# APPENDIX

BARNEGAT BAY PARTNERSHIP

RESEARCH · EDUCATE · RESTORE

# State of the Bay Report | 2016





COVER PHOTOS (l. to r.):
Dragonfly in a salt marsh. Photo by Barnegat Bay Partnership.
Common reeds at sunset. Photo by New Leaf Photography.
Rain barrel at Island Beach State Park. Photo by NJDEP.
Snapping turtle in a freshwater creek. Photo by Barnegat Bay Partnership.

OPPOSITE: White-tailed deer along the Metedeconk River.
Photo by BTMUA.
BACK COVER: A tidal marsh and pool. Photo by NRCS.

BARNEGAT BAY PARTNERSHIP
RESEARCH · EDUCATE · RESTORE


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# State of the Bay Report | 2016

## Barnegat Bay Partnership

# Director's Comments

The Barnegat Bay ecosystem and its inhabitants weathered a historic cataclysm since the publication of our *2011 State of the Bay Report* (SOTB); nonetheless, our work to assess, protect and restore the bay has continued to move forward. As has been chronicled in many places and summarized in a special section of this 2016 SOTB, Superstorm Sandy was almost unprecedented in its impacts to the bay and the human population along the Jersey Shore. We have cleaned up Sandy's wreckage as best we can and are working to rebuild our communities and waterfront neighborhoods drowned by the storm. While busy with Sandy and its aftermath, one could also argue that we have learned more about the Barnegat Bay in the past five years than in any period in the bay's history.

Perhaps most importantly, we now have a better understanding of the bay's major problem. The biggest concern in 2011 – eutrophication due to high nutrient loading – remains the bay's most serious challenge today. While eutrophication continues as the bay's biggest problem, our understanding of its causal factors have improved substantially. As a result of new science from the NJ Department of Environmental Protection (NJDEP), United States Geological Survey (USGS), and Rutgers University, specifically an assessment of the bay's hydrology and nutrient sources and/or loadings not included in previous studies, we know that the bay's total nutrient loadings are significantly higher than heretofore recognized. These previously unassessed loadings entering the bay from offshore waters have undoubtedly long been stimulating the bay's eutrophication, manifest mostly as high phytoplankton and benthic algal production in different parts of the bay. In addition to this newly recognized source, we also have the proverbial "smoking gun" about the bay's anthropogenic loadings in the form of a USGS/Rutgers study, which clearly shows that the delivery of nutrients from lawn runoff, recognized as a source but never previously quantified, is a significant and increasing source of the bay's total nutrient load. This study gives us reason to believe that the statewide fertilizer law and additional steps to reduce runoff from residential and other turf landscapes (*e.g.*, parks, athletic fields) can help improve the bay's condition.

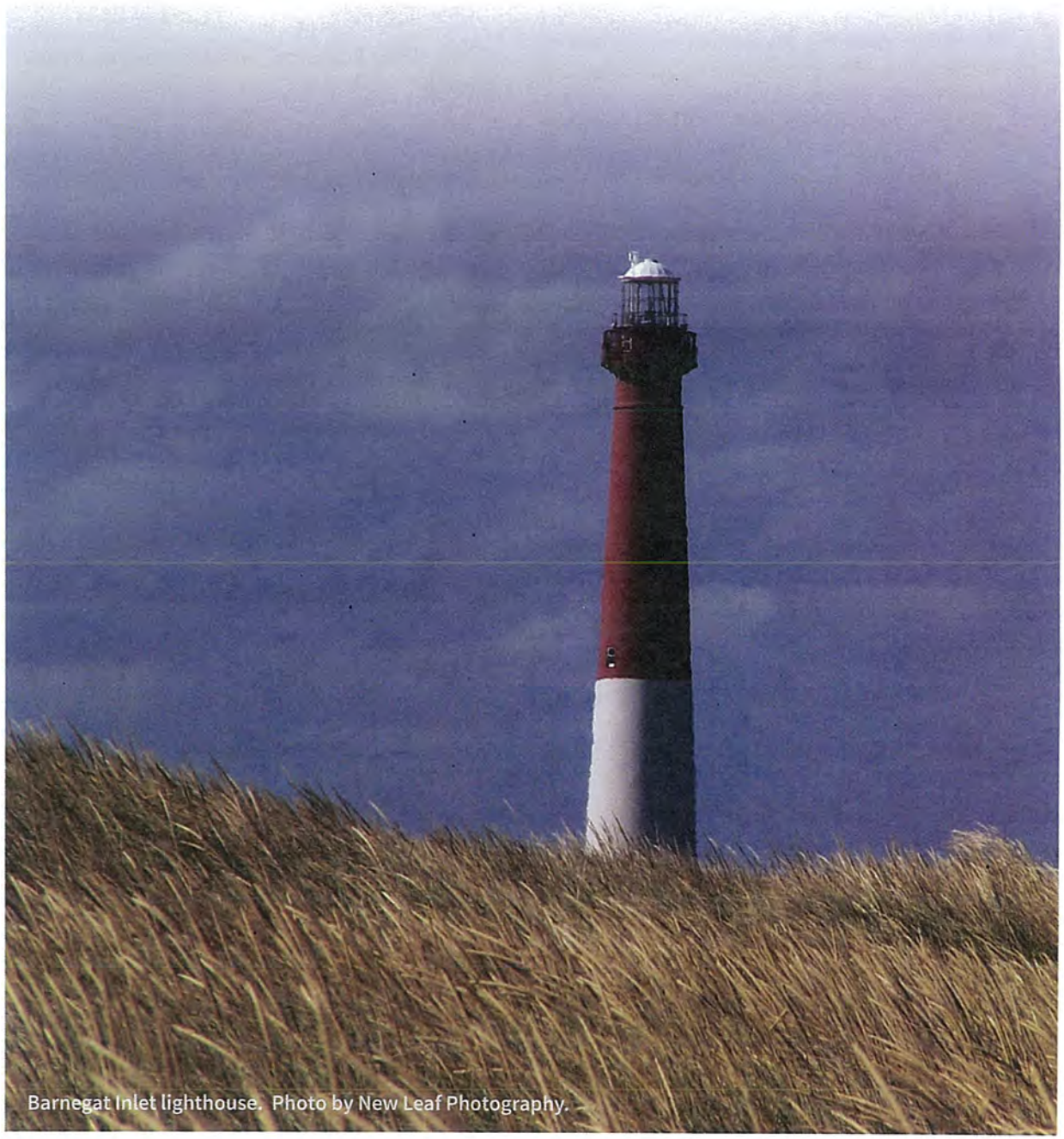
Our 2011 SOTB also identified a disturbing number of critical information gaps. Back then, we did not have enough information to identify trends in more than one-quarter of the indicators of the bay's health. We now have quality data sufficient to assess trends in three indicators (*i.e.*, algal blooms, dissolved oxygen, turbidity) where trends previously could not be determined and thus were considered "unknown." Perhaps most important, not only do we have good data for all of these indicators, but trends in the overwhelming majority of these condition indicators are not declining. Trends in dissolved oxygen even showed some improvement, and also give us hope for the future. Unfortunately, data were also unavailable for two indicators in the 2011 SOTB (*i.e.*, Watershed Integrity in the Pinelands National Reserve and Shallow Groundwater Quality), so we must continue to invest in the bay's monitoring.

Though not directly provided in condition measures herein, other research projects during the past five years have answered some important long-standing questions about the bay. Thanks to cooperation between our federal and state partners, we now have a map of the soils that lie at the bottom of the bay to guide future eelgrass and shellfish restoration efforts. Not only have we documented the current composition of the plankton in the bay, we have a record of changes in the diatom communities since before the Industrial Revolution that gives us a glimpse at how nutrients have changed in the bay since European settlement. The list of "new science" in the bay is far longer than what I've presented here; each study helps advance us toward our goals of a healthy bay.

But there is still much work to be done. While we have a better understanding of the nutrient loads to the bay, we do not know the threshold level at which nutrients become detrimental. Passage of New Jersey's Statewide Soil Health Law, which would reduce the amount of nutrients flowing off of newly disturbed land, has not yet been implemented, despite being passed with bipartisan support from the State Legislature and the Governor more than five years ago. Because we now have proof (*i.e.*, recent USGS/Rutgers studies[1]) of the significant contributions of lawn fertilizer to the bay's nutrient loading, our

collective failure to develop and implement a soil restoration standard to reduce new loadings from the developed landscape is inexcusable. The most current New Jersey Statewide Water Supply Plan, which guides the management, conservation, and development of water resources in the watershed, is more than 20 years old and clearly outdated. The NJDEP has made some notable progress in assessing the state's aquifers[2]; however, this report and the continued population growth along the Jersey Shore emphasize the importance of releasing the new State Water Supply Master Plan, so that water purveyors, water managers, municipalities, resource managers and others can work together to safeguard the economies of coastal communities and the ecology of the state's watersheds. The time to work on this critical issue is now, before the next drought.

And lastly, as we've glimpsed these past few years, climate change and sea level rise have the potential to alter ecosystem processes and our living in coastal communities in ways that we are just beginning to recognize and have yet to truly address. To face these challenges, the Barnegat Bay Partnership will continue to use the best science,available to work towards restoring and protecting this unique ecosystem that we all treasure. We hope that you will join us in this endeavor. Together we can build upon the successes of the past five years. To find out how you can help, please visit our website at http://bbp.ocean.edu.



Barnegat Inlet lighthouse. Photo by New Leaf Photography.

[1] Baker, R.J., C.M. Wieben, R.G. Lathrop, and R.S. Nicholson. 2014. Concentrations, loads, and yields of total nitrogen and total phosphorus in the Barnegat Bay-Little Egg Harbor watershed, New Jersey, 1989–2011, at multiple spatial scales. In U.S. Geological Survey Scientific Investigations Report 2014-5072. 64pp.

[2] Domber, S., I. Snook, and J.L. Hoffman. 2013. Using the Stream Low Flow Margin Methods to assess water availability in New Jersey's water-table-aquifer systems. In New Jersey Geological and Water Survey Technical Memorandum 13-3. Trenton, NJ. 76pp.

# Executive Summary

This report presents the current environmental conditions of the Barnegat Bay and its watershed, and compares current conditions to those previously documented in the *2005* and *2011 State of the Bay Report*. In this report, 17 indicators are used to assess the physical, chemical, and biotic conditions of Barnegat Bay using recent and ongoing research by academic, government, and private-sector scientists and engineers.

Studies conducted by the National Oceanic and Atmospheric Administration in 1999 and 2007 reported that Barnegat Bay was impacted by excessive macroalgae and nuisance algal blooms, and declared it highly eutrophic. These conditions were largely attributed to increasing watershed development and associated increases in non-point source nitrogen loads. The *2011 State of the Bay Report* documented continued excess nitrogen inputs to the bay, further losses in seagrass and tidal wetland habitats, and increases in the amount of water withdrawn from rivers, streams, and aquifers for human uses. However, good news was found in the continued preservation of open space throughout the watershed, and in the observed reductions in the number of bathing beach closures. •

In an effort to reduce negative impacts to the bay associated with watershed development and to better understand the bay's response to this changing environment, a number of restoration and research projects were undertaken by the members of the Barnegat Bay Partnership. The status and trends documented in this report, while not necessarily indicative of the effects of any one project, provide us with a means for measuring our progress in restoring this jewel of New Jersey.

### *Controlling Pollution and Improving Water Quality*

Water quality within the Barnegat Bay and its watershed continues to be a source of concern. A recent study estimating nutrient input to the bay for the time period of 1989-2011 indicated an increase in the amount of nitrogen being delivered to the bay. This excess nitrogen contributes to eutrophication, a process which can result in an increase in nuisance algal blooms, low dissolved oxygen, and other adverse effects that stress the biota of the bay. Within freshwater streams slightly more than half of sampling sites meet the water quality standards for aquatic life use, though the percentage of sites considered "excellent" has declined during the last sampling interval. On a bright note, the number of bathing beach closures due to pathogens continues to decrease as innovative projects address bacteria and other contaminants in stormwater.

### *Water Supplies for People and Wildlife*

As the population in the watershed has grown, the amount of water withdrawn from rivers, streams, and aquifers for human uses has increased. These withdrawals can result in reductions in the base flow of our rivers and streams, causing serious ecological repercussions as changes in the timing and amount of fresh water reaching the estuary affects water quality and habitat for many of the bay's species.

### *Protecting Land and Water*

Terrestrial and freshwater wetland habitats within the watershed continue to be lost, though the rate at which they are converted to urban settings slowed during the time period studied. Urban land (land covered with structures) now represents 34% of the land area within the watershed, and approximately 284 acres of freshwater wetlands disappeared. Tidal wetlands along the bayshore also lost approximately 238 acres; moreover, those tidal wetlands still remaining are considered moderately to severely stressed and are at risk from erosion, changes in sediment and nutrient availability, and submersion due to sea level rise. Sea grasses, a critical nursery habitat for many recreationally and commercially important fish and shellfish species, continue to struggle to recover from historic lows, though there have been some small improvements. But not all of the news is bad. Through a variety of public and private partnerships, open space preservation continues throughout the watershed, with over 11,000 acres protected over the past five years.

### *Conserving Fisheries and Wildlife*

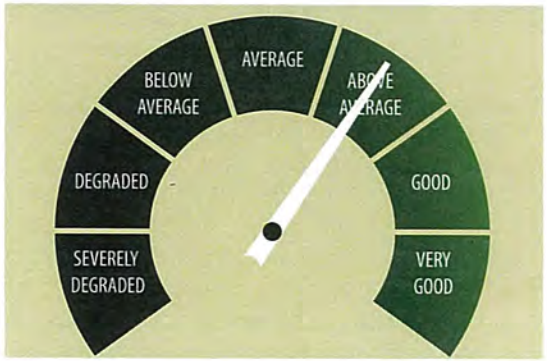
Surveys for hard clams in the estuary found a population severely depleted compared to the mid-1980s, though the abundance of hard clams in the Little Egg Harbor region have increased since the low recorded in 2001. The fish community in the northern and central segments of the bay have a diverse assemblage of species, and have been relatively stable over the past five years.

## How to Use the *State of the Bay Report*

A gauge is shown for each environmental indicator, which provides a summary, except for a few indicators for which doing so would be inappropriate. The gauge provides a summary of the indicator's status and trend, incorporating quantitative measures where available and the best scientific judgment of the review panel. Determination of an indicator's status is based on data available for 2010-2015, while the trend is based on the longest complete dataset available for that indicator. In some cases it was not practicable to use a five-year indicator for the status determination.

### *Status Ratings (needle)*

**The needle points to the appropriate status for the indicator.**




### *Trend Ratings (internal arrow)*

**A trend arrow pointing to the right indicates an improving condition.**


**A trend arrow pointing to the left indicates a deteriorating condition.**


**A bar with no arrows indicates no discernible trend.**


**A question mark indicates there was not enough data to develop a trend.**


American oystercatcher.
Photo by New Leaf Photography.

# Controlling Pollution and Improving Water Quality – Estuarine Eutrophication Assessment

## Nutrient Loading


In 2011, it was estimated that the combined total nitrogen load to the Barnegat Bay-Little Egg Harbor estuary was 749,000 kilograms of nitrogen per year (kg N/yr), an increase compared to the 2009 estimate. Analysis of the 1989-2011 estimates show an overall increase in nitrogen loads through time.

## Algal Blooms


Status: (northern)

Algal blooms have been recorded occurring throughout the bay at various time and spatial scales during the 2011-2015 time period, with the largest and most frequent blooms occurring in the northern portion of the bay. While routine monitoring for Brown Tide was discontinued in 2004, studies have shown various small-scale blooms of Brown Tide during the 2011-2015 time frame.

## Dissolved Oxygen


Three of the nine assessment units in the estuary were listed as impaired for dissolved oxygen on the state's 2014 *List of Water Quality Limited Waters*. Between 2011 and 2014 a total of 5 sampling locations had summer values below 4 milligrams per liter (mg/l), the level at which biota may begin to show signs of stress.

## Turbidity


There are three sections of the estuary that are listed as impaired for turbidity on the state's 2014 *List of Water Quality Limited Waters*. Turbidity in Manahawkin Bay limited light transmission to below one meter during the seagrass growing season for four of the five years, a condition that can be detrimental to seagrass growth. Long-term trends in turbidity are difficult to discern due to other confounding environmental factors.

## Controlling Pollution and Improving Water Quality – Freshwater Assessment

### Temperature and pH


Over the past five years, monitoring for temperature and pH has occurred at 28 stations within the watershed with varying frequency. The state's 2014 *List of Water Quality Limited Waters* identifies one station within the Barnegat Bay watershed that exceeded the temperature standard and one station that exceeded the pH standard.

### Freshwater Macroinvertebrates


Macroinvertebrates are commonly found throughout the watershed's streams, fulfilling an important role in the aquatic food web. These populations of benthic macroinvertebrates can be used as indicators of water quality. Currently, slightly more than half of the streams in the watershed meet the Surface Water Quality criteria. While the long-term trend (20+ years) in stream scores has been relatively stable, the drop in the percentage of streams classified as "excellent" over the last five years is a matter for concern.

## Controlling Pollution and Improving Water Quality – Human Use Impairments

### Bathing Beach Closures


The Ocean County Health Department (OCHD) obtains and analyzes water samples from 35 public bathing beaches in the county on a weekly basis between Memorial Day and Labor Day. The number of closures at the county's public recreational bathing beaches varies from year to year, attributable primarily to the number, duration, and intensity of rainfall events. The total number of closures has generally declined over the past five years.

### Shellfish Bed Closures


Currently, the waters of the Barnegat Bay consist of approximately 75% "approved," 6% "prohibited," and 19% "seasonal and special restricted" for shellfish harvest. There have been no substantial changes in the percentages of classified waters over the past five years.

# Water Supplies for People and Wildlife

## Streamflow


The United States Geological Survey maintains a network of stream gauging stations that measure the rate of flow in some of the major streams in the watershed on a continuous basis. Base flow accounted for 67%-94% of total streamflow at the monitored streams in 2014, and generally reflects the north to south urbanization gradient in the Barnegat Bay watershed. Over the last 40 years the percentage of base flow in the total flow has significantly declined in the northern streams.

## Water withdrawals


Fresh water is withdrawn from surface waterways and groundwater for a variety of purposes, including public supply, agriculture, landscape irrigation, commercial and industrial uses, mining, and power generation. The most recent estimate for 2010 shows that Ocean County's freshwater withdrawals averaged approximately 86 million gallons per day and have generally increased over the past several decades, closely linked to population growth.

# Protecting Land and Water

## Land Use/Land Cover


The conversion of forested areas and wetlands into urban settings reduces the amount of habitat available for plant and animal species and leads to sediment contamination, increased nutrient levels in surface waters, and increased incidences of low dissolved oxygen levels in water. Urban land use in the watershed has continued to increase, from approximately 22% of the watershed in 1986 to approximately 34% in 2016.

## Wetland Area


The wetlands within the watershed are an integral part of this sensitive ecosystem, providing habitat and a nursery for various fish, shellfish, and wildlife. There were approximately 22,795 acres of tidal wetlands and 67,034 acres of freshwater wetlands within the Barnegat Bay watershed in 2012. This represents a loss of 238 acres of tidal wetland area and 284 acres of freshwater wetland area since 2007.

## Tidal Wetland Condition


Tidal salt marshes provide essential ecosystem services, including flood protection, water quality improvements, and biogeochemical cycling, which greatly benefit the adjacent coastal communities. The wetlands in the northern Barnegat Bay are considered severely stressed, while the tidal wetlands in southern Barnegat Bay are considered moderately stressed. This is the first round of sampling of these wetlands, so no trend information is available.

10x

# Conserving Fisheries and Wildlife

## Protected Lands


Protected lands serve as important refuges for wildlife and can also serve as corridors for movement between larger parcels. These open spaces also enhance water quality and aquifer recharge by allowing rainwater to filter directly into the ground. Between January 1, 2010 and September 30, 2015, approximately 11,114 acres in the Barnegat Bay watershed were acquired by federal, state, county, local, and non-governmental agencies for conservation purposes.

## Seagrass


The long-term decline of seagrass in New Jersey's coastal bays is a major concern because it is critically important as a source of nutrition and because it provides feeding and refuge habitats for many fish and invertebrates. In the spring of 2015, there were encouraging signs of eelgrass biomass recovery, though biomass in the fall was similar to previous years. Widgeon grass biomass in central Barnegat Bay has increased substantially since the last seagrass survey.

## Shellfish Resources


Bay-wide surveys for hard clams conducted in 2011 (Little Egg Harbor) and 2012 (Barnegat Bay) estimated a standing stock of approximately 224 million clams. Overall, the abundance of hard clams in Barnegat Bay in 2012 was down approximately 23% from the last survey completed in 1985/1986. For Little Egg Harbor, the overall abundance in 2011 was down approximately 57% compared with the 1985/1986 survey. However, the abundance of hard clams in Little Egg Harbor increased 32% between 2001 and 2011.

## Estuarine Fish Communities


More diverse aquatic communities are typically more resilient to disturbances as there are multiple species that can occupy a particular role or take advantage of new or changing conditions. Estuarine fish communities in northern and central Barnegat Bay have a high degree of diversity, with no substantial changes in diversity across the sampling period.

# Contents





# Introduction

## *The National Estuary Program*

The National Estuary Program was established by Congress in 1987 via the Clean Water Act (33 U.S.C. 1330; P.L. 100-4, *et seq.*) to protect "estuaries of national significance." The Act directs the U.S. Environmental Protection Agency (USEPA) to develop plans for attaining and maintaining water quality in an estuary. The plan should include protection of public water supplies and the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife, and should allow recreational and other activities and uses in and on the water, and require control of point and non-point sources of pollution to supplement existing regulatory controls of pollution.

12x

**Point source pollution**:
a single identifiable *localized* source of air, water, thermal, noise, or light pollution.

**Non-point source pollution** *(below)*:
pollution affecting a water body from diffuse sources.

## Barnegat Bay Partnership

The Barnegat Bay National Estuary Program (BBNEP) was established in 1997, following the nomination of former Governor Christine Todd Whitman to provide an inclusive, local stakeholder-based mechanism to protect the Barnegat Bay for its economic, environmental, and cultural resources. Establishment of the BBNEP built upon the foundation that was provided by the state of New Jersey via P.L. 1987, Chapter 397, which created the Barnegat Bay Study Group. The BBNEP's *Comprehensive Conservation and Management Plan* (CCMP) was completed and approved by the partners in May 2002. The CCMP was supplemented by a *2008-2011 Strategic Plan* in which the BBNEP partners identified key priority issues and tasks to accomplish the objectives of the CCMP.

In 2010, the BBNEP changed its name to the Barnegat Bay Partnership (BBP) to better represent its mission, and a second Strategic Plan was completed for 2012-2016, focusing the efforts of all partners on those priority challenges facing the ecosystem using a manageable time frame which allows for improved progress and performance measures.

Today, the BBP is one of 28 National Estuary Programs and comprises federal, state, and local government agencies, academic institutions, nongovernmental organizations, and businesses working together to restore and protect a nationally significant estuary, the Barnegat Bay.

## Barnegat Bay: A Coastal Lagoon

The Barnegat Bay-Little Egg Harbor estuary (BB-LEH) is considered a lagoonal estuary, a semi-enclosed feature where fresh water and saltwater mix. A nearly continuous barrier island complex extends along the eastern edge of Barnegat Bay, separating it from the Atlantic Ocean. Seawater enters the bay at three locations: the Point Pleasant Canal via the Manasquan Inlet in the north, and the Barnegat Inlet and Little Egg Inlet in the south. Salinity in the bay is highest (close to seawater) near the mouths of the southern inlets and lowest near the mouths of the large rivers. Freshwater flow into the bay is primarily through surface waters, (*i.e.,* rivers and streams such as the Metedeconk River, Toms River, Cedar Creek, and Westecunk Creek) but also through groundwater input. Tidal range near the Little Egg Inlet is 3.3 feet, 4.5 feet near the Barnegat Inlet, and 1 foot at the Point Pleasant Canal. Water circulation in the bay is generally from Little Egg Inlet northward, though there is some southerly flow from the Manasquan Inlet towards the Barnegat Inlet. Residence time, or the amount of time a drop of water spends in the bay, varies from 0 to 30 days depending on starting location, with an average of 13 days.

**Watershed**:
the geographic region within which water drains into a particular body of water.

The watershed of the Barnegat Bay is approximately 670 square miles and encompasses nearly all of Ocean County and includes small portions of Monmouth and Burlington Counties.

Nutrient (substances used by living things to promote growth, generally nitrogen and phosphorous in estuaries) inputs into the Barnegat Bay are predominately from non-point sources such as stormwater runoff, groundwater, and atmospheric deposition. The types and amounts of nutrients are mostly determined by the surrounding land uses—suburban development, compared to forests or wetlands. In general, the northern portions of the watershed are more highly developed than the southern portions, and this is reflected in the nutrient loads (amounts) reaching the bay.

## Environmental Indicators

"Indicators" are specific, measureable characteristics that can be used to observe changes in environmental conditions over time. Each indicator helps us understand the current condition of a key component of the Barnegat Bay ecosystem, and whether the trend for that element is positive or negative. They also provide a tool for evaluating the effects of management actions. Collectively, the indicators provide a picture of the overall ecological condition of the Barnegat Bay.

# Introduction

*continued*

### *How were the indicators selected?*

The 17 indicators in this *State of the Bay Report* were included for their representativeness of the bay's habitat, resources, and concerns. We reviewed recent and ongoing research and evaluated what data were available and how they could describe the current conditions and the ways in which the bay has changed over the last five years.

The indicators were selected through a collaborative effort among the Barnegat Bay Partnership office, U.S. Geological Survey (USGS), New Jersey Department of Environmental Protection (NJDEP), Pinelands Preservation Alliance (PPA), U.S. Environmental Protection Agency (USEPA), and Brick Township Municipal Utilities Authority (BTMUA). Subsequent to selection, additional review of the indicators was provided by experts in the field, many of whom serve on the Barnegat Bay Partnership's Science and Technical Advisory Committee (STAC).

This report contains only a portion of the indicators that could have been included, but they provide an accurate representation of the changes to the bay. All but one of the "primary indicators" identified in the Barnegat Bay National Estuary Program's *2003 Monitoring Plan* have been included in this report (post-2003 data for the "Watershed Integrity" indicator was not available at the time of publication). Primary indicators were defined as "environmental or other resource characteristics that will provide the most effective subject areas for communicating Comprehensive Conservation and Management Plan progress to the public." Further, "secondary indicators" that provide additional detailed information were included. Taken together, they tell a story about the status and trends of both the natural resources and water quality in our watershed. As such, they serve as the basis for measuring the progress of those who are working to implement the *Barnegat Bay Comprehensive Conservation and Management Plan* and the *BBP 2012-2016 Strategic Plan*.

The data utilized in this report were generated by a number of federal and state agencies and academic institutions. The sources of data for each indicator are included at the conclusion of each indicator section. While the Barnegat Bay Partnership has strived to use only the highest quality data available (please see our Quality Assurance Performance Plan available at http://bbp.ocean.edu/pages/386.asp), we rely upon the expertise of the contributors to determine its accuracy. Therefore, questions concerning data should be addressed to the appropriate contributing source. A separate technical document has been prepared that includes the rational and statistical reasoning (if appropriate) for status and trend determinations, and can be found at http://bbp.ocean.edu/pages/386.asp.

# Estuarine Eutrophication Assessment

"Eutrophication," an increase in the rate of supply of organic matter into an ecosystem, is an important driver of Barnegat Bay's current condition. This process can lead to a cascading chain of negative environmental impacts, fueling algal blooms, creating hypoxic (low dissolved oxygen) or anoxic (no dissolved oxygen) conditions, and ultimately leading to changes in the bay's biotic communities. In the brackish and saline portions of the Barnegat Bay watershed, eutrophication is primarily driven by increases in nitrogen from non-point source pollution, but may also be affected by changes in temperature and other water-quality parameters (*e.g.* phosphorus). In freshwater rivers, creeks, and streams, phosphorous is the major nutrient of concern. The challenge that eutrophication poses begins at the headwaters of the bay in the westernmost reaches of the watershed and requires our collective action.

Sunset over Barnegat Bay. Photo by Barnegat Bay Partnership.

*Indicator*

# Nutrient Loads

*Indicator Status*


**Black-crowned night heron fishing in algal mats. Photo by New Leaf Photography.**

## *Background*

Nitrogen and phosphorus are essential nutrients for plant growth, but in excess quantities, they can adversely affect the quality of water in the Barnegat Bay-Little Egg Harbor estuary. Nitrogen and phosphorus can enter the estuary by way of groundwater discharge to streams, groundwater discharge directly to the bay, stormwater runoff, atmospheric deposition, ocean water entering the estuary, and through the release of nutrients stored in bottom sediments.

In residential and commercial areas, sources of nitrogen and phosphorus to surface- and groundwaters include lawn fertilizers, septic-system wastes, leaky sewer pipes, and industrial discharge; in agricultural areas, sources include crop fertilizers, animal manure, and septic-system wastes. Additionally, nitrogen can enter the atmosphere through automobile emissions, industrial emissions, and natural nitrogen-fixation processes, with subsequent deposition on land or water surfaces.

Estimates of the nitrogen and phosphorus load (amount that is delivered) to the Barnegat Bay-Little Egg Harbor estuary are needed to help assess the importance of nutrient sources within the watershed and to develop nutrient management strategies which can be used to help maintain or improve the ecological health of the estuary. Factors that can affect the amount of nutrients that enter a system include land use, season, and hydrologic condition (high flow or low flow).

## *Status*

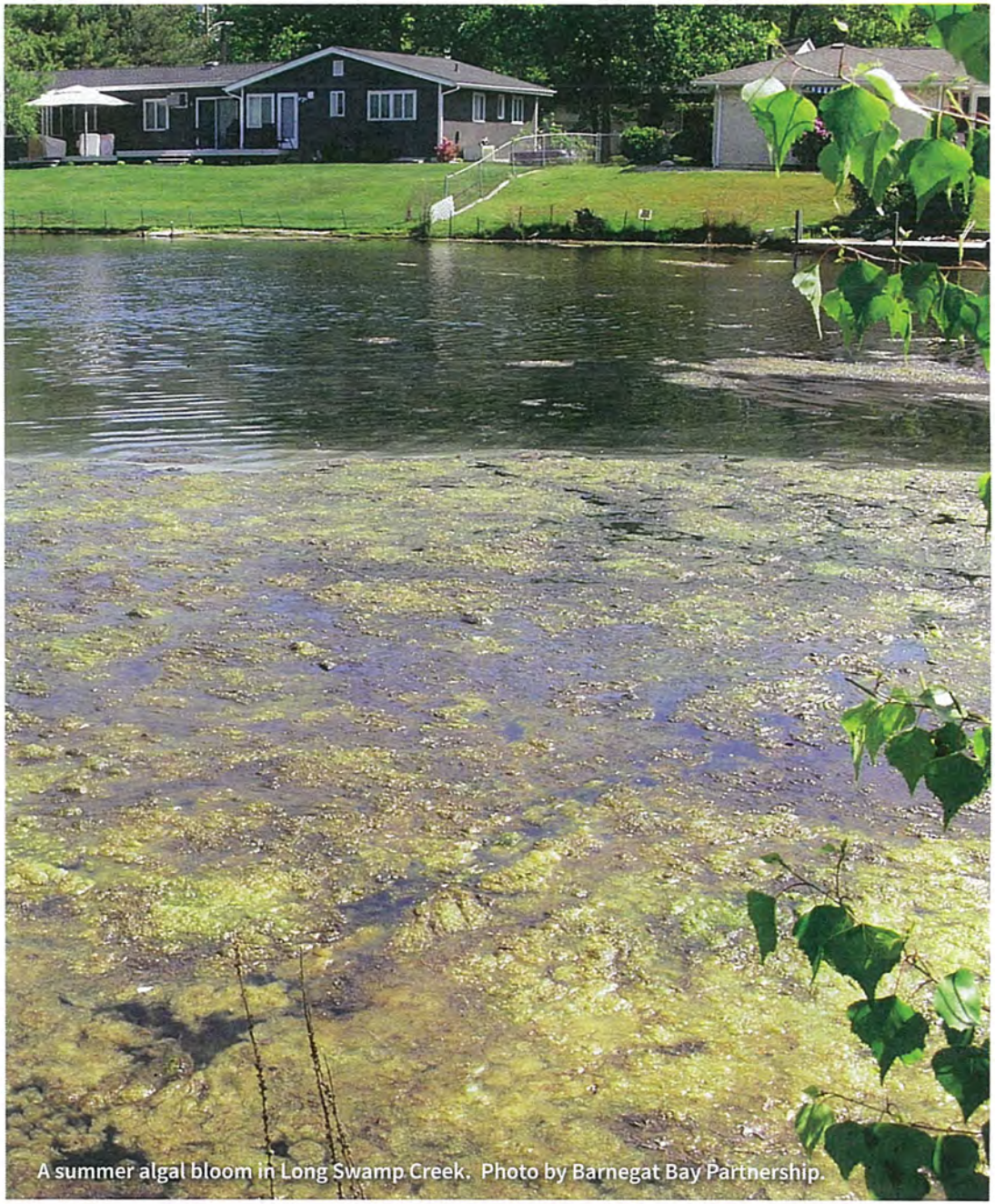
The U.S. Geological Survey recently completed a study focusing on the watershed surface- and groundwater inputs of nutrients to the estuary. Concentrations, loads, and yields (amount that is delivered per unit area) of total nitrogen and total phosphorus were calculated for 1989-2011 for all subbasins in the Barnegat Bay-Little Egg Harbor watershed at annual and seasonal time scales using surface-water quality, precipitation, streamflow, and land-use data. For this study, the watershed was divided into three segments—north, central, and south—to coincide with the natural segmentation of the estuary (Figure 1).

The median concentration of total nitrogen for sampling stations in the north segment was 0.79 milligrams per liter (mg/L). Median total nitrogen concentrations were significantly lower in the central and south segments (0.23 mg/L and 0.31 mg/L, respectively). Median total phosphorus concentrations were 0.030, < 0.010, and < 0.015 mg/L in the north, central, and south segments, respectively. Higher median concentrations of nutrients in the north segment are consistent with a greater percentage of agricultural plus urban land use.

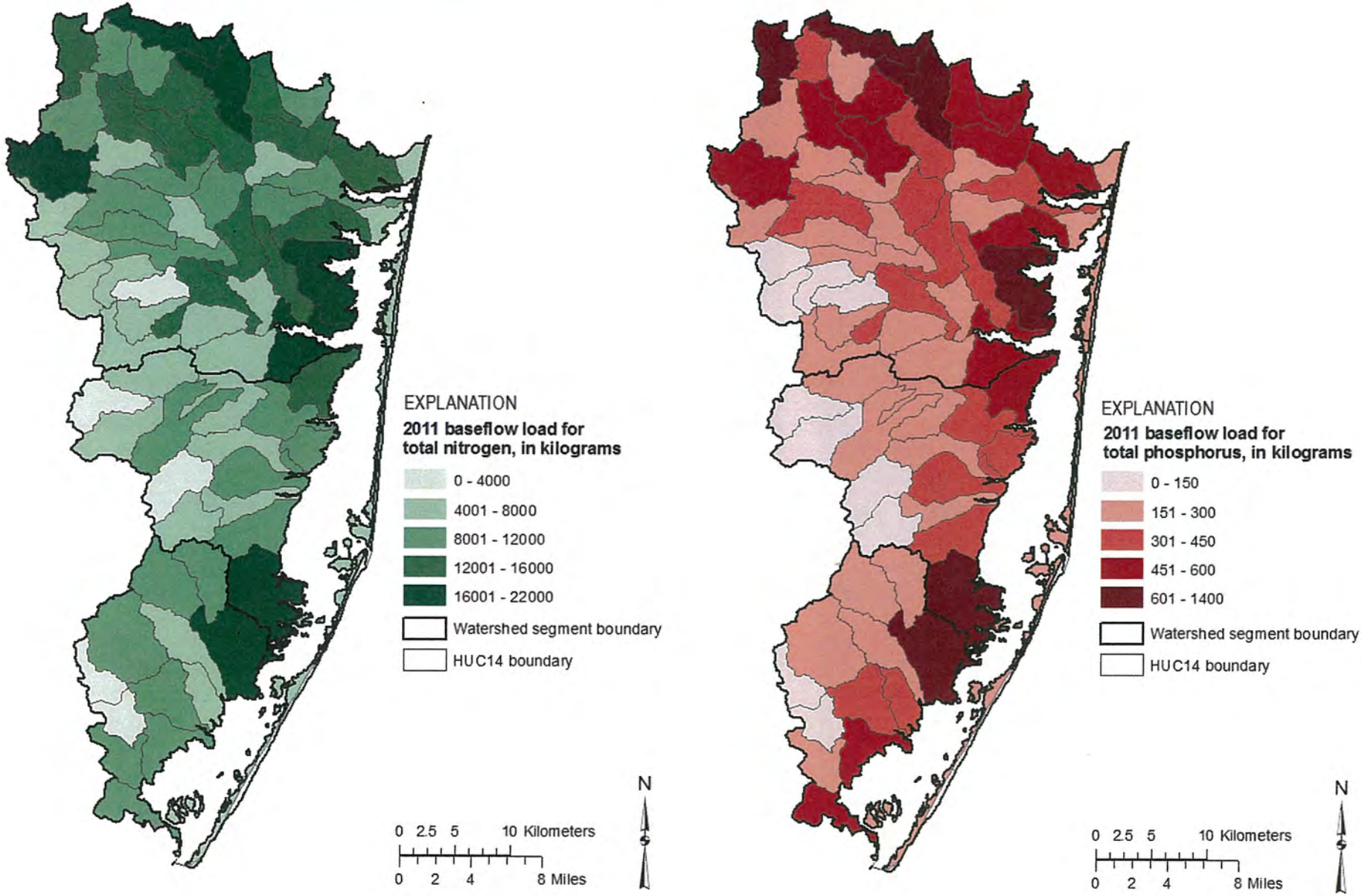
It was estimated that 749,000 kilograms (kg) of nitrogen and 28,000 kg of phosphorus were transported to Barnegat Bay-Little Egg Harbor estuary from the watershed in 2011. Approximately 79% of this load was contributed by groundwater discharge to streams (base flow) and 21% was contributed by stormwater runoff. Other studies are underway to quantify additional non-watershed inputs of nutrients to the estuary.

Subbasins with the highest yields of nutrients are concentrated in the northern part of the watershed, and have the highest percentages of urban or agricultural land use (Figure 2). Subbasins with the lowest total nutrient yields are mostly forested. Contributions of nutrients from turf (lawn)-covered areas also were assessed in cooperation with Rutgers University's Center for Remote Sensing and Spatial Analysis. It was determined that calculated concentrations of total nitrogen and total phosphorus were greater for developed–turf areas than for developed–nonturf areas, which, in turn, were greater than those for undeveloped areas.


Figure 1: Locations of water-quality sampling stations used to estimate base-flow loads of total nitrogen (TN) and total phosphorus (TP) in the Barnegat Bay-Little Egg Harbor watershed.



A summer algal bloom in Long Swamp Creek. Photo by Barnegat Bay Partnership.




18t

Figure 2: Base-flow loads for each subbasin in the Barnegat Bay-Little Egg Harbor watershed: A, total nitrogen, 2011; B, total phosphorus, 2011.

In a separate study, five streams in the Barnegat Bay-Little Egg Harbor watershed were sampled in 2010 for nutrient concentrations and stable isotope composition under base-flow and stormflow conditions to quantify and identify sources of nitrogen loading. Concentrations of total nitrogen in the five streams appeared to be related to land use, such that streams in subbasins characterized by extensive urban development (and historical agricultural land use) exhibited the highest total nitrogen concentrations (0.84–1.36 mg/L in base flow). Two streams in subbasins with the least development exhibited the lowest total nitrogen concentrations (0.16–0.26 mg/L in base flow). Measurements of nitrogen and oxygen stable isotope ratios of nitrate in surface-water samples revealed that a mixture of multiple subsurface sources, which may include some combination of animal and septic waste, soil nitrogen, and commercial fertilizers, likely contribute to the base-flow nitrogen load, and that atmospheric deposition is not a predominant source of nitrogen transported to the BB-LEH estuary from the watershed.

### Trends

Over the period of study 1989–2011, surface-water loads (base flow plus runoff) of total nitrogen for the entire BB-LEH watershed ranged from about 455,000 kg (1995) to 857,000 kg (2010) (Figure 3). Total phosphorus loads for the watershed ranged from 17,000 (1995) to 32,000 kg (2010). Total loads fluctuated with precipitation and hydrologic conditions and patterns, with precipitation having a short-term and immediate effect on runoff loads and a longer-term and sometimes delayed effect on base-flow loads. Loads also were a function of land use; the increase in loads in more recent years can be attributed at least in part to increases in urban development in the watershed.

### Data Gaps

At the time of the study (using data available through 2011), streams in the northern part of the watershed were well represented in terms of water-quality monitoring data; however, there were several streams in the southern part of the watershed for which a sufficient amount of nitrogen or phosphorus data were not available.

The loading estimates produced in this investigation are most suitable for making comparisons among seasons and years, and among subbasins. A more complete understanding of nutrient cycling in the watershed could be achieved with the use of additional, targeted water-quality monitoring in conjunction with a watershed water-quality model that considers in-stream processes, incorporates shorter time steps, and targets individual streams and reaches.

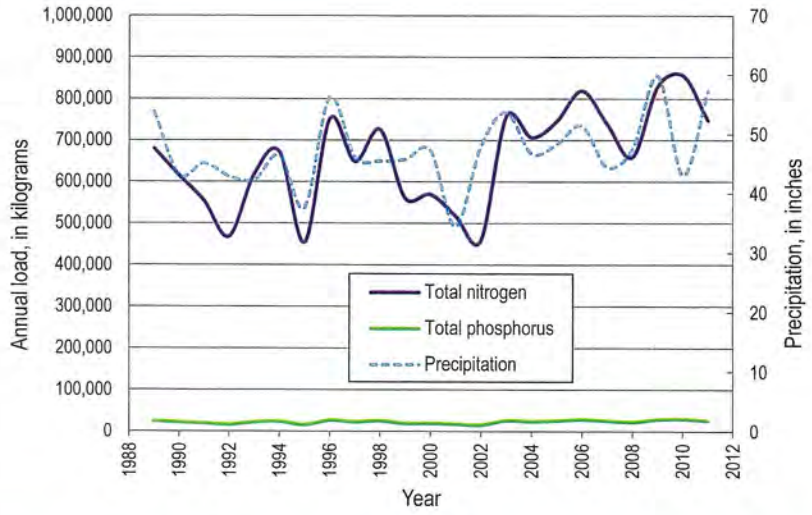



Figure 3: Load of total nitrogen and total phosphorus entering Barnegat Bay-Little Egg Harbor from the watershed, 1989–2011.

*For more detailed information, please see the full report Concentrations, loads, and yields of total nitrogen and total phosphorus in the Barnegat Bay-Little Egg Harbor watershed, New Jersey, 1989-2011, at multiple spatial scales, available at* http://dx.doi.org/10.3133/sir20145072

*and*

*Nutrient concentrations in surface water and groundwater, and nitrate source identification using stable isotope analysis, in the Barnegat Bay-Little Egg Harbor watershed, New Jersey, 2010–11, available at* http://pubs.er.usgs.gov/publication/sir20125287.

*Indicator*

# Algal Blooms

*Indicator Status (Northern Section)*


**Rockweed, a common macroalgae in the intertidal zone. Photo by New Leaf Photography.**

## *Background*

Phytoplankton blooms have been documented in Barnegat Bay, which are symptomatic of eutrophication problems. These blooms are typically characterized by the explosive growth of a single phytoplankton species, which can create an array of negative impacts. Excessive growth of some phytoplankton species generates **harmful algal blooms** (HABs), also known as brown, yellow, and red tides. Toxic forms are particularly dangerous to numerous organisms, including macroalgae, shellfish, finfish, and humans. Secondary impacts of algal blooms include shading of benthic habitats, altered grazing patterns, and changes in trophic dynamics that are detrimental to estuarine function. HAB-forming species that have been recorded in the BB-LEH estuary, include *Aureococcus anophagefferens, Dinophysis* spp., *Gymnodinium* (*Karlodinium*) spp., *Heterosigma* sp., *Pseudo-nitzschia* sp. and *Prorocentrum* spp.

Brown-tide blooms caused by the minute algal pelagophyte, *Aureococcus anophagefferens*, were first reported in New Jersey coastal bays in 1988. These blooms have typically been observed in dry years. These algal blooms can discolor the water brown and may cause negative impacts on shellfish, notably the ecologically and commercially important hard clam and scallop, as well as on seagrasses. Adverse shellfish impacts include a reduction in the growth of juvenile and adult hard clams and mussels, reduced feeding rates of adult hard clams and other shellfish, recruitment failures, and increased mortality of bay scallops. The dense shading of benthic habitats caused by these blooms may also contribute to the loss of seagrass beds, which serve as important habitat for finfish and shellfish.

Chlorophyll *a* is a plant pigment used to determine the amount of algal biomass present in a body of water. While there will be a background amount of chlorophyll *a* in a water sample due to naturally occurring phytoplankton, excessive amounts indicate an algal bloom may be occurring. Concentrations of chlorophyll greater than 5 ug/l are considered moderate degradation. The NJDEP's Bureau of Marine Water Monitoring and partners in the Barnegat Bay intensive and long-term monitoring programs, part of the Governor's Barnegat Bay Initiative, collected an average of 163 chlorophyll *a* samples per year in the estuary during the summer season from 2011-2015. In addition to this long-term data, a subset of samples from the Bureau of Marine Water Monitoring's (the Bureau) National Shellfish Sanitation Program bacteria sampling are analyzed for species composition, focusing on potential toxic species. The Bureau has also worked with NJDEP Forest Fire Service and Rutgers University, conducting routine aircraft remote sensing for chlorophyll *a* over the estuary for the spring and summer season since 2008, to monitor the spatial extent and duration of algal blooms. The aircraft data collection frequency is approximately six days a week during the summer months, and supplies a spatial data set across the bay by recording a result every one second during the flight, resulting in the ability to determine the size, duration, intensity and movement of algal blooms over time.

## *Status*

Algal blooms have been recorded occurring throughout the bay at various time and spatial scales during the 2011-2015 time period. While routine monitoring for Brown Tide was discontinued in 2004, studies have shown various small-scale blooms of Brown Tide during the 2011-2015 time frame. The Bureau of Marine Water Monitoring has also developed the capability to analyze for the presence of the Brown Tide organism, and does analysis when there is an abundance of small unidentifiable algae that could potentially be *Aureococcus anophagefferens.*

20x

## Trends

Average summer chlorophyll *a* concentrations have fluctuated both by year and bay segment (Figures 1 and 2). Overall, the cholorphyll *a* concentrations are the highest in the Barnegat Bay segment, an area from near Barnegat Inlet in the south to the Metedeconk River in the north. A comparison of the average aircraft-collected spatial data compared to the fixed station data shows differences in distribution of algae. Fixed boat monitoring from discrete points can sometimes overestimate the chlorophyll *a* concentration that would be extrapolated to the estuary. This suggests that high levels were in local areas, not bay-wide (Figure 3), and that the duration of the blooms is not long. Comparison of historical data collected by Kent Mountford for a 22-month period from 1969-1970 for the mean of five stations in the central- lower western portion of the Barnegat Bay (from Forked River south to Barnegat) to a 25-month period ending September 2015 from two stations in the same portion of the bay, shows an overall decreasing trend in concentrations (Figures 4 and 5). Some of this difference may be due to the different location of the stations for the two data sets. As mentioned above, algae densities can be very site-specific, and not bay-wide. Some identification of a Brown Tide was found during the Barnegat Bay researchers' work, but seemed to be smaller-scale blooms in localized areas.

## Data gaps

There continues to be a need for routine Brown Tide monitoring in high probability areas.

More information regarding the NJDEP phytoplankton monitoring program, including the data used in this analysis, can be found at http://www.state.nj.us/dep/wms/bmw/phytoplankton.htm.

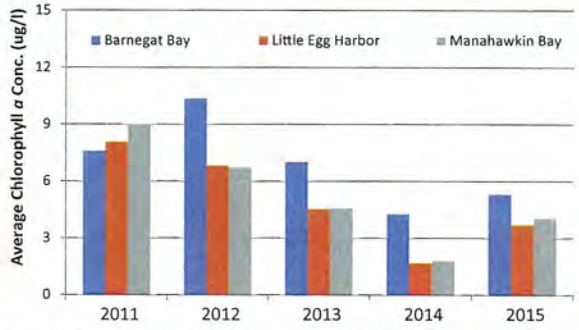



Figure 1: Average summer chlorophyll *a* concentrations in Barnegat Bay by year and bay segment from the NJDEP and partners' Barnegat Bay discrete monitoring program, 2011-2015.

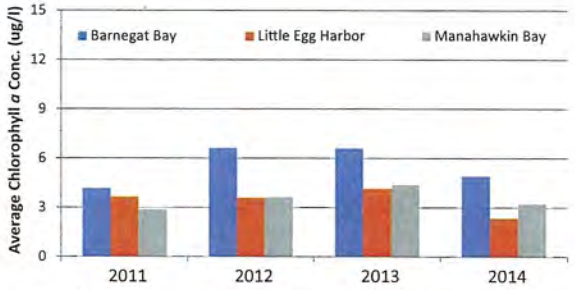



Figure 2: Average summer chlorophyll *a* concentrations in Barnegat Bay by year and bay segment from the NJDEP Bureau of Marine Water Monitoring aircraft remote sensing, 2011-2014.

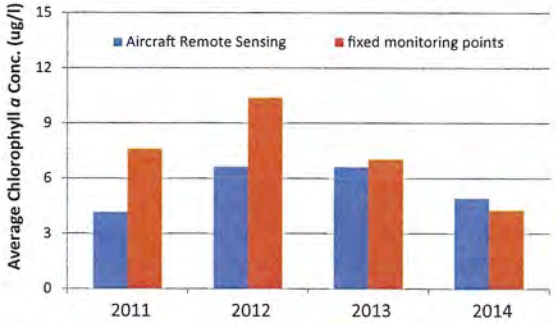



Figure 3: Comparison of annual average chlorophyll *a* concentrations in Barnegat Bay collected through aircraft remote sensing and discrete monitoring, 2011-2014.

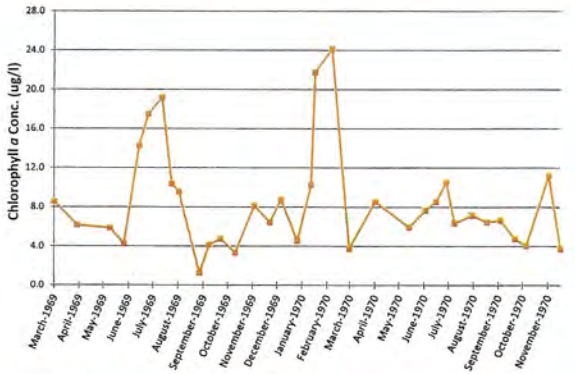



Figure 4: Historical mean chlorophyll *a* concentration of 5 stations in the central-lower western portion of Barnegat Bay.

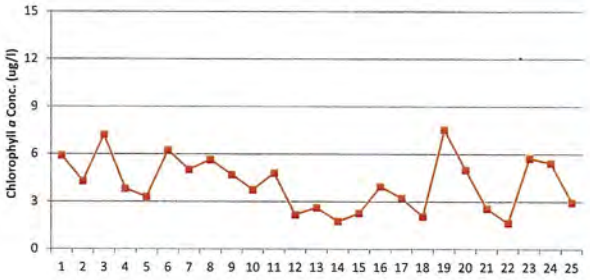



Figure 5: Mean chlorophyll *a* concentration of 2 stations in the central-lower western portion of Barnegat Bay for the 25 months ending Septermber 2015.

*Indicator*

# Dissolved Oxygen

*Indicator Status*


**Cedar Creek in Double Trouble State Park. Photo by New Leaf Photography.**

## Background

Dissolved oxygen is a fundamental requirement for the maintenance of balanced populations of fish, shellfish, and other aquatic organisms. The nature and extent of the organism's response to low oxygen concentrations depends on several factors, including the concentration of oxygen in the water, how long the organism is exposed to reduced oxygen, and the age and condition of the organism.

Because dissolved oxygen is so important to marine life, New Jersey has established surface water criteria for oxygen levels in marine waters. The surface water criterion for estuarine water is four milligrams per liter. Dissolved oxygen concentrations below two milligrams per liter are considered lethal to aquatic life, while concentrations above two, but below the four milligrams per liter designation, may support aquatic life, but warrant further study. However, prolonged periods of exposure to below-optimum conditions (between 4 and 5 milligrams per liter) may stress some aquatic life.

The NJDEP Bureau of Marine Water Monitoring assessed summer dissolved oxygen conditions from the data collected as part of the Barnegat Bay intensive and long-term monitoring programs between 2011-2015. Over the past 5 years, an average of 14 fixed stations were sampled each year, both bottom and surface water, throughout the estuary 1 to 4 times per month (Figure 1). This program included three intensive sampling events during which data was collected several times throughout the day. These data can detect daily fluctuations that may not be seen in routine monitoring, because low dissolved oxygen conditions are expected to occur in the early morning hours, which are not usually sampled by routine station monitoring. Additionally, four continuous water quality monitoring buoys, located from Toms River south to Little Egg Inlet, have been in operation from 2012-2015 (Figure 1). The buoys measure dissolved oxygen at a frequency of every 15 minutes at 3 feet below the surface; the number of summer dissolved oxygen results during this time range from 2,353 to 8,825.

## Status

There are three sections (Barnegat Bay Central West, Toms River Estuary, and Lower Little Egg Harbor Bay) of the estuary that are listed as impaired for dissolved oxygen on the state's 2014 *List of Water Quality Limited Waters*, known as the "303(d) List" (named after a section of the Clean Water Act). These listings were based on dissolved oxygen measurements obtained as part of the NJDEP's Barnegat Sampling Program between 2011-2014. However, these impaired areas are only 1/3 of the 9 sampling areas in Barnegat Bay. Furthermore, the low dissolved oxygen observed in the Lower Little Egg Harbor Bay is based on data from a sampling site located at the Little Egg Inlet, and the limited low readings there may be due to ocean upwelling.

## Trend

From 2011 to 2015, a total of 5 sampling stations had summer minimums below 4 milligrams per liter. All other stations sampled during those years did not drop below the 4 milligrams per liter threshold. The results of the continuous monitoring buoys show less than 2% of samples dropping below 4 milligrams per liter (Figure 2). Differences may be seen between the fixed and continuous monitoring locations, as fixed station data incorporates bottom samples which, at times, can be lower than mid-depth or surface results. The combined data show that low dissolved oxygen can be localized in the estuary, and may not be low through the entire water column. Variation in dissolved oxygen from year to year can be caused by a variety of factors, including the weather preceding the sample collection, water temperature, other water-quality parameters (*e.g.*, nutrients, chlorophyll *a*), and the time of sample collection.


Figure 1: Locations of the fixed routine (circles) and continuous (diamonds) water monitoring stations within the Barnegat Bay. Blue circles are fixed stations that did not record summer dissolved oxygen readings below 4 mg/l. Yellow circles indicate fixed stations where summer dissolved oxygen readings fell below the 4 mg/l threshold.

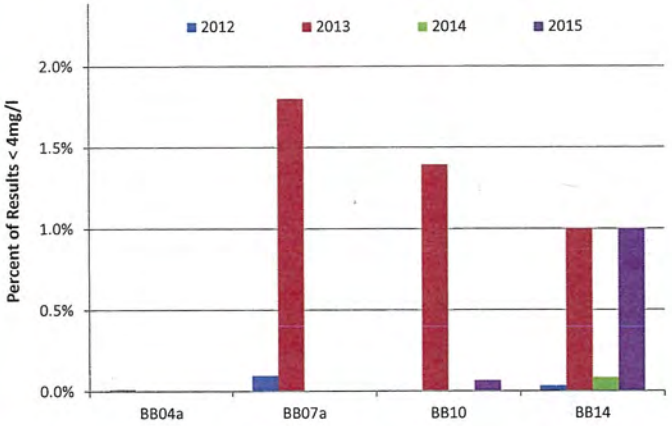



Figure 2: Percentage of continuous monitoring samples collected during the summer that fell below the 4 mg/l threshold for dissolved oxygen. BB04a is the northern continuous monitoring site and BB14 is located at Little Egg Inlet. See Figure 1 for locations.

*Data courtesy of NJDEP Bureau of Marine Water Monitoring, NJDEP Bureau of Water Quality Standards and Assessment.*

*Indicator*

# Turbidity

*Indicator Status*


**Great egret hunting in the shallows. Photo by New Leaf Photography.**

## Background

Poor water clarity in shallow estuaries can be attributed to a number of sources, including organic material (especially living or dead algae), dissolved tannins, and suspended sediments due to wind and wave action or human activity such as boating. Turbid waters may supply building material for maintaining estuarine structures and provide food and protection to resident organisms; however, the extensive particle loads of turbid waters are harmful if they bury benthic communities, inhibit filter feeders, or block light needed by seagrasses.

The New Jersey Department of Environmental Protection Bureau of Marine Water Monitoring measures turbidity directly and utilizes a secchi disk as indicators of water clarity as part of Coastal Water Quality Monitoring. Over the past 5 years, an average of 14 fixed stations were sampled each year throughout the estuary 1 to 4 times per month. Turbidity is directly measured using a turbidimeter, which is calibrated using standard solutions of known turbidity, and results are reported as nephelometric turbidity units (NTU). The turbidity standard in saline and estuarine waters contains two parts: a single sample value of 30 NTU and a 30-day average value not to exceed 10 NTU. A secondary measurement, secchi depth, is determined by lowering a disk into the water to see how far light can penetrate into the water column. Secchi depths of one meter or greater are considered healthy for seagrasses.

## Status

Three sections of the estuary (Metedeconk and Lower Tributaries, Manahawkin Bay and Upper Little Egg Harbor, and Lower Little Egg Harbor Bay) are listed as impaired for turbidity on the state's 2014 *List of Water Quality Limited Waters,* known as the "303(d) List" (named after a section of the Clean Water Act) due to exceedances of the turbidity standard from 2011-2014. However, in 2015, average turbidity in all segments of the bay were well below the threshold limits (Figure 1), and average secchi depth was greater than 1 meter in 2 of 3 segments (Figure 2).

## Trends

Turbidity varies from year to year based on a number of factors, including the weather preceding the sample collection, freshwater flows, water temperature, other water quality parameters (*e.g.,* chlorophyll *a*), and the time of sample collection. It is therefore difficult to identify long-term trends in turbidity.

*Data courtesy of NJDEP Bureau of Marine Water Monitoring.*

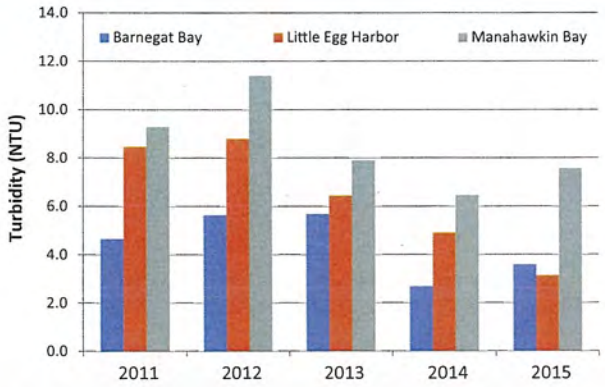



Figure 1: Average turbidity for the Barnegat Bay during the seagrass growing season (March to November) from 2011 to 2015 as recorded by the NJDEP Barnegat Bay long-term monitoring. Please see Figure 1 in the Dissolved Oxygen section for sampling locations.

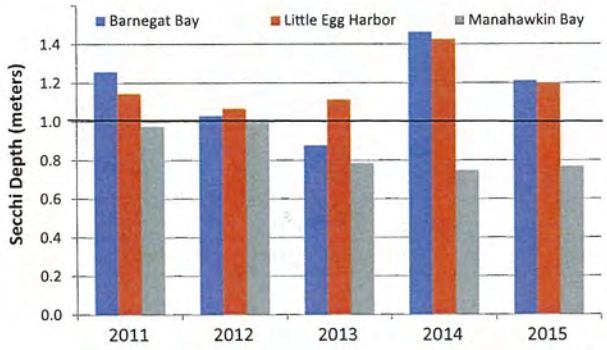
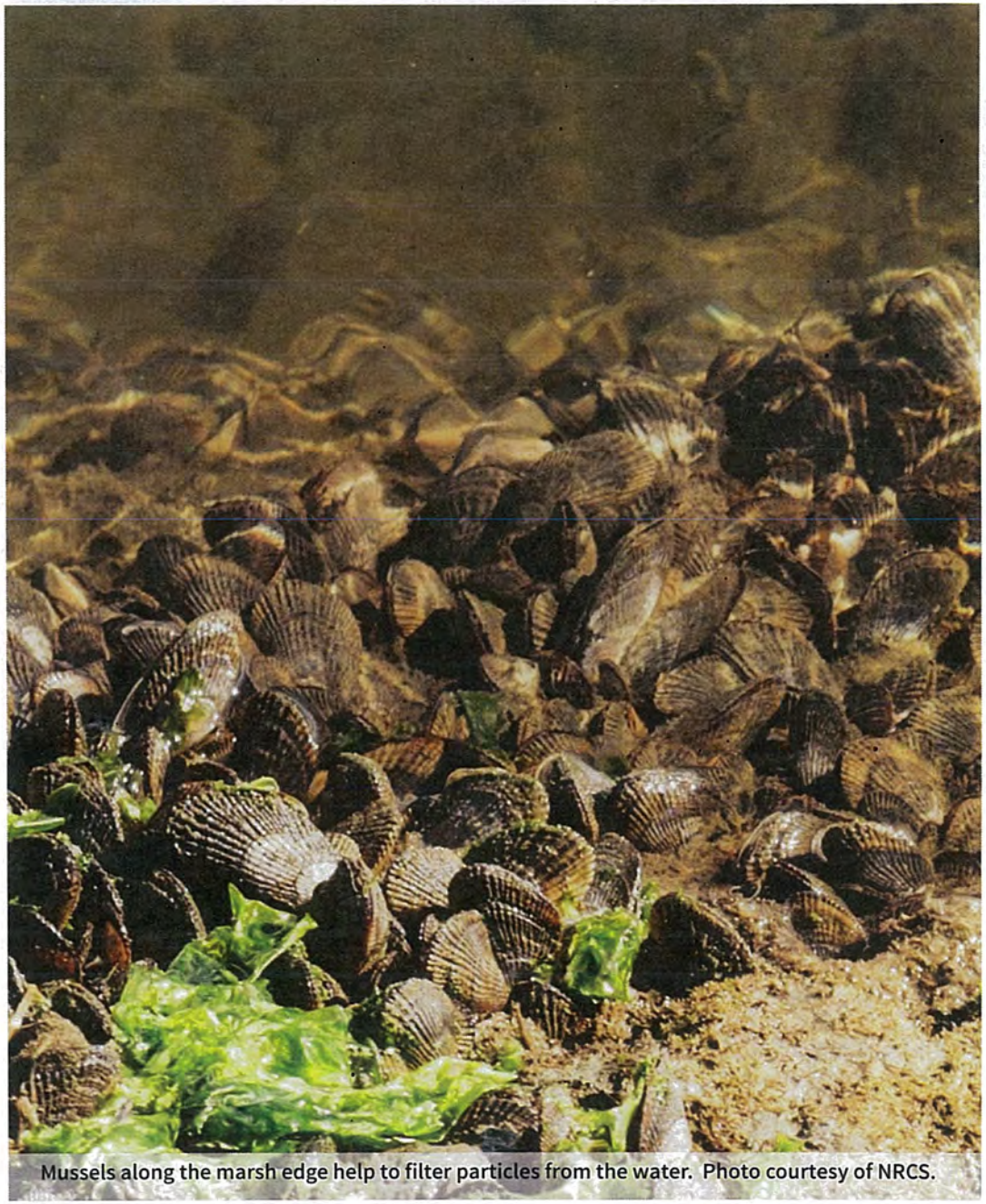



Figure 2: Average secchi depth for the Barnegat Bay during the seagrass growing season (March to November) from 2011 to 2015 as recorded by the NJDEP Barnegat Bay long-term monitoring. Please see Figure 1 in the Dissolved Oxygen section for sampling locations.



Mussels along the marsh edge help to filter particles from the water. Photo courtesy of NRCS.

Barnegat Bay salt marsh. Photo courtesy of NRCS.

26x

# Freshwater Assessment

While seemingly far from the Barnegat Bay itself, municipalities such as Plumsted, Lakehurst, Manchester, Jackson, Wall, Millstone, and Freehold contain the headwaters and tributaries that eventually join together to form the Toms River and Metedeconk River. This fresh water mixes with saltwater to create vital nursery areas for life along the entire Atlantic coast. Along with many other creeks and streams, these waterways flow through our communities, connecting all of us to Barnegat Bay.

Double Trouble State Park in the fall. Photo by New Leaf Photography.

*Indicator*

# Temperature and pH

*Indicator Status*


**Turtles basking on a wetland bank. Photo by New Leaf Photography.**

## Background

Water quality in Barnegat Bay is strongly influenced by the freshwater input from the rivers, streams, and creeks that feed into it. The major rivers and streams carry over 80% of the fresh water that enters the bay, with the remainder coming from precipitation, smaller creeks and streams, and direct groundwater discharge. This fresh water is needed to maintain an ecosystem where it mixes with saltwater to create a vital nursery area for life along the Atlantic coast. The characteristics of the incoming fresh water influence water quality in the bay, including temperature, pH, and dissolved oxygen.

Over the past five years the NJDEP and USGS have monitored temperature at 28 stations within the watershed with varying frequency (Figure 1). Stations utilized for this report had at least eight data points over the past five years.

## Temperature

Temperature is an important indicator, as many fresh water and estuarine aquatic species are adapted to living within an optimal range, and departures from that range can cause stress, leading to reduced feeding, reduced reproduction, higher metabolic costs, and even mortality. Furthermore, warmer water does not hold as much dissolved oxygen, a key component for life in aquatic environments.

## Status

The state's 2014 *List of Water Quality Limited Waters*, known as the "303(d) List" (named after a section of the Clean Water Act) identifies one station (Toms River at Route 528) within the Barnegat Bay watershed that exceeds the temperature standard. This listing is based on continuous temperature data collected by the NJDEP. Since only 1 station out of the 28 stations within the watershed has data that shows impairment, the overall status for temperature in the watershed is "Good."

## Trends

Spring and summer temperatures in each region have been generally consistent over the past four to five years, while winter temperatures have shown a slight decrease (Figure 2). Variability between years was also highest in winter, compared to summer and spring.

## Data gaps

The valid assessment of trends, seasonal changes, and comparisons of data between monitoring locations, watersheds and regions is difficult due to the short period of record. However, the development of the Barnegat Bay Long-Term Monitoring Network in 2013 should fill this data gap moving forward. In addition, the Ambient Surface Water Quality Monitoring Network (a cooperative effort between NJDEP and USGS) contains monitoring stations on the Metedeconk River, Toms River, and Cedar Creek, which have been monitored since 1998 and will continue to be monitored on a quarterly basis. These stations should be evaluated for long-term trends for temperature. In terms of temperature measurements, routine monitoring typically involves making one discreet measurement during the day. This does not represent a true minimum or maximum for the day. In order to fully assess temperature variations, continuous monitors, which record measurements throughout the day, should be utilized.

### pH

The acidity of a waterway (known as pH) is also an important indicator of freshwater ecosystem health. Transitions from natural landscapes to agricultural and suburban/urban uses are typically reflected in waterways by an increase in pH. This is particularly problematic in the central and southern portions of the watershed, where the headwaters of many of the waterways are in the Pinelands area and, therefore, have naturally low pH. The unique aquatic species endemic to the Pinelands have evolved to survive in these acidic waters, and raising the pH may have adverse consequences. The New Jersey Surface Water Quality Standards (SWQS) identifies a pH range of 3.5 - 5.5 for Pinelands waters and 4.5 - 7.5 for Inner Coastal Plain waters, which are those waters outside of official Pinelands boundaries but which still may be influenced by similar natural conditions. The SWQS in the remaining waters of the state for pH is 6.5-8.5.

### Status

During the 2011-2015 time frame, one station (Ridgeway Brook at Route 70) had a violation of the pH standard. Since only 1 station out of 28 stations within the watershed has data that shows impairment, the overall status for pH in the watershed is "Good."

### Trends

Throughout the time series in question, pH in the central segment was lower than the north and south (Figure 3).

### Data gaps

As with temperature, valid assessment of trends, seasonal changes, and comparisons of data between monitoring locations, watersheds, and regions is difficult due to the short period of record. The Barnegat Bay Long-Term Monitoring Network in 2013 should fill this data gap moving forward. In addition, the Ambient Surface Water Quality Monitoring Network (a cooperative effort between NJDEP and USGS) contains monitoring stations on the Metedeconk River, Toms River, and Cedar Creek which have been monitored since 1998 and will continue to be monitored on a quarterly basis. These stations should be evaluated for long-term trends for pH.

*Data courtesy of NJDEP and USGS through the USEPA STORET data warehouse.*

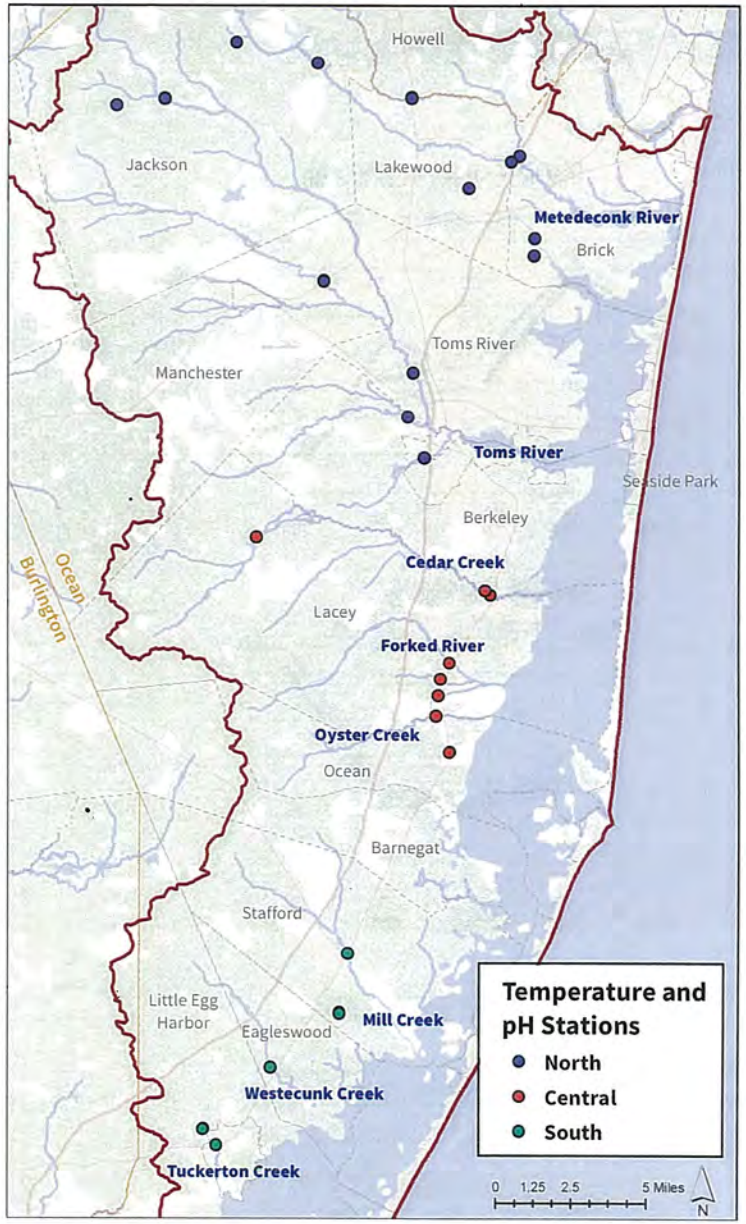


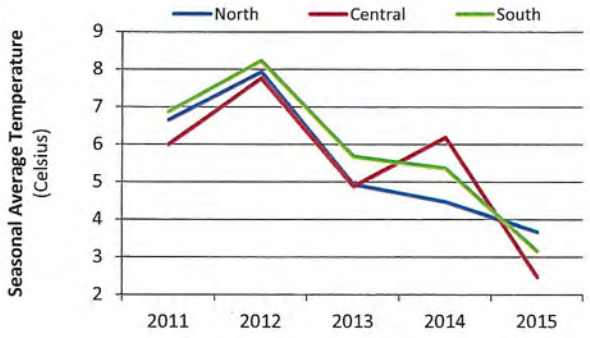

Figure 1: Temperature and pH sampling station locations within the watershed utilized in this report. Data provided by the NJDEP and USGS.

# Temperature and pH

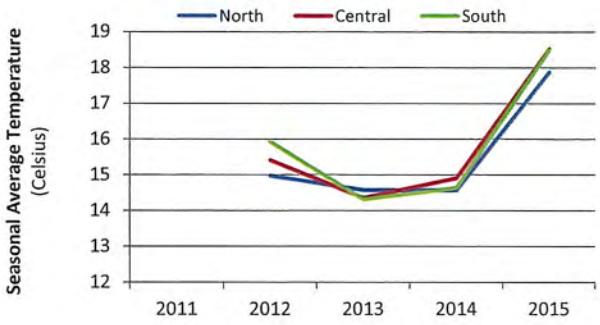
*continued*

*Temperature*

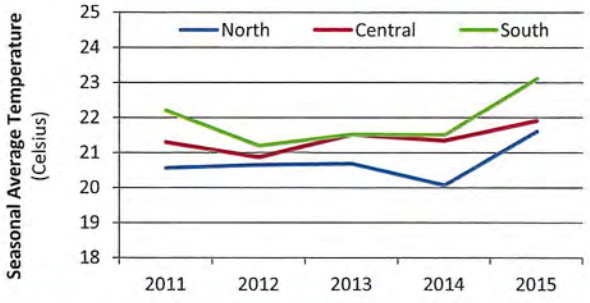
**Winter** (December-March)




**Spring** (April-May)




**Summer** (June-September)

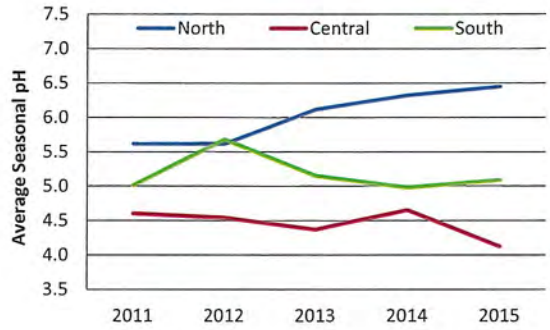



◀ Figure 2: Stream and river temperatures throughout Barnegat Bay. Winter samples were collected December-March, spring samples April-May, and summer samples June-September. See map for the locations of the sampling stations. Data provided by the NJDEP and USGS.

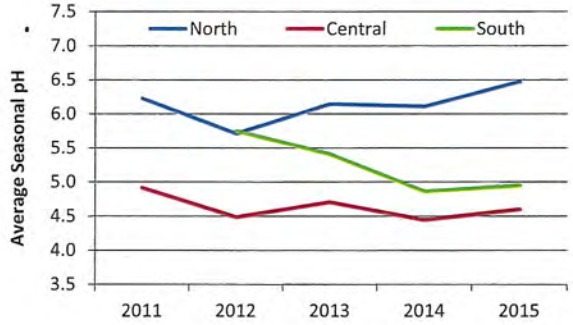
Figure 3 ▶ Stream and river pH throughout Barnegat Bay. Winter samples were collected December-March, spring samples April-May, and summer samples June-September. See map for the locations of the sampling stations. Data provided by the NJDEP and USGS.

*pH*

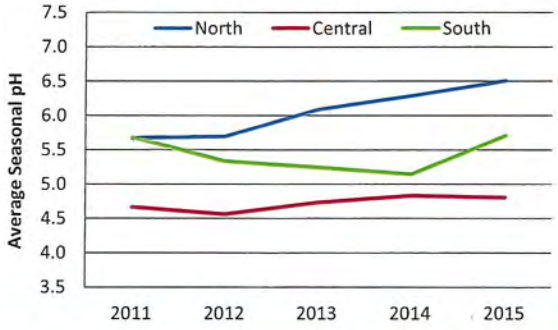
**Winter** (December- March)

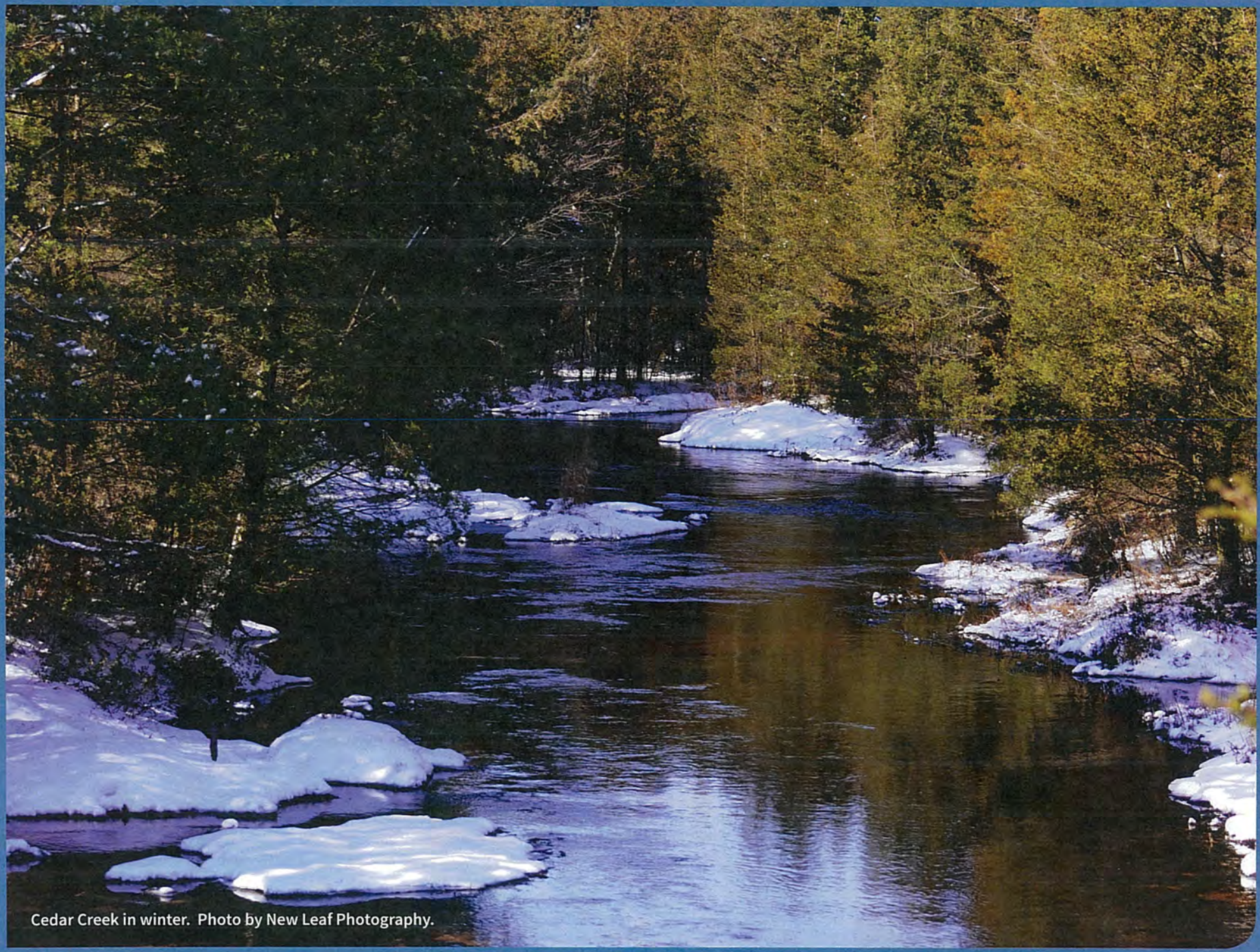



**Spring** (April-May)




**Summer** (June-September)





Cedar Creek in winter. Photo by New Leaf Photography.

*Indicator*

# Freshwater Macroinvertebrates

*Indicator Status*


**Caddisfly larvae. Photo courtesy of NJDEP Bureau of Freshwater and Biological Monitoring.**

## Background

Fresh water biological monitoring refers to the use of in-stream populations of benthic macroinvertebrates as indicators of water quality. Benthic macroinvertebrates are bottom-dwelling, "larger than microscopic" invertebrate animals inhabiting aquatic habitats. In freshwater rivers and streams, common forms are aquatic insects, worms, snails, and crustaceans. Macroinvertebrates are commonly found throughout the watershed's streams, fulfilling an important role in the aquatic food web. Species comprising the in-stream macroinvertebrate community occupy distinct niches (living spaces) governed by environmental conditions and their tolerance to pollution. Changes in environmental conditions, water quality, and/or habitat quality, may be reflected in changes in the macroinvertebrate community structure. Assessments of ambient water quality can then be based upon standardized measures of said changes in community structure.

There are a number of advantages to using benthic macroinvertebrates as indicators of fresh water quality: 1) they are good indicators of localized conditions of water quality due to their limited mobility, which makes them well-suited for the assessment of site-specific pollution impacts; 2) they are sensitive to environmental impacts from both point and nonpoint sources of pollution; and 3) they can be used to assess non-chemical impacts to the benthic habitat, such as by thermal pollution or excessive sediment loading (siltation).

The NJDEP's Bureau of Freshwater and Biological Monitoring conducts macroinvertebrate sampling through its statewide, rotating basin Ambient Macroinvertebrate Network (AMNET; Figure 1). This network is designed to evaluate the health of in-stream benthic macroinvertebrate communities using a monitoring and assessment methodology (USEPA Rapid Bioassessment Protocol) that produces an index of water quality with categories of: "excellent," "good," "fair," and "poor." As part of the AMNET monitoring, 64 freshwater stream sites within the Barnegat Bay watershed were most recently sampled in 2010-2011 (Round 4). Previous sampling rounds in the watershed were conducted in 2004-2005 (Round 3), 1999-2000 (Round 2) and Round 1 (1994-1995). Sampling protocols were modified slightly between Rounds 2 and 3 in that the sampling period was restricted from year-round, to April through November, taking macroinvertebrate life histories into account. Some sites, primarily the central and southern watershed segments, were sampled in the winter during Rounds 1 and 2.

## Status

Based on 2010-2011 sampling, 17% of the stream sites monitored in the watershed are classified as "excellent," 30% are classified as "good," 45% are classified as "fair," and 8% are classified as "poor" (Figure 2). In regard to meeting the Aquatic Life Use criteria of New Jersey's Surface Water Quality Standards (SWQS), 37 of the 64 sites (58%) are considered attaining and 42% are considered non-attaining.

## Trends

For the 2010-2011 sampling round, the percentage of sites rated as "excellent" has declined compared to the 2004-2005 sampling, going from 35% to 17%, with the percentage in the "poor" category remaining virtually unchanged between the two rounds of sampling, and increases in percentages in both the "good" and "fair" categories. The trends for each of the bay segments can be seen in Figure 3.

When the benthic macroinvertebrate index scores for sites sampled in all four sampling periods (1994-1995 through 2010-2011) is evaluated, 54 sites (95%) had no discernible trend through time and 3 sites (5%) declined.

32x

### Data gaps

As per the AMNET rotating basin schedule, samples were collected again in the Barnegat Bay watershed during the 2015 sampling season, with results expected in 2016.

For more information on the benthic macroinvertebrate monitoring and indices, see the NJDEP Bureau of Freshwater and Biological Monitoring website, www.nj.gov/dep/wms/bfbm. For more information on the SWQS and the application of benthic macroinvertebrate data in assessing Aquatic Life Use attainment, see the NJDEP Bureau of Environmental Analysis, Restoration, and Standards website, www.nj.gov/dep/wms/bears.

*Data courtesy of the NJDEP through the AMNET database.*

33X

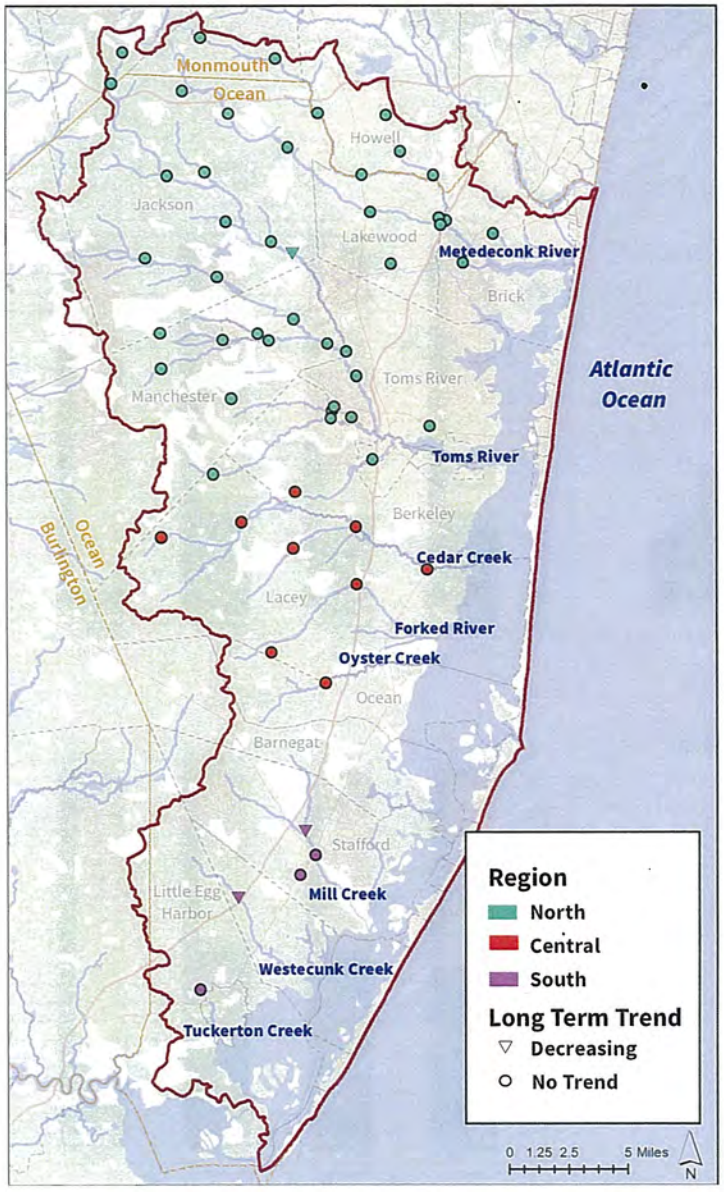



Figure 1: Location of the NJDEP AMNET sampling stations in the Barnegat Bay watershed utilized in this study. Sites denoted by a circle showed no discernible long-term trends, while those denoted by a triangle had a declining trend through time.

# Freshwater Macroinvertebrates

*continued*

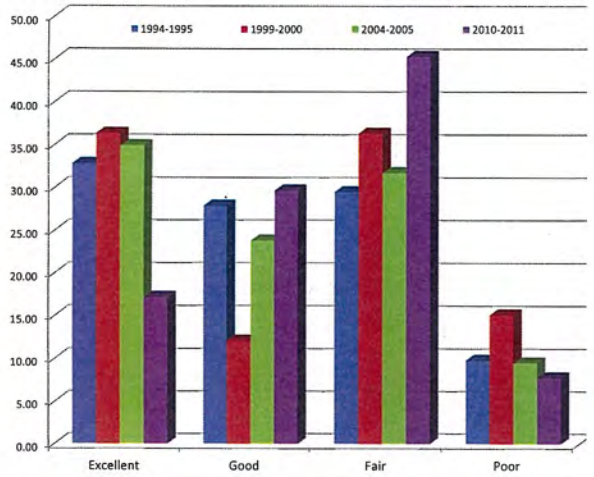
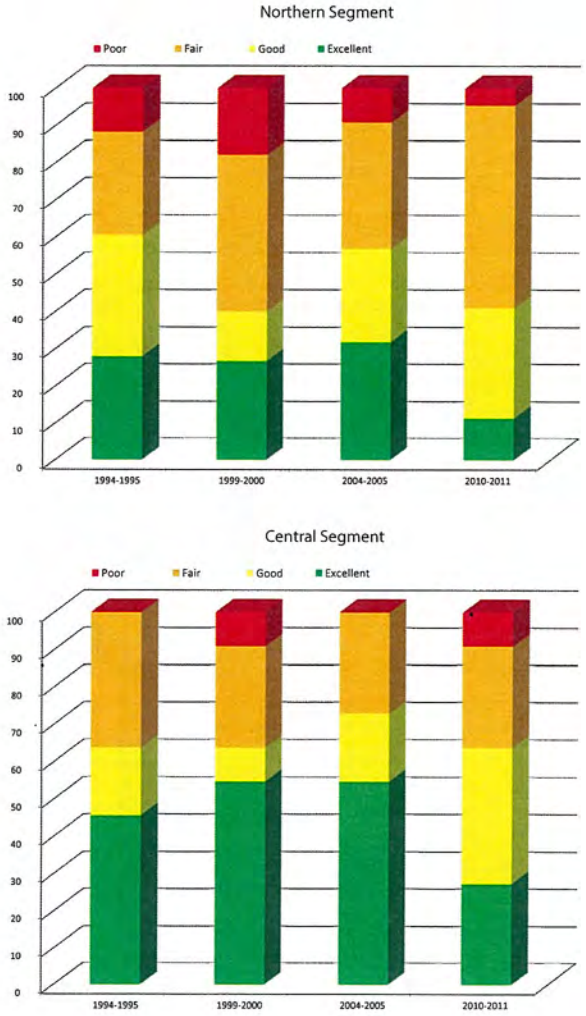



Figure 2: Percentage of sampled streams within the Barnegat Bay watershed that obtained each of the AMNET index rating categories for the four sampling rounds.



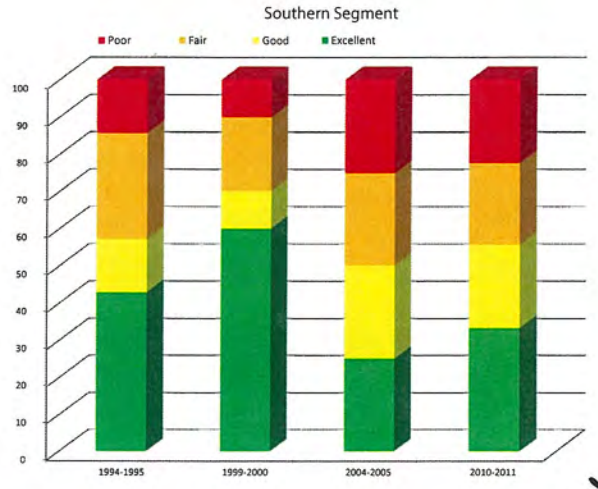




Figure 3: Percentage of sampled streams within the northern, central, and southern portions of the Barnegat Bay watershed that obtained each of the AMNET index rating categories for the four sampling rounds.

34x

# Human Use Impairments

The Barnegat Bay has long been a favorite spot for recreational activities like boating, swimming, fishing, and clamming. Unfortunately, our enjoyment of the bay can be disrupted by the presence of pollutants which force us to limit our interaction with the water in order to avoid exposure. The reasons for closing a bathing beach are often similar to those for closing waters to shellfish harvesting – the presence of pathogens like viruses, some bacteria, and parasites. These pathogens mainly originate from stormwater runoff and animal wastes.

Garrison Grant, Andrew Hassall, and Kira Dacanay of NJ Bureau of Shellfisheries collect hard clams using a hydraulic hard clam dredge during the 2012 stock assessment of Barnegat Bay. Photo by Kira Dacanay, NJ Bureau of Shellfisheries.

*Indicator*

# Bathing Beach Closures

*Indicator Status*


**Children at Barnegat Bay beach. Photo by Barnegat Bay Partnership.**

## Background

For more than 30 years the Ocean County Health Department (OCHD) has obtained and analyzed water samples from all public bathing beaches in the county on a weekly basis between Memorial Day and Labor Day. Results of bathing beach monitoring provide an indication of the levels of pathogenic bacteria in the waters utilized for recreational bathing. These findings are used by the OCHD to determine whether beaches are to remain open for bathing. Closure statistics for beaches on the bay, freshwater lakes, and rivers provide an indication of the amount of bacteria from various sources being flushed from the watershed into the waterways that eventually flow into the bay. Closure statistics also provide a general indication of the nonpoint source loadings of contaminants and pathogens other than bacteria. Stormwater typically contains suspended solids, nutrients, organic carbon, petroleum hydrocarbons, heavy metals, and pesticides, in addition to bacteria.

Freshwater samples are analyzed for fecal coliform, which is a group of coliforms present in the digestive tract of warm-blooded animals. In 2004, the NJDEP (at the suggestion of the USEPA) changed the required indicator organisms for brackish and saltwater beaches from fecal coliform to *Enterococcus*, a bacterium found in the digestive tracts of warm-blooded animals.

## Status

*Lakes*

The OCHD sampled ten public recreational bathing lake sites during the 2010-2015 bathing seasons (Figure 1). The bathing areas at the lakes represented approximately 79% of all beach closings during that six-year span. Two factors, stormwater runoff and waterfowl waste, influence the occurrence of elevated bacterial counts in lakes of the BB-LEH watershed.

Without external factors such as waterfowl, the lakes appear to recover to pre-storm coliform levels within approximately 24-36 hours after a rainfall event. With an abundance of waterfowl, the lake may require several days to recover. The severity of the initial influx of bacteria is proportional to the density of development in the area serviced by the storm drain system that empties into a given lake. Lakes (such as Harry Wright Lake in Manchester) that are surrounded by a lower density of housing, recover fairly quickly in comparison to Lake Barnegat and Deerhead Lake in Lacey Township, which receive stormwater from a relatively higher population density.

*Creeks*

The OCHD sampled two public recreational bathing creek sites during the 2010-2015 bathing seasons on the freshwater portions of Cedar Creek (Figure 1). Cedar Creek is an example of how bacteria-free a water body can be without the influence of storm drains. The stream has very few storm drains, and as a result seldom has an elevated bacteria count (four total closures from 2010-2015; two at each beach).

*Bays and Rivers*

The OCHD and Long Beach Island Health Department (LBIHD) sampled 14 public recreational bathing bay-beach sites and 9 public recreational bathing brackish-river sites (Figure 1) throughout the 2010-2015 recreational bathing beach seasons. The river sites are along the Toms, Metedeconk, and Manasquan rivers, while the bay sites are located throughout the eastern and western sides of the

36x

bay. Four bay beaches accounted for a total of seven closures over the six-year period. Of the 49 closures at river beaches during 2010-2015, 11 were at Windward Beach on the Metedeconk River in Brick Township and 24 were at Beachwood Beach on the Toms River in Beachwood Township (see sidebar). Non-point source pollution delivered via stormwater is the primary source of contamination at these beaches.

### Trends

When the data from county public recreational bathing beaches that have been sampled routinely for 15 years are analyzed, there is a general decrease in the number of bathing beaches closed due to poor water quality (Figure 2). The number of closures at bay and river beaches has decreased through the early part of the time frame and have remained relatively low over the past five years. The number of freshwater closures (predominantly lakes) has fluctuated throughout the past 15 years, though the highest number of closures occurred in 2013, before dropping over the past 2 years. The fluctuation in the number of closures is attributable primarily to the number, duration, and intensity of rainfall events occurring immediately before and during the recreational bathing season.

### Data Gaps

The results of rain-provisional sampling preliminarily indicate that many of the beach closures are rain-event driven; however, the amount of rain required to instigate a closing was not quantified. This information could be used to further refine future sampling schemes to answer questions regarding bacterial sources and pathways.

For additional information regarding beach closings and water-quality updates during the recreational bathing season, please visit the Ocean County Health Department online at http://www.ochd.org/Resources/Page/43.

*Data were provided courtesy of the Ocean County Health Department.*

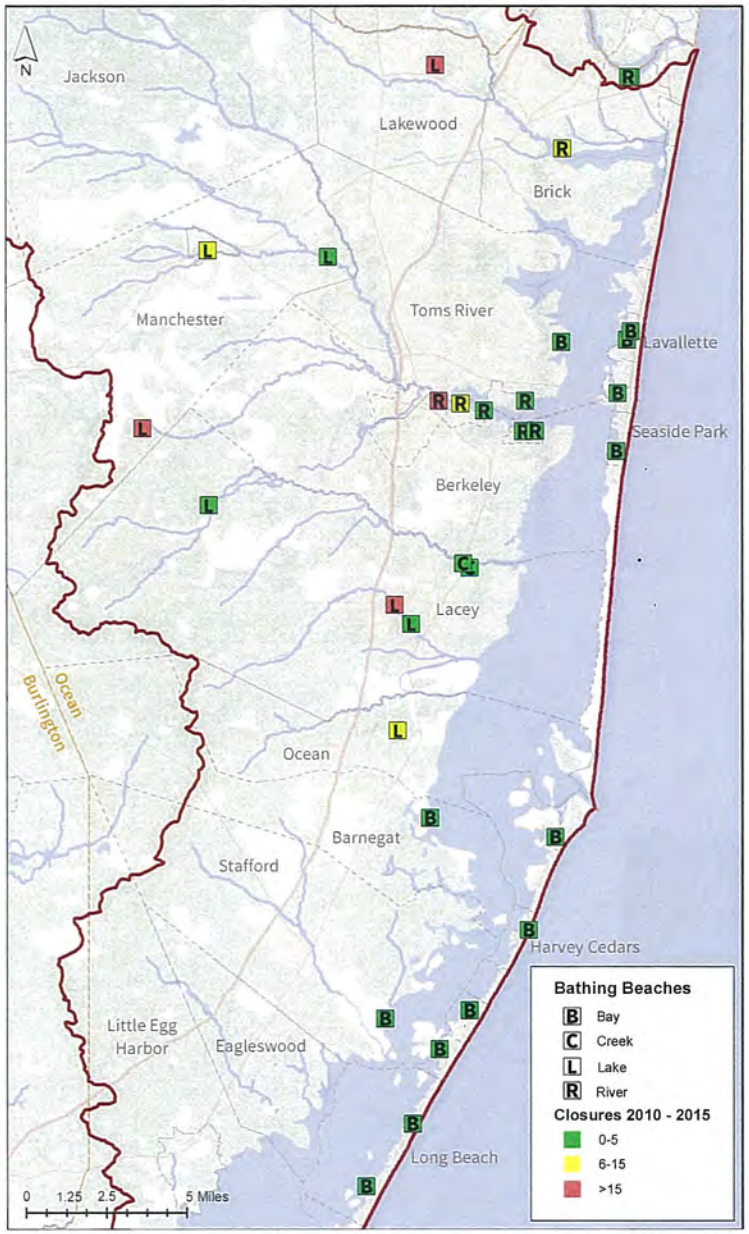



Figure 1: Location of bay, creek, lake, and river bathing beaches in the Barnegat Bay monitored for pathogens and included in this study.

A bay beach in Island Beach State Park. Photo by New Leaf Photography.

# Bathing Beach Closures

*continued*

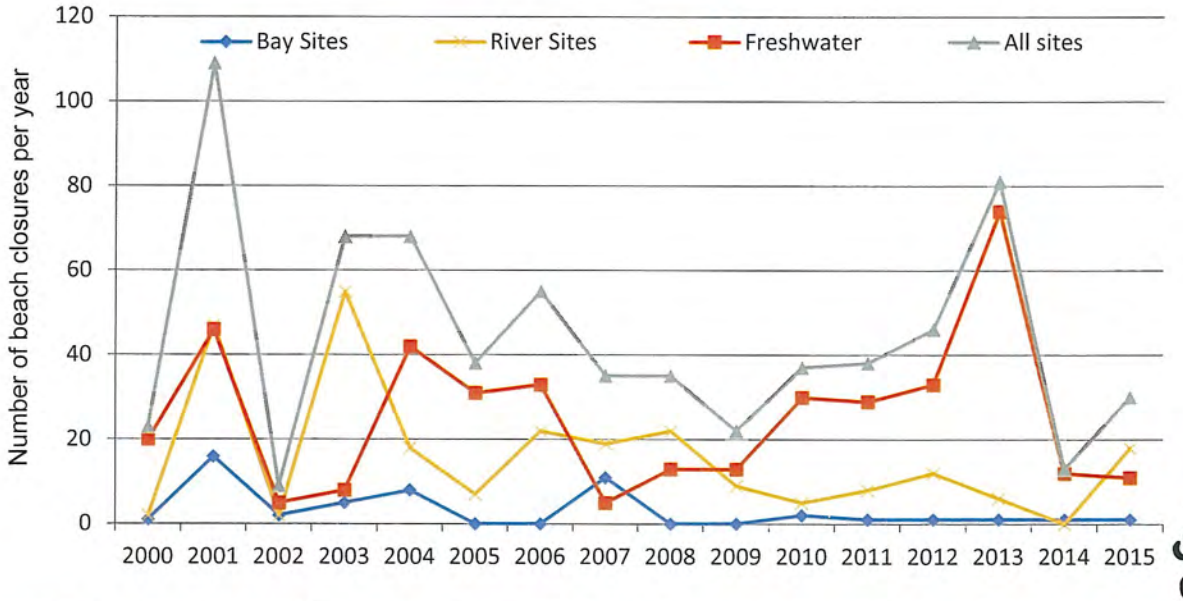



Figure 2: The annual number of bay, river, and freshwater beach closings over the last 15 years. Only those beaches (bay=14, river=9, freshwater=10) which have data for the entire time-series are included.

38x

Newly planted beachgrass. Photo by Barnegat Bay Partnership.

State of the Bay Extra:

# Beachwood Beach Project

While many river and bay bathing beaches face challenges from pathogen influx from stormwater systems in the Barnegat Bay watershed, Beachwood Beach historically experienced the most failures and elevated bacteria counts when compared to other beaches in Ocean County. In order to combat this problem, the Ocean County Health Department reviewed archived data sets and performed some basic flow and infrastructure investigations. Armed with this initial information, the NJDEP Bureau of Marine Water Monitoring then organized efforts to leverage municipal, county, and state assets to address local stormwater issues in an attempt to improve water quality at this bathing beach. Experts from the NJDEP, Ocean County, Beachwood Borough, and other agencies coordinated a targeted pollution source trackdown effort to identify local sources of pathogens near the beach. The Borough and County were granted monies from the NJDEP Environmental Infrastructure Trust, and re-engineered several key stormwater collection and discharge pipes, ultimately removing the main stormwater discharge location downstream of the bathing beach. Assistance for this project came in many forms, from the Ocean County Road Department cleaning out stormwater pipes before and during the bathing season, to the NJDEP and US Food and Drug Administration's aid in modeling both the existing water circulation patterns and the impacts of the proposed new outfall. All of this work was done in support of ultimately reducing pathogenic discharges at the beach.

At this time not all of the problem areas and sources of pathogens have been addressed, and there is a great deal of work still being conducted. But the work completed so far demonstrates that a project of this size and scope can be successful when all involved focus on a single goal. Under the coordination of the NJDEP, the overwhelmingly positive actions taken at all levels of government to address this issue make the Beachwood Beach stormwater discharge improvement project a success story for others to use as a model in the future.


**Stormwater pipe replacements undertaken as part of the Beachwood Beach Improvement Project. Photos by T&M Associates.**

39X

*Indicator*

# Shellfish Bed Closures

*Indicator Status*


**Shellfish aquaculture in Barnegat Bay. Photo by Christian Palmisano, Forty North Oyster Farms.**

## Background

The NJDEP's Bureau of Marine Water Monitoring (Bureau) monitors the shellfish-growing waters contained within the Barnegat Bay. To ensure that shellfish within these waters are safe for consumption, the waters are analyzed using coliform bacteria as an indicator of human and animal waste. Based on the National Shellfish Sanitation Program requirements, the bay waters are classified as "approved," "seasonal," "special restricted," and "prohibited." Updates to the classification of shellfish waters are completed annually and are based on the latest 30 data points for each station over multiple years.

## Status

Currently, the waters of the Barnegat Bay consist of approximately 75% "approved," 6% "prohibited," and 19% "seasonal and special restricted" for shellfish harvest (Figure 1). Poor water quality around shellfish beds is generally attributable to contamination from stormwater runoff and other nonpoint sources rather than single, point source discharges. This can be seen in the northern portion of the bay, which represents a majority of the prohibited and special restricted waters. Red prohibited classifications in the Atlantic Ocean in Figure 1, are a result of administrative buffers around wastewater discharges or known potential sources of bacterial pollution, and not due to degraded water quality.

## Trends

There have been no substantial changes in the percentages of classified waters over the past five years. From 2010-2014, an average of 3,506 samples were collected and analyzed for fecal coliform bacteria each year as part of the Bureau's monitoring program. When looked at bay-wide, there is no clear trend in the average overall coliform bacteria levels by year (Figure 2). Because bacterial concentrations can be influenced by rainfall and other meteorological conditions, this year-to-year fluctuation is not surprising. Overall, the estuary has low bacteria concentrations, less than the shellfish water standard of 14 CFU/100ml (Figure 2). High concentrations do sometimes occur in localized areas and subsequently result in different classifications (Figure 1).

For additional information on the NJDEP Bureau of Marine Water Monitoring Shellfish Sanitation Program and the latest classification maps, please visit their webpage at http://www.state.nj.us/dep/wms//bmw/index.html.

40x

*Data courtesy of the NJDEP Bureau of Marine Water Monitoring.*

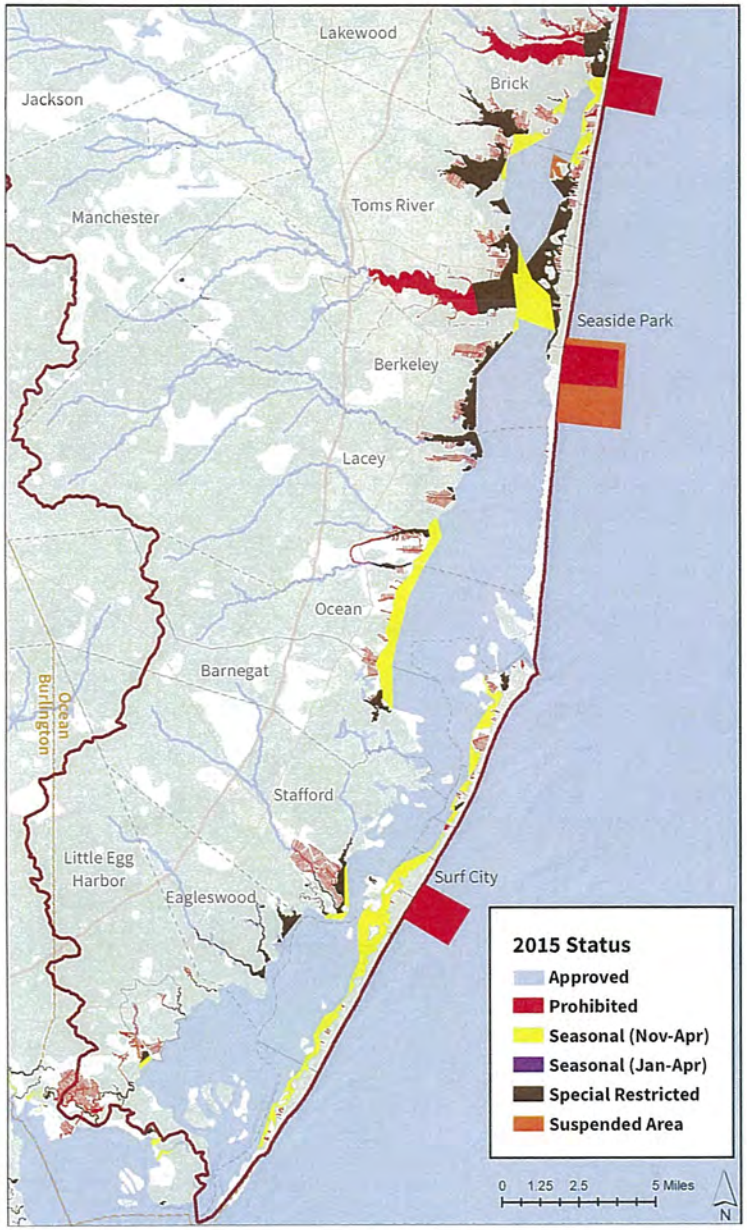



Figure 1: 2015 shellfish growing water classifications for the Barnegat Bay.

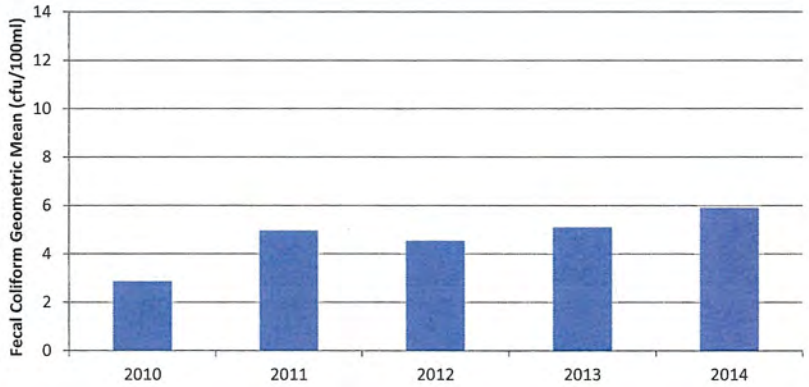



Figure 2: Bay-wide annual mean fecal coliform counts for 2010-2014.

An American oystercatcher working the mudflats.
Photo by New Leaf Photography.

State of the Bay Extra:

# Trash Free Waters

Trash that enters inland waterways, coastal waters, and oceans has become a significant challenge to water quality, habitat, complex food webs, and potentially human health. If land-based trash is not disposed of and managed correctly, it can enter freshwater and marine ecosystems.

Land-based aquatic trash consists of many different types of products and materials, especially plastics and packaging, such as bags, bottles, food containers, wrappers, and plastic utensils. In the aquatic environment, plastic trash is associated with direct impacts on aquatic life via strangulation, ingestion, or other physical harm. Additionally, there is a growing concern regarding the potential for microplastic particles, and their associated toxic chemicals, to adversely impact human health as the microplastics and toxins are consumed through the fresh- and marine-water food webs.

Various activities are held throughout the Barnegat Bay watershed by the BBP and its partners to help clean up the trash before it enters the water:

A Canada goose investigating a plastic bag from a local waterway. Photo by New Leaf Photography.

Clean Ocean Action Beach Sweeps are held twice per year (once in the spring and once in the fall) in Ocean County towns. In April 2015, over 789 people participated in the cleanup. Approximately 3,806 pounds of trash was collected (394.5 trash bags) from an estimated distance of 145.9 miles (http://cleanoceanaction.org/index.php?id=153).

The New Jersey Department of Environmental Protection hosts the annual "Barnegat Bay Blitz," consisting of cleanups at 100 locations through the Barnegat Bay watershed. The June 3, 2015 Blitz attracted over 4,000 volunteers. Approximately 1,200 bags of garbage/recycling were collected, in addition to 250 cubic yards of trash. Over the past six years, the Barnegat Bay Blitz has attracted 22,161 volunteers and resulted in the cleanup of approximately 3,037 cubic yards of trash (http://www.nj.gov/dep/barnegatbay/bbblitz.htm).

As a result of the Blitz, the NJDEP began its illegal dumping campaign known as "Don't Waste Our Open Space." While this campaign is not just focused in Barnegat Bay, it can help keep debris out of our waterways (http://www.stopdumping.nj.gov).

EPA Region 2 has initiated a Trash Free Waters (TFW) Program, seeking to help states, municipalities, academia, nonprofits, citizens, and businesses work together to develop innovative land-based aquatic trash management strategies and projects, with the ultimate goal of zero-trash loading within 10 years.

**What can we do to make our marine waters safer and healthier?** Properly dispose of all litter, including cigarette butts, and securely cover trash cans. Keep streets, sidewalks, parking lots, and storm drains clear of trash and debris – what goes down the storm drains can end up in the bay and ocean. Reduce, reuse, recycle – avoid purchasing products with excessive packaging; bring reusable bags for your purchases; recycle. Tie it down, secure it, or stow it – keep equipment and possessions on the boat and out of the water. Collect and recycle your monofilament fishing line – there are recycling bins located throughout the state. Keep outdoor furniture, decorations, trash cans, and other objects secured or stored inside during windy or stormy weather. Make a difference through prevention!

42x

# Water Supplies for People and Wildlife

Fresh water plays a crucial role in estuarine health. Not only does the mixing of fresh water with ocean water produce the salinities required by estuarine inhabitants, the rate and continuity of freshwater flow into the estuary also affects many water-quality and ecological processes. Maintaining an adequate rate of freshwater flow while addressing the needs of an ever-increasing human population will be critical in meeting estuarine water-quality and habitat goals.

Canada geese on a winter pond. Photo by BTMUA.

*Indicator*

# Streamflow

*Indicator Status*


**A tributary to the Metedeconk River. Photo by New Leaf Photography.**

## *Background*

Approximately 590 million gallons per day of fresh water enter the Barnegat Bay through more than 15 rivers, streams, and creeks. The water in these streams and creeks can be split into two components: base flow and runoff. Base flow is the sustained flow of a stream that comes largely from groundwater entering the waterway. Runoff is the portion of streamflow that comes from precipitation, snow melt, or irrigation water flowing across the land surface (or piped) before entering the waterway. In undeveloped watersheds, runoff is a small part of the total flow, and as development occurs (*i.e.,* an increase in impervious surfaces, groundwater withdrawals for irrigation and consumption), the fraction of total flow from base flow decreases. Reductions in base flow can have serious ecological repercussions, as changes in the timing and amount of fresh water entering the streams and eventually reaching the estuary can affect water quality and habitat for many of the bay's species, including humans!

The United States Geological Survey maintains a network of stream gauging stations that measure the rate of flow in some of the major streams in the watershed on a continuous basis, including the North Branch of the Metedeconk River, Toms River, Cedar Creek, and Westecunk Creek (Figure 1).

## *Status*

Base flow accounted for 67%-94% of total streamflow at the monitored streams in 2014 (Figure 2). The Westecunk Creek had the highest percentage of base flow (94%), followed by Cedar Creek (90%), Toms River (83%), and the North Branch of the Metedeconk (67%). The pattern in the percentage of base flow reflects the north to south urbanization gradient in the Barnegat Bay watershed. The status of streamflow within the watershed is classified as "unknown" because there is currently no minimum base flow criteria to judge the results against.

## *Trends*

From 2010-2014, there has been a high degree of variability in base flow in all four streams, with no overall trend present. However, over the last 40 years, the percentage of base flow in the total flow has significantly declined in the North Branch of the Metedeconk River and Toms River.

## *Data Gaps*

Continued monitoring is needed to determine if the long-term declining trend continues. Furthermore, a criteria for minimum base flow levels to support ecological health should be developed.

For additional streamflow data, including in near real-time for the continuously operated gauging stations, please visit the USGS New Jersey Water Science Center's website (http://nj.usgs.gov).

*Data courtesy of the U.S. Geological Survey.*


Figure 1: Location of continuously operating streamflow gauging stations in the Barnegat Bay watershed used in this analysis.

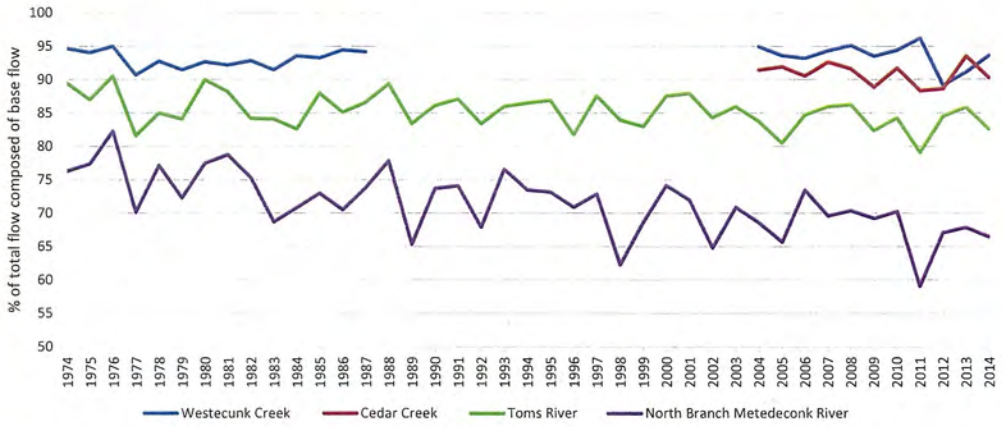



Figure 2: The percentage of total flow composed of base flow for the Westecunk Creek (blue), Cedar Creek (red), Toms River (green), and North Branch Metedeconk River (purple) from 1974-2014.


The Long Swamp Creek at Brown's Woods. Photo by Barnegat Bay Partnership.

*Indicator*

# Water Withdrawals

*Indicator Status*


**Irrigation taps spraying over lawn. Stock photo by Paul Wishart.**

## *Background*

Fresh water is important for a variety of human activities, including public supply, agriculture, landscape irrigation, commercial and industrial uses, mining, and power generation. Sources of fresh water include both surface waterways and groundwater from aquifers. Due to their proximity to the surface, unconfined aquifers are generally the easiest to access. The Kirkwood-Cohansey Aquifer system is the most used aquifer in Ocean County for this reason. Unconfined aquifers are also the most impacted by drought and pollution. Deeper, confined groundwater sources are isolated beneath the Barnegat Bay watershed. Withdrawals from these confined aquifers do not typically affect surface waterways. The Barnegat Bay watershed has several underlying confined aquifers. The Potomac-Raritan-Magothy Aquifer System is the most heavily used confined aquifer.

In a natural setting, fresh water from streams and rivers and groundwater discharge would make its way to Barnegat Bay unimpeded, but a significant amount of fresh water is withdrawn and removed from the system before it ever makes it to the bay. In 2014, public supply and industrial use were the two largest withdrawal use categories within the Barnegat Bay watershed.

Public supplies are provided for domestic, commercial, and industrial water needs in many areas of the watershed, particularly in the northern and coastal regions. In 2010, 479,365 Ocean County residents were served by public water utilities, while 97,202 were self-supplied via private wells. Most areas with public water service also have public sewer service, with wastewater being directed to one of three centralized wastewater treatment facilities and, ultimately, the Atlantic Ocean. Where public supplies are drawn from surface water or shallow aquifers, water that would otherwise make its way to the Barnegat Bay is intercepted, utilized, treated and discharged offshore. It is important to recognize that the existing centralized wastewater treatment system was developed to address water quality problems that resulted from many small discharges of questionable-quality wastewater throughout the watershed. Returning high-quality treated wastewater to its point of origin in the watershed would be ideal, though it would require a higher level of wastewater treatment, commonly known as tertiary treatment, which would only be possible with significant infrastructure upgrades. Small-scale pilot projects would be useful to move this concept forward.

## *Status*

USGS estimates that in 2010, Ocean County's freshwater withdrawals averaged approximately 85.56 million gallons per day. Discharge of treated wastewater to the Atlantic Ocean from centralized wastewater treatment facilities in 2014 averaged approximately 50 million gallons per day (Figure 1). The top two withdrawal categories were drinking water and industrial use. Table 1 details water withdrawals within the Barnegat Bay watershed.

## *Trends*

Freshwater withdrawals in the Barnegat Bay watershed and centralized wastewater treatment discharges have increased over the past several decades, and are closely linked to population growth. From 2000-2010, Ocean County added the most residents of any New Jersey county and was the second fastest growing county by percent increase. As the population increases, so will water withdrawals and treated wastewater discharges. While total water withdrawals and wastewater discharges have increased over the last 20 years, per capita wastewater discharges and per capita water withdrawals have decreased. This may be due to a shift towards higher-density housing and the success of water efficiency programs.

### *Data gaps*

Currently, it is impossible to determine the amount of water withdrawn from small wells (withdrawals of <100,000 gal/day) as they are not regulated or specifically tracked. These wells would be used for household supply or landscape irrigation where water is lost to evapotranspiration and not returned to the watershed. USGS estimates how much water is withdrawn from these smaller wells, but exact figures are not known. Available NJDEP data only reflect larger reported withdrawals, leaving billions of gallons of water unaccounted for every year. Most of these wells are drawing water from the Kirkwood-Cohansey aquifer system, which is linked to streamflow within the Barnegat Bay watershed.

*Data were provided courtesy of the NJDEP Office of Water Allocation, NJDEP Division of Water Quality, USGS, and US Census Bureau, Population Division.*

| | Total Withdrawals (Millions of gallons) | Withdrawals per day (Millions of gallons) | Percent of total use |
|---|---|---|---|
| **Surface** | | | |
| Agriculture & Irrigation | 1710.4 | 4.686 | 1.73 |
| Dewatering | 105.2 | 0.288 | 0.44 |
| Drinking Water | 1900.6 | 5.207 | 7.93 |
| Industrial | 2908.5 | 7.969 | 12.13 |
| **Confined Aquifer** | | | |
| Agriculture & Irrigation | 21.7 | 0.06 | 0.09 |
| Domestic | 10.0 | 0.027 | 0.04 |
| Drinking Water | 10844.9 | 29.712 | 45.24 |
| Industrial | 12.9 | 0.035 | 0.05 |
| Other | 162.3 | 0.445 | 0.68 |
| **Unconfined Aquifer** | | | |
| Agriculture & Irrigation | 745.9 | 2.044 | 3.11 |
| Domestic | 32.3 | 0.088 | 0.13 |
| Drinking Water | 4859.0 | 13.312 | 20.27 |
| Industrial | 260.4 | 0.713 | 1.09 |
| Other | 397 | 1.087 | 1.65 |

Table 1: NJDEP-reported water withdrawals in 2014. Note that small wells withdrawals of <100,000 gal/day) are not reported. Other categories include recovery wells, test wells, and unspecified wells.

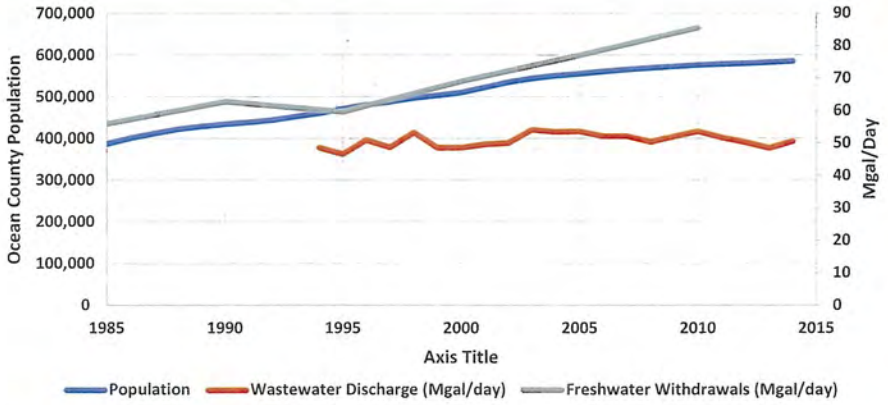



Figure 1: Freshwater withdrawal, wastewater discharges, and population growth in Ocean County for 1985-2014.

The Brick Township Municipal Utilities Authority reservoir. Photo by BTMUA.

State of the Bay Extra:

# Green Infrastructure

Stormwater runoff is a major cause of water pollution in developed areas. When rain falls on our roofs, streets, and parking lots, the water cannot soak into the ground as it should. Stormwater drains through gutters, storm sewers, and other engineered collection systems and is discharged into nearby water bodies. The stormwater runoff carries trash, bacteria, heavy metals, and other pollutants from the urban landscape. Higher flows resulting from heavy rains also can cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.

Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts and provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

Several practices fall into the category of green infrastructure and are briefly described here. Further information on each of these practices is available on EPA's green infrastructure website (https://www.epa.gov/green-infrastructure).

A bioswale in a parking lot in Island Heights. Photo by Bryce Bennett.

Rainwater harvesting in a commercial setting. Photo courtesy of US EPA.

**Porous Pavement:** Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. This practice could be particularly effective where land values are high and flooding or icing is a problem.

**Bioswales:** Bioswales are vegetated, mulched, or xeriscaped channels which provide treatment and retention. Vegetated swales slow, infiltrate, and filter stormwater flows. As linear features, they are particularly well suited to being placed along streets and parking lots.

**Rain gardens:** Rain gardens are versatile features that can be installed in almost any unpaved space. Also known as bioretention, or bioinfiltration cells, they are shallow, vegetated basins that collect and absorb runoff from rooftops, sidewalks, and streets. This practice mimics natural hydrology by infiltrating, and evaporating and transpiring—or "evapotranspiring"—stormwater runoff.

**Green Roofs:** Green roofs are covered with growing media and vegetation that enable rainfall infiltration and evapotranspiration of stored water. Green roofs can be extensive or intensive. Extensive green roofs are characterized by vegetation needing little maintenance, no permanent irrigation system and a shallow growing depth. An intensive green roof system is characterized by a variety of vegetation, advanced irrigation systems, and a deeper growing medium. These can include rooftop farms and buildings in public parks.

**Rainwater Harvesting:** Rainwater harvesting systems collect and store rainfall for later reuse on-site. Individual rain barrels that generally hold 55 gallons are typically used by homeowners while larger cisterns can be installed in commercial/municipal settings.

A rain barrel collecting roof runoff in Island Beach State Park. Photo courtesy of NJDEP.

# Protecting Land and Water

While seemingly far from the Barnegat Bay itself, municipalities such as Plumsted, Lakehurst, Manchester, Jackson, Wall, Millstone, and Freehold contain the headwaters and tributaries that eventually join together to form the Toms River and Metedeconk River. This fresh water mixes with saltwater to create vital nursery areas for life along the entire Atlantic coast. Along with many other creeks and streams, these waterways flow through our communities, connecting all of us to Barnegat Bay.

Fall leaf on water. Photo by New Leaf Photography.

*Indicator*

# Land Use – Land Cover

### *Indicator Status*


Aerial photo of Toms River.
Photo by Wallace "Smitty" Smith.

### *Introduction*

Changes in land use can have dramatic and far-reaching impacts on the environment. The conversion of forested areas and wetlands into **urban** settings directly reduces the amount of habitat available for plant and animal species not adapted to living in close proximity to humans. Further, this alteration not only disrupts hydrologic and other natural cycles, but has been linked to the degradation of estuarine habitat quality far removed from the site of disturbance through sediment contamination, increased nutrient levels in surface waters, and increased incidences of hypoxia, or low dissolved oxygen levels in water.

The NJ Department of Environmental Protection has contracted the mapping of land use/land cover across the watershed based on the visual interpretation of aerial photography since 1986. The Rutgers University Center for Remote Sensing & Spatial Analysis (CRSSA) has analyzed the mapped data for the years 1986, 1995, 2002, 2007, and 2012.

### *Status*

Updated mapping reveals that urban land use occupied approximately 110,665 acres (32%) of the Barnegat Bay watershed in 2012, excluding water. Including all altered land uses (*i.e.*, urban + barren + agriculture lands), the total altered land area is 121,347 acres, or nearly 35% (Figure 1).

*The data used for this analysis can be found on the NJDEP Bureau of GIS website at* http://www.nj.gov/dep/gis/lulc12.html.

### *Trends*

Urban land use in the watershed has continued to increase, from approximately 22% of the Barnegat Bay watershed in 1986, to approximately 32% in 2012 (Figure 2). However, the rate of conversion of forest, farm, and wetland to urban land use slowed from approximately 1,590 acres per year between 1995 and 2002, to 514 acres per year between 2007 and 2012. This recent time period closely corresponds to the Great Recession and a major slump in New Jersey's housing market. Despite this slowing, the watershed is continuing to experience a significant conversion of forested and wetland habitats to urban land cover, thereby exacerbating nutrient loading to the BB-LEH estuary.

### *Data Gaps*

As newer imagery becomes available, similar analysis will need to be conducted to determine if the rate of land conversion continues to slow.

**Urban**:
Defined here to include all land covered with structures, including but not limited to houses, buildings, and parking lots.

Intensive rooftop farm. Photo courtesy EPA.

| Land Cover Description | Acres | % of Land Area |
|---|---|---|
| Urban | 110,665 | 31.8 |
| Agriculture/Grassland | 3,876 | 1.1 |
| Barren | 6,806 | 2.0 |
| Upland Forest | 138,650 | 39.8 |
| Wetlands | 88,018 | 25.3 |
| | | |
| Land Area Total | 348,015 | |

Table 1: Year 2012 land cover as acres and as % of the Barnegat Bay watershed's land area.

| | 1986 | 1995 | 2002 | 2007 | 2012 |
|---|---|---|---|---|---|
| **URBAN LAND** | | | | | |
| Area (acres) | 78,781 | 90,044 | 101,078 | 108,094 | 110,665 |
| % of watershed | 23% | 26% | 29% | 31% | 32% |
| **ALTERED LAND** | | | | | |
| Area (acres) | 96,992 | 105,564 | 115,159 | 119,794 | 121,347 |
| % of watershed | 28% | 30% | 33% | 34% | 35% |

Table 2: Urban and altered (urban + barren + agriculture) land totals and % of the watershed land area by year.

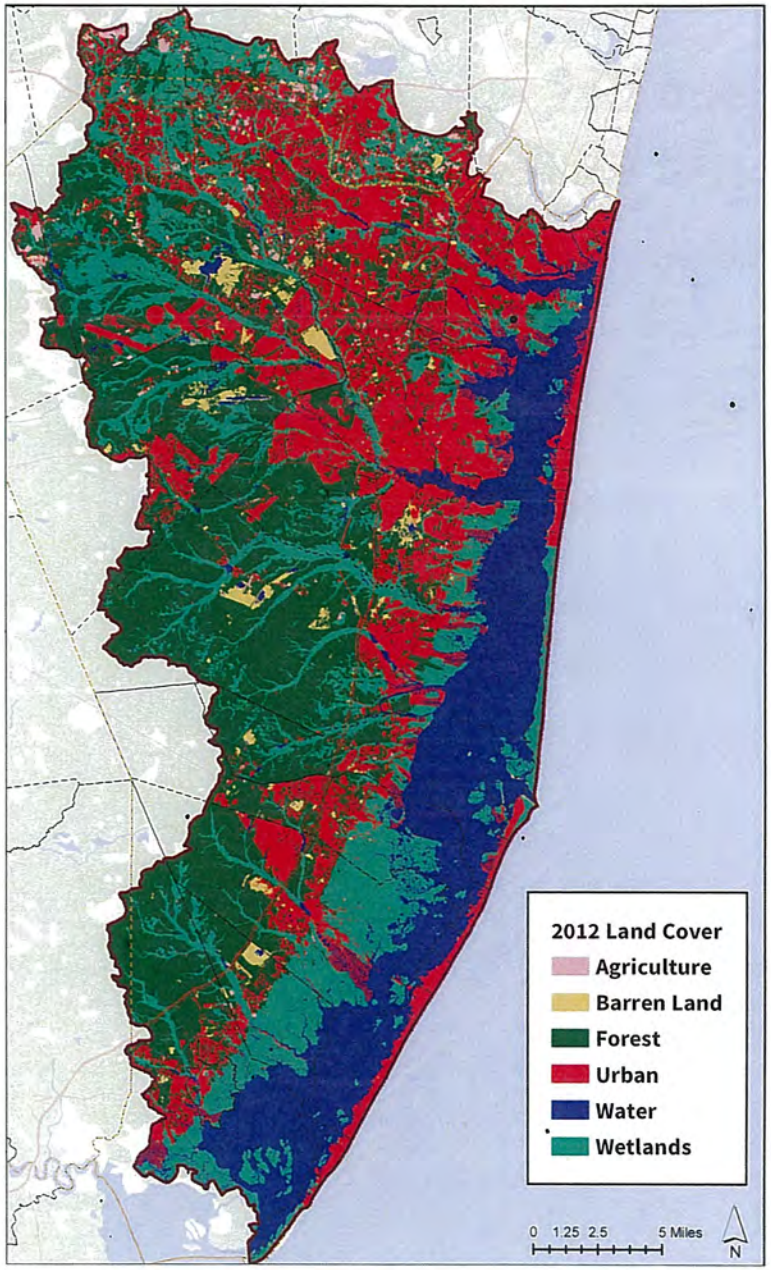
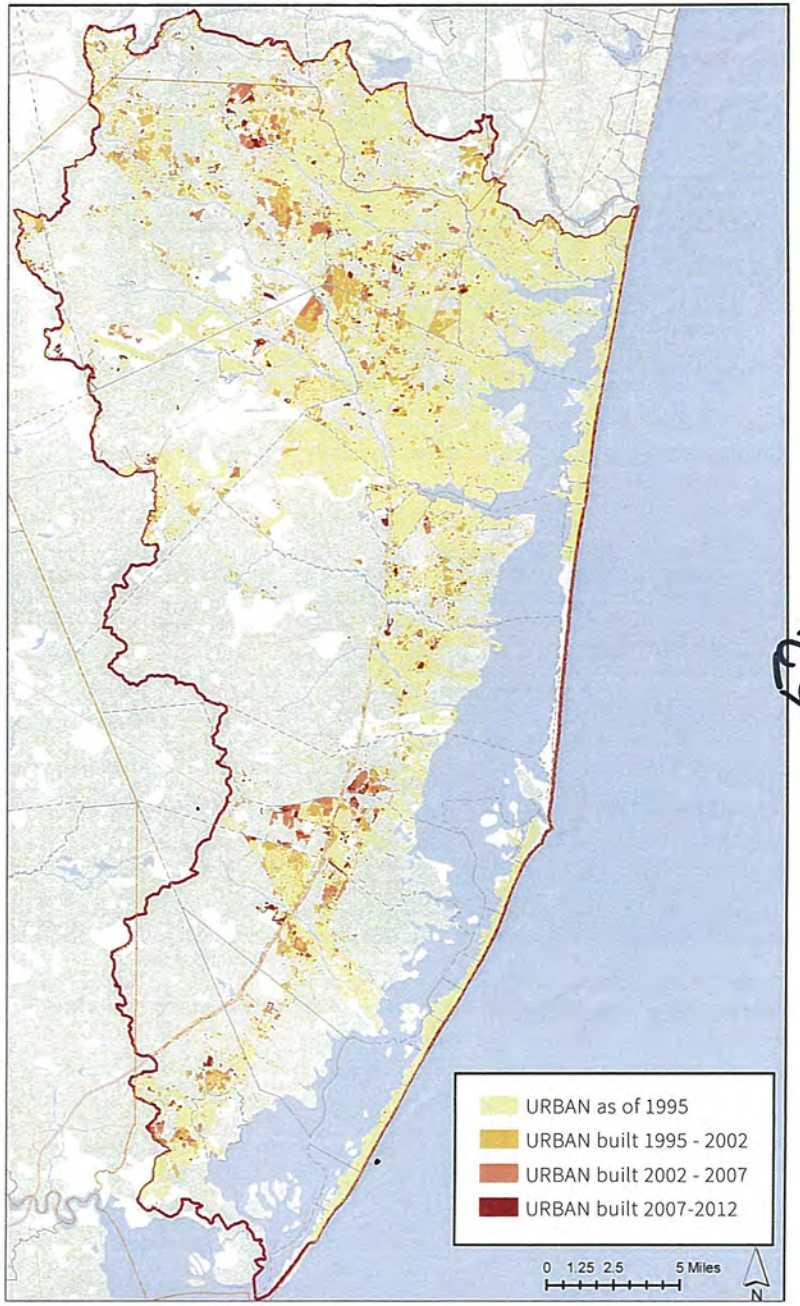



Figure 1: Map of the Barnegat Bay watershed's land use/land cover for 2012.

# Land Use – Land Cover

*continued*

Figure 2: Urban land increases from 1985-2012 within the Barnegat Bay watershed.



The "Judge's Shack" at Island Beach State Park. Photo by New Leaf Photography.

*Indicator*

# Wetland Area

*Indicator Status*


**Residential development along the edge of a salt marsh. Photo by Barnegat Bay Partnership.**

## *Background*

The Barnegat Bay estuary is home to many diverse species of plants and wildlife. The wetlands surrounding the area are an integral part of this sensitive ecosystem, providing habitat and a nursery for various fish, shellfish, and wildlife. In the latter half of the 20th century, Ocean County has experienced an exponential growth in population which has stressed the bay waters, as well as the wetlands and wildlife. Increased boat traffic wake has added to the erosion of salt marshes along the waterfront, and development along the mainland and barrier islands has changed the land cover in many places, and resulted in losses of wetlands.

The Stockton University Coastal Research Center (CRC) completed tidal- and freshwater- wetlands trends analyses using Geographic Information System (GIS) Land Use/Land Cover datasets available from the New Jersey Department of Environmental Protection (NJDEP) for the years 1995, 2002, 2007, and 2012 (conditions prior to Hurricane Sandy).

## *Status*

There were approximately 22,795 acres of tidal wetlands and 67,034 acres of freshwater wetlands within the Barnegat Bay watershed in 2012.

## *Trends*

The Barnegat Bay watershed has continued to lose tidal wetlands over the past 20 years, with losses apparent throughout the entire bay (Figure 1). The area of tidal wetland area lost between each study period has ranged from a low of 144 acres between 2002 to 2007 to a high of 295 acres between 1995 to 2002. The 238 acres of tidal wetlands lost during the most recent study period (2007-2012) was substantially higher than the previous study period, suggesting that the pace of loss is accelerating.

Tidal wetlands open to large wind fetches along the Barnegat Bay shoreline have experienced the brunt of wetlands loss. Possible reasons for the losses include erosion from boat traffic, wind-generated wave energy, sea level rise, or human alteration of the landscape that was originally delineated as wetlands. Sheltered tidal waterways and lagoons were the only areas where small gains occurred.

While the amount of freshwater wetlands within the Barnegat Bay watershed continues to decrease, the rate of the decline has slowed (Figure 2). Between 1995 and 2002, approximately 1,107 acres of the freshwater wetlands within the county were lost, while the most recent assessment suggests that 284 acres of the freshwater wetlands present in 2007 were lost by 2012. The economic slow-down of the late 2000's likely played a role in slowing freshwater wetland losses, as they are typically associated with development activities.

*Data were provided courtesy of the Richard Stockton College Coastal Research Center.*

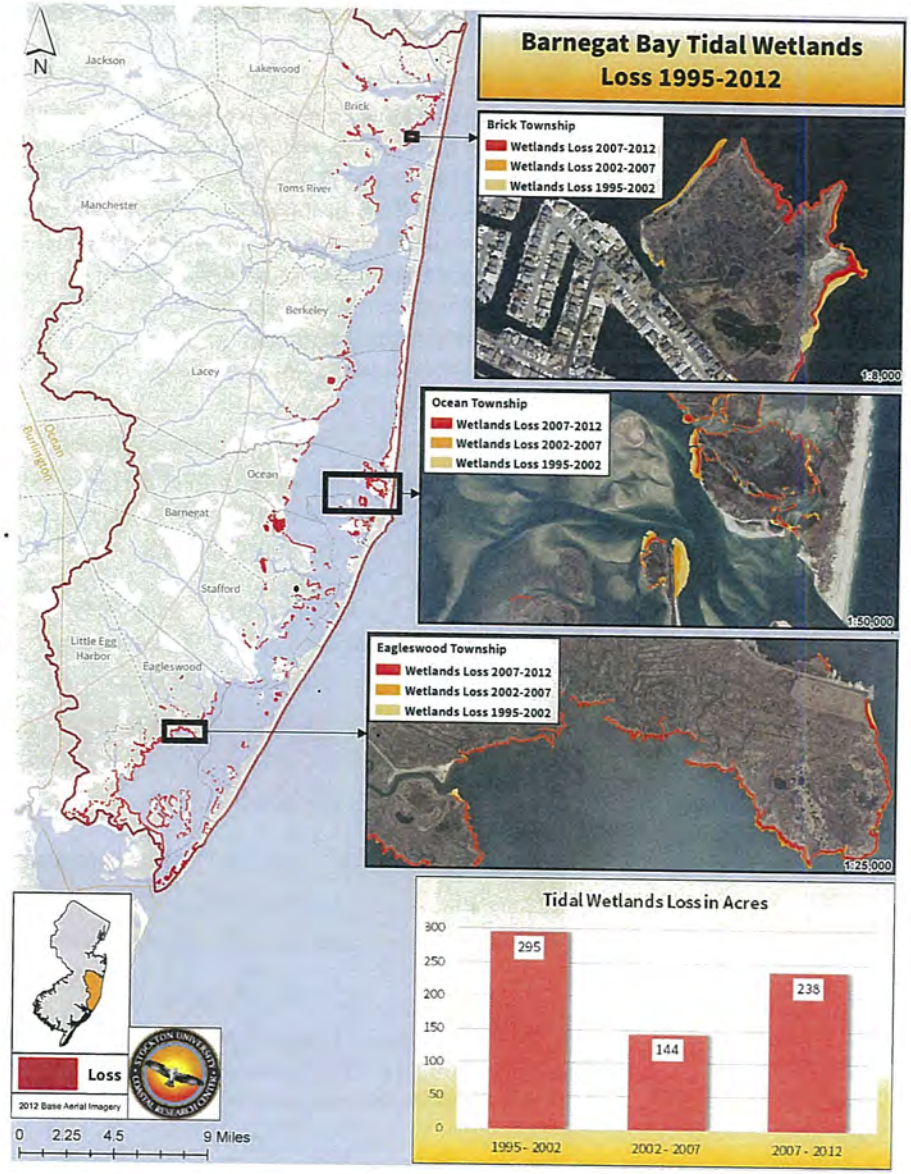



Figure 1: The areas of the main figure in red depict tidal wetlands lost in the watershed between 1995 to 2012, with close-ups of select areas in the insets. The acreage of tidal wetlands lost between study dates, as calculated from aerial photographs, are shown on the column graph.

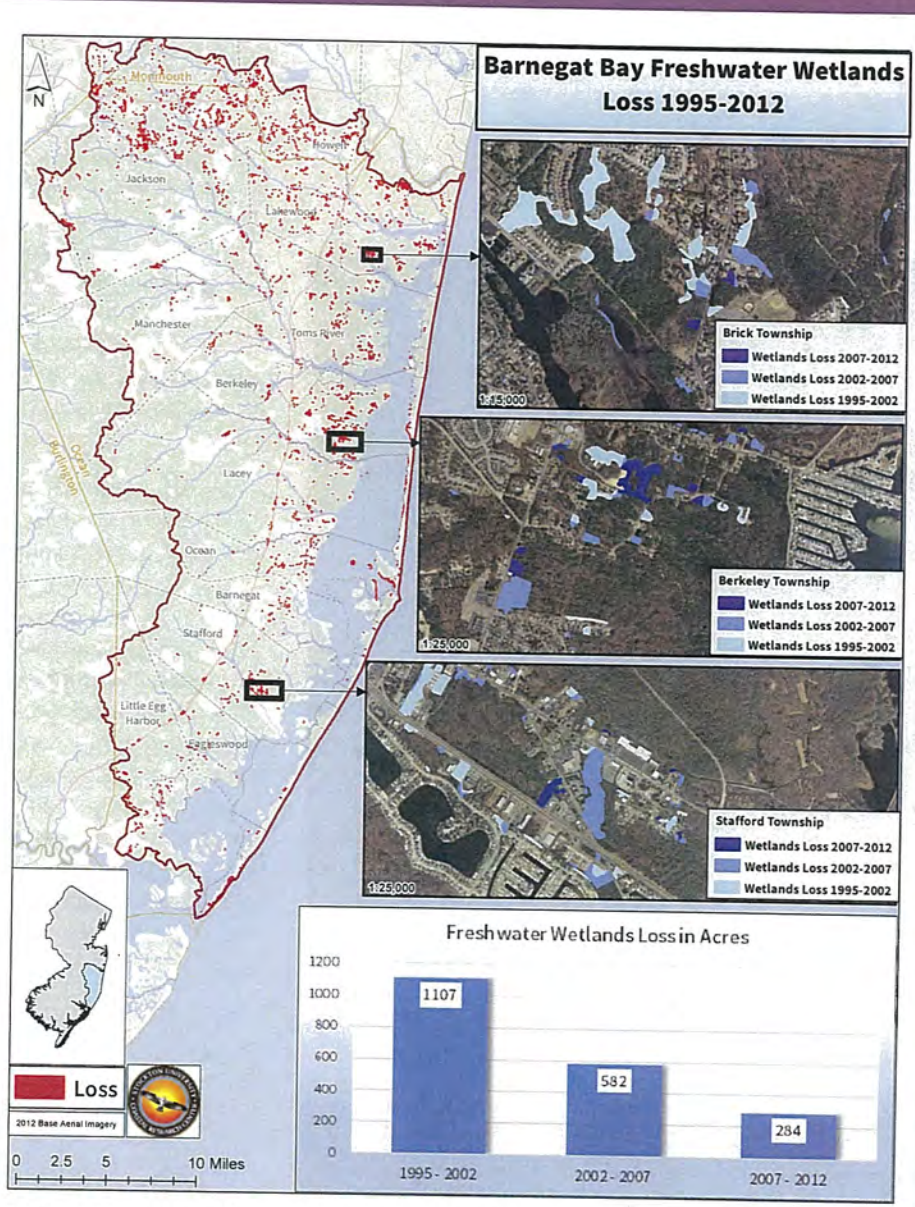



Figure 2: The areas of the main figure in red depict freshwater wetlands lost in the watershed between 1995 and 2012, with close-ups of select areas in the insets. The acreage of freshwater wetlands lost between study dates, as calculated from aerial photographs, are shown on the column graph.

*Indicator*

# Tidal Wetland Condition

*Indicator Status*


**A tidal wetland with extensive ditching and encroaching development. Photo by Barnegat Bay Partnership.**

## *Background*

Tidal salt marshes provide essential ecosystem services to the coastal communities of Barnegat Bay. These areas are the transition zones in estuaries, providing nursery, forage, and nesting habitat for fish and other wildlife, and display greater complexity and primary production than other nearby habitats. Tidal salt marshes also provide flood protection, water quality improvements and biogeochemical cycling, all of which benefit the surrounding communities. A 2012 study valued the ecosystem services of saltwater wetlands in Barnegat Bay at $155 million per year.

In 2010, the Mid-Atlantic Coastal Wetlands Assessment (MACWA) was established to assess and track the extent and condition of tidal wetlands across the Delaware Bay and Barnegat Bay estuaries. MACWA is a multi-tiered program that includes long-term, site-specific intensive monitoring, remote sensing analysis, special studies, and rapid assessments. To assess wetland condition and identify stressors affecting wetland health, rapid assessments were conducted at random wetland sites throughout the Barnegat Bay watershed and assessment began in the Great Bay/Mullica River system for comparison purposes. Wetland assessments were conducted using the Mid-Atlantic Tidal Rapid Assessment Method (Mid-TRAM) Version 3.0. This indicator is based on the Mid-TRAM findings.

## *Status*

Thirty Rapid Assessment points for the Barnegat Bay north and Barnegat Bay south watersheds were completed in 2012 and 2013, which represents a complete assessment of both of the Barnegat Bay watersheds (Figure 1). Overall, the Barnegat Bay tidal wetlands are considered moderately stressed, with northern Barnegat Bay considered severely stressed and the southern bay considered moderately stressed, though there is variation within the zones (Figure 2).

## *Trends*

Currently, there is only one data point per location, so no trend can be determined at this time. This assessment is intended to be repeated every 10 years.

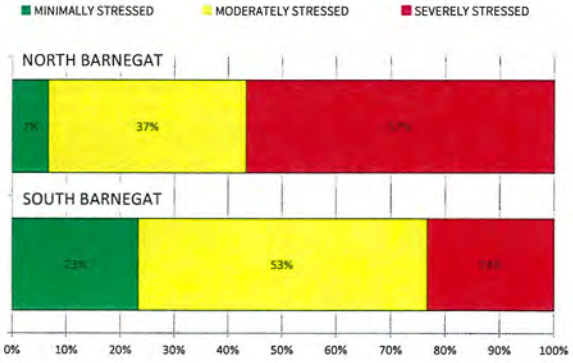



Figure 2: Tidal wetland assessment classifications for each watershed. The percentage of sites in each classification category is shown in the bar.

*Data courtesy of the Barnegat Bay Partnership.*

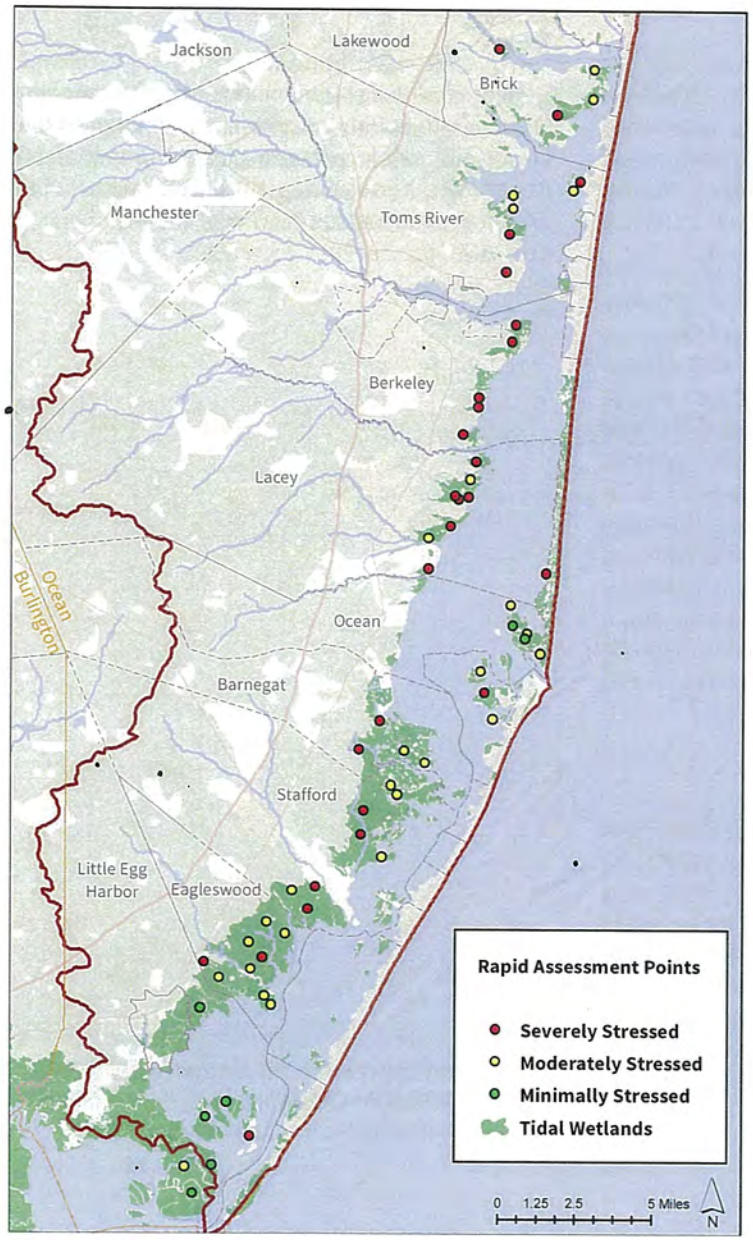



Figure 1: Location and condition of the tidal wetland assessment points in the Barnegat Bay.

State of the Bay Extra:

# Paddle for the Edge

In 2015, the Barnegat Bay Partnership developed and piloted a citizen science project called "Paddle for the Edge." The project used trained volunteers in kayaks, canoes, or stand-up paddle boards to paddle along 20 miles (35 km) of Barnegat Bay's marsh shoreline. Volunteers collected information about shoreline vegetation, condition, and recreational use at more than 650 points from Point Pleasant down to Tuckerton. Shorelines are important indicators of watershed health because they are the sites where land and water processes collide and interact. The data collected by our Paddle for the Edge volunteers are being used to analyze current shoreline conditions and, as the program continues, to look at trends in how the shorelines of Barnegat Bay are changing. This dataset may contribute to the design of future marsh restoration and living shoreline projects.

*Indicator*

# Protected Land

## *Indicator Status*


**A trail through the dunes at Island Beach State Park. Photo by New Leaf Photography.**

## *Background*

Protected lands are those areas where activities are restricted to passive recreation (such as walking, hiking, horseback riding, cross-country skiing, snowshoeing, birdwatching, nature observation, boating, picnicking, fishing, and hunting) or conservation (such as nature preserves, parks, and arboretums).

Protected lands are important because they generally have minimal human disturbances, and they also serve as important refuges for wildlife, especially for those animals that tend to avoid human interactions. A substantial amount of protected lands in Ocean County lie along rivers and streams, and can also serve as corridors for movement of wildlife between larger parcels. With low levels of impervious surfaces and other man-made development, open spaces enhance water quality and aquifer recharge by allowing rainwater to filter directly into the ground. Protected lands along the edge of the bay, usually composed of coastal wetlands and maritime forests, buffer the adjacent lands from storm surge and flooding.

## *Status*

Between January 2010 and September 2015, approximately 11,114 acres in the Barnegat Bay watershed were acquired by federal, state, county, local, and non-governmental agencies for conservation purposes (Figure 1). These purchases bring the total acreage of publicly-owned land in the watershed to over 141,935 acres. This also includes publicly-owned lands (such as the Joint Base McGuire-Dix-Lakehurst) which are not set aside for natural resource conservation, but due to size and limited land-use, is preserved in its natural state and protected from development.

## *Trends*

New Jersey has strong and continuing programs by federal, state, county government, and non-governmental organizations for protecting land. The newly acquired parcels raise the percentage of publicly-owned land from 37% of the watershed's land area in December 2009 to 41% in September 2015 (Figure 2).

## *Data gaps*

None.

*Data courtesy of Ocean County Natural Lands Trust, US Fish and Wildlife Service Edwin B. Forsythe Wildlife Refuge, and New Jersey Department of Environmental Protection Green Acres Program.*

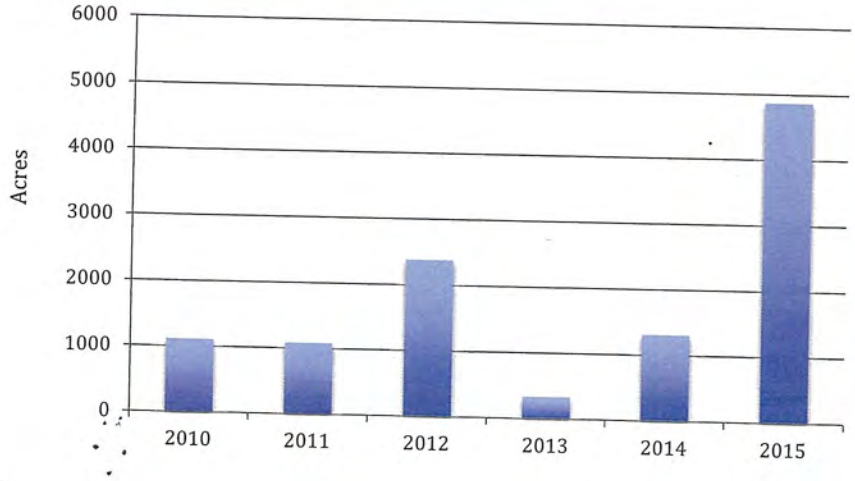



Figure 1: Acreage of protected lands acquired within the watershed from 2010-2015 by Ocean County Natural Lands Trust, US Fish and Wildlife Service, NJDEP Green Acres, and other non-governmental organizations.

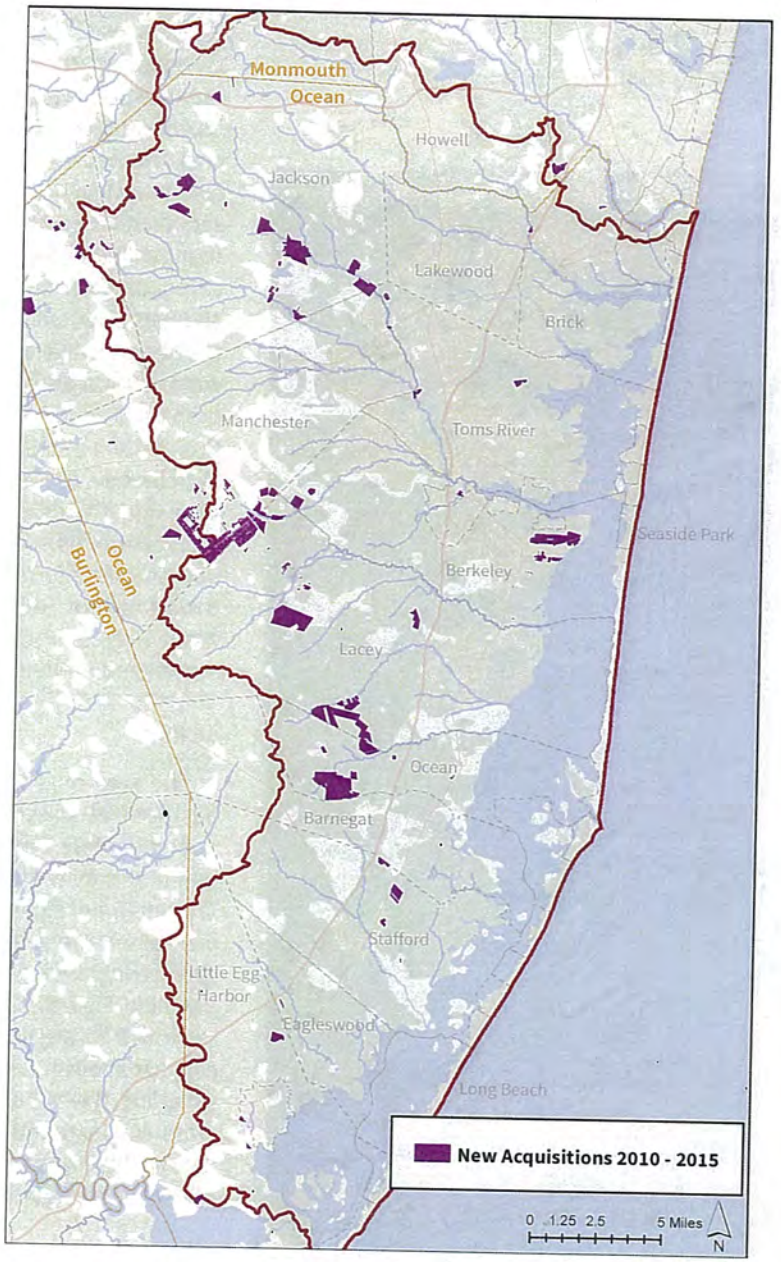



Figure 2: Map of protected areas within the Barnegat Bay watershed acquired from 2010 to 2015.

*Indicator*

# Seagrass

*Indicator Status*


**Eelgrass plants covered by encrusting organisms. Photo by Dr. Elizabeth Lacey.**

## *Background*

Seagrasses serve as habitat and food for many recreationally and commercially important estuarine and marine species (*e.g.,* bay scallop [*Argopecten irradians*], blue mussel [*Mytilus edulis*], blue crab [*Callinectes sapidus*], and weakfish [*Cynoscion nebulosus*]). Seagrass beds also play a significant role in nutrient cycling, carbon sequestration, filtering of essential elements, and wave dampening. In addition, seagrasses are excellent indicators of water and sediment quality as they indicate changes in water quality and benthic attributes. Seagrasses are impacted by water nutrient levels, elevated water temperatures, ice scouring, damage from boat props and anchors, disease and light intensity fluctuations caused by dredged or storm-tossed sediments, and algal blooms or overgrowth. By assessing the condition of seagrass beds over time, it is possible to establish accurate trends in estuarine condition. Within Barnegat Bay, eelgrass (*Zostera marina*) dominates the seagrass beds south of Toms River, while mixed eelgrass and widgeon grass (*Ruppia maritima*) beds are found in the central and northern portions of the bay.

## *Status*

The area of seagrass habitat within Barnegat Bay has not been assessed since 2009, when it covered approximately 14% of the estuarine bottom. A 2015 bay-wide survey of seagrass bed demographics (Figure 1) found a significant increase in eelgrass aboveground biomass in the southern portion of the estuary in the spring compared to 2011, the last year for which data are available (Figure 2). However, due to natural fluctuations in growth throughout the growing season, by fall the eelgrass aboveground biomass was comparable to prior sampling. Bay-wide there was no difference in widgeon grass aboveground biomass between 2015 and 2011, though there was a significant increase in widgeon grass in the central region (Figure 3).

## *Trends*

From a bay-wide perspective, eelgrass aboveground biomass reached its lowest level in 2009, and though the 2015 levels were encouraging, they do not represent a statistically significant improvement from the lows of the late 2000's. The increase in widgeon grass in the central part of Barnegat Bay is encouraging from a broad habitat perspective, though what that means for eelgrass populations and habitat use by recreationally and commercially important species is not yet clear.

## *Data Gaps*

Without future sampling it is unclear if the increase in eelgrass biomass observed in 2015 is due to temporarily favorable water quality conditions, the result of nutrient reduction efforts over the past four years, or a combination of both factors. An assessment of the extent (size and distribution) of seagrass beds in the bay is also needed.

*For additional details on seagrass distribution and abundance in the Barnegat Bay, please visit the Studies and Reports section of the BBP website at* http://bbp.ocean.edu/pages/184.asp *and search the Description field for "seagrass."*

*Data courtesy of Rutgers University (2004-2011), Barnegat Bay Partnership, and Stockton University (2015).*

Figure 1: Sampling locations for the seagrass biomass surveys used in this analysis.

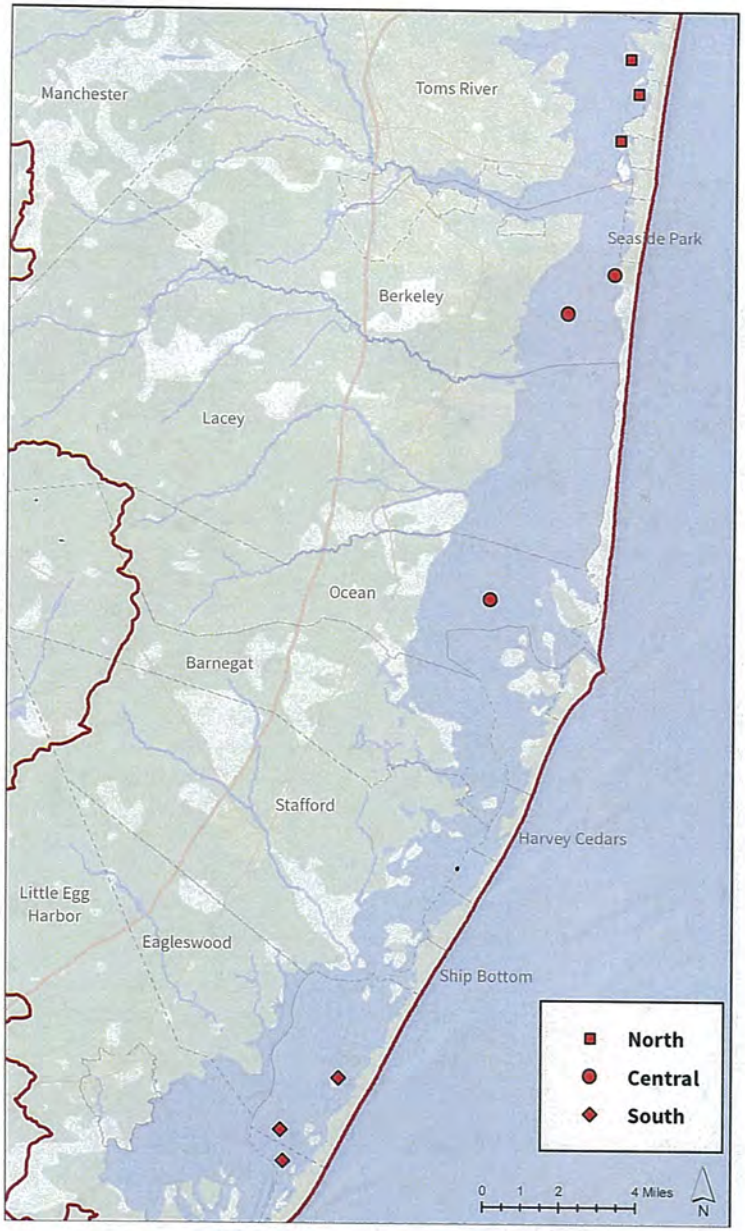



Figure 2: Annual mean above-ground biomass of eelgrass (*Zostera marina*) in the Barnegat Bay-Little Egg Harbor estuary between 2004 and 2015.

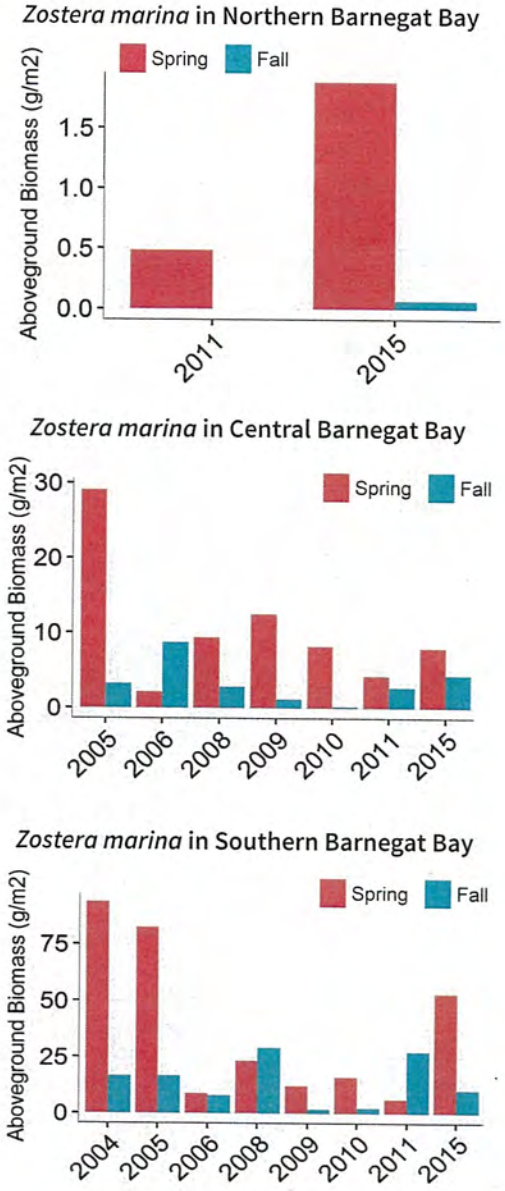
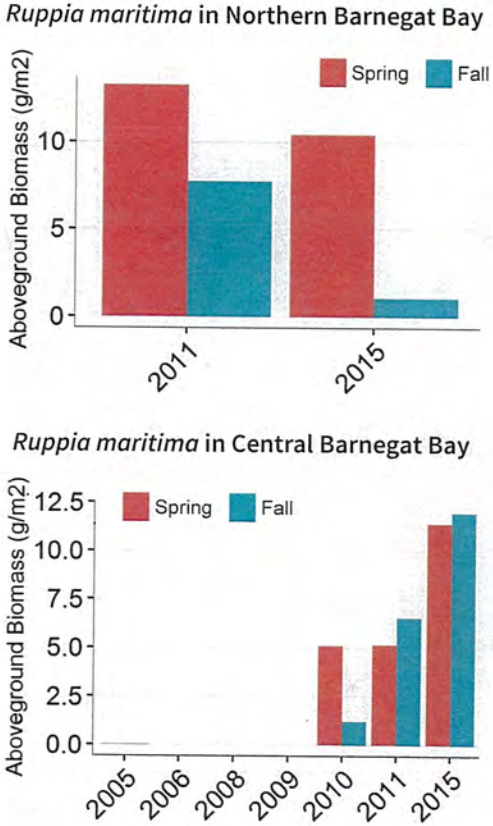



Figure 3: Annual mean above-ground biomass of widgeon grass (*Ruppia maritima*) in the Barnegat Bay-Little Egg Harbor estuary between 2004 and 2015. No widgeon grass was been recorded in southern Barnegat Bay.



Morning along the Metedeconk. Photo courtesy of BTMUA.

62X

# Conserving Fisheries and Wildlife

Mention the Barnegat Bay, and many people think of the fish, crabs, clams, and birds which reside in and around the bay. When combined with the other species found within the watershed, they form links in the food web which support the diversity of life that makes the Barnegat Bay a unique place.


A fishing boat returning home through the Barnegat Inlet. Photo by New Leaf Photography.

*Indicator*

# Shellfish Resources

*Indicator Status*


**Hard clams collected during the NJ Bureau of Shellfisheries hard clam stock assessment of Barnegat Bay, 2012. Photo by Kira Dacanay, NJ Bureau of Shellfisheries.**

## *Background*

Estuarine shellfish have limited mobility, are sensitive to environmental changes, and are a commercially and recreationally important species, making them a key indicator used to assess ecological condition/impairment of estuarine systems nationwide. Historical records note the presence of hard clams (*Mercenaria mercenaria*), Eastern oysters (*Crassostrea virginica*), and bay scallops (*Argopecten irradians*) in Barnegat Bay. For example, Barnegat Bay oyster beds were documented in *A report of the oyster industry of the United States* (Ingersoll, 1881). Native American oyster shell middens found along Barnegat Bay date back to pre-colonial time.

## *Status*

Bay-wide surveys for hard clams conducted in 2011 (Little Egg Harbor) and 2012 (Barnegat Bay) estimated a standing stock of approximately 224 million clams (Figure 1). There is currently a limited commercial wild fishery for hard clams within the Barnegat Bay, though there is an aquaculture industry active primarily in Little Egg Harbor. Hard clams are also harvested on a recreational basis, centered mainly around the southern portion of the estuary. There is limited natural recruitment of oysters into the estuary, and scallops are occasionally found during seagrass and hard clam sampling, although there is no wild fishery for either species. There is an oyster aquaculture industry beginning to develop in the bay as well.

## *Trends*

Overall, the abundance of hard clams in Barnegat Bay in 2012 was down approximately 23% from the last survey completed in 1985/1986. For Little Egg Harbor, the overall abundance in 2011 was down approximately 57% compared with the 1985/1986 survey. However, the abundance of hard clams in Little Egg Harbor increased 32% between 2001 and 2011. The 2001 survey in Little Egg found a 67% decline in abundance compared with 1985/1986. Regularly scheduled surveys will be needed to determine if this is the beginning of a rebound in hard clam abundance or a temporary increase associated with a single large spawning event.

*Data courtesy of the New Jersey Department of Environmental Protection Bureau of Shellfish.*

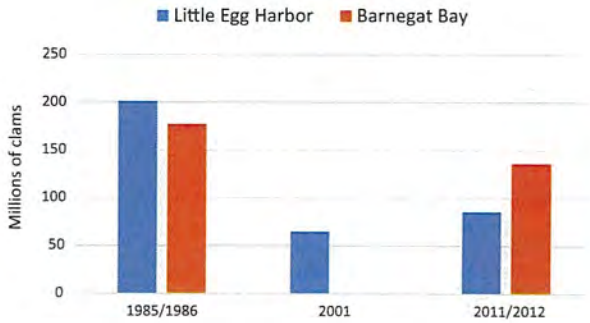



Figure 1: Hard clam abundance in Little Egg Harbor and Barnegat Bay.

Barnegat Bay oysters. Photo by Forty North Oyster Farms

*Indicator*

# Estuarine Fish Communities

*Indicator Status*


**A juvenile summer flounder. Photo by Barnegat Bay Partnership.**

## *Background*

With a mosaic of diverse habitats located within close proximity to each other, estuaries are home to a variety of aquatic organisms, many of which are of commercial or recreational importance. Within temperate estuaries like the Barnegat Bay, this includes both resident and non-resident fish across all life history stages. Because of this critical habitat function, fishery production within estuaries is higher than most other marine or freshwater systems.

The Barnegat Bay Partnership has been sampling with a 50-foot seine net at six locations within the central and northern portions of the bay for juvenile fish on a regular basis from May through October since 2012 (Figure 1). These sampling sites cover a variety of habitat types (seagrass beds, muddy bottom, sandy bottom, wetland edge) and a range of salinities, and are representative of the habitats found throughout the bay. During this time, 69 fish species, 5 crab species, and 4 jellyfish species have been collected. The most common fishes encountered were schooling forage fishes (Atlantic silversides [*Menidia menidia*], bunker [*Brevoortia tyrannus*], and bay anchovy [*Anchoa mitchilli*]), followed by juveniles of black drum (*Pogonias cromis*), silver perch (*Bairdiella chrysoura*), winter flounder (*Pseudopleuronectes americanus*), and bluefish (*Pomatomus saltatrix*).

One way to assess an aquatic community is to measure its biodiversity, or the number and amount of different kinds of organisms it contains. More diverse communities are typically more resilient to disturbances, as there are multiple species that can occupy a particular role or take advantage of new or changing conditions. One metric for quantifying diversity is the Shannon-Weiner Index, which takes into account both the different number of species and their abundances. If there are many different types of fish and they are equal in abundance, the index is high. If most of the fish at a site are of one species the index will be low, even if there are lots of very rare species. Thus, changes in diversity values can indicate a change in habitat or other conditions over time.

## *Status*

The Shannon-Weiner diversity index score at the Allen Road sampling site was, on average, higher than that of all other sites across 2012-2015. This is likely due to the presence of seagrass beds within and adjacent to the sampling site. For most sites, the 2015 diversity scores were at or near the maximum over the time frame studied, though Ocean Gate had its lowest value in 2015 (Figure 1).

## *Trends*

When examined bay-wide the average diversity scores were highest in 2012, declined in 2013 and 2014, and then increased in 2015. While most sites showed some variability between years, the differences were not significant.

## *Data gaps*

The data currently cover the northern portion of the Barnegat Bay but does not extend below Cedar Creek. Monitoring at additional sites in the central and southern portions of the bay would allow for a more accurate baywide assessment of community diversity, especially with the main inlets located within these regions.

*Data courtesy of the Barnegat Bay Partnership.*

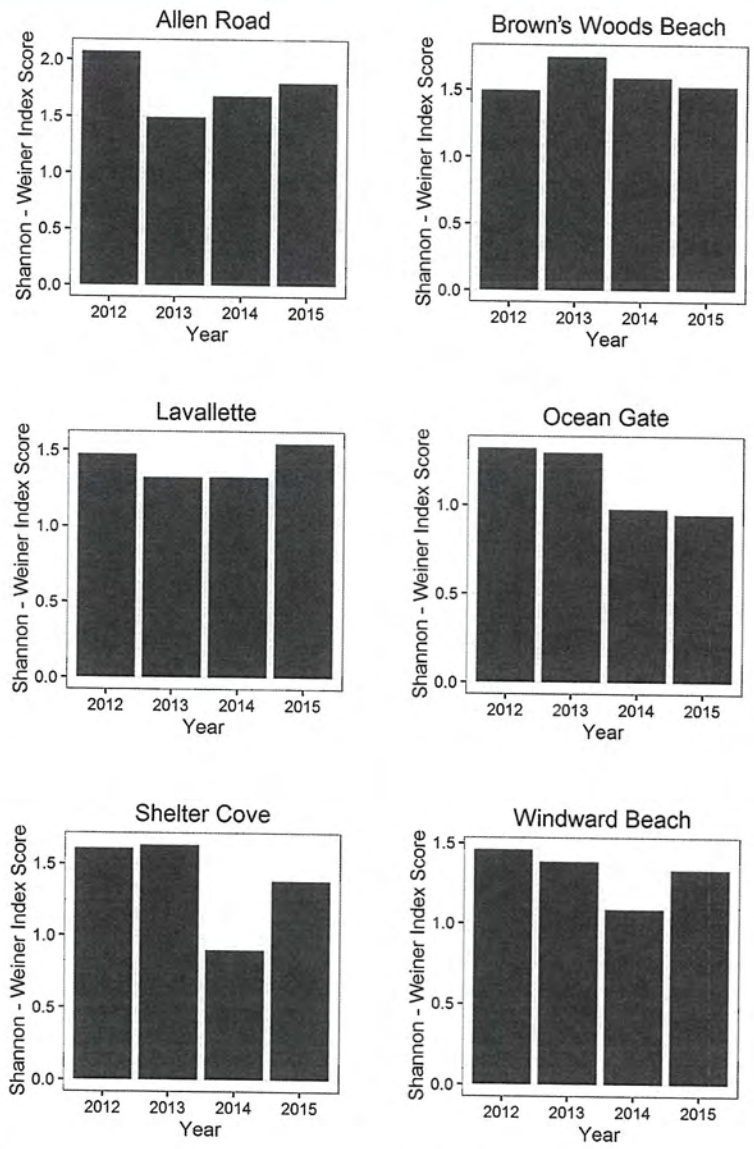




Figure 1: Location of Barnegat Bay Partnership long-term seining sites and community diversity scores.

# Hurricane Sandy: Changing the Face of the Jersey Shore?

A pleasure boat washed up on the Island Heights boardwalk following Hurricane Sandy. Photo by Barnegat Bay Partnership.


## *The Storm*

Whether you call it a hurricane, a superstorm, "Frankenstorm," or a post- or extra-tropical cyclone, most people in New Jersey won't ever forget Sandy. Originating as a tropical wave (an elongated area of low pressure) south of Jamaica, Sandy grew in size to become the second largest hurricane ever recorded, as it moved north from the Bahamas until its final landfall as a post-tropical cyclone at Brigantine, New Jersey. When Sandy struck New Jersey, the atmospheric pressure (946 millibars, a measure of the "weight" of the atmosphere that is inversely correlated with the strength of the storm) was the second lowest ever recorded north of Cape Hatteras.

Interestingly, Sandy's path (and that of the nor'easter that followed a week later) were correctly predicted by the European Centre for Medium-Range Weather Forecasts headquartered in Reading, England nearly eight days in advance of their landfalls. Several large-scale climate-change factors have been identified as contributing to Sandy's size and path. First, sea surface temperatures off the east coast of the United States were much warmer than usual, leading to large-scale atmospheric temperature increases and higher rainfall potentials (*i.e.*, warm air holds more water). Second, sea levels off the Atlantic Coast of the U.S. were near their highest levels of the past 100 years, largely due to sea level rise but also other large-scale meteorological patterns. Lastly, melting polar ice exacerbated unusual weather patterns in the northern hemisphere (*e.g.*, North Atlantic Oscillation, a "blocking Greenland front"), which prevented the typical eastward movement of North Atlantic hurricanes. As a result, Hurricane Sandy combined with a nor'easter before turning left and slamming into coastal New Jersey as an extratropical cyclone.

Sandy's strength and path maximized the interacting forces of lunar cycle, wind and water and resulted in a record-breaking storm on the Jersey Shore. The record storm surge of 8.57 feet above normal tide level was recorded at the north end of Sandy Hook. Record waves of 32.5 feet were measured at a coastal ocean buoy near Sandy Hook. Record sustained maximum wind speeds of 80 mph were measured at landfall near Atlantic City, with record peak wind gusts of 89 mph observed in Surf City.

More than 24 states were impacted by Sandy. At least 147 deaths were directly attributed to Sandy in the United States. As of this past year, approximately $75 billion in damages makes this the second-costliest hurricane (to Katrina) in the U.S. More than 325,000 housing units were damaged, another 20,000 homes were completely destroyed, and more than 19,000 businesses suffered damages of $250,000 or more in New Jersey alone. There were more than $3 billion in damages to water and wastewater lines, and treatment plants; $3 billion in damages to NJ public transit, bridges, and roads; and $1 billion in damages to power lines and systems, and natural gas lines. More than 5 million people were without power or other utilities.

Barrier island communities in Ocean County, where the storm surge was approximately 9 feet and 15–20 foot waves pounded the islands, were among the areas in New Jersey hardest hit by the storm. Extensive areas in Pt. Pleasant Beach, including the boardwalk, were damaged severely. Storm surge damaged about 90% of the properties in Mantoloking with the largest damage occurring when a breach formed between the Barnegat Bay and the Atlantic Ocean near Herbert Street at the base of the Mantoloking Bridge. To the south, the seaside sections of Brick and Toms River, along with Lavallette,

Seaside Heights, and Seaside Park, were extensively flooded. Areas bordered on the oceanfront by more complete dunes were less heavily damaged overall than areas lacking extensive dunes. Extensive portions of the oceanfront boardwalk piers and their iconic amusement parks in Seaside Heights and Seaside Park were severely damaged or destroyed. Fires fueled by broken gas lines broke out in several communities, especially Mantoloking and the Toms River community of Ortley Beach, and completely destroyed many homes. Damage on Long Beach Island was distributed unevenly throughout the island. Areas with a protective dune system, such as Harvey Cedars, Ship Bottom, Surf City, and Barnegat Light had limited damage, while areas without dunes or where dunes were breached (*e.g.*, Loveladies and the Holgate section of Long Beach Township), experienced greater destruction.

Many back-bay communities also experienced considerable storm surge and damage from the storm. Many neighborhoods in Brick and Toms River (where as many as 40% of the homes are within 2-3 feet of sea level) were inundated by the storm surge and extensively damaged. Lagoon communities and other areas built on filled wetlands throughout the watershed (*e.g.*, Shore Acres, Silver Bay, Snug Harbor, Forked River Beach, Beach Haven West, Tuckerton Beach, and Mystic and Osborne Islands) also suffered extensive damages.

### *Assessing the Storm's Impacts on the Bay's Ecology*

Immediately following the storm, the Barnegat Bay Partnership staff and its many government and other partners were involved in emergency and first response efforts. In the weeks and months following the storm, we held regular conference calls for partners to share information and coordinate various activities.

Thanks to the tremendous investment in monitoring and research activities (some of which began before the storm), most of the short-term environmental impacts of Superstorm Sandy (*e.g.*, debris [see Trash Free Waters sidebar], poor water quality, eroded wetlands, and buried SAV beds) are now known. The NJDEP and its partners and contractors cleaned up most large debris (*e.g.*, houses, cars, boats) which washed into and was submerged in water bodies and wetlands. While service at sewage-treatment plants in Ocean County was disrupted, adverse impacts to water quality (largely from pathogens affecting shellfish resources) distributed throughout the bay were fairly short-lived. Fortunately, sewage plumes and chemical spills (*e.g.*, mostly fuels) originating within the New York Harbor and flowing into the surrounding Bight stayed well offshore.

While a majority of New Jersey's coastal wetlands were inundated several days before Sandy made landfall, tidal wetlands throughout the bay, especially those in the northern end behind the Mantoloking Breach (*e.g.*, Reedy Creek and Cattus Island County Park) suffered considerable erosion (in some places, 5–10 feet) along their

**The Island Heights Yacht Club during flooding associated with Hurricane Sandy. Photo by Amanda Bottomley.**

# Hurricane Sandy: Changing the Face of the Jersey Shore?

*continued*

The Gilford Park Yacht Club during flooding associated with Hurricane Sandy. Photo by Amanda Bottomley.

edges and creek banks, as well as those interior areas exposed to wave action. These impacts to wetlands are especially worrisome because shoreline hardening (*i.e.*, bulkheading) is cutting off some supplies of sediments to the bay ecosystem that are essential for wetlands to keep pace with sea level rise. To assess these longer-term concerns, the BBP and many partners, including the EPA, NJDEP, US Fish and Wildlife Service, Partnership for the Delaware Estuary, and the Academy of Natural Sciences at Drexel University have developed and are implementing a long-term wetland monitoring and assessment program (see Wetland Condition indicator). Also, the BBP has developed and implemented a volunteer, citizen-science based monitoring program (see Paddle for the Edge sidebar) to obtain additional information about the condition of shorelines and certain other wetland resources around the bay. Lastly, the BBP is participating in statewide workgroups for living shorelines and exploring beneficial uses of dredged materials (*e.g.*, thin layer deposition), which might be used to enhance and restore some existing wetlands or possibly even create new wetlands.

Sands and coarse sediments washing over or off of the barrier islands also buried some of the bay's best eelgrass beds along the bay's eastern shores. The Barnegat Bay is home to most of the state's remaining eelgrass and other native populations of submerged aquatic vegetation (*e.g.*, widgeon grass). As noted in the *2011 State of the Bay Report*, eelgrass abundance and condition has been declining for some time. Since the storm, eelgrass abundance and condition has improved remarkably in some parts of the bay, but not in others. The abundance of widgeon grass is also increasing. The localized increases in both species is encouraging, but additional monitoring and research is needed to better understand the factors contributing to the local increases. Widgeon grass and eelgrass face ongoing and new threats to their continued existence in Barnegat Bay and New Jersey as a whole.

In the weeks and months following the storm, episodic flooding was reported throughout the watershed. Since the storm, more than 20 exceptionally high water events causing flooding have been observed in Barnegat Bay. This flooding has widely and erroneously been attributed to sand and other materials and debris having washed off of the landscape and into the bay and its tributaries as a result of Sandy. USGS studies conducted in Barnegat Bay and Great South Bay, New York have unequivocally established that the post-Hurricane Sandy high-water levels are due to high offshore sea levels caused by winter storms, not by barrier island breaching or geomorphic changes within the bays associated with the storm. In addition, dredging sands and sediments around the bay to make those areas deeper has the potential to exacerbate future flooding. This study further reinforces what scientists have been saying for years, that our climate and our lives along the shore are changing.

## *The Future: Good, Bad, or Ugly? It's Up to Us to Decide a New Vision for the Shore*

Superstorm Sandy was a tragedy for some, a life-threatening ordeal for others and, at the very least, an eye-opening event for many, many more people who lived along the shore. Sadly, it seems we are destined to repeat Sandy's tragedies and ordeals, unless everyone opens their eyes to how our world is changing and better recognizes both the challenges and the opportunities now before us.

Over the past few years, with the transfusion of federal funds, we have cleaned up a great deal of the debris and devastation and begun rebuilding the many communities destroyed by the storm. This has not been an easy task. We've all heard horror stories of the confusing regulations, the red-tape, the confusion, the profiteering, and concerns about the wasting of money. Elected officials and policy makers have cut some corners, sometimes

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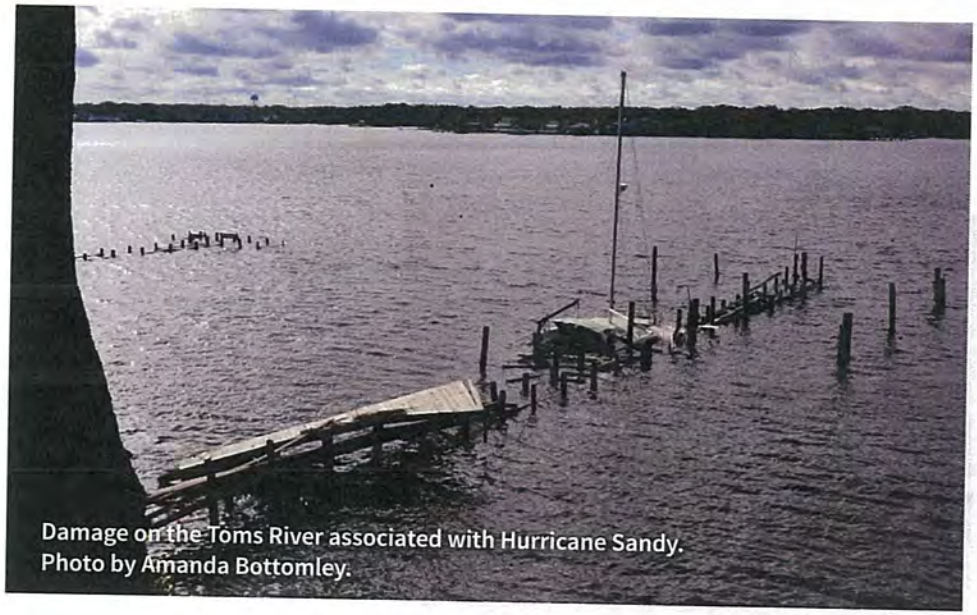
understandably, to get people in their homes and back to work. Our success in those efforts to date have been mixed. Some people are back in their homes and their lives have returned to "normal." But even for those people, normal now seems different. A lot of things still aren't fixed or the way they were. More streets keep flooding…

And now this year, people to our south are struggling with this year's storm, Jonas, which caused storm surges in Atlantic and Cape May Counties comparable to Sandy. Pam Bross spent January 23rd mopping up water that flooded her 24th Street Market in North Wildwood. It takes extreme flooding for her store off New Jersey Avenue to see flooding. The last time was during Sandy. "I just hope it isn't a sign of things to come," she said.

It's time to recognize that each event is just one more sign that life along the shore is changing. Everyone must prepare for more bad weather, more flooding, more tragedies, and more ordeals like Sandy and Jonas.

Or, we must find another way. What we have not done to date is develop a new vision for the future of the Shore. We have some hard decisions to make if we are to undo years of poor land-use decisions. The Jersey Shore faces huge social and economic challenges, but the region's future can be bright once our leaders and the public develop a vision for a safer, less risky future and redevelop so that the next storm doesn't put people back in the same situation. It won't happen overnight, but it can happen if we work together.



Damage on the Toms River associated with Hurricane Sandy. Photo by Amanda Bottomley.

A house knocked of its pilings by Hurricane Sandy. Photo by Barnegat Bay Partnership.

# Climate Change

Flooding along the Toms River.
Photo by Barnegat Bay Partnership.


## Sea level rise

The impacts of climate change have already been observed here in New Jersey, where we are experiencing rates of sea level rise well above the global average. The tide gauge at Atlantic City shows a sea level rise rate of increase of approximately 4 mm per year (about 16 inches per century) since the early 1900's (Figure 1).

Though these rates seem small and perhaps of little immediate concern, they are recognized by national and regional experts to be of sufficient magnitude to transform the character of the mid-Atlantic coast, with the potential for increased flooding episodes, large-scale loss of tidal wetlands, and possible disintegration of barrier islands. A recent report by Rutgers scientists suggests that by 2030, sea level is projected to rise by 7 to 16 inches over 2000 levels, with a best estimate of 10 inches (Miller *et al.* 2013).

## Air temperatures

The statewide average temperature in 2012 was the highest since 1895, with the five warmest years all occurring since 1998 (Figure 2). Nine of the ten warmest calendar years on record have occurred since 1990, all of which is consistent with the long-term upward trend of 2.2 °F per century (Broccoli *et al.* 2013).

As temperatures have risen, temperate zones like New Jersey have seen an earlier onset of spring. This can have severe consequences for our native flora and fauna, which rely on these temperature changes as a cue for important life history events. Furthermore, an earlier spring leads to an earlier, and longer, pollen season, which will adversely affect those who suffer from allergies. Additionally, the Union of Concerned Scientists project that the seasonal average temperatures across most of New Jersey will rise 7°F to 12°F above historic levels in winter and 6°F to 14°F in summer by late century. Under these scenarios, New Jersey can expect a dramatic increase in the number of days over 100°F.

## Precipitation

The Intergovernmental Panel on Climate Change (IPCC) predicts that "extreme precipitation events over most of the mid-latitude land masses and over wet tropical regions will very likely become more intense and more frequent by the end of this century, as global mean surface temperature increases" (IPCC 2013). These heavy precipitation events have occurred more than twice as frequently over the past 20 years compared to the prior century (Figure 3), and the trend is likely to continue. These heavy rainfall events can cause flooding, streambank erosion, and increases in the rate and amount of nutrients and sediments delivered into the estuary.

## Data Sources

IPCC 2013: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley [eds.]). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324. Available online at http://www.climatechange2013.org/report

Broccoli, Anthony J., Marjorie B. Kaplan, Paul C. Loikith, David A. Robinson. 2013. State of the Climate: New Jersey 2013. Rutgers Climate Institute; Rutgers University.

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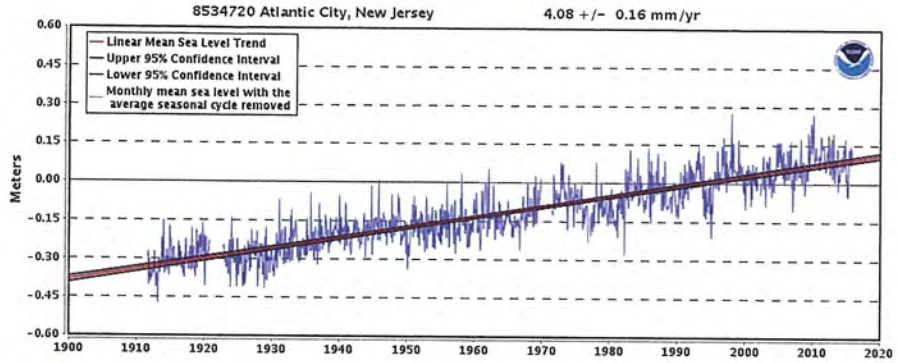


Figure 1: Tide gauge records for Atlantic City; red trend line shows steadily increasing sea level since 1912. Courtesy of NOAA.

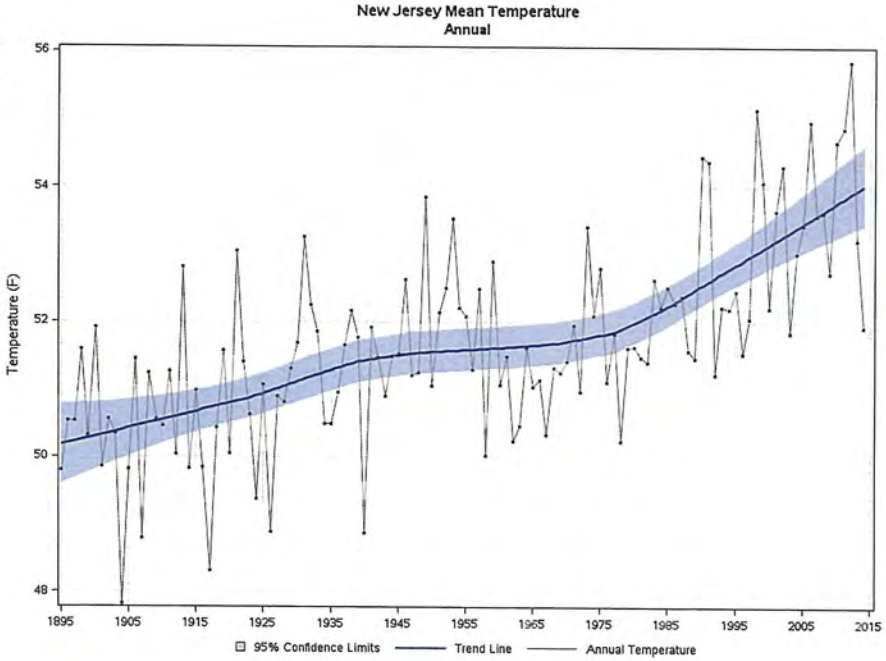


Figure 2: New Jersey statewide annual average air temperature. The gray line represents the annual temperature value. The blue line shows the overall trend in a fashion that smooths out the year-to-year variability in temperature. The light blue shaded area represents the 95% confidence interval for the trend. Courtesy of the NOAA National Climatic Data Center.

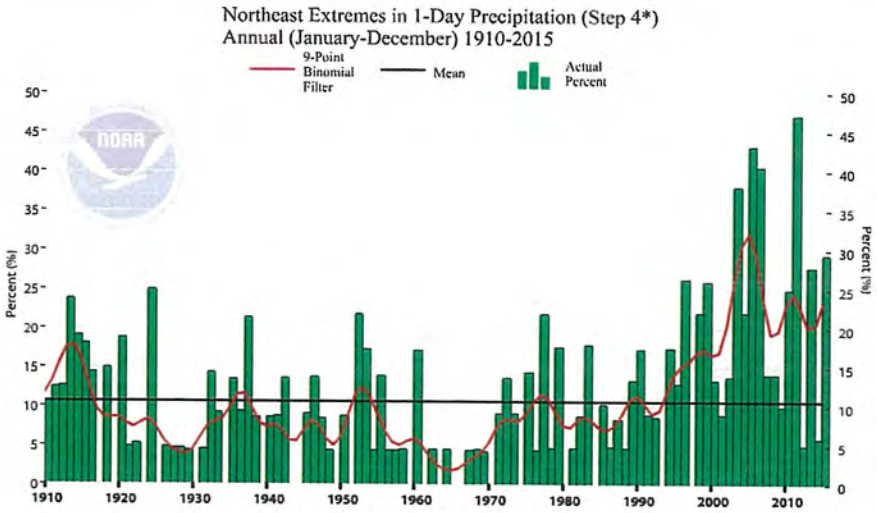


Figure 3: An index of the percentage of precipitation falling as part of a heavy precipitation event in the Northeastern United States. Courtesy of NOAA National Centers for Environmental Information.


Flooding in LBI after a nor'easter in November 2013. Photo by Barnegat Bay Partnership.

# Conclusion

The past five years in Barnegat Bay have been ones of change and upheaval. While the short-term environmental impacts of Superstorm Sandy have come into focus, we must continue to invest in monitoring and research to understand the long-term effects of Sandy and our changing climate on the bay's natural resources. What is clear from the indicators discussed in this *State of the Bay Report*, however, is that the most worrisome challenges identified in previous reports remain unchanged. Population growth within the watershed continues to drive the conversion of open space into urban land, reducing terrestrial habitats and the natural ability of the watershed to recharge groundwater and filter nutrients. Combined with unchecked withdrawals of water for human use, we are altering the amount, composition, and timing of fresh water entering the estuary. The negative effects of urbanization can be seen throughout the bay; thus, we *must* do more to reduce the bay's excessive nutrient loads and address other sources of turbidity if we are to address its dissolved oxygen and turbidity impairments, nuisance algal blooms, degraded tidal wetlands, and reduced seagrass biomass.

There is some good news in this *State of the Bay Report* as well. Open space acquisitions by Ocean County, the New Jersey Department of Environmental Protection, the US Fish and Wildlife Service, the Trust for Public Land, and other non-governmental organizations from 2010-2015 surpassed those of the previous five years, despite a slowdown as we focused on recovering from Superstorm Sandy. Closures of bathing beaches within the watershed due to pathogens and other contaminants generally declined, in large part due to a multi-agency working group which came together to tackle the recurring beach closures at Beachwood Beach. Fish communities in the northern and central parts of the bay are diverse, and hard clams, while still at very low levels, have rebounded compared to the decimated levels found in the early 2000's.

Perhaps most encouraging is the level of commitment our partners and the public have shown, both before and after Superstorm Sandy, to protecting and restoring the bay. During the past five years there has been a tremendous commitment to monitoring and research throughout the bay. Most importantly, thanks to cooperation between EPA, USGS, NJDEP, and others, we now have a working circulation model of the bay to help us better understand the movements, fluxes, and fates of nutrients throughout the ecosystem. Many people, including some of our organizational partners, have called for development of a Total Maximum Daily Load (TMDL) for nutrients in the bay. While we do not yet have the information necessary to establish such nutrient limits, we have some important tools and much needed information, and are substantially closer to having that information than we were five years ago.

In the meantime, there is still much unfinished work to be done. While we have taken some important steps to reduce the bay's nutrient load in the form of a statewide fertilizer law, we should look for ways to make the law more effective. First, the Soil Health Law, which would reduce the amount of nutrients flowing off of newly disturbed land, has not yet been fully implemented despite being passed more than five years ago. We should implement an effective soil restoration standard immediately. Second, the draft New Jersey Statewide Water Supply Plan should be shared with the public to improve the management, conservation(!), and development of water resources in the state's many watersheds, which likely will be subject to new and increasing threats with climate change. And lastly, we must make better use of two other important tools, the municipal stormwater program and watershed management planning program, to help us address the nonpoint source pollution impacting the bay.

In all of these efforts, the Barnegat Bay Partnership will continue to use the best science available to work towards understanding, protecting, and restoring this unique ecosystem that we all treasure. We need your help, so please visit our website at http://bbp.ocean.edu to learn more.

The view of Silver Bay from Ocean County Parks Headquarters. Photo by Barnegat Bay Partnership.

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A red fox on Island Beach State Park. Photo by New Leaf Photography.


BARNEGAT BAY
PARTNERSHIP
RESEARCH · EDUCATE · RESTORE

THE
# JERSEY SHORE PARTNERSHIP
*The Sand on the Beach People*

**TESTIMONY OF:**
**MARGOT WALSH, EXECUTIVE DIRECTOR**
**JERSEY SHORE PARTNERSHIP, INC.**
**AND**
**ROBERT MAINBEGER, P.E.**
**SR. VICE PRESIDENT, MOTT MacDONALD, L.L.C.**
**PRESIDENT, JERSEY SHORE PARTNERSHIP, INC.**

**BEFORE THE SENATE ENVIRONMENT & ENERGY COMMITTEE &**
**THE ASSEMBLY ENVIRONMENT AND SOLID WASTE COMMITTEE**
**AUGUST 18, 2016**

**Senate Bill S311**
**Assembly Bill A2954**
**Increase Shore Protection Fund from $25 million annually to $50 million annually**

Greetings, Chairman Senator Smith and members of the Senate Environment and Energy Committee and Vice-Chairman Assemblyman McKeon and members of the Assembly Environment and Solid Waste Committee. We thank you for the opportunity to address the importance of continued investment in the future of New Jersey's 127 mile coast.

I am Margot Walsh, Executive Director, Jersey Shore Partnership.

Our history began on October 31, 1991. The Halloween Nor'easter caused extreme beach erosion and flooding damages that were way beyond the financial resources of shore communities to rebuild their beaches and infrastructure.

In response, the Jersey Shore Partnership was launched as a not-for-profit, non-partisan organization to advocate for dedicated state funding for shore protection.

- We also know that strong, healthy, safe beaches are the magnet for the shore tourism economy, more than half the State's total tourism revenue, contributing to residential and business taxes, and thousands of jobs in retail, banking, food services, construction, entertainment and more.

- We know that future costs of mitigation will be more complex and expensive. Successful resiliency projects must include the impact of coastal storm surges on the bays, streams, lakes and rivers that are impacted by coastal storms and cause severe flooding.

- We know that, currently still viable supplemental Sandy funding, is not a permanent source of funding for a long-term fix for future storm protection projects.

- We know that the federal/state cost-sharing formula for beach maintenance will change for beaches constructed after 2000. The 65/35 formula for original beach replenishment projects will remain the same. However, the ratio for maintenance will become a 50/50 cost-share, creating additional funding challenges for the state and municipalities.

The Bottom Line:

**We cannot afford to jeopardize a uniquely successful investment in our State's economy.**

The return on the State's investment makes indisputable economic sense. The State realizes a $20 **billion per year return in shore tourism revenue and the associated influx of billions of dollars over more than 20 years from our cost-sharing partnership with the federal government on its present $25 million per year investment**.

Projections over the next 10 years present a realistic assessment of future authorized projects that exceed the current annual $25 million Shore Protection Fund. Bob Mainberger, the Partnership President, now will present the financial status of the New Jersey Shore Protection Program.

Comment:

I would like to comment that over the past 25 years, we have worked in partnership with the DEP Office of Engineering and Construction as the stewards of the Shore Protection Fund. We are proud of this relationship and the work of the DEP professionals and delighted that the division has been elevated to its own program area with Dave Rosenblatt promoted as Assistant Commissioner for Engineering and Construction.

Thank you.

*Margot Walsh*

Executive Director, Jersey Shore Partnership
*mwalshjspf@gmail.com* ***732-212-4145***

***The Jersey Shore Partnership, established in 1992, is a not-for-profit, non-partisan organization that advocates for stable funding on the state and federal levels for coastal protection and beach replenishment and on related issues and initiatives that are important to the State's coastal communities, the tourism economy and our quality of life.***

THE
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**Senate Bill S311**
**Assembly Bill A2954**
**Increase Shore Protection Fund from $25 million annually to**
**$50 million annually**

**Summary of Support Documentation:**

**PLATE 1 - State 10 Year Cost Projection Summary (est.);**

**PLATE 2 - USACE Philadelphia District 10 Year Costs Projection (est.):**
**Federal and Non-Federal (Local) Share;**

**PLATE 3 - USACE New York District 10 Year Costs Projection (est.):**
**Federal and Non-Federal (Local) Share;**

**PLATE 4 - USACE Philadelphia - New York Combined Districts 10 Year Costs Projection (est.):**
**Federal and Non-Federal (Local) Share;**

**PLATE 5 - Local Share - State and Municipal 10 Year Projected Costs (est.):**
**(Philadelphia and New York Combined Districts Costs);**

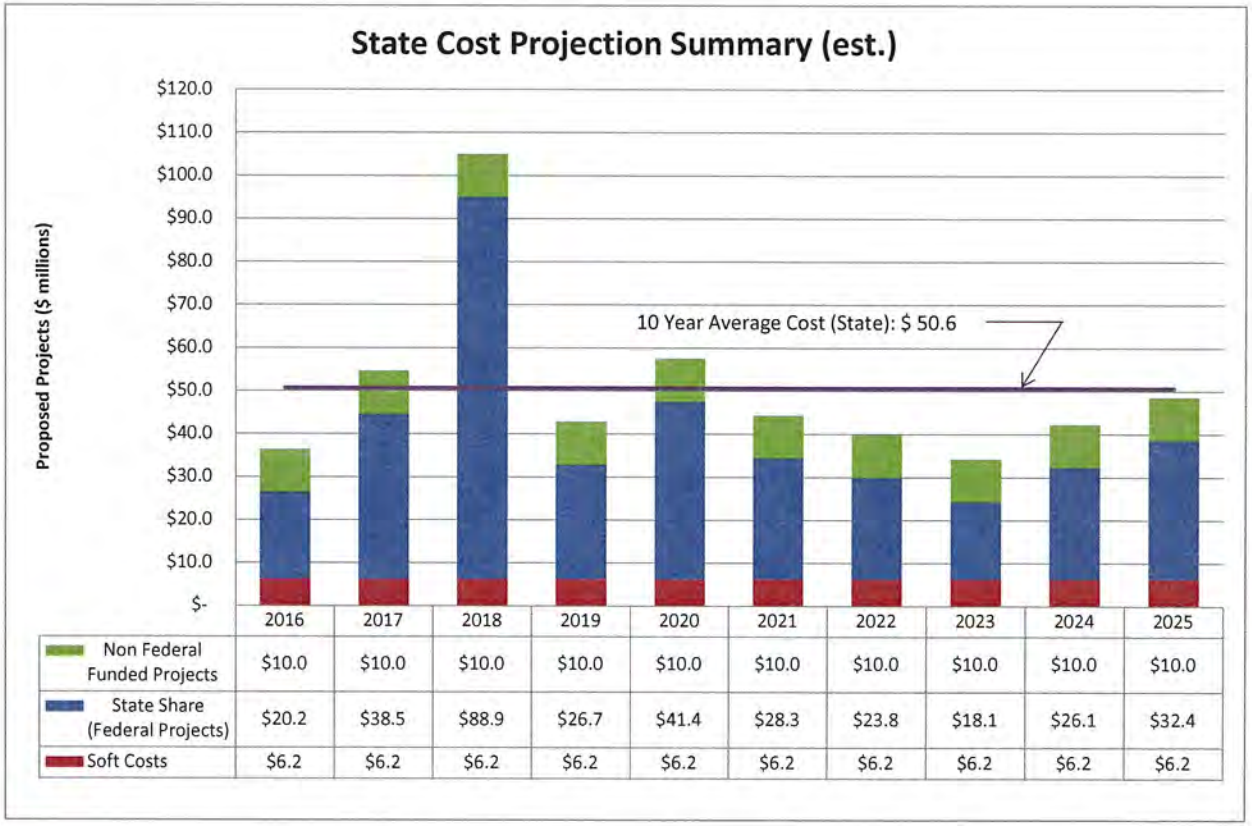
**TABLE 1 - USACE Philadelphia - New York Combined Districts 10 Year Costs Projection (est.):**
**Federal and Non-Federal (Local) Share;**

**TABLE 2 - USACE Continuing Authorities Program (CAP);**

**Continuing Authorities Program Informational Publication.**

# PLATE 1

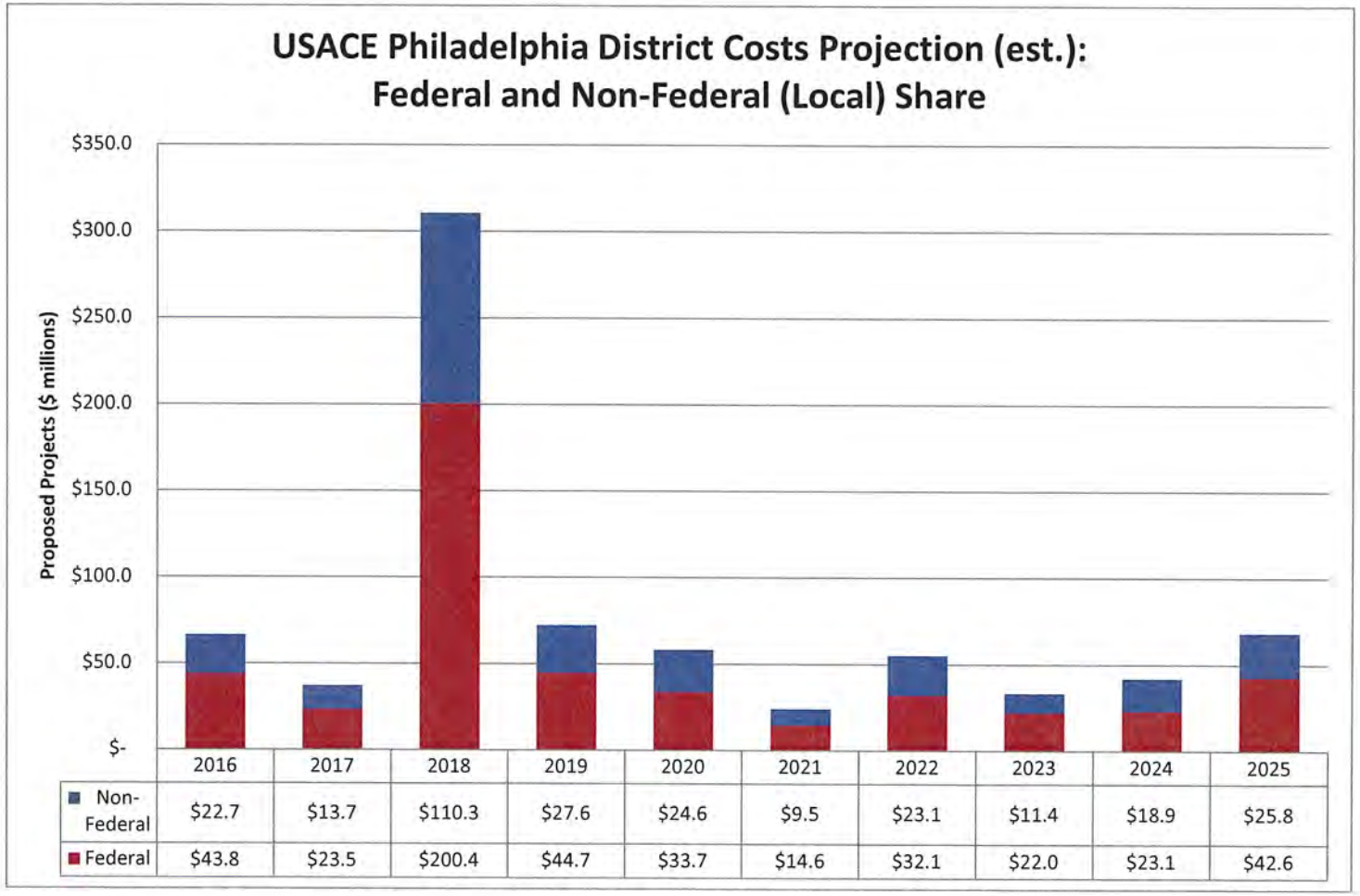
| Fiscal Year | Cost Projections ($ million) | | | |
|---|---|---|---|---|
| | Soft Costs | State Share (Federal Projects) | Non Federal Funded Projects | TOTAL |
| 2016 | $ 6.2 | $ 20.2 | $ 10.0 | $ 36.4 |
| 2017 | $ 6.2 | $ 38.5 | $ 10.0 | $ 54.7 |
| 2018 | $ 6.2 | $ 88.9 | $ 10.0 | $ 105.1 |
| 2019 | $ 6.2 | $ 26.7 | $ 10.0 | $ 42.9 |
| 2020 | $ 6.2 | $ 41.4 | $ 10.0 | $ 57.6 |
| 2021 | $ 6.2 | $ 28.3 | $ 10.0 | $ 44.5 |
| 2022 | $ 6.2 | $ 23.8 | $ 10.0 | $ 40.0 |
| 2023 | $ 6.2 | $ 18.1 | $ 10.0 | $ 34.3 |
| 2024 | $ 6.2 | $ 26.1 | $ 10.0 | $ 42.3 |
| 2025 | $ 6.2 | $ 32.4 | $ 10.0 | $ 48.6 |




*Percentage of local share varies per project agreement

# PLATE 2

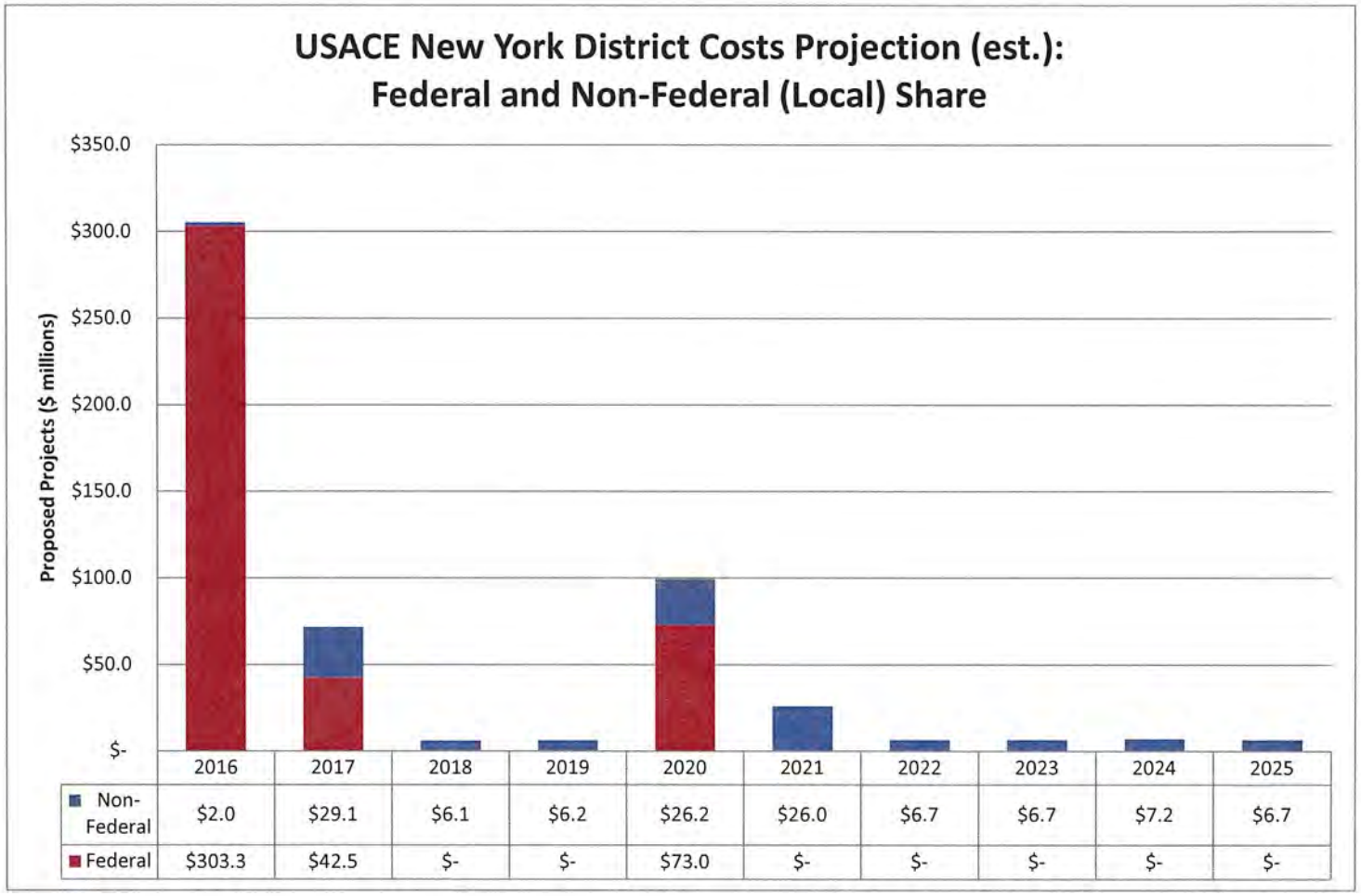
| Fiscal Year | Cost Projections ($ million) | | |
|---|---|---|---|
| | Non-Federal | Federal | TOTAL |
| 2016 | $ 22.7 | $ 43.8 | $ 66.5 |
| 2017 | $ 13.7 | $ 23.5 | $ 37.2 |
| 2018 | $ 110.3 | $ 200.4 | $ 310.6 |
| 2019 | $ 27.6 | $ 44.7 | $ 72.3 |
| 2020 | $ 24.6 | $ 33.7 | $ 58.3 |
| 2021 | $ 9.5 | $ 14.6 | $ 24.1 |
| 2022 | $ 23.1 | $ 32.1 | $ 55.2 |
| 2023 | $ 11.4 | $ 22.0 | $ 33.4 |
| 2024 | $ 18.9 | $ 23.1 | $ 42.0 |
| 2025 | $ 25.8 | $ 42.6 | $ 68.3 |




*Percentage of local share varies per project agreement

# PLATE 3

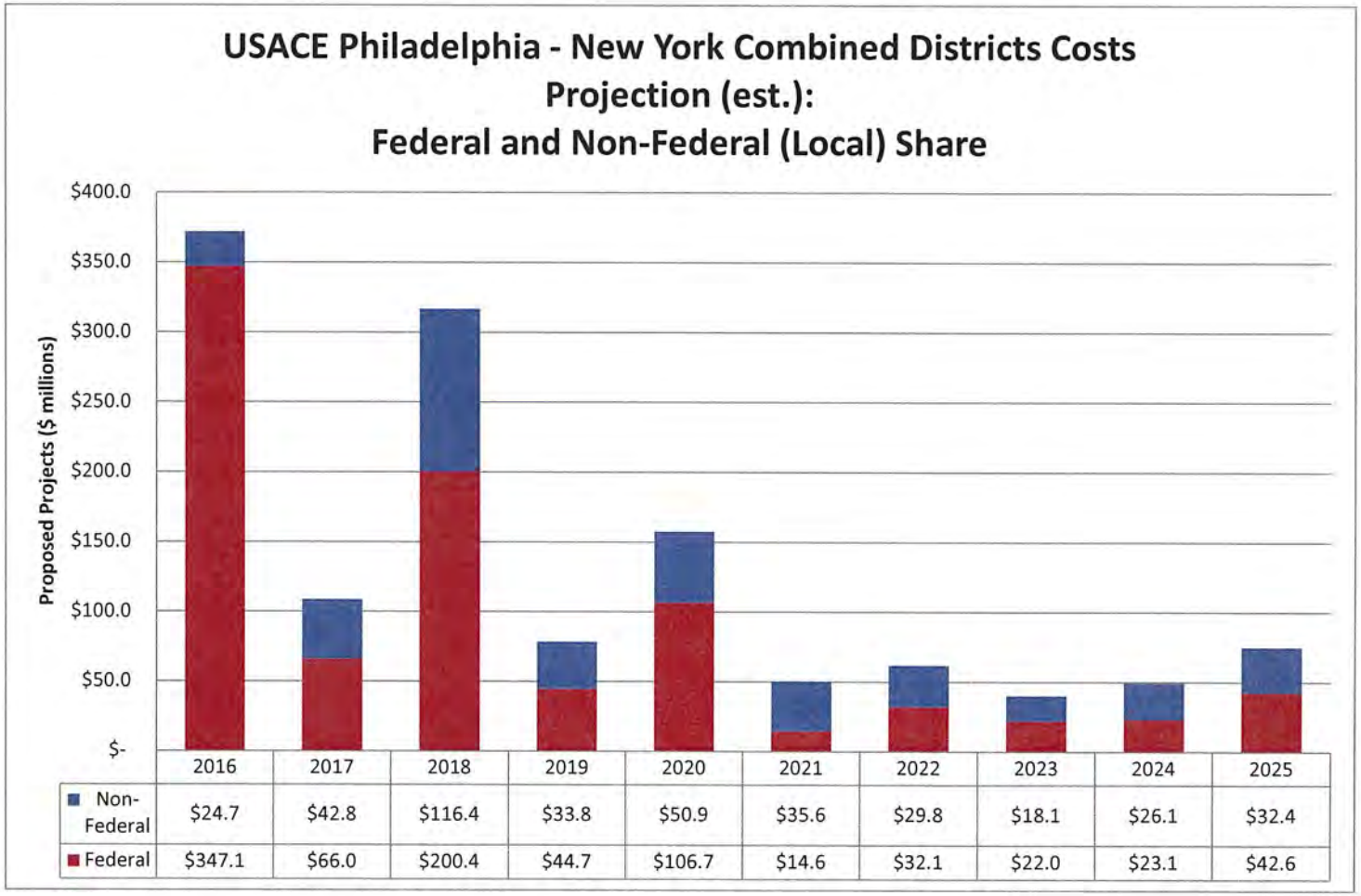
| Fiscal Year | Cost Projections ($ million) | | |
|---|---|---|---|
| | Non-Federal | Federal | TOTAL |
| 2016 | $ 2.0 | $ 303.3 | $ 305.3 |
| 2017 | $ 29.1 | $ 42.5 | $ 71.6 |
| 2018 | $ 6.1 | $ - | $ 6.1 |
| 2019 | $ 6.2 | $ - | $ 6.2 |
| 2020 | $ 26.2 | $ 73.0 | $ 99.2 |
| 2021 | $ 26.0 | $ - | $ 26.0 |
| 2022 | $ 6.7 | $ - | $ 6.7 |
| 2023 | $ 6.7 | $ - | $ 6.7 |
| 2024 | $ 7.2 | $ - | $ 7.2 |
| 2025 | $ 6.7 | $ - | $ 6.7 |




*Percentage of local share varies per project agreement

# PLATE 4

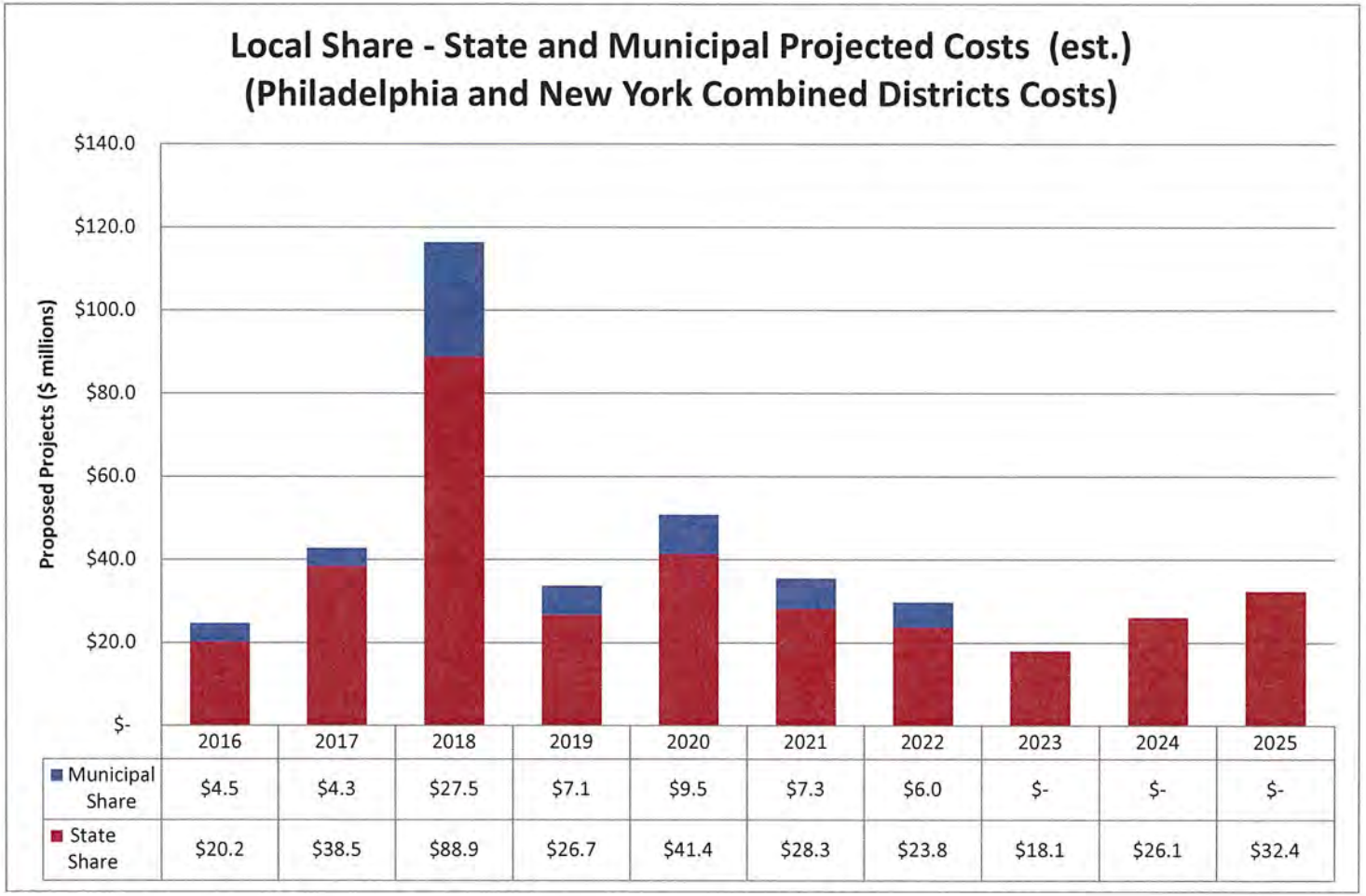
| Fiscal Year | Cost Projections: PHI-NY ($ million) | | |
|---|---|---|---|
| | Non-Federal | Federal | TOTAL |
| 2016 | $ 24.7 | $ 347.1 | $ 371.8 |
| 2017 | $ 42.8 | $ 66.0 | $ 108.8 |
| 2018 | $ 116.4 | $ 200.4 | $ 316.7 |
| 2019 | $ 33.8 | $ 44.7 | $ 78.5 |
| 2020 | $ 50.9 | $ 106.7 | $ 157.6 |
| 2021 | $ 35.6 | $ 14.6 | $ 50.1 |
| 2022 | $ 29.8 | $ 32.1 | $ 61.8 |
| 2023 | $ 18.1 | $ 22.0 | $ 40.1 |
| 2024 | $ 26.1 | $ 23.1 | $ 49.2 |
| 2025 | $ 32.4 | $ 42.6 | $ 75.0 |




*Percentage of local share varies per project agreement

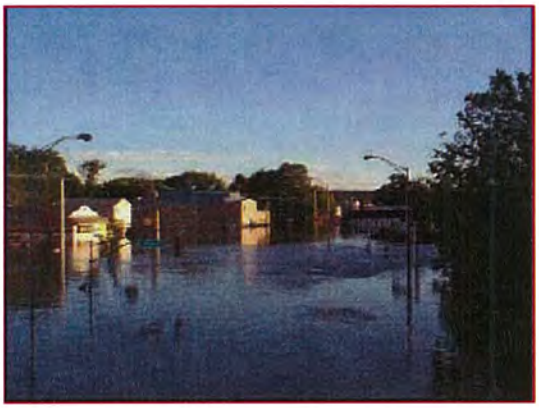
# PLATE 5

| Fiscal Year | Cost Projections ($ million) | | |
|---|---|---|---|
| | State Share | Municipal Share | TOTAL |
| 2016 | $ 20.2 | $ 4.5 | $ 24.7 |
| 2017 | $ 38.5 | $ 4.3 | $ 42.8 |
| 2018 | $ 88.9 | $ 27.5 | $ 116.4 |
| 2019 | $ 26.7 | $ 7.1 | $ 33.8 |
| 2020 | $ 41.4 | $ 9.5 | $ 50.9 |
| 2021 | $ 28.3 | $ 7.3 | $ 35.6 |
| 2022 | $ 23.8 | $ 6.0 | $ 29.8 |
| 2023 | $ 18.1 | $ - | $ 18.1 |
| 2024 | $ 26.1 | $ - | $ 26.1 |
| 2025 | $ 32.4 | $ - | $ 32.4 |




*Percentage of local share varies per project agreement

# Continuing Authorities Program



US Army Corps
of Engineers
New York District

90X

## THE PROCESS

CAP projects are completed in two phases:

1. Feasibility – this phase determines Federal interest, and completes the plan formulation process to include selection of a plan in accordance with appropriate guidance.

2. Design and Implementation – this phase consists of all technical and procurement activities through construction, after completion of the feasibility phase and decision document approval, to include an OMRR&R manual, turnover of the completed project to the local sponsor, and financial closeout.

Initiation of the feasibility phase begins when a letter requesting assistance from a sponsor is received stating the desire to participate in a solution, acknowledging the financial responsibilities in the study and project, and ability to proceed within the implementation time target. The Corps can also initiate a feasibility study based on direction given by act or committee report language accompanied by a letter from the non-Federal sponsor requesting assistance.

The first $100,000 put toward a feasibility study is fully Federally-funded. Within the first $100,000, there should be a determination of federal interest found and a project management plan developed/negotiated, as well as the feasibility cost share agreement, as costs beyond $100,000 in the feasibility phase require a feasibility cost sharing agreement to be signed and those costs to be shared 50/50 between the Corps and the non-Federal sponsor.

The conclusion of the feasibility phase is the submission and approval of the required decision document.

The design and implementation phase begins with the development/negotiation of a project partnership agreement, continues through design, and culminates in construction and turnover of the completed project to the non-Federal sponsor.

**CONTINUING AUTHORITIES PROGRAM (CAP)**
**OVERVIEW**

The Continuing Authorities Program (CAP) is comprised of ten legislative authorities under which the Secretary of the Army, acting through the U.S. Army Corps of Engineers, undertakes planning, designing, and construction of certain types of water resource and environmental restoration projects of limited scope and complexity without specific Congressional authorization. Each authority has its own requirements and strict limits on responsibilities and financial contributions of the federal partners.

**THE AUTHORITIES**

| Program Authority | Description | Federal Funding Limit – Project | Federal Funding Limit – Annual Program |
|---|---|---|---|
| Section 14* | Flood Control Act of 1946 (PL 79-526), as amended, for emergency streambank & shoreline erosion protection for public facilities & services | $1,500,000 | $15,000,000 |
| Section 103 | River & Harbor Act of 1962 (PL 87-874), as amended, amends PL 727, an act approved August 13, 1946 which authorized Federal participation in the cost of protecting the shores of publicly owned property from hurricane and storm damage. | $3,000,000 | $30,000,000 |
| Section 107* | River & Harbor Act of 1960 (PL 90-483), as amended for navigation. | $7,000,000 | $35,000,000 |
| Section 111* | River & Harbor Act of 1968 (PL 90-483), as amended, for mitigation of shoreline erosion damage caused by Federal navigation projects. | $5,000,000 | N/A |
| Section 204 | Beneficial Uses of Dredged Material on beaches, Water Resources Development Act of 1976 (PL 94-587), as amended | $5,000,000 | $30,000,000 |
| Section 205 | Flood Control Act of 1948 (PL 80-858), as amended, for flood control | $7,000,000 | $55,000,000 |
| Section 206 | Aquatic Ecosystem Restoration, Water Resources Development Act of 1996 (PL 104-303), as amended. | $5,000,000 | $50,000,000 |
| Section 208 | Flood Control Act of 1954 (PL 83-780), as amended, originally Section 2, Flood Control Act of August 28, 1937 (PL 75-406) for snagging and clearing for flood control. | $500,000 | $7,500,000 |
| Section 1135 | Project Modifications for Improvement of the Environment, Water Resources Development Act of 1986 (PL 99-662), as amended. | $5,000,000 | $40,000,000 |

*See authority specific guidance for additional information concerning funding limits applicable to this authority. Annual program limits are appropriation limits for Sections 1135, 204, and 206. For the remaining authorities, these are annual allocation limits.

US ARMY CORPS
OF ENGINEERS
NEW YORK DISTRICT

# SECTION 14

## Authority for: EMERGENCY STREAMBANK AND SHORELINE PROTECTION

**WHAT CAN THE CORPS DO?** Section 14 of the 1946 Flood Control Act, as amended, provides authority for the Corps of Engineers to plan and construct emergency streambank and shoreline protection projects to protect endangered highways, highway bridge approaches, public facilities such as water and sewer lines, churches, public and private nonprofit schools and hospitals, and other nonprofit public facilities.

The unstable conditions caused by flood induced streambank and shoreline erosion call for prompt action to eliminate the threat to public safety and to prevent interruption of vital services. This is recognized in the streamlined study and shortened time frame of the Section 14 program. Federal costs are limited to not more than $1,500,000 in one locality during any fiscal year.

A Section 14 project may include new streambank or shoreline protection works, or it may repair, restore, or modify existing works. Each project must constitute a complete solution to the problem and not commit the Federal government to additional improvements to ensure effective protection. A project is accepted for construction only after an investigation shows its engineering feasibility, environmental acceptability, and economic justification.

After a state or local agency requests Federal assistance, the Corps will conduct a feasibility study pending potential Federal interest and available funding. The feasibility study begins at Federal expense. Study costs in excess of $100,000 are shared 50/50 with the non-Federal sponsor according to a Feasibility Cost Sharing Agreement (FCSA). In the feasibility study, the problem is defined, project viability is determined, potential solutions are identified, and the most feasible plan is selected for implementation. The costs, benefits, and environmental impacts of the potential project are analyzed. A draft project partnership agreement (PPA) is drawn up by which the Federal government and the sponsor agree to share project construction costs. No more than 12 months should pass between the start of the feasibility study and the time the project is ready for construction.

**WHAT ARE THE LOCAL RESPONSIBILITIES?**

Costs for emergency streambank and shore protection projects are shared between the Federal government and a non-Federal sponsor in accordance with the Water Resources Development Act of 1986, as amended. During construction the local sponsor must contribute a minimum of 35% of the total cost of a project, with credit granted toward the amount for providing lands, easements and rights-of-way, and pay a minimum cash requirement of 5% of the total project cost. The local sponsor (a state or local government) must have the legal and financial capability to fulfill the requirements of cost sharing and local cooperation.

Formal assurances of cooperation must be furnished by the local sponsor. The sponsor

generally must agree to the following:

- Contribute a minimum of 5 percent of the total project cost in cash;
- Provide all lands, easements, rights-of-way, and relocations;
- Provide any additional cash contributions needed to make the local sponsor's share of the project costs 35 percent;
- Assume the full responsibility for all project costs above the federal cost limit of
- $1,500,000.
- Hold and save the United States free from claims for damages due to the construction and maintenance of the project, except damages due to fault or negligence of the United States or its contractors;
- Provide all access routes and relocations of utilities necessary for project construction and subsequent operation and maintenance;
- Operate, maintain, repair, replace, and rehabilitate the project as long as the project is authorized;
- Comply with provisions of pertinent federal acts in carrying out the specified nonfederal responsibilities of the project.

**HOW CAN HELP BE REQUESTED?** We may begin a PDA study after we receive a written request from the prospective sponsor. A sample letter is offered below:

*District Engineer*
*U.S. Army Corps of Engineers, New York District*
*ATTN: Planning Division*
*26 Federal Plaza, 21st Floor*
*New York, NY 10278*

*Dear Sir:*

*This letter is to seek the assistance of the U.S. Army Corps of Engineers under Section14 of the 1946 Flood Control Act, as amended, in reducing the threat of damages along (name of river, creek, or body of water) in the vicinity of (city or town, etc.).*

*(Briefly describe the nature and severity of the problem, and any issues that could affect the acceptability of possible solutions.)*

*We understand that we would be required to pay at least 35 percent of the total cost of a project, with credit granted toward this amount for providing lands, easements and rights-of-way, and that the minimum cash requirement from us would be 5 percent of the total project cost. We are able and willing to proceed to construction within a year, if a feasible project is found. Please contact (name, address, telephone) for further information.*

*Sincerely,*
*(Name and title of public official authorized to request study)*

For more information, contact Mr. Dan Falt, Continuing Authorities Program Manager, at (917) 790-8614 or Email: daniel.t.falt@usace.army.mil.

US ARMY CORPS
OF ENGINEERS
NEW YORK DISTRICT

# SECTION 205
## Authority for: FLOOD DAMAGE REDUCTION PROJECTS

### WHAT CAN THE CORPS DO?

Section 205 of the Flood Control Act of 1948, as amended, provides authority to the Corps of Engineers to plan and construct small flood damage reduction projects not specifically authorized by Congress. A project is accepted for construction only after detailed investigation clearly shows its engineering feasibility, environmental acceptability, and economic justification. Each project must be complete within itself, not a part of a larger project. The maximum Federal expenditure per project is $7,000,000, which includes both planning and construction costs. Costs of lands, easements, and operation and maintenance must be non-Federal.

There are two types of projects: structural and nonstructural. Structural projects may include levees, flood walls, diversion channels, pumping plants, and bridge modifications. Nonstructural alternatives, which have little or no effect on water surface elevations, might include measures such as floodproofing, relocation of structures, and flood warning systems.

After a state or local agency requests Federal assistance, the Corps will conduct a feasibility study pending potential Federal interest and available funding. The feasibility study begins at Federal expense. Study costs in excess of $100,000 are shared 50/ 50 with the non-Federal sponsor according to a Feasibility Cost Sharing Agreement (FCSA). In the feasibility study, the problem is defined, project viability is determined, potential solutions are identified, and the most feasible plan is selected for implementation. The costs, benefits, and environmental impacts of the potential project are analyzed. If there is a feasible solution to the flooding problem recommended by the study, a draft project partnership agreement (PPA) is drawn up by which the Federal government and the sponsor agree to share project construction costs. No more than 3 years should pass between the start of the feasibility study and the time the project is ready for construction.

### WHAT ARE THE LOCAL RESPONSIBILITIES?

Costs for Section 205 flood damage reduction projects are shared between the Federal government and a non-Federal sponsor in accordance with the Water Resources Development Act of 1986, as amended. During construction the local sponsor must contribute a minimum of 35% of the total cost of a project, with credit granted toward the amount for providing lands, easements and rights-of-way, and pay a minimum cash requirement of 5% of the total project cost. The local sponsor (a state or local government) must have the legal and financial capability to fulfill the requirements of cost sharing and local cooperation. The sponsor generally must agree to the following:

- Contribute in cash the local share of project planning and construction costs.

- Provide all lands, easements, rights-of-way, relocations, and dredged material disposal areas.
- Provide any additional cash contributions needed to make the local sponsor's share of the flood damage reduction cost at least 35 percent.
- Hold and save the United States free from damages due to the construction and maintenance of the project, except damages due to fault or negligence of the United States or its contractors;
- Comply with provisions of pertinent federal acts in carrying out the specified non-federal responsibilities of the project;
- Operate, maintain, repair, replace, and rehabilitate the project as long as the project is authorized.

**HOW CAN A STUDY BE REQUESTED?** We may begin a Section 205 study after we receive a written request from the prospective sponsor. A sample letter is offered below.

*District Engineer*
*U.S. Army Corps of Engineers, New York District*
*ATTN: Planning Division*
*26 Federal Plaza, 21st Floor*
*New York, NY 10278*

*Dear Sir:*

*This letter is to seek the assistance of the U.S. Army Corps of Engineers under Section 205 of the 1948 Flood Control Act, as amended, in reducing flood damages along (river or creek) in the vicinity of (city or town, etc.)*

*(Briefly describe the nature and severity of the flooding problem. Briefly describe the known issues that might affect the acceptability of any recommended solutions, from the perspective of local government and/or the public.)*

*It is understood that, if the study indicates a project with a federal interest is likely, the (non-federal sponsor) would be required to enter into a contract to pay half the cost of the feasibility study after the first $100,000. Further, if it is found feasible to develop a flood damage reduction project, the (non-federal sponsor) would be able to pay at least 35 percent of the total cost of a project, with credit granted toward this amount for providing lands, easements and rights-of-way, and pay a minimum cash requirement of 5 percent of the total project cost.*

*Please contact (name, address, telephone) for further information.*

*Sincerely,*
*(Name and title of public official authorized to request study)*

For more information, contact Mr. Dan Falt, Continuing Authorities Program Manager, at (917) 790-8614 or Email: daniel.t.falt@usace.army.mil.

NEW JERSEY BUILDERS ASSOCIATION

www.njba.org
www.abconvention.com
www.njmxd.com
www.foundationforhousing.com

**MEMORANDUM**

**TO:** Public Access Task Force
Sara Bluhm - NJ Business and Industry Association
Tim Dillingham- American Littoral Society
Michael Egenton - NJ Chamber of Commerce
Debbie Mans - NY/NJ Baykeeper

**FROM:** Elizabeth George-Cheniara, Esq., Vice President of Regulatory & Legal Affairs

**COPY:** Senator Bob Smith, Chair, Senate Environment and Energy Committee
Michael J. Gross, Esq., (Giordano, Halleran & Ciesla, P.C.)
Steven Dalton, Esq., (Giordano, Halleran & Ciesla, P.C.)
Rick Ricciardi, P.P. (Marathon Engineering)
Carol Ann Short, Esq., CEO, NJBA
Jeff Kolakowski, Vice President of Government Affairs, NJBA

**RE:** NJBA's Response Paper to "Draft Issue Area Discussion"

**DATE:** March 21, 2016

The New Jersey Builders Association (NJBA) appreciates the opportunity to participate in the Task Force and provide comments on the "Draft Issue Area Discussion" (Draft Proposal). NJBA recognizes the public's right to access and use tidal waterways and shores under the common law principle known as the "Public Trust Doctrine", a principle recognized in New Jersey and throughout the United States, with origins that date back to English common law and Roman civil law. But that doctrine is not the only principle to be considered in the context of a legislative effort to codify public access principles of the Public Trust Doctrine to act as authority for regulations to implement such principles. Another fundamental principle under the State and federal constitutions is the sanctity of private property. Indeed, private property rights likewise predate the founding of this country and are grounded in historic legal authority such as the Magna Carta. Accordingly, any public access statute and regulations must be consistent not only with the principles of the Public Trust Doctrine as developed through the common law over the course of years, but must also reflect and be in compliance with the New Jersey and United States Constitutional requirements.

The Supreme Court of New Jersey has been most judicious in striking the balance between the public's right of access to tidal waters under the Public Trust Doctrine on the one hand, and the rights of private property owners, the character of coastal neighborhoods, and the interests of the residents of these communities, on the other hand. Any legislative effort to now codify the



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Public Trust Doctrine should adhere to Court's careful balancing of these competing interests by requiring case-by-case, individualized determinations and balancing of the public's rights under the Public Trust Doctrine and private property rights.

The framework for such individualized determinations is established in the Supreme Court's decisions of Matthews vs. Bay Head Improvement Association, 95 N.J. 306 (1984) and discussed in Raleigh Ave. v. Beach Ass'n v. Atlantis Beach Club, Inc., 185 N.J. 40 (2005), which address the public's right to use in limited circumstances dry sand beach areas and limited rights to perpendicular access to such lands. In those cases, the Court established the public's rights are satisfied as long as reasonable access to water areas exist and that public rights of access in the context of private property are not absolute, but rather, at times it is appropriate for private property owners to exclude the public. The Matthews Court, recognizing that private land owners have an interest in upland dry sand that differs from municipal beaches and that the public's right of access is thus more limited, established factors to review on a case-by-case basis to make the determination of whether reasonable access to water areas exist and whether upland private property owners may or may not be required to provide for public access to accommodate use of tidally flowed waters. The Matthews factors include examination of:

- Geographical proximity of the dry sand to the wet sand areas.
- Availability of publicly owned upland sand area.
- The nature and extent of public demand.
- Usage of the upland by private owner.

The Raleigh Court, applying these same factors, also considered the nature and extent of surrounding development and convenience to pedestrians, and historical public usage of privately owned upland beach areas.

State and federal Constitutional taking considerations also must be addressed in any legislative process to ensure taking principles are respected in the context of governmental decisions imposing public access requirements. Both the State and federal constitutions prohibit the government from taking private property without paying just compensation. New Jersey Constitution, Art. I ¶20; United States Constitution 5th and 14th Amendments. Under Taking principles, an "essential nexus" must exist between public access requirements and the interest the government seeks to protect, and any public access exaction must be "roughly proportional" to the proposed development. Essentially, public access must be determined on a case-by-case basis to ensure State and federal constitutional principles are respected.

In recognition of the established federal and State case law, the Draft Proposal states on the first page: "There is a need for legislative expressions to direct the Department of Environmental Protection to articulate policy with respect to public access to guide its actions, and to ensure that its policy is consistent with the Public Trust Doctrine and relevant case precedent." However, the subsequent pages and recommendations for legislative construction are overly broad and would apply a "one-size-fits-all" approach to determining whether public access would be required. The Draft Proposal, therefore, does not adhere to the underlying principles and criteria implementing the Public Trust Doctrine, nor does it recognize private property rights. NJBA strongly recommends that the proposal should apply a case-by-case analysis of the particular circumstances (i.e. nature and character of residential neighborhoods, need for public access, and the legitimate interests of its residents, etc.) in order to balance private property rights with the public's right to use tidally flowed lands under the Public Trust Doctrine.

The following provides a more detailed underlying legal analysis and highlights NJBA's specific concerns and positions on aspects of the Draft Proposal, including where revision is necessary.

**Public Trust Doctrine Legal Framework**

NJBA reiterates its recognition of the public's right to access and use tidal waterways and shores under the "Public Trust Doctrine," which has long been recognized in New Jersey and the United States. However, it is equally important to recognize and incorporate the well-established private property principles, which are also fundamental under the State and federal constitutions, in the context of any public access framework.

The Supreme Court of New Jersey has judiciously struck the balance between the public's right to beach access under the Public Trust Doctrine on the one hand, and the rights of private property owners, the character of coastal neighborhoods, and the interests of the residents of these communities, on the other hand. See Raleigh Ave. Beach Ass'n v. Atlantis Beach Club, Inc., 185 N.J. 40 (2005) and Matthews v. Bayhead Improvement Association, 95 N.J. 306 (1984), and other cases such as National Association of Home Builders v. Dept. of Environmental Protection, 64 F. Supp. 2d. 354 (D.N.J. 1999).

In Matthews, the Supreme Court noted that the question of the public's right to privately-owned dry sand beaches arises in two contexts: (1) perpendicular access ("the right to cross privately owned dry sand beaches in order to gain access to the foreshore"), and (2) access "of the sort enjoined by the public in municipal beaches ... namely, the right to sunbathe and generally enjoy recreational activities". 95 N.J. at 322-23. The Court determined that "the public interest is satisfied so long as there is ***reasonable access*** to the sea," and that "private land owners may not ***in all instances*** prevent the public from exercising its rights under the public trust doctrine." Id at 326. Yet the Court also determined that "the public's rights in private beaches are not co-

extensive with the rights enjoyed in municipal beaches." Thus, the Court mandated that the extent of public access must be determined on a case by case basis: "the particular circumstances must be considered and examined before arriving at a solution that will accommodate the public's right and the private interests involved." Id. at 324.

The Supreme Court recognized that private land owners have an interest in upland dry sand that differs from that of a municipality, and hence the public's right of access is more limited. As stated by the Court:

> "Precisely what privately-owned upland sandy area will be available and required to satisfy the public's rights under the public trust doctrine ***will depend on the circumstances.*** Location of the dry sand area in relation to the foreshore, extent and availability of publicly-owned upland sand area, nature and extent of the public demand, and usage of the upland sand by the owner are all factors to be weighed and considered in fixing the contours of the usage of the upper sand." [Id. at 326]. See, NAHB v. DEP, 64 F.Supp.2d. at 360 (requiring an examination of the site-specific reasonableness factors under Matthews to determine the extent of privately-owned land required to satisfy the public's rights under the Public Trust Doctrine.)

Both the State and federal constitutions prohibit the government from taking private property without paying just compensation. New Jersey Constitution, Art. I ¶20; United States Constitution 5th and 14th Amendments. The protections afforded under both constitutions are coextensive. Littman v. Gimello, 115 N.J. 154, 161, cert. den., 493 U.S. 934, (1989).

A taking of private property without just compensation may occur either as a physical occupation of property by the government or another, or through governmental regulatory taking. Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419, 427-28, 102 S.Ct. 3164, 3171-72, 73 L.Ed.2d 868 (1982) (requiring landlords to allow television cable companies to place cable facilities in their buildings effected a taking even though the facilities occupied only one and one-half cubic feet of space); Lucas v. S. Carolina Coastal Council, 505 U.S. 1003, 112 S.Ct. 2886, 120 L.Ed.2d 798 (1992) (holding that State regulation barring all construction on barrier island residential lots constitutes taking requiring compensation unless common-law principles would have prohibited all habitable or productive improvements on lots); United States v. Causby, 328 U.S. 256, 66 S.Ct. 1062, 90 L.Ed. 1206 (1946) (noise from airplane glide path projecting onto land is in the nature of an easement, requiring compensation under Fifth Amendment); Gulf Power Co. v. U.S., 998 F. Supp. 1386, 1394-95 (N.D. Dist. Fla. 1998), aff'd, 187 F.3d 1324 (11th Cir. 1999) (where the government forced utilities to grant cable companies access to their power lines); Kaiser Aetna v. United States, 444 U.S. 164, 100 S.Ct. 383, 62

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L.Ed.2d 332 (1979) (holding that government's requirement of public access to marina joined to bay due to private development of inland lagoon constituted exercise of eminent-domain power, requiring payment of compensation); Nollan v. California Coastal Comm'n, 483 U.S. 825, 107 S.Ct. 3141, 97 L.Ed.2d 677 (1987) (holding that condition of permit to construct residence requiring grant of public easement across beach-front section of private property constituted taking).

It is well established in cases involving government regulatory dedication exactions that to survive judicial scrutiny under the Takings Clause, the dedication exaction must substantially advance a legitimate state interest. Agins v. City of Tiburon, 447 U.S. 255, 260, 100 S.Ct. 2138, 2141, 65 L.Ed.2d 106, 112 (1980). In order to do so, there must be an "essential nexus" between the required dedication and the interest the government seeks to protect. Nollan v. California Coastal Comm'n, 483 U.S. 825, 837, 107 S.Ct. 3141, 3148-3149, 97 L.Ed.2d 677, 689 (1987). Additionally, where an "essential nexus" exists, the Takings Clause requires that there be "rough proportionality" between the exaction and the proposed development. Specifically, the government "must make some sort of individualized determination that the required dedication is related both in nature and extent to the impact of the proposed development." Dolan v. City of Tigard, 512 U.S. 374, 391, 114 S.Ct. 2309, 2319-20, 129 L.Ed.2d 304 (1994).

The New Jersey Supreme Court repeated its mandate "for a case-by-case consideration in respect of the appropriate level of accommodation" in Raleigh Ave. Beach Ass'n v. Atlantis Beach Club, Inc., supra, 185 N.J. at 55. After quoting extensively from its earlier decision in Matthews, the Court then "turn[ed] . . . to an application of the Matthews factors to the circumstances of [the] case" before it in order to make a "case-by-case" determination. The Raleigh court looked at the following Matthews factors:

- *"Location of the dry sand area in relation to the foreshore."*
- *"[E]xtent and availability of publicly-owned upland sand area. Here the court looked at proximity of available public beaches and the public's access thereto".*
- *"[N]ature and extent of the public demand"*
- *"[U]sage of the upland sand land by the owner".*

In examining the location of the dry sand area in relation to the foreshore, the Court considered the nature and extent of development in the area and convenience to pedestrians. The Court paid most attention to the usage of the upland sand by the land owner. In Raleigh, the beach had historically been open to the public, and had been readily available for perpendicular access as well as for unlimited use of the dry sand beach. The Court found it unreasonable to deny access "after years of public access and use".

In sum, the Public Trust Doctrine clearly requires an individualized, case-by-case determination of the specific circumstances of each case to appropriately balance the public's rights under the Public Trust Doctrine with other considerations such as private property rights. The Court mandated consideration of the demand for public access in a particular area; the character and nature of the development in the area; the nature and extent of access traditionally afforded in the area; the availability of public beaches and their adequacy to meet demand.

**Comments Specific to the Draft Proposal**

NJBA disagrees with some statutory recommendations provided in the "Legislative and regulatory statement of findings and policy" section. Specifically, the proposal suggests that Public access findings and policy guidance should include language that establishes that:

> "It is further the policy of the state and Department to reasonably require the regulated community to provide onsite public access or offsite public access in lieu of, in a manner consistent with the Public Trust Doctrine." (Page 2.)

While NJBA appreciates that the DEP should be "reasonable" in its requirements for public access when reviewing development applications, it remains inappropriate to require the regulated community to provide either onsite or offsite public access across the board. The language should be revised to require consideration of the particular circumstances of the subject parcel, such as proximity to the public beaches or public access points, proximity to existing public access points, the nature and extent of surrounding development, and historical public usage of privately owned upland beach areas, rather than mandating on or off-site public access. Raleigh and Matthews require case-by-case, circumstance specific determinations that consider in all cases the use, type of access, whether it would be reasonable, feasible or practicable to provide public access at the particular site in question.

Moreover, NJBA is opposed to efforts to legislate for requirements of visual access, which are beyond the scope of the Public Trust Doctrine.

In terms of requiring "offsite public access in lieu of" on-site public access, NJBA's position is that under Federal case law, the State cannot mandate any alternative public access where on-site public access is not feasible or practicable.

Similarly, the proposal suggests the 2012 Coastal Management Rules' goals relating to public access should be "translated and incorporated into legislative findings and policy guidance within statute". For the reasons discussed above, NJBA strongly disagrees with the inclusion, "translation" or "incorporation" of the following prior goal:

> "New development shall provide opportunity for public access to tidal waterways and their shores on or offsite;" (Page 2.)

In NJBA's view, the goals listed in the current Coastal Zone Management Rules are appropriately worded in that they balance the various interests affected by the public access requirements, and therefore should be retained:

Additionally, public access goal no. 4 (Page 2) is overly broad in the context of public access on or across upland private property. Private property owners should not be required to provide for public amenities to accommodate fishing or other uses of tidal waters. NJBA's position is that such public amenities are governmental, not private landowner, obligations.

"The New Jersey Coastal Management Program goals and supplemental policies are:
...
3. Meaningful public access to and use of tidal waterways and their shores.
i. Preserve public trust rights to tidal waterways and their shores;
ii. Preserve and enhance views of the coastal landscape to enrich aesthetic and cultural values and vital communities;
iii. Conserve and increase safe, environmentally sound, and meaningful public access from both the land and water to the tidal waterways and their shores for recreation and aesthetic experiences;
iv. Enhance public access by promoting adequate affordable public facilities and services;
v. Balance diverse uses of tidal waterways and their shores; and
vi. Protect, enhance and promote waterfront parks;" (N.J.A.C. 7:7E-1.1(c)).

It is unclear why the following Policy Recommendations would be needed, given the Public Trust Doctrine is the underlying premise and basis for DEP's previously promulgated public access rules:

> "The DEP should have a general legislative grant of authority to make rules and regulations to maintain and promote public access through, and beyond the permitting context;"
> "Statute should use the public's PTD rights (as defined by bill) as trigger for DEP public access requirements, not necessarily development permits." (Page 3.)

NJBA remains concerned that these recommendations would empower the DEP to implement the Public Trust Doctrine in too broad a spectrum, whereas the permitting context allows applicants to have a discourse with the Department on the particular circumstances underlying the site or project. Further, the Coastal Zone Management Rules at N.JAC. 7:7-1.5 "Definitions"

define the "Public Trust Doctrine" and highlight the relevance and authority for the Department to ensure public access:

> "Public Trust Doctrine" means a common law principle that recognizes that the public has particular inalienable rights to certain natural resources. These resources include, but are not limited to, tidal waterways, the underlying submerged lands and the shore waterward of the mean high water line, whether owned by a public, quasi-public or private entity. In the absence of a grant from the State, submerged lands under tidal waterways and the shore of tidal waterways waterward of the mean high water line are owned by the State. Regardless of the ownership of these resources, under the Public Trust Doctrine, **the public has rights of access to and use of these resources, as well as a reasonable area of shoreline landward of the mean high water line.** Under the Public Trust Doctrine, the State is the trustee of these publicly owned resources and public rights for the common benefit and use of all people without discrimination. As trustee, the State has a fiduciary obligation to ensure that its ownership, regulation and protection of these properties and rights will safeguard them for the enjoyment of present and future generations. The public rights to use these resources extend both to traditional activities such as navigation and fishing, but also to recreational uses such as swimming, sunbathing, fishing, surfing, sport diving, bird watching, walking and boating. The specific rights recognized under the Public Trust Doctrine, a common law principle, continue to develop through individual court decisions. See, for example, Arnold v. Mundy, 6 N.J.L. 1 (1821), Borough of Neptune v. Borough of Avon-by-the-Sea, 61 N.J. 296 (1972), Hyland v. Borough of Allenhurst, 78 N.J. 190 (1978); Matthews v. Bay Head Improvement Association, 95 N.J. 306 (1984); Slocum v. Borough of Belmar, 238 N.J.Super. 179 (Law Div. 1989); National Ass'n of Homebuilders v. State, Dept. of Envt'l 64 F.Supp.2d 354 (D.N.J. 1999); Raleigh Ave. Beach Ass'n v. Atlantis Beach Club, Inc., 185 N.J. 40 (2005); Illinois Central R.R. v. Illinois, 146 U.S. 387 (1892); Phillips Petroleum Co. v. Mississippi, 484 U.S. 469 (1988); Karam v. NJDEP, 308 N.J. Super. 225, 240 (App. Div. 1998), aff'd, 157 N.J. 187 (1999), cert. denied, 528 U.S. 814 (1999). (Emphasis added.)

NJBA disagrees with all Policy Recommendations and all other provisions of the Draft Proposal that speak to an absolute requirement for public access on projects or development applications. Such a legislative mandate would contravene the Public Trust Doctrine for the reasons detailed at length above.

NJBA disagrees with the following Policy Recommendation: "There should be no delegation of state authority to municipalities or counties ..." (Page 3). NJBA remains supportive of the Department's rulemaking to encourage municipalities to develop Municipal Public Access Plans. See N.J.A.C. 7:7E-16.9(d). It is our view that the municipality is in the best position to identify and determine public access points that are suitable for the particular needs of their community.

However, NJBA recommends that any impediments to the development of the Plans be identified. For example, there needs to be more financial sources for municipalities to help offset the high costs involved for the comprehensive preparation necessary for the Plans. We have encouraged the Department to ensure state funding be made available. The regulatory process to prepare a Plan should be more streamlined in that the municipalities could use existing resources and information available at hand (i.e. existing tax maps, zoning maps, and aerials) to identify public accessways. Further, NJBA has encouraged that the development of the Plans should be coordinated with the municipal master planning process. There are well-established and familiar processes in place at the local level to identify the best suited locations for meaningful public access in the municipality.

It is unclear as to what "standards" are contemplated in the following Policy Recommendation: "Statute should establish standards concerning the sufficiency of proposed public access, particularly as it relates to access required to be provided through the state's regulatory processes." (Page 4). To the extent the intent of this statement is to reflect that any legislative codification of the Public Trust Doctrine should be a broadly based restatement of the established principles of the Public Trust Doctrine, NJBA agrees. However, again, NJBA reiterates that the factors and approach contemplated by Raleigh and Matthews should be followed. If the intent is to call for legislation that imposes specific standards, criteria and requirements for public access, we strongly disagree. Such action would be in direct contravention of the Public Trust Doctrine's requirement for individualized, case-by-case determinations of whether public access is required, and is better suited to a regulatory process.

The Draft Proposal discusses parking in relation to public access:

- "Parking is a necessary component of public access, and should be ... and accounted for in the permitting context affecting new development, redevelopment or substantial changes to existing uses"
- "Statute should require the development of a parking formula, but ultimately such a formula should be developed through DEP regulations" (Page 4).

Similar to the public access discussion above, NJBA objects to the imposition, particularly in legislation, of directing DEP to undertake specific parking requirements, including federal "public use" parking requirements, or defining a "formula" across the board. Instead, Raleigh and Matthews criteria should be followed in that case-by-case, site specific determinations must be undertaken to evaluate parking in relation to the proposed development, i.e. whether there is even any need or demand for on or off-street parking, or whether the existing parking facilities can accommodate the need or demand. Further, NJBA emphasizes that imposing parking

requirements would clearly deter development and redevelopment activities in those communities.

NJBA is opposed to a legislative mandate prohibiting abandonment or extinguishment of public access easements or public rights across private property. Such legislative action would be an infringement on bargained for property rights in that public access easements may expressly provide for extinguishment based on changed conditions or other circumstances, and such action would negatively affect the balance of public access rights and private property rights implemented by the courts under the Public Trust Doctrine, and would implicate State and federal constitutional takings principles. Moreover, such legislation would be inappropriate under the Public Trust Doctrine line of cases, as changed conditions over time may justify extinguishment of public access easements or public rights across private property.

NJBA strongly objects to the recommendation to "allow the public to have 24/7 access to waterfront areas for appropriate uses" (Page 6), as it would result in significant problems and concerns for private property owners and developers, municipalities and local law enforcement. This proposal raises a host of concerns and issues, including nuisance and noise issues, potential liability and safety concerns, and directly affects private property rights. Moreover, NJBA points out that the proposal has been addressed by the courts (See Avalon v. NJDEP, 403 N.J. Super. 590 (App. Div. 2008) cert. den. 199 N.J. 133 (2009) (holding that the Public Trust Doctrine does not provide any basis for a DEP rule that preempts the statutory authority of municipalities to regulated municipally-owned beaches, including deciding when they shall be open to the public), and has been previously vetted and extensively discussed, including with the DEP, thus it is unclear why this proposal is being contemplated again. While we question, in light of this history, whether such a condition would be appropriate in certain instances in the context of municipally owned lands, a legislative mandate for 24/7 access on and across private property clearly would be an overly broad, inappropriate extension of the Public Trust Doctrine.

NJBA looks forward to further discussing the above concerns with the Task Force.

**HUDSON RIVER WATERFRONT CONSERVANCY OF NJ, INC.**

**P. O. BOX 6217**
**HOBOKEN, NJ 0703**

# COMMENTS TO NJ SENATE BILL S-2490
## August 18, 2016

The following are comments to the NJ Senate Bill S-2490 providing for protection of public's rights under the Public Trust Doctrine. The comments are specifically for the northern NJ urban waterfront and the existing Hudson River Waterfront Walkway which was established in 1988.

Our comments highlighted red font are suggested changes to the bill. Comments in brackets are not intended for enactment.

1.a The public has longstanding and inviolable rights under the public trust doctrine to use and enjoy the State's tidal waters and adjacent shorelines ***including pier and docks,*** for recreational uses, including, but not limited to, bathing, swimming, fishing, and other shore-related activities ***that includes lateral travel***;

1.b. **[Add to this section,]** ***Rip rap, bulk heads, soil retaining structures and unnaturally occurring straight shore line shall be rebuttable presumptive evidence of fill activities on previously existing tidal wetlands for a distance of at least 50 feet from the current shore line.***

***[See application of this in DEP legal action and settlement against IMO RIVER LOOKOUT ASSOCIATES LLC relating to LeJardin Restaurant, Edgewater, NJ illegal filling-in of waterfront.]***

1.f. Public access includes visual and physical access to, and use of, tidal waters and adjacent shorelines ***including piers and docks***, sufficient perpendicular access ***and lateral movement*** from upland areas to tidal waters and adjacent shorelines, and the necessary support amenities to facilitate public access for all, including public parking and restrooms.

2. (New section) a. The Department of Environmental Protection shall ensure that any approval, permit, administrative order, or consent decree issued, or other action taken, by the department pursuant to the "Coastal Area Facility Review Act," P.L.1973, c.185 (C.13:19-1 et seq.), R.S.12:5-3 ***including The Waterfront Development Act, NJAC 7:7E and the Hudson River Waterfront Walkway, NJAC 7:7E-3.48***, "The Wetlands Act of 1970," P.L.1970, c.272 (C.13:9A-1

et seq.), the "Flood Hazard Area Control Act," P.L.1962, c.19 (C.58:16A-50 et seq.), the "Hackensack Meadowlands Reclamation and Development Act," P.L.1968, c.404 (C.13:17-1 et seq.), or the State's implementation of the "Coastal Zone Management Act of 1972," 16 U.S.C. s.1451 et seq., or any other law, is consistent with the public trust doctrine.

3. (New section) a. The Department of Environmental Protection shall not adopt any rule or regulation pursuant to the "Coastal Area Facility Review Act," P.L.1973, c.185 (C.13:19-1 et seq.), R.S.12:5-3 ***including The Waterfront Development Act, NJAC 7:7E and the Hudson River Waterfront Walkway, NJAC 7:7E-3.48***, "The Wetlands Act of 1970," P.L.1970, c.272 (C.13:9A-1 et seq.), the "Flood Hazard Area Control Act," P.L.1962, c.19 (C.58:16A-50 et seq.), the "Hackensack Meadowlands Reclamation and Development Act," P.L.1968, c.404 (C.13:17-1 et seq.), or the State's implementation of the "Coastal Zone Management Act of 1972," 16 U.S.C. s.1451 et seq., or any other law, that mandates on-site public access to tidal waters or adjacent shorelines as a condition of any approval, permit, administrative order, or consent decree at any existing structure or facility that requires exclusion of the public for security reasons as designated by the New Jersey Office of Homeland Security and Preparedness.

4. (New section) For any application for a permit or other approval to be issued by the Department of Environmental Protection pursuant to the "Coastal Area Facility Review Act," P.L.1973, c.185 (C.13:19-1 et seq.), R.S.12:5-3 ***including The Waterfront Development Act, NJAC 7:7E and the Hudson River Waterfront Walkway, NJAC 7:7E-3.48***, "The Wetlands Act of 1970," P.L.1970, c.272 (C.13:9A-1 et seq.), the "Flood Hazard Area Control Act," P.L.1962, c.19 (C.58:16A-50 et seq.), the "Hackensack Meadowlands Reclamation and Development Act," P.L.1968, c.404 (C.13:17-1 et seq.), or the State's implementation of the "Coastal Zone Management Act of 1972," 16 U.S.C. s.1451 et seq., or any other law, if the application provides for a change in the existing footprint of a structure, or a change in use of the property, the department shall review the existing public access provided to tidal waters and adjacent shorelines at the property and shall require as a condition of the permit or other approval that additional public access to the tidal waters and adjacent shorelines consistent with the public trust doctrine be provided, in accordance with the scale of the changes to the footprint or use, the demand for public access, and any adopted municipal public access plan or public access element of a municipal master plan. ***[This not consistent with the recommendations of the Task Force which limited it to a change of use or change of footprint of an existing structure only.]***

6 **[At the end of section 19 (b((17),** ***suggest an additional requirement that planning boards must set forth plans and.or methods and timetables to obtain access to tidal wetlands within their jurisdiction that have heretofore been blocked or made unavailable by adjoining private property owners.]***

*[ A set of provisions should be added to the effect that:*

*i. The DEP and Department of [Commerce][State] in consultation with the Hudson River Waterfront Conservancy and County and local municipalities shall assess the value of tidal wetlands which have been made unavailable to the general public by adjoining private property owners.*

*ii. Private property owners shall pay compensation to the State of New Jersey (as determined pursuant to Paragraph 1) on an annual basis for the value of the tidal wetlands which they use or occupy to the exclusion of the general public or which they have made unavailable to the general public. [Such compensation shall be retroactive to 1986.]*

*iii. Any private property owner which has heretofore created a walkway along tidal wetlands which has been deemed accepted by the Hudon River Waterfront Conservancy and DEP shall be exempt from or deemed to have satisfied such requirement of Paragraph 2 .If within 2 years of enactment of this legislation, a private property owner subject to Paragraph 2, creates a walkway in conformity with the DEP and Hudson River Waterfront Conservancy requirements, then compensation referred to in Paragraph 2 shall be deemed satisfied in full by such creation or waived.*

*iv. The DEP, County or Municipality shall have eminent domain powers to obtain a right of way over tidal wetlands. The compensation determined pursuant to Paragraph 1 shall be create a strong presumption of the valuation to be determined pursuant to such eminent domain proceeding. The DEP, County or Municipality may waive the payment of such compensation and receive an off-set credit for the same on a non-discounted payment over a period of 100 years against payment pursuant to such eminent domain proceeding.]*

**END OF COMMENTS**

**Hudson River Waterfront Conservancy**
HRWC Hudson River Waterfront Conservancy
P.O. Box 6217
Hoboken, NJ 07030
www.hudsonriverwaterfront.org
**Email**: info@hudsonriverwaterfront.org

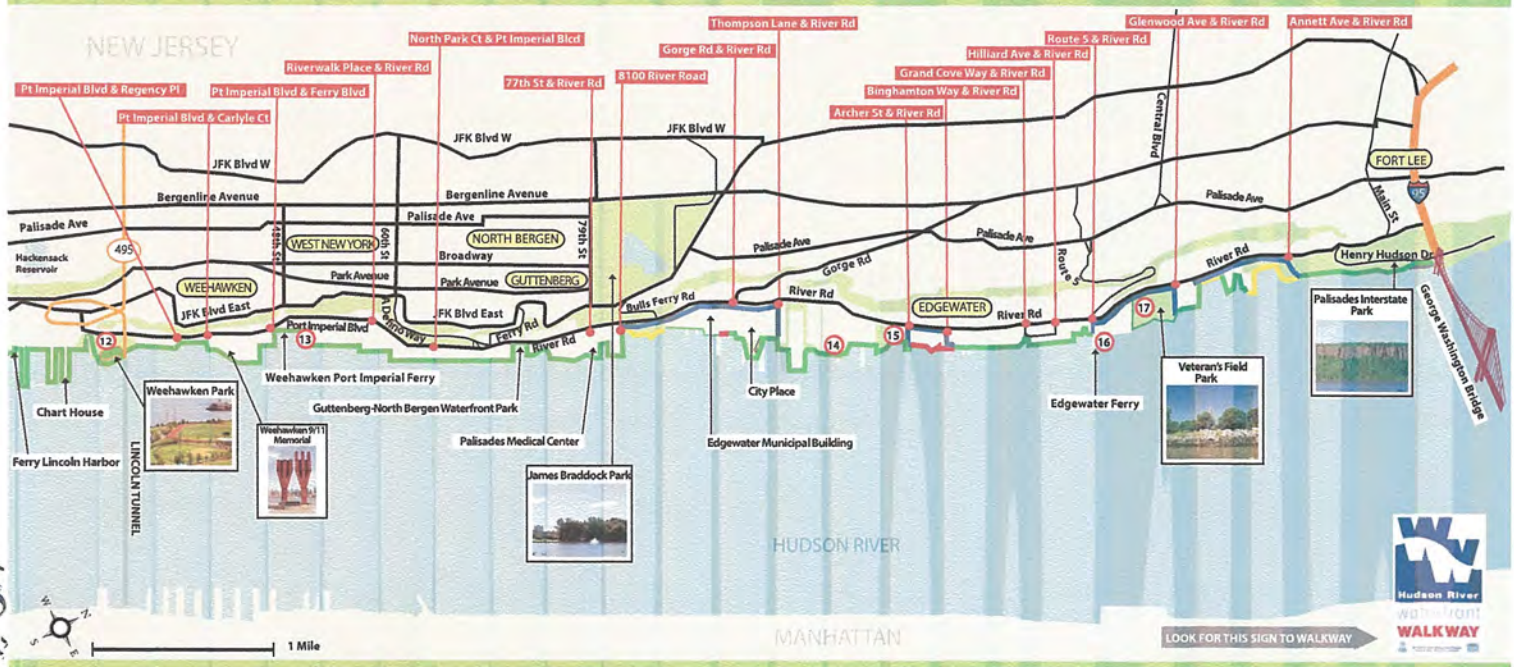
**MAP LEGEND**

- Walkway Completed
- Walkway under construction
- Walkway Planned
- Alternate Route
- Industrial Waterfront (No Access)
- Points of Access

See www.hudsonriverwaterfront.org for locations of free parking for Walkway visitors and any nearby bicycle racks.

**RESTROOMS**

12 Weehawken Park
13 Port Imperial Ferry Terminal
14 Edgewater Commons Shopping Center
15 Mitsuwa Shopping Center
16 Edgewater Ferry Terminal
17 Edgewater Veterans Park

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HUDSON RIVER
WATERFRONT CONSERVANCY
**www.hudsonriverwaterfront.org**

# WALKWAY MAP
# HUDSON RIVER
# NEW JERSEY

## Hudson River Waterfront Conservancy

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**MAP LEGEND**

- Walkway Completed
- Walkway under construction
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- Industrial Waterfront (No Access)
- Points of Access

See www.hudsonriverwaterfront.org for locations of free parking for Walkway visitors and any nearby bicycle racks.

**RESTROOMS**

1. Dennis P Collins Park
2. Bayonne Shopping Center
3. Liberty State Park
4. Central Railroad Terminal of New Jersey
5. Hyatt Hotel
6. Harborside Financial Center
7. Newport Center
8. Hoboken Train Terminal
9. Pier A
10. Pier C
11. Maxwell Center Park


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Map design by Nathalie Breakstone

**TESTIMONY**
**BEFORE THE SENATE ENVIRONMENT & ENERGY COMMITTEE &**
**THE ASSEMBLY ENVIRONMENT AND SOLID WASTE COMMITTEE**

**Thursday, August 18, 2016**

**Senate Bill S311**
**Assembly Bill A2954**
**Increase Shore Protection Fund from $25 million to $50 million annually**

**Thomas O. Herrington, Ph.D.**
**Research Professor of Coastal Engineering**
**Davidson Laboratory**
**Stevens Institute of Technology**
**Hoboken, N.J. 07030**

Thank you for the opportunity to testify today before this joint committee hearing of Senate Bill S311 and Assembly Bill A2954 that propose to increase the amount of funds annually credited to the Shore Protection Fund to $50 million dollars. This is an extremely important decision that has the potential to provide comprehensive shore protection against future storms to the State of New Jersey in the coming century.

A little less than four years ago now, Superstorm Sandy tested every level of our State's preparedness and response capabilities to an extreme coastal natural disaster – one more severe than any that have occurred in the past. Due to the foresight of the legislature, in 1992, P.L. 1992, c. 148 was enacted to establish a stable Shore Protection Fund for the restoration and maintenance of the shore. Monies from the fund have been wisely used to match federal dollars, at 35 state dollars for every 65 dollars invested by the federal government, for the construction of large-scale shore protection projects designed by the US Army Corps of Engineers to protect our coastal communities from coastal storm damage. This single law provided many of our coastal communities with the protection needed to prevent damage from Sandy's ocean storm surge and large waves. Research conducted by the Coastal Protection Technical Assistance Service, created by P.L. 1993 c. 176 and funded at 2% of the Shore Protection Fund annually, has unequivocally determined that communities with federally designed shore protection



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projects, constructed with State and Federal funds, prevented the catastrophic damage along the oceanfront that was observed in communities that did not have federal shore protection projects in place. This conclusion has been reached by many other researchers, including the US Army Corps of Engineers and FEMA in their post Sandy assessment reports.

In fact, the Corps' report actually determined that the shore protection project in Monmouth County provided significant storm damage reduction benefits for conditions well beyond which it was designed to prevent.

Unfortunately, when Superstorm Sandy made landfall in New Jersey in late October 2012, only 49% of our 98 miles of developed coast was protected by engineered shore protection projects. The majority of the remaining 51% of the developed coast suffered extreme damage due to ocean surge and wave attack that propagated unhindered across the shoreline.

The US Army Corps in partnership with the State have shore protection projects developed and ready for construction in all of our unprotected communities. There may be some debate over whether another Sandy-like storm will impact our coast again but we do know that in the last century large coastal storms have frequently caused damage to our oceanfront communities. The Sandy Supplemental Bill passed by congress in 2013 provides the incentive for the US Army Corps to swiftly complete all of the existing unconstructed shore protection projects in New Jersey. This is an opportunity that New Jersey simply cannot afford to miss; but to do this in a timely manner will require a larger annual investment in shore protection by the state.

Although the Shore Protection Fund has been primarily used to reduce potential storm damage along the oceanfront, it has also been used to construct smaller restoration and protection projects along our coastal bays. Superstorm Sandy, and very recently, winter storm Jonas revealed that our bayshore communities are also significantly vulnerable to coastal storm damage. We need to begin to think of our coastal lands as a single system consisting of ocean beaches, inlets, bays, and marshes. We need to pursue a holistic management strategy that looks to ensure that each part of the system is maintained and managed in a way that enhances the environment, our resiliency to storm events, and the tourism economy.



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Marshes provide a natural buffer to storm surge but our marshes are disappearing due to erosion from boat wakes, sea level rise, and construction along our bay shorelines. Oyster reefs that were once prolific in the bays provide a similar buffer to surge but no longer exist in the bays. Research we are conducting through the Coastal Protection Technical Assistance Service in partnership with the New Jersey DEP under a Department of Interior grant and with The Nature Conservancy through funding from NOAA is beginning to develop the knowledge and tools we need to effectively restore the protective capacity of our marshes and bay shorelines.

This past February, I had the privilege of meeting with Dr. Jose Sanchez, Director of the US Army Corps Coastal and Hydraulics Laboratory, at the Corps Headquarters in Washington DC. We discussed the Corps' initiative to begin to include natural and nature-based features in shore protection projects. This federal initiative is an outcome of the Corps' post-Sandy North Atlantic Coast Comprehensive Study, which identifies storm damage reduction along the coastal bays of New Jersey as a priority study area for the Corps. This federal initiative provides another opportunity for New Jersey to significantly leverage state dollars to provide much needed storm damage protection to our bayshore communities.

For the reasons I have outlined, namely: (1) the ability of the State to swiftly provide urgently needed coastal protection to all of our oceanfront communities, and (2) the opportunity to partner with the federal government to develop and construct bayshore storm damage reduction projects; I strongly urge you to support Senate Bill S311 and Assembly Bill A2954. The added investment in Shore Protection will continue to allow NJ to significantly leverage state dollars to obtain federal investment in protecting New Jersey's coastal resources and infrastructure. Given the significant economic damage caused by Superstorm Sandy, estimated at over $35 billion dollars, and the value of our coastal tourism economy at approximately $20 billion dollars annually, I think you will agree with me that a $50 million dollar annual investment to restore, protect, and sustain our natural coastal resources is a very wise investment.



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I would like to leave you with a final thought on an ancillary benefit that the Shore Protection Fund has generated. A portion of the 2% of the Fund provided to the Coastal Protection Technical Assistance Services is used to fulfill a commitment to the legislature to educate the next generation of coastal scientist and engineers. Annually, a quarter of the funding received by the Service is used to help graduate students defray the cost of higher education by supporting them to conduct research in support of the goals of the Shore Protection Fund. Since 1993, over 50 Masters and PhD level students have been supported by the Fund, and have graduated with advanced degrees in Coastal Engineering. Many of these graduates now work for consulting engineering firms and federal agencies engaged in NJ coastal projects. In fact, a number of graduates are working for the NY or Philadelphia District Offices of the US Army Corps of Engineers on the very projects that the Fund is used to help design and construct. Stevens is one of only a handful of coastal engineering programs left in the United States. The small annual investment that the Fund has provided in higher education has returned exponentially more benefits in terms of intellectual capital back to New Jersey and the Nation.

Over the past 20 years, the ever increasing cost of higher education has significantly reduced the number of students that can be supported through the Shore Protection Fund. Increasing the amount of funds dedicated to Shore Protection will also allow us to sustain the Fund's commitment to educate the next generation of coastal engineers and scientists. An opportunity everyone in the legislature should be very proud to continue to provide.

I would like to thank Senator Smith and Assemblyman McKeon for the opportunity to testify before this joint committee hearing today. I have submitted a written copy of my remarks for your use and would be happy to answer any questions you may have.

Thomas O. Herrington

Director, NJ Coastal Protection
Technical Assistance Service



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August 18, 2016

The Hon. Bob Smith
Chair, Environment & Energy Committee
Senator, District 17
216 Stelton Road, Suite E-5
Piscataway, NJ 08854

The Hon. Christopher "Kip" Bateman
Senator, District 16
36 East Main Street
Somerville, NJ 08876

Dear Senators:

I provide these comments regarding S-2490 on behalf of Hackensack Riverkeeper and NY/NJ Baykeeper.

Legal and Procedural Background

Our organizations have a demonstrated interest in this subject matter, as we successfully challenged the Department of Environmental Protection's (DEP) 2012 public access rules as *ultra vires*. In December 2015, the New Jersey Superior Court, Appellate Division struck down the DEP's public access rules in their entirety, while recognizing that CAFRA's permitting provisions might implicitly authorize limited portions of the Rules. Hackensack Riverkeeper, Inc. v. N.J. Dep't of Envtl. Prot., 443 N.J.Super. 293, 314 (App. Div. 2015).

In response to the Appellate Division's ruling, the New Jersey Legislature passed and Governor Chris Christie signed P.L.2015, c. 260 – legislation intended to confirm the DEP's authority to require public access as a condition of granting Coastal Area Facility Review Act ("CAFRA") and Waterfront Development Act ("WDA") permits. This legislation was important to clarify DEP's continuing ability to require public access through its permitting authority. However, P.L.2015, c. 260 did not address the fact that DEP still needs statutory authority and guidance to create a comprehensive public access regulatory scheme.

In February 2016, the DEP filed a motion requesting that the Appellate Division reconsider its opinion, based on DEP's argument that the legislative changes in P.L.2015, c. 260 had retroactively authorized its 2012 rules. The Court promptly and clearly denied the DEP's motion for reconsideration. In June 2016, the New Jersey Supreme Court denied the DEP's petition for certification and lifted a stay of the opinion previously granted by the Appellate

Division. The Supreme Court's final disposition of the case means that the issue of whether DEP had authority to promulgate its 2012 regulations has been fully and completely litigated. As such, the 2012 rules are no longer in effect, and the Legislature now has the opportunity to provide clear standards and guidance to DEP regarding public access.

Support and Suggestions for S-2490

Our organizations support the Senators' efforts to craft a bill that outlines the DEP's authority and duty to make all tidal waters and adjacent shorelines available to the public to the greatest extent possible, protect existing access, provide public access in all communities equitably, maximize different experiences of public access, and ensure that expenditure of public money maximizes public access. *See* Section 1(e). We believe that the bill could be improved with some fine-tuning and incorporation of additional clarity, detail, and guidance.

Specifically, Section 4 includes language that might create an unworkable process for DEP. Section 4 provides that DEP "shall require as a condition of the permit or other approval that additional public access to the tidal waters and adjacent shorelines consistent with the public trust doctrine be provided, in accordance with the scale of the changes to the footprint or use, the demand for public access, and any adopted municipal public access plan or public access element of a municipal master plan." Several questions arise from this language: How would DEP determine the "demand for public access?" What if a property owner is willing to provide specific onsite access that is not included in a municipal public access plan – would DEP not be able to require that access? How exactly should "the scale of the changes to the footprint or use" determine how much or what type of access is appropriate? The answers to these questions could significantly affect the quality and quantity of public access required by DEP through its permitting process. As such, we recommend that the bill be revised to be more specific and to provide additional guidance to DEP in this regard.

Furthermore, providing DEP with guidance for requiring ***offsite*** public access remains of critical importance, and we continue to support legislation that focuses on expanding quality public access in a way that provides public access in all communities equitably.

Respectfully submitted,

Andrea Leshak
Staff Attorney
Hackensack Riverkeeper
NY/NJ Baykeeper

GREATER ATLANTIC CITY CHAMBER

August 15, 2016

Senator Bob Smith, Chair
Senate Energy and Environment Committee
c/o Judith Horowitz
Office of Legislative Services
Trenton, NJ

The Honorable Joseph Kyrillos
10 Highway 35, Second floor
Red Bank, NJ 07701

The Honorable Jeff Van Drew
211 South Main Street
Cape May Court House, NJ 08210

Dear Senators Smith, Kyrillos and Van Drew:

Re: Senate Bill S311

On behalf of the members of the Greater Atlantic City Chamber, we wish to formally advise you of our support for Senate Bill S311. This bill increases the amount credited annually to the Shore Protection fund to $50 million. As you know, the South Jersey coastal region economy relies heavily on its beaches and waterways as one of its primary tourism attractions. Since Superstorm Sandy, shore protection has been underfunded and will not be able to meet the increasing costs of beach protection projects. Beach quality is a major economic driver of New Jersey's tourism economy and requires critical replenishment and protection. Under the cost-sharing partnership, the federal government provides 65% of the costs of beach replenishment and is matched with the state's 35%.

New Jersey must be prepared to meet its share of future costs to protect arrangement. Thank you for your consideration in this important matter.

Sincerely,

Robert K. Marshall,

Director of Advocacy and Legislative Affairs

Cc: Governor's office, Senate President Sweeney, Senator Jim Whelan, Assemblyman Chris Brown, Assemblyman Vincent Mazzeo

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# State of New Jersey

DEPARTMENT OF AGRICULTURE
HEALTH / AGRICULTURE BUILDING
PO BOX 330
TRENTON NJ 08625-0330

CHRIS CHRISTIE
*Governor*

KIM GUADAGNO
*Lt. Governor*

DOUGLAS H. FISHER
*Secretary*



August 12, 2016

The Honorable Bob Smith
Senator, Legislative District 17
216 Stelton Road, Suite E-5
Piscataway, NJ 08854

Dear Chairman Smith:

I am writing in response to your recent invitation to attend the Senate Environment and Energy Committee meeting on August 18, 2016. Although I will be unable to attend the meeting, I do wish to provide you and the rest of your committee with a brief update on the status of the adoption of the soil restoration standards pursuant to P.L. 2010, c.113.

The State Soil Conservation Committee works with a multi-disciplinary subcommittee of stakeholders, program staff and members of academia to develop and modify standards that include comprehensive methods to address soil compaction on construction sites. In addition to the standards proposed in 2012 and subsequently adopted, a new proposal to address Topsoil and Land Grading Standards was recently forwarded to the Office of Administrative Law for publication in the New Jersey Register. This proposal will be the subject of a sixty day comment period, and the State Soil Conservation Committee looks forward to reviewing the comments that are received.

On behalf of the State Soil Conservation Committee, I would like to acknowledge the current and future work of our Soil Conservation Districts and our shared goal of protecting the waterways and quality of water in the Garden State.

Sincerely,

Douglas H. Fisher



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MARINE TRADES
ASSOCIATION OF NEW JERSEY

August 24th, 2016

cc Tim Dillingham
Alison
Judy Horowitz
F. Y. I
Bob Smith
Folk Beach Access 6/11

The Honorable Bob Smith
State Senator
216 Stelton Road, Suite E-5
Piscataway, NJ 08854

The Honorable John F. McKeon
State Assemblyman
250 Main Street
Madison, NJ 07940

Dear Senator Smith and Assemblyman McKeon:

I am responding to your request to submit our comments in writing regarding Senate Bill 2490. As stated in my testimony at the hearing held last week, our organization has been directly involved in working on this issue for over a decade. In addition to the many meetings and hearings that have been held on this subject, we also participated in the Public Access Task Force that Senator Smith appointed. It is important to emphasize that access at marinas was never in dispute during any of the meetings of the Task Force. The report listed the 2012 rule on marinas as a consent position of all parties to maintain the status quo of the rule. This is listed as Issue #9: Commercial Marinas on page 21 of the report. This is a clear consent item as there were no discussion points or issues outlined in the final report.

Our organization has carefully reviewed this legislation and we have many concerns with the language of the bill and its implications for the recreational boating industry. This legislation does not acknowledge marinas as a consent item or exempt marinas from needing to provide additional and possibly unlimited access as a condition of a permit. There are a number of other exemptions written into this legislation that were included in the Task Force Report but not for marinas. The proposed legislation is vague and does not state how the rules will be implemented or how this will impact the 2012 adopted rules leaving the determination and interpretation up to the DEP. The DEP has already stated in their testimony that this legislation will require numerous regulatory changes that could lead to unlimited access at marinas which raises many serious concerns and challenges for our industry.

We believe that the issues in dispute surrounding public access have nothing to do with marinas and the access that they already provide. Marinas are unique and should not be compared to other methods of waterfront access. In addition to providing a gateway to the waterfront, they provide slips, public boat-ramps, fuel, fishing supplies, boat maintenance and service, restaurants and more. Access to the water

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and access to the services that marinas offer are provided to the general public. Members of the general public rent slips, launch at marina boat ramps, utilize boat repair services, purchase fuel and shop for needed boating supplies. Marinas provide the important boating infrastructure and services that allow people seeking recreation on or near the water to safely begin, enjoy and end their excursions. The very nature of their business operations ensures that the public has use of public trust waters. It is essential to their livelihood. Without these businesses, there would be no boating on any of our waterways.

In order to operate, however, marinas must be able to reasonably control and manage their property. The care, custody and control of the marina, vessels, slip-holder property, safety and attendant infrastructure is the responsibility of the marina owner and boat owner. These are small businesses on a relatively small footprint in most places throughout the state. Issues relating to 24/7 unlimited access, liability, safety or restrictions on expanding facilities have the potential to be economically disastrous to an already shrinking and struggling industry. We outlined a number of these issues in further detail in a memo to the Task Force that is included with this letter.

In 2012, the DEP rules were amended to take into consideration the nature of the family run marina business, the access already provided, and the need for a reasonable and realistic permitting process which does not unduly burden already distressed marina owners when essential maintenance and upgrades become necessary. The 2012 changes to the rules for marinas were supported during all of the hearings that were held and received praise and support by the local communities and stakeholders involved.

Therefore, we respectfully request that Senate Bill 2490 be amended as a consent item to reflect the unique nature of marinas that provide public access in New Jersey. We are requesting that language be added to exempt marinas from needing to provide additional public access as a condition of a permit beyond what the 2012 rules require.

We would appreciate your consideration of these concerns. If you would like more information or have any questions, please do not hesitate to contact me at 732-292-1051.

Sincerely,

Melissa Danko
Executive Director

c: Members, Senate Environment and Energy Committee
Members, Assembly Environment and Solid Waste Committee
Rob Nixon, State House Strategies

Enclosure

MARINE TRADES
ASSOCIATION OF NEW JERSEY

**MEMORANDUM**

**TO:** Public Access Task Force

**FROM:** Melissa Danko, Executive Director

**RE:** Comments on Report to Senator Smith from the Public Access Stakeholder Group

**DATE:** April 13, 2016

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The Marine Trades Association of New Jersey (MTA/NJ) appreciates the opportunity to participate in the Public Access Task Force and provide comments on the report being provided to Senator Smith.

Established in 1972, the MTA/NJ is a non-profit trade organization comprised of over 300 marine businesses that are dedicated to advancing, promoting and protecting the recreational marine industry and boating in NJ. Boating is a significant part of New Jersey's economy. The economic impact of boating supports approximately 12,000 jobs and $2 billion dollars in spending. Marinas are the gateway to boating and enjoying our waterways. They provide public boat ramps, fuel, supplies, slips, boat maintenance and service, fishing access and more. Marinas are a unique and essential part of our local waterfront communities that provide the important infrastructure and services that allow people seeking recreation on or near the water to safely begin, enjoy and end their excursions. Access to the water and access to the services that marinas offer are provided to the general public. The very nature of their business operations ensures that the public has use of public trust waters. It is essential to their livelihood.

Representatives of the Association have attended all of the meetings of the Task Force and offered comments, as necessary, to the discussions and recommendations of the group. It was decided during the first meeting that one of the consent positions would be that the 2012 rules for marinas would apply, meaning no further changes or recommendations would be made for marinas. The MTA/NJ supports this position and appreciates all of the work put forth by the Task Force and specifically the four co-chairs responsible for leading this effort and developing the report for Senator Smith.

The majority of the issues outlined in the report do not impact recreational marinas. However, there are a few that we would like to provide additional comments on as they relate to marinas:

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Mandating 24/7 Access to the Waterfront for Appropriate Uses: While we recognize that this may not be directed at marinas at this time, it is important to outline the issues surrounding this mandate should it be required. It is not realistic for a marina, a seasonal small business to allow access onto its property 24 hours a day, 7 days a week, 365 days a year to anyone who wishes to enter the property. Marinas currently do no permit their own customers to have access to the marina property at all times. The care, custody and control of the marina, vessels, slip-holder property and attendant infrastructure is the responsibility of the marina owner and boat owner. At many marinas and boat yards, it is logistically impossible to secure or restrict access to dangerous areas at all times and through the various seasons. Due to the nature of marinas and the services they provide, travel lifts and forklifts must have access to the water to transport boats, and therefore cannot be relocated. Many drydocks are on the water's edge. This heavy machinery and equipment poses a significant risk of injury when both in use and not in use such as when the marina is closed. A marina owner would have no effective means to enforce marina rules and regulations towards the general public. This would create a potentially hazardous and costly situation, making marina security impracticable and negatively affecting the operations of many marinas. The marina owner would need to provide additional infrastructure and security to control where the public goes when on site beyond normal business hours.

Providing different types of public access: The 2012 rules provided a number of options as to how public access requirements might be met recognizing that sites vary greatly, that one size does not fit all and that there is a need to allow for flexibility in meeting public access requirements. In regards to marinas, this takes into consideration the fact that marinas already provide meaningful public access to our waterways, access onto the water, access to fishing opportunities and more. Additionally, flexibility is critical for marinas due to the seasonal operations and configuration of these businesses.

Perpendicular Access: In regards to marinas, requiring designated perpendicular access may not always be feasible due to significant space constrictions, equipment and operations that vary from season to season. Every marina property is different in size and scope with some properties having very real physical limitations and restrictions.

As stated previously, the 2012 rules addressed many of these issues and took into consideration the nature and complexities of the family run marina business, the meaningful access already provided and the need for a reasonable, realistic and balanced approach to public access at marinas. The rules that were adopted in 2012, for marinas, will ensure the future health and growth of the recreational boating industry in New Jersey.

We appreciate the consensus of the Task Force on marinas and the opportunity to provide this input. We look forward to continuing to participate in discussions regarding this important issue.

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**Date of Intro.** _____

**Ref.** _____

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| NOTE TO SPONSOR | Notify OLS if you require changes in this document. A revised copy for introduction will be prepared on the legislative computer system. Handwritten changes will not appear in the printed bill. |

AN ACT concerning the public trust doctrine, amending P.L.1975, c.291, and supplementing Title 13 of the Revised Statutes.

Provides for protection of public's rights under public trust doctrine.

PRIME Sponsor ~~Mark-up version~~ - Suggestions on Security

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Same as _____ 14/15 Same as _____ 16/17

Suggested allocation: C.13:1D-150 et seq.

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**AN ACT** concerning the public trust doctrine, amending P.L.1975, c.291, and supplementing Title 13 of the Revised Statutes.

**BE IT ENACTED** *by the Senate and General Assembly of the State of New Jersey:*

1. (New section) The Legislature finds and declares that:

a. The public has longstanding and inviolable rights under the public trust doctrine to use and enjoy the State's tidal waters and adjacent shorelines for recreational uses, including, but not limited to, bathing, swimming, fishing, and other shore-related activities;

b. The public trust doctrine establishes the rule that ownership of land flowed or formerly flowed by tidal waters is vested in the State to be held in trust for the people, that the public has the right to tidal lands and waters for navigation, fishing, and recreational uses, and, moreover, that even land that is no longer flowed by the tide but that was artificially filled is considered to be public trust land and the property of the State;

c. This historic principle stems from Roman jurisprudence declaring that the air, running water, and shores of the sea are common to mankind. The concept was extended to English law so that public property became classified as one of two types, either property that was necessary for the state's use or property that was common and available to all citizens. The common property consisted of the air, tidally flowed waters, fish, and wild animals, and the King did not own this common property as he owned other state property, but rather held it in trust for the people. After the Revolution, all royal rights in the land that was to become the State of New Jersey became vested in the people of the State of New Jersey. In 1821, the seminal court case of Arnold v. Mundy was decided, outlining the history of the public trust doctrine and applying it to tidally flowed lands in New Jersey, and from the time it was decided, New Jersey courts have held that the State holds in trust for the people of the State those lands flowed by tidal waters to the mean high water mark;

d. The State of New Jersey has a duty to promote, protect, and safeguard the public's rights and to ensure reasonable and meaningful public access to tidal waters and adjacent shorelines;

e. The Department of Environmental Protection has the authority and the duty to protect the public's right of access to tidally flowed waters and their adjacent shorelines under the public trust doctrine and statutory law. In so doing, the department has the duty to make all tidal waters and their adjacent shorelines available to the public to the greatest extent possible, protect existing public access, provide public access in all communities equitably, maximize different experiences provided by the diversity of the State's tidal waters and adjacent shorelines, ensure that the expenditure of public moneys maximizes public use and access

**EXPLANATION – Matter enclosed in bold-faced brackets [thus] in the above bill is not enacted and is intended to be omitted in the law.**

**Matter underlined thus is new matter.**

where public investment is made, and that remove physical and institutional impediments to public access to the maximum extent possible; and

f. Public access includes visual and physical access to, and use of, tidal waters and adjacent shorelines, sufficient perpendicular access from upland areas to tidal waters and adjacent shorelines, and the necessary support amenities to facilitate public access for all, including public parking and restrooms.

2. (New section) a. The Department of Environmental Protection shall ensure that any approval, permit, administrative order, or consent decree issued, or other action taken, by the department pursuant to the "Coastal Area Facility Review Act," P.L.1973, c.185 (C.13:19-1 et seq.), R.S.12:5-3, "The Wetlands Act of 1970," P.L.1970, c.272 (C.13:9A-1 et seq.), the "Flood Hazard Area Control Act," P.L.1962, c.19 (C.58:16A-50 et seq.), the "Hackensack Meadowlands Reclamation and Development Act," P.L.1968, c.404 (C.13:17-1 et seq.), or the State's implementation of the "Coastal Zone Management Act of 1972," 16 U.S.C. s.1451 et seq., or any other law, is consistent with the public trust doctrine.

b. The Department of Environmental Protection shall ensure that any public funding issued, and any action taken on a project using public funding, is consistent with the public trust doctrine.

3. (New section) a. The Department of Environmental Protection shall not adopt any rule or regulation pursuant to the "Coastal Area Facility Review Act," P.L.1973, c.185 (C.13:19-1 et seq.), R.S.12:5-3, "The Wetlands Act of 1970," P.L.1970, c.272 (C.13:9A-1 et seq.), the "Flood Hazard Area Control Act," P.L.1962, c.19 (C.58:16A-50 et seq.), the "Hackensack Meadowlands Reclamation and Development Act," P.L.1968, c.404 (C.13:17-1 et seq.), or the State's implementation of the "Coastal Zone Management Act of 1972," 16 U.S.C. s.1451 et seq., or any other law, that mandates on-site public access to tidal waters or adjacent shorelines as a condition of any approval, permit, administrative order, or consent decree at (i) any existing structure or facility which is required to comply with either (A) the requirements of the Department of Homeland Security pursuant to 33 CFR Subchapter H Part 105 "Maritime Security: Facilities, (B) the United States Department of Transportation Pipeline and Hazardous Materials Safety Administration Hazardous Materials Regulations at 49 CFR 172.800 et seq., (C) section 112(r) of the Federal Clean Air Act, 42 U.S.C. 7412(r), and the regulations promulgated thereunder at 40 CFR Part 68, or (D) the New Jersey Toxic Catastrophe Prevention Act, N.J.S.A. 13:1K-19 et seq., (ii) any airport, railroad yard or nuclear power plant, or (iii) any other structure or facility that requires exclusion of the public for security reasons as designated by the New Jersey Office of Homeland Security and Preparedness.

From BIA/Chandler



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b. The New Jersey Office of Homeland Security and Preparedness shall designate those facilities that, for homeland security reasons, require exclusion of the public from the tidal waters or adjacent shorelines located at those facilities.

4. (New section) For any application for a permit or other approval to be issued by the Department of Environmental Protection pursuant to the "Coastal Area Facility Review Act," P.L.1973, c.185 (C.13:19-1 et seq.), R.S.12:5-3, "The Wetlands Act of 1970," P.L.1970, c.272 (C.13:9A-1 et seq.), the "Flood Hazard Area Control Act," P.L.1962, c.19 (C.58:16A-50 et seq.), the "Hackensack Meadowlands Reclamation and Development Act," P.L.1968, c.404 (C.13:17-1 et seq.), or the State's implementation of the "Coastal Zone Management Act of 1972," 16 U.S.C. s.1451 et seq., or any other law, if the application provides for a change in the existing footprint of a structure, or a change in use of the property, the department shall review the existing public access provided to tidal waters and adjacent shorelines at the property and shall require as a condition of the permit or other approval that additional public access to the tidal waters and adjacent shorelines consistent with the public trust doctrine be provided, in accordance with the scale of the changes to the footprint or use, the demand for public access, and any adopted municipal public access plan or public access element of a municipal master plan.

5. (New section) The Department of Environmental Protection may restrict public access to tidal waters and adjacent shorelines to protect critical habitat areas from injurious uses, or threatened or endangered species or their habitat areas from injury or injurious uses, but only to the extent necessary according to the needs of the habitat areas or species.

6. Section 19 of P.L.1975, c.291 (C.40:55D-28) is amended to read as follows:

19. Preparation; contents; modification.

a. The planning board may prepare and, after public hearing, adopt or amend a master plan or component parts thereof, to guide the use of lands within the municipality in a manner which protects public health and safety and promotes the general welfare.

b. The master plan shall generally comprise a report or statement and land use and development proposals, with maps, diagrams and text, presenting, at least the following elements (1) and (2) and, where appropriate, the following elements (3) through [(16)] (17):

(1) A statement of objectives, principles, assumptions, policies and standards upon which the constituent proposals for the physical, economic and social development of the municipality are based;

(2) A land use plan element

(a) taking into account and stating its relationship to the statement provided for in paragraph (1) hereof, and other master plan elements provided for in paragraphs (3) through (14) hereof and natural conditions, including, but not necessarily limited to, topography, soil conditions, water supply, drainage, flood plain areas, marshes, and woodlands;

(b) showing the existing and proposed location, extent and intensity of development of land to be used in the future for varying types of residential, commercial, industrial, agricultural, recreational, open space, educational and other public and private purposes or combination of purposes including any provisions for cluster development; and stating the relationship thereof to the existing and any proposed zone plan and zoning ordinance; and

(c) showing the existing and proposed location of any airports and the boundaries of any airport safety zones delineated pursuant to the "Air Safety and Zoning Act of 1983," P.L.1983, c.260 (C.6:1-80 et al.); and

(d) including a statement of the standards of population density and development intensity recommended for the municipality;

(3) A housing plan element pursuant to section 10 of P.L.1985, c.222 (C.52:27D-310), including, but not limited to, residential standards and proposals for the construction and improvement of housing;

(4) A circulation plan element showing the location and types of facilities for all modes of transportation required for the efficient movement of people and goods into, about, and through the municipality, taking into account the functional highway classification system of the Federal Highway Administration and the types, locations, conditions and availability of existing and proposed transportation facilities, including air, water, road and rail;

(5) A utility service plan element analyzing the need for and showing the future general location of water supply and distribution facilities, drainage and flood control facilities, sewerage and waste treatment, solid waste disposal and provision for other related utilities, and including any storm water management plan required pursuant to the provisions of P.L.1981, c.32 (C.40:55D-93 et al.). If a municipality prepares a utility service plan element as a condition for adopting a development transfer ordinance pursuant to subsection c. of section 4 of P.L.2004, c.2 (C.40:55D-140), the plan element shall address the provision of utilities in the receiving zone as provided thereunder;

(6) A community facilities plan element showing the existing and proposed location and type of educational or cultural facilities, historic sites, libraries, hospitals, firehouses, police stations and other related facilities, including their relation to the surrounding areas;

(7) A recreation plan element showing a comprehensive system of areas and public sites for recreation;



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(8) A conservation plan element providing for the preservation, conservation, and utilization of natural resources, including, to the extent appropriate, energy, open space, water supply, forests, soil, marshes, wetlands, harbors, rivers and other waters, fisheries, endangered or threatened species wildlife and other resources, and which systemically analyzes the impact of each other component and element of the master plan on the present and future preservation, conservation and utilization of those resources;

(9) An economic plan element considering all aspects of economic development and sustained economic vitality, including (a) a comparison of the types of employment expected to be provided by the economic development to be promoted with the characteristics of the labor pool resident in the municipality and nearby areas and (b) an analysis of the stability and diversity of the economic development to be promoted;

(10) An historic preservation plan element: (a) indicating the location and significance of historic sites and historic districts; (b) identifying the standards used to assess worthiness for historic site or district identification; and (c) analyzing the impact of each component and element of the master plan on the preservation of historic sites and districts;

(11) Appendices or separate reports containing the technical foundation for the master plan and its constituent elements;

(12) A recycling plan element which incorporates the State Recycling Plan goals, including provisions for the collection, disposition and recycling of recyclable materials designated in the municipal recycling ordinance, and for the collection, disposition and recycling of recyclable materials within any development proposal for the construction of 50 or more units of single-family residential housing or 25 or more units of multi-family residential housing and any commercial or industrial development proposal for the utilization of 1,000 square feet or more of land;

(13) A farmland preservation plan element, which shall include: an inventory of farm properties and a map illustrating significant areas of agricultural land; a statement showing that municipal ordinances support and promote agriculture as a business; and a plan for preserving as much farmland as possible in the short term by leveraging moneys made available by P.L.1999, c.152 (C.13:8C-1 et al.) through a variety of mechanisms including, but not limited to, utilizing option agreements, installment purchases, and encouraging donations of permanent development easements;

(14) A development transfer plan element which sets forth the public purposes, the locations of sending and receiving zones and the technical details of a development transfer program based on the provisions of section 5 of P.L.2004, c.2 (C.40:55D-141); (15) An educational facilities plan element which incorporates the purposes and goals of the "long-range facilities plan" required to be submitted to the Commissioner of Education by a school district pursuant to section 4 of P.L.2000, c.72 (C.18A:7G-4); **[and]**



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(16) A green buildings and environmental sustainability plan element, which shall provide for, encourage, and promote the efficient use of natural resources and the installation and usage of renewable energy systems; consider the impact of buildings on the local, regional and global environment; allow ecosystems to function naturally; conserve and reuse water; treat storm water on-site; and optimize climatic conditions through site orientation and design ; and

(17) A public access plan element that provides for, encourages, and promotes permanently protected public access to all tidal waters and adjacent shorelines consistent with the public trust doctrine, and which shall include a map and inventory of public access points, public facilities that support access, parking, boat ramps, and marinas; an assessment of the need for additional public access; a statement of goals and administrative mechanisms to ensure that access will be permanently protected; and a strategy that describes the forms of access to satisfy the need for such access with an implementation schedule and tools for implementation.

c. The master plan and its plan elements may be divided into subplans and subplan elements projected according to periods of time or staging sequences.

d. The master plan shall include a specific policy statement indicating the relationship of the proposed development of the municipality, as developed in the master plan to (1) the master plans of contiguous municipalities, (2) the master plan of the county in which the municipality is located, (3) the State Development and Redevelopment Plan adopted pursuant to the "State Planning Act," sections 1 through 12 of P.L.1985, c.398 (C.52:18A-196 et seq.) and (4) the district solid waste management plan required pursuant to the provisions of the "Solid Waste Management Act," P.L.1970, c.39 (C.13:1E-1 et seq.) of the county in which the municipality is located.

In the case of a municipality situated within the Highlands Region, as defined in section 3 of P.L.2004, c.120 (C.13:20-3), the master plan shall include a specific policy statement indicating the relationship of the proposed development of the municipality, as developed in the master plan, to the Highlands regional master plan adopted pursuant to section 8 of P.L.2004, c.120 (C.13:20-8).
(cf: P.L.2013, c.106, s.6)

7. This act shall take effect on the 60th day after the date of enactment.

STATEMENT

This bill would confirm in the statutes the longstanding and inviolable public rights under the public trust doctrine to use and enjoy the State's tidal waters and adjacent shorelines. The people's ownership of the tidal waters and adjacent shorelines is held in trust

by the State. This bill would ensure that the State, through the Department of Environmental Protection (DEP), protects the public's right of access to public trust lands in its funding decisions and in the implementation of the "Coastal Area Facility Review Act," R.S.12:5-3 (the waterfront development law), "The Wetlands Act of 1970," the "Flood Hazard Area Control Act," the "Hackensack Meadowlands Reclamation and Development Act," the State's implementation of the federal "Coastal Zone Management Act of 1972," or any other law. In addition, the bill requires that the DEP ensure that any public funding issued, and any action taken on a project using public funding, is consistent with the public trust doctrine. The bill also requires the DEP to ensure that any approval, permit, administrative order, or consent decree issued, or other action taken by the DEP pursuant to the above-cited statutes, is consistent with the public trust doctrine. Further, the bill provides that for any application for a permit or other approval issued pursuant to those laws, where the applicant proposes a change in the existing footprint of a structure, or a change in use of the property, the DEP is required to review the public access provided and determine whether to require additional public access consistent with the public trust doctrine and in accordance with the scale of the changes to the footprint or use, the demand for public access, and any adopted municipal public access plan or public access element of a municipal master plan.

In addition, the bill would prohibit the DEP from adopting any rule or regulation pursuant to the "Coastal Area Facility Review Act," R.S.12:5-3 (the waterfront development law), "The Wetlands Act of 1970," the "Flood Hazard Area Control Act," the "Hackensack Meadowlands Reclamation and Development Act," and the State's implementation of the federal "Coastal Zone Management Act of 1972," or any other law, that mandates on-site public access to the tidal waters or adjacent shorelines as a condition of any approval, permit, administrative order, or consent decree at any existing structure or facility that requires exclusion of the public for security reasons as designated by the New Jersey Office of Homeland Security and Preparedness. The bill would also authorize the DEP to restrict public access to tidal waters and adjacent shorelines to protect critical habitat areas from injurious uses, or threatened or endangered species or their habitat areas from injury or injurious uses, but only to the extent necessary according to the needs of the habitat areas or species.

Finally, the bill provides that a public access plan element for tidal waters and adjacent shorelines be included, where appropriate, in a municipality's master plan under the "Municipal Land Use Law."

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Provides for protection of public's rights under public trust doctrine.