

Table 11-4
List of Fish Species Known to Occur in the East River and Newtown Creek

Common Name	Scientific Name	East River	Newtown Creek[(1)]
Alewife	*Alosa pseudoharengus*	x	
American eel	*Anguilla rostrata*	x	x
American sand lance	*Ammodytes americanus*	x	x
American shad	*Alosa sapidissima*	x	x
Anchovy spp.	*Anchoa spp.*	x	x
Atlantic herring	*Clupea harengus*	x	x
Atlantic menhaden	*Brevoortia tyrannus*	x	x
Atlantic silverside	*Menidia menidia*	x	x
Atlantic tomcod	*Microgadus tomcod*	x	x
Banded killifish	*Fundulus diaphanus*	x	x
Bay anchovy	*Anchoa mitchilli*	x	x
Black sea bass	*Centropristis striata*	x	
Blueback herring	*Alosa aestivalis*	x	
Bluefish	*Pomatomus saltatrix*	x	x
Butterfish	*Peprilus triacanthus*	x	x
Cunner	*Tautogolabrus adspersus*	x	x
Fourbeard Rockling	*Enchelyopus cimbrius*	x	x
Goby spp.	Gobiidae Family	x	x
Herring spp.	Clupeidae Family	x	x
Little skate	*Raja erinacea*	x	x
Mummichog	*Fundulus heteroclitus*	x	
Naked goby	*Gobiosoma bosc*	x	x
Northern searobin	*Prionotus carolinus*	x	
Rock gunnel	*Pholis gunnellus*	x	x
Sculpin spp.	Cottidae Family	x	x
Scup	*Stenotomus chrysops*	x	
Spotted Hake	*Urophycis regia*	x	x
Striped bass	*Morone saxatilis*	x	x
Striped searobin	*Prionotus evolans*	x	x
Summer flounder	*Paralichthys dentatus*	x	x
Tautog	*Tautoga onitis*	x	x
Weakfish	*Cyanoscion regalis*	x	
White perch	*Morone americana*	x	x
Windowpane flounder	*Scophthalmus aquosus*	x	x
Winter flounder	*Pseudopleuronectes americanus*	x	x
Winter skate	*Raja ocellata*	x	x
Wrasses	Labridae Family	x	x

Notes: 2003 sampling of Newtown Creek by the DSNY as part of the environmental evaluation of the New York City Comprehensive Solid Waste Management Plan (DSNY 2005).

Sources: Able et al. 1995; DSNY 2005, EA Engineering, Science & Technology 1990; EEA 1988; LMS 1994, 1999, 2002, 2003a, 2003b; Heimbuch et al. 2007; Woodhead 1990.

The general East River and Newtown Creek fish communities are described below.

Marine Species

Winter flounder, scup, and bluefish are marine species present in the East River. Winter flounder and bluefish were also observed in Newtown Creek during the 2003 sampling conducted by DSNY (DSNY 2005). Winter flounder is an important commercial and recreational fish species that prefers cold water. Adults have a short migration pattern, moving offshore a short distance in spring and returning to shallow inshore or estuarine waters in late fall (Bigelow and Schroeder 1953). Winter flounder spawn in the lower estuary during winter and early spring and prefer sandy bottoms in shallow water where freshwater from the estuary dilutes salinities to slightly below full ocean concentration (Pereira et al. 1999). Winter flounder most likely use the lower East River and Newtown Creek as residents during the winter months. Winter flounder have a varied diet of small invertebrates and fish fry (Grimes et al. 1989).

Scup, or porgy, is a marine species reported for the East River that migrates inshore during late spring. It tends to remain close to the coast during the summer months before moving offshore during the fall to deeper waters. Scup are bottom feeders that spawn from May through August (Bigelow and Schroeder 1953).

Bluefish is a pelagic species whose young migrate into estuaries and harbors along the coast during late spring or early summer. The major spawning grounds of the bluefish are located on the outer continental shelf, and the resulting young move inshore in the late summer to forage (Bigelow and Schroeder 1953). The incidence of young bluefish in the East River and Newtown Creek is related to this migration pattern (PAS 1985).

Estuarine Species

Abundant estuarine species of the East River and Newtown Creek include resident fish, such as the bay anchovy, Atlantic silverside, striped and common killifish/mummichog (*Fundulus majalis* and *Fundulus heteroclitus*, respectively), and white perch. These species are important as forage species for larger predator fish and are commonly used as bait by fishermen.

Bay anchovy are found in salinities ranging from fresh to seawater. This species is common in its range and may be the most abundant species in the western north Atlantic (McHugh 1967 in Vougilitois et al. 1987). Bay anchovy use the Harbor Estuary extensively for spawning, embryonic development, and hatching. Spawning in the New York Bight occurs from about May through September, and females spawn many times per year (Houde and Zastrow 1991). The yolk sac stage typically lasts less than one day. The peak abundance of post-yolk sac larvae bay anchovy is in June and July. Juveniles occur from mid-August through October. Trawl data indicate that north of Delaware Bay, bay anchovy move out of estuaries and southward during the fall and are virtually absent from the inshore continental shelf of New York during the winter months (ASA 2001).

Atlantic silversides are small fish that school in shallow water and are permanent residents of the estuary. They spawn in May through early July and mature in one year. Atlantic silversides are omnivorous and feed chiefly on copepods, mysids, shrimp, amphipods, cladocerans, fish eggs, young squid, annelid worms, and mollusk larvae (Bigelow and Schroeder 1953).

Common killifish spawn primarily in fresh or brackish water, usually from spring to late summer or early autumn. Adults generally mature during their second year. Striped killifish spawn in shallow water close to shore from June through August, and again mature in their second year. Both species feed primarily on crustaceans and polychaetes (Abraham 1985).

White perch is another estuarine species that has been found in the East River and Newtown Creek. Adult white perch migrate to shallow fresh and slightly brackish water in the spring and early summer to spawn, after which they return to the lower estuary. The demersal eggs hatch in three to five days, and after approximately one month they begin to look like small adults. The juveniles inhabit creeks and inshore areas until they are about a year old (Heimbuch et al. 1994). Small white perch primarily eat invertebrates. Larger white perch in salt and brackish water eat small fish fry, crabs, shrimp, and other invertebrates. White perch of more than 200 mm in length eat mostly fish (Stanley and Danie 1983).

Anadromous Species

Anadromous species that use the East River and Newtown Creek include striped bass, tomcod, and members of the herring family. Striped bass use the East River and Newtown Creek for migration from fall through spring (PAS 1985). Mature striped bass return from marine waters to fresh water to spawn before migrating back to salt waters. The young then use the brackish waters as nursery and wintering area. Juvenile striped bass migrate to marine waters when nearing maturity. The majority of adults then spend much of their time in coastal, bay, and river mouth waters before returning to spawn in the spring each year (Bigelow and Schroeder 1953). Juvenile striped bass eat a variety of invertebrates, and adults eat a variety of fish and may also eat shrimp. Young-of-the-year and older striped bass have been shown to overwinter in large numbers in the lower Hudson River estuary. They feed primarily on invertebrates; as they grow, striped bass feed primarily on fish (Fay et al. 1983).

Tomcod is an inshore species of cod that is distributed from southern Labrador to Virginia along the Atlantic Coast. Adults may spawn in marine waters but are typically anadromous and migrate into rivers and estuaries during late fall and winter to spawn. In New York waters, the adult tomcod move out from shore to cooler waters in the spring. These fish feed mainly on small crustaceans (Bigelow and Schroeder 1953).

Alewife and American shad are members of the herring family. These species live in the ocean as adults and move into estuaries in spring on their spawning migrations. Both spawn in freshwater. Juveniles migrate from the estuaries in their first year primarily in the fall. These species primarily eat small planktonic crustaceans and other invertebrates (Bigelow and Schroeder 1953).

Catadromous Species

The single catadromous species found in the East River and Newtown Creek is American eel. Eels spawn in the Atlantic Ocean and the young move into the estuary as elvers in the spring, typically in February and March (Fahay 1978). American eels are opportunistic feeders, and juveniles eat crustaceans, polychaetes, bivalves, and fish. They grow slowly and at sexual maturity move down the estuary in the fall and out to sea (Bigelow and Schroeder 1953).

Newtown Creek Fish Community. In 2003, the DSNY sampled the fish community in Newtown Creek from January through December (DSNY 2005). Ninety-eight adult finfish, representing 16 species, were collected; the most abundant being striped bass, menhaden, tomcod, and Atlantic silverside. The bay anchovy eggs and larvae dominated these two life stages.

TERRESTRIAL RESOURCES

The land cover within the project sites are generally that of a disturbed urban area with areas devoid of vegetation or vegetated areas dominated by invasive plant species (see **Figure 11-4** and **Appendix 11.1** site photographs). Habitat classifications present within the project sites

4.2.08

Site A

Not Included In Site A

Site B

1 → *Photograph View Direction and Reference Number (See Appendix 11)*

HUNTER'S POINT SOUTH REZONING AND RELATED ACTIONS

Current Land Cover

Figure 11-4

include "urban vacant lot" and "urban structure exterior," following the nomenclature from the New York Natural Heritage Program (Edinger et al. 2002). In general, the northern half of the Site A, from 50th Avenue to about 54th Avenue, and all of Site B consist of urban structure exterior habitat. These areas are covered with impervious structures or surfaces that do not support vegetation—including the tennis facility and associated parking, New York Water Taxi ferry landing and Water Taxi Beach (a 44,000-square-foot (sf) area of sand with a volleyball net and picnic tables), and associated parking area)—or that support little to no vegetation and offer minimal habitat, i.e., rooftops and other exterior surfaces and cracks in paved areas where plants can grow, and a small number of street trees.

Table 11-5 lists plant species observed within the project sites during the October 2007 site visit. Plants observed in the scattered vegetated areas in the northern portion of Site A include invasive herbaceous species, such as mugwort, Japanese knotweed, and spurge, and such trees as white mulberry, tree-of-heaven, black locust, and Japanese zelkova. The remaining portion of Site A is urban vacant lot habitat, consisting of disturbed soils supporting mainly invasive plant species bordering the East River and Newtown Creek, and a disturbed area being used for stockpiling construction and demolition materials that is essential devoid of vegetation, as described below. One New York State Endangered plant species, late-flowering thoroughwort (*Eupatorium serotinum*) was observed in the southern portion of Site A, along the Newtown Creek shoreline.

As discussed previously, the surface topography of the project sites ranges from 1 to 10 feet above MSL and generally slopes down toward the East River with the exception of the two elevated peninsula areas (see **Figure 11-4**) located south of 54th Avenue. The entire shoreline within Site A is engineered with riprap or bulkhead (see **Figure 11-4** and **Appendix 11.1**). The ground surface consists of impervious surfaces, disturbed soils, and gravel mixed with rubble and debris. South of 54th Avenue, a vegetated band along the East River waterfront, inland of the shoreline engineering, consists primarily of disturbance tolerant trees and herbaceous plants (**Table 11-5**). The majority of the northern peninsula (immediately south of 54th Avenue) is vegetated with invasive herbaceous species dominated by mugwort, clovers, and lamb's quarters. The vegetated shoreline along the East River in the southern peninsula area consists of black locust (approximately 90 percent of the plant cover) in a 40-foot-wide band that starts on the north side of the peninsula that widens to approximately 70 feet at the mouth of Newtown Creek. Inland of this band of trees, vegetation consists of the same invasive herbaceous species that dominate the northern peninsula area (see site photographs in **Appendix 11.1**).

The engineered shoreline within Site A would be expected to provide resting and perching habitats for waterfowl and shorebirds. The rocky shoreline at the base of the upland areas in Site A would also be expected to provide resting and feeding habitat for waterfowl and shorebirds. Waterfowl known to occur along the East River during the spring and fall migratory periods include American black duck (*Anas rubripes*), American widgeon (*Anas americana*), bufflehead (*Bucephala albeola*), canvasback (*Aythya valisineria*), greater scaup (*Aythya marila*), green-winged teal (*Anas carolinensis*), hooded merganser (*Lophodytes cucullatus*), lesser scaup (*Aythya affinis*), mallard (*Anas platyrhynchos*), northern shoveler (*Anas clypeata*), red-breasted merganser (*Mergus serrator*), and ruddy duck (*Oxyura jamaicensis*) (NOAA 2001). Wading birds, such as herons and egrets, and shorebirds, such as sandpipers and gulls, might occur in the cove areas.

Table 11-5
Plants Observed Within the Project Sites, October 23, 2007

Habitat	Common	Scientific Name
Forb/herb	Green amaranth	*Amaranth retroflexus*
Forb/herb	Amaranth	*Amaranth* sp.
Forb/herb	Pimpernel	*Analgallis arvensis*
Forb/herb	Indian hemp	*Apocynum cannabinum*
Forb/herb	Mugwort	*Artemisia vulgaris*
Forb/herb	Heath aster	*Aster pilosus*
Forb/herb	Spotted spurge	*Chamaesyce maculata*
Forb/herb	Lamb's quarters	*Chenopodium album*
Forb/herb	Bull thistle	*Cirisium vulgare*
Forb/herb	Hedge bindweed	*Convolvulus sepium*
Forb/herb	Crown vetch	*Coronilla varia*
Forb/herb	Common dodder	*Cuscuta gronovii*
Forb/herb	Queen Anne's lace	*Daucus carota*
Forb/herb	Horseweed	*Erigeron canadensis*
Forb/herb	Late flowering thoroughwort	*Eupatorium serotinum*[(1)]
Forb/herb	Upright spotted spurge	*Euphorbia maculata*
Forb/herb	Bedstraw sp.	*Galium* sp.
Forb/herb	Common sunflower	*Helianthus annus*
Forb/herb	Bush clover sp.	*Lespedeza* sp.
Forb/herb	Butter and eggs	*Linaria vulgaris*
Forb/herb	White campion	*Lychnis alba*
Forb/herb	Black medick	*Medicago lupulina*
Forb/herb	Carpet weed	*Mollugo verticillata*
Forb/herb	Common evening primrose	*Oenothera biennis*
Forb/herb	Yellow wood sorrel	*Oxalis europaea*
Forb/herb	Pokeweed	*Phytolacca americana*
Forb/herb	Japanese knotweed	*Polygonum cuspidatum*
Forb/herb	Knodding smartweed	*Polygonum lapathifolium*
Forb/herb	Curled dock	*Rumex crispus*
Forb/herb	Black nightshade	*Solanum nigrum*
Forb/herb	Seaside goldenrod	*Solidago sempervirens*
Forb/herb	Common sow thistle	*Sonchus oleraceus*
Forb/herb	Field pennycress	*Thlaspi arvense*
Forb/herb	Low hop clover	*Trifolium procumbens*
Forb/herb	Common mullein	*Verbascum thapsus*
Forb/herb	Beach clotbur	*Xanthium echinatum*
Graminoid	Stink grass	*Eragrostis* sp.
Graminoid	Common reed	*Phragmites australis*
Graminoid	Knodding foxtail	*Seteria magna*
Tree/shrub	Norway maple	*Acer platanoides*
Tree/shrub	Tree-of-heaven	*Ailanthus altissima*
Tree/shrub	Autumn olive	*Elaeagnus umbellata*
Tree/shrub	White mulberry	*Morus alba*
Tree/shrub	Common cottonwood	*Populus deltoides*
Tree/shrub	Black locust	*Robinia psuedoacacia*
Tree/shrub	Weeping willow	*Salix babylonicax*
Tree/shrub	American elm	*Ulmus americana*
Tree/shrub	Japanese zelkova	*Zelkova serrata*

Note: (1) New York State Endangered, State Rank S2—Imperiled in New York State because of rarity or highly vulnerable to extirpation from New York State due to biological factors.

Structural elements within the project sites (i.e., buildings) may provide nesting and perching opportunities for passerine bird species, such as chimney swifts (*Chaetura pelagica),* pigeons (most commonly the feral rock dove, or *Columba livia*), mourning doves (*Zenaida macroura*), and other species known for their propensity to inhabit heavily urbanized areas.

The New York State Breeding Bird Atlas project provides records of birds that have the potential to breed within Block 5851C (surveyed 2000 to 2005), which includes the project sites. Examples of birds that have the potential to breed in the immediate vicinity of the project sites include rock pigeon (*Columba livia*), mourning dove (*Zenaida macroura*), blue jay (*Cyanocitta cristata*), barn swallow (*Hirundo rustica*), American robin (*Turdus migratorius*), gray catbird (*Dumetella carolinensis*), European starling (*Sturnus vulgaris*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*).

The NYSDEC Herp Atlas Project conducted a survey between 1990 and 1999, documenting the geographic distribution of New York's reptiles: turtles, snakes, lizards, and amphibians (frogs, toads, and salamanders). Amphibians and reptiles with the potential to use the habitats observed within the project sites include the eastern American toad (*Bufo a. americanus*), Fowler's toad (*Bufo fowleri*), Italian wall lizard (*Podarcis sicula*), common garter snake (*Thamnophis sirtalis*), and the eastern milk snake (*Lampropeltis t. triangulum*). Of these species, only the common garter snake has the potential to occur within the project sites.

Mammalian wildlife within the project sites are expected to be limited to common urban-breeding native and non-native species that are able to persist in urban developed and vacant lot habitats, such as mice (*Mus musculus*) and other small rodents. (No mammals were observed during the October 2007 site visit.) None of these species depend on habitats specific to the project sites.

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

Requests for information on rare, threatened, or endangered species within the immediate vicinity of the study area were submitted to NYNHP, USFWS, and NMFS. NYNHP has no records of rare or State-listed wildlife or plant species, significant natural communities, or other significant habitats, on or within the vicinity of the project sites (Conrad 2007). However, as discussed above individuals of the New York State Endangered plant species, late-flowering thoroughwort (*Eupatorium serotinum*) was observed in the southern portion of Site A, along the Newtown Creek shoreline. The USFWS list of federally threatened or endangered species and candidate species for Queens County identifies two federally threatened species (piping plover [*Charadrius melodus*] and seabeach amaranth [*Amaranthus pumilus*]) and two federally endangered species (roseate tern [*Sterna dougalli dougallii*] and shortnose sturgeon [*Acipenser brevirostrum*]) known to occur in Queens. Of these species, three are typically restricted to coastal beaches in Queens (piping plover, seabeach amaranth, and roseate tern) and are not expected to occur on or near the project sites. The potential for shortnose sturgeon to occur in the East River near the project sites is discussed below.

NMFS identified the endangered shortnose sturgeon (*Acipenser brevirostrum*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and four sea turtle species—the federally threatened loggerhead (*Caretta caretta*) and federally endangered Kemp's ridley (*Lepidochelys kempi*), green (*Chelonia mydas*), and leatherback (*Dermonchelys coriacea*)—as potentially occurring within the upper East River in the vicinity of the project sites (Colligan 2007). These species are discussed below.

SHORTNOSE STURGEON

The federally and State-listed-endangered shortnose sturgeon is a semi-anadromous bottom-feeding fish that can be found throughout the Hudson River system. These fish spawn, develop, and overwinter in the mid-Hudson River well up-estuary of the project sites (NYSDEC 2003). Shortnose sturgeon spend most of their lives in the Hudson River estuary and prefer colder, deeper waters for all life stages.

Although larvae can be found in brackish areas of the Hudson River, the juveniles (fish ranging from 2 to 8 years old) are predominately confined to freshwater reaches above the downstream saline area. The primary summer habitat for shortnose sturgeon in the middle section of the Hudson River is the deep river channel (13 to 42 m deep, or 43 to 138 feet). The river channel downstream of this middle estuary area is 18 to 48 m deep (59 to 157 feet [Peterson and Bain 2002]). The Hudson River below Tappan Zee is not considered optimal shortnose sturgeon habitat (Bain 2004).

The Hudson River shortnose sturgeon population was recently estimated to contain approximately 61,000 fish (Peterson and Bain 2002). These studies show that the population has increased approximately 450 percent since the 1970s. Size and body condition of the fish caught in these studies indicate the population is primarily healthy, long-lived adults. Although larvae can be found in brackish areas of the river, the juveniles (fish ranging from 2 to 8 years old) are predominately confined to freshwater reaches. (Peterson and Bain 2002).

Shortnose sturgeon have been reported near Staten Island in New York Harbor and near the confluence of the East River and New York Harbor. Additionally, two individuals tagged in the Hudson River have been recaptured in the Connecticut River. It is unknown whether these individuals traveled through the East River and into Long Island Sound, or exited New York Harbor into the Atlantic Ocean and then traveled north along the southern coast of Long Island and into Long Island Sound. The East River is not considered to be a high-use area for shortnose sturgeon, and there have been no documented captures of this species from within the East River (Colligan 2007). Individuals are only expected to occur near the project sites as transient individuals while traveling to or from Hudson River spawning, nursery, and overwintering areas.

ATLANTIC STURGEON

The Atlantic sturgeon, an NMFS candidate species, is also known to occur in the Hudson River and surrounding coastal waters. It is a large anadromous, bottom-feeding species that spawns in the Hudson River and matures in marine waters; females return to spawn at 18 years, males earlier (Bain 1997). In the Hudson River, Atlantic sturgeon are found in the deeper portions and do not occur farther upstream than Hudson, New York. Atlantic sturgeon migrate from the ocean upriver to spawn above the salt front from April to early July (Smith 1985, Stegemann 1999). Individuals are likely to occur in the East River, although not in high numbers (Colligan 2007). Juveniles may use the East River to migrate from the Hudson River to Long Island Sound (Savoy and Pacileo 2003). Their diet consists largely of benthic organisms (including worms and amphipods), plants, and small fish (Bain 1997, NYSDEC 2007). Overfishing, reduction of key spawning areas, and pollution have been suggested as reasons for the range-wide decline of this species (Smith 1985, Bain 2004).

SEA TURTLES

Four species of marine turtles, all State- and federally listed, can occur in western Long Island Sound and the New York Harbor complex, typically as small juveniles. Juvenile Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) turtles regularly enter the New York Harbor and bays in the summer and fall. The other two species, green sea turtle (*Chelonia mydas*) and leatherback sea turtle (*Dermochelys coriacea*), are usually restricted to the higher salinity areas of the Harbor and are rarely are found in-shore (USFWS 1997, Colligan 2007). These four turtle species mostly inhabit Long Island Sound and Peconic and Southern Bays. They neither nest in the New York Harbor Estuary nor reside there year-round (Morreale and Standora 1995). Turtles leaving Long Island Sound for the winter usually do so by heading east to the Atlantic Ocean before turning south (Standora et al. 1990). It is unlikely that these turtle species would occur in the study area in the lower East River except as occasional transients.

ESSENTIAL FISH HABITAT

The study area on the East River is within a portion of the Hudson River Estuary EFH. This EFH is situated in the NOAA/NMFS 10' x 10' square with coordinates (North) 40°50.0' N, (East) 73° 50.0' W, (South) 40°40.0' N, (West) 74°00.0' W, and includes Atlantic Ocean waters within the Hudson River Estuary affecting the following areas: Manhattan Island, College Point, NY, Long Island City, NY, Brooklyn, NY, Port Morris, NY, Unionport, NY, Flushing Bay, Astoria, NY, LaGuardia Airport, Badland Island, Rikers Island, Roosevelt Island, Wards Island, and Hells Gate, along with the East River, the Harlem River, and the Bronx River. **Table 11-6** lists the species and life stages of fish identified as having EFH in the portion of the East River near the project sites.

Table 11-6
Essential Fish Habitat Designated Species for the East River

Species	Eggs	Larvae	Juveniles	Adults
Polluck (*Pollachius virens*)			x	x
Red hake (*Urophycis chuss*)		x	x	x
Winter flounder (*Pseudopleuronectes americanus*)	x	x	x	x
Windowpane flounder (*Scopthalmus aquosus*)	x	x	x	x
Atlantic herring (*Clupea harengus*)		x	x	x
Bluefish (*Pomatomus saltatrix*)			x	x
Atlantic butterfish (*Peprilus triacanthus*)		x	x	x
Atlantic mackerel (*Scomber scombrus*)			x	x
Summer flounder (*Paralicthys dentatus*)		x	x	x
Scup (*Stenotomus chrysops*)	x	x	x	x
Black sea bass (*Centropristus striata*)	n/a		x	x
King mackerel (*Scomberomorus cavalla*)	x	x	x	x
Spanish mackerel (*Scomberomorus maculatus*)	x	x	x	x
Cobia (*Rachycentron canadum*)	x	x	x	x
Clearnose skate (*Raja eglanteria*)			x	x
Little skate (*Leucoraja erinacea*)			x	x
Winter skate (*Leucoraja ocellata*)			x	x
Sand tiger shark (*Odontaspis taurus*)		x[(1)]		
Dusky shark (*Charcharinus obscurus*)		x[(1)]		
Sandbar shark (*Charcharinus plumbeus*)		x[(1)]		x

Notes: [(1)] Neither of these species have a free-swimming larval stage; rather they are live bearers that give birth to fully formed juveniles. For the purposes of this table, "larvae" for sand tiger and sandbar sharks refers to neonates and early juveniles.

Source: National Marine Fisheries Service. "Summary of Essential Fish Habitat (EFH) Designation" posted on the Internet at http://www.nero.noaa.gov/hcd/STATES4/conn_li_ny/40407350.html

E. THE FUTURE WITHOUT THE PROPOSED ACTIONS

FLOODPLAINS AND TERRESTRIAL RESOURCES

In the future without the proposed actions, the geologic conditions, groundwater conditions, and floodplain resources would remain in their current conditions with the exception of the compensatory wetlands mitigation that will occur within Site A in compliance with the USACE and NYSDEC permits issued for the in-water and shoreline activities for Stages 2, 3, and 4 of the Queens West project (see Chapter 1, section C, "Project Background," for a discussion of the Queens West project). Site A will continue to provide limited wildlife habitat for urban-tolerant wildlife species within the vegetated portions of the site. Site B and the portions of Site A occupied by the tennis facility will continue to be of limited value to wildlife.

The compensatory mitigation to be implemented along the East River shoreline of Site A in compliance with the NYSDEC and USACE permits issued in 2003 and 2004 for the in-water and shoreline activities associated with Stages 2, 3, and 4 of the Queens West project, respectively, encompass approximately 0.7 acres (30,492 square feet). In Stage 3, which is part of Site A, this mitigation totals approximately 23,600 square feet (0.54 acres) and runs along approximately 1,100 feet of shoreline beginning at the sunken float bridge (south of 54th Avenue) to the mouth of Newtown Creek. In Stage 2, which is part of the Queens West project but not part of Site A, this mitigation totals approximately 6,982 square feet (0.16 acres) and has already been implemented by the Queens West Development Corporation (QWDC). As presented in the NYSDEC and USACE permits, the compensatory mitigation must be completed by May 31, 2012, and includes the following activities depicted on the drawings submitted by the Queens West Development Corporation with the permit application for the Queens West project:

The 23,600 square feet of high marsh wetlands in Site A would be planted within newly established shoreline stabilization to be constructed along the Site A shoreline by removing fill above Spring High Water (SHW) to meet the proposed grade. Below the area to be planted, unsuitable material armoring the shoreline will be removed and the slopes re-armored with engineered riprap—after two growing seasons, the survival rate of the planted high marsh vegetation is to be 85 percent, with not more than 5 percent of areal coverage by invasive species. The 23,600 square feet of compensatory mitigation plantings include the following:

- Creation of approximately 3,000 square feet of high marsh wetlands along the shoreline of the northern peninsula area (south of 54th Avenue to the sunken float bridge).
- Creation of approximately 3,000 square feet of high marsh wetlands along the shoreline south of the sunken float bridge by replacing approximately 200 linear feet of sheetpile bulkhead with engineered riprap slope that will accommodate the planting of the high marsh vegetation .
- Development of approximately 17,600 square feet (0.4 acres) of additional mitigation opportunities along the Site A shoreline to achieve required compensatory mitigation total of 23,600 square feet.

The mitigation within Site A also includes removal of the sunken float bridge.

In addition to the compensatory mitigation required by the NYSDEC and USACE permits, a recent Consent Order between QWDC and NYSDEC requires the removal of the recycled concrete aggregate used for the 54th Avenue outfall coffer dam and establishment of an

additional 1,200 square feet of compensatory mitigation. Approximately 350 square feet of the 1,200 square feet has been incorporated in Stage 1 of the Queens West project. The remaining 800 square feet of mitigation will be incorporated into the shoreline area of Site A that is south of 54th Avenue.

The wetlands mitigation activities will result in additional tidal wetland resources within the project sites and improved resting and perching habitat for waterfowl and shorebirds.

WATER QUALITY AND AQUATIC RESOURCES

Proposed and ongoing projects aimed at improving water quality and aquatic resources in the New York/New Jersey Harbor Estuary have the potential to improve water quality and aquatic habitat in the Upper Harbor and East River near the project sites. As described below, these projects are independent of the proposed actions, and the resulting improvements to water quality and aquatic resources will occur without the proposed actions. In addition, dry weather flows to the Bowery Bay WPCP are predicted to increase in the future without the proposed project, which also has the potential to change water quality.

NEW YORK/NEW JERSEY HARBOR ESTUARY PROGRAM (HEP) PROJECTS

The HEP Final Comprehensive Conservation and Management Plan (CCMP) included a number of goals to improve water quality and aquatic resources throughout the Harbor Estuary. To meet these goals, the CCMP outlines objectives for the management of toxic contamination, dredged material, pathogenic contamination, floatable debris, nutrients and organic enrichment, and rainfall-induced discharges. Most of these objectives aim to increase knowledge of the nature and extent of various forms of pollution (e.g., toxic chemicals, sewage overflows, and floatables), reduce inputs of these pollutants, and increase the habitat and human use potential of the Harbor Estuary area. The floatables action plan of the HEP aims to reduce the amount of debris in the two States' waters. It includes marine debris survey collection programs, improved street cleaning, combined sewer overflow and stormwater abatement, enforcement of solid waste transfer regulations, shoreline cleanup programs, and public education.

The HEP Habitat Workgroup developed watershed-based priorities for acquisition, protection, and restoration. USACE New York District began a feasibility study in 2001 to assess potential sites for habitat restoration in New York Harbor. In May 2003, the Regional Plan Association identified needs and opportunities for environmental restoration in the Hudson-Raritan Estuary. These sites involve the preservation and enhancement of tidal wetlands that will provide improved habitat for fish and macroinvertebrates as well as the birds, mammals, and reptiles that depend on these habitats. While no HEP Acquisition and Restoration Sites have been identified near the project sites, habitat restoration activities within the Harbor Estuary will benefit aquatic resources throughout the estuary, including the East River.

NEW YORK CITY PROJECTS

The EPA's National CSO Strategy of 1989 requires states to eliminate dry-weather overflows of sewers, meet Federal and State water quality standards for wastewater discharges, and minimize impacts on water quality, plant and animal life, and human health. New York City committed $1.5 billion for construction of CSO abatement facilities from 1998 to 2008. These measures include eliminating dry-weather sewage discharges to the combined sewer system, reducing illegal discharges, increasing the capture of wet-weather related floatables, reducing the toxic metals loadings, improvements to WPCPs, and mitigating discharges from CSOs.

As required by EPA's CSO Control Policy, NYCDEP initiated its Long-Term Control Plan (LTCP) Project in 2004. The LTCP Project will integrate CSO Facility Planning and the Comprehensive City-Wide Floatables Abatement Plan, incorporate ongoing Use and Standards Attainment Program (USA) Project work, and develop Waterbody/Watershed Facility Plan Reports and the LTCP for each waterbody area. The LTCP Project monitors and assures compliance with applicable Administrative Consent Orders between NYSDEC and New York City for the CSO Abatement Program. Additionally, NYCDEP plans to increase identification and control of pollutants of concern, including mercury, PCBs, and solvents. The Drainage Basin Specific and City-Wide LTCP that will be developed is intended to further control CSO discharges.

Newtown Creek, which is within the study area for water quality and aquatic resources, is considered impaired for its designated use (Use Class SD saline surface water) because of low dissolved oxygen levels, primarily due to CSO and stormwater discharges. Newtown Creek was listed on the New York State 1998 Section 303(d) list as an impaired waterbody and was scheduled as a high priority for Total Maximum Daily Load (TMDL) development before the year 2005. The 303(d) list identifies waters that do not support appropriate uses and that require development of a TMDL or other restoration strategy to reduce the input of the specific pollutant(s) that restrict waterbody uses, in order to restore and protect such uses. However, the Draft 2006 Section 303(d) list of impaired waterbodies includes Newtown Creek in the list of waters that are impaired but no longer requiring a TMDL. Newtown Creek was de-listed because other required control measures, resulting from the implementation of Consent Order signed by NYSDEC and the City in 2005, are expected to result in restoration of the waterbody.

The 2005 Consent Order directed the City to develop and submit a Waterbody/Watershed Facility Plan for Newtown Creek to address CSO discharges by June 2007 and submit a Drainage Basin Specific LTCP for Newtown Creek by February 2016. The Consent Order also establishes milestone dates for the design and construction of the in-stream aeration facilities, relief sewer/regulator modification design and construction, throttling facility design and construction, and the CSO storage facility design and construction. Most of these milestones are expected to be completed and improve the water quality and aquatic resources of Newtown Creek by the 2017 analysis year.

STATE AND REGIONAL PROJECTS

The Hudson-Raritan Estuary Ecosystem Restoration Project (HRE) is a cooperative project being led by USACE and the Port Authority of New York and New Jersey with involvement from USEPA, USFWS, National Oceanic and Atmospheric Administration (NOAA), National Resource Conservation Service, New Jersey Department of Environmental Protection, New Jersey Department of Transportation, NYSDEC, NYSDOS, NYCDEP, NYCDPR, and the New Jersey Meadowlands Commission. The study will identify the actions needed to restore the Hudson-Raritan Estuary and develop a plan for their implementation.

The study area for the program includes all of the waters of the New York and New Jersey Harbor and the tidally influenced portions of all rivers and streams that empty into and ecologically influence the Harbor. The program has drafted a plan that presents an ecosystem approach to restoration of the estuary, guidance for selecting specific projects, measurable objectives called target ecosystem characteristics, and tracking program performance.

Thirteen sites in New York and New Jersey have been identified as the first sites for potential restoration projects and feasibility level analysis. It is anticipated that expedited restoration of

these sites will provide substantial immediate value to the ecosystem. None of these sites are near the project sites. The HRE identified Newtown Creek as a potential habitat restoration site. Overall restoration measures identified by the HRE to enhance aquatic and nearshore terrestrial habitat within the East River include restoring/creating wetlands, softening and revegetating the shoreline, removing contaminated sediment, and restoring and enhancing upland habitat adjacent to the water for management of surface runoff and wildlife habitat (USACE 2004).

INCREASED FLOWS TO BOWERY BAY WPCP DRAINAGE AREA DUE TO OTHER PROJECTS

The projected average daily flow (wet and dry weather) to the Bowery Bay WPCP in the 2017 analysis year includes the 120 mgd of sanitary flow projected by NYCDEP for the Bowery Bay WPCP, plus wet weather flow[1]. Wet weather flow for the Bowery Bay WPCP was 11.32 mgd on average in 2006 and 9.25 mgd on average in 2007. On the basis of the 2006 and 2007 wet weather flows, the projected 120 mgd of sanitary flow (dry weather) in the 2017 analysis year, plus wet weather flow would be expected to be within the Bowery Bay WPCP's permitted daily flow limit of 150 mgd, and would not be expected to adversely affect compliance of the Bowery Bay WPCP effluent with the SPDES permit limits. Therefore, the projected flows for the 2017 future condition without the proposed actions would not result in significant adverse impacts to the water quality of the East River in the vicinity of the WPCP. Water quality of the East River in the vicinity of the Bowery Bay WPCP would continue to meet the Use Class I water quality standards.

Appendix 11.2 presents a detailed discussion of the InfoWorks modeling conducted to assess potential impacts to the combined sewer system, and CSO frequency and volume due to the projected future dry weather flow of 40.8 mgd, and total flow (wet and dry weather) of 44 mgd[2] within the Bowery Bay low-level drainage area. This future total flow represents an increase of approximately 8 mgd from the estimated discharge of 36 mgd in 2007 (i.e., existing condition). As presented in **Appendix 11.2**, the frequency of CSOs for the five combined sewer outfalls connected to regulators receiving sanitary sewage and stormwater from the project sites would not change from the existing condition in 2017 (i.e., remain at 29 events). However, for the entire Bowery Bay low-level drainage area, the number of CSOs would increase by 1 event in 2017 when compared to the existing condition (i.e., from 54 events in 2007 to 55 events in 2017). The projected CSO volumes discharged to the East River and Newtown Creek in 2017 without the proposed actions were estimated at approximately 1,321 mgy, an increase of about 104 mgy from the existing CSO discharge of 1,217 mgy, or an increase of 8.5 percent. Of the 37 combined sewer outfalls within the Bowery Bay low-level drainage, 14 are expected to increase by at least 0.5 mgy, with two outfalls to Dutch Kills, a tributary to Newtown Creek, representing over half of the overall increase.

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[1] Wet weather increment for Bowery Bay WPCP calculated on basis of flow data for the year 2006 and 2007 provided to HydroQual by Theresa Norris, NYCDEP on February 12, 2007 and January 22, 2008, respectively.

[2] The Bowery Bay low-level drainage area contributes an estimated 34 percent of dry weather flow for the WPCP. Therefore, in 2017, the low-level drainage area would contribute approximately 40.8 mgd of dry weather flow. The wet weather flow for the Bowery Bay WPCP low-level drainage is generally 3.4 mgd. Therefore, under the future condition without the proposed actions in 2017, the projected total flow (dry weather plus wet weather) to the Bowery Bay WPCP from the low-level drainage area would be about 44 mgd.

This minimal change in the frequency and volume of CSOs would not be expected to result in a significant adverse impact to the water quality of the East River, Newtown Creek, or Dutch Kills, and all three water bodies would be expected to meet their designated Use Class standards. Like Newtown Creek, Dutch Kills is also a Use Class SD water. However, the increase in CSO events and volume in the 2017 future without the proposed actions does indicate that future developments within the Bowery Bay low level drainage area have the potential to result in adverse impacts to the combined sewer system (see Chapter 13) that would not be consistent with the Drainage Basin Specific LTCP developed for Newtown Creek or the Drainage Basin Specific LTCP developed for the East River and Open Waters by 2017.

THREATENED OR ENDANGERED SPECIES

The threatened or endangered species and candidate species identified as having a potential to occur in the East River near the project sites as transient individuals are expected to continue to occur as transient individuals in the future without the proposed actions. These species—shortnose sturgeon, Atlantic sturgeon, and the four species of sea turtles—are expected to benefit from the water quality improvements that would occur as a result of the projects discussed in the previous section.

ESSENTIAL FISH HABITAT

EFH designated for the portion of the East River near the project sites is expected to be unchanged in the future without the proposed actions. The fish species identified as having EFH in the East River will benefit from the water quality improvements that would occur as a result of the projects discussed above in "Water Quality and Aquatic Resources."

F. PROBABLE IMPACTS OF THE PROPOSED ACTIONS

The proposed actions would also create 11 acres of open space with passive and active recreational areas contiguous with waterfront open space areas that have already been created north of Site A. These elements of the proposed actions have the potential to benefit natural resources on and near the project sites. The potential for natural resource impacts to occur as a result of the proposed actions is discussed below.

GROUNDWATER

Significant adverse impacts to groundwater are not expected to occur as a result of construction or operation of the proposed actions. Because groundwater is not used as a potable water supply in this part of Queens, the proposed actions would not affect drinking water supplies.

As discussed in Chapter 10, "Hazardous Materials," Sites A and B have been identified as having the potential for hazardous materials contamination. Implementation of the measures described in Chapter 10 during construction activities would minimize the potential for significant adverse impacts to groundwater quality.

As discussed in section D, "Existing Conditions," the analysis of groundwater samples collected within Site A did not reveal the presence of significant wide-spread groundwater contamination that could be attributed to current or past site operations. Elevated levels of metals have been attributed to intrusion of brackish water from the East River. Construction and development activities within the project sites that extend below the water table may expose localized areas of contaminated groundwater. In these cases, corrective action in accordance with regulatory

protocols would be followed, including notification of the proper regulatory agencies and clean-up under regulatory guidance. Dewatering activities for construction of the proposed actions, if necessary, may require treatment of the groundwater before discharge to the municipal sewer or the East River to minimize adverse impacts to water quality. Before any dewatering activities, sampling would be performed to ensure that any discharged groundwater meets the NYCDEP limitations for effluent to municipal sewers, should this be the designated course of action.

FLOODPLAINS AND WETLANDS

CONSTRUCTION

As discussed in section D, "Existing Conditions," the central and eastern portion of Site A and much of Site B are within the 100-year floodplain. The New York City Building Code (Title 27, Subchapter 4, Article 10) requires that residential buildings have a finished floor elevation (FFE) at or above the 100-year floodplain, while FEMA requires the FFE to be one foot above the 100-year floodplain. Clean fill would be used to raise the development area, including the areas for new streets and buildings, as well as portions of the project sites designated for the waterfront park or other open space areas that would not be covered by impervious surface or structures.

Raising the elevation of the project sites above the 100-year flood elevation would not exacerbate flooding conditions near the project sites. New York City is affected by local (e.g., flooding of inland portions of the City from short-term, high-intensity rain events in areas with poor drainage), fluvial (e.g., rivers and streams overflowing their banks), and coastal flooding (e.g., long and short wave surges that affect the shores of the Atlantic Ocean, bays such as Upper New York Bay, and tidally influenced rivers such as the East River and Newtown Creek, streams and inlets [FEMA 2007]). The floodplain within and adjacent to the project sites is affected by coastal flooding, which is influenced by astronomic tide and meteorological forces (e.g., northeasters and hurricanes [FEMA 2007]), and, therefore, would not be affected by construction of the proposed actions.

While estuarine wetlands within the study area are identified on the NWI map (see **Figure 11-2**), these areas are unvegetated, and therefore would be regulated by the USACE as waters of the United States and not as wetlands. Reported water depths along the shoreline of Sites A and B suggest the potential for NYSDEC littoral zone tidal wetlands within the in-water portions of Site A. Additionally, the wetlands mitigation activities to be conducted in accordance with the existing NYSDEC and USACE permits issued for the Queens West Project will result in the creation of vegetated high-marsh wetlands on Site A.

Reconstruction of portions of the existing shoreline engineering, described in section D, "Existing Conditions," would be conducted within the footprint of the existing bulkhead or riprap and would not likely result in the loss of littoral zone tidal wetlands. The construction of two new stormwater outfalls has the potential to result in some loss of tidal wetlands which could be offset through park design within the project sites. Measures would be implemented during these reconstruction activities to minimize any temporary impacts to littoral zone wetlands due to disturbance of bottom sediments, and to high-marsh wetlands created as part of the mitigation for the Queens West project.

The proposed actions would be covered under the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity Permit No. GP-0-08-001. To obtain coverage under this permit, a stormwater pollution prevention plan (SWPPP) would be prepared and a Notice of Intent (NOI) would be submitted to NYSDEC. The SWPPP would comply with

all of the requirements of GP-0-08-001, NYSDEC's technical standard for erosion and sediment control presented in "New York Standards and Specifications for Erosion and Sediment Control," and NYSDEC's technical standard for the design of water quantity and water quality controls (post-construction stormwater control practices) presented in the New York State Stormwater Management Design Manual. Implementation of erosion and sediment control measures, and stormwater management measures identified in the SWPPP would minimize potential impacts tidal wetlands along the edges of the project sites associated with discharge of stormwater runoff during land-disturbing activities resulting from construction of the proposed actions.

OPERATION

As discussed in Chapter 13, "Infrastructure," the proposed actions would result in a decrease in the portion of Site A covered with pervious surface from approximately 58 percent under the current conditions to 38 percent in 2017. Pervious areas would include portions of the waterfront park and other open space areas. Pervious surface would increase in Site B to approximately 35 percent from none under the current conditions.

The decrease in pervious surface would result in an increase in surface runoff generated under the design storm from approximately 87 cubic feet per second (cfs) under existing conditions to approximately 134 cfs, an increase of approximately 47 cfs. In Site B, the increase in pervious surface would result in a decrease in surface runoff generated under the design storm from approximately 42 cfs under existing conditions to approximately 36 cfs in 2017, a decrease of approximately 6 cfs. At Site B, stormwater runoff would be conveyed to a new separate storm sewer system that would discharge to a new stormwater outfall on Newtown Creek, or the combined sewer system, if NYCDEP determines, based on the Amended Drainage Plan and Site B's development plans, that the site design would incorporate appropriate stormwater best management practices (e.g., on-site detention) to meet its stormwater discharge rate requirements. Alternatively, the stornwater runoff from Site B could be conveyed to the separate storm sewer system to be developed on Site A under the new Amended Drainage Plan.

During final design of the project, and as part of the SWPPP prepared for the proposed project, stormwater management measures to reduce the amount and rate of stormwater generated within the project sites (e.g., porous pavement, bioswales, etc.) will be considered. It is anticipated that stormwater attenuation and treatment mechanisms will be included in the City's design of the streets and parks within Site A; and that the designs of these systems will be guided by the City's sustainability initiatives described in PlaNYC, Best Management Practices, and CEQR standards to ensure public and environmental health and safety. As discussed above, the floodplain within and adjacent to the site is affected by coastal flooding and would not be affected by changes in the amount of pervious surface from the proposed actions.

Operation of the project as a result of the proposed actions is not expected to result in long-term significant adverse impacts to existing NYSDEC-designated littoral zone wetlands or to high-marsh wetlands created as part of mitigation from the Queens West development. Implementation of the SWPPP developed for the project sites would minimize potential impacts to existing NYSDEC-designated littoral zone tidal wetlands as well as the high-marsh wetlands created within Site A in compliance with the NYSDEC and USACE permits issued for the Queens West project. In accordance with the Amended Drainage Plan, a new sewer system would be constructed on Site A that would separate stormwater and sanitary sewage flow. This

new system will further reduce stormwater runoff and potential for impacts to the adjacent wetlands.

As detailed in Chapter 6, "Shadows," the proposed actions would result in incremental shadows from the new development on portions of the East River during the morning hours throughout the year, and on portions of Newtown Creek south and east of the project sites in the late afternoons of the spring, summer, and fall. The current flows rather swiftly in the East River and would move phytoplankton and other natural elements quickly through the shaded areas. Therefore, project-generated shadows would not be expected to affect primary productivity in tidal wetland areas. Because of the relatively short duration of incremental shadow on Newtown Creek, aquatic and wetland resources are not anticipated to be affected, and no significant adverse impacts are expected.

AQUATIC RESOURCES

WATER QUALITY

Construction

Implementation of erosion and sediment control measures (e.g., silt fences and straw bale dikes), and stormwater management measures as part of the SWPPP during construction and operation of the proposed actions would minimize potential impacts to water quality of the East River and Newtown Creek associated with stormwater runoff during land-disturbing activities that would occur in upland areas. These activities would include demolition of existing structures, debris removal, excavation activities for site grading, foundation work and placement of utilities, and placement of clean fill within the project sites. During these activities, any hazardous materials encountered would be handled and removed in accordance with the Memorandum of Understanding, NYCDEP, NYSDEC, OSHA, and USEPA requirements, a NYCDEP-approved Remedial Action Work Plan, and a CHASP (see Chapter 10). Any underground storage tanks located on the project sites would be removed and disposed of in accordance with Federal, State, and local regulations, and contaminated soil discovered during tank removal would be remediated according to the requirements of the NYSDEC Spills program. The implementation of these measures and the SWPPP prepared for the proposed actions during construction activities would minimize the potential for significant adverse impacts to surface water quality.

In-water construction activities for the proposed actions with the potential to result in sediment disturbance include reconstruction of bulkhead or riprap areas and construction of two new stormwater outfalls. Most of these activities would be conducted from upland areas of the project sites. Site A park development is generally anticipated to be completed moving from north to south, as each of the Site A parcels is developed. During these in-water construction activities, appropriate measures would be implemented to minimize increases of suspended sediment. While disturbance of sediment has the potential to result in increased suspended sediment in the water column and resuspension and redeposition of contaminants, these effects would be localized and temporary and would not cause significant adverse impacts on the water quality of the East River or Newtown Creek. Similarly, any contaminants released to the water column as a result of sediment disturbance is expected to dissipate rapidly and would not result in significant long-term impacts to water quality.

Operation: Stormwater

As discussed above, the proposed actions would result in an increase in the portion of Site A covered by impervious surface and a decrease in the portion of S covered by impervious surface. The decrease in pervious surface in Site A would result in a net increase in surface runoff generated under the design storm of approximately 47 cfs. In Site B, the increase in pervious surface would result in a net decrease in surface runoff of approximately 6.05 cfs. As discussed previously, stormwater runoff from Site B would be conveyed to a new separate storm sewer system that would discharge to:

- A new stormwater outfall on Newtown Creek, or
- The combined sewer system, if NYCDEP determines, based on the Amended Drainage Plan and Site B's development plans, that the site design would incorporate appropriate stormwater best management practices (e.g., on-site detention) to meet its stormwater discharge rate requirements.

Alternatively, the stornwater runoff from Site B could be conveyed to the separate storm sewer system to be developed on Site A under the new Amended Drainage Plan.

During final design of the project, and as part of the SWPPP prepared for the proposed project, stormwater management measures to reduce the amount and rate of stormwater generated within the project site (e.g., porous pavement, bioswales, etc.) will be considered. It is anticipated that stormwater attenuation and treatment mechanisms will be included in the City's design of the streets and parks within Site A; and that the designs of these systems will be created around the Office of Mayor's PlanNYC Sustainability Initiatives, Best Management Practices, and CEQR standards to ensure public and environmental health and safety. Implementation of these measures, as well as other stormwater management measures specified in the SWPPP during operation of the proposed actions, would minimize potential impacts to the East River and Newtown Creek from the discharge of stormwater from the project sites. In accordance with the Amended Drainage Plan, a new sewer system would be constructed on Site A that would separate stormwater and sanitary sewage flow. This new system will further reduce stormwater runoff and potential for impacts to the adjacent wetlands.

Operation: Increased Flows to Bowery Bay WPCP Drainage

As discussed in Chapter 13, the proposed actions would result in the discharge of approximately 1.5 million gallons per day (mgd) of sanitary sewage from Sites A and B to the combined sewer system, an increase of approximately 1.5 mgd from the future without the proposed actions. This increased flow represents approximately 1.2 percent of the Bowery Bay WPCP's permitted daily flow limit of 150 mgd. Under the 2017 future condition with the proposed actions, the projected total flow (sanitary sewage (dry weather) and stormwater runoff (wet weather)) to the Bowery Bay WPCP from the low-level drainage area would be 45.6 mgd, an increase of approximately 9.3 mgd from the existing condition of about 36 mgd on average, and an increase of about 1.4 mgd from the 2017 future condition without the proposed actions. This small additional flow would not cause the Bowery Bay WPCP to be above its permitted daily flow limit of 150 mgd, or adversely affect compliance of the Bowery Bay WPCP effluent with the SPDES permit limits. Therefore, the projected 1.4 mgd flow to the Bowery Bay WPCP in the 2017 future with the proposed actions would not result in significant adverse impacts to the water quality of the East River in the vicinity of the WPCP. Water quality of the East River in the vicinity of the Bowery Bay WPCP would continue to meet the Use Class I water quality standards.

As presented in **Appendix 11.2**, the frequency of CSOs for the five combined sewer outfalls connected to regulators receiving sanitary sewage from the project sites would decrease by 1 event in 2017 with the proposed actions when compared to the existing condition and the 2017 future without the project (i.e., decrease from 29 to 28 events). This decrease can be attributed to the development of the separate storm sewer within Site A. However, for the entire Bowery Bay low-level drainage area, the frequency of CSOs would increase by 2 events when compared to the existing condition (i.e., increase from 54 events to 56 events), but would increase by only 1 event when compared to the 2017 future without the project (i.e., increase from 55 events to 56 events). The projected CSO volumes discharged to the East River, Newtown Creek, and Dutch Kills (tributary to Newtown Creek), in 2017 with the proposed actions were estimated at approximately 1,323 mgy, an increase of about 106 mgy from the existing CSO discharge of 1,217 mgy, or an increase of 8.7 percent. This percentage increase is only 0.1 percent greater than under the 2017 future condition without the proposed actions. Of the 37 combined sewer outfalls within the Bowery Bay low-level drainage area, only 2 outfalls, both of which discharge to Dutch Kills (Newtown Creek tributary) are projected to have increased CSO volume of more than 0.5 mgy, and the total increase to Dutch Kills is about 4 mgy. CSO volumes to Newtown Creek and the East River are projected to decrease by about 2.4 mgy (4 percent) and 0.1 mgy, respectively. At the combined sewer outfall located at Site B, CSO volumes are projected to decrease by 1.74 mgy under the RWCDS when compared to the future without the proposed actions, a decrease of 39 percent

As discussed for the future condition without the proposed actions, this minimal change in the frequency and volume of CSOs with the proposed actions would not result in a significant adverse impact to the water quality of the East River, Newtown Creek, or Dutch Kills. However, the projected increase in CSO events and volume in the 2017 future with the proposed action does indicate that the proposed actions have the potential to result in adverse impacts to the combined sewer system that would not be consistent with the Drainage Basin Specific LTCP developed for Newtown Creek or the Drainage Basin Specific LTCP developed for the East River and Open Waters by 2017. As discussed in Chapter 13, these potential adverse impacts to the combined sewer system will be addressed through amendments to the adopted drainage plan for this area that are currently being developed for the proposed actions. The new separate sanitary and storm sewer system developed within Site A as part of the proposed actions would be consistent with the City's goals to reduce CSOs.

Management of the landscaped portions of the waterfront park and other landscaped areas within the project sites would include implementation of an Integrated Pest Management (IPM) strategy to minimize use of fertilizers, pesticides, and herbicides, in accordance with NYCDPR policies. Implementation of the IPM would minimize potential impacts to stormwater quality from surface runoff generated within these open space areas.

AQUATIC BIOTA

Construction

Implementation of the SWPPP would minimize potential adverse impacts to aquatic biota from the discharge of stormwater during construction of the upland project elements. As described above under "Water Quality," in-water construction activities with the potential to result in sediment disturbance and resulting increases in suspended sediment include reconstruction of bulkhead or riprap areas and construction of new stormwater outfalls. Increases in suspended sediment have the potential to result in temporary adverse impacts to fish and

macroinvertebrates. However, as described previously, increases in suspended sediment would be localized and temporary and would not result in significant adverse impacts to aquatic biota of the East River or Newtown Creek. While East River and Newtown Creek sediments have been found to contain contaminants at concentrations that may pose a risk to some benthic macroinvertebrates, the resuspended sediments are expected to dissipate quickly, and redeposition within or outside the study area is not expected to adversely affect benthic macroinvertebrates or bottom fish.

Life stages of estuarine-dependent and anadromous fish species, bivalves, and other macroinvertebrates are fairly tolerant of elevated suspended sediment concentrations and have developed behavioral and physiological mechanisms for dealing with variable concentrations of suspended sediment (Birtwell et al. 1987, Dunford 1975, Levy and Northcote 1982 and Gregory 1990 in Nightingale and Simenstad 2001a, LaSalle et al. 1991). Fish are mobile and generally avoid unsuitable conditions in the field, such as increases in suspended sediment and noise (Clarke and Wilber 2000). While the localized increase in suspended sediment may cause fish to temporarily avoid the area where bottom-disturbing activities are occurring, the affected area is expected to be small. Similar suitable habitats would be available for use by fish to avoid the area being disturbed. Fish also have the ability to expel materials that may clog their gills when they return to cleaner, less sediment-laden waters. Most shellfish are adapted to naturally turbid estuarine conditions and can tolerate short-term exposures by closing valves or reducing pumping activity. More mobile benthic invertebrates that occur in estuaries have been found to be tolerant of elevated suspended sediment concentrations. In studies of the tolerance of crustaceans to suspended sediments that lasted up to two weeks, nearly all mortality was caused by extremely high suspended sediment concentrations (greater than 10,000 mg/L) (Clarke and Wilber 2000), which would not occur from the in-water work associated with the proposed actions. Therefore, temporary increases in suspended sediment resulting from in-water construction activities are not expected to result in significant adverse impacts to fish and mobile benthic macroinvertebrates.

The removal of bulkhead or riprap and construction of new stormwater outfalls would result in the loss of benthic habitat and benthic macroinvertebrates associated with these areas that are unable to move from the area of activity. The loss of these areas as habitat for benthic macroinvertebrates and fish during in-water construction activities is not expected to result in significant adverse impacts to populations of aquatic species using the East River or Newtown Creek. The permanent loss of benthic macroinvertebrates within the footprints of new outfall structures would not significantly impact the food supply for fish foraging in the area. Additionally, reconstruction of shoreline engineering (i.e., removing construction debris riprap and replacing it with engineered riprap) would have the potential to provide additional macroinvertebrate and fish habitat as well as increase the habitat diversity within the shoreline portion of the project sites. In general, the greater the physical complexity, the better the aquatic habitat. In-water structures, such as the riprap, that are sloped or stepped, have rough surfaces with many interstitial spaces, and a high surface area to volume ratio (USACE 1993) provide more surface area for algae and invertebrates that attach to surfaces (fouling community), and habitat (foraging and refuge) for fish (Heiser and Finn in Chmura and Ross 1978).

Operation

Failure to meet Class I (East River) or SD (Newtown Creek) standards, as a result of the proposed actions, is not expected. As discussed under "Water Quality," potential impacts to aquatic biota from the discharge of stormwater would be minimized through the implementation

of the SWPPP and the implementation of an IPM strategy to minimize adverse impacts to stormwater quality from vegetation management of landscaped areas. The increased discharge of sanitary sewage to the combined sewer system would not result in significant adverse impacts to water quality of the East River in the vicinity of the Bowery Bay WPCP, or within the vicinity of CSO outfalls, and, therefore, would not result in significant adverse impacts to aquatic biota.

TERRESTRIAL RESOURCES

CONSTRUCTION

As noted previously, wildlife habitat within the project sites is limited to the wading bird and waterfowl foraging habitat present within the beach area and the low-quality terrestrial habitat found on the two peninsula areas on Site A. The proposed actions would result in the demolition of existing structures, grading, and excavation during construction that would result in the removal of existing vegetation and wildlife habitat within Site A. The loss of this habitat would have the potential to adversely affect some individual birds and other wildlife currently using the limited wildlife habitat within Site A should these individuals be unable to find suitable available habitats nearby. However, the wildlife species expected to occur within this area are common to urban areas, and the loss of some individuals would not result in a significant adverse impact on the bird and wildlife community of the New York City region. Therefore, no significant adverse impacts to terrestrial resources are expected as a result of construction of the proposed actions.

OPERATION

The operation of the proposed actions would increase public access to the East River waterfront. While human activity is prevalent within the study area, the nature of the human activity under the proposed actions is expected to change. Approximately 11.0 acres of open space will be created on Site A, of which 10.65 would be a waterfront park. An additional 2.4 acres of open space would be developed on Site B. The waterfront park is intended to be linked to the existing and future waterfront parks at Queens West just to the north, creating one continuous park that extends from Anable Basin to and along Newtown Creek, with a variety of paved and planted surfaces. Although designs for the waterfront park have not yet been developed, it is expected that along the water's edge the new park would incorporate areas of bulkhead and areas with a more natural edge. Native plantings, along with the reconstruction of shoreline engineering, would enhance the wildlife habitat currently found within the project sites. The enhanced habitat that would be present as a result of the proposed actions would also have the potential to provide improved resting or stopover habitat for migratory songbirds during the spring and autumn migrations.

As discussed in Chapter 6, the proposed waterfront park on Site A would receive incremental shadow in the mornings throughout the year but would be sunlit during afternoons. The proposed shore walkway on Site B would be sunlit during mornings and early afternoons throughout the year but would experience incremental shadows in the late afternoons. The 55th Avenue open space on Site A would be in shadow for much of the day throughout the year, while the 55th Avenue open space on Site B would receive sunlight during the mornings throughout the year. Shade tolerant native plants would thrive in these areas, and would also enhance wildlife habitat. This level of shading would not be expected to result in adverse impacts to wildlife habitat or populations. Additionally, the open space areas developed within the project sites would provide habitat for wildlife. However, this increase in bird habitat for

resident and migratory species would have the potential to result in bird strikes on glass surfaces associated with the proposed development.

The maximum building heights that would be developed on the seven parcels of Site A range from 105 feet to 400 feet. These building heights would not exceed those of the Queens West project to the north, but would be taller than the generally one- to four-story buildings east of the project sites. Building height, nighttime lighting, and the reflective nature of glass façades would affect the potential for the proposed buildings to result in collisions by birds migrating at night (Schmidt-Keonig 1979, Ogden 1996, Avery et al. 1976 in Ogden 1996, Martin 1990 in Ogden 1996). Additionally, landscaping design and the design of the lower building stories would affect the potential for the proposed buildings to cause daytime bird strikes. Approximately 75 percent of nocturnally migrating songbirds do so at altitudes of between 500 and 2,000 feet (600 meters) above the surface (Deinlein undated, and Kerlinger 1995). In general, structures that are about 500 feet or less in height (i.e., below the migratory altitude for most migratory songbirds) would be expected to pose a lower risk for bird collisions. Therefore, the proposed maximum building height within the seven development parcels (i.e., 400 feet) would pose a low risk for bird losses due to building strikes, and no significant adverse impacts to populations of songbirds migrating through New York City are expected.

THREATENED OR ENDANGERED SPECIES

Prior to construction activities along the shoreline, a survey will be conducted for the state-listed endangered late-flowering thoroughwort. A mitigation plan will be developed in coordination with NYSDEC to minimize adverse impacts to this species. The mitigation plan may include measures such removing individual plants that would be impacted by construction activities and replanting them within suitable habitat developed for this plant species within the waterfront park. The preference of shortnose sturgeon and Atlantic sturgeon for deep-water habitat suggests that it is unlikely that individuals of these species would occur near the project sites except as transients. Because water quality impacts associated with construction of the proposed actions would be limited and localized to the near-shore area, the deep channel habitat preferred by these species while in transit to and from spawning and nursery habitat would not be impacted during the proposed construction. Operation of the proposed actions would not result in any significant adverse impacts on water or sediment quality. Therefore, no adverse impacts would occur to the New York State- and federally listed endangered shortnose sturgeon or to the Atlantic sturgeon.

The four turtle species noted by NMFS, when present within in-shore waters, are more likely to occur in Long Island Sound and Peconic/Southern Bays. Because they neither nest nor reside in the area year-round, and are only rarely observed in this portion of the estuary, they are not expected to be adversely affected by the construction or operation of the proposed actions.

In sum, based on the above considerations, the proposed actions are not expected to result in significant adverse impacts to any federally or State-listed endangered species or habitats of concern.

ESSENTIAL FISH HABITAT

As discussed under "Aquatic Resources," in-water construction activities with the potential to result in sediment disturbance and resulting increases in suspended sediment include reconstruction of bulkhead or riprap areas and construction of new stormwater outfalls. However, as described previously, increases in suspended sediment would be localized and

temporary and would not result in significant adverse impacts to aquatic biota of the East River or Newtown Creek and would not adversely affect EFH.

The permanent loss of benthic macroinvertebrates within the footprints of new outfall structures would not significantly impact the food supply for fish foraging in the area. Additionally, reconstruction of shoreline engineering would have the potential to provide additional macroinvertebrate and fish habitat as well as increase the habitat diversity within the shoreline portion of the project sites, resulting in potential benefits to EFH. Operation of the proposed actions would not result in any significant adverse impacts on water or sediment quality. Therefore, operation of the proposed actions would not result in significant adverse impacts to EFH.

G. REFERENCES[1]

Able, K.W., A.L. Studholme and J.P. Manderson. 1995. Habitat quality in the New York/New Jersey Harbor Estuary: An evaluation of pier effects on fishes. Final Report. Hudson River Foundation, New York, NY.

Abraham, B.J. 1985. Mummichog and Striped Killifish. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates. U.S. Fish and Wildlife Service for U.S. Army Corps of Engineers Waterways Experiment Station Coastal Ecology Group and the National Coastal Ecosystems Team, Division of Biological Services, U.S. Fish and Wildlife Service.

Adams, D.A., J.S. O'Connor, S.B. Weisberg. 1998. Final Report: Sediment Quality of the NY/NJ Harbor System. An Investigation under the Regional Environmental Monitoring and Assessment Program (R-EMAP). EPA/902-R-98-001.

AKRF, Inc. 2002. Second Avenue Subway Environmental Impact Statement. New York, NY.

ASA Analysis and Communications Inc. (ASA). 2001. 1998 Year Class Report for the Hudson River Estuary Monitoring Program. Prepared for Central Hudson Gas and Electric Corporation by ASA, New Hampton, NY.

Bain, M.B. 1997. Atlantic and shortnose sturgeons of the Hudson River: common and divergent life history attributes. Environ. Biol. Fishes 48:347-358.

Bain, M.B. 2004. Personal communication of Mark Bain (Cornell University, Ithaca, NY) with Jennifer Wallin (AKRF, Hanover, MD), April 2, 2004.

Bigelow, H.B. ad W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin of the Fish and Wildlife Service Volume 53.

Blumberg, A.F., L.A. Kahn, and J.P. St. John. 1999. Three-dimensional hydrodynamic model of New York Harbor region. Journal of Hydraulic Engineering 125:799-816.

Brosnan, T.M., and M.L. O'Shea. 1995. New York Harbor water quality survey: 1994. New York City Department of Environmental Protection, Marine Sciences Section, Wards Island, NY.

[1] This section of the chapter is new in the FEIS.

Coastal Environmental Services. 1987. Television City Project: Characterization of the Aquatic Ecology of the Site and Assessment of Potential Impacts of the Project on the Aquatic biota. Prepared for Berle, Kass, and Case, New York, New York; McKeown and Franz, Inc., New York, NY; and The Trump Organization, New York, NY.

Colligan, M. 2007. Correspondence from Ms. Mary Colligan, National Oceanic and Atmospheric Administration, National Marine Fisheries Service ; dated November 5, 2007, to Aubrey McMahon, AKRF.

Conrad, N. 2007. Correspondence from Mr. Nicholas Conrad, New York Natural Heritage Program; dated November 7, 2007, to Aubrey McMahon, AKRF.

Consolidated Edison Company of New York, Inc. (Con Edison). 1982. Environmental impacts associated with the proposed reconversion of the Ravenswood Generating Station to coal-fired operation. Submitted to the U.S. Department of Energy.

Dunning, J.D., W.E. Ross, A.F. Blumberg, and D.G. Heimbuch. 2006. Transport of Striped Bass Larvae out of the Lower Hudson River Estuary. American Fisheries Society Sympisuyn 51:273-286.

EA Engineering, Science, and Technology. 1990. Phase I feasibility study of the aquatic ecology along the Hudson River in Manhattan. Final Report. Prepared for New York City Public Development Corporation, New York, NY. Newburgh, NY.

EEA. 1988. Hudson River Center Site Aquatic Environmental Study. Final Report. Garden City, NY.

EEA, Inc. 1989. East River Landing Aquatic Environmental Study. Draft Final Report. Prepared for New York City Public Development Corporation by EEA, Inc., Garden City, NY. July 1989 Revision.

Edinger, G.J. et al. Ecological Communities of New York State: Second Edition. Albany, NY. 2002.

Fahay, M.P. 1978. Biological and fisheries data on the American eel, *Anguilla rostrata* (LeSeur). NTIS PB-297 067. National Marine Fisheries Service Technical Series Report No. 17.

Fay, C.W., R. Neves, and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (mid-Atlantic): striped bass. Study conducted by the Virginia Polytechnic Institute and State University Department of Fisheries and Wildlife Sciences for the Division of Biological Services, U.S. Fish and Wildlife Service, FWS/OBS-82/11.8. U.S. Army Corps of Engineers, TR EL-82-4.

Federal Emergency Management Agency (FEMA). 2007. Flood Insurance Study, City of New York, New York, Bronx County, Richmond County, New York County, Queens County and Kings County. Flood Insurance Study Number 360497V000A. Revised September 5, 2007.

Grimes, B.H., M.T. Huish, J.H. Kerby, and D. Moran. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (mid-Atlantic): summer and winter flounder. U.S. Fish and Wildlife Service Biological Report 82(11.112). U.S. Army Corps of Engineers, TR EL-82-4.

Hazen and Sawyer, P.C. 1983. Newtown Creek Water Pollution Control Plant. Revised application for modification of the requirements of secondary treatment under Section

301(h), PL 97-117. Prepared for the City of New York, Department of Environmental Protection.

Hazen and Sawyer, P.C. 1985. Newtown Creek water pollution control plant. Revised application for modification of the requirements of secondary treatment. VII: Additional biologic and toxics information. Prepared for the City of New York, Department of Environmental Protection.

Heimbuch, D., S. Cairns, D. Logan, S. Janicki, J. Seibel, D. Wade, M. Langan, and N. Mehrotra. 1994. Distribution Patterns of Eight Key Species of Hudson River Fish. Coastal Environmental Services, Inc. Linthicum, MD. Prepared for the Hudson River Foundation, New York, NY.

Heimbuch, D.G., D.J. Dunning, Q.E. Ross, A.F. Blumberg. 2007. Assessing Potential Effects of Entrainment and Impingement on FishStocks of the New York-New Jersey Harbor Estuary and Long Island Sound. Transactions of the American Fisheries Society 136:492-508.

Houde, E.D., and C.E. Zastrow. 1991. Bay anchovy *Anchoa mitchilli*. In Habitat Requirements for Chesapeake Bay Living Resources, S.L. Funderburk, J.A. Mihursky, S.J. Jordan and D. Riley (eds.), 2nd edition. Chesapeake Research Consortium, Inc., Solomons, MD. pp. 8-1 to 8-14.

Hurley, L.M. 1990. Field Guide to the Submerged Aquatic Vegetation of Chesapeake Bay. U.S. Fish and Wildlife Service, Chesapeake Bay Estuary Program, Annapolis, MD.

Interstate Environmental Commission (IEC). 2000. 1999. 305(b) water quality management report update to USEPA. New York, NY.

Interstate Environmental Commission (IEC). 2001. 2000 305(b) water quality management report update to USEPA. New York, NY.

Interstate Environmental Commission (IEC). 2002. Annual Report. New York, NY.

Lauer, G. 1971. Preliminary studies concerning effects of cooling system transport upon planktonic organisms at the Astoria Power Station, Queens, NY. Report prepared for Consolidated Edison Company of New York, Inc.

Lawler, Matusky and Skelly Engineers (LMS). 1994. Asoria Impingment and Entrainment Studies January 1993-December 1993. Prepared for Consolidated Edison Company of New York, Inc., New York.

Lawler, Matusky and Skelly Engineers, LLP (LMS). 2003a. New York and New Jersey Harbor Navigation Project, Aquatic Biological Sampling Program 2001-2002, Final Report. Prepared for the US Army Corps of Engineers, New York District, Environmental Review Section, Jacob K. Javits Federal Building, 26 Federal Plaza, NY, NY 10278.

Lawler, Matusky and Skelly Engineers, LLP (LMS). 2003b. New York and New Jersey Harbor Navigation Project, Aquatic Biological Survey Report 2002-2003, Draft Report. Prepared for the US Army Corps of Engineers, New York District, Environmental Review Section, Jacob K. Javits Federal Building, 26 Federal Plaza, NY, NY 10278.

Levandowsky, M and D. Vaccari. 2004. Analysis of Phytoplankton Data from Two Lower Manhattan Sites. Final Report of a Grant from the Hudson River Foundation

Litten, S. 2003. Contaminant Assessment and Reduction Project (CARP) Final Report. Bureau of Water Assessment and Management Division of Water. New York State Department of Environmental Conservation. August 14, 2003.

Lonsdale, D.J., and E.M. Cosper. 1994. Phytoplankton productivity and zooplankton feeding and productivity in the lower Hudson River estuary. Marine Sciences Research Center, SUNY, Stony Brook, NY. Final report to the Hudson River Foundation, New York, NY.

McHugh, J.L. 1967. Estuarine nekton, in Estuaries (G.H. Lauff, ed.), pp.581-620. AAAS, Washington.

Morreale, S.J. and E.A. Standora. 1995. Cumulative evidence of southward migration of juvenile sea turtles from temperate northeastern waters. Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation. Pp. 85-86. NOAA Technical Memorandum NMFS-SEFSC-361.

National Marine Fisheries Service (NMFS). "Summary of Essential Fish Habitat (EFH) Designation" posted on the internet at: http://www.nero.noaa.gov/hcd/STATES4/conn_li_ny/40407350.html

National Oceanic and Atmospheric Administration (NOAA). 2001. New York - New Jersey Metropolitan Region Coastal Resources Atlas. National Ocean Service. Office of Response and Restoration, Hazardous Materials Response Division, Seattle, WA.

National Oceanic and Atmospheric Administration (NOAA). 2007. NOAA Nautical Chart No. 1238 Edition 10, Date 9/1/06, Update 8/11/07.

New York State Department of Environmental Conservation (NYCDEC). 2004. Technical Operational Guidance Series (TOGS), 5.1.9, In-Water and Riparian Management of Sediment and Dredged Material. NY State Department of Environmental Conservation, Division of Water, Bureau of Water Assessment and Management, 625 Broadway, Albany, NY, 12233.

New York City Department of Environmental Protection (NYCDEP). 2001. 2000 New York Harbor Water Quality Survey Summary. New York, NY.

New York City Department of Environmental Protection (NYCDEP). 2002. 2001 New York Harbor Water Quality Survey Summary. New York, NY.

New York City Department of Environmental Protection (NYCDEP). 2003. 2002 New York Harbor Water Quality Survey Summary. New York, NY.

New York City Department of Environmental Protection (NYCDEP). 2004. 2003 New York Harbor Water Quality Report. New York, NY.

New York City Department of Environmental Protection (NYCDEP). 2005. 2004 New York Harbor Water Quality Report. New York, NY.

New York City Department of Environmental Protection (NYCDEP). 2006. 2005 New York Harbor Water Quality Report. New York, NY.

New York City Department of Environmental Protection (NYCDEP). 2007a. 2006 New York Harbor Water Quality Report. New York, NY.

New York City Department of Environmental Protection (NYCDEP). 2007b. New York Harbor Survey water quality data from 1995 through 2006 received from NYCDEP.

New York City Department of Parks and Recreation (DPR). 1994. Woodlands, wetlands, and wildlife. A guide to the natural areas of New York City parks. A publication of the Urban Forest and Education Program, DPR and City Parks Foundation, sponsored by the Lila Wallace – Readers Digest Fund.

New York City Department of Sanitation (DSNY). 2005. Final Environmental Impact Statement for the New York City Comprehensive Solid Waste Management Plan, CEQR No: 03-DOS-004Y.

New York State Department of Environmental Conservation (NYSDEC). NYS Breeding Bird Atlas, Records for Block 5851C as of October 23, 2007. http://www.dec.ny.gov/cfmx/extapps/bba/index.cfm?RequestTimeout=250

New York State Department of Environmental Conservation (NYSDEC). NYS Herp Atlas Project. Records as of May 29, 2007. http://www.dec.ny.gov/public/7140.htmlPBS&J. 1998. The Hudson River Park. Natural Resources Appendix to Final Environmental Impact Statement. Prepared for the Empire State Development Corporation and the Hudson River Park Conservancy.

Pereira, J.J., R. Goldberg, J.J. Ziskowski, P.L. Berrien, W.W. Morse, and D.L. Johnson. 1999. Essential Fish Habitat Source Document: Winter Flounder, *Pseudopleuronectes americanus*, Life History and Habitat Characteristics. National Marine Fisheries Service. NOAA Technical Memorandum NMFS-NE 138, http://www.nefsc.nmfs.gov/nefsc/habitat/efh/ - list

Perlmutter, A. 1971. Ecological studies related to the proposed increase in generating capacity at the Astoria Power Station of Consolidated Edison. Report prepared for the Consolidated Edison Company of New York, Inc.

Peterson, D., and M. Bain. 2002. Sturgeon of the Hudson River: current status and recent trends of Atlantic and shortnose sturgeon. Annual Meeting of the American Fisheries Society, Baltimore, MD.

Princeton Aqua Science (PAS). 1985. Description of Water Quality and Aquatic Biota and Terrestrial Ecology for the Proposed Waterfront Development Project at Hunters Point, New York. Prepared for The Port Authority of New York and New Jersey, Economic Development Department. Pg. I-1 –I-37.

Smith, C.L. 1985. The Inland Fishes of New York State. The New York State Department of Environmental Conservation.

Standora, E.A., S.J. Morreale, R.D. Thompson, and V.J. Burke. 1990. Telemetric monitoring of diving behavior and movements of Kemp's ridleys. Proceedings of the Tenth Annual Workshop on Sea Turtle Biology and Conservation. Page 133. NOAA Technical Memorandum NMFS-SEFC-278.

Stanley, J.G., and D.S. Danie. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic): white perch. U.S. Fish and Wildlife Service Biological Report FWS/OBS-82/11.7. U.S. Army Corps of Engineers, TR EL-82-4.

Stegemann, E.C. 1999. New York's Sturgeon. New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, www.dec.state.ny.us/website/dfwmr/fish/ fishspecs/sturtex.html.

Steinberg, N., J. Way, D.J. Suszkowski. 2002. Harbor Health/Human Health: an Analysis of Environmental Indicators for the NY/NJ Harbor Estuary. Prepared for the New York/New Jersey Harbor Estuary Program by the Hudson River Foundation for Science and Environmental Research. Produced under a cooperative agreement between the Hudson River Foundation and US EPA Region II.

Steinberg, N., D.J. Suszkowski, L. Clark, and J. Way. 2004. Health of the Harbor. The First Comprehensive Look at the State of the NY/NJ Harbor Estuary. A report to the NY/NJ Harbor Estuary Program. Hudson River foundation, New York, NY. 82 pp.

Stepien, J.C., T.C. Malone, and M.B. Chervin. 1981. Copepod communities in the estuary and coastal plume of the Hudson River. Estuarine, Coastal and Shelf Science 13:185-194.

TRC. 2007a. Phase II Environmental Site Assessment Report: Queens West Development Stages III and IV Site, Queens, NY. Prepared for New York City Economic Development Corporation, 110 Williams Street, New York, New York 10038.

TRC. 2007b. Geotechnical Feasibility Study: Queens West Development Stages III and IV Site, Queens, NY. Prepared for New York City Economic Development Corporation, 110 Williams Street, New York, New York 10038.

U.S. Army Corps of Engineers (USACE). 1999. New York and New Jersey Harbor Navigation Study. Draft Environmental Impact Statement.

US Army Corps of Engineers (USACE). 2004. Hudson-Raritan Estuary Environmental Restoration Feasibility Study: Harlem River/East River/Western Long Island Sound Study Area Report. US Army Corps of Engineers, New York District.

U.S. Fish and Wildlife Service (USFWS). 1997. Significant Habitats and Habitat Complexes of the New York Bight Watershed. USFWS Southern New England – New York Bight Coastal Ecosystems Program, Charlestown, RI.

Vougilitois, J.J., K.W. Able, R.J. Kurtz and K.A. Tighe. 1987. Life history and population dynamics of the bay anchovy in New Jersey. Transactions of the American Fisheries Society 116:141-153.

Woodhead, P.M. 1990. The Fish Community of New York Harbor: Spatial and temporal Distribution of major Species. Report to the New York - New Jersey Harbor Estuary Program, New York, NY.

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