Chapter 10: Water Quality and Natural Resources

A. INTRODUCTION

This chapter assesses the potential impacts to terrestrial and aquatic natural resources[1] and floodplains from the proposed development of the Brooklyn Bridge Park.

The purpose of this chapter is to:

- Describe the regulatory programs that protect floodplains, wildlife, threatened or endangered species, aquatic resources, or other natural resources within the proposed project area;
- Describe the current condition of the floodplain and natural resources within the project area, including:
  - Water and sediment quality;
  - Aquatic biota;
  - Terrestrial biota; and
  - Threatened or endangered species and species of special concern.
- Assess future floodplain, water quality and natural resources conditions without the proposed project;
- Assess the potential impacts of the proposed project on the floodplain, water quality and natural resources; and
- Develop measures, as necessary, to mitigate and/or reduce any potential significant adverse effects to water quality and natural resources.

The design approach for the park is to restore some of the natural habitat that once occurred along Brooklyn's shorelines by removing man-made structures from the shoreline and impervious paving from the upland portions of the site, while at the same time encouraging public use of the waterfront for active and passive recreation activities. The reintroduced natural habitats would be interwoven with these other park uses to create a mosaic of active and natural areas. Existing industrial material on site such as shoreline structures (bulkheads and relieving platforms), piersheds and other existing buildings, and fill material would be reused, reconstituted, or dismantled for use in the park's construction. Material dredged from the New York/New Jersey Harbor Estuary and mixed with Portland cement (processed dredged material) may be reused within the park as grading fill to help shape the natural areas to be created in the upland area between Piers 1 and 5. The majority of the project area would be open space, of which

[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." (*New York City Environmental Quality Review (CEQR) Manual*, City of New York, 2001).

approximately 65 acres would be on land and approximately 12 acres would be water activity areas. Approximately 3 acres of the open space area would contain roadways and parking areas.

As shown in Figures 1-2 through 1-4 and described in Chapter 1, "Project Description," the open space areas would be divided fairly evenly between passive and active recreation areas. The proposed pathways through the park developed through innovative use of boardwalks, floating bridges and upland paths would provide pedestrian connections to the water and other activity areas. A waterfront promenade developed from the existing high- and low-level relieving platform would extend along the existing bulkhead line between Piers 1 and 6. Through a series of sloping ramps, floating and fixed walkways, and a new beach area, park users would be able to access the water level for kayak, canoe, and/or paddle boat launching in certain areas, as well as fishing and other water-dependent activities. These walkways would also provide views of the piles and other structural components of the piers. The floating walkways would extend from the north edge of Pier 2 to the eastern edges of Piers 2 and 3 (created by removing a portion of the high-level relieving platform that connects the pier to the upland). Fifteen-foot-wide walkways would also be created along the wave attenuation pile-supported platform (wave fence) described below, that would be constructed between Piers 3 and 5 and Piers 2 and 1, and on 15-foot-wide pile-supported platforms that extend from the shoreline at the southern edge of Pier 4 all the way to the wave fence extending from the southern outboard edge of Pier 3, and across the cove under the Manhattan Bridge. Pathways would also meander through the various plant habitats developed in the upland portion of the project area. A pedestrian bridge would extend from Pier 1 to the upland area, connecting it to the walkway leading to Squibb Park.

The secure or "safe water zones" would be created for non-motorized boats (kayaks, canoes, and paddle boats) in the interpier areas between Piers 1 and 2, and Piers 3 and 4 through the installation of fixed wave fences, the fixed pile walkway south of Pier 4, and floating wave attenuators with platforms. A fixed wave fence with a 10-foot-deep solid face at Mean Low Water (MLW) would extend from the southwest corner of Pier 1 to northwest corner of Pier 2, along the northern edge of Pier 2 for 120 feet measured from the northwest corner and 80 feet measured from the northeast corner, along the southern edge of Pier 3 for 550 feet measured from the southwest corner, along the eastern edge of Pier 2 and Pier 3 (a total of 170 feet each), between the southwest corner of Pier 3 and the northwest corner of Pier 5 with a gap for the marina entrance, and along the western or outboard side of Pier 5 for 210 feet. The floating wave attenuators would be located along the northern side of Pier 2 (shoreward of where the fixed wave fence with 10-foot-deep solid face ends), along the "new" face of Piers 2 and 3, and between Piers 2 and 3. These wave fences and wave attenuators will prevent public access to areas beneath the piers and attenuate waves within the channel between the two safe water zones. The two safe water zones would be connected by a channel created through the removal of a portion of the high-level relieving platform connecting Piers 2 and 3 to the upland. An overhead pedestrian walkway would extend over this channel to connect Piers 2 and 3 to the upland and provide access for emergency vehicles.

A 185-slip marina for sailboats and powerboats, connecting to the East River through an opening in the wave fence, would be developed between Piers 4 and 5, with a boat lift located between Piers 4 and 5. The marina would provide limited boating services including utility hook-ups and fueling. The interpier area between Piers 5 and 6 would be used for mooring of historic boats. In addition to the existing water taxi service available at Fulton Ferry Landing, water transportation to the park (via water taxi) is expected to be provided at the northern portion of the project area near the John Street Site, the north side of Pier 1, the north side of Pier 3, and the south side of Pier 6.

Shallow water/subtidal habitat areas would be created along the shoreline between Piers 4 and 5, between the remnant of Pier 4 and the new shoreline alignment/beach area (through removal of fill originally placed along the shoreline during the construction of Pier 4), and between a portion of Pier 1 and the shoreline. The new beach area created on the eastern side of Pier 4 would provide direct access to the water (swimming would be prohibited) and serve as a lauching area for kayaks, canoes, and/or paddle boats. Separated from the shoreline, the decaying Pier 4 would serve as a habitat island for plants and birds. Portions of the existing bulkhead and relieving platforms between Piers 1 and 5 would be removed and replaced with riprap to create a softer edge. Other portions of the bulkhead and relieving platforms would be repaired or replaced as necessary. At Pier 1, riprap would be placed at the toe of the existing sheetpile bulkhead adjacent to the East River to protect against scouring activity and provide additional stability for the sheetpile. At the John Street Site, the remnants of the existing timber wharf would be replaced with a steel sheetpile bulkhead with retained fill. Approximately 92,000 square feet of the Pier 1 high-level platform would be removed to create a pile field habitat/kayak course.

Establishment of the maximum number of sustainable, functioning habitats is an important goal in the design of the park. Naturally landscaped areas planted to create habitats such as dune, marsh, coastal woodland, shrubland, wildflower meadow, and freshwater swale would interconnect throughout the project area. In the 33-acre upland area between Piers 1 and 6, approximately 20 acres would be converted to pervious vegetated cover (coastal woodland, shrubland, wildflower meadow, freshwater swale, and marsh). The various plant habitats that would be created within the upland area would provide habitat for wildlife and passive recreation opportunities for park visitors, and would be integral to the goal of managing stormwater generated within the park boundary to minimize stormwater discharges. The stormwater management system would establish natural drainage systems, reduce and manage runoff, use gray water collection systems (e.g., roof top collection systems), and explore the use of alternative stormwater collection systems. Vegetated swales, filter strips, extended detention basins and constructed wetlands would be components of the stormwater treatment systems. The 20-to 30-foot-high vegetated hills developed in the upland portion of the park between Piers 2 and 5 and running parallel to the shoreline would create protected pathways through the park. The gentle slopes of the waterfront side of the hills would be vegetated with manicured grass suitable for sitting and other passive recreational uses. The steeper slopes facing the BQE would have denser plantings.

Pier 1 would have landscaped areas and pathways. Piers 2 and 3 would have lawn, hedgerow, and court sports (basketball, handball and volleyball) under portions of the existing shed roofs. Pier 5 would have three outdoor multipurpose recreation fields (artificial turf), and parking. In addition, it is contemplated that the field at the outboard end of Pier 5 could be housed within an indoor athletic field structure to provide year-round sports courts while maintaining the transparency of a lightweight structure. Approximately one half of Pier 6 would be landscaped as dune habitat (and the remaining areas would have active recreation areas (volleyball courts and water play area). An existing concrete masonry building at the edge of Pier 6 that abuts the upland area would be preserved and could be used as a visitor's center and comfort station. Vegetated portions of the existing Empire-Fulton Ferry State Park and the existing Main Street Park would remain.

The park design would incorporate renewable energy technology such as photovoltaic cells, to the extent practicable, to generate some of the energy used to light exterior spaces of the park and park buildings. The rooftops of the existing sheds on Piers 2 and 3 that would be retained as part of the proposed project have been identified as potential locations for photovoltaic systems.

PRINCIPAL CONCLUSIONS

The proposed project is not expected to result in any significant adverse impacts to water quality or natural resources because:

- Most of the elements of the proposed project that would be located within the 100-year floodplain are passive recreation areas such as the waterfront promenade, shallow water habitat and newly created landscaped areas. Construction and operation of these project elements would not affect flooding within or adjacent to the project area. Additionally, the increase in pervious vegetated cover within the upland portion of the project area between Piers 1 and 6 would result in beneficial effects to the floodplain by decreasing the volume of stormwater runoff generated from within the project area. Portions of the residential structures proposed to be constructed in the upland portions of Pier 6 and the hotel and residential structures proposed for the upland portion of Pier 1 would be located within the 100-year floodplain. In the design and construction of these structures, measures would be implemented to minimize potential floodplain impacts and losses due to flooding,

- Portions of the two coves located in the interbridge portion of the project area are 6 feet deep or less and therefore may be classified as littoral zone tidal wetlands by the New York State Department of Environmental Conservation (NYSDEC). Because the fixed-pile-supported walkway proposed for the cove under the Manhattan Bridge would not impede movement of tidal waters in and out of the cove, it would not result in significant adverse impacts to tidal wetlands. During construction, measures would be implemented to minimize any temporary impacts to littoral zone wetlands due to disturbance of bottom sediments near the shoreline between Piers 1 through 6. The shoreline improvements that would result from modifications to the relieving platforms would benefit wetland resources through the creation of intertidal wetland habitat along the newly exposed shoreline between Piers 1 and 5. Additionally, the development of the shallow-water habitats would result in approximately 23,600 square feet of open water habitat, some of which would be expected to be littoral zone. Therefore, construction and operation of the proposed project would not be expected to result in significant adverse impacts to wetlands.

- Disturbance of sediment during in-water construction activities such as pile driving, bulkhead repair and replacement, removal of high- and low-level relieving platforms, and placement of riprap would not be expected to result in significant adverse impacts to floodplains, wetlands, water quality or aquatic biota. Any increase in suspended sediment resulting from these activities is expected to be temporary and localized. The hydrodynamic characteristics of the East River within the project area suggest that suspended sediment resulting from in-water construction activities would move away from the area of in-water construction while the activity is ongoing and would dissipate shortly after the completion of the sediment disturbing activity. Therefore, in-water construction activities would not be expected to result in significant adverse impacts to water quality or aquatic biota. Similarly, any contaminants released to the water column as a result of sediment disturbance would also be expected to dissipate rapidly and would not be expected to result in significant long-term adverse impacts to water quality or aquatic biota.

- The implementation of a Stormwater Pollution Prevention Plan (SWPPP) during construction and operation, an Integrated Pest Management (IPM) strategy, and the management of stormwater generated within the park boundary to minimize stormwater discharges would minimize adverse impacts to water quality and aquatic biota from the discharge of stormwater during construction and operation of the park.

- The operation of the marina and the use of the proposed wave fences would not be expected to result in any significant adverse impacts to water quality, fish or macroinvertebrates within the project area. Water depths within the proposed marina area sufficient to minimize the potential for increased suspended sediment from boat activity. As demonstrated by a hydrodynamics study, circulation and sedimentation processes showed minimal change after construction of the marina wave fences. Concentrations of water quality parameters such as dissolved oxygen (DO) would not be expected to change from the existing condition as a result of the marina. Any contaminants (sewage, petroleum, metals from biocides) accidentally released as a result of marina operations would be flushed rapidly and would not result in significant adverse impacts to water quality in or adjacent to the project area. Implementation of best management practices to minimize environmental impacts of marinas, presented in the 2003 NYSDEC publication *Environmental Compliance, Pollution Prevention, and Self-Assessment Guide for the Marina Industry* would further reduce marina-related impacts.
- The proposed project would meet the objective of the proposed plan in resulting in no net increase in overwater coverage, and would reduce the amount of shade-impacted habitat currently present within the project area. The proposed creation of the pile field through removal of a portion of the Pier 1 high-level platform, the shallow-water habitats, and replacement of existing bulkhead and relieving platforms with riprap would increase the diversity of aquatic habitats available within the project area, benefiting both fish and macroinvertebrates and Essential Fish Habitat (EFH) (those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 USC §1802(10)). Through the creation of the proposed shallow-water habitat, the proposed project would result in no net decrease in bottom habitat.
- Dredging (5,000 to 8,000 cubic yards) would be limited to areas within the safe water zones and the marina. Any impacts to water quality or aquatic biota that may occur from this minimal dredging activity would be temporary and localized. Water quality impacts would be expected to dissipate shortly after the completion of the dredging activity and fish and macroinvertebrates would be expected to reoccupy these areas. Therefore, significant adverse impacts would not be expected to occur to water quality or aquatic biota as a result of dredging.
- Neither EFH, nor the endangered shortnose sturgeon (*Acipenser brevirostrum*) would be adversely affected by the proposed project. Shortnose sturgeon are only expected to occur in the area as occasional transients and prefer the deeper water habitat of the navigation channel, which would not be affected by the proposed project.
- The four species of marine turtle (loggerhead, green, Kemp's ridley, and leatherback) would not be expected to occur within the project area except as transient individuals. Because they neither nest nor reside in the area year-round, and are only rarely observed in this portion of the estuary, they would not be expected to be impacted by the construction or operation of the proposed project. Although seals would only be expected to occur in the vicinity of the project area as occasional transient individuals, the design of the floating walkways included in the proposed project would incorporate barriers to limit the opportunity for seals to haul out and interact with park visitors or pets.

- The proposed project would not affect the availability of the state-endangered peregrine falcon nesting location that is occasionally used within the project area. Construction activities would not be expected to affect nesting success. The operation of the park has the potential to benefit the peregrine falcons by increasing prey availability through the creation of natural habitat areas that would attract additional birds to the project area.
- No significant adverse impacts to terrestrial resources are anticipated as a result of construction of the proposed project. Existing wildlife habitat within the proposed area is limited to the wading bird and waterfowl foraging habitat found within the two coves at the northern end of the project area and the relatively low-quality terrestrial habitat found within the existing Empire-Fulton Ferry State Park and Main Street Park. Adverse impacts would occur to some individual birds and other wildlife currently using this limited wildlife habitat if construction activities cause them to leave the project area and there are no suitable habitats that are available nearby. However, the wildlife species found within the project 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. Construction of the overwater walkway through the cove under the Manhattan Bridge at the northern portion of the project area has the potential to limit use of this cove as feeding habitat for wading birds and waterfowl while the piles and decking are being installed. However, this cove area is small, and the temporary loss as feeding habitat would not adversely affect the populations of wading birds and waterfowl within the New York City region. Because the overwater walkway in the cove would be expected to allow some light to reach the aquatic habitat beneath it due to its limited width and height above water, potential adverse impacts to food availability would be limited.
- Upon completion of the project, the creation of a diverse complex of terrestrial habitats throughout the site would provide significant benefits to birds and other wildlife, particularly with respect to grassland birds whose habitat is currently limited within the New York metropolitan region. The creation of the shallow-water habitats within the project area has the potential to increase foraging habitat for waterfowl, wading birds, and shorebirds. The movement of boats, canoes and kayaks within the park would not be expected to significantly affect these groups of birds.

B. METHODOLOGY

This section presents the methodology used to describe natural resources within the project area under existing and future conditions, and to assess potential impacts to these resources from the proposed project. For terrestrial resources and floodplains the study area was restricted to the project area. 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 area. The study area for water quality and aquatic resources included the overall aquatic resources within the East River, and the aquatic resources within the waterfront portion of the project area.

The analysis of potential impacts to natural resources from the proposed project considered the potential effects for the start of construction in 2008 and full operation of the park in 2012.

EXISTING AND FUTURE CONDITIONS

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

- Existing information identified in literature and obtained from governmental and non-governmental agencies such as: New York City Department of Environmental Protection (NYCDEP) Harbor Water Quality Survey (DEP 2003a); United States Environmental Protection Agency (USEPA) National Sediment Quality Survey Database, 1980-1999 (USEPA 2001); New York/New Jersey Harbor Estuary Program; USEPA Regional Environmental Monitoring and Assessment Program (R-EMAP), Federal Emergency Management Agency (FEMA), and US Army Corps of Engineers (USACOE) 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 area were submitted to the U.S. Fish and Wildlife Service (USFWS) (NY office), National Marine Fisheries Service (NMFS), and the New York Natural Heritage Program (NYNHP). NYNHP, a joint venture of the NYSDEC and The Nature Conservancy (TNC) since 1985, maintains an ongoing, systematic, scientific inventory on rare plants and animals native to New York State. 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 NMFS for federally listed threatened or endangered marine organisms.

The future without the proposed project was assessed by determining:

- Potential effects of proposed development in the vicinity of the project area on water quality and natural resources; and
- Potential effects of proposed or ongoing improvements in the vicinity of the project area on water quality and natural resources.

ASSESSMENT OF IMPACTS FROM THE PROPOSED PROJECT

Potential impacts to the floodplain, wetlands, aquatic and terrestrial resources from the proposed project were assessed using an approach that considered the following:

- The existing water quality and natural resources within the project area.
- Temporary impacts to water quality and aquatic organisms during construction of in-water components such as piling installation associated with docks, walkways over the water and wave fences; pile removal; dredging that may be required for limited areas within the safe water zones and marina; and repair or replacement of bulkheads, riprap and relieving platforms as part of the shoreline and shallow water habitat enhancement measures. 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 or nursery habitat, or EFH identified by the NMFS from temporary water quality changes and impacts associated with pile driving.
- Potential effects to aquatic resources from the discharge of stormwater during construction of the upland components of the proposed project.
- Temporary impacts to terrestrial resources associated with land clearing, grading and other upland activities associated with construction of the proposed project.

- Permanent loss of habitat for benthic macroinvertebrates and fish from construction of in-water components such as piles, wave fences, bulkhead and riprap.
- Potential beneficial aquatic habitat improvements from the creation of shallow water areas (approximately 25,000 square feet (sf)), softer shoreline edges, and the approximately 2.11-acre pile field that would result from the removal of the high-level platform from Pier 1.
- Potential long-term impacts to fish and benthic macroinvertebrate habitat as a result of shading from new over water structures such as walkways, wave fences, boat docks and slips for the marina, and mooring of historic vessels, as well as the beneficial impacts resulting from removal of a portion of the high-level relieving platform from the landward portions of Piers 2 and 3 to create the proposed channel between the two safe water zones.
- Potential long-term impacts to water quality, and to fish and benthic macroinvertebrates, from the presence of a fixed wave fence with a 10-foot-deep solid face at MLW extending from the southwest corner of Pier 1 to northwest corner of Pier 2, along the northern edge of Pier 2 for 120 feet measured from the northwest corner and 80 feet measured from the northeast corner; along the southern edge of Pier 3 for 550 feet measured from the southwest corner, along the eastern edge of Pier 2 and Pier 3 (a total of 170 feet each), between the southwest corner of Pier 3 and the northwest corner of Pier 5 with a gap for the marina entrance, and along the western or outboard side of Pier 5 for 210 feet. The balance of the wave attenuation along the northern side of Pier 2 (shoreward of where the fixed wave fence with 10-foot-deep solid face ends), along the "new" face of Piers 2 and 3 and between Piers 2 and 3, would be provided by floating platforms.
- Results of hydrodynamic modeling, as described in the following section, conducted to assess water quality and sedimentation effects associated with the marina and kayak/canoe basin design, and other design elements.
- Potential long-term impacts to water quality and aquatic biota resulting from the operation of a marina between Piers 3 and 5, and water taxi operations such as bottom disturbance by boat motors, shoreline erosion, increased suspended sediment, and accidental petroleum and sewage discharges.
- Potential long-term impacts to water quality and aquatic biota resulting from stormwater discharges during operation of the proposed project, including potential beneficial improvements resulting from the proposed project's goal of managing stormwater generated within the park boundary onsite to minimize stormwater discharges.
- Impacts to terrestrial plants and wildlife associated with land clearing activities during construction of the proposed project, and potential long-term beneficial impacts to plants and wildlife from the proposed landscaping.
- Results of empirical studies conducted within or near the project area, or relevant studies performed in other geographic areas that relate to the proposed action such as in-water construction activities, stormwater discharge, or operation of a water taxi service or marina.

Hydrodynamic Modeling

As part of the proposed project, safe water zones will be created for non-motorized boats (kayaks, canoes, and paddle boats) in the interpier areas between Piers 1 and 2, and Piers 3 and 4 through the installation of fixed wave fences and floating wave attenuators. As described above, a fixed wave fence with a 10-foot-deep solid face at MLW would extend from the southwest corner of Pier 1 to northwest corner of Pier 2, along the northern edge of Pier 2 for 120 feet measured from the northwest corner and 80 feet measured from the northeast corner, along the southern edge of Pier 3 for 550 feet measured from the southwest corner, along the eastern edge of Piers 2 and 3 (a total of 170 feet each), between the southwest corner of Pier 3 and the northwest corner of Pier 5 with a gap for the marina entrance, and along a portion of the western or outboard side of Pier 5. The balance of the wave attenuation along the northern side of Pier 2, along the "new" face of Piers 2 and 3, and between Piers 2 and 3 will be provided by floating platforms (see Figure 1-2).

A hydrodynamic modeling study was conducted by Han-Padron Associates (HPA) (2005) to assess the flushing and sedimentation characteristics that would be created by the 10-foot-deep solid face fixed wave screens as part of the proposed project. The floating wave attenuators lining the safe water zones, fixed wave fences along the "new" faces of Piers 2 and 3, and fixed wave fence on the western or outboard side of Pier 5 were not included in the modeling because they will not affect flushing. Numerical models of the East River and the Brooklyn Bridge Park project area were developed by configuring two models available in the public domain. NearCoM was used to develop the two-dimensional test model used to help establish the water surface level offset needed to simulate the residual current of the East River (net flow averaged over several tidal cycles that tends to transport material from Long Island Sound towards New York Harbor). ECOMSED was configured and implemented to perform the three-dimensional current, flushing and sediment transport numerical studies. Bathymetry data input into the modeling was derived from an existing National Oceanic and Atmospheric Administration (NOAA) database (GEODAS), high-resolution side-scan sonar data collected within the inter-pier areas of the project area, and dive inspection reports of the underpier areas of the project area. Sedimentation rates input into the model were derived from depth surveys conducted by the Port Authority of New York and New Jersey (PANYNJ) as part of its facility inspection program.

The objective of the modeling was to assess whether the flushing of the marina and safe water zones that would result from the proposed project would have the potential to adversely affect water quality, aquatic habitat, and sedimentation characteristics in and adjacent to the project area. The modeling was also used to assess the feasibility of promoting sedimentation in water portions of the project area to gradually form habitat islands for birds, an element being considered for inclusion in the proposed plan (HPA 2005).

In the modeling study, flushing was assessed using a conservative tracer to simulate the behavior that would occur during a physical dye study. The condition in which the in-water portion of the aquatic area would be considered flushed was based upon definitions or guidelines for flushing or residence time found in USACOE (1993[1]), USEPA (1993), and Blumberg et al. (2003). In general, the guidelines consider a marina to be flushed if there is between 30 and 90 percent exchange of the volume of water in the marina within approximately 24 hours (USACOE 1993, USEPA 1993), or when approximately 37 percent of the dye introduced into an area is gone within 12 to 24 hours (Blumberg et al. 2003).

In addition to the hydrodynamic characteristics of the water body where a marina is located, flushing time can be affected by the design of the marina, such as: whether the marina in question is segmented, has an elongated shape (aspect ratio, or length to width ratio, less than 0.3 or grater than 3.0), and whether the marina has square corners. The marina included in the

[1] U.S. Army Corps of Engineers (USACOE). 1993. Engineering and Design, Environmental Engineering for Small Boat Basins. Department of the Army, U.S. Army Corps of Engineers, Washington, DC 20314-1000, CEW-EH-W, Engineer Manual 1110-2-1206.

proposed plan is relatively square, having sharp corners, but has flow through the bottom, since the surrounding piers sit on pilings and though they do affect the flow, do not stop it.

HPA (2005) examined the circulation and flushing characteristics within the marina and the safe water zones in a set of scenarios that examined flushing without the proposed wave fencing (base case) and with the wave fencing under minimum tidal variation (neap tide) and maximum tide (spring tide), with and without the East River's residual flow to the New York Harbor. These scenarios were further refined by varying when the dye would be released within the tidal cycle (i.e., 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 36, 39, 42, and 45 hours after the beginning of each tidal cycle).

In order to evaluate the potential effects of wave screens on sedimentation rates within the project area, and determine whether the concept of using closely spaced piles to encourage development of small islands should be included as an element of the proposed project, HPA modified the model to project sediment transport. On the basis of existing information on sediment characteristics within the project area and the type of flow regime known to occur in the East River, the parameters for resuspension, settling, deposition and bed consolidation were used in the modeling. Confidence in the model was established by comparing it to historic sediment accumulation information. The sedimentation modeling study considered three cases.

- A Base Case (without wave fence) to show the efficacy of the model in projecting sediment accumulation in those areas known to be accreting sediment on the basis of the historical data;
- A scenario where the wave fences are present; and
- A scenario where the wave fences are present and tightly spaced clusters of piles have been added in the proposed shallow water habitat area toward the eastern end of the pile field that would be created by the removal of a portion of the Pier 1 high-level platform, and in the cove within the interbridge area.

C. REGULATORY CONTEXT

In-water activities associated with the proposed project such as: bulkhead repair or replacement; placement of additional armoring riprap; construction of the marina, overwater walkways, and wave fence; dredging; discharge of stormwater; and activities within the New York State Coastal Zone would require compliance 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 waterbodies, 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 Certificate from NYSDEC.

Section 404 of the Act requires authorization from the Secretary of the Army, acting through the USACOE, for the permanent or temporary discharge of dredged or fill material into navigable waters and other waters of the United States. Waters of the Unites 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 the USACOE, 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 would be regulated pursuant to this Act. The USACOE must evaluate the probable impacts including cumulative impacts of the proposed activity on the public interest (benefits of the proposed activity versus potential detriments).

Coastal Zone Management Act of 1972 (16 USC §§ 1451 to 1465)

The Coastal Zone Management Act of 1972 established a voluntary participation program to encourage coastal states to develop programs to manage development within the state's designated coastal areas to reduce conflicts between coastal development and protection of resources within the coastal area. Federal permits issued in New York must be accompanied by a Coastal Zone Consistency Determination that evaluates consistency with New York's federally approved coastal zone management program.

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 to 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 ground waters 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 one acre or more.

Waterfront Revitalization of Coastal Areas and Inland Waterways Act (Sections 910-921, Executive Law, Implementing Regulations 6 NYCRR Part 600 et seq.)

Under the Waterfront Revitalization of Coastal Areas and Inland Waterways Act, the New York State Department of State (NYSDOS) is responsible for administering the Coastal Management Program (CMP). The Act also authorizes the State to encourage local governments to adopt Waterfront Revitalization Programs (WRP) that incorporate the state's policies. New York City has a WRP administered by the Department of City Planning.

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 salt-water 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 one 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 project area.

SETTING

GEOLOGICAL CONDITIONS

The project area is situated at an approximate elevation of 10 feet above sea level (U.S. Geological Survey Jersey City and Brooklyn Topographic Quadrangles). Like many waterfront areas, the upland portion of the project area was filled to raise its grades and create more usable land. While the source of the fill is unknown, fill material used to extend the coastline historically often included wastes such as coal ash, incinerator ash and demolition debris. As described in detail in Chapter 11, "Hazardous Materials," soil samples collected within the upland portions of Piers 6 and 1 contained above-background levels of polycyclic aromatic hydrocarbons and metals. The upland portions of Piers 2 through 5 contained above-ground background levels of polycyclic aromatic hydrocarbons. Elevated levels of these contaminates are typical of urban fill material encountered in industrial areas of New York City. Within the interbridge area, soils have been found to have elevated total metals concentration. This area was also found to have hazardous levels of lead, likely associated with deteriorating lead-based paints from the overlying Manhattan Bridge. Additionally, soil exhibiting elevated concentrations of petroleum-related contaminants above recommended cleanup guidelines was found within the project area north of the Manhattan Bridge. Soil testing near existing garages on Piers 6, 5 and 1 detected elevated concentrations of volatile organic compounds and semi-volatile organic compounds that may also be indicative of similar petroleum contamination from underground petroleum storage tanks and former vehicle maintenance and repair activities.

The native subsurface soils in Brooklyn consist of sediments from the Wisconsin Age Upper Pleistocene deposits. The sediments are glacial in origin and are made up of terminal and ground moraine deposits as well as glacial outwash. The subsurface sediments are mostly an unsorted and unstratified mix of sand, silt, clay, boulders and gravel, which together constitute the Upper Glacial Aquifer. Bedrock comprises an undifferentiated mix of crystalline rock including gneiss, schist, limestone and granodiorite. The bedrock surface is expected to be at a depth of approximately 50 to 100 feet below grade (USGS 1981).

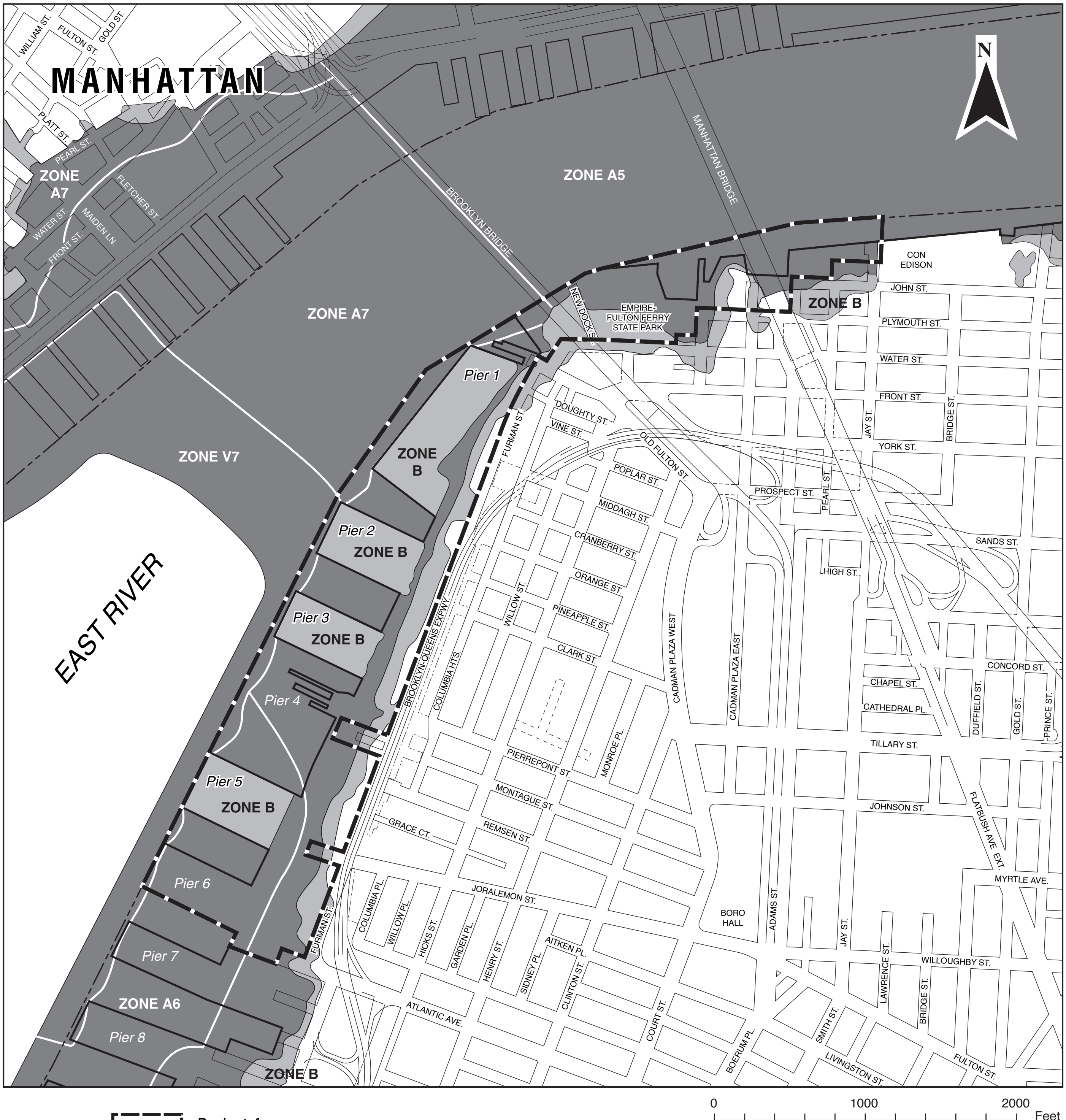
GROUNDWATER

Groundwater within the project area is encountered at a depth of approximately eight to 10 feet below surface grade. Groundwater is expected to flow in a westerly direction toward the East River. Groundwater is not used as a potable water supply in this part of Brooklyn and non-potable use is limited. Potable water in Brooklyn is provided by New York City's public water supply, which comprises a system of upstate reservoirs. No significant levels of contaminants were detected in groundwater samples collected within the project area (see Chapter 11, "Hazardous Materials").

FLOODPLAINS AND WETLANDS

Figure 10-1 presents the 100-year floodplain (area with a 1 percent chance of flooding each year) and 500-year floodplain (area with a 0.2 percent chance of flooding each year) boundaries within the project area. As presented in Figure 10-1, much of the project area is within the 100-year floodplain. The 100-year flood elevation is 10 feet above National Geodetic Vertical Datum (NGVD), which approximates mean sea level. All of Pier 6 and much of the upland area between Pier 6 and Pier 3 is within the 100-year floodplain. The floodplain narrows between Piers 3 and Pier 1 although it still covers about half of the area in this portion of the project area. Piers 5, 3, 2, and 1 are above the 100-year floodplain but within the 500-year floodplain. The 100-year floodplain covers much of Empire-Fulton Ferry State Park and then the remaining shoreline portion of the project area to the north but does not extend into the Con Edison property. **Figure 10-1**

The entire shoreline within the project area is engineered with bulkhead, platform, or riprap (northern portion of the project area along the John Street Site north of Manhattan Bridge), which limits the potential for tidal marsh plants or submerged aquatic vegetation. The USFWS National Wetlands Inventory (see Figure 10-2) classifies the majority of the waters in the project area 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 **Figure 10-2**



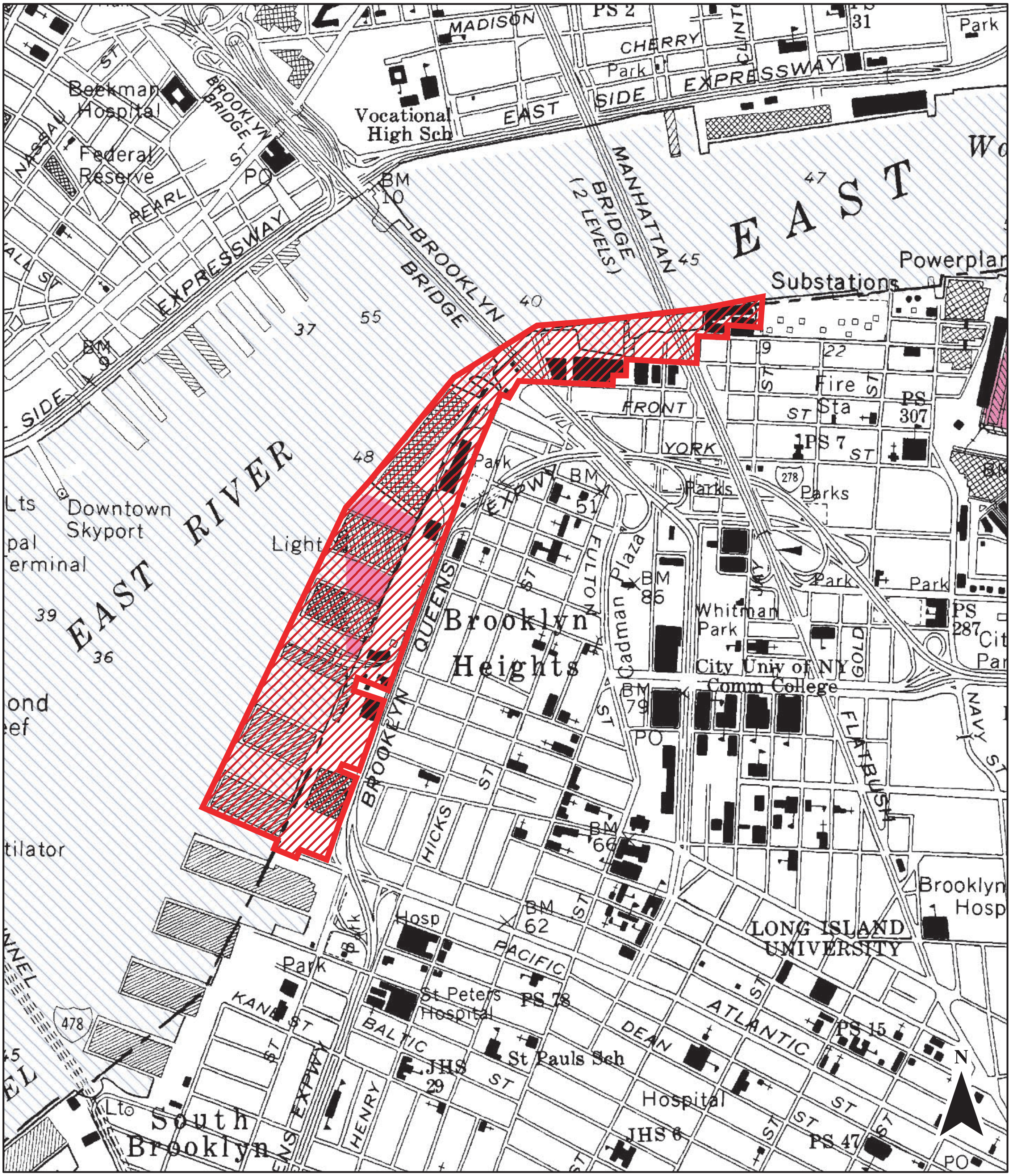
Project Area

ZONE B	500-Year Flood Boundary
	100-Year Flood Boundary
ZONE A1 / ZONE A5	Zone Designations
	100-Year Flood Boundary
ZONE B	500-Year Flood Boundary

Flood Plain Map

Figure 10-1

7.18.05



0 980 Feet

Project Area

NWI WETLAND CLASSIFICATION

E1UBL

E1UBLX

National Wetlands Inventory Map

Figure 10-2

smaller than 6 or 7 cm, and less than 30 percent vegetative cover. The area between Piers 1 and 2, and portions of the areas between Piers 2 and 3, and 3 and 4, are classified as estuarine subtidal with unconsolidated bottom with excavation (E1UBLx). A jurisdictional determination will be requested from the USACOE. However, the waters within the project area do not contain tidal wetland plants, and would, therefore, be regulated by the USACOE as waters of the U.S. but would likely not be classified as wetlands. The East River is designated as littoral zone (shallow waters six feet or less in depth that are not included in other NYSDEC tidal wetland categories) by NYSDEC (Figure 10-3). However, NYSDEC regulations state that *actual* water depths determine whether or not an area is a littoral zone. Water depths within the portion of the project area between Piers 1 and 6 range from approximately 6 feet or less (2 meters or less) to approximately 40 feet (12.5 meters) MLW. Areas with water depths at or shallower than 6 feet at MLW that may be classified as littoral wetland by the NYSDEC occur near the shoreline under Pier 5, near the shoreline of Pier 4, and near the shoreline under Piers 2, 3, and 4.

Figure 10-3

Two cove areas are present in the northern portion of the project area between the Brooklyn and Manhattan Bridges. The larger and more southern cove area between the two bridges contains shallow littoral zone habitat with depths less than 6 feet at low tide. This cove has a sand and gravel beach. The smaller cove near the end of Adams Street under the Manhattan Bridge has a small beach area with a finer substrate than the larger cove. Although both beaches provide intertidal habitat and could be classified under the USFWS NWI system as estuarine intertidal wetland with unconsolidated shore, they would likely be regulated by the USACOE as waters of the U.S. and not as wetlands because they are unvegetated. Both coves have areas with depths less than 6 feet MLW, which would be designated as littoral zone wetlands by the NYSDEC.

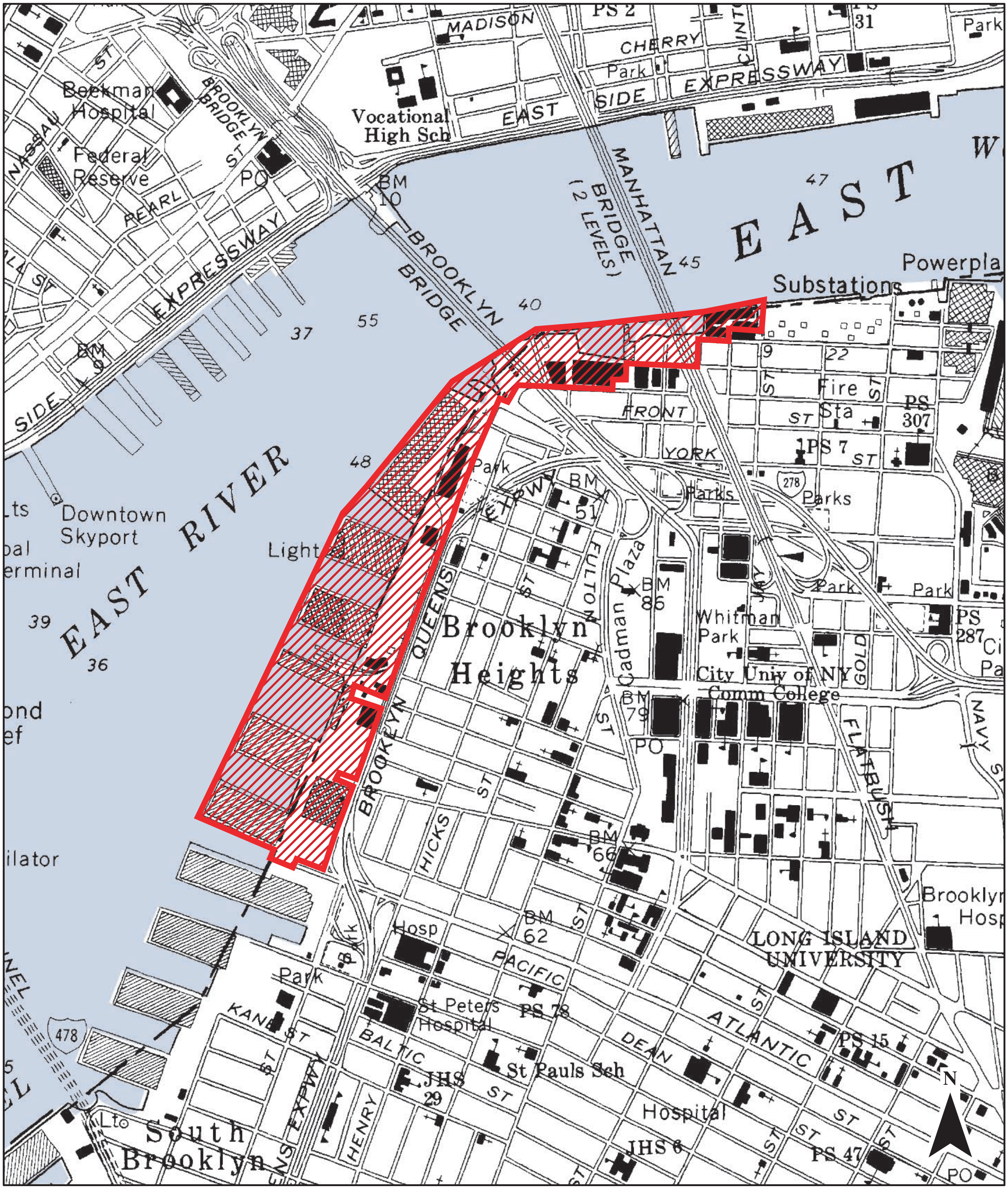
AQUATIC RESOURCES

SURFACE WATER RESOURCES IN THE PROJECT AREA

The project area is located along the eastern shore of the lower 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 1219 meters (m)). Water depth in the federal navigation channel is maintained to 40 feet (12 meters below mean low water (MLW) from the Battery to the former Brooklyn Navy Yard, and 35 feet (about 11 meters) 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 meters) in areas just north of Hell Gate.

Maximum current velocities in the lower East River range between approximately 5 and 6 knots (8.4 to 10 feet per second). The East River shoreline is almost entirely bulkheaded or riprapped. Surface current velocity measurements recorded at Pier 5 within the project area in June 2004 at flood tide ranged from 0.15 to 1.23 knots (0.25 to 2.08 feet per second). 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 1.3 meters (4.3 feet) at the Battery, 1.5 meters (5.1 feet) at Hell Gate east of the project area, and increasing to 2.2 meters (7.2 feet) 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 water body (Hazen and Sawyer 1983).

5.17.05



0 980
Feet

Project Area

DEC WETLAND CLASSIFICATION

Littoral Zone

NYSDEC Tidal Wetland Map

BROOKLYN BRIDGE PARK Figure 10-3

Sources of freshwater flow to the East River are the Bronx River, Westchester Creek, Hudson River, combined sewer overflows (CSOs), and wastewater point sources (e.g., Newtown Creek and Red Hook wastewater treatment facilities). The Red Hook wastewater treatment plant effluent discharges to the East River just north of the project area. There are over 100 CSO outfalls on the East River in the stretch from the Triborough Bridge to the Battery. Approximately 28 CSO outfalls are present on the stretch of river between the Williamsburg Bridge and the Battery (IEC 2002).

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 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 Class 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.
- Total coliform—The monthly geometric mean from a minimum of 5 examinations shall not exceed 10,000 colonies/100 milliliters (mL).
- 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.

The City of New York has monitored New York Harbor water quality for over 90 years through the Harbor Survey. DEP 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 (DEP 2002). The proposed project is in the Inner Harbor Area, which includes the lower East River to the Battery.

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 a number of aquatic species have a limited salinity tolerance.

Average temperatures within the Upper Bay range from about 3.7 to 23.8°C (38.7 to 74.8°F) (USACOE 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 lower East River measured near the project area during the 1995–2002 Harbor Survey ranged from approximately 1.8 to 25.5°C (35 to 77°F) (DEP 2003a).

Salinity varies at any given point 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 toward the bottom, while freshwater from the rivers draining to the estuary remain toward the top. Average salinity differences throughout the water column in the harbor are generally between 1 and 3 parts per thousand (ppt) (USACOE 1999a). However, the swift tidal currents and limited freshwater inflow result in vertical mixing that prohibits the formation of large salinity gradients in this part of the river.

Salinity measurements taken in the lower East River near the project area between 1995 and 2002 generally ranged from about 10 to 29 ppt, with bottom water salinity generally only slightly greater than surface water salinity. Periodic high freshwater flows in extremely wet years can occasionally create oligohaline conditions (salinity less than 5 ppt) for relatively short periods. Salinity data collected as part of the Westway study in the vicinity of the Williamsburg Bridge indicated mean salinities of 15.3 ppt in winter and 23.8 ppt in early spring (USACOE 1984).

The results of recent Harbor Surveys (DEP 2001, 2002, 2003b) 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 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 (DEP 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).

Recent survey data from the Harbor Survey station closest to the project area, mid-stream off of Pier 10 in Brooklyn just to the south, indicate that the water quality in this part of the lower East River is generally good. The following section provides a summary of the water quality conditions in the sampling region (Inner Harbor Area) of the Harbor Survey that includes the project area. Table 10-1 presents a summary of water quality measurements at the Pier 10 station in 2002.

Table 10-1
2002 DEP Water Quality Data for the Pier 10 Sampling Station

Parameter	Top Waters			Bottom Waters		
	Low	High	Avg	Low	High	Avg
Total Fecal Coliform (per 100 mL)	7.4	7.8	7.5	NM		
Dissolved Oxygen (mg/L)	4.4	14.0	8.5	4.3	10.8	6.0
Secchi Transparency (ft)	2.0	6.0	4.3	NM		
Chlorophyll *a* (µg/L)	0.8	8.5	3.0	NM		

Notes: NM = not measured; chlorophyll *a* measurements are for the East 23rd Street Station.
Source: DEP 2003a.

The presence of 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 1999, 2000 and 2001 New York Harbor Water Quality Regional Summaries (DEP 2000, 2001, 2002), 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 following a rain event. 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 (DEP 2001). In 2002, fecal coliform concentrations near the project area were below 8 colonies/100mL. Further upstream at the East 23rd Street station, fecal coliform bacteria concentrations peaked as high as 830 colonies/100 mL, but generally remained below 200 colonies/100 ML (DEP 2003a).

DO in the water column is necessary for respiration by all aerobic forms of life, including fish and such invertebrates as crabs, clams, and zooplankton. The bacterial breakdown of high organic loads from various sources can deplete DO to low levels and 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 concentrations in the Inner Harbor Area have increased over the past 30 years from an average that was below 3 mg/L in 1970 to above 5 mg/L in 2001, a value fully supportive of ecological productivity (DEP 2002). In 2002, DO concentrations near the project area (Station E1) were above the 4 mg/L standard for Use Class I waters (DEP 2003a). All pH levels in the New York Harbor Area are in attainment.

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. DEP is implementing a 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 treatment plant, which discharges to the East River upstream of the project area are expected to be completed in 2007. In 2000, the last year for which there is chlorophyll *a* data for the Pier 10 station, the average concentration was 1.3 µg/L and never exceeded 20 µg/L. In 2002, concentrations at East 23rd Street averaged 3.0 µg/L and never exceeded 20 µg/L (DEP 2003a).

Secchi transparency is a measure of the clarity of surface waters. Transparency greater than 5 feet (1.5 meters) is indicative of 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) are generally 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 about 3.5 and 5.5 feet (1 to 1.7 meters). Average Secchi transparency near the project area in 2002 was 4.3 feet (1.3 meters). Two of the ten measurements taken in 2002 were less than 3 feet (0.9 meters), indicating that water quality in this area is periodically impaired by reduced water transparency (DEP 2003a).

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, multi-media contaminant identification and trackdown 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 the water in the Harbor 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, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), metals (mercury, cadmium, and lead), and pesticides (dieldrin and chlordane).

Two CARP sampling areas are near the project area: Lower East River (LER) near the Navy Ship Yard, and at the outfall of the Red Hook Sewage Treatment Plant (RHSTP) just to the north of the project area. A trace organics platform sampler (TOPS) was used in 1998 and 1999 to sample the water column for trace organics (pesticides, dioxin, methyl mercury, PAHs) (Donlon et al. 1999). Samples from the LER sampling area exceeded the NYS water quality standards for benzo(b,k)fluoranthene and benzo(a)pyrene in 1998, but not in 1999 (Litten et al. 1999). Total PCBs were the only other trace contaminant reported in samples from the LER site (Litten and Fowler 1999). Samples from the RHSTP contained measurable concentrations of three pesticides (DDT, chlordane, and mirex), methyl mercury, and dissolved mercury (Litten and Fowler 1999, Litten et al. 1999).

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 due to natural and human actions. USACOE (1999a) reports that sediments in Upper New York Bay vary from coarse sands and gravels in high-energy areas to fine-grained silts and clays in low-energy areas. 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 caused by strong tidal currents in the river.

Typical of any urban watershed, New York Harbor Estuary sediments, including the lower East River, are contaminated due to a history of industrial uses in the area. Contaminants found throughout the New York Harbor Estuary included 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 upon 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 significantly from 75 percent in 1993 to 48 percent in 1998 (Steinberg et al. 2004).

In August 1993, sediments were sampled in the East River/Upper Harbor just below the project area between Piers 8 and 9A as part of the USEPA Regional Environmental Monitoring and Assessment Program (R-EMAP) (USEPA 2001). The sediments sampled at this location contained elevated levels of some heavy metals, PAHs), total PCBs, and isomers of the pesticide DDT (DDE and DDD). Two metals (lead and mercury) and a few PAHs were present at concentrations that would be likely to pose a risk to aquatic organisms such as benthic invertebrates.

Sediments sampled in 2002 near Pier 6 on the Manhattan side of the East River across from the project area contained elevated levels of PAHs, Aroclor 1248 (a commercial PCB mixture), and some heavy metals (AKRF 2002). Isomers of the pesticide DDT were not detected at this location. Some PAHs and three metals (lead, mercury, and silver) were present at concentrations that may pose a risk to aquatic organisms.

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 are tolerant of highly variable conditions.

Aquatic habitats within the project area include underpier areas for Piers 2 through 6, and the southern portion of Pier 1, and open water interpier areas between Piers 1 through 6. The majority of Pier 1, the portion parallel to the shoreline, is on fill. The southern portion of Pier 1 that is perpendicular to the shoreline, and the remaining 5 piers within the project area, are on piles. Water depths in underpier areas are shallower near the shoreline and deepen toward the pierhead line, ranging from approximately 6 feet or less (2 meters or less) MLW near the shoreline to approximately 26 feet (7.8 meters) MLW for Piers 1 through 5, and from approximately 20 feet (6.1 meters) at the shoreline to approximately 33 feet (10.2 meters) MLW at the pierhead line for Pier 6. Water depths in the interpier areas are also shallower near the shoreline and deepen toward the pierhead line, generally ranging from approximately 11 feet (3.3 meters) MLW to 40 feet (12.5 meters) MLW near the pierhead line. Other habitats include open water subtidal habitats along the bulkheaded or riprapped shoreline near the two bridges at the northern portion of the project area, and the intertidal and subtidal habitats within the two coves between the two bridges.

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. Several species can obtain larger sizes as chains or in colonial forms. 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, low light penetration has often precluded the occurrence of phytoplankton blooms. Because of the rapid currents and large tidal excursion distances, 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.

In studies 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 *Nannochlorus 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 Algae. Submerged aquatic vegetation (SAV) are rooted 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 seen on 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 riverbanks severely limit inhabitation of this area by SAV. Common macroalgae known to occur within the East River include *Fucus*, *Ulva*, and *Enteromorpha* (Perlmutter 1971).

Zooplankton

Zooplankton are an integral component of aquatic food webs—they are primary grazers on phytoplankton and detritus material, and are themselves used by organisms of higher trophic levels as food. The higher-level consumers of zooplankton typically include forage fish, such as bay anchovy, as well as commercially and recreationally important species, such as striped bass and white perch 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 established in Long Island Sound and New York Harbor.

Benthic Invertebrates

Invertebrate organisms that inhabit river bottom sediments as well as 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 carbon (or living material); 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 that can be retained on a 0.5 mm screen (macroinvertebrates) as well as smaller forms, such as nematodes (a class of roundworm) and harpacticoid copepods (order of copepods that are primarily benthic) 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 the primary factors influencing benthic invertebrate communities; secondary factors include currents, wave action, predation, succession, and disturbance.

Over 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 aquatic earthworms, segmented worms, snails, bivalves and soft shell clams, barnacles, cumaceans, amphipods, isopods, crabs and shrimp. Epifauna include hydrozoans, sea anemones, flatworms, oligochaete worms, polychaetes, bivalves, barnacles, gammaridean and caprellid amphipods, isopods, sea squirts, hermit crabs, rock crabs, grass shrimp, sand shrimp, blue crabs, mud dog whelks, mud crabs, horseshoe crabs, blue mussels, softshell clams, and a sea slug (EA Engineering, Science, and Technology 1990, Able et al. 1995, New York City Department of Parks and Recreation (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 have adapted to the East River's hard bottoms and rapid currents by living within the abandoned tubes 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, low velocity areas near piers and pilings. Common soft substrate organisms included oligochaete worms, the soft shelled clam *Mya arenaria*, and a variety of flatworms, nemerteans, polychaetes, and crustaceans (Hazen and Sawyer 1985).

Benthic macroinvertebrate sampling conducted between Piers 1 and 2 in the proposed project area in 1986-1987 identified a total of 22 taxa (EEA 1989). Abundance was highest in late summer (27,907 individuals per square meter) and lowest in the spring (847 individuals per square meter) when water dissolved oxygen levels were relatively low. The high summer abundance can be attributed almost entirely to a single species, *Streblospio benedicti*, a pollution-tolerant oligochaete.

Benthic macroinvertebrates collected by the USACOE (1999b) at interpier locations within the Bush Terminal on the Brooklyn waterfront south of the project area found benthic macroinvertebrates to be similar between interpier areas and navigation channels of the New York-New Jersey Harbor Estuary. The dominant species collected were similar to those reported in other studies within the Harbor Estuary. Samples collected in November and February were dominated by a few species of polychaete worms, primarily *Streblospio benedicti* followed by *Nereis* spp, and members of the family Paraonidae. Oligochaetes and the bivalve *Lacuna vincta* were also present. By May, mollusks became the dominant group, comprising primarily *Mulinia lateralis*. Sea grapes (*Molgula manhattensis*) and little surf clam (*Mulinia lateralis*) dominated the samples collected in August, followed by oligochaetes and the polychaete worms *Leitoscoloplos fragilis* and *Tellina* sp. Crabs collected in the interpier areas were similar to those collected in the navigation channel, although horseshoe crab and mud crab were collected more frequently in the interpier areas than the channels, fiddler crab were only collected at the interpier stations, and rock crab and green crab were generally less abundant in the interpier areas than the navigation channels.

Benthic macroinvertebrates sampling conducted in 1993-1994 just below the study area between Piers 8 and 9A as part of the USEPA Regional Environmental Monitoring and Assessment Program (R-EMAP) (Adams et al. 1998) suggested that the benthic community was highly impacted, consisting primarily of pollution-tolerant organisms. A benthic macroinvertebrate sampling program conducted in July 2002 between Piers 6 and 9 on the Manhattan shoreline of the East River, opposite the project area, also found large numbers of pollution-tolerant benthic invertebrate (primarily polychaetes in the families Capitellidae and Spionidae) (AKRF 2002). However, pollution-sensitive benthic invertebrate species (e.g., *Ampelisca* sp.) were also collected at this location. Five pollution-sensitive species were collected: a snail, an amphipod, two polychaetes, and a clam. Other invertebrates collected were mussels, crabs, shrimp, isopods, nematodes, and several species of polychaete.

Fish

New York City is located at the convergence of several major river systems, all of which connect to the New York Bight portion of the Atlantic Ocean. This convergence has resulted in a mixture 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 10-2 lists fish that have the potential to occur in the East River.

Despite the relatively low value of the East River 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, lack of shoals and protected habitat, reduced water quality, and possibly a lack of prey, probably explain why the East River experiences only limited utilization by fish at various times of the year. The swift currents act to scour the river bottom and prevent accumulation of sediment. Consequently, the benthic community in deeper channel areas is characterized by attached rather than infaunal species. During the summer months, diminished water quality—particularly low levels of dissolved oxygen—can also limit fish presence (PAS 1985).

Table 10-2
Fish Species With the Potential to Occur in the East River

Common Name	Scientific Name
Alewife	*Alosa pseudoharengus*
American eel	*Anguilla rostrata*
American shad	*Alosa sapidissima*
Atlantic herring	*Clupea harengus*
Atlantic silverside	*Menidia menidia*
Atlantic tomcod	*Microgadus tomcod*
Bay anchovy	*Anchoa mitchilli*
Bluefish	*Pomatomus saltatrix*
Butterfish	*Peprilus triacanthus*
Mummichog	*Fundulus heteroclitus*
Northern searobin	*Prionotus carolinus*
Scup	*Stenotomus chrysops*
Striped bass	*Morone saxatilis*
Summer flounder	*Paralichthys dentatus*
White perch	*Morone americana*
Winter flounder	*Pseudopleuronectes americanus*

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

The following sections provide first a description of the general East River fish community, followed by a description of the fish community known or expected to occur in the interpier and shoal habitats that occur within the project area.

<u>*Marine Species*</u>. Winter flounder, scup, and bluefish are marine species present in the East River. 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 reduces salinities to slightly below full strength (Pereira et al. 1999). Capture of adult-size winter flounder during the winter months

in the lower East River indicates possible spawning activity (PAS 1985). Flounder are most likely utilizing the lower East River 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 that migrates inshore during late spring. It tends to stay close to the coast during the summer months before moving offshore during the fall to deeper waters. The scup is a bottom feeder that spawns from May through August (Bigelow and Schroeder 1953).

Bluefish were reported as an abundant species captured in the East River during the USACOE Westway Study. Bluefish is a pelagic fish 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 in the outer half of the continental shelf, and the resulting young move inshore in the late summer to feed (Bigelow and Schroeder 1953). Incidence of young bluefish in the East River is probably related to this migration pattern (PAS 1985).

Estuarine Species. Species that have been found in abundance within the East River are the resident fish bay anchovy, Atlantic silverside, striped and common killifish, and white perch. These species are important as forage species for larger predator fish and are commonly used as bait by fishermen. They are resident estuarine fish although considered euryhaline (PAS 1985).

Bay anchovy is 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 uses 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, and few are caught in ichthyoplankton samples. 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 1 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 an additional estuarine species that has been found in the East River. 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 3 to 5 days, and after approximately 1 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 include striped bass and tomcod, and members of the herring family. Striped bass use the East River 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).

Two of the common anadromous species are members of the herring family—alewife and American shad. These species live in the sea 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 crustaceans and other invertebrates (Bigelow and Schroeder 1953).

Catadromous Species. The single catadromous species common to the East River is American eel. Eels spawn at sea 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).

Interpier/Shoal Fish Community. Fish sampling was conducted in the project area between Piers 1 and 2 in 1986 and 1987 (EEA 1989). Sampling was conducted twice per month for one year using a 30-foot otter trawl. The most abundant species collected was alewife, followed by striped bass and winter flounder. Other species collected included: Atlantic silverside, summer flounder, Atlantic herring, Atlantic tomcod, white perch, northern searobin, butterfish, and bluefish.

USACOE conducted a sampling program at two New York Harbor berthing areas and marine terminals from October 1998 through September 1999, to obtain information on the relative distribution and seasonal use of these areas by demersal fish (collected with bottom trawl) and benthic macroinvertebrates. Two representative areas were selected for sampling, a New Jersey site, and the Bush Terminal, called the South Brooklyn Site. The South Brooklyn Site was considered characteristic of the Red Hook and Brooklyn Marine Terminals located along the Brooklyn waterfront south of the project area. Depths at the locations sampled are similar to those in the project area with nominal depths at the interpier locations ranging from 24 to 29 feet. The channel station had a nominal depth of 41 feet (USACOE 1999a). While these samples were collected at an active marine terminal, the habitat would be expected to be similar to that present in the interpier areas within the project area.

Winter flounder was the dominant species collected by the USACOE at the interpier stations during the late-fall and early winter, in contrast to the dominance by bay anchovy and weakfish in sampling conducted within navigation channels during this same period. Other abundant species in the interpier area included back sea bass, bay anchovy, and striped bass. Striped bass accounted for over 60 percent of the fish collected in the interpier locations in November but were absent from samples collected in the approach channel. Most of the individuals collected were within the size range for young-of-year, which are known to overwinter in the lower Hudson River Estuary.

From December through March the number of individuals collected by the USACOE in the interpier locations appeared to decrease, with winter flounder and Atlantic silverside comprising the most abundant species. The number of individuals collected increased again in April and May, with large catches of striped bass and anadromous herring (alewife and blueback herring). Striped bass and weakfish were the dominant species collected in July. Bay anchovy were found from early summer through September, and were the dominant species collected in August and September. Other species collected in large numbers in the interpier areas in August and September included Atlantic silverside, alewife, scup and butterfish (USACOE 1999b). Subsequent sampling conducted by the USACOE to assess winter flounder distribution in the Harbor Estuary during the spawning period found adult winter flounder in the Upper Bay areas to be more common in navigation channel habitat from December through April, with a shift toward higher abundance in shallow/shoal areas in May and June. Winter flounder spawning appeared to be most prevalent in the Lower Bay in areas of coarse (gravel/sand) substrate. Fine sediment substrates are more common in the Upper Bay and are more characteristic of low energy or low velocity areas that may not promote sufficient aeration of demersal eggs (those attached to the bottom) such as those produced by winter flounder. Winter flounder juveniles, on the other hand, were more prevalent in the Upper Bay and Arthur Kill/Newark Bay areas, away from the apparent spawning areas (LMS 2003a and b).

Ichthyoplankton abundance and species composition of samples collected by the USACOE in the interpier areas followed a seasonal pattern and was similar to that observed in samples collected in navigational channels in the New York-New Jersey Harbor Estuary. Post-yolk sac larvae of Atlantic herring, American sand lance and winter flounder were collected in February. Eggs began to appear in March, comprising fourbeard rockling, winter flounder, and sculpins. Winter flounder eggs peaked in April, when Atlantic menhaden eggs were also collected. Weakfish and tautog eggs became abundant in May and June. Post yolk-sac larvae were most abundant in May and June, dominated by Atlantic menhaden, windowpane flounder and bay anchovy. Overall, weakfish was the most abundant species collected, followed by tautog, Atlantic menhaden, bay anchovy, fourspot flounder, hogchoker, and winter flounder. Eggs were the dominant lifestage collected and abundance was greatest in May and June (USACOE 1999b).

ENDANGERED, THREATENED, AND SPECIAL CONCERN SPECIES

Requests for information on rare, threatened or endangered species within the immediate vicinity of the project area were submitted to USFWS (NY office), NMFS, and the NYSDEC New York Natural Heritage Program (NYNHP). No records of rare, threatened or endangered species or sensitive habitats were reported by the USFWS (Stilwell 2003). The NYNHP records indicate that the peregrine falcon (New York State endangered) has nested within the project area within the last 10 years (Ketcham 2003). Peregrines nest on ledges and small shallow caves on high cliff walls, man-made platforms, or urban areas on bridges and tall buildings. In the New York City area, courtship occurs in February and March with egg laying in April and May. They typically return to the same nest every year. However, records for the locations in and near the project area do not indicate that these birds nest there every year.

The NMFS indicated that the federally listed and state-listed endangered shortnose sturgeon (*Acipenser brevirostrum*) and four species of marine turtle (loggerhead, green, Kemp’s ridley, and leatherback) may be present in the project area as seasonal transients (Rusanowsky 2004).

Shortnose sturgeon is an anadromous bottom-feeding fish that can be found throughout the Hudson River system but spawns, develops, and overwinters well north of the project area in the Hudson River, and prefers colder, deeper waters for all lifestages. The Hudson River below Tappan Zee is not considered optimal shortnose sturgeon habitat (Bain 2004) and sturgeon would be expected to occur rarely south of the southern tip of Manhattan (Bain 1997). Therefore, individuals are only expected to use the Upper Harbor and East River when traveling to or from the upriver spawning, nursery and overwintering areas on the Hudson River. Hudson River shortnose sturgeon would not be expected to migrate from the Harbor Estuary through the East River to Long Island Sound because this species generally only uses marine waters associated with the estuary of the river in which it spawns (Bain 1997), in this case the Hudson River. Fish that may pass through the lower East River would be expected to use the deeper channel areas as opposed to the near-shore areas in the vicinity of the project area.

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 above the downstream saline area. The primary summer habitat for shortnose sturgeon in the middle section of the Hudson River Estuary is the deep river channel (13 to 42 meters deep, 43 to 138 feet) (Peterson and Bain 2002).

Four species of marine turtles, all state and federally listed, can occur in New York Harbor. Juvenile Kemps ridley (*Lepidochelys kempii*) and large 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 (USFWS 1997). However, 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 project area in the lower East River except as occasional transients.

ESSENTIAL FISH HABITAT

The project area on the East River is within a portion of the Hudson River Estuary EFH that is situated in the NOAA/NMFS 10' x 10' square with coordinates (North) 40°50.0' N, (East) 74°00.0' W, (South) 40°40.0' N, (West) 74°10.0' W, which includes Atlantic Ocean waters within the square affecting the following: the Hudson River and Bay from Guttenberg, NJ, south to Jersey City, NJ, including the Global Marine Terminal and the Military Ocean Terminal, Bayonne, NJ, Hoboken, NJ, Weehawken, NJ, Union City, NJ, Ellis Island, Liberty Island, Governors Island, the tip of Red Hook Pt. on the west tip of Brooklyn, NY, and Newark Bay. The area of the East River containing the Brooklyn Bridge Park project area has been identified as EFH for 15 species of fish. Table 10-3 lists the species and life stages of fish identified as having EFH in the East River.

TERRESTRIAL RESOURCES

From a natural resources perspective, the majority of the proposed Brooklyn Bridge Park corridor is located within disturbed, urban areas where either no vegetation exists, ornamental vegetation (e.g., areas landscaped with lawn and scattered shade trees) exists, or highly invasive species exist. Terrestrial and avian wildlife along the corridor and in the parks is generally limited to species tolerant of urban conditions.

Table 10-3
Essential Fish Habitat Designated Species for the East River

Species	Eggs	Larvae	Juveniles	Adults
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
Sand tiger shark (*Odontaspis Taurus*)		X		
Sandbar shark (*Charcharinus plumbeus*)		X		X

Source: National Marine Fisheries Service. "Summary of Essential Fish Habitat (EFH) Designation" posted on the internet at http://www.nero.noaa.gov/ro/STATES4/new_jersey/40407400.html.

Habitat characteristic of urban vacant lots occurs at two locations—at the northern portion of the project area in the vicinity of the John Street Site and at the southern portion of the project area in the upland area between Piers 3 and 4. Vegetation in these areas consists of invasive species typical of disturbed areas. Trees, saplings, and shrubs included tree-of-heaven (*Ailanthus altissima*), black cherry (*Prunus serotina*), eastern cottonwood (*Populus deltoides*), and sumacs (*Rhus* spp.). Herbaceous vegetation includes ragweed (*Ambrosia artemisiifolia*), goldenrods (*Solidago* spp.), asters (*Aster* spp.), sweet clover (*Melilotus alba*), and grasses such as Japanese brome grass (*Bromus japonicus*), orchard grass (*Dactylis glomerata*), and fescue grass (*Festuca* sp.).

The existing recreation areas (Empire-Fulton Ferry Park, Hillside Park, and Squibb Park) contain wildlife habitat characteristic of areas landscaped with mowed lawn and shade trees. Birds observed in the project area during a site visit included northern mockingbird (*Mimus polyglottos)*, purple martin (*Progne subis*), purple finch (*Carpodacus purpureus*), house sparrow (*Passer domesticus)*, mourning dove (*Zenaida macroura*), and pigeon (*Columba livia)*. Examples of birds found within landscaped areas and successional woodlands within the New York City metropolitan region that have the potential to breed within the vicinity of the project area based on 1980 to 1985 observations recorded by the New York State Breeding Bird Atlas project (Blocks 5850A, 5750B, and 5750D (NYSDEC 2004)) include: pigeon, mourning dove, chimney swift (*Chaetura pelagica)*, barn swallow (*Hirundo rustica)*, blue jay (*Cyanocitta cristata)*, American robin (*Turdus migratorius*), northern mockingbird, downy woodpecker (*Picoides pubescens)*, northern flicker (*Colaptes auratus)*, eastern kingbird (*Tyrannus tyrannus)*, black-capped chickadee (*Poecile atricapillus)*, brown thrasher (*Toxostoma rufum)*, chipping sparrow (*Spizella passerine)*, song sparrow (*Melospiza melodia)*, northern cardinal (*Cardinalis cardinalis)*, red-winged blackbird (*Agelaius phoeniceus)*, American crow (*Corvus brachyrhynchos)*, European starling (*Sturnus* *vulgaris)*, common grackle (*Quiscalus quiscula)*, house finch (*Carpodacus mexicanus)*, and house sparrow. Other wildlife with the potential to occur within the project area include gray squirrel (*Sciurus carolinensis*), mice and other small rodents.

The bulkheaded shorelines and piers would be expected to provide resting and perching habitats for waterfowl and shorebirds. The two small coves with sand and gravel beaches and riprap, described previously as occurring within the northern portion of the project area, along either side of the Brooklyn Bridge, would also be expected to provide resting and feeding habitat for shorebirds and waterfowl. Waterfowl known to occur along the East River during the spring and fall migratory periods include American black duck, American wigeon, bufflehead, canvasback, Goldeneye, greater scaup, green-winged teal, hooded merganser, lesser scaup, mallard, northern shoveler, red-breasted merganser, and ruddy duck (NOAA 2001). Waterfowl that might be expected to occur in the East River shoreline and in the coves within the project area throughout the year include American black duck, Canada goose and mallard. Wading birds such as herons and egrets, and shorebirds such as sandpipers and gulls, would also be expected to occur in the cove areas. As noted above, peregrine falcons have been recorded nesting in the project area within the last 10 years.

E. THE FUTURE WITHOUT THE PROPOSED PROJECT

PROJECT AREA

In the future without the proposed project, no major changes are anticipated for the project area. It is assumed that without approval of the proposed project and the actions necessary to implement it, a mix of waterfront industry, open space, vacant land and structures would continue to characterize the project area. The wildlife habitat and resources currently found within the project area would remain unchanged from the existing condition.

OUTSIDE THE PROJECT AREA

Chapter 2, "Land Use, Zoning, and Public Policy," discusses commercial, residential and other land development projects that have been proposed outside the immediate project area. These proposed development projects would not be expected to significantly affect aquatic or terrestrial resources in the vicinity of the project area.

There are proposed and ongoing projects aimed at improving water quality and aquatic resources in the New York/New Jersey Harbor Estuary, which have the potential to result in water quality and aquatic habitat improvements in the Upper Harbor and East River in the vicinity of the project area. These projects are independent of the proposed project. Improvements that result from these projects would occur without the proposed project, and are expected to continue through the construction and operation of the Brooklyn Bridge Park.

NY/NJ HEP PROJECTS

Several of the future water quality improvement efforts in the Lower Hudson River Estuary would be coordinated by the New York/New Jersey Harbor Estuary Program (HEP). The Final Comprehensive Conservation and Management Plan (CCMP) for the HEP (NY/NJ HEP 1996) included a number of goals to improve water quality and aquatic resources in the area. The CCMP outlines objectives for the management of toxic contamination, dredged material, pathogenic contamination, floatable debris, nutrients and organic enrichment, and rainfallinduced discharges. The HEP Habitat Workgroup has developed watershed-based priorities for identifying acquisition, protection, and restoration sites for the preservation and enhancement of tidal wetlands that would provide improved habitat for fish and macroinvertebrates as well as the birds, mammals, and reptiles that depend on these habitats. No NY/NJ HEP Acquisition and Restoration Sites have been identified in the vicinity of the project area. NY/NJ HEP Acquisition and Restoration Sites in closest proximity to the Upper Bay are listed below. NY/NJ HEP actions taken with respect to these sites would occur with or without the proposed project.

- *Liberty State Park*—Located in the Upper New York Bay, it has been identified for restoration, including permanent protection of natural areas, enhancement of emergent habitat, and restoration of oyster beds;
- *Bush Terminal*—Located in Upper New York Bay on the Brooklyn shoreline, it was chosen as a priority restoration site for salt marsh restoration.

The Contamination Assessment and Reduction Project (CARP), sponsored by PANYNJ, is a component of HEP focused on understanding the fate and transport of contaminants discharged to the estuary, and using this information to develop measures that may be necessary to reduce sediment contamination. The principal chemicals of concern include dioxins/furans, polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), metals (mercury, cadmium, and lead), and pesticides (dieldrin and chlordane). Continued research and monitoring programs are anticipated to play a role in the development of future management strategies for Harbor sediments (NY/NJ HEP undated, USACOE 1999a).

STATE AND REGIONAL PROJECTS

The Hudson-Raritan Estuary Ecosystem Restoration Project is a cooperative project being led by the USACOE that was funded by a House of Representatives Resolution on 15 April 1999. PANYNJ is a co-sponsor of this project. Other agencies involved in this project include USEPA, USFWS, NOAA, National Resource Conservation Service, New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Transportation (Office of Maritime Resources), NYSDEC, NYSDOS, NYCDEP, New York City Parks and Recreation, and New Jersey Meadowlands Commission. The focus of the study is to 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 the waters of the New York and New Jersey Harbor and the tidally influenced portions of all rivers and streams that empty into the Harbor and ecologically influence the Harbor. The program would identify measures and plans to restore natural areas within the estuary and enhance their ecological value, and address habitat fragmentation and past restoration and mitigation efforts that were piecemeal in nature. Thirteen initial representative restoration sites in New York and New Jersey have been targeted as the first sites for inclusion as potential restoration projects for feasibility level analysis. It is anticipated that expedited restoration of these representative restoration sites would provide substantial immediate value to the ecosystem. None of these sites occurs in the vicinity of the project area. Therefore, actions taken by the Hudson-Raritan Estuary Ecosystem Restoration Project with respect to these sites would occur with or without the proposed project.

The New York sites include:

- Alley Pond Park (bordering western Long Island Sound);
- Old Place Creek (a tributary to the Arthur Kill);
- Newtown Creek (a tributary to the lower East River);

- Brookville Creek (a tributary to Jamaica Bay);
- Dreier Offerman Park (bordering Coney Island Creek near The Narrows);
- Sherman Creek (a tributary to the Harlem River);
- Pelham Lagoon and Turtle Cove (a tributary to western Long Island Sound); and
- Tallapoosa (a tributary to western Long Island Sound).

The New Jersey sites include:

- Leonardo (bordering Raritan Bay),
- Rahway River (a tributary to Raritan Bay),
- Marquis Creek (a tributary to Raritan Bay),
- Liberty State Park (on western Upper New York Bay), and
- Kearny Marsh (with tributaries that drain to Newark Bay).

In addition to the 13 representative sites, three spin-off sites have been identified. These are restoration sites being evaluated in parallel to the representative sites. They include the Lower Passaic River and Hackensack Meadowlands in New Jersey, and Gowanus Canal in New York (a tributary to the Upper New York Bay).

The Comprehensive Port Improvement Plan (CPIP), sponsored by PANYNJ, is a multi-agency plan for implementing economic development and environment improvement decisions for the Port of New York and New Jersey. Among the priority objectives for the Plan are the identification and protection of significant habitats, the investigation of innovative best management practices for reduction of non-point sources of water pollutants, and the incorporation of green technologies in port improvement projects.

NYSDEC and NJDEP, in coordination with the IEC, would continue to develop total maximum daily loads (TMDLs) and to identify priority waterbodies in bi-annual 305(b) reports to USEPA. TMDLs, once implemented, would reduce the daily inputs of various contaminants in an effort to improve water quality. New York State provided $255 million to implement wastewater improvements, nonpoint source abatement and aquatic habitat restoration projects in 1998. The State intends to continue water quality improvement projects in the Harbor for the foreseeable future.

NEW YORK CITY PROJECTS

USEPA'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. CSOs are the largest single source of pollutants and pathogens to the New York Harbor Estuary. DEP has taken several steps in recent years to mitigate discharges from CSOs, which, in combination with improvements that have been made to water pollution control plants (WPCPs), are expected to result in future improvements in coliform, dissolved oxygen, and floatables levels in the New York Harbor area. Improvements have included replacing deteriorating and obsolete equipment and pilot-testing new technologies (IEC 2005). These improvements have led to increased wet-weather capture and treatment at WPCPs from just 18 percent in 1989 to 72 percent in 2003 (DEP 2004). The introduction of secondary treatment to the Newtown Creek WPCP, the last of the 14 New York City facilities to be upgraded to secondary treatment, is expected to be complete in 2007 (IEC 2005). New York City committed $1.5 billion for construction of CSO abatement facilities over the period 1998-2008. This should result in some improvement in coliform, DO, nutrients, and floatables in the East River well as the rest of the Harbor Estuary.

F. THE FUTURE WITH THE PROPOSED PROJECT

The proposed project has been designed to maintain and enhance the integrity and habitat complexity of the existing aquatic and terrestrial environments. The goal of these habitat enhancement measures is to generate a net environmental benefit by establishing the maximum number of sustainable, functioning habitats at the Brooklyn Bridge Park, and restoring much of the natural heritage of the Brooklyn waterfront. These diverse habitats will be linked together ecologically, supporting each other in ecological function and providing valuable living space to support wildlife that reside in or migrate through the city, drawing birds, butterflies and fish to the park and enhancing the experience of park users. Construction of the proposed project would start in 2007 and is expected to be completed by 2012. The following sections discuss the potential for natural resource impacts to occur as a result of the proposed project.

GROUNDWATER

Significant adverse impacts to groundwater would not be expected to occur as a result of construction or operation of the proposed project. Because groundwater is not used as a potable water supply in this part of Brooklyn, the proposed project would not have the potential to affect drinking water supplies. During demolition of existing structures, grading, and removal of fill from low-level relieving platforms, any hazardous materials encountered would be handled and removed in accordance with DEP, NYSDEC, Occupational Safety and Health Administration (OSHA), and USEPA requirements, and a construction health and safety plan (CHASP) (see Chapter 11, "Hazardous Materials"). As discussed in Chapter 11, "Hazardous Materials," the analysis of groundwater samples collected within the project area did not reveal the presence of significant wide-spread groundwater contamination. However, trace levels of petroleum-related contaminants were identified in localized areas near underground storage tanks or former maintenance facilities where the use of petroleum and/or solvents was common. Construction and development activities within the project area 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 project, if necessary, may require treatment of the groundwater prior to discharge to the municipal sewer or the East River to minimize adverse impacts to water quality. Prior to any dewatering activities, sampling would be performed to insure that any discharged groundwater meets the DEP limitations for effluent to municipal sewers, should this be the designated course of action.

The proposed reuse of processed (mixed with Portland cement) dredged material from the Harbor Estuary as grading fill within the upland area between Piers 1 and 5 would not result in significant adverse impacts to groundwater. The placement of processed dredged material would be in accordance with a Beneficial Use Determination (BUD) issued by the NYSDEC for the proposed project. The BUD will include specifications (chemical and physical standards) for the processed dredged material that will be used within the park, to ensure that it is non-hazardous and that its use will be protective of the environment.

FLOODPLAINS AND WETLANDS

CONSTRUCTION

Most of the elements of the proposed project that would be located within the 100-year floodplain are passive recreation areas such as the waterfront promenade, shallow water habitat and newly created landscaped areas. Portions of the waterfront promenade would be created from the existing high- and low-level relieving platforms that run along the shoreline between Piers 1 and 6. It would not require construction within the 100-year floodplain other than the excavation of existing fill from the top of the existing low-level relieving platform located inland of the high-level platform, followed by demolition of the low-level platform and stabilization of the newly exposed shoreline with riprap and intertidal wetland vegetation. Other portions of the park promenade (at Piers 2 and 3) would be created by excavating the overlying fill from the low-level relieving platform, then grading and restabilizing the newly exposed shoreline with riprap and intertidal vegetation. This reuse of the existing relieving platforms would not affect flooding within or adjacent to the project area. Approximately 20 of the 33 acres located within the upland portion of the project area between Piers 1 and 6 would be graded and converted to pervious landscaped plant habitats. This increase in pervious cover would have the potential to result in beneficial effects to the floodplain by decreasing the volume of surface runoff generated from within the project area. The only activities proposed to occur within the floodplain portion of the existing Empire-Fulton Ferry State Park are those associated with landscaping, which would not result in significant adverse impacts to the floodplain.

Portions of the residential structures proposed to be constructed in the upland portions of Pier 6 and the hotel and residential structures proposed for the upland portion of Pier 1 would be located within the 100-year floodplain. In the design and construction of these structures, measures would be implemented to minimize floodplain impacts and losses due to flooding, in compliance with 6 NYCRR 502, described previously in Section B, “Regulatory Context.” Such measures would include incorporating adequate drainage to reduce exposure to flood hazards, and elevating the structure above flood hazard level or flood-proofing the lower levels. All public utilities and facilities associated with the project are to be located and constructed to minimize or eliminate flood damage. The proposed construction and operation of these structures would not be expected to result in significant adverse impacts to the floodplain or result in increased flooding of adjacent areas.

While estuarine wetlands are identified on the NWI map that includes the project area (see Figure 10-2), these areas are unvegetated and would not be regulated by the USACOE as wetlands but would be regulated as waters of the United States. Portions of the two coves within the project area, located in the interbridge area and under the Manhattan Bridge, contain littoral zone tidal wetlands that would be regulated by the NYSDEC. A 10-foot-wide fixed pile supported walkway is proposed for the smaller cove located under the Manhattan Bridge (see Figure 1-4). The spacing between pairs of piles (bents) would not impair the movement of tidal waters into or out of the cove. Additionally, the piles would replace a small portion of the littoral zone. Therefore, the placement of the proposed fixed-pile-supported walkway through this cove would not result in significant adverse impacts to NYSDEC littoral zone tidal wetlands.

Portions of the project area near the shoreline between Piers 1 through 6 are 6 feet or less in depth at MLW (see Section D, “Existing Conditions”) and, therefore, may be considered littoral zone tidal wetland by NYSDEC. During construction, measures would be implemented to minimize any temporary impacts to littoral zone wetlands due to disturbance of bottom sediments that may result from: construction of the previously described waterfront promenade from the existing high-level and low-level relieving platforms, the removal of a portion of the existing bulkhead and relieving platform to form the proposed shallow-water habitats between Piers 4 and 5, and upland of Pier 4; replacement of timber sheet pile with steel sheet pile and riprap on the eastern (newly exposed) edge of Pier 1; and replacement of the timber wharf at the John Street Site. Containment booms would be used to contain floatables, and piles would be cut at the mudline by divers or broken by machine. A small amount of dredging (5,000 to 8,000 cy) would be required within the NYSDEC littoral zone in the marina and safe water zones.

The shoreline improvements that would result from modifications to the relieving platforms and upland fill areas adjacent to the shoreline would benefit wetland resources, and offset the littoral zone affected by dredging and the replacement of the existing timber wharf with steel sheetpile bulkhead and retained fill at the John Street Site. The installation of the sheetpile bulkhead with retained fill would result in the loss of any littoral zone wetlands present under the remnants of the wharf within an approximately 3,000 square foot area (0.07 acres). Intertidal wetland habitat would be created along the newly exposed shoreline adjacent to the waterfront promenade between Piers 1 and 5 that would be armored with riprap and planted with intertidal vegetation. The two buildings proposed for the upland area adjacent to Pier 1 would cast shadows on a portion of the shallow water habitat that would be created along the shoreline. Because the shadows would be off the shallow water habitat by mid-morning, significant adverse impacts would not be expected to occur to wetland vegetation that may be planted in this area. The development of the shallow-water habitats, including the beach area east of Pier 4, would result in approximately 25,000 square feet open water habitat, some of which would be expected to be littoral zone.

OPERATION

Operation of the proposed project would not be expected to result in long-term significant adverse impacts to existing or newly created littoral zone wetlands or to intertidal wetlands created as a result of the proposed project. The shallow water habitats created east of the marina and inland of Pier 4 would be inaccessible to boats using the marina, and to kayaks and canoes. The shorelines in these areas would be stabilized with riprap and stubs of piles that were cut as a result of the development of the waterfront promenade. The SWPPP developed for the project area, and prepared with the goal of managing stormwater generated within the park boundary onsite to minimize stormwater discharges, would minimize potential impacts to existing NYSDEC littoral zone tidal wetlands as well as the littoral and intertidal wetlands created as a result of the proposed project. As discussed previously, the spacing of pile bents would not impair the movement of tidal waters into or out of the cove under the Manhattan Bridge, and would not, therefore, result in long-term significant adverse impacts to littoral zone tidal wetlands.

AQUATIC RESOURCES

WATER QUALITY

Construction

Implementation of erosion and sediment control measures, and stormwater management measures as part of the SWPPP during construction and operation of the proposed project would minimize potential impacts to water quality of the East River associated with stormwater runoff during land disturbing activities that would occur in upland areas. These activities would include demolition of existing structures, debris removal, placement of processed dredged material in the upland areas between Piers 1 and 5, and grading. During these activities, any hazardous materials encountered would be handled and removed in accordance with NYCDEP, NYSDEC, OSHA, and USEPA requirements, and a construction health and safety plan (CHASP) (see Chapter 11, "Hazardous Materials"). minimizing the potential for adverse impacts to water quality. The erosion and sediment control measures included in the SWPPP would be in accordance with those presented in NYSDEC's New York Standards and Specifications for Erosion and Sediment Control and would include measures specified in the BUD for the reuse of processed dredged material to control the run-on and run-off of stormwater to areas being used to store the processed dredge material prior to use as grading fill. Best management practices would be used to minimize uncontrolled dispersion of this material within the project site. The proposed reuse of processed dredged material from the Harbor Estuary as grading fill within the upland area between Piers 1 and 5 would not result in significant adverse impacts to surface water. Its placement would be in accordance with a BUD issued by the NYSDEC for the proposed project. The BUD would include specifications (chemical and physical standards) for the processed dredged material that will be used within the park, to ensure that it is non-hazardous and that its use will be protective of the environment.

In-water construction activities for the proposed project that result in sediment disturbance include the following:

- Driving of piles used to support the proposed wave fences and floating platforms between Piers 1 through 5, the overwater walkway from the waterfront promenade south of Pier 4 to the fixed wave fence extending south of the outboard end of Pier 3 and across the cove under the Manhattan Bridge, and to anchor the floating platforms.
- Bulkhead repair and replacement, including the replacement of the timber sheetpile at the eastern edge of the newly exposed portion of Pier 1 with steel sheetpile bulkhead, and replacement of timber bulkhead/wharf on the John Street Site with steel sheetpile and retained fill.
- Cutting or breaking of piles at the mud line within the pile field created by removing a portion of the Pier 1 high-level platform, piles removed from Piers 2 and 3 to create the channel between the safe water areas to allow passage for kayaks and canoes, and piles removed as part of the modifications to the low-level relieving platforms to create the waterfront promenade.
- Fill removal from the low-level relieving platform, bulkhead removal, and shoreline grading associated with the development of the park promenade, shallow-water habitats, and beach area.
- Placement of riprap along newly exposed shoreline and at the toe of a portion of the existing sheetpile bulkhead along the East River at Pier 1, the newly exposed shorelines created as a result of the removal of fill from the low-level relieving platform and the shallow-water habitats that would be planted with inter-tidal wetland plants.
- Any bottom disturbance associated with the driving of piles and subsequent development of the marina, or small amount of dredging (5,000 to 8,000 cy) that may be needed in the marina and the channel between the safe water areas formed by removing the eastern portions of the high-level relieving platform of Piers 2 and 3.

The majority of these activities would be conducted from a construction barge. While disturbance of sediment has the potential to result in increased suspended sediment in the water column and resuspension and redeposition of contaminants, these temporary effects would be localized and confined to the immediate vicinity of pile driving, shoreline disturbance, and dredging. On the basis of the rapid flushing and accumulation rates of sediment identified for the project area (see hydrodynamic analysis discussed below), any increase in suspended sediment would move away from the area of in-water construction and would be expected to dissipate shortly after the completion of the sediment disturbing activity. Therefore, in-water construction activities would not be expected to result in significant adverse impacts to water quality. Similarly, any contaminants released to the water column as a result of sediment disturbance would be expected to dissipate rapidly and would not be expected to result in significant long-term impacts to water quality. Containment booms would be used to contain floatables during shoreline enhancement activities associated with the development of the waterfront promenade and shallow-water habitat areas.

Operation

The conversion of approximately 20 acres of the upland portion of the project area to pervious landscaped plant habitat between Piers 1 and 6 would reduce the amount of stormwater to be managed within the project area. Implementation of stormwater management measures such as natural drainage systems, bioswales, extended detention basins/retention ponds and constructed wetlands as part of the SWPPP during operation of the proposed project would minimize potential impacts to the East River from the discharge of stormwater from the project area. A goal of the stormwater management plan, which would be incorporated into the SWPPP prepared for the proposed project, is to manage stormwater generated within the park boundary onsite to minimize stormwater discharges to the combined sewer system. Stormwater runoff would be managed by overland flow (sheet flow) over pervious and impervious surface, drop inlets or a series of catch basins, drainage piping and outfalls that would direct the stormwater to the East River. The first objective of the stormwater management plan would be to direct the majority of the surface runoff to a series of vegetated landscapes, bioswales or retention ponds prior to discharging to the East River. Some of these bioswales may be developed in valleys formed between parallel ridge landforms running from north to south developed on the project site through the use of the processed dredged material as grading fill. This proposed use of processed dredged material to as grading fill to develop landforms in the upland areas between Piers 1 and 5 would be in accordance with a BUD issued by the NYSDEC for the proposed project. The BUD will include specifications (chemical and physical standards) for the processed dredged material that will be used within the park to ensure that it is non-hazardous and that its use will be protective of the environment and would not affect the quality of stormwater generated within the park.

A second objective of the stormwater management plan is to integrate the park's stormwater drainage system with either the existing NYCDEP stormwater overflow sewer outfalls (9 existing sewer outfalls exist on the project site between Jay Street and Atlantic Avenue) connecting to these outfalls between the regulators and the East River, or to proposed new storm sewer outfalls. Modifications to existing grades and infrastructure removal plans to accommodate the proposed project may result in new stormwater outfalls at Empire-Fulton Ferry State Park/Fulton Ferry Landing, the southern end of Pier 1, and at the foot of Piers 2 through 5. Stormwater runoff generated within the park that is not directed to the East River as overland flow (e.g., stormwater that is directed to a series of vegetated landscapes, bioswales or retention ponds) would be conveyed via a series of drainage piping to either existing NYCDEP stormwater overflow sewer outfalls, or the new stormwater outfalls developed within the park. All stormwater management measures included in the SWPPP would meet the water quality and quantity sizing criteria outlined in the NYSDEC's New York State Stormwater Management Design Manual. Implementation of an IPM strategy (to maintain healthy plants with minimal use of fertilizers, pesticides and herbicides) would minimize potential impacts to stormwater quality from surface runoff generated within the landscaped open space areas.

The management of stormwater within the project area would minimize impacts to the city infrastructure (combined sewer and WPCP) and would minimize the potential for the proposed project to result in increased CSOs and associated adverse impacts to East River water quality. As presented in Chapter 13, "Infrastructure," the proposed project is expected to result in a 640,000 gallons per day (gpd) net increase in sanitary sewage flow to the Red Hook WPCP, which discharges to the East River. The average monthly flow at this WPCP for the latest 12 months of records available (March 2004 through February 2005) is 30 million gallons per day (mgd), which is one half of the WPCP's designed treatment capacity of 60 mgd. Therefore, the additional sewage flow to the Red Hook WPCP resulting from the proposed project, amounting to 1.1 percent of the WPCP's designed treatment capacity, would not cause the Red Hook WPCP to exceed its design capacity, or cause the WPCP to exceed its SPDES permit conditions. The project area and the surrounding portions of Brooklyn are serviced by a combined sewer system for the conveyance of sewage and stormwater (see Chapter 13, "Infrastructure"). The small increase in sewage flow resulting from the proposed project would also not be expected to result in a significant change in CSOs through the nine regulators located within the project area. Therefore, the additional sewage flow resulting from the proposed project would not result in significant adverse impacts to East River water quality.

Stormwater generated within the project area currently enters the East River as sheetflow from the piers or through storm sewers that receive stormwater from the upland portions of Piers 1 through 6. Furman Street and the streets north of the Brooklyn Bridge discharge stormwater to the municipal combined sewer system, but Empire Stores, Empire-Fulton Ferry Park, and Main Street Park within the project area do not (see Chapter 13, 'Infrastructure"). Because the goal of the stormwater management plan for the proposed project is to manage stormwater generated within the project area on-site, a reduced volume of stormwater would be directed to the municipal combined sewer system. This management plan would result in a reduction of stormwater directed to the Red Hook WPCP. Therefore, stormwater generated within the Brooklyn Bridge Park would not affect the current operation of the municipal combined sewer system or CSOs to the East River.

As discussed in the previous section, the spacing of the pilings for the two proposed fixed-pile-supported walkways (south of Pier 4 and the cove under the Manhattan Bridge), the wave fences, and floating platforms, would not impair tidal movement, and therefore, would not be expected to adversely affect water quality. Boat fueling and sanitary system/pump out stations would be located at the southeastern end of the marina dock, adjacent to the upland area that would be used to accommodate minor boat repair and supply, and a boathouse for management of kayak/canoe rentals.

The 10-foot-deep wave fences proposed for the marina area, between Piers 1 and 2, and extending along the northern edge of Pier 2 for 120 feet measured from the northwest corner and 80 feet measured from the northeast corner, along the southern edge of Pier 3 for 550 feet measured from the southwest corner, along the eastern edge of Pier 2 and Pier 3 (a total of 170 feet each), between the southwest corner of Pier 3 and the northwest corner of Pier 5 with a gap for the marina entrance, and along the western or outboard side of Pier 5 for 210 feet have the potential to affect flushing within the marina and the safe water zones. In order to determine whether there would be sufficient flushing within these areas, a hydrodynamic analysis was conducted by HPA (2005) (described in Section B, “Methodology”). The hydrodynamic modeling indicated that flushing times within the marina and safe water zones throughout the year are always two hours or less, and most often less than one hour. Furthermore, the HPA study suggested that there would be little change in the hydrodynamic and sedimentation characteristics within the project area after the wave fences are installed. There is considerable circulation provided by waters beneath the wave fences (which only extend 10 feet into the water column at MLW), and also a considerable portion of the flow through the area is parallel to the wave fences, flowing perpendicular to the piers. After construction of the wave fences, the flushing time would be well within the 12- to 24-hour guidelines established by USACOE (1993) and USEPA (1993) for minimizing water quality impacts in marinas.

The operation of the marina, including the boat fueling and sanitary/pump out stations proposed to be located at the southeastern end of the marina dock, would not be expected to result in significant adverse impacts to water quality. Implementation of best management practices to minimize environmental impacts of marinas, presented in the 2003 NYSDEC publication *Environmental Compliance, Pollution Prevention, and Self-Assessment Guide for the Marina Industry*, would minimize water quality impacts that have been attributed to marina operation resulting from accidental discharge of sewage from boats or during operation of pumpout stations, or the release of oil from boats and fuel during operation of the boat fueling facility (McMahon 1989 in USEPA 1993, NCDEM 1990, Alzieu 1986, Laughlin and Linden 1987, Cleary and Stebbing 1987, Espourteille 1988, and Young et al. 1979 in Milliken and Lee 1990). Should contaminants (e.g., sewage, petroleum, metals from biocides in boat paint) be released into the marina as a result of marina operation, the results of the hydrodynamic analysis indicate they would be flushed rapidly. Because marinas that are well flushed do not generally result in water quality impacts (McMahon 1989 in USEPA 1993, UK CEED 2000, and Young et al. 1979 in Milliken and Lee 1990), the operation of the proposed marina and would not result in significant adverse impacts in or adjacent to the project area. Concentrations of water quality parameters such as DO are not expected to change from the existing condition as a result of the marina.

Additionally, the 12 foot (3.7 meters) to 28 foot (8.7 meters) MLW water depths within the marina are greater than the minimum 10-foot depth found to minimize sediment disturbance from boats (USACOE 1994, Asplund 2000, Gucinski 1981 in Klein 1997). This range of depths would also be sufficient to allow a clearance of 2 to 3 feet between the propeller of a vessel and the bottom during low waters identified as necessary to prevent increased turbidities associated with boat operations (NOAA 1976 in USACOE 1993). Therefore, boat operations would not be expected to result in increased suspended sediment within the project area. Similarly, the depths at the three proposed water taxi locations are also greater than 10 feet deep at MLW. Therefore, the operation of water taxis would not be expected to result in significant adverse impacts to water quality.

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. In-water project elements such as pile driving, bulkhead repair and replacement, modification of the relieving platforms to create the waterfront promenade, modification of the relieving platforms to create the shallow water habitats, and small amount of dredging in the marina and safe water zones (5,000 to 8,000 cy), as described above under “Water Quality,” have the potential to result in temporary adverse impacts to fish and macroinvertebrates due to the following:

- Increases in suspended sediment;
- Noise associated with pile driving; and
- Loss of bottom habitat and associated benthic invertebrates.

On the basis of the rapid flushing and the slow sediment accumulation rates identified for the project area in the hydrodynamic analysis discussed in the previous section “Water Quality,” any temporary increase in suspended sediment associated with pile driving, and other in-water construction activities resulting in sediment disturbance, would be localized and expected to dissipate shortly after the completion of the sediment disturbing activity and would not be expected to result in significant adverse impacts to water quality. The hydrodynamic modeling indicated that flushing times within the project area throughout the year are always two hours or less, and most often less than one hour. Therefore, suspended sediment originating from an area of in-water construction activity would dissipate from the project area within two hours and in most instances within an hour or less. Sediments throughout the Harbor Estuary contain contaminants. While East River sediments have been found to contain contaminants at concentrations that may pose a risk to some benthic macroinvertebrates, the hydrodynamic environment within the project area would result in rapid dissipation of these sediments such that redeposition within or outside the project area would not be 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 would be 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 project. Therefore, temporary increases in suspended sediment resulting from in-water construction activities would not be expected to result in significant adverse impacts to fish and mobile benthic macroinvertebrates.

Pile driving can produce underwater sound pressure waves that can affect fish, with the type and intensity of sounds varying with factors such as the type and size of the pile, firmness of the substrate, depth of water, and the type and size of the pile driver. Larger piles and firmer substrate require greater energy to drive the pile resulting in higher sound pressure levels (SPL).

Hollow steel piles appear to produce higher SPLs than similarly sized wood or concrete piles (Hanson et al. 2003). Sound attenuates more rapidly in shallow waters than in deep waters (Rogers and Cox 1988 in Hanson et al. 2003). SPLs generated by the driving of hollow steel piles with impact hammers can reach levels that injure fish (Hanson et al. 2003), and may not generate sound in the frequencies that elicits avoidance behavior in fish. Impact hammers generate short pulses of sound with little of the sound energy occurring in the infrasound frequencies, the sound frequencies that have been shown to elicit an avoidance response in fish (Enger et al. 1993, Knudsen et al. 1994, and Sand et al. 2000 in Hanson et al. 2003). Therefore, fish have been observed exhibiting an initial startle response to the first few strikes of an impact hammer, after which fish may remain in an area with potentially harmful sound levels (Dolat 1997, NMFS 2001 in Hanson et al. 2003). While there is little data available on the SPL required to injure fish, fish with swim bladders and smaller fish have been shown to be more vulnerable (Hanson et al. 2003).

At least two pile driving rigs would be operating during the in-water construction period to install between 750 to 1000 piles that would be needed for the proposed plan in-water elements. Each rig would be able to drive 4 or 5 timber piles per day, and one or two steel pipe or concrete piles a day. The length of time for driving each timber pile should be less than an hour or two, and would occur in shallow waters where sound pressure levels would dissipate more quickly, and individual fish would not be expected to be exposed to potentially dangerous SPLs long enough to result in mortality. It is anticipated that operation of two pile driving rigs would be needed for one to two years because of seasonal windows imposed by regulatory agencies when in-water construction is not permitted (typically mid-November through mid-April). Both rigs would operate in the same portion of the project area, moving to the next in-water construction area when pile installation is complete. This would minimize the area of aquatic habitat affected by pile driving at any given period of time, and would maintain areas of suitable habitat for fish to move into while pile driving is conducted in a particular section of the project area. Therefore, the pile driving that would occur as a result of the proposed project would not be expected to result in significant adverse impacts to aquatic biota.

The installation of piles, removal of bulkhead, removal of piles and relieving platform, and placement of additional riprap to further armor the bulkhead at the channel side of Pier 1 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. Approximately 20,700 square feet (0.48 acres) of benthic habitat would be disturbed through the placement of riprap at the toe of the sheetpile bulkhead along the outboard edge of Pier 1. Replacement of the remnants of existing wharf at the John Street Site with sheetpile bulkhead and retained fill would result in the permanent loss of benthic habitat in a 3,000 square foot (0.07 acres) area. The gradual loss of these areas as habitat for benthic macroinvertebrates and fish at the same time that new surfaces would be installed and shallow water habitats created would not be expected to result in significant adverse impacts to populations of aquatic species using the East River or Upper Harbor. The permanent loss of benthic macroinvertebrates within the piling footprints and the footprint of the new sheetpile bulkhead system at the John Street Site would not significantly impact the food supply for fish foraging in the area because the proposed shallow water habitats and riprap stabilization of the shoreline would provide additional macroinvertebrate and fish habitat as well as increase the habitat diversity within the project area. In general, the greater the physical complexity the better the aquatic habitat. In-water structures such as the riprap proposed along the shoreline between Piers 1 and 5, and at the toe of the sheetpile bulkhead on the outboard edge of Pier 1, that are sloped or stepped, have rough surfaces with many interstitial spaces and a high surface area to volume ratio (USACOE 1993) that provide more surface area for algae and invertebrates that attach to surfaces (fouling community), and habitat (foraging and refuge) for fish (Heiser and Finn[1] in Chmura and Ross 1978[2]).The riprap placed within the approximately 20,700 square footprint at the toe of the Pier 1 sheetpile bulkhead along the East River would provide complex hard bottom habitat that is generally not available within the project area. Additionally, the piles, and new bulkhead (Pier 1 and John Street Site) installed would provide surface for encrusting organisms, and the riprap and piles would provide refuge for macroinvertebrates and fish.

In summary, during construction of the in-water project elements, temporary increases in suspended sediment, noise generated by pile driving and loss of bottom habitat and benthic macroinvertebrates unable to move from the area of activity would not be expected to result in significant adverse impacts to aquatic biota of the East River.

Operation

As discussed under "Water Quality," potential impacts to aquatic biota from the discharge of stormwater would be minimized through the reduction in stormwater generated within the project area resulting from the conversion of impervious surface to pervious landscaped areas and recycling of gray water, the management of stormwater generated within the project area on site to minimize stormwater discharges in accordance with New York State stormwater management guidelines, and the implementation of a IPM strategy to minimize adverse impacts to stormwater quality from vegetation management of landscaped areas.

The presence of the wave fences and operation of the marina would not result in adverse impacts to water quality, and, therefore, would not be expected to result in significant adverse impacts to fish or benthic macroinvertebrates. The results of the hydrodynamic modeling indicate that the hydrodynamic characteristics within the project area following the construction of the park would not be significantly different from the existing condition and would not be expected to affect the quality of fish and macroinvertebrate habitat. The in-water structures (piles, riprap, bulkhead) associated with the proposed project would increase the diversity of habitats available within the project area and would not be expected to adversely affect fish and macroinvertebrates.

One of the objectives of the proposed plan is for the proposed project to generate a net environmental benefit. With this in mind, the in-water uses were designed with the goal of not increasing the area of overwater coverage and shading of aquatic habitat currently present within the project area, or removing more aquatic habitat than was being created in the shallow water areas. It has been maintained that shading of estuarine habitats can result in decreased light levels which can lower productivity of primary producers and adversely affect invertebrates, and fish that use these areas particularly with respect to use as foraging habitat (Able et al. 1998).

[1] Heiser, D.W., and E.L. Finn, Jr. 1970. Observations of juvenile chum and pink salmon in marina and bulkheaded areas. Supplemental Progress Report, Puget Sound Stream Studies, Sate of Washington Department of Fisheries, management and Research Division, Seattle, WA 28pp.

[2] Chmura, G.L., and N.W. Ross. 1978. The Environmental Impacts of Marinas and Their Boats: A Literature Review With Management Considerations. RI Department of Environmental Management, Marine Advisory Service, NOAA/Sea Grant, University of Rhode Island Marine Memorandum 45. 36pp.

Table 10-4 lists the proposed plan elements that would extend over the water and the approximate overwater coverage that would be added by these elements, as well as the overwater coverage that would be removed. The area of overwater coverage for each of these elements is provided for illustrative purposes. The coverages for individual elements will be further refined as the project design progresses, maintaining an overwater coverage no greater than what is currently present.

Table 10-4
Change in Overwater Coverage from the Proposed Project

	Square Feet	Acres
Overwater Coverage Added		
Inter-bridge Foot Bridge	3,000	0.069
John Street – Water Taxi Platform and Gangway	3,140	0.07
Fixed Pier and Wave Fence between Piers 1 and 2	8,550	0.196
Safe Water Floats between Piers 2 and 3	23,400	0.54
Fixed Gangway and Ramps to Floats at Piers 2 and 3	13,800	0.32
Pier 1 Water Taxi Platform and Gangway	1,040	0.024
Vehicle Bridges Over Piers 2 and 3 Deck Removal	3,600	0.083
Pier 3 Water Taxi Platform and Gangway	1,040	0.024
Piers 2 to 4 Safe Water Boom	3,920	0.09
Marina Fixed Pier and Wave Fence Piers 3 to 5	12,000	0.28
Marina Dock and Slips	45,000	1.03
South of Pier 4 - Fixed Pier Connection to Wave Fence	10,200	0.23
Pier 5 Historic Boat Mooring (8 vessels)	12,000	0.275
Pier 5 Fixed Wave Fence	1,500	0.03
Pier 6 Water Taxi Platform and Gangway	3,140	0.07
TOTAL	**145,330**	**3.34**
Overwater Coverage Removed		
Pier 1 Partial Deck Removal	92,000	2.11
Pier 2 Deck Removal	20,000	0.46
Pier 3 Deck Removal	20,000	0.46
Lower Level Platform Removal between Piers 4 and 5	15,000	0.344
TOTAL	**147,000**	**3.37**
NET COVERAGE	**(1,670)**	**(0.04)**

The no net increase in overwater coverage would be achieved through the removal of a portion of the high-level platform from Pier 1 that is supported on piles (2.11 acres), the removal of the eastern portions of the high-level relieving platform from Piers 2 and 3 (0.92 acres) to create the channel between the two safe water zones, as well as the removal of the low level platform along the current shoreline between Piers 4 and 5 (0.34 acres). The amount of area shaded by the proposed overwater structures will be affected by the height of overwater structure, width, construction materials, orientation to the arc of the sun (Burdick and Short 1995, Fresh et al. 1995 and 2000, Olson 1996 and 1997 in Nightingale and Simenstad 2001b) and piling density. The proposed project would add overwater structures in areas where they are currently not present, such as the marina, the walkways through the cove, in the area between Piers 5 and 6 proposed for the mooring of historic vessels, along the fixed wave fence, on the fixed pile walkway south of Pier 4, on the floating platforms located from the north side of Pier 2, along the newly exposed east side of Piers 2 and 3, to the south side of Pier 3, and for the water taxi platforms proposed to be located at John Street, between Piers 2 and 3, north of Pier 1 and south of Pier 6. However, most of these structures are narrow (less than 15 feet) and would, therefore, permit some light to reach the water and mudline under them. Even the 20-foot-wide floating walkways along the edges of Piers 2 and 3 would allow some light to penetrate under the platforms. NYSDEC generally considers aquatic habitat under an overwater structure to be shade-impacted after the first 15 feet from the structure's edge. The walkway over the cove under the Manhattan Bridge is proposed to be 10 feet wide. The fixed pile walkway located south of Pier 4 is proposed to be 15 feet wide. In the conceptual design for the marina, the main walkway is approximately 10 feet wide, the cross walkway is 8 feet wide and the finger walkways are 5 feet wide. Therefore, these walkways would be expected to result in minimal adverse impacts to habitat from shading. Additionally, the newly exposed eastern edges of Piers 2 and 3 may allow light under portions of these two piers that are currently in shade. The removal of portions of the low-level relieving platform would also allow more light to reach aquatic habitats than is currently available. Therefore, the proposed project would not have the potential to result in significant adverse impacts to aquatic habitat due to shading from overwater structures, and because most of the new overwater structures added are narrow (less than 15 feet wide), could actually result in greater benefits through a decrease in shade-impacted area compared to the existing condition than is evident simply by comparing the change in overwater coverage.

In the proposed plan, an approximately 2.11-acre pile field would be created between Piers 1 and 2 by removing the Pier 1 high-level platform. This would create lighted fish habitat with structure that is not currently available within the project area. Pile fields have been found to be preferred habitat for diverse number of fish species in the Harbor Estuary (Able et al. 1998). The creation of this pile field would result in benefits to the fish community in the project and adjacent areas. Another concept included in the proposed plan is the creation of shallow-water habitats in areas along the shoreline that are currently bulkhead or under relieving platforms. These areas would include an approximately 10,000-square-foot area created by removing the inland fill portion of the decaying Pier 4, and the removal of approximately 15,000 square feet of low-level platform between Piers 4 and 5 east of the marina. This would create approximately 25,000 square feet (0.57 acres) of shallow-water habitat not currently available within the project area, and increase the diversity of habitats available to fish and macroinvertebrates. The area of shallow-water habitat created within the park offsets the area of benthic habitat removed through the installation of the sheetpile bulkhead at the John Street Site (3,000 square feet) and the habitat lost within the footprint of the riprap added to the toe of the existing Pier 1 sheetpile bulkhead along the East River (20,700 square feet). The results of the sediment transport study conducted as part of the hydrodynamic study indicate that a shallow water mudflat may be created over time next to the pile field, between Pier 1 and the shoreline.

Replacing bulkhead with riprap as part of the development of the waterfront promenade, and as part of stabilizing the shoreline within the created shallow-water habitats, and the creation of the beach at Pier 4 would also enhance the habitat available to macroinvertebrates and fish. River bottoms with greater physical complexity create better habitats. Sloping structures create more habitat than those with vertical elements by allowing vertical zonation, with varying species of organisms having distinct depth preferences in their distributions (USACOE 1993).

In summary, the implementation of the SWPPP, and IPM strategy, and the stormwater management concept of managing stormwater on site to minimize stormwater discharges would minimize adverse impacts to aquatic biota from the discharge of stormwater during operation of the park. The operation of the marina and the use of the proposed wave fences would not be expected to result in significant adverse impacts to fish and macroinvertebrates within the project area. The proposed project would meet the objective of the proposed plan of not increasing the amount of overwater coverage and shading within the project area, and the narrow width of some of the overwater walkways may reduce the amount of shade-impacted habitat currently present within the project area. The proposed creation of the pile field from a portion of Pier 1 high-level platform, the creation of shallow-water habitats, and replacement of existing bulkhead with riprap would increase the diversity of aquatic habitats available within the project area, benefiting both fish and macroinvertebrates. While the placement of riprap at the toe of the Pier 1 sheetpile bulkhead would remove some aquatic habitat, it would also increase the complexity of aquatic habitat available within the project area. The shallow-water habitat created within the project area would offset the aquatic habitat affected by the installation of riprap at Pier 1 and the sheetpile bulkhead at the John Street Site.

THREATENED OR ENDANGERED SPECIES

As discussed in Section D, "Existing Conditions," the preference of shortnose sturgeon for deep water habitat suggests that it is unlikely that individuals of this species would occur within the project area except as transients. Furthermore, the Hudson River below Tappan Zee is not considered optimal shortnose sturgeon habitat and this species would be expected to occur only rarely south of the Battery. Because water quality impacts associated with pile driving and other construction activities that disturb bottom sediment would be localized, the deep channel habitat preferred by this species while in transit to and from spawning and nursery habitat in the upper portion of the Hudson River would not be impacted during construction of the proposed project. Therefore, the proposed project would not be expected to result in significant adverse impacts to shortnose sturgeon.

The four species of marine turtle (loggerhead, green, Kemp's ridley, and leatherback) would not be expected to occur within the project area except as transient individuals. Because they neither nest, nor reside in the area year-round, and are only rarely observed in this portion of the estuary, they would not be expected to be impacted by the construction or operation of the proposed project.

As discussed previously, the peregrine falcon nesting location within the project area is not used every year. The proposed project would not affect the availability of this nesting location. Because peregrine falcons appear to be fairly tolerant of human activity (Nadareski 2002), should the nest be active when construction is initiated in 2008, construction activities would not be expected to adversely affect nesting success. Nor would construction activities or the operation of the proposed project be expected to affect the suitability of the nesting location. The operation of the park has the potential to benefit peregrine falcon by increasing prey availability through the creation of natural habitat areas that would attract additional birds to the project area.

Although not identified as a concern by the NMFS, seals have the potential to occur within the project area as occasional transient individuals. While the construction and operation of the proposed project would not be expected to result in significant adverse impacts to seals because they would rarely occur within the project area, the design of the floating walkways included in the proposed project would incorporate barriers such as continuous railings, to limit the opportunity for seals to haul out within the project area and come in contact with park visitors or their pets.

ESSENTIAL FISH HABITAT

Construction of the proposed project would not be expected to result in significant adverse impacts to EFH for the reasons discussed above under "Aquatic Biota." The proposed project would result in benefits to EFH by:

- Not increasing the amount of overwater coverage and potentially decreasing shade-impacted areas by removing portions of existing decking and relieving platforms, and by sizing platforms and walkways such that there is a potential for light to reach the underlying aquatic habitat; and
- Increasing the diversity of aquatic habitats available within the project area through the creation of the pile field, the shallow-water habitats, and replacement of existing bulkhead with riprap.

TERRESTRIAL RESOURCES

CONSTRUCTION

As noted previously, wildlife habitat within the proposed Brooklyn Bridge Park area is limited to the wading bird and waterfowl foraging habitat found within the two coves at the northern end of the project area, and the relatively low-quality terrestrial habitat found within the existing Empire-Fulton Ferry State Park and Main Street Park. Although the bird and other wildlife species expected to occur within the project area are those tolerant of urban conditions and the current noise level within the project area, land clearing activities in the upland portions of the site have the potential to disturb wildlife individuals currently using Empire-Fulton Ferry State Park. Adverse impacts would occur to some individual birds and other wildlife currently using this limited wildlife habitat if construction activities cause them to leave the project area and there are no suitable habitats that are available nearby. However, the wildlife species expected to occur within the project 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 anticipated as a result of construction of the proposed project.

Construction of the fixed-pile-supported walkway through the cove under the Manhattan Bridge at the northern portion of the project area has the potential to limit use of the cove for feeding habitat while the piles and decking are being installed. However, this cove area is small, and the temporary loss as feeding habitat would not adversely affect the populations of wading birds and waterfowl within the New York metropolitan region. Because the pedestrian fixed-pile-supported walkways are limited in width, they are expected to allow some light to reach the aquatic habitat beneath them, and any potential adverse impacts to food availability would be limited.

OPERATION

One of the goals of the proposed plan is to create the maximum number of sustainable, functioning habitats at the Brooklyn Bridge Park that would function as an ecological cohesive whole and need only modest management to ensure their long-term survival. With that goal in mind, the proposed plan includes the development of a variety of terrestrial habitats using native plant species that interconnect throughout the project area. Examples include dune, marsh, coastal woodland, shrubland, wildflower meadow, and freshwater swales. In the 33-acre upland area between Piers 1 and 6, approximately 20 acres would be converted to pervious vegetated cover (coastal woodland, shrubland, wildflower meadow, freshwater swale, and marsh). The various plant habitats that would be created within the upland area would provide habitat and forage for birds, butterflies and other insects and other wildlife currently not available within the vicinity of the project area, and provide passive recreation opportunities for park visitors. Certain of these habitats (e.g., freshwater swale, filter strips, and constructed wetlands) would be integrated with the goal of managing stormwater generated within the park on site. Pier 1 would have landscaped areas and pathways. Piers 2 and 3 would have lawn, hedgerow), and outdoor recreation sports courts under a portion of the existing shed roof. Approximately one half of Pier 6 would be landscaped as dune habitat and the remaining areas would have active recreation areas (volleyball courts and water play area). Vegetated portions of the existing Empire-Fulton Ferry State Park and Main Street Park would remain. The development of these habitats would result in significant benefits to birds and other wildlife, particularly with respect to grassland birds whose habitat is currently limited within the New York metropolitan region.

The creation of shallow-water habitat within the project area would increase the availability of foraging habitat for wading birds and waterfowl within the project area. Movement of boats in the marina, and canoes and kayaks in the safe water zones has the potential to affect some individual shorebirds, waterfowl and wading birds by causing some individuals to temporarily take flight when a boat or kayak approaches. Bird responses to boat movement would depend on the speed of the vessel, sound, size and amount of visual intrusion (UK CEED 2000). This avoidance of boats and kayakers is not expected to significantly affect habitat availability for shorebirds, wading birds and waterfowl within the project area. No nesting of shorebirds, waterfowl or wading birds would be expected to occur within the project area, therefore, operation of the park would not affect nesting success for these species.

In summary, the construction of the proposed project would not be expected to result in any significant adverse impacts to birds and other wildlife. Upon completion of the project, the creation of a diverse complex of terrestrial habitats throughout the site would provide significant benefits to birds and other wildlife, particularly with respect to grassland birds, whose habitat is currently limited within the New York metropolitan region. The creation of the shallow-water habitat within the project area would increase foraging habitat for waterfowl, wading birds and shorebirds. The movement of boats, canoes, and kayaks within the park would not be expected to significantly affect these groups of birds. ✷