



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

Reappraisal Report of Shellfish Growing Area NE2 Navesink River



October 2012

State of New Jersey
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Kim Guadagno, Lt. Governor

NJ Department of Environmental Protection
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Reappraisal Report of Shellfish Growing Area NE2

Navesink River

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Data from January 1, 2008– December 31, 2011

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Cover Photo – Hartshorne Park, Middletown Twp. (photo by Tracy Fay)

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EXECUTIVE SUMMARY

The Navesink River is located in Monmouth County, New Jersey and is part of the Shrewsbury River Basin. The water quality data presented in this Reappraisal of the Navesink River was collected between January 1, 2008 and December 31, 2011 using the Systematic Random Sampling (SRS) strategy. Approximately 1,550 water samples were collected and tested for total coliform bacteria. The Navesink River is appropriately classified, as supported by the total coliform levels and no changes to these classifications are proposed.

DESCRIPTION OF GROWING AREA

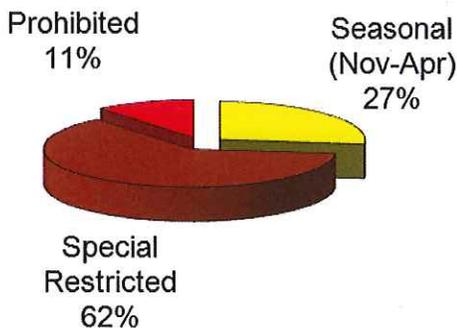
Location & Description

Shellfish growing area, NE2, the Navesink River, is located in Monmouth County and connects to the Sandy Hook Bay via the Shrewsbury River (see adjacent figure). The Navesink River is part of the Shrewsbury River Estuary, but for the purpose of this report, it is examined as a separate growing area. The Navesink River is approximately 8 miles long. There are numerous small creeks off of the Navesink River, including Swimming River, Jumping Brook, McClee’s Creek, and Claypit Creek.

Seven municipalities surround the Navesink River; they are Middletown, Tinton Falls, Red Bank, Fair Haven, Rumson, Highlands, and Sea Bright. In total, the Navesink River drains an area of 95 square miles (Keelen, 2003).

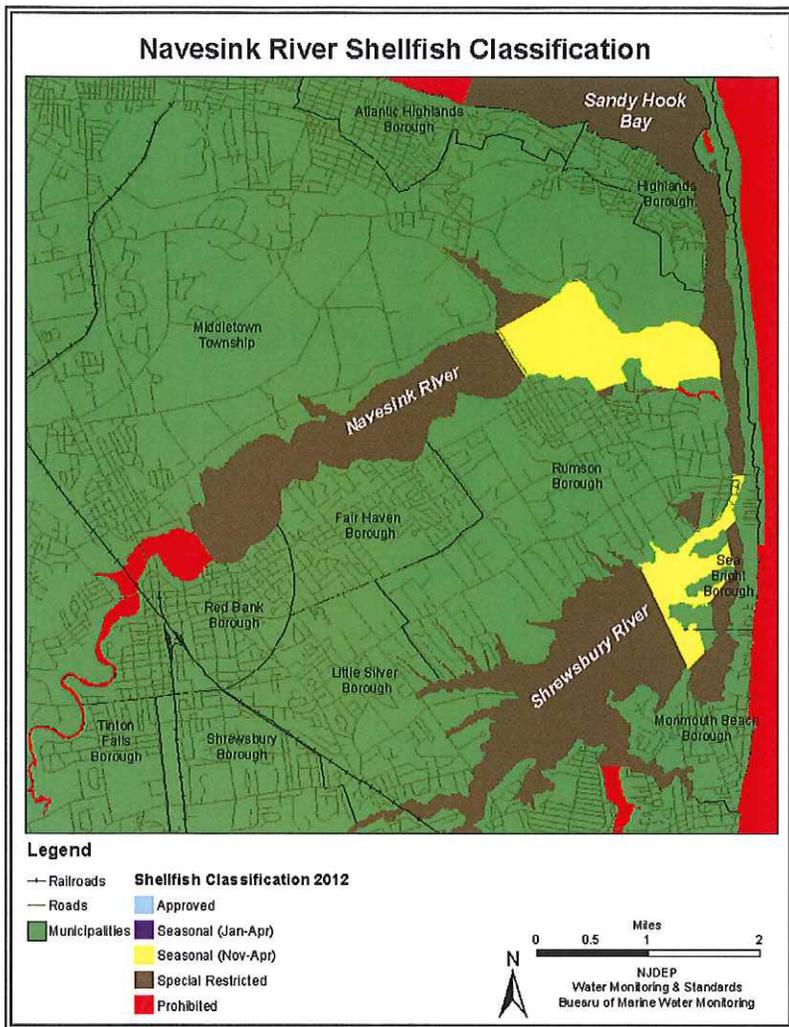


Shellfish Classification % NE2



Growing Area Classification Summary

The approximate size of this shellfish growing area is 2,520 acres. Shellfish classifications in this growing area include *Seasonal (November-April)*, *Special Restricted*, and *Prohibited* waters (see figure on page 2). There are no *Approved* waters in this growing



area. There are currently about 677 acres of *Seasonal (November-April)* waters, 1,568 acres of *Special Restricted* waters, and 275 acres of *Prohibited* waters in the Navesink River.

The *Seasonal (November-April)* waters can be found on the eastern end of the Navesink River, starting from the Oceanic Bridge and extending northward to Locust Point, then eastward toward Lower Rocky Point, excluding waters within Claypit Creek (see N.J.A.C. 7:12 for official boundaries).

The majority of waters in this shellfish growing area are classified as *Special Restricted*. The *Special Restricted* classification means that it is prohibited to harvest shellfish from these waters for direct market; a special permit must be issued to be in compliance with the State of New Jersey's Relay or Depuration Programs. Recreational harvest of shellfish is not permitted from *Special Restricted* waters. Currently, the *Special Restricted* waters are located in the western section of the Navesink River,

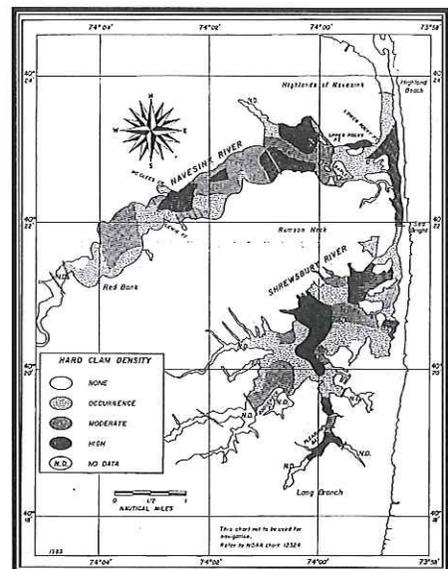
starting from the Oceanic Bridge extending westward until the Highway 35 Bridge (Cooper's Bridge) in Red Bank. Other *Special Restricted* areas include Claypit Creek, Shrewsbury River, and some unnamed waterways in the lower Navesink (see N.J.A.C. 7:12 for official boundaries).

Prohibited waters can be found in the upper Navesink River and in some unnamed waterways (see N.J.A.C. 7:12 for official boundaries).

This area is displayed in 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 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

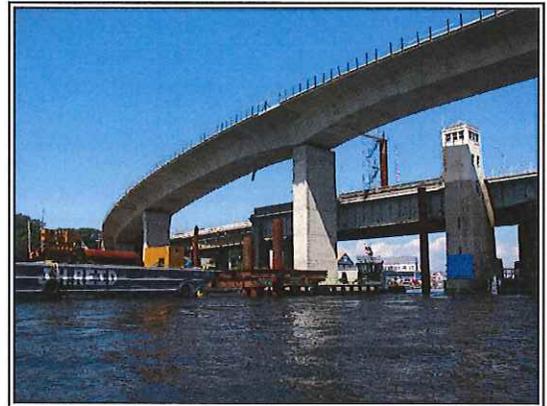


scallops (*Aequipecten irradians*), oysters (*Crassostrea virginica*), ocean quahogs (*Arctica islandica*), surf clams (*Spisula solidissima*), and sea scallops (*Placopecten magellanicus*) (NMFS, 2007).

The Navesink 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, see figure on page 2). 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.

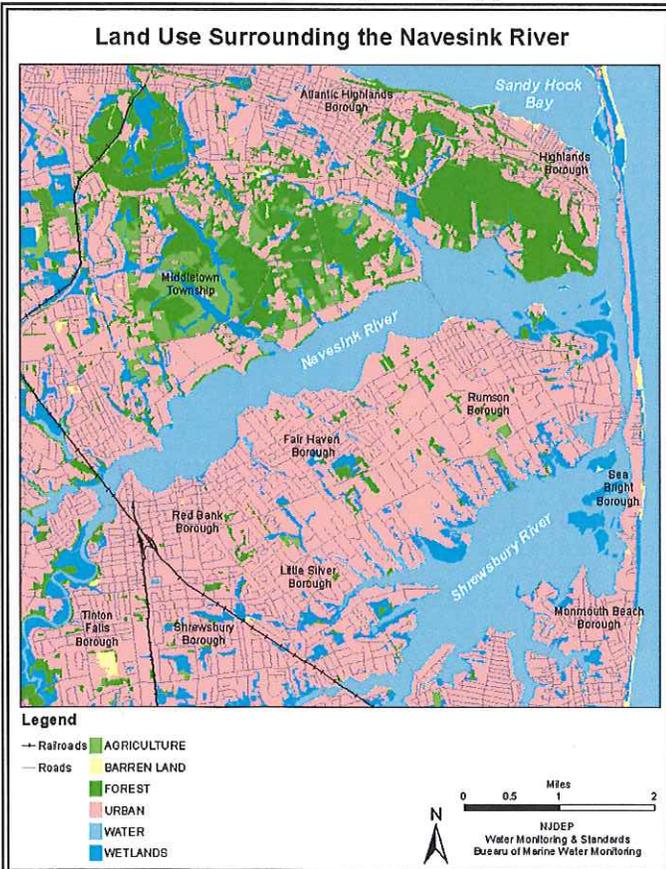
SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

A storm water study was completed in the vicinity of Red Bank in 2008. The results of this study were written in a separate report, entitled 'Coastal Nonpoint Source Pollution Monitoring Program: Upper Navesink River Storm Water Study', available at <http://www.nj.gov/dep/bmw/reports.htm>. Follow-up monitoring is planned as needed.



Vegetation is an essential part of the marine ecosystem, offering habitat and nursery grounds for numerous species. In the Navesink 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*).

Waterfowl are known to inhabit this area, especially during winter months. Herons, ducks, geese, and egrets are common sights. The area is a well-known tourist spot on the New Jersey shore and entertains an influx of population in the summer months.



A new Highlands-Sea Bright Bridge (Route 36) was constructed from 2008-2011, the older bascule bridge was removed (see above figure).

Land Use

The current land use surrounding the Navesink River is predominately urban and residential (see adjacent figure). However, there are sections of forest, barren lands, wetlands, and agricultural areas. Most properties in this area contain a single family home. Most residential development is single family homes; however, there are some

higher density cluster developments in the area, primarily in Sea Bright Borough. Historically, most of this region has been urban land used for residential housing. Since this region is already highly developed there has not been much residential growth in recent years. The surrounding landscape had not changed significantly since the last shoreline survey.

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 Navesink River. However, there are two domestic treatment facilities in the general vicinity. The Two River Water Reclamation Authority (TRWRA), and the Township of Middletown Sewage Authority (TOMSA); both discharge treated wastewater into the Atlantic Ocean.



The Two River Water Reclamation Authority has six member towns: Monmouth Beach, Fair Haven, Little Silver, Shrewsbury Borough, Oceanport, and West Long Branch. It also has six customer towns: Sea Bright, Rumson, Red Bank, Eatontown, Shrewsbury Township and part of Tinton Falls, plus Fort Monmouth. TRWRA recently upgraded the plant enabling it to handle average flows of 13.83 MGD (TRWRA, 2012, see adjacent photo Source: <http://www.trwra.org>).

The Township of Middletown Sewage Authority (TOMSA) was founded in 1968 and is located in Belford (TOMSA, 2012). Middletown, Atlantic

Highlands, and Highlands use the facility and the effluents are discharged to the Atlantic Ocean via the Monmouth County Bayshore Outfall Authority (MCBOA).

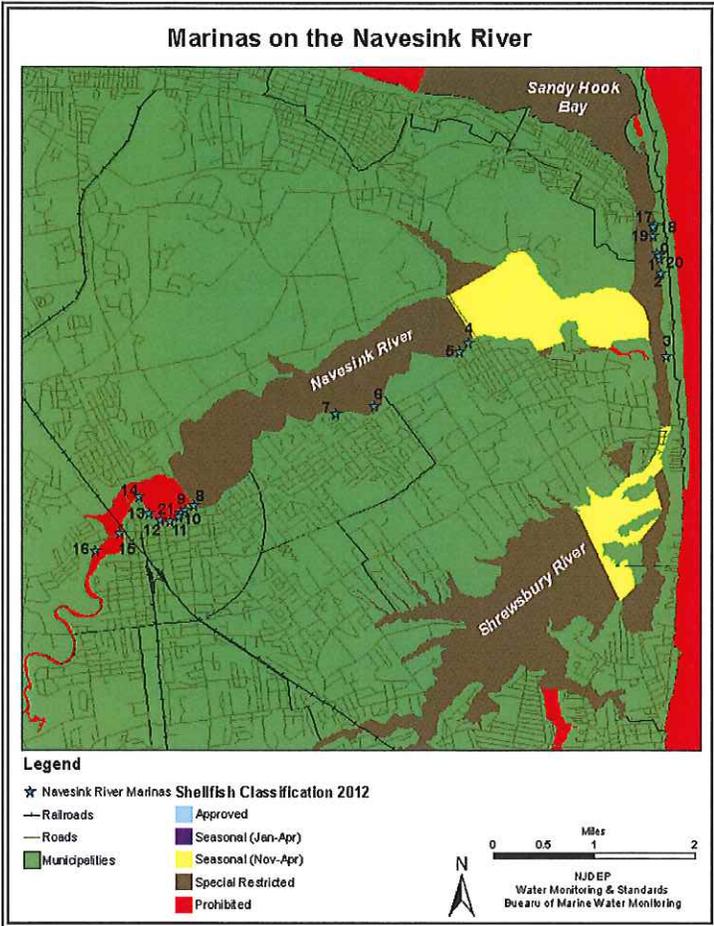
According to New Jersey Pollutant Discharge Elimination System (NJPDDES), there are a few facilities with an active Discharge to Groundwater (DGW) permit in this area. Besides groundwater dischargers, septic systems are occasionally used where public sewer lines are unavailable. When a septic system's 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.

There are 21 marinas in the Navesink River (see page 5 figure). The waters enclosed by the marina are classified as *Prohibited*. Depending on the size of the marina and the water quality, water immediately adjacent to each marina may be classified as *Prohibited*, *Special Restricted*, *Seasonal (November – April)*, or *Seasonal (January – April)*. Marina buffer zones were calculated using the Virginia Model or the marina buffer equation, depending on the location. The size of each buffer zone is shown in the table

below. Additional information on the marina equations used for buffer generation can be found in the NJDEP *Shellfish Growing Area Report Guidance Document (2007)*.



Map Key	Marina Name	Est. Total Slips	Buffer Radius (ft)
0	Oceanview Marina	20	448
1	Quay Restaurant & Marina	30	549
2	Fairbanks Motels & Marina	30	391
3	Sea Bridge Condos Marina	25	501
4	Oceanic Marina	100	1590
5	Barnacle Bill's Marina	40	1267
6	Shrewsbury River Yacht Club	26	1022
7	Fair Haven Yacht Works	70	1489
8	Irwin's Yacht Works & Marine	45	950
9	Marine Park Municipal Marina	29	763
10	Monmouth Boat Club	42	918
11	Mark C. Peterson Ent.	32	801
12	Riverview Towers Condo	27	565
13	Molly Pitcher Inn & Marina	75	1227
14	Oyster Point Hotel & Marina	40	896
15	Sea Land Marina	10	448
16	Chris's River Plaza Marina	50	1002
17	Brooks Marina	60	896
18	Ocean 150	20	517
19	Unknown Condo	24	439
20	Unnamed Marina	40	323
21	Unnamed Marina 2	24	694

Spills, Unpermitted Discharges, and Closures

Spills reported to the DEP hotline (1-877-WARN-DEP) are passed on to the BMWWM 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, BMWWM 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 August 27, 2011 all state waters in New Jersey were closed for shellfish harvest in preparation of Hurricane Irene. The waters of the Navesink River remained closed until September 7, 2011, when water and tissue tests showed that the shellfish were safe for human consumption. There were no other spills causing shellfish bed closures in the Navesink River during the January 1, 2008 and December 31, 2011 time period.

The process of dredging can impair water quality and contaminate shellfish beds near dredging and disposal sites. BMWWM is given the opportunity to review such project through CAFRA submission and

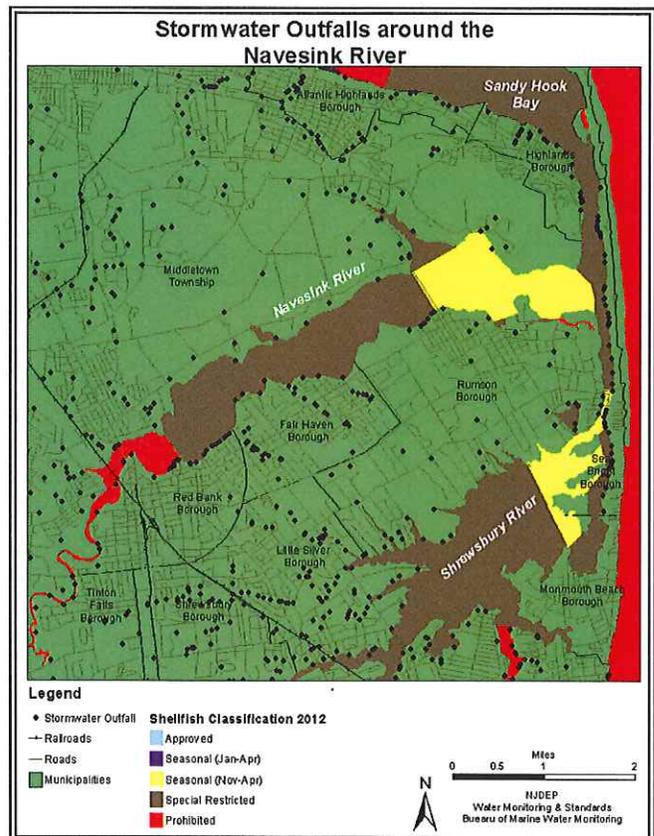
will deny a project if the proposed dredging or disposal site can potentially contaminate shellfish beds or impair water quality. BMW's comments are taken into consideration by the NJDEP, Division of Land Use Regulations (DLUR) when approving or denying a permit.

Stormwater Discharges

Environmental pressures on shellfish beds in New Jersey can originate from pollutants that enter growing waters via stormwater discharges. Runoff is a term for the surface water that moves from land to the ocean. During this transition the water picks up both nutrients and pollutants. While some of this runoff provides nutrients for plants and animals, it also carries pollutants that can potentially contaminate the waters. Various pollutants include animal waste, agricultural pesticides, and bacteria from faulty septic systems and failing municipal infrastructure. Storm drains along roads collect the runoff and transmit it to storm water outfalls. The outfalls discharge the runoff into streams, bays, oceans, and other bodies of water. Storm water outfalls are one of the most significant non-point sources of pollution. They are often found in urban areas, and are especially common within lagoon communities. The first flush after a rain event often carries the most pollutants.

There are numerous storm water inputs into the Navesink River and its tributaries, especially in Red Bank and Sea Bright Boroughs (see adjacent figure). These numerous storm water inputs have the potential to negatively impact the water quality within this growing area. Stormwater outfalls are one of the most significant non-point sources of pollution in this shellfish growing area. Considering the substantial amount of outfalls in this area, it is crucial to understand the importance of their regulation, in order to prevent pollution.

The Bureau of Marine Water Monitoring conducts storm water projects to help determine potential sources of pollution. Water samples are taken before and during a storm event, and the preceding days in order to determine the effect of runoff. Once a possible source of the problem is identified, the appropriate people (usually the municipality/county) are notified to remedy the situation. A storm water project took place in the upper Navesink River over the last couple of years, the findings can be found in a separate document entitled, 'Coastal Nonpoint Source Pollution Monitoring Program: Upper Navesink River Storm Water Study', available at <http://www.nj.gov/dep/bmw/reports.htm>.



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).

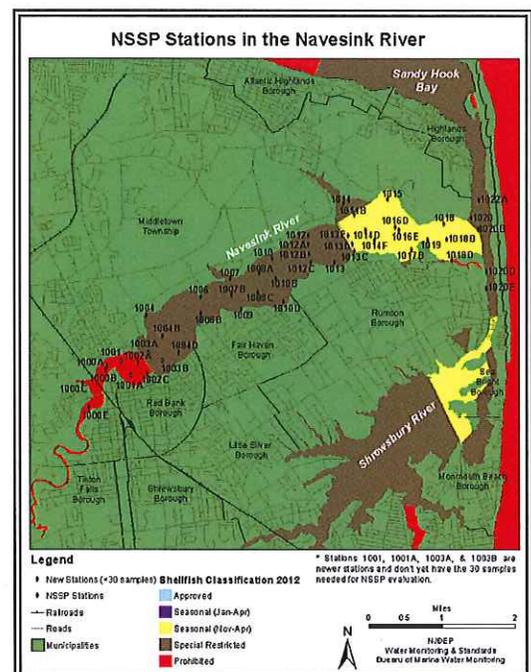
CRITERIA FOR SYSTEMATIC RANDOM SAMPLING STRATEGY				
Classification	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric Mean (MPN/100 mL)	Max. 90 th Percentile (MPN/100 mL)	Geometric Mean (MPN/100 mL)	Max. 90 th Percentile (MPN/100 mL)
Approved	70	330	14	49
Special Restricted	700	3300	88	300

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.

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

Approximately 1,550 water samples were collected between January 1, 2008 and December 31, 2011 and analyzed by the three-tube, three-dilution or four-tube four-dilution standard total coliform fermentation method according to APHA (1970, 1995). The adjacent figure shows the

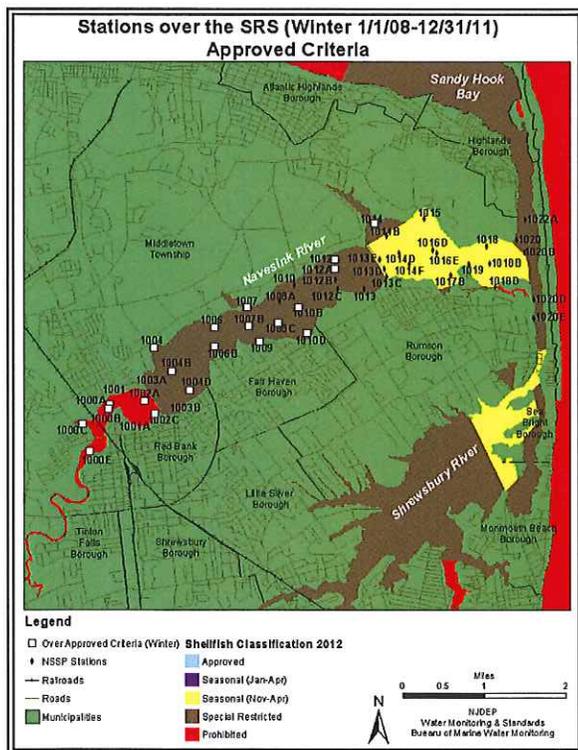
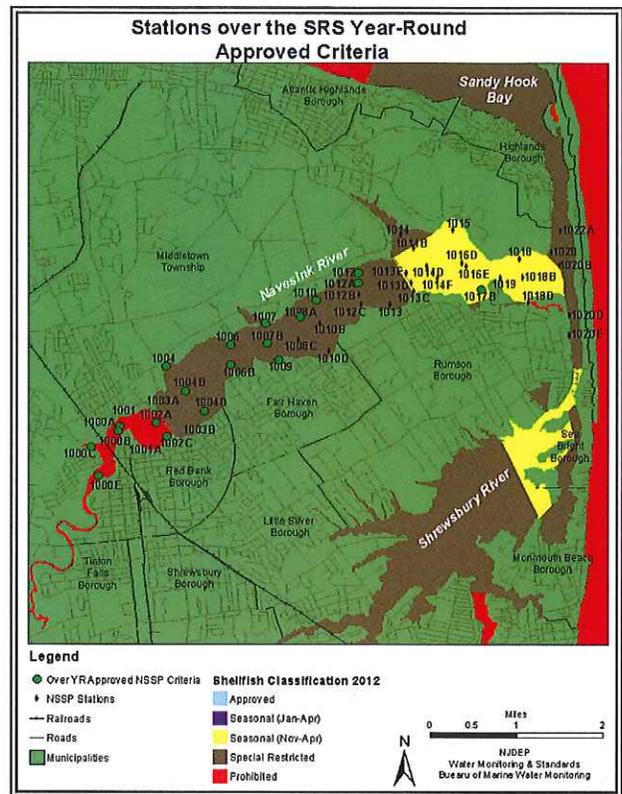


Shellfish Growing Water Quality monitoring stations in the Navesink River. Nearly 1,600 stations are monitored each year for coliform levels throughout the state; 48 are located in Navesink River. Stations 1001, 1001A, 1003A, & 1003B are newer stations, added to sampling plan during the last report on this area. These stations do not yet have the 30 sample size that is required for analysis by NSSP, but can be considered when analyzing trends.

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. Nineteen sampling stations exceeded the NSSP criteria for *Approved* waters (see adjacent figure).

There are no *Approved* waters within this shellfish growing area. All the noted stations are located in *Seasonal (Nov-Apr)*, *Special Restricted*, or *Prohibited* waters.



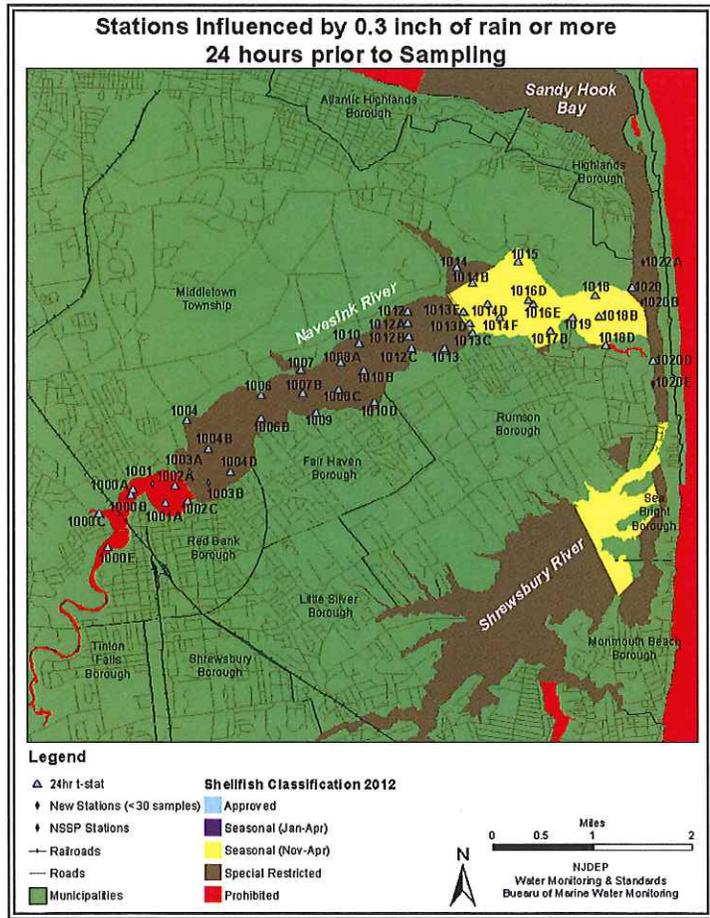
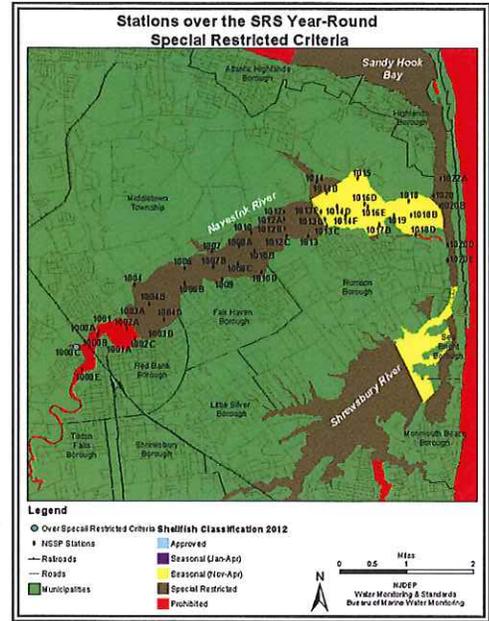
A portion of the Navesink River is classified as *Seasonal (Nov-Apr)*. Harvesting of shellfish in this area is permitted from November through April (winter). One station, 1017B, is located in *Seasonal (Nov-Apr)* waters and is above the year-round *Approved* criteria. In order to fully evaluate if these waters are correctly classified, the timeframe was extended to capture a sample size of 30 for the winter 'season'. When the time frame was extended back to January 1, 2004 in order to get the 30 SRS samples for winter, there are 20 stations over the SRS criteria for *Approved* waters during the winter, however, station 1017B was not one of them (see adjacent figure). Twenty-five stations were over the SRS criteria for *Approved* waters during the summer months when the timeframe was extended to January 1, 2006 to get thirty or more samples in the summer months; however, the *Seasonal* waters are closed during the summer months. This means that when the sample size is extended to fit NSSP seasonal guidelines, the *Seasonal (Nov-Apr)* waters are still in compliance. In summation, this station 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. One station, 1000C, exceed the SRS year round criteria for *Special Restricted* waters; this station is located in the upper *Prohibited* portion of the river (see adjacent figure).

Rainfall Effects

A *t*-test is used to compare log-transformed total coliform values for wet verses dry data. The *t*-statistical probability must be less than or equal to 0.05 for a station to be rainfall impacted. There is also a wet/dry cutoff for each growing area that dictates what data is considered 'wet' and what data is considered 'dry'. The scenario used for this growing area was based on a wet/dry cutoff of 0.3 inch.



Rainfall amounts 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; this shellfish growing area uses station RA003.

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.

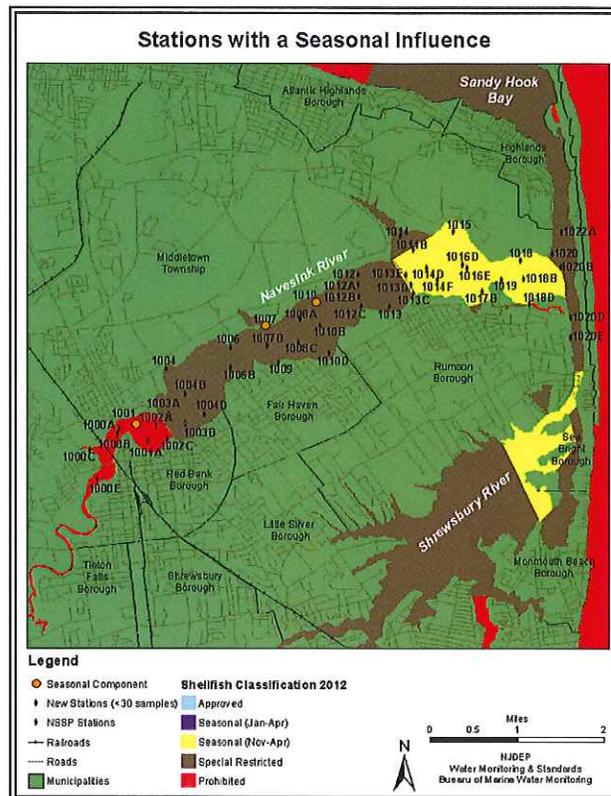
Rainfall appears to be a significant factor for the stations located in this growing area. The 'first flush' after 0.3 inch of rainfall impacts the entire river (see adjacent figure). Rainfall appears to be a significant factor for the stations located in this growing area; especially within 24 hours of a rain event. This is expected since this area is urban and is abundant in impervious surfaces.

Seasonal Effects

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.

This area undergoes a population surge in the summer, which increases sewage use as well as other utilities. Therefore, it is probable that the stations with a seasonal component are affected by non-point source pollution from increased summer population and/or increased use of water-related activities (boating, etc.) during the summer.

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



RELATED STUDIES

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

Nutrients

Coastal water quality is monitored for ecological health parameter including dissolved oxygen and total nitrogen. Samples are collected on a quarterly basis at 10 stations within the Navesink 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 Navesink River, but for more information on the phytoplankton in New Jersey waters please 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 scheduled 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 bathing beach station in the Navesink River; CCMPMC0051. BMWM utilizes this data as adjunct information; the closure of shellfish waters does not correspond with these results. Please see <http://www.njbeaches.org/> for further information.

Toxic Monitoring

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

USEPA National Coastal Assessment Program (NCA)

USEPA National Coastal Assessment EMAP and its partners began sampling in the coastal and estuarine water of the United States in 1990. Data collected include water column parameters, sediment chemistry

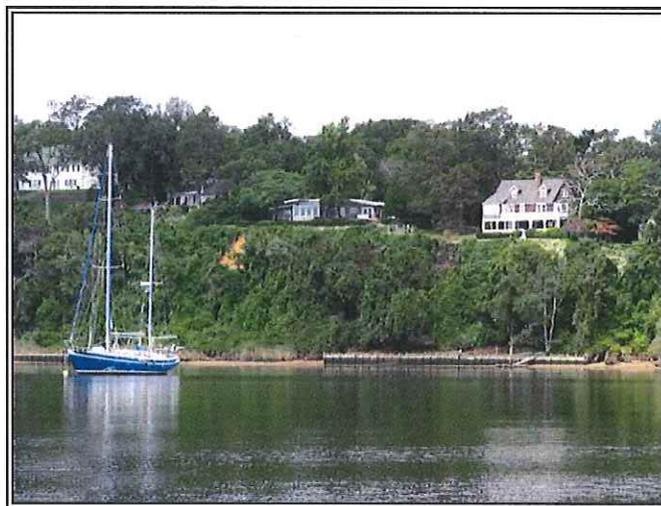
& toxicity, benthic communities, and tissue contaminants. No NCA Metal data is currently available for the Navesink River in the January 1, 2008 to December 31, 2011 timeframe. Oftentimes, this data is used as an indication of areas that need to be investigated further concerning human and/or ecosystem health issues. Station NJ05-021N-A was sampled on 9/21/05; 2 parameters exceeded ERM levels (zinc & mercury), 9 more exceeded ERL levels (arsenic, cadmium, chromium, copper, lead, nickel, silver, fluorene, & dieldrin). Station NJ06-0068-A was sampled on 10/4/06; 2 parameters exceeded the ERL levels (silver & pp-DDE). 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 Navesink 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, 2008 to December 31, 2011. Systematic Random Sampling strategy was used to collect the samples, laboratory tests were run for total coliform, and a thorough analysis of the data was assembled for this report. The bacteriological data for each station supports the respective criteria for their classification under the total coliform standard. Based on the data, this growing area is adequately classified.



There were 5 stations with a seasonal component. It was found that the urban areas in the Navesink River are impacted by rainfall accumulations above 0.3 inch, particularly right after a rain event. On analysis it was found that none of the impacted stations require a change in classification.

Analyses of the Navesink 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). Historical data indicates higher levels of bacteria in the upper portion of the river, making the area *Prohibited*. Potential sources of pollution in this area include high urban land use, marinas, and old infrastructure. The majority of the Navesink River is classified as *Special Restricted*, and should remain so because it exceeds *Approved* criteria year round and *Approved* criteria during the winter (with the extended timeframe of January 1, 2004 to December 31, 2011), but does not exceed *Special Restricted* criteria. The lower portion of the river is sufficiently classified as *Seasonal (Jan-Apr)*, although

station 1017B will be monitored closely during the winter months. The Navesink River is appropriately classified, as supported by the total coliform levels sampled from January 1, 2008 to December 31, 2011 and no changes to these classifications are proposed.

RECOMMENDATIONS

There are no recommended changes in classification for the Navesink River.

There are no recommended changes in monitoring schedule for the Navesink River.

The recommendation for further study is closely monitor station 1017B, which exceeds the *Approved* criteria year-round, but fit within the criteria during the winter months with an extended timeframe. Otherwise, continue sampling under the existing sampling protocol.

LITERATURE CITED

American Public Health Association (APHA). 1995, 1970. Standard Methods for the Examination of Water and Wastewater, 19th ed., American Public Health Association, Washington, DC.

Ingmanson, D. and W. Wallace, 1989. Oceanography: An Introduction. Wadsworth Publishing Co., Belmont, CA.

Keelen, Kate & Jerry, 2003. The Navesink Watershed: A Short History. Navesink Swimming River Group.

National Oceanic and Atmospheric Administration (NOAA). Rainfall Data from station RA003. Accessed monthly. <http://www.noaa.gov/>

N.J.A.C. (New Jersey Administrative Code), 2005, 2006, 2007, & 2008. Department of Environmental Protection. Chapter 7:12.

NJDEP Annual Report on Shellfish Growing Area NE2, Navesink River, 2008-2011. Water Monitoring & Standards, Marine Water Monitoring, Leeds Point, NJ.

NJDEP Field Sampling Procedures Manual, 2005. New Jersey Department of Environmental Protection, Trenton, NJ.

NJDEP Coastal Nonpoint Source Pollution Monitoring Program: Upper Navesink River Storm Water Study, 2008. Water Monitoring & Standards, Marine Water Monitoring, Leeds Point, NJ.

NJDEP Shellfish Growing Area Report Guidance Document, 2007. New Jersey Department of Environmental Protection, Marine Water Monitoring, Leeds Point, NJ.

NJDEP State of New Jersey Shellfish Growing Water Classification Charts. 2005, 2006, 2007 & 2008. New Jersey Department of Environmental Protection, Marine Water Monitoring, Leeds Point, NJ.

NJDEP's Division of Fish & Wildlife, 1980's. Hard Clam Density in the Navesink River. New Jersey Department of Environmental Protection, Division of Fish and Wildlife, Port Republic, NJ.

NMFS. 2007. Marine Fisheries Annual Landings Results for New Jersey 2005. National Marine Fisheries Service, Fisheries Statistics and Economics Division, Silver Spring, MD.

NSSP, 2007 Revision. National Shellfish Sanitation Program. Guide for the Control of Molluscan Shellfish. Model Ordinance. Interstate Shellfish Sanitation Conference. US Public Health Service, Food and Drug Administration, Washington, DC

Township of Middletown Sewage Authority (TOMSA) History. Edited May 7, 2007 Accessed June 21, 2007. <http://www.tomsanj.com/>

Two Rivers Water Reclamation Authority (TRWRA). About. Edited June 7, 2007. Accessed October 17, 2012. <http://www.trwra.org/>

APPENDICES

- A. Statistical Summary (1/1/08-12/31/11)
 - Statistical Summary: Winter (Extended Timeframe 1/1/04-12/31/11)
 - Statistical Summary: Summer (Extended Timeframe 1/1/06-12/31/11)
- B. Seasonal Evaluation
- C. Precipitation
 - Rainfall Amount
 - Weather Observations
 - Wet/Dry Statistics
- D. Data Listing: January 1, 2008 to December 31, 2011