

EXECUTIVE SUMMARY

This 2019 Comprehensive Conservation and Management Plan (CCMP) was developed by the Barnegat Bay Partnership (BBP), established as one of the nation's 28 National Estuary Programs (NEPs) in accordance with Section 320 of the Clean Water Act (33 U.S.C. § 1330; as amended by P.L. 100-4 and P.L. 114-162). The BBP works collaboratively with its broad array of partners to protect the Barnegat Bay-Little Egg Harbor estuary and its contributing watershed. This 2019 CCMP represents a revision of the BBP's original CCMP, completed in 2002, when the program was formally approved and accepted into the NEP by the Environmental Protection Agency. In 2016, EPA's NEP guidance identified the need for all NEPs to update and/or revise their CCMP to reflect the accomplishments of programs to date, the changes in the status and trends in conditions within each NEP's Study Area (geographic boundaries), and any new challenges within the systems.

Like all NEPs, the BBP is a non-regulatory program, which works by developing and implementing the CCMP, the "master plan" identified by its management conference partners, which includes municipal, county, state, and federal government agencies, academic institutions, and private, corporate, and non-governmental stakeholders. The BBP's management conference is organized into various committees (*i.e.*, Policy Committee, Advisory Committee, Science and Technical Advisory Committee, and Communication and Education Committee), each with different members, expertise, and responsibilities. As stated in the Clean Water Act, one primary purpose of the management conference is to develop a CCMP that identifies priority corrective actions and timelines addressing point and nonpoint sources of pollution to restore and maintain the chemical, physical, and biological integrity of the estuary. These actions include the restoration and maintenance of water quality, balancing indigenous populations of shellfishes, fishes and wildlife with recreational activities in the estuary, and assuring that the designated uses of the estuary are protected. The plan contains a number of technical elements (*e.g.*, research, monitoring, and assessment), and equally important communication and education activities.

To oversee revision of its CCMP, the BBP established a Steering Committee, drawn from all its management conference committees (*i.e.*, Policy Committee, Advisory Committee, Science and Technical Advisory Committee, and Communication and Education Committee). The Steering Committee initiated the revision process with a review of the BBP's overall vision, its previous priority goals, objectives, and all previous actions.

To ensure an understanding of the public's concerns and priorities, and public engagement and support for the BBP's priorities, the BBP and its partners conducted outreach to the public during 38 events held during 2016-2018 to solicit input on the issues of concern about the estuary. The top issues of concern, in no particular order, were as follows: (1) reducing sources of NPS

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pollution, especially nutrients from fertilizers; (2) restricting future development and preserving more open space; (3) addressing blooms of nuisance bay nettle, *Chrysaora chesapeakei*, spreading throughout the bay; (4) protecting wetlands, eelgrass and shellfish beds, and other characteristic bay habitats; (5) increasing water conservation efforts, especially by seasonal residents, (6) addressing the issue of flooding and more frequent storms, and (7) educating children and adults about the Barnegat Bay and its watershed. As this information was accumulated, the Steering Committee began revising the BBP's vision, priority goals, objectives, and actions. Revision of these core components was developed with the assistance of contracted experts and aided by technical workgroups drawn from our partner organizations.

The growing human population in the watershed and its accompanying development still represent a major challenge to the entire estuarine ecosystem; moreover, eutrophication due to excessive nutrient loadings (primarily nitrogen) from human activities remains one of the biggest problems within the bay itself. However, the BBP's vision and other components of the CCMP have been revised to reflect the growing realization of recognized climate change factors (e.g., more frequent and larger storms, sea level rise, coastal acidification) and uncertainties regarding rates of change of those factors, all of which affect the bay's water quality, water supplies, habitats, living resources, and human uses of the ecosystem.

WHAT'S NEW IN THIS CCMP?

This is the first revision of the BBP's CCMP since the publication of the original CCMP in 2002; the original document did not include the phrases/words climate change, sea level rise, or jellyfish.

Most 2002 priority areas (water quality, water supply, habitats and living resources) remain; one 2002 priority (human activities and competing uses) was removed and a new priority (land use) was added; see Chapters 4-7. Many existing actions remain ongoing but have been modified and re-organized; see Appendix E, Changes to Existing CCMP Action Items. A number of previous actions were dropped for various reasons (no longer relevant, lack of funding); Appendix E, Changes to Existing CCMP Action Items. This CCMP identifies holistic ecosystem targets; see Chapter 3. This CCMP identifies specific goals, objectives, and actions within each priority area; see Chapters 4-7.

The revised CCMP reflects significant improvements in our understanding of the bay's ecology and the efforts needed to protect and restore its water quality and supplies, habitats, and biotic resources, and builds upon outreach and actions initiated in Barnegat Bay that eventually were implemented to protect water quality, habitats, and living resources throughout the state.

CLIMATE CHANGE VULNERABILITY ASSESSMENT

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With climate change recognized as increasingly impacting coastal communities and economies, EPA guidance identified the need to assess the vulnerability of all CCMP actions to recognized climate change stressors, and specifically, to consider the likelihood and magnitude of climate change impacts upon proposed CCMP actions. Thus, the BBP followed a process (EPA 2014) and made use of its own partners, regional experts, and the latest science to assess the vulnerability of its actions to the following stressors: 1) warmer and more variable winter weather, 2) warmer and more variable summer weather, 3) warmer water, 4) drought, 5) more frequent and bigger storms, 6) sea level rise, and 7) coastal acidification.

These climate stressors varied widely in their potential adverse impacts on different CCMP actions. Some categories of actions, such as education or coordination activities, were thought to be minimally affected by climate change stressors; however, other actions, such as wetland or shoreline restoration, were recognized to be potentially or significantly impacted by the identified climate change stressors. More frequent and bigger storms, sea level rise, and drought were recognized as the most likely and significant stressors affecting the largest number of CCMP actions. Changes in both winter and summer weather were considered equally likely but had different mechanisms of impact. Warmer water and coastal acidification, though generally considered to be the least likely and least consequential stressors to most CCMP actions, were identified as having significant potential impacts on some uses of the bay (*e.g.*, tourism, shellfish culture, fishing).

CCMP GOALS AND ECOSYSTEM TARGETS

The BBP and its partners adopted an ecosystem-based management (EBM) approach to the development of the CCMP. This approach includes consideration of human and natural systems, an adaptive management framework, and public participation and engagement as central to developing technical, management, and policy solutions to environmental challenges. Using this approach, the BBP established goals in four priority areas.

Water Quality - To protect and improve water quality throughout Barnegat Bay and its watershed by reducing the causes of water quality degradation to achieve swimmable, fishable and drinkable water, and to support aquatic life.

Water Supply - To ensure adequate water supplies and flow in the Barnegat Bay Watershed for ecological and human communities now and in the future.

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Living Resources - To protect, restore, and enhance habitats in the Barnegat Bay and its watershed as well as ensure healthy and sustainable natural communities of plants and animals both now and in the future.

Land Use - To improve and sustain collaborative regional approaches to responsible land use planning and open space preservation in the watershed that protect and improve soil function(s), water quality, water supply, and living resources.

While Action Items in the CCMP are organized into these four priority areas, some actions impact or affect more than one priority area; moreover, some goals require actions in more than one priority area. Thus, to guide our collective efforts, the following aspirational Ecosystem-Based Targets were developed. These targets are broad, with each individually spanning and integrating actions and changes in several priority areas. In addition, each of these targets is based upon existing data sets and is included as a component within an existing monitoring program. The targets identified below have been developed taking into account the challenges of not only guarding against future loss/degradation in each respective area, but also working toward measurable improvement/restoration of these natural resources.

The BBP will work with its partners towards reaching the following **Ecosystem-Based Targets**.

- **Public Beach Openings/Closures:** Work with the partners to (1) increase the number of bay beaches and lakes within the Barnegat Bay watershed open for swimming from the 2018 baseline; (2) reduce the average number of annual beach closure days below that of 2016-2018; and (3) Increase monitoring and public notification/advisory processes to ensure timely notice even for bathing beaches not yet open for the season.
- **Approved Shellfish Areas:** Upgrade 5% of the potentially harvestable shellfish acreage that is currently restricted or closed for shellfishing in 2018.
- **Submerged Aquatic Vegetation (SAV) Extent:** Maintain the overall extent of SAV present in 2009 and restore an additional 10 acres of SAV.
- **Wetland and Riparian Buffer Preservation:** Maintain or increase the current acreage of upland buffers adjacent to all wetland and riparian corridors.
- **Wetland Protection:** Maintain overall extent of tidal wetland acreage, as identified in 2015 baseline aerial imagery, and restore or enhance 10 acres of tidal wetlands impacted by sea level rise and erosion through nature/natural based strategies.

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- **Clam restoration:** Return the hard clam abundance in Little Egg Harbor to 1985/87 levels (approximately 200,000,000).
- **Ecological Flows:** Maintain flow levels at least 30% over minimum ecological flows for gauged waterways within the watershed.
- **Water Conservation and Reuse:** Reduce five-year rolling average water withdrawals 10% below the 2010 estimate of 85.56MGD.

Within each of the four priority areas, supporting objectives were developed to achieve the goals and broader ecosystem targets. Like the development of goals and targets, these objectives were developed by the Steering Committee and reviewed, refined, and approved by all program partners.

WATER QUALITY OBJECTIVES

The bay's water quality is critical to the bay's overall condition, as well as to coastal communities within the region and their tourism-based economies. Eutrophication of the bay caused by high nutrient loading is the major problem affecting the northern portions of the bay, while recent science suggests sediment pollution may be an equally important challenge affecting the southern portion of the bay. Our understanding of the bay has improved substantially in recent years; however, continued monitoring and science are essential to improving the bay as our world changes. The primary water quality objectives are the following:

1. Reduce sources of nutrients, contaminants, debris, and other pollutant loadings from point and nonpoint source pollution;
2. Assess status and trends of water quality throughout the watershed;
3. Conduct studies to improve scientific understanding of new and emerging issues pertaining to the chemical, physical, and biological conditions and dynamics in the Barnegat Bay and its watershed; and
4. Increase public education, engagement, and stewardship regarding water quality in the watershed.

WATER SUPPLY OBJECTIVES

The Barnegat Bay watershed provides important water supplies for human and non-human uses, and these supplies are vulnerable to sea-level rise, storm surges, saltwater intrusion, drought, and contamination. Like all estuaries, the ecology of Barnegat Bay-Little Egg Harbor ecosystem is primarily determined by the nature of its freshwater inputs. Thus, the primary water supply objectives include the following:

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1. Protect, maintain, and enhance adequate existing water supplies and surface and groundwater flows to the Barnegat Bay-Little Egg Harbor estuary;
2. Prevent degradation of water supplies;
3. Monitor and assess status and trends of water supply throughout the watershed;
4. Review existing literature/successful pilots and conduct studies to improve scientific understanding of new and emerging issues pertaining to water conservation, advanced potable treatment options, and reuse; and
5. Educate consumers regarding water supply issues and water conservation and reuse.

LIVING RESOURCES OBJECTIVES

Healthy estuaries ensure the survival of many species of fishes, birds, mammals and reptiles. They provide vital nesting and feeding habitats as well as maintaining a healthy environment by trapping sediments and pollutants from rivers and streams. Some organisms like hard clams and oysters live year-round in estuarine habitats, whereas, others like horseshoe crabs and striped bass use them to complete a small part of their life cycle. Estuaries also provide stopovers for migratory bird species such as snow geese and mallard ducks and deliver critical ecosystem services.

The Barnegat Bay ecosystem is comprised of a diversity of upland and wetland habitats, from submerged habitats within the bay, to low-lying coastal and freshwater wetland habitats, to uplands of pine and oak forests. Five habitat types were identified as characteristic of, and critical to, the living resources, ecology, and economy of the watershed, and will comprise the focus of the BBP's future Habitat Protection and Restoration Plan. All of these habitats are vulnerable to different factors, including climate change:

- 1) Tidal wetlands, including intertidal marshes;
- 2) Emergent, scrub-shrub, and forested freshwater wetlands;
- 3) Subtidal beds of submerged aquatic vegetation (SAV), mostly eelgrass and widgeon grass;
- 4) Shellfish beds and reefs of clams and oysters; and
- 5) upland forest, including portions of the Pine Barrens ecosystem.

The protection and/or restoration of those priority areas serves as a means of improving water quality, protecting water supplies, and safeguarding productive habitats for fishes, shellfishes and other wildlife. To protect, restore, and enhance habitats in the Barnegat Bay and its watershed, as well as to ensure healthy and sustainable natural communities of plants and animals both now and in the future, the Living Resources Objectives include the following:

1. Develop and implement Habitat Protection and Restoration Plans for ecologically sensitive habitats;
2. Restore and maintain sustainable populations of fish and wildlife;

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3. Monitor and assess status and trends of living resources throughout the watershed;
4. Conduct studies to improve scientific understanding of living resources and ecologically sensitive habitats; and
5. Increase education and public outreach related to habitats and living resources.

LAND USE OBJECTIVES

The Barnegat Bay watershed has experienced intense growth and development over the last half century. With more than 33% of the watershed developed to date, additional development increasingly impacts and threatens the remaining natural resources of the watershed. Sustaining the health, diversity and economic importance of the watershed's natural resources, while continuing to manage development, is a shared responsibility among municipal, county, regional, and state planners, land-use managers, and government officials. Land use managers are also challenged by the impacts of sea level rise on the sustainability and resilience of the watershed's natural resources, built communities, citizenry, and the regional economy. Improving collaborative regional approaches to responsible land use planning and open space protection in the watershed is critical to protect and improve soil function, water quality, water supplies, and living resources.

Thus, the BBP developed the following Land Use objectives:

1. Work to raise the level of awareness of the BBP CCMP and provide technical support to state, counties and municipalities to reflect and complement the CCMP goals and objectives in plans and land use practices;
2. Encourage economically and environmentally sustainable land-use development and redevelopment practices that conserve, restore and enhance Barnegat Bay resources;
3. Support acquisition, planning, and sustainable management of open space for people and nature;
4. Support the conservation, protection and restoration of wetlands;
5. Conduct studies to improve scientific and societal understanding of the impacts of current and future land use practices on the Barnegat Bay and watershed; and
6. Increase education and outreach efforts targeted at sustainable land-use practices for public and private lands.

MONITORING AND HABITAT PLANS

Since its establishment, the BBP has periodically reported the status and trends in the bay's condition (*i.e.*, the BBP's 2005, 2011, and 2016 State of the Bay Reports) using a comprehensive suite of agreed-upon indicators to assess water quality, water supply, critical habitats, and living resources. Development and use of indicators in the early reports was hampered by a lack of

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monitoring data consistently collected over time (*e.g.*, data were insufficient in 2011 to report trends for one-third of the 19 indicators), but data availability improved substantially by 2016.

With the revision of the CCMP using an EBM approach, the BBP has established holistic ecosystem targets. Monitoring these ecosystem components and assessing our collective progress toward these newly established targets is important to assessing the effectiveness of our collective. The BBP and its partners have agreed to review all existing monitoring programs and identify and incorporate any needed monitoring components into a Monitoring Plan in advance of the next State of the Bay Report in 2021.

The revised CCMP provides an overview about the characteristic habitats of the watershed: coastal marshes, freshwater wetlands, submerged aquatic vegetation, shellfish beds and reefs, and upland forests. Some of these habitats have been nationally and internationally recognized for their uniqueness and their importance to sustaining fish and listed above wildlife populations; some of these habitats also provide critical ecosystem services. General threats, including climate change and sea level rise and their potential impacts to these habitats, are also identified. A habitat plan will be developed in the coming year to provide more detailed information at a finer scale to support the protection and restoration of priority areas.

FINANCIAL AND COMMUNICATION PLANS

Since the creation of the first CCMP in 2002, the Program Office has grown from four to more than 10 staff and now conducts research, monitoring, communication, and outreach activities. New challenges have emerged with this growth in BBP staffing and activities (*e.g.*, more offices, laboratory, field support, and other work areas, the need for more comprehensive financial support of CCMP implementation). A recently completed BBP Needs Assessment (BBP, 2019) also recommended development of a new financial plan to grow CCMP implementation to protect the bay and its resources and to address other identified challenges (*e.g.*, facilities).

The BBP has begun revising its 2016 Communication Plan as a separate document to be completed during the coming year. The revision will align the Communication Plan with the priorities of the revised CCMP and will also build on the recommendations of the Needs Assessment Report to grow the capacity and improve the effectiveness of the BBP, including its partners, to implement the CCMP. Social media outreach and marketing strategies will be incorporated into this revised Communication Plan, scheduled for completion within a year of the publication of the revised CCMP.

THE CCMP: CHARTING A COURSE TO THE FUTURE

This CCMP represents the consensus of the public agencies, organizations and bay stakeholders that comprise the management conference of the Barnegat Bay Partnership. It has been developed consistent with EPA's 2016 Guidance and Section 320 of the Clean Water Act to protect and restore an "estuary of national significance," the Barnegat Bay.

We thank our many partners for their engagement and encouragement throughout this entire revision process. We recognize their past efforts and continuing dedication to the protection and restoration of the bay and its invaluable living resources, and their support of their neighbors living, working, and playing in the bay's coastal communities. Lastly, we stand alongside them on our ever-changing coast, committed to our shared vision of a healthy and thriving Barnegat Bay watershed that sustains a vibrant coastal economy and our quality of life.