

Final Restoration Plan and
Environmental Assessment
for the Lincoln Park West
Wetland Restoration Project

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EXECUTIVE SUMMARY

This Final Restoration Plan/Environmental Assessment (RP/EA) has been prepared by the National Oceanic and Atmospheric Administration (NOAA) in consultation with the New Jersey Department of Environmental Protection (NJDEP), the U.S. Army Corps of Engineers, NY District (ACOE), the Hudson County Department of Parks and Recreation (HCDPR), and others. This Final RP/EA describes the process by which the project partners identified and evaluated alternatives to restore intertidal wetlands and associated habitats in an area of Jersey City, Hudson County, New Jersey that is referred to as the Lincoln Park West Wetland Restoration Project (LPWWRP).

Working under the requirements of the National Environmental Policy Act (NEPA) and New Jersey state environmental laws, the project partners considered three restoration alternatives to produce the desired water quality and habitat benefits at the Project Area. After thorough consideration of alternatives to accomplish the goal of restoring intertidal wetlands, specifically *Spartina alterniflora*-dominated salt marsh, to as much of the site as possible, NOAA and its project partners have identified either Alternative 2.5 or 2.5.1 as the preferred alternative, with plans to implement 2.5.1 if there are sufficient funds to implement the Pond Option specified in Alternative 2.5.1.

The LPWWRP site is located in a highly urbanized area of the Hackensack Meadowlands within the Arthur Kill ecosystem. The site is a parcel of land approximately 40-acres in size located on the eastern shore of the Hackensack River in Jersey City, Hudson County, New Jersey. The LPWWRP site is part of the Lincoln Park Complex, a parcel approximately 270 acres in size that is owned by the HCDPR. The site lies between the Hackensack River to the west, US Highway Truck Route 1 and 9 to the south and east, and Duncan Avenue to the north, and is part of the Lincoln Park complex. The HCDPR has owned the Lincoln Park Complex since 1905 and has dedicated the property to permanent open space and recreational usage.

The Project Area was formerly used as the Lincoln Park West Sanitary Landfill. The landfill contains unclassified municipal waste, construction, and demolition materials, including household garbage, wood, bottles, ash, metal, cloth, gravel, brick, and plastic. The landfill will be closed according to an NJDEP Solid and Hazardous Waste Program Closure and Post-Closure Plan Approval received May 20, 2009, in conjunction with restoration activities.

In the past, the site was dominated by *Spartina* species, however landfill operations by Hudson County and filling associated with the US Army Corps of Engineer's (ACOE) construction and maintenance of the Hackensack River navigation channel raised the surface elevation on the site beyond all but the most extreme high tides. The site is currently dominated by common reed (*Phragmites australis*), with several small remnant salt marsh communities located along the Hackensack River. There is an approximately 10-acre, man-made lake (i.e., West Lake) that has some limited tidal exchange via a buried culvert, and there are several small stagnant ponds that are remnants of historic tidal creeks. A concrete bulkhead forms an artificial barrier between the Hackensack River and the northern half of the site. Tidal exchange is limited to a few places where the bulkhead has deteriorated. The purpose of this Project is to modify the existing degraded environment for the purpose of restoring the native salt marsh community to the Project Area.

The Lincoln Park West Wetland Restoration Project presents a valuable opportunity to combine funds, experience, and resources from a number of sources to accomplish a dynamic restoration project that will restore a significant area of coastal wetlands in the Arthur Kill ecosystem.

Since 2006, the NJDEP – Office of Natural Resource Restoration (ONRR), has served as the lead agency for the project. With assistance provided by the NOAA Restoration Center, NJDEP –ONRR

has been responsible for restoration planning and project management. The NJDEP has funded the production of this Final RP/EA and the accompanying set of Plans and Specifications. The department will provide funding from its State Natural Resource Damage Recovery Fund towards project construction.

The NJDEP and the ACOE have contributed and will continue to provide substantial resources towards this project including expertise, materials, and funds. Specifically, the NJDEP and ACOE have provided \$1.2 million for a Feasibility Study and a Draft Ecosystem Restoration Report and Environmental Assessment.

The HCDPR has agreed to provide construction materials, handling facilities, and staging areas, and will continue to own and maintain the site under a conservation easement agreement to be executed with the State of New Jersey.

The HCDPR, the NJDEP, the ACOE, and the Port Authority of New York and New Jersey have partnered to provide clean sand material from an ACOE navigational dredging project for use at the LPWWRP.

NOAA, the United States Fish and Wildlife Service, the State of New Jersey, and the State of New York, who collectively serve as the federal and state natural resource Trustees for resources impacted by the Exxon Bayway and B.T. Nautilus oil spills, have resolved to contribute about \$2.4 million dollars in civil and criminal settlement funds from those cases towards this project. The LPWWRP comports with the Trustees' mandate to utilize the Exxon Bayway and B.T. Nautilus settlement funds to implement projects that will restore tidal wetlands in the New York/New Jersey Harbor Estuary, and specifically the Arthur Kill ecosystem. Additionally, the NJDEP applied for, and is proposed by NOAA to receive, a recipient of American Recovery and Reinvestment Act (ARRA) funds as the non-federal sponsor of the Lincoln Park West Wetland Restoration Project. NOAA proposes to fund the LPWWRP with \$10.6 million of the \$167 million in federal ARRA funds Congress has authorized for NOAA to administer for the restoration of coastal resources.

In 2006, the project partners evaluated seven restoration alternatives using a ranking matrix. The ranking matrix allowed the Team to evaluate an alternative based on each alternative's institutional, public, and technical significance, acceptability, completeness, effectiveness, efficiency, relative risk, relative uncertainty, and opportunity cost. This Final RP/EA retains the use of the ranking matrix but groups the original seven alternatives into three sets of alternatives; the preferred alternative, the non-preferred alternative, and a no-action alternative.

The preferred alternative restores approximately 34 acres of estuarine wetlands and open water habitats, including open water/mudflat, high marsh, low marsh, and scrub-shrub communities. The entire site would be over-excavated by approximately two-feet to remove remnant waste materials from prior land filling activities and would have approximately two feet of clean fill placed over it. The newly created marsh plains would be planted with a mix of *Spartina alterniflora* in the low marsh areas and *Spartina patens*, *Distichlis spicata*, *Juncus gerardii*, *Spartina cynosuroides*, and other native tidal marsh species.

Implementation of the proposed Project will alter the existing physical, ecological, cultural, aesthetic, socioeconomic, and recreational conditions of the Project Area but will not create any significant or long-term adverse impacts. There will be specific short-term temporary and minor adverse impacts associated with the proposed Project during construction.

Coordination between multiple federal, state, and municipal entities and the public has been an integral component of this Project. Input from many natural resource professionals has continually been solicited and relied upon.

On October 12, 2009 NOAA published a notice of availability and opportunity to comment on the Draft RP/EA in the Jersey Journal, Hudson County's leading daily newspaper, and the Star Ledger, North Jersey's leading daily paper. The public comment period ran for 15 days and ended October 27, 2009. NOAA received no comments from the public on the Draft RP/EA.

This RP/EA also addresses the permits, approvals and regulatory requirements, necessary for Project implementation.

1.0 INTRODUCTION

This Final Restoration Plan/Environmental Assessment (Final RP/EA) has been prepared by the National Oceanic and Atmospheric Administration on behalf of the designated natural resource Trustees for the resources impacted by the Exxon Bayway and B.T. Nautilus oil spills. NOAA has prepared this document in consultation with the New Jersey Department of Environmental Protection (NJDEP), the United States Army Corps of Engineers, NY District (ACOE) and the Hudson County Department of Parks and Recreation (HCDPR), and other project partners. In this document, NOAA describes the process by which the project partners identified and evaluated three restoration alternatives for restoring inter-tidal wetlands in an area of Jersey City, Hudson County, New Jersey that is referred to as the Lincoln Park West Wetland Restoration Project (LPWWRP). The LPWWRP presents a valuable opportunity to restore intertidal wetlands, specifically *Spartina alterniflora*, in a highly urbanized area of the Hackensack Meadowlands and restore a portion of the natural resources that were injured by the Exxon Bayway and B.T. Nautilus oil spills.

NOAA, the United States Fish and Wildlife Service (USFWS), the State of New Jersey, and the State of New York, who collectively serve as the federal and state natural resource Trustees for resources impacted by the Exxon Bayway and B.T. Nautilus oil spills, have resolved to contribute about \$2.4 million dollars in civil and criminal settlement funds from those cases towards this project. Additionally, the NJDEP applied for, and is proposed by NOAA to be funded as a recipient of, American Recovery and Reinvestment Act (ARRA) funds as the non-federal sponsor of the Lincoln Park West Wetland Restoration Project. NOAA proposes to fund the Lincoln Park West Wetland Restoration Project site with \$10.6 million of the \$167 million in federal ARRA funds Congress has authorized NOAA to administer for restoration of coastal resources.

In accordance with requirements of the National Environmental Policy Act (NEPA), the Clean Water Act (CWA), New Jersey environmental laws, and other applicable federal and state laws, NOAA and its partners carefully considered three restoration alternatives to produce the desired water quality and habitat improvements at the LPWWRP site. This document describes the restoration planning, analysis, and decision-making process by which the agency and its partners identified either Alternative 2.5 or 2.5.1 as a preferred alternative to restore the LPWWRP site and compensate the public for the natural resources damages resulting from the Exxon Bayway and B.T. Nautilus oil spills, with plans to implement 2.5.1 if there are sufficient funds.

NOAA has prepared this Final RP/EA to present the preferred restoration alternative to the public for review and comment. This document describes the proposed project site and its history; discusses the purpose and need of the proposed action; provides information on the existing conditions at the site; analyzes the alternatives the agency and its partners considered for accomplishing the desired restoration at the site; and, presents information on the potential environmental consequences that could result from implementing the preferred alternative. Additionally, NOAA presents information on applicable federal and state environmental regulations and requirements, and other applicable law, and describes how the project partners will attempt to address and mitigate for any deficiencies and inconsistencies that could be considered adverse to the environment or the health, welfare, and safety of the public and its environs.

1.1 AUTHORITY

This Final RP/EA was prepared by NOAA on behalf of the Trustees and fulfills their respective authorities and responsibilities as natural resource Trustees under the Federal Water Pollution Control Act, 33 U.S.C. § 1251, *et seq.* (also known as the Clean Water Act or CWA), and other applicable federal or state laws.

1.2 NEPA COMPLIANCE

Actions undertaken by the Trustees to restore natural resources or services are subject to the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.*, and the regulations guiding its implementation at 40 C.F.R. Parts 1500 through 1517. NEPA and its implementing regulations outline the responsibilities of federal agencies when preparing environmental documentation. In general, federal agencies contemplating implementation of a major federal action must produce an environmental impact statement (EIS) if the action is expected to have significant impacts on the quality of the human environment. When it is uncertain whether the proposed action is likely to have significant impacts, federal agencies prepare an environmental assessment (EA) to evaluate the need for an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact (FONSI), which satisfies the requirements of NEPA, and no EIS is required. For a proposed restoration plan, if a FONSI determination is made, the Trustees may then issue a final restoration plan describing the preferred restoration action(s).

In accordance with NEPA and its implementing regulations, this Final RP/EA: summarizes the current environmental setting; assesses the injury to or loss of natural resources or ecological services associated with the Site; describes the purpose and need for restoration actions; identifies alternative actions; evaluates the alternatives and their feasibility; assesses their applicability and the potential direct, indirect, or cumulative impacts on the quality of the physical, biological and cultural environment of the alternatives; and, summarizes the opportunity the Trustees provided for public participation in the decision-making process. This information will be considered by the agency to determine whether preparation of an EIS is warranted prior to identification of the final restoration action.

1.3 PUBLIC PARTICIPATION

Public coordination tools may include post cards, newsletters, newspaper postings, and public meetings. Depending upon the type and level of the public comments provided as part of the public notice of availability of the Draft RP/EA, forums may be held to inform the public of project activities and to elicit additional comments and discussion.

Public notice was made on Oct 12, 2009 in the Jersey Journal, Hudson County's leading daily newspaper and in the Star Ledger, North Jersey's leading daily paper. The public comment period commenced on October 12, 2009, ran for 15 days, and ended on October 27, 2009. NOAA received no comments from the public on the Draft RP/EA.

The Final RP/EA can be viewed electronically at <http://www.darrp.noaa.gov/>.

2.0 PURPOSE AND NEED FOR THE ACTION

The purpose of the proposed action is to fund the LPWWRP to redress natural resource injuries resulting from the Exxon Bayway and B.T. Nautilus oil spills. NOAA, the United States Fish and Wildlife Service, the State of New Jersey, and the State of New York, who collectively serve as the federal and state natural resource Trustees for resources impacted by the Exxon Bayway and B.T. Nautilus oil spills, have resolved to contribute about \$2.4 million dollars in civil and criminal settlement funds from those cases towards this project.

Additionally, the NJDEP applied for, and is proposed by NOAA to be funded as a recipient of, ARRA funds as the non-federal sponsor of the Lincoln Park West Wetland Restoration Project. NOAA proposes to fund the LPWWRP with \$10.6 million of the \$167 million in federal ARRA funds Congress has authorized the agency to administer for restoration of coastal resources.

The proposed action would restore wetland hydrology, increase the duration of flooding across the marsh plain, and maximize an increase in the acreage of tidally influenced open water bodies such as creeks and ponds, which will result in increased habitat for native salt marsh species, increased habitat for birds and other wildlife, and increased fish access to nursery habitat. Additionally, the completed project would provide a valuable area for public access to, and recreational use of, a dynamic restored wetland environment in the heart of a highly urbanized area of the Hackensack Meadowlands. The need for the proposed action is to compensate the public for injuries to natural resources caused by the Exxon Bayway and B.T. Nautilus oil spills.

2.1 INCIDENT SUMMARIES

Exxon Bayway Spill

On January 1-2, 1990 an uncontrolled release of #2 fuel oil spilled from the Exxon Bayway facility's underwater pipeline located in Linden, New Jersey into the Arthur Kill, a saltwater channel between New Jersey and Staten Island, NY. Approximately 567,000 gallons of oil were released and impacted fish and wildlife habitats, including wetlands, in the immediate area of the spill. The spill resulted in the oiling of more than 100 acres of tidal salt marsh on Staten Island and in New Jersey; some wetlands located closest to the release salt marsh cordgrass (*Spartina alterniflora*) experienced a large-scale die-off. Representatives of the City and State of New York, the State of New Jersey, the City of Elizabeth, New Jersey, the U.S. Fish and Wildlife Service (USF&WS), and NOAA, who collectively serve as the designated natural resource Trustees, responded to the incident in order to assess and quantify the impacts to natural resources. Under authority of the Clean Water Act (CWA), NOAA, the United States Fish and Wildlife Service (US F&WS), the State of New Jersey and the State of New York conducted a damage assessment as Trustees, and filed a claim for natural resources damages against Exxon, the owner and operator of the Bayway Linden facility. Exxon settled with the Trustees and paid over \$11.5 million in natural resource damages to be used to restore the injured natural resources resulting from the Exxon Bayway spill. The Trustees are jointly administering the settlement funds to accomplish the restoration of the natural resources impacted by the spill.

B.T. Nautilus Spill

On June 7, 1990 the B.T. Nautilus, a large British tanker ship owned and operated by the Nautilus Motor Tanker Co., Ltd, ran aground in the Kill Van Kull and leaked approximately 260,000 gallons of #6 fuel oil into the waters of New York and New Jersey. The natural resource Trustees for this spill are the City and State of New York, the State of New Jersey, the U.S. Fish and Wildlife Service (USF&WS), and NOAA. Representatives of the Trustees responded to the incident and conducted a damage assessment to determine the extent of injury to natural resources. The spill resulted in the contamination of significant areas of shoreline in both states. Piping plovers, which have been listed

as threatened by the US F&WS and as endangered by the State of New Jersey has listed as endangered, and their habitat were oiled. Pursuant to their authority under the CWA, the Trustees filed a claim for natural resource damages against Nautilus Motor Tanker Co. Ltd. Settlement was reached in April of 1994, and Nautilus Motor Tanker Co., Ltd. provided \$4 million to the Trustees to settle the natural resource damage claim. The Trustees are jointly administering the settlement funds to accomplish the restoration of the natural resources injured by the spill.

2.2 OVERVIEW OF POST-SPILL PLANNING

NOAA, the United States Fish and Wildlife Service (US F&WS), the State of New Jersey, and the State of New York, collectively serve as the designated federal and state natural resource Trustees for the natural resources impacted by the Exxon Bayway and B.T. Nautilus Oil Spills.

The Exxon Bayway and B.T. Nautilus oil spills adversely impacted natural resources in the New York/New Jersey Harbor Estuary, and specifically the Arthur Kill. In response to the Exxon Bayway and B. T. Nautilus oil spills, the local, state, and federal natural resource Trustees formed the New York/New Jersey Harbor Oil Spill Restoration Committee. The Committee, which consists of NOAA, the US Fish and Wildlife Service, the States of New York and New Jersey, and the city of New York, was established to allocate and administer the settlement funds recovered under the Clean Water Act and manage the planning, implementation, oversight, and monitoring of the natural resource restoration of the injured natural resources funds collected pursuant to the legal settlements reached under the Clean Water Act, for restoration of injured natural resources.

Since 2006, the NJDEP and NOAA, in communication with the Committee, have led efforts to plan and design the proposed Lincoln Park West Wetland Restoration Project. The LPWWRP is a part of a larger proposed plan to restore and improve approximately 90 acres of the property in the Lincoln Park Complex via activities including: a landfill closure; wetland habitat restoration and recreational improvements (golf course and trails); and the beneficial reuse of harbor navigation materials (clean sand). The site will be excavated, with material removed and capped, in order to create tidal creeks, intertidal marshes, and connected upland transitional areas. It is estimated that it will cost \$ 13.6 million dollars to complete the LPWWRP.

The Trustees have determined that the LPWWRP will restore significant coastal wetland habitat in the vicinity of, and of the same type as, the shoreline that was adversely impacted by the two spills. The Trustees have resolved to contribute about \$2.4 million of Exxon Bayway and B.T. Nautilus settlement funds to the LPWWRP.

2.3 SITE DESCRIPTION

The Lincoln Park Wetland Restoration Project is located within a parcel of land totaling approximately 40 acres in size. This parcel is located on the eastern shore of the Hackensack River in Jersey City, Hudson County, New Jersey and lies between the Hackensack River to the west, State Route 1 and 9 to the south and east, and the Lincoln Park West Sanitary Landfill to the north (see Figure 1). The Project Area is part of the Lincoln Park complex, an approximately 270-acre parcel owned by the Hudson County Department of Parks and Recreation (HCDPR) since 1905 and dedicated by Hudson County for permanent open space and recreational usage. The HCDPR has been the owner of the Lincoln Park Wetland Restoration Project Area since 1905.

The Lincoln Park West Sanitary Landfill covers approximately 30 acres and is located immediately north of the Lincoln Park West Wetland Restoration Project Area. This landfill is being closed and

re-developed as a golf course complex (by others). The landfill is located along Duncan Avenue and contains unclassified municipal waste, construction, and demolition materials, including household garbage, wood, bottles, ash, metal, cloth, gravel, brick, and plastic. Dumping activities ceased at the landfill prior to 1982. The landfill will be closed according to an NJDEP Solid and Hazardous Waste Program Closure and Post-Closure Plan Approval received May 20, 2009, in conjunction with restoration activities. Some of the unclassified municipal waste is located within the Lincoln Park Wetland Restoration Project Area and will need to be excavated prior to the proposed restoration activities.

The Lincoln Park West Wetland Restoration Project Area is shown on a composite of the U.S. Geologic Survey (USGS) topographic maps of Jersey City and Weehawken, NJ 7.5-minute quadrangle, provided as (see Figure 2). The proposed Project Area totals approximately 40 acres in size, and centers approximately on a northing of 690,620 feet and an easting of 604,858 feet using the New Jersey State Plane Coordinates (North American Datum 1983, Zone 18).

The Project Area is currently dominated by common reed (*Phragmites australis*), with dirt access roads and trails interspersed throughout the site. Salt marsh cordgrass (*Spartina alterniflora*) fringes the southern portion of the site along the Hackensack River and a few small tidal creeks. A concrete bulkhead forms an artificial barrier between the Hackensack River and the northern portion of the western boundary of the site. Even the highest tides are prevented from normal flooding of the northern section of the marsh, with the exception of a few areas where the wall has deteriorated and some limited tidal flushing occurs. The eastern portion of the site contains an approximately 10-acre, man-made lake (i.e., West Lake) that was excavated in the late 1930s, and several stagnant pools. The man-made lake is connected to the Hackensack River via a buried 36-inch (3-foot) diameter culvert. Although this culvert is occluded with mud and sediment, some limited tidal exchange occurs between the lake and the Hackensack River. The small pools are each less than one acre in size and are possible remnants of tidal creeks that were historically present in the Project Area and were buried as a result of inconsistent filling activities during the early part of the 20th century. Site features are shown on Figure 3.

Current recreational activities within the Project Area are varied and include birding, boating, fishing and crabbing from the Hackensack River shoreline. There is no public boat launch located in close proximity to the Project Area. A trail runs through the site, connecting other areas of the Lincoln Park Complex to the shoreline. There is a proposal by the New Jersey Meadowlands Commission for an eight-mile long waterfront park known as the Hackensack River Walk that would terminate at the northwestern corner of the site.

2.4 SITE HISTORY

Historically, the western portion of the Project Area functioned as a salt marsh dominated by native grass species while the eastern portion functioned as a freshwater wetland system dominated by Atlantic white cedar. Timber harvesting resulted in the elimination of the forest system and grass species dominated the site.

A concrete bulkhead was built in 1914 along the Hackensack River as part of a park building project. The park building project was never completed due to a lack of funding. Today, the bulkhead provides access to the Hackensack River, although it prevents normal tidal flows from reaching a large part of the Project Area. In addition, portions of the salt marsh area near the Hackensack River were filled with dredge material as a result of Hackensack River navigation channel construction and maintenance. As a result, currently only a small fringe of salt marsh dominated by native grasses still exists on-site. This small fringe, located in the southwestern portion of the site south of the bulkhead,

is dominated by *Spartina alterniflora* and includes a small tidal channel extending approximately 500 feet into the Project Area. Currently, the land use within this portion of the site is open space, consisting primarily of upland grass-dominated areas, with small patches of trees and small pockets of open water located throughout. Dirt access roads and trails are interspersed throughout the site, providing access to the bulkhead and the Hackensack River. The dominant species is *Phragmites australis*.

The adverse environmental impacts associated with the historical construction and subsequent modifications to the Hackensack River navigation channel severely limited or eliminated access to intertidal marshes by juvenile anadromous fish species that previously used these areas as nurseries and refuge areas. Feeding, nesting, and roosting areas for waterfowl, wading birds, and shorebirds were also degraded. Remnant salt marshes that exist today within the greater Hackensack River ecosystem rarely provide the quality of habitat for avian and fish species that historically existed in the area. Restoring salt marshes to their original structure and degree of habitat complexity is essential to the ecological health of the Hackensack River ecosystem.

3.0 AFFECTED ENVIRONMENT

This section provides information on the physical, biological, and cultural environments within the proposed LPWWRP area. The information in this Section, together with other information in this document, provides the basis for the evaluation of the potential environmental impacts of the alternative restoration actions listed in Section 4. The scope of the environmental impacts addressed in this Final RP/EA include those on wildlife, fish and invertebrates, essential fish habitat, threatened and endangered species, farmland and urban development, recreation resources, water and sediment quality, air quality, cultural resources, hazardous and toxic waste, and environmental justice.

3.1 Physical Environment

3.1.1. Geomorphology

Topography within the Project Area is nearly level (see Figure 4). Elevations range from a minimum of sea level at the water's edge to a maximum of approximately 10 feet above mean sea level where fills have been historically deposited. Elevations within the Project area range from sea level at the water's edge to less than 20 feet (ft) (6 meters) above mean sea level (Figure 3). The expanse of estuarine flatlands identified as the Hackensack Meadowlands surround portions of the Hackensack River in the vicinity of the Project and reference areas (Hudson County Planning Board [HCPB] 2002).

The site is located within the Newark Basin of the glaciated Piedmont Lowlands Province of northern New Jersey where regional bedrock consists of the Triassic age Brunswick Formation (HCPB 2002). This formation is predominantly grayish-red to reddish-brown in color, evenly to irregularly bedded, thin to thick-bedded shale, siltstone, very fine to coarse-grain sandstone, and red-matrix conglomerate. The site is also underlain with the Lockatong Formation, which consists of coarse to fine grained arkosic sandstone, also underlies the site. Surficial geology consists of salt marsh and estuarine deposits laid down in salt marshes, estuaries, and tidal channels during Holocene sea-level rise. These deposits consist of silt, sand, peat, clay, and minor pebble gravel; are dark-brown to black; and are as much as 300 feet thick.

3.1.2. Soils

Soils within the Project area consist of material from the Quaternary period, part of the stratified drift lithologic unit, and are generally made up of silt and sand particles. Typically area soils have a significant urban land component due to the extensive amount of landfill and development activities in the county. Specifically, soils in the Project area consist entirely of the Sulfaquent-Udorthent-Psamment soil association. This association consists of very poorly drained, very deep, mineral and organic soils, generally located on tidal flats and similar areas overlain by fill materials. None of the soils in the Sulfaquent-Udorthent-Psamment Association are listed as soils of significant statewide importance (USDA-NRCS 1990). The soil mapping units within the Project Area are Sulfaquent-Udorthent-Psamments (NJ036) and open water (NJW), as shown on Figure 5.

A geotechnical investigation of subsurface soils was conducted by the USACE in the fall of 2002. Soil borings were taken at 25 locations across the Project area. Subsurface soils consist of generally poorly graded sands, silty/clayey/clay sands, and clays, as described using the Unified Soil Classification System (USACE Engineer Manual [EM] 1110-1-1906 and EM 111-1-1804). Organics, such as plant roots and decaying organic material, are found in the upper layers of these soils. However, a subsurface layer of peat (a highly organic soil) was found at depths ranging from 6–8 ft below the surface in the wetlands area near the Hackensack River. This subsurface peat layer likely represents the marsh surface prior to fill activities associated with the dredging of the Hackensack River. The water table is fairly shallow, ranging from 2–6 ft below the ground surface. Landfill debris represents a significant component of the soils on site.

3.1.3. Air Quality

The USEPA measures community-wide air quality based on daily measured concentrations of six criteria air pollutants: carbon monoxide, sulfur dioxide, respirable particulate matter, lead, nitrogen oxides, and ozone. Based on these measurements of air quality, the USEPA designates attainment areas and non-attainment areas nationwide. Non-attainment areas are designated in areas where air pollution levels persistently exceed the National Ambient Air Quality Standards (NAAQS).

Hudson County is located in the New York–Northern New Jersey–Long Island Air Quality Control Region. Similar to most urban industrial areas, emissions from automobiles, manufacturing processes, utility plants, and refineries have impacted air quality in the Project Area. Based on the NAAQS six primary pollutants, Hudson County, including the Project Area, is designated as a non-attainment area for ozone, a maintenance area for carbon monoxide, and an attainment area for sulfur dioxide, respirable particulate matter (PM₁₀), lead, and nitrogen oxides (USEPA 2002b). The conformity threshold value for nitrogen oxides and ozone precursors is 25 tons per year.

3.1.4. Noise

Noise is generally defined as unwanted sound. The day-night noise level (L_{dn}) is widely used to describe noise levels in any given community (USEPA 1978). The unit of measurement for L_{dn} is the “A”-weighted decibel (dBA), which closely approximates the frequency responses of human hearing.

The primary source of noise in the Project Area is vehicular traffic on local roadways, and bridges, boat traffic on the Hackensack River, park maintenance activities (e.g., lawn mowing), and local construction projects that may be underway. Although noise level measurements have not been obtained in the Project Area, they can be approximated based on existing land uses. The typical L_{dn} in residential areas ranges from 39 dBA for wooded residential areas to 59 dBA for old urban residential areas (USEPA 1978). It can be assumed that the existing sound levels in the Project Area are roughly within this range.

3.1.5. Water Resources

3.1.5.1. Groundwater Resources

The Project Area is located within the Piedmont and Blue Ridge provinces and is underlain by the Newark Basin of Aquifers in the Mesozoic Basin. The Newark Basin is the largest basin within the aquifers contained in the Mesozoic Basin, and yields the highest groundwater withdrawal. Precipitation and infiltration are the primary sources of recharge for the aquifer. The Newark Basin contains the Stockton Formation, Lockatong Formation, and Brunswick Group stratigraphic units (Trapp and Horn 1997).

The groundwater quality in the Mesozoic Basin is generally suitable for drinking and other reasonable uses. However, iron, manganese, and sulfate occur locally in objectionable concentrations (Trapp and Horn 1997). The predominant ions present in most New Jersey groundwater are calcium, magnesium, and bicarbonate (USGS 1988). Groundwater in the Newark Basin is generally of good quality. Median dissolved-solids concentrations are below the national drinking water standards and range from 32–219 milligram/liter (mg/L). Median chloride concentrations are 16.0 mg/L and hard groundwater ranges from 121–180 mg/L. Iron concentrations are below the national drinking water standard of 300 microgram/liter $\mu\text{g/L}$, and median concentrations of nitrate plus nitrite are below the national drinking water standard of 10 mg/L (USGS 1988).

3.1.5.2. Surface Water

The Project Area is located within the Hackensack River (below the Amtrak bridge) watershed (Hydrologic Unit Code 02030103180100 as shown on Figure 9), which is a sub-basin of the Hackensack River (below Hirshfeld Brook) watershed. The NJDEP Division of Watershed Management has divided watersheds in New Jersey into several Watershed Management Areas. The Project Area is located within the Hackensack, Hudson, and Pascack Watershed Management Areas (WMA 5).

The Project site is encompassed within an approximately 260-acre watershed that includes all of Lincoln Park. The Project Area is bordered on the western side by the tidally-influenced Hackensack River. NJDEP classifies the surface water of the Hackensack River, and tributaries from Overpeck Creek south to the State Route 1 and 9 crossing, as Saline Estuarine-2 (SE-2). NJDEP designated uses of SE-2 water include: maintenance, migration, and propagation of the natural and established biota; migration of diadromous fish; maintenance of wildlife; secondary contact recreation; and, any other reasonable uses. The Hackensack River is 45 miles long and has a drainage area of 202 square miles (mi^2). Approximately 139 mi^2 of the watershed is located within New Jersey and the remaining 63 mi^2 is located in New York. Major tributaries of the Hackensack River include Pascack Creek, Berry's Creek, Overpeck Creek, and Wolf Creek; major impoundments include Oradell Reservoir, Lake Tappan, and Woodcliff Reservoir (NJDEP 1996b). The Hackensack River basin is 4 to 7 miles wide, with 23 mi^2 of tidal marshes that extend 10 miles upstream from the mouth of the river at Newark Bay to Oradell Dam, the limit of tidal influence. The Hackensack River basin became rapidly urbanized in the later part of the 20th century with the downstream reaches being polluted to varying degrees by municipal and industrial point discharges (USGS 1986). Extensive mosquito ditching occurred throughout the watershed in the early part of the 20th century (USACE 1999a). Consequently, a large portion of the tidal wetlands dried up, and eventually became developed for commercial and residential use.

The Lincoln Park Complex contains three major ponds that are all connected via culverts. The streets adjacent to the park drain into the Jersey City storm sewer system, which is separate from the park's

drainage system (Jennings 2001). The three ponds gather surface water runoff and direct it towards the southwestern section of the Project Area. One of these three major ponds is an approximately 10-acre, man-made lake (West Lake) located in the eastern portion of the Lincoln Park Wetland Restoration Project Area. This lake is currently connected directly to the Hackensack River via a 36-inch diameter culvert. This culvert has a one-way flap gate on the Hackensack River side of the pipe, however the gate is propped open and does not function. Other small ponds (less than 1 acre in size) occur within the Project Area and are possible remnants of tidal creeks that were historically present but were buried as a result of inconsistent filling activities during the early part of the 20th century.

Wetland hydrology within the Project Area was observed to be associated with seasonal high groundwater tables, surface saturation, and influence from the Hackensack River. The hydroperiod of a wetland defines the seasonal pattern of water levels. Following the Cowardin system (Cowardin et al., 1979), the hydroperiod of wetlands and open water systems within the Project Area include: subtidal (tidal open water areas), regularly flooded (tidal emergent wetlands), irregularly flooded (tidal emergent wetlands), permanently flooded (freshwater open water areas), and seasonally flooded (freshwater emergent wetlands).

3.1.5.3. Tidal Influences

NOAA, National Ocean Service (NOS) predicts that the tidal range (i.e., Mean Low Water [MLW] to Mean High Water [MHW]) at the confluence of the Hackensack River and Newark Bay (one river mile downstream of the site) is 5.2 feet for mean tide and 6.29 feet for spring tide, and at the Amtrak Railroad Bridge (2.7 miles upstream of the site) is 5.29 feet for mean tide and 6.40 feet for spring tide (NOS 2001). Temporary water level recorders were placed throughout the Hackensack River in recent years by various entities conducting studies or designing flood control or ecosystem restoration projects. The New Jersey Meadowlands Commission (NJMC) had maintained the longest tidal records in recent years, although there are numerous tidal records that continuously recorded water levels for two months or more. Along with the tidal range, many other tidal data are useful in evaluating existing conditions and in designing a tidal wetland restoration project. Below are the tidal data and their definitions.

Mean High Water Spring (MHWS) – the average elevation of the high tides that occur on the New and Full Moon;

Mean Higher High Water (MHHW) – the average elevation of the higher of the high tides within a tidal cycle;

Mean High Water (MHW) – the average elevation of all high tides;

Mean Tide Level (MTL) – the average elevation of MHW and MLW;

Mean Low Water (MLW) – the average elevation of all low tides;

Mean Lower Low Water (MLLW) – the average elevation of the lower of the low tides within a tidal cycle; and

Mean Low Water Spring (MLWS) – the average elevation of the low tides that occur on the New and Full Moon.

Table 4 summarizes many of the tidal datums from various tidal records in the area. It is important to note that most of these gauges were not recording synchronously. Thus, storm surges, rainfall and runoff discharge patterns vary at all gauge locations and for all record periods. Additional information on the tidal data collection equipment and program, and the tidal data calculated for use for this Project were first presented in the ERR/EA (USACE 2006).

For this Project, six water level recorders were deployed throughout and adjacent to the Project Area from June 4, 2002 through August 16, 2002. The location of gauges in the Project Area are shown on

Figure 10. Table 5 summarizes the water level records for these gauges. Site-specific tidal data were collected, and a tidal analysis was conducted, in order to accurately and completely model the existing hydrodynamic conditions in the Project Area. Based on these data, plant communities were surveyed and biobenchmarks were developed to identify the elevations at which desirable and undesirable plant communities were found in the Project Area. Additional information on the gauge locations, the hydrodynamic model, and biobenchmarks are presented in the ERR/EA (USACE 2006).

According to the literature (USFWS 1997), salinity ranges from 0 to 16 parts per thousand (ppt) in the Hackensack River. The portion of the river from the mouth, upriver to Cromakill Creek, is considered a moderate salinity (mesohaline: 5 to 18 ppt) zone, while the portion of the river above Cromakill Creek to the Town of Hackensack is considered a low salinity (oligohaline: 0.5 to 5 ppt) zone (USFWS 1997). Salinities recorded for the Project Area range from 12 to 23 ppt in the tidal creek, and 5 to 18 ppt in the man-made lake (i.e., West Lake) (USACE 2002d). The Project Area is located within the mesohaline zone and portions of the Project Area receive daily tidal inundation.

Historical fill activities that occurred in the early part of the 20th century raised much of the marsh surface in the Project Area above the range of normal tidal influence (supratidal). As a result, many of the remnant tidal creeks and ponds were cut off from regular tidal flushing, reducing the salinities throughout much of the marsh to low (oligohaline) or zero (freshwater) level (USACE 1999a).

Table 4. Comparison of Tidal Datums in the Hackensack River from Short Term Water Level Recorders

	<i>Tide Datums from Previous Studies</i>				<i>Tide Datums Generated for Lincoln Park Project</i>			<i>Data used in Lincoln Park Restoration Design</i>	
	From New Jersey Meadowlands Commission, done by Woods Hole Group, Inc., 2000-2001				From Louis Berger Marsh Resources Report, March 2001 ⁴	Raw Data from NJMC ⁵	NOAA Tide Station #8518750 ⁶		Raw Data from USACE
	Riverbend ¹	Berry Creek ²	Mill Creek ³	Doctors Creek ^{**}	Riverbend	Battery	Lincoln Park ^{**}		
	June 1999 - Dec 2000	June 1999 - June 2000	May-Sep 1998	May-Nov 1998	June 8-July 19, 2001	June 8-July 19, 2001	June 8-July 19, 2001		
River miles from Lincoln Park gauge	1.5 Miles Upstream	5.8 miles upstream	8.8 miles upstream	9.8 Miles upstream	1.5 miles upstream	11.5 miles downstream	0 miles upstream	Adjusted to account for all MLW and MLLW readings	
MHHW	3.80	4.01	4.43	4.33	3.69	3.38	3.41	3.44	
MHW	3.50	3.71	4.15	4.04	3.68	3.08	3.39	3.38	
MTL	0.75	0.85	1.44	1.46	1.04	0.93	0.93	0.75	
MLW	-2.00	-2.02	-1.27	-1.12	-1.60	-1.23	-1.54	-1.89	
MLLW	-2.21	-2.25	-1.45	N/A	-1.64	-1.47	-1.62	-2.00	
Range ^{*****}	5.50	5.73	5.42	5.16	5.28	4.31	4.93	5.27	
Great Diurnal Range ^{*****}	6.07	6.26	5.88	N/A	5.33	4.85	4.95	5.44	

Notes:

See USACE (2006) for more detail on tidal datums. All elevations in ft National Geodetic Vertical Datum 1929 (NGVD29).

N/A = Not Applicable

*Difference between NGVD29 and NAVD (ft) = -1.11

**Gauge missed some MLW and MLLW readings

***Approximate locations, measured along center of Hackensack River using USGS Topographic Maps

****Range is MLW to MHW

*****Great Diurnal Range is MLLW to MHHW

Sources:

¹ WHG 2001; ² WHG 2000a; ³ WHG 2000b; ⁴ The Louis Berger Group 2001; ⁵ Hobbel 2001; ⁶ NOS 2001.

Table 5. Summary of Installed Water Level Recorders

Gauge Period	A	B	C	D	E	F
Description	middle lake	west lake	creek	north of path	south of path	Hackensack River
Start of Record	6/7/2001	6/26/2001	6/4/2001	7/25/2001	7/19/2001	6/8/2001
End of Record	7/19/2001	7/19/2001	7/25/2001	8/16/2001	8/16/2001	7/19/2001
East NAD 83 ft	606080	605807	604309	604387	604290	603983
North NAD 83 ft	690070	690461	690440	691119	691134	690359
Water Level Statistics - in ft NGVD29						
Minimum	2.1	1.1	3.1	4.0	3.2	-2.7
Mean	2.2	1.5	3.3	4.2	4.0	1.0
Maximum	2.5	2.0	5.2	4.4	4.7	4.4
Total rainfall (inches)	4.38	1.93	4.80	1.44	1.85	4.38

3.2. BIOLOGICAL RESOURCES

3.2.1. Vegetated Habitats

Vegetation surveys, including site evaluations, aerial photography interpretation, cover type mapping, and quadrat sampling, were conducted by the USACE at the Project Area in 2001 (USACE 2002a) and was included in the 2004 ERR/EA. Surveys were conducted again in 2007 by NJDEP, along with wetland and open water community delineation within the Project Area. Bio-benchmarking surveys were conducted (2007) to determine the maximum, minimum, and mean elevation ranges for targeted vegetated communities. The following section presents a summary of the most current survey information on wetland and upland plant communities identified in the Project Area, and the results of bio-benchmarking surveys.

3.2.1.1. Uplands

Uplands within the Project Area consist of forest/scrub-shrub and herbaceous community types, totaling 12.8 acres, or 32.1 percent of the Project Area. These community types occur as fairly large patches throughout the Project Area. Evidence of disturbance within the upland community types is apparent, and includes disturbed soils, household trash, and construction debris. The ground in the southwest corner of the Project Area is heavily littered with old bottles, cans, sheet metal, and other miscellaneous debris. Table 1 presents the existing cover types and areas of upland and wetland habitat types in the Project Area. Existing habitat types are shown on Figure 6.

Upland forest/scrub-shrub habitat includes scattered mature trees such as white mulberry (*Morus alba*), tree-of-heaven (*Ailanthus altissima*), quaking aspen (*Populus tremula*), and black willow (*Salix nigra*). The sapling/shrub layer in this community is sparse and includes quaking aspen and tree-of-heaven saplings and shrubs such as common elderberry (*Sambucus canadensis*) and winged elm (*Ulmus alata*). The herbaceous layer in this community is sparse and includes species such as white snakeroot (*Ageratina altissima*), climbing nightshade (*Solanum dulcamara*), and rough goldenrod (*Solidago rugosa*). *Phragmites* covers 5.31 acres, or 13.3 percent of the upland portion of the Project Area.

3.2.1.2. Wetlands

Historic filling, construction of a hardened shoreline, and other anthropogenic disturbances during the early 20th century have resulted in a reduction of wetland acreage and function within the Project area. Historically, wetlands within the Project area were salt marshes dominated by *S. alterniflora*. Presently, wetlands in the Project area consist primarily of highly degraded, tidally and non-tidally influenced, emergent marshes dominated by *Phragmites*, interspersed with minor components of salt marsh and scrub-shrub habitat.

The NJDEP Wetlands Inventory map indicates that five wetland/open water habitats have been mapped within the Project Area (see Figure 7). NJDEP mapped wetland/open water areas include artificial lake, herbaceous wetland, deciduous wooded wetland, saline marsh (low marsh), *Phragmites* wetland, and tidal water. Wetlands in the Project Area also are divided into estuarine and palustrine wetlands, based on NJDEP mapped wetlands and field surveys (see Figure 8). Estuarine wetlands occur in areas that are hydrologically connected to the Hackensack River and are primarily confined to the western portion of the Project Area. Palustrine wetlands include the wetlands associated with the large man-made lake and small ponds that are scattered throughout the site. Although the man-made lake does experience some tidal influence due to a culvert that connects the lake hydrologically to the Hackensack River, the lake is considered more similar to the palustrine ponds than to the estuarine system.

A wetland delineation survey was conducted in 2001 by USACE 2002b and was included as part of the December 2006 Draft ERR/EA. The wetland delineation conducted in 2007 updates and replaces the USACE survey in this Final RP/EA. Wetland and open water communities within the Project Area were delineated in 2007 in accordance with the procedures outlined in the U.S. Army Corps of Engineers' *Wetlands Delineation Manual* (Environmental Laboratory, 1987) and the 1989 Interagency *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. Wetlands, as defined in these manuals, are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands thus possess three characteristics: 1) hydric soils, 2) wetland hydrology, and 3) hydrophytic vegetation. A total of 26.04 acres of wetlands and open water were identified within the Project Area.

A request for a Letter of Interpretation (LOI) to verify the jurisdictional boundaries and confirm the resource value of the wetlands and waters within the Project Area was submitted to the NJDEP. Following a site inspection conducted in October 2007, the NJDEP approved the wetland delineation, assigned resource values that established transition areas, and issued LOI /Line Verification DLUR File No. 0906-07-0009.1, a copy of which is provided in Appendix A.

Table 1. Existing Habitats within the Project Area.

Existing Habitat Type	Area (Ac.)
Palustrine Wetlands	
Open Water (POW)	10.36
Emergent - <i>Phragmites</i> (PEM)	5.63
Scrub-Shrub (PSS)	0.43
Estuarine Wetlands	
Open Water (TOW)	0.81
Emergent - <i>Spartina</i> (EEM)	0.45
Emergent - <i>Phragmites</i> (EEM)	5.74
Scrub-Shrub (ESS)	2.62
Total	26.04
Uplands	
Herbaceous (UH)	4.10
Herbaceous - <i>Phragmites</i> (UH)	5.31
Forest/Scrub-Shrub	3.39
Total	12.80
Undisturbed	1.05
Total	39.89

3.2.1.3. Habitat Zonation

Estuarine wetlands occupy approximately 9.62 total acres (24.1 percent) of the Project Area, and include 0.81 acre (2.0 percent) of open water, 0.45 acre (1.1 percent) of *Spartina*-dominated emergent marsh, 5.74 acres (14.4 percent) of *Phragmites*-dominated emergent marsh, and 2.62 acres (6.6 percent) of scrub-shrub wetland. Estuarine wetlands are divided into intertidal (regularly flooded twice daily by tides) and supratidal (irregularly flooded) areas (Cowardin et al. 1979, Tiner 1985). The intertidal areas are confined to a portion of shoreline located directly adjacent to the Hackensack River in the southwestern portion of the Project Area that are inundated by the diurnal tidal cycle. The intertidal areas are almost entirely dominated by *S. alterniflora*.

The supratidal areas receive infrequent tidal inundation and are almost entirely dominated by *Phragmites*, which exhibited a mean height of 216 cm, vegetative cover of 75–100%, and mean stem density of 136 stems per square meter (USACE 2002a). *Phragmites* dominates many salt marsh wetlands in northern New Jersey that have been disturbed or degraded (Tiner 1985). Other species observed within supratidal areas include shrubs such as marsh elder (*Iva frutescens*) and groundsel tree (*Baccharis halimifolia*), and herbaceous species such as salt-marsh fleabane (*Pluchea purpurascens*) and swamp rose mallow (*Hibiscus palustris*). All vegetated estuarine wetlands within the Project Area are considered by the US Environmental Protection Agency (USEPA) to be priority wetlands.

Open water and intertidal mudflat habitat is located along the Hackensack River shoreline on the western edge of the Project boundary. Approximately one third of the mudflat habitat grades into the

remnant intertidal *S. alterniflora* marsh, whereas the remainder of the mudflat is bordered by the concrete bulkhead hardened shoreline. The majority of the mudflat habitat is relatively devoid of cobble, rock, and other debris, and is composed of fine, cohesive sediments, which is of relatively high value as fish and wildlife habitat. No submerged aquatic vegetation (SAV) beds occur within the estuarine open water habitat.

Palustrine wetlands occupy approximately 16.42 acres (41.2 percent) of the Project Area, including designated open water habitat. Similar to the supratidal areas, the majority of the palustrine emergent wetlands are dominated by expansive stands of *Phragmites* (5.63 acres, 14.1 percent), interspersed with small forest/scrub-shrub patches (0.43 acre, 1.1 percent) comprised of swamp rose mallow, groundsel tree, and marsh elder. The remainder of the palustrine systems consist of open water habitat (10.36 acres, 26 percent) and includes the +/- 10-acre man-made lake.

Palustrine open water habitat on site has the potential to support SAV, especially in deeper areas of the lake. Species that may occur within palustrine open water include waterweed (*Elodea* spp.), pondweed (*Potamogeton* spp.), and milfoil (*Myriophyllum* spp.). A number of these species serve as food and/or cover for various species of waterfowl, fish, and invertebrates. The smaller ponds scattered throughout the site may dry out during the summer and would not be able to support SAV. However, these ponds are capable of supporting algal mats and free-floating plants such as duckweed (*Lemna* spp. and *Spirodela* spp.). Palustrine mudflat habitat is limited to a very narrow fringe of sediment around the lake that is exposed periodically.

Table 2 presents a listing of the plant species observed in the Project Area during the wetland delineation field efforts and the respective wetland indicator status.

Table 2. Vegetation Observed Within the Project Area

Common Name	Scientific Name	Wetland Indicator Status
white snakeroot	<i>Ageratina altissima</i>	FACU-
tree-of-heaven	<i>Ailanthus altissima</i>	NL
common ragweed	<i>Ambrosia artemisiifolia</i>	FACU
mugwort	<i>Ambrosia vulgaris</i>	NL
green milkweed	<i>Asclepias viridiflora</i>	FACU
common milkweed	<i>Asclepias syriaca</i>	NL
groundsel tree	<i>Baccharis halimifolia</i>	FACW
Queen's Ann lace	<i>Daucus carota</i>	FACU
white thoroughwort	<i>Eupatorium album</i>	FAC
swamp rosemallow	<i>Hibiscus moscheutos</i>	OBL
spotted touch me not	<i>Impatiens carpensis</i>	FACW
marsh elder	<i>Iva frutescens</i>	FACW+
white mulberry	<i>Morus alba</i>	UPL
red mulberry	<i>Morus rubra</i>	FACU

princess tree	<i>Paulownia tomentosa</i>	UPL
common reed	<i>Phragmites australis</i>	FACW
common pokeweed	<i>Phytolacca americana</i>	FACU+
Japanese knotweed	<i>Polygonum cuspidatum</i>	FACU-
salt-marsh fleabane	<i>Pluchea purpurascens</i>	OBL
cottonwood	<i>Populus deltoides</i>	FAC
quaking aspen	<i>Populus tremula</i>	FACU
black locust	<i>Robinia pseudoacacia</i>	FACU-
blackberry	<i>Rubus allegheniensis</i>	FACU-
weeping willow	<i>Salix babylonica</i>	FACW-
black willow	<i>Salix nigra</i>	FACW+
common elderberry	<i>Sambucus canadensis</i>	FACW-
climbing nightshade	<i>Solanum dulcamara</i>	FAC-
early goldenrod	<i>Solidago juncea</i>	NL
rough goldenrod	(<i>Solidago rugosa</i>)	FAC
smooth cordgrass	<i>Spartina alterniflora</i>	OBL
winged elm	<i>Ulmus alata</i>	FACU

Key to indicator categories

OBL: Obligate Wetland, occur almost always (estimated probability >99%) under natural conditions in wetlands.

FACW: Facultative Wetland, usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands.

FAC: Facultative, equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).

FACU: Facultative Upland, usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%).

NL: Not listed.

A positive (+) sign following an indicator indicates a frequency toward the higher end of a category.

A negative (-) sign following an indicator indicates a frequency toward the lower end of a category.

Sources: 1995 Supplement to the List of Plant Species that Occur in Wetlands: Northeast (Region 1), US Fish and Wildlife Service, August, 1995.

National List of Plant Species that Occur in Wetlands: Northeast (Region I), US Fish and Wildlife Service, May 1988.

3.2.2. Shellfish

Previous studies conducted by Cerrato (1986), USFWS (1998), and USACE (1998) indicate a presence and high abundance of clams, particularly soft-shelled clam (*Mya arenaria*), throughout Newark Bay. However, Iocco et al. (2000) conducted sediment profile imagery and grab sampling throughout Newark Bay and found bivalves to be absent in their survey. Discrepancies among the results of the surveys were most likely related to differences in sampling methods (Iocco et al. 2000).

A survey conducted by the USACE (2002e), and a literature review conducted by USFWS (1996) suggest that the common shellfish species found in the vicinity of the Project Area include blue crab

(*Callinectes sapidus*), fiddler crab (*Uca* spp.), grass shrimp (*Palaemonetes pugio*), ribbed mussel (*Geukensia demissa*), and white-fingered mud crab (*Rhithropanoeps harrisii*). Blue crab is the only edible shellfish species captured during the USACE (2002e) survey. Table 6 presents the shellfish species that have been observed or are likely to occur in the vicinity of the Project Area.

3.2.3. Finfish

Finfish species captured in the Hackensack River are consistent with those expected in a tidal river and marsh complex in coastal New Jersey (USACE 2000a, b, USACE 2002d, e). The USFWS (1996) literature review and the USACE (2002d) fish survey in the Hackensack River and Newark Bay found freshwater, marine, anadromous and catadromous finfish species. Fish species likely to occur in the vicinity of the Project Area include alewife (*Alosa pseudoharengus*), American eel (*Anguilla rostrata*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic needlefish (*Strongylura marina*), Atlantic tomcod (*Microgadus tomcod*) bay anchovy (*Anchoa mitchilli*), bluefish (*Pomatomus saltatrix*), catfish (brown bullhead [*Ameiurus nebulosus*] and white catfish [*A. catus*]), common carp (*Cyprinus carpio*), crevelle jack (*Caranax hippos*), gizzard shad (*Dorosoma cepedianum*), killifish (banded killifish [*Fundulus diaphanus*], mummichog [*F. heteroclitus*], and striped killifish [*F. majalis*]), northern kingfish (*Menticirrhus saxatilis*), pumpkinseed (*Lepomis gibbosus*), striped bass (*Morone saxatilis*), white perch (*M. americana*), summer flounder (*Paralichthys denntatus*), weakfish (*Cynoscion regalis*), and winter flounder (*Pseudopleuronectes americana*) (USFWS 1996, USACE 2002d). Table 6 presents the finfish species that have been observed or are likely to occur in the vicinity of the Project Area.

In an attempt to establish a progressive anadromous fish management plan, the NJDEP, Division of Fish, Game, and Wildlife, Bureau of Marine Fisheries, has conducted several studies addressing upstream migratory impediments to, and restoration possibilities for, anadromous species such as clupeid (i.e., alewife, blueback herring [*Alosa aestivalis*], American shad [*A. sapidissima*], and hickory shad [*A. mediocris*]), Atlantic tomcod, and striped bass (Zich 1977, NJDEP 1986, Durkas 1992). Zich (1977) determined that poor American shad spawning runs in New Jersey are the result of the combined effects of pollution, habitat displacement, man-made blockage, and overfishing. Alewife and blueback herring are the only species on the anadromous fish management plan that were collected in the Hackensack River (Zich 1977).

Table 6. Shellfish and Finfish Species Likely to Occur in the Vicinity of the Project Area

Common Name	Scientific Name	Project Area	Reference Area
Shellfish			
Blue crab	<i>Callinectes sapidus</i>	X	X
Fiddler crab	<i>Uca</i> spp.	X	X
Grass shrimp	<i>Palaemonetes pugio</i>	X	X
Ribbed mussel	<i>Geukensia demissa</i>	X	X
White-fingered mud crab	<i>Rhithropanoepus harrisii</i>	x	x
Finfish			
Alewife	<i>Alosa pseudoharengus</i>	X	X
American eel	<i>Anguilla rostrata</i>		X
Atlantic menhaden	<i>Brevoortia tyrannus</i>	x	x
Atlantic needlefish	<i>Strongylura marina</i>	X	
Atlantic silverside	<i>Menidia menidia</i>	X	X
Atlantic tomcod	<i>Microgadus tomcod</i>	x	x
Banded killifish	<i>Fundulus diaphanus</i>	X	
Bay anchovy	<i>Anchoa mitchilli</i>	x	x
Bluefish	<i>Pomatomus saltatrix</i>	X	X
Brown bullhead	<i>Ameiurus nebulosus</i>		x
Common carp	<i>Cyprinus carpio</i>	x	x
Crevelle jack	<i>Caranax hippos</i>		X
Gizzard shad	<i>Dorosoma cepedianum</i>	X	X
Inland silverside	<i>Menidia beryllina</i>	x	x
Mummichog	<i>Fundulus heteroclitus</i>	X	X
Northern kingfish	<i>Menticirrhus saxatilis</i>	X	
Pumpkinseed	<i>Lepomis gibbosus</i>		x
Striped bass	<i>Morone saxatilis</i>	X	X
Striped killifish	<i>Fundulus majalis</i>	x	x
Summer flounder	<i>Paralichthys denntatus</i>	X	X
Weakfish	<i>Cynoscion regalis</i>	x	x
White catfish	<i>Ameiurus catus</i>		x
White perch	<i>Morone americana</i>	X	X
Winter flounder	<i>Pseudopleuronectes americana</i>	x	x

Source: USFWS 1997, USACE 2002d. Compiled by Northern Ecological Associates, Inc.

Key: X = Species observed during field surveys.

x = Species likely to occur in the area.

3.2.4. Benthic Resources

Although there are no known studies of benthic resources in or adjacent to the Project Area, several surveys have been done approximately one mile downstream of the Project Area in Newark Bay. Historically, Newark Bay benthic assemblages have been characterized by low diversity (Cerrato 1986). The Project Area is located near the New York/New Jersey industrial and urban core with increasingly of New York/New Jersey which has caused a detrimental effect on fish and wildlife populations in the area (USACE 1987). Development and a variety of industrial pollutants are present in the Hackensack River, probably due to heavy development and the presence of 13 landfills in the Hackensack River drainage basin that have contributed to degraded water quality and reduced habitat (New York/New Jersey Harbor Spill Restoration Committee 1996).

A survey conducted by the USACE (1987) classified the overall benthic organism abundance of Newark Bay as moderate. Benthic communities from the USACE survey are dominated by polychaete worms, which are habitat generalists with high tolerance to environmentally stressful conditions such as low dissolved oxygen levels. Results of the USACE survey showed polychaete worms (i.e., *Streblospio benedicti* and *Sabellaria vulgaris*), as well as soft-shell clam, to be the dominant species during both the spring and summer periods. Survey results also showed some polychaete worm species (i.e., *Scolecopelides viridis*, *Nereis succinea*, and *Polydora ligni*) collected during the spring being replaced by polychaete worms (i.e., *Spio setosa*), barnacle (i.e., *Balanus improvisus*), and tunicate (i.e., *Molgula manhattensis*) during the summer (USACE 1987). The USACE (1987) concluded that the moderate species abundance and generally low species diversity in the benthos are results of a stressed environment where the development of the benthic community is restricted.

The USFWS (1996) conducted a literature search of benthic resources in the Hackensack River. This literature search revealed evidence from one survey that found 53 different benthic species dominated by polychaetes (36%), mollusks (15%), and amphipods (11%). Also, epibenthic invertebrate species included grass shrimp, mysid shrimp (*Neomysis americana*), sand shrimp (*Crangono septemspinosa*), white-fingered mud crab, and several species of amphipods.

Iocco et al. (2000) conducted sediment profile imagery (SPI) and grab sampling throughout Newark Bay and found polychaete worms to be the dominant species during the spring and fall (see Table 7). Polychaete worms *Streblospio benedicti*, Cirratulidae (lowest possible identification level [LPIL]), and *Leitoscoloplos* (LPIL) had the highest average abundance during the spring while dwarf surf clam (*Mulinia lateralis*), *Mediomastus* (LPIL), and *Streblospio benedicti* had the highest average abundance during the fall. Surveys also revealed that oligochaete worms were present during the spring and fall, whereas bivalves, such as dwarf surf clam, were only present during the fall (Iocco et al. 2000).

Table 7. Benthic Species Likely to Occur in the Vicinity of the Project Area

Common Name	Taxa
Segmented worms	Annelida
Bristle worm	Polychaeta
Fringed worm	Cirratulidae ¹
Blood worm	<i>Glycera americana</i>
Capitellid thread worm	<i>Heteromastus filiformis</i>
Orbinid worm	<i>Leitoscoloplos</i> ¹
Orbinid worm	<i>Leitoscoloplos fragilis</i>
Orbinid worm	<i>Leitoscoloplos robustus</i>
Red-gilled mud worm	<i>Marenzellaria viridis</i>
Capitellid thread worm	<i>Mediomastus</i> ¹
Common clam worm	<i>Nereis succinea</i>
Trumpet worm	<i>Pectinaria gouldii</i>
Paddle worm	Phyllodoceidae ¹
Mud worm	<i>Polydora cornuta</i>
Mud worm	<i>Polydora ligni</i>
Sand-builder worm	<i>Sabellaria vulgaris</i>
Mud worm	<i>Scolecopides viridis</i>
Mud worm	<i>Spio Setosa</i>
Mud worm	<i>Streblospio benedicti</i>
Fringed worm	<i>Tharyx acutus</i>
Aquatic earthworm	Oligochaeta ¹
Mollusks	Mollusca
Bivalve	Bivalvia ¹
Surf clam	<i>Mulinia lateralis</i>
Soft shell clam	<i>Mya arenaria</i>
Jointed-leg animals	Arthropoda
Crustacean	Crustacea
Barnacle	Cirripedia (Subclass)
Bay barnacle	<i>Balanus improvisus</i>
Amphipod	Amphipoda (Order) ¹
Decapod	Decapoda (Order)
Sand shrimp	<i>Crangono septemspinosa</i>
Grass shrimp	<i>Hippolytes</i> spp.
White-fingered mud crab	<i>Rhithropanopeus harrisi</i>
Mysid shrimp	Mysidacea (Order)
Mysid shrimp	<i>Neomysis americana</i>
Tunicates	Chordata
Ascidians	Ascidacea
Sea grapes	<i>Molgula manhattensis</i>

Source: USACE 1987, USFWS 1997, and Iocco et al. 2000. Compiled by Northern Ecological Associates, Inc.

¹ LPIL – Lowest Possible Identification Level.

3.2.5. Reptiles and Amphibians

The USACE conducted wildlife surveys, including reptile and amphibian surveys, in the Project Area and a nearby reference marsh during the spring and fall of 2001 (USACE 2002f). According to the NJDEP, Division of Fish and Wildlife, Endangered and Non-game Species Program, 48 reptile and amphibian species are likely to occur in Hudson County, New Jersey (NJDEP 2001). Based on the USACE’s surveys there is little suitable habitat for reptiles and amphibians present in the Project Area. The majority of amphibians (i.e., frogs, toads, and salamanders) require freshwater ponds, streams, and/or vernal pools for breeding habitat (Conant and Collins 1991, NJDEP 2001). Although the Project Area supports a number of wetlands, ponds, and the lake, these areas are occasionally subjected to saltwater influence, which precludes the majority of frogs and salamanders from breeding.

Despite the saltwater influence, three species of reptile were observed within the Project Area during field surveys, including common snapping turtle (*Chelydra serpentina*), red-eared slider (*Trachemys scripta elegans*), and eastern garter snake (*Thamnophis sirtalis sirtalis*). Additionally, northern diamondback terrapins (*Malaclemys terrapin terrapin*) could potentially use remnant *S. alterniflora*-dominated wetlands within the Project Area. Table 8 presents the reptile and amphibian species that have been observed or are likely to occur in the Project Area.

Table 8. Reptile and Amphibian Species Observed or Likely to Occur in the Project Area

Common Name	Scientific Name	Project Area	Reference Area
Common garter snake	<i>Thamnophis sirtalis</i>	x	
Common snapping turtle	<i>Chelydra serpentina</i>	X	X
Eastern garter snake*	<i>Thamnophis sirtalis sirtalis</i>	X	
Eastern box turtle	<i>Terrapene carolina</i>	x	
Fowler’s toad	<i>Bufo woodhousii fowleri</i>	x	
Northern diamondback terrapin	<i>Malaclemys terrapin terrapin</i>		X
Red-eared slider	<i>Trachemys scripta elegans</i>	X	

Source: USACE 2002f. Compiled by Northern Ecological Associates, Inc.

Key: X = Species observed during field surveys.

x = Species likely to occur in the area.

3.2.6. Birds

Avian surveys, using point counts, observation stations, and playback tapes, were conducted in the Project Area and a nearby reference marsh by the USACE in June and October 2001 (USACE 2002g). A diverse bird community was observed in the variety of habitats found in the Project Area and the reference area. Specifically, as indicated in Table 9, 71 bird species were observed during the spring and fall avian surveys (USACE 2002g).

The man-made lake and the Hackensack River in the Project Area provide feeding, resting, and brood-rearing habitat for a number of waterfowl, gulls, and wading birds. Specifically, Canada goose (*Branta canadensis*), American black duck (*Anas rubripes*), mallard (*Anas platyrhynchos*), gadwall

(*Anas strepera*), and blue-winged teal (*Anas discors*) are waterfowl species observed within the Project Area (USACE 2002g). Additionally, the forest/scrub-shrub portions of the Project Area provide habitat for a wide range of resident and migratory passerines. Examples of the most commonly observed passerines utilizing this habitat type include American goldfinch (*Carduelis tristis*), American robin (*Turdus migratorius*), cedar waxwing (*Bombycilla cedrorum*), downy woodpecker (*Picoides pubescens*), gray catbird (*Dumetella carolinensis*), and rufus-sided towhee (*Pipilo erythrophthalmus*). *Phragmites*-dominated portions of the Project Area provide habitat for species such as common grackle (*Quiscalus quiscula*), common yellowthroat (*Geothlypis trichas*), and red-winged blackbird (*Agelaius phoeniceus*).

The limited amount of existing salt marsh habitat within the Project Area does not meet the minimum habitat area requirements for marsh specialists such as sharp-tailed sparrows (*Ammoodramus caudacutus*) and marsh wrens (*Cistothorus palustris*). However, these species were observed at the reference area. Several state-listed avian species were identified during field sampling activities, and are discussed in Section 3.4.2 Threatened, Endangered, and Special Concern Species.

Table 9. Bird Species Observed in the Project Area

Common Name	Scientific Name	Project Area	Reference Area
American black duck	<i>Anas rupripes</i>	X	X
American coot*	<i>Fulica americana</i>		X
American crow	<i>Corvus brachyrhynchos</i>	X	X
American goldfinch	<i>Carduelis tristis</i>	X	
American kestrel*	<i>Falco sparverius</i>	X	
American redstart	<i>Setophaga ruticilla</i>	X	
American robin	<i>Turdus migratorius</i>	X	
American woodcock*	<i>Scolopax minor</i>	X	
Barn swallow	<i>Hirundo rustica</i>	X	X
Belted kingfisher	<i>Ceryle alcyon</i>	X	
Black-capped chickadee	<i>Parus atricapillus</i>	X	X
Black-crowned night-heron*	<i>Nycticorax nycticorax</i>	X	X
Blue jay	<i>Cyanocitta cristata</i>	X	
Blue-winged teal*	<i>Anas discors</i>	X	
Brant	<i>Branta bernicla</i>		X
Brown creeper	<i>Certhia americana</i>	X	
Brown-headed cowbird	<i>Molothrus ater</i>	X	
Brown thrasher*	<i>Toxostoma rufum</i>	X	
Canada goose	<i>Branta canadensis</i>	X	X
Cedar waxwing	<i>Bombycilla cedrorum</i>	X	
Clapper rail	<i>Rallus longirostris</i>		X
Common grackle	<i>Quiscalus quiscula</i>	X	X
Common yellowthroat	<i>Geothlypis trichas</i>	X	X
Dark-eyed junco	<i>Junco hyemalis</i>	X	
Double-crested cormorant	<i>Phalacrocorax auritus</i>	X	X
Downy woodpecker	<i>Picoides pubescens</i>	X	

Common Name	Scientific Name	Project Area	Reference Area
Eastern kingbird*	<i>Tyrannus tyrannus</i>	X	
European starling	<i>Sturnus vulgaris</i>	X	
Gadwall	<i>Anas strepera</i>	X	X
Gray catbird	<i>Dumetella carolinensis</i>	X	
Great blue heron*	<i>Ardea herodias</i>	X	X
Great crested flycatcher	<i>Myiarchus crinitus</i>	X	
Great egret	<i>Casmerodius albus</i>	X	X
Greater black-backed gull	<i>Larus marinus</i>	X	X
Greater yellowlegs	<i>Tringa melanoleuca</i>		X
Green heron	<i>Butorides striatus</i>	X	
Green-winged teal*	<i>Anas crecca</i>	X	
Herring gull	<i>Larus argentatus</i>	X	X
Killdeer	<i>Charadius vociferus</i>	X	
Least bittern*	<i>Ixobrychus exilis</i>	X	
Least flycatcher*	<i>Empidonax minimus</i>	X	
Least tern*	<i>Sterna antillarum</i>	X	
Lesser black-backed gull	<i>Larus fuscus</i>	X	
Mallard	<i>Anas platyrhynchos</i>	X	X
Marsh wren	<i>Cistothorus palustris</i>	X	X
Mourning dove	<i>Zenaida macroura</i>	X	
Mute swan	<i>Cygnus olor</i>		X
Northern harrier*	<i>Circus cyaneus</i>		X
Northern mockingbird	<i>Mimus gunlachii</i>	X	
Northern pintail	<i>Anas acuta</i>		X
Palm warbler	<i>Dendroica palmarum</i>	X	
Peregrine falcon*	<i>Falco peregrinus</i>		X
Purple finch	<i>Carpodacus purpureus</i>	X	
Red-tailed hawk	<i>Buteo jamaicensis</i>	X	
Red-winged blackbird	<i>Agelaius phoeniceus</i>	X	X
Ring-billed gull	<i>Larus delawarensis</i>	X	X
Ring-necked pheasant	<i>Phasianus colchicus</i>	X	
Rufus-sided towhee	<i>Pipilo erythrophthalmus</i>	X	
Sandpiper species	<i>Scolopacidae species</i>		X
Sharp-shinned hawk*	<i>Accipiter striatus</i>		X
Sharp-tailed sparrow	<i>Ammodramus caudacutus</i>		X
Short-eared owl*	<i>Asio flammeus</i>	X	
Snow goose	<i>Chen caerulescens</i>	X	
Snowy egret	<i>Egretta thula</i>		X
Song sparrow	<i>Melospiza melodia</i>	X	X
Swamp sparrow*	<i>Melospiza georgiana</i>	X	
Tree swallow	<i>Tachycineta bicolor</i>	X	
Tricolored heron*	<i>Egretta tricolor</i>	X	
Warbling vireo	<i>Vireo gilvus</i>	X	

Common Name	Scientific Name	Project Area	Reference Area
White-throated sparrow	<i>Zonotrichia albicollis</i>	X	
Willow flycatcher	<i>Empidonax traillii</i>	X	
Yellow-crowned night-heron*	<i>Nyctanassa violacea</i>	X	
Yellow-rumped warbler	<i>Dendroica coronata</i>	X	
Yellow-shafted flicker	<i>Colaptes auratus</i>	X	X
Yellow warbler	<i>Dendroica petechia</i>	X	

Source: USACE 2002g. Compiled by Northern Ecological Associates, Inc.

Key: * State-listed threatened, endangered, or special concern species.

X = Species observed during field surveys.

3.2.7. Mammals

Numerous small terrestrial mammals (e.g., mice, rabbit, squirrel) are known to inhabit New Jersey (NJDEP 2002a). Site-specific surveys for small mammal usage of the Project Area were conducted in June and October 2001. Results of these surveys confirmed the presence of seven mammal species within the Project Area including white-footed mouse (*Peromyscus leucopus*), house mouse (*Mus musculus*), southern red-backed vole (*Clethrionomys gapperi*), Norway rat (*Rattus norvegicus*), eastern cottontail rabbit (*Sylvilagus floridanus*), muskrat (*Ondatra zibethicus*), and raccoon (*Procyon lotor*) (Table 10) (USACE 2002f). These mammals are generalist species that have adapted to urban environments.

Mammals were observed in almost every community type within the Project Area. Mice and voles were predominately observed in *Phragmites*-dominated wetlands and upland forested areas. Evidence of raccoon and muskrat activity was observed along several of the small ponds scattered throughout the Project Area. Eastern cottontails were commonly observed within woodlands, along roads and paths, and grazing in the maintained playing fields within and adjacent to the Project Area. Muskrats were the only mammals observed at the reference area during survey activities. Muskrat houses and muskrat individuals were observed in, and swimming between, the salt marsh and *Phragmites*-dominated wetlands (USACE 2002f).

Table 10. Mammal Species Observed in the Project Area

Common Name	Scientific Name	Project Area	Reference Area
Eastern cottontail rabbit	<i>Sylvilagus floridanus</i>	X	
House mouse	<i>Mus musculus</i>	X	
Muskrat	<i>Ondatra zibethicus</i>	X	X
Norway rat	<i>Rattus norvegicus</i>	X	
Raccoon	<i>Procyon lotor</i>	X	
Southern red-backed vole	<i>Clethrionomys gapperi</i>	X	
White-footed mouse	<i>Peromyscus leucopus</i>	X	

Source: USACE 2002f. Compiled by Northern Ecological Associates, Inc.

Key: X = Species observed during field surveys.

3.3. CULTURAL AND HUMAN ENVIRONMENT

As a portion of the larger Abraham Lincoln Memorial County Park, Lincoln Park West was never fully developed. Historic maps consistently show the area as uninhabited, undesirable marsh and lowland (USACE 2003). Large portions of the property are covered with recent garbage. The only structure currently on the property is the concrete bulkhead along the Hackensack River shore. The Project Area remains undeveloped, with areas of upland herbaceous, forest/scrub-shrub, salt marsh, and salt and fresh water-influenced *Phragmites* wetlands. Subsurface investigations did not identify significant cultural resources within the Area of Potential Effect. The following sections describe the existing prehistoric and historic resources in the vicinity of the Project Area.

3.3.1. Prehistoric

The Project Area is in proximity to two prehistoric sites. The nearest site (i.e., 26 Hd 7) is approximately 700 feet to the east on higher ground. Prior to landfilling, the Project Area would have been wet marshland, which is unlikely to have been inhabited by prehistoric groups (USACE 2003).

3.3.2. Historic

Historic maps show that there was no sign of development in the Project Area until 1904. Although development was proposed, it was never constructed. By 1911 there were several structures and a man-made lake in the Project Area. The structures are all on pilings and the two most notable are indicated on the map as the Jersey City Gun Club and the Passaic River Yacht Club. Many facilities were proposed but never constructed. The most notable changes to the property were the concrete bulkhead, built early in the twentieth century, and State Route 1 and 9, which separated the western and eastern portions of the Park by the early 1940s (USACE 2003).

3.3.3. Population

Based on the 2000 Census, the population of Jersey City was estimated at 240,055. Over the past 10 years Jersey City has experienced a relatively small population increase of 5.0% (Hudson County Planning Board [HCPB] 2002). In contrast, the population of Hudson County increased 10.0% and the State of New Jersey increased 8.9% over the same period. In 2000, Hudson County's total population was estimated at 608,975. Approximately 7.2% of New Jersey's population (8.4 million) resides in Hudson County, the most densely populated county in the state.

3.3.4. Economy, Income and Employment

Prior to the economic downturn of 2008-2009, the economy in Hudson County was experiencing growth and development in almost every aspect of the economy. The unemployment rate was down, job generation and retention was up, development was on the rise, the crime rate was down, and the quality of life continued to improve. In particular, many state and Federal programs and increased tourism opportunities have contributed to the improved economy (HCPB 2002). Current statistics are unavailable at the time of this writing.

In 1990, the average per capita income in Hudson County was estimated at \$14,480, which was lower than the statewide average of \$18,714, and ranked 19th out of the 21 New Jersey counties. Hudson County has historically had a relatively low per capita income because of the high levels of unemployment and public assistance it has experienced (HCPB 2002). However, by 1999, the average per capita income had risen to \$27,662 for Hudson County residents, and \$35,612 for the state. The 1999 per capita income level places Hudson County at 17th of New Jersey's 21 counties,

which is 78% of the state average and 97% of the national average of \$28,546 (Hudson County Economic Development Corporation 2002).

The unemployment rate in Hudson County has experienced fluctuations throughout the past decade ranging from 5.7–11.2%. However, in 2000, unemployment was estimated at its lowest rate in recent history (5.7%) (New Jersey Department of Labor 2002). Employment in the manufacturing, retail trade, insurance, and real estate industries comprised the bulk of the work force, with smaller percentages employed in agriculture, forestry, fishing, and mining industries. Prior to the economic downturn, Hudson County was projected to have large gains in employment through 2010, due to an expanding local economy, strategic redevelopment, including redevelopment of waterfront areas, and supportive government policies (HCPB 2002).

3.3.5. Housing

Hudson County has a rich history of providing for the diverse needs of its residents. From the latter part of the 1800's to the late 1970's, significant population surges resulting from various ethnic immigrant populations occurred throughout Hudson County. The flood of immigrants placed a strain on the ability of local communities to provide the needed housing to handle the new residents. This influx of people forced the county to address the needs of low-income residents and emphasized the difficulties of ensuring reasonable quality, safe shelters for thousands of people. Today, Hudson County still has high concentrations of low-income families and more than 7,000 deteriorated housing units in need of rehabilitation (HCPB 2002).

In 2000, there were approximately 240,618 housing units in Hudson County, including the 93,648 units located in Jersey City. Most of the homes in Hudson County were constructed prior to 1940. In 1990, 84.4% of Hudson County's housing units were multi-family, containing two or more families (HCPB 2002).

3.3.6. Education

The average enrollment of school age students in Jersey City has been steadily increasing over the past 20 years and is expected to continue rising. In 1990, approximately 28.3% of Jersey City residents age 25 or older had achieved a high school education or higher and 13.3% had achieved a bachelor's degree or higher.

3.4. THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

The project partners contacted the NJDEP Natural Heritage Program (NHP) and NOAA's National Marine Fisheries Service (NMFS) to request information on any known occurrences of federal or state endangered, threatened, proposed, or candidate species of flora or fauna or any critical habitats known to support those species within the vicinity of the Project Area. The USFWS New Jersey Field Office website was reviewed to determine whether any federally listed species may occur in the Project Area. Agency correspondence is provided in Appendix B.

3.4.1. Federally Listed Species

The table *Federally Listed and Candidate Species Occurrences in New Jersey by County and Municipality* located on the U.S. Fish and Wildlife Service's (USFWS) New Jersey Field Office website (<http://www.fws.gov/northeast/njfieldoffice/>) indicates that there are no Federally-listed species known to occur in Hudson County, New Jersey. Therefore, no additional correspondence with the USFWS is required.

The NMFS reports in its February 5, 2009 and June 16, 2009 correspondence that no threatened or endangered species under the jurisdiction of NMFS are expected to occur within the Project Area. In accordance with the Fish and Wildlife Coordination Act, NMFS lists the Hackensack River as an important migratory pathway for the anadromous species alewife and blueback herring. These species are listed by NOAA as species of concern.

3.4.2. State Listed Species

The NJDEP NHP reports in its January 29, 2009 correspondence that the Natural Heritage Database and Landscape Project Database indicate Cattle Egret, Glossy Ibis, Little blue Heron, Snowy Egret and Peregrine Falcon are known to occur within the Project Area (see Table 11). Cattle Egret, Glossy Ibis, Little blue Heron, and Snowy Egret are considered species of special concern. Special concern applies to species that warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a Threatened species. At the national level, the peregrine falcon has been removed from the Federal Endangered Species List. This is based on USFWS data that indicates the American peregrine has recovered in sufficient numbers throughout most of the country. The peregrine is still listed as an endangered species in the state of New Jersey, due to the concerns of human disturbance and the threat of contaminants in the environment.

Although, the state-listed endangered Least tern (*Sterna antillarum*), the state-listed threatened Yellow-crowned Night Heron (*Nyctanassa violacea*), and Black-crowned Night Heron (breeding population only) (*Nycticorax nycticorax*) were not identified by NJDEP as inhabiting the Project Area, these species were observed within the Project Area during USACE ecological sampling activities conducted in 2002. Black-crowned Night Herons forage in marshes and along the edges of ponds and creeks. Within coastal tidal marshes, black-crowned night herons will forage in shallow tide pools, tidal channels, mudflats and in the vegetated marsh. Preferred roosting habitat consists of mixed hardwood forests and scrub-shrub habitats. Hardwood species preferred by the Black-crowned Night Heron include Red maple (*Acer rubrum*), Sweetgum (*Liquidambar styraciflua*), Black gum (*Nyssa sylvatica*), and Blueberry (*Vaccinium* spp.). Herons will also roost in marshes that contain shrubs such as marsh elder (*Iva frutescens*). Yellow-crowned Night Herons roost in habitats similar to those of the Black-crowned Night Heron, including dredge spoil islands and bay islands containing forested wetlands or scrub-shrub thickets. They often nest in colonies in trees or shrubs overhanging the water. Yellow-crowned night herons forage along the shores of tidal creeks and tide pools within salt and brackish marshes dominated by *S. alterniflora*. They also wade in shallow water and mudflats in search of prey.

The ERR/EA (USACE 2006) indicates the state-listed endangered Short-eared Owl (*Asio flammeus*) is likely to occur in the Project Area. In addition, seven New Jersey Division of Fish and Wildlife species of special concern were identified as likely to be found in the Project Area, including the Fowlers Toad (*Bufo woodhousii fowlen*), American Kestrel (*Falco sparverius*), Great blue Heron (*Ardea herodias*), Least Bittern (*Ixobrychus exilis*), Least Flycatcher (*Empidonax minimus*), Sharp-shinned Hawk (*Accipiter striatus*), and Tricolored Heron (*Egretta tricolor*). In addition, the USFWS' New Jersey Field Office has designated species of concern for the breeding populations of six species that are likely to occur in the Project Area. These species include the American Woodcock (*Scolopax minor*), Blue-winged Teal, Brown Thrasher (*Toxostoma rufum*), Eastern Kingbird (*Tyrannus tyrannus*), Green-winged Teal (*Anas crecca*), and Swamp Sparrow (*Melospiza georgiana*).

In addition, Jersey City, Hudson County, New Jersey is not listed on Attachment C – Known Locations of Swamp Pink in New Jersey or Attachment D – Known Location of Bog Turtles in New Jersey pursuant to the tables located in N.J.A.C. 7:7A.

Table 11. State-listed Species Occurrence in the Project Area.

Common Name	Scientific Name	State Status
Cattle Egret	<i>Bubulcis ibis</i>	SC
Glossy Ibis	<i>Plegadis falcinellus</i>	SC/S
Little Blue Heron	<i>Egretta caerulea</i>	SC
Peregrine Falcon	<i>Falco peregrinus</i>	E
Snowy Egret	<i>Egretta thula</i>	SC/S

Source: New Jersey Natural Heritage Program, 2009

E= are those whose prospects for survival in New Jersey are in immediate danger because of a loss of or change in habitat, over-exploitation, predation, competition, disease, disturbance, or contamination. SC= Special Concern - applies to animal species that warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a Threatened species. This category would also be applied to species that meet the foregoing criteria and for which there is little understanding of their current population status in the state.

S= Stable species-a species whose population is not undergoing any long-term increase/decrease within its natural cycle.

Status for species separated by a slash (/) indicate a dual status. The first status refers to the state breeding population, and the second status refers to the migratory or winter population.

4.0 PROJECT ALTERNATIVES

This section describes the process by which NOAA, its co-Trustees, and other project partners including the NJDEP, ACOE, and the HCDPR, developed restoration alternatives for the LPWWRP area and evaluated the environmental impacts and benefits of those alternatives. Based on these analyses, the Trustees are proposing to implement Alternative 2.5, or 2.5.1 if sufficient funding is available to implement the Pond Option, as the preferred alternative to accomplish restoration at the LPWWRP site.

Three alternatives were developed including a no action alternative, wetland restoration with optional pond enhancement alternative, and wetland restoration without pond enhancement alternative. Except for the no action alternative, each restoration alternative includes options for the removal of the fill previously placed at the site, re-contouring the landscape so the optimum duration of tidal flooding could be achieved for the desired habitat, and planting native vegetation on the newly graded landscape. This Project was designed to maximize, to the greatest extent possible, the area of *S. alterniflora*-dominated salt marsh, within the limitations of the space available for restoration activities. To meet this objective, alternative restoration plans were developed to remove and control the spread of *Phragmites*, including enhancement of the adjacent pond. The pond is a source of extensive *Phragmites* growth and low resource value. Tidal elevations amenable to *Phragmites* establishment and growth were avoided as much as possible to minimize the potential for *Phragmites* invasion in the future.

The bio-benchmarks and the tidal elevations observed and analyzed at the site identified a target grading range between 0.75 to 2.5 feet NGVD29 (Figure 12). *S. alterniflora* was observed to be growing between 0.1 to 3.1 feet NGVD29. The lowest point at which *Phragmites* was observed was 2.7 feet NGVD29. The aforementioned target grading range was planned for because it offered room for the low marsh to expand, and it conservatively let the marsh adjust to the different friction conditions that the marsh could experience as the plants grow, without sacrificing acreage of low marsh. The creek layouts were adjusted so the slopes of the low marsh would provide for adequate drainage. Mudflats would exist on the banks of all the proposed and enhanced creeks at low tide. A hydrodynamic model was created and calibrated to validate the proposed alternatives, so that all proposed locations of low marsh were within the duration of flooding that currently exists for *S. alterniflora* on-site. This numerical model is explained, and its results can be found in Appendix B (USACE 2006).

The existing 1,000 foot concrete bulkhead/retaining wall located along the Hackensack River remained in all alternatives, at the request of the NJDEP, the local sponsor for the project. The retaining wall, while dilapidated, has historic and recreational value to the community. A 35 foot wide buffer is maintained aside the retaining wall at all times. No excavation will occur here in order to protect and maintain the structural integrity and stability of the wall. The sections of the site that are not protected by the retaining wall have tidal creeks and embayments that cut into the site from the Hackensack River. These features would be enhanced to convey the proper hydrodynamic exchange into the proposed intertidal wetland. Based on the hydrodynamic modeling, it was predicted that the banks of the Hackensack River adjacent to the site, and in the enhanced creeks themselves, would be mostly stable. Based on soil investigations, the substrate of an historic creek bed has the correct soil characteristics and texture to support a tidal creek once again.

The 36-inch diameter culvert that currently connects the lake to the Hackensack River is another feature that remained in place for all alternatives. Although daylighting the culvert was initially considered as an alternative, the buried culvert traverses the site under the center section of the landfill, where elevations exceed 15 feet NGVD29. There was no indication that a historical tidal

creek existed along the footprint of the buried culvert. It currently offers limited hydrologic exchange between the two bodies of water, as the culvert on the lake-side has filled up with approximately 2.5 feet of silt. It was not economically feasible or ecologically preferable to unearth the culvert. Instead, the culvert will remain active throughout the process of excavating and de-watering the fill materials and throughout the phase of de-watering of clean sand back-fill that will be delivered to the site in a sand slurry mix. The pipe will be crushed in place and retired from use after these activities.

The excavation plan for the restoration alternatives called for the minimum amount of earth movement, while achieving the following objectives:

1. Restoring/creating/enhancing the most acres of low marsh (*S. alterniflora*);
2. Maintaining public access to the site;
3. Incorporating various restoration features, including:
 - a. Maximizing tidal creek fringe and essential fish habitat;
 - b. Offering diverse habitats within close proximity (i.e., open water, low and high marsh, and upland);
4. Creating contiguous pristine ecosystems;
5. Enhancing existing ecological functions; and
6. Removing *Phragmites* rhizomes and preventing reestablishment.

The excavated material will be placed on top of the existing upland landfill. *Phragmites* rhizomes will be sifted out and removed from excavated sediment to the greatest extent possible to avoid reestablishment of *Phragmites* in the upland portions of the Project Area. All excavation and disposal locations will be capped with at least 1 foot of clean fill material to ensure that any possible remnants of the existing landfill will be away from active hydraulic, sediment, and benthic zones. The landfill will be closed according to an NJDEP Solid and Hazardous Waste Program Closure and Post-Closure Plan Approval received May 20, 2009. The specific design elements for all three alternatives are described in the following sections.

4.1 ALTERNATIVE 1

The goal of the first alternative restoration plan at Lincoln Park was to create a tidal wetland within the footprint of the existing *Phragmites* dominated fill area without extending to the adjacent 9.1 acres of open water pond. All of the options within Alternative 1 explore this avenue. Alternative 1.1 and Alternative 1.2 keep the amount of material to be excavated and removed to a minimum, while utilizing all of the access paths that exist throughout the site. The areas that were lower than elevation 10 feet NGVD29 were identified using the existing topographic mapping. From those areas, the locations closest to the existing tidal connection south of the retaining wall comprised the low marsh area, with the exception of the dirt roads and paths that currently traverse the site. Culverts were needed for this alternative to hydraulically connect the proposed salt marsh restoration areas under the existing roads and paths.

4.1.1 Alternative 1.1.

An upland island was planned in the central/west section of the Project Area. Large deciduous trees currently exist on this upland area, which has existing elevations greater than 15 feet NGVD29, and lower elevations surrounding it. Similar forested habitats exist in the southern and northern sections of the site, but their proximity to the site's boundary made them better suited as upland peninsulas that protrude into the proposed wetland to offer varied habitat (See Figure 13).

The creeks were laid out to hydraulically connect the low marsh within the zone with elevations 10 feet NGVD29 or lower. Existing depressions in the topography were tied into the creek for the purpose of minimizing excavation costs. These depressions currently collect and hold stagnant water, creating prime breeding grounds for mosquitoes. They do not offer high ecological value in their current condition. Some creeks were placed strategically to create a hydraulic buffer between the low/high marsh and upland habitat, to minimize *Phragmites* invasion from the upland to the low and high marshes. The lake and the retaining wall would remain unchanged from its existing condition.

Channels were designed to tidally connect all the low and high marsh areas. The main tidal channel that connects the site to the Hackensack River would be 70 feet wide at the inlet and 2 feet deep at MLW (-2 feet NGVD29). The channel side slopes at this inlet would be stabilized using filter fabric with *S. alterniflora* plugs planted through it. All of the proposed tidal creeks would have 1:3 side slopes. This main creek would narrow to a 10 foot wide creek in less than 300 feet. The primary tidal creek, which extends east from the inlet opening, maintains a depth of -2 feet NGVD29. All other creeks have a depth of -1 foot NGVD29, with 1:3 side slopes.

For Alternative 1.1, 11.5 acres of low marsh and 6.3 acres of high marsh would be created. At low tide, 1.9 acres of tidal channels and 2.9 acres of mudflat would be present. A total of 22.6 acres would be restored. The excavated material would be placed in the northern section of the site, in a mound approximately 8 feet high, over 14.9 acres of the existing landfill. The entire site (i.e., 22.6-acre restored wetland area and 14.9-acre disposal area) would have 1 foot of clean fill placed over it. The newly created marsh would be planted with a mix of *S. alterniflora*, *S. patens* and other native tidal marsh species. The transition from marsh to existing grade would be planted with salt-tolerant herbaceous plants and salt-tolerant shrubs (e.g., *Iva frutescens*). Alternative 1.1 would generate 200,000 cubic yards (cy) of excavated material and would require placement of 60,000 cy of clean fill.

There were several issues of concern associated with Alternative 1.1. By leaving in the existing paths, the amount of marsh available for marsh creation diminishes significantly. Also, the presence of the paths creates a potential opportunity for disturbance by the public, such as illegal dumping or filling. In addition, the dirt roads and paths lie at between 5 and 8 feet NGVD29, a prime elevation for *Phragmites* to re-invade if the site is not properly managed. The marsh would wrap around the path, but the slopes from the marsh up to the roads/paths would be vulnerable to *Phragmites* invasion.

4.1.2 Alternative 1.2

Alternative 1.2 would have the same exterior boundary as Alternative 1.1. However this plan includes removal of the southern dirt road/path that separates the areas targeted for restoration in Alternative 1.1 (see Figure 14). Alternative 1.2 also had the same goals of keeping the amount of excavated material to a minimum by starting with areas lower than 10 feet NGVD29. Culverts under the dirt road/path would not be needed and the lake would remain unchanged in this alternative. The upland island and upland forested peninsulas described in Alternative 1.1 would also be included in Alternative 1.2.

Alternative 1.2 would convert additional areas from the dirt road/path and upland/*Phragmites* habitat to low marsh. This would increase the low marsh acreage by over 4 acres compared to Alternative 1.1. Without the dirt road/path the creek layout would not have the restrictions of culverts. Thus, creek layout was modified to incorporate more of the stagnant depressional pools in the northwest section of the site, although the overall length of the creeks remained the same.

This plan offers a more contiguous marsh plain and eliminates the need for culverts to hydraulically connect all proposed low marsh areas to the hydrology source. By removing the southern road/path that traversed the low marsh, *Phragmites* invasion would be curtailed and it would allow for the center of the marsh to be less disturbed by the public. A road/path exists at the northern boundary of the site. This northern road/path could be elevated using the excavated material, to offer a broader vista of the entire site. The northern road/path could be designed and maintained to prohibit *Phragmites* growth (i.e., mowing and treatments). Thus, the road/path could serve as the northern *Phragmites* barrier for the entire proposed low and high marsh.

The morphology and stabilization methods proposed for tidal channels in Alternative 1.1 are the same for Alternative 1.2.

For Alternative 1.2, 15.8 acres of low marsh and 7.0 acres of high marsh would be created. At low tide, 1.9 acres of tidal channels and 2.9 acres of mudflat would be present. A total of 27.6 acres would maximally be restored. The excavated material would be placed in the northern section of the site in a mound approximately 8 feet high, over 18.3 acres of the existing landfill. The entire site would have 1 foot of clean fill placed over it. The newly created marsh would be vegetated in the same manner described for Alternative 1.1. Alternative 1.2 would generate 236,000 cy of excavated material and would require placement of 74,000 cy of clean fill.

Although this alternative meets the design goals better than Alternative 1.2, it still does not maximize the area of intertidal salt marsh to its full potential.

4.2 ALTERNATIVE 2

The second alternative expands upon Alternative 1. The new feature in Alternative 2 is an open water connection, with or without optional lake enhancements, between the lake and the site's primary source of hydrology, the Hackensack River. By increasing the tidal range and prism of the lake, more flushing will occur in the lake. Currently, the tidal fluctuation of the lake is 0.5 foot, compared to the Hackensack River, which has a tidal range of over 5 feet. Also, by increasing the salinity of the lake, the perimeter of the lake will support an ecosystem more suitable for *S. alterniflora* species and less suitable for *Phragmites*, the current perimeter species.

4.2.1 Alternative 2.1

Alternative 2.1 features a change in the pond/wetland ecosystem that would be expected to occur without the need to regrade the perimeter of the lake. Construction activities around the lake would focus only on clearing/grubbing of the *Phragmites* and planting of *S. alterniflora*. With an increase in tidal range of 1.5 to 2 feet, intertidal marsh would be expected to occupy a band approximately 15-foot wide band around the perimeter of the lake (see Figure 15).

Alternative 2.1 would extend the tidal creek system east to connect to the lake and convert the surrounding upland/*Phragmites* habitat to low marsh. The morphology and stabilization methods of the tidal channels proposed in Alternative 1 would remain unchanged.

For Alternative 2.1, 17.9 acres of low marsh and 7.1 acres of high marsh would be created. At low tide, 2.0 acres of tidal channels and 3.1 acres of mudflat would be present. A total of 30.0 acres would be restored. The excavated material would be placed in the northern section of the site in a mound approximately 8 feet high, over 19.0 acres of the existing landfill. The entire site would have 1 foot of clean fill placed over it. The newly created marsh would be vegetated in the same manner

described previously. Alternative 2.1 would generate 244,000 cy of excavated material, and would require placement of 79,000 cy of clean fill.

A primary concern with Alternative 2.1 is the high volume (and associated high cost) of material to be excavated, to implement the alternative.

4.2.2 Alternative 2.2

Alternative 2.2 attempts to optimize the ecological benefits gained for each dollar invested. The added benefit of increasing the hydrodynamic flushing of the lake would greatly enhance the lake and the park ecosystems. The addition of the lake into the tidal hydrodynamic scheme of the Project could also be done at a minimal cost per ecological benefit. Alternative 2.2 begins with all the features of Alternative 2.1, but reduces the area of low marsh by 4 acres in the northwest and northeast sections of the site. The 4.0 acres that were eliminated from consideration were the farthest from the existing tidal connection and were areas of higher existing elevation, thus resulting in higher proposed cut volumes, upland disposal volumes, and clean fill volumes. The proposed tidal creek was modified and would provide increased flooding to the proposed low marsh areas (see Figure 16).

The morphology and stabilization methods of the tidal channels proposed in Alternative 1.1, 1.2 and 2.1 would remain unchanged.

For Alternative 2.2, 16.9 acres of low marsh and 5.9 acres of high marsh would be created. At low tide, 1.3 acres of tidal channels and 1.8 acres of mudflat would be present. A total of 25.9 acres would be restored. The excavated material would be placed in the northern section of the site in an approximately 8 foot high mound, over 16.0 acres of the existing landfill. The entire site would have 1 foot of clean fill placed over it. The newly created marsh would be vegetated in the same manner described previously. Alternative 2.2 would generate 206,000 cy of excavated material and would require placement of 67,000 cy of clean fill.

One concern with Alternative 2.2 is that leaving intact an upland peninsula in the northern central section of the proposed restoration area may provide an opportunity for re-invasion by *Phragmites*. The elevations in this area are appropriate for *Phragmites* establishment and growth.

4.2.3 Alternative 2.3

The design goal of achieving a contiguous marsh was enhanced in Alternative 2.3 (see Figure 17). The upland peninsula in the northern central section of the proposed restoration area was not included in the previous layouts because the existing elevations exceed 10 feet NGVD29. Thus, to convert this area to a low marsh community would involve more excavation than converting some of the other areas. Despite the added expense of including this area in the low marsh design, the high marsh fringe is the most vulnerable to *Phragmites* invasion, and exclusion of this area from restoration greatly increases the boundary of the high marsh to existing grade. Transforming this area into low marsh would create a more contiguous tidal ecosystem.

The morphology and stabilization methods of the tidal channels proposed in the previous alternatives would remain unchanged.

For Alternative 2.3, 17.5 acres of low marsh and 5.5 acres of high marsh would be created. At low tide, 1.3 acres of tidal channels and 1.8 acres of mudflat would be present. A total of 26.2 acres would be restored. The excavated material would be placed in the northern section of the site, in a mound approximately 8 feet high, over 16.4 acres of the existing landfill. The entire site would have

1 foot of clean fill placed over it. The newly created marsh would be vegetated in the same manner described previously. Alternative 2.3 would generate 212,000 cy of excavated material and would require placement of 69,000 cy of clean fill.

Alternative 2.3 would accomplish the purpose and need of the Project, however, one of its cost savings measures (a 1.0 ft depth of clean cap) was found to be less protective by the Trustees and by State regulatory authorities. Additionally, Alternative 2.3 would provide 26.2 total acres of wetland restoration, whereas Alternative 2.5 would provide 39.9 total acres of restored wetlands and make better use of the available budget to maximize the restoration potential of the site.

4.2.4 Alternative 2.4

Alternative 2.4 is a modification of Alternative 2.1, with the upland peninsula in the northern central section of the proposed restoration area converted to low marsh (see Figure 18). Thus, Alternative 2.4 includes many of the previous features proposed. To summarize, the areas lower than 10 feet NGVD29 and the southern dirt/path would be removed and regraded to low marsh elevations. Just as all of the options in Alternative 2, the lake would be connected to the Hackensack River. Also, Alternative 2.4 would not truncate the areas furthest from the Hackensack River.

The morphology and stabilization methods of the tidal channels proposed in the previous alternatives would remain unchanged.

For Alternative 2.4, 18.5 acres of low marsh and 6.8 acres of high marsh would be created. At low tide, 2.0 acres of tidal channels and 3.1 acres of mudflat would be present. A total of 30.3 acres would be restored. The excavated material would be placed in the northern section of the site, in a mound approximately 8 feet high, over 19.4 acres of the existing landfill. The entire site would have 1 foot of clean fill placed on it. The newly created marsh would be vegetated in the same manner described previously. Alternative 2.4 would generate 250,000 cy of excavated material and would require placement of 80,000 cy of clean fill.

Alternative 2.4 would also accomplish the purpose and need of the Project, however, one of its cost savings measures (a 1.0 ft depth of clean cap) was found to be less protective by the Trustees and by State regulatory authorities. Additionally, Alternative 2.3 would provide 30.3 total acres of wetland restoration compared to 39.9 total acres provided by Alternative 2.5, based on the available budget if used to maximize the restoration potential of the site.

4.2.5 Alternative 2.5 (Preferred Alternative)

Alternative 2.5 maximizes the creation of low marsh, minimizes excavation, and also proposes the creation and enhancement of additional upland and wetland community types within the Project Area. Alternative 2.5 would connect the lake with the tidal channel system (see Figure 19) and would provide a continuous low marsh/tidal creek complex stretching over 1,200 feet from the Hackensack River to the lake. This modification would reduce the potential for re-invasion by *Phragmites* from the upland areas. Wetland and upland scrub-shrub communities would be planted to provide vertical heterogeneity. The establishment of native woody stem vegetation would promote plant and wildlife species diversity. The morphology of the tidal channels proposed in the previous alternatives would remain unchanged. The use of rip-rap in the vicinity of a weir structures and bridge will be evaluated as a means of provided channel stabilization.

A footpath would be constructed on uplands along the northern portion of the Project Area, along the western edge of the lake on uplands crossing the primary tidal channel on a footbridge, and along the

southern edge of the marsh complex. The addition of a walkway/nature path through the Project Area would continue to be coordinated with Hudson County and would complement plans for other trails and environmental/visitor centers in the area, as well as the Hackensack River Walk.

Alternative 2.5 would result in approximately 34.4 acres of wetland and open water habitats, including 19.9 acres of low marsh, 1.4 acres of high marsh, 12.4 acres of tidal channels and mudflat, and 0.7 acre of scrub-shrub wetlands. The lake would not be physically altered by construction, but an additional hydrologic connection to the Hackensack River would be created. Herbaceous and scrub-shrub uplands would cover 3.2 acres, while walkways and the footbridge would account for 0.6 acres. A total of 39.9 acres would be included in the restoration Project. Wherever waste is over-excavated within the Project Area, clean fill material will be required to establish the required elevations. The newly created marsh plain would be vegetated in the same manner described previously.

The excavation of the Project Area will involve the removal of approximately 269,000 cy of material from the wetland restoration area and placing the material atop the existing landfill. Areas within the wetland restoration area containing waste will be over-excavated by two feet and then filled with clean material requiring the placement of approximately 250,000 cy of clean fill for the entire project (approximately 100,000 cy for the wetland restoration area and approximately 150,000 cy for the landfill closure project).

The clean fill that would be placed over the site would be beneficially re-used sand dredged from the upcoming USACE/Port Authority of NY and NJ dredging of the Anchorage Channel. Although the landfill closure and golf course development projects would use sand from the same source and would complement the LPWWRP, these actions are not part of the federal actions being considered in this Final RP/EA. A total of about 250,000 cubic yards of sand would be needed for all 3 projects. A temporary Sand Containment and Dewatering Facility (CDF) would be placed in an upland area east of the lake to receive and dewater clean sand fill. Sand would be shipped to the site by barge, hydraulically pumped to the CDF, and dewatered prior to placement over the salt marsh areas.

4.2.5.1 Alternative 2.5.1, Implementing the Pond Option (Preferred Alternative, if sufficient funding is available)

Alternative 2.5.1 would deliver exactly the same configuration of services and acreages as Alternative 2.5 but with the addition of enhancing the services provided by the connected pond (see Figure 20). This alternative, known as the Pond Option, would not only connect the lake with the tidal channel system, it would provide a re-graded and deepened pond with a continuous wetland edge planting constructed on a re-contoured shoreline bench. This modification would create the greatest reduction in the potential for re-invasion by *Phragmites* from all upland areas and the pond edge.

Alternative 2.5.1 would result in approximately the same acres benefits as described in Alternative 2.5 with the addition of a 9.1 acre enhancement of the pond condition. The lake would be physically altered by construction, and would enhance the habitat value of the pond and the 1,200 foot long length of the hydrologic connection to the Hackensack River that was created leading to it. A total of 39.9 acres would be included in the restoration Project. The lake would be over excavated by two feet depth and backfilled with clean sand materials. The pond edge would have a bench of sand backfill set at an elevation within 0.0' to 1.0' to provide a suitable planting zone for intertidal emergent grasses. The newly created marsh bench within the pond would be vegetated in the same manner as the wetland described in Alternative 2.5.

The excavation of the Project Area will involve the removal of approximately 326,000 cy of material from the wetland restoration area and placing the material atop the existing landfill (269,000 from the wetland and 56,500 approximately from the pond). Areas within the wetland restoration and the pond area containing waste will be over-excavated by two feet and then filled with clean material requiring the placement of approximately 280,000 cy of clean fill for the entire project (approximately 130,000 cy for the wetland restoration area and approximately 150,000 cy for the landfill closure project).

The clean fill that would be placed over the site would be beneficially reused sand dredged from the upcoming USACE/Port Authority of NY and NJ dredging of the Anchorage Channel as per Alternative 2.5. The temporary Sand Containment and Dewatering Facility (CDF), described in Alternative 2.5 would handle the processing of the additional 30,000 cubic yards of clean material needed for backfilling of the pond.

Table 12 below presents a summary of the Proposed Habitat Types within the Project Area that will result through implementation of Alternative 2.5 and/or the 2.5.1 Option. NOAA and its project partners have identified either Alternative 2.5 or 2.5.1 as a preferred alternative, with plans to implement 2.5.1 if there are sufficient funds.

Table 12. Proposed Habitat Types for the Project Area

Proposed Habitat Type	Area (Ac.)
Estuarine Wetlands	
Open Water/Mudflat (TOW/MF)	12.38
Emergent - High Marsh (EEM)	1.35
Emergent - Low Marsh (EEM)	19.92
Scrub-Shrub (ESS)	0.70
Total	34.35
Uplands	
Herbaceous (UH)	0.59
Scrub-Shrub (USS)	1.32
Forest (UF)	1.32
Total	3.23
Walkways and Bridge	0.56
Undisturbed	1.75
Total	39.89
Open Water	
Open Water/Pond with wetland bench (Alternative 2.5.1)	9.1

4.3 ALTERNATIVE 3

The third alternative is a no-action alternative. This would leave the Lincoln Park West Wetland Restoration Project site in the current state – at least temporarily. The site could exist temporarily in its current condition until Hudson County completes the landfill closure and capping that the state of NJ is requiring. Until that time, existing Phragmites grasslands would remain in place and either expand or contract depending on competition from other vegetation entities. Existing upland

shrub/scrub and woodland areas would likely expand or contract dependent on yearly fluctuations of weather conditions, rainfall, and presence of pests and disease. The site in its current condition would continue to provide limited services to marine finfish and shellfish. In the short term, Alternative 3 would necessitate the need for a redesign of the landfill closure plan.

Table 13. Summary of Restoration Alternatives

	No Action	Alt.1.1	Alt.1.2	Alt. 2.1	Alt. 2.2	Alt. 2.3	Alt. 2.4	Alt. 2.5	Alt 2.5.1
Acres of Channel	0	1.89	1.89	1.99	1.32	1.32	1.99	3.9	3.9
Acres of Mudflat	0	2.88	2.88	3.06	1.84	1.84	3.06		
Acres of Intertidal	0	11.48	15.82	17.86	16.86	17.52	18.52	19.2	19.2
Acres Supratidal	0	6.31	6.97	7.12	5.85	5.49	6.76	2.2	2.2
Open water Pond	0	0	0	0	0	0	0	0	9.1
Total Acres Restored	0	22.56	27.57	30.04	25.88	26.17	30.33	39.9	50.0
CY excavated	0	200,000	236,000	244,000	206,000	212,000	250,000	269,000	326,000
CY clean fill	0	60,000	74,000	79,000	67,000	69,000	80,000	100,000	130,000

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 PROPOSED ACTION

This section presents the environmental impacts of the proposed Project on physical, ecological, cultural, aesthetic, socioeconomic, and recreational conditions of the Project Area. Alternative 2.5 or Alternative 2.5.1 (Pond Option), is identified as the preferred alternative because it most effectively meets the stated goals of the project, namely: to compensate the public for injuries to natural resources caused by the Exxon Bayway and B.T. Nautilus oil spills by: restoring the historic tidal hydrologic connection between the restoration site and Hackensack River; increasing the percent cover of *Spartina alterniflora*; improving the aesthetic viewshed associated with the site; enhancing fisheries and wildlife breeding, nursery, forage and refuge habitat; and, providing a cost effective means to accomplish the restoration of marsh acreage and functionality. Alternatives 2.5 or 2.5.1 also meets the goals of the NOAA Restoration Center's ARRA Competitive Grant Program.

5.1.1 GEOMORPHOLOGY AND SOILS

Implementation of the preferred alternative would result in significant changes to existing topography. However, these changes are expected to be beneficial. The existing topography would be modified throughout the majority of the site according to the preferred restoration plan, and the project would involve: excavation of accumulated waste associated with the adjacent landfill, historic fill material, and *Phragmites*-dominated areas; creation of intertidal and supratidal areas, including the creation of tidal creeks to supply an additional tidal hydrology source; and, deposition of excavated spoil material on the landfill. The design for the preferred restoration plan includes restoring 19.2 acres of low marsh and 1.3 acres of high marsh. Tidal channels and mudflat would cover 3.9 acres, and scrub-shrub wetlands would cover 0.9 acres. The lake would not be physically altered by construction, but an additional hydrologic connection to the Hackensack River would be created. Herbaceous and scrub-shrub uplands would cover 2.8 acres, while walkways and the footbridge would account for 0.7 acres. A total of 39.2 acres of habitat would be restored.

Activities proposed for the intertidal zone include connecting the Hackensack River and the existing man-made lake via a primary tidal creek and creating additional secondary tidal creeks to increase the hydrology supply across the site. The majority of the restoration area is currently at an elevation of 10 feet NGVD29 or lower. Material from this area would be excavated and deposited atop the adjacent landfill as part of the landfill closure process and according to the following specifications:

- Primary tidal creeks would range from 70 ft wide at the mouth to 10 ft wide, at a depth of -2 ft NGVD29, grading up to 0.75 ft NGVD29 on a 1:3 slope. Secondary tidal creeks would be approximately 10 ft wide, at a depth of -1 foot NGVD29, grading up to 0.75 ft NGVD29 on a 1:3 slope.
- Mudflat areas are the portions of the channels that, at low tide, extend from mean low water (-1.89 ft NGVD29) to the edge of the intertidal community (0.75 ft NGVD29).
- Intertidal zone slopes would vary depending on the distance between tidal creeks/mudflat (0.75 ft NGVD29) and the upper limit of the intertidal community (2.5 ft NGVD29).
- The supratidal zone would extend from the intertidal zone to the upper limit of the restoration area, on a 1:3 slope.
- Excavated spoil material would be deposited in specified upland areas within the Project Area to a depth of approximately 8 ft above the existing elevation.

The entire restoration area would be excavated approximately 2 feet below the desired depth and clean fill material would be placed over the existing soil. In addition, the upland disposal area would

receive a cap of clean sand fill. The clean sand fill would be beneficially reused sand dredged from the USACE/Port Authority of NY and NJ dredging of the Anchorage Channel. This clean fill material has been approved by USACE and NJDEP for use as cap material for this Project.

No significant or long-term impacts would occur to geology within the Project Area.

5.1.2 LAND USE AND ZONING

Implementation of the preferred alternative would result in a change of land cover types from *Phragmites*-dominated land, upland herbaceous, and forest/scrub-shrub to a predominantly a saline marsh ecosystem with minor components of upland herbaceous and scrub-shrub habitats. Land uses in the Project Area are primarily recreational and open space uses and the increased area of salt marsh would provide additional recreational opportunities and open land. Accordingly, no negative impacts to land use are anticipated as a result of the construction of the preferred alternative.

The entire Project Area is located in a Parks-Open Space zone as defined by the Jersey City zoning regulations. Construction of the preferred alternative would be consistent with the current city zoning regulations and policies. Accordingly, no significant impacts to zoning would result from construction of the preferred alternative.

5.1.3 WATER RESOURCES

The following sections present Project impacts associated with regional hydrogeology and groundwater resources, surface water, and tidal influences.

5.1.3.1 Regional Hydrogeology and Groundwater Resources

The excavation and regrading of the Project Area and off-site disposal of excavated materials for the proposed Project would change the existing grades. However, the preferred alternative is not expected to have significant negative impacts on the regional hydrology and groundwater resources.

5.1.3.2 Surface Water

The proposed Project is expected to result in temporary increases in turbidity during construction. Excavation of the waste material to create tidal creeks and excavation of the marsh plain also may cause a temporary degradation of water quality in the Hackensack River and areas within the Project Area during construction. However, best management practices would be used to minimize and/or prevent sediments from entering the Hackensack River, including installation of a temporary water exclusion berm at the main inlet and floating turbidity barrier just offshore, as well as other erosion and sedimentation controls, to protect the Hackensack River to the maximum extent possible during construction. Therefore, turbidity caused by construction activities should be minimal and re-suspended sediments are likely to quickly settle out of the water column or be dissipated by the tidal fluctuations of the Hackensack River. Accordingly, turbidity and sedimentation would have minimal impact to the overall surface water quality of the Project Area and the Hackensack River. A Clean Water Act Section 404(b)(1) Guidelines Evaluation was completed for the ERR/EA (USACE 2006). Soil Erosion and Sediment Control Plan authorization from the Hudson, Essex, and Passaic Counties Soil Conservation District will be acquired prior to any construction activities.

5.1.3.3 Tidal Influences

The proposed Project would significantly alter the tidal influence of the Project Area. The intent of the excavation is to extend the existing tidal creeks (both primary and secondary channels), lower the marsh plain elevation, and provide better overall tidal inundation and circulation within the Project Area. The alteration of on-site tidal influences is vital to providing the necessary hydrology for salt marsh habitat restoration and is not expected to cause significant offsite impacts. Additional information on tidal influences and the hydrodynamic model are included in the ERR/EA (USACE 2006).

5.1.4 VEGETATION

This section describes impacts to wetland and upland vegetation resources. Implementation of the preferred alternative would result in conversion of a relatively degraded wetland complex and associated uplands to valuable and vital salt marsh wetland habitat. Accordingly, there would be positive impacts on vegetation as a result of implementation of the preferred alternative.

5.1.4.1 Wetlands

Implementation of the preferred alternative would have a long-term beneficial impact on wetlands. Currently, only small patches of remnant salt marsh exist within the Project Area. Creation of additional high value salt marsh as the result of conversion of low value *Phragmites*-dominated habitat would restore a significant extent of salt marsh was historically present on the site. This conversion would also have a positive effect on the existing diversity of wildlife habitat on site.

Although the USEPA considers all estuarine wetlands in the Project Area as priority wetlands, salt marsh is designated as priority habitat in New Jersey (USEPA 1994), and is therefore a desirable unique feature in the landscape that is ecologically and environmentally more valuable than the existing *Phragmites*-dominated wetlands. Specifically, *Phragmites*, forest/scrub-shrub, and upland herbaceous habitats would be permanently converted to salt marsh, resulting in a net increase of 16.5 acres of salt marsh habitat in the Project Area.

Impacts to wetland vegetation include removal of vegetation during construction activities. Existing mature trees and shrubs will be left intact to the greatest extent possible during construction. However, in the interest of removing waste material from within the Project Area, it is unlikely that significant numbers of trees will be preserved. Additionally, once construction is completed, the wetland vegetation would be restored by planting with native salt marsh species. Woody species will be planted as well in the appropriate habitat types to increase vertical heterogeneity within the Project Area.

Temporary impacts to approximately 2,000 square feet of wetlands and 3,200 square feet of transition area adjacent to the Hackensack River and north of the Project Area are anticipated from construction of the temporary above-ground dredge conveyance pipeline associated with the CDF facility. This pipeline is needed to bring clean sand fill to the site from a barge in the Hackensack River, and would be in place for up to ten weeks. Temporary impacts would be restored, as appropriate, following completion of the CDF operation. The CDF Operation would be authorized and permitted by the NJDEP Waterfront Development Permit (see section 6 for list of applicable permits and authorizations).

5.1.4.2 Uplands

Implementation of the preferred alternative will result in the permanent conversion of approximately 10 acres of upland vegetation to wetland vegetation. Specifically, 5.3 acres of upland *Phragmites*-

dominated habitat, 4.1 acres of upland herbaceous, and 3.4 forest scrub-shrub would be disturbed and converted. The preferred alternative includes the establishment of approximately 2.3 acres of upland scrub-shrub habitat interspersed amongst the tidal creeks and salt marsh. Since salt marsh is considered a priority habitat in New Jersey and is considered to be of higher value than the existing upland habitats, the Project Team decided that conversion to salt marsh is acceptable.

However, HCDPR has expressed interest in saving and transplanting as many of the shrubs and trees from the forest/scrub-shrub areas as feasible to preserve some of the character and nature of the Project Area, and provide newly created upland areas a head start on achieving stable and diverse habitat restoration goals (Jennings 2002). This approach may be feasible. However, excavation of waste material is a Project priority and may compromise the salvage of on-site woody species. Also, *Phragmites* is seen as an aggressive wetland transitional species that tends to form expansive monocultures and is undesirable. Therefore, excavation of expansive networks of *Phragmites* rhizomes is also a Project priority and may also compromise salvage of on-site woody species. Therefore, a loss of upland vegetation is anticipated due to construction of the preferred alternative. However, this impact would be offset by the net increase in priority wetland habitat.

5.1.5 FISH AND WILDLIFE

This section identifies the impacts to fish and wildlife due to the proposed Project, including shellfish, finfish, benthic resources, reptiles and amphibians, birds, and mammals. In addition, a *Final Fish and Wildlife Coordination Act Section 2(b) Report* has been prepared by the USFWS (2004).

5.1.5.1 Shellfish

The proposed Project would have a temporary impact on existing shellfish during construction. Excavation of the tidal creeks and marsh surface would dislodge and eradicate the existing shellfish (e.g., ribbed mussels), and would have a detrimental impact on specific individuals. However, shellfish species are expected to recolonize the Project Area immediately following construction with recruitment from nearby, unaffected portions of the Hackensack River adjacent to the Project Area (Hettler 1989, LaSalle et al. 1991).

An increase in turbidity and sedimentation are expected from construction activities and may affect the ability of nearby filter feeding shellfish to feed. However, best management practices, including erosion and sedimentation controls, would be used to minimize and/or prevent sediments from entering the Hackensack River, in order to protect the Hackensack River to the maximum extent possible during construction. The increased turbidity and sedimentation from construction activities are expected to quickly settle out of the water column. Any fine re-suspended sediment (silt and clay) that does not settle would be dispersed with the tidal fluctuation from the Hackensack River and would have minimal impact on existing and nearby nekton species.

The proposed Project would have an overall beneficial result on the existing shellfish species. The excavation of the primary and secondary tidal creeks and excavation of the marsh surface would restore tidal hydrology to the Project Area, promote tidal inundation, and improve the quality and quantity of suitable mudflat substrate. Additionally, the creation of salt marsh and additional deeper/wider tidal creeks would provide expanded habitat with substantial feeding opportunities and reduced predation risk, and encourage recruitment and establishment of shellfish and nekton species in the tidal creeks and marsh surface (Hettler 1989). In general, results from spring, summer, and fall nekton sampling events support the proposed Project. Shellfish sampling data indicated either higher or no difference in use of *S. alterniflora* habitat versus *Phragmites* habitat in the Project Area (USACE 2002d).

Some burrowing crab species (mud crab) and shrimp species (grass shrimp) may be removed during excavation activities. The overall impact to these mobile shellfish species would be minimal due to their ability to relocate to deeper waters of the Hackensack River to seek food and shelter during construction activities. Following construction activities, individuals can return to the Project Area and colonize the tidal channels and marsh plain.

5.1.5.2 Finfish and Essential Fish Habitat

Similar to the shellfish species, the proposed Project would have a temporary impact on finfish during construction. The increase in turbidity and sedimentation from dredging and excavation could potentially lead to gill abrasions and may suffocate individual fish in the Project Area, as well as hinder predation efficiency of sight feeding fish at or adjacent to the Project Area. However, best management practices, including erosion and sedimentation controls, would be used to minimize and/or prevent sediments from entering the Hackensack River, in order to protect the Hackensack River to the maximum extent possible during construction. Therefore, turbidity and sedimentation caused by the construction activities should be minimal and are likely to quickly settle out of the water column. In addition, fish are generally mobile, would be able to avoid direct impacts from construction activities, and seek the deeper water of the Hackensack River for shelter. Accordingly, risks from suffocation and gill abrasions are expected to be minimal.

The removal of benthic macroinvertebrates and dispersion of nekton species would temporarily impact food sources for finfish in the Project Area during construction. However, the existing fish species are expected to relocate and feed in the unaffected portion of the Hackensack River. In addition, benthic macroinvertebrates and nekton species are expected to recolonize the Project Area immediately following construction with recruitment from nearby, unaffected portions of the Hackensack River (Hettler 1989, LaSalle et al. 1991). Therefore, impacts to finfish due to loss of food availability are expected to be minimal.

Construction of the proposed Project would also result in beneficial impacts for some finfish species. *Phragmites* is documented to degrade marsh function, reduce tidal exchange, and restrict the free movement of aquatic life (Weinstein and Balletto 1999). Excavation and replanting of the marsh plain, and widening and extending the tidal creeks would replace the dense monospecific stands of *Phragmites* with *Spartina* species and other beneficial marsh species and promote tidal inundation of the marsh plain. Weinstein and Balletto (1999) found marshes dissected by numerous tidal creeks were used more by fish than marsh habitat with low drainage densities. In addition, fish were observed to be concentrated near the interface between the salt marsh and open water, with individuals leaving the marsh on ebb tide having fuller stomachs than individuals captured in adjacent tidal creeks.

Additionally, the results from spring, summer, and fall nekton sampling events generally support the proposed Project. Finfish sampling data indicated higher use of *S. alterniflora* habitat versus *Phragmites* habitat in the Project Area during spring and fall sampling. However, use of *S. alterniflora* habitat was lower than use of *Phragmites* during the summer sampling event (USACE 2002d). This may be attributed to the fact that the majority of the catch during the summer sampling event was killifish. Killifish exhibit no preference between *S. alterniflora* and *Phragmites* communities, but prefer areas with loose, muddy substrate into which they can burrow.

The Hackensack River provides a migratory pathway for anadromous fish such as alewife and blueback herring as they travel to spawning grounds in upstream portions of the river. Increased turbidity and degraded water quality resulting from construction activities may impede the migration

of these species to their spawning areas. To minimize impacts to anadromous fish, the proposed Project would adhere to the construction window imposed by NMFS, namely that no work be performed within the Hackensack River between March 1st and June 30th.

EFH has been designated near the Project Area. Winter flounder, and EFH-designated species may use the Hackensack River adjacent to the Project Area for spawning. Other EFH-designated species and their prey may also be present. To protect winter flounder EFH, NMFS recommends that work within the Hackensack River be avoided from January 1st to May 31st. Provided Best Management Practices are used to isolate the Project Area from the Hackensack River and minimize the release of sediments to the river during construction, work within the Project Area does not require a timing restriction.

The increase in salt marsh acreage and the creation of tidal channels would physically allow more fish movement in and out of the salt marsh and lake. The increased volume of water and improved water quality in the restored salt marsh would increase the availability and quality of habitat for all trophic levels of aquatic organisms. In particular, these improvements would benefit forage fish for EFH-designated species, as many of these forage fish spend most or all of their life in salt marshes. Larger numbers of small, resident forage fish in the salt marsh would provide an increased food source for larger predatory EFH-designated species that would also be able to move more easily into and out of the salt marsh due to the presence of primary and secondary tidal channels and removal of tidal restrictions. Improved water and sediment quality will result in more expansive benthic habitat required for demersal fish species, including EFH-designated species.

Construction activities may result in short-term increases in erosion and delivery of sediment to nearby wetlands and waters. Most EFH-designated species likely to occur in the Hackensack River are typically found in the often turbid conditions of estuaries and can avoid temporary increases in suspended sediments. Impacts will be mitigated by measures including isolating the construction area from the Hackensack River, performing in-water work during low tide, working in dry conditions within a temporary water exclusion berm and floating turbidity barrier to minimize migration of turbidity offsite, and re-stabilizing soils with plant material and seeding following earthwork completion. Additionally, best management practices for soil erosion and sediment control will be implemented and maintained to minimize sediment entering waterways. For these reasons, no long-term adverse impacts to EFH or EFH-designated species or their prey are expected from the proposed Project.

5.1.5.3 Benthic Resources

Excavation of intertidal and subtidal areas will result in the direct loss of benthic species and habitat in the Project Area during and immediately following construction. Benthic communities in areas temporarily isolated from tidal flow would also be lost. Additionally, excavation has the potential to result in erosion and delivery of sediment to the Hackensack River and adjacent wetlands, with associated impacts to the benthic community. Epibenthic organisms such as shrimp and crabs are mobile and can avoid areas of increased suspended sediment. However, most adult benthic infauna have limited mobility and sediment deposition may result in burial or impaired feeding.

Potential impacts to the benthic and epibenthic communities of the adjacent Hackensack River and other wetlands would be minimized and avoided by employing and maintaining best management practices for soil erosion and sediment control. Impacts to benthic macroinvertebrates would be temporary, as recolonization would commence immediately following construction. Recruitment of benthic and epibenthic organisms would come from nearby, unaffected areas of the Hackensack River (Hettler 1989, LaSalle et al. 1991). LaSalle et al. (1991) found that the species composition and

relative abundances of benthic macroinvertebrates in a newly developed salt marsh are similar to those reported from natural marshes, with a trend toward greater density and more well-established populations for some species, with age of the constructed marsh complex. For these reasons, no long-term adverse impacts to benthic resources are expected from the proposed Project.

5.1.5.4 Reptiles and Amphibians

Based on the results of on-site surveys in 2001, little suitable habitat for reptiles and amphibians currently exists within the Project Area (USACE 2002f). In addition, those species found or expected on-site are fairly mobile and could relocate during construction activities. Accordingly, although some individuals may be lost during construction, the loss is expected to be minor. Therefore, no significant impacts to reptiles and amphibians are anticipated.

The creation of salt marsh within the Project Area would potentially benefit a number of reptiles that inhabit Hudson County. The increased area of salt marsh may provide suitable nesting and foraging habitat for diamondback terrapins, which are known to inhabit the Hackensack River and its associated salt marshes (USACE 2002f). Additionally, common snapping turtles also utilize salt marsh habitat for foraging, and although not observed during the 2001 reptile and amphibian surveys, mud turtles (*Kinosternon subrubrum*) can tolerate brackish water and may potentially utilize the restored salt marsh habitat.

5.1.5.5 Birds

Birds in the Project Area may temporarily be affected by construction activities. During construction, heavy machinery activity, increased noise levels, vegetation clearing, and earth moving activities may cause displacement of individuals and nesting failure/disruptions near construction activities. However, avian species are highly mobile and are expected to avoid direct mortality. Accordingly, no significant impacts to birds are anticipated.

Beneficial impacts to birds would result from the conversion of the generally *Phragmites*-dominated habitat to a salt marsh ecosystem. The expanded salt marsh would provide increased habitat for, and likely attract, salt marsh bird specialists, such as clapper rails (*Rallus longirostris*), sharp-tailed sparrows and marsh wrens. Additionally, salt marshes provide valuable foraging and nesting habitat for a variety of herons, egrets, and waterfowl.

Conversely, the removal of trees (i.e., forest/scrub-shrub) within the Project footprint would decrease the amount of habitat available for birds. Most of the birds that utilize the forested habitat within the Project Area are generalists and would disperse to other areas of similar habitat nearby. However, tree removal will be minimized, and planting of native shrubs and increased edge habitat along the border of the new marsh complex, would provide habitat for a number of forest/upland bird species.

5.1.5.6 Mammals

Mammals may be temporarily affected by construction activities on-site. During construction, heavy machinery activity, increased noise levels, vegetation clearing, and earth moving activities may cause mortality of some less-mobile small mammal species (e.g., mice and voles) individuals, or indirectly cause displacement of individuals during construction activities. However, most mammals are highly mobile and are expected to avoid direct mortality. Also, the less mobile species typically have high reproductive capability and thus can be expected to repopulate rapidly. Accordingly, no significant impacts to mammals are anticipated.

Long-term beneficial impacts to mammals would result from the conversion of the existing *Phragmites*-dominated habitat to a salt marsh ecosystem. Construction of the preferred alternative would provide increased habitat for species that utilize salt marshes, such as muskrat and raccoon. Creation of additional salt marsh would provide a greater area of higher quality habitat for these species in the Project Area.

However, conversion of existing habitat, especially the forested areas, would decrease habitat available for forest dwelling species such as gray squirrel (*Sciurus carolinensis*) and some small mammal species. Some of these species would disperse from the Project Area and recolonize similar habitats adjacent to the site.

5.1.6 RARE, THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

This section discusses the proposed Project's impacts on Federal and state-listed threatened and endangered species and species of special concern. Correspondence received from these agencies is presented in Appendix B.

5.1.6.1 Federal Species

No federally-listed threatened and endangered species or species of special concern are known to occur within the proposed Project Area. Accordingly, no federally-listed threatened and endangered species are likely to be impacted by the construction of the preferred alternative. Dredging of the tidal creeks and excavation of the marsh plain has the potential to cause temporary increases in turbidity and degraded water quality during construction and may impede the migration of the special concern fish species alewife and blueback herring to their upstream spawning areas. As a result, NMFS prohibits construction within the Hackensack River from March 1st to June 30th. In addition, best management practices, such as the use of hay bales, silt curtains, and erosion and sedimentation controls, would be implemented and maintained in areas adjacent to the river during construction to minimize sediments entering the river. The proposed Project would have overall benefits for fish and wildlife through the restoration of tidal hydrology to a degraded site, as well as the potential future use of the site by Federally-listed threatened and endangered species and their prey species.

5.1.6.2 State Species

The special concern species cattle egret, glossy ibis, little blue heron, and snowy egret, and the state-listed endangered peregrine falcon, are known to occur within the Project Area (Appendix B). The state-listed endangered least tern, the threatened yellow-crowned night heron, and black-crowned night heron (only breeding populations listed) were observed within the Project Area during USACE ecological sampling activities conducted in 2002. The wading species (herons, egrets and ibis) forage in brackish marshes, tidal channels, and mudflats and roost in scrub-shrub thickets and forested wetlands. These wading bird species would be temporarily displaced from the Project Area during construction by heavy machinery activity, increased noise levels, vegetation clearing, and earth moving activities. However, avian species are highly mobile and are expected to avoid direct mortality, to quickly return to the site following restoration activities due to the projected high value foraging habitats in the marsh, tidal channels, and mudflats. Scrub-shrub habitat has been incorporated into the tidal marsh complex and is anticipated to provide possible roosting and nesting habitat for avian species. The peregrine falcon is a particularly mobile species with expansive hunting territories, and temporary displacement from a relatively small area is not expected to significantly affect this species. Following restoration activities, the marsh would serve as high value hunting habitat for the peregrine falcons.

The state listed-endangered short-eared owl and a number of species of special concern including Fowlers toad, American kestrel, great blue heron, least bittern, least flycatcher, sharp-shinned hawk, tricolored heron, American woodcock, blue-winged teal, brown thrasher, eastern kingbird, green-winged teal, and swamp sparrow are likely to occur in the vicinity of the Project. These species may temporarily be affected by construction activities, and would likely avoid the Project Area for the duration of construction. However, most of these species are highly mobile avian species and are expected to avoid direct mortality. Some mortality of the less mobile Fowler's toad may occur, but this species would return to the restoration site following cessation of construction.

Therefore, no significant impacts to state threatened, endangered, or special concern species are anticipated, and the proposed Project would have overall benefits for these species.

5.1.7 SOCIO-ECONOMICS

This section discusses the impacts of the proposed Project on population, income and employment, housing, and education within the Project Area.

5.1.7.1 Population

Implementation of the preferred alternative would neither induce, nor inhibit, growth in the surrounding communities since the surrounding area is almost completely developed and has minimal potential for expansion. Furthermore, construction of the preferred alternative would have no impact on the number, density, or racial composition of residents living in the Project vicinity.

5.1.7.2 Economy, Income and Employment

The preferred alternative would have a positive direct economic impact on existing businesses surrounding the Project Area due to dramatic changes and improvements to the value and appearance of the Park. There would also be a minor indirect beneficial economic impact on the local economy during construction of the preferred alternative due to the increase in purchases of supplies and food by construction workers during the construction phase. With the exception of the short-term increase in employment of construction workers involved with the Project construction, there would be no impact on employment in the community surrounding the Project Area.

5.1.7.3 Housing

The proposed Project would not have any significant impacts on housing in Jersey City, Hudson County, New Jersey.

5.1.7.4 Education

Implementation of the preferred alternative would have no negative impacts on the structure or value of education received by school age children in the surrounding communities. However, construction of the preferred alternative would provide children with a clean, safe environment for environmental education programs and passive recreation (e.g., after school activities).

5.1.8 CULTURAL RESOURCES

This section discusses the impacts of the preferred alternative on prehistoric and historic cultural resources within the Project Area.

5.1.8.1 Prehistoric

Prehistoric activity in this marsh environment would have been limited to hunting and/or fishing and would not have involved settlement. As a result, the existence of cultural resources would be limited to no more than a stray find that would not provide useful information beyond what the nearby site (26 Hd 7) has already provided. Therefore, implementation of the proposed Project would have no impacts on significant prehistoric resources.

5.1.8.2 Historic

With the exception of the concrete bulkhead along the Hackensack River, there are no historic structures in the Project Area. Due to the extremely poor condition of the bulkhead and its lack of association with the proposed original park plans, the bulkhead is not considered eligible for inclusion in the National Register of Historic Places. Although the eastern portion of Lincoln Park was considered by the New Jersey Historic Preservation Officer to be eligible for inclusion in the National Register of Historic Places, the Project Area (i.e., Lincoln Park West, west of State Route 1 and 9) does not contribute to the eligibility of the Park. Therefore, implementation of the proposed Project would have no impacts on significant historic resources.

5.1.9 FLOODPLAINS

The footprint of the entire preferred alternative project area would be constructed within the 100-year tidal flood limit of the Hackensack River. Although the entire footprint of the preferred alternative is located within the flood fringe of the Hackensack River, construction of the salt marsh would not increase the jurisdictional area of floodplains within Jersey City. Subsequently, there would be no significant impact on the floodplain of the Hackensack River from implementation of the preferred alternative.

Although not a primary objective of the Project, construction of the salt marsh would provide additional floodwater storage capacity and improve flood flow de-synchronization along the Hackensack River. Accordingly, constructing of the preferred alternative would be consistent with the Hudson County Master Plan policy of implementing environmental mandates into urban planning (HCPB 2002).

5.1.10 COASTAL ZONE MANAGEMENT

Based on review of the applicable New Jersey Rules on Coastal Zone Management (NJDEP 1997), the guidelines applicable to the Project have been identified. The proposed Lincoln Park Wetland Restoration Project is consistent with New Jersey's Coastal Zone Management Program. A New Jersey Coastal Zone Management Consistency Evaluation is provided in Appendix C and is under review by the NJDEP Office of Dredging and Sediment Technology as a requirement of compliance with the Waterfront Development Law (N.J.S.A. 12:5-3).

5.1.11 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

The proposed Project would have no significant impact on any of the existing Hazardous Toxic and Radioactive Waste (HTRW) sites, upstream or downstream of the Project Area. The waste encountered in the excavated/restored areas will be relocated to the upland disposal area atop the adjacent landfill. A 2-foot cap of clean fill material will then be placed. Wetland and upland vegetation, wildlife, and the public will be protected from contact with contaminated soils/sediments.

Additionally, the landfill and all deposited material will be re-graded and capped as part of the NJDEP Solid and Hazardous Waste Program Closure and Post-Closure Plan Approval. The closure of the landfill is not part of the LPWWRP activities, but the clean fill materials proposed to be used would be used by both activities as described previously. Several sediment samples taken in the man-made lake exceeded ER-M levels for SVOCs and metals, and one sample exceeded the ER-L for a pesticide. However, sediments in the man-made lake would not be disturbed by implementation of Alternative 2.5, so there would be no increase in potential ecological risk from sediment contaminants. Sediments in the man-made lake would be dredged and permanently placed in the closed and capped landfill within the Hudson County landfill closure area and a clean backfill of 2.0' would be placed in the pond bottom. This would reduce exposure to wildlife to the greatest extent. Alternative 2.5.1 is the preferred optimal approach for this purpose. If funding becomes available for this option before the project award date, then it will become the preferred alternative to Alternative 2.5.

5.1.12 NAVIGATION

The proposed Project would not affect navigation of the Hackensack River. Temporary, minor increases in turbidity and sedimentation of the Hackensack River may occur as a result of on-site excavation. However, the amount of sediment deposited into the Hackensack River would have a negligible impact to navigation.

The CDF facility would require a barge to be situated in the Hackensack River, approximately 200 feet off of the Project Area, for a period of up to ten weeks. This barge would carry sand for use as clean fill material for the wetland restoration Project, as well as the landfill closure and golf course development projects. The barge would be located outside of the federal navigation channel and would be operated and marked in accordance with all applicable U.S. Coast Guard regulations. Therefore, implementation of the proposed Project would have no impacts on navigation.

5.1.13 AESTHETICS AND SCENIC RESOURCES

Short-term adverse impacts to the aesthetic and scenic resources in the Project Area would be minor. Aesthetic values would be reduced temporarily during construction, due to the presence of construction equipment and construction activities. However, these impacts would be temporary, and scenic and aesthetic values would be restored and enhanced as a result of the Project. Permanent, minor, adverse impacts include the loss of aesthetic values by removal of trees within the footprint of the preferred alternative. HCDPR has expressed interest in saving and transplanting as many of the shrubs and trees from the forest/scrub-shrub areas as is feasible during Project construction, to preserve some of the character and nature of the Project Area (Jennings 2002).

Long-term positive impacts on aesthetic and scenic resources would occur from implementation of the preferred plan. The preferred plan would create unobstructed view corridors of the Hackensack River, which are currently obstructed by dense stands of *Phragmites*. Specifically, the walkway and footbridge created proposed as part of the preferred alternative would provide visual vantage points for views of the surrounding marsh and the Hackensack River. In addition, planting native shrubs in and around the Project Area would increase the aesthetic and scenic value of the site. Therefore, implementation of the proposed Project would have no impacts on aesthetics and scenic resources.

5.1.13.1 RECREATION

Implementation of the preferred alternative would result in a positive long-term impact on recreation. Recreational opportunities that currently exist, such as hiking, jogging, birding, and fishing, would be

enhanced by implementation of the preferred alternative. Specifically, the construction of the walkway along and within the salt marsh would provide access to the marsh and lake and create viewing areas for birders and other wildlife enthusiasts. Additionally, the walkway would be integrated into the existing trail system within the Project Area and eventually could become part of the planned Hackensack River Walk. Implementing the preferred alternative would be consistent with the long-term environmental awareness and recreation goals for Lincoln Park.

Temporary impacts associated with implementation of the preferred alternative may include limited public access to the existing trail system and the Hackensack River during the construction phase. No significant or long-term negative impacts to recreational resources in the Project Area are expected as a result of the Project.

5.1.14 TRANSPORTATION

Temporary impacts to the land-based transportation resources in the Project Area would be associated with the movement of construction equipment and workers' vehicles during the construction phase of the Project. Specifically, the gravel parking area adjacent to the existing playing fields may be used as contractor parking and equipment staging areas during construction. However, these impacts are expected to be minimal, short-term, and limited to the period of construction. The preferred alternative would not result in a significant long-term increase in traffic. During construction, coordination with local officials would occur as needed to minimize effects to the local traffic patterns and parking.

On-site transportation of excavated material from the salt marsh restoration area to the upland disposal site would be restricted to the existing gravel road system within and immediately adjacent to the Project Area. Improvements, such as minor widening or deposition of rock to stabilize the roadbed in low lying areas may be required to support heavy machinery (e.g., dump trucks and front-end loaders). However, the impacts resulting from these improvements would be minor.

The Hackensack River is the only navigable waterway located in the Project vicinity. The preferred alternative identifies minimal excavation activities at the mouth of the primary tidal creek. This activity would not significantly impact the navigability of the Hackensack River. Therefore, there would be no significant impact to water-based transportation.

5.1.15 AIR QUALITY

The Project is located in an ozone non-attainment area. Off-road construction equipment used on-site may produce minor amounts of NAAQS criteria pollutants in the immediate vicinity of the Project Area. However, construction activities would have no significant or long-term impacts on air quality. Based on the current design, emissions calculations indicate the Project is under the conformity threshold value of 25 tons per year for nitrogen oxides and ozone precursors. As required by the approved closure plan, measures will be taken during construction as required to minimize particulate circulation due to dust, etc. Therefore, there would be no significant impact to air quality.

5.1.16 NOISE

There would be a minor increase in noise levels in the immediate Project vicinity during construction due to the increase in worker vehicles and traffic, and the operation of construction equipment. However, these impacts are expected to be minimal and short-term, and limited to the period of active construction. There would be no long-term impact on noise levels.

5.1.17 AIR TRAFFIC

The preferred alternative project area is about 3.75 miles from Newark Airport and about 7.4 miles from Teterboro Airport. The project would be within the 5-mile perimeter of Newark Airport as described in the Federal Aviation Administration's (FAA) Advisory Circular 150/5200-33B. These guidelines provide recommendations to land use planners and project developers regarding practices that may attract wildlife populations that are hazardous to air traffic within a 5-mile radius. Impacts of the project on air traffic could potentially include an increase in waterfowl using the area due to the increase in amount of tidal wetlands. Geese in particular rank high on the list of 25 species groups as to relative hazard to aircraft. Other guilds that are likely to use the project area have low hazard rankings. Canada Goose (*Branta canadensis*) and Brant (*Branta bernicla*) are the most likely species that are of concern, but both species are already using the area currently. These species would most likely use the open water component of the proposed project, rather than the spartina wetlands component. "Loafing" as the FAA terms roosting or idle standing, is a behavior common to both resident and migratory populations, however, the well known behavior of loafing by large flocks of resident geese on lawns in parks, airports, sports fields, and corporate lawns and golf courses would be discouraged by the planting of native *Spartina* grasses. Canada Geese are particularly drawn to lawns for two reasons: they can digest grass, and when they are feeding with their young, manicured lawns give them a wide, unobstructed view of any approaching predators. Because *Spartina* grass in its tall form lacks these features it is not likely to attract large numbers or flocks of idle birds or foraging birds.

According to the FAA and other sources, migratory Canada geese have been in decline for over a decade, whereas the population of resident geese has seen near exponential growth. Because they never leave their familiar year-round habitats, and due to this dramatic increase in population size, resident geese are responsible for most conflicts with urban and suburban owners of agricultural fields and lawns.

Native marshes and restored marshes such as the planned Lincoln Park restoration within the NY/NJ Harbor typically attract small numbers of breeding pairs from Spring through early Summer. Young can be seen with swimming with parents in tidal creeks during the summer and on through the summer molt when many of the birds are temporarily flightless. Geese are in part colonial and congregate in flight in large numbers, especially during Fall migration in October.

The largest areas of congregation at Lincoln Park are within the areas of lawns designated for active and passive recreational use. Highest areas of concentration are within open water lakes especially where lawn and lake meet (personal communication Carl Alderson). Because of the diminishing numbers of migratory geese on the Atlantic flyway and due to the limited numbers of Resident type geese attracted seasonally to a salt marsh, the creation of tidal marsh and tidal creeks are not believed to cause a significant impact to air travel due to preferred alternative project area. Consultation with the FAA and the operators of Newark Liberty International will be sought in accordance with the 5-mile radius guideline stated in the Advisory. Avian population monitoring will be conducted for three years post restoration.

5.2 NO-ACTION ALTERNATIVE

Alternative 1, No Action, was not preferred since it does not meet the project goal or purpose. The site in its current condition permits only limited finfish and wildlife forage, breeding, nursery and refuge habitat. The baseline analysis showed that the site currently supports only a limited diversity of species. The No Action alternative does not promote an increase in fisheries and wildlife habitat

and is therefore not conducive to replacing the natural resources that were lost as a result of the Exxon Bayway and B.T. Nautilus oil spills. The Trustees believe that restoring the habitat to a mix of low marsh and emergent high marsh plant species communities, and removing historic fill material in order to enable natural hydrologic exchange, is necessary to benefit the fish and wildlife species and compensate the public. This alternative will not benefit fish and wildlife species; nor will it compensate the public or restore lost habitat function and has therefore not been further considered in this evaluation.

5.3 NON-PREFERRED ALTERNATIVES

This section presents the environmental impacts of the non-preferred Project Alternatives on physical, ecological, cultural, aesthetic, socioeconomic, and recreational conditions of the Project Area.

Alternative 1 would adequately meet the stated goals of the project, namely: to compensate the public for injuries to natural resources caused by the Exxon Bayway and B.T. Nautilus oil spills by: restoring the historic tidal hydrologic connection between the restoration site and Hackensack River; increasing the percent cover of *Spartina alterniflora*; improving the aesthetic viewshed associated with the site; enhancing fisheries and wildlife breeding, nursery, forage and refuge habitat; and, accomplishing the restoration of marsh acreage and functionality cost effectively. The selection also meets the goals set forth by the NOAA Restoration Center's ARRA Competitive Grant Program. However this Alternative was not preferred because it would not maximize the potential of the site to provide the goals and benefits set forth for the project. Relative to the preferred alternative, this alternative provided a combination of benefits that when taken together resulted in a lesser gain than that of the preferred alternative.

There were several issues of concern associated with Alternative 1. Both Alternative 1.1 and 1.2 options provided reduced gains relative to any of the Alternative 2 configurations. These two alternatives: result in a lesser gain of acreage converted from landfill to restored wetland; reduce the acres of *Phragmites* dominated area to a lesser extent; and fail to provide connectivity to the pond. Notably, these two alternatives greatly reduce improvement to Essential Fish Habitat. By leaving in the existing paths, the amount of marsh available for marsh creation diminishes significantly. Also, the presence of the paths creates a potential opportunity for disturbance by the public, such as illegal dumping or filling. In addition, the dirt roads and paths lie at between 5 and 8 feet NGVD29, a prime elevation for *Phragmites* to re-invade if the site is not properly managed. The marsh would wrap around the path, but the slopes from the marsh up to the roads/paths would be vulnerable to *Phragmites* invasion.

Although Alternative 1.1 did meet the design goals better than Alternative 1.2, it did not maximize the area of intertidal salt marsh to its full potential.

5.3.1 GEOMORPHOLOGY AND SOILS

Implementation of the non-preferred alternative would result in significant changes to existing topography. However, these changes are expected to be beneficial. The existing topography would be modified throughout the majority of the site according to the preferred restoration plan, and would involve excavation of accumulated waste associated with the adjacent landfill, historic fill material, and *Phragmites*-dominated areas; creation of intertidal and supratidal areas, including the creation of tidal creeks to supply an additional tidal hydrology source; and, deposition of excavated spoil material on the landfill. The design for the preferred non-preferred restoration plan includes restoring no more than 27.57 acres of combined habitat improvements. The lake would not be physically altered by construction, and a hydrologic connection would not be made to the Hackensack River.

The intertidal zone includes connecting the Hackensack River via a primary tidal creek and creating additional secondary tidal creeks to increase the hydrology supply across the wetland site only. The majority of the restoration area is currently at an elevation of 10 feet NGVD29 or lower. Material from this area would be excavated and deposited atop the adjacent landfill as part of the landfill closure process and according to the following specifications:

The entire restoration area would be excavated approximately to only 1 foot below the desired depth and clean fill material would be placed over the existing soil. The clean sand fill would be substantially less cubic yards in Alternative 1.0 of beneficially reused sand dredged from the USACE/Port Authority of NY and NJ dredging of the Anchorage Channel. While this provided a cost savings, it did not adequately address the need to protect wildlife from the underlying substrate which may contain residual contaminants.

No significant or long-term impacts would occur to geology within the Project Area.

5.3.2 LAND USE AND ZONING

Implementation of the non-preferred alternative would result in a change of land cover types from *Phragmites*-dominated land, upland herbaceous, and forest/scrub-shrub to predominantly a saline marsh ecosystem with large components of remnant upland herbaceous and scrub-shrub habitats. Land uses in the Project Area are primarily recreational and open space uses and the increased area of salt marsh would provide additional recreational opportunities and open land. Accordingly, no negative impacts to land use are anticipated as a result of the construction of the non-preferred alternative.

The entire Project Area is located in a Parks-Open Space zone as defined by the Jersey City zoning regulations. Construction of the non-preferred alternative would be consistent with the current city zoning regulations and policies. Accordingly, no significant impacts to zoning would result from construction of the non-preferred alternative.

5.3.3 WATER RESOURCES

The following sections present the non-preferred Project impacts associated with regional hydrogeology and groundwater resources, surface water, and tidal influences.

5.3.3.1 Regional Hydrogeology and Groundwater Resources

The excavation and regrading of the Project Area and off-site disposal of excavated materials for the proposed Project would change the existing grades. However, the non-preferred alternative is not expected to have significant negative impacts on the regional hydrology and groundwater resources.

5.3.3.2 Surface Water

The non-preferred alternative is expected to result in temporary increases in turbidity during construction. Excavation of the waste material to create tidal creeks and excavation of the marsh plain also may cause a temporary degradation of water quality in the Hackensack River and areas within the Project Area during construction. However, best management practices would be used to minimize and/or prevent sediments from entering the Hackensack River, including installation of a temporary water exclusion berm at the main inlet and floating turbidity barrier just offshore, as well as other erosion and sedimentation controls, to protect the Hackensack River to the maximum extent

possible during construction. Therefore, turbidity caused by construction activities should be minimal and re-suspended sediments are likely to quickly settle out of the water column or be dissipated by the tidal fluctuation of the Hackensack River. Accordingly, turbidity and sedimentation would have minimal impact to the overall surface water quality of the Project Area and the Hackensack River. A Clean Water Act Section 404(b)(1) Guidelines Evaluation was completed for the ERR/EA (USACE 2006). Soil Erosion and Sediment Control Plan authorization from the Hudson, Essex, and Passaic Counties Soil Conservation District will be acquired prior to any construction activities.

5.3.3.3 Tidal Influences

The non-preferred alternative would significantly alter the tidal influence of the Project Area. The intent of the excavation is to extend the existing tidal creeks (both primary and secondary channels), lower the marsh plain elevation, and provide better overall tidal inundation and circulation within the Project Area. The alteration of on-site tidal influences is vital to providing the necessary hydrology for salt marsh habitat restoration and is not expected to cause significant offsite impacts. Additional information on tidal influences and the hydrodynamic model are included in Appendix B (USACE 2006).

5.3.4 VEGETATION

This section describes impacts to wetland and upland vegetation resources. Implementation of the non-preferred alternative would result in conversion of a relatively degraded wetland complex and associated uplands to valuable and vital salt marsh wetland habitat. Accordingly, there would be positive impacts on vegetation as a result of implementation of the non-preferred alternative. Benefits, relative to any of the configurations identified in Alternative 2, are reduced in acreage. Total conversion of filled and degraded *Phragmites* dominant habitats results in total 27.57 acres. This compared to a minimum 39.9 acres of restored habitats in the preferred alternative.

5.3.4.1 Wetlands

Implementation of the non-preferred alternative would have a long-term beneficial impact on wetlands. Currently, only small patches of remnant salt marsh exist within the Project Area. Creation of additional high value salt marsh as the result of conversion of low value *Phragmites*-dominated habitat would restore a significant extent of salt marsh -historically present on the site. This conversion would also have a positive effect on the existing diversity of wildlife habitat on site.

Although the USEPA considers all estuarine wetlands in the Project Area as priority wetlands, salt marsh is designated as priority habitat in New Jersey (USEPA 1994), and considered to be ecologically and environmentally more valuable than the existing *Phragmites*-dominated wetlands. Specifically, *Phragmites*, forest/scrub-shrub, and upland herbaceous habitats would be permanently converted to salt marsh, resulting in a net increase of 15.82 acres of salt marsh habitat in the Project Area compared to 19.8 acres in the preferred alternative.

Impacts to wetland vegetation include removal of vegetation during construction activities. This alternative leaves intact the greatest extent of existing mature trees and shrubs. However, in the interest of removing waste material from within the Project Area, it is less critical to leave numbers of trees than to protect from contaminated waste material.

Temporary impacts to approximately 2,000 square feet of wetlands and 3,200 square feet of transition area adjacent to the Hackensack River and north of the Project Area are anticipated from construction

of the temporary above-ground dredge conveyance pipeline associated with the CDF facility. This pipeline is needed to bring clean sand fill to the site from a barge in the Hackensack River, and would be in place for up to ten weeks. Temporary impacts would be restored as appropriate following completion of the CDF operation.

5.3.4.2 Uplands

Approximately 6 acres of upland vegetation would be permanently converted to wetland vegetation resulting from implementation of the non-preferred alternative. The non-preferred alternative includes the establishment of approximately 6.3 acres of upland scrub-shrub habitat interspersed amongst the tidal creeks and salt marsh. Since salt marsh is considered a priority habitat in New Jersey and is considered to be of higher value than the existing upland habitats, the Project Team decided that the greatest number of acres conversion of to salt marsh was preferred. This alternative did not fully meet that objective.

However, HCDPR has expressed interest in saving and transplanting as many of the shrubs and trees from the forest/scrub-shrub areas as feasible to preserve some of the character and nature of the Project Area, and provide newly created upland areas a head start on achieving stable and diverse habitat restoration goals (Jennings 2002). This approach may be feasible. However, excavation of waste material is a Project priority and may compromise the salvage of on-site woody species. Also, *Phragmites* is seen as an aggressive wetland transitional species that tends to form expansive monocultures and is undesirable. Therefore, excavation of expansive networks of *Phragmites* rhizomes is also a Project priority and may also compromise salvage of on-site woody species. Therefore, while Alternative 1 sought to preserve the greatest extent of upland, a loss of upland vegetation is anticipated due to construction of the non-preferred alternative. However, this impact would be offset by the net increase in priority wetland habitat. The alternative does not adequately address the need to reduce *Phragmites* in the project area.

5.3.5 FISH AND WILDLIFE

This section identifies the impacts to fish and wildlife due to the proposed Project, including shellfish, finfish, benthic resources, reptiles and amphibians, birds, and mammals. In addition, a *Final Fish and Wildlife Coordination Act Section 2(b) Report* has been prepared by the USFWS (2004).

5.3.5.1 Shellfish

The non-preferred alternative would have a temporary impact on existing shellfish during construction. Excavation of the tidal creeks and marsh surface would dislodge and eradicate the existing shellfish (e.g., ribbed mussels), and would have a detrimental impact on specific individuals. However, shellfish species are expected to recolonize the Project Area immediately following construction with recruitment from nearby, unaffected portions of the Hackensack River adjacent to the Project Area (Hettler 1989, LaSalle et al. 1991).

An increase in turbidity and sedimentation are expected from construction activities and may affect the ability of nearby filter feeding shellfish to feed. The increased turbidity and sedimentation from construction activities are expected to quickly settle out of the water column. Any fine re-suspended sediment (silt and clay) that does not settle would be dispersed with the tidal fluctuation from the Hackensack River and would have minimal impact on existing and nearby nekton species.

The non-preferred alternative would have an overall beneficial result on the existing shellfish species. The excavation of the primary and secondary tidal creeks and excavation of the marsh surface would

restore tidal hydrology to the Project Area, promote tidal inundation, and improve the quality and quantity of suitable mudflat substrate. Additionally, the creation of salt marsh and additional deeper/wider tidal creeks would provide expanded habitat with substantial feeding opportunities and reduced predation risk, and encourage recruitment and establishment of shellfish and nekton species in the tidal creeks and marsh surface (Hettler 1989). In general, results from spring, summer, and fall nekton sampling events support the proposed Project. Shellfish sampling data indicated either higher or no difference in use of *S. alterniflora* habitat versus *Phragmites* habitat in the Project Area (USACE 2002d).

Some burrowing crab species (mud crab) and shrimp species (grass shrimp) may be removed during excavation activities. The overall impact to these mobile shellfish species would be minimal due to their ability to relocate to deeper waters of the Hackensack River to seek food and shelter during construction activities. Following construction activities, individuals can return to the Project Area and colonize the tidal channels and marsh plain. The non-preferred alternative did not maximize the potential for invertebrate recolonization due to the large amount of acreage that would remain intact of the existing fill.

5.3.5.2 Finfish and Essential Fish Habitat

Similar to the shellfish species, the non-preferred alternative would have a temporary impact on finfish during construction. The increase in turbidity and sedimentation from dredging and excavation could potentially lead to gill abrasions and may suffocate individual fish in the Project Area, as well as hinder predation efficiency of sight feeding fish at or adjacent to the Project Area. However, best management practices, including erosion and sedimentation controls, would be used to minimize and/or prevent sediments from entering the Hackensack River, in order to protect the Hackensack River to the maximum extent possible during construction. Therefore, turbidity and sedimentation caused by the construction activities should be minimal and are likely to quickly settle out of the water column. In addition, fish are generally mobile, would be able to avoid direct impacts from construction activities, and seek the deeper water of the Hackensack River for shelter. Accordingly, risks from suffocation and gill abrasions are expected to be minimal.

The removal of benthic macroinvertebrates and dispersion of nekton species would temporarily impact food sources for finfish in the Project Area during construction. However, the existing fish species are expected to relocate and feed in the unaffected portion of the Hackensack River. In addition, benthic macroinvertebrates and nekton species would be expected to recolonize the non-preferred alternative immediately following construction with recruitment from nearby, unaffected portions of the Hackensack River (Hettler 1989, LaSalle et al. 1991). Therefore, impacts to finfish due to loss of food availability are expected to be minimal.

Construction of the non-preferred alternative would also result in beneficial impacts for some finfish species. *Phragmites* is documented to degrade marsh function, reduce tidal exchange, and restrict the free movement of aquatic life (Weinstein and Balletto 1999). Excavation and replanting of the marsh plain, and widening and extending the tidal creeks would replace the dense monospecific stands of *Phragmites* with *Spartina* species and other beneficial marsh species and promote tidal inundation of the marsh plain. Weinstein and Balletto (1999) found marshes dissected by numerous tidal creeks were used more by fish than marsh habitat with low drainage densities. In addition, fish were observed to be concentrated near the interface between the salt marsh and open water, with individuals leaving the marsh on ebb tide having fuller stomachs than individuals captured in adjacent tidal creeks.

Additionally, in general the results from spring, summer, and fall nekton sampling events generally support the proposed Project. Finfish sampling data indicated higher use of *S. alterniflora* habitat versus *Phragmites* habitat in the Project Area during spring and fall sampling. However, use of *S. alterniflora* habitat was lower than use of *Phragmites* during the summer sampling event (USACE 2002d). This may be attributed to the fact that the majority of the catch during the summer sampling event was killifish. Killifish exhibit no preference between *S. alterniflora* and *Phragmites* communities, but prefer areas with loose, muddy substrate into which they can burrow.

The Hackensack River provides a migratory pathway for anadromous fish such as alewife and blueback herring as they travel to spawning grounds in upstream portions of the river. Increased turbidity and degraded water quality resulting from construction activities may impede the migration of these species to their spawning areas. To minimize impacts to anadromous fish, the proposed Project would adhere to the construction window imposed by NMFS, namely that no work be performed within the Hackensack River between March 1st and June 30th.

EFH has been designated near the Project Area. Winter flounder, an EFH-designated species may use the Hackensack River adjacent to the Project Area for spawning. Other EFH-designated species and their prey may also be present. To protect winter flounder EFH, NMFS recommends that work within the Hackensack River be avoided from January 1st to May 31st. Provided Best Management Practices are used to isolate the Project Area from the Hackensack River and minimize the release of sediments to the river during construction, work within the Project Area does not require a timing restriction.

The increase in salt marsh acreage and the creation of tidal channels would physically allow more fish movement in and out of the salt marsh and lake. The increased volume of water and improved water quality in the restored salt marsh would increase the availability and quality of habitat for all trophic levels of aquatic organisms. In particular, these improvements would benefit forage fish for EFH-designated species, as many of these forage fish spend most or all of their life in salt marshes. Larger numbers of small, resident forage fish in the salt marsh would provide an increased food source for larger predatory EFH-designated species that would also be able to move more easily into and out of the salt marsh due to the presence of primary and secondary tidal channels and removal of tidal restrictions. Improved water and sediment quality will result in more expansive benthic habitat required for demersal fish species, including EFH-designated species.

Construction activities may result in short-term increases in erosion and delivery of sediment to nearby wetlands and waters. Most EFH-designated species likely to occur in the Hackensack River are typically found in the often turbid conditions of estuaries and can avoid temporary increases in suspended sediments. Impacts will be mitigated by measures including isolating the construction area from the Hackensack River, performing in-water work during low tide, working in dry conditions within a temporary water exclusion berm and floating turbidity barrier to minimize migration of turbidity offsite, and re-stabilizing soils with plant material and seeding following earthwork completion. Additionally, best management practices for soil erosion and sediment control will be implemented and maintained to minimize sediment entering waterways. For these reasons, no long-term adverse impacts to EFH or EFH-designated species or their prey are expected from the proposed Project.

Similar to the findings of impacts to invertebrates, the non-preferred alternative did not maximize the potential for invertebrate recolonization due to the large amount of acreage that would remain intact of the existing fill and also the lack of connectivity to the pond and its resources.

5.3.5.3 Benthic Resources

The excavation of intertidal and subtidal areas called for in the non-preferred alternative will result in the direct loss of benthic species and habitat in the Project Area during and immediately following construction. Benthic communities in areas temporarily isolated from tidal flow would also be lost. Additionally, excavation has the potential to result in erosion and delivery of sediment to the Hackensack River and adjacent wetlands, with associated impacts to the benthic community. Epibenthic organisms such as shrimp and crabs are mobile and can avoid areas of increased suspended sediment. However, most adult benthic infauna have limited mobility and sediment deposition may result in burial or impaired feeding.

Potential impacts to the benthic and epibenthic communities of the adjacent Hackensack River and other wetlands would be minimized and avoided by employing and maintaining best management practices for soil erosion and sediment control. Impacts to benthic macroinvertebrates would be temporary, as recolonization would commence immediately following construction. Recruitment of benthic and epibenthic organisms would come from nearby, unaffected areas of the Hackensack River (Hettler 1989, LaSalle et al. 1991). LaSalle et al. (1991) found that the species composition and relative abundances of benthic macroinvertebrates in a newly developed salt marsh are similar to those reported from natural marshes, with a trend toward greater density and more well-established populations for some species, with age of the constructed marsh complex. For these reasons, no long-term adverse impacts to benthic resources are expected from the proposed Project.

However, the non-preferred alternative did not maximize the potential for benthic recolonization due to the large extent of acreage that would remain intact of the existing fill and lack of connectivity to the pond.

5.3.5.4 Reptiles and Amphibians

Based on the results of on-site surveys in 2001, little suitable habitat for reptiles and amphibians currently exists within the Project Area (USACE 2002f). In addition, those species found or expected on-site are fairly mobile and could relocate during construction activities. Accordingly, although some individuals may be lost during construction, the loss is expected to be minor. Therefore, no significant impacts to reptiles and amphibians are anticipated.

The creation of salt marsh within the non-preferred alternative project area would potentially benefit a number of reptiles that inhabit Hudson County. The increased area of salt marsh and associated upland may provide suitable nesting and foraging habitat for diamondback terrapins, which are known to inhabit the Hackensack River and its associated salt marshes (USACE 2002f). Additionally, common snapping turtles also utilize salt marsh habitat for foraging, and although not observed during the 2001 reptile and amphibian surveys, mud turtles (*Kinosternon subrubrum*) can tolerate brackish water and may potentially utilize the restored salt marsh habitat.

5.3.5.5 Birds

Birds in the non-preferred alternative project area may temporarily be affected by construction activities. During construction, heavy machinery activity, increased noise levels, vegetation clearing, and earth moving activities may cause displacement of individuals and nesting failure/disruptions near construction activities. However, avian species are highly mobile and are expected to avoid direct mortality. Accordingly, no significant impacts to birds are anticipated.

Beneficial impacts to birds would result from the conversion of the generally *Phragmites*-dominated habitat to a salt marsh ecosystem. The expanded salt marsh would provide increased habitat for, and likely attract, salt marsh bird specialists, such as clapper rails (*Rallus longirostris*), sharp-tailed sparrows and marsh wrens. Additionally, salt marshes provide valuable foraging and nesting habitat for a variety of herons, egrets, and waterfowl.

Conversely, the removal of trees (i.e., forest/scrub-shrub) within the Project footprint would decrease the amount of habitat available for birds. This alternative minimizes the loss to the greatest extent, however most of the birds that utilize the forested habitat within the Project Area are generalists and would disperse to other areas of similar habitat nearby. However, tree removal will be minimized, and planting of native shrubs, and increased edge habitat along the border of the new marsh complex would provide habitat for a number of forest/upland bird species.

5.3.5.6 Mammals

Mammals may be temporarily affected by construction activities on-site. During construction, heavy machinery activity, increased noise levels, vegetation clearing, and earth moving activities may cause mortality of some individuals of less mobile small mammal species (e.g., mice and voles), or indirectly cause displacement of individuals during construction activities. However, most mammals are highly mobile and are expected to avoid direct mortality. Also, the less mobile species typically have high reproductive capability and thus can be expected to repopulate rapidly. Accordingly, no significant impacts to mammals are anticipated.

Within the non-preferred alternative project area, long-term beneficial impacts to mammals would result from the conversion of the existing *Phragmites*-dominated habitat to a salt marsh ecosystem. Construction of the non-preferred alternative would provide increased habitat for species that utilize salt marshes, such as muskrat and raccoon. Creation of additional salt marsh areas adjacent to a large area of remnant upland habitat would provide a greater area of higher quality habitat for these species of all alternative configurations.

Conversion of existing habitat, especially the forested areas, would decrease habitat available for forest dwelling species such as gray squirrel (*Sciurus carolinensis*) and some small mammal species. Some of these species would disperse from the Project Area and recolonize similar habitats adjacent to the site. This alternative has the least amount of conversion, therefore the smallest loss to forest dwellers. However, this option does not protect wildlife from direct contact with contaminated fill materials and does not therefore meet adequately the objective of protecting wildlife from contact.

5.3.6 RARE, THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

This section discusses the non-preferred alternative project area impacts on Federal and state-listed threatened and endangered species and species of special concern. Correspondence received from these agencies is presented in Appendix B.

5.3.6.1 Federal Species

As stated in Section 3.6.1, no Federally-listed threatened and endangered species or species of special concern are known to occur within the proposed Project Area. Accordingly, no Federally-listed threatened and endangered species are likely to be impacted by the construction of the non-preferred alternative. Dredging of the tidal creeks and excavation of the marsh plain has the potential to cause temporary increases in turbidity and degraded water quality during construction and may impede the migration of the special concern fish species alewife and blueback herring to their upstream spawning

areas. As a result, NMFS prohibits construction within the Hackensack River from March 1st to June 30th. In addition, best management practices, such as hay bales, silt curtains, and erosion and sedimentation controls, would be implemented and maintained in areas adjacent to the river during construction to minimize sediments entering the river. The proposed Project would have overall benefits for fish and wildlife through the restoration of tidal hydrology to a degraded site, as well as the potential future use of the site by Federally-listed threatened and endangered species and their prey species.

5.3.6.2 State Species

The special concern species cattle egret, glossy ibis, little blue heron, and snowy egret, and the endangered peregrine falcon are known to occur within the Project Area (Appendix B). The state-listed endangered least tern, threatened yellow-crowned night heron, and black-crowned night heron (only breeding populations listed) were observed within the Project Area during USACE ecological sampling activities conducted in 2002. The wading species (herons, egrets and ibis) forage in brackish marshes, tidal channels, and mudflats and roost in scrub-shrub thickets and forested wetlands. These wading bird species would be temporarily displaced from the Project Area during construction by heavy machinery activity, increased noise levels, vegetation clearing, and earth moving activities. However, avian species are highly mobile and are expected to avoid direct mortality, and would quickly return to the site following restoration activities due to the projected high value foraging habitats in the marsh, tidal channels, and mudflats. Scrub-shrub habitat has been incorporated into the tidal marsh complex and is anticipated to provide possible roosting and nesting habitat for avian species. The peregrine falcon is a particularly mobile species with expansive hunting territories, and temporary displacement from a relatively small area is not expected to significantly affect this species. Following restoration activities, the marsh would serve as high value hunting habitat for the peregrine falcons.

The state listed-endangered short-eared owl and a number of species of special concern including Fowlers toad, American kestrel, great blue heron, least bittern, least flycatcher, sharp-shinned hawk, tricolored heron, American woodcock, blue-winged teal, brown thrasher, eastern kingbird, green-winged teal, and swamp sparrow are likely to occur in the vicinity of the Project. These species may temporarily be affected by construction activities, and would likely avoid the Project Area for the duration of construction. However, most of these species are highly mobile avian species and are expected to avoid direct mortality. Some mortality of the less mobile Fowler's toad may occur, but this species would return to the restoration site following cessation of construction.

Therefore, no significant impacts to state threatened, endangered, or special concern species are anticipated, and the non-preferred alternative project area would have overall benefits for these species.

5.3.7 SOCIO-ECONOMICS

This section discusses the impacts of the non-preferred alternative project area on population, income and employment, housing, and education within the Project Area.

5.3.7.1 Population

Implementation of the non-preferred alternative would neither induce, nor inhibit, growth in the surrounding communities since the surrounding area is almost completely developed and has minimal

potential for expansion. Furthermore, construction of the non-preferred alternative would have no impact on the number, density, or racial composition of residents living in the Project vicinity.

5.3.7.2 Economy, Income, and Employment

The non-preferred alternative would have a positive direct economic impact on existing businesses surrounding the Project Area due to dramatic changes and improvements to the value and appearance of the Park. There would also be a minor indirect beneficial economic impact on the local economy during construction of the non-preferred alternative due to the increase in purchases of supplies and food by construction workers during the construction phase. With the exception of the short-term increase in employment of construction workers involved with the Project construction, there would be no impact on employment in the community surrounding the Project Area.

5.3.7.3 Housing

The proposed Project would not have any significant impacts on housing in Jersey City, Hudson County, New Jersey.

5.3.7.4 Education

Implementation of the non-preferred alternative would have no negative impacts on the structure or value of education received by school age children in the surrounding communities. However, construction of the non-preferred alternative would provide children with a clean, safe environment for environmental education programs and passive recreation (e.g., after school activities).

5.3.8 CULTURAL RESOURCES

This section discusses the impacts of the non-preferred alternative on prehistoric and historic cultural resources within the Project Area.

5.3.8.1 Prehistoric

Prehistoric activity in this marsh environment would have been limited to hunting and/or fishing and would not have involved settlement. As a result, the existence of cultural resources would be limited to no more than a stray find that would not provide useful information beyond what the nearby site (26 Hd 7) has already provided. Therefore, implementation of the non-preferred alternative project would have no impacts on significant prehistoric resources.

5.3.8.2 Historic

With the exception of the concrete bulkhead along the Hackensack River, there are no historic structures in the Project Area. Due to the extremely poor condition of the bulkhead and its lack of association with the proposed original park plans, the bulkhead is not considered eligible for inclusion in the National Register of Historic Places. Although the eastern portion of Lincoln Park was considered by the New Jersey Historic Preservation Officer to be eligible for inclusion in the National Register of Historic Places, the Project Area (i.e., Lincoln Park West, west of State Route 1 and 9) does not contribute to the eligibility of the Park. Therefore, implementation of the proposed non-preferred alternative project would have no impacts on significant historic resources.

5.3.9 FLOODPLAINS

The footprint of the entire non-preferred alternative would be constructed within the 100-year tidal flood limit of the Hackensack River. Although the entire footprint of the non-preferred alternative is located within the flood fringe of the Hackensack River, construction of the salt marsh would not increase the jurisdictional area of floodplains within Jersey City. Subsequently, there would be no significant impact on the floodplain of the Hackensack River from implementation of the non-preferred alternative.

Although not a primary objective of the Project, construction of the salt marsh would provide additional floodwater storage capacity and improve flood flow desynchronization along the Hackensack River. Accordingly, constructing of the non-preferred alternative would be consistent with the Hudson County Master Plan policy of implementing environmental mandates into urban planning (HCPB 2002).

5.3.10 COASTAL ZONE MANAGEMENT

Based on review of the applicable New Jersey Rules on Coastal Zone Management (NJDEP 1997), the guidelines applicable to the Project have been identified. The proposed Lincoln Park Wetland Restoration Project is consistent with New Jersey's Coastal Zone Management Program. A New Jersey Coastal Zone Management Consistency Evaluation is provided in Appendix C and is under review by the NJDEP Office of Dredging and Sediment Technology as a requirement of compliance with the Waterfront Development Law (N.J.S.A. 12:5-3).

5.3.11 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The proposed non-preferred alternative project would have no significant impact on any of the existing Hazardous Toxic and Radioactive Waste (HTRW) sites, upstream or downstream of the Project Area. The waste encountered in the excavated/restored areas will be relocated to the upland disposal area atop the adjacent landfill. A 1-foot cap of clean fill material will then be placed. Wetland and upland vegetation, wildlife, and the public will be protected from contact with contaminated soils/sediments. Additionally, the landfill and all deposited material will be regraded and capped as part of the NJDEP Solid and Hazardous Waste Program Closure and Post-Closure Plan Approval. Several sediment samples taken in the manmade lake exceeded ER-M levels for SVOCs and metals, and one sample exceeded the ER-L for a pesticide. However, sediments in the manmade lake would not be disturbed by the proposed Project, so there would be no increase in potential ecological risk from sediment contaminants.

5.3.12 NAVIGATION

The non-preferred alternative project would not affect navigation of the Hackensack River. Temporary, minor increases in turbidity and sedimentation of the Hackensack River may occur as a result of on-site excavation. However, the amount of sediment deposited into the Hackensack River would have a negligible impact to navigation.

The CDF facility would require a barge to be situated in the Hackensack River, approximately 200 feet off of the Project Area for a period of up to ten weeks. This barge would carry sand for use as clean fill material for the wetland restoration Project, as well as the landfill closure and golf course development projects. The barge would be located outside of the federal navigation channel and would be operated and marked in accordance with all applicable U.S. Coast Guard regulations. Therefore, implementation of the non-preferred alternative project would have no impacts on navigation.

5.3.13 AESTHETICS AND SCENIC RESOURCES

Short-term adverse impacts to the aesthetic and scenic resources in the non-preferred alternative project area would be minor. Aesthetic values would be reduced temporarily during construction, due to the presence of construction equipment and construction activities. However, these impacts would be temporary, and scenic and aesthetic values would be restored and enhanced as a result of the Project. Permanent, minor, adverse impacts include the loss of aesthetic values by removal of trees within the footprint of the non-preferred alternative. HCDPR has expressed interest in saving and transplanting as many of the shrubs and trees from the forest/scrub-shrub areas as is feasible during Project construction, to preserve some of the character and nature of the Project Area (Jennings 2002).

Long-term positive results of the construction of the non-preferred alternative project aesthetic and scenic resources would occur from implementation of the preferred plan. The preferred plan would create unobstructed view corridors of the Hackensack River, which are currently obstructed by dense stands of *Phragmites*. Specifically, the walkway and footbridge created as part of the non-preferred alternative would provide visual vantage points for views of the surrounding marsh and the Hackensack River. In addition, planting native shrubs in and around the Project Area would increase the aesthetic and scenic value of the site. Therefore, implementation of the non-preferred alternative project would have no impacts on aesthetics and scenic resources.

5.3.14 RECREATION

Implementation of the non-preferred alternative would result in a positive long-term positive gain towards recreation. Recreational opportunities that currently exist, such as hiking, jogging, birding, and fishing, would be enhanced by implementation of the non-preferred alternative. Specifically, the construction of the walkway along and within the salt marsh would provide access to the marsh and lake and create viewing areas for birders and other wildlife enthusiasts. Additionally, the walkway would be integrated into the existing trail system within the Project Area and eventually become part of the planned Hackensack River Walk. Implementing the non-preferred alternative would be consistent with the long-term environmental awareness and recreation goals for Lincoln Park.

Temporary impacts associated with implementation of the non-preferred alternative may include limited public access to the existing trail system and the Hackensack River during the construction phase. No significant or long-term negative impacts to recreational resources in the non-preferred alternative project area are expected as a result of the Project.

5.3.15 TRANSPORTATION

Temporary impacts to the land-based transportation resources in the non-preferred alternative project would be associated with the movement of construction equipment and workers' vehicles during the construction phase of the Project. Specifically, the gravel parking area adjacent to the existing playing fields may be used as contractor parking and equipment staging areas during construction. However, these impacts are expected to be minimal, short-term, and limited to the period of construction. The non-preferred alternative would not result in a significant long-term increase in traffic. During construction, coordination with local officials would occur as needed to minimize effects to the local traffic patterns and parking.

On-site transportation of excavated material from the salt marsh restoration area to the upland disposal site would be restricted to the existing gravel road system within and immediately adjacent to

the project area. Improvements, such as minor widening or deposition of rock to stabilize the roadbed in low lying areas may be required to support heavy machinery (e.g., dump trucks and front-end loaders). However, the impacts resulting from these improvements would be minor.

The Hackensack River is the only navigable water located in the Project vicinity. The non-preferred alternative identifies minimal excavation activities at the mouth of the primary tidal creek. This activity would not significantly impact the navigability of the Hackensack River. Therefore, there would be no significant impact to water-based transportation.

5.3.16 AIR QUALITY

The Project is located in an ozone non-attainment area. Off-road construction equipment used on-site may produce minor amounts of NAAQS criteria pollutants in the immediate vicinity of the non-preferred alternative project area. However, construction activities would have no significant or long-term impacts on air quality. Based on the current design, emissions calculations indicate the Project is under the conformity threshold value of 25 tons per year for nitrogen oxides and ozone precursors. Measures will be taken during construction as required to minimize particulate circulation due to dust, etc. Therefore, there would be no significant impact to air quality.

5.3.17 NOISE

There would be a minor increase in noise levels in the immediate Project vicinity during construction due to the increase in worker vehicles and traffic, and the operation of construction equipment. However, these impacts are expected to be minimal and short-term, and limited to the period of active construction. There would be no long-term impact on noise levels in the non-preferred alternative project area.

5.3.18 AIR TRAFFIC

The non-preferred alternative project area is also about 3.75 miles from Newark Airport and about 7.4 miles from Teterboro Airport. The project would be within the 5-mile perimeter of Newark Airport as described in the Federal Aviation Administration's (FAA) Advisory Circular 150/5200-33B. These guidelines provide recommendations to land use planners and project developers regarding practices that may attract wildlife populations that are hazardous to air traffic within a 5-mile radius. Impacts of the project on air traffic could potentially include an increase in waterfowl using the area due to the increase in amount of tidal wetlands. Geese in particular rank high on the list of 25 species groups as to relative hazard to aircraft. Other guilds that are likely to use the project area have low hazard rankings. Canada Goose (*Branta canadensis*) and Brant (*Branta bernicla*) are the most likely species that are of concern, but both species are already using the area currently. These species would most likely use the open water component of the proposed project, rather than the spartina wetlands component. "Loafing" as the FAA terms roosting or idle standing, is a behavior common to both resident and migratory populations, however, the well known behavior of loafing by large flocks of resident geese on lawns in parks, airports, sports fields, and corporate lawns and golf courses would be discouraged by the planting of native *Spartina* grasses. Canada Geese are particularly drawn to lawns for two reasons: they can digest grass, and when they are feeding with their young, manicured lawns give them a wide, unobstructed view of any approaching predators. Because *Spartina* grass in its tall form lacks these features it is not likely to attract large numbers or flocks of idle birds or foraging birds.

According to the FAA and other sources, migratory Canada geese have been in decline for over a decade, whereas the population of resident geese has seen near exponential growth. Because they

never leave their familiar year-round habitats, and due to this dramatic increase in population size, resident geese are responsible for most conflicts with urban and suburban owners of agricultural fields and lawns.

Native marshes and restored marshes such as the planned Lincoln Park restoration within the NY/NJ Harbor typically attract small numbers of breeding pairs from Spring through early Summer. Young can be seen with swimming with parents in tidal creeks during the summer and on through the summer molt when many of the birds are temporarily flightless. Geese are in part colonial and congregate in flight in large numbers, especially during Fall migration in October.

The largest areas of congregation at Lincoln Park are within the areas of lawns designated for active and passive recreational use. Highest areas of concentration are within open water lakes especially where lawn and lake meet (personal communication Carl Alderson). Because of the diminishing numbers of migratory geese on the Atlantic flyway and due to the limited numbers of Resident type geese attracted seasonally to a salt marsh, the creation of tidal marsh and tidal creeks are not believed to cause a significant impact to air travel for the non-preferred alternative project area. Consultation with the FAA and the operators of Newark Liberty International will be sought in accordance with the 5-mile radius guideline stated in the Advisory. Avian population monitoring will be conducted for three years post restoration.

5.4 CUMULATIVE IMPACTS

The actions of the Preferred Alternative (either 2.5 or 2.5.1) would have no substantial impacts on adjacent lands or natural resources. And when considered with other unrelated activities that are being planned in the same vicinity or within a similar time frame, the preferred alternative is not anticipated to have adverse cumulative effects. Direct and indirect negative impacts of this alternative would be short-term only and would occur only during the construction period. These impacts would occur from constructing the confined placement area (de-watering) and the wetland excavation area, which would result in temporary air, noise, and visual impacts due to increased volume of vehicles in the Park and on local roads and temporary loss or disturbance of vegetation.

The project area will be contained from contact with the Hackensack River via the construction of a temporary containment wall. Settling basins, silt fencing, sediment curtains and other barriers will control and restrict the release of sediment to the estuary. There are no negative impacts due to increased risk of flooding due to this project alternative. The hydrodynamic analysis, performed using the RMA-2 model, showed that the marsh plain and channel network design allows for proper inundation and drainage of the site as the tide floods and ebbs. The inundation criteria have been met for the site.

The comprehensive restoration of the Lincoln Park West marsh is a priority of the Trustees, the Harbor Estuary Program, the Hudson County Parks system, and of citizens groups at large. The completion of this project would be vitally important to the health of the Hackensack River, and should assist in promoting similar projects within the watershed.

To determine whether components of the actions presented by Alternatives 2.5 and 2.5.1 could cumulatively contribute to potential adverse impacts, the project team identified three activities that are not part of the proposed action which may potentially create cumulative effects. These include increased deposition of sediment from normal tidal exchange; increased nutrient loading; and increased potential for air strike hazard. The Trustees have planned construction elements for the proposed action and will coordinate long-term management plans with the County to reduce potential impacts to the environment to an acceptable level of risk. These are discussed below.

Tidal Exchange and Deposition of Sediment

The Hackensack River is the source of tidal flow into the constructed marsh. When the marsh is constructed the sand cap will provide clean habitat for benthic organisms and a clean environment for finfish and other wildlife that will derive food from benthic organisms. However, tidal exchange with the Hackensack River may result in additional sediment deposition overlaying areas of the clean sand cap.

Sediment test results in the Hackensack demonstrate that the water does contain contaminants consistent with the types found in high concentration in the bottom substrate. Tidal waters incoming from the Hackensack River are likely to carry some amount of contaminated material to the newly restored marsh. This may increase risk of exposure to benthic organisms. At this time it is uncertain what amount of deposition may occur, where it may occur and if the concentrations will pose a risk to the environment. The uncertainty posed by this off-site action requires us to perform due diligence tasks to insure the quality of the habitat. A sediment sampling program has been adopted that will make a yearly assessment of the clean cap and the sediment deposits above the clean cap. The assessment will help determine what, if any, new risk is posed. It is unlikely that deposition on the marsh surface will result in a greater risk to the environment than currently presented by the open landfill containing high levels of several priority pollutants.

Adjacent Golf Course Creating Increased Nutrient Loads

Hudson County Parks Department will be constructing a 9-hole golf course on about 40 acres beyond and adjacent to the marsh and the transitional upland buffer zone. This pending adjacent action may lead to use and runoff of higher levels of nitrogen and phosphorous than has been use and produced at the site to date. Golf courses are often the source of undesirable quantities of nutrient and pesticide runoff into water bodies. To mitigate for possible harm from this action, the County has developed plans and specifications for construction of the golf course which includes a stormwater management design that directs water run-off into a treatment facility. The design would move run-off water into a temporary holding pond, and then into the water treatment plant to be constructed on site. Clean water released from the facility will then be directed on-site underground. All plans for treatment must meet the approval of the NJDEP Freshwater Wetland Permit guidelines. Any negative impacts to the wetland have been avoided by the implementation of this plan.

Adjacent Golf Course Creating an Attractive Nuisance (Resident Canadian Geese)

The action of constructing a golf course adjacent to a wetland will produce uncertain increased activity of nuisance wildlife, particularly Canada Geese. The combined effect of constructing two types of habitats desirable to resident geese, a restored wetland area and a golf course, is uncertain. The geese are considered a nuisance by the State of New Jersey for several reasons. They produce large amounts of fecal matter and they are often destructive to habitats that are essential to other organisms: both plant and animal. To lessen the potential for increased use by Canada Geese, the project team has provided plans and specifications that eliminate all connective mowed lawn pathways between the marsh and the golf course. The area between the course and the wetland will provide a tall grass/shrub buffer between the two areas. Geese are often drawn to sites that allow easy access between lawn and marsh. This action will greatly reduce the desirability of the two habitats taken together. This action will help reduce the likelihood of fecal matter induced nutrient run-off to the marsh.

Geese also present a challenge to air traffic. As stated, the additional action of the golf course will produce uncertain increased activity by geese attracted to the combination of desirable habitats. Lawns, golf courses and wetland activities are given specific mention as geese attractants in the FAA Wildlife Advisory Circular of August 2007. In order to reduce avian airstrike hazard, the FAA’s guidance document suggests that activities that encourage avian use be minimized or restricted within concentric distances of 5,000 ft, 10,000 ft, and a 5-mile range to protect from air strike. For all airports, the FAA recommends a distance of 5 statute miles between the farthest edges of the airport’s Air Operations Area (AOA) and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace. The project is at a distance of 17,950 feet of the closest runway at Newark Liberty International Airport. That is to say, the project is within the outer perimeter area of approach, departure and circling airspace, but outside of the more restrictive interior zones.

In order to assist the FAA, the United States Fish and Wildlife Service (USFWS) Division of Migratory Bird management in cooperation with the USDA produced a “Final Environmental Impact Statement: Resident Canada Goose Management”, dated 2007. The proposed action by the USFWS is Integrated Damage Management and Population Control”. This study found that a combination of lethal and non-lethal controls would be more effective at controlling population than by non-lethal controls alone. A study by NJDEP Division of Watershed Management, “Management of Canada Geese in Suburban Areas” states that an integrated approach is needed. The project team, along with Hudson County Parks Department has reviewed the findings of these studies and has determined to adopt a plan for goose control whereby the methodology is effective and consistent with the findings of these studies. NJDEP and Hudson County have signed an MOA whereby the County Parks Department will provide a written plan to control wildlife nuisance species to within an acceptable level of risk for air strike management. Current personnel at the Hudson County Division of Parks have been overseeing operations at the Hudson County park system, and Lincoln Park in particular, for more than 25 years. The Lincoln Park complex, which is comprised of more than 250 acres, consists of a number of fields, lakes, open spaces, tracks, tennis courts, etc. Over this time, the county has experienced little or no trouble related to resident Canada Geese. Should the implementation of the proposed new projects at Lincoln Park West result in problems associated with these geese, the County is committed to the use of best management practices for wildlife control in addressing such issues.

6.0 COMPLIANCE WITH KEY STATUTES, REGULATIONS, AND POLICIES

Table 14. Federal and State Agency Permits, Approvals, and Consultation Required for the Project

Permits and Approvals	Status	Agency ¹	Action ²
<i>Federal</i>			
Clean Water Act of 1977, as amended	Under Review	USACE, NJDEP, USEPA	Under Section 404, issue a Nationwide 27 Permit.
Coastal Zone Management Act of 1972, as amended	Attached and Under Review	NOAA, NJDEP	Provide a Coastal Consistency Certification for the Project.
Clean Air Act	Completed	USACE, USEPA	Under Section 176, prepare a Clean Air Act General Conformity for the Project.
Endangered Species Act of 1973, as amended	Completed	USFWS, NMFS	Consult on Federally- listed threatened and endangered species.

Marine Mammal Protection Act of 1972, as amended	Completed	USFWS, NMFS	Review of, and comments on, the Project to determine impacts to marine mammals.
Fish and Wildlife Coordination Act, as amended	Completed	USFWS, NMFS, USACE	Consult on wildlife resources and conservation practices.
National Historic Preservation Act of 1966, as amended	Completed	NJHPO (NJDEP)	Per Section 106, review of, and comment on, the Project to determine effects on cultural resources that are listed in, or eligible for listing in, the NRHP.
Executive Order 11988, Floodplain Management	Addressed in EA	USACE	Evaluate the potential effects of the Project with regard to floodplains.
Executive Order 11990, Protection of Wetlands	Addressed in EA	USACE	Evaluate the potential effects of the Project with regard to wetlands.
Farmland Protection Policy Act of 1981, as amended	Addressed in EA	NRCS	Analysis of impacts of the Project on prime and unique farmland.
Water Resources Planning Act of 1965, as amended	Addressed in EA	USACE	Assessment of impacts of the Project on water resources and related land resources.
Wild and Scenic Rivers Act, as amended	Addressed in EA	USDI (NPS), USDA (USFS)	Analysis to determine impacts of the Project on specific river reaches or areas that are classified as “wild, scenic, or recreational.”
Estuary Protection Act, as amended	Addressed in EA	USEPA, NMFS	Evaluate the impacts of the Project on estuarine areas.
Archeological and Historic Preservation Act of 1974, as amended	Addressed in EA	NJHPO (NJDEP)	Evaluation of the impacts of the Project on archaeological and historical resources.

Permits and Approvals	Status	Agency	Action¹
Rivers and Harbors Appropriation Act of 1899, as amended	Addressed in EA	USACE	Evaluate the impacts of the Project on navigable waters.
National Environmental Policy Act of 1969, as amended	Addressed in EA	USACE (Lead Agency)	Evaluation of the impacts of the Project on a broad range of environmental resources.
Coastal Barrier Resources Act (CBRA), Public Law 97-348 (96 Stat. 1653; 16 U.S.C. 3501 et seq.), enacted October 18, 1982	Not Applicable	USFWS	Evaluate potential impacts to coastal barrier systems.
Hazardous, Toxic and Radioactive Waste Guidance	Addressed in EA	USACE	Guidelines for managing hazardous wastes associated with the Project.
Magnuson-Stevens Fishery Conservation and Management Act of 1990	Completed	NMFS	Evaluate the impacts of the Project on anadromous fish species or fishery resources.
Safe Drinking Water Act	Not Applicable	USEPA	Evaluate compliance of the Project on public drinking water supplies.

<i>State and Local</i>			
NJDEP Rules and Regulations – Threatened, and Endangered Species	Completed	NJDEP	Consult on state and Federal listed threatened and endangered species.
NJDEP Rules and Regulations – Freshwater Wetland Protection Act Rules	Under Review	NJDEP	Evaluation of the effects of the Project on existing freshwater wetlands and associated transition areas.
NJDEP Rules and Regulations – Flood Hazard Area Act	Under Review	NJDEP	Evaluation of the effects of the Project on streams.
NJDEP Rules and Regulations – Waterfront Development Permit	Under Review	NJDEP	Evaluation of the effects of the Project on waterfront areas.
Review under State Historic Preservation Act (SHPA)	Completed	NJHPO (NJDEP)	Review to determine effects on properties listed in, or eligible for listing in, the NRHP.
Permit under the State Pollutant Discharge Elimination System (SPDES)	Not Applicable	NJDEP	Evaluation of the effects of the Project on discharges to water bodies.
Permit for Coastal Erosion Hazard Areas	Not Applicable	NJDEP	Evaluation of the effects of the Project on coastal erosion hazard areas.
Water Quality Certification	Under Review	NJDEP	Evaluation of the effects of the Project on water quality.
Soil Erosion and Sediment Control Plan		Hudson County	Plan for the control of soil erosion and sediments.
Transportation Permit		Jersey City	Permit from planning board for truck routing
City Easements		Jersey City	Temporary easement for construction access and activities

Notes: ¹ Review of the Project's Draft EA and Final EA is required before the issuance of permits.

7.0 REFERENCES

- Alderson, Carl, Phillip A. Brown and Christopher Aquila. 2000. Resident Bird Census Classification System - Rules and Guidelines for Breeding Bird Surveys. Natural Resources Group. City of New York Parks & Recreation. In-house Report.
- Bartoldus, C.C., E.W. Garbisch, and M.L. Kraus. 1994. Evaluation for Planned Wetlands (EPW): A Procedure for Assessing Wetland Functions and a Guide to Functional Design. Environmental Concern, Inc., St. Michaels, MD. 287 pp.
- Broome, S.W. 1990. Creation and restoration of tidal wetlands of the Southeastern United States. In Kusler, J.A. and Kentula, M.E., eds. *Wetland Creation and Restoration: The Status of the Science*. Island Press, Washington, DC. pp 37-72.
- Broome, S.W., Seneca, E.D., and Woodhouse, W.W.Jr. 1983. The effect of source, rate and placement of nitrogen and phosphorus fertilizers on growth of *Spartina alterniflora* transplants in North Carolina. *Estuaries* 6: 212-226.
- _____. 1986. Long-term growth and development of transplants of the salt-marsh grass *Spartina alterniflora*. *Estuaries* 9: 63-74.
- Brower, J.E. and J.H. Zar. 1984. *Field and laboratory methods for general ecology*. 2nd ed., Wm. C. Brown, Dubuque, 226 pp.
- Cerrato, R.M. 1986. The Benthic Fauna of Newark Bay (summary). Marine Sciences Research Center, State University of New York, Stony Brook, New York. Special Report 59.
- Chow, Ven, Te. 1959. *Open Channel Hydraulics*, McGraw-Hill, New York.
- Conant, R. and J.T. Collins. 1991. *A Field Guide to Reptiles and Amphibians Eastern/Central North America*. Houghton Mifflin Company, New York, New York. 450 pp.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. FWS/OBS-79/31, Washington, D.C. 103 pp.
- Craft, C.B., Reader, J., Sacco, J.N., and Broome, S.W. 1999. Twenty-five years of ecosystem development of constructed *Spartina alterniflora* (Loisel) marshes. *Ecological Applications* 9: 1405-1419.
- Durkas, S.J. 1992. Impediments to the Spawning Success of Anadromous Fish in Tributaries of the NY/NJ Harbor Watershed. American Littoral Society. 11 pp. + appendix.
- Environmental Laboratory. 1987. *U.S. Corps of Engineers Wetland Delineation Manual*. Tech. Rpt. Y-87-1, U.S. Army Corps of Engineer Waterways Experiment Station, Vicksburg, MS.
- Federal Interagency Committee for Wetland Delineation. 1989. *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington, D.C. Cooperative technical publication.

Gorski, S.W. 2002. Letter Communication on July 22, 2002, from S. Gorski, Field Offices Supervisor, NMFS, Habitat Conservation Division, New Jersey to M. Alvarez, Planning Division, USACE, New York District. (usually cited as NMFS...)

Hatch, Mott, MacDonald (HMM). 2003. County of Hudson County Landfill Closure Plan, Lincoln Park Landfill, Jersey City, New Jersey. HMM No. 208242. December 2003.

Hettler, W.F., Jr. 1989. Nekton Use of Regularly-Flooded Saltmarsh Cordgrass Habitat in North Carolina, USA. *Marine Ecology Progress Series* 56: 111-118.

Hobbel, C. 2001. Personal Communication between Christine Hobbel, Senior Water Quality Specialist, New Jersey Meadowlands Commission, New Jersey, and Kerry Anne Donohue, Hydraulic Engineer, USACE, New York, New York, in September 2001.

Hudson County Economic Development Corporation. 2002. Economic and Demographic Profile, Hudson County, New Jersey, January 2002. Hudson County Economic Development Corporation, Jersey City, New Jersey. 33 pp. www.hudsonedc.org (Retrieved August 25, 2002).

Hudson County Planning Board (HCPB). 2002. 2002 Master Plan, Hudson County, New Jersey. Prepared by Heyer, Gruel & Associates, PA, New Brunswick, New Jersey. Adopted February 20, 2002. 204 pp. <http://www.hudsoncountynj.org/downloads/masterplan.asp> (Retrieved September 30, 2002).

Interagency Work Group on Wetland Restoration. 2002 (pre-print). An Introduction and User's Guide to Wetland Restoration, Creation, and Enhancement. Developed by the Interagency Workgroup on Wetland Restoration: National Oceanic and Atmospheric Administration, Environmental Protection Agency, Army Corps of Engineers, Fish and Wildlife Service, and Natural Resources Conservation Service. 51pp.

Iocco, L.E., P. Wilber, R.J. Diaz, D.G. Clarke, and R.J. Will. 2000. Benthic Habitats of New York/New Jersey Harbor: 1995 Survey of Jamaica, Upper, Newark, Bowery, and Flushing Bays. Final Report. 33 pp. + tables and figures.

Jennings, K.L. 2001. Personal Communication between K. Jennings of Hudson County Division of Parks and Recreation, Jersey City, New Jersey, and USACE, New York, New York.

_____. 2002. Personal Communication between K. Jennings of Hudson County Division of Parks and Recreation, Jersey City, New Jersey, and S. Watts, Project Manager, Northern Ecological Associates, Inc., Portland, Maine, on July 1, 2002.

Kusler, J.A., and M.E. Kentula. 1990. Wetland creation and restoration. Island Press, Washington, D.C.

LaSalle, M.W., M.C. Landin, and J.G. Sims. 1991. Evaluation of the Flora and Fauna of a *Spartina alterniflora* Marsh Established on Dredged Material in Winyah Bay, South Carolina. *Wetlands* 11(2): 191-208.

Levin, L.A., Talley, D., and Thayer, G. 1996. Succession of macrobenthos in a created salt marsh. *Marine Ecology Progress Series* 141: 67-82.

Lord, H.A. 2002. Letter Communication from H. Lord, Data Request Specialist, NJDEP, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program to S. Watts, Project Manager, Northern Ecological Associates, Inc., Portland, Maine, on June 28, 2002.

Meadowlands Environmental Research Institute (MERI). 2003. <http://cimic.rutgers.edu/meri/> (Retrieved February 10, 2003).

Minello, T.J. and Zimmerman, R.J. 1992. Utilization of natural and transplanted Texas salt marshes by fish and decapod crustaceans. *Marine Ecology Progress Series* 90: 273-285.

National Climatic Data Center. 2003. National Environmental Satellite, Data, and Information Service – Precipitation Data. <http://www.ncdc.noaa.gov/oa/ncdc.html> (Retrieved January 2003).

National Marine Fisheries Services (NMFS). 1998. The 1996 Amendments to the Magnuson-Stevens Fishery Conservation and Management Act.

National Oceanographic and Atmospheric Administration, National Ocean Service (NOS). 2001. Center for Operational Oceanographic Products and Services Web Site, Historical Water Level Observations. Station: The Battery, NY, ID # 8518750. <http://coops.nos.noaa.gov/cgi/bin/station> (Retrieved September 2001).

New Jersey Administrative Code (NJAC). 2003. New Jersey Department of Environmental Protection Rules and Statutes. West Publishing Company. <http://www.nj.gov/dep/rules/> (Retrieved August 2003).

New Jersey Department of Environmental Protection (NJDEP). 1986. Anadromous Herring Run Restoration. NJDEP, Division of Fish, Game and Wildlife, Marine Fisheries Administration, Bureau of Marine Fisheries. 30 pp.

_____. 1996a. New Jersey GIS Resources Data CD-ROM Series 1, Volume 1, Freshwater Wetlands and Land Use Land Cover. NJDEP, Office of Information Resources Management (OIRM), Bureau of Geographic Information and Analysis (BGIA), Trenton, New Jersey.

_____. 1996b. New Jersey 1996 State Water Quality Inventory Report: A Report on the Water Quality in New Jersey Pursuant to the New Jersey Water Quality Planning Act and Section 305(b) of the Clean Water Act. 233 pp.

_____. 1997. Technical Manual for Land Use Regulation Program. NJDEP, Bureau of Inland and Coastal Regulations, Coastal Zone Management Permits. Coastal Permit Program Rules (N.J.A.C. 7:7). Trenton, NJ.

_____. 1998. Surface Water Quality Standards: New Jersey Administrative Code 7:9B. 120 pp.

_____. 1998. *Guidance for Sediment Quality Evaluations* (November 1998). 32 pp.

_____. 2001. Field Guide to Reptiles and Amphibians of New Jersey. NJDEP, Division of Fish & Wildlife, Endangered & Nongame Species Program. Prepared by J. Gessner and E. Stiles. 37 pp.

_____. 2002a. Mammals of New Jersey. NJDEP, New Jersey Division of Fish and Wildlife. <http://www.state.nj.us/dep/fgw/chkmamls.htm> (Retrieved September 12, 2002).

_____. 2002b. New Jersey Landfill Status Database Search Results. NJDEP, Division of Solid and Hazardous Waste. <http://www.state.nj.us/dep/dshw/> (Retrieved August 6, 2002).

New Jersey Department of Labor. 2002. Office of Labor Planning and Analysis. Division of Labor Market and Demographic Research. Bureau of Labor Force Statistics. Local Area Unemployment Statistics. <http://www.wnjp.state.nj.us> (Retrieved August 5, 2002).

New Jersey Endangered and Nongame Species Program (NJENSP). 2004. Special Concern – Species Status Listing. <http://www.state.nj.us/dep/fgw/ensphome.htm> (Retrieved February 20, 2004).

New Jersey Statutes Annotated (NJSA). 2003. New Jersey Department of Environmental Protection Rules and Statutes. West Publishing Company. <http://www.nj.gov/dep/rules/> (Retrieved August 2003).

New York/New Jersey Baykeeper (NY/NJ Baykeeper). 2002. <http://www.nynjbaykeeper.org/> (Retrieved August 15, 2000).

New York-New Jersey Harbor Estuary Program (NYNJHEP). 1996. Final Comprehensive Conservation and Management Plan for the New York-New Jersey Harbor Estuary Program, including the Bight Restoration Plan.

New York/New Jersey Harbor Spill Restoration Committee. 1996. Natural Resource Restoration Plan for Oil and Chemical Releases in the New York/New Jersey Harbor Estuary. Draft Report.

Rasmussen, P.W., Heisey, D.M., Nordheim, E.V., and Frost, T.M. 1993. Time series intervention analysis: unreplicated large-scale experiments. In Scheiner, S.M. and Gurevith, J., eds. Design and Analysis of Ecological Experiments. Chapman and Hall, New York.

Sacco, J.N., Seneca, E.D., and Wentworth, T. 1994. Infaunal community development of artificially established salt marshes in North Carolina. *Estuaries* 17: 489-500.

Schwarz, C. 1998. Impact Studies. www.math.sfu.ca/stats/Courses/Stat-650/Notes/Handouts/node108.html.

Shisler, J.K. 1990. Creation and restoration of tidal wetlands of the northeastern United States. In Kusler, J.A. and Kentula, M.E., eds. Wetland Creation and Restoration: The Status of the Science. Island Press, Washington, DC. pp 143-170.

Smith T.J. and Odum, W.E. 1981. The effect of grazing by snow geese on coastal salt marshes. *Ecology* 62: 98-106.

Staples, J.C. 2002. Letter Communication from J. Staples, Assistant Supervisor, United States Fish and Wildlife Service, New Jersey Field Office to S. Watts, Project Manager, Northern Ecological Associates, Inc., Portland, Maine, on July 15, 2002.

Stewart-Oaten, A., Murdoch, W.M., and Parker, K. 1986. Environmental impact assessment: “pseudo-replication” in time? *Ecology* 67: 929-940.

The Louis Berger Group, Inc. 2001. Marsh Resources Meadowlands Mitigation Bank Phase 2 – Hydrologic and Hydraulic Analysis Report. Prepared for Marsh Resources, Inc. March 2001.

- Thien, S.J. 1979. A flow diagram for teaching texture-by-feel analysis. *Journal of Agronomic Education*. 8:54-55.
- Tiner, R.W. 1985. *Wetlands of New Jersey*. United States Fish and Wildlife Service, National Wetland Inventory, Newton Corner, MA. 117 pp.
- Trapp, H. and M.A. Horn. 1997. *Groundwater Atlas of the United States, Segment 11, Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, and West Virginia*. Hydrologic Investigations Atlas 730-L. United States Geological Survey (USGS). Reston, VA. 24 pp.
- United States Army Corps of Engineers (USACE). 1987. *Newark Bay/Kill Van Kull Navigation Project. Final Supplement to the Final Environmental Impact Statement. Appendices*. January 1987. USACE, New York District.
- _____. 1998. *Existing Biological Data for the New York and New Jersey Harbor: 1998*. USACE, New York District.
- _____. 1999a. *Section 1135 Program Preliminary Restoration Plan, Lincoln Park West Habitat Restoration Project, Jersey City, New Jersey*. Prepared on November 16, 1999.
- _____. 1999b. *Water Resources Policies and Authorities – Ecosystem Restoration – Supporting Policy Information*. Department of the Army, Washington, DC. Engineer Pamphlet (EP) 1165-2-502.
- _____. 2000a. *Final Draft Fish Survey Report. South River Flood Control and Ecosystem Restoration Project, South River, New Jersey*. Prepared by Northern Ecological Associates, Inc., Portland, Maine, for USACE, New York District.
- _____. 2000b. *South River Fish Data Documentation. South River Flood Control and Ecosystem Restoration Project, South River, New Jersey*. Prepared by Northern Ecological Associates, Inc., Portland, Maine, for USACE, New York District.
- _____. 2000c. *Planning Guidance Notebook*. Department of the Army, Washington, D.C. Engineer Regulation (ER) 1105-2-100.
- _____. 2000d. *Final South River Restoration Monitoring Plan. South River Flood Control and Ecosystem Restoration Project, South River, New Jersey*. Prepared by Northern Ecological Associates, Inc. Portland, Maine, for USACE, New York District.
- _____. 2001. *Resource Management Associates (RMA)-2, Waterways Experiment Station Version 4.5*, WexTech Systems, Valhalla, New York.
- _____. 2002a. *Lincoln Park West Final Community Mapping and Vegetation Field Sampling Report*. Prepared by Northern Ecological Associates, Inc. Portland, Maine, for USACE, New York District. 18 pp. + appendices.
- _____. 2002b. *Lincoln Park West Wetlands Report – Salt Marsh Restoration Wetlands Delineation, Jersey City, New Jersey*. Prepared by Kupper Associates, Piscataway, New Jersey for USACE, New York District. 7 pp. + appendices.

_____. 2002c. Lincoln Park West Draft Evaluation for Planned Wetlands Data and Documentation, Lincoln Park West, Section 1135 Project, Jersey City, New Jersey. Prepared by Northern Ecological Associates, Inc., Portland, Maine, for USACE, New York District. 11 pp. + appendices.

_____. 2002d. Lincoln Park West Spring/Summer and Fall Nekton Field Sampling Report. Lincoln Park West, Section 1135 Project, Jersey City, New Jersey. Prepared by Northern Ecological Associates, Inc., Portland, Maine, for USACE, New York District. 48 pp. + appendices.

_____. 2002e. Rahway River Nekton Sampling Final Data and Documentation, Spring and Fall Sampling Events. Rahway River, New Jersey, Section 1135 – Project Modifications to Improve the Environment. Prepared by Northern Ecological Associates, Inc., Portland, Maine, for USACE, New York District. 21 pp + appendix.

_____. 2002f. Lincoln Park West Final Spring/Summer and Fall Wildlife Field Sampling Report. Lincoln Park West, Section 1135 Project, Jersey City, New Jersey. Prepared by Northern Ecological Associates, Inc., Portland, Maine, for USACE, New York District. 19 pp. + appendices.

_____. 2002g. Lincoln Park West Final Spring/Summer and Fall Avian Field Sampling Report. Lincoln Park West, Section 1135 Project, Jersey City, New Jersey. Prepared by Northern Ecological Associates, Inc., Portland, Maine, for USACE, New York District. 27 pp. + appendices.

_____. 2003. Draft Phase IA Cultural Resources Investigation for the Lincoln Park West Section 1135 Project, Jersey City, Hudson County, New Jersey. Prepared by Panamerican Consultants, Inc., Buffalo, New York, for USACE, New York District.

_____. 2006. Lincoln Park West Draft Ecosystem Restoration Report/Environmental Assessment. Lincoln Park West, Section 1135 Project, Jersey City, New Jersey. Prepared by Northern Ecological Associates, Inc., Portland, Maine, for USACE, New York District. 105 pp. + appendices.

United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS). 1990. New Jersey Important Farmlands Inventory: Prime Farmlands.

United States Environmental Protection Agency (USEPA). 1978. Protective Noise Levels. A Supplement to the USEPA Report: Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA/ONAC 550/9-74-004, March, 1974, Office of Noise Abatement and Control, Washington, D.C. United States.

_____. 1994. Priority Wetlands for the State of New Jersey. USEPA, Region 2, Marine and Wetlands Protection Branch.

_____. 2002a. USEPA Superfund Sites. <http://www.epa.gov/superfund/sites/index/htm> (Retrieved August 6, 2002).

_____. 2002b. Currently Designated Nonattainment Areas for All Criteria Pollutants. <http://www.epa.gov/oar/oaqps/greenbk/> (Retrieved August 9, 2002).

United States Fish and Wildlife Services (USFWS). 1996. Significant Habitats and Habitat Complexes of the New York Bight Watershed. United States Department of the Interior, Fish and Wildlife Service, Southern New England – New York Bight Coastal Ecosystems Program Office, Charlestown, Rhode Island. 1,025 pp.

_____. 1997. Significant Habitats and Habitat Complexes of the New York Bight Watershed: Hackensack Meadowlands, Complex #19. http://training.fws.gov/library/pubs5/web_link/text/hm_form.htm (Retrieved July 15, 2002).

_____. 1998. Assessment of the Dredged Material Management Plan for the Port of New York and New Jersey. Draft Fish and Wildlife Coordination Act, Section 2b Report. Pleasantville, New Jersey.

_____. 2003. Planning Aid Letter from Clifford G. Day, Supervisor, USFWS, to Leonard Houston, Chief, Environmental Analysis Branch, New York District, USACE, on 18 April 2003.

_____. 2004. Final Fish and Wildlife Coordination Act Section 2(b) Report. Lincoln Park West 1135 Ecosystem Restoration Project, Jersey City, Hudson County, New Jersey. 15 pp.

United States Geological Survey (USGS). 1986. National Water Summary 1985: Hydrologic Events and Surface-Water Resources. USGS Water-Supply Paper 2300. U.S. Government Printing Office, Washington, DC. 506 pp.

_____. 1988. National Water Summary 1986: Hydrologic Events and Ground-Water Quality. USGS Water-Supply Paper 2325. U.S. Government Printing Office, Washington, DC. 560 pp.

_____. 1997. Groundwater Atlas of the United States, Segment 11, Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, and West Virginia. Hydrologic Investigations Atlas 730-L. USGS, Reston, VA. Prepared by H. Trapp and M.A. Horn. 24 pp.

U.S. Department of Transportation Federal Aviation Administration. Aug 2007. Advisory Circular (AC) 150/5200-33B, *Hazardous Wildlife Attractants on or near Airports*. Section 1-4, *Protection of Approach, Departure, and Circling Airspace*.

Weinstein, M.P. and J.H. Balletto. 1999. Does the Common Reed, *Phragmites australis*, Affect Essential Fish Habitat? *Estuaries* 22(3B): 793-802.

Woods Hole Group, Inc. (WHG). 2000a. Tidal Datum Analysis for Hackensack Meadowlands Development Commission – Berrys Creek Canal Tide Gauge. Prepared for the Hackensack Meadowlands Development Commission, December, 2000.

_____. 2000b. Tidal Datum Analysis for Hackensack Meadowlands Development Commission – Mill Creek Tide Gauge. Prepared for the Hackensack Meadowlands Development Commission, April, 2000.

_____. 2001. Tidal Datum Analysis for Hackensack Meadowlands Development Commission – Riverbend Tide Gauge. Prepared for the Hackensack Meadowlands Development Commission, September, 2001.

Zedler, J.B. 1993. Canopy architecture of natural and planted cordgrass marshes: selecting habitat evaluation criteria. *Ecological Applications* 3: 123-138.

Zeff, M.J. 1999. Salt marsh tidal channel morphometry: applications for wetland creation and restoration. *Restoration Ecology* 7: 205-211.

Zich, H.E. 1977. The Collection of Existing Information and Field Investigation of Anadromous Clupeid Spawning in New Jersey. New Jersey Division of Fish, Game and Shellfisheries. Report No. 41M. 28 pp.

8.0 LIST OF PREPARERS

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Gwendolyn McCarthy	Legal Counsel	Review and comment on RPEA (NOAA 2009)
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Steve McDevitt	GIS Specialist, Planning Division	Provided final preferred alternative (i.e., NER Plan) design.
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Kerry Anne Donohue	Hydraulic Engineer, Civil Resources Branch; Engineering Division	Assisted in all phases of the Project. Developed and designed restoration alternatives; conducted hydrodynamic modeling, surveying, and tidal analysis; provided technical assistance with Topography, Geology, Soils and Water Resources sections; and, prepared Description of Restoration Alternatives and Costs.
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Hudson County Division of Parks and Recreation		
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Northern Ecological Associates, Inc. (NEA)		
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Sarah C. Watts	Project Manager (NEA)	ERR/EA (2006) Manager, Technical Review. Assist with development of Restoration Alternatives; and, prepare Introduction, Purpose and Need, Problem and Opportunity Identification, Existing Environment, Description of Benefits, CE/ICA, National Ecosystem Restoration Plan, Environmental Impacts, Project Implementation, Public and Agency Involvement and Scoping, Summary and Conclusions, Recommendations, and List of Preparers sections.
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Stephenie Swiezynski	Environmental Scientist	Prepare Topography, Geology and Soils, Socio-economics – Population, Economy, Income, and Employment, and Education sections.
Karla Hyde	CAD/GIS Specialist	Prepare ERR/EA Figures and perform acreage calculations.
Janelle Lavallee	CAD/GIS Specialist	Prepare ERR/EA Figures and perform acreage calculations.
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