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

Sanitary Survey Report of Shellfish Growing Area NE3

Shrewsbury River

Data from January 1, 2007 – December 31, 2010

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

NJ Department of Environmental Protection
Bob Martin, Commissioner

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Data from January 1, 2007 – December 31, 2010

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Cover Photo – Meadow Ave., Monmouth Beach (photo by Tracy Fay)

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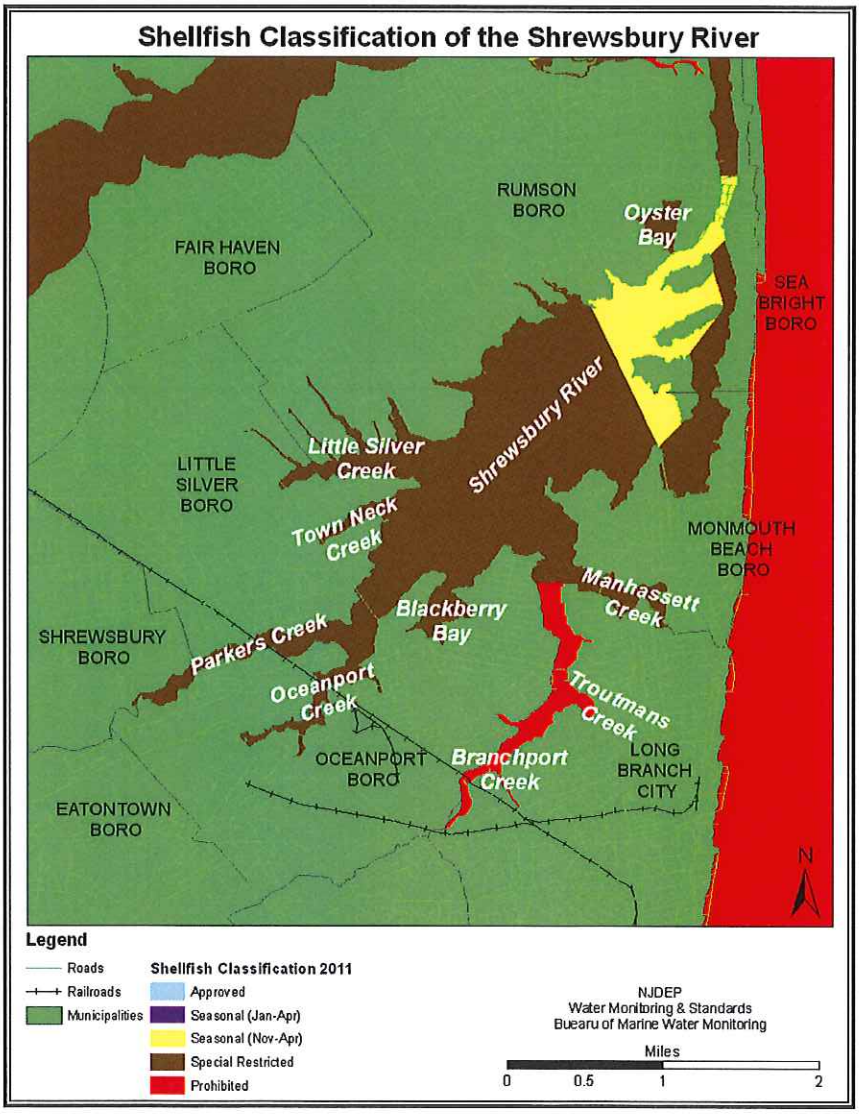
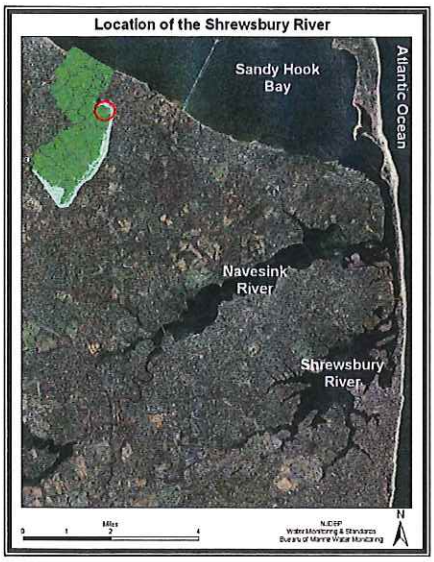
EXECUTIVE SUMMARY

The Shrewsbury River is located in Monmouth County, New Jersey. The water quality data presented in this Sanitary Survey of the Shrewsbury River was collected between January 1, 2007 and December 31, 2010 using the Systematic Random Sampling (SRS) strategy. Approximately 1,500 water samples were collected and tested for total coliform bacteria. Most of the waters in the Shrewsbury River are classified as *Special Restricted*, however, there is a section of *Seasonal (Nov-Apr)* in the eastern portion of the river, and a section of *Prohibited* waters in the Branchport Creek area. Twenty stations exceeded the *Approved* criteria set by the National Shellfish Sanitation Program (NSSP). There are no *Approved* waters in the Shrewsbury River and 30 sets of data show the stations in the *Seasonal (Nov-Apr)* section fit within the criteria for the months they are open for harvest. Two stations exceeded the *Special Restricted* criteria set by the National Shellfish Sanitation Program (NSSP), but these stations are located in the area that was downgraded to *Prohibited* in the last report. Therefore, analyses of the Shrewsbury River shellfish growing area samples indicate that the total coliform geometric mean and/or estimated 90th percentile levels meet the standards of the National Shellfish Sanitation Program (NSSP).



DESCRIPTION OF GROWING AREA

Location & Description



The Shrewsbury River is located in northern Monmouth County. Tidal waters enter the Shrewsbury River Basin via Sandy Hook Bay. The Shrewsbury River connects to the Navesink River via a narrow channel (see adjacent figure). The Navesink River is part of the Shrewsbury River Basin, but for the purpose of this report, it is examined as a separate growing area.

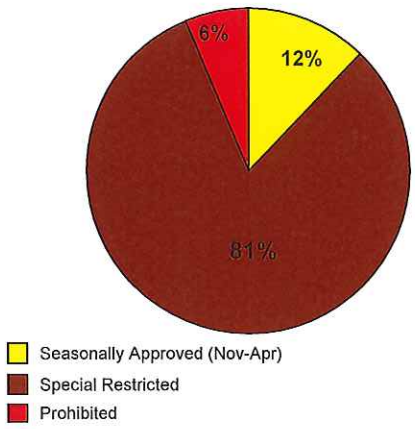
There are numerous small creeks off of the Shrewsbury River including Little Silver Creek, Parkers Creek, Oceanport Creek, and Branchport Creek; however, these creeks are not significant freshwater sources.

Seven municipalities surround the Shrewsbury River; they are Rumson Borough, Little Silver Borough, Shrewsbury Borough, Oceanport Borough, Long Branch City, Monmouth Beach Borough, and Sea Bright Borough (see adjacent figure). In total, the Shrewsbury River drains an area of 27 square miles.

Growing Area Classification Summary

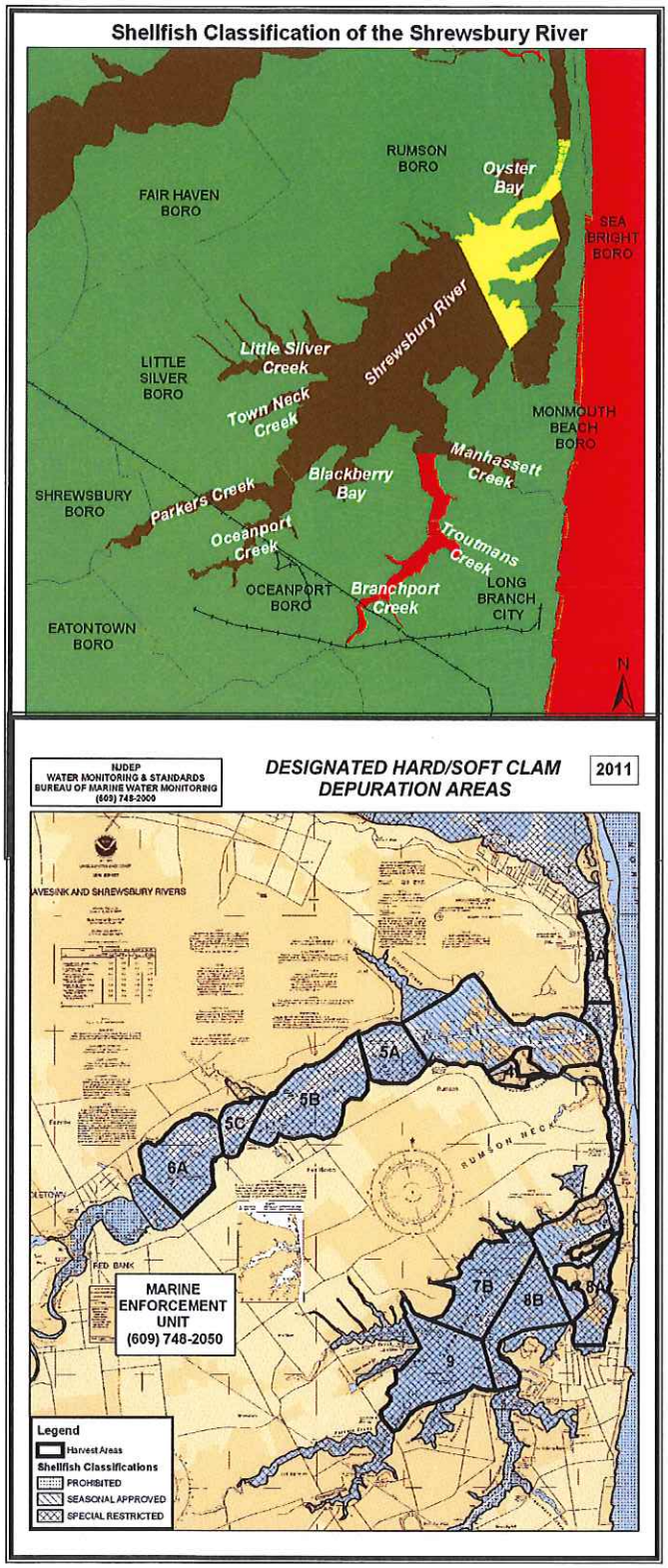
The approximate size of this shellfish growing area is 2,325 acres. Shellfish classifications in this growing area include *Seasonal (November-April), Special Restricted,* and *Prohibited* waters (see figure on following page). There are approximately 285 acres of *Seasonal (November-April)* waters, 1,890 acres of *Special Restricted*, and 150 acres of *Prohibited* waters in the Shrewsbury River.

Shellfish Classification Percentages in the Shrewsbury River



The *Seasonal (November-April)* waters can be found on the eastern end of the Shrewsbury River. (see N.J.A.C. 7:12 for official boundaries). These waters are open for harvest from November 1st to April 30th, and closed for harvest from May 1st to October 31st of each year.

The majority of waters in this shellfish growing area are classified as *Special Restricted.* This means that shellfish can only be harvested pending further processing (depuration or relay). Recreational harvest of shellfish is not permitted from *Special Restricted* waters. The



Special Restricted waters are located throughout the Shrewsbury River, including the connector to Sandy Hook Bay, Oyster Bay, and all of the waters west of the *Seasonal (Nov – Apr)* section (see adjacent figure). *Special Restricted* waters are approved for harvest, followed by depuration or relay, which help to cleanse bacteria from the shellfish. Harvesting clams for either depuration or relay requires issuance of a Special Permit, acquired at the Bureau of Marine Water Monitoring. Also, under the Special Permit Program, shellfish can only be harvested from designated lots in *Special Restricted* waters (see below figure).

The last growing area report for the Shrewsbury River downgraded a 150 acres section of South Shrewsbury River, Branchport Creek, and Troutmans Creek to a *Prohibited* classification. This downgrade was made official February 9, 2009 and was adopted into regulation on January 3, 2011 (N.J.A.C. 7:12).

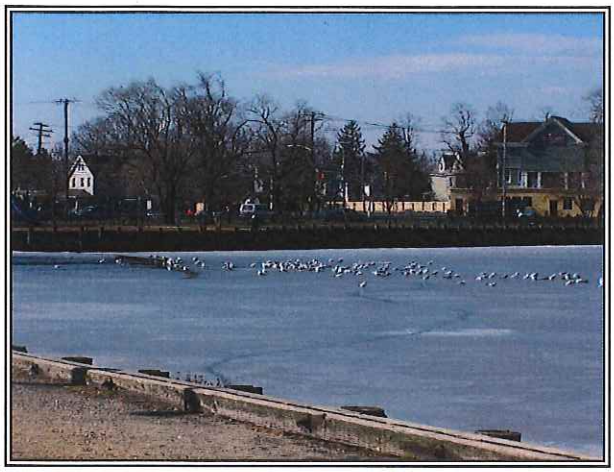
The Shrewsbury River is displayed on chart # 3 of the current State of New Jersey Shellfish Growing Water Classification Chart (NJDEP) or on the Bureau of Marine Water Monitoring's (BMWM) website at http://www.state.nj.us/dep/bmw/; the official and most current classification descriptions can be found at N.J.A.C. 7:12.

Evaluation of Biological Resources

Shellfish species harvested in New Jersey include hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), mussels, bay scallops (*Aequipecten irradians*), oysters (*Crassostrea virginica*), ocean quahogs (*Arctica islandica*), surf clams (*Spisula solidissima*), and sea scallops (*Placopecten magellanicus*). (NMFS, 2007).

The Shrewsbury River has moderate to high densities of hard clams (according to the last clam census in the 1980's done by NJDEP's Fish & Wildlife). Populations of soft clams also reside within this estuary. Factors that contribute to having a viable resource include salinity, dissolved oxygen levels, bottom conditions, and predation.

SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES



Shoreline surveys were conducted on six dates; see the Appendix for further details.

Waterfowl are known to inhabit this area, especially during winter months. Herons, ducks, geese, and egrets are common sights. When the tributaries ice over in winter months, the bird populations tend to accumulate on the ice (see adjacent figure).

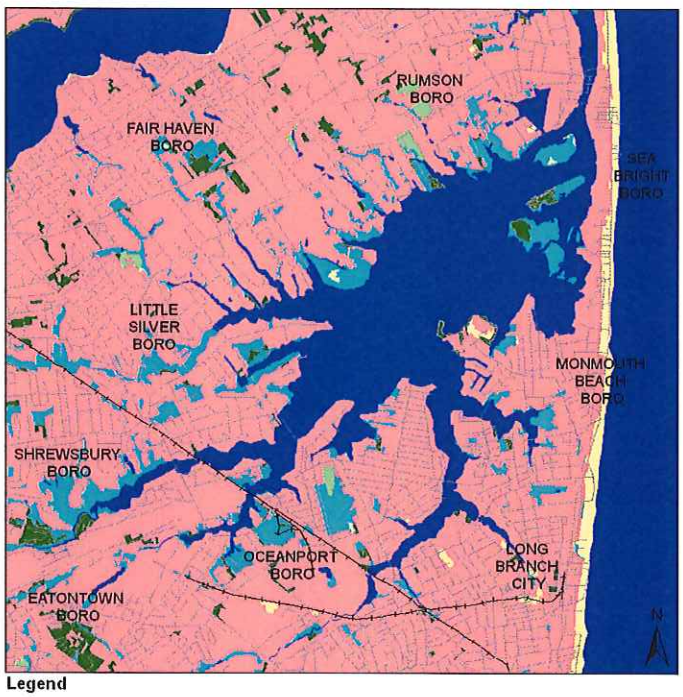
Vegetation is an essential part of the marine ecosystem, offering habitat and nursery grounds for numerous species. In the Shrewsbury River, the submerged aquatic vegetation (SAV) is prevalent in shallow areas. Some of the most common species of SAV include widgeon grass (*Ruppia maritima*), sago pondweed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

The area is a well-known tourist spot on the New Jersey shore and entertains an influx of population in the summer months. The surrounding landscape had not changed significantly since the last shoreline survey; although some residential homes were rebuilt along the Shrewsbury River and a few new bulkheads and natural shorelines were noted on survey.

Land Use

The current land use surrounding the Shrewsbury River is predominately urban, commonly residential (see adjacent figure). However, there are sections of wetlands and speckles of barren lands, forests, and agricultural areas. Seven municipalities surround the Shrewsbury River; they are Rumson Borough, Little Silver Borough, Shrewsbury Borough, Oceanport Borough, Long Branch City, Monmouth Beach Borough, and Sea Bright Borough. Most residential development is single family homes, however, there are some higher density cluster developments in the area, primarily in Sea Bright Borough. Monmouth Park Racetrack is located in Oceanport Borough, along Branchport Creek. The property formally occupied by Fort Monmouth is located along in Oceanport Brough, along Parkers Creek. Two Rivers Water Reclamation Authority is located in Monmouth Beach, along the Shrewsbury River.

Land Use Patterns Surrounding the Shrewsbury River



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 direct discharges into the waters of the Shrewsbury River. However, there are two domestic treatment facilities in the general vicinity, Two River Water Reclamation Authority (TRWRA) and Long Branch Sewerage Authority (LBSA); both discharge treated wastewater into the Atlantic Ocean.

The TRWRA was founded in 1965 and had its first flow in 1971 (TRWRA, 2011 / see below figure). It has six member towns: Monmouth Beach, Fair Haven, Little Silver, Shrewsbury Borough, Oceanport, and West Long Branch. It also has seven customer communities: Sea Bright, Rumson, Red Bank, Eatontown, Shrewsbury Township, Tinton Falls, and Fort Monmouth. Overall the TRWRA serves 90,000 people and discharges treated wastewater one-half mile off Monmouth Beach into the Atlantic Ocean. Since the last reappraisal, the TRWRA completed a plant expansion and upgrade required by the NJDEP. Among other things, the upgrade now allows them to handle average flows of 13.83 MGD (TRWRA, 2011). Currently, the TRWRA facilities include 200 miles of sanitary sewer mains, 18 pump stations, and 9 meter chambers (TRWRA, 2011).

(Source: TRWRA, 2011 http://www.trwra.org/tr/tr.nsf/site/water-reclamation-overview)

Long Branch's wastewater is handled by the Long Branch Sewerage Authority. The LBSA was founded in 1953 and had its first flow in 1968 (LBSA, 2011). This wastewater treatment facility has a permitted design flow of 5.4 million gallons per day of discharged treated wastewater effluent, which is discharged into the Atlantic Ocean.

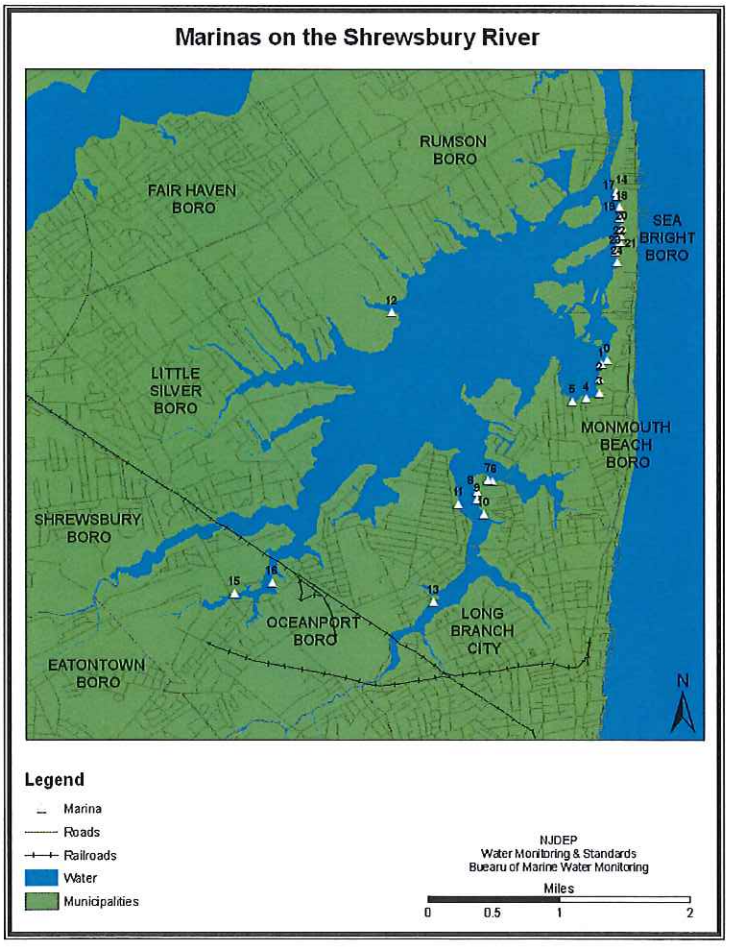
According to New Jersey Pollutant Discharge Elimination System (NJPDES), there are a few facilities with active Discharge to Groundwater (DGW) permits in this area. Besides groundwater dischargers, septic systems are occasionally used where public sewer lines are unavailable. When a septic system's leach field fails septic waste may pond on the grounds surface and can flow 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.

Boating is a very popular summertime activity within the Shrewsbury River. According to the BMW's latest marina survey, there are a total of 25 marinas in the Shrewsbury River (see below figure). The majority of the marinas, 15, are located in Sea Bright Borough or Monmouth Beach Borough. 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. For additional information on the marina equations used for buffer generation see the Shellfish Growing Area Report Guidance Document 2007.

Although good for tourism, the marinas, and the accompanying boats, can discharge many harmful pollutants into the water. Gas fumes, oil, and grease from boats and marinas can contribute to the contamination of the waters. There are some irresponsible boat owners who do not use available pumpout stations or pumpout boats, instead dumping human wastes directly into the local waterbodies; which is not allowed since the Shrewsbury River was made a "No Discharge Zone" in 2000 (EPA, 2011). The biological and chemical contamination associated with marina facilities may be of public health significance.



The 'Clean Marina' program is voluntary and provides guidelines that aim, "to protect water quality and coastal resources by preventing and reducing nonpoint sources of pollution" (NJDEP Clean Marina, 2011). No marinas in this growing area have yet to be certified as New Jersey Clean Marina; however, Long Branch Ice Boat and Yacht Club has signed a Clean Marina Pledge Card. Signing a Clean Marina Pledge Card 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, 2011).

Spills, Unpermitted Discharges, and Closures

Spills reported to the DEP hotline (1-877-WARN-DEP) are passed on to the BMWM when shellfish waters are involved. 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.

On April 16, 2007, the Department closed the waters of Raritan Bay, Sandy Hook Bay, the Navesink River and the Shrewsbury River to shellfish harvesting. This closure was necessary due to degraded water quality resulting from exceptional rainfall and associated water quality problems that occurred on the days prior to April 16th. Samples collected on April 18th showed all waters of Raritan Bay and Sandy Hook Bay were unacceptable for shellfish harvest. Subsequent samples on April 20th showed significant improvement, and additional samples on April 22nd showed that coliform bacteria levels were now acceptable for harvest under the Special Permit Program for depuration harvest. As has been done for some previous spills, coliphage viral samples were collected and analyzed by the Bureau of Marine Water Monitoring. These showed acceptable levels in Sandy Hook Bay and in the Navesink River, but not in Raritan Bay. Based on these results, the Department revoked the closure order for a portion Sandy Hook Bay and for the Special Restricted waters of the Navesink River and Shrewsbury River. On April 24, 2007, a partial revocation of shellfish beds was issued. This partial revocation included *Special Restricted* waters of the Navesink River, the Shrewsbury River, and a portion of Sandy Hook Bay (special permit areas 1, 2, 3, 5, 6, 7, 8, 9, & 10). The *Seasonal (Nov–Apr)* waters of the Navesink River and the Shrewsbury River were not included in this partial revocation. It was not until May 3, 2007 that the *Seasonal (Nov-Apr)* waters in the Navesink River and Shrewsbury River returned to their normal *Seasonal (Nov-Apr)* status. However, these waters are normally closed to harvest from May through October, so the *Seasonal (Nov-Apr)* waters were not actually harvestable until November 1, 2007.

On February 9, 2009, the Department suspended harvest of all shellfish, from approximately 150 acres within the South Shrewsbury River, Branchport Creek and Troutmans Creek, previously classified as *Special Restricted.* At the time, this downgrade was based on the most recent three years of monitoring data and showed declining water quality, primarily due to nonpoint source impacts related to rainfall. This downgrade was adopted into regulation on January 3, 2011 (N.J.A.C. Title 7 Chapter 12, et seq.)

Due to exceptional rainfall in the NY/NJ Harbor, the waters of Raritan Bay, Sandy Hook Bay, Navesink River and Shrewsbury River were closed for shellfish harvesting on March 17, 2010. This prohibition was made to assure that the public health was not imperiled by the consumption of shellfish that may be subject to pollution or to any other conditions which may render shellfish dangerous to health because of degraded water quality resulting from exceptional rainfall in the NY/NJ Harbor area. This prohibition was revoked on March 27, 2010 following sample monitoring that determined the waters safe for harvesting of shellfish. All waters were returned to their prior classification as described at N.J.A.C. Title 7 Chapter 12, et seq.

There were no other significant spills, unpermitted discharges, or closures concerning the Shrewsbury River during the January 1, 2007 to December 31, 2010 time period.

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

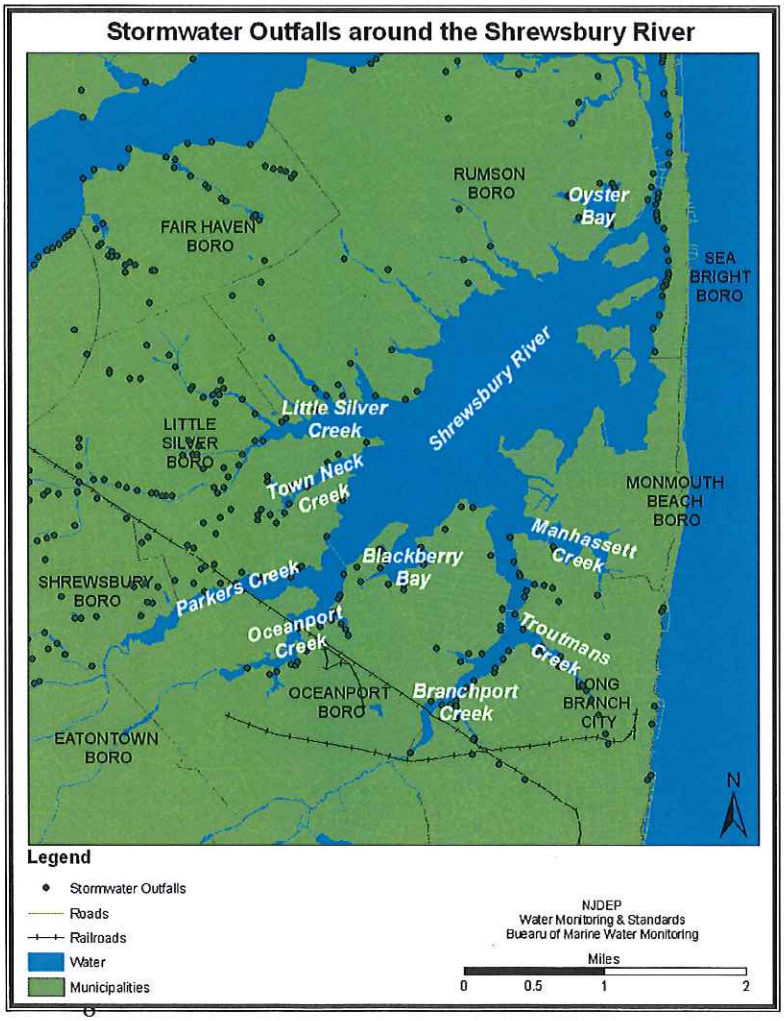
shellfish beds or impair water quality. BMWM's comments are taken into consideration by the NJDEP, Division of Land Use Regulations (DLUR) when approving or denying a permit.

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 animal waste, agricultural pesticides, 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.

There are many storm water inputs into the Shrewsbury River and its tributaries, especially in Oceanport and Brachport Creeks (see adjacent figure). Stormwater outfalls are one of the most significant non-point sources of pollution. Stormwater outfalls are mostly found in urban areas, and are especially common within lagoon communities. 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. 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. Currently, there is not a storm water study scheduled for the Shrewsbury River, however, this report recommends a storm water study in the area



of Branchport Creek (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* (2007). 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).

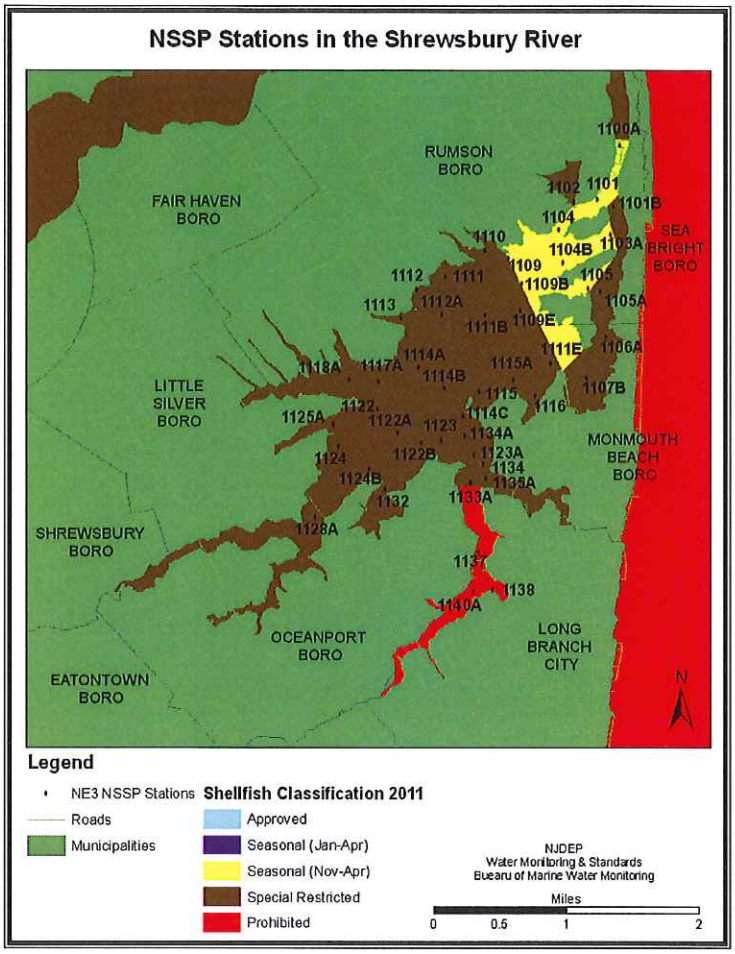
Each shellfish producing state is directed to adopt either the total coliform or fecal coliform criterion. While New Jersey bases its growing water classifications on the total coliform criterion, the laboratory does have the ability to make corresponding fecal coliform determinations. Each classification criterion is composed of a measure of the statistical 'central tendency' (geometric mean) and the relative variability of the data set. For the Systematic Random Sampling Strategy, variability is expressed as the estimated 90th percentile. The following table shows the statistical criteria for the SRS strategy. The criteria were developed by the NSSP to ensure that shellfish harvested from designated waters would safe for human consumption (NSSP, 2007).

CRITERIA FOR SYSTEMATIC RANDOM SAMPLING STRATEGY				
	Total Coliform Criteria		**Fecal Coliform Criteria**	
	Geometric mean (MPN/100 mL)	**Max. 90th Percentile** (MPN/100 mL)	**Geometric mean** (MPN/100 mL)	**Max. 90th Percentile** (MPN/100 mL)
Approved Classification	70	330	14	49
Special Restricted Classification	700	3300	88	300

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 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,* 2007.

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 (2007). 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



Over 1,500 water samples were collected between January 1, 2007 to December 31, 2010 and analyzed by the three-tube, three-dilution or four-dilution standard total coliform fermentation method according to the American Public Health Association (1970, 1995). The adjacent figure shows the Shellfish Growing Water Quality monitoring stations in the Shrewsbury River. Forty-six stations are monitored each year for coliform levels in the Shrewsbury River. The Shrewsbury River is sampled by one assignment run. The data for this report was collected from 46 stations in the Shrewsbury River (see Appendix).

Compliance with NSSP Criteria

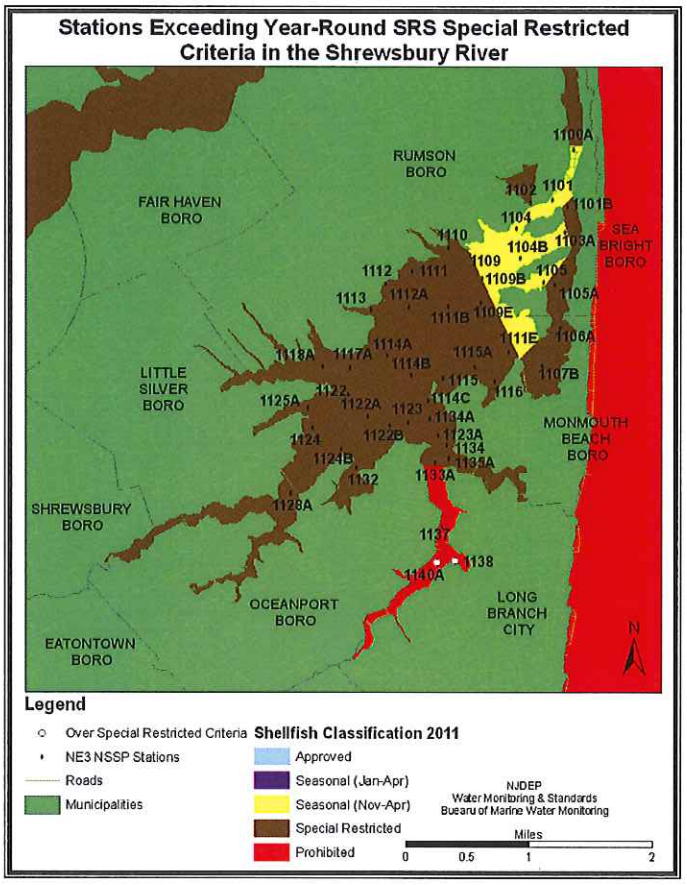
Each sampling station must comply with its respective criteria according to the National NSSP *Guide for the Control of Molluscan Shellfish* (2007) for *Approved, Seasonal,* or *Special Restricted* waters, based on a minimum of 30 data sets. In order for waters to be classified as *Approved,* the total coliform geometric mean must be below 70 MPN/100ml and the total coliform Est. 90th Percentile must be below 330 MPN/100ml. Twenty sampling stations exceeded the NSSP criteria for *Approved* waters (see Appendix). There are no Approved waters within this shellfish growing area. All the noted stations are located in *Seasonal (Nov-Apr)* or *Special Restricte*d waters.

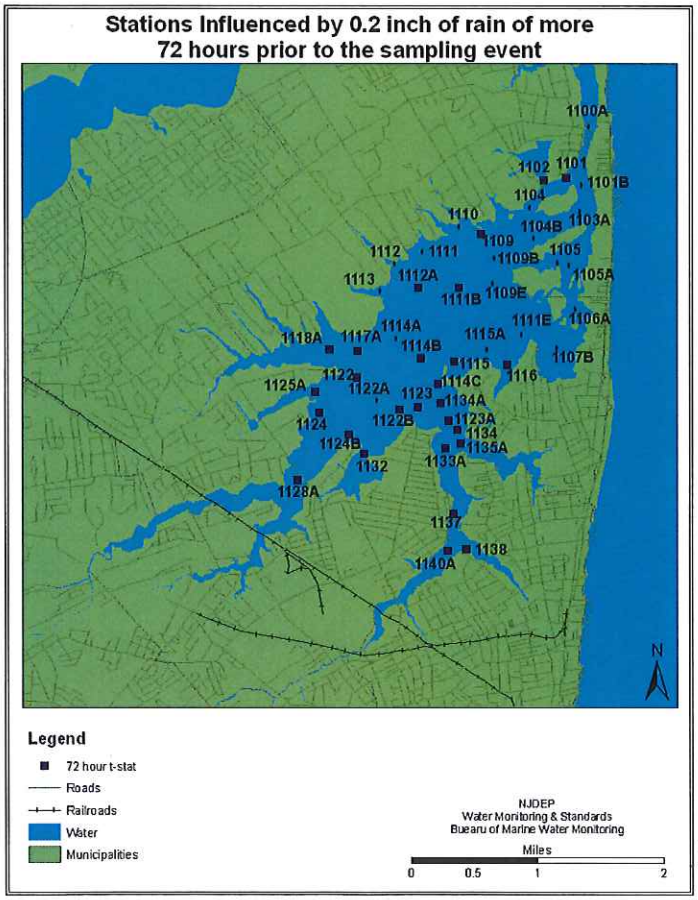
An eastern portion of the Shrewsbury River is classified as *Seasonal (Nov-Apr)*. Harvesting of shellfish in this area is permitted from November through April (winter) and prohibited from May through October (summer). One station, 1104, is located in *Seasonal (Nov-Apr)* waters and is above the *Approved* criteria during the winter, when the waters are open for harvest. However, this is only based on a sample size of 11, to fully evaluate if these waters are correctly classified; the timeframe was extended to capture a sample size of at least 30 for each season. When the time frame is extended back to January 1, 2000 in order to get the 30 or more SRS samples for both summer and winter, this station no longer exceeds the *Approved* criteria during the winter. With the extended timeframe, twenty-two stations were over the SRS criteria for *Approved* waters during the summer, but none of these stations are in *Approved* or *Seasonal* waters. Ten stations were above the SRS criteria for *Approved* waters during the winter months with the extended timeframe, but none of these stations are in *Approved* or *Seasonal (Nov-Apr)* waters. This means that when the sample size is extended to fit NSSP guidelines, the *Seasonal (Nov-Apr)* waters are

still in compliance. In summation, station 1104 will be closely watched, but for now, no changes in classification will be made as a result of the available data.

For waters to be classified as *Special Restricted,* the Geometric Mean must be below 700 MPN/100ml and the Est. 90th Percentile must be below 3300 MPN/100ml. Two stations exceeded the SRS total coliform NSSP *Special Restricted* criteria; stations 1138 and 1140A (see adjacent figure). These two stations along with station 1137 were reactivated in 2005 in order to accurately assess the Branchport Creek area.

The last reappraisal report on the Shrewsbury River (data from October 1, 2003 to September 30, 2007) downgraded approximately 150 acres of waters from *Special Restricted* to *Prohibited.* This downgrade encompassed a section of South Shrewsbury River, Branchport Creek, and Troutmans Creek; stations 1138 and 1140A are located in this area. Since stations 1138 and 1140A are now located in *Prohibited* waters, all stations are in compliance with the NSSP *Special Restricted* criteria.





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.

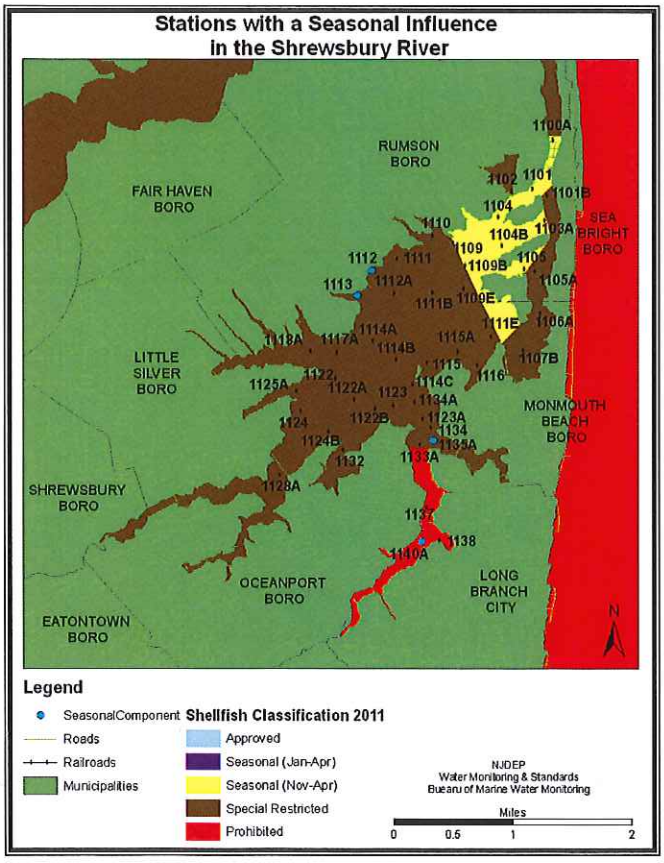
A *t*-test is used to compare log-transformed total coliform values for wet verses dry data. The *t*-statistical probability must be less than or equal to 0.05 for a station to be rainfall impacted. There is also a wet/dry cutoff for each growing area that dictates what data is considered 'wet' and what data is considered 'dry'. Rainfall data are based

on the closest established NOAA/NWS station; each assignment run is assigned to a weather station to accurately reflect the rainfall at the sampling stations. NOAA rainfall station RA004.

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 scenario used for this growing area was based on a wet/dry cutoff of 0.2 inch. The data were analyzed at '24hr prior to sampling', '48hr prior to sampling', and '72hr prior to sampling'. Rainfall analysis shows that the Shrewsbury River is influenced by rain, particularly around 0.2 inch of rain or more. There were 5 stations that triggered within the first 24 hours prior to sampling, and 22 stations within the 48 hours prior to sampling. Within the 72 hours prior to the sampling event 27 stations in the Shrewsbury River showed a *t*-stat below 0.05 (see above figure). Overall, there are both immediate and extended effects on the coliform levels in the river due to rainfall. Rainfall appears to be a significant factor for the stations located in this growing area. This is expected since this area is urban and is abundant in impervious surfaces.

Seasonal Effects



The Shrewsbury River 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. Temperature, precipitation, wind, and the general circulation of the atmosphere have seasonal variations that affect the marine environment (Ingmanson and Wallace, 1989). Seasonal variation may also be the result of a variety of conditions, including specific agricultural land-use practices, biological activity, stream flow and/or sediment.

Seasonal components were observed at four stations (see adjacent figure). SRS seasonal components were assessed using a *t*-test to compare log-transformed total coliform values for summer verses winter data. The *t*-statistical probability must be less than or equal to 0.05 for a station to have a seasonal component (see Appendix). All of the stations with a seasonal component had higher coliform values in the summer.

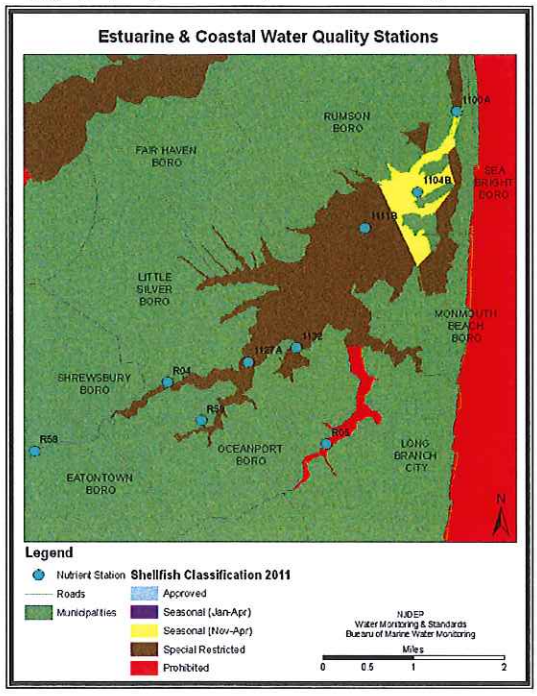
Overall, none of the noted stations had a geometric mean that exceeded the established values for the present classifications. The Est. 90th Percentile values for these stations also fit within criteria. No changes in classification are needed as a result of the seasonal components at these stations.

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. Samples are collected on a quarterly basis at 9 stations within the Shrewsbury River. The parameters are evaluated, analyzed, and presented in a separate report by the Bureau of Marine Water Monitoring, available 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.

The Bureau of Marine Water Monitoring and USEPA (United States Environmental Protection Agency) Region 2 conduct routine helicopter surveillance throughout the summer to determine the occurrence of species of marine phytoplankton that could produce biotoxins. BMWM, in accordance with the NSSP requirements, also analyzes the data. There is not a phytoplankton station in the vicinity of the Shrewsbury River, but for more information on the Phytoplankton reports visit the BMWM website, www.nj.gov/dep/bmw.

Bathing Beaches

The WM&S group cooperatively works with the New Jersey Department of Health and local health agencies to monitor the bathing beaches in New Jersey. Together, these agencies implemented 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. 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.

There is one 'non-bathing' station located within this shellfish growing area, however, data is only available through 2009; regular sampling was discontinued at this station after 2009. For more information on bathing beach data and closures please see the following website: www.njbeaches.org.

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. Currently, no NCA data is available for the Shrewsbury River for the years 2007-2010. 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 no mussel watch station in the Shrewsbury River. 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, 2007 to December 31. Systematic Random Sampling strategy was used to collect the samples. Laboratory tests were run for total coliform in accordance with the standards of the National Shellfish Sanitation Program (NSSP). A thorough analysis of the data was assembled for this report.

Twenty stations exceeded the SRS *Approved* criteria, however, there are no *Approved* waters in the Shrewsbury River. The *Seasonal (Nov-Apr)* portion of the Shrewsbury River fits within the criteria when

the timeframe is extended to have at least 30 samples. Two stations exceeded the SRS *Special Restricted* criteria; however, these stations are located in *Prohibited* waters. Therefore, analyses of the Shrewsbury River shellfish growing area samples indicate that the total coliform geometric mean and/or estimated 90th percentile levels meet the standards of the National Shellfish Sanitation Program (NSSP).

RECOMMENDATIONS

There are no recommendations for classification changes in this sanitary survey report. The Shrewsbury River is currently sampled by one assignment run under the Systematic Random Sampling strategy. There are currently forty-six stations and ten runs are done per year. The recommendation for the Shrewsbury River is that the monitoring schedule be maintained. The rainfall/storm water study done in 2005-2006 was very beneficial in providing insight into the actual conditions of the upper Navesink River; if at all possible, a storm water study is recommended in the area of South Shrewsbury, Branchport Creek, and Troutmans Creek. This will give insight the possible pollution source/s.

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APPENDICES

A. Statistical Summary

B. Seasonal Evaluation

C. Precipitation

- Rainfall Amount
- Weather Observations
- Wet/Dry Statistics

D. Data Listing: January 1, 2007 – December 31, 2010

E. Shoreline Survey Reports