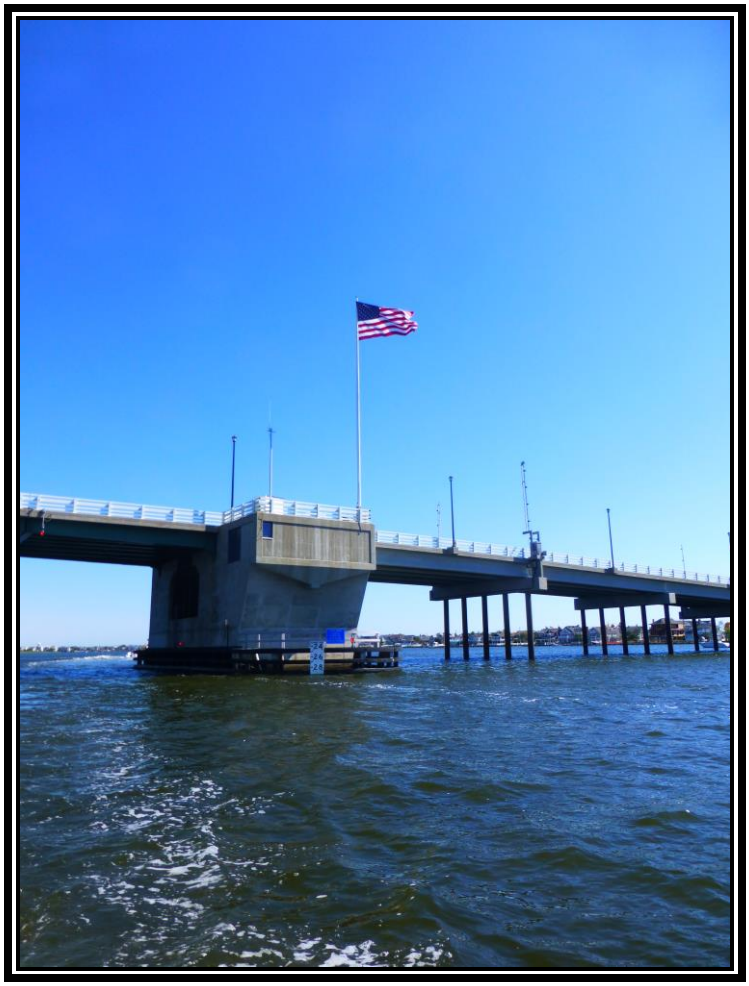
NJ Department of Environmental Protection
Water Monitoring and Standards
Marine Water Monitoring

Reappraisal Report of Shellfish Growing Area BB1

Northern Barnegat Bay



December 2014

Data from January 1, 2010 - June 30, 2014

State of New Jersey
Chris Christie, Governor
Kim Guadagno, Lt. Governor

NJ Department of Environmental Protection
Bob Martin, Commissioner

Reappraisal Report of Shellfish Growing Area BB1

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New Jersey Department of Environmental Protection (NJDEP)

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December 2014
Data from January 1, 2010 - June 30, 2014

Report prepared by:

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This report was written under the direction of NJDEP WM&S administration. Special acknowledgment is given to the Boat Captains, the laboratory staff, and the technical and support staff.

Cover Photo – Herbert Street Bridge (photo by Tracy Fay)

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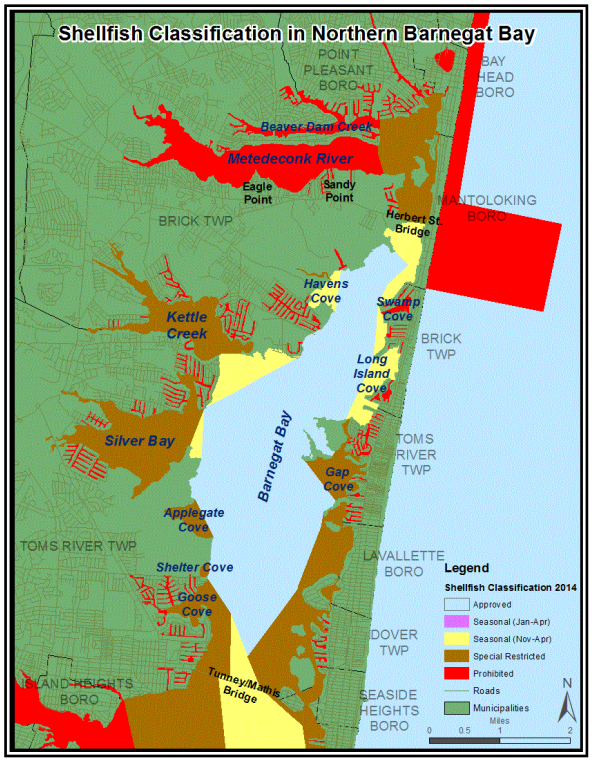
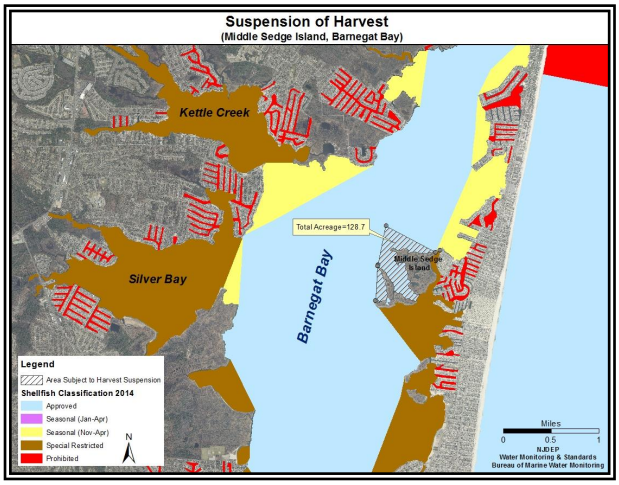
EXECUTIVE SUMMARY

The Northern Barnegat Bay is made up of the waters from Bay Head to Seaside Heights, which includes the Metedeconk River and the northern portion of the Barnegat Bay. The sampling strategy for this area is Systematic Random Sampling and there are currently 73 stations sampled in this growing area. Data was analyzed from January 1, 2010 through June 30, 2014 for fecal coliform. Two sampling stations in the Northern Barnegat Bay area (BB1) are not in compliance with the National Shellfish Sanitation Program's (NSSP) classification criteria.

Currently, the headwaters of the Metedeconk River down past Sandy Point and Beaver Dam Creek are classified as *Prohibited*, and the remaining waters of Metedeconk River down to the Herbert Street Bridge are classified as *Special Restricted* (see adjacent figure). A portion of the waters south of the Herbert Street Bridge are classified as *Seasonal (Nov-Apr)* before the waters turn to an *Approved* section of the Barnegat Bay. Kettle Creek and Silver Bay are classified as *Special Restricted*, with buffers of *Seasonal (Nov-Apr)* waters before the waters turn to *Approved* in the Barnegat Bay. Many of the small coves along the shoreline, like Haven's Cove, and Long Island Cove are classified as *Seasonal (Nov – Apr)*. However, some of the more southern coves, like Applegate Cove, Shelter Cove, and Goose Creek are classified as *Special Restricted*. The eastern portion of the Barnegat Bay from above Gap Cove to the Tunney/Mathis Bridge is also classified as *Special Restricted*. Between this *Special Restricted* area on the eastern shore and the *Special Restricted* area of Goose Creek there is a section of *Seasonal (Nov-Apr)* waters. This growing area ends at the Tunney-Mathis Bridge, where the Central Barnegat Bay begins. Apart from marina buffers and lagoon, the rest of the Barnegat Bay in this growing area is classified as *Approved*. There are no direct discharges into the waters of the Northern Barnegat Bay.





The current shellfish growing area classification in the Northern Barnegat Bay will be modified as a result of station 1615A not meeting the NSSP criteria. An estimated 128.7 acres around Middle Sedge Island will be suspended until the area can be reclassified in regulation (see adjacent figure and the "*Recommendations*" section of this report for more information).

The 503 acres in the Metedeconk River that were recommended for an upgrade in the previous Sanitary Survey report are still awaiting a regulatory update

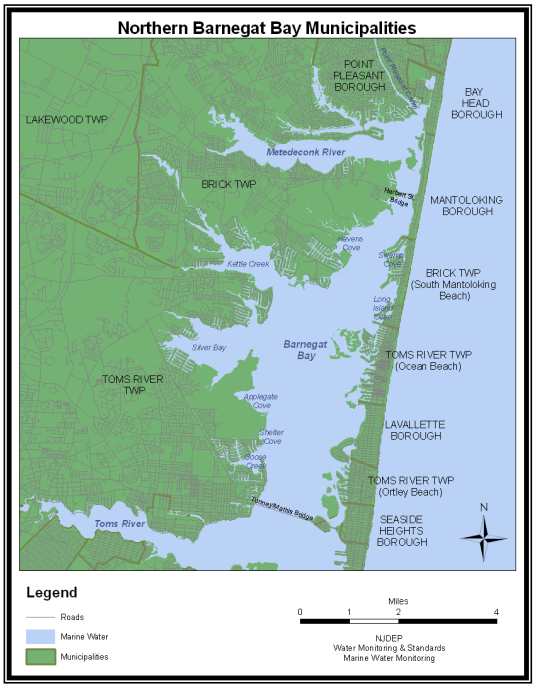
(N.J.A.C. 7:12). The headwaters of the river will remain *Prohibited* to around Eagle Point. Once adopted into regulation, just east of Eagle Point to the Herbert Street Bridge will be a *Special Restricted* shellfish classification (see "*Growing Area Classification Summary*" and the prior report on BB1 for further information). Nevertheless, proposed classification changes are subject to change based on continual water quality results.

DESCRIPTION OF GROWING AREA

Location & Description

This growing area, Northern Barnegat Bay, is located in Ocean County and includes the waters of Metedeconk River and the northern section of the Barnegat Bay. The Barnegat Bay estuary is about 64-square miles and drains approximately 1,350-square miles (US Fish and Wildlife Service, 1997). The average depth of the estuary is 5-feet; therefore, it is considered a shallow estuary (US Fish and Wildlife Service, 1997). For the designation of shellfish growing areas, the waters of the entire Barnegat Bay are broken up into northern, central, inlet, and southern sections. This growing area is referred to as the Northern Barnegat Bay. The northern boundary is within the Point Pleasant Canal and the southern boundary is the Tunney/Mathis Bridge (see figure below).

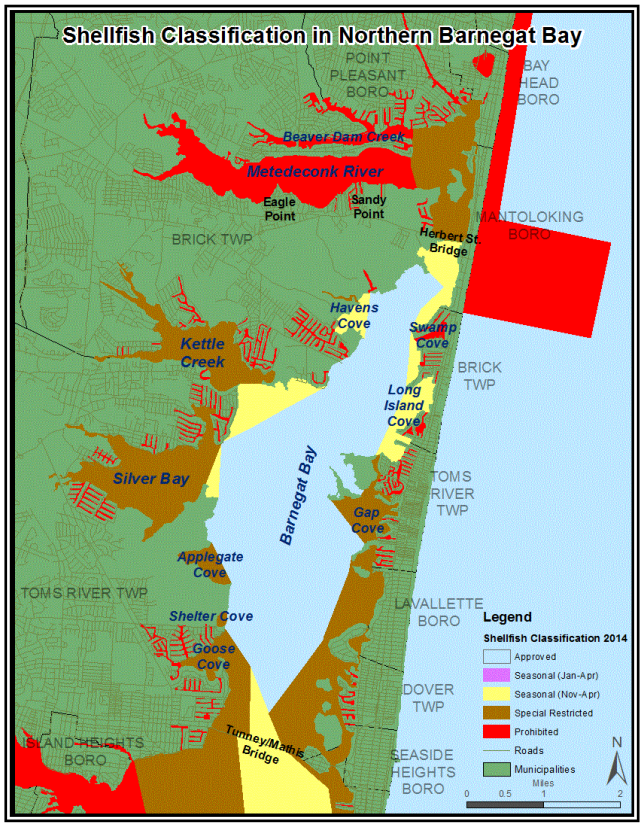
The Metedeconk River is a large waterway surrounded by urban areas. There are many small tributaries that flow into the headwaters of the Northern Barnegat Bay, which include Beaver Dam Creek, Cedar Bridge Creek, and North Branch Creek. However, Toms River, which is located just south of this growing area, is the greatest freshwater influence to the Barnegat Bay (U.S. Fish and Wildlife Service, 1997). These freshwater inputs mix with the salt water of the bay to create an estuary. The Barnegat Bay Inlet can be found just south of Island Beach State Park, approximately twelve miles southeast of the Tunney-Mathis Bridge. The inlet governs the tides in Barnegat Bay and provides a tidal flush for the bay water.



Eight municipalities surround this growing area; Toms River Township, Brick Township, Point Pleasant Borough, Bay Head Borough, Mantoloking Borough, Berkeley Township, Lavallette Borough, and Seaside Heights Borough.

Growing Area Classification Summary

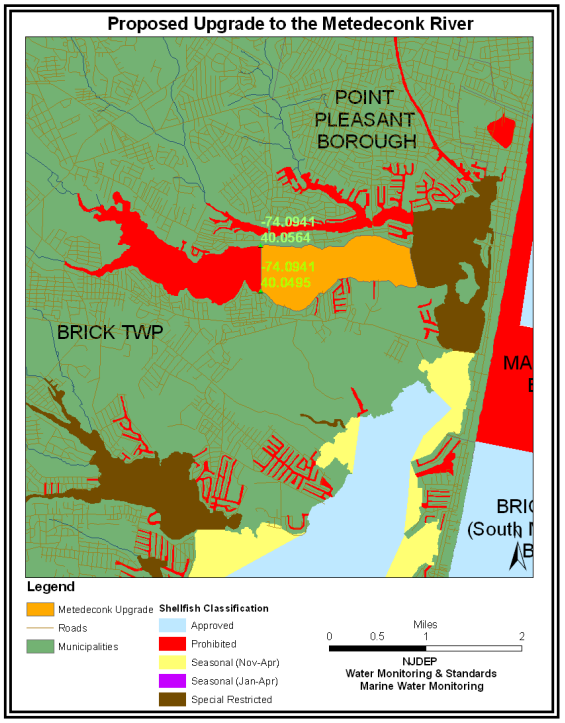
This Northern Barnegat Bay growing area includes almost 11,000 acres of marine water. Water samples are collected and analyzed, and then determinations are made on how the shellfish waters should be classified.



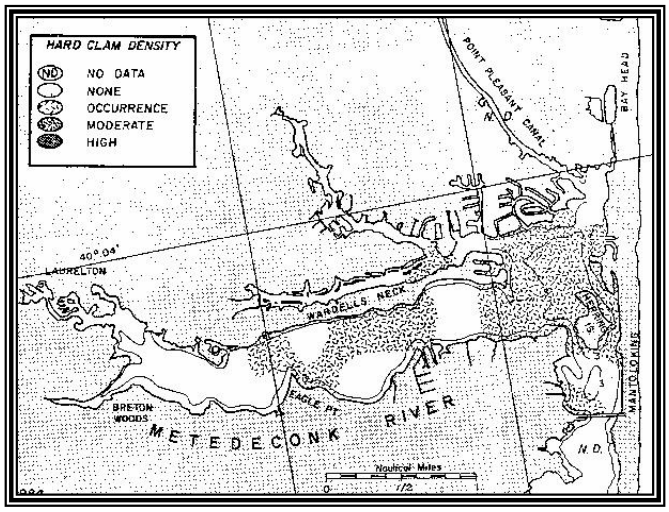
The inland waters of Metedeconk River are *Prohibited* for harvesting shellfish. The eastern section of Metedeconk River is *Special Restricted.* The Metedeconk River is surrounded by urban land use and a number of marinas. A portion of the waters south of the Herbert Street Bridge are classified as *Seasonal (Nov-Apr)* before the waters turn to an *Approved* section of the Barnegat Bay. Kettle Creek and Silver Bay are classified as *Special Restricted*, with buffers of *Seasonal (Nov-Apr)* waters before the waters turn to *Approved* in the Barnegat Bay. Many of the small coves along the shoreline, like Haven's Cove, and Long Island Cove are classified as *Seasonal (Nov – Apr).* However, some of the more southern coves, like Applegate Cove, Shelter Cove, and Goose Creek are classified as *Special Restricted*. The eastern portion of the Barnegat Bay from above Gap Cove to the Tunney/Mathis Bridge is also classified as *Special Restricted*. Between this *Special Restricted* area on the eastern shore and the *Special Restricted* area of Goose Creek there is a section of *Seasonal (Nov-Apr)* waters. This growing area ends at the Tunney-Mathis Bridge, where the Central Barnegat Bay begins. Apart from marina buffers, the rest of the Barnegat Bay in this growing area is classified as *Approved* (see above figure). All lagoons are classified as *Prohibited*.

The last Sanitary Survey report analyzed data from May 1, 2006 to April 30, 2010. This report recommended an upgrade for a portion of the Metedeconk River that is still pending a regulatory update (N.J.A.C. 7:12). The headwaters of the river will remain *Prohibited* to around Eagle Point. Once adopted into regulation, five-hundred three acres just east of Eagle Point to the Herbert Street Bridge will become a *Special Restricted* shellfish classification (see adjacent figure and the prior report on BB1 for further information). The western section of the Metedeconk will remain *Prohibited*, as well as Beaver Dam Creek, marinas, and the lagoons. Nevertheless, proposed classification changes are subject to change based on continual water quality results.

The State of New Jersey Shellfish Growing Water Classification Charts (NJDEP) display the classification of this area; this information can also be found on the Bureau of Marine Water Monitoring's (BMWM) website at http://www.state.nj.us/dep/bmw/; the official classification descriptions can be found at N.J.A.C. 7:12.



Evaluation of Biological Resources



Commercially important shellfish native to New Jersey include: hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), blue mussels (*Mytilus edulis*), eastern oysters (*Crassostrea virginica*), ocean quahogs (*Arctica islandica*), surf clams (*Spisula solidissima*), sea scallops (*Placopecten magellanicus*), and bay scallops (*Aequipenctin irradians*). According to the NSSP, scallops are considered shellfish except when the final product form is the adductor muscle only (2013).

The Northern Barnegat Bay area is not particularly productive at this time. An occurrence of hard clam and soft clams were documented in this area in the 1980's by NJDEP Fish, Game, & Wildlife (see above figure). There are higher densities of hard clams in the southern portion of Barnegat Bay due to the open water and sandflat areas. However, portions of northern Barnegat Bay are sometimes used for shellfish aquaculture, notably Swan Point and Good Luck Point. Factors that contribute to having a viable resource include: salinity, dissolved oxygen levels, bottom conditions, and predation.

SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

Barnegat Bay has been a "No Discharge Zone" since 2003 and there are two sewage pumpout boats available to recreational boaters in Northern Barnegat Bay (USEPA, 2003). The 'Bay Saver' and 'Bay Defender' typically operate Memorial Day weekend through the end of September (OCDOP, 2014). These boats remove sewage from recreational boats with onboard tanks to prevent the emptying of waste directly into the waters of Barnegat Bay. Since 1998, over 900,000 gallons of concentrated effluent water have been removed from vessels with the Ocean County's Pumpout Boat Program (2014).

There are many marinas in this area, which have significant high use in the summer months due to the influx of tourists. Ortley Beach and surrounding areas are well-known tourist spots on the New Jersey shore during the summer. Therefore, the waters in the summertime have the potential to receive more pollutants due to factors like increased population and recreational boating.

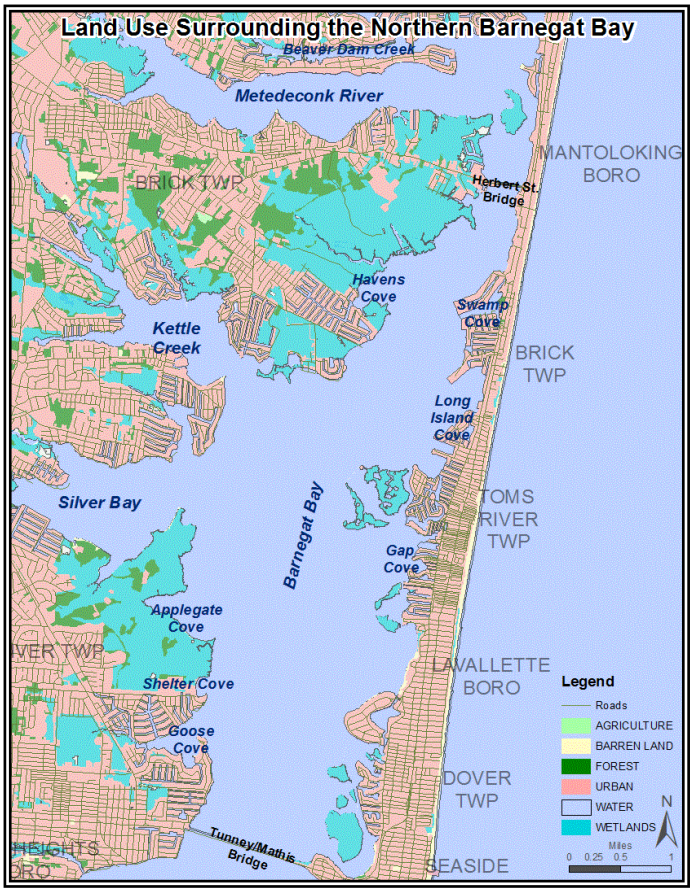
Waterfowl are known to inhabit the Northern Barnegat Bay, especially during winter months. At low tide many gulls, ducks, and geese occupy the sandbars and shoreline. Oftentimes, these waterfowl also nest within the wetlands. Bird waste can add to contamination of the waters, which can contribute to high coliform values.

Vegetation is an essential part of the marine ecosystem, offering habitat and nursery grounds for numerous species. In the Northern Barnegat Bay, the submerged aquatic vegetation (SAV) is prevalent in shallow areas. Some of the most common species of SAV in New Jersey include widgeon grass (*Ruppia maritima*), sago pondweed (*Potamogeton pectinatus*), horned pondweed (*Zannichellia palustris*) and eelgrass (*Zostera marina*).

This area was heavily influenced by Superstorm Sandy in October of 2012. Since Superstorm Sandy there has been a lot of construction on condominiums and residential homes and rebuilding of docks, bulkheads and other structures at residential homes and commercial marinas (see adjacent photo). There are still areas that have undergoing repairs or have not been repaired (see Appendix for shoreline survey reports).

Land Use

The majority of land use in this area is divided into wetlands, urban, and forested areas (see adjacent figure). Urban areas are found on the majority of the shoreline. The eastern coastline of the Barnegat Bay has high urban land use and endures a spike in population during the summer months. Amongst the urban areas there are many marinas, which have significant high use in the summer months due to the influx of tourists. Mantoloking Neck and Cattus Island County Park are wetland areas. Wetlands serve to purify water; organic and inorganic materials are removed for plant growth. The condition of the wetlands is very important to the health of the shellfish.

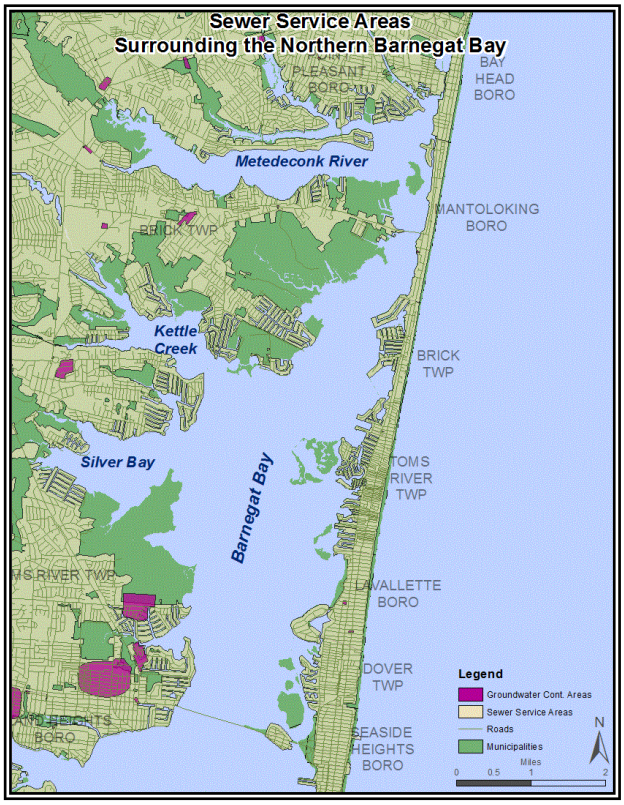


Forested areas are intermittent in the Northern Barnegat Bay growing area. Most of the forested areas are inland and not located near the shoreline. Agricultural land use is even less frequent than forested areas. The agricultural areas also tend to be situated inland.

The back-bay waters make the Northern Barnegat Bay area a suitable locale for lagoon communities. A lagoon is essentially a manmade canal, surrounded by bulkheaded properties, with access to the bay. Lagoon communities gradually became regulated under the Wetlands Act of 1970 (N.J.S.A. 13:9A). In 1978, construction of lagoon communities was greatly restricted. Lagoon areas are laden with stormwater outfalls that often drain directly into the canal water. Additionally, many homeowners have docks, which are used to store their own boats. Although there are pump out stations at many marinas, some boat owners will illegally discharge sanitary waste directly into the bay water. For these reasons, all lagoons are classified as *Prohibited*. The area directly outside all lagoons are appropriately classified as *Prohibited, Seasonal (Nov - Apr), Seasonal (Jan - Apr),* or *Special Restricted*.

Surface and Ground Water Discharges

A surface water discharge involves the release of treated effluent from various municipal and industrial facilities directly into a river, stream, or the ocean. There are no known effluent discharges directly into the Northern Barnegat Bay waters. The Ocean County Utilities Authority's Northern Water Pollution Control Facility (NWPCF) treats the domestic wastes and handles the sanitary wastewater to most of the surrounding municipalities. This plant is located in Brick Township. The capacity of the plant is 32 million gallons per day (OCUA, 2014). The NWPCF provides wastewater treatment service to Bay Head, Brick, Mantoloking, Point Pleasant Beach, Point Pleasant Borough, Lakewood & Jackson Township. Sewage from the Manasquan River Regional Sewage Authority is also treated by the facility. The facility sends the treated effluent one mile into the Atlantic Ocean at a location east of Mantoloking Borough. As a precautionary measure, the NSSP requires a closed safety zone, so ocean waters adjacent to the outfall line are classified as *Prohibited* for the harvesting of shellfish for a distance of approximately one mile offshore (see growing area Atlantic Ocean: Central Region for more information). Although the ocean outfall line is not within the confines of the Northern Barnegat Bay area; the pipeline runs through this growing area. Therefore, there is the potential for leaks and breaks in the line, which would affect the surrounding waters.



The remaining communities (Toms River Township, Lavallette, and Seaside Heights), as well as many municipalities located in the Central Barnegat Bay (BB2) are served by the Ocean County Utilities Authority's Central Water Pollution Control Facility (CWPCF) in Bayville. The capacity of the plant is 32 million gallons per day (OCUA, 2014). This facility also discharges to the Atlantic Ocean approximately a mile offshore of Island Beach State Park (see growing area Atlantic Ocean: Central Region for more information).

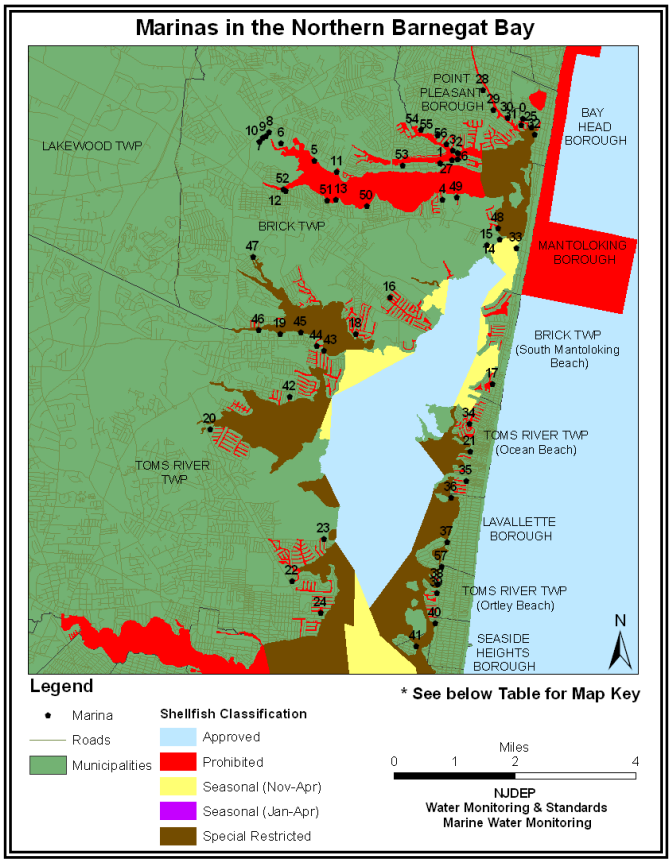
According to New Jersey Pollutant Discharge Elimination System (NJPDES), there are a few facilities with an active Discharge to Groundwater (DGW) permit in this area. Besides groundwater dischargers, septic systems are occasionally used where public sewer lines are inaccessible (see adjacent figure). When a septic system's leach field fails septic waste may pond on the ground's surface and can flow directly or be transported by stormwater to storm sewers and ultimately discharge to surface water. Failing septic systems can be a significant localized source of bacteria.

Marinas

Marina facilities have the potential to affect the suitability of shellfish growing areas for the harvest of shellfish. The biological and chemical contamination associated with marina facilities may be of public health significance. The Barnegat Bay was made a "No Discharge Zone" in 2003 (USEPA, 2003).

Boating is a very popular summertime activity within Barnegat Bay. According to the BMWM's latest

marina survey, there are a total of 57 marinas in the Northern Barnegat Bay (see below figure and Appendix for map key). There are also many lagoon and waterfront communities with additional boat slips. The waters enclosed by a marina are classified as *Prohibited*. Depending on the size of the marina and its water quality, the water immediately adjacent to each marina may be classified as *Prohibited*, *Special Restricted*, or *Seasonal (Jan-Apr* or *Nov-Apr)*. A *Seasonal* classification does not allow harvest during summer months when the marina is active. Although there are marinas throughout this growing area, they are particularly numerous in Metedeconk River, Kettle Creek, and the eastern shoreline of the bay.



The 'Clean Marina' program is voluntary and provides guidelines that aim, "to reduce the sources and impacts of nonpoint source pollution, including sewage facility management, fueling operations, fish and solid waste management and boat cleaning" (NJDEP Clean Marina, 2013). Six marinas in this growing area have been certified as New Jersey Clean Marinas (NJDEP Clean Marina, 2013). These marinas are Baywood Marina, Brennan Boat Co. and Marina, Inc., Green Cove Marina, Sherman's Boat Basin, Shore Haven Yacht Club, and Jersey Shore Marina and Boat Sales, Inc. Five other marinas in the Northern Barnegat Bay have signed a Clean Marina Pledge Card, which means that, "the marina owners and operators pledge to identify opportunities and implement practices to control pollution associated with activities occurring at marinas, enhance the surrounding environment and encourage responsible boating practices as recommended in the New Jersey Clean Marina Guidebook." (NJDEP Clean Marina, 2013).

For additional information on the marina equations used to generate marina buffers please see the Shellfish Growing Area Report Guidance Document, 2012.

Spills, Unpermitted Discharges, and Closures

The process of dredging can impair water quality and contaminate shellfish beds that are living near dredging and disposal sites. BMWM is given the opportunity to review such project through CAFRA submission and will deny a project if the proposed dredging or disposal site can potentially contaminate shellfish beds or impair water quality. BMWM's comments are taken into consideration by the NJDEP's Division of Land Use Regulations (DLUR) when approving or denying a permit.

Spills reported to the NJDEP hotline (1-877-WARN-DEP) are passed on to the BMWM when shellfish waters might be impacted. Since there is a direct relationship between the pollution of shellfish growing areas and the transmission of diseases to humans, BMWM must carefully assess each spill occurrence. If the spill is determined to be detrimental to the shellfish beds, then a closure is made in the impacted area to

protect public health. The closure is not lifted until the source of the problem is fixed/eliminated and all samples in that area fit within the appropriate classification criteria.

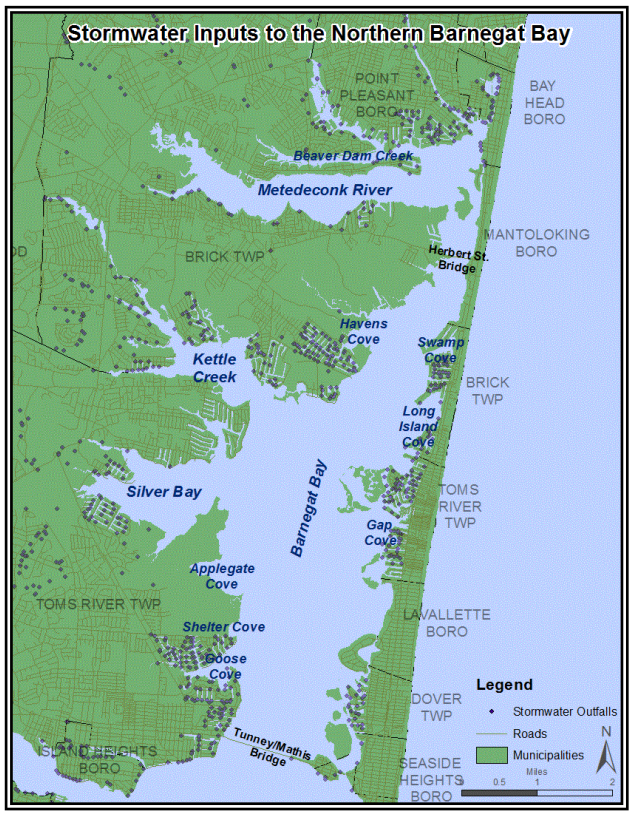
The tourist population in the summertime inundates the utility usage in the Northern Barnegat Bay area. However, the cold winter months also prove hard on water and sewer lines. Therefore, breaks and/or leaks can happen at any time and the WM&S's BMWM must be ready to respond to spills and assess the probable effects on the shellfish waters.

All state waters in New Jersey were closed for shellfish harvest in preparation for Hurricane Irene in 2011 and Superstorm Sandy in 2012. In both instances the shellfish growing waters of the state remained closed until water and, in some cases, tissue tests showed that the shellfish were safe for human consumption.

There were no other significant spills, unpermitted discharges, or closures concerning the Northern Barnegat Bay since the last report on the area. Closures prior to this time period are discussed in the prior reports on this area, see www.nj.us.gov/dep/bmw for more information.

Stormwater Discharges

Runoff is a term for the surface water that moves from land to the ocean. Storm drains along roads collect runoff and transmit it to stormwater outfalls. The outfalls deposit the runoff directly into the bay, or indirectly via other waterbodies. Therefore, pollutants in the runoff gradually make their way to the bay/ocean waters. During this transition the water picks up both nutrients and pollutants. While some nutrients in the runoff provide food for plants and animals, excessive nutrient loads can lead to eutrophic conditions, where algae and other organisms proliferate and cause low levels of dissolved oxygen. In this region, runoff from the urban areas is the most likely cause of pollutants. Pollutants, like bird wastes, agricultural pesticides, animal waste, and remnants from faulty septic systems enter the water through runoff. Fecal waste carries a great deal of bacteria, and runoff can easily bring the bacteria to swimming beaches and other waterbodies. Among other things, this can cause human sickness through recreational contact or through consumption of contaminated shellfish.



Stormwater outfalls are one of the most significant non-point sources of pollution. There are many storm water inputs into the Northern Barnegat Bay shellfish growing area, especially in lagoon areas, like Havens Cove (see adjacent figure). Lagoon stormwater discharges are especially harmful because lagoons see little tidal flushing, heavy boat usage, and high quantities of bulkheading.

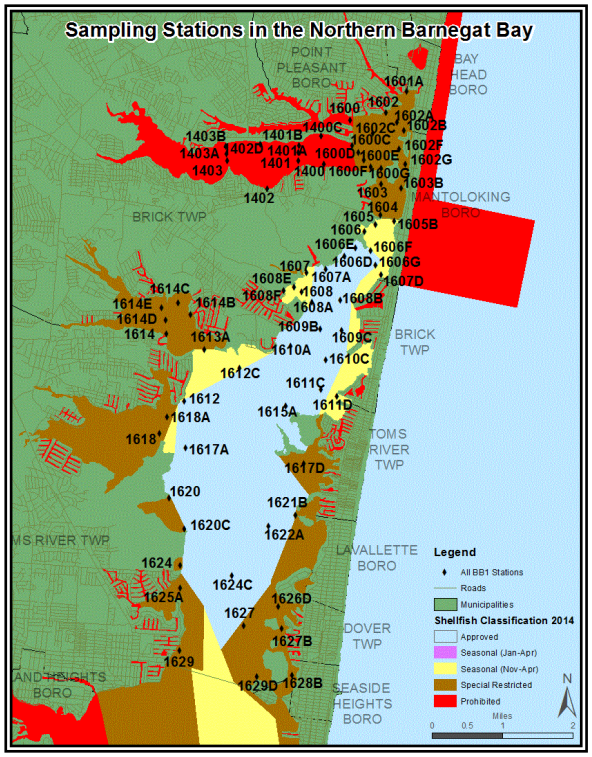
WM&S's BMWM has the ability to conduct stormwater projects. For example, water samples are taken before and during a storm event in order to determine the effect of runoff. Once a possible source of the problem is identified, then the appropriate State and local officials are notified to attempt to remedy the situation. Historically, storm water work has been done in the Seaside Heights area, as discussed in previous reports. Due to the increase in fecal coliform levels it will be recommended in this report to do an intensive study into the areas of Cattus Island County Park and Middle Sedge Island (see the '*Recommendations'* section).

WATER QUALITY STUDIES

Sampling Strategy

The State Shellfish Control Authority has the option of choosing one of two water monitoring sampling strategies for each growing area. For additional information on the types of sampling strategies see the NJDEP *Shellfish Growing Area Report Guidance Document* (2012). This shellfish growing area is not impacted by discharges from sewage treatment facilities or combined sewer overflows; therefore, it was sampled under the Systematic Random Sampling Strategy (SRS).

Each shellfish producing state is directed to adopt either the fecal coliform or fecal coliform criterion. New Jersey bases its growing water classifications on the fecal coliform criterion. Each classification criterion is composed of a measure of the statistical 'central tendency' (geometric mean) and the relative variability of the data set. The criteria for the bacterial acceptability of shellfish growing waters are provided in the NSSP *Guide for the Control of Molluscan Shellfish*, 2013 Revision. For the Systematic Random Sampling Strategy, variability is expressed as the estimated 90th percentile.



The water quality of each growing area must be evaluated before an area can be classified as *Approved, Seasonal (Nov-Apr or Jan-Apr), Special Restricted,* or *Prohibited.* A *Seasonal* area must be sampled and meet the *Approved* criterion during the time of the year that it is open for harvest. The criteria for the bacterial acceptability of shellfish growing waters are provided in the NSSP *Guide for the Control of Molluscan Shellfish*, 2013 Revision.

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 2005). Water quality sampling, shoreline, and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish*, 2013 Revision. Data management and analysis were accomplished using database applications developed for the Bureau of Marine Water Monitoring. Mapping of data was performed with Geographic Information System software (GIS: ArcMap).

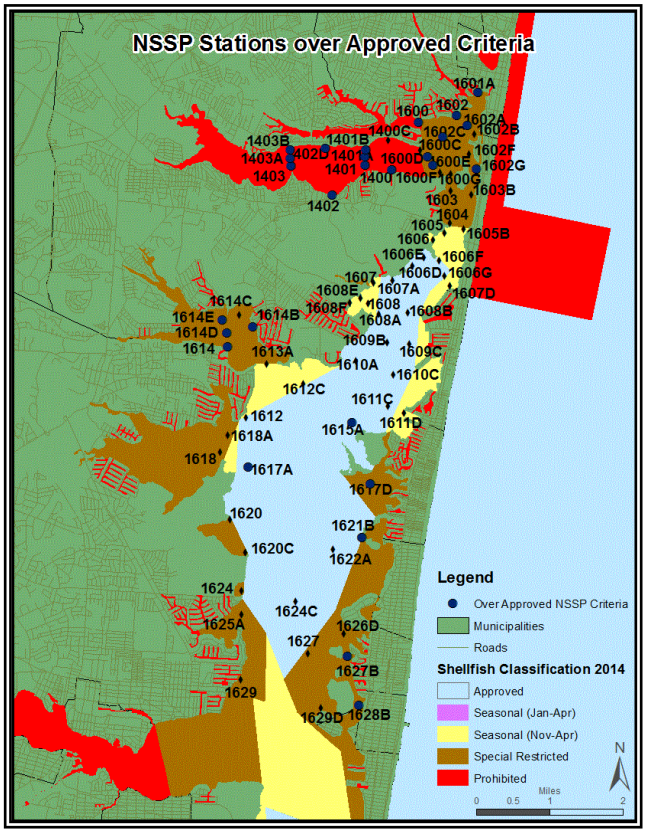
Bacteriological Quality

Approximately 2,500 water samples were collected in the Northern Barnegat Bay between January 1, 2010 and June 30, 2014. The adjacent figure shows the Shellfish Growing Water Quality monitoring stations in the Northern Barnegat Bay. Over 1,400 NSSP stations total are monitored each year for coliform levels throughout the state; 73 are located in the Northern Barnegat Bay and were sampled with the Systematic Random Sampling (SRS) strategy.

Compliance with NSSP Criteria

According to the National Shellfish Sanitation Program's (NSSP) *Guide for the Control of Molluscan Shellfish* (2013 Revision), the water quality of each growing area must be evaluated before an area can be classified as *Approved, Seasonal (Nov-Apr or Jan-Apr), Special Restricted,* or *Prohibited*. A *Seasonal* area must be sampled and meet the *Approved* criterion during the time of the year that it is open for harvest. The summer season runs from May through October, and the winter season runs from November through April.

Three separate assignment runs are required for this large growing area. Two of these assignment runs are in Barnegat Bay (087, & 108) and one assignment (077) is in Metedeconk River. This report examined the data from the assignment runs done in-between January 1, 2010 and June 30, 2014. These assignment runs provided sufficient samples for evaluation, bearing in mind the sample size must be at least 30 for each station according to the Systematic Random Sampling strategy.



The NSSP establishes the guidelines for classification. In order for waters to be classified as *Approved* the Geometric Mean must be below 14 CFU's/100mL. For waters to be classified as *Special Restricted* the Geometric Mean must be below 88 CFU's/100mL. The Estimated 90th Percentiles must also fit within NSSP criteria.

Twenty-seven stations exceeded the SRS year round criteria for *Approved* waters; stations 1615A & 1617A are located in *Approved* waters (see adjacent figure).

Station 1615A was below the Geometric Mean criteria (13.2), but exceeded the Est. 90th Criteria, which in this case was 36 (Station 1615A had an Estimated 90th of 77.1). There is a private home (currently vacant) on an island nearby and wetlands; with numerous birds, otherwise, no obvious cause for the increase in coliform levels can be surmised at this time. Antibiotic Resistance Analysis (ARA) was performed on some samples acquired during a shoreline survey, and results showed potential animal, domestic, and human sources. There will be a suspension of harvest around station 1615A for the 2015 shellfish classification maps (See

"*Recommendations*" for more information).

Station 1617A was below the Geometric Mean criteria (7.8), but exceeded the Est. 90th Criteria, which in this case was 36 (Station 1617A had an Est 90th of 40.7). This station is offshore of Cattus Island County Park. ARA was also run on a sample from station 1617A, and results showed a human source. There will not be a suspension of harvest at this time (See "*Recommendations*" for more information).

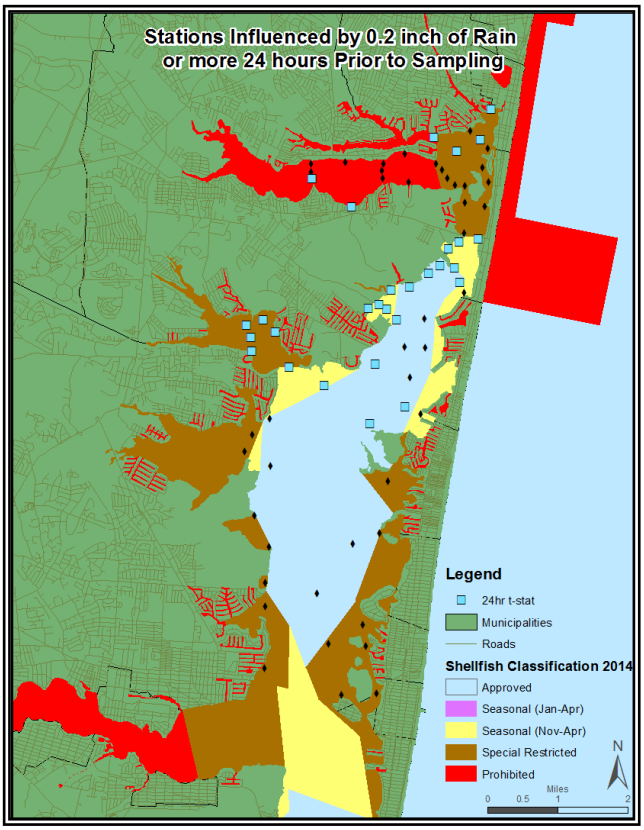
With the timeframe extended to 30+ samples for summer, a total of thirty-six stations exceeded the *Approved* criteria, three of which are located in *Seasonal* waters. Stations 1608, 1608E, and 1608F, located in Havens Cove, exceed the criteria, but these waters are closed for harvest during the summer months. The source of coliform appears to be coming from the Baywood lagoon community.

With the timeframe extended to 30+ samples for winter, a total of five stations exceeded the *Approved* criteria during the winter, none of which are located in *Seasonal* or *Approved* waters.

One station, 1403, exceeded the NSSP SRS *Special Restricted* criteria, but it is already located in *Prohibited* waters of the Metedeconk River, therefore, not a concern at this time.

Rainfall Effects

Precipitation patterns in the coastal areas of New Jersey are typical of the Mid-Atlantic coastal region. Summer storms are localized and often associated with thunder and lightning activity. Winter storms are frequently associated with northeasters. Hurricanes can occur during the summer and early fall.



The Metedeconk River drainage basin covers an area of approximately 34.9 square miles, and has numerous small tidal creeks, like Reedy Creek and Beaver Dam Creek.

Ocean waters enter the Barnegat Bay through the inlet at Barnegat Light. The tidal range for Barnegat Bay, as measured at the Barnegat Inlet, is approximately three feet, although this range varies throughout the bay (US Fish and Wildlife Service, 1997). Tidal influx allows dilution of pollutants in bay water with the ocean water that is typically of higher water quality. The exchange rate at the Barnegat Bay Inlet is about 7% per tide, which means the complete turnover of the bay waters takes approximately 50 days (US Fish and Wildlife Service, 1997). Since the inlet is about twelve miles south of the Tunney-Mathis Bridge, the Northern Barnegat Bay area does not see prime tidal flushing. However, this tidal flow helps to improve the water quality of the sections adjacent to the urban shorelines, which are often contaminated by runoff. Everything considered, coliform levels are still low enough for

many of the waters of the Barnegat Bay to remain classified as *Approved*.

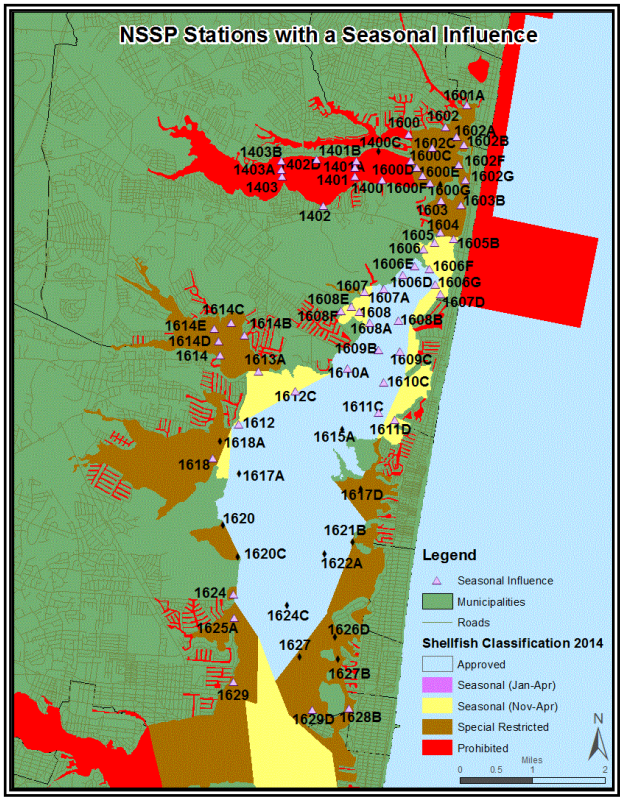
Rainfall amounts are based on the closest established NOAA/National Weather Service station; each assignment run is assigned to a weather station to accurately reflect the rainfall at the sampling stations. A *t*-test is used to compare log-transformed total coliform values for wet verses dry data. The *t*-statistical probability must be less than or equal to 0.05 for a station to be rainfall impacted. There is also a wet/dry cutoff for each growing area that dictates what data is considered 'wet' and what data is considered 'dry'.

The effects of the 'first flush' should be captured by the '24 hours prior to sampling' *t*-statistics. *T*-statistics are also determined for the 'cumulative 48 hours prior to sampling' and the 'cumulative 72 hours prior to sampling'. These *t*-statistics help to determine if there is a delayed impact on the waterbody.

The best scenario that represented this growing area was based on a wet/dry cutoff of 0.2 inch. Once this was determined, the data were analyzed at '24 hours prior to sampling', '48 hours prior to sampling', and '72 hours prior to sampling'. Rainfall appears to be a significant factor for the stations located in this growing area. The 'first flush' after 0.2 inch of rainfall impacts various spots close to the shoreline, which is expected since this area has high urban land use and is abundant in impervious surfaces (see figure on previous page), although the Metedeconk River has a more delayed rainfall effect.

Seasonal Effects

The Northern Barnegat Bay undergoes a population surge in the summer, which increases sewage use as well as other utilities. Therefore, it is probable that the stations with a seasonal component are affected by non-point source pollution from increased summer population and/or increased use of water-related activities (boating, etc.) during the summer. Seasonal variation may also be the result of a variety of conditions, including temperature, precipitation, specific agricultural land-use practices, biological activity, stream flow and/or sediment.



Statistically significant seasonal impacts were observed at fifty-nine of the seventy-three stations (see adjacent figure). SRS seasonal components were assessed using a *t*-test to compare log-transformed fecal coliform values for summer verses winter data. The *t*-statistic probability must be less than or equal to 0.05 for a station to have a seasonal component. All but two of the stations with a seasonal component had higher coliform values in the summer. However, none of the noted stations had a geometric mean that exceeded the established values for the present classifications. The Est. 90th Percentile values for these stations also fit within criteria. No changes in classification are needed as a result of the seasonal components at these stations.

RELATED STUDIES

Water Monitoring and Standard's (WM&S) Bureau of Marine Water Monitoring (BMWM) also monitors New Jersey waters for levels of nutrients (estuarine monitoring), phytoplankton, and bathing beach standards.

Nutrients

Coastal water quality is monitored for ecological health parameter including dissolved oxygen and total nitrogen. The parameters are evaluated, analyzed, and presented on the web at: www.nj.gov/dep/bmw.

Phytoplankton

Phytoplankton are photosynthetic algae that play a critical role at the base of aquatic food webs. Phytoplankton studies are used to show what species are present and in what concentration. BMWM, in accordance with the NSSP requirements, collects and analyzes phytoplankton data throughout the summer to determine the occurrence of marine phytoplankton species that could produce biotoxins. For more information on the Phytoplankton program visit the BMWM website, www.nj.gov/dep/bmw.

Bathing Beaches

WM&S cooperatively works with the New Jersey Department of Health and local health agencies to monitor the bathing beaches in New Jersey. Together, these agencies implement the Cooperative Coastal Monitoring Program (CCMP). With this program, the coastal and estuarine waters that are open to the public for recreational bathing are surveyed and regularly monitored for the concentration of bacteria. The CCMP, in conjunction with US Army Corps of Engineers, also carries out the NY/NJ Harbor Estuary Program's Floatables Action Plan that utilizes aerial surveillance to detect floating solid waste and debris. Flights are schedules for six days a week, weather permitting, during the summer months.

Typically, bathing beach samples are taken once a week for the entire summer. These samples are tested for Enterococci as a fecal coliform indicator. Ocean and bay recreational beaches are subject to opening and closing procedures of the State Sanitary Code. Local health agencies and law enforcement may close a bathing beach if the results exceed the State Sanitary Code of 104 Enterococci per 100 mL. Stations must be re-sampled when bacteria concentrations exceed the primary contact standard of 104 Enterococci per 100 mL of sample (NJDEP CCMP, 2012). Consecutive samples that exceed the standard require the closing of the beach until a sample is obtained that is within the standard. Environmental stations are not bathing beaches and do not require re-sampling. Beaches can also be closed at any time if health or enforcement agencies believe it is in the interest of public health. BMWM utilizes these data as adjunct information; the closure of shellfish waters does not correspond with these results. Please see http://www.njbeaches.org/ for further information.

Toxic Monitoring

Toxic chemicals such as heavy metals, pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) are dangerous chemicals that can be found in the environment. These substances can be released into the environment by storm drains, runoff, sewage treatment facilities, and atmospheric deposition. Bottom dwelling organisms are most vulnerable to these chemicals and may pose a risk to human health if consumed.

USEPA National Coastal Assessment Program (NCA)

USEPA National Coastal Assessment EMAP and its partners began sampling in the coastal and estuarine water of the United States in 1990. Data collected include water column parameters, sediment chemistry & toxicity, benthic communities, and tissue contaminants. These data are collected once every five (5) years, as part of USEPA's National Aquatic Resource Surveys. Currently, no new NCA data is available for the Northern Barnegat Bay. Please see http://www.epa.gov/emap/nca/index.html for further information and the most recent data.

National Oceanic and Atmospheric Administration (NOAA) Mussel Watch

The National Oceanic and Atmospheric Administration (NOAA) Mussel Watch Program monitors the levels of toxins and metals in shellfish. The blue mussel, *Mytilus edulis*, occurs worldwide and effectively takes up toxins and metals from seawater and sediments. The toxins and metals then become concentrated in the mussel's living tissues. Assays from the living tissues of this shellfish can be made easily and cheaply. The Mussel Watch Program monitors metals such as mercury, lead, zinc, nickel, cadmium, copper, chromium, aluminum, silicon, manganese, iron, arsenic, selenium, tin, antimony, thallium, and silver. The program also monitors toxins such as the synthetic organic compounds that are widely used in pesticides, solvents, flame-retardants, and other products. There is a no mussel watch station in the Northern Barnegat Bay. Please see http://ccma.nos.noaa.gov/about/coast/nsandt/musselwatch.aspx for further information and the most recent data.

CONCLUSIONS

The appendix lists the water quality data obtained from the sampling period of January 1, 2010 to June 30, 2014. Systematic Random Sampling strategy was used to collect the samples, laboratory tests were run, and a thorough analysis of the fecal coliform data was assembled for this report. The bacteriological data for each station must support the respective criteria for the current classification under the fecal coliform standard. Based on the data, twenty-seven stations exceeded the SRS *Approved* criteria; two stations, 1615A and 1617A, are not in compliance since they are within *Approved* waters. The *Seasonal (Nov-Apr)* portions of the Northern Barnegat Bay fit within the criteria when the timeframe is extended to have at least 30 samples during the winter months. One station exceeded the SRS *Special Restricted* criteria; however, this station, 1403, is located in the Metedeconk River, in *Prohibited* waters (not the section intended for the upgrade). Therefore, analyses of the Northern Barnegat Bay shellfish growing area samples indicate that the fecal coliform geometric mean and/or estimated 90^{th} percentile levels of all but two stations meet the standards of the National Shellfish Sanitation Program (NSSP).

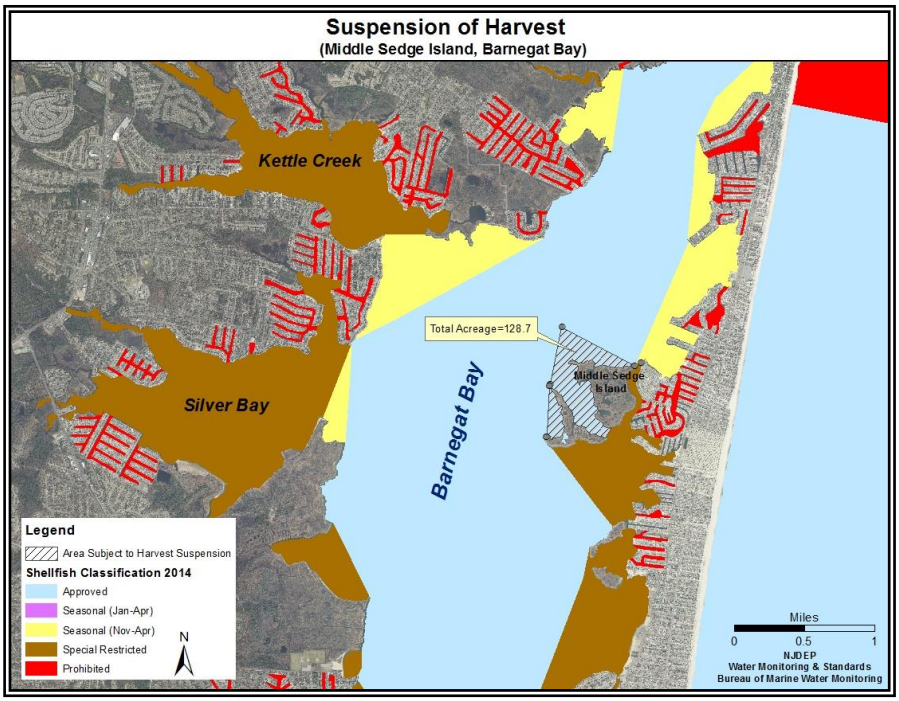
There were fifty-nine stations with a seasonal component. It was found that the urban areas in the Northern Barnegat Bay are impacted by rainfall accumulations above 0.2 inch. The Brick Township area is particularly impacted by the 'first flush' of rainfall, which then spreads throughout the Barnegat Bay. On analysis it was found that none of the seasonal impacted stations require a change in classification.

RECOMMENDATIONS

The western portion of the Metedeconk River is and should remain *Prohibited*, one station did exceed *Special Restricted* criteria, there is an abundance of marinas, and high urban land use. The eastern portion of the Metedeconk River will be upgraded from *Prohibited* to *Special Restricted* pending a regulatory

change. The existing section of *Special Restricted* waters fits within its current classification and should remain *Special Restricted* in part due to the surrounding urban land use. Many of the *Seasonal* and *Special Restricted* areas in the Barnegat Bay buffer urban areas, runoff, outfalls, and marinas. The rest of Barnegat Bay is *Approved*.

There will be a suspension of harvest around station 1615A for the 2015 shellfish classification maps. It is estimated the suspension of harvest will encompass 128.7 acres (see below figure). One NSSP station, 1615A, is within the suspended area. There are no bathing beaches, marinas, or nutrient stations in the area at this time.



At this time, a suspension of harvest is not recommended for the area around station 1617A because the station was close to meeting criteria, and more shoreline work needs to be conducted.

In addition to more shoreline investigations, stations will be added in the general area to help determine the potential sources of pollution. Stations 1611A, 1612B, 1612F, 1616, 1617B, and 1620H are being re-activated, and four new stations, 1616C, 1617G, 1617H, & 1617I, are being added to sampling run 087 for the 2015 sampling year. Although these stations will not have enough sampling events to be assessed with NSSP criteria for a couple of years, the preliminary data will be used to better understand the flow and highlight areas for the shoreline survey. It is also suggested, if resources allow, to conduct an intensive study (rainfall, tide, season) into the areas of Cattus Island County Park and Middle Sedge Island within the Northern Barnegat Bay, in order to find more information and possible pollution sources.

Technically, the recommended downgrade would encompass waters of Barnegat Bay and its tributaries east of a line beginning at the tip of Chadwick Island (with coordinates latitude 40 degrees 0 minutes 0.4 seconds North and longitude 74 degrees 4 minutes 20.8 seconds West) across Middle Thoroughfare to the northeastern tip of Middle Sedge Island (coordinates latitude 39 degrees 59 minutes 59.5 seconds North and longitude 74 degrees 4 minutes 24.0 seconds West), thence in a westerly direction to coordinates latitude 40 degrees 0 minutes 13.9 seconds North and longitude 74 degrees 4 minutes 59.1 seconds West, then in a southerly direction to the northeastern tip of NW Point Island with coordinates latitude 40 degrees 0 minutes 13.9 seconds North and longitude 74 degrees 4 minutes 59.1 seconds West, then following the shoreline of NW Point Island in a southerly direction to a coordinates latitude 39 degrees 59 minutes 52.0 seconds North and longitude 74 degrees 5 minutes 5.2 seconds West, thence in a southeasterly direction to the southeasternmost tip of NW Point Island with coordinates latitude 39 degrees 59 minutes 33.3 seconds

North and longitude 74 degrees 5 minutes 6.7 seconds West, then along the southern shore to a Department maintained marker on the southwestern tip of NW Point Island, then joining the already existing *Special Restricted* waters (see N.J.A.C. 7:12 for official classification changes)

Otherwise, continue sampling under the existing sampling protocol and analyzing the samples for fecal coliform.

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APPENDICES

A. Statistical Summary

B. Seasonal Evaluation

C. Precipitation

- Rainfall Amount
- Wet/Dry Statistics

D. Data Listing – January 1, 2010 through June 30, 2014

E. Map Key of Marinas in the Northern Barnegat Bay

F. Shoreline Survey Reports