Chapter 11: Natural Resources

11.1 INTRODUCTION

This chapter of the Environmental Impact Statement (EIS) presents the analysis the Federal Railroad Administration (FRA) and the New Jersey Transit Corporation (NJ TRANSIT) conducted of the potential impacts from the Hudson Tunnel Project on natural resources in New Jersey (including in the Meadowlands), the Hudson River, and New York. Natural resources evaluated include floodplains, wetlands, groundwater, surface and navigable waters, water quality, aquatic biota, terrestrial resources, and threatened or endangered species and species of special concern. The Port Authority of New York and New Jersey (PANYNJ), in its role as Project Sponsor, has accepted and relied on the evaluations and conclusions of this chapter.

This chapter reflects the following changes made since the Draft Environmental Impact Statement (DEIS) for the Hudson Tunnel Project:

- The chapter includes updated information related to the affected environment and any related updates to the analysis of potential impacts.
- The chapter incorporates design modifications related to the permanent features of the Project (e.g., modifications to surface tracks and tunnel alignment) and changes to construction methods and staging. In particular, this chapter reflects the reduction in impacts to wetlands in the Meadowlands and changes to construction methods in the Hudson River.
- The chapter includes updated information related to consultation in accordance with applicable natural resources regulations.

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11.2 ANALYSIS METHODOLOGY

During development of this EIS, FRA and NJ TRANSIT developed methodologies for evaluating the potential effects of the Hudson Tunnel Project in coordination with the Project's Cooperating and Participating Agencies (i.e., agencies with a permitting or review role for the Project). The methodologies used for analysis of natural resources are summarized in this chapter.

11.2.1 REGULATORY CONTEXT

Following completion of the DEIS, the PANYNJ became the Project Sponsor for the Hudson Tunnel Project (see Chapter 1, "Purpose and Need," Section 1.1.2, for more information). Consistent with the roles and responsibilities defined in Section 1.1.1 of that chapter, as the current Project Sponsor, the PANYNJ will comply with mitigation measures and commitments identified in the Project's Record of Decision (ROD).

A number of Federal and state laws and regulations and Federal Executive Orders (EOs) apply to natural resources within the vicinity of the Project site, including the following. Federal and state regulations related to coastal zone management are discussed in Chapter 21, "Coastal Zone Consistency."

11.2.1.1 FEDERAL

- ***Clean Water Act (33 United States Code (USC) §§ 1251-1387):*** The Clean Water Act, also known as the Federal Water Pollution Control Act, is intended to restore and maintain the chemical, physical, and biological integrity of U.S. waters. It regulates point sources of water pollution (i.e., discharges of municipal sewage, industrial wastewater, stormwater, and the discharge of dredged or fill material into navigable waters and other waters of the U.S.) and non-point source pollution (i.e., runoff from streets, agricultural fields, construction sites, and mining). Section 404 of the Clean Water Act requires authorization from the Secretary of Army, acting through the U.S. Army Corps of Engineers (USACE), before dredged or fill material may be discharged into waters of the United States.
- ***Rivers and Harbors Act of 1899 (33 USC § 403):*** Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the USACE for: the construction of any structure in or over any navigable waters of the U.S.; the excavation from or deposition of material in these waters; or any obstruction or alteration in these waters. The purpose of this Act is to protect navigation and navigable channels.
- ***Executive Order (EO) 11990, Protection of Wetlands:*** In accordance with EO 11990, and U.S. Department of Transportation (USDOT) Order 5660.1a, *Preservation of the Nation's Wetlands*, Federal agencies must avoid undertaking or providing assistance for new construction in wetlands unless there is no practical alternative to such construction and the proposed action includes all practicable measures to minimize harm to the wetland.

- ***Floodplain Management EO 11988:*** EO 11988 requires Federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. USDOT Order 5650.2, *Floodplain Management and Protection*, contains policies and procedures for implementing EO 11988. For actions with a significant encroachment in the floodplain, the USDOT Order requires a finding that the proposed action is the only practicable alternative and that an evaluation was conducted to identify whether other alternatives are available to avoid or reduce adverse impacts on the floodplain.
- ***Magnuson-Stevens Fishery Conservation and Management Act (16 USC §§ 1801-1883):*** The Magnuson-Stevens Act was established to protect and restore productive fisheries and rebuild depleted stocks in the U.S. The law establishes Essential Fish Habitat (EFH) for nearly 1,000 species of fish. For each species, the EFH is the waters and substrate necessary for fish for spawning, breeding, feeding, or growth to maturity. This law requires Federal agencies to consult with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA-NMFS) on Federal actions that may adversely affect areas designated as EFH. FRA has completed consultation with NMFS in accordance with the Magnuson-Stevens Fishery Conservation and Management Act, the results of which are discussed below in Sections 11.6.3.2, 11.7.3.2, and 11.9.2.
- ***Marine Mammals Protection Act of 1972 (16 USC § 31) :*** The Marine Mammals Protection Act prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.
- ***Fish and Wildlife Coordination Act (PL 85-624; 16 USC §§ 661-667d):*** The Fish and Wildlife Coordination Act entrusts the Secretary of the Interior and NOAA 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 (such as a dam) of a body of water.
- ***Section 1424(e) of the Safe Drinking Water Act (PL 93-523):*** Section 1424(e) of the Safe Drinking Water Act of 1974 provides special protection for aquifers that are the sole or principal drinking water resource for an area.
- ***Endangered Species Act of 1973 (16 USC §§ 1531-1544):*** The Endangered Species Act prohibits the importation, exportation, taking, possession, and other activities involving species covered under the Act. The Act also provides for the protection of critical habitats on which endangered or threatened species depend for survival. This Act requires Federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) and NOAA-NMFS for any actions that may jeopardize threatened or endangered species, or destroy or adversely modify their critical habitats. FRA has completed consultation with NMFS and USFWS in accordance with Section 7 of the Endangered Species Act (ESA), the results of which are discussed below in Section 11.6.3.4, Section 11.7.3.4, and Sections 11.8 and 11.9.
- ***EO 13112, Invasive Species:*** EO 13112 requires Federal agencies to prevent, to the extent practicable and permitted by law, the introduction of invasive species and provide for their control.
- ***Migratory Bird Treaty Act (50 CFR Parts 10, 20, 21, EO 13186):*** The Migratory Bird Treaty Act makes it unlawful to pursue, hunt, take, capture, kill, or sell birds listed therein. Over 800 species are currently protected under the Act. FRA has completed consultation with USFWS

in accordance with the Migratory Bird Treaty Act, the results of which are discussed in Section 11.6.2.5 and Sections 11.8 and 11.9.

- ***Bald and Golden Eagle Protection Act (16 USC §§ 668-668c):*** The Bald and Golden Eagle Protection Act prohibits anyone without a permit issued by the Secretary of the Interior, acting through USFWS, from "taking" bald or golden eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." FRA has completed consultation with USFWS in accordance with the Bald and Golden Eagle Protection Act, the results of which are discussed in Sections 11.6.2.6 and Sections 11.8 and 11.9.

11.2.1.2 NEW JERSEY

- ***Tidelands Act (New Jersey Statutes Annotated (NJSA) 12:3-1):*** Under this act, a grant, lease, or license is required from the State of New Jersey for activities on state-owned lands that are now tidally flowed, or were formerly tidally flowed.
- ***Freshwater Wetlands Protection Act (New Jersey Administrative Code (NJAC) 7:7A):*** These regulations govern activities within freshwater wetland areas of New Jersey. Freshwater wetland areas within the Hackensack Meadowlands District are not subject to the rules at NJAC 7:7A but are subject to USACE Section 404 regulations under the Clean Water Act.
- ***Surface Water Quality Standards for New Jersey Waters (NJAC 7:9B):*** These standards establish the designated uses to be achieved, provide management guidelines, and specify the water quality criteria necessary to protect the state's waters.
- ***New Jersey Pollutant Discharge Elimination System (NJPDES)(NJAC 7:14A-1)***: Under Section 402 of the Clean Water Act, stormwater discharges to the waters of the U.S. require authorization by a National Pollutant Discharge Elimination System (NPDES) permit or pursuant to an authorized state permit program. New Jersey has established the New Jersey Pollutant Discharge Elimination System (NJPDES) program as authorized under the Clean Water Act.
- ***Stormwater Management Rules (NJAC 7:8, Stormwater Management):*** The New Jersey Department of Environmental Protection (NJDEP) implements the Stormwater Management Rules through the review of permits issued by the Division of Land Use Regulation (i.e., Flood Hazard Area, Freshwater Wetlands, the Coastal Area Facility Review Act (CAFRA), Waterfront Development and Coastal Wetlands). These rules establish the stormwater management design and performance standards for new (proposed) development.
- ***Water Supply Management Act (NJSA 58:1A):*** This act declares that water resources are public assets of the state, held in trust by the state for its citizens in order to maintain an adequate supply of water, present and in the future. NJDEP implements the Act through the Water Supply Allocation Permit rules (NJAC 7:19) through which the agency manages water diversion such as construction dewatering, water quantity and quality, issues permits, and handles drought warnings, water emergencies and water quality emergencies.
- ***Soil Erosion and Sediment Control Act (NJSA 4:24-43 et seq.):*** Any project proposing more than 5,000 square feet of soil disturbance must have a Soil Erosion and Sediment Control (SESC) Plan certified by the local district to ensure that the project meets the Standards for Soil Erosion and Sediment Control in New Jersey.
- ***Endangered and Nongame Species Act (NJSA 23:2A-2 et seq.; NJAC 7:25-4):*** This act protects species or subspecies of wildlife indigenous to the state listed in the regulations.

11.2.1.3 NEW YORK

- ***Tidal Wetlands Act (Article 25, New York Environmental Conservation Law (ECL); 6 New York Codes, Rules and Regulations (NYCRR) Part 661):*** Tidal wetlands regulations apply anywhere tidal inundation occurs on a daily, monthly, or intermittent basis, including along the tidal waters of the Hudson River. The regulations govern activities within mapped wetlands or a designated adjacent area.
- ***Protection of Waters (Article 15, Title 5, ECL; 6 NYCRR Part 608):*** The Protection of Waters permit program regulates activities that affect surface waters (streams, lakes, and ponds) of New York State. Surface water and groundwater quality standards and effluent limitations in New York State are regulated pursuant to 6 NYCRR Parts 701 and 703. Part 701, Classifications–Surface Waters and Groundwater, assigns specific categories to New York waters. These standards establish the designated uses to be achieved and specify the water quality criteria necessary to protect surface waters.
- **State Pollutant Discharge Elimination System *(SPDES) (ECL Article 3, Title 3; Article 15; Article 17, Titles 3, 5, 7, 8; Article 21; Article 70, Title 1; Article 71, Title 19; Implementing Regulations 6 NYCRR Part 750)***: New York State has established the State Pollutant Discharge Elimination System (SPDES) program for controlling wastewater and stormwater discharges to groundwaters and surface waters; the SPDES program is an authorized program under 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]; 6 NYCRR Part 182)***: These regulations prohibit the taking, import, transport, possession, or selling of any endangered or threatened species of fish or wildlife, or any hide, or other part of species listed in the regulations.
- **Grants of Lands Under Water *(Public Lands Law, Section 75)***: Title of the bed of numerous bodies of water is held in trust for the people of the State of New York under the jurisdiction of the Office of General Services. Section 75 of the Public Lands Law authorizes grants, leases, easements and lesser interests, including permits, for the use of state-owned land underwater consistent with the public interest in the use of state-owned lands underwater for purposes of navigation, commerce, fishing, bathing, and recreation; environmental protection; and access to the navigable waters of the state; with due regard for the need of affected owners of private property to safeguard their property. Permission may be required to build on these lands, including docks, boathouses or marinas, or to install utilities over or through.
- **Hudson River Park Act (New York Legislature Chapter 592, Section 7845):** Enacted by the New York Legislature in June 1998, this legislation formally designated Hudson River Park and established the Hudson River Park Trust (HRPT) to continue the planning, construction, management, and operation of the park. In approving the Act, the New York State Legislature found development of Hudson River Park to be a matter of state concern and in the interest of the people of the state. Further, the Legislature found that the park will enhance the ability of citizens of the state to enjoy the Hudson River, one of the great natural and public resources of the state. Because the marine environment of the park is known to provide critical habitat for striped bass and other aquatic species, the Hudson River Park Act noted that it is in the public interest to protect and conserve this habitat. The Act stated the creation of the park will result in quality of life and economic benefits and will encourage, promote, and expand public access to the river, promote water-based recreation, and enhance the natural, cultural and historic aspects of the Hudson River. Finally, the Legislature determined it is in the public interest to encourage park uses and allow limited commercial uses in the park. The Act designated approximately 400 acres of in-water area within Hudson River Park's boundaries as an Estuarine Sanctuary. The Sanctuary Management Plan, developed by HRPT, 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. It provides guidance on balancing the needs of these various park uses and identifies 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. It includes goals for improving waterfront access, and environmental education and research. The Act was amended in 2018 to allow HRPT to enter into a lease for a new below-grade rail tunnel beneath the park between West 27th and West 30th Streets (i.e., the new Hudson River Tunnel included as part of the Preferred Alternative for the Hudson Tunnel Project).

11.2.2 ANALYSIS TECHNIQUES

This chapter presents an evaluation of existing conditions for natural resources using a range of data sources, including those listed below:

- USFWS National Wetland Inventory (NWI) maps
- USFWS Information for Planning and Consultation (IPaC) system results
- U.S. Geological Survey (USGS) topographic maps
- Soils data and maps, U.S. Department of Agriculture (USDA) Web Soil Survey
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs)
- NMFS EFH information
- Coordination with USFWS and NMFS
- NJDEP GeoWeb database tideland maps, wetland maps, and floodplain maps
- Information from NJDEP Office of Natural Lands Management
- NJDEP, Natural Heritage Program (NJNHP)
- New Jersey Sports and Exposition Authority (NJSEA), Natural Resources Management Department
- New York State Department of Environmental Conservation (NYSDEC) tidal wetlands maps
- NYSDEC Environmental Resource Mapper information
- NYSDEC 2000-2005 Breeding Bird Atlas results
- NYSDEC Herp Atlas Project results
- New York State Department of State (NYSDOS) Significant Coastal Fish and Wildlife Habitats maps and information
- Information from New York Natural Heritage Program (NYNHP)
- New York City Department of Environmental Protection (NYCDEP) Harbor Water Quality Survey reports
- Hudson River Estuary Program
- Information gathered for the Access to the Region's Core (ARC) Project Final Environmental Impact Statement (FEIS)
- Results from field reconnaissance
- Published and unpublished studies (see the references listed in Section 11.10 below)

This chapter presents FRA and NJ TRANSIT's assessment of impacts to natural resources from the Preferred Alternative on the basis of results of empirical studies conducted by other researchers within or near the study area and other relevant studies performed in other geographic

areas that relate to the Preferred Alternative, as well as through consultation with regulatory and resource agencies such as NMFS, USFWS, NYSDEC, NJDEP, the U.S. Environmental Protection Agency (EPA), and the USACE (also see **Appendix 11** for agency correspondence related to natural resource issues and consultation).

11.2.3 STUDY AREAS

The study areas for the assessment of terrestrial natural resources consists of the Project site as described in Chapter 4, "Analysis Framework," including all areas where the Preferred Alternative would have construction activities or permanent Project features and where the North River Tunnel rehabilitation activities would occur. Where resources such as wetlands or other ecological communities extend beyond the Project site and the Preferred Alternative would have the potential to affect these resources, the study area includes adjacent areas.

The study area for aquatic resources includes Penhorn Creek in the vicinity of the surface alignment in New Jersey, and in the Lower Hudson River where the new tunnel and low-cover area would be located and where the North River Tunnel rehabilitation would occur. Penhorn Creek is a tidal tributary of the Hackensack River.

11.3 AFFECTED ENVIRONMENT: EXISTING CONDITIONS

11.3.1 NEW JERSEY

The western half of the study area within New Jersey is located within the New Jersey Meadowlands, a large complex of tidal marshes and impounded wetlands surrounded by developed areas that include paved parking areas, warehouse and industrial development, and transportation infrastructure such as major highways and secondary roads. Natural areas, including wetland habitats and adjacent upland habitats have been documented, by NJSEA and NJDEP, to provide habitat for many resident and migratory species, including some species that have been listed by state or Federal regulatory agencies as being of special concern, threatened, or endangered. The following sections describe the natural resources within and outside the Meadowlands study area.

11.3.1.1 FLOODPLAINS

A floodplain is any land area susceptible to being inundated by riverine or coastal flood waters. The 100-year floodplain is the area of that has a 1 percent chance of flooding in any given year. That area is mapped by FEMA on its FIRMs. FEMA's maps also indicate the Base Flood Elevation (BFE), which is the height of flooding that can be expected in the 100-year flood within the floodplain. The BFE is measured not from ground or sea level, but from a fixed tidal benchmark established by NOAA called the North American Vertical Datum of 1988 (NAVD88).

As shown in **Figure 11-1**, based on the preliminary FIRM dated January 30, 2015 and pending National Flood Hazard data dated August 28, 2019, most of the New Jersey study area, other than the land on the Palisades above the Preferred Alternative's rock tunnel alignment is within the 100-year floodplain, mapped as Zone AE.[1] Small portions of the study areas are within the 500-year floodplain (the area with a 0.2 percent chance of flooding in a given year). Conservatively, the approximate elevation of the 500-year floodplain is +11.7 feet NAVD88 on the basis of the 500-year stillwater elevation at the confluence of Penhorn Creek with the Hackensack River.[2] West of Tonnelle Avenue in North Bergen, New Jersey, the Project site is within the 100-year floodplain

[1] FEMA 2021.

[2] FEMA 2014.

3/30/21

HUDSON TUNNEL PROJECT

Flood Hazard Areas, Preliminary FIRM: New Jersey Study Area

Figure 11-1

and BFEs range from 4 to 9 feet NAVD88. Between Tonnelle Avenue and the east side of the Palisades, the Project site is not within the 100-year or 500-year floodplain. East of the Palisades the Project site is within the Hudson River floodplain and BFEs range from 9 to 11 feet (**Figure 11-1**). The BFE within the Hudson River is 16 feet and is mapped in the preliminary FIRM as Zone VE, indicating that it is an area subject to additional hazards due to storm-induced velocity wave action, a 3-foot or higher breaking wave.

The dominant source of flooding in the Hackensack River is tidal surge emanating from the Atlantic Ocean through various waterbodies to Newark Bay and the Hackensack River mouth. Tidal flooding west of Tonnelle Avenue propagates from the Hackensack River upstream along Penhorn Creek, a tributary of the Hackensack River, past the Northeast Corridor (NEC) track embankment, which crosses the creek approximately 2.2 miles upstream of its mouth. East of the Palisades, tidal surge from the Atlantic Ocean, and to a lesser extent wave runup,[3] is the primary cause of flooding in the study area adjacent to the Hudson River.[4]

11.3.1.2 WETLANDS

The analysis of wetlands in the New Jersey study area included review of the NWI published by USFWS and of NJDEP wetland maps, and a field reconnaissance in fall 2016. The NWI shows large areas of estuarine wetlands and smaller areas of freshwater wetlands within the New Jersey study area in the Hackensack Meadowlands (see **Figure 11-2**).

The freshwater wetlands shown on the NWI are riverine unknown perennial wetlands that have unconsolidated bottoms and are permanently flooded (designated by USFWS as R5UBH). As shown on the NWI, this R5UBH wetland is mapped on Penhorn Creek as it crosses the NEC east of County Road in Secaucus, New Jersey and the Project alignments and again near Secaucus Road in Secaucus, New Jersey, and on a wetland area immediately north of the NEC near the New York, Susquehanna & Western Railway (NYSW) right-of-way at the eastern edge of the Meadowlands.

The estuarine tidal wetlands within the study area (see **Figure 11-2**) include an intertidal wetland (designated by USFWS as E2EM5P6) spanning both sides of the NEC from County Road to Penhorn Creek that is irregularly flooded, oligohaline, (i.e., brackish water with a salinity ranging from 0.5 to 3.0 parts per thousand [ppt]), and dominated by emergent *Phragmites australis* (a large perennial reed species that is invasive within the U.S.). Outside Penhorn Creek, the NWI indicates large areas of oligohaline intertidal wetlands along both sides of the NEC east of Secaucus Road that are irregularly flooded, dominated by emergent *Phragmites australis*, and partially drained and ditched (E2EM5Pd6). A wetland mitigation project that NYSW is implementing within its right-of-way in compliance with a Department of Army permit is located within a portion of the area mapped as E2EM5Pd6. More information on the NYSW mitigation site is provided in Section 11.3.1.2.1 below. In addition, the NWI indicates subtidal wetlands with the following characteristics in small areas close to Penhorn Creek and County Road: subtidal wetlands with an unconsolidated bottom that is permanently flooded, oligohaline, and excavated (E1UBLx6); and subtidal wetland with an unconsolidated bottom that is permanently flooded (E1UBL). Field reconnaissance conducted in fall 2016 confirmed these wetland types and approximate locations.

NJDEP-mapped wetlands are located in the study area (see **Figure 11-3**). These wetlands are designated by NJDEP with the land use/land cover code and "*Phragmites* Dominate Interior Wetlands." They are located along both sides of the NEC in the Meadowlands area between

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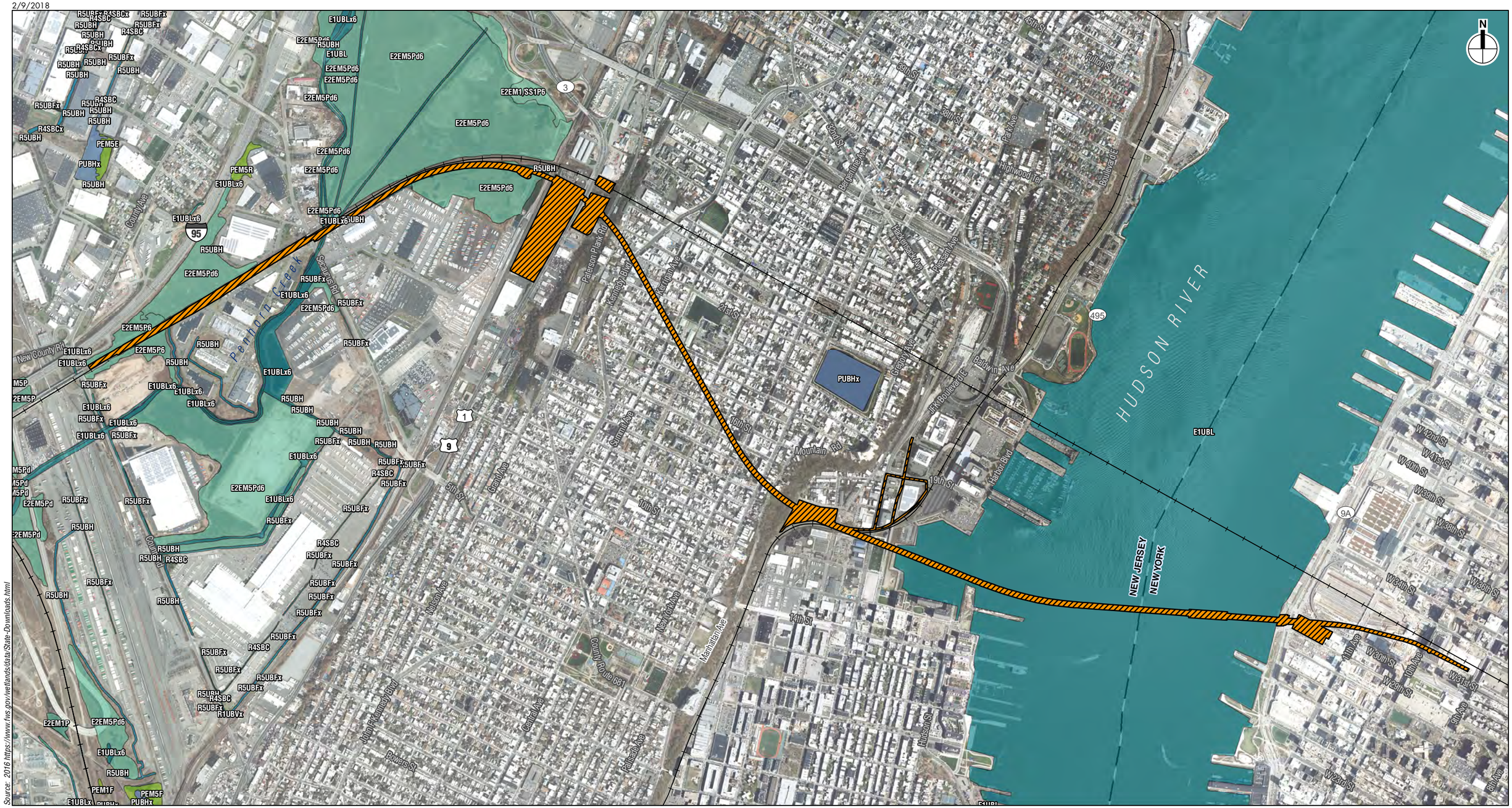
[3] Wave runup refers to the height above the stillwater elevation (tide and surge) reached by the swash, or the fluctuation of the mean water level.

[4] FEMA, 2014



Source: 2016 https://www.fws.gov/wetlands/data/State-Downloads.html

Project Site

Existing Northeast Corridor

Wetland Type (Map Codes)

Freshwater Emergent Wetland (PEM)

Freshwater Pond (PUB, PAB)

Estuarine and Marine Wetland (E2, M2)

Riverine (R)

Estuarine and Marine Deepwater (E1, M1)

0 5,000 FEET

HUDSON TUNNEL PROJECT

Wetlands Mapped by the National Wetlands Inventory

Figure 11-2

2/8/2018

HUDSON TUNNEL PROJECT

Wetlands Mapped by the
New Jersey Department of Environmental Protection
Figure 11-3

County Road and the NYSW right-of-way. This wetland type and approximate wetland locations were confirmed during site reconnaissance.

FRA delineated wetlands within the New Jersey study area in November and December 2016 in accordance with the USACE's three-parameter approach for identifying wetlands.[5] These wetlands are shown in **Figures 11-4a through 11-4c.** The USACE confirmed the presence of these delineated wetlands and provided FRA with an Approved Jurisdictional Determination on May 9, 2017. **Appendix 11** provides detailed information on the wetlands delineation and the USACE Approved Jurisdictional Determination. Two of these wetlands are located along the NEC and are tidally influenced emergent marshes that correspond with the locations of NWI-mapped wetlands E2EM5P6, R5UBH, E1UBLx6, and E2EM5Pd6. The other two emergent wetlands are not associated with any NWI-mapped wetlands. One of these two wetlands is a non-adjacent wetland along the NEC determined not to be under USACE jurisdiction. The other is located along the Hudson-Bergen Light Rail (HBLR) right-of-way in Hoboken. The Hoboken wetland is not mapped by NJDEP, but the USACE determined it to be jurisdictional waters of the United States based on the fact that the tide is held back by a tide gate situated beneath the Hudson River Waterfront walkway.

11.3.1.2.1 NYSW Wetland Mitigation Site

An existing USACE-approved wetland mitigation site is located within the Project area in Secaucus, New Jersey just south of the NEC and west of Tonnelle Avenue (see **Figure 11-4b**). The USACE approved the implementation of a plan within a 3-acre portion of the NYSW right-of-way to mitigate for the NYSW's activities undertaken in North Bergen, New Jersey that resulted in 3 acres of fill to waters of the U.S. On December 12, 2012, NYSW entered into a settlement agreement, including a conservation easement to the mitigation site, with the USACE to resolve claims related to NYSW's alleged failure to complete mitigation activities associated with a Department of the Army permit in 1995 (DA Permit No. 90-0679). As designed, the wetland mitigation project is to include palustrine scrub-shrub, emergent, aquatic bed, and open water habitats. NYSW implemented the mitigation plan in 2014. North Bergen Combined Sewer Overflow (CSO)[6] outfall 011A discharges to the southernmost end of the mitigation site. NJDEP holds a conservation easement on the mitigation site.

11.3.1.3 GROUNDWATER

The New Jersey portion of the study area lies within the Piedmont physiographic province of the Appalachian Highlands (for a detailed discussion of the geology of the study area, see Chapter 15, "Geology and Soils"). The western half of the New Jersey study area is within the Hackensack River basin. The eastern portion of the study area includes the Palisades diabase sill[7] underlying Union City and Hoboken and into the formations underlying the Hudson River. Groundwater is

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[5] Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Miss; U.S. Army Corps of Engineers. 2011. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (version 2.0), ed. J.S. Wakeley, R.W. Lichvar, C.V. Noble, and J.F. Berkowitz. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

[6] A combined sewer overflow (CSO) is the discharge or release of water from a combined sewer system (a sewer system designed to collect storm water runoff, domestic sewage, and industrial wastewater in the same pipe and bring it to wastewater treatment facilities) caused by snowmelt or stormwater runoff.

[7] An intrusion of crystalline, igneous rock that is rich in magnesium and iron, emplaced at medium to shallow depths within the earth's crust.

6/5/2017

Wetlands data source: 2015 NJ Department of Environmental Protection (NJDEP)

Delineated Wetland Boundary

0 500 FEET

HUDSON TUNNEL PROJECT

Delineated Wetlands

Figure 11-4a

6/5/2017

Wetlands data source: 2015 NJ Department of Environmental Protection (NJDEP)

Delineated Wetland Boundary

Existing NYSW Wetland MitigationSite

0 500 FEET

HUDSON TUNNEL PROJECT

Delineated Wetlands

Figure 11-4b

5/25/2017

Wetlands data source: 2015 NJ Department of Environmental Protection (NJDEP)

Delineated Wetland Boundary

0 500 FEET

HUDSON TUNNEL PROJECT

Delineated Wetlands

Figure 11-4c

found in the consolidated bedrock formations (i.e., bedrock aquifers[8]) and in overlying unconsolidated deposits throughout the study area in New Jersey (i.e., surficial aquifers[9]).[10] Most of the wells in the study area draw water from the bedrock aquifers where groundwater is stored and transmitted in fractures (separations in rock that divides it into two or more pieces).

No sole-source aquifers, community or non-community water supply wells, or well-head protection areas exist within the vicinity of the study area in New Jersey.[11] Eleven water supply wells (including domestic, industrial, and irrigation wells) are located within a quarter-mile of the Project site, as shown in **Figure 11-5**.[12] On the basis of the thickness of unconsolidated sediments overlying the bedrock aquifers within the study area and the well depths, these wells are likely supplied by bedrock aquifers.

Groundwater in the study area is classified as "Class II Ground Water for Potable Water Supply."[13] According to the following NJDEP Ground Water Quality Standards:

> The primary designated use for Class II ground waters is the provision of potable ground waters with conventional water supply treatment, either at their current water quality (Class II-A) or subsequent to enhancement or restoration of regional water quality so that the water will be of potable quality with conventional water supply treatment (Class II-B).

As discussed in Chapter 16, "Contaminated Materials," currently or formerly contaminated sites in the vicinity of the Project site have the potential to result in groundwater contamination in the study area. As a result, NJDEP has identified groundwater contamination Classification Exception Areas (a designation indicating there is groundwater pollution in a localized area caused by a discharge at a contaminated site) in which one or more water quality parameters exceeds the Class II Groundwater Quality Standard at NJAC 7:9C.

11.3.1.4 SURFACE AND NAVIGABLE WATERS

The surface alignment portion of the Project site crosses through the Penhorn Creek watershed (see **Figure 11-6**) within the Meadowlands, which the Meadowlands Environmental Research Institute (MERI) divides into four subwatersheds.[14] Penhorn Creek is a tributary to the Hackensack River and drains a portion of the Meadowlands to the east of the Hackensack River. The ridgeline of the Palisades sill forms the eastern boundary of Penhorn Creek's watershed, and the ridgeline running through Secaucus forms the western boundary of the watershed. Dikes formed by roadway fill constructed across the Meadowlands and the Hackensack River form the northern and southern boundaries of the watershed, respectively. Penhorn Creek's bed elevation is lower than much of the tidal range in the Hackensack River; however, its waters are regulated by a tide gate at St. Paul's Avenue (see **Figure 11-6**) near its mouth.[15]

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8 Bedrock aquifers within the New Jersey study area include fractured-rock aquifers of the Newark Basin part of the Piedmont Region (Brunswick Aquifer, Lockatong Formation, Stockton Formation), and igneous and metamorphic rocks of the Manhattan Prong.

9 Surficial glacial aquifers and confining units in New Jersey include lake-bottom sediment and sand and gravel.

10 Herman 1998.

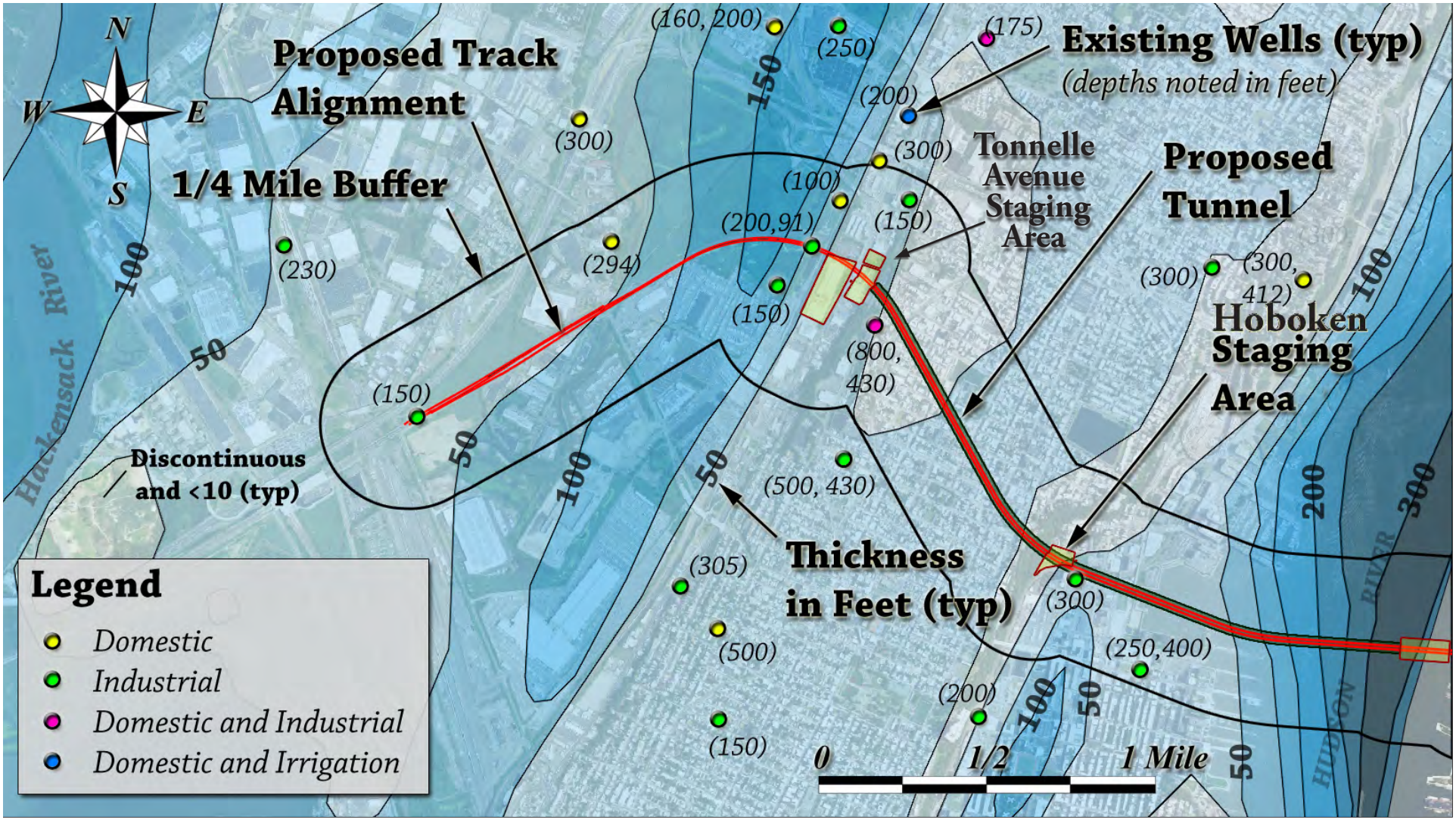
11 NJDEP, 2016b.

12 NJDEP, 2021.

13 NJAC 7:9C: State of New Jersey, 2010.

14 MERI, 2016a.

15 NJMC, 2006.



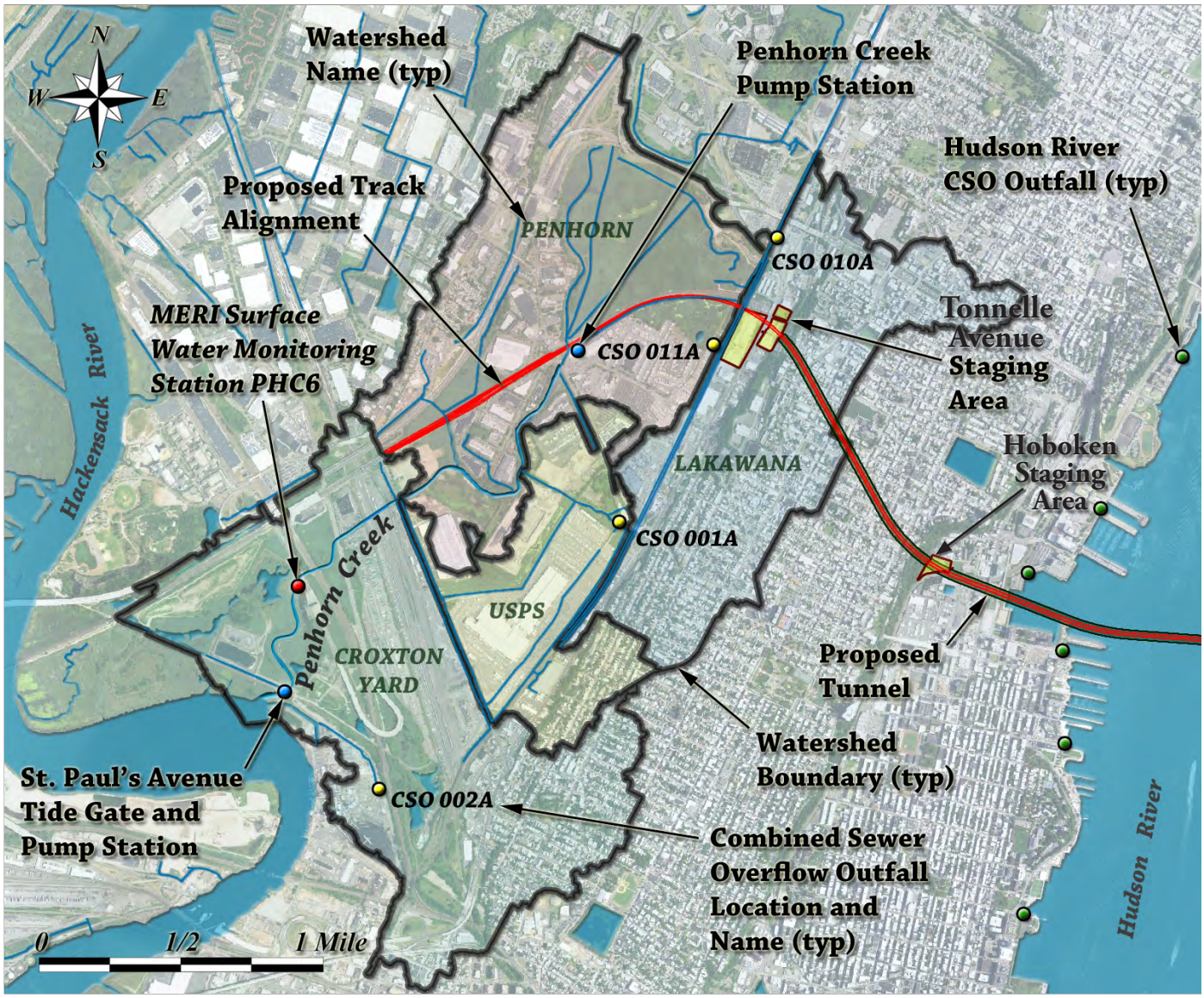
Source: NJ GeoWeb, 2016b; NJDEP, 2016a; modified by AKRF

HUDSON TUNNEL PROJECT

Thickness of Unconsolidated Sediments and Groundwater Wells

Figure 11-5

11.8.17



Source: NJDEP, 2016; modified by AKRF

HUDSON TUNNEL PROJECT

Penhorn Creek Drainage

Figure 11-6

Penhorn Creek is carried under the NEC just east of Secaucus Road via two 48-inch diameter culverts spaced approximately 6 feet apart. This twin culvert serves as the outlet for the large wetland area located north of the NEC. A tributary to Penhorn Creek (Penhorn Creek tributary), converges with Penhorn Creek immediately south of the twin culverts and drains the wetlands south of the NEC (these wetlands correspond with Wetland CD as shown on **Figure 11-4b**). Just south of the twin culvert, Penhorn Creek water surface elevation is controlled by a 10-inch-wide broad-crested weir with no conduits, which was part of a nearby decommissioned pump station. The existing decommissioned pump station at the weir is neither functional nor maintained. The weir maintains the upstream water surface elevation of Penhorn Creek and associated wetlands, and the Penhorn Creek Tributary). From the weir, Penhorn Creek flows south under Secaucus Road. There is a tide gate/pump station just upstream of Penhorn Creek's confluence with the Hackensack River that limits tidal influence to the creek.

Several municipal CSO outfalls[16] discharge to the Penhorn Creek watershed (see **Figure 11-6**). As discussed previously, the CSO outfall closest to the Project site, the North Bergen CSO outfall 011A (NJPDES Number NJ0108898), discharges to the NYSW wetland mitigation site, which then drains to the wetlands within the Project site (see **Figure 11-6**). No surface waters other than the Hudson River are located within the portion of the study area east of the Palisades. Instead, runoff within this urbanized area is conveyed to the Hudson River by storm sewers and CSO outfalls (see **Figure 11-6**).

11.3.1.4.1 Water Quality

Surface Water Quality Standards for New Jersey Waters (NJAC 7:9B) establish the designated uses to be achieved, provide management guidelines, and specify the water quality criteria necessary to protect the state's waters. Designated uses include potable water, propagation of fish and wildlife, recreation, agricultural and industrial supplies, and navigation. These are reflected in use classifications assigned to specific waters.

All waters of Penhorn Creek are classified FW2-NT/SE2. FW2-NT represents fresh waters that are non-trout and not in the Pinelands. SE2 waters are saline waters of estuaries. The combined classification, FW2-NT/SE2 includes waterways where there may be a salt water/fresh water interface. The exact point of demarcation between the fresh and saline waters is defined as "that point where the salinity reaches 3.5 parts per thousand at mean high tide".[17]

MERI operates a surface water monitoring station, station PHC6, on Penhorn Creek[18] (see **Figure 11-6**). With the exception of three samples, collected on July 16, 2002, February 19, 2014, and November 30, 2017, all measured salinity concentrations, which have been collected quarterly from 1993 to the present, were below 3 parts per thousand (ppt), indicating that the waters may be below the salinity threshold for the saline waters classification and therefore classified as FW2-NT. However, concentrations at PHC6 are highly dependent on the condition of the downstream tide gate. A malfunction of this tide gate would have the potential to allow higher salinity water from the Hackensack River to move up Penhorn Creek with the flood tide, increasing the salinity of the creek, thus resulting in the freshwater and saline water classification for the creek.

The NJPDES permit for North Bergen Township Municipal Utilities Authority's (MUA's) CSO outfall 011A[19] indicates that the Penhorn Creek tributary receiving the discharge is classified SE2. The NJPDES permit also indicates that it is a C2 or Category Two water, which is New Jersey's lowest

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16 http://www.nj.gov/dep/dwq/cso.htm, last accessed March 2021.

17 NJAC 7:9B.

18 MERI, 2021.

19 NJDEP, 2015.

antidegradation designation below Outstanding National Resource Waters[20] and Category One waters.

Table 11-1 summarizes water quality parameters and heavy metal concentrations reported for MERI Station PHC6, as well as the NJDEP surface water quality standards for Class SE2 waters, including Penhorn Creek. Dissolved oxygen (DO) and biological oxygen demand (BOD) have increased over the years, indicating some improvement in water quality (increased DO) but also some level of continued pollution (increased BOD). Except for copper, dissolved heavy metal concentrations remained below their respective acute standards from 1996 through 2020.

Table 11-1
NJDEP Water Quality Standards and Data for Penhorn Creek Sampling Station PHC6

Parameter	NJDEP SWQS for Class SE2 Waters	Water Quality Data (Average)					
		1993-1995	1996-2000	2001-2005	2006-2010	2011-2015	2016-2020
Ammonia (mg/L)	0.115 (acute); 0.030 (chronic)	3.85	1.97	2.42	1.27	2.25	1.76
BOD (mg/L)	No standard	5.37	4.66	9.20	8.67	9.33	13.06
Dissolved oxygen (mg/L)	Not less than 4.0 at any time	4.69	6.22	5.87	6.01	7.39	7.26
Nitrate (mg/L)	No standard	-	0.30	2.91	1.70	6.78	1.28
Temperature (°C)	Summer seasonal average shall not exceed 29.4°C	18.3	15.0	13.5	13.7	13.6	15.8
Cadmium (µg/L)[1]	40 (acute); 8.8 (chronic)	30.7	4.8	3.8	1.4	1.4	0.2[2]
Chromium (µg/L)	No standard	23.8	5.5	8.0	7.2	3.5	3.7
Copper (µg/L)[1]	4.8 (acute); 3.1 (chronic)	24.7	9.3	13.8	16.3	79.0	26.8
Lead (µg/L)	210 (acute); 24 (chronic)	69.4	50.2	41.1	33.2	21.9	14.1
Nickel (µg/L)[1]	64 (acute); 22 (chronic)	27.6	22.7	22.9	9.1	7.0	3.2
Zinc (µg/L)[1]	90 (acute); 81 (chronic)	155.7	37.4	43.6	61.5	62.2	43.9

Notes:

1. The NJDEP surface water quality standards for cadmium, copper, nickel, and zinc are based on water hardness and expressed in terms of dissolved criteria.
2. In this time period, cadmium measurements were only collected quarterly from January 2016 to May 2017.

Except for nitrate, for which fewer samples were collected in each year range except 2016-2020, average values were based on 10 samples for 1993-1995, 20 samples for 1996-2000, 16 samples for 2001-2005, 20 samples for 2006-2010, 19 samples for 2011-2015, and 16 samples for 2016-2020.

Sources: MERI 2021; NJAC 7:9B Surface Water Quality Standards.

11.3.1.4.2 Aquatic Biota

11.3.1.4.2.1 Macroinvertebrates

The portion of the study area along the NEC in the Meadowlands features aquatic biota[21] in the wetlands and Penhorn Creek. These include two common mollusks: the mud snail (*Nassarius*

[20] An USEPA designation that applies to New Jersey surface waters classified as freshwater 1 waters and "Pinelands waters;" these waters are considered nondegradation waters that are set aside because of their unique ecological significant, exceptional recreational significance, or exceptional water supply significance.

[21] Aquatic biota are organisms living in or depending on the aquatic environment.

obsoleta) and ribbed mussel (*Geukensia demissa*). Common epibenthic[22] crustaceans of the tidal and semi-tidal (impounded) streams and wetlands in this area include blue crab (*Callinectes sapidus*), fiddler crabs (*Uca* spp.), white-fingered mud crabs (*Rhithropanoepus harrisii*), mysid shrimp (*Neomysis americana*), sand shrimp (*Crangon septemspinosa*), grass shrimp (*Palaemonetes pugio*), and several species of amphipods.[23] Neither the NJDEP's Landscape Project–Piedmont Plains nor USFWS's IPaC databases list any threatened or endangered invertebrate species in the study area.

11.3.1.4.2.2 Fish

The most abundant and commonly occurring fish in the New Jersey Meadowlands, which are therefore likely to occur in the Meadowlands portion of the study area, include mummichog (*Fundulus heteroclitus*), Atlantic silverside (*Menidia menidia*), inland silverside (*Menidia beryllina*), white perch (*Morone americana*), blueback herring (*Alosa aestivalis*), Atlantic tomcod (*Microgadus tomcod*), brown bullhead (*Ameriurus nebulosus*), striped killifish (*Fundulus majalis*), striped bass (*Morone saxatilis*), pumpkinseed sunfish (*Lepomis gibbosus*), American eel (*Anguilla rostrata*), and bay anchovy (*Anchoa mitchilli*). An inventory of fisheries resources conducted by the Hackensack Meadowlands Development Commission (now the NJSEA) in 1989 (HMDC Inventory of Fisheries Resources 1989) reported that the mummichog, closely associated with salt marsh habitats, comprised 85 percent and 91 percent of the total catches during the two years of sampling of the study. A 2001–2003 fish inventory reconfirmed mummichog to be the most abundant fish species within the Meadowlands.[24]

Other common resident fish known to occur in the Hackensack River include white catfish (*Ameiurus catus*) and the non-native common carp (*Cyprinus carpio*); these have the potential to occur in Penhorn Creek. Alewife (*Alosa pseudoharengus*), blueback herring, American shad (*Alosa sapidissima*), Atlantic tomcod, and striped bass are anadromous fish (i.e., fish that migrate from salt water to spawn in fresh water) that use the Hackensack River and associated marshes such as Penhorn Creek in the spring. Some marine fish, such as juvenile Atlantic menhaden (*Brevoortia tyrannus*) and juvenile bluefish (*Pomatomus saltatrix*), also occur in the Hackensack River[25] and have the potential to occur in Penhorn Creek.

11.3.1.5 TERRESTRIAL RESOURCES

11.3.1.5.1 Ecological Communities

The study area includes the wetlands/industrial landscape of the Meadowlands and the urban landscape east of the Palisades in Weehawken and Hoboken. The study area is best described

[22] Epibenthic crustaceans are those that live on the surface of sediments at the bottom of a water body.

[23] Cerrato 2006.

[24] Bragin et al. 2005.

[25] Bragin et al. 2005.

as including "railroad" community[26], mowed lawn[27], urban vacant lot[28], and successional southern hardwoods[29] communities.[30] The railroad community represents the NEC tracks and is largely covered by ballast and unvegetated areas. A few ruderal species (i.e., plants growing in waste places and along roadsides), including common mullein (*Verbascum thapsus*), pokeweed (*Phytolacca americana*), and common mugwort (*Artemisia vulgaris*), are found on the slope adjacent to the railroad tracks. An additional area of railroad community comprises the portion of potential haul route Option 3 that is located west of the HBLR and south of 19th Street in Weehawken. Adjacent to this area of railroad community is a largely unvegetated concrete-lined stormwater drainage ditch with sparse patches of grass. The mowed lawn and urban vacant lot communities are vegetated primarily by herbaceous species, including crabgrass (*Digitaria* sp), Kentucky bluegrass (*Poa pratensis*), English plantain (*Plantago lanceolata*), common mugwort, and clovers (*Trifolium* spp.). The successional southern hardwoods community is confined to narrow bands at the toe of slope of the railroad tracks (NEC and HBLR adjacent to potential haul route Option 3). Dominant species within the successional southern hardwoods community include black locust (*Robinia pseudoacacia*), grey birch (*Betula populifolia*), eastern cottonwood (*Populus deltoides*), princess tree (*Paulownia tomentosa*), and tree of heaven (*Ailanthus altissima*) in the tree stratum; common blackberry (*Rubus allegheniensis*), multiflora rose (*Rosa multiflora*), and winged sumac (*Rhus copallinum*) in the shrub stratum; Asiatic bittersweet (*Celastrus orbiculatus*) and poison ivy (*Toxicodendron radicans*) in the vine stratum; and common mugwort in the herbaceous stratum.

11.3.1.5.2 Wildlife

Approximately half of the study area is located in an industrial and heavily urbanized landscape dominated by buildings, transportation infrastructure, and other impervious surfaces that offers minimal habitat for wildlife other than urban-adapted generalists that are ubiquitous throughout the metropolitan area. The remaining portions of the study area (e.g., the wetland complex associated with Penhorn Creek in the Meadowlands) are capable of supporting more rich and diverse communities of wildlife. These habitats are still subjected to high levels of noise and other indirect and direct forms of human disturbance, and are further degraded by invasive species and pollution. As such, the wildlife communities in these areas are lacking in number or diversity of species and dominated by disturbance-tolerant species.

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[26] Edinger et al. (2014) define this community as "a permanent road having a line of steel rails fixed to wood ties and laid on gravel roadbed that provides a track for cars or equipment drawn by locomotives or propelled by self-contained motors. There may be sparse vegetation rooted in the gravel substrate along regularly maintained railroads. The railroad right of way may be maintained by mowing or herbicide spraying."

[27] Edinger et al. (2014) define this community as "residential, recreational, or commercial land, or unpaved airport runways in which the groundcover is dominated by clipped grasses and there is less than 30 percent cover of trees. Ornamental and/or native shrubs may be present, usually with less than 50 percent cover. The groundcover is maintained by mowing and broadleaf herbicide application."

[28] Edinger et al. (2014) define this community as "an open site in a developed, urban area that has been cleared either for construction or following the demolition of a building. Vegetation may be sparse, with large areas of exposed soil, and often with rubble or other debris."

[29] Edinger et al. (2014) define this community as "a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed."

[30] The "Classification of Vegetation Communities of New Jersey: Second Iteration" by Breden et al. does not include descriptions of "cultural" vegetation communities, the category to which the vegetation communities of the study area belong. Therefore, Edinger et al. 2014 was used to classify vegetation communities within the New Jersey and New York study areas.

11.3.1.5.2.1 Birds

The most substantive habitat for supporting birds and other wildlife in the study area is the wetland complex around Penhorn Creek. Based on the wetland's relatively large size, the dominance of non-native common reed (*Phragmites australis*) within it and its isolation within a heavily urbanized area, breeding bird species likely to use this habitat include marsh birds, waterbirds, and land birds that are tolerant of degraded habitat conditions and ubiquitous in urban wetland habitats. Examples include red-winged blackbird (*Agelaius phoeniceus*), song sparrow (*Melospiza melodia*), swamp sparrow (*Melospiza georgiana*), marsh wren (*Cistothorus palustris*), common yellowthroat (*Geothlypis trichas*), gray catbird (*Dumetella carolinensis*), European starling (*Sturnus vulgaris*), yellow warbler (*Setophaga petechia*), barn swallow (*Hirundo rustica*), tree swallow (*Tachycineta bicolor*), mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), Canada goose (*Branta canadensis*), green heron (*Butorides virescens*), and spotted sandpiper (*Actitus macularia*). Some additional species that nest elsewhere in the region may use this wetland as foraging habitat, including herring gull (*Larus argentatus*), ring-billed gull (*Larus delawarensis*), osprey (*Pandion haliaetus*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), and snowy egret (*Egretta thula*).

During winter, birds likely to use the habitats within the study area include only a few temperate migrants and non-migratory species, such as white-throated sparrow (*Zonotrichia albicollis*), European starling, house sparrow (*Passer domesticus*), Canada goose, brant (*Branta canadensis*), herring gull (*Larus argentatus*), and ring-billed gull (*Larus delawarensis*). During spring and fall migration, the same species that nest in the area may also use the wetland as a stopover habitat on route to more northern breeding grounds or southern wintering grounds. Some additional species that are not likely to nest or overwinter in the area, such as the least sandpiper (*Calidris minutilla*), and northern harrier (*Circus cyaneus)* might also use the wetland as a stopover habitat during their migration.

Elsewhere in the New Jersey portion of the study area, where terrestrial habitat is limited to manicured lawns, street trees, roadside margins of ruderal vegetation, and small, fragmented woodlots, bird species likely to occur during the breeding season and winter would be limited to synanthropic, urban-adapted generalists, many of which are non-native. Examples include the American robin (*Turdus migratorius*), European starling, house sparrow, rock dove (*Columba livia*), northern mockingbird (*Mimus polyglottos*), and American crow (*Corvus brachyrhynchos*). Some additional species may occur in these areas very briefly during spring and fall migration, and include common songbirds such as the yellow-rumped warbler (*Setophaga coronata*), ovenbird (*Seiurus aurocapilla*), Swainson's thrush (*Catharus ustulatus*), and Baltimore oriole (*Icterus galbula*).

11.3.1.5.2.2 Mammals

Mammals that are expected to occur in the marsh of the Meadowlands near Penhorn Creek include muskrat (*Ondatra zibethica*), raccoon (*Procyon lotor*), meadow vole (*Microtus pennsylvanicus*), and occasionally, white-tailed deer (*Odocoileus virginianus*). Mammals that may occur elsewhere in the study area include eastern cottontail (*Sylvilagus floridanus*), white-footed mouse (*Peromyscus leucopus*), gray squirrel (*Sciurus carolinensis*), woodchuck (*Marmota monax*), masked shrew (*Sorex cinereus*), eastern mole (*Scalopus aquaticus*), and white-tailed deer.

11.3.1.5.2.3 Reptiles and Amphibians

Common reptile species with potential to occur in the wetlands around Penhorn Creek include snapping turtle (*Chelydra serpentina*), eastern painted turtle (*Chrysemys picta*), northern diamondback terrapin (*Malaclemys terrapin*), eastern garter snake (*Thamnophis setalis*), and northern water snake (*Nerodia sipedon*). Milk snake (*Lampropeltis triangulum*), eastern garter snake, and brown snake (*Storeria dekayi*) may occur in the small areas of woodland and

shrub/scrub elsewhere in the study area. The newly described southern leopard frog species (*Rana kauffeldi*; formerly classified as *Rana sphenocephala utricularius*) that is endemic to the New York metropolitan area and inhabits coastal freshwater and brackish wetlands[31] also has the potential to occur in the wetlands around Penhorn Creek.

11.3.1.6 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

FRA consulted with NJNHP which identified the following threatened, endangered, special concern, and rare species, wildlife habitats, and ecological communities as having the potential to occur in the study area or its vicinity: glossy ibis (*Plegadis falcinellus*; special concern), little blue heron (*Egretta caerulea*; special concern), osprey (*Pandion haliaetus*; threatened), snowy egret (*Egretta thula*; special concern), yellow-crowned night-heron (*Nyctanassa violacea*; threatened), shortnose sturgeon (*Acipenser brevirostrum*; endangered), Atlantic sturgeon (*Acipenser oxyrinchus,* endangered), black-crowned night-heron (*Nycticorax nycticorax*; threatened), barn owl (*Tyto alba*; special concern), and floating marsh-pennywort (*Hydrocotyle ranunculoides*; endangered) (see **Appendix 11**).[32] Shortnose and Atlantic sturgeon would only occur in the Hudson River and is discussed in Section 11.3.2.4 below.

The NJDEP's Landscape Project–Piedmont Plains database identified the study area as foraging habitat for little blue heron, snowy egret, yellow-crowned night-heron, and glossy ibis.[33]

According to USFWS's IPaC database, there are no Federal threatened or endangered species or critical habitats (including wildlife refuges or fish hatcheries) within the New Jersey portion of the study area. USFWS's IPaC database identified a number of migratory birds of conservation concern protected under the Migratory Bird Treaty Act and the bald eagle (*Haliaeetus leucocephalus*) protected under the Bald and Golden Eagle Protection Act as having the potential to occur within the study area (see **Table 11-2**).

[31] Newman et al. 2012, Feinberg et al. 2014.

[32] NJNHP 2021.

[33] NJDEP 2021.

Table 11-2
Migratory Birds of Concern
Listed in USFWS IPaC Resource List

Common Name	Scientific Name
American oystercatcher	*Haematopus palliatus*
Bald Eagle	*Haliaeetus leucocephalus*
Black skimmer	*Rynchops niger*
Black-billed cuckoo	*Coccyzus erythropthalmus*
Blue-winged warbler	*Vermivora cyanoptera*
Bobolink	*Dolichonyx oryzivorus*
Canada warbler	*Cardellina canadensis*
Cerulean warbler	*Setophaga cerulea*
Clapper Rail	*Rallus crepitans*
Dunlin	*Calidris alpina arcticola*
Eastern Whip-poor-will	*Antrostomus vociferus*
Evening Grosbeak	*Coccothraustes vespertinus*
Golden Eagle	*Aquila chrysaetos*
Golden-winged warbler	*Vermivora chrysoptera*
Hudsonian godwit	*Limosa haemastica*
Kentucky warbler	*Geothlypis formosa*
Least tern	*Sternula antillarum*
Lesser Yellowlegs	*Tringa avipes*
Long-eared Owl	*Asio otus*
Nelson's Sparrow	*Ammodramus nelsoni*
Prairie warbler	*Setophaga discolor*
Prothonotary Warbler	*Protonotaria citrea*
Purple sandpiper	*Calidris maritima*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-throated Loon	*Gavia stellata*
Ruddy Turnstone	*Arenaria interpres morinella*
Rusty blackbird	*Euphagus carolinus*
Seaside sparrow	*Ammodramus maritimus*
Semipalmated Sandpiper	*Calidris pusilla*
Short-billed Dowitcher	*Limnodromus griseus*
Snowy Owl	*Bubo scandiacus*
Whimbrel	*Numenius phaeopus*
Willet	*Tringa semipalmata*
Wood thrush	*Hylocichla mustelina*
Source: USFWS IPaC Resource List: https://ecos.fws.gov/ipac/	

FRA has completed consultation with NMFS and USFWS in accordance with Section 7 of the ESA and with USFWS in accordance with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (see **Appendix 11** for correspondence).

11.3.1.6.1 Glossy Ibis

NJDEP has records of glossy ibis foraging within the study area. The glossy ibis is a migratory waterbird whose range was limited to Florida before an explosive expansion along the entire

Atlantic coast all the way to Maine occurred throughout the 20th century.[34] By the 1970s, the glossy ibis was the most abundant waterbird in New Jersey.[35] Populations then began to decline and the glossy ibis is now listed as a species of special concern at the state level by NJDEP, even though it is considered a fairly common breeding bird in the state.[36] The glossy ibis is a common breeding bird in the coastal marshes around the New York metropolitan area,[37] and has the potential to nest and forage within the wetland around Penhorn Creek. Glossy ibises inhabit freshwater and brackish wetlands and salt marshes, and nest on a variety of substrates, including reed beds, shrubs, and trees.[38] They have been documented nesting in marshes densely invaded by common reed, such as the wetlands in the study area. By commonly nesting in busy areas, such as coastal marshes of the New York metropolitan area[39] and near highways,[40] glossy ibis demonstrate a high tolerance of habitat degradation and indirect human disturbance.

11.3.1.6.2 Little Blue Heron

The little blue heron has been recorded by NJDEP as foraging in the study area. It is considered uncommon, local, and declining in New Jersey[41] and is listed as a species of special concern at the state level by NJDEP. Following a peak in the mid-1990s, recent surveys found only 45 birds in 12 colonies in the state.[42] The little blue heron is primarily a coastal species with preferred habitats including wetlands and forests that border waterbodies. Little blue herons nest in trees or shrubs near fresh, brackish, or salt water. They forage in a variety of freshwater and marine-estuarine habitats, including marshes, swamps, streams and rivers, ponds, lakes, tidal flats, and flooded fields.[43] Penhorn Creek and the surrounding wetlands represent suitable nesting and foraging habitat for little blue herons, thus the species has the potential to occur in this area.

11.3.1.6.3 Osprey

The osprey is listed as threatened at the state level by NJDEP and has been documented by NJDEP nesting and foraging in the study area. Osprey populations in New Jersey have recovered significantly in recent decades following steep range-wide declines that occurred throughout the mid-20th century, and ospreys are currently common in the state.[44] Ospreys nest in dead trees and on a variety of artificial structures such as utility poles, buoy towers, and platforms erected specifically for their use. Ospreys have the potential to nest on trees or artificial structures in and around the wetlands surrounding Penhorn Creek, and have the potential to occur over the open waters of the wetlands while foraging for fish. Ospreys are not likely to occur anywhere else within the New Jersey portion of the study area.

11.3.1.6.4 Snowy Egret

The snowy egret is listed as a species of special concern at the state level by NJDEP and has been documented by NJDEP foraging in the study area. Populations in the state have declined

34 Medler 2008.
35 Boyle Jr. 2011.
36 Boyle Jr. 2011.
37 Medler 2008.
38 Davis and Kircher 2000.
39 Medler 2008.
40 Davis and Kircher 2000.
41 Boyle Jr. 2011.
42 Boyle Jr. 2011.
43 Rodgers Jr. and Smith 2012.
44 Boyle Jr. 2011.

sharply in recent years.[45] In New Jersey, snowy egrets typically nest in colonies with other wading birds in thick vegetation on barrier, dredge-spoil, and salt-marsh islands in estuarine areas. They also most commonly use estuarine habitats for foraging.[46] The marshes around Penhorn Creek have the potential to sometimes be used as foraging habitat by snowy egrets, but nesting is unlikely and nowhere else in the study area is there suitable nesting or foraging habitat for snowy egrets.

11.3.1.6.5 Yellow-Crowned Night Heron

Yellow-crowned night herons are scarce in New Jersey and the species is listed as threatened at the state level by NJDEP. Their breeding range within the state is primarily limited to Cape May and Atlantic Counties,[47] where they nest on barrier, spoil, and bay islands in coastal areas, and in swamps, forested wetlands, and forested uplands near lakes, rivers, and creeks in more inland areas.[48] Nests are located in shrubs or trees, usually near water.[49] Although yellow-crowned night herons are not known to nest within the study area, they have the potential to use Penhorn Creek and its associated wetlands as foraging habitat. Yellow-crowned night herons from nesting colonies around New York City are known to use the Meadowlands for foraging[50] and NJDEP has a record of yellow-crowned night herons foraging in the study area. Therefore, yellow-crowned night herons are considered by NJDEP to have the potential to occur in the wetlands on the western side of the study area, around Penhorn Creek, while foraging. Yellow-crowned night herons would not be expected to occur elsewhere within the study area.

11.3.1.6.6 Black-Crowned Night Heron

The breeding population of black-crowned night herons in New Jersey declined throughout the mid-20th century, but numbers appear to have stabilized in recent years and the species is still considered locally common during the summer.[51] Black-crown night herons are listed as threatened at the state level. Black-crowned night herons will nest in a variety of wetlands, including freshwater, brackish, and salt marshes. They will use an even wider array of habitats for foraging, including swamps, streams, rivers, ponds, lakes, lagoons, tidal mudflats, salt marshes, freshwater marshes, ditches, canals, reservoirs, and wet agricultural fields.[52] NJDEP has a record of black-crowned night herons foraging in the study area, and black-crowned night herons are considered to have the potential to forage within Penhorn Creek and the surrounding wetlands. Black-crowned night herons will nest on a variety of substrates, including common reed, and numerous species of trees and shrubs. Black-crowned night herons therefore have the potential to nest within the wetlands around Penhorn Creek, although NJDEP does not have any records of black-crowned night herons nesting anywhere within the study area.

11.3.1.6.7 Barn Owl

The barn owl is uncommon and local throughout the year in New Jersey,[53] and is listed as a species of special concern at the state level by NJDEP. The majority of the population in the state

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45 Boyle Jr. 2011.

46 Parsons and Master 2000.

47 Boyle Jr. 2011.

48 Watts 2011.

49 Watts 2011.

50 Boyle Jr. 2011.

51 Boyle Jr. 2011.

52 Hothem et al. 2010.

53 Boyle Jr. 2011.

is concentrated around the Delaware Bayshore, the Hackensack Meadowlands and lower Hudson River, and the Piedmont and Highlands.[54] NJDEP has a record of a non-breeding season sighting of a barn owl in the study area. Barn owls use a variety of open habitats, including marshes, grasslands, old fields, and agricultural fields, and will commonly nest on or in buildings and other human-made structures. They can often be found nesting in metropolitan areas, including New York City.[55] Barn owls have the potential to occur in the study area, and would be most likely to occur in the wetland complex surrounding Penhorn Creek.

11.3.1.6.8 Migratory Birds

Of the 34 migratory bird species of conservation concern listed in **Table 11-2** only one, the seaside sparrow, has the potential to breed near the Project site on the basis of its habitat associations, geographic range within New Jersey, listing as a breeding bird of the Meadowlands by the New Jersey Sports and Exposition Authority[56], and records of the New Jersey Natural Heritage Program (see **Appendix 11**). The seaside sparrow is a very uncommon breeding birds of the Meadowlands and prefer marshes dominated by saltmarsh cordgrass, unlike the phragmites-dominated marsh surrounding the Project site. Therefore, seaside sparrow is not likely to occur near the Project site.

11.3.1.6.9 Floating Marsh-Pennywort

NJDEP identifies the state-endangered floating marsh-pennywort as occurring in the study area just north of the NEC. Floating marsh-pennywort is a perennial floating aquatic plant in the Apiaceae family. It is found in shallow, slow-moving or stagnant waters or in muddy soils. Threats to populations of floating marsh-pennywort include development, herbicide runoff, and displacement by invasive species.[57] FRA observed a population of floating marsh-pennywort within the study area on November 1, 2016, and it is documented as occurring within the NYSW mitigation site. NJDEP has records of additional populations of floating marsh-pennywort documented within the study area, and nearby within Penhorn Creek dating from 2019 (see **Appendix 11**).

11.3.2 HUDSON RIVER

11.3.2.1 AQUATIC RESOURCES

The Project site 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 Harbor 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 Harbor during the ebb phase. The typical tidal range in the Hudson River is approximately 5 feet.[58] Average tidal velocities near the Project site are about 2.4 feet per second, and the average predicted ebb flow is about 2.6 feet per second.[59] Freshwater and higher salinity waters are well mixed during low-flow conditions, but are stratified under high-flow conditions when freshwater

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54 Boyle Jr. 2011.

55 Marti et al. 2005.

56 https://s3.us-east-2.amazonaws.com/njmc/pdfs/general/meadowlands-bird-list-10-15-ol.pdf.

57 WDNR 2005.

58 Geyer and Chant 2006.

59 NOAA 2013.

inflow from upriver overrides the denser saltwater layer.[60] The lower Hudson River is polyhaline (indicating moderate salinity, less than seawater, with salinity of 18-30 ppt) in summer and fall months and mesohaline (less salinity, 5-18 ppt) in spring and early summer.[61]

The USACE maintains a Federally authorized navigation channel at a depth of 40 to 48 feet below mean low water (MLW) from the mouth of the Hudson River upstream to approximately 59th Street.[62] Bathymetric surveys[63] conducted by the USACE in April 2016 showed depths ranging from about 36 to 48 feet below mean lower low water (MLLW)[64] on the eastern side of the navigation channel, and depths from 33 to 51 feet below MLW on the western side of the navigation channel in the Project vicinity.[65] Shallower depths were found near or adjacent to piers and other structures, and depths rapidly increased to 40 feet or more over a distance of less than 200 feet from these structures. NOAA's Nautical Chart #12335 shows current water depths ranging from 3 to 17 feet below MLLW around the piers outside the navigation channel, and from 40 to 54 feet below MLW within the navigation channel. At the edges of the channel, depths are about 20 to 30 feet below MLLW.[66] Sedimentation in the lower Hudson River tends to be highest in the shallows on the west side of the river.[67] Sedimentation within the interpier areas where current velocities are lower ranges from 1 to 2 feet per year.[68]

11.3.2.1.1 Water Quality

Federal agencies such as the USACE, multi-jurisdictional agencies such as the PANYNJ, the states of New Jersey and New York, New York City, and cooperative efforts such as the New York–New Jersey Harbor Estuary Program (HEP) have implemented programs to monitor and improve water quality in the New York–New Jersey Harbor and connected waterbodies. These programs have, over time, resulted in water quality improvements documented by monitoring programs such as the Harbor-Wide Water Quality Monitoring Report for the New York–New Jersey Harbor Estuary and the NYCDEP New York Harbor Water Quality Report. The City of New York has monitored harbor water quality with an annual survey for more than 90 years.

NYSDEC classifies the lower Hudson River as Class I saline surface waters from Battery Park in Manhattan upstream to Spuyten Duyvil, New York, including the Project site area. Suitable uses of Class I waters are secondary contact recreation[69], fishing, and fish propagation and survival. NJDEP classifies the lower Hudson River in the Project site area as SE2 saline surface waters. Suitable uses of SE2 waters are secondary contact recreation, maintenance and propagation of

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60 Moran and Limburg 1986.

61 Ristich et al. 1977.

62 USACE 2016.

63 Bathymetry is the study of underwater depths of a water body; the underwater equivalent to underwater topography. Bathymetric surveys chart seafloor relief or terrain as contour lines (called depth contours or isobaths).

64 Mean lower low water, as defined by NOAA, represents the average height of the lowest tide recorded at a tide station each day over the National Tidal Datum Epoch.

65 USACE 2016, sheet 5 of 11.

66 NOAA 2016.

67 Geyer 1995.

68 Smith 1992.

69 "Secondary contact recreation" means recreational activities where the probability of water ingestion is minimal and includes, but is not limited to, boating and fishing.

biota, and maintenance of diadromous fish[70] and wildlife. **Table 11-3** presents the surface water quality standards for the Project area in the Hudson River for both New Jersey and New York jurisdictions.

Table 11-3
NYSDEC and NJDEP Surface Water Quality Standards

Parameter	NYSDEC Class I Waters	NJDEP Class SE2 Waters
Temperature	No standard	Summer seasonal average shall not exceed 29.4°C (84.9°F)
Salinity (psu)	No standard	No standard
pH	Normal range shall not be extended by more than 0.1 pH unit	6.5 – 8.5
Dissolved oxygen (DO) (mg/L)	Not less than 4.0 at any time	Not less than 4.0 at any time
Fecal coliform (cfu/100mL)	Monthly geometric mean, from a minimum of five examinations, shall not exceed 2,000 cfu/100mL	Monthly geometric mean, based on a minimum of five samples shall not exceed 770 cfu/100mL
Enterococcus (cfu/100mL)(1)	EPA Bathing Standard = 35 cfu/100mL	EPA Bathing Standard = 35 cfu/100mL
Secchi transparency (ft)	No standard	No standard
Total suspended solids (mg/L)	None from sewage, industrial wastes or other wastes that will impair usage	None of which would render the water unsuitable for the designated uses

Note: (1) NYSDEC does not identify a standard for enterococcus; however, EPA provides a standard for bathing of 35 cfu/100mL; NJDEP does establish enterococcus standards, but not for SE2 waters.

Sources: 6 NYCRR Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations; NJAC 7:9B Surface Water Quality Standards; EPA Recreational Water Quality Criteria (Office of Water 820-F-12-058)

11.3.2.1.1.1 New York Water Quality Monitoring

The Project site falls within the NYCDEP Harbor Survey Inner Harbor study area, which includes the Hudson River from the New York City–Westchester County line through the Battery to the Verrazano Narrows; the Lower East River; and the Kill Van Kull–Arthur Kill system.[71] Class I portions of the Hudson River in New York County are listed as impaired for polychlorinated biphenyls (PCBs) and other toxins, which may include mercury, dioxins/furans, polycyclic aromatic hydrocarbons (PAHs), pesticides, and other heavy metals.[72] Results of recent Harbor Surveys conducted by NYCDEP (2010, 2012, 2013, 2014, 2016, 2017, 2018) show that the water quality of New York–New Jersey Harbor, including the lower Hudson River within the Inner Harbor, has improved since the 1970s as a result of measures undertaken by New York City (e.g., improvements to wastewater treatment plants and increased capture of stormwater runoff) and others.[73] Recent water quality data (2000-2019) from NYCDEP Harbor Survey stations N3B, N4, and N5, which are located in the vicinity of the study area are presented below in **Table 11-4**. Station N4 is located closest to the Project site, just to the north off 42nd Street. Station N3B is

[70] A fish that migrates between fresh and salt waters. Diadromous fish include anadromous fish (fish that spend most of their lives in saltwater and migrate to freshwater to spawn such as striped bass and sturgeon) and catadromous fish (fish that spend most of their lives in freshwater and migrate to saltwater to spawn such as the American eel).

[71] NYCDEP 2019.

[72] NYSDEC 2016.

[73] NYCDEP 2019.

located at the northern end of Manhattan off 125th Street and Station N5 is located at the southern end of Manhattan at the Battery, where the lower Hudson River meets the Upper New York Harbor.

Between 2000 and 2019, temperature, salinity, and pH were similar from Station N3B downstream to Station N5. Temperatures ranged from about 32 to 85°F, with an average of 67°F at the surface and 63 to 65°F at the bottom. As a tidal estuarine system, the lower Hudson River exhibits a wide range of salinity, from less than 1 ppt to 44.7 ppt[74] at Station N4 near the Project site. Average dissolved oxygen measurements upstream and downstream from the Project site showed similar variation, ranging from 7.0 to 7.3 mg/L at the surface and 6.0 to 6.4 mg/L at the bottom. Dissolved oxygen near the Project site fell below the standard for Class I waters only six times at the surface and 25 times at the bottom over the 15-year period. These data are consistent with those reflecting Harborwide improvements in dissolved oxygen levels over the past couple of decades.[75] NYCDEP indicates that by 2012, fecal coliform[76] levels had not exceeded the standard at any of its monitoring sites in the Harbor since the early 1990s. Similarly, enterococci[77] levels did not exceed the bathing standard at monitoring sites in the lower Hudson River.[78]

11.3.2.1.1.2 New Jersey Water Quality Monitoring

Water quality within the New Jersey waters of the Inner Harbor is monitored as part of the New York Harbor Water Quality Report, on which NYCDEP and NJDEP collaborate. Through the HEP, data are collected from NYCDEP and the New Jersey Harbor Dischargers Group (NJHDG) in order to develop water quality trend assessments for the New York–New Jersey Harbor Estuary. NJHDG's water quality reports focus on a total of 68 sampling sites throughout the harbor, including those monitored as part of NYCDEP's Harbor Survey and discussed above. Data for New Jersey waters collected by NJHDG at Stations 32 and 33 are presented in **Table 11-5** below. Station NJHDG-32 is located closest to and north of the Project site near Harbor Survey Station N4. Station NJHDG-33 is located south of Project site near the Holland Tunnel.

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74 Salinity measurements in practical salinity units (psu) and parts per thousand (ppt) are nearly equivalent. Historically, salinity has been presented in ppt.

75 NYCDEP 2013.

76 Coliform bacteria generally originate in the intestines of warm-blooded animals. Waters are tested for fecal coliform as an indicator of possible presence of disease causing organisms to determine suitability for consumption of the water.

77 Enterococci are bacteria that live in the intestinal tracts of warm-blooded animals, including humans. Waters are tested for enterococci as an indicator of possible contamination by fecal waste and the possible presence of disease causing organisms.

78 NYCDEP 2013.

Table 11-4
NYCDEP Water Quality Data for Lower Hudson River Sampling Stations N3B, N4, and N5
(2000-2019, all months)

Parameter	Station N3B						Station N4*						Station N5					
	Surface Waters			Bottom Waters			Surface Waters			Bottom Waters			Surface Waters			Bottom Waters		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Temperature (°F)	32.4	84.7	67.1	33.7	79.8	65.0	32.3	85.0	66.5	34.6	78.7	64.3	33.2	83.1	65.6	31.7	77.3	63.4
Salinity (psu)	0.2	23.1	11.6	0.2	27.9	20.3	0.3	26.1	13.9	0.3	44.7	22.6	0.6	28.6	17.4	2.9	32.8	25.3
pH	7.0	8.6	7.6	7.0	8.5	7.5	7.0	8.7	7.6	6.5	8.3	7.5	6.8	8.4	7.6	7.0	8.2	7.6
Dissolved oxygen (mg/L)	1.2	20.2	7.3	1.1	16.4	6.0	0.7	23.8	7.2	0.6	24.1	6.1	0.8	22.2	7.0	0.6	26.2	6.4
Fecal coliform (cfu/100 mL)(1)	1	4,240	113	-	-	-	1	4,000	153	-	-	-	1	22,000	191	-	-	-
Enterococcus (cfu/100mL)	1	860	27	-	-	-	1	790	26	-	-	-	1	400	23	-	-	-
Secchi transparency (ft)	0.5	5.5	2.5	-	-	-	0.5	6	2.6	-	-	-	0.5	8	3.2	-	-	-
Total suspended solids (mg/L)	0.5	256.0	17.6	-	-	-	0.6	186	17.9	-	-	-	0.5	87.4	14.9	-	-	-

Notes:

All three stations are located in Class I waters. Station N4 (*) is located at 42nd Street, nearest the study area.

Fecal coliform, enterococcus, secchi transparency, and total suspended solids were either not measured at all or not measured consistently in bottom waters.

(1) Compliance with the fecal coliform standard is based on a monthly geometric mean comprising at least 5 measurements, for which data are not available to calculate, and not on the basis of the maximum fecal coliform value presented here. The maximum values occurred in 2011, a year characterized by higher than usual precipitation (NYCDEP 2013).

Source: NYCDEP Harbor Survey Water Quality Data 2000-2019.

Table 11-5
NJHDG Water Quality Data for Sampling Stations 32 and 33
(2003-2019, all months)

Parameter	NJHDG-32			NJHDG-33		
	Min	Max	Avg	Min	Max	Avg
Temperature (°F)	32.8	81.9	63.1	33.0	81.6	62.5
Salinity (psu)	0.9	67.9	16.5	1.3	31.4	18.5
pH	5.3	9.3	7.5	5.5	9.0	7.5
Dissolved oxygen (mg/L)	3.0	18.2	7.9	3.0	18.0	8.0
Fecal coliform (cfu/100 mL)(1)	2	7,100	101	1	1,600	91
Enterococcus (cfu/100mL)	1	400	24	1	384	24
Secchi transparency (ft)	1.0	8.0	2.9	1.0	8.0	3.0
Total suspended solids (mg/L)	4	494	50.3	1.0	342	42.0

Notes: All numbers represent surface water samples; no bottom water samples were taken. Water quality data from NJHDG sampling stations are available starting in 2003.

(1) As with the NYCDEP Harbor Survey data, compliance with the fecal coliform standard is based on a monthly geometric mean comprising at least 5 measurements, for which data are not available to calculate, and not on the basis of the maximum fecal coliform value presented here.

Sources: New Jersey Harbor Dischargers Group Water Quality Data, obtained from the National Water Quality Monitoring Council (www.waterqualitydata.us/provider/STORET/NJHDG).

Water quality measurements by NJHDG in New Jersey waters were consistent with NYCDEP's Harbor Survey measurements over the same sampling period. Temperatures ranged from about 33°F to 82°F, both at and downstream of the Project site. Salinity ranged from 0.9 ppt to 67.9 ppt, with average salinities similar to average surface salinity measured at NYCDEP Station N4. Dissolved oxygen ranged from 3.0 mg/L at both stations to 18.2 mg/L at NJGDG-32 and 18.0 mg/L at NJHDG-33; averages were about the same for both stations, at 7.9 mg/L for NJHDG-32 and 8.0 mg/L for NJHDG-33. Over the sampling period, dissolved oxygen measurements fell below the standard 13 times at NJHDG-32 and six times at NJHDG-33. Average fecal coliform levels were 101 cfu/100mL at the Project site and 91 cfu/100mL downstream of the Project site. NJHDG et al. reported that long-term trends showed improvement in fecal coliform levels.[79] Near the Project site, seasonal geometric means for fecal coliform ranged from 0 to 50 cfu/100mL in the summers of both 2006 and 2009.[80] Similar long term trends have been demonstrated for enterococcus, which has decreased over much of the Harbor except at stations in the Raritan River and Arthur Kill systems.[81] These trends are consistent with those recorded by NYCDEP's Harbor Survey program.

11.3.2.1.2 Sediment Quality

Complex flow patterns lead to widely variable sediment characteristics throughout the New York–New Jersey Harbor and connected waterbodies. Lower Hudson River sediments are primarily silt and clay.[82] Typical of most urban watersheds, sediments in the New York–New Jersey Harbor, including the lower Hudson River where the Project site is located, are contaminated due to a history of surrounding industrial uses. EPA's National Estuary Program Coastal Condition Report rates overall New York–New Jersey Harbor sediment quality as poor, based on sediment toxicity,

79 NJHDG et al. 2011.

80 NJHDG et al. 2011.

81 NJHDG et al. 2011.

82 USACE 1999, EEA 1988.

contamination, and/or total organic carbon levels.[83] The lower Hudson River is listed as being impaired for PCBs and other toxic materials,[84] and the suspected source for these impairments is contaminated sediment. EPA has designated the 200-mile stretch of the Hudson River from the Battery upstream to Hudson Falls, New York, a Superfund site as a result of PCB contamination. Contaminants found throughout the New York–New Jersey Harbor Estuary include pesticides such as chlordane and dichlorodiphenyltrichloroethane (DDT), heavy metals like mercury, cadmium, lead, and copper, PCBs, and various PAHs.[85] While the sediments of the harbor are generally contaminated, the concentrations of most sediment contaminants (e.g., dioxin, DDT, PCBs, and mercury) have decreased on average by an order of magnitude over the past few decades, mainly due to control measures implemented through the Clean Water Act.[86]

11.3.2.1.3 Aquatic Biota

The New York–New Jersey Harbor Estuary, including the lower Hudson River, supports a diverse and productive aquatic community of more than 100 species of finfish, more than 100 invertebrate species, and a variety of phytoplankton and zooplankton.

11.3.2.1.3.1 Primary Producers

Primary producers are plants or microorganisms that can convert light energy or chemical energy into organic matter (e.g., plant growth or cell growth) which is then eaten by other organisms. Primary producers are the base of the aquatic food chain. In the Hudson River, primary producers include phytoplankton[87] and macroalgae.[88] 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 lower Hudson River, with lesser contributions from dinoflagellates[89] and green algae.[90] Phytoplankton sampling in the lower Hudson River between 1991 and 2000 resulted in the collection of 71 taxa[91]; the most abundant species were *Nannochloris atomus* and *Skeletonema costatum*.[92] Phytoplankton sampling from 1996-2003 on the Hudson River near Pier 26, downstream of the Project site, found that the most dominant species were: *Asterionella japonica*, *Chaetoceros subtilis*, *Coscinodiscus excentricus*, *Ditylum brightwelli*, *Eucampia zodiacus*, *Gyrosigma* sp., *Nitzchia reversa*, *Pseudonitzchia seriata*, *Rhizosolenia setigera*, and *Ebria tripartite*.[93] The most common benthic macroalgae, or large multicellular algae, present in the Project site area include sea lettuce (*Ulva* spp.), green fleece (*Codium fragile*), and brown algae (*Fucus* spp.).[94] While nutrient

[83] EPA 2012.

[84] Other toxic materials may include mercury, dioxins/furans, PAHs, pesticides, and other heavy metals.

[85] Rohmann and Lilienthal 1987.

[86] Steinberg et al. 2004.

[87] Microscopic marine plants. The two main classes of phytoplankton are dinoflagellates and diatoms.

[88] Large algae that can be seen by the naked eye.

[89] Dinoflagellates are a type of photosynthetic plankton (a microscopic marine plant that uses sunlight to synthesize foods from carbon dioxide and water).

[90] Brosnan and O'Shea 1995.

[91] Plural of "taxon." Organisms identified down to the lowest taxonomic unit possible (i.e., not always down to species) for example: a phylum, order, family, genus, or species.

[92] NYCDEP 2007.

[93] Levandowsky and Vaccari 2004.

[94] PBS&J 1998.

concentrations in most of the harbor are high, low light penetration has often precluded the occurrence of phytoplankton blooms. Limited light penetration also restricts the distribution of submerged aquatic vegetation (SAV) in the vicinity of the Project site.[95] Extensively developed shorelines and swift currents further limit SAV growth in this area.

11.3.2.1.3.2 Zooplankton

Zooplankton are an integral component of aquatic food webs; they are primary grazers on phytoplankton and detritus, and serve as prey for higher trophic level organisms. Consumers of zooplankton typically include forage fish, such as bay anchovy, as well as commercially and recreationally important species in their early life stages, such as striped bass and white perch. Zooplankton sampling in the Hudson River between 1991 and 2000 resulted in the collection of 16 taxa, most commonly *Tintinnopsis* spp. and nauplius of copepods.[96]

11.3.2.1.3.3 Benthic Invertebrates

Major benthic invertebrate groups in the New York–New Jersey Harbor Estuary include: aquatic earthworms (oligochaetes), segmented worms (polychaetes), snails (gastropods), bivalves, barnacles, cumaceans, amphipods, isopods, crabs, and shrimp.[97] Most benthic invertebrates that have been found in the area are classified as pollution-tolerant species.[98] A study conducted between the summers of 2002 and 2004 collected a total of 145 benthic invertebrate taxa in the Hudson River Park area, downstream of the Project site.[99] Abundant species in this sampling program include: polychaetes *Mediomastus* spp., *Streblospio benedicti*, *Leitoscoloplos* spp., *Heteromastus* spp., *Spio setosa*, and *Tharyx* spp.; bivalves *Mulinia lateralis* and *Tellina agilis*; gastropods *Acteocina canaliculata* and *Rictaxis punctostriatus*; crustacean *Leocon americanus*; and oligochaete worms.[100] Blue crab (*Callinectes sapidus*) and American lobster (*Homarus americanus*) may also be present within the Upper Harbor region.[101]

11.3.2.1.3.4 Finfish

The finfish community in the New York–New Jersey Harbor and connected waterbodies is typical of large coastal estuaries and inshore waterways along the mid-Atlantic Bight in that it supports a variety of estuarine, marine, catadromous (migrating from fresh water to spawn in the sea), and anadromous (migrating from salt water to spawn in fresh water) fish species that use its waters for spawning and nursery, migratory, and foraging purposes. The Lower Hudson River and Upper Harbor fish community is spatially and seasonally dynamic. **Table 11-6** lists fish species known to occur within the Harbor Estuary that have the potential to occur in the lower Hudson River near the Project site. A 2002-2004 survey collected a total of 41 fish species from the Hudson River Park region, the most abundant being bay anchovy, Atlantic herring (*Clupea harengus*), striped bass, and blueback herring, all of which use open water habitat.[102]

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95 Olson et al. 1996.

96 NYCDEP 2007.

97 EEA 1988, EA 1990, Coastal 1987, PBS&J 1998.

98 Adams et al. 1998.

99 Bain et al. 2006.

100 Bain et al. 2006.

101 NMFS 2001.

102 Bain et al. 2006.

Table 11-6
Finfish Species with the Potential to Occur in the Lower Hudson River

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*
Blueback herring[1]	*Alosa aestivalis*
Bluefish[1]	*Pomatomus saltatrix*
Atlantic 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*

Table 11-6 (Cont'd)
Finfish Species with the Potential to Occur in the Lower Hudson River

Common Name	Scientific Name
Pollock	*Pollachius virens*
Rainbow smelt	*Osmerus mordax*
Red hake(1)	*Urophycis chuss*
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*
Shortnose sturgeon	*Acipenser brevirostrum*
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 by Bain et al. (2006) between 2002 and 2004 at Hudson River Park downstream of Project site.

Sources: Bain et al. 2006, Woodhead 1990, EEA 1988, EA 1990, LMS 1994, 1999, 2002, 2003a, 2003b, Able et al. 1995

11.3.2.2 ESSENTIAL FISH HABITAT (EFH)

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The NMFS designates EFH within squares identified by latitude and longitude coordinates. The Project site is within a portion of the Hudson River estuary EFH that includes the Hudson River and Bay from Guttenberg, New Jersey south to Jersey City, New Jersey, including the Global Marine Terminal and the Military Ocean Terminal, Bayonne, New Jersey; Hoboken, New Jersey; Weehawken, New Jersey; Union City, New Jersey; Ellis Island; Liberty Island; Governors Island; the tip of Red Hook Point on the west tip of Brooklyn, NY; and Newark Bay, New Jersey. **Table 11-7** lists the species for which EFH is designated, and the life

stages of those fish identified as having EFH there, in the portion of the Hudson River at and near the Project site.[103] **Appendix 11** provides the consultation with NMFS with respect to EFH in the vicinity of the Project site.

Table 11-7
Essential Fish Habitat Designated Species by Designated Life Stage in the Vicinity of the Project Site

Species	Eggs	Larvae	Juveniles	Adults
Red hake (*Urophycis chuss)*	✓	✓	✓	✓
Winter flounder (*Pseudopleuronectes americanus*)	✓	✓	✓	✓
Windowpane flounder (*Scophthalmus aquosus*)	✓	✓	✓	✓
Atlantic herring (*Clupea harengus*)		✓	✓	✓
Bluefish (*Pomatomus saltatrix*)			✓	✓
Long-finned squid/Longfin Inshore Squid (*Loligo pealeii/ Doryteuthis pealeii*))	✓			
Atlantic butterfish (*Peprilus triacanthus*)		✓		
Summer flounder (*Paralichthys dentatus*)*		✓	✓	✓
Clearnose skate (*Raja eglanteria*)			✓	✓
Little skate (*Leucoraja erinacea*)			✓	✓
Winter skate (*Leucoraja ocellata*)			✓	✓

Note: * Habitat Areas of Particular Concern (HAPC) have been designated for summer flounder in the Greater Atlantic Region. HAPCs are subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. HAPC for summer flounder is defined as "All native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH is HAPC. If native species of submerged aquatic vegetation (SAV) are eliminated then exotic species should be protected because of functional value, however, all efforts should be made to restore native species." There is no SAV in the study area, therefore, HAPC for summer flounder does not exist within the study area.

Source: NMFS EFH Mapper at https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper accessed March 24, 2021.

11.3.2.3 WILDLIFE

On and over the open waters of the Hudson River, urban-adapted waterbirds such as double-crested cormorant (*Phalacrocorax auritus*), ring-billed gull, herring gull, and Canada goose occur year-round. Common terns, least terns, and osprey can also be found foraging for fish over the river during spring, summer, and fall. During winter, additional waterbirds, such as bufflehead (*Bucephala albeola*), red-breasted merganser (*Mergus serrator*), horned grebe (*Podiceps auritus*), brant, lesser scaup (*Aythya affinis*), greater scaup (*Aythya marila*), green-winged teal (*Anas carolinensis*), American widgeon (*Anas americana*), common goldeneye (*Bucephala clangula*), surf scoter (*Melanitta perspicillata*), black scoter (*Melanitta americana*), common loon (*Gavia immer*), canvasback (*Aythya valisineria*), and ruddy duck (*Oxyura jamaicensis*), can also often be found on the river, usually in nearshore areas.[104]

[103] NOAA 2016.

[104] Fowle and Kerlinger 2001.

11.3.2.4 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

NJNHP identified shortnose sturgeon (endangered) and Atlantic sturgeon (endangered) as having the potential to occur in the lower Hudson River study area in 2021. In 2016, both NMFS and NYNHP identified shortnose sturgeon and Atlantic sturgeon (endangered) as having the potential to be present within the lower Hudson River study area. FRA has completed consultation with NMFS and USFWS in accordance with Section 7 of the ESA. The following sections discuss these species. **Appendix 11** includes the correspondence from these agencies.

11.3.2.4.1 Shortnose Sturgeon

NMFS indicated that no eggs or larval shortnose sturgeon occur in the saline waters of the lower Hudson River or its adjacent bays and tributaries;[105] however, older life stages (juveniles and adults) are present in the Hudson River and connected waterbodies. The shortnose sturgeon is an anadromous bottom-feeding fish that can be found throughout the Hudson River from the Battery to the Federal Dam at Troy. Peterson and Bain (2002) estimated that the Hudson River shortnose sturgeon population contained about 61,000 fish. Shortnose sturgeon may occasionally use areas of the lower Hudson River downstream of the George Washington Bridge; however, spawning, nursery, and overwintering areas are located well upstream of the Project site.[106] Although larvae can be found in brackish regions of the Hudson River, juveniles from 2 to 8 years old are predominately confined to reaches upriver from the Project site. Bain et al. reported that primary summer habitat for shortnose sturgeon is the river channel, where water depths range from 43 to 138 feet, in the middle section of the Hudson River Estuary.[107] However, more recently the New York State Thruway Authority conducted mobile tracking of tagged shortnose sturgeon within the Hudson River north of the Project site, between the George Washington Bridge and Stony Point and found that approximately 58 percent of all detections of shortnose sturgeon were in waters shallower than 20 feet,[108] indicating some use of shallower water habitat within that portion of the Hudson River. The Hudson River south of the Tappan Zee Bridge (now the Governor Mario M. Cuomo Bridge), including the portion of the lower Hudson River where the Project site is located, is not considered optimal shortnose sturgeon habitat.[109]

Long-term Hudson River monitoring data collected by the New York utilities and others since the 1970s have also indicated that shortnose sturgeon occur in greatest abundance north of the Tappan Zee Bridge (now the Governor Mario M. Cuomo Bridge). Hoff et al. reported most captures of adult shortnose sturgeon during river monitoring efforts by Hudson River electric utilities were made between approximately river mile 24 and river mile 76, or from the Tappan Zee Bridge (now the Governor Mario M. Cuomo Bridge) to Poughkeepsie.[110] Shortnose sturgeon were collected between the Statue of Liberty (south of river mile 0) and the George Washington Bridge (river mile 12) during winter sampling in 2003-2004 and 2004-2005 (15 and 18 shortnose sturgeon, respectively). These sturgeon were collected within the channel, and all but two individuals were collected north of approximately river mile 2,[111] suggesting that shortnose sturgeon are still rare in the lower Hudson River in the vicinity of the Project site. During sampling conducted between 2002

[105] NMFS 2016.

[106] Bain et al. 2007.

[107] Bain et al. 2007.

[108] NMFS 2017a.

[109] Bain 1997.

[110] Hoff et al. 1988.

[111] Young 2005, Mattson 2005.

and 2004 near Hudson River Park, just downstream of the Project site, no sturgeon were collected.[112]

11.3.2.4.2 Atlantic Sturgeon

NMFS indicated that no eggs or larval Atlantic sturgeon occur in the saline waters of the lower Hudson River or its adjacent bays and tributaries;[113] however, older life stages (adults and subadults) could occur in the study area. The Atlantic sturgeon is an anadromous[114] bottom-feeding species that occurs within the New York–New Jersey Harbor and Hudson River estuaries.[115] Adults of this species spawn in freshwater rivers and migrate between riverine and coastal marine waters. In the Hudson River, Atlantic sturgeon are found in deeper waters and generally do not occur farther upstream than Hudson, New York. Adults migrate from the ocean upriver to spawn in fresh water above the salt front from late April to early July.[116] Females migrate from the river back to marine waters following spawning, but males may remain in the river until October or November. Early life stages (i.e., eggs, larvae, and smaller juveniles) are relatively intolerant of salinity; young-of-year Atlantic sturgeon exhibit poor survival at salinities ranging from 5 to 10 ppt, and older juveniles (Age-1 and Age-2) may tolerate salinities up to 12 ppt.[117]

In the New York–New Jersey Harbor, Atlantic sturgeon typically occur in deeper waters. According to recent surveys conducted by NMFS and multiple state agencies in the region[118], the majority of Atlantic sturgeon occurred in waters between 32 to 49 feet in depth; many of these sturgeon were found off the west coast of Long Island.[119] Tagging studies have indicated that Atlantic sturgeon from this aggregation have been detected in the Hudson River north of the Project site.[120] While Atlantic sturgeon are not expected to occur in significant numbers within the study area, transient sub-adults (i.e., larger juveniles that have migrated from the river to the nearshore coastal waters of the Atlantic Ocean) may be present as they move through shallower marine waters along the Atlantic coast; adults are most likely to be seasonal migrants and would occur primarily in the deeper waters of the river channel adjacent to the Project site.

11.3.2.4.2.1 Critical Habitat

The study area is located within an area designated as critical habitat for Atlantic sturgeon.[121] 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 (PBFs) of critical habitat that are essential to the conservation of the species include:

- PBF #1—Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0 to 0.5 ppt range) for settlement of fertilized eggs, refuge, growth, and development of early life stages.

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[112] Bain et al. 2006.

[113] NMFS 2016.

[114] Fish that spend most of their lives in saltwater and migrate to freshwater to spawn.

[115] Woodhead 1990.

[116] Smith 1985, Stegemann 1999.

[117] Kynard and Horgan 2002, ASMFC 2012.

[118] The reference for these studies, Dunton et al. 2010, includes an author from NYSDEC and received data from NJ, ME, and MA state agencies.

[119] Dunton et al. 2010.

[120] NMFS 2017a.

[121] NMFS 2017b. 82 Federal Register 39160; August 17, 2017.

- PBF#2—Aquatic habitat with a gradual downstream salinity gradient of 0.5 up to as high as 30 ppt and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development.
- PBF #3—Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: unimpeded movement of adults to and from spawning sites; seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary; and staging, resting, or holding of subadults or spawning condition adults.
- PBF #4—Water, between the river mouth and spawning sites, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support: spawning; annual and interannual adult, subadult, larval, and juvenile survival; and larval, juvenile, and subadult growth, development, and recruitment (e.g., 13°C to 26°C for spawning habitat and no more than 30°C for juvenile rearing habitat, and 6 milligrams per liter (mg/L) dissolved oxygen or greater for juvenile rearing habitat).

The Project site contains physical and biological features identified under PBFs #2, #3, and #4. Spawning habitat (PBF #1) does not occur in the vicinity of the Project site, which is much too far downstream in high salinity waters and does not contain hard substrate.

11.3.2.5 SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The NYSDOS has designated 15 Significant Coastal Fish and Wildlife Habitats within New York City. The Project site falls within one of these designated areas, the Lower Hudson Reach. Significant Coastal Fish and Wildlife Habitats are coastal habitats identified and evaluated for significance by NYSDEC 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.[122] 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. NYSDEC identified the Lower Hudson Reach as a Significant Coastal Fish and Wildlife Habitat in part because it provides an important wintering habitat for young-of-the-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, which is part of the greater Hudson River Estuary system that supports a diverse and historically highly productive ecosystem of fish and invertebrate species.[123] 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 animals 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.[124] In addition, the portion of the Project site beneath the Hudson River east of the New York pierhead line is located within (beneath) the Hudson River Park Estuarine Sanctuary.

USFWS also designated the Lower Hudson River Estuary, from the Battery at the southern tip of Manhattan up to Stony Point at river mile 41, as a Significant Habitat Complex because it is a

[122] NYSDOS 1984.

[123] Briggs and Waldman 2002, NYDOS 1992.

[124] NYSDOS 1992.

regionally significant nursery and wintering habitat for a number of anadromous, estuarine, and marine fish species, including striped bass, and is 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.[125] Striped bass are anadromous their range extends 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.[126]

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.[127] Although most migrate to sea, some striped bass adults remain in the Hudson River year-round, never migrating. 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 increase in the spring.

The Hudson River supports one of the principal spawning populations of striped bass along the U.S. Atlantic coast. Other important spawning populations include Delaware Bay, Chesapeake Bay, the Roanoke and Chowan 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, NY (river mile 42) upstream to Saugerties, New York (river mile 106).[128] Fecundity depends on age and size and females may produce up to several million pelagic eggs.[129] Utilities' fish surveys conducted from 1998 to 2007 during May and June primarily collected 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 (Governor Mario M. Cuomo Bridge) region. The spawning area is considerably upriver of the Project site.

Larval striped bass recruit to the lower salinity areas of the Hudson River well upstream of the Project site from May to July. Larvae are abundant throughout the Hudson River during this time and are more common from the Tappan Zee Bridge (Governor Mario M. Cuomo Bridge) to Hyde Park than the lower estuary. Striped bass juveniles begin to move to shallower nursery habitat in the lower estuary. Juvenile abundances typically peak in July and August upstream of Hyde Park in deeper (greater than 20 feet deep) bottom habitats. Many juvenile striped bass move downstream by the end of their first summer to occupy the lower estuary and into New York Harbor, western Long Island Sound, and along the south shore of Long Island. Juvenile striped bass remain near shore until November or December, before moving to deeper coastal waters; juveniles, however, may overwinter (December through March) in the interpier areas within the Hudson River Park, which is adjacent to the Project site.[130] The lower Hudson River, including the area near the Project site, contains striped bass throughout the year and provides important winter habitat (mid-November to mid-April) for young-of-the-year, yearling, and older striped bass.[131]

At two to three years old, 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

[125] USFWS 1997.

[126] Bain et al. 2006.

[127] Waldman et al. 1990.

[128] CHGE et al. 1999, ASA 2010.

[129] ASMFC 2015.

[130] AKRF, Inc. et al. 1998, Dunning et al. 2009, CHGE et al. 1999.

[131] Heimbuch et al. 1994, NYSDOS 1992.

individuals are thought to mature and remain year-round in the upper freshwater portion of the estuary, while others adopt an anadromous pattern and, once sexually mature, spend most of their time in coastal saltwater habitats migrating into freshwater and brackish habitats in the spring to spawn.[132]

Adult striped bass are top predators and are prey to few other animals. Adult striped bass in the Lower Hudson–Raritan Estuary prey upon at least 20 different taxa, dominated by a variety of small-bodied and juvenile fishes and crustaceans.[133] The coastal stock is healthy, with spawning stock biomass well above the target level specified in the Interstate Fisheries Management Plan[134] and stocks at historically high levels.[135]

11.3.3 NEW YORK

11.3.3.1 FLOODPLAINS

As shown in **Figure 11-7**, based on the revised preliminary FIRM for New York City released in January 2015, most of the Project site in Manhattan falls within the 100-year floodplain of the Hudson River, Zones VE and AE. The portion of the Hudson River floodplain close to the Manhattan shoreline is within Zone VE with a BFE of 16 feet NAVD88, indicating that it is subject to additional hazards due to storm-induced velocity wave action, a 3-foot or higher breaking wave. The upland area of Manhattan within the Project site is within Zone AE with a BFE generally ranging from 11 to 12 feet NAVD88 with a small portion at 10 feet at the A Yard. A small portion of the Project site is within the 500-year floodplain.

11.3.3.2 WETLANDS

The NWI designates the Hudson River as an E1UBL—an estuarine subtidal wetland that has an unconsolidated bottom and is permanently flooded (see **Figure 11-2**). 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. The Hudson River within the study area does not contain wetland vegetation and would not meet the definition of wetland as used by the USACE and EPA since the 1970s for regulatory purposes under the Clean Water Act.

Near the Project site, NYSDEC has mapped the waters of the Hudson River west of the Manhattan pierhead line as littoral zone tidal wetlands (see **Figure 11-8**). Littoral zone tidal wetlands are defined as permanently flooded lands under waters less than or equal to 6 feet of tidal waters at MLW that are not included in another tidal wetland category. Water depths at the pierhead line are deeper than 6 feet at MLW, ranging from 18 to 30 feet at MLLW. Therefore, NYSDEC would not regulate activities in this portion of the Project site under Article 25 of the NY ECL.

According to the NYSDEC Environmental Resource Mapper, there are no NYSDEC-mapped freshwater wetlands or submerged aquatic vegetation (SAV) within the New York study area. The New York study area outside of the Hudson River is highly developed and contains no wetland or surface water features.[136]

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[132] Zlokovitz et al. 2003.

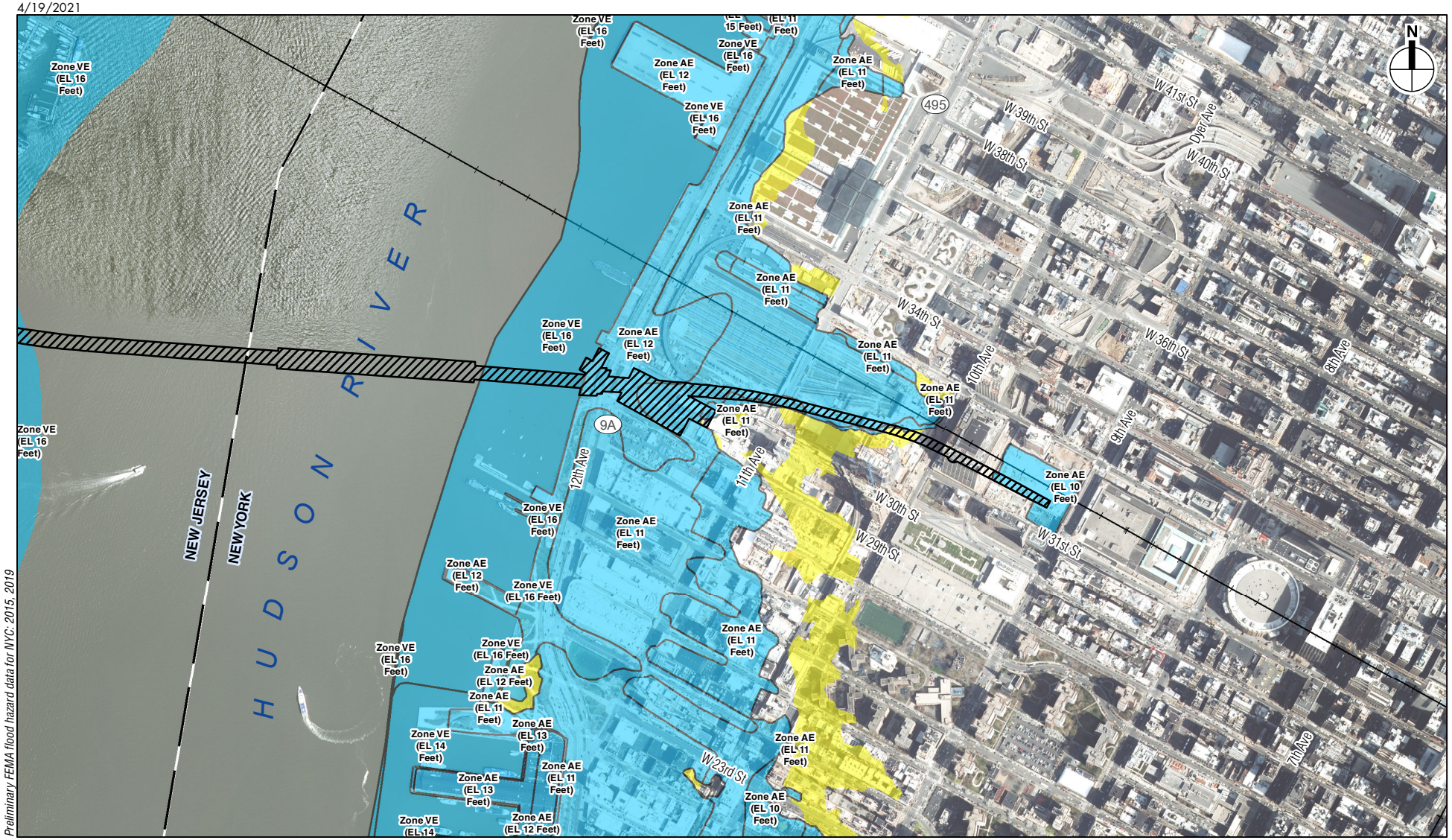
[133] Steimle et al. 2000. Dunning et al. 2009.

[134] ASMFC 2015.

[135] NYSDEC 2010.

[136] NYSDEC Environmental Resource Mapper 2021

4/19/2021



Preliminary FEMA flood hazard data for NYC, 2015, 2019

Project Site

Zone + EL 1% Annual Chance Flood Hazard (100-year floodplain)

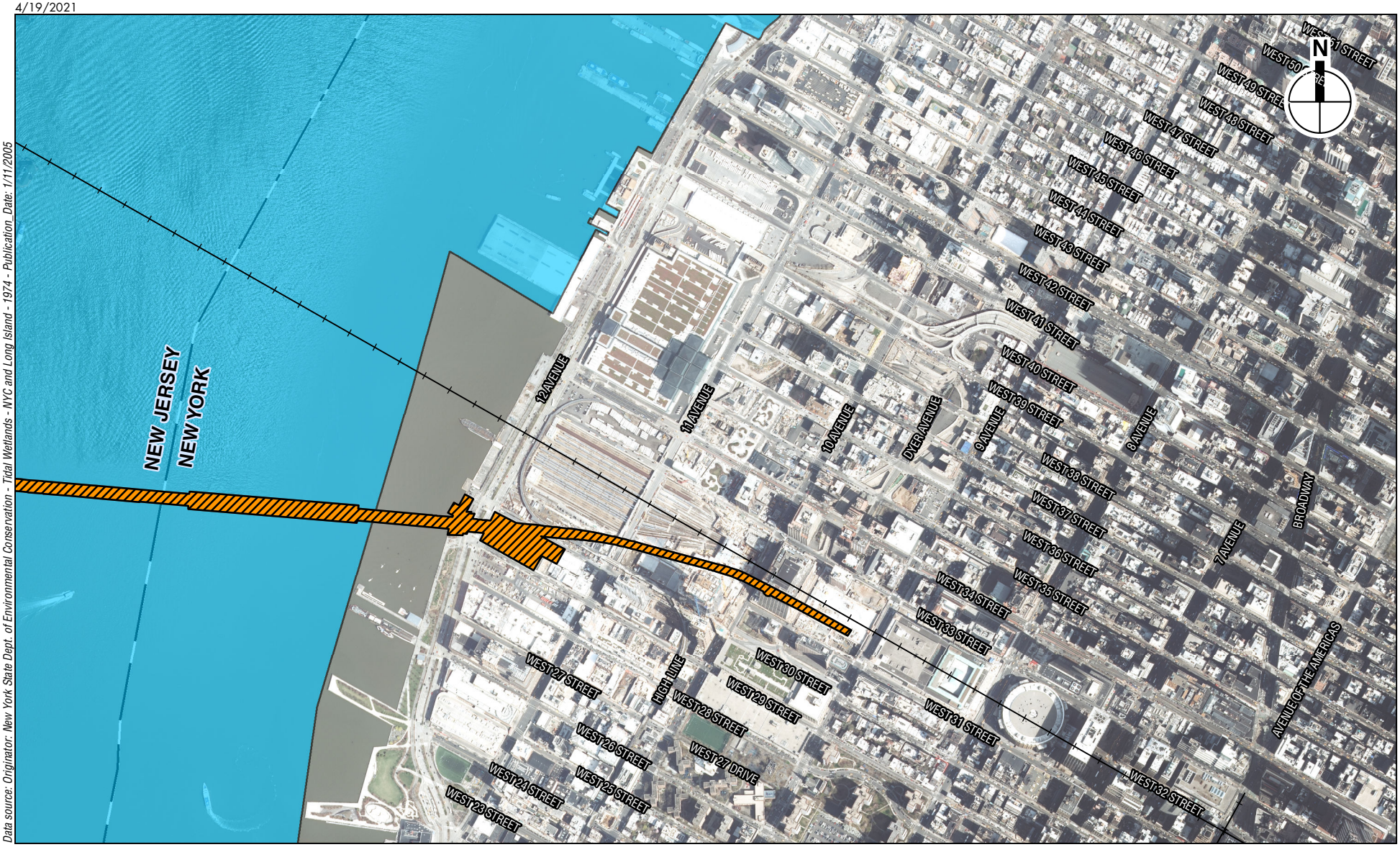
0.2% Annual Chance Flood Hazard (500-year floodplain)

0 2,000 FEET

HUDSON TUNNEL PROJECT

Flood Hazard Areas, Preliminary FIRM: New York Study Area

Figure 11-7



HUDSON TUNNEL PROJECT

NYSDEC Littoral Zone Tidal Wetlands

Figure 11-8

11.3.3.3 GROUNDWATER

Groundwater is not used as a potable water supply in New York City. Groundwater levels in the Manhattan study area, recorded during geotechnical surveys as part of the ARC Project, ranged from between 5 feet and 20 feet below ground surface. West of about Eleventh Avenue, groundwater levels are within 10 feet of the ground surface, and vary by about 4 feet with the tidal cycle of the Hudson River. Groundwater is expected to flow toward the Hudson River.

11.3.3.4 TERRESTRIAL RESOURCES

11.3.3.4.1 Ecological Communities

The study area is located within the urban landscape of Manhattan's Hudson Yards neighborhood, and the habitat primarily consists of roadways, railyards, buildings, and a few narrow bands of street trees. The study area is best described as having "terrestrial cultural" communities, which are defined as "communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical conformations of the substrate (e.g., soil, bedrock, etc.), or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence."[137] The terrestrial cultural communities that are present within the study area include paved road/path,[138] urban structure exterior,[139] railroad,[140] mowed lawn with trees,[141] and flower/herb garden.[142] The paved road/path, railroad, and urban structure exterior communities are unvegetated and represent the surrounding streets, railyards, and residential/commercial buildings respectively. The mowed lawn with trees community is found in small portions of the study area as street trees between concrete sidewalks and paved roads. The most common street trees in New York City are London planetree (*Platanus acerfolia*), Norway maple (*Acer platanoides*), Callery pear (*Pyrus calleryana*), honey locust (*Gleditsia triacanthos*), and pin oak (*Quercus palustris*).[143] The flower/herb garden community is found planted along the High Line, a public park built on a converted former railroad trestle. Vegetation along the High Line consists of trees, shrubs, wildflower, and grasses that are generally selected for their vigor and benefit to

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[137] Edinger et al. 2014.

[138] Edinger et al. (2014) define this community as "a road or pathway that is paved with asphalt, concrete, brick, stone, etc. There may be sparse vegetation rooted in cracks in the paved surface."

[139] Edinger et al. (2014) define this community as "the exterior surfaces of metal, wood, or concrete structures (such as commercial buildings, apartment buildings, houses, bridges) or any structural surface composed of inorganic materials (glass, plastics, etc.) in an urban or densely populated suburban area. These sites may be sparsely vegetated with lichens, mosses, and terrestrial algae; occasionally vascular plants may grow in cracks. Nooks and crannies may provide nesting habitat for birds and insects, and roosting sites for bats."

[140] Edinger et al. (2014) define this community as "a permanent road having a line of steel rails fixed to wood ties and laid on a gravel roadbed that provides a track for cars or equipment drawn by locomotives or propelled by self-contained motors. There may be sparse vegetation rooted in the gravel substrate along regularly maintained railroads. The railroad right of way may be maintained by mowing or herbicide spraying."

[141] Edinger et al. (2014) define this community as "residential, recreational, or commercial land in which the groundcover is dominated by clipped grasses and forbs, and is shaded by at least 30 percent of trees. Ornamental and/or native shrubs may be present, usually with less than 50 percent cover. The groundcover is maintained by mowing and broadleaf herbicide application."

[142] Edinger et al. (2014) define this community as "residential, commercial, or horticultural land cultivated for the production of ornamental herbs and shrubs. This community includes gardens cultivated for the production of culinary herbs."

[143] Peper et al. 2007.

wildlife, including pollinators (e.g., flat-topped aster (*Doellingeria umbellate)*, white sweet clover (*Melilotus albus*), butterfly milkweed (*Asclepias tuberosa)*, and seaside goldenrod (*Solidago sempervirens*)).

11.3.3.4.2 Wildlife

Natural habitats available to terrestrial wildlife within the study area are limited to small buffers between areas of urban residential/commercial land use and human disturbance. As a consequence, these habitats are of limited value to native wildlife. The study area is otherwise developed and covered by buildings, railyards, asphalt, and maintained lawns. As such, only the most urban-adapted, generalist species that can tolerate highly degraded environments and high levels of human activity currently have the potential to occur within the study area.

11.3.3.4.2.1 Birds

Birds species commonly found in the New York study area were identified using the *Breeding Bird Atlas,* a periodic census of the distribution of breeding birds across New York State. The most recent census was conducted from 2000-2005 and documented eight species as confirmed or probable/possible breeders in the survey block in which the study area is located (Block 5751D) (see **Table 11-8**). However, the 9-square-mile survey block spans natural areas where there is habitat to support these species, while the study area contains habitat that is suitable for only a few of the most urban-adapted birds. The bird species that are considered most likely to breed within the study area are the non-native European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and rock pigeon (*Columbia liva*). These are extremely disturbance-tolerant, generalist species that can thrive in heavily developed, urban environments.

Table 11-8
New York State
Breeding Bird Atlas 2000-2005
for Block 5751D

Common Name	Scientific Name
American kestrel	*Falco sparverius*
Rock pigeon	*Columba livia*
Mourning dove	*Zenaida macroura*
Northern mockingbird	*Mimus polyglottos*
European starling	*Sturnus vulgaris*
Northern cardinal	*Cardinalis cardinalis*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
Source: 2000-2005 NYS Breeding Bird Atlas for Block 5751D.	

11.3.3.4.2.2 Mammals

Habitat for mammals is limited within the study area, and is likely to be used only by urban-adapted and synanthropic species (those that benefit from an association with humans). These include the raccoon (*Procyon lotor*), Norway rat (*Rattus norvegicus*), gray squirrel (*Sciurus carolinensis*), and domestic cat (*Felis catus*).

11.3.3.4.2.3 Reptiles and Amphibians

The study area in New York comprises lots covered by buildings, asphalt, and railyards in a heavily urbanized and residential/commercial setting and does not provide habitat for reptiles or amphibians.

11.3.3.5 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

No Federally listed species were indicated by the USFWS IPaC system as occurring within the study area.

In consultation dated May 2021, NYNHP indicated that the state-listed endangered peregrine falcon (*Falco peregrinus*) and the yellow bumblebee (*Bombus (Thoracobombus) fervidus*), an unlisted species identified as of conservation concern, have the potential to occur within a half-mile of the Project site in New York.[144] These species are described below.

11.3.3.5.1 Peregrine Falcon

The peregrine falcon is listed as endangered at the state level by NYNHP. It is globally widespread and common in many areas,[145] and populations in New York State have grown dramatically since the 1980s. Peregrine falcons have become increasingly common in urban areas, demonstrating a tolerance of human disturbance and an ability to exploit resources in human-modified environments.[146] It has been stated that peregrine falcons will tolerate almost any level of human activity taking place below their nest provided that the nest is inaccessible to humans.[147] Urban peregrine falcons appear to have particularly high tolerance thresholds compared with those in more remote areas.[148] In several cities within New York State, including New York City, peregrine falcons nest in bridges and high-rise buildings among high levels of noise and human activity associated with the urban environment.[149] NYNHP identified peregrine falcon as occurring within a half-mile of the Project site.

11.3.3.5.2 Yellow Bumblebee

The yellow bumblebee is an unlisted species that is considered to be critically imperiled at the state level by NYNHP. The primary threat to yellow bumble bees are exotic pathogens in addition to habitat loss, insecticides, and urbanization. Yellow bumblebees are generalist foragers that nest both above and below ground.[150] Within the study area, the yellow bumblebee would have the potential to occur along the High Line where there is ample vegetation and flowering plants for foraging and nesting.

11.4 AFFECTED ENVIRONMENT: FUTURE CONDITIONS

11.4.1 OVERVIEW

In the future, ongoing and proposed projects within the study area by the analysis year of 2033 may result in impacts or improvements to natural resources in the study area. This condition is the baseline against which the impacts of both the No Action and Preferred Alternatives are compared.

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[144] NYNHP 2021.

[145] White et al. 2002.

[146] Cade et al. 1996, White et al. 2002.

[147] Ratcliffe 1972.

[148] White et al. 2002.

[149] Frank 1994, Cade et al. 1996, Loucks and Nadaraski 2005.

[150] NYNHP 2021.

11.4.2 NEW JERSEY

In the New Jersey study area, by the analysis year of 2033 improvements to natural resources are anticipated to continue through the implementation of several initiatives, including the New Jersey Meadowlands Commission Master Plan and the Rebuild By Design project in Hoboken.

The New Jersey Meadowlands Commission (renamed the NJSEA in 2015) adopted a Master Plan in 2004 that set the planning framework for environmental protection and development in the Meadowlands District (NJSEA is currently the planning authority for the 30.4-square-mile district). The primary goal of the Master Plan is the protection of the district's valuable natural resources (particularly 8,400 acres of wetlands) while promoting economic growth through sustainable redevelopment practices, with an emphasis on limiting urban sprawl and improving mass transit.

In addition, NJDEP is planning the Rebuild By Design project, an initiative to reduce frequent flooding in Hoboken due to major storm surges and high tides, and heavy rainfall events. That project proposes numerous green infrastructure elements, such as landscaped berms and levees and bioretention basins, to resist and delay flooding. Within the study area, the Rebuild By Design project will include a resist feature: a flood barrier to be located along Park Avenue south of the HBLR and curving along the HBLR. This project has the potential to provide wildlife habitat for urban adapted wildlife species, and improve ecological communities along the waterfront.

11.4.3 HUDSON RIVER

In the future, water quality in the lower Hudson River will continue to gradually improve as a result of the ongoing implementation of several initiatives in New York and New Jersey. Examples of these initiatives include the HEP, Hudson Raritan Estuary (HRE) Ecosystem Restoration Project, New York City Citywide Long-Term Control Plan, and the New Jersey Environmental Infrastructure Financing Program (NJEIFP) to address CSO discharges, Vision 2020 and the next New York City Comprehensive Waterfront Plan, the New York City Green Infrastructure Plan, and PlaNYC/OneNYC.

Elements of the HEP and other programs such as the HRE Ecosystem Restoration Project that are specifically directed at improving biological resources and habitats will result in improvements to natural resources over time. The HRE has identified the Hudson River Park Estuarine Sanctuary (located in the Hudson River eastward of the Manhattan pierhead line) as a restoration site. Restoration opportunities identified for the Sanctuary include creation, restoration, and enhancement of shallow water habitat and providing environmental interpretation.[151] Restoration opportunities pursued within the Sanctuary as part of the HRE would also occur under the Preferred Alternative.

The New York City Department of City Planning (NYCDCP) developed the *Vision 2020: New York City Comprehensive Waterfront Plan* to establish goals for the New York City waterfront, with the intention of promoting various ecological objectives and enhancing sustainability and climate resilience planning through the incorporation of climate change considerations, among other goals. The plan seeks to make improvements to water quality and aquatic resources through measures such as additional nitrogen reduction at the Bowery Bay, Tallman Island, Hunts Point, and Wards Island wastewater treatment plants (WWTPs);[152] additional reduction in CSOs with the increased capture of stormwater runoff through implementation of the New York City Green Infrastructure Plan;[153] improved flushing of constrained water bodies; and optimization of existing

[151] USACE and PANYNJ 2009, HRPT 2002.

[152] NYCDCP 2011.

[153] NYCDCP 2016.

sewer systems through improvements to drainage, interceptors, and tide gates.[154] NYCDCP is in the process of developing the city's next Comprehensive Waterfront Plan. As of 2019, the Green Infrastructure Plan reported about 10,000 green infrastructure assets (such as bioswales[155]) had been constructed, were in construction, or were in design.[156] In addition to reducing nitrogen discharges from WWTPs, PlaNYC goals that would result in improvements to water quality and aquatic resources include construction of grey infrastructure projects to reduce the discharge of untreated water to waterways, and reintroduction of oysters and eel grass. OneNYC, an update to PlaNYC, focuses on growth, equity, sustainability, and resiliency, and includes similar initiatives to improve water quality through wastewater treatment and stormwater management, as well as initiatives focusing on the resiliency and adaptability of the New York City's infrastructure.

As required by EPA's CSO Control Policy, NYCDEP initiated the development of the Long-Term Control Plan (LTCP) project in 2004. The LTCP project, recently amended in 2012 through an agreement between NYCDEP and NYSDEC, integrates CSO Facility Planning projects and the Comprehensive City-Wide Floatables Abatement Plan, and incorporates ongoing Use and Standards Attainment Program (USA) project work. As part of the 2012 agreement, NYCDEP will develop 10 waterbody-specific LTCPs and a citywide LTCP with the goal of achieving waterbody-specific water quality standards consistent with the Federal CSO Policy and the water quality goals of the Clean Water Act. As of November 2018, 10 of the waterbody-specific LTCPs have been approved by NYSDEC, the plan for Jamaica Bay has been submitted, and planning for the citywide LTCP is ongoing. A number of LTCP projects are under way.

These anticipated programs and initiatives should gradually improve living conditions for aquatic biota and potentially allow more pollution-intolerant species to occur in the Hudson River. Overall, however, communities of aquatic biota within the lower Hudson River are anticipated to be largely composed of the same species as at present.

In addition, efforts to characterize and understand sediment contamination are likely to lead to improvements in sediment quality over time. The Contamination Assessment and Reduction Project (CARP), sponsored by the 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, 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.[157]

11.4.4 NEW YORK

Natural resources in the New York study area are expected to remain essentially unchanged from the existing condition in the 2033 analysis year with the exception of landscaping added as a result of new open space areas. As discussed in detail in Chapter 6A, "Land Use, Zoning, and Public Policy," Section 6A.4.3, the New York study area is currently undergoing extensive redevelopment and many sites are currently under construction with high-density developments, and will be redeveloped with high density developments in the future under the No Action condition. These developments, including the Hudson Yards overbuild project (at the Western Rail Yard and Eastern Rail Yard), will result in new open space areas with landscaping that will benefit urban

[154] NYCDCP 2011.

[155] Bioswales are long, narrow depressions or channels designed with absorbent soils or other substrates, and planted with deep-rooted vegetation. They filter, retain, and route excess runoff and are particularly suitable along streets and parking lots.

[156] NYCDCP 2019.

[157] Landeck Miller et al. 2011.

wildlife and ecological communities in the vicinity of the Project site. In addition, the Tenth Avenue spur of the High Line may be completed by 2033, which will provide additional wildlife habitat, particularly for insect pollinators.

11.5 IMPACTS OF NO ACTION ALTERNATIVE

For purposes of analysis in this EIS, FRA and NJ TRANSIT have assumed that with the No Action Alternative, no new passenger rail tunnel would be built across the Hudson River and no rehabilitation of the North River Tunnel would occur. Additionally, FRA and NJ TRANSIT assumed that the North River Tunnel would remain functional and in operation at least through the FEIS analysis year of 2033, and that maintenance would continue as necessary to address ongoing deterioration and maintain service. This alternative would have no effect on natural resources.

11.6 CONSTRUCTION IMPACTS OF THE PREFERRED ALTERNATIVE

11.6.1 OVERVIEW

This section considers potential impacts resulting from the approximately 11-year construction period of the Preferred Alternative. Construction of the various Project elements, including the proposed rail tunnel, tracks and permanent access road, structures such as retaining walls, buildings, and viaduct foundation would result in both surface and subsurface disturbances and therefore would have the potential to affect natural resources. In addition, the in-water work at the low-cover area within the Hudson River and the rehabilitation of the North River Tunnel are also evaluated.

11.6.2 NEW JERSEY

11.6.2.1 FLOODPLAINS

The Project Sponsor would construct Project elements including fill, structures, and roadways (construction roads and permanent access roads), at or below the BFE in a number of areas. Accordingly, construction crews would handle equipment and materials as required by state and local regulations to ensure the safety of workers and protect adjacent uses. Because the source of floodwaters is tidal, the BFE would not be affected by displacement of floodplain storage or conveyance as a result of construction. Accordingly, the Preferred Alternative would not affect the floodplain or result in flooding of adjacent areas during construction.

11.6.2.2 WETLANDS

As discussed in Section 11.3, New Jersey wetlands within the study area include four delineated wetlands, two of which correspond to wetlands mapped by both NWI and NJDEP.

Construction activities and installation of erosion and sediment control measures and security fencing would temporarily impact approximately 1.5 acres of emergent wetlands and associated open water areas within the emergent wetlands along the surface tracks of the Preferred Alternative in the Meadowlands in New Jersey (Delineated Wetlands A and CD) (see **Table 11-9**).

Implementation of erosion and sediment control measures (e.g., hay bales, silt fences, and inlet protection) in accordance with the Stormwater Pollution Prevention Plan (SPPP) required under NJPDES General Permit NJ0088323 for Construction Activity Stormwater (General Permit 5G3) would minimize indirect impacts to wetlands due to deposition of soil and other material. During final design and construction of the Project, the Project Sponsor would prepare the SPPP and site-specific soil erosion and sediment control plan in accordance with the Standards for Soil Erosion

and Sediment Control in New Jersey, have it certified by the Hudson-Essex-Passaic Soil Conservation District, and would implement the SPPP as part of the Project's best management practices (BMPs) for construction. Following the completion of construction, wetlands temporarily affected during construction would be restored back to original topography and stabilized with mulch, straw, or hay.

Prior to other construction activities associated with the Preferred Alternative, existing culverts under the NEC surface tracks would be extended to maintain drainage and minimize indirect permanent impacts to wetlands. Construction of the new culverts and culvert extensions would include the installation of a temporary cofferdam and sump pits to divert water flow around the work area to control infiltration of groundwater during placement and anchoring of culverts or extensions. Water removed during cofferdam dewatering would be treated with temporary sediment control measures before being discharged back to surface waters or wetlands.

A culvert would be installed for a construction access road to the Hoboken shaft site and staging area within the small 0.4-acre emergent wetland (Wetland F) (**Figure 11-4c**) to maintain drainage under the access road during construction.

Based on implementation of BMPs in accordance with the SPPP and wetland restoration/mitigation activities, construction of the Preferred Alternative would not result in adverse impacts to wetlands. All temporary impacts to wetlands and associated open water areas would require permits from the USACE under Section 404 of the Clean Water Act and from NJDEP under Section 401 of the Clean Water Act. **Appendix 11** includes Information in Support of Section 404(b)(1) Analysis and a Conceptual Compensatory Mitigation Plan.

Table 11-9
Summary of Temporary Impacts to Wetlands and Associated Open Waters

Wetlands and Associated Open Waters within the Limit of the Project	Temporary Impact Due to Construction Activity (Acres)
Wetland A	0.6
Wetland B	0.0
Wetland CD outside the NYSW wetland mitigation site	0.9
TOTAL TEMPORARY IMPACT WITHIN DELINEATED WETLANDS	**1.5**

11.6.2.2.1 NYSW Wetland Mitigation Site

The Preferred Alternative would result in approximately 0.05 acres of temporary impacts to the NYSW wetland mitigation site, in addition to 0.29 acres of permanent impacts, which are described in Section 11.7.2.2.1. Similar to the other portions of the surface alignment, temporary impacts would result from the installation of erosion and sediment control measures and security fencing, and culverts with associated riprap outlet protection. Following the completion of construction, the 0.05 acres impacted would be restored back to original topography and stabilized.

11.6.2.3 GROUNDWATER

Construction of various elements of the proposed surface alignment, including retaining walls, culverts, and bridge abutment foundations within the unconsolidated sediments to the west of the Palisades, may require construction dewatering. Groundwater recovered during dewatering for these elements, as well as groundwater diverted from the construction area, would be from the surficial aquifer and would not result in adverse impacts to groundwater resources of the deep bedrock aquifers comprising the water supply for most of the wells in the study area. Should

construction dewatering exceed 100,000 gallons per day of water (70 gallons per minute pumping capacity), a dewatering permit from NJDEP would be required (NJAC 7:19). A Short Term Permit-by-Rule would be required if the duration of dewatering is less than 31 days. A Dewatering Permit-by-Rule would be required if dewatering would occur for 31 days or longer and from within a cofferdam or similar confined space. The Project Sponsor would implement measures during construction (e.g., sheeting or similar methods) to minimize groundwater intrusion such that dewatering is minimized to the extent practicable. Groundwater contamination encountered during construction dewatering would be treated according to New Jersey surface water quality standards and discharged to existing surface water bodies in accordance with the regulations at NJAC 7:14A-1.1 et seq. (a NJPDES permit may be required).

The rate of groundwater seepage in the Palisades portion of the new Hudson River Tunnel is expected to be very low. Groundwater that could seep into the Palisades portion of the tunnel would be highly alkaline, and could exceed New Jersey groundwater quality standards for volatile organic compounds and pesticides. Inflow water collection and disposal from excavations would include some combination of sumps, pumps, sediment settling tanks, and oil and water separation at the construction staging sites and access shaft sites. If the Project contractor uses a temporary spoils pit to store spoils on the west side of Tonnelle Avenue at the Tonnelle Avenue staging area, the below-grade area would be lined or otherwise managed to reduce groundwater inflow into the pit and to minimize the potential for discharge to groundwater. Water pumped from excavation sites would be tested and treated, if required, before disposal to a municipal sewer under applicable permits and in conformance with applicable discharge limits. Although construction dewatering is not expected to affect water supply wells near the tunnel alignment, prior to construction an assessment would be made of the potential impacts and mitigation measures would be implemented if required.

Water that infiltrates into the two tubes of the North River Tunnel is currently pumped to the sump in the Weehawken shaft where it is treated and discharged to the Hudson River through an existing permitted outfall in accordance with NJDEP NJPDES Permit Number NJ0164640. Amtrak is required to sample the discharge annually for contaminants in accordance with the NJPDES permit and submit the results to NJDEP. During rehabilitation, drainage would continue to be pumped to the Weehawken sump, where Amtrak would treat it as necessary prior to discharge to the Hudson River in accordance with the NJPDES permit. Therefore, the discharged water would not have the potential to result in adverse impacts to water quality or aquatic biota of the Hudson River.

The Hoboken fan plant and ventilation shaft in New Jersey would extend well below the water table. To avoid potential destabilization of soils that could occur from lowering of the groundwater table, slurry walls extending into rock would be used for excavation support to cut off groundwater inflow at the Hoboken shaft. As an additional groundwater cutoff measure, a grouting program to fill cracks and other voids in the rock mass below and adjacent to the shaft may be required in order to minimize groundwater inflow.

Because of relatively high permeability rates in the Stockton Formation, a moderate amount of dewatering and seepage control would likely be required for construction of the new Hudson River Tunnel between the Palisades and the Hudson River. However, seepage rates would be limited through tunnel construction methods and there would not be any adverse impacts to surrounding wells, all of which are constructed in deeper rock formations. Dewatering would require an NJDEP construction dewatering permit (NJAC 7:19) should it exceed 100,000 gallons per day of water (70 gallons per minute pumping capacity). A Short Term Permit-by-Rule would be required if the duration of dewatering is less than 31 days. A Dewatering Permit-by-Rule would be required if dewatering would occur for 31 days or longer from within a confined space. Dewatering and

seepage effluent[158] from this portion of the tunnel would be pumped to the Hoboken staging and fan plant site for treatment prior to discharge to a municipal sewer.

It is anticipated that dewatering and seepage effluent from the Hudson River portion of the tunnel would also be pumped to the Hoboken staging and fan plant site for treatment prior to discharge to a municipal sewer.

For the reasons described above, construction of the Preferred Alternative would not result in adverse impacts to groundwater resources.

11.6.2.4 SURFACE AND NAVIGABLE WATERS

Construction activity in the surface tracks segment along approximately 6,785 linear feet of stream would result in temporary impacts to Penhorn Creek. Culverts in Penhorn Creek that currently run underneath the existing surface tracks would be extended prior to placement of fill material for the retaining wall at the western end of the surface alignment and for the retaining wall east of Secaucus Road. These include the following construction activities:

- Extension of the existing twin 48-inch culvert that conveys Penhorn Creek under the new embankment. This twin culvert serves as the outlet for the large wetland area located north of the NEC.
- Construction of new culverts beneath the permanent access road adjacent to the viaduct and at the outlet to the NYSW wetland mitigation site.
- Replacement of the weir on Penhorn Creek downstream from the culvert extension.

In the DEIS, the Preferred Alternative included a culvert for this Penhorn Creek tributary to carry it beneath the rail right-of-way and new surface access road. Since publication of the DEIS, Amtrak modified the design to remove this culvert. Instead, the Penhorn Creek tributary would be relocated. It would remain open, passing under the rail viaduct and the access road along the railroad embankment wall. The relocated portion of the Penhorn Creek tributary would be a trapezoidal channel with a natural bottom developed to reflect a natural channel design. The new construction and maintenance access road would be elevated on a trestle for approximately 315 feet from the right bank of Penhorn Creek to the end of the railroad embankment retaining wall and would comprise open grid steel grating. This open grid steel grating access road would be above the Penhorn Creek tributary. The inoperable pump station would be demolished and removed, and the weir just south of the NEC would be removed. A new weir would be installed downstream of the twin 48-inch culvert extension to maintain surface water elevations in the upstream portion of Penhorn Creek and associated wetlands.

The existing culverts beneath the NEC are critical drainage elements that would be carefully maintained during culvert extension and construction in order to minimize impacts to flow patterns within wetlands and discharges to Penhorn Creek. New culverts would be constructed beneath the permanent access road adjacent to the viaduct and at the outlet to the NYSW wetland mitigation site.

Construction of the culvert extension, construction of the trapezoidal channel, replacement of the weir, and installation of new culverts has the potential to impact surface and navigable waters due to discharge of sediment and temporary occupation of Penhorn Creek during the culvert extension and weir replacement. Flow within Penhorn Creek would be maintained throughout the culvert extension. A temporary cofferdam and sump pits would be installed to divert Penhorn Creek water flow around the work area to control infiltration of groundwater during placement and anchoring of culverts or extensions. Water removed during cofferdam dewatering would be treated with

[158] A discharge of water or wastewater.

temporary sediment control measures developed in consultation with NJDEP (e.g., sediment control basin) before being discharged back to Penhorn Creek. In consultation with NJDEP, measures would be implemented during the replacement of the weir to minimize impacts to surface waters of Penhorn Creek. With the implementation of these measures, the construction of the Preferred Alternative would not result in adverse impacts to surface and navigable waters.

11.6.2.4.1 Water Quality

Implementation of erosion and sediment control measures in accordance with the SPPP would minimize the potential for sedimentation into Penhorn Creek during installation of drainage culverts, construction of the trapezoidal channel for the relocated Penhorn Creek tributary, and other construction activities that have the potential to discharge sediment to waters that discharge to Penhorn Creek. The plan would include measures such as the construction of water quality and detention basins, installation of silt fence, hay bales and/or fabric filters at the construction periphery, and vegetative stabilization of soils to prevent sedimentation into surface waters. The SPPP and site-specific soil erosion and sediment control plan would be prepared in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, certified by the Hudson-Essex-Passaic Soil Conservation District, and would be implemented as part of the Preferred Alternative's BMPs for construction.

Installation of culvert extensions in Penhorn Creek would have the potential to result in temporary increases in suspended sediment during culvert construction. Construction of culvert extensions would include the installation of a temporary cofferdam and sump pits to divert Penhorn Creek water flow around the work area to control infiltration of groundwater during placement and anchoring of culverts or extensions. Water removed during cofferdam dewatering would be treated with temporary sediment control measures developed in consultation with NJDEP (e.g., sediment control basin) before being discharged back to Penhorn Creek.

11.6.2.4.2 Aquatic Biota

Implementing BMPs to minimize sediment resuspension during construction of culvert extensions, relocation of a portion of the Penhorn Creek tributary, and the maintenance of flow through existing culverts, and implementing erosion and sediment control measures in accordance with the SPPP would minimize water quality impacts to Penhorn Creek and emergent wetlands, and adverse effects to benthic invertebrates and fish. To protect anadromous species spawning run in Penhorn Creek, no in-water or sediment- generating activities and pile driving would occur between March 1 and June 30.

Construction of the viaduct in the Meadowlands would require the driving of approximately 600 two-foot-diameter steel pipe piles into the wetlands associated with Penhorn Creek using an impact hammer. The viaduct piles would be at least 650 feet from Penhorn Creek. Pile driving would generate underwater noise in the wetlands that may be transmitted through saturated soils and into very shallow, inundated wetland pools adjacent to Penhorn Creek. These underwater noise levels would be reduced by using a wooden, rubber, and/or composite plastic cushion block to reduce the energy delivered to the pile. With the 650-foot separation from Penhorn Creek and use of cushion block, underwater noise levels in the creek would be below the level that causes behavioral effects or recoverable physiological injury (e.g., hemorrhaging of internal organs, increased stress hormones) to fish.[159] **Appendix 11-3** provides a detailed discussion of the effects

[159] Biological thresholds recognized by the National Marine Fisheries Service and U.S. Fish and Wildlife Service for evaluations of the potential impacts of underwater noise for fishes. https://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/consultation/index.html#technical United States Fish and Wildlife Service (USFWS). 2015. Biological Opinion for the SR 30/US 98 Pensacola Bay Bridge Replacement. FWS No. 04EF3000-2013-F-0264. 52 pp.

of underwater noise to fish. Fish in the wetlands within the immediate vicinity of impact pile driving may experience behavioral effects such as temporary avoidance of the area affected by incremental increases in underwater noise, called the ensonified area. However, elevated underwater noise levels would be temporary, and these behavioral effects would only occur during active impact pile driving, which would occur intermittently over the anticipated 3 to 4 months needed to drive the piles.

11.6.2.5 TERRESTRIAL RESOURCES

11.6.2.5.1 Ecological Communities

As discussed in Section 11.3, ecological communities within the study area are primarily unvegetated or dominated by ruderal species. Construction of the Preferred Alternative would result in disturbance to approximately 1.7 acres of the upland successional southern hardwoods community. In addition, if haul route Option 3 along the western side of the HBLR tracks to 19th Street in Weehawken is developed, vegetation would be cleared from the footprint of the route, along and adjacent to the concrete-lined stormwater drainage ditch. This area would be restored and re-vegetated with native plant species after the construction period. All tree clearing associated with the Preferred Alternative in the Meadowlands and associated with off-street haul route Option 3 would occur between October 1 and March 14 to minimize potential impacts to breeding birds protected under the Migratory Bird Treaty Act, as discussed below. Implementation of erosion and sediment control measures in accordance with the Project's SPPP would minimize potential impacts to ecological communities adjacent to the Project site. Therefore, construction of the Preferred Alternative would not result in adverse impacts to ecological communities.

11.6.2.5.2 Wildlife

Construction of the Preferred Alternative, including retaining walls, culverts, access roads, and a pile-supported viaduct, would result in the temporary loss of approximately 1.5 acres of wetlands and associated open water areas due to the installation of erosion and sediment control measures and security fencing. Approximately 1.7 acres of upland successional southern hardwoods community would also require clearing within the NEC right of way. Additional upland successional southern hardwoods community would be cleared (approximately 0.31 acres along the HBLR for off-street haul route Option 3). Otherwise, all land-disturbing construction activities would occur within existing cleared areas or along roadside and rail track margins and other such degraded areas.

The proposed wetland and successional southern hardwoods community impact areas are widespread and common habitat types throughout the region and are of low overall quality to native wildlife, due to the prevalence of invasive species and the disturbed nature of the habitat. Portions of these habitats that would be lost during construction would represent a negligible reduction in the amount of such habitat available to wildlife in the vicinity of the Project area. Any reductions in the number of individuals inhabiting these communities would not impact the size or viability of their local populations and would not change the assemblage of wildlife species present.

To minimize any potential direct impacts to migratory birds protected under the Migratory Bird Treaty Act with the potential to breed in the vicinity of the Project site, vegetation clearing and/or initial placement of fill material in the Meadowlands, and tree clearing along the HBLR for off-street haul route Option 3, would not occur during the primary breeding period for most bird species (April through July) and would instead occur between October 1 and March 14 (i.e., prior to or after the breeding season), to prevent birds from attempting to breed where additional construction activity would later occur. These measures would further avoid any potential direct impacts to birds, particularly threatened species and wading birds species of special concern identified on the state level that could nest or forage within the wetlands around Penhorn Creek. Overall, land

disturbance in New Jersey required to construct the Preferred Alternative would not have adverse effects to wildlife species.

Noises generated during construction of the Preferred Alternative would not be likely to have long-lasting or adverse effects to wildlife in the area due to high existing levels of noise and other human disturbance from the surrounding urban and industrial land uses. As discussed in Section 11.3 above, wildlife communities in the Project area have been established under noisy existing conditions associated with the urban environment and current railroad activity, and as such, are largely composed of disturbance-tolerant species. Visual and auditory disturbances during construction would have the potential to temporarily displace some individuals of some species from the immediate vicinity of the site of activity, but the construction activities would not be expected to increase levels of disturbance to the extent that there would be alterations in species assemblages or otherwise negative changes to wildlife communities in the surrounding area relative to the present state. Individuals that would potentially briefly relocate in response to the construction noise would be expected to easily distance themselves from the activity and acquire suitable alternative habitat nearby. Any such temporary relocation away from the area of disturbance would not be expected to adversely affect these individuals in the long term.[160]

The noisiest construction activity in the New Jersey portion of the study area, including the Meadowlands surrounding Penhorn Creek, would be the impact driving of piles to support the viaduct and other portions of the surface alignment. Pile driving noise would potentially displace birds and other wildlife from the immediate surroundings. The pile driving would be estimated to last approximately one year. Birds and other wildlife would instead seek alternative breeding habitat nearby, which is abundant in the marshes around Penhorn Creek and elsewhere in the greater Meadowlands area. For this reason, and because pile driving would only span the breeding season of one year, construction of the Preferred Alternative would not adversely affect the size or viability of wildlife populations.

Non-breeding animals have a greater ability to relocate to alternative habitat to avoid disturbance than they do while nesting/breeding. Displacement of any wildlife by pile impacting noise during non-breeding seasons would represent a temporary effect that would not be expected to adversely affect wildlife or permanently alter the assemblage of species currently present. Given the abundance of comparable wetland habitat in the surrounding area that would not be affected by construction noise, wildlife present during the pile installation period would not be likely to have difficulty avoiding the disturbance and would have the ability to return after pile installation was complete. Overall, noises generated during construction of the Preferred Alternative would not have permanent or long-lasting adverse effects to wildlife within the Project area.

11.6.2.6 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

According to USFWS's IPaC database (see **Appendix 11**), there are no Federal threatened or endangered species or critical habitats (including wildlife refuges or fish hatcheries) within the New Jersey portion of the study area. Therefore, construction of the Preferred Alternative does not have the potential to adversely affect Federally listed species under the responsibility of USFWS. Additionally, because no nesting sites have been identified as occurring in the Project vicinity, construction of the Preferred Alternative is not likely to adversely affect bald eagles. USFWS concurred with these findings on May 12, 2017 (see **Appendix 11**). The Preferred Alternative would result in the relocation of the Penhorn Creek tributary just east of Secaucus Road, which contains documented populations of the state-listed endangered floating marsh-pennywort. In 2019, NJDEP determined that on the basis of additional populations of floating marsh-pennywort documented in the vicinity of the Project site, the Preferred Alternative would not adversely impact

[160] Gill et al. 2001.

the local population due to the extent of suitable habitat and amount of plants that would be left undisturbed. Therefore, the Preferred Alternative would not result in adverse impacts to floating marsh-pennywort.

Construction of the Preferred Alternative would occur within wetlands that serve as potential nesting and/or foraging habitat for state-listed birds, including glossy ibis, little blue heron, osprey, snowy egret, yellow-crowned night heron, and black-crowned night heron. The barn owl is also considered to have the potential to occur in the wetlands around Penhorn Creek at any time of year. As discussed above in Section 11.6.2.5.2, the 1.5 acres of wetland and associated open water areas temporarily lost during Preferred Alternative construction would represent a negligible reduction in the amount of such habitat available to these species in the vicinity of the Project area and would not impact the size or viability of their local populations. An abundance of interior wetland habitat surrounding Penhorn Creek would remain when the Preferred Alternative is complete, and glossy ibis, little blue heron, osprey, snowy egret, yellow-crowned night heron, black-crowned night heron, and barn owl would all have the same potential to occur in this area as at present.

To minimize the potential for impacts to birds potentially using this wetland habitat, vegetation clearing and/or initial placement of fill material would not occur in the primary breeding period for most bird species (April through July) and would instead occur between October and March (i.e., prior to or after the breeding season), to prevent birds from attempting to breed where additional construction activity would later occur. These measures would further avoid any potential direct impacts to threatened species and species of special concern birds that could nest or forage within the wetlands around Penhorn Creek. Measures to be implemented to minimize potential impacts to endangered, threatened, or special concern on the state level will be developed in consultation with NJDEP.

Noises generated during construction of the Preferred Alternative would not be likely to have long-lasting or adverse effects to threatened, endangered and special concern species potentially occurring in the area. As discussed in Section 11.3, the wildlife communities in the Project area have been established under noisy existing conditions associated with the urban environment and current railroad activity. Presence of any individuals of these species under these conditions inherently indicates a high tolerance of noise. Visual and auditory disturbances during construction would exceed baseline levels and have the potential to temporarily displace some individuals of some species from the immediate vicinity of the site of activity, but the construction activities would not be expected to increase levels of disturbance to the extent that these species would altogether abandon the area. Impacts would be limited to the periphery of the habitat, where conditions are already degraded by edge effects and the habitat is subjected to the greatest levels of human disturbance. More interior portions of the wetland complex would be unaffected, and any individuals that would potentially be displaced by the disturbances occurring on the edges would be expected to easily distance themselves from the activity and acquire suitable alternative habitat nearby. Any such temporary relocation away from the area of disturbance would not be expected to adversely affect these individuals in the long term.[161]

The noisiest construction activity that would be conducted in the wetland habitats where threatened and special concern species of birds have the potential to occur would be the pile driving to support the viaduct and other segments of the surface alignment. This indirect disturbance could temporarily displace any glossy ibises, little blue herons, ospreys, snowy egrets, yellow-crowned night herons, black-crowned night herons, or barn owls potentially occurring in the immediate vicinity. However, given that the pile driving would occur along the existing rail corridor, where existing noise levels are extremely high from railroad activity, these species might not be

[161] Gill et al. 2001.

likely to forage and/or nest in close proximity to the affected area. While not anticipated to nest within the Project site due to the predominance of phragmites in the wetlands within the surface alignment, much of the marsh surrounding the Project site would be unaffected by construction noise and remain available to any seaside sparrows seeking to nest in the area. The pile driving would be estimated to last approximately one year. Because pile driving would only span the breeding season of one year, construction of the Preferred Alternative would not adversely affect the size or viability of the populations of these bird species.

Pile driving would not be likely to affect glossy ibises, little blue herons, ospreys, snowy egrets, and yellow-crowned night-herons because they are migratory and only on rare occasions remain in New Jersey for the winter.[162] Black-crowned night herons and barn owls, which can occur in New Jersey year-round, would be likely to avoid the immediate vicinity of the areas in which pile driving were occurring. Given the extensiveness of contiguous marsh and the abundance of additional marsh habitat elsewhere in the surrounding area, any such non-breeding black-crowned night herons and barn owls displaced by the pile driving noise would not be expected to experience adverse effects by temporarily relocating away from the disturbance.

Overall, noises generated during construction of the Preferred Alternative would not have adverse effects to endangered, threatened, or special concern species within the Project area.

11.6.3 HUDSON RIVER

11.6.3.1 AQUATIC RESOURCES

Components of the Preferred Alternative that have the potential to impact aquatic resources include installation and removal of the cofferdams, increased vessel activity, and ground stabilization through deep soil mixing in the 3-acre low-cover area (as described in detail in Chapter 3, “Construction Methods and Activities,” Section 3.3.5). Potential impacts would be associated with sediment resuspension, underwater noise, and alteration of sediment characteristics, as described below.

11.6.3.1.1 Water Quality

As discussed in Chapter 3, “Construction Methods and Activities,” Section 3.3.5, the Preferred Alternative would have in-water construction work where the tunnel alignment would be relatively shallow below the river bottom, referred to as the low-cover area. Soil improvement in the river bottom would strengthen the soil of the river bed. Hardening the soil in this area would reduce the risk of difficulties during tunneling and provide long-term protection for the tunnel. In that area, a 3-acre area of river bottom in New York waters within the Hudson River would be strengthened using deep soil mixing, which mixes native soils with cement with large diameter augers or paddles. This method would result in a stronger, solidified cemented soil with a consistency equivalent to a hard clay, i.e., a moderate-strength “soilcrete.”

Soil improvement through deep soil mixing within the 3-acre low-cover area would be conducted within temporary cofferdams, minimizing potential increases in suspended sediment and adverse impacts to water quality. Therefore, the only potential impacts to water quality would result from the installation and removal of cofferdams (discussed in Section 11.6.3.1.3 below). In general, installation of cofferdams, like pile driving, does not result in significant levels of sediment disturbance. The greatest potential for increased turbidity typically occurs when the pile is removed.[163] Sediment disturbance associated with installation and removal of the cofferdams would result in minor, short-term increases in suspended sediment and re-deposition of sediments

[162] Boyle Jr. 2011.

[163] MPCA 2017.

and associated contaminants. Turbidity curtains would be deployed during cofferdam removal and the cofferdams would not be removed until the improved soil has hardened in order to minimize the effects of sediment resuspension. The Project Sponsor would implement a Pollution Prevention Plan, which may include measures such as use of a containment boom and spill socks, developed for the in-water construction activities to minimize the potential for discharge of materials to the Hudson River during sheet pile and king pile installation and deep soil mixing activities conducted from construction barges.

Increases in suspended sediment associated with installation and removal of the cofferdams would be temporary and localized to the immediate vicinity of construction activities. The average tidal current in the Hudson River is 1.4 knots;[164] therefore, any sediment re-suspended during sediment-disturbing activities would move away from the area of in-water construction, either a short distance upstream or downstream depending on the tidal direction, and would dissipate quickly after the completion of the activity. Similarly, any contaminants released to the water column as a result of sediment disturbance would dissipate quickly and would not result in adverse long-term impacts to water quality.

During rehabilitation of the existing North River Tunnel, water in the tunnel would continue to be discharged to the north and south tube mid-river sump pumps, which empty into the Weehawken sump, and finally discharge to the Hudson River. This water is and would continue to be monitored and discharged in accordance with Amtrak's active discharge permit NJPDES Permit No. NJ0164640, and would therefore not result in adverse impacts to water quality.

As described in Chapter 3, "Construction Methods and Activities," Section 3.3.6.3, a concrete-type grout would first be injected into the voids of the Manhattan Hudson River bulkhead (permeation) and then followed with an application of ground freezing in preparation for tunnel boring through the foundation of the bulkhead. The jet grouting procedure (using combinations of primarily cementitious materials mixed with additives) would be conducted at a pressure high enough to travel horizontally through the riprap voids, but low enough not to exceed the resistance of the overlying ground weight. In this manner, it is unlikely that any grout would be introduced to the Hudson River or have potential adverse effects on water quality as a result of the injection of jet grout into the bulkhead.

Soil improvement within the low-cover area would require permits from the USACE under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, from NYSDEC under Article 15 of the ECL. FRA received concurrence from NMFS under Section 7 of the Endangered Species Act that the Hudson Tunnel Project, including the modifications made to the Project since publication of the DEIS, would not affect ESA-listed species.

As described in Chapter 3, "Construction Methods and Construction Activities," Section 3.3.6.1, ground improvement activities for the Hudson River bulkhead would affect operations at the adjacent West 30th Street Heliport and would require the relocation of helicopter fueling facilities, if the heliport has not already relocated prior to the construction for the Hudson Tunnel Project. If the Hudson Tunnel Project must relocate the fueling facilities, the heliport's above-ground fuel tank would be moved either to a new permanent location, if that location can be identified (possibly near West 30th Street), or to a temporary new location. The temporary location might be within the heliport property or potentially on a new fueling barge that would be moored at the heliport. In either case, the fueling facility would comply with all applicable regulatory restrictions related to siting such a facility. If a temporary fuel barge is used, it would be moored for approximately 18 to 24 months on the New York side of the Hudson River near the West 30th Street Heliport during construction near the shoreline. The fuel barge would be 30 to 40 feet long and would hold 8,000

[164] Geyer and Chant 2006.

gallons of fuel. The barge would be equipped with spill containment measures and would be moored in accordance with a United States Coast Guard-approved mooring plan. With these measures in place, the temporary fuel barge would not have the potential to adversely affect water quality.

11.6.3.1.2 Sediment Quality

Installation and removal of cofferdams may result in temporary increases in suspended sediment containing low to moderate levels of contamination. Any sediments and associated contaminants resuspended during installation and removal of the cofferdams would be expected to be localized and would dissipate quickly with the tidal currents. Resuspended sediment would be expected to settle out over sediment with similar levels of contamination, and thus would not result in adverse impacts to sediment quality. Ground stabilization through deep soil mixing would be contained within the cofferdams and would not result in increased turbidity or contaminant resuspension in the river. The deep soil mixing would result in alteration of the sediment characteristics from soft bottom to soilcrete within the 3-acre low-cover area.

During rehabilitation of the North River Tunnel, discharges to surface water would be in accordance with the existing NJPDES permit and would not result in the introduction of contaminants that could impact sediment quality.

11.6.3.1.3 Aquatic Biota

The in-water construction activities described above would have potential temporary adverse impacts to fishes and benthic macroinvertebrates in a localized area surrounding the construction due to: temporary increases in suspended sediment, underwater noise, and shading during cofferdam installation/removal and ground stabilization via deep soil mixing. Shading impacts would be minimal from the barges associated with this work, as each barge would be small (approximately 30 feet wide by 90 feet long) in comparison to the area of the river left unshaded and moored-in-place in relatively deep waters at any given time.

11.6.3.1.3.1 Suspended Sediment

Life stages of estuarine and anadromous fish and macroinvertebrate species are generally tolerant of elevated suspended sediment concentrations and have evolved behavioral and physiological mechanisms for dealing with variable and potentially high concentrations of suspended sediment.[165] Any sediment re-suspension that could occur during in-water work would be temporary, minimal, and localized, and would be well below physiological impact thresholds of larval and adult fish and benthic macroinvertebrates. Additionally, because fish are mobile and generally avoid unsuitable conditions such as high suspended sediment concentrations,[166] the effects of habitat avoidance would not significantly affect their condition, fitness, or survival. Most shellfish are adapted to naturally turbid estuarine conditions and can tolerate short-term exposures by closing valves or reducing pumping activity.

Based on preliminary design, cofferdams consisting of alternating king piles and sheet piles in the low-cover area would likely be installed in two sections in order to minimize the area of riverbed that is disturbed at any one time; as each stage is completed, the piles would be removed. The individual cofferdams would each be approximately 600 feet long and 110 feet wide. The in-water work would begin at the location of the cofferdam closest to the Manhattan shoreline and move outward toward and into the 45-foot-deep Federal navigation channel. Installation and removal of cofferdams would take place during weekday working hours (12 hours per day, 5 days per week). There would be minimal sediment resuspension associated with the installation and removal of

[165] Birtwell et al. 1987, Dunford 1975, LaSalle et al. 1991, Nightengale and Simenstad 2001.

[166] Clarke and Wilber 2000.

each cofferdam and cofferdams would not be removed until the improved soil has hardened. As discussed above in Section 11.3.2.1.1, the Project site in the Hudson River is strongly influenced by the tidal and riverine currents of the Hudson River, and therefore, any temporary increase in suspended sediment associated with in-water construction activities would be localized and would dissipate shortly following cessation of the sediment disturbing activity. Installation and removal of the cofferdams would be an intermittent disturbance occurring over the 13-week in-water activity per each cofferdam, and would therefore have a limited effect on suspended sediment concentrations within any given location during the course of construction. The use of turbidity curtains during cofferdam removal would further minimize the effects of sediment resuspension. Tidal currents would dissipate any resuspended sediments such that redeposition within or outside the Project area would not adversely affect benthic macroinvertebrates or bottom-dwelling finfish. Ground stabilization through deep soil mixing would be contained within the cofferdams and would not result in additional sediment resuspension that could affect aquatic biota.

11.6.3.1.3.2 Underwater Noise

In-water construction would result in temporary increases in underwater noise from vessel activity and driving the sheet pile and king piles into the sediment for the cofferdams. During construction, there would be up to four barges moored in-place in the work area from which cofferdam installation and removal and deep soil mixing activities would be conducted; two smaller vessels would be used periodically to deliver materials and carry personnel to and from the site. Personnel would travel to the barges from an existing pier to the work area via tugboat or dingy, and construction materials would be delivered by a second small vessel. The temporary increase in vessel activity over the approximately 13 months of in-water work for each cofferdam section would result in an incremental increase in underwater noise levels in the vicinity of the Project site, which could lead to habitat avoidance by fish and some macroinvertebrates in the immediate vicinity of the Project site. 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.

Installation and removal of steel sheet pile and steel pipe king piles with a vibratory hammer would result in a temporary increase in underwater noise during installation of each cofferdam section. Elevated underwater noise would be temporary, as the cofferdams would be installed in two sections, with each section being completed within 14 weeks (12 hours of pile driving per day, for 5 days per week for each cofferdam) with up to 4 weeks for removal). Installation of the sheet pile and king piles for the cofferdam structures would result in temporary increased underwater noise levels that would not be expected to exceed the threshold for physiological injury to fishes.[167] As described in detail in FRA's consultation with NMFS under Section 7 of the Endangered Species Act and under the Magnuson-Stevens Fishery Conservation and Management Act in **Appendix 11-1,** and the EFH assessment in **Appendix 11-3**, underwater noise levels would be below levels that would cause behavioral effects at distances more than 230 feet (70 meters) from each pile being installed. Any fish that enters the area within 230 feet of the pile being driven would be expected to detect the elevated noise levels and move away. Because of the wide width of the Hudson River where the cofferdams would be constructed, it is unlikely that these avoidance behaviors would adversely affect fish spawning, foraging, resting, and migration. The temporary loss of foraging habitat within and in the vicinity of the soil improvement area, when compared with

[167] For vibratory driving of steel sheet piles, typical noise levels at a distance of 33 feet from the pile have been reported as 175 dB SPLpeak, 160 dB SPLrms, and 160 dB for the 1-second SEL. These sound levels are continuous rather than percussive and would not exceed the threshold of 206 dB SPL peak that is associated with the onset of recoverable physiological injury to fishes.

the available suitable habitat that would still be available within the lower Hudson River, would not result in an adverse impact to aquatic biota. For these reasons, the temporary increase in underwater noise during construction of the Preferred Alternative would not have adverse effects on aquatic biota.

11.6.3.2 ESSENTIAL FISH HABITAT

For the reasons identified above, construction of the Preferred Alternative would not result in adverse impacts to water quality, aquatic habitat, or aquatic biota of the Hudson River. Consultation with NMFS with respect to additional measures to minimize potential impacts to Essential Fish Habitat and anadromous fish during migration was completed on March 17, 2021 (see **Appendix 11**). As a result of consultation with NMFS, FRA would not conduct in-water construction activities, such as installation and removal of cofferdam structures, from January 21 through June 30 to minimize potential impacts to overwintering and migrating striped bass and to migrating anadromous species such as alewife and blueback herring. Once the cofferdams are completed, activities associated with the deep soil mixing could occur and would not have the potential to adversely impact Essential Fish Habitat. Therefore, the Preferred Alternative would not result in adverse impacts to the suitability of the Project site for fish species identified by NMFS as having EFH in the Lower Hudson River Estuary.

11.6.3.3 WILDLIFE

The temporary loss of open water habitat during the 13 months needed to conduct the soil improvement within each of the two cofferdam sections of the low-cover area (for a potential of up to 26 months total, depending on the staging) would not adversely affect waterbirds foraging within this portion of the Hudson River due to the availability of similar foraging habitat within the immediate vicinity of the Project site. Any individuals affected by any temporary increase in boat activity or other human activity would be expected to avoid the area and use suitable available habitat nearby. Therefore, construction of the Preferred Alternative would not result in adverse impacts to wildlife using the Hudson River.

11.6.3.4 THREATENED, ENDANGERED OR SPECIAL CONCERN SPECIES

Because the Lower Hudson River Estuary is used by shortnose sturgeon (juveniles and adults) and Atlantic sturgeon (adults and subadults) primarily for migration rather than extended occupation for feeding or reproduction, it is unlikely that construction would significantly affect these species. Although shortnose sturgeon were found in the Hudson River channel south of the George Washington Bridge,[168] the number collected was relatively low. Atlantic sturgeon are more likely to occur in deep water habitat of the Hudson River in the vicinity of the Project site during migration to and from upriver foraging, overwintering, and/or spawning grounds. It is unlikely that individuals of either species would occur in the vicinity of the Project site except perhaps as occasional transients. However, the Project Sponsor would require that construction workers check the area surrounded by the cofferdam for sturgeon before the deep soil mixing begins. Should sturgeon become entrapped within the cofferdam area, work would cease and NOAA Fisheries would be notified.

The potential for Project vessel interaction with sturgeon is extremely minimal, as barges would be moored-in-place in relatively deep water during in-water work, and two small vessels would be used periodically to transport personnel and materials to the site.

Because any impacts to water or sediment quality associated with the Preferred Alternative's in-water construction activities in the low-cover area would be localized and temporary, the deep

[168] Bain et al. 2006.

channel habitat typically used by shortnose and Atlantic sturgeon is unlikely to be adversely affected during construction.

As described in detail in FRA's consultation with NMFS under Section 7 of the Endangered Species Act in **Appendix 11-1,** increased underwater noise during installation and removal of each cofferdam would likely lead to avoidance of the work area, but would not reach the level that causes recoverable physiological injury. Any sturgeon that enters the area within 230 feet of the pile being driven would be expected to detect the elevated noise levels and move away. Because of the wide width of the Hudson River where the cofferdams would be installed and removed, this avoidance behavior is unlikely to affect sturgeon foraging or migration to upriver spawning grounds. Cofferdam installation and removal would not occur from January 21 through June 30, so as to avoid impacts to anadromous fish migration, including sturgeon. While a small portion of the river would have elevated underwater noise levels resulting from pile driving and removal, there would be room for fish passage both in the shallower waters to the east and in the river channel to the west during installation and removal of each of the two or three cofferdam sections. Overwintering juvenile sturgeon are not expected to occur in this portion of the river; but any sturgeon that might be present in the winter prior to January 21 would likely be found in the deeper waters of the channel where water temperatures are warmer than those found in the shallower off-channel areas[169] and would not be exposed to elevated noise levels.

Deep soil mixing activities would be contained within the cofferdams, in accordance with BMPs for minimizing silt and as recommended by NMFS for the protection of sturgeon.[170] Sturgeon feed on the river bottom (i.e., they are benthic feeders), and soil improvement through deep soil mixing in the 3-acre low-cover area would temporarily disturb foraging habitat within each section. However, when compared to the available suitable habitat that would still be available within the lower Hudson River, this temporary loss of foraging habitat would not result in an adverse impact to sturgeon.

As discussed above (see Section 11.6.3.1.1), FRA received concurrence from NMFS under Section 7 of the Endangered Species Act that the soil improvement activities within the low-cover area are not likely to adversely affect ESA-listed species under following conditions: in-water construction would occur during the period of July 1 through January 20 with cofferdams installed in two sections; the area surrounded by the cofferdam would be checked for sturgeon prior to deep soil mixing and if any sturgeon become entrapped within the cofferdam area, work would cease and NOAA Fisheries would be notified; and, the cofferdams would not be removed until the improved soil is hardened (see **Appendix 11**).

11.6.3.4.1 Critical Habitat

Given the location of the Project, in-water construction activities would not occur in the vicinity of hard bottom substrate in low salinity waters, and the installation of the cofferdams (including king piles) would not remove any soft substrate used for juvenile foraging and physiological development. Overwintering juvenile sturgeon are not expected to occur in the portion of the river where cofferdams would be used; any sturgeon that might occur in this region of the Hudson River would likely be found in the deeper waters of the channel where water temperatures are warmer than those found in the shallower off-channel areas,[171] where construction would occur. Therefore, this element of the critical habitat would not be adversely modified or destroyed by the Project. As the in-water construction activities would only produce minimal increases in suspended sediment

[169] Bain et al. 2007, NMFS 2017a.

[170] NMFS 2016.

[171] Bain et al. 2007, NMFS 2017a.

between 5 to 10 mg/L,[172] and the effects of sediment resuspension would be minimized through the use of a turbidity curtain, the in-water construction activities 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 Project. Given the width of the Hudson River in the study area (approximately 4,500 feet), the temporary addition of 600-foot long cofferdams between July and January for each of two construction years 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. FRA received concurrence from NMFS under Section 7 of the Endangered Species Act that the soil improvement activities within the low-cover area under the proposed in-water construction period of July 1 through January 20 for the installation and removal of cofferdams is not likely to adversely affect designated critical habitat under NMFS jurisdiction (see **Appendix 11**).

11.6.3.5 SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The Preferred Alternative would result in the modification of 3 acres of bottom habitat within the Lower Hudson Reach due to the soil improvement through deep soil mixing. This portion of the river is a designated Significant Coastal Fish and Wildlife Habitat largely based on its importance in providing wintering habitat for young-of-the-year and yearling-or-older striped bass. Since striped bass spawning and larval habitat occur in freshwaters well upriver of the low-cover area, and striped bass juveniles and adults are widely distributed throughout the estuary, these life stages would not be adversely affected by construction of the Preferred Alternative. Likewise, the Preferred Alternative would not have adverse effects on aquatic habitat for other fish and invertebrate species, or on migratory birds that use the region. In-water construction activities in the 3-acre soil improvement area would have the potential to result in temporary increases in suspended sediment that would be localized and expected to dissipate quickly and would not result in adverse impacts to aquatic biota. Installation of the sheet pile and king piles for the cofferdam structures used for the two phases of soil improvement would result in temporary increases in underwater noise levels that would not be expected to exceed the threshold for physiological injury to fishes. Fish would likely avoid portions of the river in proximity to the cofferdam while piles are driven. To minimize potential impacts to overwintering striped bass and spring migration of striped bass and other anadromous species to upriver spawning grounds, no pile installation or removal would occur from January 21 through June 30. Additionally, during the in-water work period (July 1st through January 20th), the majority of the work would be conducted within the cofferdam and would not result in significant increases of underwater noise. The temporary loss of foraging habitat within and in the vicinity of the soil improvement area, when compared to the available suitable habitat that would still be available within the lower Hudson River, would not result in adverse impacts to striped bass or other aquatic biota.

Due to the limited potential for in-water construction activities of the Preferred Alternative to affect water quality, and the limited potential for pile driving to result in adverse impacts to fish, the Preferred Alternative would not result in adverse impacts to fish including the striped bass, and wildlife species, or adversely affect the designation of this portion of the Hudson River as a Significant Coastal Fish and Wildlife Habitat.

[172] FHWA 2012.

11.6.4 NEW YORK

11.6.4.1 FLOODPLAINS

In New York, the tunnel portal near Tenth Avenue and the ventilation shaft and fan plant at Twelfth Avenue (which would be an open shaft for much of the construction period) and A Yard, where track connections would be made, are located within the 100-year floodplain (Zone AE with a BFE of +12 feet NAVD88 and +10 feet NAVD88 at A Yard). Small portions of the Project site are located in the 500-year floodplain (**Figure 11-7**). The floodplain within and adjacent to the study area is affected by coastal flooding and would not be affected by construction or regrading/filling of the floodplain as would occur within a riverine floodplain. Coastal floodplains are influenced by astronomic tide and meteorological forces (e.g., nor'easters and hurricanes) rather than local flooding caused by precipitation.[173] Therefore, the occupancy of the floodplain during construction would not affect the flood elevation or increase risks due to flooding adjacent to the study area.

Additionally, the only construction associated with the rehabilitation of the North River Tunnel that would take place within the New York study area would be within the tunnels and would not affect surrounding floodplains. Therefore, no adverse impacts on floodplain are anticipated as a result of construction of the Preferred Alternative, including the rehabilitation of the North River Tunnel.

11.6.4.2 WETLANDS

As discussed in Section 11.3, the only NWI wetlands in New York within the Project site consist of NWI estuarine wetlands with unconsolidated bottoms (E1UBL). These NWI mapped wetlands within the Hudson River are not vegetated and would not be regulated as wetlands under the Clean Water Act. Additionally, the study area does not contain NYSDEC littoral zone tidal wetlands because the Hudson River is too deep in this location to meet the littoral zone tidal wetlands definition of permanently flooded lands under waters less than or equal to 6 feet of tidal waters at MLW that are not included in another tidal wetland category. Therefore, construction of the Preferred Alternative in New York would not result in adverse impacts to wetlands.

11.6.4.3 GROUNDWATER

Ground freezing along the Preferred Alternative's tunnel alignment from the Twelfth Avenue shaft site to the Hudson River bulkhead would temporarily obstruct groundwater flow through the area within a closed system of pipes, avoiding any adverse impact from construction of the tunnel on the surrounding groundwater regime.[174] Groundwater would be restricted from entering the construction area in the location treated with ground freezing. Because ground freezing occurs within a closed, sealed system of pipes, and instrumentation would be implemented to measure the freezing process and flow and pressure of the brine within the pipes, there would be limited potential for release of chemicals to groundwater. Should a leak occur, the circulation system would have an automatic shutoff control that would be triggered in the event of a sudden drop in coolant pressure, limiting the release of coolant into nearby groundwater. Potential groundwater drawdown during ground freezing would be limited to no more than 2 feet in this highly compressible area to avoid issues of settlement. Permeation grouting, which would be used to further stabilize the bulkhead by filling the void spaces of the riprap, would also divert groundwater flow within the vicinity of the grout. Slurry walls would be used in the cut-and-cover sections of tunnel construction to stabilize the ground and to control leakage and limit groundwater drawdown outside of the excavation site. Groundwater monitoring wells or piezometers may be used at certain locations to track the extent of groundwater level lowering.

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[173] FEMA 2013.

[174] McCann et al. 2009.

Groundwater infiltration during construction of the Preferred Alternative in the New York portion of the Project site is expected to be low. Some combination of sumps, pumps, and sediment settling tanks and oil and water separators would be used for groundwater collection, as external dewatering is not an option given the highly compressible soils. It is anticipated that no major dewatering equipment (e.g., deep wells, ejectors, vacuum wellpoints) would be required or allowed outside the limits of excavations; therefore, any groundwater requiring handling would likely come exclusively from within the excavations. Any groundwater recovered during dewatering of excavation shafts or materials excavated during the tunnel boring process would be pumped, tested, and treated before disposal to the New York City stormwater or combined sewer system under an NYCDEP Discharge Permit from the Bureau of Wastewater Treatment and in conformance with applicable discharge limits. Discharge of groundwater exceeding 10,000 gallons of groundwater per day would require additional approval from NYCDEP's Bureau of Water and Sewer Operations, Division of Connections and Permitting. In the event groundwater may be discharged to a NYCDEP outfall that drains to the Hudson River, a New York SPDES permit would be required.

Prior to construction, groundwater testing would be conducted to determine the quality of the groundwater that would be encountered. Should any significantly contaminated groundwater (e.g., volatile organic compounds, petroleum contamination, or other visual evidence) be encountered, it would be stored temporarily on-site and disposed of off-site at a facility approved for receiving and processing it. Handling of potential groundwater contamination issues is discussed in greater detail in Chapter 16, "Contaminated Materials."

In summary, with the measures described above in place, construction of the Preferred Alternative would not result in an adverse effect to groundwater.

11.6.4.4 SURFACE AND NAVIGABLE WATERS

During construction, stormwater on the Project's construction sites in New York City would be discharged to the New York City sewer system, and from there directed to municipal wastewater treatment facilities for treatment before discharge to the Hudson River. Therefore, there would be no adverse effect to waters of the Hudson River from construction activities associated with the Preferred Alternative in New York.

11.6.4.5 TERRESTRIAL RESOURCES

11.6.4.5.1 Ecological Communities

As discussed under Section 11.3, ecological communities within the New York study area are primarily unvegetated terrestrial cultural communities. Most construction activities would occur below ground. Construction of the Preferred Alternative's ventilation shaft and fan plant, excavation in West 30th Street and Tenth Avenue, and use of the Twelfth Avenue staging area for construction staging would involve conversion of areas of paved road/path community to urban structure exterior community.

Construction of the new alignment would result in the potential removal of approximately 15 street trees within the median of Twelfth Avenue. All work would be performed in compliance with Local Law 3 of 2010 and the New York City Department of Parks and Recreation's (NYC Parks) Tree Protection Protocol to minimize potential adverse impacts. In addition, all required replacement and/or restitution for removed trees would be provided in compliance with Local Law 3 and Chapter 5 of Title 56 of the Rules of the City of New York (the Project Sponsor would either plant the required number of replacement trees, as directed by NYC Parks, or pay for the cost of tree replacement to be conducted by NYC Parks). All tree work would be carried out under the supervision of a certified arborist, following a tree protection plan approved by New York City Parks' Manhattan Borough Forester. Construction of the new alignment would not disturb

vegetated communities with high ecological value. Therefore, construction of the Preferred Alternative would not result in adverse impacts to ecological communities. Similarly, rehabilitation of the existing tunnel would occur exclusively subsurface within the existing tunnel. Therefore, rehabilitation of the existing tunnel would not result in adverse impacts to ecological communities.

11.6.4.5.2 Wildlife

As discussed in Section 11.3, habitat within the New York study area is primarily limited to buildings, streets, and other impervious surfaces. Existing levels of human disturbance are extremely high. As such, wildlife in the area is limited to the most urban-adapted, synanthropic species, most of which are non-native (e.g., house sparrow, European starling, rock dove, Norway rat). Visual and auditory disturbances during construction would potentially temporarily displace some individuals of some species from the immediate vicinity of the site of activity, but these individuals would easily relocate to areas nearby given the extensive availability and continuity of the same habitat. Construction activities would increase levels of disturbance to the extent that there would be temporary alterations in species assemblages or otherwise temporary changes to wildlife communities in the surrounding area. The same depauperate[175] community of generalist species of wildlife would occur as at present. Overall, construction of the Preferred Alternative would not have adverse impacts to wildlife in the New York study area.

11.6.4.5.3 Threatened, Endangered, or Special Concern Species

Construction activities for the Preferred Alternative would occur primarily subsurface, although there would be above-ground construction at the Twelfth Avenue staging area. Construction activities would not adversely affect existing habitats on the High Line. Therefore, there would be no loss of habitat for the yellow bumblebee. There would also be no potential impact to peregrine falcon nesting sites, which in New York City are limited to bridges and the rooftops of tall buildings. Urban peregrine falcons have a particularly high tolerance for noise and indirect human disturbance,[176] and would not be affected by any construction activities of the Preferred Alternative. Urban peregrine falcons primarily prey upon rock doves,[177] whose abundance would not change as a result of the Preferred Alternative. Prey availability and foraging habitat therefore would not be affected. Overall, peregrine falcons would not be adversely impacted by the Preferred Alternative and would have the same potential to occur in the Project area as at present.

11.7 PERMANENT IMPACTS OF THE PREFERRED ALTERNATIVE

11.7.1 OVERVIEW

This section considers the permanent impacts on natural resources as a result of the Preferred Alternative once it is complete when both the North River Tunnel and the new Hudson River Tunnel are in operation in the year 2033.

11.7.2 NEW JERSEY

As described and analyzed in the DEIS, the two new tracks of the surface alignment for the Preferred Alternative through the Meadowlands were on a viaduct east of Secaucus Road that transitioned to an approximately 1,900-foot-long sloped embankment as the alignment curved

[175] Lacking in numbers or variety of species.

[176] White et al. 2002.

[177] DeMent et al. 1986, Rejt 2001.

away from the NEC on new right-of-way through an undeveloped wetland area. A permanent access road would run along the south side of the new surface alignment.

Following publication of the DEIS, Amtrak modified the design for the Preferred Alternative, replacing the sloped embankment with a viaduct. In addition, Amtrak shifted the permanent access road (included in the DEIS design along the southern side of the new surface alignment between Secaucus Road and the Conrail–NYSW freight rail right-of-way) northward to run beside the viaduct. These changes would reduce the overall footprint of the Preferred Alternative, since a viaduct would require less right-of-way than a sloped embankment.

11.7.2.1 FLOODPLAINS

As described in Chapter 2, "Project Alternatives and Description of the Preferred Alternative," the Preferred Alternative is being designed with a Design Flood Elevation (DFE) of BFE plus 5 feet. All Project elements would be either above the DFE or would be floodproofed appropriately (i.e., entrances and openings would be raised above the DFE, or any entrances below the DFE would be watertight). The DFE for the Project would be at least elevation 14 feet NAVD88 west of the Palisades and elevation 16 feet NAVD88 for the Hoboken fan plant. The Preferred Alternative's surface alignment, which is located west of the Palisades, would be on a retained fill embankment and viaduct that are a minimum of 15 feet above the BFE and would also be above the 500-year floodplain elevation of 11.7 feet NAVD88. The New Jersey portal for the new tunnel at Tonnelle Avenue would be slightly below the DFE, but the adjacent approach tracks and surrounding areas would be above the DFE. Soil berms and other design features would be included in the Project at this location to prevent floodwater from entering the tunnel. Additional information on flooding and resilience is provided in Chapter 14, "Greenhouse Gas Emissions and Resilience," Section 14.3.

Because the source of floodwaters is tidal, there would be no increase in flooding due to displacement of floodplain storage or conveyance as a result of permanent structures or fill proposed for the Preferred Alternative. Accordingly, the Preferred Alternative would have no adverse floodplain impacts on adjacent uses.

11.7.2.2 WETLANDS

The surface alignment would result in the unavoidable permanent loss of approximately 4.4 acres of emergent wetlands and associated open water areas within the footprint due to the placement of retained fill, retaining walls, viaduct, bridge abutments, permanent access road, culverts and culvert extensions in and near the Meadowlands and within the footprint of a construction access road in Hoboken (see **Figures 11-4a and 11-4b** and **Table 11-10)**.

Additionally, these same elements have the potential to result in indirect impacts to wetlands due to changes in hydrology within the study area, or shading due to the viaduct. The open grid steel grated road that would be approximately 5 feet above the relocated Penhorn Creek tributary would allow some light to penetrate through, resulting in minimal shading impacts. Altering the hydrology of wetlands within the study area (e.g., flooding, draining) would disturb the ecology of the wetlands and their distribution. A culvert would be installed for the construction access road to the Hoboken shaft site and staging area within the small 0.4 acre emergent wetland (Wetland F) (**Figure 11-4c**) to maintain drainage under the access road. Once construction of the Project in this area is complete, the construction access road would either be removed and soils stabilized, or the access road and culvert would remain in place to be used as maintenance access for the HBLR. The new weir installed downstream of the twin 48-inch culvert extension would maintain surface water elevations in the upstream portion of Penhorn Creek and associated wetlands.

Approximately 1.2 acres of the proposed viaduct would be located above wetlands and associated open waters. The viaduct would be a solid structure positioned between 18 and 19 feet above the

surface of the wetlands and located immediately south of the NEC tracks. This elevation above the emergent wetland combined with the southern exposure would allow sufficient sunlight to reach the wetland during periods of the day to support the existing plant community. Therefore, shading of wetlands due to the viaduct would not result in significant adverse impacts to wetlands.

Mitigation for direct and indirect wetland impacts would be determined in consultation with NJDEP and the USACE under Sections 404 and 401 of the Clean Water Act and Section 10 of the Rivers and Harbors Act in accordance with the 404(b)(1) guidance and the 2008 Rule for Compensatory Mitigation for Losses of Aquatic Resources (40 CFR Part 230), and would include the purchase of mitigation credits from an approved mitigation bank within the same watershed unit(s) as the Project site.

Table 11-10
Summary of Permanent Impacts to Wetlands and Associated Open Waters

Wetlands and Associated Open Waters within the Limit of the Project	Permanent Impact Due to Construction Activity (Acres)
Wetland A	0.8
Wetland B	0.01
Wetland CD (outside the NYSW Wetland Mitigation Site)	3.2
Wetland F	0.4
Total Impact within Delineated Wetlands	**4.4**

11.7.2.2.1 NYSW Wetland Mitigation Site

Since publication of the DEIS, Amtrak has modified the design of the Preferred Alternative in the Meadowlands, resulting in a reduction in the Project's footprint there and a corresponding reduction in the area of where permanent impacts would occur to the 2.5-acre NYSW wetland mitigation site. Whereas the DEIS described 0.3 acres of permanent wetland impacts at the NYWS mitigation site, with the modified design, the Preferred Alternative would result in approximately 0.09 acres of permanent wetland impacts within the NYSW wetland mitigation site. The Preferred Alternative would result in permanent impacts to a total of 0.29 acres of the mitigation site, including 0.09 acres of wetland area and 0.2 acres of upland area, and would require that the conservation easement on that portion of the site be removed.

The piles supporting the Preferred Alternative's viaduct in this area (24 2-foot piles), the pier in the western edge of the site, and a portion of a permanent access road would contribute to the permanent loss of wetland area within the NYSW wetland mitigation site. A culvert would be installed at the outlet of the wetland mitigation site and sized to maintain flow through the system. The Preferred Alternative has the potential to result in indirect impacts to the wetland mitigation site and adjacent wetlands due to changes in hydrology and hydraulics associated with the loss of wetland area and change in the discharge point or structure from the wetland mitigation site to the adjacent wetland. The Project Sponsor, in cooperation with the other Project Partners, would conduct any additional evaluations requested by NJDEP during the permitting process for the Project to confirm that the outlet structure for the wetland mitigation site is designed to minimize hydraulic impacts to the wetland mitigation site and the North Bergen CSO outfall 011A. The Project Sponsor will provide appropriate mitigation for the 0.29 acres of permanent impacts to the NYSW mitigation site, including 0.09 acres of wetland area and 0.2 acres of upland area, through the purchase of wetland mitigation credits (see the Conceptual Compensatory Mitigation Plan provided in **Appendix 11**).

Approximately 0.03 acres of viaduct would be located above the NYSW wetland mitigation site. As with the other portions of the viaduct, this section of viaduct would be positioned between 18 and 19 feet above the surface of the wetland. This elevation above the emergent wetland combined with the southern exposure would allow sufficient sunlight to reach the wetland during periods of the day to support the existing plant community. Therefore, shading due to the viaduct would not result in adverse impacts to the NYSW wetland mitigation site.

11.7.2.3 GROUNDWATER

The Preferred Alternative would not result in permanent groundwater impacts for any Project elements west of the Palisades. The rate of groundwater seepage in the Palisades portion of the tunnel would be very low. Although long-term seepage control is not likely to impact water supply wells adjacent to the tunnel alignment, prior to construction an assessment would be made of the potential impacts and mitigation measures would be implemented as necessary.

No permanent groundwater impacts are anticipated in New Jersey for either the fan plant and ventilation shaft or the Hudson River portion of the tunnel east of the Palisades.

11.7.2.4 SURFACE AND NAVIGABLE WATERS

11.7.2.4.1 Surface Water Drainage

The Preferred Alternative would maintain the long-term function and conveyance of all crossing and adjacent watercourses. As discussed above in Section 11.6.2.4, the Penhorn Creek tributary that currently runs along the south side of the railroad embankment in a ditch east of Secaucus Road would be relocated but would remain open, passing under the access road along the railroad embankment wall. The retained fill would fill approximately 1,100 feet of the Penhorn Creek tributary at this location. The relocated portion of the Penhorn Creek tributary would be a trapezoidal channel with a natural bottom developed to reflect a natural channel design. The replacement weir on Penhorn Creek would maintain surface water elevations upstream in Penhorn Creek and wetland areas. The Project Sponsor, in cooperation with the other Project Partners, will coordinate with NJDEP and USFWS with respect to the design of the weir during the permitting process for the Project. Additionally, existing culverts beneath the NEC would be maintained and new culverts would be installed beneath the permanent access road.

West of the Palisades tunnel portal, the Preferred Alternative would include surfaces that are vegetated or ballasted which mimic or reduce existing stormwater runoff rates and volumes. Runoff from the new surface tracks, viaduct, and adjacent access roads would discharge directly to tidal waterbodies and in accordance with State of New Jersey requirements, management of runoff rate and volume is not required. The exception to the volume concern is approximately 700 feet of proposed rail line immediately to the west of the Palisades tunnel portal. The ballasted and vegetated rail corridor over this 700-foot portion would result in less runoff than what presently discharges from the existing largely impervious conditions in that area and therefore management of runoff rate and volume would not be required.

The construction of the new Hoboken fan plant would potentially (depending upon its final configuration) require groundwater recharge and management of stormwater. The Project Sponsor will implement the addition of these components accordance with stormwater BMPs and in accordance with New Jersey stormwater requirements.

11.7.2.4.2 Water Quality

As part of the design of the relocated portion of the Penhorn Creek tributary, the Project Sponsor will collect soil samples within the footprint of the relocated channel in accordance with a sampling plan developed in consultation with NJDEP and USFWS. Any soils that would be exposed within the channel bottom that are determined to have contaminants of concern to NJDEP and USFWS

will be either removed for disposal at a licensed facility or covered with at least 2 feet of clean fill material. With these measures in place, the relocation of this portion of the Penhorn Creek tributary would not result in adverse impacts to water quality of the tributary and Penhorn Creek.

The proposed rail line, its associated structures (e.g., retaining walls, abutments, and viaduct) and new service roadway have the potential to accumulate pollutants on surfaces that could then be entrained in runoff and degrade the water quality of receiving surface water bodies. These potential water quality impacts are expected to be a result of distributed pollutants, mainly from trains and service vehicles. Post-construction stormwater management measures would be implemented as required to treat runoff from the Preferred Alternative and meet all local and NJDEP requirements prior to discharge to existing drainage systems. Stormwater quality for the Hoboken fan plant would be managed as part of the stormwater BMPs implemented for that site in accordance with NJDEP requirements.

Drainage from the new tunnel would be treated as required by the local municipality before discharge to the public sewer system.

11.7.2.4.3 Aquatic Biota

With the installation of culverts and a new weir downstream of the twin 48-inch diameter culvert that would be designed in consultation with NJDEP and USFWS to minimize adverse impacts to the hydrology of wetlands within the study area and Penhorn Creek, and the removal or capping of any soils with contaminants of concern within the relocated portion of the Penhorn Creek tributary, the Preferred Alternative would not result in permanent adverse impacts to macroinvertebrates and fish of Penhorn Creek and associated wetlands.

11.7.2.5 TERRESTRIAL RESOURCES

11.7.2.5.1 Ecological Communities

The Preferred Alternative would result in the permanent establishment of railroad and roadway ecological communities within the surface track portion of the Project site. Operation of the Preferred Alternative would require maintenance of vegetation within the right-of-way of the new alignment, similar to rail right-of-way elsewhere along the NEC. Standard Amtrak right-of-way maintenance includes herbicide application and/or pruning and cutting and measures to minimize indirect impacts to adjacent ecological communities (e.g., minimizing any discharge of herbicides to the adjacent wetlands and only using those approved for application near surface waters). On the basis of these standard maintenance measures, operation of the Preferred Alternative would not result in adverse impacts to ecological communities.

11.7.2.5.2 Wildlife

As discussed above, the Preferred Alternative would permanently affect approximately 4.4 acres of wetland habitat and associated open water habitats associated with Penhorn Creek and a small wetland in Hoboken due to the surface tracks, access road, retaining walls, viaduct piles, and culverts. The permanent loss of approximately 4.4 acres of wetland and open water habitat would not result in adverse impacts to wildlife given the availability of similar habitat adjacent to the Project site within the Meadowlands. Potential indirect effects due to changes in wetland hydrology would be offset to the extent feasible through the design of culvert structures and a new weir sufficient to maintain the hydrology of wetlands within the study area. The Project Sponsor will conduct additional evaluations to confirm that the culverts are designed to minimize secondary wetland impacts due to changes in hydrology. With the minimization of indirect impacts to wetland habitats, the Preferred Alternative would not result in adverse impacts to wildlife habitat and wildlife.

Operation of the Hoboken fan plant would not likely result in a noticeable incremental increase in noise levels to the point that wildlife would avoid the area or experience any other negative impacts at either the individual or population levels. Natural resources at the potential fan plant site are extremely limited, and wildlife inhabiting this area is limited to urban-adapted, generalist species that are highly tolerant of anthropogenic noise, such as the house sparrow, European starling, and Norway rat.

Operation of trains along the new surface tracks, and any increases in motor vehicle usage or other human activities in the area during operation of the Preferred Alternative, would also not be expected to increase noise levels above existing conditions to an extent that would displace or otherwise negatively affect wildlife in the surrounding area. The wildlife community currently in this area was established under noisy existing conditions created by regional transportation activity, including operating railroads and highways, and other industrial activities near the Project site. As such, these species and individuals are inherently tolerant of high levels of disturbance and would not be expected to experience negative effects from the incremental increase in noise during operation of the new surface tracks. Operation of the North River Tunnel after rehabilitation would not increase train traffic or otherwise change operation from the existing conditions, and therefore, would not have the potential to affect wildlife. Overall, operation of the Preferred Alternative would not have adverse impacts to wildlife.

11.7.2.6 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

The Preferred Alternative would result in permanent impacts to approximately 4.4 acres of wetlands and associated open water habitat associated with Penhorn Creek and the small wetland in Hoboken, and there would be some potential changes in hydrology that would be minimized through the design of culvert structures and a new weir that would maintain water flow. As discussed above in Section 11.6, the permanent loss of wetland areas would represent a negligible reduction in the amount of such habitat available to the state-listed birds potentially in the area and would not impact the size or viability of their local populations. An abundance of interior wetland habitat surrounding Penhorn Creek would remain once the Preferred Alternative is in place, and glossy ibis, little blue heron, osprey, snowy egret, yellow-crowned night heron, black-crowned night heron, and barn owl would all have the same potential to occur in this area as at present. In 2019, NJDEP determined that on the basis of additional populations of floating marsh-pennywort documented in the vicinity of the Project site, the Preferred Alternative would not adversely impact the local population due to the extent of suitable habitat and amount of plants that would be left undisturbed. Therefore, the Preferred Alternative would not result in adverse impacts to the marsh-pennywort.

No listed wildlife species are considered to have the potential to occur near the Hoboken fan plant or Palisades tunnel portal, and therefore, operation of these elements of the Preferred Alternative would not have any impacts to such species. Operation of trains along the new surface tracks, and any increases in motor vehicle usage or other human activities in the area during operation of the Preferred Alternative, would also not be expected to increase noise levels above existing conditions to an extent that would displace or otherwise negatively affect any listed bird species from the surrounding area. The bird community currently in this area was established under noisy existing conditions created by regional transportation activity, including operating railroads and highways, and other industrial activities near the Project site. As such, these species and individuals are inherently tolerant of high levels of disturbance and would not be expected to experience negative effects from the incremental increase in noise during operation of the new surface tracks. Operation of the North River Tunnel after rehabilitation would not increase train traffic or otherwise change operation from the existing conditions, and therefore, would not have the potential to significantly affect endangered, threatened, or special concern species.

11.7.3 HUDSON RIVER

11.7.3.1 AQUATIC RESOURCES

11.7.3.1.1 Water Quality

The Preferred Alternative would not result in an adverse impact to the movement of tidal waters or the NYSDEC-designated use classification of the Hudson River within the Project site. Excess grout material and native soil that accumulates during deep soil mixing would be removed for off-site transport and would not affect water quality once the cofferdams are removed. The introduced soilcrete in the low-cover area would be composed of a mixture of cement and native soil, and would not result in leaching of contaminants into the water column. In Manhattan, water removed in the tunnel from the Twelfth Avenue shaft would be discharged to the city combined sewer downstream of the regulator, requiring a NYSDEC SPDES permit. The recovered water would be treated in accordance with permit requirements prior to being conveyed to the Hudson River. Therefore, operation of the Preferred Alternative would not result in adverse effects to water quality.

11.7.3.1.2 Sediment Quality

The Preferred Alternative would result in alteration of the sediment characteristics within the 3-acre low-cover area, where fine-grained silt/clay sediments would be mixed with cement grout. The resulting soilcrete would be similar to a firm or dense soil substrate and would not lead to leaching or resuspension that could adversely affect sediment quality. Beyond the limited low-cover area, the Preferred Alternative would not result in adverse effects to sediment quality.

11.7.3.1.3 Aquatic Biota

As discussed above, the operation of the Preferred Alternative would not result in adverse impacts to water or sediment quality that would have the potential to result in adverse impacts to aquatic biota. In the approximately 3-acre ground improvement area in the Hudson River where grout would be mixed to form a hard soilcrete (see discussion in Section 11.6.3.1.1), the approximately 3-acre low-cover area of fine-grained silt/clay sediments would temporarily not provide habitat for infaunal macroinvertebrates, or those that live within the sediment, resulting in a loss of forage for fish. In this area, when construction is complete the 3 acres of soilcrete would initially be available as hard bottom habitat for encrusting organisms tolerant of soilcrete, which would provide some foraging habitat for benthic feeders. About 2.3 acres of the soilcrete would be approximately level with the surrounding riverbed, and over time, sediments would be deposited over the soilcrete in this lower profile area at sedimentation rates typical of the lower Hudson River, providing some soft bottom habitat for benthic invertebrates. Therefore, within this 2.3-acre portion of the low-cover area, the modification of the river bottom to achieve the soil improvement necessary to protect the Preferred Alternative would not result in adverse impacts to aquatic biota.

Approximately 0.7 acres of soilcrete area (approximately 110 feet wide and 270 feet long) would be between 1 and 2 feet above the existing mudline (i.e., river bottom). This elevated portion of the soilcrete would provide habitat for encrusting organisms, which would provide some foraging habitat for fish. However, because it would be higher than the surrounding river bottom, this area may have a lower potential to accumulate sediment that would provide soft-bottom habitat for benthic invertebrates and would not, therefore, provide forage habitat to soft-bottom feeding fish species such as windowpane, skates, and summer and winter flounder. As compensation for the change in the nature and elevation of bottom habitat within the 0.7 acres, the Project Sponsor will monitor this area, in coordination with the USACE, NMFS and NYSDEC, for five years to assess its recovery as fish foraging habitat and will include the submittal of regular monitoring reports. The Project Sponsor will also monitor the recovery of the remaining 2.3 acres of soilcrete for five years post-construction. The loss of soft-bottom habitat within the 0.7-acre elevated portion of the

soilcrete represents a small loss of this type of habitat within the harbor estuary in the context of the thousands of acres of such habitat available, and would not adversely affect populations of benthic invertebrates. Consultation with NYSDEC is ongoing with respect to additional mitigation for the ground improvement area within the Hudson River. NYSDEC recommendations include contribution to the Estuarium[178] at Pier 26 within Hudson River Park or purchase of credits from the Saw Mill Creek Wetland Mitigation Bank on Staten Island. With these measures in place, the Preferred Alternative would not adversely impact aquatic biota or commercial or recreational fishing activity within the study area.

11.7.3.2 ESSENTIAL FISH HABITAT

As discussed above under Section 11.6.3.2, consultation with NMFS with respect to potential impacts to Essential Fish Habitat and anadromous fish during migration was completed on March 17, 2021 (see **Appendix 11**). For the reasons identified above, the Preferred Alternative would not result in adverse impacts to water quality, but would permanently modify 0.7 acres of river bottom due to the establishment of an area hardened with soilcrete that would be between 1 and 2 feet above the mudline of the Hudson River. While this elevated portion of the soilcrete would provide suitable habitat for encrusting organisms that provide forage for some fish species, it would not provide forage habitat for those fish species that prefer soft-bottom habitat such as windowpane, skates, and summer and winter flounder. Despite the potential benefit for some EFH species, because it would not provide forage habitat for other fish species the Preferred Alternative would result in an adverse effect on EFH that would not be substantial. As compensation for the change in the nature and elevation of bottom habitat within the 0.7 acres, the Project Sponsor will monitor this area, in coordination with the USACE, NMFS and NYSDEC, for five years to assess its recovery as fish foraging habitat. The Project Sponsor will also monitor the recovery of the remaining 2.3 acres of soilcrete for five years post-construction.

11.7.3.3 WILDLIFE

Upon completion of construction activities, typical wildlife use of the Hudson River would continue. The Preferred Alternative would result in changes under the water's surface in the low cover area, but would not adversely impact waterfowl or shorebirds using the lower Hudson River.

11.7.3.4 THREATENED, ENDANGERED, OR SPECIAL CONCERN SPECIES

For the reasons identified above in Section 11.7.3.1.3, the operation of the Preferred Alternative would not result in adverse impacts to water or sediment quality, and therefore, would not result in adverse impacts to threatened, endangered, or special concern species in the Hudson River. The 2.3-acre portion of the low-cover area in which the soilcrete area would not extend above the mudline would initially be unsuitable for burrowing organisms because of its relatively hard surface, but over time natural river currents would deposit sediments on top of the soil and grout mixture. These sediments could provide habitat for soft-bottom organisms that would provide forage for sturgeon. Encrusting organisms tolerant of soilcrete would colonize the 0.7 acres that would be elevated between 1 and 2 feet above the mudline. These sediments could provide habitat for benthic organisms that would provide forage for sturgeon. This area is outside the 45-foot-deep Federal navigation channel but within an area of the river that is approximately 50 feet deep. Juvenile and adult Atlantic sturgeon in this part of the Hudson River typically occur in deeper waters and may occur in this area as transients, in the case of migrating adults, or for foraging, in the case of juveniles and subadults. Despite the conversion of soft-bottom habitat to hard-bottom habitat, the loss of this area as foraging habitat for Atlantic sturgeon is small relative to the

[178] https://www.clarkson.edu/news/hudson-river-park-trust-names-clarkson-university-consortium-partners-new-state-art.

unaffected soft-bottom habitat in the lower Hudson River. Therefore, the conversion of this area as foraging habitat for Atlantic sturgeon may affect but is unlikely to adversely affect this species.

Shortnose sturgeon also have the potential to use the 0.7-acre portion of the Hudson River affected by the elevated soilcrete as foraging habitat. However, considering the thousands of acres[179] of suitable foraging habitat in the lower Hudson River that would be unaffected by the Preferred Alternative, the loss of this 0.7-acre area of foraging habitat for shortnose sturgeon in the lower Hudson River is not likely to adversely affect this species.

The slight increase in the elevation of the river bottom in this location would not cause any obstruction of passage for either species of sturgeon. FRA received concurrence from NMFS under Section 7 of the Endangered Species Act that the Preferred Alternative is not likely to adversely affect ESA-listed species under NMFS jurisdiction (see **Appendix 11**). After construction is complete, the Project Sponsor will monitor the recovery of the 0.7 acres of elevated soilcrete and the remaining 2.3 acres of soilcrete for five years as foraging habitat. Monitoring of this area will be conducted in consultation with the USACE, NMFS, and NYSDEC and will include the submittal of regular monitoring reports.

11.7.3.4.1 Critical Habitat

Given the location of the Project in saline waters near the mouth of the Hudson River, the permanent features of the Hudson River Tunnel beneath the river (i.e., the area of permanent soilcrete) would not impact hard-bottom substrate in low salinity waters where Atlantic sturgeon spawn and where eggs and larvae are found. The proposed addition of soilcrete in the low cover area of the Project alignment where ground hardening is proposed would convert soft substrate along the salinity gradient, which is used for juvenile foraging and physiological development, to artificial hard bottom in an area encompassing 0.7 acres. The addition of this hard-bottom area in place of this soft-bottom substrate would adversely modify designated critical habitat for Atlantic sturgeon but represents a small area relative to the thousands of acres of available foraging habitat suitable for Atlantic sturgeon in the Hudson River. The addition of soilcrete would also result in an increased elevation of approximately 2 feet above the river bottom at a water depth of approximately 45 to 50 feet. Given the width of the Hudson River in the study area (approximately 4,500 feet), the permanent impact to 0.7 acres of deep-water, soft-bottom habitat would not create 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 conversion of 0.7 acres of soft-bottom habitat to artificial hard-bottom habitat would not have significant effects on water flow, dissolved oxygen levels, salinity, or water temperature. Therefore, this aspect of the designated critical habitat for Atlantic sturgeon would not be adversely modified. Following the issuance of the final critical habitat rule, FRA reinitiated consultation with NMFS requesting concurrence with its finding that critical habitat for Atlantic sturgeon would not be adversely modified. FRA received concurrence from NMFS under Section 7 of the Endangered Species Act that the Preferred Alternative is not likely to adversely affect designated critical habitat under NMFS jurisdiction (see **Appendix 11**).

11.7.3.5 SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT

The Lower Hudson Reach has been identified as a Significant Coastal Fish and Wildlife Habitat primarily because of its use by large numbers of juvenile striped bass as wintering habitat. 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. Spawning occurs in freshwaters far upstream of

[179] The lower Hudson River Estuary has an estimated 78,322 acres (https://www.dec.ny.gov/lands/48367.html).

the study area and would not be adversely affected by the operation of the Preferred Alternative. Because striped bass spawning occurs well upriver of the Project site, the majority of the larval striped bass are also located upstream of the study area. Furthermore, the highest abundance of juvenile striped bass is also upstream of the study area, nearly 90 miles north. The 0.7-acre low-cover area of fine-grained silt/clay sediments that would be permanently modified would not result in an adverse impact to striped bass given the ubiquity of this bottom habitat elsewhere in the lower Hudson River. After construction is complete, the Project Sponsor will monitor the recovery of the 0.7 acres of elevated soilcrete and the remaining 2.3 acres of soilcrete for five years to assess the habitat use and re-sedimentation of the modified river bottom. Monitoring of this area will be conducted in consultation with the USACE, NMFS, and NYSDEC and will include the submittal of regular monitoring reports. With implementation of measures recommended through these consultations, the permanent operation of the Preferred Alternative would not adversely affect the designation of this portion of the Hudson River as a Significant Coastal Fish and Wildlife Habitat.

11.7.4 NEW YORK

11.7.4.1 FLOODPLAINS

Within New York City, tidal flooding is the primary cause of flood damage. While the Preferred Alternative would result in the placement of additional structure within the 100-year floodplain, the floodplain within and adjacent to the study area is affected by coastal flooding and would not be affected by any additional structures as would occur within a riverine floodplain. Coastal floodplains are influenced by astronomical tide and meteorological forces (e.g., northeasters and hurricanes) and not by fluvial flooding.[180] Additionally, the DFE criterion for the Preferred Alternative was established at the BFE plus 5 feet, which accounts for a conservative estimate related to future sea level rise plus a factor of uncertainty.

In New York, the tunnel portal and the new Twelfth Avenue fan plant site are located within the 100-year floodplain (Zone AE), with an elevation of +12 feet NAVD88. The Tenth Avenue fan plant would be located beneath the building at 450 West 33rd Street at approximately -18.3 feet NAVD88, which is 12 feet below the BFE and 17 feet below the DFE. The Tenth Avenue fan plant would be protected by the Long Island Rail Road perimeter wall that will be constructed around the West Side Yard as part of the West Side Yard Perimeter Protection Project and would not alter the floodplain. The elevation of all building openings that may permit the entry of water in a flood event would be located above the DFE. Any openings that cannot be raised above the DFE would be protected by waterproof closures designed to withstand the anticipated pressure of water at the DFE (see Chapter 14, “Greenhouse Gas Emissions and Resilience,” Section 14.3, for a more detailed assessment of impacts related to flooding). Additionally, above-grade structures would utilize existing impervious footprints and/or foundations and would result in minimal, if any, change in the floodplain. Below-grade structures, such as the tunnel and railroad systems, would not have the potential to alter the floodplain.

There would be no change in the footprint of the existing North River Tunnel within the New York study area and its long-term operation would be similar to that of the existing condition. Therefore, the permanent operation of the Preferred Alternative, including the rehabilitated North River Tunnel, would not have the potential to result in adverse impacts to the 100-year floodplain or 500-year floodplain in the New York study area, or result in additional flooding adjacent to the Project site.

[180] FEMA 2013.

11.7.4.2 WETLANDS

There are no NYSDEC littoral zone tidal wetlands or wetlands as defined by the Clean Water Act within the Project site. Therefore, the Preferred Alternative would not have the potential to result in adverse impacts to wetlands.

11.7.4.3 GROUNDWATER

No adverse permanent impacts on groundwater are anticipated as a result of the Preferred Alternative. Although the below-grade structures would have the potential to modify groundwater flow patterns, groundwater would be expected to flow around these structures and continue to flow toward the Hudson River.

11.7.4.4 TERRESTRIAL RESOURCES

11.7.4.4.1 Ecological Communities

As discussed in Section 11.6, all Project structures with the exception of the Twelfth Avenue fan plant would be located subsurface. Therefore, operation of the Preferred Alternative would not result in adverse impacts to ecological communities. Similarly, rehabilitation of the North River Tunnel would occur exclusively subsurface within the existing tunnel, and operation of the existing tunnel would remain unchanged. The Preferred Alternative would not adversely affect existing or future ecological communities and the habitat provided to wildlife within the High Line, or habitat that would be located within the Hudson Yards development. Therefore, operation of the Preferred Alternative would not result in adverse impacts to ecological communities.

11.7.4.4.2 Wildlife

Existing levels of human disturbance in the New York study area are extremely high and the wildlife in the area is therefore limited to the most urban-adapted, synanthropic species (e.g., house sparrow, European starling, rock dove, Norway rat). Operation of the Twelfth Avenue fan plant would not increase levels of disturbance to the extent that there would be alterations in species assemblages or otherwise negative changes to wildlife communities in the surrounding area. The same depauperate community of generalist species of wildlife would occur as at present. All other operations would occur underground where no impacts to wildlife could occur. Overall, there would be no permanent impacts to wildlife in the New York study area from the operation of the Preferred Alternative.

11.7.4.4.3 Threatened, Endangered, or Special Concern Species

Operation of the Twelfth Avenue fan plant would not adversely impact any yellow bumblebees potentially occurring on the High Line, or any peregrine falcons occurring anywhere in the New York study area. Urban peregrine falcons have a particularly high tolerance for noise and indirect human disturbance,[181] and any minor incremental increases in noise above the high existing noise levels of the New York study area would not displace or otherwise affect peregrine falcons. All other operations would occur underground where no impacts to yellow bumblebees or peregrine falcons could occur. Therefore, no permanent adverse impacts to endangered, threatened, or special concern species in the New York study area would result from the operation of the Preferred Alternative.

[181] White et al. 2002.

11.8 SUMMARY OF IMPACTS AND ASSOCIATED MITIGATION AND MINIMIZATION MEASURES

Table 11-11 summarizes the temporary and permanent natural resource impacts of the Preferred Alternative within the New Jersey, Hudson River, and New York Project areas. Section 11.9 lists the measures that the Project Sponsor will implement for the Preferred Alternative to avoid, minimize, or mitigate adverse impacts to natural resources during and following construction. The lead Federal agency will be responsible for ensuring that the Project Sponsor implements these measures, which will be identified in the ROD. The USACE will be responsible for ensuring that the Permittees listed on any Department of the Army Permit relevant to the Project implement the measures necessary for compliance with the terms and conditions of the permit.

Table 11-11
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
New Jersey				
Floodplains	No adverse impacts anticipated.	N/A	No potential adverse impacts.	N/A
Wetlands	• Temporary impacts to approximately 1.5 acres of emergent wetlands and associated open water areas within the emergent wetlands along the surface tracks (Delineated Wetland A and CD).	• Implementation of measures that minimize impacts to wetlands in the vicinity of construction activities in the Meadowlands, such as the use of low-ground-pressure vehicles and marsh matting. • Implementation of erosion and sediment control measures (e.g., hay bales and silt fences, seeding and mulch, straw or hay) set forth in an SPPP and site-specific soil erosion and sediment control plan, which would be prepared in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, and would be implemented as part of the Project's BMPs. • Restoration of disturbed wetlands back to original topography and stabilization with mulch, straw, or hay following the completion of construction. • Inclusion of a culvert within the construction access road in Hoboken to maintain drainage under the haul route. • Development of a soil sampling plan to determine levels of contaminants in material exposed during construction, and coordination with NJDEP and USFWS should contaminated materials be found.	• Permanent impacts to approximately 4.4 acres of emergent wetlands and associated open water areas outside the NYSW mitigation site, and 0.09 acres within the existing NYSW mitigation site within the footprint of the retained embankment, viaduct, permanent access roads, culverts, retaining walls, bridge abutment over the freight railroad right-of-way in and near the Meadowlands, and access road in Hoboken. • Alteration of storm-water flow into wetlands as a result of permanent Project elements. • Alteration of wetland hydrology due to changes in flooding and draining resulting from the access road.	• Development and implementation of mitigation for wetland impacts in consultation with NJDEP and the USACE in accordance with the 404(b)(1) guidance and the 2008 Mitigation Rule, including the purchase of mitigation credits from an approved mitigation bank within the same watershed unit as the Project site. •Track ballast and gravel in access roads would reduce storm-water runoff rates and volumes. • Implementation of post-construction stormwater management measures as required to treat runoff. • Design culverts to minimize secondary wetland impacts due to changes in hydrology. • Replacement of a weir downstream of the twin 48-inch culvert to maintain upstream wetland water levels, the design of which will be coordinated with NJDEP and USFWS. • Use of open grid steel grating for the access road above the Penhorn Creek tributary (which is within the delineated wetland CD) to minimize shading impacts.

Table 11-11 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Groundwater	• Possible construction dewatering, during which a potential encounter with contaminated groundwater may occur.	• Control seepage using sheeting, using grout to fill cracks and other voids in rock or similar methods. • Treatment of any groundwater contamination encountered during construction dewatering in New Jersey to state surface water quality standards, with discharge to existing surface water bodies in accordance with the regulations at NJAC 7:14A-1.1 et seq. (an NJPDES permit may be required).	No potential adverse impacts.	N/A
Surface and Navigable Waters	• Potential increases in suspended sediments and discharge of sediments to Penhorn Creek may temporarily impact water quality and aquatic biota.	• Implementation of erosion and sediment control measures (e.g., hay bales and silt fences, seeding and mulch, straw or hay) set forth in an SPPP and site-specific soil erosion and sediment control plan in order to minimize the potential for sedimentation into Penhorn Creek. • During installation of culvert extensions and replacement of weir in Penhorn Creek, use of best management measures developed in consultation with NJDEP to minimize sediment resuspension (e.g., cofferdam or turbidity curtain) while at the same time maintaining flow within Penhorn Creek.	• Permanent alteration of the Penhorn Creek channel where culverts would be extended. • Alteration of stormwater flow throughout as a result of Project elements in New Jersey. • Potential for contaminated soils to be present on the bottom of the relocated portion of the Penhorn Creek tributary.	• Design culverts associated with the surface alignment to avoid changes in hydrology. • Track ballast and gravel in access roads would reduce stormwater runoff rates and volumes. • Implementation of post-construction stormwater management measures as required to treat runoff from access road and surface alignment. • Implement stormwater BMPs at the Hoboken fan plant and shaft site. • Replacement of the weir downstream of the twin 48-inch culvert to maintain upstream Penhorn Creek and Penhorn Creek tributary water levels, the design of which would be coordinated with NJDEP and USFWS. • Development of a soil sampling plan to determine whether contaminated soils need to be excavated or covered with clean fill.

Table 11-11 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Aquatic Biota	• Potential increases in suspended sediments in Penhorn Creek and in-water construction activities may temporarily impact aquatic biota and affect anadromous fish spawning.	•Limit any in-water or sediment generating activities and pile driving so that these activities do not occur from March 1 through June 30 to protect anadromous species spawning in Penhorn Creek.	No potential adverse impacts.	N/A
Terrestrial Resources	• Disturbance to approximately 1.7 acres of the upland successional southern hardwoods community within the NEC right of way. Additional successional southern hardwood community would be cleared along the HBLR for off-street haul route Option 3. • Approximately 1.5 acres of wetland associated open water areas lost as available habitat to wildlife in the area.	• All tree clearing associated with the Preferred Alternative and off-street haul route Option 3 would occur between October 1 and March 14 to minimize impacts to breeding birds protected under the Migratory Bird Treaty Act. • Restoration of disturbed wetlands back to original topography following the completion of construction. • Upland areas disturbed as a result of construction will be stabilized in accordance with the SPPP.	• Approximately 4.5 acres of emergent wetlands and associated open water areas (including the NYSW mitigation site) lost as available habitat to wildlife in the area.	• Development and implementation of mitigation for wetland impacts in consultation with NJDEP and the USACE, including the purchase of mitigation credits from an approved mitigation bank within the same watershed unit as the Project site.
Threatened, Endangered, or Special Concern Species	• Potential temporary disturbance to state-listed birds as a result of construction activities.	•Vegetation clearing and/or initial placement of fill material would occur between October 1 and March 14 to avoid impacts to breeding birds.	No potential adverse impacts.	N/A

Table 11-11 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Hudson River				
Aquatic Resources, including Essential Fish Habitat and Significant Coastal Fish and Wildlife Habitat	• Temporary loss of bottom habitat within cofferdam area as a result of deep soil mixing. • Temporary impacts to aquatic biota as a result of increased suspended sediment, underwater noise, and shading associated with the installation and removal of cofferdams.	• Installation and removal of steel sheet pile and steel pipe king piles in the Hudson River low-cover area with a vibratory hammer. • To minimize impacts to overwintering and migrating striped bass and other anadromous fish species, no cofferdam installation or removal would occur between January 21 and June 30. Remove cofferdam within turbidity curtains. Remove cofferdam only after improved soil has hardened.	• Permanent fill within 0.7 acres of bottom habitat as a result of deep soil mixing that would result in soilcrete 1 to 2 feet above the existing mudline.	• Monitoring of the recovery of the 0.7 acres for five years, in consultation with the USACE, NMFS, and NYSDEC, as fish foraging habitat, including regular monitoring reports that will be available on the Project website. • Also monitor the recovery of the remaining 2.3 acres of soilcrete for five years post-construction. • Additional mitigation required by NYSDEC for the modification of bottom habitat within the Hudson River to be developed during permitting. Consultation with NYSDEC is ongoing.
Wildlife	No potential adverse impacts.	N/A	No potential adverse impacts.	N/A
Threatened, Endangered, or Special Concern Species	• Temporary loss of sturgeon foraging habitat within cofferdam as a result of deep soil mixing. • Temporary impacts to sturgeon as a result of increased suspended sediment, underwater noise, and shading associated with vessels used during the installation and removal of cofferdams for the 3-acre low cover area.	• Use of cofferdams in the low-cover area to contain deep soil mixing activities, in accordance with BMPs for minimizing silt and as recommended by NMFS for the protection of sturgeon. • To minimize potential behavioral impacts to migrating subadult and adult Atlantic sturgeon, cofferdam installation and removal would not occur between January 21 and June 30.	• Permanent fill within 0.7 acres of bottom habitat as a result of deep soil mixing that would result in soilcrete 1 to 2 feet above the existing mudline. Would not result in adverse impacts.	• FRA received concurrence from NMFS under Section 7 of the Endangered Species Act that the Preferred Alternative is not likely to adversely affect ESA-listed species and designated critical habitat under NMFS jurisdiction.

Table 11-11 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Threatened, Endangered, or Special Concern Species (Cont'd)		• The cofferdam would not be removed until the improved soil is hardened. • The area surrounded by the cofferdam would be checked for sturgeon before the deep soil mixing begins. Should sturgeon become entrapped within the cofferdam area, work would cease and NOAA Fisheries would be notified.		
New York				
Floodplains	No adverse impacts anticipated.	N/A	• The tunnel portal and the new Twelfth Avenue fan plant site are located within the 100-year floodplain (Zone AE), with an elevation of +12 feet NAVD88. • The Tenth Avenue fan plant would be located beneath the building at 450 West 33rd Street at approximately -18.3 feet NAVD88, which is 12 feet below the BFE and 17 feet below the DFE.	• The elevation of all building openings that may permit the entry of water in a flood event would be located above the DFE. Any openings that cannot be raised above the DFE would be protected by waterproof closures designed to withstand the anticipated pressure of water at the DFE.
Wetlands	No wetlands present.	N/A	No wetlands present.	N/A
Groundwater	• Potential for encounter with contaminated groundwater during construction.	• Any contaminated groundwater encountered would be stored temporarily on-site and disposed of off-site at a facility approved for receiving and processing it.	No potential adverse impacts.	N/A
Surface and Navigable Waters	No potential adverse impacts. There are no surface and navigable waters in the New York study area other than the Hudson River.	N/A	No potential adverse impacts. There are no surface and navigable waters in the New York study area other than the Hudson River.	N/A

Table 11-11 (Cont'd)
Summary of Potential Impacts to Natural Resources and Proposed Mitigation and Impact Minimization Measures

Resource	Potential Temporary Construction Impact	Mitigation and/or Impact Minimization Measure	Potential Permanent Impact	Mitigation and/or Impact Minimization Measure
Terrestrial Resources	• Potential removal of approximately 15 street trees within the median of Twelfth Avenue.	• Replacement and/or restitution for tree removal in accordance with Local Law 3 and Chapter 5 of Title 56 of the Rules of the City of New York. • All tree work would be carried out under the supervision of a certified arborist, following a tree protection plan approved by NYC Parks' Manhattan Borough Forester.	No potential adverse impacts.	N/A
Threatened, Endangered, or Special Concern Species	No potential adverse impacts.	N/A	No potential adverse impacts.	N/A

11.9 MEASURES TO AVOID, MINIMIZE, AND MITIGATE IMPACTS

As identified in **Table 11-11**, the Project Sponsor will employ the following measures during and following construction of the Preferred Alternative to avoid, minimize, or mitigate adverse impacts to natural resources**.** The lead Federal agency will be responsible for ensuring that the Project Sponsor implements these measures, which will be identified in the ROD.

11.9.1 NEW JERSEY

- Design of culverts associated with the surface alignment to avoid changes in hydrology, and therefore to minimize secondary wetland impacts due to changes in hydrology.
- Use of open grid steel grating for the access road above the Penhorn Creek tributary to minimize shading impacts.
- Replacement of the weir downstream of the twin 48-inch culvert to maintain upstream wetland, Penhorn Creek, and Penhorn Creek tributary water level elevations, the design of which would be coordinated with NJDEP and USFWS.
- Development and implementation of mitigation for direct and indirect wetland impacts in consultation with NJDEP and the USACE, including the purchase of mitigation credits from an approved mitigation bank within the same watershed unit as the Project site.
- Implementation of measures that minimize impacts to wetlands in the vicinity of construction activities in the Meadowlands, such as the use of low-ground-pressure vehicles and marsh matting.
- Implementation of erosion and sediment control measures (e.g., hay bales, silt fences, and post-construction stabilization with seeding and mulch, straw or hay) set forth in an SPPP and site-specific soil erosion and sediment control plan, which would be prepared in accordance

with the Standards for Soil Erosion and Sediment Control in New Jersey, and would be implemented as part of the Project's BMPs for construction to minimize discharge of sediment to Penhorn Creek and wetlands.

- Collection of soil samples within the footprint of the relocated channel in accordance with a sampling plan developed in consultation with NJDEP and USFWS. Any soils that would be exposed within the channel bottom that are determined to have contaminants of concern to NJDEP and USFWS will be either removed for disposal at a licensed facility or covered with at least 2 feet of clean fill material.
- Restoration of disturbed wetlands back to original topography and stabilization with mulch, straw or hay following the completion of construction.
- Inclusion of a culvert within the construction access road in Hoboken to maintain drainage under the haul route.
- If necessary, elimination of adverse effects to nearby wells and wetlands by controlling seepage using sheeting or similar methods.
- If the Project contractor uses a temporary spoils pit to store spoils on the west side of Tonnelle Avenue at the Tonnelle Avenue staging area, the below-grade area will be lined or otherwise managed to reduce groundwater inflow into the pit and to minimize the potential for discharge to groundwater.
- Although construction dewatering is not expected to affect water supply wells near the tunnel alignment, prior to construction an assessment would be made of the potential impacts and mitigation measures would be implemented if required.
- Treatment of any groundwater contamination encountered during construction dewatering in New Jersey to state surface water quality standards with discharge to existing surface water bodies in accordance with the regulations at NJAC 7:14A-1.1 et seq. (a New Jersey Pollutant Discharge Elimination System permit may be required).
- Implement measures during construction (e.g., sheeting or similar methods, and a grouting program to fill cracks and other voids in the rock mass) to minimize groundwater intrusion such that dewatering is minimized to the extent practicable.
- During installation of culvert extensions and replacement of the weir in Penhorn Creek, use of cofferdams and other best management measures developed in consultation with NJDEP to minimize sediment resuspension (e.g., cofferdam or turbidity curtain) while at the same time maintaining flow within Penhorn Creek.
- In the Meadowlands and along the off-street haul route Option 3 in Weehawken, limit tree and other vegetation clearing and/or initial placement of fill material to the period between October 1 and March 14 (i.e., prior to or after the breeding season, which is April through July), to prevent birds from attempting to breed where additional construction activity would later occur.
- Limit any in-water or sediment-generating activities and pile driving so that these activities do not occur from March 1 through June 30 to protect anadromous species spawning in Penhorn Creek.
- Implementation of stormwater BMPs for construction of the Hoboken fan plant.
- Use of a comprehensive stormwater management system to treat Project runoff and meet all local and state requirements prior to discharge to existing drainage systems.
- Treatment, if appropriate, for drainage from the new Hudson River Tunnel to meet local requirements prior to discharge (under permit) to a public sewer.

11.9.2 HUDSON RIVER

- Use of cofferdams in the low-cover area to contain deep soil mixing activities, in accordance with BMPs for minimizing silt and as recommended by NMFS for the protection of sturgeon.
- Installation and removal of steel sheet pile and steel pipe king piles in the Hudson River low-cover area with a vibratory hammer. Turbidity curtains would be used during cofferdam removal and cofferdams would not be removed until the improved soil has hardened.
- Sheet and king pile installation and removal would not occur from January 21 through June 30 to avoid impacts to overwintering and migrating striped bass and other anadromous fish.
- The area surrounded by the cofferdam would be checked for sturgeon prior to deep soil mixing. Should sturgeon become entrapped within the cofferdam area, work would cease and NOAA Fisheries would be notified.
- In the 0.7-acre area of the river bottom where the soilcrete would extend above the existing mudline, implementation of a five-year monitoring program following completion of construction, in consultation with the USACE, NMFS, and NYSDEC, to assess recovery as fish foraging habitat. Also monitor the recovery of the remaining 2.3 acres of soilcrete for five years post-construction. The Project Sponsor will consult with these same agencies to develop the parameters to be monitored and the other aspects of the monitoring program during permitting and in advance of construction activities, and will work with these agencies to negotiate any remediation activities if needed. Regular monitoring reports will be submitted to the USACE, NMFS, and NYSDEC and will be made available on the Project website. The need for remediation actions, if any, will be determined by the NMFS, NYSDEC, and the USACE on the basis of the regular monitoring results submitted by the Project Sponsor. In addition to the monitoring, NYSDEC is requesting additional mitigation for the modification of bottom habitat within the Hudson River. NYSDEC recommendations include contribution to the Estuarium at Pier 26 within Hudson River Park or purchase of credits from the Saw Mill Creek Wetland Mitigation Bank on Staten Island. Consultation with NYSDEC is ongoing.

11.9.3 NEW YORK

- Conducting groundwater testing prior to construction to determine the quality of the groundwater that would be encountered. Should any significantly contaminated groundwater (volatile organic compounds, petroleum contamination, or other visual evidence) be encountered, it would be stored temporarily on-site and disposed of off-site at a facility approved for receiving and processing it.
- Performing all tree clearing work in compliance with New York City Local Law 3 of 2010 and NYC Parks' Tree Protection Protocol. In addition, all required replacement and/or restitution for removed trees would be provided in compliance with Local Law 3 and Chapter 5 of Title 56 of the Rules of the City of New York.

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