EXPEDITED RECONNAISSANCE STUDY

Section 905(b) (WRDA 86) Preliminary Analysis

Hudson - Raritan Estuary Environmental Restoration

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1. STUDY AUTHORITY

The Hudson - Raritan Estuary Environmental Restoration Study is being carried out under the Corps of Engineers' General Investigations (GI) Program. The study was authorized in a resolution of the Committee on Transportation and Infrastructure of the U.S. House of Representatives, dated 15 April 1999, which reads:

> *"Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That, the Secretary of the Army is requested to review the reports of the Chief of Engineers on the New York and New Jersey Channels, published as House Document 133, 74th Congress, 1st Session; the New York and New Jersey Harbor Entrance Channels and Anchorage Areas, published as Senate Document 45, 84th Congress, 1st Session; and the New York Harbor, NY Anchorage Channel, published as House Document 18, 71st Congress, 2nd Session, as well as other related reports with a view to determining the feasibility of environmental restoration and protection relating to water resources and sediment quality within the New York and New Jersey Port District, including but not limited to creation, enhancement, and restoration of aquatic, wetland, and adjacent upland habitats."*

Funds to conduct the Section 905(b) Preliminary Analysis were provided in the FY 2000 Energy and Water Development Appropriations Act (House Report 106-336).

2. STUDY PURPOSE

The purpose of this reconnaissance study is to evaluate the potential for Federal interest in implementing solutions to environmental degradation and other related water resource and sediment problems and needs, including environmental restoration and protection, within the New York and New Jersey Port District. If Federal interest is demonstrated, the study will also result in the development of a Project Study Plan (PSP) and the negotiation of a Feasibility Cost Sharing Agreement (FCSA) with the non-Federal partners for the next phase of study.

3. LOCATION OF PROJECT/CONGRESSIONAL DISTRICT

3.1 Project Location

The New York and New Jersey Port District (The Port District) is delineated as the surrounding greater metropolitan New York City region within an approximate 25-mile radius of the Statue of Liberty in the New York - New Jersey harbor. This highly developed urban area encompasses

approximately 2,000 square miles with an average density of nearly 6,000 people per square mile (see figure 1).

The Port District is centered around the New York - New Jersey Harbor, which is located in the Hudson - Raritan Estuary System (HRES). The HRES extends from the Sandy Hook-Rockaway Transect north up the Hudson River to the Tappan Zee Bridge. It includes the tidally influenced portions of rivers flowing into the system including the Hackensack, Passaic, Raritan, Shrewsbury, and Navesink Rivers, the Harlem River, and the East River from the Battery through Hells Gate to the Long Island Sound (LIS). The HRES also includes the western portion of the Long Island Sound (LIS) extending east to Greenwich Cove, Connecticut on the north shore of the LIS and Matinecock Point, Long Island, New York on the south shore.

The geographic location of the HRES coincides with the core of the New York Bight region and habitat complex. The New York Bight region forms the northern portion of the Mid-Atlantic Bight Region of the North Atlantic Ocean. The New York Bight region drains an extensive watershed extending from the Adirondack Mountains to the north, the drainage areas of the Hackensack River, the Passaic River, the Raritan River, and the Shrewsbury/Navesink Rivers to the west, and the Coastal Plain flatlands of southern Long Island and areas of Westchester County and Connecticut to the east. The open water area of the New York Bight region extends south from New York Harbor along southeastern New Jersey to the mouth of Delaware Bay, east along southern Long Island to Montauk Point, and seaward to the edge of the continental shelf.

3.2 Congressional Districts

The Port District is located in two states, New York and New Jersey, and encompasses 26 Congressional Districts. Table 1 lists the affected Congressional Districts and their representatives.

Table 1. Congressional Districts and Representatives

New Jersey		New York	
District	**Senator/Representative**	**District**	**Senator/Representative**
NJ	Honorable Frank Lautenberg	NY	Honorable Charles E. Schumer
NJ	Honorable Robert G. Torricelli	NY	Honorable Daniel P. Moynihan
NJ-05	Honorable Marge Roukema	NY-03	Honorable Peter T. King
NJ-06	Honorable Frank Pallone, Jr.	NY-04	Honorable Carolyn McCarthy
NJ-07	Honorable Bob Franks	NY-05	Honorable Gary L. Ackerman
NJ-08	Honorable William J. Pascrell, Jr.	NY-06	Honorable Gregory W. Meeks
NJ-09	Honorable Steven R. Rothman	NY-07	Honorable Joseph Crowley
NJ-10	Honorable Donald M. Payne	NY-08	Honorable Jerrold Nadler
NJ-11	Honorable Rodney Frelinghuysen	NY-09	Honorable Anthony D. Weiner
NJ-12	Honorable Rush Holt	NY-10	Honorable Edolphus Towns
NJ-13	Honorable Robert Menendez	NY-12	Honorable Nydia M. Velazquez
		NY-13	Honorable Vito J. Fossella
		NY-14	Honorable Carolyn B. Maloney
		NY-15	Honorable Charles B. Rangel
		NY-16	Honorable Jose E. Serrano
		NY-17	Honorable Eliot L. Engel

New Jersey		New York	
District	**Senator/Representative**	**District**	**Senator/Representative**
		NY-18	Honorable Nita M. Lowey
		NY-19	Honorable Sue Kelly
		NY-20	Honorable Benjamin A. Gilman

4. PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS

4.1 Prior Studies and Existing Projects – Navigation and Flood Control

The first Federal navigation improvements to the HRES were originally authorized by the River and Harbors Act of 1874. Since that time there has been continuous improvement and maintenance of navigation channels within the HRES. Most of the improvements consisted of deepening and realignment of formerly natural channels that would maintain an estimated natural depth of less than 20 feet MLW. There are currently more than 200 miles of Federally maintained channels in the HRES. A listing of the authorized Federal navigation projects in the HRES is provided in Attachment 1.

The first Federal flood control projects in HRES watershed were authorized by the Flood Control Act of 1937. Since the 1960's there has been an extensive flood control effort implemented in the HRES watershed. There are Federal flood control projects on many of the rivers and streams in the watershed. These projects typically focus on the protection of low lying areas from tidal surges and stream bank overflow during storm events. Structural elements of flood control projects in HRES watershed include dams, levees, tide gates, flood walls, floodwater diversion tunnels, by-pass channels, stream channel modifications, and retention ponds. A listing of the authorized Federal flood control projects in the HRES is also provided in Attachment 1.

4.2 Prior Studies and Existing Projects – Ecosystem Restoration

A number of ongoing studies and reports by the New York District have recommended aquatic ecosystem restoration at a variety of locations within the Port District, evincing the strong level of Federal, state and local support for restoration within the HRES. The following is a listing of these reports, including a brief description of ecosystem restoration opportunities identified in each report and the current status of the study.

Jamaica Bay Ecosystem Restoration Project: Reconnaissance Report. December 1995.

The reconnaissance study identified two approaches to aquatic ecosystem restoration in Jamaica Bay: recontouring of selected areas of the Bay bottom to restore flow patterns and flushing rates that will benefit benthic and fishery habitats and site specific restoration measures, such as regrading, ditching, vegetative plantings, and dike removal designed to improve local habitat value. Plans for recontouring the Bay bottom are being coordinated with current point and non-point source control efforts, such as Combined Sewer Overflow (CSO) controls. The feasibility study commenced FY1996 and is currently scheduled for completion in FY2002.

Specific restoration sites and associated measures identified in the reconnaissance report include:

- Dead Horse Bay: excavate fill, regrade and replant to establish salt marsh;
- Gerritsen Creek: establish salt marsh and upland scrub shrub forest to complement existing restoration efforts by NYC Department of Parks and Recreation;
- Paerdegat Basin: recontour tributary bottom, establish fringe salt marsh and adjacent scrub shrub forest;
- Fresh Creek: recontour tributary bottom, establish fringe salt marsh and adjacent scrub shrub forest;
- Spring Creek: extensive *Phragmites* removal, regrade and replant to establish low and high salt marsh, scrub shrub forest, and upland grasslands;
- Hawtree-Bergen Basins: expand salt marsh, restore sand dune and vegetation;
- Bayswater State Park: replace deteriorated breakwater with environmentally compatible wave attenuation structure, extensive Phragmites removal, establish low and high salt marsh;
- Dubos Point: restore tidal creeks, regrade and replant to establish salt marsh;
- Brant Point: install environmentally compatible wave attenuation structure, regrade and replant to establish salt marsh and dune vegetation;
- Investigate options to improve flushing and water quality in back bay area by
  - installing culvert(s) at JFK Airport South Runway Extension to restore hydrologic connection between east and west sides of Grassy Bay;
  - filling in burrow pits to return historical depths at Grassy Bay;
  - deepening and/or widening channels leading to back bay
- Investigate extent and causes of local water quality problems at Goose Pond;
- Oyster Reef Construction: create an Eastern Oyster (*Crassirostris virginica*) reef at a suitable location to be determined in Jamaica Bay; and
- Eelgrass Restoration: plant eelgrass (*Zostera marina*) at suitable locations to be determined in Jamaica Bay.

Since preparation of the reconnaissance study, a Feasibility Cost Sharing Agreement (FCSA) has been executed and feasibility phase investigations are underway for the Jamaica Bay Ecosystem Restoration Project. The New York City Department of Environmental protection is the feasibility study non-Federal partner.

<u>South River Flood Control and Ecosystem Restoration Project: Reconnaissance Report. March 1995.</u>

The project area is the South River from the Durhernal Lake Dam to the confluence with the Raritan River in Middlesex County, New Jersey. Long-term commercial and industrial activities in and around the South River have led to the loss and degradation of many of the areas natural resources, resulting in a corresponding reduction in plant, animal, and habitat diversity and abundance.

The proposed restoration site is a contiguous 350-acre area bounded by the Washington Canal to the east, the South River to the south and west, and the Raritan River to the north. Identified

restoration opportunities include: creation of high emergent marsh, creation of intertidal mudflat, creation of a tidal creek ecosystem, creation of forest/scrub-shrub habitat, and creation of a permanently flooded tidal pond. The Federal Cost Sharing Agreement was executed in March 1996. The feasibility study is in progress and is scheduled for completion in 2001. The New Jersey Department of Environmental Protection is the feasibility study non-Federal partner.

Hudson River Ecosystem Restoration Project: Reconnaissance Report. December 1995.

The reconnaissance analysis focused on aquatic ecosystems of the Hudson River north of the Tappan Zee bridge. The overall project will be studied in four phases. The first phase identified restoration opportunities at three degraded wetland sites. Restoration measures include fill removal, regrading, and restoration of hydrologic connections. The Federal Cost Sharing Agreement was executed in September 1996. The feasibility study is in progress and the first phase is scheduled for completion in 2001. The New York State Department of Environmental Conservation and the New York State Department of State are the feasibility study non-Federal partners.

Specific restoration sites and associated measures being developed in the first phase of the feasibility study include:

- Mill Creek Marsh: re-establish tidal marsh elevations and restore hydrologic connection;
- Schodack – Houghtaling South: fill removal, regrading, and establish buffer zone; and
- Schodack – Houghtaling North: fill removal, regrading, and expansion of fringe marsh with shoreward buffer zone.

Flushing Bay and Creek Ecosystem Restoration Project: Reconnaissance Report. April 1996.

The reconnaissance study identified four major categories of aquatic ecosystem restoration, which include improvement of water chemistry through increased flow and flushing rates, tidal wetland restoration, freshwater wetland restoration, and bank/shoreline stabilization. Measures identified to improve flow and flushing rates include dredging of Flushing Bay and Creek, partial or total removal of the dike at LaGuardia Airport, and reorientation of the Federal navigation channel. Assessment of these measures would be coordinated with current Combined Sewage Overflow control programs. The proposed restoration measures are anticipated to double the acreage of existing tidal wetlands within the Flushing Bay and Creek watershed, and restore ecosystem functions and value to existing degraded wetland sites. The Federal Cost Sharing Agreement was executed in September 1999. The feasibility study is in progress and is scheduled for completion in 2002. The Port Authority of New York and New Jersey and the New York City Department of Environmental Protection are the feasibility study non-Federal partners.

Specific restoration sites and associated measures identified in the reconnaissance report include:

- Willow Lake: extensive *Phragmites* removal, regrade and replant to establish sedge and emergent sedge wetlands;

- Flushing Creek: extensive *Phragmites* removal, regrade and replant to establish high and low salt marsh, establish forested upland buffer zones;
- Roosevelt Avenue at Flushing Creek: extensive *Phragmites* removal, regrade and replant to establish high and low salt marsh, establish forested upland buffer zones; and
- Various locations on the western shore of College Point: stabilize shoreline, install wave attenuation structure, regrade and replant to establish salt marsh.

Since preparation of the reconnaissance study, a Feasibility Cost Sharing Agreement (FCSA) has been executed and feasibility phase investigations are underway for the Flushing Bay Ecosystem Restoration Project.

The Rahway and Woodbridge River Basins, New Jersey, Flood Control and Environmental Restoration Project: Reconnaissance Report. July 1999.

The reconnaissance report identified restoration measures at four sites along the Rahway River and its tributaries, and one site along the Woodbridge River. Proposed restoration measures will connect or expand existing wetlands, and address multiple objectives such as habitat diversity, threatened and/or endangered species habitats, and recreational areas. Significant aspects of the proposed restoration measures include relocation or reconfiguration of a levee at the Rahway River, reconnection of the stream channel and its historic floodplain along stretches of the Rahway River, and increasing tidal exchange at wetland areas of the Woodbridge River. The report also proposes a CSO inventory of the Rahway River in support of the identified restoration measures.

Specific restoration sites and associated measures identified in the reconnaissance report include:

- Northern portion of Joseph Medwick Park in Carteret: reconnect approximately 14 acres of isolated wetlands to the river system and increase tidal flow;
- Ashbrook - Robinson's Branch complex: restore streambank morphology and riparian habitat, stabilize stream banks, and expand fringing wetlands;
- East Branch and mainstem of the Rahway River, in Millburn, Springfield, Maplewood and South Orange: connect and expand highly fragmented wetlands, replace invasive species with natural vegetation; and
- Woodbridge River at Port Reading: wetland restoration at two parcels adjacent to an existing NJDEP restoration project.

The Section 905(b) Preliminary Analysis has been certified by HQUSACE and the feasibility phase is anticipated to be initiated in FY 2000 upon execution of the Feasibility Cost Sharing Agreement (FCSA).

Bronx River Basin Ecosystem Restoration Project: Reconnaissance Report. August 1999.

The reconnaissance report identified restoration measures at 18 sites. Proposed restoration measures will increase base flow in the Bronx River, re-establish the connection between the stream and its floodplain, and re-establish freshwater wetlands and salt marsh. These measures will significantly increase habitat value in the Bronx River Basin. The report also proposed a

comprehensive watershed management plan as a product of the feasibility phase analysis. Restoration measures in the Bronx River Basin would be coordinated with the efforts of the Use and Standards Attainment Study currently ongoing in the Bronx River.

Specific restoration sites and associated measures identified in the reconnaissance report include:

- Six Pond Locations in Westchester County: Increase stream flow, restore floodplain wetlands, re-introduce native wetland and riparian forest plant species;
- Old Yonkers Mill: regrade and replant to restore floodplain wetlands, remove structure for canoe and fish passage;
- Shoelace Park and areas north: regrade and replant to restore floodplain wetlands, re-introduce native wetland and riparian forest plant species, reconstruct trail;
- Parkland surrounding Burke Ave. bridge: regrade and replant to restore floodplain wetlands, re-introduce native wetland and riparian forest plant species, stabilize stream bank;
- Bronx Zoo north and south ponds: restore floodplain wetlands;
- 180th Street dam: assess potential for fish passage;
- Starlight Park area: restore wetlands for storm water retention, reconfigure bank to improve habitat;
- 172nd Street weir: improve stream flow, remove flow and fish passage impediment, restore tidal wetlands and vegetative buffer;
- Abandoned Cement plant and docks: create mussel habitat, restore shoreline access, create vegetative riparian buffer;
- Hunts Point: restore tidal wetlands, reconfigure bank to improve habitat;
- Soundview park area: Restore tidal wetland, remove fill and reconfigure bank to improve habitat; and
- Soundview Lagoon area: increase flow and flushing rate by breaching (removing) rock armor jetty, restore tidal wetlands, reconfigure banks to improve habitat.

The Section 905(b) Preliminary Analysis has been certified by HQUSACE and the FCSA is currently being negotiated with the potential non-Federal sponsors.

Saw Mill River Basin Ecosystem Restoration Project: Reconnaissance Report. September 1999.

The reconnaissance report identified restoration measures at 9 sites. Proposed restoration measures will increase base flow in the Saw Mill River, re-establish the connection between the stream and its floodplain, and re-establish freshwater wetlands. These measures will significantly increase habitat value in the Saw Mill River Basin. The report also proposed a comprehensive watershed management plan as a product of the feasibility phase analysis.

Specific restoration sites and associated measures identified in the reconnaissance report include:

- New Castle duck pond: Sediment trapping, regrade and replant to establish wetlands; aquatic habitat restoration;
- Tertia Brook at New Castle: Riparian restoration; improved flood conveyance;
- Elmsford former stump dump: Riparian restoration, water chemistry improvements; connection of rails-to-trails pathway;

- Woodlands Lake at Irvington: Support county restoration effort with sediment trap; regrade and replant to restore wetlands; and bank stabilization;
- Chestnut Ridge Way at Dobbs Ferry: replant and regrade to restore wetlands;
- Mt. Hope Cemetery at Hastings-on-Hudson: replant and regrade to restore wetlands; flood detention;
- Nepera Park in Yonkers: Riparian restoration; in-stream habitat enhancements;
- Carpet Mills Complex in Yonkers: Urban stream restoration; and
- Larkin Plaza in Yonkers: "Daylighting" covered reach.

The Section 905(b) Preliminary Analysis has been certified by HQUSACE and the FCSA is currently being negotiated with the potential non-Federal sponsor.

Continuing Authorities Program: Lincoln Park Preliminary Restoration Plan: November 1999.

Lincoln Park is located in Jersey City on the Hackensack River. The area is adjacent to former dredge disposal sites. Restoration is being investigated under authority of section 1135 of WRDA 1986. The site includes approximately 100 acres of woodland, open waters, and degraded tidal wetlands dominated by monocultural stands of *Phragmites*. A significant salt marsh restoration opportunity has been identified at this site. Restoration measures include fill removal and restoration of tidal flow. Work on the Environmental Restoration Report began in February 2000. The Environmental Restoration Report is scheduled for completion in May 2001. The non-Federal partner is the New Jersey Department of Environmental Protection.

Beneficial Uses of Dredged Material for Habitat Creation, Enhancement, and Restoration in New York – New Jersey Harbor. Draft February 1999.

This report describes various potential beneficial uses of dredged material for habitat development. Beneficial uses identified in this report include: creation of upland habitat, restoration of borrow pits, creation of wetlands for treatment and wetlands for habitat, recontouring for restoration of shallow water habitat, filling of dead end basins, creation of artificial reefs, creation of bird habitat, creation of shellfish habitat such as oyster reefs and mud flats, and creation of submerged aquatic vegetation habitat. Specific candidate sites are described for:

- Borrow pit restoration: Jamaica Bay and Lower New York Bay;
- Treatment wetlands: Bergen Basin and Thurston basin;
- Bird habitat: Hoffman and Swinburne Islands, and Floyd Bennett Field;
- Filling highly degraded dead end basins: Newtown Creek and Gowanus Creek; and
- Artificial reefs: New York Bight.

Document finalization is anticipated for FY 2000.

Existing Biological Data for New York and New Jersey Harbor. March 1998.

The New York and New Jersey Harbor Baseline Biological Reconnaissance Survey: April 1999.

These two reports provide an extensive and current assessment of existing environmental conditions within the New York – New Jersey Harbor.

4.3 Prior Studies and Reports by Others

The existing literature relating to the Port District ecosystems is too extensive to list in its entirety in this document. The titles of key comprehensive survey documents used to guide the reconnaissance analysis include the following:

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

Northeast Coastal Areas Study: Significant Coastal Habitats of Southern New England and Portions of Long Island, New York. U.S. Fish and Wildlife Service, Southern New England – New York Bight Coastal Ecosystems Program. Charlestown, RI. August 1991.

New York/New Jersey Harbor Estuary Program Comprehensive Conservation and Management Plan. New York/New Jersey Harbor Estuary Program.

Long Island Sound Study: Comprehensive Conservation and Management Plan. Long Island Sound Estuary Program.

New York/New Jersey Harbor Estuary Program Habitat Workgroup Acquisition and Restoration Priorities Sites List. New York/New Jersey Harbor Estuary Program. Undated.

5. PLAN FORMULATION

5.1 General

The New York District coordinated with interested Federal, State and local entities, and citizen groups to identify problems and formulate potential solutions for environmental restoration and protection. Information on water resources problems was gathered from numerous public agencies, private organizations, and individual citizens during public meetings and meetings with other Federal and non-Federal resource agencies. The New York/New Jersey Harbor Estuary Program (HEP) Habitat Workgroup was instrumental in the identification of ecosystem degradation problems and restoration opportunities. Site visits were conducted by the New York District to further identify problems and opportunities, formulate reconnaissance level alternatives, and determine the type and scope of investigations, which would be included in a feasibility study.

The following criteria were established to identify, evaluate and select potential alternatives:

- There is a strong likelihood of developing a technologically feasible and cost effective project, using proven technology;

- Ecological resources within the study area are of demonstrated national, regional or local significance;
- There is a reasonable probability that the identified projects will contribute significantly to improvement in the ecosystem of the HRES;
- There is a clear linkage between implementation of restoration alternatives and measurable improvements in the ecosystem;
- The identified alternatives are within the authority of the Corps of Engineers and the non-Federal partner to implement;
- There is a reasonable assurance that a public entity (*i.e.*, state or local unit of government) is capable and willing to participate as a non-Federal partner in a cost shared feasibility study.

During the reconnaissance phase, the New York District conducted an extensive alternative identification and screening process, in cooperation with Federal and state resource agencies and environmental interest groups. First, restoration opportunities were initially identified, then categorized and screened, as follows:

1. Restoration opportunities which met Federal budgetary criteria and should be recommended for inclusion in the feasibility study;
2. Restoration opportunities which met Federal budgetary criteria, but would be more appropriately considered under separate authorities (i.e., Sections 1135 or 206);
3. Restoration opportunities which met Federal budgetary criteria, but are already being considered under separately authorized studies (e.g., Jamaica Bay, Flushing Bay)
4. Restoration opportunities, which have technical merit but do not meet Federal budgetary criteria and should be pursued by state and local interests (e.g., CSO abatement, land use controls).

Only Category 1 restoration opportunities were considered in further detail as potential reconnaissance level alternatives.

5.2 Existing Conditions

A general overview of existing conditions reveals that the HRES contains a wide range of aquatic and terrestrial habitat types in a relatively small geographic area. Wetland habitat was once a dominant feature in the HRES. According to the U. S. Fish and Wildlife Service, approximately 300,000 acres of tidal wetlands and underwater lands have been filled and only about 20% (15,500) acres of the once existing tidal wetlands remain. Freshwater wetlands have been effectively eliminated in many upland areas. The U. S. Fish and Wildlife Service also reports that there were approximately 224,000 acres of freshwater wetlands in New York City prior to the American Revolution. Only a few small, scattered areas of freshwater wetland remain.

There are also scores of degraded tidal creeks in the HRES. Flow reducing structures, such as weirs and tide gates, and stream encroachments caused by rail and road bed structures have restricted tidal exchange. These tidal creek encroachments impede the passage of fish and reduce the tidal reach into the creeks. Estuarine mud flats exist at many locations throughout the HRES. These areas are often littered with debris and the remains of dilapidated coastal structures. Large areas of sand beach and unconsolidated shore are found on the New Jersey and Staten Island shores of Raritan Bay and on the southern shores of Brooklyn, Queens, and Nassau County. These areas support extensive recreational activity that often severely limits their ecological functions. Marine rocky inter-tidal habitats are found on the Westchester County shoreline of Long Island Sound. These areas typically exhibit reduced tidal exchange due to fill and tidal creek encroachments.

A more specific review of existing conditions in the HRES requires a discussion of each of the regionally significant habitat complexes within the HRES. These significant habitat complexes include Jamaica Bay and Breezy Point, Raritan Bay - Sandy Hook Bay, Arthur Kill, Hackensack Meadowlands, the East River Narrows at the western end of the LIS, and the Lower Hudson River.

Jamaica Bay and Breezy Point Habitat Complex. Jamaica Bay is located on the southwestern tip of Long Island. Breezy Point is the western tip of the Rockaway barrier beach to the south of Jamaica Bay and Rockaway Inlet. Jamaica Bay is a saline to brackish, eutrophic estuary covering about 25,000 acres. Nearly all of the wetlands around the perimeter of the Bay have been filled. The center of the bay is dominated by subtidal open water and extensive low-lying islands with areas of salt marsh, intertidal flats, and uplands used by nesting waterbirds. The extensive intertidal areas in the center of the Bay are rich in food resources, which attract a variety of fish, shorebirds, and waterfowl.

The Jamaica Bay and Breezy Point habitat complex has been substantially altered by extensive dredging, filling, and development in and around the Bay. Jamaica Bay exhibits poor water quality, loss of upland and wetland buffer, and degradation of habitat areas. Virtually the entire watershed of Jamaica Bay is urban, which contributes significant runoff and CSO output into the Bay. There are contaminated sediments in the area causing adverse effects on benthic organisms and bioaccumulation further up the food chain. The mean depth of the bay has been increased by dredging from 3 to 13 feet, with some areas dredged deeper than 60 feet, contributing to hypoxic and anoxic conditions in these poorly flushed areas.

Raritan Bay - Sandy Hook Bay Habitat Complex. The Raritan Bay and Sandy Hook Bay habitat complex forms the southeastern portion of the HRES between the southern shoreline of Staten Island, Richmond County, New York, and the northern shoreline of Monmouth County, New Jersey. Raritan Bay - Sandy Hook Bay is a large embayment measuring 109 square miles with a surface area of about 69,188 acres. The inshore portion of the bays within this habitat complex has a total area of 33,500 acres. This area supports several types of habitat including shallow estuarine open waters, sandy beach, maritime forest, salt marsh, mudflats, and riparian forest. There are a few undeveloped areas at the mouths of tidal creeks that have been identified as the last remnants of this type of habitat in the HRES. The Raritan Bay and Sandy Hook Bay habitat

complex also supports the greatest variety of state and federally listed species of all the habitat complexes in the HRES (see Table 2).

Overall, the watershed and shoreline of Raritan Bay has been mostly developed or degraded by urban uses. Sediments in some areas of western Raritan Bay are highly contaminated and oil and chemical spills in the bays and surrounding areas are still common. Western Raritan Bay suffers from extremely low dissolved oxygen concentrations. Direct harvest of shellfish is not permitted in much of the bay due to high fecal bacteria counts and beaches are regularly closed because of excessive bacterial contamination following summer rains. The states of New York and New Jersey have issued continuous health advisories concerning the consumption of shellfish harvested in the area. Recreational beach use creates significant stress on the already diminished natural habitats in this area. Dams at the major rivers, tidal creeks, and tributaries impede anadromous fish runs that historically occurred there.

Arthur Kill Habitat Complex. The Arthur Kill habitat complex includes the northwestern corner of Staten Island in New York City, adjacent portions of the Arthur Kill and Kill van Kull in both New York and New Jersey, and tributaries and wetlands feeding into the Arthur Kill from Union and Middlesex Counties, New Jersey. The area includes all or portions of the Elizabeth River, Morses Creek, Piles Creek, Rahway River, Smith Creek, and Woodbridge Creek. This complex consists of four major habitat groupings: colonial wading bird breeding sites or heronries, waterbird foraging areas, freshwater marshes and wooded swamps, and upland forests. The freshwater wetland areas and forested buffers are some of the only remaining feeding and roosting areas for waterbirds and migratory stopover habitat for songbirds and raptors. This area also contains several plants and natural communities reaching their northeast limit, thus making them rare in New York State.

The wetlands and heronries of the Arthur Kill habitat complex are within one of the most intensively industrialized and urbanized corridors in the northeastern United States. Many wetland and filled coastal areas are dominated by monocultural stands of *Phragmites*. Significant upland and wetland communities are isolated and discontinuous due to urban development. This habitat complex has suffered severe habitat loss and degradation due to extensive physical encroachment and chemical pollution stresses. Sediments in areas of the Arthur Kill are contaminated and toxic. Anadromous fish runs are impeded by dams and other structures on several tributaries. Poor flushing in many areas exacerbates water quality problems.

Hackensack Meadowlands Habitat Complex. The Hackensack Meadowlands habitat complex is located in northeastern New Jersey, in the lower Hackensack River drainage that flows into the northern end of Newark Bay. This habitat complex includes the remaining tidal wetlands and adjacent palustrine wetlands and uplands along the lower Hackensack River and the aquatic habitat and adjacent upland habitat of Overpeck Creek. This 8,400-acre wetland area is the largest remaining brackish wetland complex in the HRES supporting significant concentrations of waterfowl, wading birds, shorebirds, raptors, anadromous fish, and estuarine fish.

The Hackensack Meadowlands is dominated by intertidal and intermittently flooded *Phragmites* marshes. This area also contains shallow tidal bay/mudflats, low salt marsh, remnant high salt marsh, brackish impoundments, freshwater impoundments, and remnant palustrine forest.

Upland habitats found on landfills include grassland, shrubland, and early successional forest. Much of the wetland area in the Meadowlands is degraded due to physical disturbances, such as filling and alterations to natural hydrologic connections, and the prevalence of *Phragmites.* Leachate contamination from extensive landfills in the area is common. Numerous point sources, stormwater runoff from developed areas and highways, and other non-point sources have severely degraded water and sediment quality in areas of the habitat complex.

East River Narrows Habitat Complex. The East River Narrows at the western end of the LIS constitutes the westernmost section of (LIS) between Hells Gate, at the convergence of the Harlem and East Rivers, and the Hempstead Sill, a major shoal area extending north and south across the Sound from Matinecock Point on Long Island, to the New York-Connecticut boundary. Significant habitat types found along the northern shore of this complex are offshore islands with colonial wading bird rookeries, rocky intertidal areas, and tidal wetland areas including marshes, mudflats, tidal creeks, and protected open-water coves. The southern shore of this complex consists of shallow bays separated from each other by prominent necks of land (Great Neck and Manhasset Neck) protruding into LIS. The surrounding shorelines are typically densely urbanized or disturbed. The southern shore of the Narrows complex contains some of the most significant waterfowl wintering concentration areas in the HRES.

Urban coastal development, hydrologic modifications, and the creation of fast land out of wetlands has greatly encroached upon and impacted existing natural ecosystems and fish and wildlife populations. The waters of this area typically suffer from hypoxia in the summer that has caused fish kills in recent years. Water and sediment quality are degraded due to numerous point sources, including leachate from the Pelham Bay landfill and several CSO outfalls. The Bronx River, Hutchinson River, and various tidal creeks contain dams and other structures that impede anadromous fish passage.

Lower Hudson River Habitat Complex. The Lower Hudson River estuary is the portion of the Hudson River extending from the Battery at the southern tip of Manhattan north to Stony Point at the northern end of Haverstraw Bay. This habitat complex includes all riverine and estuarine habitats, including open water and tidal wetlands in this stretch of the river. This section of the river is a significant nursery and wintering habitat for a number of anadromous, estuarine, and marine fish species, and is a migratory and feeding area for birds and fish that feed on the abundant fish and benthic invertebrate resources in this area. This is the primary nursery and overwintering area for striped bass in the HRES and one of the most significant nursery and overwintering areas for the total North Atlantic striped bass population. Many other fish also use the lower estuary as a nursery area. The lower Hudson River estuary is considered among the most productive systems on the northern Atlantic coast for fisheries. In the Gowanus Canal, contaminated sediments resulted in severely degrades aquatic habitat and water quality.

Most of the shoreline habitat on the eastern side of the river is bulkheaded, armored or dominated by extensive pier, pile field, and inter-pier areas. The western shoreline above Fort Lee, New Jersey, is dominated by a rocky, talus slope shoreline at the base of the Palisades. The lower estuary has only a few relatively minor freshwater tributaries. The only major tributary in this zone is the Croton River, and its flow has been greatly reduced by impoundments for New York City's Croton Reservoir system. There are very few major marsh areas in this stretch of the river,

with the exception of Piermont and Grassy Point marshes and the mouth of the Croton River. Piermont Marsh is a 1,000-acre brackish tidal marsh and adjacent intertidal mudflat. Both Piermont Marsh and Grassy Point are dominated by monocultural stands of *Phragmites*. The exotic zebra mussel (*Dreissena polymorpha*) has displaced native species and greatly reduced phytoplankton populations in the mid- and upper Hudson River estuary. This reduction in available primary production is expected to impact fish and invertebrate populations in the lower Hudson River estuary.

5.3 Federal and State Listed Species

There are numerous Federal and State Listed species located within the HRES watershed, demonstrating the technical significance of the ecological resources targeted for potential restoration efforts.

Table 2. Number of Federal and State Listed Species in HRES Habitat Complexes

Listing	Habitat Complexes					
	Jamaica Bay – Breezy Pt.	Raritan Bay	Arthur Kill	Hackensack Meadowlands	East River Narrows	Lower Hudson
Federal						
Endangered	3	6	1	1	0	2
Threatened	3	3	0	0	1	1
Concern	2	1	2	2	1	1
State						
Endangered	2	10	8	6	2	2
Threatened	2	4	7	4	1	1
Concern	8	1	3	0	2	1
Rare plants	5	3	4	0	2	0

5.4 Expected Future Conditions

A number of significant habitat improvement efforts by the Corps of Engineers and others are currently underway and include:

- Water quality improvement projects, such as the CSO abatement program, the Use and Standards Attainment Program, and Sewage Treatment Plant upgrades;
- Implementation of the Comprehensive Conservation Management Plans of the two National Estuary Programs in the region and implementation of local watershed management plans, which will have positive effects on water quality and future coastal land uses;
- Several localized environmental restoration projects throughout the region, such as salt marsh restoration at Alley Pond Park and Powells Cove;
- Ongoing Corps of Engineers ecosystem restoration efforts at Jamaica Bay, Flushing Bay, Bronx River, Sawmill River, Hudson River, Rahway and Woodbridge Rivers, South River and Lincoln Park.

However, despite localized efforts to improve ecological conditions, the overall trend of declining habitat quality in the HRES is expected to continue in the absence of a major, coordinated habitat restoration initiative. Forces that limit a positive trend in improved habitat quality within the HRES include: increased human population in the coastal zone, continued

coastal and upland development, and the small, localized scale of environmental restoration efforts. The dispersed and localized nature of ongoing environmental restoration planning and project implementation limits the extent of habitat improvements in the HRES. Recently, these localized restoration efforts are more coordinated, but there is currently no regional, watershed-based restoration program that can plan and coordinate ecosystem restoration projects over a large enough area to significantly improve overall habitat quality in the HRES.

5.5 Identified Problems

The major environmental problems in the HRES are extensive habitat loss and degradation that have reduced the functional and structural integrity of ecosystems with in the HRES. These environmental problems are due to the direct and indirect impacts of three hundred years of urban coastal development in the Port District. Development induced impacts on the environment include: modifications to the natural hydrologic regime resulting from channelization and other navigation improvements, the creation of fast land in former aquatic habitats, shoreline hardening and other alterations, and the overall increase in impervious area throughout the watershed. Adverse impacts on aquatic habitats have been exacerbated by the degradation of water and sediment quality resulting from extensive pollution loading, and from reduced flow and flushing rates in many areas. These physical and chemical encroachments on the natural environment have eradicated habitats in some areas and severely degraded many remaining habitats.

Examples of adverse direct and indirect impacts on aquatic ecosystems abound throughout the HRES. Local stakeholders identified more than 82 specific sites where the ecosystem had been severely degraded. Each type of aquatic ecosystem in the HRES is identified as having been adversely affected at one or more sites. The reconnaissance analysis identified seven degraded habitat types: inter-tidal wetlands/mudflats, freshwater wetlands/riparian habitat, benthic habitat, shallow water habitat, shoreline/coastal habitat, fish habitat, and shellfish habitat. In order to illustrate the magnitude of habitat degradation in the HRES, the following list presents a sample of water bodies that exhibit degradation for each of the seven habitat types.

- **Inter-tidal wetlands and mudflats** have been filled and eradicated in areas such as the Hunts Point and College Point areas of the East River, and have been filled and severely degraded in areas such as the Arthur Kill, Raritan Bay, Flushing Bay, Jamaica Bay, and Hackensack Meadowlands.

- **Fresh water wetlands** have been filled and eradicated throughout the Port District. Remaining fresh water wetlands in the areas of Flushing Creek, Tibbets Brook, Bronx River, and the Saw Mill River have been severely degraded by adjacent land use and riparian encroachments.

- **Benthic habitats** have been severely degraded due to contaminated sediments resulting from industrial effluents and municipal discharges in the Passaic River, Bronx River, Raritan Bay, Jamaica Bay, and the Lower Hudson River.

- **Shallow water habitats** have been severely degraded in areas where dredged material, coal ash, and construction debris were used to create adjacent fast lands. Examples of areas where dredged material was used to create adjacent fast land can be found in Jamaica Bay at locations such as Mill Basin in Brooklyn and Norton Basin - Little Bay in Queens.

- **Shoreline and coastal habitats** have been severely degraded by filling and bulkheading, and have led to monocultural stands of invasive species (e.g., *phragmites)* in areas such as Floyd Bennett Field in Jamaica Bay and Old Place Creek in the Arthur Kill.

- **Fish habitat** has been severely degraded throughout the estuarine waters of the Port District. Adverse impacts on fish habitats have been caused by the placement of structures that impede anadromous fish passage on tidal rivers and creeks, such as the Hutchinson River, Bronx River, and Rahway River. Dredging has disrupted the natural hydrologic regime causing low flow rates and poor flushing in areas such as Jamaica Bay, Flushing Bay, and Gowanus Creek. Submerged habitats, such as rock outcrops, have been removed from the East River at Hells Gate and the Harlem River at Spuyten Duyvil.

- **Shellfish habitat** has been eradicated in areas such as the Hudson River, Harlem River, and East River, and portions of Raritan Bay, by dredging and historical over-harvesting. Shellfish habitat has been severely degraded by sediment contamination and poor water quality in areas such as Gowanus Creek.

Other ecosystem degradation problems identified in the reconnaissance analysis are more widespread and diffuse in nature. For example, Brownfields and refuse landfills located throughout the HRES contribute to ecosystem degradation through contaminants transported by runoff and leachate. However, the extent of ecosystem degradation related to Brownfields and refuse landfills is unknown, and a survey to identify the source and extent of these problems is beyond the scope of this reconnaissance effort. Also, the best abatement methods for the HRES have not been identified and must await the results of more detailed technical studies.

Another general problem in the HRES is the habitat destruction and degradation caused by marine debris. The New York District maintains a drift removal program that removes hazards to navigation. However, many areas of the HRES are outside the jurisdiction of this program. A third general problem in the HRES is the loss of salt marsh in areas such as Jamaica Bay where terrestrial barriers prevent landward accretion of the system. Comparisons of aerial photographs of Jamaica Bay taken during the past 30 years show decreases in salt marsh acreage in areas where coastal structures prevent natural landward accretion.

Overall, the cumulative impacts of urban coastal development on aquatic and upland habitats in the HRES have greatly reduced the quality of coastal habitats and the environmental benefits those habitats provide to the nation. Populations of fish, shellfish, and fish eating birds have been severely reduced through the combined impacts of habitat loss and degradation, pollution, and historical over-fishing and over-harvesting. Consequently, commercial and recreational uses of environmental resources within the HRES have also been reduced and restricted. The states of New York and New Jersey have issued fishing advisories restricting the consumption of

numerous fish and shellfish species taken from the HRES. For example, hard clams harvested in Raritan Bay may not be consumed until they have been depurated in cleaner waters, thereby limiting the commercial viability of the local hard clam industry. Local beaches are typically closed on multiple occasions each summer, due to bacterial contamination. Furthermore, the disruption of the natural hydrology creates conditions favorable to mosquito populations, potentially contributing to adverse health effects in the region.

5.6 Opportunities – General

Opportunities for environmental restoration and protection have been identified in three areas:

- implementation of site specific (Category 1) environmental restoration projects, as identified in the reconnaissance analysis,
- development of a Comprehensive HRES Environmental Restoration Opportunities Report to identify additional restoration opportunities and coordinate their implementation, and
- development of a HRES Brownfields Opportunity Report.

5.6.1 Opportunities – Site Specific Environmental Restoration Opportunities

The reconnaissance investigation identified 82 potential (Category 1) environmental restoration sites for inclusion in the reconnaissance analysis, based on information gathered from meetings with numerous Federal and non-Federal agencies, the HEP Habitat Workgroup, private organizations, individual citizens, and site visits (see Figure 2: Site Map and Attachment 2: Comprehensive Site List).

The 82 identified sites constitute a menu of significant restoration opportunities in the HRES that will be further analyzed in the feasibility phase. During the feasibility analysis, additional restoration opportunities to be studied under this authority may be identified. The feasibility analysis will determine which restoration opportunities will be recommended for construction.

The 82 potential restoration sites were grouped according to the same seven habitat types used to categorize water resource and sediment problems in the HRES (section 5.2). The seven habitat types are: inter-tidal wetlands/mudflats, freshwater wetlands/riparian habitat, benthic habitat, shallow water habitat (including eel grass), shoreline/coastal habitat (including dunes and coastal bird habitat), fish habitat (including anadromous fish runs and submerged structure), and shellfish habitat. Attachment 2: Comprehensive Site List contains a complete listing and brief description of each site.

5.6.2 Opportunities – Comprehensive HRES Ecosystem Restoration Opportunities Report

During the reconnaissance analysis, the non-Federal partners, Federal and non-Federal agencies, citizen groups, and other stakeholders identified several potential ecosystem restoration opportunities without having formulated site preferences for these opportunities. For example, stakeholders have indicated support for the restoration of fish habitat by building artificial reefs

to increase submerged structure in the HRES. However, an analysis of artificial reef placement in the HRES has not yet been done, so the stakeholders have not been able to propose sites for artificial reef placement. As another example, stakeholders have requested the restoration of former salt marsh areas without specific site designations. The Comprehensive HRES Ecosystem Restoration Opportunities Report would provide the framework within which the interconnectedness and dynamics of natural systems can be incorporated into the identification of future restoration opportunities. This report would be the comprehensive document that coordinates restoration opportunities in the context of watershed and regional water resources management programs and objectives, including potential restoration initiatives by other Federal and non-Federal agencies and other stakeholders.

Overall, the reconnaissance analysis has identified the need for seven (7) detailed investigations that would lead to the identification of future restoration opportunities in the HRES. The results of these investigations would provide the local partners, other Federal and non-Federal agencies, and stakeholders with an integrated ecosystem based menu of restoration opportunities in the HRES. These restoration opportunities would not necessarily be included in the feasibility level plan formulation analysis or recommendation for construction under this authority, but they may be pursued under other authorities or by other agencies. The overall purpose of identifying these additional opportunities is to address the problem of habitat fragmentation in the HRES and to promote restoration in the context of broader watershed or regional restoration initiatives which will involve actions by other Federal and non-Federal agencies and other stakeholders. The subjects of these studies include:

- an analysis of artificial reef placement,
- establishment of siting criteria for future salt marsh restoration opportunities,
- identification of areas suitable for benthic habitat restoration,
- characterization of the impacts of refuse landfills on adjacent habitat,
- identification and characterization of road and rail infrastructure encroachments on tidal creeks,
- identification of areas suitable for seal habitat restoration, and
- identification of areas suffering from habitat destruction and degradation caused by marine debris and dilapidated shoreline structures.

The results of these studies/investigations would be compiled within a Comprehensive HRES Ecosystem Restoration Opportunities Report. This technical report will be suitable for incorporation as an appendix to the Feasibility Study.

5.6.3 Opportunities – HRES Brownfields Opportunities Coordination Report

The HRES is one of the most populated and heavily industrialized coastal areas in the world, and has suffered severe ecological impacts from a century of industrial development. There are many coastal areas in the HRES, such as along the Arthur Kill, Bronx River, and Harlem River that contain abandoned, idled, or under-utilized industrial or commercial properties where expansion or redevelopment is complicated by real or perceived environmental contamination. These properties are commonly referred to as Brownfield sites. Brownfield sites that do not pose a serious public health risk to the community do not qualify as Superfund toxic waste National Priority sites. Within the HRES watershed, Brownfield sites may be point sources or contributors

to non-point sources, they may contain contaminated sediments or fill, and they may also be sources of dilapidated coastal structures and marine debris.

The Corps supports and participates in Federal initiatives to advance Brownfield Revitalization objectives when these goals concur with the objectives of authorized water resources and environmental projects. Opportunities to contribute to State and local government Brownfield Revitalization efforts, which will impact upon the Corps' ecosystem restoration objectives within the HRES, may exist. Coordination of Brownfield Revitalization efforts, such as contaminant assessment, may enhance proposed ecosystem restoration and advance Brownfield redevelopment objectives. Supplementing existing information characterizing Brownfield sites in the HRES would support ecosystem restoration opportunities by identifying the potential impacts of Brownfield sites on proposed ecosystem restoration efforts.

The HRES Brownfields Opportunities Coordination Report would be based on existing inventories of Brownfield sites conducted by the States of New York and New Jersey and others, supplemented with additional data collection in areas not previously evaluated. Preliminary hazardous, toxic, and radioactive waste (HTRW) investigations of Brownfield sites may be undertaken where Brownfield concerns may complicate environmental restoration efforts. The HRES Brownfields Opportunities Coordination Report will be a technical report documenting findings obtained through contacts, file reviews, and site verification. The technical report will be suitable for incorporation as an appendix to the Feasibility Study. If the preliminary investigations indicate that further investigations at a proposed restoration site are necessary, the technical report will make recommendations regarding any additional work required, identify potential Brownfield impacts on ecosystem restoration efforts, and propose a specific authority under which more detailed investigations could be conducted.

5.7 Alternative Plans - Ecosystem Restoration

The reconnaissance phase investigation identified 82 ecosystem restoration sites that meet the criteria for Federal participation in the feasibility analysis (Category 1). During the feasibility phase, the preliminary assessment and screening of these sites will be coordinated with existing watershed and regional water resource programs and objectives in order to prioritize ecosystem restoration opportunities in the HRES.

Nine sites representing the restoration measures that would be applied to the seven habitat types are presented in more detailed analysis to demonstrate that Federal participation in a feasibility study is warranted. The selection of these nine sites for further discussion is not intended to imply that these sites have a higher priority for restoration. They were selected solely to provide examples of the type of restoration activities that could be employed for each of the seven habitat categories.

5.7.1 Alternative Plans – Alley Pond Park, Queens County, NY

Alley Pond Park consists of 650 acres of parkland around Alley Creek, a tidal creek that was once one of the major tributaries into Little Neck Bay on the southern shore of the Long Island

Sound at the East River Narrows. At one time, the area was an expanse of salt marshes and mud flats and included freshwater wetlands at the headwaters of Alley Creek. Fill deposited in the tidal areas has increased site elevations from two to twenty feet in some areas. Tidal exchange is further inhibited by encroachments on the former stream channel by the road bed and bridge supports of Northern Boulevard and the Long Island Railroad. With the exception of an 18-acre salt marsh restoration north of the Long Island Railroad conducted by the Port Authority in conjunction with New York City Parks, the entire area is a monocultural stand of *Phragmites* from the banks of the stream upland to the steep grades of Oakland Ravine. Alley Pond Park is a nesting area for Osprey (NY State special concern species) and is used as a wintering area by the northern harrier (NY State threatened species).

Ecosystem restoration at Alley Pond Park would include restoration of the natural hydrology to improve tidal exchange and extend the salinity gradient further into the former salt marsh area. Fill removal and regrading would be used to achieve elevations appropriate for restoration of low and high marsh and a wetland shrub buffer. Reductions to stream channel encroachments at Northern Boulevard and the Long Island Railroad may be accomplished through culverts, dredging, and/or road bed reconfiguration. Stream morphology including plan form and channel geometry will be restored extending tidal wetlands to the southern end of the filled in area. Restoration plans for this site would be coordinated with on-going CSO siting and abatement programs. Potential salt marsh restoration at this site includes approximately 60 acres.

5.7.2 Alternative Plans – Leonardo, Monmouth County, NJ:

The proposed restoration area is located between the Earle Naval Pier and the Leonardo State Marina on Raritan Bay in the Township of Middletown. The 55-acre Leonardo site consists of low and high marsh of varying quality, filled in marsh areas, sandy beach, and woody fringes. A small, unnamed tidal creek, runs through the proposed restoration area. The site is a known breeding area for horseshoe crabs and wading birds. The site also hosts the savannah sparrow (NJ threatened) in migration.

The objective of restoration efforts at Leonardo would be to improve the quality of existing inter-tidal wetlands and create additional wetlands in filled areas. Revegetation of the dunes would expand existing breeding grounds for black skimmer (NJ endangered), least tern (NJ endangered), and American oystercatcher, which breed nearby. Removal of invasive *Phragmites* and Japanese knotweed, fill removal, and regrading would be used to restore low and high marsh. Regrading fill areas and restoring natural stream morphology would extend the tidal reach into an approximately 30 acre area of former tidal wetlands.

5.7.3 Alternative Plans – Old Place Creek, Richmond County, NY

Old Place Creek is the most extensive meandering tidal creek in northern Staten Island. The site includes approximately 100 acres of *Phragmites* dominated high marsh with a narrow strip of intertidal marsh. Its current headwaters include Graniteville Swamp and the Staten Island Corporate Park. The creek is culverted in many areas and cut off from much of its former drainage area, which includes Goethals Pond and Bridge Creek. The tidal areas of Old Place

Creek include vegetated and non-vegetated wetlands. Non-tidal stretches of the creek include some fresh water wetlands and pond areas. Tidal and non-tidal portions of the creek run through a heavily industrialized area containing railroad yards, oil tank farms, bulkheads, docks, road systems, landfills, and numerous industrial and residential buildings, both occupied and abandoned.

Ecosystem restoration of Old Place Creek would include the hydrologic reconnection of Old Place Creek, Goethals Pond, and Bridge Creek. The reconnection of these currently separate drainages would restore a more natural hydrology to the area. The extent of the hydrologic reconnection would be dependent upon the potential for negative impacts on existing ecosystem functions. Hydrologic reconnection, whether full or partial, would be accomplished through the establishment of a more natural stream morphology requiring fill removal and regrading, removal of dikes and stream flow impediments, and recontouring of the stream channel. Restored habitat would include approximately 30 acres of low and high salt marsh, 12 acres of fresh water wetlands, creation of wetland shrub buffers, riparian habitat, and woodland fringe.

5.7.4 Alternative Plans – Tibbetts Brook, Westchester and Bronx Counties, NY

Tibbetts Brook flows south approximately 3 miles from a 12-acre man-made pond in Tibbetts Brook Park in Westchester County into the 16-acre Van Cortlandt Lake located in Van Cortlandt Park, Bronx County. Formerly the brook continued to flow south to the estuarine waters of Spuyten Duyvil at the Bronx-Manhattan border. Much of the floodplain of the former and existing creek has been filled and the riparian habitat either eradicated or severely degraded. However, there are currently some 80 acres of low quality emergent and forested wetland around Tibbetts Brook, including wetlands at Elm, Maple, Sycamore, and Birch ponds within the boundaries of Van Cortlandt Park.

The significant components of restoration at Tibbetts Brook are the restoration of a more natural stream morphology and the reestablishment of floodplain vegetation including mixed emergent wetlands and riparian forest. Stream channel restoration would be coupled with the hydraulic reconnection and restoration of floodplain wetlands and riparian forest. The hydraulic properties of the stream would be modified through removal of flow impediments and reestablishment of a more natural plan form and geometry for the channel. The floodplain fringe would be planted to support a diverse riparian forest community linking to the existing established upland forest to create a larger more contiguous forest stand. The restoration of stream morphology, the reconnection of the stream to the floodplain, the creation wetlands and the establishment of additional forest community in this reach of Tibbetts Brook would establish a habitat corridor between Tibbetts Brook Park and Van Cortlandt Park.

5.7.5 Alternative Plans – Passaic River, Passaic, Essex, and Bergen Counties, NJ

The Passaic River flows from headwaters in the Passaic Meadows wetland complex to the heavily industrialized areas of Newark Bay. Decades of industrial activity in the Newark Bay section of the river including filling of wetlands, effluent discharge, dredging, and refuse dumping have severely degraded habitats in the area. Benthic habitat has been especially

damaged due to the accumulation of contaminated sediments in the area. The degradation of benthic habitat has made this an unfavorable feeding area for wading birds and waterfowl.

The restoration plan for the Passaic River may include the removal of contaminated sediments in the non-Superfund portions of the river between Kearney Point Reach and Harrison Reach, and replacement with clean material. Removed sediment would be replaced with a similar or lesser volume of clean material, depending upon the habitat value added by replacing sediment. Another restoration option might include the application of recently developed decontamination technologies. The habitat objective is to restore conditions that would support a viable benthic community including worms, shellfish, snails, sponges, and jellyfish in the lower reaches of the Passaic River. This restoration objective is consistent with recent improvements in water quality and increased levels of dissolved oxygen in sections of Newark Bay. The restored benthic community would support species currently living and feeding in adjacent inter-tidal areas including many invertebrate species such as fiddler crab and blue crab. Restoration of benthic habitat in this section of the Passaic River would extend available foraging areas for wading birds and waterfowl.

5.7.6 Alternative Plans – Mill Basin, Kings County, NY

Mill Basin and the adjacent East Mill Basin surround a mostly man-made promontory of land (also known as Mill Basin) in the Brooklyn neighborhood of Bergen Beach, located between Paerdegat Basin and Mill Creek in Jamaica Bay. The muddy fine sand that characterized bay bottom in this area was used extensively as landfill material in the creation of local infrastructure including the nearby Belt Parkway and John F. Kennedy Airport. East Mill Basin was a source of this material, having been dredged to a depth of 40 to 45 feet throughout its length. Previously, the mean depth in this area was less than 6 feet and included eel grass habitat and inter-tidal wetlands. Current depths at the entrance to East Mill Basin range from 14 to 16 feet, restricting tidal exchange in the basin and greatly increasing residence time. The long residence time exacerbates the water quality problems including hypoxic or anoxic conditions and toxic accumulation.

The restoration plan for East Mill Basin includes the placement of muddy fine sand in the deeper reaches of the basin and dredging the basin entrance to reduce the extreme gradient, and thereby increasing tidal exchange, reducing residence time, and improving water quality. The USFWS reports that reducing the depth of East Mill Basin to less than 20 feet may increase the minimum dissolved oxygen in the bay to an acceptable level (above 3.5 mg/l). Restored shallow water habitat in this area would be populated by a number of plentiful amphipod crustacean species that are prime food sources for juvenile and adult winter flounder as well as for diving ducks.

5.7.7 Alternative Plans – Floyd Bennett Field, Kings County, NY

Floyd Bennett Field is a 1,448-acre former civic aviation facility largely created by the filling of salt marsh islands in Jamaica Bay, located between Bergen Beach in Brooklyn and Rockaway, Queens. The airfield was decommissioned in 1950, and reverted to grassland habitat until recent succession of open areas into shrub and developing forest eliminated most grasslands. Much of

the shoreline was bulkheaded with sheet pile, which is now in various stages of dilapidation. There are currently some small areas of low marsh and mudflat along the shoreline of the bay but most of the area is over run with *Phragmites* and upland successional shrub. Approximately 140 acres of grassland are maintained, which is one of the few sizable grasslands within New York City. This grassland area supports a variety of grassland birds, several of which are rare and/or declining in the northeastern United States. Floyd Bennett Field has become a critical migratory and nesting location due to its regionally unique grassland habitat.

Restoration plans for Floyd Bennett Field would create a shoreline-upland habitat continuum including inter-tidal wetland and mudflat, high marsh, shrub buffer, sand dune, grassland, and coastal meadow habitats. Much of the restoration effort would be directed towards improving and increasing bird habitat. Dilapidated sheet pile bulkhead would be removed. The coastal profile would be regraded to appropriate elevations capable of supporting high and low marsh. Existing sand dunes would be revegetated and extended along the eastern shore. Upland grasslands and coastal meadow will be restored through extensive regrading and planting efforts.

5.7.8 Alternative Plans – Hutchinson River, Westchester and Bronx Counties, NY

The Hutchinson River flows from its headwaters in Westchester County approximately 8 miles south to Eastchester Bay. Major habitat types include waterfowl foraging areas, freshwater marshes and woody swamps, upland and riparian forests, tidal wetlands, and inter-tidal mud flats. Major environmental problems include modifications to the natural hydrologic regime resulting from stream channelization, degradation of water chemistry, and destruction of aquatic and riparian habitat throughout the watershed. Fish passage, including historic Alewife runs, has been eradicated by weir/dam structures. Urban development within the watershed has degraded the structure of natural systems and greatly reduced the river's ability to perform critical ecological functions. Direct development impacts include: loss of wetland acreage, destruction of aquatic and riparian habitat, floodplain encroachment, stream bank erosion, increased sedimentation, nutrient and pollutant loading, water chemistry degradation, channel aggradation, and flow impediments. Indirect development impacts include: increased peak rates and volumes of runoff, reduced base flows and groundwater recharge, and increased acreage containing non-native invasive species.

The significant components of riparian and tidal restoration at the Hutchinson River are the restoration of a more natural stream morphology and the reestablishment of floodplain vegetation including mixed emergent wetlands and riparian forest. Stream channel restoration would be coupled with the hydraulic reconnection and restoration of freshwater wetlands, tidal wetlands, and riparian forest. The hydraulic properties of the stream would be modified through reconfiguration or removal of the weir/dam structures and reestablishment of a more natural plan form and geometry for the channel. Anadromous fish passage would be restored through the removal of passage impediments, such as the weir/dam structures, or through the creation of fish passage structures, such as fish ladders. The floodplain fringe would be planted to support a diverse riparian forest community linking to the existing established upland forest to create a larger more contiguous forest stand.

5.7.9 Alternative Plans – Keyport, Monmouth County, NJ

Keyport Harbor is located at the mouth of Matawan Creek in Monmouth County, NJ. The shallow offshore waters just beyond the harbor, within approximately two miles of the New Jersey coastline have historically been significant oyster bed locations. Over harvesting, dragging, sedimentation, and decreased water quality have all contributed to the severe degradation of this habitat. Recent studies of water quality in the HRES indicate that the waters in the area offshore of Keyport Harbor have become suitable for oyster habitat.

The significant components of shellfish habitat restoration offshore of Keyport Harbor include the identification of the reef site, placement of hard substrate material to support a layer of oyster cultch, and capping of the substrate with sufficient seed oysters from areas of natural set. The reef would be located in an area with stable bottom sands to avoid the erosive effects of sand scouring and in an area where natural larval supply is sufficient to support a self sustaining reef. Hard substrate would be placed to create a three-dimensional structure favorable to oyster colonization and to restore some of the natural functions of hard bottom structures, such as nursery, habitat, and feeding areas for numerous fish, shellfish, and crustaceous species. The layer of oyster cultch would be approximately 6 to 8 inches thick. First year seeding would require seed oysters originating from either the Connecticut side of Long Island Sound or Oyster Bay, Long Island. The restoration effort may also include placement of adult oysters to increase the likelihood of establishing a self-sufficient oyster population.

5.8 Project Benefits

Ecosystem restoration is a high priority mission for the Corps of Engineers. Restoration and protection of crucial HRES ecosystems including entire communities of plants, animals, and microorganisms will be a significant contribution to national ecosystem restoration (NER) through the restoration of a more naturalistic, functioning, and self-regulating estuary system. Measurement of contributions to NER are based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity. These net changes will be measured in physical units or indexes but not in monetary units. Ecosystem restoration plans formulated in the feasibility study will be subject to cost effectiveness/incremental cost analysis (ER 1165-2-502, 30 Sep 99).

Consideration of ecosystem restoration within a watershed perspective is supported by Corps ecosystem restoration policy (ER 1165-2-501, 30 Sep 1999). The New York District intends to employ the watershed/habitat complex approach to aquatic ecosystem restoration in the HRES by taking into account the interconnectedness of water and land resources, the dynamic nature of ecosystem relationships and functions, and the regional contribution of individual ecosystem restoration opportunities. This approach will: promote restoration in the context of the connectivity of habitats within the larger ecosystem; and provide opportunities to conserve, protect, and enhance critical habitats used by migratory birds, anadromous fish, marine mammals, endangered species, and other fish and wildlife. The watershed/habitat complex approach will also promote wetland restoration, reduction of environmental degradation and contamination, and the recovery of fish and wildlife populations in jeopardy. The Comprehensive HRES Environmental Restoration Opportunities Report and the HRES

Brownfields Opportunity Report will provide critical information for future restoration and management decisions affecting regional and watershed planning and management efforts.

Ecosystem restoration opportunities identified in this reconnaissance study include the habitats of federally and state-listed endangered and threatened species and candidates for listing. Site specific restoration opportunities also include areas that contain significant concentrations of indigenous species or habitats that are otherwise important to critical life-history stages of indigenous species. These restoration opportunities are at or in the vicinity of sites that are used regularly by such species, either seasonally or year-round, for such purposes as:

- breeding, nesting, or spawning;
- migration pathways and stopover areas, including areas of open space in urban areas;
- roosting;
- nursery;
- staging;
- dispersal corridors;
- core concentration areas;
- overwintering areas;
- major feeding or foraging areas.

The benefits of restoration and protection of these areas include the maintenance of regional biological diversity and enhancement of regional representatives of biological communities. The watershed/habitat complex approach also seeks to enhance the linkages among habitats within the ecosystem that encourages species mobility and migration.

Habitat areas identified as restoration opportunities in this reconnaissance report support living resources which are natural assets of significant economic and social value to the more than 12 million people who live in the Port District, whether as consumable finfish, shellfish, waterfowl, and other resources, or as non-consumable but viewable wildlife and plants such as migratory birds and woodland flowers. Restoration of the natural hydrology in some areas of the HRES will decrease mosquito habitat and produce positive health benefits in the region. This report makes no attempt to estimate the economic value to society of healthy fish, wildlife, and plant populations and their habitats. However, the economic importance of the ecological viability and health of coastal and marine ecosystems in the HRES, to the Port District, to the northeast region of the U.S., and to the nation overall must be emphasized. The essential habitats identified as candidates for restoration are among the most ecologically and economically valuable habitats in the Port District.

6. FEDERAL INTEREST

Ecosystem restoration is one of the primary missions of the Corps of Engineers Civil Works Program. The Corps objective in ecosystem restoration planning is to contribute to national ecosystem restoration (NER) by increasing the net quantity and/or quality of desired ecosystem resources (ER 1105-2-100, 22 Apr 2000). Within the Civil Works program, priority is given to restoration projects that restore degraded ecosystem structures and functions, including the

ecosystem's hydrology and plant and animal communities, to a less degraded, more natural condition (ER 1165-2-501, 30 Sep 1999).

The critical national significance of the aquatic and upland habitats in the HRES has been demonstrated by the designation of the Hudson River as an American Heritage River, and by the inclusion of the New York - New Jersey Harbor Estuary and LIS in the early phases of the National Estuary Program. The project area supports numerous endangered and threatened species, and species of special concern as identified in Table 2.

The U.S. Fish and Wildlife Service has also identified several regionally significant habitat complexes within the Port District. These significant habitat complexes include: Jamaica Bay and Breezy Point, Raritan Bay - Sandy Hook Bay, Arthur Kills, Hackensack Meadowlands, Lower Hudson River, the Palisades, Preakness Ridge, Passaic Meadows, portions of the Long Island Grasslands, the East River Narrows at the western end of the LIS, the New York - New Jersey Highlands, and Hempstead Bays - South Oyster Bay.

The diverse habitat complexes of the HRES support a wide variety and large number of migratory species. The U.S. Fish and Wildlife Service has identified the regional and national significance of the HRES in relation to its critical function as a migratory pathway. Ecosystem restoration opportunities identified in this report would strongly support the USFWS National Waterfowl Plan. The confluence of the Hudson River, Raritan Bay, LIS, and associated tributaries concentrates marine, estuarine, anadromous, and catadromous fish in the estuary system. The location at the bend in the coastline of the Atlantic Coast where the east-west oriented shoreline of the New England and Long Island coasts meets the north-south oriented shorelines of the mid-Atlantic coast concentrates those species of birds, insects, and fish that seasonally traverse these shores in both directions and funnels them into the HRES. The north-south oriented migratory corridors of the New York - New Jersey Highlands, Watchung Ridges, and the Hudson River valley also concentrate overland migrating species through or near to the HRES.

It is expected that the non-monetary NER benefits of proposed restoration efforts within the HRES will exceed project costs. Accordingly, the proposed restoration efforts identified during the expedited reconnaissance study are consistent with Federal law, regulation and policy.

7. PRELIMINARY FINANCIAL ANALYSIS

The following public entities have indicated their potential willingness to serve as non-Federal partners for the feasibility study:

- The Port Authority of New York and New Jersey
- New Jersey Department of Environmental Protection
- New York State Department of Environmental Conservation
- New York State Department of State
- New York City Department of Environmental Protection
- New York City Economic Development Corporation.

Each public entity has indicated that it understands the feasibility and construction cost sharing responsibilities and is willing to enter into negotiations for the feasibility phase of the investigation. Copies of letters of intent from each potential local sponsor are included in Attachment 3.

All potential non-Federal partners are aware that they will be responsible for 50% of the cost of the feasibility phase, and that 50% of the non-Federal share (*i.e*., 25% of feasibility study costs) may be work in-kind. They are also aware that as non-Federal partners they will be responsible for 35% of total project implementation costs. The potential sponsors are aware that they are responsible for 100% of all lands, easements, rights-of-way, relocations, and disposal area costs for the project (LERRD). In the event that LERRD costs exceed 35% of total project costs, the non-Federal partners are aware that they may be reimbursed for the increment of LERRD costs over their required 35% share. Finally, the non-Federal partners are also aware that they will be responsible for operating and maintaining the project at 100% non-Federal expense upon completion of construction.

8. SUMMARY OF FEASIBILITY STUDY ASSUMPTIONS

A number of assumptions have been used to guide development of the project study plan and schedule for the feasibility study. These assumptions are listed below.

1. The decision document will be an integrated Feasibility Report and Environmental Impact Statement (EIS) prepared by the New York District.

2. The Feasibility Report will present the results of the Comprehensive HRES Environmental Restoration Opportunities Report and the HRES Brownfields Opportunity Report. The Comprehensive HRES Environmental Restoration Opportunities Report will contain both structural and non-structural recommendations. The structural recommendations will form a project or projects that may be implemented under the Corps of Engineers Civil Works program. The non-structural recommendations will consist of a set of management measures that can be implemented by the non-Federal partners. The decision document will address the project (i.e., structural recommendations) as an independent project that does not rely on the non-structural recommendations. However, the Federal project would benefit from implementation of the non-structural recommendations.

3. The non-Federal partners do not have concurrent fiscal years and current budgets have already been passed. Therefore, the exact amount of funds available for reallocation within existing budgets cannot be determined at this time. The feasibility study schedule shown in Section 9 may be extended during development of the Project Study Plan.

4. A Micro Computer Assisted Cost Estimating System (MCACES) cost estimate will be performed on the structural features that comprise the selected plan. The cost of non-structural management measures to be implemented by the non-Federal sponsor will be developed at a lesser level of detail with comparative cost estimating techniques.

5. An approved real estate gross appraisal will be required for the draft feasibility report.

6. There will be only one conference before the Alternative Formulation Briefing (AFB). There will be no AFB Decision Conference, since the decision to have an AFB conference has already been made. Quality Control certification of the AFB package will be provided prior to the AFB conference. The AFB technical memorandum will be provided to HQ one month prior to the AFB. The AFB technical memorandum will document the results of plan formulation, cost effectiveness analysis, and selection of the recommended plan. However, feasibility level design and MCACES cost estimates for the selected plan will be prepared after the AFB, in time to be included in the Draft Feasibility Report and DEIS.

7. A cost effectiveness and incremental analysis (CE/ICA) will be prepared for ecosystem restoration features. Plan features which have both ecological as well as traditional economic benefits (such as streambank stabilization using bioengineering techniques) will be evaluated with both CE/ICA and traditional benefit-cost evaluation techniques and integrated in order to evaluate and select the recommended plan.

9. FEASIBILITY STUDY MILESTONES

A three-year schedule has been developed for the feasibility study. However, the schedule may need to be extended to four years, due to first year non-Federal funding constraints. One of the potential non-Federal partner's fiscal year began on 1 July 2000 and the Section 905(b) report and PSP were not available in time to include the feasibility study in the sponsors' FY 1999/2000 budgets. Therefore, only minimal non-Federal funds can be reprogrammed prior to the partner's next fiscal year, which begins on 1 July 2001. Because the exact amount of funds available for reprogramming cannot be determined at this time, the feasibility study schedule shown in Table 4 may be extended during development of the Project Study Plan.

Table 4: Feasibility Study Milestones

Milestones	Date
P5 – Execute Federal Cost Sharing Agreement	Jan-01
P6 – Initial Feasibility Study Coordination Meeting	Mar-01
P7 – Initial Screening of Alternatives	Feb-02
Alternative Formulation Briefing	Feb 03
P8 – Submit Draft Report and Draft EIS	Oct-03
P9 – Submit Final Report and Final EIS	Mar-04
P10 – Division Engineers Public Notice	Apl-04

10. FEASIBILITY PHASE COST ESTIMATE

Table 5 contains an initial estimate of the cost to complete the feasibility study effort. These preliminary feasibility study task cost estimates represent the anticipated level of effort to study only those sites that 1) have been advocated in the reconnaissance phase by a potential non-

Federal partner and at least two other non-Federal agencies, or 2) have been advocated by the New York/New Jersey Harbor Estuary Program Habitat Workgroup.

The preliminary feasibility study task cost estimates for technical tasks are based on average costs per acre or average costs per site calculated from costs of previous, on-going, or planned New York District feasibility studies. The costs of non-technical tasks are extrapolated proportionally from previous New York District feasibility studies according to the anticipated level of effort for the Hudson – Raritan feasibility study. All preliminary cost estimates were reviewed by relevant personnel within the New York District. The feasibility study cost estimate will be intensively reviewed and refined during the development of the Project Study Plan.

Table 5
Feasibility Study Cost Estimate

Study Tasks	Federal Cost	Non-Federal Cost	Total Task Cost
JA – Engineering Appendix	$5,576,500	$5,576,500	$11,153,000
JB – Socio-Economic Studies Report	$73,000	$73,000	$146,000
JC – Real Estate Analysis/Report	$92,500	$92,500	$185,000
JD – Environmental Studies/Report	$2,359,000	$2,359,000	$4,718,000
JE – USFWS Coordination Act Report	$25,000	$25,000	$50,000
JF – HTRW Studies/Report	$75,000	$75,000	$150,000
JG – Cultural resources Report	$227,500	$227,500	$455,000
JH – Cost Estimates	$250,000	$250,000	$500,000
JI – Public Involvement Documents	$123,000	$123,000	$246,000
JJ – Plan Formulation Report	$291,500	$291,500	$583,000
JQ – Alternative Formulation Briefing	$31,500	$31,500	$63,000
JK – Draft Report Documentation	$125,000	$125,000	$250,000
JL – Final Report Documentation	$50,000	$50,000	$100,000
JP – Management Documents	$48,000	$48,000	$96,000
K – Draft PCA Package	$25,000	$25,000	$50,000
L – Project Management Plan	$25,000	$25,000	$50,000
Total All Accounts	**$9,397,500**	**$9,397,500**	**$18,795,000**

11. RECOMMENDATIONS

It is recommended that this 905(b) Preliminary Analysis be approved as a basis for developing the Project Study Plan, negotiating the Feasibility Cost Sharing Agreement with the non-Federal sponsors, and proceeding to the feasibility phase of the study. There are sufficient indications that cost-effective engineering solutions to ecosystem degradation problems in the Port District can be formulated that will result in positive net NER benefits in excess of monetary and non-monetary project costs. These potential solutions are consistent with Army and budgetary policies and meet the criteria for Federal participation in project implementation.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority for authorization and/or implementation funding.

12. POTENTIAL ISSUES AFFECTING INITIATION OF FEASIBILITY PHASE

Discussions with the potential non-Federal partners indicate no issues, which would preclude their signing a Feasibility Cost Sharing Agreement. The sponsors have indicated their willingness and capability to fulfill their commitments under the potential agreement. The only remaining issue is whether to execute one FCSA for the entire HRES through PANYNJ; or two FCSA's, one for the New Jersey sites, and one for the New York sites. Discussions are currently underway with the sponsors to determine the most advantageous approach for budgeting and scheduling purposes.

13. VIEW OF OTHER RESOURCE AGENCIES

The implementation of a watershed based approach to the restoration of the HRES and its watershed has received support from the U. S. Fish and Wildlife Service, the USDA Natural Resources Conservation Service, the New York Department of Environmental Conservation, the New York Department of State Division of Coastal Resources, the New Jersey Department of Environmental Protection, New Jersey Maritime Resources, the Port Authority of New York and New Jersey, New York City Department of Environmental Protection, and the New York City Economic Development Corporation. Restoration objectives common to these agencies and the Corps have been identified in the reconnaissance analysis. This project is being coordinated with Federal, state and local agencies responsible for management decisions on the separate ecosystem components of the HRES. This cooperative effort will achieve greater ecosystem restoration benefits than individual uncoordinated efforts could achieve alone.

14. PROJECT AREA MAPS

Three project area maps follow as Figures 1, 2, and 3.

William H. Pearce
Colonel, Corps of Engineers
District Engineer

Attachment 1

Authorized Flood Control and Navigation Projects in the New York and New Jersey Port District

FLOOD CONTROL PROJECTS WITHIN THE NEW YORK AND NEW JERSEY PORT DISTRICT

Raritan Bay and Sandy Hook Bay, N.J. Beach Erosion and Hurricane Protection. (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized by the Flood Control Act of 23 Oct. 1982 in accordance with House Document No. 464, 87th Congress, second session.
Rahway, N.J. (Condition of Improvement, 30 September 1986)	Authorization: By 2nd Endorsement letter from OCE dated 12 June 1964, the project was formally adopted for future construction under section 205 of the 1948 Flood Control Act, as amended.
Atlantic Coast of New York City From East Rockaway Inlet to Rockaway Inlet and Jamaica Bay, N.Y. (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized by the Flood Control Act of 26 October 1965 in accordance with House Document No. 215, 89th Congress, First Congress, First Session. Section 72 of the Water Resources Development Act of 6 March 1974 modified the project authorization to permit separate construction of the beach erosion control portion of the multiple purpose project.
Elizabeth River, N.J. (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized by the Flood Control Act of 1965 substantially in accordance with House Document No. 249, 89th Congress, first session.
South Orange, N.J. (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized by the Flood Control Act of 1965 substantially in accordance with House Document No. 67, 89th Congress, first session.
Staten Island, Fort Wadsworth to Arthur Kill, N.Y. Beach Erosion Control and Hurricane Protection (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized by the Flood Control Act of 27 October 1965 in accordance with House Document No. 181, 89th Congress, First Session.
Yonkers, N.Y. (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized by the Flood Control Act of 1965 substantially in accordance with House Document No. 258, 89th Congress first session.
Green Brook Township, N.J. and Vicinity Snagging and Clearing—Green Brook (Condition of Improvement, 30 September 1986)	Authorization: The Project was authorized pursuant to Section 208 of the 1954 Flood Control Act subject to satisfactory assurances that local interests will comply with the requirements of local cooperation.
Morris and Passaic Counties, N.J. Snagging and Clearing—Pompton River (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized pursuant to section 13 of the 1946 Flood Control Act.
Lincoln Park and Pequannock Township, N.J. Snagging and Clearing—Beaver Brook and Pequannock Township Ditch (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized pursuant to section 2 of the Flood Control Act approved 28 August 1937, was amended.

NAVIGATION PROJECTS WITHIN THE NEW YORK AND NEW JERSEY PORT DISTRICT

Mamaroneck Harbor, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1922, modified 1935 & 1960.
Larchmont Harbor, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1899, modified 1907.
Echo Bay Harbor, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1910, modified 1973.
New Rochelle Harbor, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1922.
East Chester Creek, N.Y. (Hutchinson River) (Condition of Improvement, 30 September 1986)	Existing project adopted 1950.
Westchester Creek, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1922, modified 1954.
Bronx River, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1913.
Flushing Bay and Creek, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 23 October 1962.
Manhasset Bay, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1930.
Hempstead Harbor, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1910 and modified 1968.
Glen Cove Harbor, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1888, modified 1895.
Glen Cove Creek, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1925.
Jones Inlet, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1945.
East Rockaway Inlet, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1930.
Jamaica Bay, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1910, modified 1945 and 1950.
Sheepshead Bay, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1912.
Coney Island Channel, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1907.
Coney Island Creek, N.Y. (Condition of Improvement, 30 September 1986)	Exiting project adopted 1935.
Bay Ridge & Red Hook Channels, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1899, modified 1930.
Gowanus Creek Channel, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1881 to 1952.
Buttermilk Channel, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1902, modified 1935 & 1962.
East River, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1915, modified 1916 to 1970.
Wallabout Channel, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1899.
Newtown Creek, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1919, modified 1930 and 1937.

Harlem River, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1878, modified to 1913.
Hudson River Channel, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1913, modified to 1937.
New York Harbor, N.Y. (Condition of Improvement, 30 September 1986)	Existing project: Ambrose, southerly entrance, Bayside and Main Ship Channels adopted 1884, modified 1933, 1937, 1958, 1965, and 1982.
New York and New Jersey Channels (Condition of Improvement, 30 September 1986)	Existing project adopted 1933, modified 1935, 1950, 1965, and 1985.
Newark Bay, Hackensack & Passaic Rivers, N.J. (Condition of Improvement, 30 September 1986)	Existing project, Newark, adopted 1922, modified 1943, 1954, 1964, 1966, 1975 and 1985. The Kill Van Kull and Newark Bay Channels, New York and New Jersey adopted for construction in 1985.
Elizabeth River, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1935.
Rahway River, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1935.
Woodbridge Creek, N.Y. (Condition of Improvement, 30 September 1986)	Existing project 1902.
Lemon Creek, Staten Island, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1937.
Great Kills Harbor, Staten Island, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 1927, modified 1938.
Raritan River, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1919, modified 1930, 1937 and 1940.
Washington Canal and South River, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1930.
Raritan River to Arthur Kill Cut-Off Channel, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1935.
Cheesequake Creek, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1880.
Matawan Creek, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1881.
Keyport Harbor, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1882.
Way Cake Creek, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1945.
Shoal Harbor & Compton Creek, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1935.
Sandy Hook Bay at Leonardo, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1950.
Sandy Hook Bay, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1937.
Shrewsbury River, N.J. (Condition of Improvement, 30 September 1986)	Existing project adopted 1919,1935,1950, and 1965.
Little Neck Bay, N.Y. (Condition of Improvement, 30 September 1986)	Existing project adopted 23 October 1962.
Atlantic Coast of New Jersey, Sandy Hook to Barnegat Inlet Beach Erosion Control (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized by the River and Harbor Act of 3 July 1958 in accordance with the House Document No. 332, 85th Congress, second session. The cost-sharing on beach one (Sea Bright to Ocean Township) was modified by the Supplemental Appropriation Bill for 1985.
Perth Amboy, N.J. Beach Erosion Control	Authorization: The project was authorized by the River and Harbor Act of 27 October 1965 in accordance with House

(Condition of Improvement, 30 September 1986)	Document No. 186, 89th Congress, first session.
Liberty State Park, N.J. Levee and Seawall and Pedestrian Walkway (Condition of Improvement, 30 May 1987)	Authorization: The project was authorized by Section 152 of the Water Resources Development Act of 1976 (PL94-587) and the Supplemental Appropriation Act of 1985.
Staten Island Rapid Transit Railway Co. Bridge (B&O) Across Arthur Kill, N.Y. & N.J. Alteration of Bridges (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized under provisions of the Truman-Hobbs Act of 21 June 1940. The secretary of the Army, on 5 July 1949 ordered alteration of the existing bridge.
New York Harbor, New York and New Jersey Collection and Removal of Drift (Condition of Improvement, 30 September 1986)	Authorization: The project was authorized in 1915 and modified in 1917 and 1930. The latest modification was by the Water Resources Development Act of 1974 (PL 93-251).