1.0 Introduction

The Hudson-Raritan Estuary (HRE) is located within one of the most urbanized regions in the United States. The waters and nearshore habitats of the HRE were once ecologically productive, but centuries of industrialization and urbanization have degraded the environmental conditions. This history has resulted in severe habitat loss and degradation, poor water quality, pervasive sediment contamination and lack of public access to the estuary. These actions have significantly impacted the ecological integrity and health of the estuary and consequently the societal values of the region. Due the severity of the impacts many programs have been initiated by various Federal, state, municipal, or non-governmental organizations that have implemented successful habitat restoration projects. However, there has been no explicit consensus regarding estuary-wide restoration goals and objectives and, therefore, no comprehensive system-wide plan to guide the process. Success is measured on a project-by-project basis, without consideration of the value of the project in the context of what is needed for the entire Estuary. Often, little consideration is given to past restoration efforts or alternate restoration opportunities.

The Draft Comprehensive Restoration Plan (CRP) has been prepared as a collaborative effort among many agencies and non-governmental organizations. It is intended to address the need for a comprehensive master plan for ecological restoration within the HRE study area, broadly defined as the area within 25 miles of the Statue of Liberty. It provides a framework for an estuary-wide ecological restoration program by presenting restoration targets that have been identified and developed in cooperation with the region's stakeholders. The CRP outlines a comprehensive strategy for restoration and presents the opportunity to coordinate separate restoration and habitat improvement projects into a well-defined program to efficiently and effectively address the estuary's needs. It also provides the opportunity to track the progress and challenges of individual projects to increase the likelihood for future successes. In addition, the CRP will serve as a central source document that can be drawn upon to foster and mobilize broad public support for diverse HRE restoration efforts.

The Draft Comprehensive Restoration Plan is comprised of two volumes: Volume I provides the broad framework of the plan by introducing the program goal and objectives, laying out a strategy for success, and identifying opportunities to meet those objectives. Volume II provides technical guidance to interested stakeholders for planning, evaluating, and conducting individual restoration projects for the Target Ecosystem Characteristics (TECs) habitats within the Estuary.

The following sections of Volume I provide background on the study and introduce the restoration philosophy, program goal, and objectives that are critical components of the CRP. Subsequent chapters provide additional information on the ecological conditions of the HRE study area, and detailed descriptions of the restoration targets and objectives, and identify opportunities for achieving these targets. Volume I of the Comprehensive Restoration Plan is organized in the following chapters:

1.1 Study Background

The Comprehensive Restoration Plan is the culmination of decades of planning and outreach efforts among the region's stakeholders and scientists. Comprehensive restoration planning was initiated in 1988, when the U.S. Congress recognized the New York-New Jersey Harbor Estuary (i.e., the HRE study area) as an estuary of national importance and inducted the Estuary into the National Estuary Program (NEP) in response to a request by the governors of New York and New Jersey. In conjunction with this designation was the formation of the New York-New Jersey Harbor Estuary Program (HEP), which brought together Federal, State, local, and non-government organizations interested in improving the ecological conditions within the HRE. The HEP completed a Comprehensive Conservation and Management Plan (CCMP) in March 1996. The CCMP documented the condition of the environmental resources of the HRE and proposed a series of critical actions to address the environmental threats facing these ecosystems. Included among its recommendations was the development of a comprehensive regional plan to restore and protect habitat within the HRE (HEP 1996).

The CCMP's recommendation to restore the Hudson-Raritan Estuary received support from the region's stakeholder's, including state and municipal regulators and policy makers, Federal agencies, non-governmental organizations, environmental advocates as well as the public. In response to this broad support, the U.S. Congress authorized the U.S. Army Corps of Engineers (USACE) to investigate and identify opportunities to implement the CCMP's habitat goals within the estuary. The 2000 USACE Reconnaissance Study determined Federal interest in restoration (USACE 2000) and, in 2001, the HRE Ecosystem

What is the Harbor Estuary Program?

Incorporation of the Hudson-Raritan Estuary (the study area) into the National Estuary Program required the creation of an organizational structure, the New York-New Jersey Harbor Estuary Program (HEP), to provide program direction and help carry out key actions. HEP was established in 1988. HEP's primary program goals were to develop and implement a conservation plan that would curb the harmful effects of pollution and garner public awareness, appreciation, and support for the HRE. HEP's major accomplishments include preparing the initial conservation strategy for the estuary (CCMP); developing a community based process for nominating sites for acquisition and restoration; providing site information via an online interactive map; developing a contaminant assessment program that will be used to reduce contaminants (Contaminant Assessment and Reduction Program [CARP]); developing the first ever harbor-wide water quality survey; refining and using modeling tools to assess loading reductions for nutrients and pathogens; mapping public access sites and needs; and supporting numerous outreach and stewardship programs. Active participants in the HEP program include:

Federal Government

- National Oceanic & Atmospheric Administration (NOAA)
- National Park Service (NPS)
- U.S. Army Corps of Engineers (USACE)
- U.S. Department of the Interior
- U.S. Environmental Protection Agency (USEPA)

State and Local Governments

- Interstate Environmental Commission
- New Jersey Department of Environmental Protection (NJDEP)
- New Jersey Meadowlands Commission (NJMC)
- New York City Department of Environmental Protection (NYCDEP)
- New York State Department of Environmental Conservation (NYSDEC)
- New York State Department of State
- The Port Authority of New York/New Jersey (PANYNJ)
- State of New Jersey
- State of New York

Non-Government Organizations

- Citizens Advisory Committee
- Hudson River Foundation (HRF)
- National Parks Conservation Association
- New Jersey Harbor Dischargers Group
- Science and Technology Advisory Committee
- NY/NJ Baykeeper
- Metropolitan Waterfront Alliance
- So many more…

Restoration Feasibility Study was initiated by the USACE in partnership with The Port Authority of New York & New Jersey (PANYNJ) (Figure 1-1).

The USACE and the PANYNJ have worked with many partners to create a Comprehensive Restoration Plan that can achieve the objectives of the region's stakeholders first expressed in the CCMP. Throughout the planning process, the region's stakeholders emphasized the need for collaborative planning and a regional partnership, in which stakeholders look beyond political boundaries to focus on estuary-wide issues through research-based planning. The stakeholders emphasized the need for a plan that included the acquisition and preservation of ecologically valuable lands, as well as active restoration and enhancement of habitat.

Early on in the planning phase of the HRE Ecosystem Restoration Feasibility Study, the USACE and the PANYNJ conducted a "Needs and Opportunities" evaluation to identify local interests in ecosystem restoration. During the public outreach for this study, stakeholders representing local, State, and Federal agencies, scientists, citizens, and business interests emphasized the need for a collaborative, ecosystem-based restoration strategy that would tie local sites and specific needs to projects into a cohesive effort. The Needs and Opportunities Report identified potential restoration opportunities, and emphasized the importance of habitat acquisition to the future environmental health of the estuary (RPA 2003).

For several years, the HEP Habitat Workgroup has been nominating priority acquisition and restoration sites working with hundreds of organizations, elected officials and community proponents within the HRE since 1994. This program helps direct potential project sponsors to ecologically important lands that are privately owned and potentially vulnerable to development. Information about the priority sites is made available to the public and potential sponsors on the New York City Open Accessible Space Information System (NYC OASIS) website. In 2001, the PANYNJ initiated the Hudson-Raritan Estuary Resources Program, which established a $60 million fund to acquire and preserve ecologically valuable tracts of land around agency facilities in New York and New Jersey. The PANYNJ works closely with the HEP Habitat Workgroup to identify the most valuable sites for acquisition. The Needs and Opportunites Report added to the list of existing candidate sites developed through the HEP Habitat Workgroup.

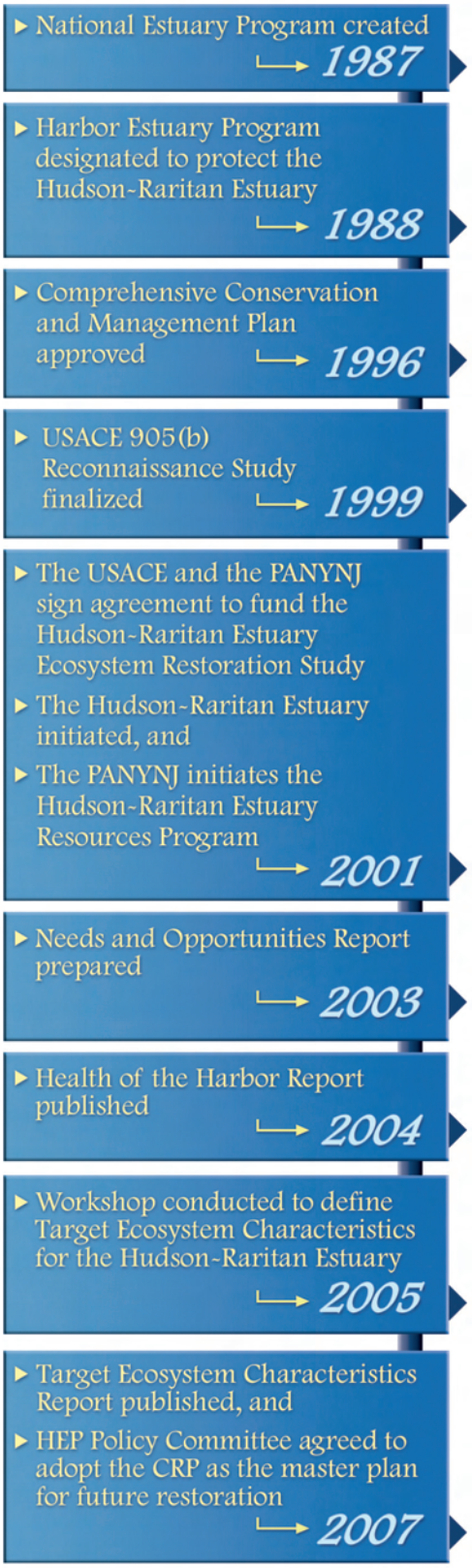

Figure 1-1. Timeline of important events in the Hudson-Raritan Estuary study area.

In addition to the value placed on habitat acquisition and preservation, both the Needs and Opportunities Report and the CCMP emphasized the value of a coordinated and comprehensive plan for habitat restoration and preservation within the HRE study area. Since 2005, Cornell University and the Hudson River Foundation (HRF) have provided support to focus the development of the Comprehensive Restoration Plan by working with the region's stakeholders and scientists to establish broad-based, non-site specific goal and restoration targets (TECs). The TECs can be used to identify and design restoration projects and measure programmatic success. The Comprehensive Restoration Plan uses the TECs as the framework for an estuary-wide ecological restoration program, and outlines a strategy for ecological restoration within the Hudson-Raritan Estuary.

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

The CRP will establish a forum for all stakeholders in the HRE study area to coordinate, discuss, and plan restoration efforts. The HEP provides a structure that encourages open communication among the region's stakeholders, and the HEP structure can be built upon to facilitate restoration planning and to promote CRP programmatic success. Through collaboration with the HEP, the approach employed to prepare the CRP has already fostered broad consensus on harbor-wide restoration goals and targets as well as a shared vision of a restored future state. This collaborative framework recommends that all restoration and acquisition programs, regardless of the authority under which they are conducted, work toward shared estuary-wide goals.

1.2 Restoration Goals and Targets

The HRE has a long history of physical and chemical habitat degradation and unchecked industrial and residential development, along with vast navigation and infrastructure improvements. These alterations have resulted in ecosystem-level changes to the HRE causing dramatic shifts in the community structure, types of habitat and the population of organisms inhabiting the area. Ecological restoration, as defined by the Society of Ecological Restoration, is the process of assisting with the recovery of an ecosystem that has been degraded, damaged or destroyed. Developing a plan to assist with the recovery of such an altered ecosystem required extensive coordination with the region's stakeholders and scientists.

Scientists from various Federal, state, and local agencies, non-government organizations, and institutions gathered in a series of workshops and meetings to craft a strategy to develop an ecological restoration plan for such an urbanized estuary. From the beginning of the planning effort, they acknowledged that the estuary will remain a populous area with a landscape continuously re-shaped by humans, and that a "renaturing" approach to habitat restoration would be the most realistic for the HRE. This approach entails designing an ecosystem where nature and people co-exist, a system wherein environmental and societal needs are equivalent ecosystem elements (Bain et al. 2007).

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

TEC	Target Statement
Coastal Wetlands	Create and restore coastal wetlands, at a rate exceeding the annual loss or degradation of wetlands in the HRE study area, to produce a net gain in acreage.
Islands for Waterbirds	Restore and protect roosting, nesting, and foraging habitat for long-legged wading birds on islands in the HRE study area.
Coastal and Maritime Forests	Create a linkage of forests accessible to avian migrants and dependent plant communities from Rockaway Peninsula, NY to the coasts of New York and Raritan Bays to Sandy Hook, NJ.
Oyster Reefs	Establish oyster reefs at several locations in the HRE study area.
Eelgrass Beds	One eelgrass beds in each of the eight HRE planning regions that can support eelgrass.
Shorelines and Shallows	Create or restore shoreline and shallow sites that meet a 3-zone criterion specified for an integrated site 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 HRE.
Tributary Connections	Reconnect freshwater streams and inland habitats to the estuary to provide a range of quality habitats to aquatic organisms.
Enclosed and Confined Waters	Upgrade the water quality in enclosed waterways and tidal creeks within the estuary to match or surpass the designated use 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

The scientists agreed that the restoration program should be focused on creating and restoring a variety of 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. The CRP Program Goal is:

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

To define a successful restoration program within the HRE, it was essential to identify specific restoration targets that are collectively critical to the estuary's ecological viability. For this purpose, a team of estuarine scientists identified a set of 11 TECs, each of which is an important ecosystem property or feature that is of ecological and/or societal value. The TECs identified in Table 1-1 are estuarine-dependant habitat types, habitat complexes, contamination issues, and societal values that have been selected to guide the HRE Ecosystem Restoration Study. The TECs reflect the interests of HRE stakeholders and incorporate the habitat and degradation issues repeatedly emphasized in the past two decades of HEP outreach efforts. By increasing the quantity of physical habitat value and species diversity, the HRE study area will become more sustainable and resilient.

Establishing measurable objectives was the next critical step in defining the restoration program. These objectives will allow the HRE stakeholders to prioritize actions and track progress in achieving the program goal over time. The estuarine scientists established short – and long-term objectives for each TEC, as are presented in Table 1-2. In the short-term (i.e. by 2015), the success of the restoration program will be measured against whether or not the short-term objectives for each TEC were met. Many of these short-term actions will be initial efforts to test the feasibility of restoring these habitat types, measure performance, or to provide opportunities for technical innovation. Evaluation of successes and challenges encountered while attempting to meet these short-term objectives will serve to feed an adaptive management strategy designed to refine and strengthen the long-term plan.

The HRE's stakeholders have been involved throughout the development of the program goal, the TECs, and their measurable objectives to ensure that the program is designed to meet the needs of the region's interested agencies and non-governmental organizations. The TECs have been refined through input received from these stakeholders, and they represent a consensus on the framework for the restoration master plan for the HRE (outlined in Appendix A).

Table 1-2. Short-Term and Long-Term Objectives for Target Ecosystem Characteristics (TECs) in the Hudson-Raritan Estuary (HRE) study area.

TEC	2015	2050
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