

# HUDSON-RARITAN ESTUARY Comprehensive Restoration Plan

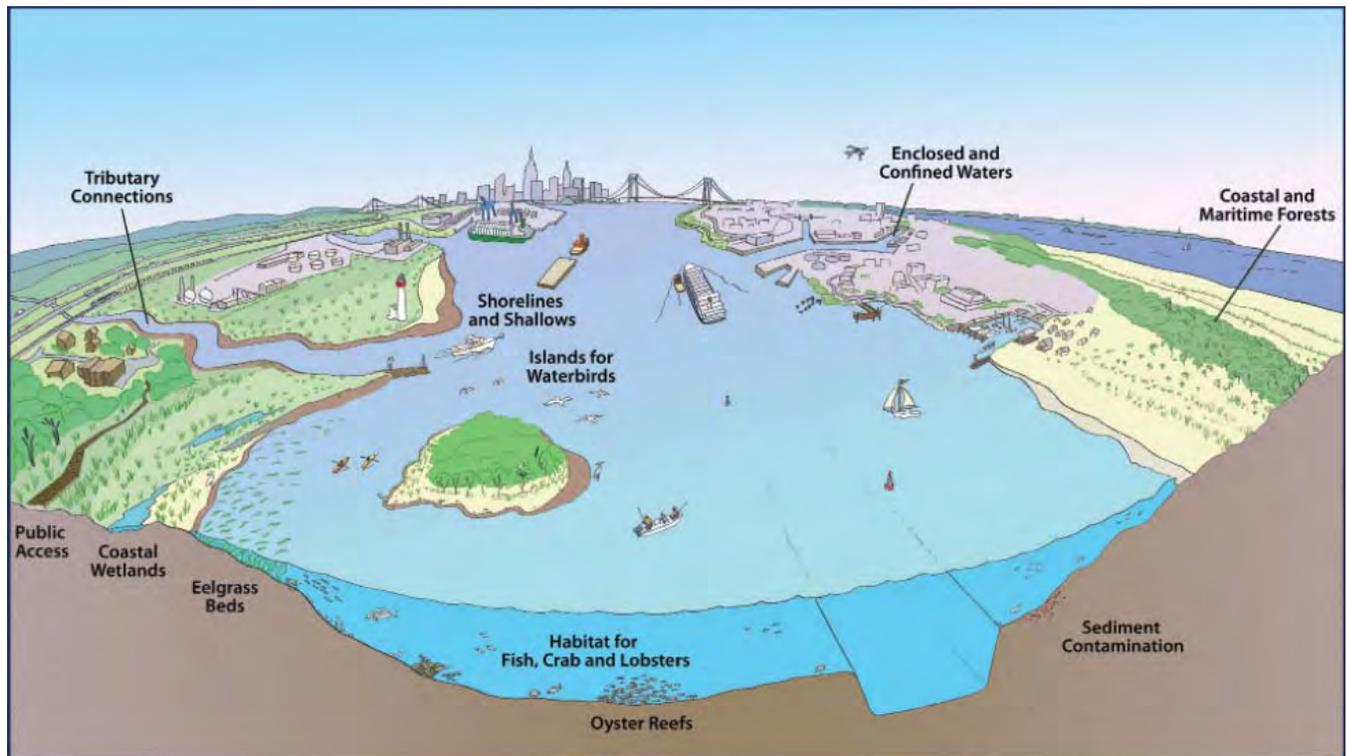
## EXECUTIVE SUMMARY

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## Contents

Introduction .....	1
Study Area .....	4
Restoration Programs .....	5
Target Ecosystem Characteristics .....	11
Restoration Opportunities in the HRE .....	11
Comprehensive Restoration Plan Implementation and Management .....	15

## Introduction

The Hudson-Raritan Estuary (HRE) is located within one of the most urbanized regions in the United States and centuries of industrialization and urbanization have degraded the environmental conditions. Although there are many existing Federal, state, municipal and non-governmental habitat restoration programs that are able to achieve successful restoration objectives, to date there has been no consensus on the restoration goal and objectives on an estuary-wide scale. As a result, success of individual restoration efforts is measured on a project level, without consideration of the benefits achieved in the context of the entire Hudson-Raritan Estuary. The Comprehensive Restoration Plan (CRP), which is 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 their non-Federal sponsor, The Port Authority of New York & New Jersey (PANYNJ) in March 2009. It is intended to be used by environmental and community groups, government agencies, and other restoration practitioners throughout the region to work towards a series of common restoration goals to provide ecological benefits to the estuary.

The collaborative planning effort was initiated in 1988, when Congress recognized the New York & New Jersey Harbor as an estuary of national importance and accepted the HRE into the National Estuary Program (NEP). Following this designation, the Harbor Estuary Program (HEP), an organization composed of Federal, State agencies and local organizations, completed a Comprehensive Conservation and Management Plan (CCMP) in March of 1996. Included among the CCMP's recommendations was the development of a comprehensive strategy for habitat protection and restoration. The USACE and The PANYNJ joined the process of developing the strategy in 1999 with the initiation of the HRE Ecosystem Restoration Feasibility Study.

The purpose of the study is to develop a long-term strategy to restore and enhance degraded environments within the HRE in partnership with the regional stakeholders. The HEP Policy Committee adopted the CRP in December 2010 as the path forward for restoring the Harbor Estuary.

As a first step in the planning process, the HEP Habitat and Public Access Workgroups' acquisition and restoration site nomination process helped to catalog numerous restoration opportunities. Additional sites were identified during outreach efforts conducted as a part of the USACE's Needs

### DEVELOPMENT OF THE TARGET ECOSYSTEM CHARACTERISTICS

The Hudson River Foundation in cooperation with Cornell University guided the development of the restoration targets for the Hudson-Raritan Estuary, by defining the program goal, identifying candidate restoration objectives, and defining the 11 Target Ecosystem Characteristics (TECs).

The development of the TECs are documented in two reports:

Setting Targets for Restoration of the Hudson-Raritan Estuary: Report of an Interdisciplinary Workshop (2006)

Target Ecosystem Characteristics for the Hudson-Raritan Estuary: Technical Guidance for Developing a Comprehensive Ecosystem Restoration Plan (2007)

To learn more, please visit: [www.hudsonriver.org](http://www.hudsonriver.org)

and Opportunities evaluation. Collectively, as of March 2009, 296 restoration and acquisition sites and 436 public access sites were cataloged and included in HEP’s New York City Open Accessible Space Information System (NYC OASIS).

To ensure that the HRE Ecosystem Restoration Feasibility Study was based on sound scientific principles, beginning in 2005 the Hudson River Foundation and Cornell University were invited to participate in the development of a strategy to restore this highly urbanized estuary. A series of workshops were held with estuarine scientists and restoration practitioners to develop the framework for the restoration plan. Scientists from various Federal, state, and local agencies, non-government organizations, and institutions gathered to craft the strategy for ecological restoration on an estuary-wide scale. From the beginning, there was consensus among the participants that the restoration program should be focused on creating and restoring habitats with high ecological value and function interspersed within the human-dominated landscape, and to allow public access to the waterfront to appreciate the estuary. 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 that is of ecological and/or societal value (Table 1). The TECs 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.

TARGET ECOSYSTEM CHARACTERISTICS FOR THE HUDSON-RARITAN ESTUARY	
	Coastal Wetlands
	Islands for Waterbirds
	Coastal and Maritime Forests
	Oyster Reefs
	Eelgrass Beds
	Shorelines and Shallows
	Habitat for Fish, Crab, and Lobsters
	Tributary Connections
	Enclosed and Confined Waters
	Sediment Contamination
	Public Access

Table 1. Target Ecosystem Characteristics for the Hudson-Raritan Estuary

## Study Area

The HRE spans many political and ecological borders, which poses 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. The eight planning regions of the HRE study area 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 1).

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 (USFWS 1997). The complex geological and glacial history of the HRE study area created this unique

and diverse estuary, which contains a great variety of sediments, landforms, bedrock types that support diverse groups of ecological communities, such as residents and migrants of almost 300 species of birds; over 100 species of fish; countless plant species; and many important terrestrial and aquatic invertebrates (Steinberg et al. 2004, USFWS 1997).

The HRE is the most densely populated estuary in the United States, with more than 20 million residents (USACE 2006a) and a long history of physical and chemical habitat alteration. Unchecked industrial and residential development along with vast navigation and infrastructure improvements have resulted in ecosystem level changes to the HRE causing dramatic shifts in aquatic community structure and the populations of organisms inhabiting the area. Contaminants are widespread throughout the estuary, and in some areas the levels in the water, sediments and biota far exceed regulatory benchmarks, and sewage-related contamination issues are still a common problem.



*Figure 1. The eight Planning Regions of the Hudson-Raritan Estuary study area. The Statue of Liberty is represented by the star.*

The HRE has suffered extensive losses in wetland habitat and aquatic communities such as eelgrass and oyster beds (USACE 2004b, Squires 1992). Approximately 300,000 acres (1,214 km<sup>2</sup>) of tidal wetlands and subtidal waters have been filled in the study area and only about 18% (15,500 acres [63 km<sup>2</sup>]) of the 85,000 acres of historic tidal wetlands remain. The losses of shoreline aquatic vegetation have resulted in increased turbidity, shoreline erosion, and reductions in wildlife breeding and wintering grounds. Alterations in tidal exchange have transformed much of the remaining shallow water habitat from the originally diverse wetland plant assemblages to monocultures of invasive species (USACE 2004).

The HRE study area contains examples of invaluable open spaces with functional aquatic habitats, such as Jamaica Bay, the Hackensack Meadowlands, and Sandy Hook Bay. The aquatic vegetation in these areas contributes to preserving the integrity and productivity of the nearshore zone (Bain et al. 2007). For decades the islands of the HRE study area have functioned as rookeries, supporting over a thousand breeding pairs of long-legged wading birds (Kerlinger 2004). Some of these areas, scattered throughout the HRE study area, have been preserved or restored. However, many of these valuable environmental assets represent isolated sites that are typically surrounded by industrialized or densely populated urban areas and are vulnerable to degradation from surrounding land uses. Although they currently support some fish and wildlife, many of these open areas are severely degraded and would benefit from habitat improvements.

## Restoration Programs

Ecosystem restoration and conservation programs have existed in the HRE study area for decades, and these efforts have often been successful. Some restoration programs coordinated by state governments and local organizations focus on habitat protection, in which existing natural lands are acquired and protected from development. Land acquisition of wetlands and other valuable open spaces remains an important component of any restoration plan and one that goes directly to the objective of preventing habitat losses. Many current programs often consist of physically altering degraded areas and re-creating upland, wetland, and aquatic habitat to restore the habitat's ecological values, thereby complementing the approach of preventing habitat loss. Several factors led to the increasing trend of restoration programs in the HRE study area, such as funding availability, incorporating restoration considerations into resource management programs, the expansion of restoration ecology and scientific information, and increased stakeholder awareness. Many of these on-going programs are described in Table 2.

Table 2 Examples of Current Restoration Programs and Studies in the Hudson-Raritan Estuary Study Area.

<p><b>Lower Passaic River Restoration Project, NJ</b></p> <p>USACE, USEPA, NJDOT, NJDEP, NOAA, USFWS</p> <p>Status: Feasibility Study</p> <p>Website: <a href="http://www.ourpassaic.org">www.ourpassaic.org</a></p> <p>Develop a comprehensive watershed-based plan for the remediation and restoration of the Lower Passaic River Basin. Habitat losses of floodplains, wetlands, waterfowl nesting areas, and valuable fish spawning and benthic habitats will be remedied through restoration of specific habitats, vegetative buffer creation, shoreline stabilization, and aquatic habitat improvements. The remedy will include long-term, effective reduction of toxicity, mobility, and volume of sediment contamination to improve habitat and reduce potential effects to human health and the environment.</p>	<p><b>Hudson River Estuary Program</b></p> <p>NYSDEC</p> <p>Status: Implementation</p> <p>Website: <a href="http://www.dec.ny.gov/lands/4920.html">www.dec.ny.gov/lands/4920.html</a></p> <p>Based on 1996 Action Plan; comprehensive restoration of intertidal and subtidal freshwater and oligohaline habitats, conservation of natural resources, promote full public use and enjoyment of the river.</p>	<p><b>Hackensack Meadowlands Restoration Program, NJ</b></p> <p>USACE, New Jersey Meadowlands Commission</p> <p>Status: Feasibility Study</p> <p>Website: <a href="http://www.nan.usace.army.mil/harbor/envt.htm">www.nan.usace.army.mil/harbor/envt.htm</a></p> <p>Develop a comprehensive watershed-based restoration plan. Initiated to acquire and enhance significant wetland habitat, this program also plans to improve tidal flow and manage connectivity, monitor water quality, and develop a hydrodynamic model to address flood control and water quality improvement. Opportunities also exist for cleanup of sediments that have been contaminated by numerous non-point sources.</p>
<p><b>Gowanus Canal and Bay Restoration Study, NY</b></p> <p>USACE, NYCDEP, Gowanus Canal Community Development Corporation, Urban Divers, Friends and Residents of Greater Gowanus</p> <p>Status: Feasibility Study</p> <p>Website: <a href="http://www.nan.usace.army.mil/harbor/envt.htm">www.nan.usace.army.mil/harbor/envt.htm</a></p> <p>Restoration opportunities include selective dredging or capping to reduce sediment contaminants, wetland creation, and water quality improvements in confined waterways.</p>	 <p><b>Harbor Estuary Program</b></p> <p>USEPA, USACE, PANYN, NY, NJ, Local Government, NGOs.</p> <p>Status: Planning</p> <p>Website: <a href="http://www.harborestuary.org">www.harborestuary.org</a></p> <p>Established as part of the National Estuary Program, the HEP manages a multi-year effort to develop and implement a plan to protect, conserve, and restore the HRE.</p>	<p><b>New York City Pier Restoration, NY</b></p> <p>Hudson River Park Trust, HEP, Patagonia Soho, NYU, Harbor Estuary Stewardship Program</p> <p>Status: Planning</p> <p>Website: <a href="http://www.fohrp.org">www.fohrp.org</a></p> <p>The dilapidated piers are being reconstructed into public spaces for mixed uses, including lawn/garden areas, scenic overlooks, playgrounds, athletic fields, event</p>
<p><b>Bridge Creek Wetland Restoration Project, NY</b></p> <p>NOAA and NYSDEC</p> <p>Status: Planning</p> <p>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 will restore 18 acres (0.07 km<sup>2</sup>) of wetlands near the Arthur Kill.</p>	<p><b>Metropolitan Waterfront Alliance</b></p> <p>Status: On-Going</p> <p>Website: <a href="http://www.waterwire.net">www.waterwire.net</a></p> <p>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.</p>	<p><b>Flushing Bay and Creek Restoration Study, NY</b></p> <p>USACE, NYCDEP, PANYNJ</p> <p>Status: Feasibility Study</p> <p>Flushing Bay's ecosystem has been degraded through filling, shoreline hardening, and effluent from CSOs and landfills. Potential restoration measures for the area include: tidal and freshwater wetland restoration, complete removal of an earthen dike that restricts tidal flow, stabilizing shoreline, and debris removal.</p>

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<p><b>Contamination Assessment and Reduction Project (CARP)</b></p> <p>HRF, PANYNJ, NJDOT, NYSDEC, NJDEP, USACE, USEPA, USGS, Environmental Defense, multiple universities and research groups</p> <p>Status: On-Going</p> <p>Website: <a href="http://www.carpweb.org/main.html">www.carpweb.org/main.html</a></p> <p>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). This data collection and modeling effort revealed the extent to which persistent, legacy chemicals continue to contaminate the HRE study area and recommends sediment remediation as the most significant method of contaminant control. 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.</p>	<p><b>Jamaica Bay Ecosystem Restoration Project NY</b></p> <p>USACE, NYCDEP, National Park Service</p> <p>Status: Feasibility Study</p> <p>Website: <a href="http://www.nan.usace.army.mil/project/newyork/factsh/pdf/jamaica.pdf">http://www.nan.usace.army.mil/project/newyork/factsh/pdf/jamaica.pdf</a></p> <p>Investigate chronic loss of perimeter wetlands and the benefits of restoring the underwater borrow pits in Norton Basin and Little Bay.</p> <p>Other projects work to promote better water circulation and restore tidal flow, maritime forests, and benthic habitat.</p>	<p><b>Bronx River Restoration, NY</b></p> <p>USACE, NYCDEP, Westchester County Dept. Of Planning</p> <p>Status: On-Going</p> <p>This study is developing a watershed restoration plan for the Bronx River Basin.. The findings of the plan will both identify potential restoration opportunities and aid in informing the site selection prioritization process. This plan will also identify key non-structural components of environmental restoration and maintenance operations and actions that would complement the proposed restoration actions.</p>
<p><b>Office of Natural Resource Restoration, NJDEP</b></p> <p>Status: On-Going</p> <p>Website: <a href="http://www.nj.gov/dep/nrr/">www.nj.gov/dep/nrr/</a></p> <p>Similar to Federal Trustees like NOAA and USFWS, the NJDEP's Office of Natural Resource Restoration (ONRR) assesses damages to natural resources and works to accurately identify instances where environmental injuries are caused by specific releases. If a responsible party is identified, restoration and/or compensation for damages will be reached through a settlement, which will specify an adequate dollar amount for compensation and a proposed use of the funds. Settlements cover initial assessment and litigation costs, as well as fund restoration projects or habitat acquisitions.</p>	<p><b>Liberty State Park, NJ</b></p> <p>USACE and NJDEP</p> <p>Status: Pre-construction</p> <p>Website: <a href="http://www.nan.usace.army.mil/harbor/envt.htm">www.nan.usace.army.mil/harbor/envt.htm</a></p> <p>This is one of the first restoration studies conducted under the HRE study authority, and will include 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.</p>	<p><b>Woodbridge Creek Restoration &amp; Mitigation Project, NJ</b></p> <p>USACE, PANYNJ, NOAA, and NJDEP</p> <p>Status: Construction</p> <p>This project includes tidal wetland restoration and preservation to reconnect nearly 70 acres (0.28 km<sup>2</sup>) of healthy existing and newly created wetlands to the Arthur Kill and provide public access and educational nature trails.</p>
	<p><b>Passaic River Coalition, NJ</b></p> <p>Status: On-Going</p> <p>Website: <a href="http://www.passaicriver.org">www.passaicriver.org</a></p> <p>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 Restoration Initiative, 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.</p>	<p><b>Natural Resources Group, NY</b></p> <p>NYC Department of Parks &amp; Recreation</p> <p>Status: On-Going</p> <p>Website: <a href="http://www.nycgovparks.org/">www.nycgovparks.org/</a></p> <p>The NRG, 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 (0.8 km<sup>2</sup>) of critical estuarine habitat. Many larger programs include salt marsh restoration components, like Turtle Cove in the Bronx, Spring Creek in Brooklyn (with USACE), and Alley Park in Queens, New York.</p>

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<p><b>Spring Creek Ecosystem Restoration Study</b></p> <p>USACE, NYC Department of Parks and Recreation NRG          Status: Feasibility Study</p> <p>The proposed ecosystem restoration project seeks to improve the habitat in Spring Creek Park by restoring approximately 37 acres of habitat, 17 acres of inter-tidal salt marsh, and 20 acres of coastal grassland and maritime shrubland combine</p>	<p><b>Gowanus Canal Community Development Corporation</b></p> <p>GCCDC          Status: On-Going          Website: <a href="http://www.gowanus.org">www.gowanus.org</a>.</p> <p>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. Our 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.</p>	<p><b>The Urban Divers Estuary Conservancy</b></p> <p>Urban Divers          Status: On-Going          Website: <a href="http://www.urbandivers.org">www.urbandivers.org</a></p> <p>The Urban Divers Estuary Conservancy is a not for profit environmental &amp; 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); with a special focus on the urban estuary, its watershed and the community that lives, learns, works, play and worship in and along its shore.</p>
<p><b>Oyster Reef Restoration</b></p> <p>NY/NJ Baykeeper          Status: On-Going          Website: <a href="http://www.nynjbaykeeper.org">www.nynjbaykeeper.org</a></p> <p>The NY/NJ Baykeeper's Oyster Restoration Program has been possible due to the dedicated support of hundreds of volunteers. Several studies have been initiated including the Oyster Gardening Program, the Keyport Harbor and Navesink River oyster plantings, and the proposed benthic habitat restoration at Jamaica Bay. They have also partnered with Rutgers University, NY Meadowlands Commission, and Hackensack Riverkeeper to implement oyster research in the Hackensack River.</p>	<p><b>Newark Bay Superfund Site</b></p> <p>USEPA; NOAA          Status: On-going          Website: <a href="http://www.epa.gov/region02/superfund">www.epa.gov/region02/superfund</a></p> <p>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.</p>	<p><b>Hackensack River Keeper Programs Hackensack Riverkeeper, Inc.</b></p> <p>Status: On-going          Website: <a href="http://www.hackensackriverkeeper.org">www.hackensackriverkeeper.org</a></p> <p>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.</p>
<p><b>Harbor Herons Project, NY/NJ</b></p> <p>New York City Audubon Society          Status: On-Going          Website: <a href="http://www.nycaudubon.org/projects/harborherons/">www.nycaudubon.org/projects/harborherons/</a></p> <p>The Harbor Herons Project, led by the New York city Audubon Society, conducts annual breeding bird surveys of heron, egret, and ibis colonies in NYC, providing valuable information on their population status and breeding habits. The program has recently been expanded to include monitoring of shoreline areas to gain information on foraging areas.</p>	<p><b>Bronx River Alliance</b></p> <p>Status: On-Going          Website: <a href="http://www.bronxriver.org">www.bronxriver.org</a></p> <p>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.</p>	<p><b>Friends &amp; Residents of Greater Gowanus</b></p> <p>Status: On-Going          Website: <a href="http://www.frogg.us">www.frogg.us</a>.</p> <p>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.</p>

Table 2 Examples of Current Restoration Programs and Studies in the Hudson-Raritan Estuary Study Area.

<p><b>Salt Marsh Restoration &amp; Monitoring, NY</b></p> <p>NYS DOS Division of Coastal Resources</p> <p>Status: On-Going</p> <p>Website: <a href="http://www.dec.ny.gov/lands/5116.html">www.dec.ny.gov/lands/5116.html</a></p> <p>Program provides guidance for developing and monitoring salt marsh restoration programs to standardize methodology and ensure successful results.</p>	<p><b>Raritan Riverkeeper</b></p> <p>NY/NJ Baykeeper</p> <p>Status: On-Going</p> <p>Website: <a href="http://www.nynjbaykeeper.org">www.nynjbaykeeper.org</a></p> <p>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.</p>	<p><b>New York City Department of Environmental Protection (NYCDEP)</b></p> <p>Status: On-going</p> <p>Website: <a href="http://www.nyc.gov/dep">www.nyc.gov/dep</a></p> <p>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).</p>
<p><b>Lincoln Park Wetland Restoration, NJ</b></p> <p>NOAA; NJDEP; USACE</p> <p>Status: On-Going</p> <p>Website: <a href="http://www.gov/recovery">www.gov/recovery</a></p> <p>The Lincoln Park Wetland Restoration project received \$10.6 million in Federal Recovery Act funds to restore native salt marsh community and increase public access to a restored urban ecological oasis. Restoration of the tidal wetland hydrology at the site will be accomplished by excavating previously placed dredged and landfill material and re-contouring the site to create intertidal habitat and tidal creeks. This project will restore approximately 24 acres of wetland and 11 acres of transition area and will create 4,500 linear feet of tidally flowed creeks.</p>	<p><b>Old Place Creek Tidal Wetlands Restoration, NY</b></p> <p>NOAA, USEPA, USFWS, USDA, USACE, NYSDEC</p> <p>Status: On-Going</p> <p>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).</p>	<p><b>PANYNJ Hudson Raritan Estuary Resources Program</b></p> <p>Status: On-Going</p> <p>In 2001, the PANYNJ established a \$60 million fund 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. Properties considered for the program are sites that environmental groups identified as candidates for preservation and provide public access to waterfront areas, buffer areas around existing Port Authority facilities, or preserve key natural resource areas.</p>
<p><b>KeySpan Corporation in Staten Island, NY</b></p> <p>USACE, PANYNJ</p> <p>Status: Constructed</p> <p>This site is located adjacent to the Keyspan corporation facility in Staten Island, NY. The \$5,400,000 project was constructed to mitigate from potential shallow water impacts resulting from the deepening of the Arthur Kill Channel. restored nine acres of tidal marsh by removing Phragmites, 36,200 cubic yards of soil, re-contouring the site to elevations suitable for native plants and planting 107,000 native plants.</p>	<p><b>Gerritsen Creek Ecosystem Restoration Project, NY</b></p> <p>USACE, NYC Department of Parks &amp; Recreation, NRG</p> <p>Status: On-Going</p> <p>Project's goal is to improve the aquatic and coastal grassland habitats by improving tidal connectivity and removing invasive species near the junction of Gerritsen Creek and Mill Creek, immediately west of Floyd Bennett Field in Jamaica Bay. The proposed project will restore approximately 20 acres of salt marsh and 15 acres of rare coastal grassland.</p>	<p><b>Coastal Habitat Restoration Program</b></p> <p>American Littoral Society</p> <p>Status: On-Going</p> <p>Website: <a href="http://www.LittoralSociety.org">www.LittoralSociety.org</a></p> <p>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 (removal of derelict boats and other large debris from aquatic habitats); International Coastal Cleanup (New York State); Heel the Hook (including restoration of barrier beach plant communities on Sandy Hook, NJ); Shrewsbury Island Marsh Restoration Project; NJ Living Shorelines Initiative; Shadow Lake Fishway; and a coastal habitat restoration database.</p>

Table 2 Examples of Current Restoration Programs and Studies in the Hudson-Raritan Estuary Study Area.

<p><b>Elders Point Marsh Island Restoration - Beneficial Use of Dredged Material</b></p> <p>USACE, PANYNJ, NPS, NYSDEC, NYCDEP</p> <p>Status: Constructed</p> <p>Website: <a href="http://www.nan.usace.army.mil/project/newyork/factsh/pdf/elders.pdf">http://www.nan.usace.army.mil/project/newyork/factsh/pdf/elders.pdf</a></p> <p>Restoration of Elder's Point Marsh in Jamaica Bay involves using dredged material to restore island elevation and replanting salt marsh vegetation. Construction of the Elders Point East Marsh Island took place in 2006-2007, as mitigation for the New York &amp; New Jersey Harbor Navigation Project. Implementation of restoration at Elders Point and Yellow Bar Hassock has been proposed through beneficial use of dredged material from the New York &amp; New Jersey Harbor Navigation Project per Section 207 authority and in cooperation with The Port Authority of New York &amp; New Jersey, the non-Federal sponsor. Approximately 34 acres of salt marsh habitat is being constructed at Elders Point West via placement of approximately 200,000 cubic yards of dredged material; up to 60 acres of salt marsh habitat is proposed for restoration at Yellow Bar Hassock via placement of approx. 250,000 cubic yards of dredged material.</p>	<p><b>Jamaica Bay Watershed Protection Plan (JBWPP) Ecosystem Pilot Projects</b></p> <p>NPS, HRF, NYCDEP</p> <p>Status: On-Going</p> <p>Website: <a href="http://www.nyc.gov/html/dep/html/dep_projects/jamaica_bay.shtml">www.nyc.gov/html/dep/html/dep_projects/jamaica_bay.shtml</a></p> <p>The JBWPP Ecosystem Pilot Projects is a program designed to improve overall water quality in Jamaica Bay. Two pilot projects include conducting small-scale oyster reef and eelgrass bed habitat restoration to improve ecological function and potentially reduce nutrients in localized areas in Jamaica Bay. If successful, these project may lead to larger habitat restoration projects implemented bay-wide. 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 will also invest in water quality improvements in Jamaica Bay as part of the 2010 agreement between the New York State Department of Environmental Conservation, Natural Resources Defense Council and New York City, the City will invest \$15 million for marshland restoration projects within Jamaica Bay.</p>	<p><b>Joseph P. Medwick Park Restoration Project, NJ</b></p> <p>USACE, PANYNJ, in partnership with Middlesex County, NJ, Department of Parks and Recreation</p> <p>Status: Constructed</p> <p>The site is located in the northern portion of Joseph P. Medwick Park along the southern shore of the Rahway River, Rahway, N.J. The \$3,300,000 project was constructed to mitigate for potential shallow water impacts resulting from the deepening of the Arthur Kill Channel. Approximately 14 acres of tidal wetlands were restored by removing Phragmites and approximately 30,000 cubic yards of soil, re-contouring the site to elevations suitable for native plants, and planting 270,000 plugs of native wetland plants. Water flow to the area has been reestablished, improving the water and soil quality and promoting the return of native fish and wildlife.</p>
<p><b>Soundview Park Ecosystem Restoration Study, NY</b></p> <p>USACE, NYC Department of Parks &amp; Recreation, NRG</p> <p>Status: In-Design</p> <p>In December 2009, the District executed a Project Partnership Agreement (PPA) with New York City Department of Parks and Recreation. This PPA allows for the Design and Implementation (construction) of the project. Award of a construction contract could occur as early as the end of calendar year 2010.</p> <p>The project involves approximately 3 acres in Soundview Park immediately north of the park's lagoon area. The area would be converted to vegetated tidal wetland from what is a currently Common Reed (Phragmites sp.) and debris dominated area.</p>	<p><b>Long Island Sound Study</b></p> <p>Save the Sound, NOAA, USEPA, USFWS, CTDEP, NYSDEC, NYCDEP</p> <p>Status: On-Going</p> <p>Website: <a href="http://www.longislandsoundstudy.net">www.longislandsoundstudy.net</a></p> <p>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.</p>	<p><b>USACE Aquatic Ecosystem Restoration Programs</b></p> <p>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.</p>

## Target Ecosystem Characteristics

The 11 TECs define restoration actions relating to specific habitat types, complexes, contamination issues or societal values that collectively contribute to the overall program goal of the establishment of a mosaic of habitats to provide society with new and increased benefits from the estuary environment. Each TEC provides its own unique range of ecological services that together define the critical habitat and societal needs for the HRE and promote increased biotic diversity, sustainable ecosystem functions and public access. 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). Each TEC was assigned both short-term and long-term quantitative objectives (Table 3).

## Restoration Opportunities in the HRE

Two approaches were used to identify opportunities to conduct restoration activities and achieve the TEC objectives: site specific and regional analyses. As described above, the HEP and the USACE have catalogued 296 priority restoration sites (CRP sites). While many of the identified restoration sites provide opportunities to restore the TECs, additional areas are needed to achieve the ambitious objectives of the program. To supplement the CRP sites, a series of Geographic Information System analyses were conducted to identify areas that may present additional opportunities to meet the TEC objectives. These estuary-wide analyses helped to guide the planning efforts and to estimate whether the TEC objectives are achievable, given the existing conditions of the HRE.

Each planning region within the HRE was evaluated for potential restoration opportunities. The types and quantity of restoration opportunities vary greatly among the planning regions (Table 4). The number of CRP sites in each planning region and the types of restoration opportunities that have been identified for each region along with a description of the restoration opportunities are provided below:

- *Jamaica Bay* – Fifty-five (55) CRP sites have been identified in the Jamaica Bay planning region. There is widespread potential for the creation and restoration of a variety of habitats including coastal wetlands, oysters, eelgrass beds, islands for waterbirds and maritime forests, as well as complex habitats involving combined TECs. In this region there is also 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 the bathymetric depressions that experience hypoxic conditions. Although there is much potential to conduct habitat restoration within the Jamaica Bay planning region, contamination issues are pervasive within the Bay and its tributaries. The surface sediments within this region have high concentrations of PCBs, DDT, as well as Total Dioxins and Furans.
- *Lower Bay* – Fifty-seven (57) CRP sites have been identified in the Lower Bay planning region. This planning region offers the potential to create and restore large expanses of a variety of

Table 3. 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.

 Coastal Wetlands	One new wetland that provides at least five primary functions in each HRE region (1,200 total acres)	Continue restoration at a rate of 400 acres per year for a total system gain of 15,200 acres
 Islands for Waterbirds	Enhance at least one island in each of the four main island groups within the HRE study area	All islands in the four main island groups provide roosting and nesting sites
 Coastal and Maritime Forests	Establish one new forest of at least 50 acres and rehabilitate at least 200 additional acres of existing forest.	Establish 500 acres of new forest among three sites, and rehabilitate another 500 acres of existing forest.
 Oyster Reefs	500 acres of reef habitat across 10-20 sites	5,000 acres of established oyster reef habitat
 Eelgrass Beds	Create one test bed in each HRE region	Three established beds in each HRE region capable of supporting eelgrass
 Shorelines and Shallows	Establish new shorelines and shallows sites in three HRE regions	Restore all available shorelines and shallows sites in three HRE regions, and two sites in other planning regions
 Habitat for Fish, Crab, and Lobsters	Complete a set of two functionally related habitats in each HRE region	Complete four sets of at least two functionally related habitats in each HRE region
 Tributary Connections	One less barrier per year to passage between at least three different inland habitats	Continue reconnecting habitats at a rate of one project per year until all barriers within the HRE study area are removed or made passable
 Enclosed and Confined Waters	Improve the water quality or environmental conditions of eight confined water bodies to meet their current designated use classification	Improve the water quality or environmental conditions of eight confined water bodies to meet the criteria of their receiving waters
 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 point and upgrade one access point in each of the HRE regions per year	All waters of the HRE are accessible within a short walk or public transit trip

Table 4. Type and quantity of restoration opportunities among planning regions

HRE Planning Region	CRP Sites*												
Jamaica Bay	55	38	0	20	0	0	0	10	2	1	9	6	10
Lower Bay	57	15	1	12	4	1	3	7	5	3	0	2	2
Lower Raritan River	33	4	0	6	0	0	2	0	0	0	0	6	2
Arthur Kill / Kill Van Kull	54	14	2	8	0	0	9	4	2	3	0	2	4
Newark Bay / Hackensack River / Passaic River	40	23	2	15	0	0	6	15	3	6	0	7	11
Lower Hudson River	9	5	0	4	0	0	2	3	0	0	0	2	4
Harlem River / East River / W. Long Island Sound	41	20	3	11	0	0	10	7	3	6	2	3	8
Upper Bay	5	2	0	1	0	0	1	2	0	1	1	1	4
<b>TOTAL CRP Sites</b>	<b>296</b>	<b>121</b>	<b>8</b>	<b>77</b>	<b>4</b>	<b>1</b>	<b>33</b>	<b>48</b>	<b>15</b>	<b>20</b>	<b>12</b>	<b>29</b>	<b>45</b>

habitats including oysters, coastal wetlands, eelgrass beds, island habitat for waterbirds, and maritime forests. Oyster restoration opportunities appear to be the most abundant in the Lower Bay planning region, when compared to other regions. Sandy Hook Bay and the Shrewsbury and Naversink rivers meet many of the habitat requirements of eelgrass beds. The only mapped existing eelgrass beds are present in the Shrewsbury River. The Lower Bay also has many tributaries with dams that could be modified to provide passage for anadromous fish. Similar to Jamaica Bay however, the Lower Bay planning region has extensive contamination issues. The sediments of Raritan Bay and to a lesser extent Sandy Hook Bay and Lower Bay contain relatively high concentrations of DDT, PCBs, Dioxins and Furans.

- 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. Thirty-three (33) CRP Restoration Sites are located within this planning region, although specific restoration actions have not been identified for 21 of these sites. 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 for fish migration. Relatively few public access points have been identified on the lower Raritan River and its tributaries. This planning region represents a substantial opportunity to bring the public to the waterfront.
- Arthur Kill / Kill Van Kull* - The region offers substantial opportunities to restore coastal wetlands, shorelines and shallows, tributary connections, and waterbird habitat, and to increase the existing public access. There are also opportunities within this planning region

to reverse human-induced alterations that have led to habitat degradation. There are 54 CRP Restoration Sites in this planning region. 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 represent an opportunity to restore the habitat in an effort to attract nesting waterbirds again. Water quality issues and surface sediment contamination are pervasive in the Arthur Kill and Kill Van Kull planning region. Dozens of 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. Forty (40) of the CRP Restoration Sites are located in this planning region, and there are USACE HRE spin-off projects to identify additional opportunities in the Lower Passaic River and the Hackensack Meadowlands. Preliminary screening indicates that this planning region offers more than 2,000 acres of coastal wetland creation 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 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 shall take contamination concentrations, the potential for the transport of contaminants, and attractive nuisance issues into consideration prior to construction. In this planning region, the sequencing of restoration opportunities relative to remedial actions within these areas are coordinated through integration and partnership with EPA's Superfund program.
- *Lower Hudson River* - Relatively few of the CRP Restoration Sites are located in this planning region. Nine (9) of these sites are located along the Manhattan and Bronx shorelines in New York, and two are located in New Jersey, and there are no identified restoration activities for these sites. Coastal wetland and oyster restoration opportunities may 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. Public access to the waterfront is a very important TEC in this densely populated region. Few public access points have been identified for lower Westchester County and the Bronx, New York.
- *Harlem River / East River / Western Long Island Sound* - This planning region 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 islands are within the waters of this planning region representing the potential to improve

habitat for waterbirds. There are also many opportunities to reverse human-induced habitat degradation. Forty-one (41) CRP Restoration Sites are located within this planning region. The majority of islands in the HRE study area are located within this planning region. Reports of invasive vine and tree species on many of these islands suggest that there are numerous opportunities to improve habitat for roosting and nesting waterbirds. This planning region provides opportunities to improve water quality in the bays and harbors of western Long Island Sound. Surface sediment contamination issues are pervasive along the East River in this planning region. In particular, predicted concentrations of PCBs in the sediments along the entire East River are among the highest in the HRE study area.

- *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 five (5) of the CRP Restoration Sites are located within the Upper Bay, and three of these sites are potential public access points with no habitat restoration component. Liberty State Park in Jersey City, NJ and the Gowanus Canal in Brooklyn, NY are the only CRP Restoration Sites in this region with plans for habitat restoration. However, since the Gowanus Canal was placed on the Environmental Protection Agency’s National Priorities List in early 2010, a remediation per the Superfund Program will likely be necessary prior to implementing restoration.

Opportunities to restore habitat and reduce the effects of human disturbance are abundant throughout the HRE study area. Many site-specific opportunities have been identified in the CRP Restoration Sites and through the GIS analyses, but this is not a comprehensive list of restoration opportunities. Additional opportunities to restore some of the TECs are available in the aquatic environment, and many additional restoration sites could be identified.

The USACE is currently conducting a Feasibility Study on the HRE to further evaluate the CRP sites and to identify additional CRP sites. The region’s stakeholders are encouraged to identify additional restoration opportunities to increase the number of CRP Restoration Sites, particularly through site reconnaissance and new GIS information.

## 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 more suited 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 established a Restoration Work

Table 5. Actual construction costs are escalated to January 2008 price levels and adjusted for New York City locality. Construction management costs are included and determined by NY District USACE methodology. Management costs are a function of total construction cost. Engineering and design costs were approximated at 2% of total construction cost. Where applicable, monitoring costs are assumed based on complexity and frequency and generally for a period of five years. Contingency costs were estimated at approximately 20% for projects not yet constructed (assumed contingencies were included for constructed projects).

TEC	Unit of restoration	Low observed (\$/unit)	Median observed (\$/unit)	High observed (\$/unit)	# of data sets used	Data sources and references
Coastal Wetlands	Acre of wetlands restored	\$218,587	\$277,009	\$713,569	5	USACE, New York District cost estimates for Brooklyn Union Gas, Staten Island, NY; Elders Point East, Jamaica Bay, NY; Medwick Park Restoration, NJ; Woodbridge Creek Restoration & Mitigation (+ Option), NJ
	Cubic yard of material excavated or filled	\$49	\$53	\$144		
Oyster Reefs	Acre of habitat restored	\$51,457	\$52,478	\$109,776	3	USACE, Baltimore District cost estimate for Cheapeake Bay Oyster Restoration, MD, and USACE, Norfolk District cost estimates for the Great Wicomico and Lynnhaven rivers oyster restoration projects, VA.
	Cubic yard of shell placed for habitat <sup>1</sup>	\$30	\$45	\$75		
Eelgrass	Acre of habitat restored <sup>2</sup>	\$1,080	\$16,600	\$170,083	8	Shafer, D., & Bergstrom, P. (USACE-ERDC & NOAA Chesapeake Bay Office, 2007). <i>Large-Scale Submerged Aquatic Vegetation Restoration in Chesapeake Bay: Status Report, 2003-2006</i> .
Habitat for Fish, Crabs & Lobsters	Cubic yard of rock placed for habitat	\$38	N/A	\$621	2	(1) USACE, New York District cost estimate for proposed lobster habitat restoration, New York Harbor. (2) Massachusetts Division of Marine Fisheries, cost estimate for hard-bottom habitat mitigation project, Boston Harbor, MA.
Tributary Connections <sup>8</sup>	Dam removal: square feet of dam removed	\$32	\$180	\$378	8	University of Rhode Island, <i>The Costs for Environmental Restoration Projects</i> . Retrieved from: <a href="http://www.edc.uri.edu/restoration/html/tech_sci/socio/costs.htm">http://www.edc.uri.edu/restoration/html/tech_sci/socio/costs.htm</a>
	Fish ladders: river miles accessible	\$7,069	\$26,772	\$280,900	7	
Enclosed & Confined Waters	Cubic yard of material excavated or filled <sup>4</sup>	\$17	\$43	\$61	3	USACE, New York District cost estimates for Norton Basin, Fresh Creek and Paerdegat basins, Jamaica Bay, New York.
Sediment Contamination	Cubic yard of sediment excavated <sup>5</sup>	\$184	\$296	\$1,003	12	Lower Passaic River, NJ Draft Focused Feasibility Study. (2007) <i>Appendix J, Cost Estimates</i> . Retrieved from <a href="http://www.ourpassaic.org">http://www.ourpassaic.org</a>

1. Lower unit costs based on shell material provided by state-owned (Virginia) fossil shell bed, including transportation to restoration site.
2. Lower unit costs based on passive seed dispersal methods; higher unit costs based on intensive hand-planting by divers, including storage of plant material and monitoring  
All costs normalized to a common 8.4% survival rate.
3. Costs for dam removals dependent on construction materials of dam, debris removal, complexity of disassembly.  
Costs for fish ladders dependent on type of ladder installed, height, complexity of installation.
4. Costs based on net volume of material cut and filled.
5. Includes costs for excavation and placement

Group in February 2010 to bring Federal, state and local groups together to manage and implement habitat restoration activities in the HRE.

Achieving the objectives of the TECs will also require a substantial dedication of funds and creative funding strategies. Implementing restoration projects and monitoring them to increase the likelihood of success is costly. Table 5 provides an estimate of the costs to achieve the objectives of several of the TECs.

At this early stage of planning, accurately estimating project costs for all of the restoration opportunities would not be possible. The costs to conduct restoration vary greatly by project and by type of restoration (i.e. TEC). However, a rough estimate of the costs to achieve the Coastal Wetlands objectives would be between \$226 and \$856 million dollars (2008) for the short-term objective

(Continued next page)

(constructing 1,200 acres) and \$3.3 to \$10.8 billion for the long-term objective (constructing 14,000 acres), based on average costs per acre for this type of project. Considering that these are only the costs associated with one of the eleven Target Ecosystem Characteristics, funding to implement all the targets will be difficult to secure.

Providing funding for restoration on basin-wide scale requires a well-planned strategy for acquiring funds from a variety of sources. Innovative local financing techniques combined with State and Federal funding opportunities will generate the support necessary to make these projects a reality. A variety of Federal, state, local, and private funding opportunities are available for habitat restoration. For larger endeavors, it may 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 to achieve economy of scale benefits. For many of the TECs, it may be possible to obtain mitigation and/or Natural Resources Damage Assessment funding to support restoration projects. Several funding opportunities that may be used for habitat restoration in the HRE study area are highlighted in Table 6.

Any restoration opportunity proposed within the HRE is best described as a complicated, multi-jurisdictional regulatory challenge. The resource management agencies are tasked with balancing multiple, often conflicting goals of resource protection, conservation and providing for compatible uses of the environment. 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:

1. Habitat exchange issues: physical alteration of an existing habitat to create a different habitat (i.e. habitat exchange).
2. Placement of fill in water: there may be opportunities where fill placement would have a positive effect on the aquatic environment, but it is generally discouraged and not permitted by regulators.
3. Beneficial use of dredged material: as material becomes available from the on-going navigation improvements, opportunities to improve habitat through the beneficial use of dredged material are likely to arise.
4. Attractive nuisance issues: creating an “attractive nuisance” through the restoration of habitat can occur when the restoration site has the potential to release contamination into the food chain (wildlife or human).
5. 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.

VARIABLES	BLM	BOR	DOT	NMFS	NRCS	USACE	USEPA	USFS	USFWS	USGS
<b>Primary Authorities/Mission</b>										
Regulatory				●		■	●		●	
Land Management	●	■	■			■		●	■	
Water Resources Management	■	●			●	●		■		
Planning Assistance			●	■	●	●	●		■	
Research		■	■	●	■	■	●	●	■	●
<b>Watershed Perspective</b>										
Planning Framework	■	●	■	■	●	●	●	●	■	
Education/Communication	■				●	■	●	■		
Research			■		●	■	●	●		●
NEPA Compliance	●	●	●	●	●	●		●	●	●
NEPA Enforcement							●			
CWA Compliance	●	●	●	●	●	●		●	●	●
CWA Enforcement						●	●			
ESA Compliance	●	●	●	●	●	●	●	●	●	●
ESA Enforcement	■	■	■	●	■	■	■	■	●	■
Coordinate fiscal partnerships				●	●	●	●	●		●
Work with State and local partners		●	●		●	●	●			
<b>Watershed based decisions</b>										
Watersheds define mission										
Set program goals (strategic)	■			■	■		●	●	■	
Set project objectives (tactical)	●	■	■	■	●	●		■	■	●
Establish program priorities	●			■			●	●	■	■
Coordinate decision process	■	■	■	■	●	●	●	●	■	■
ID objective indicators	●	■	■	■	●	■	●	●	■	●
Guide information inventory	●	●	●	●	●	■	●	●	●	●
Define management measures	●	●	●	●	●	■	●	●	●	
Guide measures monitoring	●	■	■	■	■	■	●	●	■	●
Monitor objective indicators	●	■	■	●	■	■	●	●	●	■
Evaluate objective achievement	●						●	●		
ID decision stakeholders	●	●			●		●	●		
Organize stakeholder concerns	●	●			●		●	●		
<b>Watershed Objective Focus</b>										
Water supply		●			■	■	■	■		■
Water quality	■	■	■	■	■	■	●	■	■	■
Erosion/sediment control	■	■	■		●	■	●	■	■	■
Recreational Fish and Wildlife	■	■		●	■	■	■	●	●	■
Commercial Fish and Wildlife				●			■		■	■
Endangered species/ecological diversity	■	■	■		■	■	■	■		■
Flood damage reduction	■	●			●	●		■		■
Transportation/navigation			●			●				
Hydropower		●				■				
Sustainability of process	■			■			■	●	■	
Monitoring and research	■	■	■	■	■	■	●	●	■	●
<b>Focus of Watershed Scale</b>										
Small	●		●	■	●	■	●	●	●	●
Medium	■	●	■	●	■	●	●	■	●	●
Large		●	■	●		●	●		■	●

*Table 6 (Opposite). Select Federal agencies and activities related to the watershed planning process. Adapted from NRC (1999). Federal agencies include the U.S. Bureau of Land Management (BLM), U.S. Bureau of Reclamation (BOR), U.S. Department of Transportation (DOT), National Marine Fisheries Service (NMFS), Natural Resources Conservation Service (NRCS), U.S. Army Corps of Engineers (USACE), U.S. Environmental Protection Agency (USEPA), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), and the U.S. Geological Service (USGS). Other acronyms: NEPA (National Environmental Policy Act), CWA (Clean Water Act), and ESA (Endangered Species Act).*

The success of the CRP in improving the estuary ecosystem is directly related to and dependent upon successful partnering among stakeholders. CRP management must incorporate 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 must 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 should be periodically reviewed and updated to acknowledge successes, outline new restoration targets, specify implementation schedules, and reaffirm commitments to the estuary and its stakeholders. This review should be carried out by the CRP management. The following questions should be asked during review:

- What actions have been implemented?
- What TECs have been addressed?
- Is the overall intent of the plan being met?
- Is there new information or are changing conditions occurring?
- Are there new concerns not originally considered that need resolution?

During this process, it may also be advantageous to evaluate the governance structure established to manage the CRP. How this plan is managed directly relates to program momentum and success and can affect how decisions are reached, what perceptions are held, and which organizations are most influential (USEPA 2005). 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 propose ways to resolve those conflicts among stakeholders.

This Comprehensive Restoration Plan for the Hudson-Raritan Estuary has been prepared by the U.S. Army Corps of Engineers (USACE) and The Port Authority of New York and New Jersey (PANYNJ) 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](http://www.nan.usace.army.mil/harbor/crp). Or a hardcopy can be ordered from \_\_\_\_ by emailing \_\_\_\_\_.





