NJ Department of Environmental Protection
Water Monitoring and Standards

Reappraisal Report of Shellfish Classification for Growing Area SE6 Great Sound to Richardson Sound

April 2015

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

NJ Department of Environmental Protection
Bob Martin, Commissioner

Reappraisal Report of Shellfish Classification for Growing Area SE6 Great Sound to Richardson Sound

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ACKNOWLEDGMENTS

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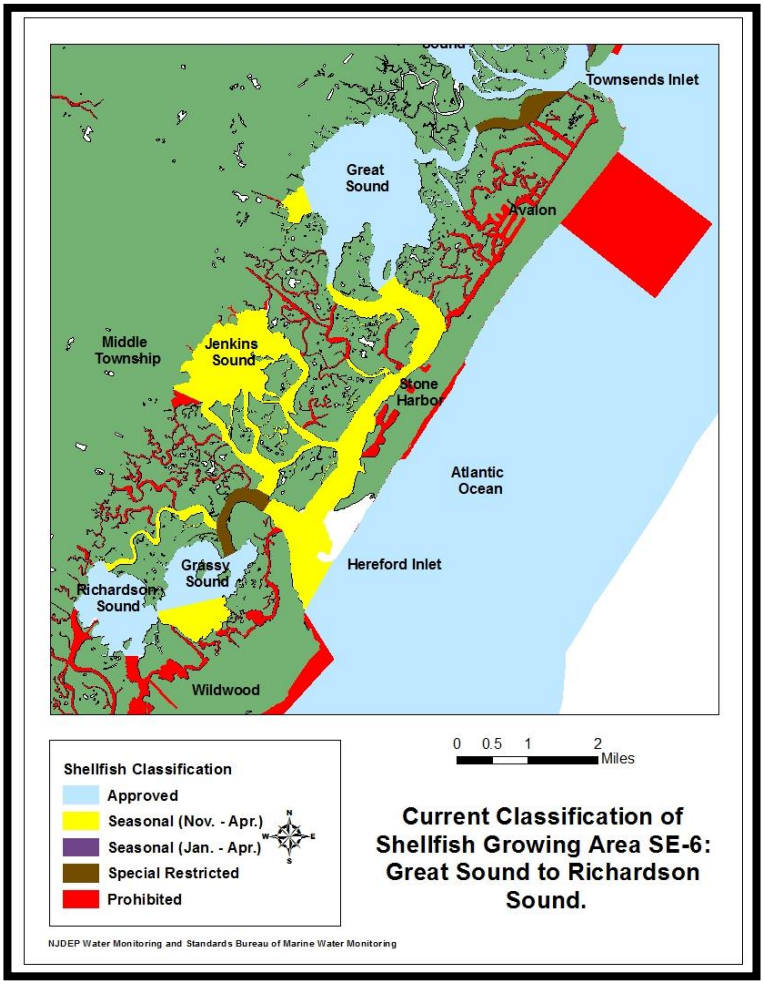
Cover Photo – Stone Harbor Boulevard Bridge and Stone Harbor Marina from end of 83rd Street, Stone Harbor, Cape May County

TABLE OF CONTENTS

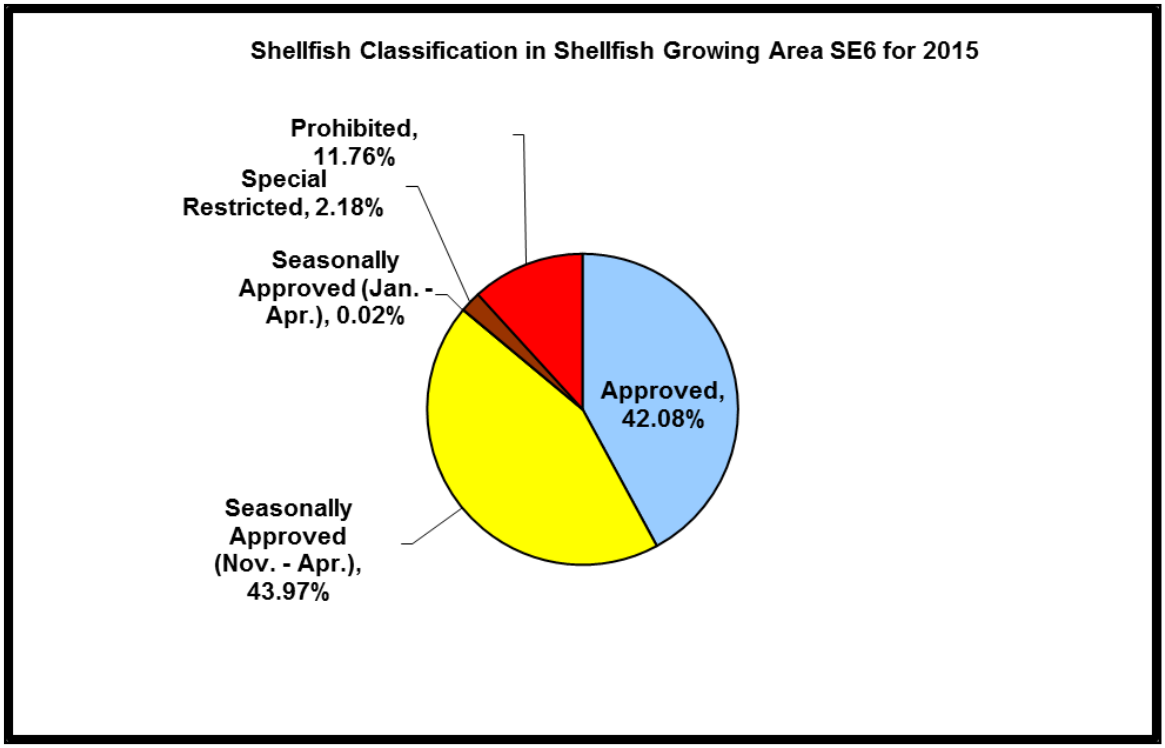
EXECUTIVE SUMMARY

Shellfish Growing Area SE-6, Great Sound to Richardson Sound, is located in the southeastern part of New Jersey, southwest of the city of Avalon and northwest of the city of Wildwood in Cape May County. The approximate size of this shellfish growing area is 7,083.4 acres and the shellfish classification for this growing area is *Approved (42.08%), Seasonally Approved (November to April) (43.97%), Seasonally Approved (January to April) (0.02%), Special Restricted (2.18%),* and *Prohibited (11.76%)* for shellfish harvesting (as seen in the figure to the right).



This report includes water quality data collected between May 2010 and April 2015 using the Systematic Random Sampling (SRS) strategy for all of the sampling stations in this shellfish growing area because there are no adverse pollution sources that are directly discharging into these shellfish waters. Approximately 3,900 water samples were analyzed for fecal coliform bacteria from 108 monitoring stations All but one of the sampling stations in this shellfish growing area meet the *Approved, Seasonally Approved (November to April), Seasonally Approved (January to April), Special Restricted,* and *Prohibited* fecal coliform shellfish classification criteria for water quality year-round, in the summer months, and in the winter months, using the fecal coliform mTEC analysis, and are in compliance with the fecal coliform criteria for the *Approved, Seasonally Approved (November to April), Seasonally Approved (January to April), Special Restricted,* and *Prohibited* classifications of this shellfish growing area, as specified by the National Shellfish Sanitation Program (NSSP). Sampling Station 3312 exceeded the *Approved* shellfish classification criteria year-round and in the summer for the *Approved* shellfish waters of Great Sound. This station will be closely monitored

during shoreline surveys of this shellfish growing area. There were no observed changes to pollution sources of this area as documented in the shoreline survey included in this report.



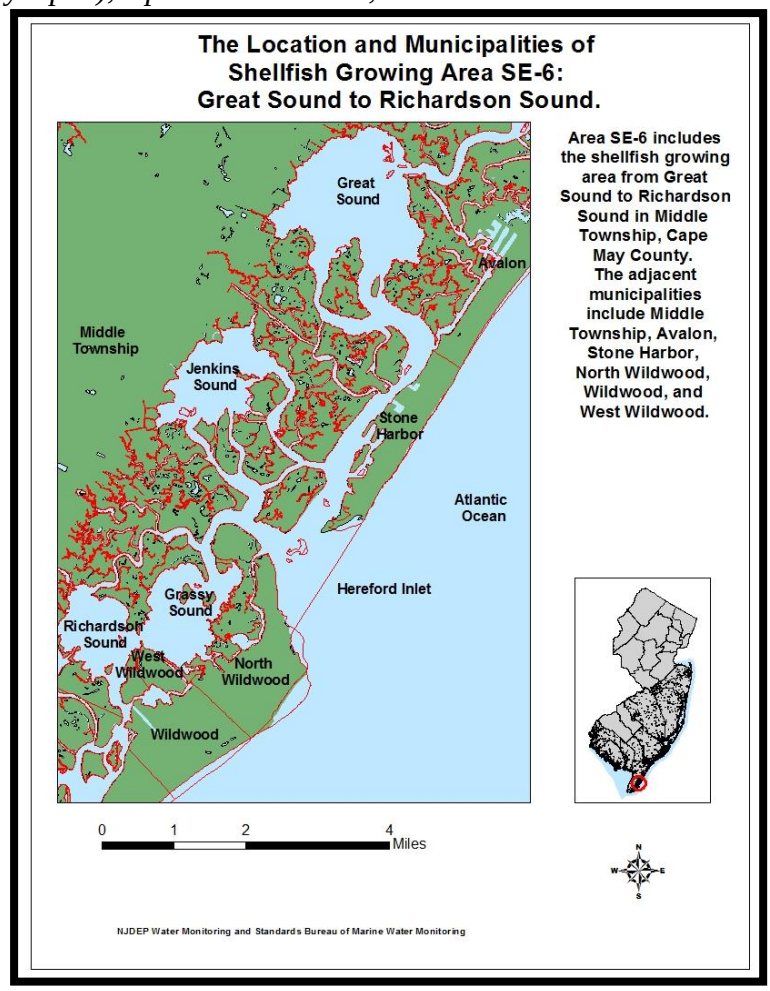
DESCRIPTION OF GROWING AREA

LOCATION & DESCRIPTION

Shellfish Growing Area SE-6 is located in the southeastern part of New Jersey; southwest of the city of Avalon and northwest of the city of Wildwood in Cape May County.

The waters of this shellfish growing area are bordered to the north by Avalon Boulevard (Route 601), to the west by the Garden State Parkway in Middle Township, to the south by Wildwood Boulevard (Route 47), and to the east by the municipalities of Avalon, Stone Harbor, North Wildwood, West Wildwood, and Wildwood. The locations of the adjacent municipalities are shown in the figure on the next page. Population statistics for the adjacent municipalities can be found in the previous sanitary survey report of this shellfish growing area, which was written in December 2004 and included the population statistics from the 2000 census of this area.

The approximate size of this shellfish growing area is 7,083.4 acres, and the shellfish classification for this growing area is *Approved, Seasonally Approved (November-April), Seasonally Approved (January-April), Special Restricted*, and *Prohibited* for shellfish harvesting. There are approximately 2,980.7 acres of *Approved* waters, 3,114.5 acres of *Seasonally Approved (November-April)* waters, 0.3 acres of *Seasonally Approved (January-April)* waters, 154.9 acres of *Special Restricted* waters, and 833.3 acres of *Prohibited* waters in this shellfish growing area. The *Approved* waters are located in Great Sound, Richardson Sound, and the north part of Grassy Sound. The *Seasonally Approved (November-April)* waters are located in Gull Island Thorofare, Cresse Thorofare, the east part of Scotch Bonnet Creek, Jenkins Sound, Nichols Channel, Dung Thorofare, Drum Thorofare, Jenkins Channel, Great Channel, the south part of Old Turtle Thorofare, and the south part of Grassy Sound. The *Seasonally Approved (January-April)* waters are located in an unnamed creek on the northwest side of Great Sound. The *Special Restricted* waters are located in Grassy Sound Channel, Taugh Creek, an unnamed creek off of Drum Thorofare in Little Sand Meadow, and two unnamed creeks on the northwest side of Great Sound. The *Prohibited* waters include the rest of the waters in this shellfish growing area. The locations of Great Sound, Jenkins Sound, Great Channel, Grassy Sound, and Richardson Sound can be seen in the figure above.

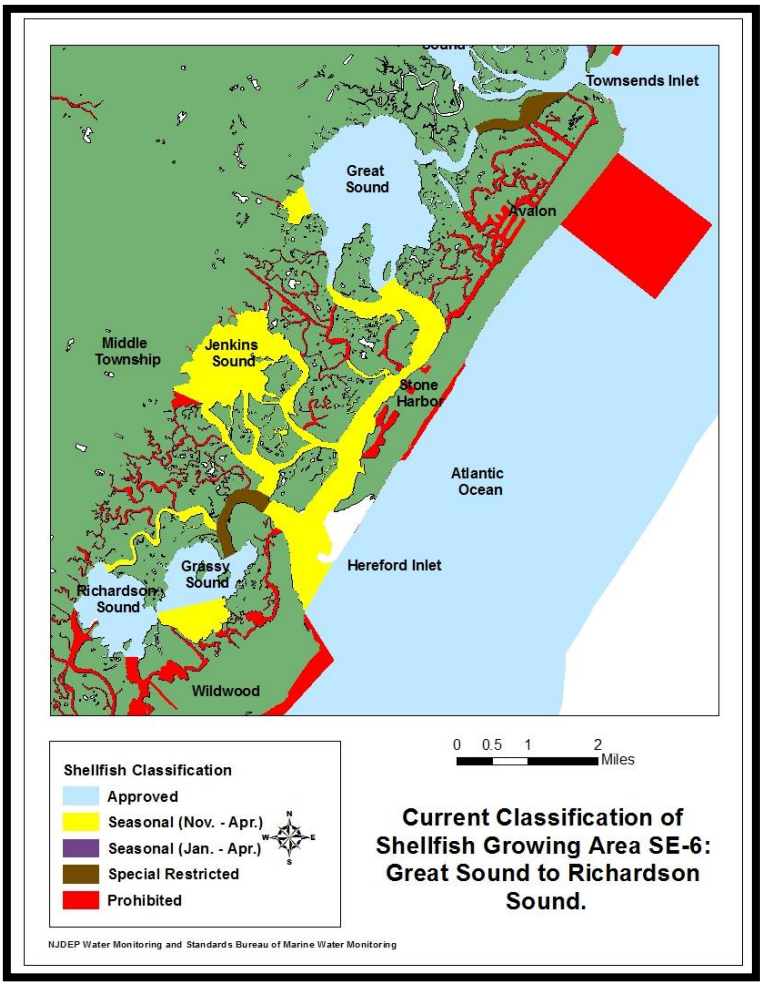


Tidal flushing of this area mainly occurs through Hereford Inlet and Townsends Inlet. The figure above shows the location of Hereford Inlet. This area can be found on Chart 16 of the "State of New Jersey 2015 Shellfish Growing Water Classification Charts" (NJDEP, 2015). The current classification of this shellfish growing area can be seen in the figure on the next page.

GROWING AREA CLASSIFICATION

The waters of this shellfish growing area are primarily classified as *Approved*, *Seasonally Approved (November-April)*, *Seasonally Approved (January-April)*, *Special Restricted*, and *Prohibited* (see page 3 for description of shellfish classification of this area).

A reappraisal report for Shellfish Growing Area SE6 was written in 2011 using water quality data from 2006 to 2011. In this report, there were 41 sampling stations that showed a correlation between total coliform MPN and rainfall at 24 hours cumulative with a wet/dry cutoff of 0.2 inches of rain, and 71 sampling stations that showed a seasonal component. The water quality of the water samples collected at all of the sampling stations in this shellfish growing area met the existing shellfish classification criteria. (Wesighan, 2011).



In the 2012 Annual Review of Shellfish Growing Area SE-6 for the Great Sound to Richardson Sound area, no classification change was proposed for this shellfish growing area. No water samples collected at the sampling stations in this shellfish growing area exceeded the existing shellfish classification criteria, and the data supported the existing shellfish classification for this area. However, it was recommended that the entire growing area be sampled using the Systematic Random Sampling (SRS) strategy (NJDEP, 2004, NJDEP, 2005).

In the 2013/2014 Annual Review of Shellfish Growing Area SE6 for this area, all but one of the water samples collected at the sampling stations in this shellfish growing area met the existing shellfish classification criteria. Sampling station 3312, located in the southeast of Great Sound, exceeded the *Approved* shellfish classification criteria. It was recommended that this sampling station be closely monitored during shoreline surveys of this shellfish growing area (NJDEP, 2014).

The last Sanitary Survey for Shellfish Growing Area SE-6 (Great Sound to Richardson Sound) was written in 2007 using water quality data from 2002 to 2007. In this report, approximately 66.7 acres of *Prohibited* shellfish waters in Old Turtle Thorofare were upgraded to the *Seasonally Approved (November-April*) shellfish classification (November – April) (Wesighan, 2007).

EVALUATION OF BIOLOGICAL RESOURCES

This growing area has a wide diversity of biological resources. The total shellfish landings for New Jersey from 2010 to 2015 can be seen in the table below (NMFS, 2015). The total shellfish landings includes hard clams, soft clams, blue mussels, bay scallops, eastern oysters, ocean quahogs, surf clams, sea scallops, and blue crabs. Shellfish landing statistics had not been verified and posted for 2014 or 2015 at the time this reappraisal report was written.

NEW JERSEY SHELLFISH LANDINGS 2010 TO 2015 (NMFS, 2015).

NEW JERSEY SHELLFISH LANDINGS 2010 to 2015		
YEAR	POUNDS OF MEAT (millions)	$ VALUE (exvessel)
2010	61,976,167	144,863,008
2011	65,425,598	177,229,339
2012	57,692,498	146,048,687
2013	46,002,626	96,407,954
2014	*	*
2015	*	*

* No data available

Hard clams (*Mercenaria mercenaria)* are the primary shellfish resource that is commercially harvested in this shellfish growing area. The table on the next page shows the Hard Clam Landings for 2010 to 2015 (NJDEP, 2011).

HARD CLAM LANDINGS 2010 TO 2015 (NMFS, 2015).

HARD CLAM LANDINGS 2010 to 2015		
YEAR	POUNDS OF MEAT (millions)	$ VALUE (exvessel)
2010	*	*
2011	14,831,350	9,003,694
2012	18,408,860	13,100,352
2013	17,231,460	12,044,144
2014	*	*
2015	*	*

* No data available

Blue crabs (*Callinectes sapidus*) are also harvested in this area. Great Sound, Jenkins Sound, Grassy Sound, Richardson Sound, and Hereford Inlet are also utilized for fishing, boating, and other marine activities. Many species of fish can also be found in the waters of this shellfish growing area.

Many species of animals and vegetation can be found in the marshes of this shellfish growing area. Wildlife populations (birds and animals) are actual contributors to water quality in Gull Island Thorofare, Cresse Thorofare, Great Channel, Jenkins Sound, Hereford Inlet, Old Turtle Thorofare, Grassy Sound Channel, and the south part of Grassy Sound. Birds sometimes may accumulate around the groins, jetties, seawalls, and bulkheads on the coast of this shellfish growing area, and fecal matter from these birds could affect the water quality.

This shellfish growing area is almost completely surrounded by a shoreline of marshes, with areas of bulkheads, erodable shorelines, and beaches composing the remainder of the shoreline. Bulkheads are located along the east and west shorelines of Great Channel (west of Stone Harbor), along the east and west shorelines of the upper section of Grassy Sound Channel, along the southwest shoreline of Grassy Sound, along the east and west shorelines of the lower section of Grassy Sound Channel, and along the east shoreline of Post Creek Basin (south of West Wildwood). Areas with an erodable shoreline include the southwest shoreline of Holmes Cove in Great Sound, a small section of the southwest shoreline of Great Channel, a small section along the north and south shorelines of the upper section of Grassy Sound Channel, along the northeast shoreline of Beach Creek, a small section along the east and west shorelines of lower Old Turtle Thorofare, a small section along the northeast shoreline of Richardson Sound, and along the southwest shoreline of Grassy Sound. The Hereford Inlet area is bordered to the north by beaches and to the south by bulkheads.

This area also includes a wide variety of marsh types and vegetation, including vegetated salt marshes, tidal ponds, tidal waters, tidal mud flats, tidal sand flats, non-tidal ponds, sandy developed beaches, sandy undeveloped beaches, developed areas, and small areas of coastal scrub shrub. These marsh types and vegetation are located throughout the adjacent shoreline of this shellfish growing area. Hereford Inlet is bordered on the north shore with sandy developed beaches and on the south shore with developed areas. Vegetated salt marshes, tidal mud flats, tidal sand flats, and tidal waters primarily border Great Sound, Jenkins Sound, Grassy Sound, and Richardson Sound.

SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

SHORELINE SURVEY

The shoreline surveys for Shellfish Growing Area SE-6: Great Sound to Richardson Sound were done on April 30, 2015 and June 23, 2015.

During the shoreline survey of this area on April 30, 2015, Boat Captain Mark Resciniti took a picture of the area south of Great Sound where sampling station 3312 is located, and large flocks of egrets were seen along the shoreline of Great Sound in this area.

During the shoreline survey of this area on June 23, 2015, it was seen that the stormwater outfalls in Stone Harbor at the ocean were redirected to lagoon areas off of Great Channel (see figure on page 16). In Phase 1 for 2010, the stormwater outfall pipes at the ocean from 104th Street to 107th Street were relocated to the lagoon area off of Great Channel at 105th Street. In Phase 2 for 2012, the stormwater outfall pipes at the ocean from 97th Street to 101th Street were relocated to the lagoon area off of Great Channel at 97th Street. In Phase 3 for 2015/ 2016, it is proposed to relocate the stormwater outfall pipes from the ocean at 84th Street to 93rd Street and to the lagoon area off of Great Channel at 82nd Street. All three of the lagoon areas are Prohibited to shellfish harvesting. The stormwater outfall pipes at 111th Street and 114th Street are still present and it is proposed to remove them with redirection point and completion date still to be determined.

Stone Harbor Marina along Stone Harbor Boulevard in Middle Township now has a total of 200 wet slips, and Smugglers Cove Marina on 83rd Street in Stone Harbor has now been included on the list of marinas in this shellfish growing area.

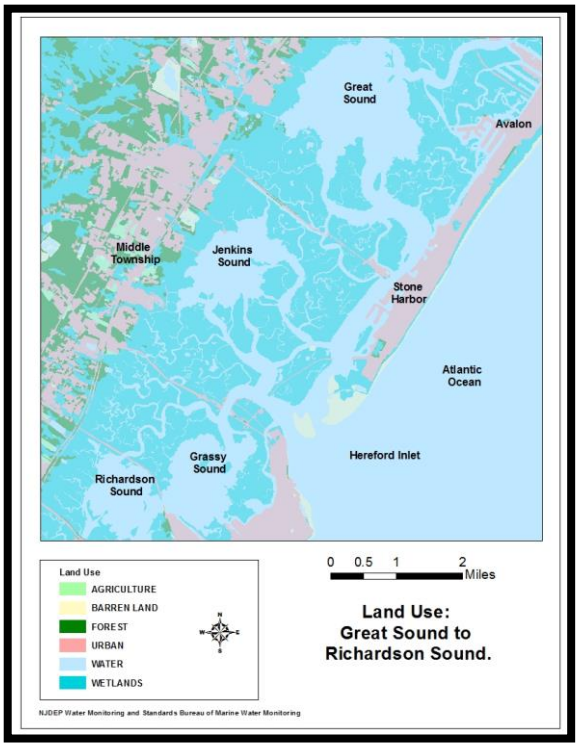
There have been minor changes to this area since the 2007 sanitary survey of this shellfish growing area. Some new building constructions were seen along the adjacent shorelines of Avalon, Stone Harbor, North Wildwood, West Wildwood, and Wildwood.

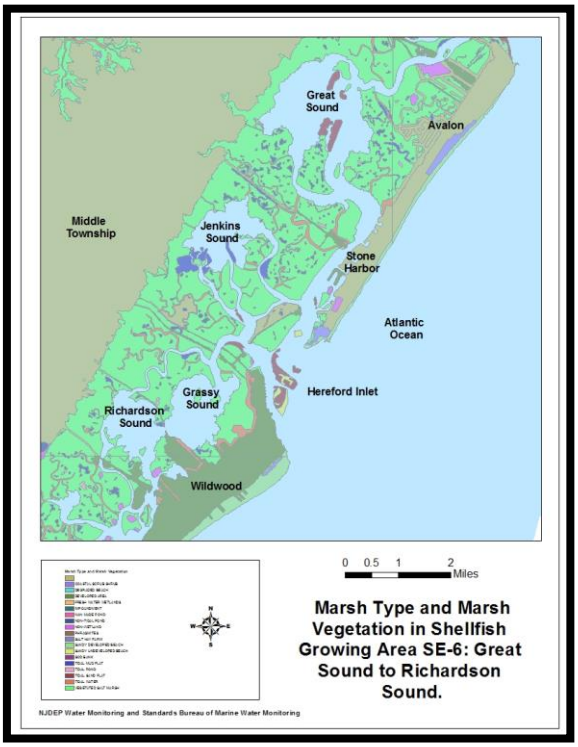
LAND USE

The major land use patterns for the municipalities adjacent to this shellfish growing area are urban, with some wetland areas and a few forest areas (see figure below).

The urban areas to the east of this shellfish growing area are the resort communities of Avalon, Stone Harbor, North Wildwood, West Wildwood, and Wildwood and the urban areas to the west of this shellfish growing area are the communities of Swainton, Cape May Court House, Mayville, and Rio Grande in Middle Township. These areas are urban-residential communities, with some commercial businesses. The populations in the resort communities of Avalon, Stone Harbor, North Wildwood, West Wildwood, and Wildwood fluctuate greatly, especially during the summer months, because these communities are known for their recreational bathing beaches, their summer tourism industry, and the seasonal boating and fishing activities. Population pressures during the summer months can potentially have an impact on the water quality of the waters in this shellfish growing area. There are currently 19 marinas in this area.

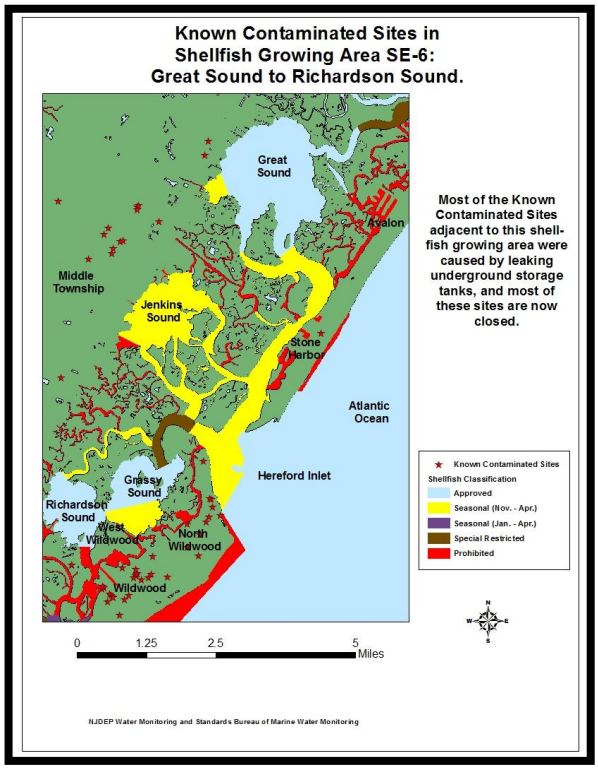
The wetlands and forest areas to the west of this shellfish growing area act as a buffer for the communities and facilities on the western side of the bay. Since some of these communities and the Cape May County Park and Zoo are still connected to private septic systems, there is a potential for pollutant inputs from these sources into these shellfish growing waters, which is why continued monitoring of the water quality in these shellfish growing waters is so very important (APHA, 1995).





KNOWN CONTAMINATED AREAS

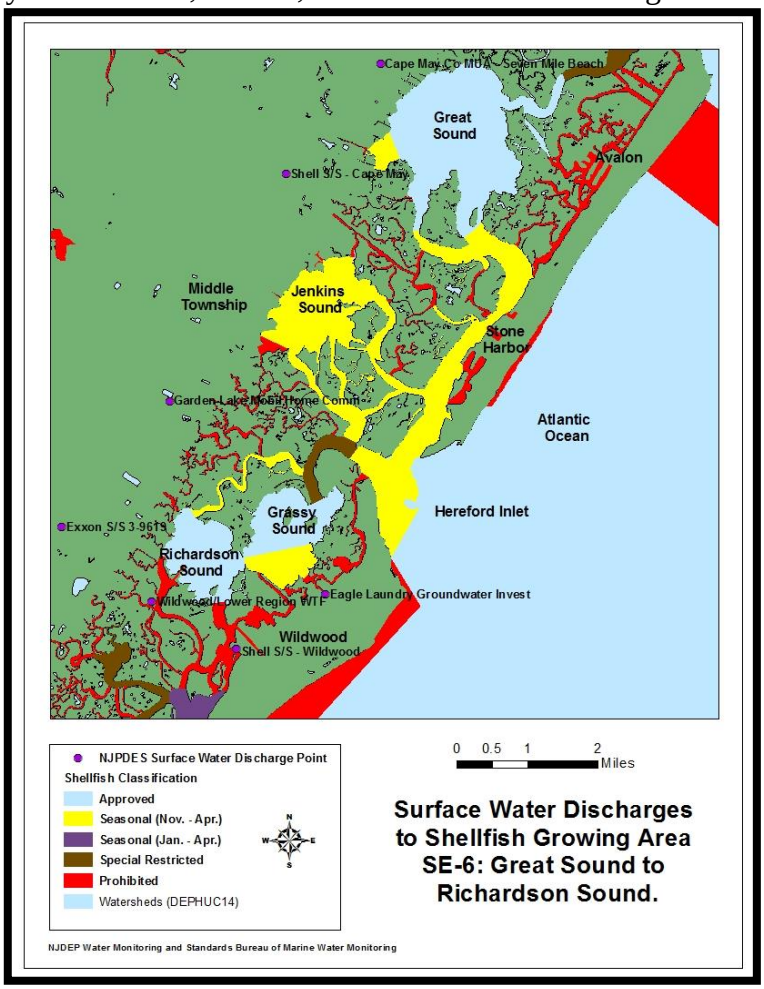
NJDEP, Site Remediation Program (SRP) has established a list of the Known Contaminated Sites (KCSNJ), Classification Exception Area (CEA) and Currently Known Extent (CKE) of groundwater pollution. KCSNJ are those non-residential sites and properties within the state where contamination of soil or groundwater has been confirmed at levels equal to or greater than applicable standards. This list of Known Contaminated Sites may include sites where remediation is either currently under way, required but not yet initiated or has been completed. CEA and CKE areas are geographically defined areas within which the local groundwater resources are known to be compromised because the water quality exceeds drinking water and groundwater quality standards for specific contaminants (NJDEP).



SURFACE WATER DISCHARGES

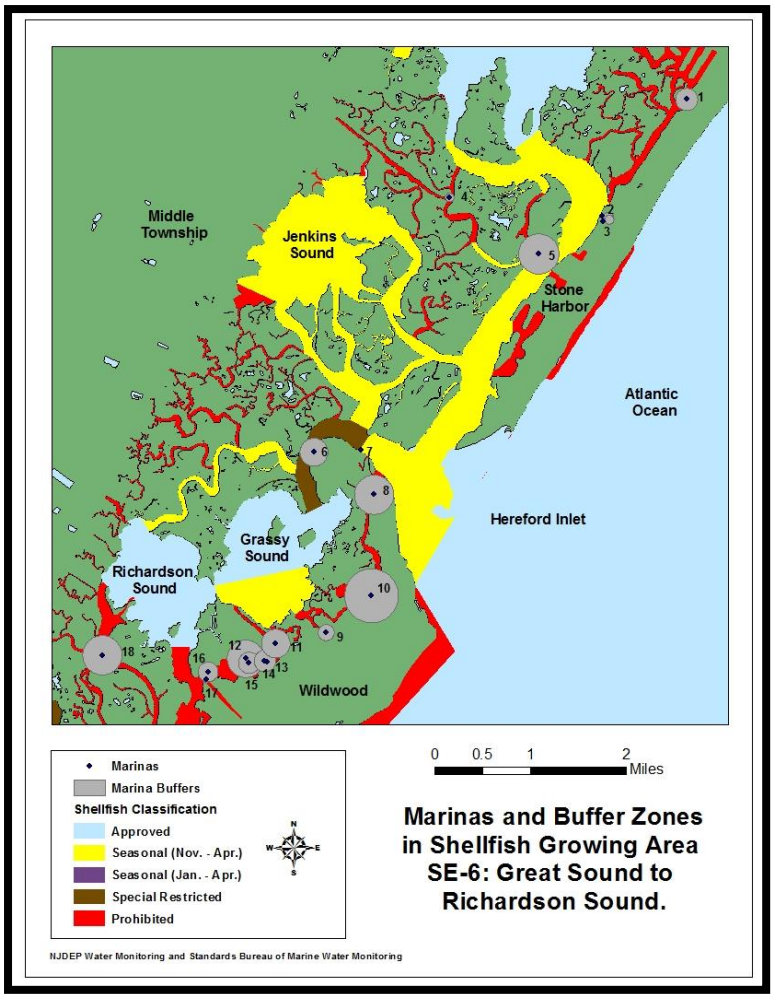
The discharge of pollutant from a point source is authorized under New Jersey Pollutant Elimination System (NJPDES), and the regulations are found at N.J.A.C. 7:14A. The main purpose of the NJPDES program is to ensure proper treatment and discharges of wastewater. By doing so, the permit limits the amount or concentration of pollutants that can be discharged into ground water, streams, rivers, and the ocean. Facilities regulated under this program include mines, schools, hospitals, large corporate office buildings, industrial manufacturing facilities, campgrounds, mobile home parks, food processor, potable water treatment plants, sewage treatment plants, or any dischargers that may have the potential to impact water quality. As of December 2010, there were 6,752 active permits. The number of active permits includes permits for all NJPDES permit classes, including Discharge to Surface Water (DSW), Discharge to Groundwater (DGW), Significant Indirect User (SIU), Discharge of Stormwater (DST), and Residuals (RES), (NJDEP, Division of Water Quality).

A surface water discharge involves the release of treated effluent from various municipal and industrial facilities directly into a river, stream, or the ocean. According to the NJPDES program, there were seven surface water discharges found in this shellfish growing area.



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 18 marinas in area SE-6: Great Sound to Richardson Sound, as shown in the table on the next page and the figure to the right. The waters enclosed by the marina (the marina basin) are classified as *Prohibited*. Depending on the size of the marina, the water quality, flushing rates, and the depth of the water, shellfish waters immediately adjacent to each marina may be classified as *Prohibited*, *Special Restricted*, or *Seasonally Approved* (no harvest during summer months when the marina is normally active). Marina buffer zones for this shellfish growing area were calculated using the New Jersey Marina Buffer Equation. For any marina buffers going into *Approved* shellfish waters, the marina buffer is currently being recalculated using a dilution analysis computer program developed by the State of Virginia and the USFDA, and the marina buffer size will be edited in future reports. The size of each buffer zone is shown in the table on the next page.

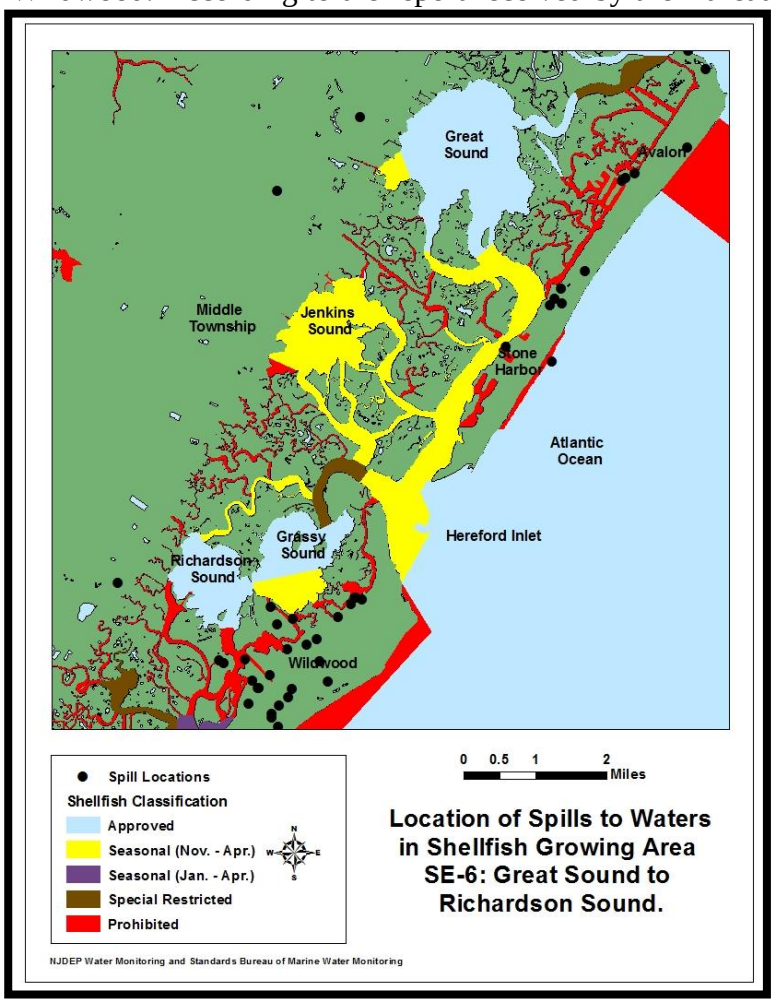
For additional information on the marina equations used for buffer generation see the *Shellfish Growing Area Report Guidance Document*, 2007.

Map Key	Marina Name	Location	# of Wet Slips Total/Boats > 24ft.	Size of Buffer Area (radius; feet)	Average Water Depth (ft)	Pumpout Facility
1	54th & Bay Park Marina	Stone Harbor	30/30	317	24	No
2	Stone Harbor Municipal Marina	Stone Harbor	30/30	401	15	No
3	Smugglers Cove Marina	Stone Harbor	Floating Dock only	0	15	No
4	Camp Marine Services	Stone Harbor	30/30	430	13	Yes
5	Stone Harbor Marina	Middle Township	200/126	697	24	Yes
6	Grassy Sound Marina	Middle Township	57/10	385	12	Yes
7	Dad's Place Marina	Middle Township	33/0	339	6	No
8	Hereford Inlet Marina	North Wildwood	50/6	483	6	Yes
9	Canal Side Boat Rental	North Wildwood	8/8	327	6	No
10	North Wildwood Municipal Marina	North Wildwood	120/120	1267	6	Yes
11	B & E 26th Street Marina	West Wildwood	75/75	1002	6	Yes
12	West Bay Marina	West Wildwood	36/3	394	6	No
13	Spraydock Marina	West Wildwood	28/0	312	6	No
14	Gallo's Marina	West Wildwood	30/0	323	6	No
15	Bridgeport Marina	West Wildwood	75/0	500	6	Yes
16	Hayes Waterway Marina	Wildwood	25/10	318	11	No
17	Ottens Harbor Marine Service	Wildwood	6/0	107	11	No
18	Pier 47 Marina	Middle Township	110/60	1082	5	Yes

SPILLS OR OTHER UNPERMITTED DISCHARGES

Some of the major spills to the waters of this shellfish growing area for the time period of this report (2010 to 2015) include the following:

On July 18, 2013, a sewage spill was reported for the area of Delaware Avenue between 13th and 14th Streets in North Wildwood. According to the report received by the Bureau of Marine Water Monitoring, an undetermined amount of sewage spilled onto the ground at the intersection of these roads from a force main leak that caused the sewage to bubble up out of the ground every time the pumps at the 10th Street pump station would start up. The sewage would then spill into a nearby stormwater drain. Beach Creek is located about 73 yards west of the spill and the shellfish classification for Beach Creek is *Prohibited* to shellfish harvesting. The nearest *Seasonally Approved (November-April)* shellfish water is Grassy Sound, which is located about 745 yards west of the spill. However, this sewage spill was reported as under control with the pumps at the 10th Street pump station throttled back to prevent the discharge from coming out onto the street and the cleanup of the area underway at the time this report was received. The spill was reported as terminated on July 19, 2013. This sewage spill did not occur during the shellfish harvesting season, so the waters of this shellfish growing area did not need to be closed to shellfish harvesting.



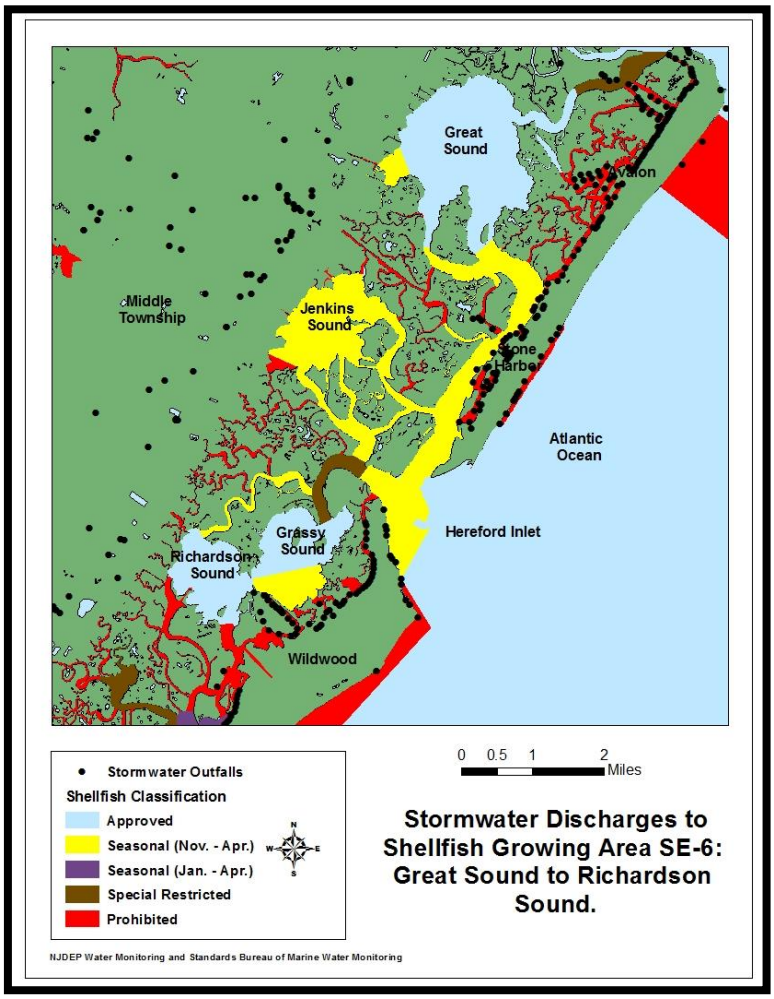
On April 24, 2013, a sewage spill was reported for the area of Stone Harbor Boulevard and the Garden State Parkway in Middle Township. According to the report received by the Bureau of Marine Water Monitoring, approximately 3,000 to 5,000 gallons of sewage spilled when the contractors working on the parkway expansion cracked a12 inch force main that is fed by the Mayville pump station and between 500 to 1,000 gallons of

sewage may have spilled into the marsh area east of the Stone Harbor Boulevard pump station which is northeast of the intersection. The Cape May County M.U.A. was notified of the spill at 8:30pm. The Cape May County M.U.A. personnel shut down the pump station and the sewage from the force main break was being pumped into the gravity sewer located in front of the Stone Harbor Boulevard pump station. Crooked Creek is located about 851 yards east of the spill and the shellfish classification of Crooked Creek is *Prohibited* to shellfish harvesting. The nearest Seasonally Approved (November-April) shellfish water is Holmes Cove, which is located about 1,564 yards northeast of the spill. This sewage spill was reported as terminated and cleaned up by 11:45pm.

The locations of all reported spills to the waters in this shellfish growing area can be seen in the figure on the previous page. Of the major spills reported for this shellfish growing area during the time period of this report (2010 to 2015), none of these spills were known to have impacted the water quality of this shellfish growing area and there were no shellfish closures of this shellfish growing area due to possible impacts by these spills.

STORMWATER DISCHARGES

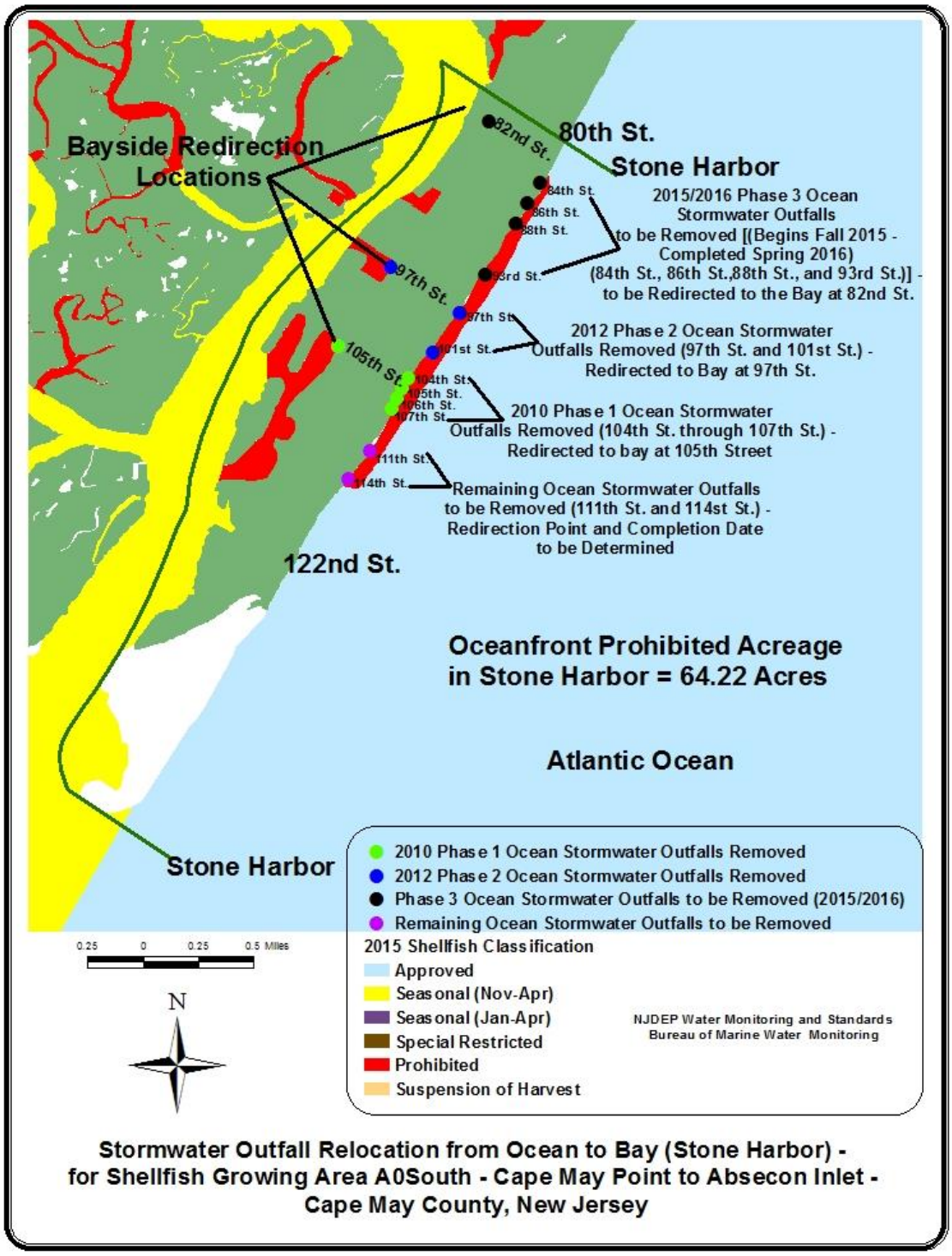
The stormwater inputs to this shellfish growing area are the result of rainwater, which would normally be absorbed into vegetated soils and used to recharge aquifers, maintain stream base flow, and maintain waterway health, instead being collected on top of impervious surfaces, such as parking lots, rooftops, and roadways, and then temporarily collected in detention basins, and finally dumped into streams, creeks, wetlands, lakes, bays, and rivers. This runoff can carry a variety of waste materials, such as domestic and wild animal fecal materials, petroleum and other toxic materials spilled from automobiles, and fertilizer and pesticide materials used on neighboring lots.



There are many stormwater outfalls located along the borders of this shellfish growing area. These stormwater outfalls mainly border Wildwood Canal, Hoffman Canal, and Beach Creek (west of Wildwood, West Wildwood, and North Wildwood), the south side of Hereford Inlet, the east side of Great Channel, Muddy Hole Creek, Stone Harbor Creek (west of Stone Harbor), Long Reach, Princeton Harbor, and Pennsylvania Harbor (west of Avalon) (see figure to the right). There are also some stormwater outfalls located to the west of this area in Middle Townships near the Garden State Parkway and Route 9.The figure on the next page shows the bayside redirection locations of the stormwater outfalls from the ocean to the lagoon areas off of Great Channel in Stone Harbor for 2010 and 2012, and the proposed redirection locations for 2015 and 2016, with redirection point and completion date for the 111th Street and 114th Street stormwater outfalls yet to be determined.

These stormwater outfalls have the potential to impact the water quality of this shellfish growing area. However, there is no current evidence from water quality and bathing

beach data that these shellfish growing waters are directly impacted by the outflow from these stormwater outfalls, which is why these shellfish waters are sampled using the Systematic Random Sampling (SRS) strategy.



Stormwater Outfall Relocation from Ocean to Bay (Stone Harbor) - for Shellfish Growing Area A0South - Cape May Point to Absecon Inlet - Cape May County, New Jersey

WATER QUALITY STUDIES

SAMPLING STRATEGY

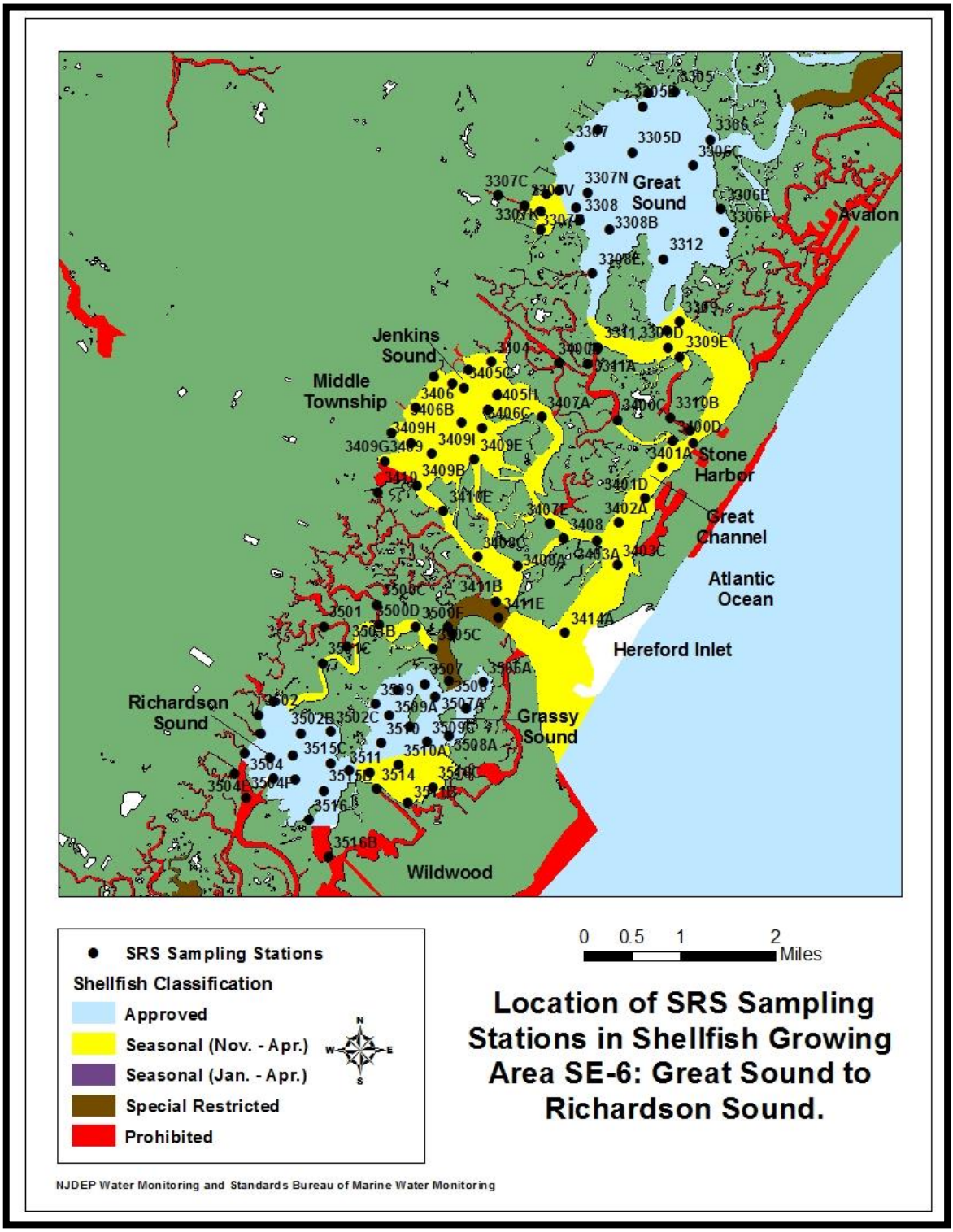
The State Shellfish Control Authority has the option of choosing one of two water monitoring sampling strategies for each growing area. For additional information on the types of sampling strategies, see the *Shellfish Growing Area Report Guidance Document, 2007*. There were no direct discharges to this shellfish growing area. Therefore, it was sampled under the Systematic Random Sampling (SRS) Strategy.

METHODS

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 1992).

From 2010 through 2015, approximately 3,900 water samples were collected for fecal coliform bacteria from 108 monitoring stations. The locations of these stations are shown in the figure on the next page. These samples were analyzed by using the fecal coliform mTEC method (APHA, 1970). Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish*, Revised 2009.

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


Great Sound
Avalon
Jenkins Sound
Middle Township
Stone Harbor
Great Channel
Atlantic Ocean
Hereford Inlet
Grassy Sound
Richardson Sound
Wildwood
SRS Sampling Stations
Shellfish Classification
Approved
Seasonal (Nov. - Apr.)
Seasonal (Jan. - Apr.)
Special Restricted
Prohibited
N
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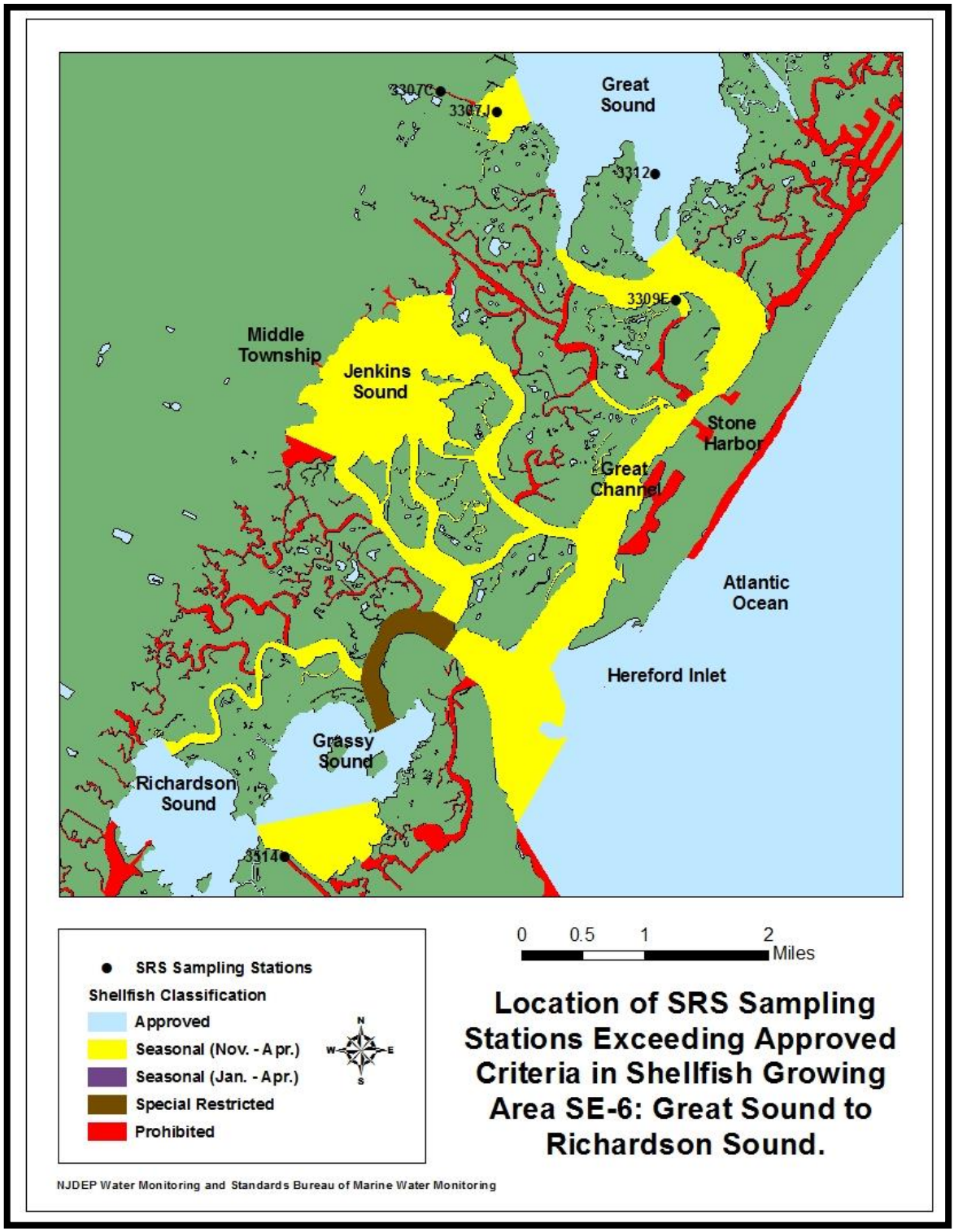
0 0.5 1 2
Miles
Location of SRS Sampling Stations in Shellfish Growing Area SE-6: Great Sound to Richardson Sound.
NJDEP Water Monitoring and Standards Bureau of Marine Water Monitoring

BACTERIOLOGICAL QUALITY

The statistical summaries for the areas sampled according to Systematic Random Sampling (SRS) Strategy are listed at the end of this report in the Appendix. This shellfish growing area is composed of three assignment areas, Assignment 255 (Hereford Inlet and Jenkins Sound), Assignment 267 (Grassy Sound and Richardson Sound), and Assignment 287 (Great Sound). The water samples collected in these assignments 255 are sampled using SRS sampling strategy seasonal with a flood tide preference. The water samples collected in Assignment 267 are sampled using SRS sampling strategy year round, with a sample taken once a month from October to April and two times from May to October. The water samples collected in Assignment 287 are sampled using SRS sampling strategy year-round, with a water sample taken once a month from January to April and three times from May to October. The figure on the preceding page show all of the sampling stations for this area. The raw data listings for each sampling station in accordance with the National Shellfish Sanitation Program (NSSP) criteria are given at the end of this report in the Appendix.

COMPLIANCE WITH NSSP SRS CRITERIA

Five of the sampling stations in this shellfish growing area exceeded the *Approved* shellfish classification criteria (see the figure on next page). Sampling stations 3307C, 3307J, 3309E, 3312, and 3514 exceeded the *Approved* shellfish classification criteria year-round . Sampling station 3307C is located in the *Prohibited* waters of Holmes Creek, sampling station 3307J is located in the *Seasonally Approved (November to April)* waters of Holmes Cove, sampling station 3309E is located in the *Seasonally Approved (November to April)* waters of Cresse Thorofare and Muddy Hole, sampling station 3312 is located in the *Approved* waters of Great Sound, and sampling station 3514 is located in the *Prohibited* waters of Post Creek, south of Grassy Sound. Only sampling station 3312 exceeded the existing shellfish classification criteria for these shellfish waters. This sampling station will be closely monitored during shoreline surveys of this shellfish growing area. Some of the sampling stations in this growing area are located in shellfish waters which could possibly be impacted by potential sources of pollution, such as the activities in and around the marinas, and the stormwater released from the stormwater outfall pipes into the waters of this area and these shellfish waters are classified accordingly. Except for Sampling Station 3312, there were no water samples collected at these sampling stations that exceeded the NSSP shellfish classification criteria for water quality in the *Approved, Seasonally Approved (November-April), Seasonally Approved (January-April), Special Restricted,* and *Prohibited* waters of this shellfish growing area.

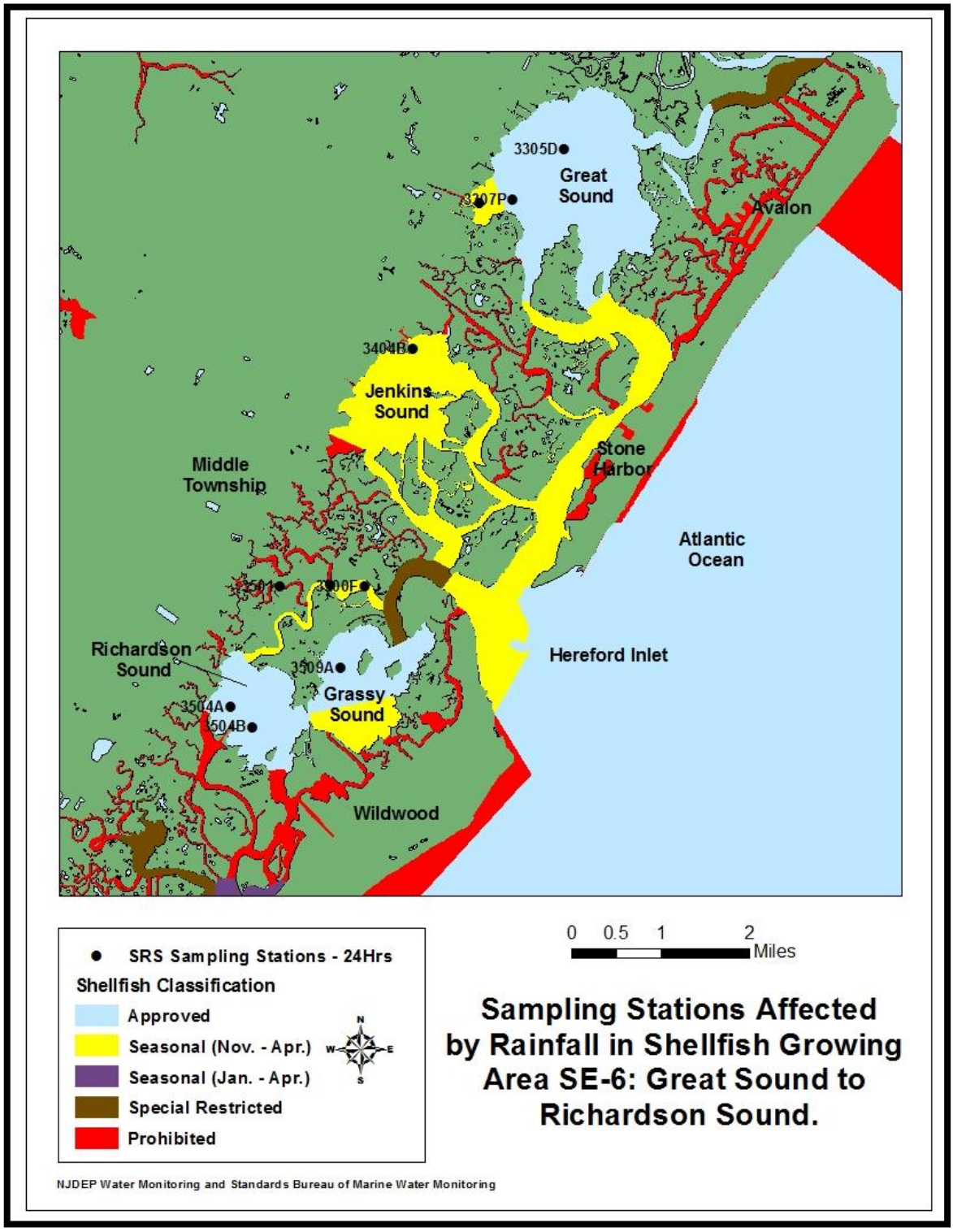

3307C
3307J
Great Sound
3312
3309E
Middle Township
Jenkins Sound
Stone Harbor
Great Channel
Atlantic Ocean
Hereford Inlet
Grassy Sound
Richardson Sound
3314
SRS Sampling Stations
Shellfish Classification
Approved
Seasonal (Nov. - Apr.)
Seasonal (Jan. - Apr.)
Special Restricted
Prohibited
N
W
E
S
0 0.5 1 2
Miles
Location of SRS Sampling Stations Exceeding Approved Criteria in Shellfish Growing Area SE-6: Great Sound to Richardson Sound.
NJDEP Water Monitoring and Standards Bureau of Marine Water Monitoring

RAINFALL EFFECTS

Non-point source pressures on shellfish beds in New Jersey originate in materials that enter the water via stormwater. These materials include bacteria, as well as other waste that enters the stormwater collection system.

Rainfall impacts were assessed by using a t-test to compare the fecal coliform MPN values from water samples collected during wet weather to water samples collected during dry weather from 5/1/2010 to 4/30/2015. The Wet/Dry Statistics were calculated based on a post impact time of 24 hours prior to the day of sampling and a wet/dry cutoff of 0.2 inches of rain. Any rainfall amounts above 0.2 inches are considered to be a wet condition. A sampling station is considered to be impacted by rainfall when the t-statistic probability is 0.05 or less, but not zero. Using these parameters for the rainfall data, 10 sampling stations showed an impact from rainfall for this shellfish growing area from 5/1/2010 to 4/30/2015 (see figure on next page).

The Bureau of Marine Water Monitoring has begun to identify particular stormwater outfalls that discharge excessive bacteriological loads during storm events. In some cases, specific discharge points can be identified. When specific outfalls are identified as significant sources, the Department works with the county and municipality to further refine the source(s) of the contamination and implement remediation activities.


3305D
Great Sound
3307P
Avalon
3404B
Jenkins Sound
Middle Township
Stone Harbor
Atlantic Ocean
3500F
Richardson Sound
3509A
Hereford Inlet
Grassy Sound
3504A
3504B
Wildwood
SRS Sampling Stations - 24Hrs
Shellfish Classification
Approved
Seasonal (Nov. - Apr.)
Seasonal (Jan. - Apr.)
Special Restricted
Prohibited
N
W
E
S
0 0.5 1 2
Miles
Sampling Stations Affected by Rainfall in Shellfish Growing Area SE-6: Great Sound to Richardson Sound.
NJDEP Water Monitoring and Standards Bureau of Marine Water Monitoring

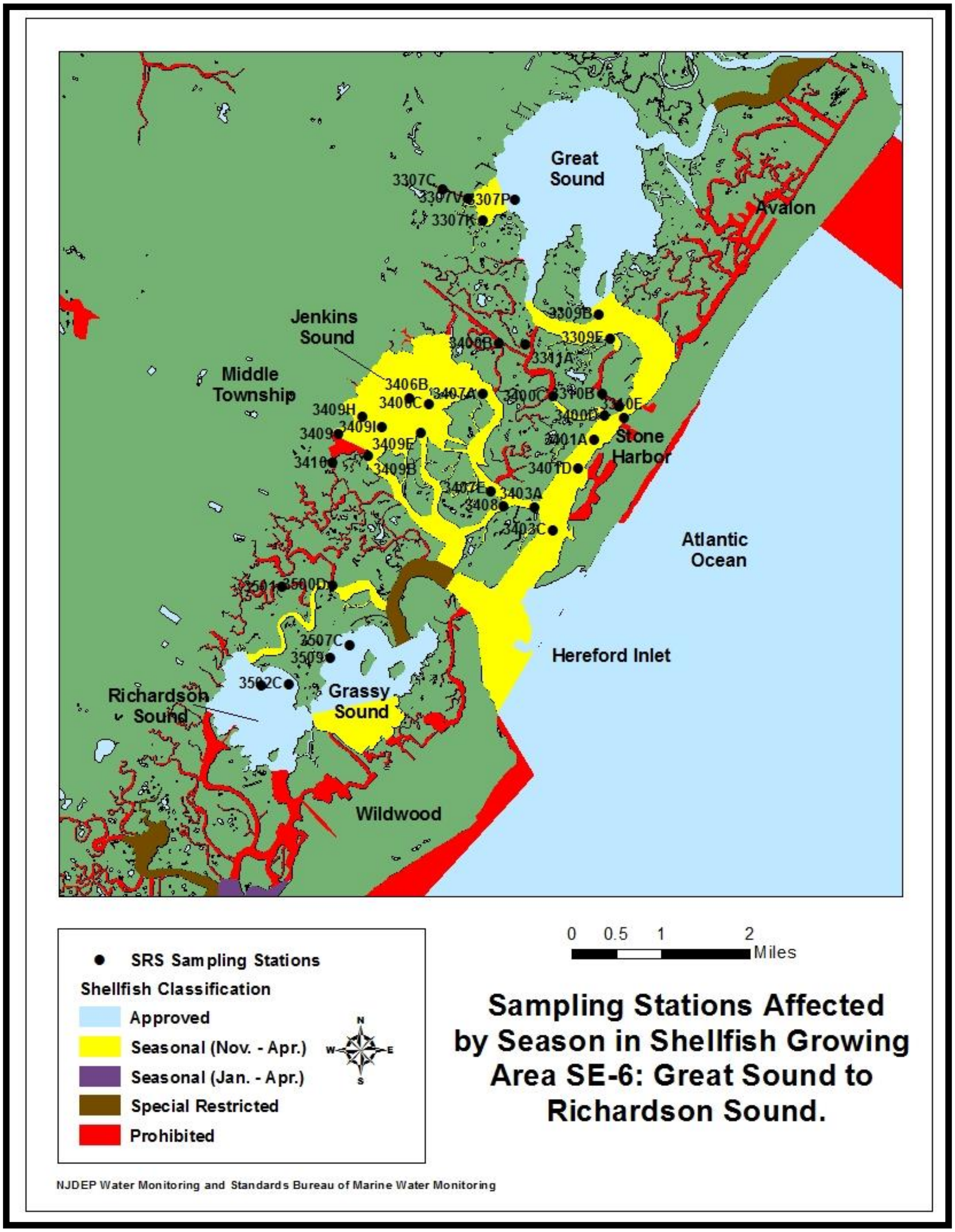
SEASONAL EFFECTS

Temperature, precipitation, wind, and the general circulation of the atmosphere have seasonal variations that affect the marine environment.

Shellfish are filter-feeding organisms that live in the sand, silt, and mud on the bottom of oceans and bays. They have a range of tolerance to specific environmental conditions, such as temperatures, salinity levels, oxygen levels, quantity and availability of food, and water quality. Seasonal effects on these variables will have an effect on shellfish populations. For example, different species of shellfish require very specific salinity levels for survival. Since salinity levels can have an effect on the species found in certain waters of an area, the salinity level is important for a complete understanding of the complex ecological balance in the marine environment. At a time of the year when rainfall is low, where evaporation exceeds precipitation, the salinity of the marine environment in certain areas is higher than it is in regions where precipitation exceeds evaporation. This can affect the quantity and type of shellfish found in a specific area.

Seasonal variations also affect human activities, with generally more human activity in the warmer months of the year. An increase in human activities in or near the marine environment can have an impact on shellfish populations. Increased pressure from human activities on already stressed failing septic systems and overloaded wastewater treatment facilities can cause sewage to spill into the marine environment, which can negatively impact the water quality of a shellfish growing area by increasing the coliform levels in the water.

Seasonal effects were assessed using a t-test to compare log-transformed fecal coliform values for summer versus winter data. The figure on the next page shows the locations of these 34 sampling stations. All but five of these sampling stations showed a higher fecal coliform geometric mean during the summer than during the winter, which is most likely due to increased population pressures resulting from the summer tourism industry. Sampling stations 3307P, 3502B, 3502C, 3507C, and 3509 showed a higher fecal coliform geometric mean during the winter than during the summer. However, these five stations still met their existing *Approved* shellfish classification criteria. Assignment 255 (The Hereford Inlet and Jenkins Sound area) was sampled with a seasonal preference during the winter.

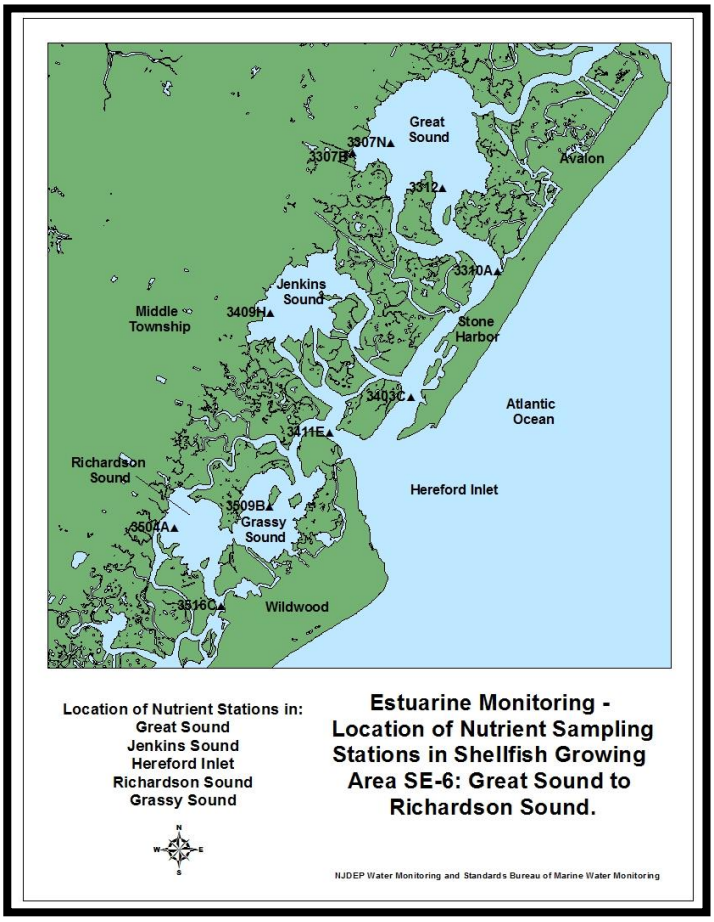


Sampling Stations Affected by Season in Shellfish Growing Area SE-6: Great Sound to Richardson Sound.

RELATED STUDIES

NUTRIENTS

According to the Marine Water Sampling Assignments Schedule for Assignments 255, 267, and 287, there were 10 stations in Shellfish Growing Area SE-6 that were sampled under the estuarine monitoring program for chemical parameters including nutrients. The nutrient stations in this area were sampling stations **3307B**, **3307N**, **3310A**, **3312**, **3403C**; **3409H**, **3411E**, **3504A, 3509B, and 3516C** (see the figure to the right for the location of these nutrient stations). In the 2014 Marine Water Sampling Assignments Schedule for Assignments 255, 267, and 287, sampling station **3504A** is the only nutrient station in this shellfish growing area.

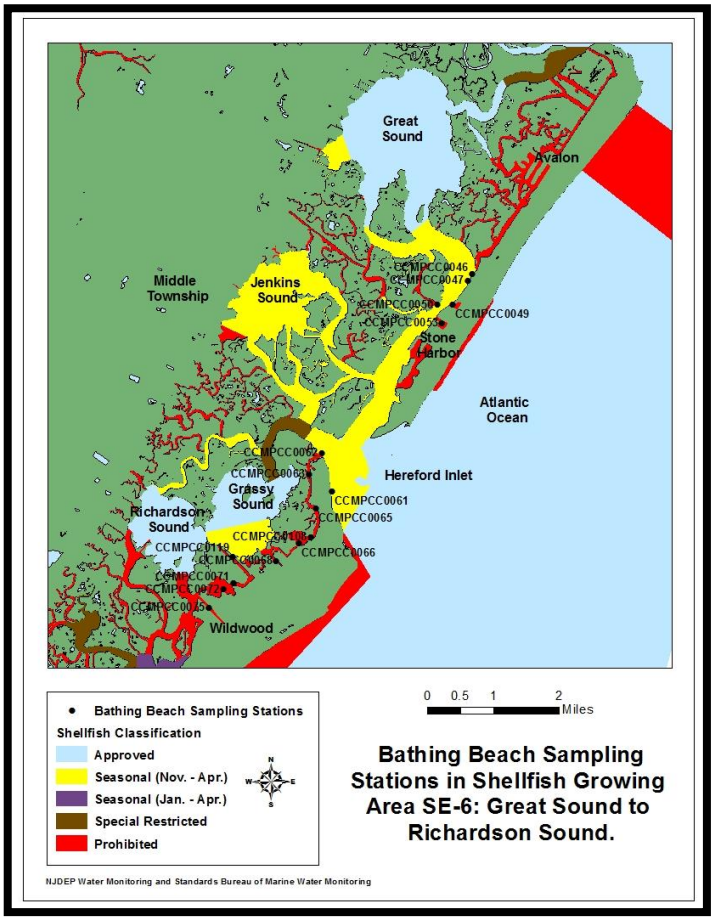


At these nutrient stations, the various parameters measured include water temperature (in Celsius), salinity levels, Secchi Depth, total suspended solids, dissolved oxygen levels, ammonia levels, nitrate and nitrite levels, orthophosphate levels, total nitrogen levels, and the inorganic nitrogen to phosphorus ratios (Zimmer, 2001).

Water quality at the nutrient stations in this shellfish growing area are consistent with the water results found throughout the State. For more detailed information concerning dissolved oxygen and nutrient levels, see the Estuarine Monitoring Report published by the NJDEP. The report is available electronically at: www.state.nj.us/dep/wms/bmw.

BATHING BEACH

There are 16 bathing beach sampling stations in this shellfish growing area and they are located along the eastern shoreline of this shellfish growing area (see the figure to the right for the locations of these bathing beach sampling stations). A review of the bathing beach data for the water samples collected at these sampling stations showed that the geometric mean levels for these stations generally meet the enterococcus criteria. The water quality sample results for these bathing beach sampling stations have been posted on the beach web site at: www.njbeaches.org under Ocean Beach Information.



CONCLUSIONS

Based on the bacteriological data assessed, most of the sampling stations in this shellfish growing area meet the *Approved* shellfish classification criteria, year-round, in the summer, and in the winter. Therefore, most of the sampling stations in this area were in compliance with their existing shellfish classification criteria. However, there was one sampling station (**3312**) that exceeded the NSSP shellfish classification criteria for water quality in the *Approved* waters of this shellfish growing area. Sampling station **3312** will be closely monitored during shoreline surveys of this area.

No classification changes are recommended. It is prohibited to harvest shellfish from the *Special Restricted* waters in this shellfish growing area without a special permit issued in compliance with the State of New Jersey's Depuration Program.

RECOMMENDATIONS

No changes, continue sampling using the existing Systematic Random Sampling (SRS) Strategy for Assignment 255, 267, and 287.

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