Attachment C: Natural Resources

A. INTRODUCTION

This chapter examines the proposed installation's potential impacts on floodplains, wetlands, and aquatic natural resources[1] near the installation site, which is generally located at the foot of Gansevoort Street within Hudson River Park (see Attachment A, "Project Description and Environmental Screenings"). As described in Attachment A, the proposed installation would involve construction of a skeletal stainless steel sculpture located at the site of the former Pier 52 shed building. This chapter will cover:

- The regulatory programs that protect floodplains, wildlife, threatened or endangered species, aquatic resources, or other natural resources within the project site;
- The current condition of the floodplain and natural resources within the study area, including water and sediment quality, and biological resources, including aquatic biota and threatened or endangered species and species of special concern;
- The floodplain, water quality, and natural resources conditions in the future without the proposed installation (the No Action Alternative); and
- The potential impacts of the proposed installation on the floodplain, water quality, and natural resources (the With Action condition).

The proposed installation would result in the installation of a skeletal stainless steel sculpture supported by piles entirely within the footprint of the former Pier 52 shed building. The sculpture would have no sides, roof, or bottom platform.

PRINCIPAL CONCLUSIONS

The construction of the proposed installation would not result in any significant adverse impacts on natural resources. Increases in suspended sediment resulting from in-water construction activities would be temporary and localized and would dissipate quickly. Elevated underwater noise from pile driving would be intermittent, localized, and short in duration. The prohibition of pile driving from November through April in Hudson River Park would minimize potential impacts to striped bass and other overwintering fish, and to winter flounder spawning in the vicinity of the installation site.

Subadult and adult shortnose sturgeon and Atlantic sturgeon (federally-listed endangered species) may use the lower Hudson River in the vicinity of the proposed installation as a migration corridor to or from foraging, overwintering, and/or spawning grounds. In this portion of the Hudson River,

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[1] The *City Environmental Quality Review (CEQR) Technical Manual* defines natural resources as "(1) the City's biodiversity (plants, wildlife, and other organisms); (2) any aquatic or terrestrial areas capable of providing suitable habitat to sustain the life processes of plants, wildlife, or other organisms; and (3) any areas capable of functioning in support of the ecological systems that maintain the City's environmental stability."

these species would be more likely to occur in the deeper water habitat of the navigation channel, and would only occur in the shallow waters where the proposed installation would be located as occasional transient individuals. It is anticipated that all piles located within the Hudson River would be installed to the required tip elevation using a vibratory hammer. If the vibratory hammer alone does not advance the pile to the required tip elevation, an impact hammer would be used. Any impact hammering would be conducted in conjunction with a soft start and cushion block to minimize the effects of increased underwater noise. With these measures, exposure of sturgeon to potentially disturbing levels of underwater noise would be minimized and increased underwater noise levels would not affect the deeper water habitats, nor would it obstruct movement of migrating sturgeon past the project. Therefore, the proposed installation may affect, but would be unlikely to adversely affect shortnose and Atlantic sturgeon.

The minimal occupation of the river bottom by the piles (up to 71.1 square feet or 0.002 acres) and minimal over-mudline coverage by the pile caps (31.47 square feet per single pile foundation and 90.71 square feet for a double pile foundation, or up to 0.011 acres in total), would result in a minimal change in foraging habitat for striped bass and other fish species, and would not adversely affect the suitability of this portion of the Hudson River as winter flounder spawning habitat. Operation of the proposed installation, including nighttime safety lighting that meets U.S. Coast Guard specifications, would be consistent with the use of this portion of the park as specified in the Hudson River Park Estuarine Sanctuary Management Plan, and would not result in significant adverse impacts to floodplains, water and sediment quality, aquatic habitat, fish or benthic macroinvertebrates, Essential Fish Habitat (EFH), or Significant Coastal Fish and Wildlife Habitat (SCFWH) resources. No NYSDEC or USACE wetlands occur onsite and therefore, no disturbance to such resources would result from the proposed installation.

B. METHODOLOGY

OVERVIEW

Because the proposed installation would not have the potential to affect the floodplain or wetlands beyond the project site, the study area for these resources is limited to the boundaries of the proposed installation. Potential effects to threatened or endangered species were evaluated for a distance of at least one half mile from the project site. The study area for water and sediment quality and aquatic resources includes the overall aquatic resources within the lower Hudson River and the Hudson River waterfront portion of the project site. It is anticipated that construction would begin in May 2019, with the project operational by May 2020.

The proposed installation would comprise a skeletal stainless steel sculpture above precast pile supported concrete column foundations and pile caps at the location of the former Pier 52 shed building. The concreted columns and pile caps and supporting steel pipe piles would be located within the Hudson River and on the southern edge of the Gansevoort Peninsula within Hudson River Park. The installation would have the same dimensions as the outline of the 1966 pier shed, which was 325 feet long, 65 feet wide, and approximately 52 feet tall. The sculpture would not have an overwater platform. Six pre-cast concrete pile caps (either 6-foot-4-inch diameter by 2-foot6-inch deep for a single-pile foundation or 14-foot-4-inch long by 6-foot-4-inch wide by 2-foot-6-inch deep for a double-pile foundation) located below the water line but above the mudline are the only components with any potential to shade aquatic habitat of the Hudson River.

Within the Hudson River, the stainless steel framework would be supported by between 7 and 14 30-inch-diameter steel pipe piles attached to the 7 pre-cast concrete pile caps, with the intent of having one pile per column. Prior to pile installation, an indicator pile program would be performed over the course of approximately 12 noncontiguous days, where 12-inch diameter steel pipe test piles would be driven at each pile location to determine whether subsurface obstructions exist in the proposed pile locations. For each pile location where there are no obstructions, a single 30-inch pipe pile would be driven and a 6-foot-4-inch diameter by 2-foot-6-inch deep pre-cast pile cap installed. Should an impediment be encountered by the test pile that prohibits establishing a particular pile to the design depth, a two pile foundation connected by a 14-foot-4-inch long by 6-foot-4-inch wide by 2-foot-6-inch deep pre-cast pile cap would be installed at that location. The two pile foundation would allow the piles to be driven to shallower depths and then capped together to provide the required structural stability. The pile caps would be located at least one foot above the mudline. On Gansevoort Peninsula, the framework would be supported by 10 12-inch diameter steel pipe piles with pile caps. The westernmost footing would be located at the edge of the riprap, and temporary removal of the riprap in preparation for pile installation would take place partially below the water line. During installation of the piles on the shoreline of the Peninsula, including the westernmost footing, erosion and sediment control Best Management Practices (BMPs) (e.g., turbidity curtains, shoring box) would be implemented to minimize the potential for discharge of sediments to the river. Once the pile is installed, the riprap would be returned to the shoreline such that the elevation is not altered. Each of the upland pile footings, and the pile at the edge of the riprap, would result in disturbance of approximately 225 square feet on the riprap shoreline, for a total area of disturbance of 1,350 square feet (0.03 acres). The permanent footprint of the 10 piles on land would be approximately 80 square feet, assuming the use of 5 pile caps measuring 4 feet long by 4 feet wide.

Three additional 12-inch-diameter piles would be installed in the river a short distance from the sculpture in order to hold solar-powered marine lanterns to serve as safety lighting, if required by regulatory agencies. It is anticipated that all piles located on the Peninsula and within the Hudson River would be installed to the required tip elevation using a vibratory hammer. If the vibratory hammer alone does not advance the pile to the required tip elevation, an impact hammer would be used. Any impact hammering would be conducted in conjunction with a soft start and cushion block to minimize the effects of increased underwater noise. In-water pile driving is expected to be completed during normal work hours over approximately 30 noncontiguous days within the four-month in-water construction period. The in-water foundation construction is anticipated to occur from May through August 2019, and the project would be operational by May 2020.

EXISTING CONDITIONS

The installation site is located in the Hudson River directly adjacent to the Gansevoort Peninsula, within Hudson River Park at approximately Gansevoort Street. The installation site also includes the riprap shoreline of the Gansevoort Peninsula (see **Figure A-1**).

Existing conditions for floodplain, wetlands, and aquatic resources within the study area were summarized from:

- Existing information identified in literature and obtained from governmental and nongovernmental agencies, such as the New York City Department of Environmental Protection (NYCDEP) Harbor Water Quality Survey; NYCDEP City-Wide Long Term Combined Sewer Overflow (CSO) Control Planning Project reports; U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory maps and federally listed threatened or endangered species for New York County, New York; studies conducted within the Hudson River Park; New York/New Jersey Harbor Estuary Program; Federal Emergency Management Agency (FEMA) flood insurance rate maps (FIRMs); and USACE studies conducted as part of the New York and New Jersey Harbor Navigation Project.

- Responses to requests for information on rare, threatened, or endangered species in the vicinity of the installation site. These requests were submitted to the National Marine Fisheries Service (NMFS) and the NYSDEC Natural Heritage Program (NHP). In addition to the state program, the USFWS maintains information for federally listed threatened or endangered freshwater and terrestrial plants and animals, and the NMFS does the same for federally listed threatened or endangered marine organisms.

THE FUTURE WITHOUT THE PROPOSED INSTALLATION

The future without the proposed installation assumes that the sculpture would not be constructed. Therefore, no in-water or upland work would occur, and no natural resources would be impacted.

THE FUTURE WITH THE PROPOSED INSTALLATION

For the proposed installation, the assessment of potential impacts on the floodplain, wetlands, terrestrial, and aquatic resources considers the following:

- The existing water quality and natural resources of the Hudson River in the vicinity of the installation site and in the No Action Alternative.
- The potential for upland construction to result in temporary impacts to terrestrial and aquatic resources.
- The potential for construction of in-water components to result in temporary or permanent impacts to water quality and aquatic organisms. These potential impacts may include:
  - Temporary increases in suspended sediment and release of contaminants during sediment disturbance;
  - Temporary increase in underwater noise during pile driving;
  - Temporary increase in shading during construction;
  - Temporary loss of fish breeding, nursery, or foraging habitat, or EFH identified by NMFS, during in-water construction activities;
  - Shading of aquatic habitat by the pre-cast concrete pile caps; and
  - Loss of habitat within the footprint of the piles.
- The potential for operation of the proposed installation to adversely affect water quality of the Hudson River, when compared to the No Action Alternative.

C. REGULATORY CONTEXT

In-water activities associated with the proposed installation must comply with federal and state legislation and regulatory programs that pertain to activities in coastal areas, surface waters, floodplains, wetlands, and the protection of species of special concern. The proposed installation would abide by permit conditions established for development within the Hudson River Park authorized under Section 10 of the Rivers and Harbors Act. Applicable federal and state regulations are discussed below.

FEDERAL REGULATIONS

RIVERS AND HARBORS ACT OF 1899

Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the Secretary of the Army, acting through USACE, for the construction of any structure in or over any navigable water of the United States, the excavation from or deposition of material in these waters, or any obstruction or alteration in navigable waters of the United States. The purpose of this Act is to protect navigation and navigable channels. Any structures placed in or over navigable waters, such as pilings, piers, or bridge abutments up to the mean high water line, are regulated pursuant to this Act.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (16 USC §§ 1801 TO 1883)

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

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

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

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

The Endangered Species Act of 1973 recognizes that endangered species of wildlife and plants are of aesthetic, ecological, educational, 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 STATE REGULATIONS

PROTECTION OF WATERS, ARTICLE 15, TITLE 5, ECL, IMPLEMENTING REGULATIONS 6 NEW YORK CODE OF RULES AND REGULATIONS (NYCRR) PART 608

NYSDEC is responsible for administering the Protection of Waters Act and regulations to govern 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.

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 hid, or other part of these species as listed in 6 NYCRR §182.6.

HUDSON RIVER PARK ESTUARINE SANCTUARY MANAGEMENT PLAN

The Sanctuary Management Plan, developed by the Hudson River Park Trust, identifies management policies for the Hudson River Park Estuarine Sanctuary with respect to resource protection and preservation, public access and recreation, education, and research activities. The purpose of the Sanctuary Plan is to provide guidance on balancing the needs of these various park uses and identify procedures for monitoring and enforcing park policies, laws, and regulations to manage and protect the Hudson River and the Sanctuary.

The preservation objectives focus on controlling the solid waste and water pollution that may result from waterfront activities while improving water quality, aquatics, wildlife habitat, and promoting native species and sustainable design. The Estuarine Sanctuary Management Plan goals include improving waterfront access, enhancing in-water safety, and encouraging the use of the waterfront through special events and programs. Educational objectives include expanding learning opportunities within the Sanctuary through special programs and facilities, and developing partnerships with local and regional educational organizations. Research goals focus on analyzing the river habitats and their relationships with biotic and abiotic sources, assessing impacts of development activities, and developing methods for habitat improvement.

D. EXISTING CONDITIONS

Per the 2014 *City Environmental Quality Review (CEQR) Technical Manual*, a natural resources assessment considers the plant, wildlife, and other species in the context of the surrounding environment, habitat, or ecosystem, and examines a project’s potential to impact those resources. Groundwater, soils, and geologic features; natural and human-created habitats; and any areas used by wildlife may be considered in a natural resources analysis. Stormwater runoff may also be considered in a natural resources assessment and evaluated in the context of its impact on local ecosystem functions and on the quality of adjacent waterbodies.

In accordance with the *CEQR Technical Manual*, this section describes existing natural resource conditions within the terrestrial and water quality and aquatic resources study areas.

FLOODPLAINS AND WETLANDS

Figure C-1 presents the 100-year floodplain boundary (area with a 1% annual-chance of flooding each year, Zones AE and VE) for the study area according to the FEMA preliminary FIRM for New York City released in 2013. The Base Flood Elevation (BFE) (the 100-year flood elevation – Zone VE, which indicates an area of high flood risk subject to inundation by the 1 percent annual-chance flood event with additional hazards due to storm-induced velocity wave action, i.e., a 3-foot or higher breaking wave) at the installation site in the Hudson River is at elevation +16 feet North American Vertical Datum of 1988 (NAVD88). At the north end of the installation site, the piles that would be installed on Gansevoort Peninsula may fall within Zone AE BFE of +13 feet NAVD88.

As discussed in Attachment D, "Historic and Cultural Resources," the Hudson River bulkhead between Battery Place and West 59th Street has been determined eligible for listing on the State/National Registers of Historic Places. The shoreline in the vicinity of the installation site is engineered, consisting of riprap and granite wall on wider concrete blocks with piles and buried timber relieving platforms.

No vegetated tidal wetlands, and therefore, no wetlands that would be regulated by USACE, are present within the vicinity of the proposed installation. There are no NYSDEC mapped tidal wetlands in the vicinity of the installation (see **Figure C-2**). As shown in **Figure C-3**, the USFWS National Wetland Inventory classifies the installation area as E1UBL (estuarine subtidal unconsolidated bottom). Subtidal areas are continuously submerged substrates (below extreme low water). Unconsolidated bottoms have at least 25 percent cover of particles smaller than 2.5 or 2.8 inches, and less than 30 percent vegetative cover.

TERRESTRIAL RESOURCES

A portion of the proposed installation would be installed on the riprap shoreline on the southern end of the Gansevoort Peninsula. The surrounding area is dominated by impervious surfaces. Vegetation is scant and limited to street trees, and landscaped shrubs and flowers along the Hudson River Bikeway and in the median of Route 9A. The existing Gansevoort Peninsula shoreline is unvegetated and comprises riprap, concrete rubble, and debris. Only the most urban-adapted terrestrial wildlife species are expected to occur near the installation site, including house sparrow (*Passer domesticus*), European starling (*Sternus vulgaris*), rock dove (*Columba livia*), Norway rat (*Rattus norvegicus*), and gulls.

AQUATIC RESOURCES

SURFACE WATER RESOURCES IN THE STUDY AREA

The study area for the proposed installation is located within the Lower Hudson River Estuary, a tidally influenced portion of the Hudson River that is part of the New York/New Jersey Harbor Estuary, which also includes upper and lower New York Harbor, Arthur Kill, Kill Van Kull, East River, Raritan Bay, and Jamaica Bay. Saltwater from Upper New York Bay enters the lower Hudson River Estuary during the flood phase of the tidal cycle and lower salinity water is discharged from the Estuary to the Bay during the ebb phase, resulting in a partially stratified estuary. Tidal flows entering the lower Hudson River from the Upper Harbor during the flood phase are approximately balanced out by the range of fresh water flows (NYCDEP 2007). Freshwater and higher salinity waters are well mixed during low-flow conditions but are stratified under high-flow conditions when the freshwater layer overrides the saltwater layer (Moran and Limburg 1986). Ristich et al. (1977) classified the lower Hudson River Estuary as polyhaline (18 to 30 parts per thousand [ppt]) in late summer and autumn, and mesohaline (5 to 18 ppt) in spring and early summer. The typical tidal range on the Hudson River is approximately 5 feet with average tidal currents of approximately 2 feet per second (Geyer and Chant 2006). Within the installation site, water depths at mean lower low water (MLLW) range from 4 to 15 feet deep. The river is approximately 4,400 feet wide at the proposed installation location. Aquatic habitat within the vicinity of the proposed installation consists of open water, pile fields, under pier, and interpier areas.

WATER QUALITY

Title 6 of NYCRR Part 703 includes surface water standards for each use class of New York surface waters. The lower Hudson River is designated as Use Classification I saline surface waters. Best uses for Class I waters are secondary contact recreation and fishing. Water quality should be suitable for fish propagation and survival.

The results of recent Harbor Surveys conducted by NYCDEP (NYCDEP 2010, 2012, 2016, and 2018) show that the water quality of New York Harbor, including the Lower Hudson Estuary, has improved significantly since the 1970s as a result of measures undertaken by the City (e.g., infrastructure improvement such as major improvements to wastewater treatment facilities and increased capture of stormwater runoff) and others (NYCDEP 2013). Recent water quality data (2000 to 2017) from the NYCDEP Harbor Survey station off West 42nd Street (Station N4), the station closest to Pier 52, indicate that the water quality in this part of the lower Hudson River generally meets the water quality standards for Use Classification I waters (see **Table C-1**). Dissolved oxygen[2] (DO) concentrations met the standard for Class I waters for the majority of the time between 2000 and 2015; surface DO failed to meet the standard only once, and DO at the bottom failed to meet the standard 14 times. Average chlorophyll-*a*[3] values were not indicative of high nutrient concentrations. Secchi transparency[4] during the time period was generally indicative of low water clarity, which is likely due to relatively high suspended solid concentrations that are common in estuarine waters. Within the study area, temperature ranged from 32.3°F to 85°F at the surface and from 34.9°F to 78.7°F at the bottom. Salinity ranged from 0.3 to 25.1 psu at the surface and from 0.3 to 30.5 psu at the bottom.

[2] DO in the water column is necessary for respiration by aquatic biota. The bacterial breakdown of high organic loads can deplete DO and result in low DO levels. Persistently low DO can degrade habitat and affect aquatic biota. Consequently, DO is one of the most universal indicators of overall water quality in aquatic systems.

[3] High levels of nutrients can lead to excessive plant growth (a sign of eutrophication) and depletion of DO. 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 (NYCDEP 2010).

[4] Secchi transparency is a measure of the clarity of surface waters. Transparency greater than 5 feet (1.5 meters) indicates relatively clear water. Decreased clarity can be caused by high suspended solid concentrations or blooms of plankton. Secchi transparencies less than 3 feet (0.9 meters) may be considered indicative of poor water quality conditions. Average Secchi readings in the Inner Harbor area have remained relatively consistent since measurement of this parameter began in 1986, ranging between approximately 3.5 and 5.5 feet (1.1 to 1.8 meters) (NYCDEP 2012).

Table C-1
NYCDEP Harbor Survey Water Quality Data for West 42nd Street Sampling Station (2000 to 2017)

Parameter [Use Class I Standard]	Surface Waters			Bottom Waters		
	Min	Max	Avg	Min	Max	Avg
Temperature (F) [*No standard*]	32.3	85.0	66.3	34.9	78.7	64.0
Salinity (psu) [*No standard*]	0.3	25.1	14.1	0.3	30.5	22.6
Fecal coliform (colonies per 100 mL [*Monthly geometric mean less than or equal to 2,000 colonies/100mL from five or more samples*]	1	4,000	150	-	-	-
Dissolved oxygen (mg/L) [*Never less than 4 mg/L*]	0.7	14.7	7.5	0.6	13.5	6.3
Secchi transparency (ft) [*No standard*]	0.5	6	2.7	-	-	-
Chlorophyll-*a* (µg/L) [*No standard*]	0.5	63.9	5.0	-	-	-

Notes: Compliance with the fecal coliform standard is based on a monthly geometric mean (for which the data are not available to calculate) and not on the basis of the maximum fecal coliform value presented here, which is the maximum fecal coliform value obtained during weekly sampling events.
Sources: NYCDEP 2018

Suspended sediments vary with season and weather – near bottom concentrations range between 100 and 200 milligrams per liter (mg/L) in summer, 100 to 400 mg/L during high discharge periods, and greater than 800 mg/L at times of maximum flow (Geyer 1995). Sedimentation in the lower Hudson River is greatest in the shallows on the west side of the river (Geyer 1995). The mean sedimentation rate for the portion of the estuary just north of Pier 52, at Pier 76 adjacent to 34th Street, has been estimated at 4.1 inches/year, with higher sedimentation rates occurring in the underpier areas than in the interpier areas (EEA 1988).

SEDIMENT QUALITY

Complex flow patterns lead to widely variable sediment characteristics throughout the area. The primary constituents of Hudson River sediments are silt and clay (USACE 1999, EEA 1988). Typical of any urban watershed, New York Harbor Estuary sediments are contaminated due to a history of industrial uses in the area. The sediment quality index (based on sediment toxicity, sediment contaminants, and total organic carbon) for the portion of the Hudson River near Pier 52 was rated poor by the National Estuary Program Coastal Condition Report during 2000–2001 sampling (USEPA 2007). The Lower Hudson River Estuary is listed as being impaired for sediments, which are contaminated with polychlorinated biphenyls (PCBs) and other toxics (NYSDEC 2016). Contaminants found throughout the New York Harbor Estuary include pesticides such as chlordane and DDT, metals such as mercury, cadmium, lead, and copper, PCBs, and various polycyclic aromatic hydrocarbons (PAHs) (Rohmann and Lilienthal 1987). 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, PCBs, and mercury) have decreased on average by an order of magnitude over the past several decades mainly due to control measures implemented through the Clean Water Act (Steinberg et al. 2004).

AQUATIC BIOTA

The New York/New Jersey Harbor Estuary, including the lower Hudson River Estuary, supports a diverse and productive aquatic community of over 100 species of finfish, more than 100 invertebrate species, and a variety of phytoplankton and zooplankton. The following sections provide a brief description of the aquatic biota found in the Harbor Estuary, focusing on the lower Hudson River.

Primary Producers

Phytoplankton

Phytoplankton are microscopic plants whose movements within the system are largely governed by prevailing tides and currents. Light penetration, turbidity, and nutrient concentrations are important factors in determining phytoplankton productivity and biomass. Diatoms such as *Skeletonema costatum* and *Thalassiosira* spp. generally dominate the phytoplankton community within the study area, with lesser contributions from dinoflagellates and green algae (Brosnan and O'Shea 1995). Phytoplankton sampling in the Lower Hudson River over a 10-year period between 1991 and 2000 resulted in the collection of a total of 71 taxa. The most frequently collected taxa were *Nannochloris atomus* (found in 98 percent of the samples) and *Skeletonema costatum* (52 percent of samples) (NYCDEP 2007). Phytoplankton sampling from 1996 through 2003 near Pier 26 on the Hudson River, downstream of the installation site, indicated that the most dominant species were *Asterionella japonica*, *Chaetoceros subtilis*, *Coscinodiscus excentricus*, *Ditylum brightwelli*, *Eucampia zodiacus*, cf. *Gyrosigma* sp., *Nitzchia reversa*, cf. *Pseudonitzchia seriata*, *Rhizosolenia setigera*, and *Ebria tripartite* (Levandowsky and Vaccari 2004). While nutrient concentrations in most areas of New York Harbor are relatively high, low light penetration has often precluded the occurrence of phytoplankton blooms.

Submerged Aquatic Vegetation and Benthic Algae

Limited light penetration also restricts the distribution of submerged aquatic vegetation (SAV) in the vicinity of the installation site (Olson et al. 1996). The extensively developed shoreline and swift currents also severely limit inhabitation of this area by SAV. Benthic macroalgae are large multicellular algae that are important primary producers in the aquatic environment. Species of macroalgae that occur in the Harbor Estuary include sea lettuce (*Ulva* spp.), green fleece (*Codium fragile*), and brown algae (*Fucus* spp.) (PBS&J 1998).

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 (*Anchoa mitchilli*), as well as commercially and recreationally important species, such as striped bass (*Morone saxatilis*) and white perch (*Morone americana*) during their early life stages. Zooplankton sampling in the Hudson River over a 10-year period between 1991 and 2000 resulted in the collection of a total of 16 taxa. The most frequently collected taxa were *Tintinnopsis* spp. (31 percent of samples) and copepods in the nauplius stage (25 percent of samples) (NYCDEP 2007).

Benthic Invertebrates

The major groups of benthic invertebrates collected in the Estuary include aquatic earthworms (oligochaetes), segmented worms (polychaetes), snails (gastropods), bivalves, barnacles, cumaceans, amphipods, isopods, crabs, and shrimp (EEA 1988, EA 1990, Coastal 1987, PBS&J

1998). Bain et al. (2006) collected a total of 145 benthic invertebrate taxa within Hudson River Park between July 2002 and June 2004. Examples of abundant species include the polychaetes *Mediomastus* spp., *Streblospio benedicti*, *Leitoscoloplos* spp., *Heteromastus* sp., *Spio setosa*, and *Tharyx* spp.; the bivalves *Mulinia lateralis* and *Tellina agilis*; the gastropods *Acteocina canaliculata* and *Rictaxis punctostriatus*; the crustacean *Leucon americanus*; and oligochaetes. This invertebrate sampling showed an unusually abundant and diverse invertebrate community at a sampling station just downstream of Pier 52, adjacent to 12th Street.

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 Harbor Estuary and lower Hudson River that supports marine fish, estuarine fish, anadromous fish (fish that migrate up rivers from the sea to breed in fresh water), and catadromous fish (fish that live in fresh water and migrate to marine waters to breed). **Table C-2** lists fish species known to occur within the Harbor Estuary and have the potential to occur in the vicinity of Pier 52. Bain et al. (2006) collected 41 species of fish from within the Hudson River Park Estuarine Sanctuary between June 2002 and June 2004. Bay anchovy, Atlantic herring (*Clupea harengus*), striped bass, and blueback herring (*Alosa aestivalis*) were most abundant. All of these species use open waters (Bain et al. 2006). The sampling station south of Gansevoort Street near 12th Street had the highest fish abundance of all sites sampled (Bain et al. 2006).

Table C-2
Finfish Species With the Potential to Occur in the Vicinity of the Installation Site

Common Name	Scientific Name
Alewife[1]	*Alosa pseudoharengus*
American eel[1]	*Anguilla rostrata*
American sand lance	*Ammodytes hexapterus*
American shad[1]	*Alosa sapidissima*
Atlantic cod	*Gadus morhua*
Atlantic croaker[1]	*Micropogonias undulatus*
Atlantic herring[1]	*Clupea harengus*
Atlantic mackerel	*Scomber scombrus*
Atlantic menhaden[1]	*Brevoortia tyrannus*
Atlantic moonfish	*Selene setapinnis*
Atlantic needlefish	*Strongylura marina*
Atlantic seasnail	*Liparis atlanticus*
Atlantic silverside[1]	*Menidia menidia*
Atlantic sturgeon	*Acipenser oxyrhynchus*
Banded killifish	*Fundulus diaphanous*
Bay anchovy[1]	*Anchoa mitchilli*
Black sea bass	*Centropristis striata*
Blackfish	*Tautoga onitis*
Blueback herring[1]	*Alosa aestivalis*
Bluefish[1]	*Pomatomus saltatrix*
Butterfish[1]	*Peprilus triacanthus*
Clearnose skate	*Raja eglanteria*
Conger eel	*Conger oceanicus*
Crevalle jack	*Caranx hippos*
Cunner[1]	*Tautogolabrus adspersus*
Fawn cusk eel	*Lepophidium cervinum*
Feather blenny[1]	*Hypsoblennius hentzi*
Fourbeard rockling	*Enchelypus cimbrius*
Foureye butterflyfish	*Chaetodon capistratus*
Four-spot flounder	*Paralichthys oblongus*
Gizzard shad[1]	*Dorosoma cepedianum*
Goosefish[1]	*Lophius americanus*
Grey snapper	*Lutjanus griseus*
Grubby(1)	*Myoxocephalus aenaeus*
Gulf Stream flounder(1)	*Citharichthys arctifrons*
Hickory shad(1)	*Alosa mediocris*
Hogchoker(1)	*Trinectes maculatus*
Inshore lizardfish	*Synodus foetens*
Lined seahorse[1]	*Hippocampus erectus*
Little skate	*Raja erinacea*
Longhorn sculpin	*Myoxocephalus octodecimspinosus*
Lookdown[1]	*Selene vomer*
Mummichog	*Fundulus heteroclitus*
Naked goby	*Gobiosoma bosci*
Northern stargazer[1]	*Astroscopus guttatus*
Northern kingfish[1]	*Menticirrhus saxatilis*
Northern pipefish[1]	*Syngnathus fuscus*
Northern puffer	*Sphoeroides maculatus*
Northern searobin[1]	*Prionotus carolinus*
Orange filefish	*Aluterus schoepfi*
Oyster toadfish	*Opsanus tau*
Planehead filefish	*Monacanthus hispidus*
Pollock	*Pollachius virens*
Rainbow smelt	*Osmerus mordax*
Red hake[1]	*Urophycis chuss*

Table C-2
Finfish Species With the Potential to Occur in the Vicinity of the Installation Site (cont'd)

Common Name	Scientific Name
Rock gunnel	*Pholis gunnellus*
Rock sea bass[1]	*Centropristis philadelphica*
Rough scad	*Trachurus lathami*
Scup[1]	*Stenotomus chrysops*
Seaboard goby[1]	*Gobiosoma ginsburgi*
Sheepshead	*Archosargus probatocephalus*
Short bigeye	*Pristigenys alta*
Silver hake[1]	*Merluccius bilinearis*
Silver perch	*Bairdiella chrysoura*
Smallmouth flounder	*Etropus microstomus*
Spot[1]	*Leiostomus xanthurus*
Spotfin butterflyfish	*Chaetodon ocellatus*
Spotted hake[1]	*Urophycis regia*
Striped anchovy[1]	*Anchoa hepsetus*
Striped bass[1]	*Morone saxatilis*
Striped burrfish	*Chilomycterus schoepfi*
Striped cuskeel	*Ophidion marginatum*
Striped killifish	*Fundulus majalis*
Striped mullet	*Mugil cephalus*
Striped searobin[1]	*Prionotus evolans*
Summer flounder[1]	*Paralichthys dentatus*
Tautog	*Tautoga onitis*
Threespine stickleback	*Gasterosteus aculeatus*
Tomcod[1]	*Microgadus tomcod*
Weakfish[1]	*Cynoscion regalis*
White hake	*Urophycis tenuis*
White mullet	*Mugil curema*
White perch[1]	*Morone americana*
Windowpane[1]	*Scophthalmus aquosus*
Winter flounder[1]	*Pseudopleuronectes americanus*
Yellowtail flounder	*Limanda ferruginea*

Note: [1] Collected within Hudson River Park by Bain et al. (2006) from June 2002 through June 2004.
Sources: Bain et al. 2006; Woodhead 1990; EEA 1988; EA Engineering, Science & Technology 1990; LMS 1994, 1999, 2002, 2003a, 2003b; Able et al. 1995

ESSENTIAL FISH HABITAT

NMFS designates EFH within 10' x 10' squares identified by latitude and longitude coordinates. Pier 52 is within a portion of the Hudson River estuary EFH that is situated in the 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. This square includes the following waters: 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 Point on the west tip of Brooklyn, NY, and Newark Bay. **Table C-3** lists the species and life stages of fish identified as having EFH in the portion of the Hudson River near the installation site. **Appendix B** contains the EFH Assessment Worksheet which describes EFH in the vicinity of the proposed installation.

Table C-3
Essential Fish Habitat Designated Species in the Vicinity of the Installation Site

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Red hake (*Urophycis chuss*)		M,S	M,S	M,S	
Winter flounder (*Pleuronectes americanus*)	M,S	M,S	M,S	M,S	M,S
Windowpane flounder (*Scopthalmus aquosus*)	M,S	M,S	M,S	M,S	M,S
Atlantic sea herring (*Clupea harengus*)		M,S	M,S	M,S	
Bluefish (*Pomatomus saltatrix*)			M,S	M,S	
Long finned squid (*Loligo pealei*)	n/a	n/a			
Short finned squid (*Illex illecebrosus*)	n/a	n/a			
Atlantic butterfish (*Peprilus triacanthus*)		M	M,S	M,S	
Atlantic mackerel (*Scomber scombrus*)			S	S	
Summer flounder (*Paralicthys dentatus*)		F,M,S	M,S	M,S	
Scup (*Stenotomus chrysops*)	S	S	S	S	
Black sea bass (*Centropristus striata*)			M,S	M,S	
Surf clam (*Spisula solidissima*)	n/a	n/a			
Ocean quahog (*Artica islandica*)	n/a	n/a			
Spiny dogfish (*Squalus acanthias*)	n/a	n/a			
King mackerel (*Scomberomorus cavalla*)	X	X	X	X	
Spanish mackerel (*Scomberomorus maculatus*)	X	X	X	X	
Cobia (*Rachycentron canadum*)	X	X	X	X	
Clearnose skate (*Raja eglanteria*)			X	X	
Little skate (*Leucoraja erinacea*)			X	X	
Winter skate (*Leucoraja ocellata*)			X	X	
Bluefin tuna (*Thunnus thynnus*)	X	X	X	X	
Smooth dogfish (*Mustelus canis*)	X	X	X	X	
Sand tiger shark (*Carcharias taurus*)		X(1)			
Dusky shark (*Carcharinus obscurus*)		X(1)			
Sandbar shark (*Carcharinus plumbeus*)		X(1)		X	

Notes:
S = EFH designation includes seawater salinity zone (salinity > 25%)
M = EFH designation includes mixing water / brackish salinity zone (0.5% < salinity < 25%)
F = EFH designation includes tidal freshwater salinity zone (0% < salinity < 0.5%)
n/a = Insufficient data for this life stage exists and no EFH designation has been made
(1) Species does not have a free-swimming larval stage; rather they are live bearers that give birth to fully formed juveniles. For the purposes of this table, "larvae" for sand tiger, dusky, and sandbar sharks refers to neonates and early juveniles.
Sources: NMFS "Summary of Essential Fish Habitat (EFH) Designation" at http://www.greateratlantic.fisheries.noaa.gov/hcd/STATES4/new_jersey/40407400.html; http://www.greateratlantic.fisheries.noaa.vog/hcd/ny3.html; http://www.nero.noaa.gov/hcd/skateefhmaps.htm; and NMFS EFH Mapper at http://www.habitat.noaa.gov/protection/efh/habitatmapper.html.

THREATENED OR ENDANGERED SPECIES, OR SPECIAL CONCERN SPECIES

NMFS (2017) identified adult and subadult shortnose sturgeon (*Acipenser brevirostrum*, federal endangered) and Atlantic sturgeon (*Acipenser oxyrinchus*, federal endangered) as having the potential to be present within the Hudson River in the vicinity of the installation site. Shortnose sturgeon would likely be using the lower Hudson River as a migration corridor to and from foraging, overwintering, and/or spawning grounds located upstream of the installation site. Due to the distance from shortnose sturgeon spawning grounds in the Hudson River, and the higher salinity of the river in the vicinity of the installation site, shortnose sturgeon eggs, larvae, and young-of-the-year would not occur near the installation site. The lower Hudson River in the vicinity of the installation site is not a known overwintering, spawning, or foraging ground for Atlantic sturgeon, and early life stages of this species are likewise not expected to occur in the area. Atlantic sturgeon may occur in the study area as they migrate upriver to freshwater habitat, or downriver back to coastal waters.

SHORTNOSE STURGEON

The state and federally listed endangered shortnose sturgeon is an anadromous bottom-feeding fish that can be found throughout the Hudson River system. These fish spawn, develop, and overwinter well upriver of the former Pier 52, and prefer colder, deeper waters at all life stages. Shortnose sturgeon may occasionally use areas of the lower Hudson River downstream of the George Washington Bridge (river mile 12); however, spawning, nursery, and overwintering areas are located well upstream of the proposed installation (Bain et al. 2007). Although larvae can be found in brackish areas of the river, juveniles (fish ranging from two to eight years old) are predominately confined to freshwater reaches above the salt front, and far upriver from the installation site. Long-term Hudson River monitoring data, collected by the New York Utilities and others since the 1970s, have indicated that shortnose sturgeon inhabit deepwater habitats and occur in greatest abundance north of the Tappan Zee Bridge. Hoff et al. (1988) reported that most captures of adult shortnose sturgeon during river monitoring of fish distributions by the Hudson River electric utilities from 1969 to 1980 occurred upriver of the installation site, between river mile 23.6 and 76 (New York/New Jersey border to Poughkeepsie). No sturgeon were found in interpier areas of the Hudson River Park during sampling between June 2002 and March 2004 (Bain et al. 2006). While they mainly occur upriver, shortnose sturgeon have been found downstream of the George Washington Bridge by the Utilities' long-term monitoring program. These sturgeon were found in the navigation channel, not in shallow areas like that of the installation site.

ATLANTIC STURGEON

Atlantic sturgeon is an anadromous species that occurs within the New York Harbor Estuary and the Hudson River Estuary. In the Hudson River, Atlantic sturgeon are found in the deeper portions and typically do not occur further upstream than Hudson, New York. Atlantic sturgeon migrate from the ocean upriver to spawn above the salt front from April to early July (Smith 1985, Stegemann 1999). Female sturgeon migrate from the river back to ocean waters following spawning, but males may remain in the river until October or November. Any Atlantic sturgeon that occur in the lower Hudson River would be migratory individuals and would likely remain in the deeper waters of the navigation channel.

The installation site is located within an area designated as critical habitat for Atlantic sturgeon.[5] Critical habitat for Atlantic sturgeon has been designated for the length of the tidal Hudson River from lower Manhattan to the Federal Dam at Troy. For Atlantic sturgeon, the physical or biological features of critical habitat that are essential to the conservation of the species include:

- Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (0 to 0.5 ppt) for settlement of fertilized eggs, refuge, growth, and development of early life stages;

[5] 82 Federal Register 39160; August 17, 2017

- Aquatic habitat with a gradual downstream salinity gradient of 0.5 to 30 ppt and soft substrate downstream of spawning sites for juvenile foraging and physiological development;
- Water of appropriate depth to support: unimpeded movement of adults to/from spawning sites, seasonal movement of juveniles, and staging/resting/holding of subadults or spawning condition adults. Water depths greater than or equal to 1.2 meters (3.9 feet) in the main river channel; and
- Water, especially in the bottom meter of the water column, with temperature, salinity, and oxygen values that support: spawning, annual and interannual survival, and growth, development, and recruitment.

SEA TURTLES

New York and New Jersey waters may be warm enough to support loggerhead (*Caretta caretta*; federally threatened, state endangered) and Kemp's ridley (*Lepidochelys kempi*; endangered) turtles from May through mid-November, and green sea turtles (*Chelonia mydas*) from June through October; those that do occur in these waters are typically small juveniles. Leatherback sea turtles (*Dermochelys coriacea*; endangered) may be found in the waters off New York and New Jersey during the warmer months, but this species generally prefers deep, pelagic waters over shallow, nearshore waters, and would not be expected in the vicinity of the study area. The New York-New Jersey Harbor complex of which the lower Hudson River is a part is considered to be of marginal or lower quality sea turtle habitat, and observations of these species are infrequent (Ruben and Morreale 1999, USACE 2001). Overall, sea turtles have the potential to occur within the study area on rare occasions, and only as transient individuals, rather than for long-term occupation for breeding, wintering, or growth and development.

SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The New York State Department of State (NYSDOS) has designated 15 SCFWHs within New York City. The proposed installation site falls within one of these designated areas, the Lower Hudson Reach. SCFWHs are coastal habitats designated by NYSDOS based on the uniqueness of the habitat; presence of protected or vulnerable species; recreational, education, and other uses; abundance of ecologically important species; and habitat irreplaceability (NYSDOS 1984). The Lower Hudson Reach includes the 19-mile stretch of the Hudson River from Battery Park to the tip of Manhattan and from there north to Yonkers near Glenwood, and includes areas with deep waters, shallows, piers, and interpier basins. NYSDOS designated the Lower Hudson Reach as a SCFWH in part because it provides an important wintering habitat for young-of-year, yearling, and older striped bass. In addition, the Lower Hudson Reach is one of the few large tidal river mouth habitats in the northeastern United States, and is part of the greater Hudson River Estuary system that supports a diverse and historically highly productive ecosystem of fish and invertebrate species (Briggs and Waldman 2002, NYSDOS 1992). Significant numbers of other fish species and waterfowl also use the Lower Hudson Reach, including winter flounder, summer flounder, white perch, Atlantic tomcod, Atlantic silversides, bay anchovy, hogchoker, and American eel. The Lower Hudson Reach is potentially important for bluefish and weakfish young-of-year, American shad, blue crab, Atlantic sturgeon, and shortnose sturgeon. Planktonic and benthic organisms that provide an important food source are also present, including copepods, rotifers, mysid shrimp, nematodes, oligochaetes, polychaetes, and amphipods. Wintering waterfowl that use habitat in the Lower Hudson Reach include canvasback, scaup, mergansers, mallards, and Canada geese (NYSDOS 1992).

USFWS (1997) also designated the Lower Hudson River Estuary, from the Battery at the southern tip of Manhattan upstream to Stony Point at river mile 41, as a Significant Habitat Complex due to its regional significance as nursery and wintering habitat for a number of anadromous, estuarine, and marine fish species, including striped bass, and its use as a migratory and feeding area for birds and fish that feed on the abundant fish and benthic invertebrate resources found in this portion of the estuary. Striped bass are anadromous and range from along the North American Atlantic coast from Canada to northern Florida. Striped bass was one of the four most abundant species collected within Hudson River Park from June 2002 through June 2004 (Bain et al. 2006).

Adult striped bass spend much of the year from summer through late winter in the nearshore coastal waters of the Atlantic Ocean. Northward migration of Hudson River fish along the Atlantic coast extends as far north as the Bay of Fundy, Nova Scotia, with older fish tending to travel farther north (Waldman et al. 1990). Although most migrate to sea, some striped bass adults remain in the Hudson River year-round and do not migrate. During winter, these resident adults (ages 4 and older) are joined by migratory adults returning to the estuary to spawn. Adults aggregate near the mouths of their natal rivers and begin moving upstream to spawn as water temperatures rise in the spring.

The Hudson River supports one of several principal spawning populations, which also include Delaware Bay, Chesapeake Bay, the Roanoke and Chowant Rivers and Albemarle Sound, North Carolina, the Santee River in South Carolina, and the St. Johns River in northern Florida. Peak spawning in the Hudson River typically occurs between mid-May and mid-June in freshwater areas where currents are moderate to swift, from Indian Point (river mile 42) upstream to Saugerties (river mile 106) (CHGE et al. 1999, ASA 2010). Depending on their age and size, females produce up to several million pelagic eggs (ASMFC 2015). Utilities' fish surveys conducted from 1998 to 2007 during May and June primarily observed striped bass eggs upstream of Indian Point at river mile 46. Peak densities typically occur near Cornwall, New York (river mile 56 to 61) with very few eggs found south of the Tappan Zee Bridge region. The spawning area is considerably upriver of Pier 52.

Larval striped bass recruit to the lower salinity areas of the Hudson River well upstream of Pier 52 during summer (May to July). Larvae are abundant throughout the Hudson River during this time, but are more common from the Tappan Zee Bridge upstream to Hyde Park, rather than in the lower estuary. As juveniles, striped bass begin to move to shallower nursery habitat in the lower estuary. Juvenile abundance typically peaks in July and August upstream of Hyde Park in deeper bottom habitats (greater than 20 feet deep). Many juvenile striped bass move downstream by the end of their first summer to the lower estuary and into New York Harbor, western Long Island Sound, and along the south shore of Long Island where they remain near shore until November or December (CHGE et al. 1999, Dunning et al. 2009). At this time, some juveniles may move to deeper water, although they have been documented as using interpier areas within the Hudson River Park for overwintering habitat from December through March (AKRF et al. 1998, Dunning et al. 2009, CHGE et al. 1999). The lower Hudson River, including the area near Pier 52, contains striped bass throughout the year and provides important winter habitat (mid-November to mid-April) for young-of-year, yearling, and older striped bass (Heimbuch et al. 1994, NYSDOS 1992).

At two to three years old, adult striped bass leave Atlantic coast estuaries and begin the typical seasonal coastal migration, northward during the spring and summer and southward during the fall. Some individuals are thought to mature and remain year-round in the upper freshwater portion of the estuary, while others adopt an anadromous life style and, once sexually mature, spend most of their time in coastal saltwater habitats, migrating into freshwater and brackish habitats in the spring to spawn (Zlokovitz et al. 2003). Adult striped bass are top predators and are prey to few other organisms. In the lower Hudson River Estuary, striped bass prey upon at least 20 different taxa, dominated by a variety of small-bodied and juvenile fishes and crustaceans (Steimle et al. 2000, Dunning et al. 2009). The coastal stock is healthy, with spawning stock biomass well above the target level specified in the Interstate Fisheries Management Plan (ASMFC 2009) and stocks at historically high levels (NYSDEC 2010).

E. THE FUTURE WITHOUT THE PROPOSED INSTALLATION

Without the proposed installation, the shallow open waters at the terminus of Gansevoort Street would remain as it is under the existing condition, no work would occur on the Gansevoort Peninsula shoreline or within the Hudson River within the installation site, and there would be no impact on natural resources.

With or without the proposed installation, elements of the New York/New Jersey Harbor Estuary Program and other programs such as the Hudson-Raritan Estuary (HRE) Restoration Project that are specifically directed at improving biological resources and habitats, would be expected to result in improvements to natural resources over time. The HRE has identified the Hudson River Park Estuarine Sanctuary as a restoration site. Restoration opportunities identified for the Sanctuary include creation, restoration, and/or enhancement of shallow water habitat and provision of environmental interpretation (USACE and PANYNJ 2009, Hudson River Park Trust 2002). Restoration opportunities pursued within the Sanctuary as part of the HRE would occur with or without the proposed installation. In addition, as required by USEPA's CSO Control Policy, NYCDEP initiated the development of the Long-Term Control Plan (LTCP) Project in 2004. The LTCP Project integrates CSO Facility Planning Projects and the Comprehensive City-Wide Floatables Abatement Plan, and incorporates ongoing Use and Standards Attainment Program Project work. The East River and Open Waters Waterbody/Watershed Facility Plan report (NYCDEP 2007) includes measures for controlling combined sewer overflows to the Hudson River and is the first step in developing the LTCP for the open water areas of the New York Harbor. Recent efforts resulting from this plan include monitoring water quality at more than 70 locations; installing depth sensors at more than 115 combined sewer regulators; piloting real-time monitors at five CSO outfalls to estimate CSO volume, duration of overflow, and peak flow during wet weather periods; and installing weather stations at waste water treatment plants. These efforts are intended to result in future improvement to coliform, dissolved oxygen, and floatables levels in the Harbor Estuary.

Efforts to characterize and understand sediment contamination will likely lead to improvements in sediment quality over time. The Contamination Assessment and Reduction Project (CARP), sponsored by the Port Authority of New York and New Jersey (PANYNJ), 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, PCBs, polyaromatic hydrocarbons (PAHs), metals (mercury, cadmium, and methyl mercury), and organochlorine pesticides. Continued research and monitoring programs are anticipated to play a role in the development of future management strategies for Harbor sediments (Landeck Miller et al. 2011).

F. PROBABLE IMPACTS OF THE PROPOSED INSTALLATION

With the proposed installation, the pile-supported stainless steel sculpture would be constructed over a period of 12 months; in-water construction activities comprising pile driving and installation of the pile caps and concrete columns would be completed over 4 months (May-August 2019). Pile driving would occur over approximately 30 noncontiguous days within this 4-month period, not including the 12-day test pile program. Barge-based equipment would remain in use for the duration of the 12-month construction duration. Construction would result in a slight and temporary increase in vessel activity and shading from construction vessels. Suspended sediment levels would be temporarily elevated during pile driving and movement of construction vessels. Underwater noise levels would also be temporarily elevated during construction. Pile driving for both the in-water and upland piles would use a combination of techniques in order to minimize impacts from underwater noise. It is anticipated that all piles located on the Peninsula and within the Hudson River would be installed to the required tip elevation using a vibratory hammer. If the vibratory hammer alone does not advance the pile to the required tip elevation, an impact hammer would be used. Any impact hammering would be conducted in conjunction with a soft start and cushion block to minimize the effects of increased underwater noise. In-water piles, pile caps, and concrete columns would be installed using a barge-mounted crane, and upland piles would be installed using either land-based or barge-mounted equipment. The prefabricated stainless steel elements of the superstructure would be installed on the piles likely using a combination of barge and land-based equipment.

As shown in **Table C-4**, the proposed installation would result in the permanent loss of 34.4 square feet of bottom habitat in the footprint of the single pile foundations supporting the sculpture, and an additional 2.4 square feet in the footprint of the piles for the safety lighting, for a total of 36.8 square feet. If double pile foundations are required, 68.7 square feet of bottom habitat would be lost in the footprint of the piles, for a total of 71.1 square feet. Installation of the upland piles would not result in the loss of bottom habitat, as they would be located on the riprap shoreline of Gansevoort Peninsula.

Table C-4
Potential In-Water Footprint of Proposed Installation

Pile Type	Number of Piles	Footprint of Piles (square feet)	Over-mudline Coverage* (square feet)
30” Steel Pipe, Single Foundation	7	34.4	154.4
30” Steel Pipe, Double Foundation	14	68.7	475.6
12” Steel Pipe, Single Foundation	3	2.4	-
Total using single foundation	***10***	***36.8***	***154.4***
Total using double foundation	***17***	***71.1***	***475.6***

Notes:
Three 12” steel pipe piles supporting the safety lighting would be required in both scenarios. The concrete pile caps would be below the water and above the mudline, and would result in some shading of aquatic habitat. Areas given for the double foundation scenario assume that double foundations would be necessary for each of the 7 pile locations, which represents the worst case scenario and the maximum possible square footage.
*The over-mudline footprint does not include the pile located at the edge of the riprap shoreline, as this pile cap would be installed below the surface and would not result in shading of aquatic habitat. It also does not include the footprint of the piles themselves, as aquatic habitat would not be available in these locations.

Once the piles are installed, the precast concrete pile caps and concrete columns would be installed followed by the prefabricated 40-foot-tall 8-inch diameter stainless steel columns, the 65-foot-long cross beams, bent roof beams at the top, and finally transverse ridge beams. The following sections discuss the potential for the construction and operation of the proposed installation to result in impacts to natural resources.

FLOODPLAINS AND WETLANDS

As discussed in "Existing Conditions," the landside piles would fall within the Preliminary FIRM (January 2015) 100-year flood elevation. New York City is affected by local (e.g., flooding of inland portions of the city from short-term, high-intensity rain events in areas with poor drainage), fluvial (e.g., rivers and streams overflowing their banks), and coastal flooding (e.g., long and short wave surges that affect shorelines and coastal waters). Because the portion of the Hudson River within the study area is tidal, its water level is mainly controlled by tidal conditions, rather than freshwater inflow from upriver. The floodplain within and adjacent to the installation site is affected by coastal flooding, and the minimal occupation of the floodplain by the concrete columns and steel pipe columns above the ground surface on Gansevoort Peninsula and by the pile caps, concrete columns and steel pipe columns within the Hudson River would not have the potential to affect the floodplain. Upon completion of the pile installation, riprap would be returned to the shoreline such that its elevation is not altered and the existing topography is maintained. Therefore, the proposed installation would not have the potential to result in significant adverse impacts to the 100-year floodplain or result in additional flooding adjacent to the installation.

As discussed in "Existing Conditions," there are no NYSDEC-mapped wetlands in the study area. The only NWI wetlands within the installation site consist of estuarine wetlands with unconsolidated bottom (E1UBL). These NWI-mapped wetlands within the Hudson River are not vegetated and would not be regulated as wetlands under the Clean Water Act. Therefore, the proposed installation would not result in adverse impacts to wetlands.

TERRESTRIAL RESOURCES

Construction and operation of the proposed installation would not result in significant adverse impact on terrestrial resources. Increased noise during construction may lead to avoidance of the immediate vicinity of construction activities. However, wildlife with the potential to use the habitats provided by green spaces that occur along the Hudson River Bikeway would be those tolerant of urban conditions, including noise. While they may temporarily avoid the Gansevoort Peninsula, wildlife would likely relocate to suitable habitat nearby and return to the installation site following completion of construction.

Temporary storage of riprap during upland pile installation would result in temporary disturbance of approximately 8,125 square feet of land on the Gansevoort Peninsula (about 25 feet wide by 325 feet long). Even generalist and disturbance-tolerant native species are unlikely to be supported by the limited habitat available in this area. As this location is entirely impervious and unvegetated, except for some opportunistic plants that grow in the riprap, and currently does not provide suitable habitat for wildlife, riprap storage would not result in adverse impacts to terrestrial resources. The riprap shoreline would be returned to its existing condition once installation is complete, and operation of the proposed installation would not impact terrestrial resources.

AQUATIC RESOURCES

WATER AND SEDIMENT QUALITY

In-water construction activities for the proposed installation have the potential to result in temporary adverse impacts to water and sediment quality due to sediment disturbance from pile driving and movement of construction vessels.

Construction

In-water construction activities for the proposed installation (i.e., pile driving and vessel movement) would occur outside the November 1 to April 30 window in which pile driving is prohibited in Hudson River Park. Pile driving activities would be completed over approximately 30 noncontiguous days within the 4-month in-water construction period.

Sediment-disturbing activities associated with the proposed installation include pile driving and movement of construction vessels. In order to minimize resuspension of bottom sediment, vessel movement in areas where water depths would not be sufficient to allow clearance between the propeller(s) and bottom sediment would be limited to the extent possible. Pile installation generally does not result in significant levels of sediment disturbance (MPCA 2017) and would not result in significant sediment resuspension. During installation of the upland piles and the pile at the edge of the riprap, erosion and sediment control BMPs (e.g., turbidity curtain, shoring box) would be used to minimize the discharge of sediment to the Hudson River.

Sediment disturbance associated with the pile driving and removal of the temporary test piles would be minimal but if it should occur, would have the potential to result in minor, short-term increases in suspended sediment and resuspension and re-deposition of contaminants. Increases in suspended sediment due to pile driving would be temporary and localized, and confined to the immediate vicinity of construction activities. The average tidal current in the Hudson River is 1.4 knots (Geyer and Chant 2006); therefore, any sediment resuspended during construction would move away from the area of in-water activities and would dissipate shortly after the completion of construction. Additionally, the temporary localized increases in suspended sediment during pile driving would be intermittent, followed by a period of no sediment disturbing activity while the next pile is being prepared for installation. The test pile program would take approximately 12 noncontiguous days. Pile driving would be completed during typical work hours over a period of approximately 30 noncontiguous days. Therefore, in-water construction activities due to the proposed installation would not result in significant adverse impacts to water quality. Similarly, any contaminants released to the water column as a result of sediment disturbance would dissipate rapidly, would be consistent with the contamination levels of the immediate vicinity, and would not result in significant adverse long-term impacts to water or sediment quality.

Operation

The spacing of the piles for the proposed installation (about 65 feet) would not affect the movement of tidal waters or the DEC-designated use classification of the Hudson River within the installation site. There would be no stormwater discharge associated with the proposed installation, as there is no platform included with the framework. Long-term maintenance is anticipated to comprise periodic power washing with water, and would not include any soaps or other cleaning agents. Therefore, operation of the proposed installation would not result in adverse impacts to water or sediment quality.

AQUATIC BIOTA

Construction

In-water construction activities for the proposed installation have the potential to result in temporary adverse impacts to fish and macroinvertebrates due to the following:

- Temporary increase in underwater noise from vessel activity and pile driving;
- Temporary increase in suspended sediment; and

- Temporary shading from construction vessels.

In-water pile driving for the proposed installation would be conducted using a barge-mounted crane. Upland piles would be installed concurrently using either barge or land-based equipment. Pile driving would be completed in approximately 30 noncontiguous days, and would occur during typical work hours.

Temporary Increase in Underwater Noise

In-water construction would result in temporary increases in underwater noise from vessel activity and pile driving. Two barges at a time, one for the crane and one for material delivery, would be used during construction of both the foundation and the sculpture's frame; the other construction equipment (e.g., crane/lift/picker) would be on land. The temporary increase in vessel activity over the 12-month construction duration would result in an incremental increase in underwater noise levels in the vicinity of the proposed installation, which could lead to habitat avoidance by fish and some macroinvertebrates. This minimal increase in the number of vessels present in the area, and the associated underwater noise, would be well within the typical range of vessel activity in the lower Hudson River, which is an area of heavy commercial vessel traffic. As such, aquatic organisms in the area are likely acclimated to ambient noise levels and would not be adversely affected by the minimal increase in vessel noise.

Driving and removal of the 12-inch diameter steel pipe test piles and subsequent installation of the 30-inch-diameter and 12-inch-diameter steel pipe piles would result in a temporary increase in underwater noise during pile driving. As recommended by NMFS to minimize noise impacts, it is anticipated that piles within the Hudson River would be installed to the required tip elevation using a vibratory hammer. If the vibratory hammer alone does not advance the pile to the required tip elevation, an impact hammer would be used. Any impact hammering would be conducted in conjunction with a soft start and cushion block to minimize the effects of increased underwater noise. Installation of the piles would result in temporary increased underwater noise levels that would not be expected to exceed the threshold for physiological injury to fishes.[6] The projected noise at the source and distance to relevant thresholds for species in the action area was determined based on the NMFS Greater Atlantic Regional Fisheries Office (GARFO) Acoustic Tool spreadsheet (version updated 11/30/2016). **Tables C-5 through C-8** present the estimated sound levels and distances to species injury and behavioral thresholds associated with the pile installation.

[6] Sound levels associated with vibratory hammering are continuous rather than percussive and would not exceed the threshold of 206 dB SPLpeak that is associated with the onset of recoverable physiological injury to fishes. Impact hammering using a cushion block would likewise not exceed the 206 dB SPLpeak threshold.

Table C-5
Proxy Projects for Estimating Underwater Noise

Project Location	Water Depth (m)	Pile Size (inches)	Pile Type	Hammer Type	Attenuation Rate (dB/10m)
Florence, OR - Siuslaw River	3	30"	Steel Pipe	Vibratory	5
El Cerrito, CA - San Francisco Bay	1-2	12"	Steel Pipe	Vibratory	5
El Cerrito, CA – San Francisco Bay	1-2	12”	Steel Pipe	Cushioned Impact	5

Table C-6
Proxy-Based Estimates for Underwater Noise

Type of Pile	Hammer Type	Estimated Peak Noise Level (dB_{Peak})	Estimated Pressure Level (dB_{RMS})	Estimated Single Strike Sound Exposure Level (dB_{sSEL})
30" Steel Pipe	Vibratory	200	180	167
12" Steel Pipe	Vibratory	182	167	157
12” Steel Pipe	Cushioned Impact	181	166	156

Table C-7
Estimated Distances to Sturgeon/Salmon Injury and Behavioral Thresholds

Type of Pile	Hammer Type	Distance (m) to 206dB_{Peak} (injury)	Distance (m) to sSEL of 150 dB (surrogate for 187 dBcSEL injury)	Distance (m) to Behavioral Disturbance Threshold (150 dB_{RMS})
30" Steel Pipe	Vibratory	NA	44.0	70.0
12" Steel Pipe	Vibratory	NA	24.0	44.0
12” Steel Pipe	Cushioned Impact	NA	22.0	42.0

Table C-8
Estimated Distances to Sea Turtle Injury and Behavioral Thresholds

Type Pile	Hammer Type	Distance (m) to 180 dB RMS (injury)	Distance (m) to 166 dBRMS (behavior)
30" Steel Pipe	Vibratory	10.0	38.0
12" Steel Pipe	Vibratory	NA	12.0
12” Steel Pipe	Cushioned Impact	NA	10.0

Exposure to underwater noise levels of 180 dB re 1µPA RMS can result in injury to sea turtles. Exposure to underwater noise levels of 206 dB Peak and 187 dB cSEL can result in injury to sturgeon. In addition to the “peak” exposure criteria which relates to the energy received from a single pile strike, the potential for injury exists for multiple exposures to noise over a period of time; this is accounted for by the cSEL threshold. The cSEL is not an instantaneous maximum noise level, but is a measure of the accumulated energy over a specific period of time (e.g., the period of time it takes to install a pile). When it is not possible to accurately calculate the distance to the 187 dB cSEL isopleth, the distance to the 150 dB sSEL isopleth is calculated. The further a fish is from the pile being driven, the more strikes it must be exposed to in order to accumulate enough energy to result in injury. At some distance from the pile, a fish is far enough away that, regardless of the number of strikes it is exposed to, the energy accumulated is low enough that there is no potential for injury.

Behavioral effects, such as avoidance or disruption of foraging activities, may occur in sturgeon exposed to noise above 150 dB RMS and sea turtles exposed to noise above 166 dB re 1µPA RMS. It is expected that underwater noise levels would be below the 150 dB RMS threshold for sturgeon at distances beyond a maximum of approximately 230 feet (70 meters) from the pile being installed, and below the 166 dB re 1µPA RMS threshold for sea turtles beyond a maximum of 125 feet (38 meters) from the pile being installed. It is reasonable to assume that sturgeon or sea turtles, upon detecting underwater noise levels above the relevant behavioral threshold, would modify their behavior such that it redirects their course of movement away from the ensonified area and therefore, away from the installation site. If any movements away from the ensonified area do occur, it is extremely unlikely that these movements would affect essential sturgeon and sea turtle behaviors (e.g., foraging, resting, and migration), as the Hudson River is sufficiently large enough to allow sturgeon and sea turtles to avoid the ensonified area while continuing to forage and migrate. The behavioral threshold used for the sturgeon analysis is the standard recommended by NMFS to evaluate potential underwater noise impacts to all fishes, including other anadromous species such as river herring (alewife and blueback herring) and American shad, as well as striped bass and American eel.

For the proposed installation, the distance to the 187 dB cSEL (or 150 dB sSEL) isopleth is no greater than 144 feet (44 meters) for sturgeon and other fish, and the distance to the 180 dB re 1 µPA RMS isopleth is no greater than 33 feet (10 meters) for sea turtles. In order to be exposed to potentially injurious levels of noise during installation of the piles, a fish would need to be within 44 meters and sea turtles would need to be within 10 meters of the pile being driven. This is extremely unlikely to occur as it is expected that fish would modify their behavior at 230 feet (70 meters) and sea turtles would modify their behavior at 125 feet (38 meters) from the pile being installed, and quickly move away from the area before cumulative injury levels are reached, as described above. Given the small distance a fish or sea turtle would need to move to avoid the disturbance levels of noise, and the availability of non-ensonified waters, there would be no significant adverse effect to fish or sea turtles from the temporarily increased noise. Avoidance of the ensonified area by fish and sea turtles would constitute a temporary loss of foraging habitat within the avoided section of the river. The temporary loss of foraging habitat in this location, when compared with the similar suitable habitat that would still be available within the lower Hudson River, would not result in an adverse impact to aquatic biota.

Temporary Increases in Suspended Sediment and Shading

Shading impacts would be minimal from the vessels associated with the proposed installation, as the barges would be small in comparison to the area of the river left unshaded at any given time. There is no submerged aquatic vegetation in the vicinity of the installation site. The proposed installation would result in temporary increases in suspended sediment concentrations from pile installation and vessel movement. As discussed above, any temporary increase in suspended sediment associated with pile driving would be localized and would dissipate shortly after the completion of the sediment disturbing activity. During installation of the upland piles and the pile at the edge of the riprap, sediment resuspension would be minimized through the use of turbidity curtains or other BMPs for erosion and sediment control. Vessels would maintain sufficient distance above the riverbed so that sediment disturbance from their movements would be minimized. Tidal currents would dissipate any resuspended sediments such that re-deposition within or outside the study area would not adversely affect benthic macroinvertebrates or bottom fish.

Life stages of estuarine-dependent and anadromous fish species, bivalves, and other macroinvertebrates are generally tolerant of elevated suspended sediment concentrations and have evolved behavioral and physiological mechanisms for dealing with variable concentrations of suspended sediment (Birtwell et al. 1987, Dunford 1975, Nightingale and Simenstad 2001, LaSalle et al. 1991). Fish are mobile and generally avoid unsuitable conditions such as areas of increased suspended sediment. Any sediment suspension during in-water work would be temporary, minimal, and localized, and would be well below physiological impact thresholds of adult and larval estuarine fish and benthic macroinvertebrates. Pile driving is an intermittent activity and would therefore have limited effect on suspended sediment concentrations within any given location during the duration of construction. Fish and macroinvertebrates would be expected to return to the installation site following completion of construction.

Operation

Installation of the piles would result in the permanent loss of approximately 36.8 square feet of benthic habitat and benthic macroinvertebrates located within the footprint of the piles that are unable to move from the area of disturbance. Even if double pile foundations were required, the amount of bottom habitat lost would only be 71.1 square feet. In either case, the loss of benthic macroinvertebrates within this footprint would be minimal and would not significantly impact the food supply for fish foraging in the area. The new piles, which would be pre-cast with a textured form liner pattern below the water line to accommodate marine growth, would provide additional vertical surface for algae and encrusting organisms (such as mussels and other bivalves), and may provide suitable refuge for fish that prefer structured habitat. If single pile foundations are used, the pile caps associated with the proposed installation would result in approximately 154.4 square feet of over-mudline coverage (approximately 28.2 square feet per pile cap, spaced 65 feet apart at center). If double pile foundations are used, the pile caps would result in a maximum of 475.6 square feet of over-mudline coverage (approximately 78 square feet per pile cap, spaced 65 feet apart at center). The pile caps would be located at least one foot above the mudline, and sunlight may not be able to reach benthic habitat beneath the pile caps closest to the bottom. This minimal amount of aquatic habitat impacted due to shading would not result in significant adverse impacts to aquatic biota. Additionally, the pile caps may offer small areas of structure to a portion of the river where there is none. The framework would not result in substantial overwater coverage, as each steel column would be less than one foot in diameter and elevated above the water's surface. Other than the safety lighting, no nighttime lighting (i.e., architectural lighting) is associated with the proposed installation. The minimal occupation of the river bottom by the piles (up to 71.1 square feet or 0.002 acres) and minimal over-mudline coverage by the pile caps (0.011 in total), would result in a minimal change in foraging habitat for striped bass and other fish species, and would not adversely affect the suitability of this portion of the Hudson River as winter flounder spawning habitat.

The safety lighting would be mounted on piles that extend above the surface of the water, and would be similar to the safety lights that already exist along the shores of Manhattan. Therefore, it would not result in illumination that would be detrimental to fish or birds. For these reasons, the proposed installation would not result in significant adverse impacts to the aquatic community.

ESSENTIAL FISH HABITAT

For the reasons identified above and described in detail in the EFH assessment included in **Appendix B**, the proposed installation would not result in significant adverse impacts to water quality, aquatic habitat, or aquatic biota. Therefore, the proposed installation would not result in significant adverse impacts to EFH in the study area.

THREATENED OR ENDANGERED SPECIES, OR SPECIAL CONCERN SPECIES

The loss of up to 71.1 square feet of river bottom in the footprint of the piles would constitute a de minimis loss of potential foraging habitat for shortnose and Atlantic sturgeon when compared to the amount of similar habitat in the lower Hudson River, and would not adversely impact shortnose and Atlantic sturgeon or sea turtles.

Overall, sea turtles have the potential to occur within the study area on rare occasions, and only as transient individuals, rather than for long-term occupation for breeding, wintering, or growth and development. Noise from pile driving would be minimized by using a vibratory hammer, and using a soft start and cushion block when driving with an impact hammer is necessary. Therefore, the proposed installation may affect but is not likely to adversely affect sea turtles.

The proposed installation would not result in significant adverse impacts to critical habitat for Atlantic sturgeon. Given the location of the installation site, in-water construction activities would not occur in the vicinity of hard bottom substrate in low salinity waters, and the installation of piles would not remove any soft substrate used for juvenile foraging and physiological development. As the pile installation would only produce minimal increases in suspended sediment, it would have insignificant effects on water depth, water flow, dissolved oxygen levels, salinity, temperature, or the ability for Atlantic sturgeon to migrate in the vicinity of the proposed installation. The sculpture would not add a physical barrier to passage between the river mouth and spawning sites necessary to support unimpeded movement of adults to and from spawning sites, seasonal movement of juveniles, and staging, resting, or holding of subadults or spawning condition adults. The loss of 0.002 acres of soft bottom habitat in the footprint of the piles would modify designated critical habitat for Atlantic sturgeon. However, this represents a small area relative to the thousands of acres of available foraging habitat suitable for Atlantic sturgeon in the Hudson River. The installation site is also located in shallow waters less suitable for foraging compared to the deep waters of the navigation channel.

Because shortnose and Atlantic sturgeon are more likely to occur in deep waters of the Hudson River in the vicinity of the installation site during migration to and from upriver foraging, overwintering, and/or spawning grounds, it is unlikely that individuals of either species would occur at the installation site except as occasional transients. Migration of Atlantic sturgeon into the Hudson River during spring and migration from the river during summer and early fall would not be obstructed by pile driving activities, which would occur in shallow waters and would not result in increased underwater noise in the deeper navigation channel. Since the aquatic resource impacts associated with the proposed installation's in-water construction activities would be localized, including elevated noise levels from pile driving via vibratory hammer and cushioned impact hammer, if necessary, the deep channel habitat typically used by shortnose and Atlantic sturgeon would not be adversely impacted during construction of the proposed installation. Outside the restricted period, noise levels associated with behavioral disturbance (187 dB cSEL or 150 dB sSEL) would not adversely affect the deep channel habitat where sturgeon would most likely be found. As discussed above, it is expected that underwater noise levels would be below the 150 dB RMS threshold for sturgeon at distances beyond a maximum of approximately 230 feet (70 meters) from the pile being installed, and below the 166 dB re 1μPA RMS threshold for sea turtles beyond a maximum of 125 feet (38 meters) from the pile being installed.

It is reasonable to assume that sturgeon or sea turtles, upon detecting underwater noise levels above the relevant behavioral threshold, would modify their behavior such that it redirects their course of movement away from the ensonified area and therefore, away from the installation site. In order to minimize exposure of sturgeon to elevated noise levels during pile driving, the in-river piles would be driven to their final depth using a vibratory hammer. If necessary, the piles would be seated using an impact hammer, which would be used in conjunction with a soft start and cushion block to attenuate noise. The proposed installation would only require short periods of pile driving, so the daily duration of elevated underwater noise reaching the behavioral threshold would be relatively short. The threshold for injury would not be reached during pile driving for either the 30-inch or 12-inch diameter piles, as described above (see **Tables C-7 and C-8**). If present in the area, shortnose and Atlantic sturgeon would likely avoid the area within a maximum of 230 feet of pile installation (where the behavioral threshold could be met), but would be expected to return following completion of pile driving. The temporary loss of potential foraging habitat during pile driving would not result in significant adverse impacts to sturgeon. The permanent loss of approximately 36.8 square feet, or 71.1 square feet if double pile foundations are required, of benthic habitat and benthic macroinvertebrates located within the footprint of the piles would be minimal and would not significantly impact foraging opportunities for sturgeon in the area. Therefore, the installation may affect but would not likely adversely affect shortnose or Atlantic sturgeon.

SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The Lower Hudson Reach was designated as an SCFWH primarily due to its use as wintering habitat by large numbers of juvenile striped bass. Adult striped bass enter the Hudson River to spawn during spring and summer but spend most of their time in coastal waters, not within the study area for the proposed installation. Spawning occurs in fresh water far upstream of the installation site and would not be adversely affected by the construction or operation of the proposed installation. Because striped bass spawning occurs well upriver of the installation site, the majority of larval striped bass are also located upstream of the installation site; the highest abundance of juvenile striped bass is also upstream of the study area. Because striped bass larvae and juveniles are widely distributed throughout the Hudson River, with peak abundance upstream of the installation site, avoidance of the installation site during construction would not result in adverse impacts to the striped bass population. Due to the restriction of pile driving between November 1 and April 30 in Hudson River Park, when juveniles are using the area for wintering habitat, there is limited potential for in-water construction activities to result in adverse impacts to striped bass and other species.

The de minimis occupation of the river bottom by the piles (up to 71.1 square feet or 0.002 acres) and minimal over-mudline coverage by the pile caps (0.011 in total), would result in a minimal change in foraging habitat for striped bass and other fish species, and would not adversely affect the suitability of this portion of the Hudson River as winter flounder spawning habitat. As described above, the construction and operation of the proposed installation also would not adversely impact water or sediment quality. Therefore, the proposed installation would not result in significant adverse impacts to the Lower Hudson Reach SCFWH.

HUDSON RIVER PARK ESTUARINE SANCTUARY

At the time the Hudson River Park Act was passed and the Sanctuary created, Hudson River Park included a mix of commercial, industrial, and collapsing piers. The Act made it clear that a spectrum of uses – recreational, commercial, and municipal, and a combination of piers, docks, platforms, and other structures, including new construction, were contemplated for the Park. The designation of the Park as an Estuarine Sanctuary acknowledged the importance of the Hudson River ecosystem as well as the need to allow public access and management opportunities in the Park’s boundaries in a manner which promotes and preserves aquatic resources. This designation was intended to ensure that the needs of various park uses were balanced. The Park is meant to encourage, promote, and expand public access to the Hudson River, promote water-based recreation, and enhance the natural, cultural, and historic aspects of the Hudson River.

The design and construction of the proposed installation would be protective of aquatic resources and would be consistent with the intended uses of the Hudson River Park Estuarine Sanctuary. The proposed installation is a sculpture, and would promote the arts and enhance the passive public open space within Hudson River Park with public art that references the cultural and historic aspects of the Hudson River. . The Hudson River Park Trust has confirmed that the sculpture would not impede future construction of the Gansevoort Peninsula as a landscaped public park, nor limit construction of the planned beach on the Peninsula's southern edge. The sculpture's design would also allow for future access to and from the water once the Peninsula is fully designed for recreational use.

The use of a framework instead of an enclosed structure and the very small over-mudline coverage of the pile caps (total of up to 475.6 square feet, but spread evenly among 6 pile caps spaced about 65 feet apart) would allow light to continue to penetrate the water column, resulting in very minimal potential effects to aquatic resources from shading. Installation of the piles would use a vibratory hammer to the extent possible, and cushion blocks if impact hammering is required, in order to minimize the potential effects of increased underwater noise during construction. Sediment resuspension would be minimal and localized, and would only occur during pile driving. The piles would constitute up to 71.1 square feet of bottom habitat loss, which is a de minimis loss compared to the amount of similar habitat that would continue to be available in the Park and in the Hudson River.

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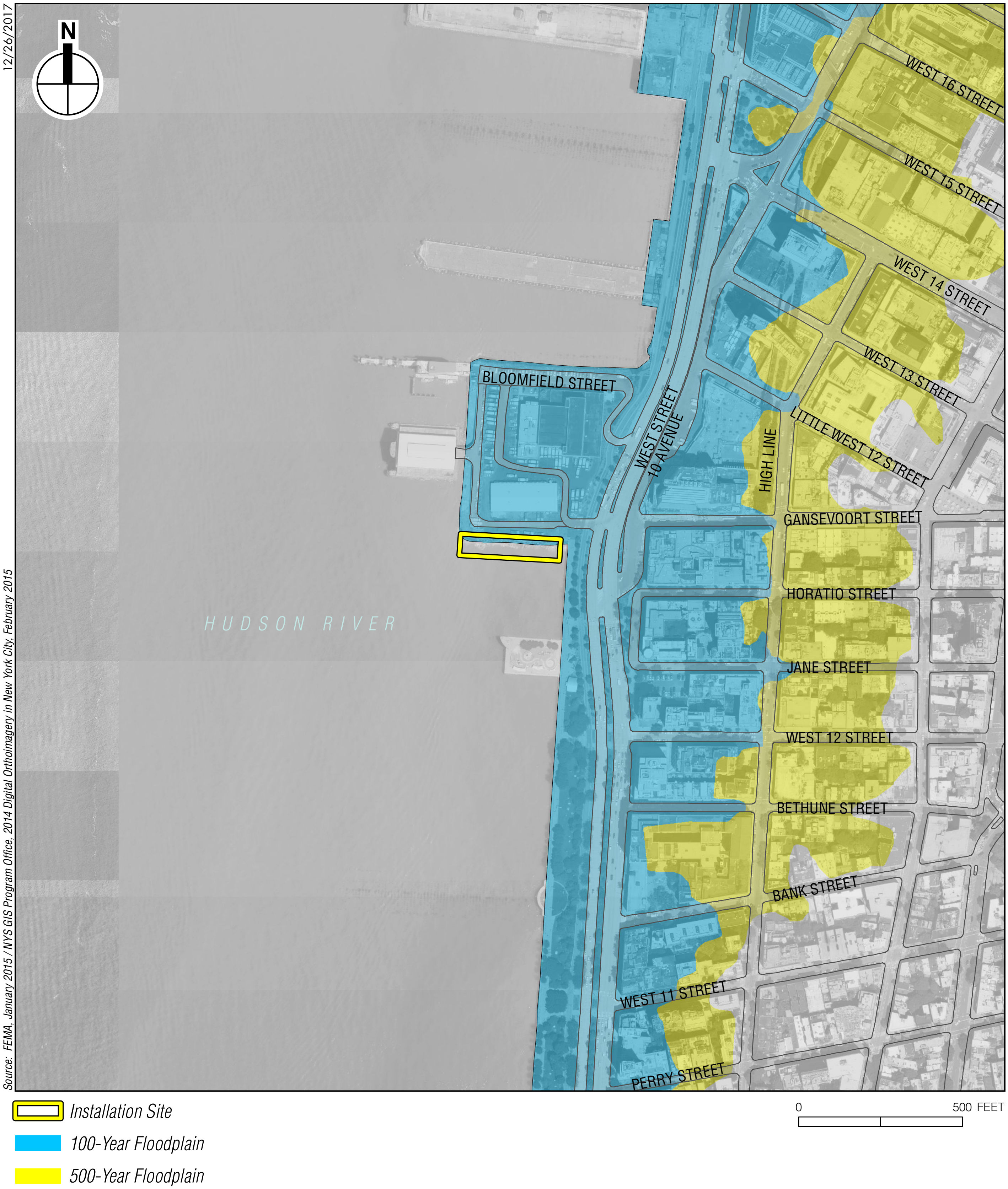
12/26/2017

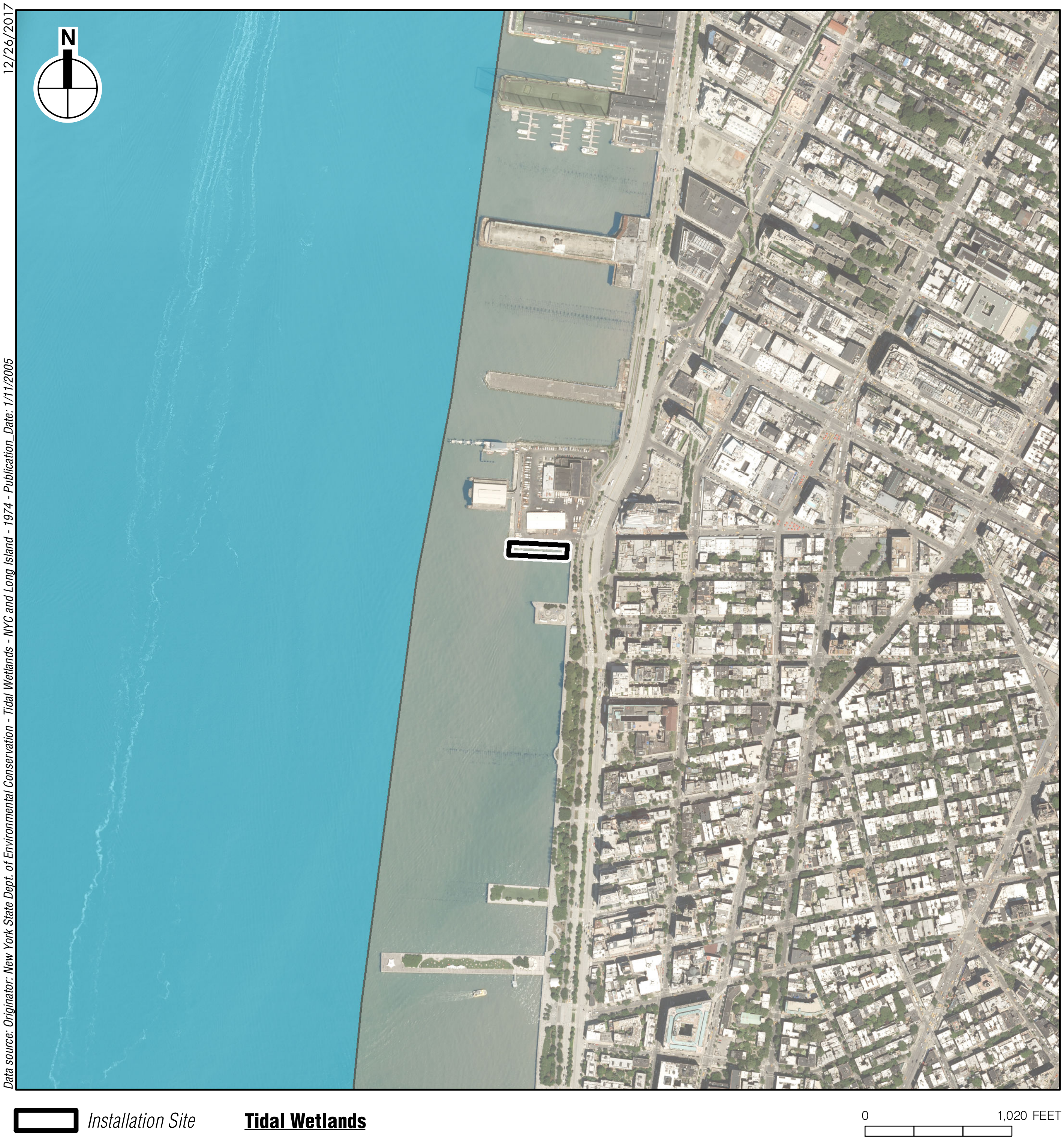


Source: FEMA, January 2015 / NYS GIS Program Office, 2014 Digital Orthoimagery in New York City, February 2015

DAY'S END PUBLIC ART INSTALLATION AT GANSEVOORT PENINSULA

Floodplains

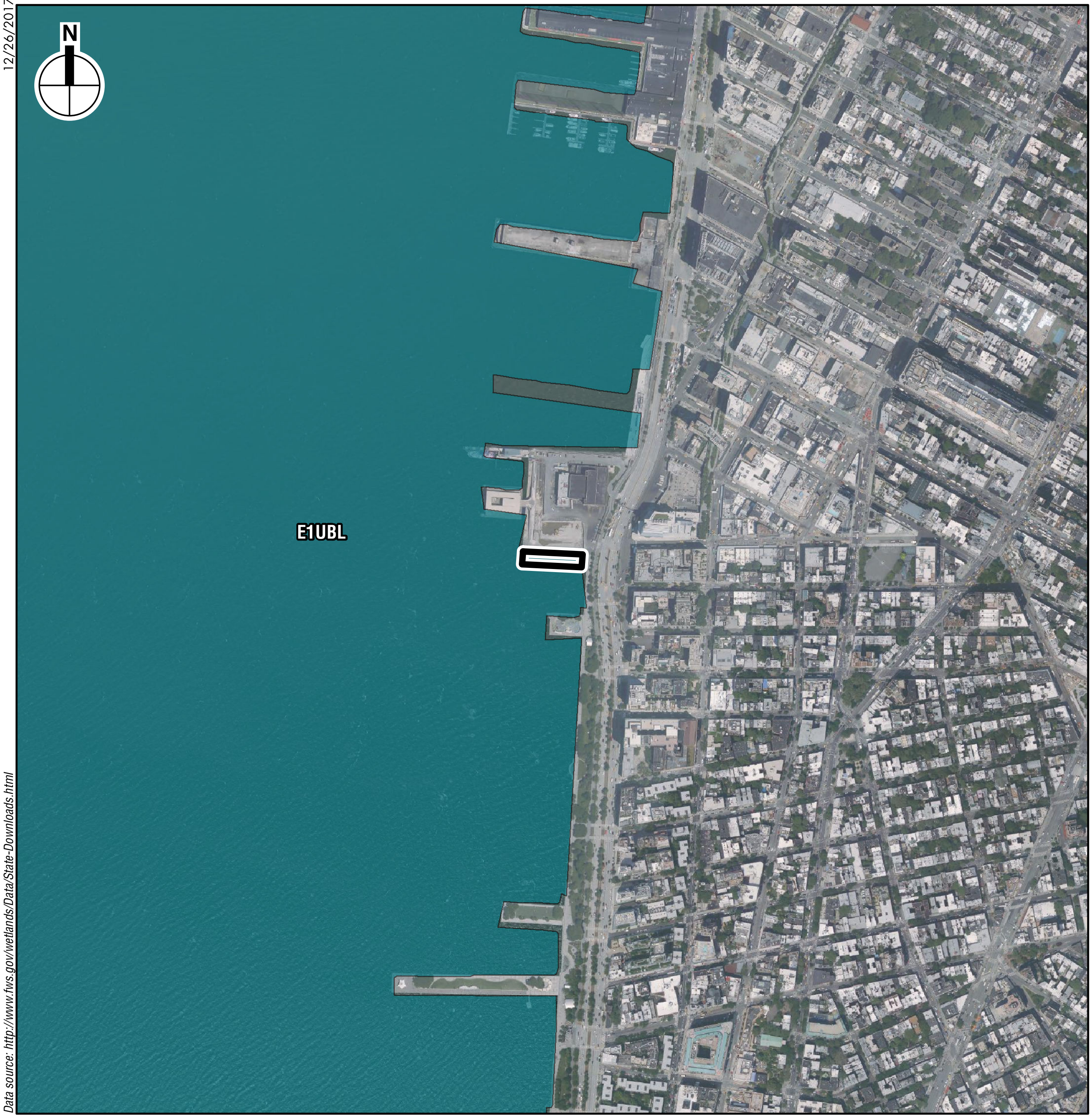
Figure C-1



New York State Department of Environmental Conservation
Tidal Wetlands

DAY'S END PUBLIC ART INSTALLATION AT GANSEVOORT PENINSULA

Figure C-2



12/26/2017

Data source: http://www.fws.gov/wetlands/Data/State-Downloads.html

Installation Site

Wetland Type (Map Codes)

Estuarine and Marine Deepwater (E1, M1)

0 1,230 FEET

U.S. Fish and Wildlife Service
National Wetlands Inventory

DAY'S END PUBLIC ART INSTALLATION AT GANSEVOORT PENINSULA

Figure C-3