



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

**Sanitary Survey Report for Shellfish Growing Area A0North
(Monmouth Beach to Sandy Hook)**



January 2015

State of New Jersey
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NJ Department of Environmental Protection
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Sanitary Survey Report for Shellfish Growing Area A0North (Monmouth Beach to Sandy Hook)

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Cover Photo – Monmouth Beach and Sea Wall, Monmouth Beach, NJ

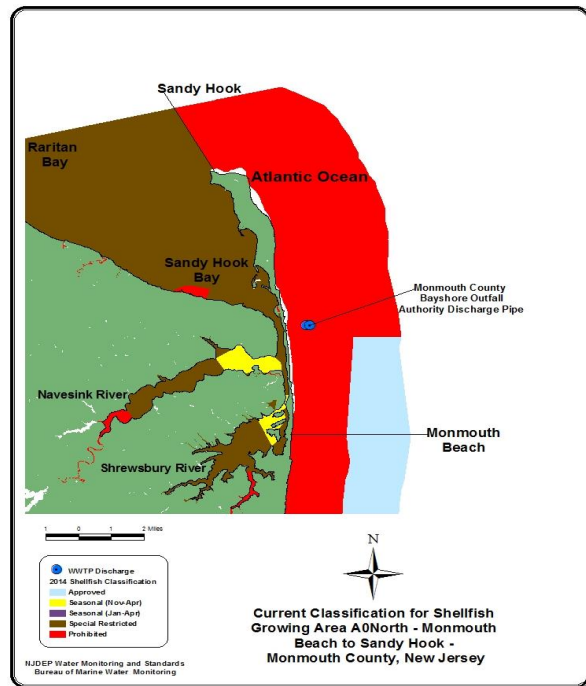
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EXECUTIVE SUMMARY

For this Sanitary Survey, an analysis of water quality samples taken between January 2011 and September 2014 for Shellfish Growing Area A0North – Monmouth Beach to Sandy Hook (A0North), suggests there were no stations that exceeded the National Shellfish Sanitation Program (NSSP) classification criteria for their respective locations.

The Atlantic Shellfish Growing waters of A0North consist of 27,781 acres with 3,695 of those acres classified as *Approved* and 24,086 designated as *Prohibited*. A0North extends along approximately 11.25 nautical miles of the Atlantic Ocean from Monmouth Beach in the south, northward beyond Sandy Hook, and then offshore or east from these locations by three nautical miles. Current Shellfish growing water classifications for A0North can be viewed in the figure to the right. A0North classification charts (i.e., 2 and 3) can also be reviewed in the 2014 Shellfish Growing Water Classification Maps section (see www.state.nj.us/dep/wms/bmw).



As A0North is an Atlantic Ocean Shellfish Growing Area, it should be noted that classifications for New Jersey ocean waters are either *Approved* or *Prohibited*. There is a necessity for a *Prohibited* water classification in A0North, as this shellfish growing area has a direct discharge pipe and outfall, present in the area. This infrastructure is managed by the Monmouth County Bayshore Outfall Authority (MCBOA), and utilized by the Township of Middletown Sewerage Authority (TOMSA), and Bayshore Regional Sewerage Authority (BRSA). Wastewater treatment plant outfalls require the designation of safety zones or *Prohibited* areas that act as buffer zones with regard to the model ordinance contained in NSSP. These buffers are used as a precaution to protect public health in the event accidental discharge of untreated sewage occurs. NSSP also requires the use of Adverse Pollution Condition (APC) sampling strategy in shellfish growing areas where direct discharge could potentially impact the water quality with increased bacterial contamination.

Storms can create bacterial contamination due to flooding of sewerage infrastructure or damage to such processes. During the time frame that this report was written, three storms had particular impact on State shellfish growing waters. Those storms were Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy. Shellfish Growing Area A0North, had its greatest impact from Superstorm Sandy, as that storm had the greatest impact on sewerage infrastructure. Although Hurricane Irene and Superstorm Sandy caused the closure of all State waters, initially, A0North waters were not closed for a prolonged period following either storm. Aside from these storms, there have been no ongoing impacts to the waters of A0North from treatment plant error, operations, or discharge.

Continuous upgrades have helped these plants facilitate operations in an efficient and reliable fashion. This in turn has contributed to providing a record of acceptable water quality for this shellfish growing area. In that no classification criteria were exceeded during the time frame of this report, current classifications will remain in effect for A0North with no adjustments recommended for this reporting period.

GROWING AREA PROFILE

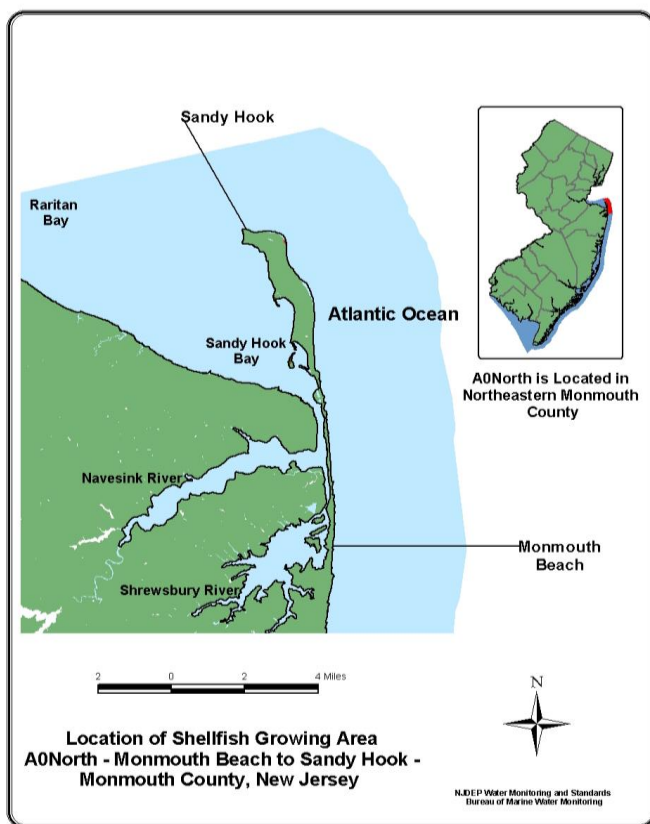
LOCATION AND DESCRIPTION

This Sanitary Survey covers the ocean shellfish growing waters from Monmouth Beach to Sandy Hook, as shown in the figure to the right. It extends along approximately 11.25 miles of the Atlantic Ocean covering an area from Monmouth Beach in the south, north to Sandy Hook (approx. 9.13 mi.), then again north (approx. 2.11 mi.) off Sandy Hook, and offshore (east) from these locations, encompassing an area of water located within a portion of the State's three mile jurisdictional limit (Please Note: all references to "miles" in this report are in Nautical Measure, whereby, one nautical mile equates to 6,086 feet).

The *Prohibited* waters of A0North are bordered to the west by a peninsula type land formation that runs from Monmouth Beach in the south toward Sandy Hook in the north. The New York Bight and the shipping lanes associated with ingress and egress into New York and northern New Jersey are close by to the northeast. The Atlantic Ocean waters of A0North mix readily with the waters of Sandy Hook and Raritan Bays to the west and Lower New York Bay to the north.

Several rivers feed into the bays that eventually mix with the waters of A0North. The largest of these would include the Shrewsbury, Navesink, Raritan, and Hudson rivers.

About 50 percent of the land adjacent to this shellfish growing area consists of a number of urban towns along the shore. This would be the sector from Monmouth Beach in the south to the base of Sandy Hook. Sandy Hook comprises the central to northerly sector and it is primarily a national recreation area. As a result, the central to northern section is less populated and contains fewer building structures.



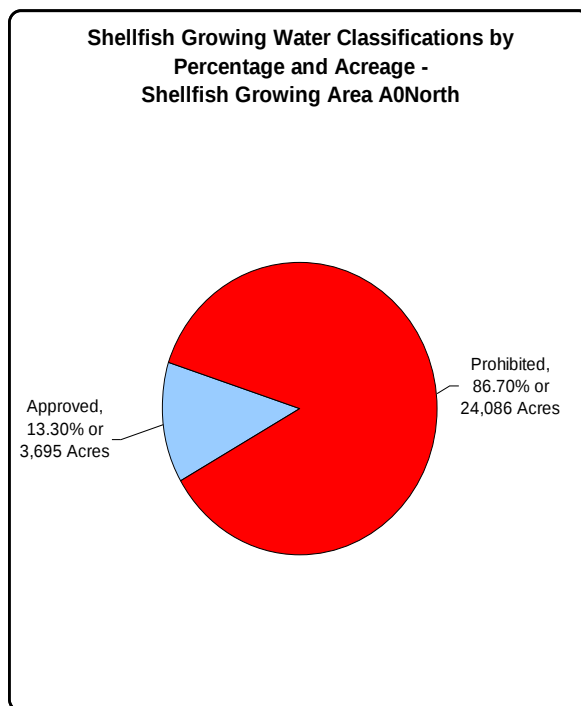
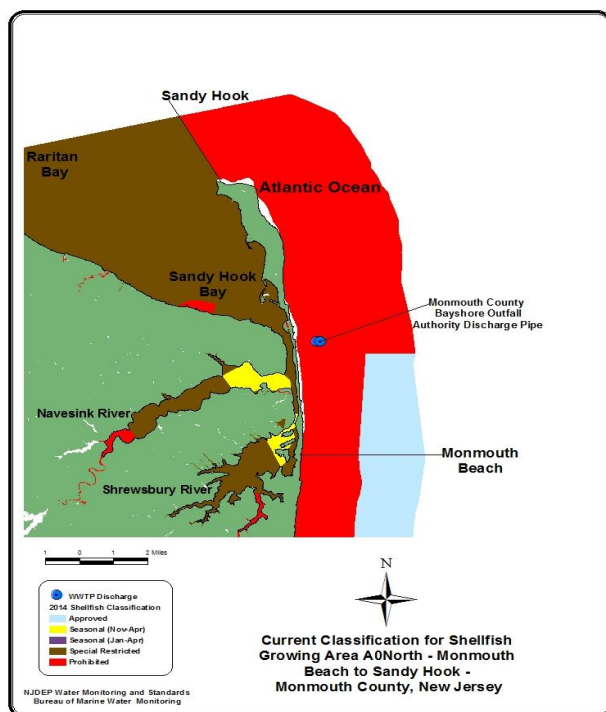
There is a direct source input into this shellfish growing area. This comes from the outfall for the Monmouth County Bayshore Outfall Authority discharge pipe.

Stormwater outfall inputs are absent along the ocean shoreline of A0North. Any waters having been impacted by such sources are primarily directed to the bayside. Storm water runoff eventually enters the waters of A0North after being substantially diluted by the waters of the Shrewsbury, Navesink, Raritan, and Hudson rivers along with Sandy Hook, Raritan, and Lower New York Bays.

GROWING AREA CLASSIFICATION SUMMARY

Aside from WM&S/BMWM annual reports, the last comprehensive written report for A0North was a Reappraisal completed in 2012. Classifications from the 2012 Reappraisal will remain unchanged for this Sanitary Survey as the data suggest there is no current need for adjustment.

Shellfish Growing Area A0North consists of 27,781 acres. 3695 acres are classified as *Approved* waters and 24,086 are designated as *Prohibited*. Current classifications along with growing water acreage and percentages are shown below. As noted in the Executive Summary, A0North classifications can also be reviewed using charts 2, and 3 of the 2014 Shellfish Growing Water Classification Maps section (see www.state.nj.us/dep/wms/bmw).



EVALUATION OF BIOLOGICAL RESOURCES

Historically, *Approved* ocean waters have been used for harvesting surf clams (*Spisula solidissima*) and blue mussels (*Mytilus edulis*) by dredge boats licensed by the Division of Fish and Wildlife. Surf clams (for bait purposes only - non-human consumption) can also be

harvested from *Prohibited* areas under a special program administered by WM&S/BMWM and enforced by the Division of Fish and Wildlife.

In addition to being the State's largest molluscan fishery (i.e., regarding lbs. landed), New Jersey's surf clam fishery generally leads all other surf clamming states in total annual landings (2013 was an exception), according to statistics from NOAA's National Marine Fisheries Service. The table below denotes commercial landings in pounds of meat and ex-vessel value for New Jersey surf clams from 1993 through 2013.

Commercial Data for Surf Clams Showing Pounds of Meat and Ex-vessel Value for New Jersey Landings (1993 - 2013) - Source: NOAA Fisheries		
Year	Lbs. of Surf Clams Landed	Ex-vessel Value
1993	47,978,097	\$ 21,802,735
1994	48,572,236	\$ 26,840,477
1995	46,329,437	\$ 27,443,281
1996	48,740,881	\$ 28,983,170
1997	45,603,401	\$ 27,168,453
1998	44,751,327	\$ 23,060,750
1999	49,299,900	\$ 25,371,922
2000	58,047,629	\$ 31,371,354
2001	52,872,341	\$ 29,326,676
2002	53,590,740	\$ 29,172,373
2003	51,336,955	\$ 27,431,645
2004	43,521,704	\$ 22,284,335
2005	38,967,993	\$ 20,028,662
2006	43,643,726	\$ 25,106,785
2007	44,791,212	\$ 26,546,602
2008	39,346,425	\$ 24,349,551
2009	32,893,521	\$ 20,568,576
2010	25,089,484	\$ 16,010,934
2011	16,930,215	\$ 10,980,834
2012	20,512,064	\$ 12,352,632
2013	18,728,815	\$ 10,918,271

At the time this report was written, the National Marine Fisheries Service reported the primary biological resources of commercial importance for New Jersey waters from 0 – 3 miles [w/in the State's three (3) mile jurisdictional limit] were Bluefish, Common Eels, Menhaden, Blue Claw Crabs, American Lobster, Hard Clams, Surf Clams, and Eastern (Atlantic) Oysters.

From three to two hundred miles out, the Atlantic Surf Clam, American Lobster, and Bluefish remain an important part of the market species sought after by New Jersey fishermen along with the Ocean Sea Scallop, Ocean Quahog, Butterfish, Croaker, Summer Fluke, Winter Fluke,

Anglerfish, Silver Hake, Atlantic Sea Herring, Atlantic Mackerel, Menhaden, Scup, Black Sea Bass, Gray Sea Trout, shark, skate, Swordfish, Tilefish, Bigeye Tuna, Yellowfin Tuna, and Atlantic Squid.

In terms of pounds landed, surf clam totals are the largest, and for the shellfish growing water classification purposes of this report, surf clams as a shellfish and by number of pounds landed, will remain the primary focus.

Since New Jersey's surf clam industry is generally at the national forefront in total landings, monitoring, management, and conservation of this resource is very important to the State. In this regard, the New Jersey Surf Clam Advisory Committee, comprised of industry and government representatives sets the quotas for harvest, in conjunction with the Commissioner for the New Jersey Department of Environmental Protection. A brief history of those quotas and bi-valves with the largest landings for the State are shown in the tables that follow.

New Jersey Surf Clam Quotas in Industry Bushels by Year (1996 – 2014) - Source: New Jersey Department of Environmental Protection, Bureau of Shellfisheries	
Surf Clam Harvest Year	Surf Clam Quotas in Industry Bushels
1996 - 1997	600,000
1997 - 1998	600,000
1998 - 1999	700,000
1999 - 2000	700,000
2000 - 2001	700,000
2001 - 2002	600,000
2002 - 2003	600,000
2003 - 2004	275,000
2004 - 2005	350,000
2005 - 2006	237,000
2006 - 2007	240,000
2007 - 2008	198,000
2008 - 2009	58,368
2009 - 2010	55,296
2010 - 2011	55,296
2011 - 2012	49,152
2012 - 2013	24,576
2013 - 2014	14,592

Ocean Bi-Valves w/ Largest Landings Reported for New Jersey (0 - 3 Miles Distance from Shore highlighted in yellow)									
	DISTANCE FROM N. J. SHORE								
	0 - 3 MILES		3 - 200 MILES		HIGH SEAS		COMBINED TOTALS		
COMMON BI-VALVE NAME	Pounds of Meat (000)	Dollars (000)	Pounds of Meat (000)	Dollars (000)	Pounds of Meat (000)	Dollars (000)	Total Pounds of Meat (000)	Total Dollars (000)	Price/ Pound of Meat
Surf Clam	7,959	4,641	17,130	11,370	-	-	25,089	16,011	\$.64
Sea Scallops	56	497	14,098	108,492	-	-	14,155	108,990	\$7.70
Ocean Quahog	2,141	1,104	11,307	6,775	-	-	13,448	7,878	\$.59
-- TOTALS --	10,156	6,242	42,535	126,637	-	-	52,692	132,879	
Adapted from: Landings by Distance from U.S. Shores, 2010, State of New Jersey, National Marine Fisheries Service - Fisheries Statistics and Economics Division - Report printed on: 01/06/14									

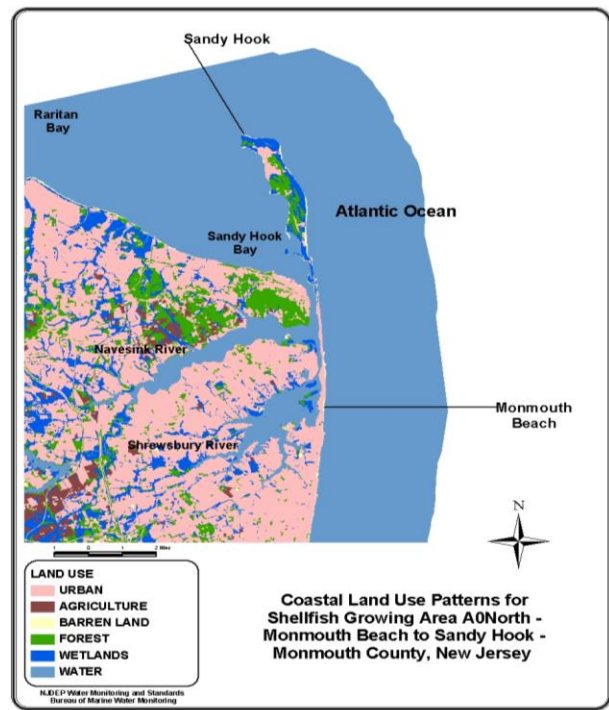
SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

Shoreline surveys or site-specific tours of areas nearby or abutting shellfish growing waters can provide insight as to the location and nature of land use, surface water discharges, marinas, unpermitted discharges, and stormwater inputs. A shoreline survey of A0North was conducted on July 18, 2014, and the following sections detail information derived collectively from that survey, and those that preceded it.

LAND USE

The land adjacent to the Atlantic Ocean shellfish growing area known as A0North has coastal geophysiography similar to that of a barrier island. Although there are many similarities, it is actually a peninsula type land mass with the Atlantic Ocean toward the east, Sandy Hook Bay, the Navesink and Shrewsbury Rivers on the western side, the Raritan River and bay to the northwest, and the Hudson River to the north (see figure to the right).

The barrier island-like shoreline, forming and abutting this shellfish growing area, consists of urban development. This development is primarily residential with some commercial business supporting recreational use and commerce. Along the areas shoreline, there are numerous beaches providing a recreational and economic resource to local and State economies.



When considering the geomorphology of this location, it is apparent that interactions of the ocean, bay, and rivers have exerted a strong physical influence in shaping the area. These bodies of water have also helped to mold the manner in which people have lived, worked, and developed the land through the ages.

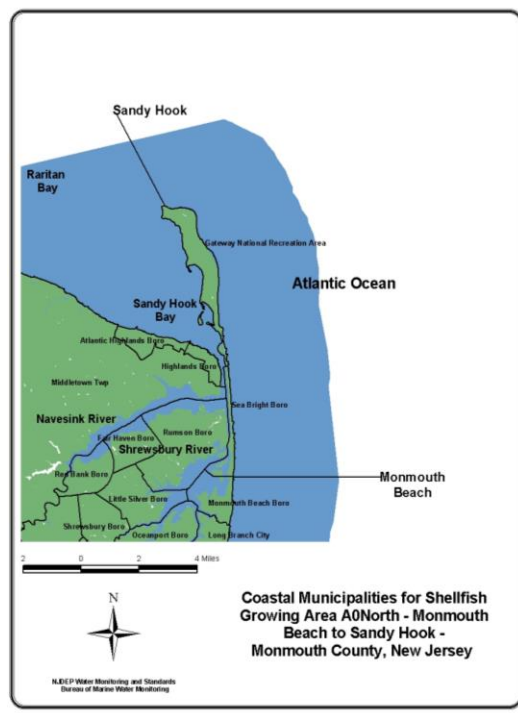
Land use surrounding A0North is somewhat divided. The northern extent (Sandy Hook - a 1665-acre barrier beach peninsula) contains the Gateway National Recreation Area. In years past, the US Army had active military installations on Sandy Hook. Prior to Super Storm Sandy, individuals from the US Coast Guard and National Park Service comprised an average year-round population of approximately 130 residents on Sandy Hook. Since Super Storm Sandy, year-round residency has virtually ended.

There are multitudes of visitors that come to Sandy Hook every year in order to see the national park facilities. Sandy Hook also serves as the location for the NJ Marine Sciences Consortium and the National Ocean and Atmospheric Administration, along with the Northeast Fisheries Science Center.

Larger urban communities exist to the north, northwest, and west of A0North. The largest of these would be New York City to the north.

The land use in the southerly and central communities bordering A0North is predominantly urban. Smaller scale urban development is generally associated with the southeastern communities from Monmouth Beach to Sea Bright Boro and the southwestern or intercoastal towns from Rumson Boro to Atlantic Highlands Boro. These municipalities are shown in the map to the right.

Historically, the land and waters comprising the southern portion of A0North have provided a location for vacationing, hunting, and commercial/sport fishing. For some, the location has provided year-round residence but for many, it has provided a place to relax and enjoy time away from work in a shore rental or secondary home. Although year-round residency has generally grown over the years, population increase is traditionally more apparent in warmer seasons associated with secondary homeowner and rental use.



Increased population could cause impact to the waters of this growing area. However, higher population fluctuations in the summer months would seem unlikely to affect potential surf clam harvests as harvesting takes place during the less crowded time frame from October 1 through May 31.

The spread of development within the land bordering A0North has slowed due to the lack of available land for building but there are some new construction projects. Because of their coastal location, homes and businesses within these areas can require repair on a frequent basis. There are also reconstruction or construction projects created from tear down and refurbishment projects.

Impact from construction is unlikely though as projects bordering on eco-sensitive areas are required by local, state, and federal regulations to utilize specific setbacks and buffers as a means of protecting flora and fauna specific to wetland, riparian, or estuarine locations. The use of these buffers can never be understated as their utilization helps to assure that construction is less likely to significantly impact shellfish growing areas.

Aside from contributing to productivity, wetland and estuarine zones provide valuable habitat for many marine species during some point of their life cycle. Plant species within these zones often cleanse contaminants from the ecosystem while enhancing the quality of water prior to its reaching the ocean.

A limited area of wetlands is present in close proximity to urban development in A0North. From south to north, these wetlands can be seen at the mouths of the Shrewsbury and Navesink Rivers, and some portions of Sandy Hook Bay.

As mentioned previously, there are numerous mainland communities situated just to the west of A0North, and larger cities to the northwest, and north. Presently, the Data Listings for shellfish growing areas monitored by WM&S/BMWM [waters to the north (New York) are outside WM&S/BMWM classification jurisdiction] suggest that the nature of land use in monitored areas may impact the back bay waters and rivers to the west and northwest of this growing area. Specifically, the industry and cities located to the northwest, along with the agriculture, horse farms, and large estates located to the west of this site (up the Shrewsbury and Navesink Rivers), provide nutrient loading. Additionally, industrial and commercial locations/operations can provide other inputs affecting surrounding water quality. The distance, however, from input sources to this growing area provides substantial dilution.

Pockets of homes well to the west of Shellfish Growing Area A0North utilize septic systems. Septic is primarily utilized in areas of lower population density, where there is, generally, less availability for access to city sewage infrastructure. Although there is impact from septic, farm, and agricultural use further to the west, these impacts are greatly reduced by distance and dilution prior to reaching shellfish growing area A0North.

Most of the homes within the communities surrounding A0North are serviced by municipal wastewater treatment facilities. WM&S/BMWM data suggest that current wastewater treatment infrastructure for surrounding communities is sufficient and improvements within those facilities have steadily kept up with community needs or demand.

SURFACE WATER DISCHARGES – TREATMENT FACILITY WASTEWATER EFFLUENTS

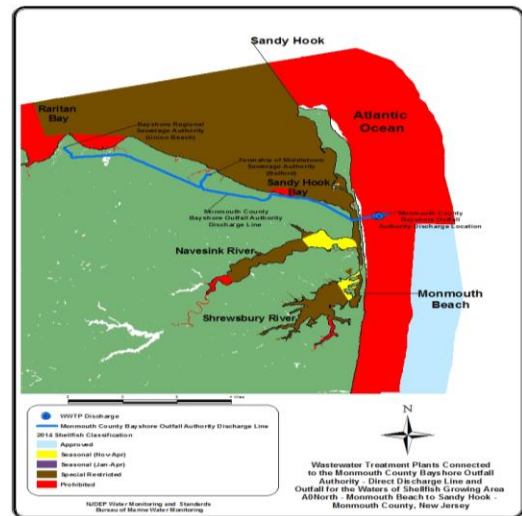
Evaluation and compliance of shellfish growing areas is ascertained using NSSP criteria contained in the *Guide for the Control of Molluscan Shellfish*, 2013. Interaction between the State and treatment plants is important in determining plant efficiency, which integrally relates to the eventual effluent quality discharged into ocean waters off the coast of New Jersey. State effluent standards for direct discharge are presented in the table on the next page. The wastewater treatment facilities discussed in this section have continuously maintained the standards shown in that table.

The wastewater treatment facilities representing potential point sources of contamination in the A0North Shellfish Growing Area are the Township of Middletown Sewerage Authority (TOMSA) and Bayshore Regional Sewerage Authority (BRSA). Effluents from TOMSA and BRSA pass through the Monmouth County Bayshore Outfall Authority (MCBOA) discharge pipe, located in A0North.

Effluent Standards for Direct Discharge to Surface Water from Publicly/Privately Owned Wastewater Treatment Facilities – NJPDES Permit Regulations (7:14A – 12.2 – 12.5)	
Avg. BOD ₅ Level/Wk.	≤ 45 mg/L
Avg. BOD ₅ Level/Mo.	≤ 30 mg/L
Avg. BOD ₅ % Removal/ Mo.	≥ 85%
or Avg. CBOD ₅ Level/Wk.	≤ 40 mg/L
or Avg. CBOD ₅ Level/Mo.	≤ 25 mg/L
or Avg. CBOD ₅ % Removal/ Mo.	≥ 85%
Avg. TSS Level/Wk.	≤ 45 mg/L
Avg. TSS Level/Mo.	≤ 30 mg/L
Avg. TSS % Removal/ Mo.	≥ 85%
Geo. Mean FC/Wk.	≤ 400 MPN/100 mL
Geo. Mean FC/Mo.	≤ 200 MPN/100 mL

The Monmouth County wastewater treatment plants mentioned herein utilize secondary activated sludge treatment. Secondary treated effluent is then released through the MCBOA ocean outfall. As mentioned previously, significant buffers (*Prohibited areas*) have been established around the ocean outfall providing a safety zone.

Updated summaries of MCBOA along with the TOMSA and BRSA facilities are presented in the following sections. The figure to the right shows the outfall location and the table below shows the waste type, design flow, and discharge characteristics of each plant.



Map Key(s) - Direct Discharge(s) to Waters of Shellfish Growing Area A0North			
Facility Name	Waste Type	Waste Quantity (Design Flow - MGD)	Discharge
Monmouth County Bayshore Outfall Authority	Residential Wastewater Influent w/ Light Industrial Input	33	Secondary Treated Effluent
Township of Middletown Sewerage Authority via the Monmouth County Bayshore Outfall Authority Discharge Pipe	Residential Wastewater Influent w/ Light Industrial Input	10.8	Secondary Treated Effluent
Bayshore Regional Sewerage Authority via the Monmouth County Bayshore Outfall Authority Discharge Pipe	Residential Wastewater Influent w/ Light Industrial Input	16.0	Secondary Treated Effluent

Monmouth County Bayshore Outfall Authority

The Monmouth County Bayshore Outfall Authority (MCBOA or the Authority) offices are situated at 200 Harbor Way in Belford. MCBOA was created by the Monmouth County Board of Chosen Freeholders in 1969 to act as a separate county authority to assist in the cleanup of Raritan and Sandy Hook Bays.

With supportive infrastructure, the specific goal of MCBOA is to pump secondary treated effluent to the Atlantic Ocean from the Township of Middletown Sewerage Authority (TOMSA) in Belford and the Bayshore Regional Sewerage Authority (BRSA) in Union Beach. In total, MCBOA, TOMSA, and BRSA serve 13 municipalities in the northeastern Monmouth County shore region.

Effluents from the treatment facilities were formerly discharged into the waters of Raritan and Sandy Hook Bays. MCBOA now collects these effluents at two pumping stations and conveys them to an offshore outfall located in the Atlantic Ocean. The effluents receive far greater dispersion and dilution in the ocean, resulting in improved water quality for Raritan and Sandy Hook Bays.

MCBOA presides over a 14.1 mile effluent pipeline that runs between BRSA and TOMSA. From TOMSA in Belford, the discharge line runs just northeast of Highlands Bridge where Sea Bright ends and Sandy Hook begins (due east of the intersection of Center and Kay Streets). Secondary effluent then heads out into the Atlantic Ocean through a discharge pipe to an outfall located 0.79 nautical miles offshore (4815 ft.).

The depth of the ocean exceeds 35 feet where the outfall is positioned. Effluent discharge is executed by means of a 640-foot multi-port, single line diffuser design. To be exact, the discharge line (from shore) heads out into the Atlantic Ocean for a distance of 4,175 feet and the multi-port, single line diffuser continues from that point for another 640 feet.

The MCBOA facilities consist of two 25 million gallon per day (MGD) pump stations located in Belford and Union Beach. The electric pumps at MCBOA's Belford and Union Beach pump stations operate at 400 and 500 horse power, respectively. These units function with variable frequency drives. A variable speed pump will require less adjustment to flow conditions and have more balance in matching effluent flow at any given time. This helps prevent bypassing and keeps pumps processing as needed. Variable speed pumps are also intended to match average daily flow rates from treatment facilities in order that discharge and dilution are more uniform. NJPDES lists the flow rating or capability for MCBOA at 33 MGD.

Each pumping station also has a 600 horsepower diesel pump, which can be utilized for emergency duty during power outages or storm periods. In addition, each facility has a four acre equalization lagoon to temporarily store treated effluent, facilitate peak flows, smooth out daily flow variations, and provide storage during wet and peak storm flows. Although each pumping station is rated at 25 MGD, capacities are actually considered closer to the previously mentioned 33 MGD with the addition of equalization lagoons.

All treated effluent is pumped through 14.1 miles of 42” and 48” pre-stressed concrete cylinder pipe. It is then discharged to the Atlantic Ocean through a 48” steel and concrete ocean outfall. Details of the Township of Middletown Sewerage Authority and Bayshore Regional Sewerage Authority, which are serviced by MCBOA, follow in the next two sections.

Township of Middletown Sewerage Authority

The Township of Middletown Sewerage Authority (TOMSA) is located at 100 Beverly Way in Belford and was constructed in 1969. The communities or townships it services are Middletown Township, Highlands, and Atlantic Highlands.

The facility is staffed 24 hours a day Monday through Friday and 16 hours a day on Saturday and Sunday. In addition to its overall operation, TOMSA oversees approximately 350 miles of sewer line and 7000 manholes.

This treatment facility utilizes 13 pump stations, which are overseen on a continuously interactive basis with the aid of their Supervisory Control And Data Acquisition (SCADA) System. All pump stations operate with dual pumps. The stations are all located in Middletown Township. Nine out of the 13 pump stations have standby power (backup generators) available on site and there is a portable generator available for the other four stations. Of the nine backup generators, three are diesel, five are propane, and one is run by natural gas.

Automatic alarms are on line for high water, power failure, and breakdown. Plant operators handle alarms and the collection crew is on call in the event of an automatic alarm occurring during those hours on Saturday or Sunday when the plant is not staffed. Essentially, duplicate units or backup machinery is available for all emergencies and or needed repairs.

Sodium hypochlorite is used for chlorination, and chlorination is continuous. If the plant experiences low chlorine effluent residual, chlorinator alarm systems will notify plant personnel. The plant uses two, 6,500-gallon tanks for chlorination and two manual chemical pumps. Recordings for total chlorine residual are taken six times per day, and bacterial testing is performed daily.

Treated effluent flows through the MCBOA discharge line. It flows toward an outfall situated in the Atlantic Ocean, northeast of the Highlands Bridge.

TOMSA’s primary purpose is to produce secondary treated effluent as a Secondary, Activated Sludge Plant. Sludge, a by-product of this treatment process is collected and shipped to a landfill in Morrisville, PA.

Bayshore Regional Sewerage Authority

The Bayshore Regional Sewerage Authority (BRSA) is located at 100 Oak Street in Union Beach. This plant was constructed in 1972. BRSA is currently staffed 16 1/2 hours a day. Actual hours of operation take place between 7:00 AM and 11:30 PM during the summer and 8:00 AM

and 12:30 AM during the winter. BRSA's service area includes Holmdel, Union Beach, Hazlet, Keansburg, Aberdeen, Matawan, Keyport, and a portion of Marlboro.

The plant also oversees and maintains 12 miles of interceptor sewer lines. They clean and TV inspect 1/5 of the interceptor lines every year. BRSA officials suggest that they do not see a lot of inflow and infiltration problems with the interceptor lines but suggest that individual towns do have problems with stormwater inflow and infiltration.

BRSA utilizes three pump stations. They are located in West Keansburg, Hazlet, and Matawan. All pump stations operate with dual pumps. Each pump station has standby power. They utilize three backup generators that run on natural gas, diesel, or gasoline.

Automatic alarms are on line for high water, power failure, and breakdown. The plant operator is notified in the event of an automatic alarm. Duplicate units or backup machinery can also be brought on line for emergency repairs.

Sodium hypochlorite is used to chlorinate. Chlorination is continuous and they utilize four, 4,200-gallon tanks, and four pumps. Treatment with sodium hypochlorite at BRSA is automatic, controlling NaOCl feed proportionally to flow.

Recordings for total chlorine residual are taken 6 times per day, and bacterial testing is performed daily. Were there to be an emergency (e.g., low chlorine effluent residual, chlorinator or chlorinator recorder malfunction), Chlorinator Alarm Systems will notify plant personnel.

BRSA functions as a Secondary, Activated Sludge Plant producing secondary treated effluent like TOMSA. And, BRSA's effluent is also carried out to the Atlantic Ocean by the MCBOA discharge pipe and distribution outfall. However, after going through the sludge press process, BRSA's engineering differs from that of TOMSA, as residually remaining sludge is then incinerated, producing ash that is then stored for subsequent removal from the facility.

SPILLS, UNPERMITTED DISCHARGES, AND CLOSURES

Aside from Hurricane Irene and Superstorm Sandy, which brought about the immediate closure of all State waters, there have been no spills or unpermitted discharges that resulted in the closure of waters in Shellfish Growing Area A0North, during this reporting period. Leaks or spills that do take place within New Jersey's shellfish growing waters are often the result of a variety of circumstances such as boats sinking or issues with sewage treatment plants such as pump station failure, broken sewer lines, sewer line back up, manhole overflow, broken pipes in commercial or residential locations, along with improper run off from commercial or residential locations, construction, and road runoff.

Often, the spills or unpermitted discharges noted above have limited impact on the chemical or bacteriological water quality in a shellfish growing area like A0North. Generally, the spills and discharges are rather small, and their distance to these shellfish growing waters is such that impact is reduced from dilution, percolation, and absorption. From the perspective of this report, which is generally founded on bacteriological results for fecal coliform, WM&S/BMWM station

data for A0North continue to show relatively good water quality. Again, no specific spill or discharge brought about the closure of shellfish growing waters for A0North during this reporting period.

STORMWATER DISCHARGES

Environmental pressures on shellfish beds in New Jersey can originate in materials that enter growing waters via stormwater. These materials include bacteria, as well as other waste that enters the stormwater collection system. Management of stormwater runoff along this section of coastline (adjacent to A0North) consists of directing flow into rivers and back bays (away from the ocean), as shown in the map to the right.

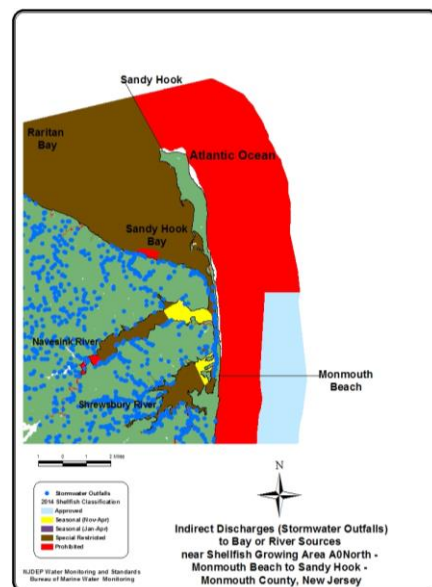
Shoreline investigations for A0North have revealed no stormwater outfalls discharging into the ocean. A small amount of storm runoff enters the ocean waters from non -channeled runoff but the majority is channeled into storm drains within most surrounding communities.

Runoff from Sandy Hook should generally be less impacting than other areas to the west of A0North. As Sandy Hook is not comprised of large commercial or industrial infrastructure, the absorption ability of substantial sand deposits, which comprise the area, filter and absorb a major percentage of impurities.

It should be noted that Sandy Hook has a wastewater treatment plant, which services all establishments located within the 1665-acre peninsula. The facility is known as the Sandy Hook Wastewater Plant, and is operated by the Water and Wastewater Division of the National Park Service for the Sandy Hook Unit - Gateway National Recreational Area. This plant was not mentioned in the section on Direct Discharge as it utilizes absorption/dispersal pools rather than pumping effluent discharge directly into the Atlantic. There are eight pools or “percolation lagoons,” which are utilized on a rotating basis. Treated effluent eventually passes to ground water via these pools.

This facility also incorporates water treatment within its operative processes. Water derived from a well, located at some distance to the south of the percolation lagoons, is treated for the purpose of public use and consumption.

Treated well water at Sandy Hook is reportedly of good quality, which suggests there is no impact to ground water from effluent percolation. With this, it appears unlikely that any impact to nearby ocean waters would result from percolation processes utilized in wastewater treatment. If coliform bacteria are discharged into percolation lagoons, natural processes appear successful in the elimination of coliform bacteria.



It is unlikely that this plant would cause impact to the ocean waters of A0North according to authorities at the Sandy Hook Wastewater Treatment Plant. In the event of a plant mishap due to infrastructural problems or error, they contend the distance to the shellfish growing waters of A0North coupled with absorption processes should eliminate bacterial loading and stormwater runoff concerns.

It was apparent that Superstorm Sandy (“Sandy”) greatly impacted the Sandy Hook Water and Wastewater Treatment Facilities, during the July 14, 2014 shoreline survey. These facilities were still undergoing substantial repair (see shoreline survey and pictures folder) during that shoreline survey. Wastewater treatment, in particular was greatly affected by “Sandy” but the nature of issues the plant has undertaken both during and after that storm suggests plant authorities have been correct about their assumptions on distance and absorption processes, reducing concern for bacteriological impact to the waters of A0North.

There are landfills situated to the northwest (Staten Island Area) of A0North, which have or had potential for contributing negative influence on the water quality in the northern portion of the growing area. The last active use of any landfill in proximity to A0North ended with the closure of the Fresh Kills Landfill during spring of 2001. It had been legally mandated to close by December 31, 2001. Although runoff from landfill sites on Staten Island still might contribute to impacted water quality in the northern and northeastern perimeters of this growing area during larger storm events, this likelihood has been reduced with the closure of Fresh Kills Landfill.

Rain events are of particular interest when reviewing the monitoring data for stations in the northerly quadrants of A0North. Factors of consideration for contributors to the occurrence of elevated coliform levels after storm events within certain sectors of A0North include the interaction of hydrological and meteorological processes. These would include precipitation events contributing stormwater outflows from nearby bays and rivers along with the orientation of winds and tides.

Nearby shipping lanes, former landfills, and larger urban communities to the North (New York) and northwest (Raritan Bay area) may also play an integral role in water quality data in the northern extreme of this growing area, following storm events. Specifically, bacteriological water quality (as indicated by coliform counts) can be negatively influenced during periods following storm activity for a variety of reasons.

WATER QUALITIES STUDIES

SAMPLING STRATEGY

Shellfish growing area A0North was sampled using the Adverse Pollution Condition (APC) sampling strategy. This required using a minimum of the most recent fifteen samples collected for each of the sampling stations in Assignment 561, which brought about an analysis of data from January 2011 through September 2014.

With the APC strategy, the 15-sample composite of data is supported by a minimum requirement of five samples per year. The APC strategy is utilized in areas where direct discharge inputs exist

with potential to influence bacteriological water quality. New Jersey commonly uses APC strategy for its ocean shellfish growing waters, as there are a number of wastewater treatment outfalls within these waters.

Each shellfish producing state is directed to adopt either the total coliform or fecal coliform criterion to classify its waters. The criteria were developed to ensure that shellfish harvested from designated waters would be free of pathogenic (disease-producing) bacteria. Combinations of coliform analysis criterion may also be used.

While New Jersey had been using fecal coliform analysis (direct 3 tube, A-1) and criteria for its ocean waters and total coliform analysis (3 tube, three dilution) and criteria for its back bay areas, BMWM/WM&S switched all State shellfish growing areas over to the criteria for fecal coliform in February, 2012, and the method for analysis changed as well.

BMWM/WM&S now use mTEC agar plating to facilitate the fecal coliform bacteriological analysis for samples taken within New Jersey shellfish growing areas, and had been acquiring adjunct mTEC data for its growing areas for some time in order to statistically facilitate the transition to mTEC. Statistical facilitation, in the case of Shellfish Growing Area A0North refers to the combination of past, 3 tube, A-1 data with current mTEC data in order to obtain statistically valid measurements during the transition.

Each classification criterion is composed of a measure of the statistical “central tendency” (geometric mean) and the relative variability of the data set. For the Adverse Pollution Condition sampling strategy, variability is expressed utilizing the 90th percentile. Although the State has only *Approved* and *Prohibited* classifications in its ocean waters, an area to be *Approved* under the *Seasonal* classification using APC would have to be sampled and meet the criterion during the time of year that it is *Approved* for the harvest of shellfish. The table that follows shows the statistical criteria for the APC strategy.

Statistical Criteria for Adverse Pollution Condition Sampling Strategy					
	Total Coliform Criteria		Fecal Coliform Criteria		
	Geometric mean (MPN/100 mL)	No more than 10% of samples can exceed (MPN/100 mL)	Geometric mean (MPN/100 mL)	No more than 10% of samples can exceed (MPN/100 mL)	
Approved Water Classification	70	330	14	49 w/ direct 3-tube, A1	31 w/ mTEC Agar
Special Restricted Water Classification	700	3300	88	300 w/direct 3-tube, A1	163 w/ mTEC Agar

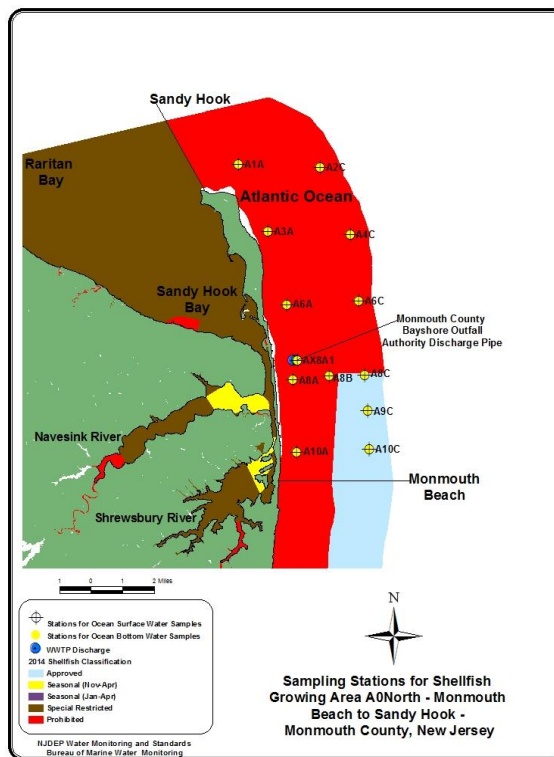
Data management and analysis was accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the Geographic Information System (GIS: ARCMAP).

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 2005).

Water quality sampling, analysis, and shoreline/watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish*, 2013.

The results were compiled from Assignment 561. A review of the records suggests that 416 water samples were collected for fecal coliform bacteria between 2011 and 2014 and analyzed using mTEC agar plating analysis. Additional information on lab methodology and sampling strategy can be found in the Shellfish Growing Area Report Guidance Document.

Twenty-six stations (13 surface and 13 bottom stations) were monitored during each year and specifically analyzed for the time frame that comprises this Sanitary Survey. The Shellfish Growing Water Monitoring Stations for Monmouth Beach to Sandy Hook (A0North) are shown in the map to the right.



BACTERIOLOGICAL QUALITY

Compliance with NSSP APC Approved Criteria

For this Reappraisal, final analyses in conjunction with NSSP requirements for *Approved* waters suggests stations within this shellfish growing area met *Approved* criteria for this reporting period. No stations had geometric means or 90th percentile scores that exceeded requirements for *Approved* shellfish growing waters using fecal coliform direct 3 tube, A-1 in combination with mTEC analysis.

The appropriate data analysis for this shellfish growing area suggests that the geometric mean shall not exceed 14 MPN/100 mL and not more than 10% of the samples should exceed 49 MPN/100 mL, if one were using 3 tube, A-1 analysis for fecal coliform (FC). When using a combination of FC analyses (i.e., 3 tube, A-1 and mTEC), which is utilized in this report, the analysis for geometric mean remains the same statistically (i.e., geo-mean should not exceed 14 MPN/100 mL) but the 90th percentile is statistically described as no more than 10 % of the samples should exceed 33 MPN/100 mL with 16 samples.

As the geo-means and 90th percentiles statistically comply with these descriptions, current classifications for this area were readily met with regard to NSSP criteria. If the two analyses were not combined, the 90th percentile for mTEC would normally be no more than 10 % of the samples should exceed 31 MPN/100 mL. *Prohibited* classifications will remain though to

provide buffers or safety zones for wastewater effluent from MCBOA and the potential for inputs from the Raritan and Sandy Hook embayment's.

Rainfall Effects

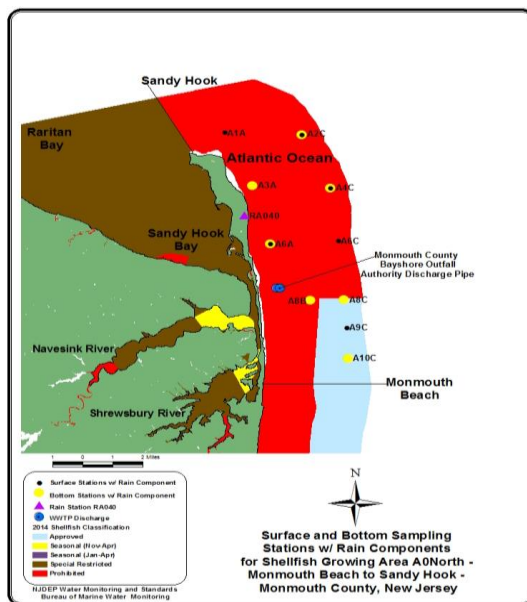
Precipitation patterns in coastal areas of New Jersey are typical of the Mid-Atlantic coastal region. Summer storms are localized and often associated with thunder and lightning activity. Winter storms are frequently associated with northeasters. Hurricanes can occur during the summer and early fall.

As suggested in the Executive Summary, storms and the excess precipitation they provide can help contribute bacterial loading to State shellfish growing waters. Bacteriological contributions can increase for numerous reasons as stormwater inputs can greatly increase non-point source runoff, and may cause flooding of sewerage infrastructure or damage to such processes.

Three storms had particular impact on State shellfish growing waters during the period data was gathered for this report. Those storms were Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy. Shellfish Growing Area A0North had its greatest impact from Superstorm Sandy, as that storm had the greatest impact on sewerage infrastructure. Although Hurricane Irene and Superstorm Sandy caused the closure of all State waters, initially, A0North waters were not closed for a prolonged period following either storm.

Precipitation data for A0North was provided by the National Oceanic and Atmospheric Administration (NOAA) with WM&S'/BMWM's use of station RA040. Additional information on annual storm averages, duration, intensity, and event volume is provided in the Shellfish Growing Area Report Guidance Document.

Based on Wet/Dry statistics, there were six surface sampling stations and seven bottom stations (13 total) that showed rainfall components in relation to water quality for this shellfish growing area (see map to the right). Of the six surface stations, one was in *Approved* waters and five were in *Prohibited*. For the seven bottom stations, two were in *Approved* waters and five were in *Prohibited* waters.



Rainfall components must register a t-statistical probability less than 0.05. The Wet/Dry Statistics were calculated based on an impact time of 48 hours prior to the day of sampling and a wet/dry cutoff of 0.25 inches of rain, as these criteria produced the most results for impact. These stations were generally located throughout this shellfish growing area. All rain component stations showed higher geometric means during wet conditions with three samples. The highest geo-means for rain component stations (those above 14 MPN/100 mL) were found for stations A10C (A - B), A2C (P - S), A4C (P - B), and A4C (P - S) at 14.9, 21.2, 17.7, and 15.8 MPN/100 mL, respectively.

In the Statistical Summary, the highest year round geometric mean recorded for any rain component station was 5.5 MPN/100 mL. The highest year round 90th percentiles were recorded at 6.3% > 33 MPN/100 mL with 16 samples for stations A10C (A – B), A2C (P – B), A3A (P – B), A4C (P – B), A4C (P – S), and A6A (P – B). With this, impact was apparent from rainfall but required no change in shellfish classifications.

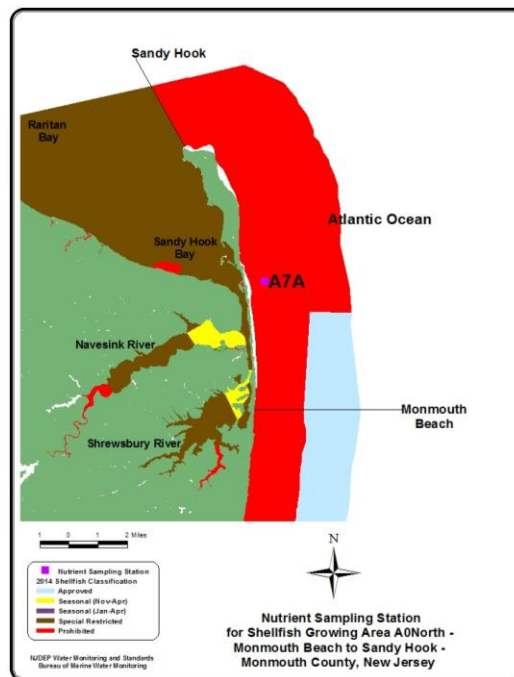
RELATED STUDIES

Nutrients

WM&S/BMWM perform additional water quality studies related to the bacteriological monitoring program. Nutrient monitoring and the collection of nutrient data is an example of one of those studies, and is part of WM&S'/BMWM's Ambient Marine Water Monitoring Program.

Stations for the Ambient Marine Water Monitoring Program are derived from an area weighted probabilistic sampling design. This provides a broader assessment, based on acreage of estuarine waters. Ocean waters are also sampled although in lessor frequency than State back bay waters.

Currently, there are 40 + nutrient sampling stations within the estuarine waters of New Jersey. At the time this shellfish growing area report was written, ocean nutrient sampling for this growing area involved station A7A, as shown in the map to the right.



Chlorophyll data are also contained within the nutrient data. As such, WM&S'/BMWM is able to maintain an ongoing picture of algal activity within State waters. This chlorophyll data also proves to be useful as adjunct information for the Bureau's phytoplankton monitoring program.

Increased chlorophyll levels are also identified by WM&S/BMWM with the aid of a remote chlorophyll flight sensor. WM&S'/BMWM's remote aircraft sensing began in 2007, and involves partnerships with New Jersey's Forest Fire Service (plane services), Rutgers (data storage); USEPA Region 2 (funding). With this program, flights take place six days a week, weather permitting, during spring and summer. These flights provide estimates of State coastal chlorophyll levels and a perspective on bloom conditions/trends.

If chlorophyll sensing suggests an area of the State is experiencing a bloom, WM&S/BMWM target sample from shore or by boat. Subsequently, such samples are analyzed at the Leeds Point Lab so species type and concentration levels are known.

Further information on nutrients within State waters is available at www.state.nj.us/dep/wms/bmw in report sections such as those referring to Estuarine and Coastal Water Quality. Ambient results and nutrient data additionally serve other reports such as the States' Integrated Assessment Report.

Phytoplankton Monitoring

The WM&S/BMWM phytoplankton monitoring program involves the collection of water column samples in order to evaluate and determine the presence of marine biotoxins associated with certain algal species, as NSSP requires shellfish harvesting states to have a Biotoxin Contingency Plan. Were there to be a toxic algal bloom for some duration, shellfish tissue samples would also be analyzed, and if found to contain toxins, the State would be required to close impacted shellfish growing waters.

Although New Jersey's marine waters are generally not associated with toxic algal species or blooms of this type, the Biotoxin Contingency Plan is required for public health and safety, as ingestion of shellfish that have fed on toxic algal species, can cause an array of human health issues.

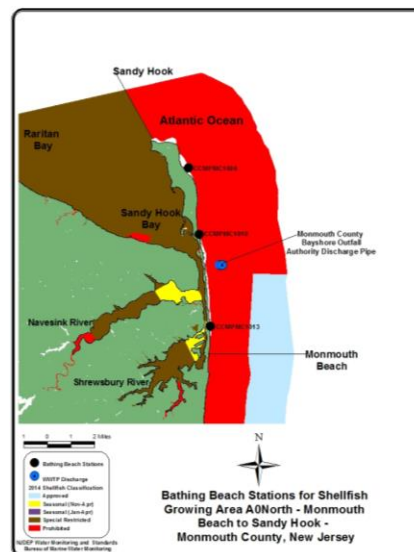


It is more frequently the discoloration of the water from algal blooms that causes issues along New Jersey's coastal waters rather than the toxicity of the phytoplankton. For example, brown tides resulting from one of New Jersey's more frequent algal blooms can be spotted in back bay waters, inlets, and occasionally the ocean, near inlet passageways. This generally occurs during May and June. However, aside from the bloom causing discoloration of the water, there are no known threats to human health from brown tides. For this reason, they are not considered in classifying waters for shellfish harvest.

Cooperative Coastal Monitoring

WM&S/BMWM also oversee the Cooperative Coastal Monitoring Program (CCMP). CCMP involves coastal water quality assessments and pollutant source investigation. There are two components to this program. These are recreational water quality monitoring at New Jersey bathing beaches and aerial surveillance of State coastal waters.

Water quality monitoring for the bathing beach component is administered by NJDEP, the Department of Health and local environmental health agencies interacting within their regions of coastal New Jersey. These agencies collect water samples each week at 180 ocean and 35 bay monitoring stations from mid-May through mid-September. Samples are taken on Monday and continued sampling through the week is performed as required. Samples are analyzed for enterococci bacteria concentrations at these monitored stations.



Enterococci are used as a fecal coliform indicator in marine recreational waters (US EPA, 1986). The acceptable rate for the “steady state geometric mean indicator density” for enterococci in the waters of marine bathing beaches is 35 MPN/100 mL or less, and 104 enterococci/100 mL is also considered acceptable as a one time exposure (Cabelli, 1983).

At the time this report was written, A0North had three primary bathing beach stations as shown in the map above. Data for Cooperative Coastal Monitoring or bathing beach stations is available at <http://www.njbeaches.org>.

The other component of the CCMP program, aerial surveillance, is conducted six days a week, weather permitting. Having this component provides an evaluative tool to aerially observe coastal water quality and potential pollution reports.

Flight paths are coordinated to observe the eastern coastal and inter-coastal waters of the State during the week. The aerial component of the CCMP program works in conjunction with the United States Army Corps of Engineers. It is part of the NY/NJ Harbor Estuary Program Floatables Action Plan. If floating solid waste and debris are spotted by aerial surveillance, the Army Corps attempts to respond with water-skimming vessels.

CONCLUSIONS

The following was concluded based on the water quality data from March 29, 2011 through August 18, 2014. The shellfish growing waters within this 11.25 mile stretch, known as A0North, continue to meet NSSP criteria for classification as *Approved*. At present, most A0North waters will remain classified as *Prohibited* though, in order to fulfill requirements for buffers, dilution, public health, and safety in relation to the direct outfall present in these shellfish growing waters, or the potential for inputs from nearby contributing water sources.

Although limited in their impact, there were rainfall components noted for some stations. Generally, impact was limited due to relatively low fecal coliform levels in relation to those components.

The secondary treated effluents from the Township of Middletown Sewerage Authority and Bayshore Regional Sewerage Authority, which flow through the Monmouth County Bayshore Outfall Authority discharge pipe and ocean outfall, are not impacting the shellfish growing waters of this area with significant coliform levels.

There were no indications that inputs such as spills caused significant impact to the waters of this growing area. The absence of inputs from stormwater outfalls along the coastal shoreline of A0North greatly reduces concern for impact to the waters of this growing area, as well. In addition, stormwater discharge into back bay waters appears to be significantly diluted prior to reaching the ocean waters of A0North.

At present, coliform levels are far too low in the data that supports this report to suggest there is substantial impact from any of the potential sources mentioned in this section and throughout this Sanitary Survey. The monitoring data derived by WM&S/BMWM, supports a predominately good characterization for water quality in A0North through the years and at present.

RECOMMENDATIONS

With regard to the summarizations presented in this report, there are no changes proposed for A0North Assignment 561, monitoring stations, or sampling strategy (APC) planned at this time. Current classifications are deemed to be acceptable in A0North when reviewing the water quality data presented for this Sanitary Survey. Therefore, the classifications will also remain unchanged for this reporting period.

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SUPPORTING DOCUMENTATION

Data sheets – Sanitary Survey Report for Shellfish Growing Area A0North (Monmouth Beach to Sandy Hook), January 2015 (see the Shellfish Growing Area Reports section at www.state.nj.us/dep/wms/bmw).

Shoreline survey field notes and pictures – Sanitary Survey Report for Shellfish Growing Area A0North (Monmouth Beach to Sandy Hook), January 2015 (see the Shellfish Growing Area Reports section at www.state.nj.us/dep/wms/bmw).