

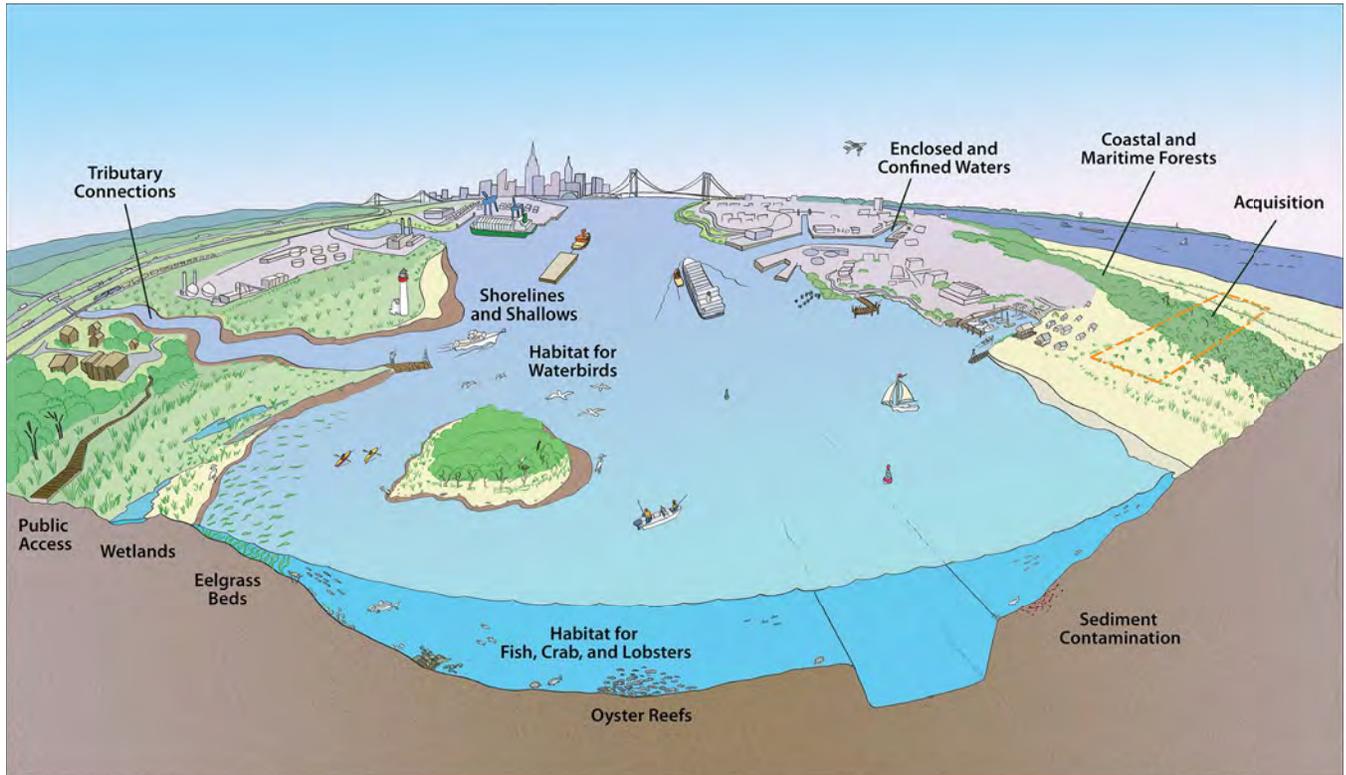
HUDSON-RARITAN ESTUARY Comprehensive Restoration Plan

EXECUTIVE SUMMARY



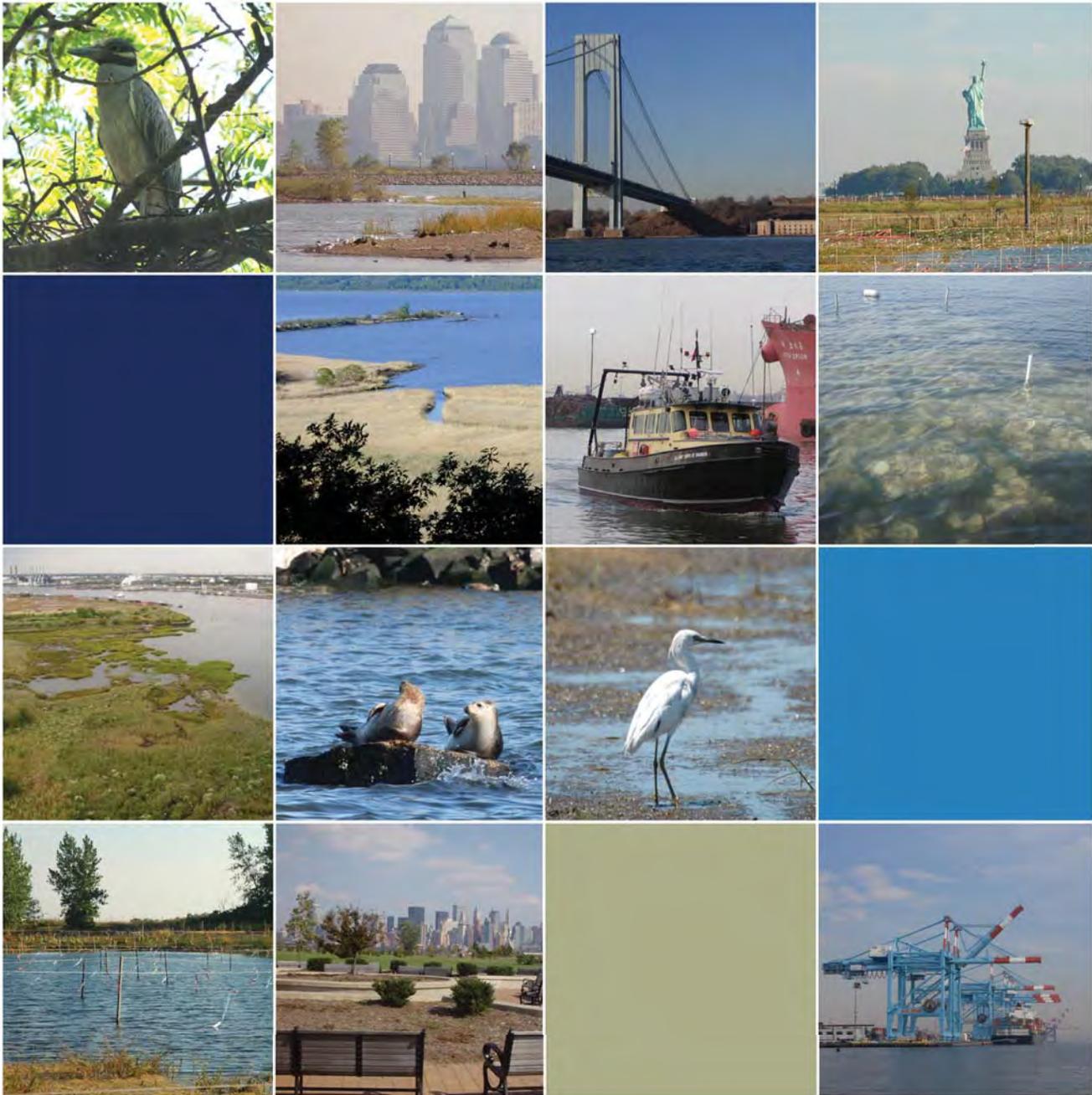
September 2014

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Introduction

The Hudson-Raritan Estuary (HRE), located within one of the most urbanized regions in the United States, has undergone centuries of industrial and residential development. Coincident with extensive navigation and infrastructure improvements, urbanization and industrialization within the HRE have resulted in extensive degradation of aquatic and terrestrial ecosystems, including wetlands, stream corridors, island rookeries, and shellfish beds. In March 2009, the Draft Comprehensive Restoration Plan (CRP), a master plan to guide ecosystem restoration efforts within the HRE, was published by the U.S. Army Corps of Engineers (USACE) in partnership with the non-Federal sponsor, The Port Authority of New York & New Jersey (PANY&NJ), and the New York - New Jersey Harbor & Estuary Program (HEP). The Draft CRP was the culmination of years of collaborative planning amongst the region's stakeholders and estuarine scientists. Prior to release of the CRP, there was no regional consensus on ecosystem restoration goals or objectives among Federal, state, municipal, and non-governmental habitat restoration programs within the HRE. As a result, individual restoration efforts were measured and assessed on a project-specific basis, without considering the benefits achieved in the context of the entire Hudson-Raritan Estuary.

The collaborative planning effort for restoring the HRE was initiated in 1988 when, at the request of the Governors of New York and New Jersey, the U.S. Environmental Protection Agency (USEPA) designated the New York - New Jersey Harbor as an estuary of national importance and accepted it into the National Estuary Program (NEP). Following this designation, in March 1996 the HEP completed a Comprehensive Conservation and Management Plan (CCMP) which included a recommendation for the development of a comprehensive strategy for habitat protection and restoration. In April 1999, U.S. Congress authorized the USACE to conduct the Hudson Raritan Estuary Ecosystem Restoration Feasibility Study. The USACE and the PANY&NJ then initiated the HRE Feasibility Study whose goal was to develop a long-term strategy to restore and enhance degraded environments within the HRE in partnership with regional stakeholders (Figure 1).

The CRP is intended for use by environmental and community groups, government agencies, and other restoration practitioners throughout the region as a framework that guides work in order to meet a series of shared restoration goals that provide ecological benefits to the estuary. The HEP, composed of Federal, State and local agencies, and non-profit organizations, adopted the Draft CRP in December 2009 as the path forward for restoring the HRE. Extensive outreach efforts to solicit public comments on the Draft CRP have been conducted since its publication in 2009. The CRP was presented at national and local ecosystem restoration conferences, and public outreach meetings held in each of the eight HRE Planning Regions. Proposed revisions to the Draft CRP were presented and discussed at



Figure 1. Timeline of Comprehensive Restoration Plan Milestones

a stakeholder workshop in May 2012. In all, 28 government offices, 22 academic institutions, 60 non-profit and civic organizations, and 25 other organizations have contributed to the development of the CRP for the HRE.

In the past five years, significant progress has been made in obtaining public input on the Draft CRP, refining the restoration objectives, conducting pilot- and large-scale ecosystem restoration projects, identifying additional restoration sites, coordinating with other major planning initiatives, and developing a framework to coordinate ecosystem restoration in the HRE.

In October 2012, Hurricane Sandy moved up the coast of New Jersey and New York and drove a catastrophic storm surge onto the coastlines of New Jersey and New York. Flooding and storm surge dramatically altered coastal habitats within the HRE and damaged many wastewater treatment plants, resulting in the discharge of approximately 10.3 billion gallons of untreated and partially-treated sewage into New York and New Jersey waters. The devastating effects of Hurricane Sandy heightened awareness of the need for resilient coastal communities that can protect valuable infrastructure and homes against future storms. In the aftermath of the storm, Federal, state, and municipal assessment and planning documents emphasized the need for natural, nature-based and engineered features that would protect the coastline of the HRE. Many recommendations of these plans directly coincide with the goals and objectives of the CRP, and a portion of the funds made available to rebuild after Hurricane Sandy were designated to restore and create resilient coastal habitats.

The following sections provide a brief review of the Draft CRP for the HRE, outline planned revisions, and describe activities undertaken since the 2009 publication.

Study Area

The HRE spans many political and ecological borders, posing a challenge to planning for restoration on an estuary-wide scale. To facilitate restoration planning among the diverse habitat types and stakeholder communities, the HRE study area was delineated into eight planning regions. These include: (1) Jamaica Bay, (2) Lower Bay, (3) Lower Raritan River, (4) Arthur Kill/Kill Van Kull, (5) Newark Bay, Hackensack River, and Passaic River, (6) Lower Hudson River, (7) Harlem River, East River, and Western Long Island Sound, and (8) Upper Bay (Figure 2).

The HRE study area includes all tidally influenced portions of rivers flowing into New York and New Jersey Harbor including the Hudson, Raritan, Hackensack, Passaic, Shrewsbury, and Navesink Rivers. The complex geological and glacial history of the HRE study area created this unique estuary, which contains a great variety of sediments, landforms, and bedrock types that support diverse ecological communities. Residents and migrants of almost 300 species of birds, over 200 species of fish, and many important terrestrial and aquatic invertebrates, mammals, reptiles and amphibians inhabit the HRE study area.



Figure 2. The eight Planning Regions of the Hudson-Raritan Estuary study area. The Statue of Liberty is represented by the star.

Target Ecosystem Characteristics

On behalf of the HRE Ecosystem Restoration Feasibility Study, the Hudson River Foundation and Cornell University were tasked with the coordination of the development of a science-based strategy to restore the ecologically diverse and highly urbanized HRE. They organized a series of workshops with estuarine scientists and restoration practitioners to develop the framework for the restoration plan. These scientists developed the CRP Program Goal:

To develop a mosaic of habitats that provides society with renewed and increased benefits from the estuary environment.

To achieve this goal, the estuarine scientists identified 11 Target Ecosystem Characteristics (TECs), each of which defines specific goals for an important ecosystem property or feature of ecological and or societal value. A twelfth TEC, "Acquisition," was added in response to public comment (Table 1). The TECs were designed to reflect the broad interest of HRE stakeholders and address habitat and degradation issues. Achieving the objectives of the TECs will increase the sustainability and ecological value of the HRE.

Table 1. Target Ecosystem Characteristics (TECs) in the Hudson-Raritan Estuary study area.

TEC	Target Statement
 Wetlands	Create and restore coastal and freshwater wetlands, at a rate exceeding the annual loss or degradation, to produce a net gain in acreage.
 Habitat for Waterbirds	Restore and protect roosting, nesting, and foraging habitat (i.e., inland trees, wetlands, shallow shorelines) for long-legged wading birds.
 Coastal and Maritime Forests	Create a linkage of forests accessible to avian migrants and dependent plant communities.
 Oyster Reefs	Establish sustainable oyster reefs at several locations.
 Eelgrass Beds	Establish eelgrass beds at several locations in the HRE study area.
 Shorelines and Shallows	Create or restore shoreline and shallow sites with a vegetated riparian zone, an inter-tidal zone with a stable slope, and illuminated shallow water.
 Habitat for Fish, Crab, and Lobsters	Create functionally related habitats in each of the eight regions of the Hudson Raritan Estuary.
 Tributary Connections	Reconnect and restore freshwater streams to the estuary to provide a range of quality habitats to aquatic organisms.
 Enclosed and Confined Waters	Improve water quality in all enclosed waterways and tidal creeks within the estuary to match or surpass the quality of their receiving waters.
 Sediment Contamination	Isolate or remove one or more sediment zone(s) that is contaminated until such time as all HRE sediments are considered uncontaminated based on the all related water quality standards, related fishing / shelling bans or fish consumption advisories, and any newly-promulgated sediment quality standards, criteria or protocols.
 Public Access	Improve direct access to the water and create linkages to other recreational areas, as well as provide increased opportunities for fishing, boating, swimming, hiking, education, or passive recreation.
 Acquisition	Protect ecologically valuable coastal lands throughout the Hudson-Raritan Estuary from future development through land acquisition.

The 12 TECs define restoration actions relating to specific habitat types, complexes, contamination issues or societal values. Each TEC was assigned short-term and long-term quantitative objectives (Table 2); restoring the TECs would collectively contribute to achieving the overall program goal of the CRP. The TECs provide the basis for a decisive environmental agenda for the estuary as well as a long-term strategy capable of changing with environmental conditions and human needs (Bain et al. 2007).

In May 2012, the USACE convened a workshop for the original TEC workshops' participants to provide an update on the HRE Ecosystem Restoration Program and to obtain consensus about proposed modifications to the Draft CRP. The USACE presented public and stakeholder comments regarding the Draft CRP and led discussion of proposed strategies for responding to the major comments.

Workshop participants agreed to the following major modifications to the TECs:

1. Add a twelfth TEC, "**Acquisition.**" **Acquisition** is added to the list of TECs to highlight the importance of protection and preservation of existing open and undeveloped lands (Table 1).
 The HEP and the Trust for Public Land reviewed the history and pace of recent acquisitions and developed targets for the Program. Acquisitions within the HRE from 1998 to 2011 ranged from 0 to 400 acres per year, with an average acquisition of 140 acres per year. To create an ambitious yet reachable goal, acquisition of 200 acres per year was selected to define the short-term and long-term goals for this TEC.
2. **Coastal Wetlands** are changed to **Wetlands** in order to be more inclusive of valuable freshwater habitats.
3. Increased emphasis is placed on the importance of Riparian Forests and Stream Restoration in the **Tributary Connections** TEC.
4. The **Habitat for Fish, Crabs, and Lobsters, Wetlands, and Shorelines & Shallows** TECs now place additional emphasis on the value of Shellfish Species other than **Oysters**.
5. Living Shorelines and shellfish restoration are now emphasized in the **Shorelines & Shallows** TEC.
6. More emphasis is placed on Coastal Forests in the **Coastal and Maritime Forest** TEC.
7. The **Islands for Waterbirds** TEC has been changed to **Habitat for Waterbirds** in recognition of the value of nearby foraging habitat for breeding waterbird populations.
8. The **Habitat for Waterbirds** TEC has been modified placing greater emphasis on the importance of **Shorelines & Shallows** and **Maritime Forests** associated with foraging habitat for Shorebirds and Seabirds.

In addition to expanding the habitat types and actions included in the TECs, modifications were made to the short- and long-term objectives. Significant changes to the objectives are described below.

1. Many commented that the objectives for the **Wetlands** TEC were overly ambitious (i.e., 1,200 acres created by 2015; 15,200 acres created by 2050). Therefore, the objectives were modified

Table 2. Short-Term and Long-Term Objectives for Target Ecosystem Characteristics (TECs) in the Hudson-Raritan Estuary (HRE) study area, including a list of ecosystem services offered by each TEC.

TEC	2020	2050
 Wetlands	Create and/or restore a total of 1,000 total acres of freshwater and coastal wetland	Continue creating an average of 125 acres per year for a total system gain of 5,000 acres
 Habitat for Waterbirds	Enhance at least one island without an existing waterbird population in HRE regions containing islands and create or enhance at least one foraging habitat	All suitable islands provide roosting and nesting sites and have nearby foraging habitat
 Coastal and Maritime Forests	Establish one new maritime forest of at least 50 acres and restore at least 200 acres among several coastal forest/upland habitat types	500 acres of maritime forest community among at least three sites and 500 acres of restored coastal forest/upland habitat
 Oyster Reefs	20 acres of reef habitat across several sites	2,000 acres of established oyster reef habitat
 Eelgrass Beds	Create one bed in at least three HRE regions	Three established beds in each suitable HRE region
 Shorelines and Shallows	Develop new shorelines sites in two HRE regions	Restore available shoreline habitat in three HRE regions
 Habitat for Fish, Crab, and Lobsters	Complete a set of two related habitats in each HRE region	Complete four sets of at least two related habitats in each HRE region
 Tributary Connections	Restore connectivity or habitat within one tributary reach per year	Continue rate of restoring and reconnecting areas
 Enclosed and Confined Waters	Upgrade water quality of eight enclosed waterways	Upgrade water quality of all enclosed waterways
 Sediment Contamination	Isolate or remove at least 25 acres of contaminated sediment	Isolate or remove at least 25 acres every 2 years
 Public Access	Create one access and upgrade one existing access per year	All waters of the HRE are accessible
 Acquisition	Acquire and preserve 1,000 acres of coastal property	Acquire and preserve 200 acres of coastal property per year for a total of 6,000 acres

based on recent wetland restoration and creation projects undertaken in the HRE. Large-scale **Wetlands** restoration and mitigation projects conducted in the HRE between 2002 and 2012 were identified, and the acreage of restored habitat was quantified. During this period, 197 acres were restored in ecosystem restoration projects and 474 acres of wetlands were restored through large-scale mitigation projects and the establishment of mitigation banks. Recognizing that the mitigation projects represented losses to habitat typically at a 2:1 ratio, only one-half of the mitigation acreage was considered as success towards achieving the TEC objectives. Therefore, in the period from 2002 to 2012, approximately 434 acres of wetlands were restored. The revised short-term objective for the **Wetlands** TEC is based on doubling the success achieved during that period. Twice the success over the past ten years (868 acres) was rounded up to 1,000 acres of created/restored freshwater and coastal wetlands by 2020. The long-term objective was revised to creation/restoration of 5,000 acres of wetlands by 2050.

2. The **Habitat for Waterbirds** objectives were revised to focus only on restoring habitat on islands that do not currently support breeding waterbird populations. Enhancement of foraging habitat was also included as an objective.
3. The **Coastal and Maritime Forest** objectives were revised to place additional emphasis on creating and enhancing more than one type of forest community. The objectives now specify the creation of 50 acres of Maritime Forest by 2020 and 500 acres of Maritime Forest by 2050. The objectives also include the restoration of 200 acres among several coastal forest types by 2020, and 500 acres of coastal forest restored by 2050.
4. As **Oyster Reef** restoration is still in the pilot study phase in the HRE, objectives for the **Oyster Reef** TEC were reduced to the creation of 20 acres of reef habitat over several sites by 2020 and 2,000 acres of established reef habitat by 2050.
5. The **Eelgrass Beds** objectives were modified because the HRE does not contain suitable habitat for Eelgrass in every planning region. The objectives are now to create **Eelgrass Beds** in three planning regions by 2020, and to create three beds in each suitable planning region by 2050.
6. The **Tributary Connections** objectives were modified to include restoring riparian habitat along HRE tributaries as well as removing or re-engineering impediments to fish passage. For both the 2020 and 2050 timeframes, the objective has been modified to restoring connectivity or habitat within one tributary reach per year.

On-Going Restoration Programs

Ecosystem restoration and conservation programs have been implemented in the HRE study area for decades; many of these efforts have been successful. Some restoration programs coordinated by Federal, state and local governments, and non-governmental organizations focus on physically altering degraded areas and re-creating upland, wetland, and aquatic habitat to restore lost ecological function. Since the publication of the Draft CRP, several factors led to an increasing number of restoration programs in the HRE study area, such as funding availability, incorporating restoration considerations into integrated water resource management or redevelopment programs, the expansion of restoration ecology and scientific information, and increased stakeholder awareness. Many of these on-going programs are described in Table 3.

Table 3. Examples of Current Restoration Programs and Studies in the Hudson-Raritan Estuary Study Area.

	<h3>New York City Pier Restoration, NY</h3> <p>Hudson River Park Trust, HEP, Patagonia Soho, NYU, Harbor Estuary Stewardship Program</p> <p>Status: On-Going</p> <p>Website: http://www.hudsonriverpark.org/</p> <p>The dilapidated piers are being reconstructed into public spaces for mixed uses, including lawn/garden areas, scenic overlooks, playgrounds, athletic fields, event space, community docks, historic resources, and educational and research facilities. The 550-acre park is 70 percent complete with thirteen reconstructed piers and dozens of landscaped acres.</p>	<h3>Oyster Restoration Research Project (ORRP), NY/NJ</h3> <p>NY/NJ Baykeeper, Hudson River Foundation USACE, the PANYNJ, NOAA, Urban Assembly New York Harbor School, and others.</p> <p>Status: On-Going</p> <p>Website: http://www.hudsonriver.org/download/ORRP_Phase1.2013.pdf</p> <p>The ORRP has been constructing experimental oyster reefs in the HRE since 2010. These reefs were designed to mimic natural oyster reefs and to allow regular assessment of oyster development and ecosystem functions The ORRP is currently using the reefs to monitor and analyze: reef development (health and growth of mollusks; disease and die-off, predation); base environmental data (water salinity, turbidity, temperature, dissolved oxygen concentrations, nutrient loading); ecosystem development (presence and biological productivity of a reef fish community; and other flora and fauna, improvements in water quality). This project will also serve as a platform for numerous education and outreach opportunities. Partners will have access to the data collected to further engage in the public in the oyster restoration effort and the overall ecosystem restoration agenda.</p>
<h3>Jamaica Bay Watershed Protection Plan (JBWPP) Ecosystem Pilot Projects, NY</h3> <p>NYCDEP, NPS</p> <p>Status: On-Going</p> <p>Website: http://www.nyc.gov/html/dep/pdf/jamaica_bay/JBWPP_Update_100112_FINAL.pdf</p> <p>The JBWPP Ecosystem Pilot Projects were designed to improve overall water quality in Jamaica Bay. Two pilot projects include small-scale oyster reef and eelgrass bed habitat restoration to improve ecological function and potentially reduce nutrients in localized areas in Jamaica Bay. Other pilot projects include ribbed mussel experiments, algae harvesting, algae turf scrubbers at wastewater treatment facilities, and implementing best management practices for stormwater management in the watershed. The NYCDEP has also invested resources to improve the ecology and water quality of the bay and for salt marsh restoration projects as part of the 2010 agreement between the NYSDEC, Natural Resources Defense Council and New York City.</p>	<h3>East River Waterfront Esplanade Eco Park Project, NY</h3> <p>NYCEDC</p> <p>Status: On-Going</p> <p>Website: http://www.nycdec.com/project/east-river-waterfront-esplanade</p> <p>The esplanade project will provide continuous public access for about a mile and a half from Pier 35 down to the Battery Maritime Building. Many portions of the project offering public open space, active recreational areas, and an EcoPark opened to the public between 2011 and 2013. The remainder of the pier is anticipated to be complete in early spring 2015.</p>	



Jamaica Bay Marsh Islands Restoration, Jamaica Bay, NY

USACE, NYSDEC, NYCDEP, PANY&NJ, NPS

Status: On-going

Website: <http://www.nan.usace.army.mil/Missions/CivilWorks/ProjectsInNewYork/EldersPointJamaicaBaySaltMarshIslands.aspx>

Restoration of marsh islands in Jamaica Bay involves using dredged material to restore island elevation and replanting salt marsh vegetation. More than 150 acres of marsh islands have been restored within the bay. The marsh island restoration efforts are being monitored and are providing valuable data on the cause of the problems and are helping to identify the most effective future restoration options. This program also has significant implications for the future success of restoration activities from beneficially using sand from the Operations and Maintenance (O&M) Program.

Old Place Creek Tidal Wetlands Restoration & Mitigation Project, NY

NOAA, USEPA, USFWS, USDA, USACE, NYSDEC, PANY&NJ

Status: On-Going

Website: http://www.panynj.gov/press-room/press-item.cfm?headline_id=1321

Studied under the Estuary Restoration Act of 2000, as amended, the site is part of the larger Old Place Creek Wetland, Staten Island, NY and a tributary to the Arthur Kill. Restoration will reinstate tidal flow to a 25-acre remnant salt marsh that is currently isolated from the creek by a berm and overrun by non-native vegetation (Phragmites). The project was delayed but is now being constructed by PANY&NJ as part of mitigation for the Goethals Bridge Replacement Project.

Citywide Combined Sewer Overflow Dredging Project, NY

NYCDEP

Status: On-Going

Website: http://www.nyc.gov/html/dep/html/cso_long_term_control_plan/index.shtml

Under the CSO Dredging Program, the NYCDEP is dredging contaminated sediments from poorly flushed waterbodies to improve water quality and habitat. Hendrix Creek was dredged to remove the CSO mounds in 2011. The following waterbodies will also be dredged as a part of this program: Paerdegat Basin, Gowanus Canal, Flushing Bay, Flushing Creek, Bergen Basin, Thurston Basin, Fresh Creek, and Newtown Creek.

Gerritsen Creek Ecosystem Restoration Project, NY

USACE, NYC Department of Parks & Recreation, NRG

Status: Constructed

Website: <http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/487245/fact-sheet-gerritsen-creekmarine-park-ny.aspx>

The project restored approximately 20 acres of salt marsh and 20 acres of rare coastal grassland. Restoration activities were completed and the park was opened to the public in 2012.

Lincoln Park Wetland Restoration Project, NJ

NOAA, NJDEP, USACE

Status: Constructed

Website: <http://www.habitat.noaa.gov/highlights/landfillturnedurbanoasis.html>

The Lincoln Park Wetland Restoration project received Federal Recovery Act funds to restore native salt marsh community and increase public access to a restored urban ecological area. This project restored 42 acres of wetland, stream and salt marsh habitat along the Hackensack River within the 270-acre Lincoln Park in Jersey City, New Jersey.



Joseph P. Medwick Park Restoration Project, NJ

USACE, PANY&NJ, in partnership with Middlesex County, NJ, Department of Parks and Recreation

Status: Constructed

Website: http://www.nan.usace.army.mil/Portals/37/docs/harbor/Harborfact/FS_carteret_FEB_2013.pdf

Approximately 14 acres of tidal wetlands were restored in the northern portion of Joseph P. Medwick Park along the southern shore of the Rahway River, Rahway, N.J. The project was constructed to mitigate for potential shallow water impacts resulting from the deepening of the Arthur Kill Channel.

KeySpan Corporation Marsh Restoration Project in Staten Island, NY

USACE, PANY&NJ

Status: Constructed

Website: <http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/487669/fact-sheet-salt-marsh-mitigation-project-at-keyspan-corporation-site-staten-isl.aspx>

Nine acres of tidal marsh were restored adjacent to the Keyspan corporation facility in Staten Island, NY. The project was constructed to mitigate from potential shallow water impacts resulting from the deepening of the Arthur Kill Channel.

South Bronx Greenway – Hunts Point Landing Project, NY

NYCEDC

Status: Constructed

Website: <http://www.nycdc.com/projects>

The South Bronx Greenway creates sustainable connections between the waterfront and the residential and business communities in the Hunts Point peninsula in the south Bronx. Hunts Point Landing is a new public open space located along the Greenway at the southern end of the Hunts Point peninsula, adjacent to the former Marine Transfer Station site. Hunts Point Landing includes a new fishing pier, ecological restoration through tidal pools, a kayak launch, and passive recreational areas.



Liberty State Park Restoration Project, NJ

USACE and NJDEP

Status: Pre-construction and Engineering Design

Website: <http://www.nan.usace.army.mil/Missions/CivilWorks/ProjectsInNewJersey/HRELlibertyStatePark.aspx>

Restoring natural habitats to the 251 acre interior of Liberty State Park was one of the first restoration studies conducted under the HRE study authority. The project design includes the reintroduction of tidal wetland habitat, protection and enhancement of freshwater wetlands, native grasslands and maritime forests, and creation of public access trails for the approximately 4.3 million visitors a year. Contingent upon funding, construction could begin at Liberty State Park at any time.

Soundview Park Ecosystem Restoration Project, NY

USACE, NYC Department of Parks & Recreation, NRG

Status: Constructed

Website: <http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/487636/fact-sheet-soundview-park-bronx-new-york.aspx>

The project involved restoring aquatic resources and adjacent upland habitats in southern Soundview Park to improve water quality through nutrient removal, sediment trapping and providing habitat for fish species. Approximately 3.7 acres, dominated by common reed (Phragmites) and debris was restored into a vegetated tidal wetland immediately north of the park's lagoon area.

Spring Creek (South), NY

NYSDEC, USACE, and NPS

Status: Plans and Specifications

Website: <http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/487640/fact-sheet-spring-creek-park-ny.aspx>

Spring Creek (South) is a 150+ acre restoration site located to the north of Jamaica Bay that is owned by the National Park Service. The NYSDEC was awarded funding through the Federal Emergency Management Agency's Hazard Mitigation Grant program (HMGP) in 2013 to prepare designs/permits (Phase 1) and construction (Phase 2; upon FEMA approval). Original ecosystem restoration designs consisting of high and low marsh, berm and maritime forest will be modified to serve as natural/nature based features providing flood storage and wave attenuation aiding in managing the flood risks for the Spring Creek community.



Bridge Creek Wetland Restoration Project, NY

NOAA and NYSDEC

Status: Constructed

Website: <http://www.publicaffairs.noaa.gov/releases2006/apr06/noaa06-r110.html>

This project on Staten Island is part of a larger effort to restore degraded wetland habitat, remove invasive species, and preserve existing wetlands and uplands using NRDA funds from the 1990 oil spill in the Arthur Kill. The project restored 10 acres of wetlands creating habitat for nearshore and inshore finfish, crabs, ocean bottom invertebrates and various waterfowl near the Arthur Kill.

Lower Passaic River, NJ Investigation and Feasibility Study for Remediation and Ecosystem Restoration

USACE, USEPA, NJDOT, NJDEP, NOAA, USFWS

Status: Remedial Investigation/Feasibility Study

Website: www.ourpassaic.org

The purpose of the study was to develop a comprehensive watershed-based plan for the remediation and restoration of the Lower Passaic River Basin. Overall goals included remediation of sediment contamination, improvement of water quality, restoration of degraded shorelines and habitat, creation of new habitat and improvement of human uses along a 17-mile stretch of the Lower Passaic and in several tributaries from Dundee Dam to Newark Bay. The Final Focused Feasibility Study and Proposed Plan for the remediation of the lower 8.3 miles of the river was released in April 2014.



Gowanus Canal Remedial Investigation and Feasibility Study, NY

USEPA

Status: Remedial Investigation/Feasibility Study

Website: www.epa.gov/region02/superfund/npl/gowanus/

Investigatory work is underway at the former Fulton Manufactured Gas Plant (MGP) and Former Citizens Gas Works MGP and contaminated soils have been removed from the former Metropolitan Gas Light Company MGP. A FS was released to the public on December 30, 2011. In September 2013, EPA issued a Record of Decision to address the contamination in the Canal. Following clean up of the Gowanus Canal by USEPA, ecosystem restoration may take place including wetland creation and water quality improvements in confined waterways.



Newark Bay, NJ Remedial Investigation and Feasibility Study

USEPA and NOAA

Status: Remedial Investigation/Feasibility Study

Website: <http://www.ournewarkbay.org/>

The USEPA has been studying the Newark Bay since 2004 to determine the nature and extent of sediment contamination, determine potential risks of contamination, and to determine the significant, on-going sources of pollution. The Newark Bay Study Area includes the bay and portions of the Hackensack River, the Arthur Kill and the Kill Van Kull. The remedial investigation of this portion of the site is being paid for by potentially responsible parties with oversight by the USEPA in partnership with the trustees. This study will assess the nature and extent of contamination in the Newark Bay Study Area and develop cleanup plans to address those problems.

Bronx River, Westchester & Bronx Counties, NY Ecosystem Restoration Study

USACE, NYCDEP, Westchester County Dept. Of Planning

Status: Feasibility Study

Website: <http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/487682/fact-sheet-bronx-river-basin-westchester-bronx-counties.aspx>

This study is developing a restoration plan for the Bronx River Basin and will identify potential restoration opportunities and recommendations for construction authority.



Waterfront Vision and Enhancement Strategy, NY

NYCEDC, NYCDPC, and the Mayor's Office

Status: On-Going

Website: <http://www.nycedc.com/project/waterfront-vision-and-enhancement-strategy>

The NYCEDC Waterfront Vision and Enhancement Strategy will create a new sustainable blueprint for the City's more than 500 miles of shoreline. Each of the many initiatives under this program includes providing public access to the shoreline for active and passive waterfront recreation as well as ecological enhancements at the water's edge. The program includes 130 projects conducted by 12 City agencies.



Contamination Assessment and Reduction Project (CARP), NY/NJ

HRE, PANY&NJ, NJDOT, NYSDEC, NJDEP, USACE, USEPA, USGS, Environmental Defense, multiple universities and research groups

Status: On-Going

Website: www.carpweb.org/main.html

The CARP began in the 1990s to identify and quantify sources of contamination in the HRE and reduce levels of contaminants in sediments, water, and organisms (e.g., fish tissue). The CARP products can provide new and important information on managing contaminants and insight into their fate and transport, but the models still require additional data collection and refinement to answer most project-specific questions.

Harbor Herons Project, NY/NJ

New York City Audubon Society & New Jersey Audubon Society

Status: On-Going

Website: <http://nycaudubon.org/issues-of-concern/harbor-herons>

The Harbor Herons Project, led by the New York City and New Jersey Audubon societies, conducts annual breeding bird surveys of heron, egret, and ibis colonies in NYC, providing valuable information on their population status and breeding habits.



Oyster Reef Restoration/ Gardening Program, NY/NJ

NY/NJ Baykeeper

Status: On-Going

Website: www.nynjbaykeeper.org

The NY/NJ Baykeeper's Oyster Restoration Program focuses on repopulating the New York and New Jersey bays with oysters and creating sustainable habitat in order to monitor and improve the health of the estuary's eco-system. Baykeeper was able to secure a protected area at Naval Weapons Station Earl and in 2011, Baykeeper and the Rutgers Center for Urban and Environmental Sciences (CUES) initiated preliminary oyster survivability studies.

Hudson River Estuary Program, NY

NYSDEC

Status: On-going

Website: www.dec.ny.gov/lands/4920.html

The Estuary Program protects and improves the natural and scenic Hudson River watershed. The program was created in 1987; its work focuses on the tidal Hudson and its adjacent watershed from the federal dam at Troy to upper New York harbor. Its core mission is to: Ensure clean water; Protect and restore fish, wildlife and their habitats; Provide water recreation and river access; Adapt to climate change; and Conserve the world famous scenery.

Harbor Estuary Program, NY/NJ

HRF, USEPA, USACE, PANY&NJ, NY, NJ, Local Government, NGOs.

Status: Planning

Website: www.harborestuary.org

A partnership of Federal, state, and local governments; scientists; civic and environmental advocates; and educators under the National Estuary Program to work together to protect and restore healthy waterways and productive habitats, manage sediments, foster community stewardship, engage the public, and improve safe public access to our waterways. HEP and its Restoration Work Group have provided overall program direction for the Hudson-Raritan Estuary Comprehensive Restoration Plan.

Long Island Sound Study, NY

Save the Sound, NOAA, USEPA, USFWS, CTDEP, NYSDEC, NYCDEP

Status: On-Going

Website: www.longislandsoundstudy.net

Part of the National Estuary Program, this program is a collaborative effort to protect and restore degraded fish and wetland habitat. Particular focus is given to hypoxia, habitat restoration, public involvement and education, and water quality monitoring.



PANY&NJ Hudson Raritan Estuary Resources Program

Status: On-Going

Website: <http://www.panynj.gov/about/coastal-eco-systems.html>

In 2001, the PANY&NJ established a \$60 million program to acquire and preserve ecologically valuable tracts of land around agency facilities in New York and New Jersey. The program is designed to help the Port Authority balance its redevelopment plans with the need to preserve critical habitats and waterfront areas for public use. The PANY&NJ acquired 18 ecologically valuable sites for preservation within the HRE between 2004 and 2012. In 2014, PANY&NJ has reauthorized an additional \$60 million to acquisition of valuable land.

New York City Department of Environmental Protection Programs

Status: On-going

Website: www.nyc.gov/dep

The NYCDEP leads many restoration efforts to protect and improve water quality and the NYC water supply. Related efforts include creating a mosaic of salt marsh and upland habitat at Alley Creek in Queens, NY and helping to implement the Jamaica Bay Watershed Protection Plan (2007).

Metropolitan Waterfront Alliance

Status: On-Going

Website: <http://www.waterfrontalliance.org/>

Comprised of hundreds of civic organizations, public agencies, companies, utilities, and community groups, the MWA is working to transform the waterways of the HRE to make the waters of NYC cleaner and more accessible. Coordination with diverse stakeholders has resulted in creating a clear agenda of action.

USACE Aquatic Ecosystem Restoration Programs, NY/NJ

Status: On-Going

Website: <http://www.nan.usace.army.mil>

USACE's traditional programs of flood risk management and navigation were broadened in the 1990's when Congress requested the Corps to also pursue ecological restoration as a mission area. Increasing scientific and public interest in the restoration of aquatic ecosystems offers an opportunity to broaden USACE's restoration mission. USACE is currently involved in a variety of activities focused on restoring hydrologic and geomorphic processes within the aquatic ecosystem. This should, in turn, help other Federal and state agencies with whom the USACE cooperates in restoration projects and programs, focus on other important restoration program elements such as habitat preservation, reintroduction of native species, and pollution control.

New York – New Jersey Harbor Coalition

Status: On-Going

Website: <http://www.harborcoalition.org/press-room-updates/tag/mwa>

The NY-NJ Harbor Coalition is a campaign of local and national advocacy organizations focused on transforming our region's waterways into a truly world-class harbor and estuary with waterfront parks, ecological health and critical infrastructure to meet the economic, environmental and recreational needs of the residents.



NYC Department of Parks & Recreation's Natural Resources Group Restoration Program

Status: On-Going

Website: <http://www.nycgovparks.org/greening/natural-resources-group>

The Natural Resources Group, which is a division of the Parks Department, has pioneered the field of urban ecological restoration and acquired natural lands, stabilized eroding shorelines, and conducted restoration programs throughout NYC. Several programs are specifically focused on coastal restoration, and when complete, will add approximately 200 acres of critical estuarine habitat.

American Littoral Society's Coastal Habitat Restoration Program

Status: On-Going

Website: www.LittoralSociety.org

ALS provides community-based restoration of habitats important to the coast, spanning from Jamaica Bay to Delaware Bay as well as in Sarasota Bay, Florida. Project examples within the HRE include Jamaica Bay Clean Sweep, Shrewsbury Island Marsh Restoration Project, NJ Living Shorelines Initiative, and the Shadow Lake Fishway.

Trust for Public Land

Status: On-Going

Website: www.tpl.org

Since 1972, the Trust for Public Land has protected land from inner cities to wilderness, pioneering new land conservation techniques across the nation. One of TPL's goals is to provide close-to-home nature, and in the forty years since, TPL has grown into the nation's premier conservation organization creating parks and protecting urban watersheds and habitat.



Gowanus Canal Community Development Corporation, NY

Status: On-Going

Website: www.gowanus.org

The Gowanus Canal Community Development Corporation (GCCDC) is a neighborhood preservation non-profit organization dedicated to the revitalization of the Gowanus Canal area in Brooklyn for the past twenty-nine years. The community-based group has an extensive record of initiatives and involvement in the physical improvement of the Gowanus Canal and the surrounding communities. GCCDC's efforts are focused on the environmental remediation of the Gowanus Canal, housing, economic development, and commercial revitalization.

Bronx River Alliance, NY

Status: On-Going

Website: www.bronxriver.org

The Alliance, comprised of Federal, state, and local organizations, serves as a coordinated voice to protect, improve, and restore the river. They prepared an Ecological Restoration and Management Plan and the Bronx River Greenway Plan that offers a comprehensive view of the restoration of the Bronx River and the parks along its banks. They also coordinate outreach, education, and recreation programs.



The Urban Divers Estuary Conservancy, NY

Status: On-Going

Website: http://www.thebx.net/info/_organizations_urbandivers.php

The Urban Divers Estuary Conservancy is a not for profit environmental & cultural organization committed to active participation in the restoration, revitalization, restoration, protection, as well as a commitment to public education for our coastal resources (rivers, oceans, marine wildlife, green open spaces).

Hackensack Riverkeeper Programs Hackensack Riverkeeper, Inc., NJ

Status: On-going

Website: www.hackensackriverkeeper.org

Hackensack Riverkeeper, Inc. carries out its mission through a combination of both formal and informal environmental education projects focused on raising the level of awareness and sensitivity of the people of the Hackensack River watershed. Hackensack Riverkeeper, Inc. also advocates the responsible restoration and conservation of the various fish and wildlife habitats that exist within the watershed.

Passaic River Coalition, NJ

Status: On-Going

Website: <http://www.passaicriver.org/>

The Passaic River Coalition has been working since 1969 to improve the Passaic River watershed by gathering and using pertinent data to protect drinking water, preserve sensitive wildlife habitat, improve water quality, create new open space, and promote natural flood control management. This organization has led or participated in many initiatives including: Lower Passaic River Remedial Investigation and Feasibility Study, New Jersey's watershed management area (WMA) programs, Blue Acres Program to reduce flood conditions, and a Land Trust to acquire properties of ecological significance and unique landscape character for water resource protection.

Raritan Riverkeeper, NJ

NY/NJ Baykeeper

Status: On-Going

Website: <http://nynjbaykeeper.org/resources-programs/raritan-riverkeeper/>

The Raritan Riverkeeper, as a program of Baykeeper, stops polluters, champions public access, and influences land use decisions. The Riverkeeper pursues opportunities for land preservation and habitat restoration, and partners with other groups to advocate for the Raritan River's environmental importance, as well as its value as a recreational and cultural resource.

Friends & Residents of Greater Gowanus, NY

Status: On-Going

Website: <http://froggbrooklyn.org/>

FROGG is a community based grass-roots organization advocating for environmentally sound community planning for the Gowanus Canal neighborhoods. They work to see the Gowanus Canal brought back to life with water quality standards that sincerely meet state standards for fishable and contact use; not only for the community but also for local wildlife.

Response to Hurricane Sandy

Immediately after Hurricane Sandy, Federal, state and local agencies, as well as civic and academic organizations, evaluated the devastating impacts and provided recommendations to repair the damage and increase resiliency against future storms. Significant coordination has been required to ensure a comprehensive response and eliminate redundancies in current and proposed programs. Programs developed in response to Hurricane Sandy are summarized in Table 4. These responses focus on ecological resources within the HRE, not on repairing the extensive damage to the communities and personal property within the region.



Table 4. Examples of Coastal Restoration Responses to Hurricane Sandy Within the HRE Study Area

U.S. Army Corps of Engineers (USACE)

North Atlantic Coast Comprehensive Study (NACCS) -

<http://www.nad.usace.army.mil/CompStudy.aspx>

Funding: \$19.5 Million (Maine to Virginia) -

Goals of the NACCS are to provide coastal storm risk management strategies and promote coastal resilient communities and robust, sustainable coastal landscape system (considering future sea level rise and climate change scenarios) to reduce risk to vulnerable coastal populations, property, ecosystems, and infrastructure. Study provides a Regional Coastal Framework that identifies: opportunities, potential solutions and parametric costs by region/state; activities warranting additional analysis; and barriers to providing comprehensive protection to affected coastal areas.

Report: Interim Report 1 (March, 2013)

<http://www.nad.usace.army.mil/Sandy.aspx>

Funding: \$221.7 Million

(Repair of Constructed Projects per FCCE Act, PL 84-99 and Restoration of Constructed Projects per PL- 113-2)

Projects within HRE include:

- East Rockaway Inlet to Rockaway Inlet
- Atlantic Coast of New York City, Rockaway Inlet to Norton Point (Coney Island), NY
- Oakwood Beach, NY
- Raritan Bay and Sandy Hook -Section 506 (Keansburg)
- Sandy Hook to Barnegat Inlet, NJ (Seabright to Ocean Township and Asbury Park to Manasquan Inlet)

Hurricane Sandy Coastal Projects Performance Evaluation Study

<http://www.nad.usace.army.mil/Portals/40/docs/ComprehensiveStudy/Final%20Performance%20Evaluation%20Study%20with%20cover%20letter.pdf>

Funding: \$500,000

Goal of this study was to conduct an evaluation of the performance of existing projects constructed by the Corps and impacted by Hurricane Sandy for the purposes of determining their effectiveness and making recommendations for improvements to the projects.

Ongoing Studies

- Rahway River Basin, NJ
- Raritan Bay to Sandy Hook Bay, Highlands, NJ
- Raritan Bay to Sandy Hook Bay, Leonardo, NJ
- Shrewsbury River & Tributaries, NJ
- South Shore of Staten Island, NY
- North Shore of Long Island, Bayville, NY
- Jamaica Bay, Marine Park and Plumb Beach, NY (incorporated into Rockaway Reformulation Study)
- Continuing Authorities Program - McClellan Pier, Hudson River, NY (Section 14)

Sandy Disaster Relief Appropriations Act (PL-113-2)-

<http://www.gpo.gov/fdsys/pkg/PLAW-113publ2/pdf/PLAW-113publ2.pdf>

Supplemental appropriations to address damages caused by Hurricane Sandy and to reduce future flood risk that will support the long-term sustainability of the coastal ecosystem and communities, and reduce the economic costs and risks associated with large-scale flood and storm events. Current estimate of USACE Coastal Restoration Program within New York District is \$3.2 Billion including Repair of 8 Constructed Projects per Flood Control Coastal Emergencies (FCCE) Act, PL 84-99; 29 Operations and Maintenance (O&M) Projects; 7 Authorized Ongoing Construction Projects; 4 Authorized but Unconstructed Projects (ABU), 11 Ongoing Studies; and 3 Continuing Authorities Program (CAP) Projects. NOTE: total program is for projects within the NY District not just HRE Study Area.

Report: Interim Report 2 (May, 2013) -

<http://www.nad.usace.army.mil/Sandy.aspx>

Funding: \$1.101 Billion Projected Construction of Authorized But Unconstructed (ABU) Projects

\$11.5 Million – Ongoing Studies

Projects included in Report 2 within the HRE ONLY:

Authorized but Unconstructed Projects

- Passaic Main Stem, NJ (Passaic River and Newark Bay upstream to the Dundee Dam)
- Raritan Bay to Sandy Hook Bay, Port Monmouth, NJ
- Raritan Bay to Sandy Hook Bay, Union Beach, NJ
- South River, Raritan River Basin, NJ
- Atlantic Coast of New York City, Rockaway Inlet to Norton Point, NY (Coney Island)
- East Rockaway Inlet to Rockaway Inlet and Jamaica Bay, NY (Reformulation Study)/also Ongoing Study)
- Joseph G. Minish Waterfront Park and Historic Area, NJ



U.S. Department of Interior

Sandy Disaster Relief Appropriations Act

<http://www.doi.gov/news/pressreleases/interior-announces-475-million-in-hurricane-sandy-relief.cfm>

Funding: \$271 Million -

New York; \$42 Million - New Jersey;

\$104 Million New York & New Jersey

Hurricane Sandy Rebuilding Task Force - USDOJ

DOI's responsibilities include the restoration of coastal natural systems such as wetlands and barrier dunes, protection of critical infrastructure (water treatment, wastewater, emergency responses, etc), economic revitalization (tourism, beach access), and data sharing to understand impacts and vulnerability of our coastal environment.

National Park Service/Construction

Funding: \$248.6 Million New York; \$0.2 Million New Jersey; \$74.4 Million New York & New Jersey

Funding for response and recovery for clean-up of storm debris and repairs to national park units along the eastern seaboard. Over \$150 million of this funding is allocated for storm response and recovery at Gateway National Recreation Area total. Much of this funding is to restore critical park infrastructure, including public access facilities. However, a portion of the funding is allocated to the restoration of natural areas, such removing wreckage and restoring impacted wetland areas and coastlines (\$2.7 million) and repairing the breached freshwater West Pond in Jamaica Bay (\$1 million).

Hurricane Sandy Coastal Resiliency

Competitive Grants Program -

<http://www.nfwf.org/hurricanesandy/Pages/home.aspx>

Funding: \$175 Million (TBD amount within HRE)

National Fish and Wildlife Foundation (NFWF) administered program that supports projects that reduce community's vulnerability to the growing risks from coastal storms, sea level rise, flooding, erosion and associated threats through strengthening natural ecosystems that also benefit fish and wildlife.

Bureau of Safety and Environmental Enforcement

Funding: \$2.85 Million New Jersey

Funding for repairs and future mitigation measures to prevent or reduce wind and water impacts from future storms at the Ohmsett oil spill research facility in Leonardo, New Jersey.

National Park Service/Historic Preservation Fund

Funding: \$16 Million New York; \$16 Million New Jersey

Funding for historic preservation grants to States.

National Parks Service/Jamaica Bay Science and Resilience Institute

Funding: \$3.6 Million New York

Funding supports the Jamaica Bay Science and Resilience Institute to develop innovative approaches and conduct research that will enhance understanding of resilience in the urban, coastal ecosystems. The Institute is led by a Consortium of 9 academic organizations led by City University of NY working with Federal, state, local agency partners and stakeholders.

U.S. Environmental Protection Agency (USEPA)

Sandy Disaster Relief Appropriations Act

Funding: \$340 Million - New York; \$229 Million - New Jersey

Funding for 1) infrastructure resiliency upgrades beyond Federal Emergency Management Agency (FEMA) support for infrastructure repair, as part of the Clean Water State Revolving Fund and the Drinking Water State Revolving Fund; 2) water quality monitoring to evaluate the effects of Sandy on water quality in the coastal zones of NJ and sediment monitoring to support the water monitoring program; and 3) assessment and remediation of Leaking Underground Storage Tanks.

U.S. Department of Housing and Urban Development (HUD)

Rebuild by Design Competition: Winning Proposals Announced June 2, 2014 - BIG U; Living with the Bay: A Comprehensive Regional Resiliency Plan for Nassau County's South Shore; New Meadowlands: Productive City + Regional Park; Resist, Delay, Store, Discharge: A Comprehensive Strategy for Hoboken; Hunts Point Lifelines; Living Breakwaters

<http://www.rebuildbydesign.org>

Rebuild by Design is dedicated to create innovative community- and policy-based solutions to protect U.S. cities that are most vulnerable to increasingly intense weather events and future uncertainties. Initiated by HUD and the Hurricane Sandy Rebuilding Task Force, Rebuild by Design's aim has been to connect the world's most talented researchers and designers with the Sandy-affected area's businesses, policymakers and local groups to better understand how to redevelop their communities in environmentally - and economically - healthier ways and to be better prepared.

National Oceanic and Atmospheric Administration (NOAA)

NOAA Office of Response and Restoration, U.S. Coast Guard (USCG)

Funding: \$140 Million

NOAA's Office of Response and Restoration is working with the U.S. Coast Guard and affected facilities to reduce the impacts of pollution caused by spread oil, hazardous materials and debris in coastal NY and NJ. Motiva Enterprises spill in Sewaren, NJ, Phillips 66 Refinery spill in Linden, NJ, and Kinder Morgan spill in Carteret, NJ were affected areas.

President Obama's Hurricane Sandy Rebuilding Task Force

The Task Force's Rebuilding Strategy Report serves as a model for communities across the nation facing greater risks from extreme weather and to continue helping the Sandy-affected region rebuild. The Rebuilding Strategy contains policy recommendations to ensure entire communities are better able to withstand and recover from future storms.

New York State

NY Rising Governor's Office of Storm Recovery -

<http://stormrecovery.ny.gov/>

Funding: \$30 Billion

Federal aid for efforts to repair and rebuild from the storm damage; better respond to future disasters; and better protect the state from the impact of future storms. Investments include rebuilding and strengthening critical infrastructure in the areas of transportation, fuel supply, water supply, wastewater treatment systems, electric distribution systems and flood protection systems and building new natural infrastructure (including wetlands, reefs, dunes, and berms to reduce the impact of wave action, storm surges and sea level rise).

New York State Community Development Block Grant Disaster Recovery Program -

<http://www.nyshcr.org/Programs/NYS-CDBG-DR/>

Funding: \$25 Million

Funding for the preparation of Community's Reconstruction Plan supporting recovery and increased resiliency for communities affected by Hurricanes Sandy and Irene, and Tropical Storm Lee. Regions include Capital Region/North Country/Mohawk Valley, Catskills/Hudson Valley, Long Island, New York City and Southern Tier/Central New York. Planning areas within New York City included Breezy Point, Howard Beach, Lower Manhattan, Red Hook, and Rockaway East and West.



New York State Department of State (NYSDOS) NYS 2100 Commission Report: Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure -

<http://www.governor.ny.gov/assets/documents/NYS2100.pdf>

The Commission reviewed the vulnerabilities faced by the State's infrastructure systems, and developed recommendations to increase New York's resilience. Recommendations included: 1) Explore options of natural systems to protect coastal communities against natural disasters such as those seen by Hurricane Sandy (e.g. beaches/dunes); 2) Explore ecological restoration as a cost effective approach to hazard mitigation; and 3) Jamaica Bay Marsh Island Restoration.

State of New Jersey

Department of Community Affairs – Sandy Recovery Division -

<http://www.state.nj.us/dca/divisions/sandyrecovery/>

Report: Community Development Block Grant Disaster Recovery Action Plan

Develop a plan for encouraging sustainable community initiatives and implementing green building, energy efficiency and storm hazard mitigation measures.



Office of the Mayor of the City of New York

New York City Department of City Planning
New York-Connecticut Sustainable Communities Consortium

Report: Coastal Climate Resilience, Urban Waterfront Adaptive Strategies -

http://www.nyc.gov/html/dcp/html/sustainable_communities/sustain_com7.shtml

Report identifies the range of adaptive strategies that can increase the resilience of urban coastal areas to control hazards associated with sea level rise. These strategies include opportunities for habitat restoration and ecological benefits such as living shorelines, beaches and dunes, constructed wetlands, artificial reefs, floating islands, constructed breakwater islands, and coastal morphology alteration.

PlaNYC,
Special Initiative for Rebuilding and Resiliency (SIRR)

Report: SIRR Report 2013, A Stronger More Resilient New York -

www.nyc.gov/html/sirr/html/report/report.shtml

Specific Initiatives and recommendations to rebuild New York City and ensure coastal resilient shorelines including installation of wetlands for wave attenuation (#14); creation of living shorelines and floating breakwaters for wave attenuation (#15/17); use of soft infrastructure as flood protection and study innovative coastal protection techniques (#31); and conduct wetland restoration/wetland mitigation banking (#33).

Report: Hurricane Sandy After Action: Report and Recommendations to Mayor Michael R. Bloomberg -

http://www.nyc.gov/html/recovery/downloads/pdf/sandy_aar_5.2.13.pdf

The summary report, prepared by the Office of the Mayor recommends that the NYCDEP create a plan to remove debris, including hazardous materials, from wetlands and beaches.



Restoration Opportunities in the HRE

Although significant progress towards achieving the goals outlined in the Draft CRP has been made since 2009, there are numerous opportunities to enhance success. Opportunities to restore habitat and reduce the effects of human disturbance are abundant throughout the HRE study area. While many site-specific opportunities have been included through the HEP and USACE nomination process for identifying and cataloguing CRP Restoration Sites, these do not provide a comprehensive list of restoration opportunities. Additional opportunities to restore some of the TECs are available in offshore or sub-aqueous environments of the HRE, and many additional restoration sites could be identified. Since publication of the Draft CRP, the USACE and HEP have collected all available information on each CRP Site to assess opportunities for restoration. Some of the sites were included in ongoing restoration projects, and others were removed from the list for other reasons. More than 400 restoration opportunities have been reviewed as part of the HRE Ecosystem Restoration Feasibility Study, including the original 296 sites identified in the Draft CRP, as well as new sites. To date, there are currently 287 CRP Restoration Sites in the updated CRP which will be evaluated as part of the HRE Feasibility Study (Figure 3). Additional information on the individual sites is now available on New York City's Open Access Space Information System (OASIS). <http://www.oasisnyc.net/map.aspx>

To meet the overall goal of the Program, multiple TECs should be incorporated into each restoration project in order to achieve the greatest ecological benefits at a single location. Many of the TECs address the performance of multiple ecosystem functions. Since Hurricane Sandy made landfall in October 2012, there is increased awareness in the coastal storm risk management functions that can be provided by the TECs. Coastal Wetlands, Eelgrass Beds, and Oyster Reefs can break offshore waves and attenuate their energy. Following Sandy, the Disaster Appropriations Act of 2013 and many other partner programs identified restoration activities, green infrastructure and Natural / Nature-Based Features that highlighted existing CRP sites as well as new opportunities within New York City. Many of the general concepts and initiatives can be applied to most shorelines throughout the region.

The types and numbers of restoration opportunities vary greatly among the planning regions (Table 5). The number of CRP Restoration Sites and types of restoration opportunities in each planning region, along with a description of the identified restoration opportunities, are below:

Jamaica Bay – There is widespread potential for the creation and restoration of a variety of habitats within Jamaica Bay. These include coastal wetlands, oysters, eelgrass beds, habitat for waterbirds, coastal and maritime forests, and the creation of habitat complexes involving two or more TECs. Forty-three (43) CRP Restoration Sites have been identified in the Jamaica Bay planning region. Of these, two were highlighted in the New York City Waterfront Revitalization Plan (NYC WRP), 16 were highlighted in the New York City Department of City Planning Comprehensive Waterfront Plan (NYC CWP) and the Jamaica Bay Marsh Islands were highlighted in the NYS 2100 Commission Report. In addition, the New York City Special

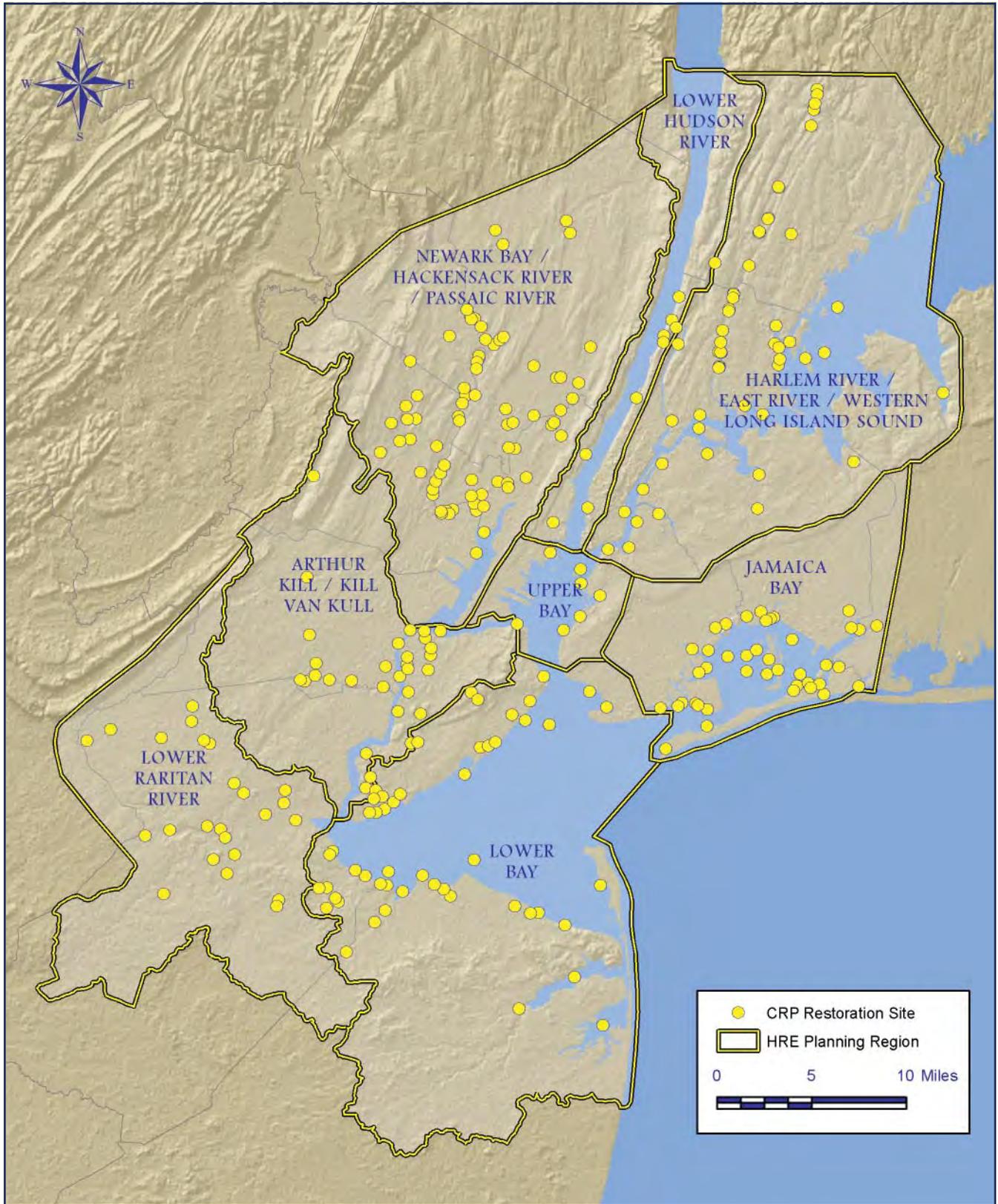


Figure 3. CRP restoration Sites to be evaluated in the updated CRP as part of the HRE Feasibility Study

Table 5. Type and quantity of restoration opportunities among planning regions.

HRE Planning Region	CRP Sites*											
Jamaica Bay	43	33	1	30	3	0	21	22	6	16	40	13
Lower Bay	49	31	1	36	1	1	6	4	16	0	37	22
Lower Raritan River	26	6	0	7	0	0	1	3	5	0	9	6
Arthur Kill/Kill Van Kull	33	21	2	17	0	0	5	7	14	0	24	10
Newark Bay/ Hackensack River/ Passaic River	76	37	0	4	0	0	13	31	41	5	62	33
Lower Hudson River	9	3	0	6	0	0	4	3	1	0	5	7
Harlem River/ East River/W. Long Island Sound	45	14	3	13	2	0	12	11	9	7	20	12
Upper Bay	6	3	0	0	1	0	3	5	0	1	5	4
TOTAL CRP Sites	287	148	7	113	7	1	65	86	92	29	202	107

Initiative for Rebuilding and Resiliency (SIRR) recommended restoring wetlands, oyster reefs, living shorelines, and coastal forests in Jamaica Bay due to their wave-attenuating properties. In particular, the report includes Phase I initiatives of restoring these features at Brant Point and Howard Beach in Queens, and at Plumb Beach in Brooklyn. The NY Rising Community Reconstruction Plan also highlights several CRP sites as part of the New York Governor’s Office of Storm Recovery’s Plan to protect the Howard Beach Community. Jamaica Bay also offers the potential to reduce the effects of human disturbance by improving water and sediment quality in the former tidal creeks that are now enclosed basins and in sub-aqueous bathymetric depressions that experience seasonal hypoxia or anoxia. Significant coordination will continue as a result of the recently established Jamaica Bay Science and Resilience Institute which will provide a forum to advance research, enhance partner coordination, and leverage programs to restore Jamaica Bay.

Lower Bay – This planning region offers the potential to create and restore large expanses of a variety of habitats including oysters, coastal wetlands, eelgrass beds, habitat for waterbirds, and coastal

and maritime forests. Compared to other regions, oyster restoration opportunities appear to be most abundant in the Lower Bay planning region. Forty-nine (49) CRP Restoration Sites have been identified in the Lower Bay planning region. Of these sites, 15 were highlighted in the NYC WRP, and 13 were highlighted in the NYC CWP. In addition, the SIRR recommends the establishment of living shorelines in Tottenville, Staten Island, Oakwood Beach – Buyout Initiative and breakwaters at Great Kills Harbor and the south shore of Staten Island. Sandy Hook Bay and the Shrewsbury and Navesink Rivers meet many of the habitat requirements of eelgrass beds. The only mapped existing eelgrass beds in the HRE study area occur in the Shrewsbury River. The Lower Bay also has many tributaries with dams and culverts that could be modified or removed to provide passage for diadromous fish.

Lower Raritan River – The region includes opportunities to restore coastal wetlands, coastal forests, and potentially oysters along the lower Raritan River, and to improve tributary connections throughout the planning region. Twenty-six (26) CRP Restoration Sites are located within this planning region. There are several opportunities to improve fish passage and connect habitats along tributaries throughout the Lower Raritan River planning region. For example, the installation of fish passage structures on the Duhernal Dam on the South River would open over 170,000 feet of stream corridor for fish migration. Relatively few public access points have been identified on the lower Raritan River and its tributaries. This planning region may represent a substantial opportunity to bring the public to the waterfront.

Arthur Kill / Kill Van Kull – The region offers substantial opportunity to restore coastal wetlands, shorelines and shallows, tributary connections, and waterbird habitat, and to increase existing public access. There are 33 CRP Restoration Sites in this planning region. Five of these sites are highlighted in the NYC WRP, and 14 are highlighted in the NYC CWP. In addition, the SIRR includes recommendations for the establishment of wetlands, living shorelines and reefs at Saw Mill Creek on Staten Island. Coastal wetland creation and restoration opportunities are abundant in the northwestern portion of Staten Island. Pralls Island, Shooters Island and the Isle of Meadows once had established colonies of hundreds of waterbirds. These islands and surrounding wetlands represent an opportunity to restore suitable habitat to attract nesting waterbirds again. Water quality issues and surface sediment contamination are pervasive in the Arthur Kill and Kill Van Kull planning region in part due to the port and navigation infrastructure, and chemical and petroleum facilities. Dozens of Combined Sewer Outfalls (CSOs) discharge into the Kill Van Kull, the Elizabeth River and the Rahway River. Public waterfront access opportunities are limited in this planning region.

Newark Bay / Hackensack River / Passaic River – The Newark Bay, Hackensack River, and Passaic River planning region offers substantial opportunities to restore coastal and freshwater wetlands, create and restore coastal upland habitats, repair human-induced habitat degradation, and provide increased public access to the waterfront. Seventy-six (76) of the CRP Restoration Sites are located in this planning region. Preliminary screening indicates that this planning region offers more than 2,000 acres of coastal wetland creation/restoration opportunities. Contamination issues are pervasive in this planning region. Dozens of CSOs are located along the lower Passaic River and within Newark Bay, and poor water quality in Newark Bay fails to meet the New Jersey Department of Environmental Protection (NJDEP) Best Use Class identified for the waterbody. Numerous EPA Superfund Sites are located within the planning region, perhaps most notably the Diamond Alkali site along a 17-mile stretch of the lower Passaic River. Habitat restoration plans will need to carefully consider contamination concentrations, the potential for the transport of contaminants, and attractive nuisance issues prior to construction. In this planning region, the sequencing of restoration opportunities relative to remedial actions are coordinated through integration and partnership with USEPA’s Superfund program.

Lower Hudson River – Coastal wetland, shorelines and shallows (living shorelines) and oyster restoration opportunities exist along the Lower Hudson River. The high density urban development along the shorelines in this planning region may offer opportunities to enhance shoreline structures and adjacent waters by incorporating habitat features and structures into their designs. However, relatively few restoration sites have been identified in this planning region. Nine CRP Restoration Sites are located along the Hudson River shoreline in Manhattan, the Bronx and in New Jersey. Of these nine sites, two were highlighted in the NYC WRP and seven were highlighted in the NYC CWP. Public access to the waterfront is a very important TEC in this densely populated region, and most of the identified restoration opportunities include enhanced public access.

Harlem River / East River / Western Long Island Sound – This planning region (which is adjacent to the Long Island Sound Study Area) offers a variety of opportunities to create and restore each of the TEC habitats. Extensive shallow littoral and subtidal waters provide the opportunity to create a variety of aquatic habitat types. Many of the islands in the HRE study area are located within this planning region; these represent the potential to improve habitat for waterbirds, primarily by removing invasive vine and tree species. There are also many opportunities to reverse human-induced habitat degradation. Forty-five (45) CRP Restoration Sites are located within this planning region. Of these sites, eight were highlighted in the NYC WRP and 19 were highlighted in the NYC CWP. Breakwaters off the coast of City Island were recommended under the full-build option by the SIRR in the 2013 PlaNYC Report. This planning region provides opportunities to improve water quality in the bays and harbors of western Long Island Sound through programs such as the CSO dredging and ecosystem restoration planned for Flushing Creek.

Upper Bay - The Upper Bay planning region is the smallest and among the most urbanized of the HRE planning regions. The shorelines of the region are heavily lined with piers and bulkheads, and a network of navigation channels runs throughout the subtidal waters of this planning region. Relatively few habitat restoration opportunities have been identified for this planning region. Only six of the CRP Restoration Sites are located within the Upper Bay, including Bush Terminal/Brooklyn Sunset Park, which was highlighted in both the NYC WRP and NYC CWP, and the Gowanus Canal which was highlighted in the NYC CWP. In addition, the SIRR recommends the installation of wetlands, living shorelines and reefs at Bay Ridge Flats as an additional full-build recommendation of the PlaNYC Report. Liberty State Park in Jersey City, New Jersey represents one of the largest opportunities for habitat restoration in the Upper Bay planning region. However, since the Gowanus Canal was placed on the USEPA's National Priorities List in early 2010, Superfund program level remediation will be necessary prior to implementing restoration.

Each of the 287 CRP sites was further evaluated as part of the HRE Restoration Feasibility Study. Project Summary Sheets were prepared including available data, proposed TEC restoration actions and an example conceptual plan for each site. These summary sheets are available on the USACE website (www.nan.usace.army.mil) and information will be included in the OASIS database. New sites can be considered for inclusion as CRP Restoration Sites through the HEP Restoration Work Group nomination process.

Comprehensive Restoration Plan Implementation and Management

Habitat restoration requires coordination among agencies and organizations since restoration opportunities do not always follow park boundaries, or state and county lines. Smaller groups and community organizations are ideal proponents for smaller, localized actions, while Federal agencies are strategically positioned to hold leadership and key partnership roles in large-scale restoration, protection, and sustainable use programs. For this reason, the HEP Restoration Work Group (RWG) brings Federal, state and local non-government organizations together to manage and implement habitat restoration activities in the HRE. The RWG has membership with specific expertise in the HRE study area and a willingness to spend time and effort reviewing documents and addressing critical issues.

The Current HEP RWG participants include representatives from the following agencies and organizations:

- United States Environmental Protection Agency
- United States Army Corps of Engineers
- National Park Service
- National Oceanic and Atmospheric Administration
- The Port Authority of New York & New Jersey
- New Jersey Department of Environmental Protection
- New York State Department of Environmental Conservation
- New York City Department of Parks & Recreation
- New York City Department of Environmental Protection
- New York/New Jersey Baykeeper
- The Hudson River Foundation
- The Nature Conservancy
- The Trust for Public Land

Achieving the objectives of the TECs will also require a substantial dedication of funds and creative funding strategies. Providing funding for restoration on an estuary-wide scale requires a comprehensive strategy for acquiring funds from a variety of sources. As part of the HRE Feasibility Study, the cost of each restoration opportunity will be assessed at either a planning or feasibility level. Although costs are not finalized, the partners acknowledge that restoration will be expensive and leveraging of programs is critical to meeting the objectives of the CRP. Innovative local financing techniques, combined with state and Federal funding opportunities, will generate the support necessary to make these projects a reality. Partnering with the USACE under their Continuing Authorities Program (CAP), General Investigation (GI) studies, or Construction General (CG) projects is a strategy to substantially increase the amount of funding available for restoration projects. Specifically, the HRE Feasibility Study will request new

authorization to construct a subset of the 287 CRP sites. This subset will be evaluated and designed at a greater level of detail in order to be recommended for construction authorization. The remaining sites will be recommended for future feasibility studies pursuant the Civil Works Transformation Initiative. The programs listed above require a cost-share agreement between the USACE and the non-Federal sponsor.

The Disaster Relief Appropriations Act of 2013 (PL-113-2) has provided funding through programs administered by multiple Federal agencies for green infrastructure and natural and nature-based features (NNBFs) to provide coastal resilience to areas impacted by Hurricane Sandy. These funds are used to identify opportunities to enhance resilience that could include the implementation of TECs within the HRE. For example, the USACE's North Atlantic Comprehensive Study (scheduled for January 2015) will provide a coastal framework that will identify a range of potential solutions (including NNBFs) by region/state. The U.S. Department of Interior and the National Fish and Wildlife Foundation administer the Hurricane Sandy Coastal Resiliency Competitive Grants program. These grants support projects that reduce community's vulnerability to the growing risks from coastal storms, sea level rise, flooding, erosion and associated threats through strengthening natural ecosystems that also benefit fish and wildlife.

Other Federal grants for NNBFs/ecosystem restoration are available through programs administered by the Federal Emergency Management Agency (FEMA), U.S. Department of Housing and Urban Development (HUD), USEPA, the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Department of Agriculture (USDA). Funding opportunities are also available from many state-administered programs in both New York and New Jersey, as well as from non-profit organizations. The PANY&NJ's Hudson-Raritan Estuary Resources Program (authorized in 2001 having expended \$60 million to date), was recently reauthorized, and provides an additional \$30 million each for the states of New York and New Jersey to preserve open space and habitat throughout the Hudson-Raritan Estuary study area.

For larger endeavors, it would be beneficial to develop strategic partnerships with other organizations (formal or informal) to identify opportunities for collaboration on restoration projects. Developing cost-sharing agreements and partnerships can result in larger programs that achieve economy-of-scale benefits. For many of the TECs, it may be possible to obtain mitigation and or Natural Resources Damage Assessment (NRDA) funding to support restoration projects.

Policy Considerations

Any restoration opportunity proposed within the HRE is best described as a complicated, multi-jurisdictional regulatory challenge, especially in the aftermath of Hurricane Sandy. The resource management agencies are tasked with balancing multiple but often conflicting goals of resource protection, conservation, coastal resiliency, and providing for compatible waterfront uses. There are many policy issues that should be addressed in a consistent manner during the regulatory approval process throughout the HRE study area. Currently, there are differences in the regulatory approach and policies among agencies that have the statutory authority to regulate restoration activities. Examples of potential conflicts include:

- *Habitat exchange issues:* physical alteration of an existing habitat to create a different habitat (i.e., habitat exchange).
- *Placement of fill in water and beneficial use of dredged material:* the existing Federal Navigation Channel Maintenance and future Harbor Navigation Programs will provide opportunities to improve habitat and coastal resiliency through the beneficial use of dredged material. This fill placement would have a positive effect on the aquatic environment for restoration or provide flood protection. However, the placement of fill is generally discouraged and not permitted by regulators.
- *Attractive nuisance issues:* creating an “attractive nuisance” through the restoration of habitat can occur when the restoration site has the potential to release contaminants into the food chain (wildlife or human).
- *Contaminated sediments:* due to the urban nature of the HRE, it is highly unlikely that the HRE would be cleaned up to acceptable risk guidance benchmarks. Given this challenge, in order to implement restoration in the HRE, agencies need to discuss the concept of “acceptable” for this urban estuary.

The success of the CRP in improving the estuary ecosystem is directly related to and dependent upon successful partnering among stakeholders. CRP management through the HEP RWG incorporates technical guidance, financial guidance, public involvement, and monitoring into the structure and mechanisms to accommodate the dynamic process of long-term environmental restoration. Ecological changes that will be brought about by plan implementation, as well as ongoing changes to the physical and chemical environment of the harbor induced by human activities, will require adjustments to the management of the CRP over time. The CRP management will also have a mechanism to track progress in meeting the program goal, TEC objectives, and documenting lessons learned during implementation.

The CRP is a long-term strategy for restoration in the HRE study area, and thus will be periodically reviewed and updated to acknowledge successes, outline new restoration targets, specify implementation schedules, and reaffirm commitments to the estuary and its stakeholders. Although

the CRP is a planning document to coordinate stakeholders and build consensus, conflicts among jurisdictions, agencies, and the public are inevitable. Therefore, updates to the plan can encourage public participation and advance consensus building among stakeholders.

This Comprehensive Restoration Plan for the Hudson-Raritan Estuary has been prepared by the U.S. Army Corps of Engineers (USACE) and partially funded by The Port Authority of New York and New Jersey (PANY&NJ) as a part of the HRE Ecosystem Restoration Feasibility Study. The full report can be downloaded from: <http://www.watersweshare.org> or www.nan.usace.army.mil/harbor/crp.

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Alley Pond, Queens, NY

List of Acronyms

ABU	Authorized But Unconstructed	NJDOT	New Jersey Department of Transportation
CAP	Continuing Authorities Program	NNBF	Natural and Natural-Based Features
CARP	Contamination Assessment and Reduction Program	NOAA	National Oceanic and Atmospheric Administration
CCMP	Comprehensive Conservation Management Plan	NPL	National Priorities List (USEPA)
CDBG	Community Development Block Grant	NRDA	Natural Resource Damage Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	NRG	Natural Resources Group of the New York City Department of Parks and Recreation
CG	Construction General	NYCCWP	New York City Comprehensive Waterfront Plan
CRP	Comprehensive Restoration Plan	NYCDEP	New York City Department of Environmental Protection
CSO	Combined Sewer Outfall	NYCDPR	New York City Department of Parks and Recreation
CUES	Center for Urban and Environmental Studies	NYCEDC	New York City Economic Development Corp.
CWA	Clean Water Act	NYC OASIS	New York City Open Accessible Space Information Systems
CZMA	Coastal Zone Management Act	NYCWRP	New York City Waterfront Revitalization Plan
EPA	U.S. Environmental Protection Agency	NYSDEC	New York State Department of Environmental Conservation
FCCE	Flood Control Coastal Emergencies	NYSDOS	New York State Department of State
FEMA	Federal Emergency Management Agency	NYSDOT	New York State Department of Transportation
FROGG	Friends of Greater Gowanus	O&M	Operation and Maintenance
GCCDC	Gowanus Canal Community Development Corp.	PANY&NJ	Port Authority of New York and New Jersey
GIS	Geographical Information System	RWG	Restoration Work Group
HEP	New York/New Jersey Harbor Estuary Program	SIRR	Special Initiative for Rebuilding and Resiliency
HMGP	Hazard Management Grant Program	TBD	To Be Determined
HRE	Hudson-Raritan Estuary	TEC	Target Ecosystem Characteristic
HRF	Hudson River Foundation	USACE	U.S. Army Corps of Engineers
HUD	Housing and Urban Development	USCG	U.S. Coast Guard
JBWPP	Jamaica Bay Watershed Protection Plan	USDA	U.S. Department of Agriculture
MCY	Million Cubic Yards	USDOJ	U.S. Department of Interior
MGP	Manufactured Gas Plant	USEPA	U.S. Environmental Protection Agency
NACCS	North Atlantic Coast Comprehensive Study	USGS	U.S. Geological Survey
NEP	National Estuary Program	USHUD	U.S. Department of Housing and Urban Development
NFWF	National Fish and Wildlife Foundation	USFWS	U.S. Fish and Wildlife Service
NGO	Non-Governmental Organization	WRDA	Water Resources Development Act
NJDEP	New Jersey Department of Environmental Protection		



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