Sanitary Survey of Shellfish Growing Area SE-5: Ludlam Bay to Townsends Inlet 2001 - 2010

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SANITARY SURVEY OF

SHELLFISH GROWING AREA SE-5:

LUDLAM BAY TO TOWNSENDS INLET

2001 – 2010

April 2010

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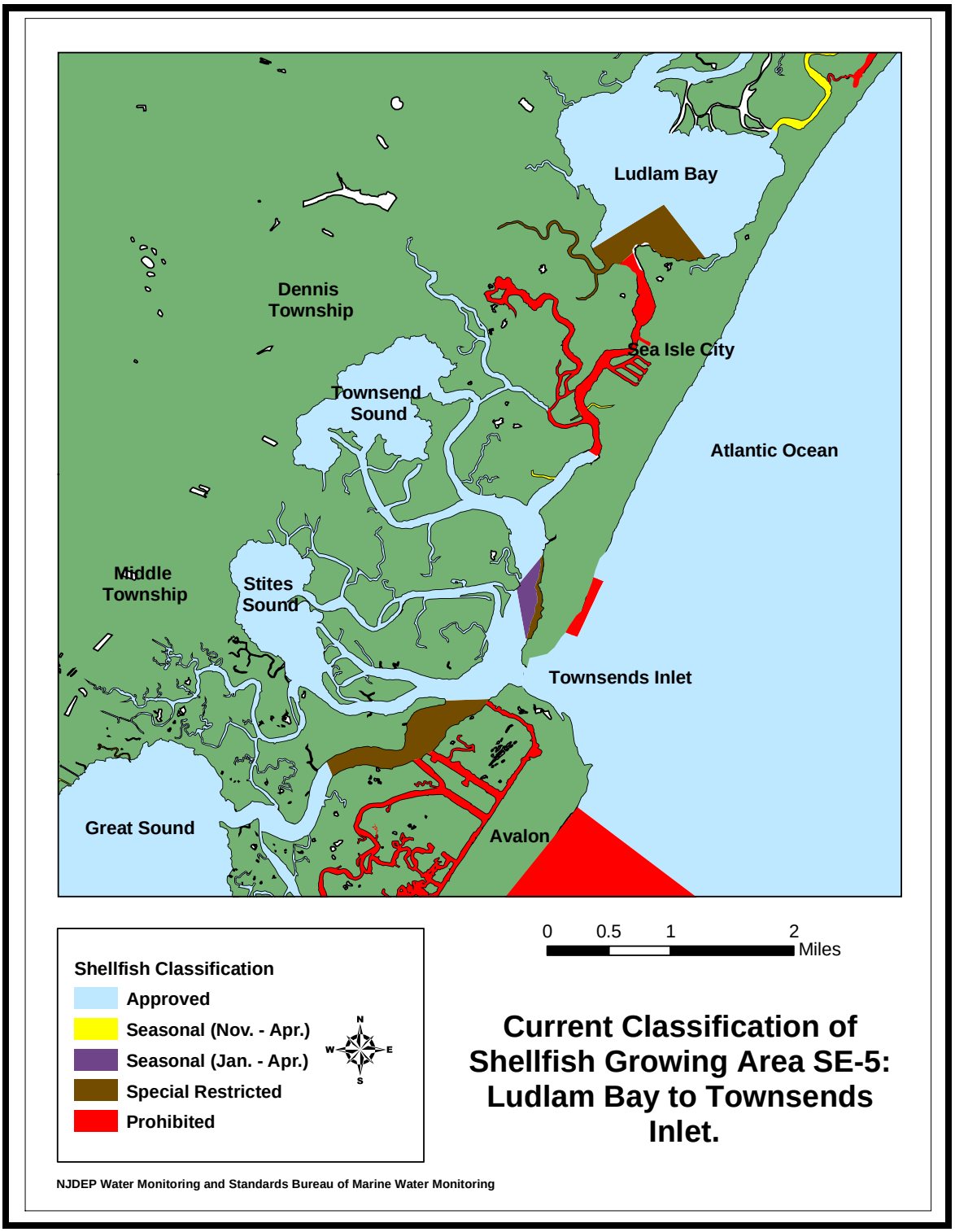
EXECUTIVE SUMMARY

Shellfish Growing Area SE-5; Ludlam Bay to Townsends Inlet, is located in the southern part of New Jersey, northwest of the city of Avalon and southwest of Strathmere, in Cape May County. This area includes the shellfish growing waters from Ludlam Bay in the north, to the north of Great Sound in the south. Great Sound is not included in this shellfish growing area. The water quality data presented in this Sanitary Survey of Shellfish Growing Area SE-5; Ludlam Bay to Townsends Inlet, were collected between May 2001 and April 2010 using the Systematic Random Sampling (SRS) strategy for the sampling stations from Ludlam Bay to Townsends Inlet because there are no adverse pollution sources that are directly discharging into these shellfish waters, and the Adverse Pollution Condition (APC) strategy for the sampling stations from Townsends Inlet to Great Sound because there are some adverse pollution sources, such as marinas and storm water outfalls, that are indirectly discharging into these shellfish waters. The approximate size of this shellfish growing area is 3,574 acres, and the shellfish classification for this growing area is *Approved, Seasonally Approved (November-April), Seasonally Approved (January to April), Special Restricted* and *Prohibited* for shellfish harvesting (as seen in the figure below). All sampling stations were in compliance with the total coliform criteria for the *Approved, Seasonally Approved (November-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). No classification changes are recommended for 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.



CURRENT CLASSIFICATION OF SHELLFISH GROWING AREA SE-5.

INTRODUCTION

PURPOSE

The primary purpose of this report is to comply with the guidelines of the National Shellfish Sanitation Program (NSSP) that are established by the Interstate Shellfish Sanitation Conference (ISSC). Reports generated under this program form the basis for classifying shellfish waters for the purpose of harvesting shellfish for human consumption. As such, they provide a critical link in protecting human health.

FUNCTIONAL AUTHORITY

The authority to carry out these functions is divided between the Department of Environmental Protection (DEP), the Department of Health and Senior Services, and the Department of Law and Public Safety.

The Bureau of Shellfisheries, in the Division of Fish and Wildlife, issues harvesting licenses and leases for shellfish grounds under the Authority of N.J.S.A. 50:2 and N.J.A.C. 7:25. This bureau, in conjunction with the Bureau of Marine Water Monitoring (BMWM), is responsible for administering and or suspension of the Hard Clam Relay Program.

The Bureau of Law Enforcement, in the DEP Division of Fish and Wildlife, and the Division of State Police, in the Department of Law and Public Safety, enforce the provisions of the statutes and rules mentioned above.

The Department of Health and Senior Services is responsible for the certification of wholesale shellfish establishments and, in conjunction with the BMWM, administers the depuration program.

The division of authority between the three agencies can be seen in Figure 1.

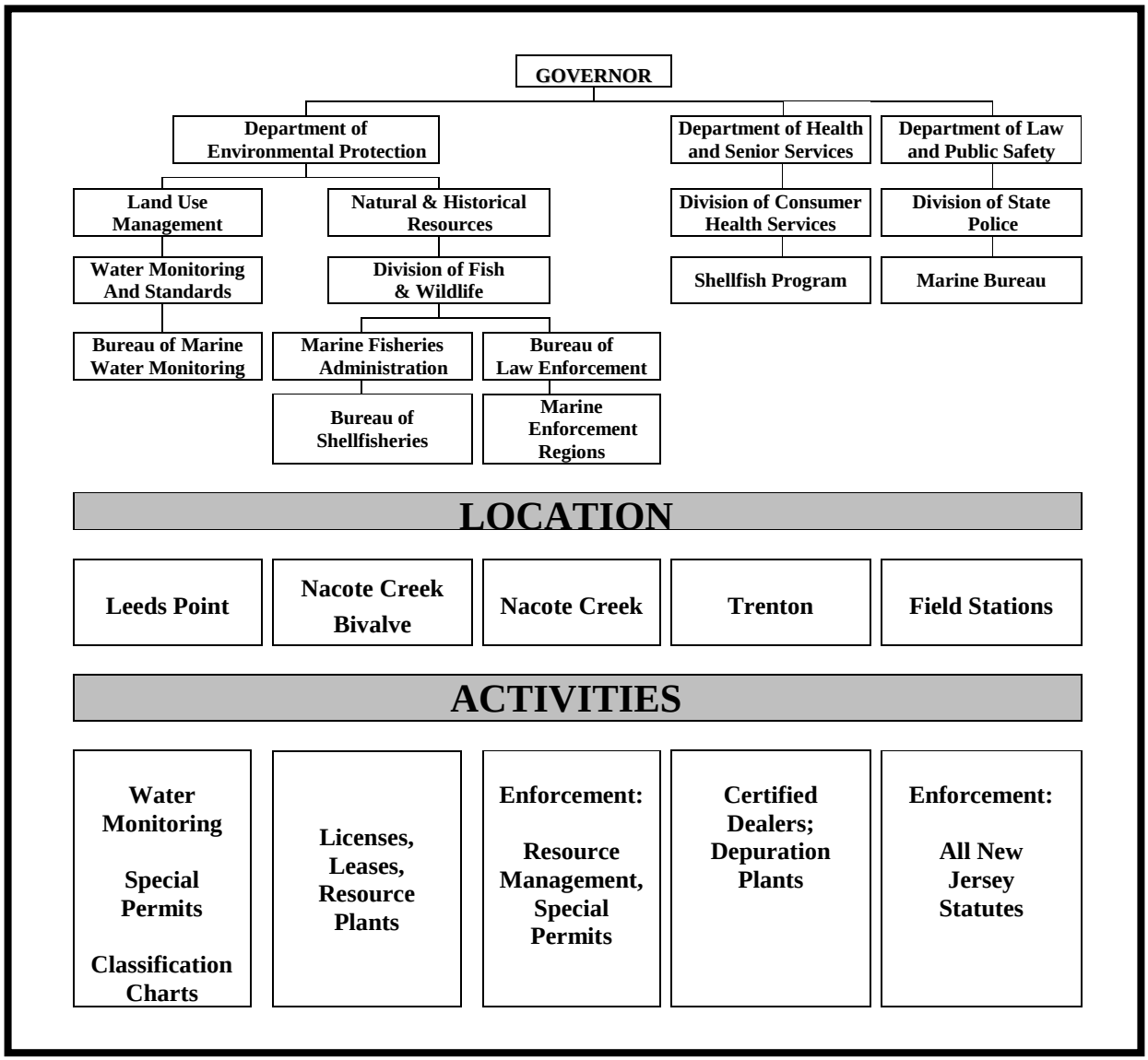


FIGURE 1: STATE OF NEW JERSEY SHELLFISH AGENCIES

IMPORTANCE OF SANITARY CONTROL OF SHELLFISH

Emphasis is placed on the sanitary control of shellfish because of the direct relationship between pollution of shellfish growing areas and the transmission of diseases to humans. Shellfish borne infectious diseases are generally transmitted via a fecal-oral route. The pathway is complex and quite circuitous. The cycle usually begins with fecal contamination of the shellfish growing waters. Sources of such contamination are many and varied. Contamination reaches the waterways via storm water runoff from urban and agricultural areas and from direct discharges such as wastewater treatment facilities.

Clams, oysters and mussels pump large quantities of water through their bodies

during the normal feeding process. During this process the shellfish also concentrate microorganisms, which may include pathogenic microbes, and toxic heavy metals/chemicals. It is imperative that a system is in place to reduce the human health risk of consuming shellfish from areas of contamination.

Accurate classifications of shellfish growing areas are completed through a comprehensive sanitary survey. The principal components of the sanitary survey report include:

1. An evaluation of all actual and potential sources of pollution,
2. An evaluation of the hydrology of the area and
3. An assessment of water quality. Complete intensive Sanitary Surveys are conducted every 12 years with interim narrative evaluations (Reappraisals) completed on a three-year basis. If major changes to the shoreline or bacterial quality occur, then the intensive report (Sanitary Survey) is initiated prior to its l2 year schedule. Also, if only a section of a growing area is either upgraded or downgraded from its current shellfish classification, a partial intensive report (Partial Sanitary Survey) is conducted for that shellfish growing area. Annual Reviews are written on a yearly basis for each shellfish growing area.

The following narrative constitutes this bureau's assessment of the above mentioned components to comply with the twelve year sanitary survey and to determine the current classification of the shellfish growing waters of Shellfish Growing Area DB5, Ludlam Bay to Townsends Inlet.

GROWING AREA PROFILE

LOCATION AND DESCRIPTION

Shellfish Growing Area SE-5; Ludlam Bay to Townsends Inlet, is located in the southern part of New Jersey, northwest of the city of Avalon and southwest of Strathmere, in Cape May County (see Figure 2). This area includes the shellfish growing waters from Ludlam Bay in the north, to the north of Great Sound in the south. Great Sound is not included in this shellfish growing area.

The principal bodies of water in this area are Ludlam Bay, Townsends Sound, Stites Sound, and Townsends Inlet (see Figure 2). This area also includes Devauls Creek, Maple Swamp, Big Elder Creek, Little Elder Creek, Swimming Creek, Ludlam Thorofare, Sunks Creek, Mill Creek, Scraggy Creek, Ware Thorofare, Mill Thorofare, Townsend Channel, Clem Thorofare, Granny Creek, Mud Thorofare, Jonadab Creek, Uncle Aarons Creek, Kitts Thorofare, Bottle Creek, Middle Thorofare, North Channel, South Channel, Leonard Thorofare, Ingram Thorofare, Gravens Thorofare, Cornell Harbor, Pennsylvania Harbor, Princeton Harbor, S Creek, Deep Creek, Rachael Gut, Salt Creek, Cat Run, Deep Thorofare, and Paddy Thorofare (see Figures 2, 3, 4, 5, and 6). The shellfish classification of this growing area is *Approved*, *Seasonally Approved (November to April)*, *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited*, and the approximate size of this shellfish growing area is 3,574 acres.

The *Approved* waters are located in Ludlam Bay (excluding the Special Restricted part in the south of Ludlam Bay), Main Channel, Townsend Sound, Mill Creek, Ware Thorofare, Mill Thorofare, Clem Thorofare, Townsend Channel, the south part of Ludlam Thorofare, Stites Sound, Kitts Thorofare, Middle Thorofare, North Channel, South Channel, Townsends Inlet, Deep Creek, Deep Thorofare, Leonard Thorofare, and the south part of Paddy Thorofare. The *Seasonally Approved (November-April)* waters are located in an unnamed creek on Gull Island which is west of Ludlam Thorofare, and in Scraggy Creek which is east of the central part of Ludlam Thorofare and west of Sea Isle City. The *Seasonally Approved (January-April)* waters are located in the south part of Townsend Channel north of Townsends Inlet. The *Special Restricted* waters are located in the south part of Ludlam Bay, in Big Elder Creek, the east side of Townsend Channel north of Townsends Inlet, and the north and central parts of Ingram Thorofare. The *Prohibited* waters include the rest of the waters in this shellfish growing area.

The shellfish waters in this growing area are bordered to the north by Upper Township, to the east by Sea Isle City and Avalon, and to the west by Dennis

Township and Middle Township. The locations of the adjacent municipalities are shown in Figure 2. Population statistics for the adjacent municipalities can be found in the previous reappraisal report of this shellfish growing area, which was written in October 2006 and included the population statistics from the 2000 census of this area.

Tidal flushing of this area mainly occurs through Townsends Inlet (see Figure 3).This shellfish growing area can be found on Chart 15 of the "2009 State of New Jersey – Shellfish Growing Water Classification Charts" (NJDEP, 2006). Figure 7 shows the current classification of this shellfish growing area.

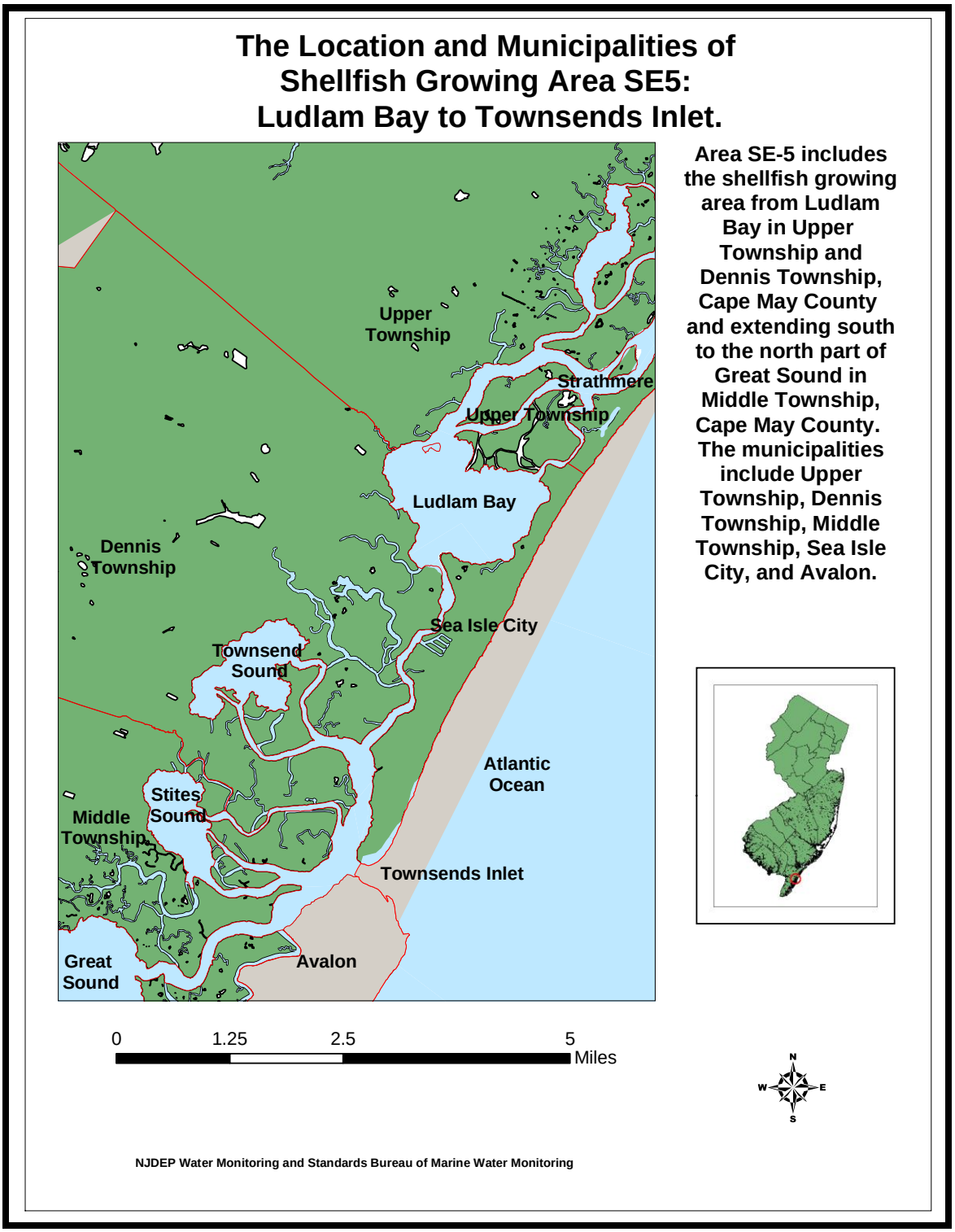


FIGURE 2: LOCATION AND MUNICIPALITIES OF SHELLFISH GROWING AREA SE-5.

FIGURE 3: LOCATION OF LUDLAM BAY IN DISTANCE FROM THE WEST END OF 29TH STREET, IN SEA ISLE CITY.

FIGURE 4: LOCATION OF LUDLAM THOROFARE FROM THE WEST END OF 58TH STREET, IN SEA ISLE CITY.

FIGURE 5: LOCATION OF TOWNSEND CHANNEL WEST OF TOWNSENDS INLET.

FIGURE 6: LOCATION OF TOWNSENDS INLET NORTH OF AVALON.

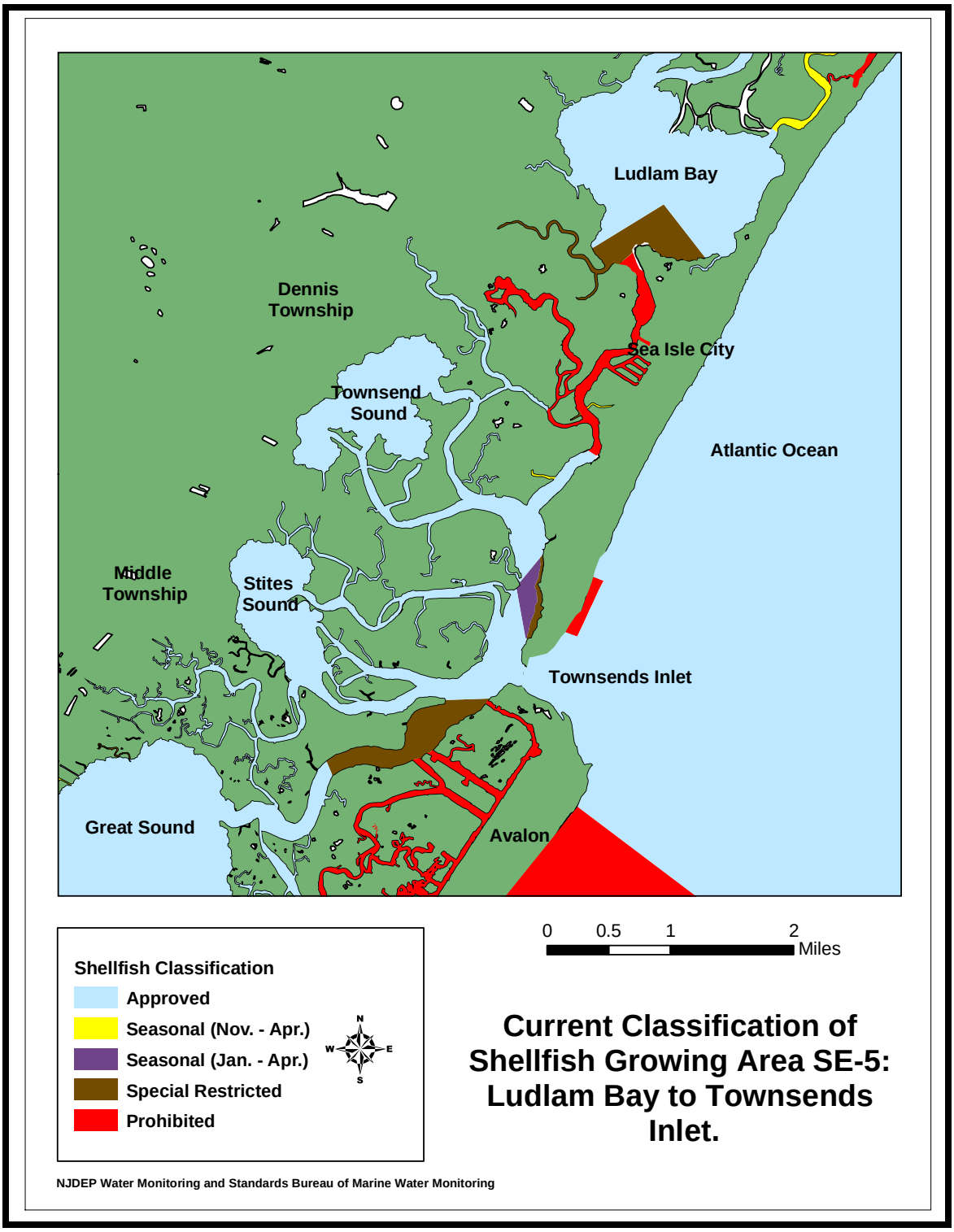


FIGURE 7: CURRENT CLASSIFICATION OF SHELLFISH GROWING AREA SE-5.

HISTORY OF GROWING AREA CLASSIFICATION

The waters of this shellfish growing area are classified as *Approved, Seasonally Approved (November-April), Seasonally Approved (January-April), Special Restricted* and *Prohibited.* There are approximately 2,851 acres of *Approved* waters, 3 acres of *Seasonally Approved (November-April)* waters, 39 acres of *Seasonally Approved (January-April)* waters, 327 acres of *Special Restricted* waters, and 355 acres of *Prohibited* waters in this shellfish growing area.

A reappraisal report for Shellfish Growing Area SE-5, using water quality data from 1997 to 2001, was written in July 2003. In this report, all of the sampling stations met the *Approved* total coliform classification criteria for water quality and no classification change was proposed for this shellfish growing area. However, two of the sampling stations in this shellfish growing area showed a tidal component and 16 sampling stations showed a seasonal component to water quality.

In the Reappraisal of Shellfish Growing Area SE-5, written in 2004 using water quality data from 1999 to 2003, no classification change was proposed for this shellfish growing area and all of the sampling stations met the existing shellfish classification criteria. However, APC sampling station **3225A** showed a tidal component and nine sampling stations showed a seasonal component to water quality.

In the Reappraisal of Shellfish Growing Area SE-5, written in 2006 using water quality data from 2001 to 2006, no classification change was proposed for this shellfish growing area and all of the sampling stations met the existing shellfish classification criteria. However, 36 sampling stations showed a rainfall component, seven sampling stations showed a tidal component, and three sampling stations showed a seasonal component to water quality.

In the 2005 to 2008 Annual Reviews of Shellfish Growing Area SE-5 for the Ludlam Bay to Townsends Inlet area, no classification changes were proposed for this shellfish growing area (NJDEP, 2005, NJDEP, 2006, NJDEP, 2007, NJDEP, 2008). No 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, in the 2005 Annual Review of this shellfish growing area, two sampling stations (APC sampling stations **3303A** and **3303B**) were added to this shellfish growing area southwest of Avalon in Long Reach and Gravens Thorofare, respectively, due to an administrative decision to keep all of the sampling stations from the north of Great Sound to Ludlam Bay in Shellfish Growing Area SE-5. The last Sanitary Survey for Shellfish Growing Area SE-5 (Ludlam Bay to Townsends Inlet) was written in 1996.

METHODS

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

Approximately 2,856 water samples were collected for total and fecal coliform bacteria between 2001 and 2010 and analyzed by the three tube MPN (Most Probable Number) method (the indicator density of bacteria colonies most likely to produce a particular combination of positive and negative results in test tubes) (APHA, 1970). Figures 8 and 9 show the Shellfish Growing Water Quality monitoring stations in the Ludlam Bay to Townsends Inlet area. Approximately 75 stations are monitored during each year in Shellfish Growing Area SE-5. Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish,* 2003 Revision (USPHS, 2003 Revision).

Data management and analysis was accomplished using database applications developed for WM&S/BMWM. Mapping of pollution data was performed with the Geographic Information System (GIS: ArcMap®).

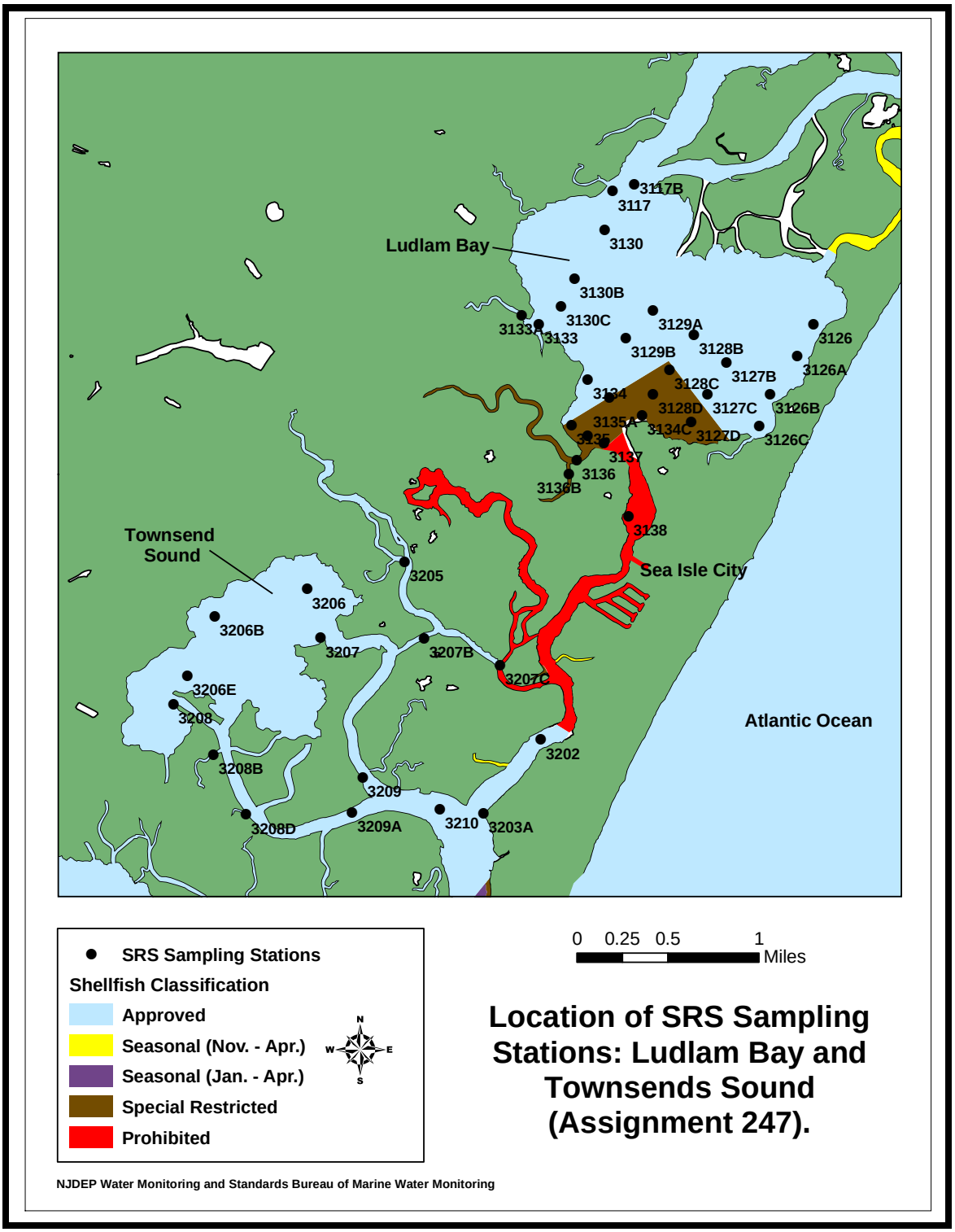


FIGURE 8: SRS SAMPLING STATIONS IN SHELLFISH GROWING AREA SE-5: LUDLAM BAY AND TOWNSENDS SOUND.

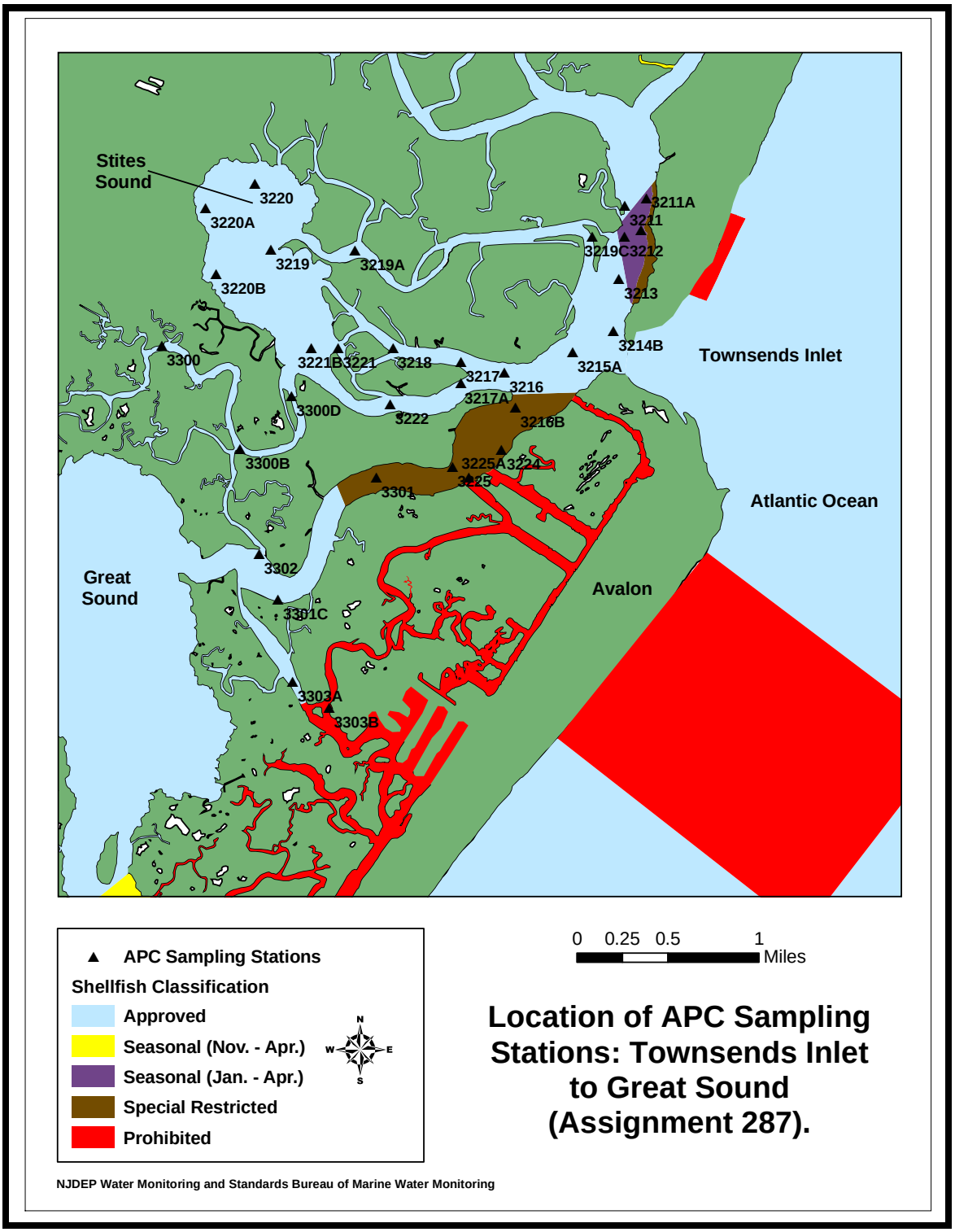


FIGURE 9: APC SAMPLING STATIONS IN SHELLFISH GROWING AREA SE-5: TOWNSENDS INLET TO GREAT SOUND.

BACTERIOLOGICAL INVESTIGATION AND DATA ANALYSIS

The water quality of each growing area must be evaluated before an area can be classified as *Approved, Seasonally Approved (November to April), Seasonally Approved (January to April), Special Restricted,* or *Prohibited*. Criteria for bacterial acceptability of shellfish growing waters are provided in NSSP *Guide for the Control of Molluscan Shellfish,* 2003 Revision (USPHS, 2003 Revision).

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*.

This shellfish growing area was sampled using the Systematic Random Sampling strategy, year-round with no tidal preferences, for the stations from Ludlam Bay to Townsend Sound (Assignment 247). The stations from Townsends Inlet to Great Sound were sampled using the Adverse Pollution Condition strategy, year-round with no tidal preferences (Assignment 287).

NSSP CRITERIA

Each shellfish-producing state is directed to adopt either the total coliform criterion, or the fecal coliform criterion. While New Jersey bases its growing water classifications on the total coliform criterion, it does make corresponding fecal coliform determinations in specific growing areas. These data are viewed as adjunct information and are not directly used for classification. This report is based on the total coliform criteria.

The criteria were developed to ensure that shellfish harvested from the designated waters would be free of pathogenic (disease-producing) bacteria. Each classification criterion is composed of a measure of the statistical 'central tendency' (geometric mean) and the relative variability of the data set. For the Adverse Pollution Condition sampling strategy, variability is expressed utilizing the 90^{th} percentile (see Table 1). For the Systematic Random Sampling strategy, variability is expressed as the 90^{th} percentile (see Table 2).

Areas to be approved under the "Seasonal" classification must be sampled and meet the criterion during the time of the year that it is approved for the harvest of shellfish.

TABLE 1: CRITERIA FOR ADVERSE POLLUTION CONDITION SAMPLING STRATEGY

	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric mean (MPN/100 mL)	**No more than 10% of samples can exceed (MPN/100 mL)**	**Geometric mean (MPN/100 mL)**	**No more than 10% of samples can exceed (MPN/100 mL)**
Approved Water Classification	70	330	14	49
Special Restricted Water Classification	700	3300	88	300

TABLE 2: CRITERIA FOR SYSTEMATIC RANDOM SAMPLING STRATEGY

	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric mean (MPN/100 mL)	**Estimated 90th percentile (MPN/100 mL)**	**Geometric mean (MPN/100 mL)**	**Estimated 90th percentile (MPN/100 mL)**
Approved Water Classification	70	330	14	49
Special Restricted Water Classification	700	3300	88	300

SHORELINE SURVEY

CHANGES SINCE LAST SURVEY

The shoreline survey that was performed for this area on May 20, 2010 determined that there have not been any changes since the last reappraisal of this area.

There were photographs taken during the shoreline survey of this shellfish growing area on May 20, 2010. Figures 3, 4, 5, and 6 show the locations of Ludlam Bay, Ludlam Thorofare, Townsend Channel, and Townsends Inlet, Figures 17 and 18 show the locations of some of the marinas in Avalon and Sea Isle City, and Figure 21 shows the storm water outfall pipe located at the west end of 58th Street in Sea Isle City.

LAND USE

An extensively urbanized area to the east and north and tidal wetlands to the south and west border much of this area. The urban areas to the east are resort areas (Sea Isle City, Avalon, and Strathmere) with significant boating and marine activities during the summer months (see Figures 10 and 16). There are currently 24 marinas in this area. The wetlands to the west of the growing area act as a buffer for the communities on the western side of the bay. Devauls Creek, Mill Creek, and Deep Creek cross the Garden State Parkway into these communities, and are upstream of this shellfish growing area. Since some of these communities are still on septic systems, there is a potential for pollutant inputs into these shellfish growing waters, which is why continued monitoring of the water quality in these waters is very important (APHA, 1995).

The area immediately west of the Garden State Parkway is part of the Pinelands Comprehensive Management Plan, and is listed as a Regional Growth Area (northwest of Townsend Sound), and a Rural Development Area (west of Stites Sound). According to the New Jersey Pinelands Commission, a Regional Growth Area is "an area that can accommodate existing and future growth while protecting the essential character and environment of the pinelands". The Pinelands Comprehensive Management Plan permits from 1.5 to 5.25 dwelling units per developable acre of land in a Regional Growth Area. The New Jersey Pinelands Commission describes a Rural Development Area as "an area that can attempt to protect characteristic Pinelands features, while allowing modest development to proceed, giving municipalities leeway to determine land uses". The Pinelands Comprehensive Management Plan permits one dwelling unit per 3.2 acres of private, undeveloped upland for a Rural Development Area.

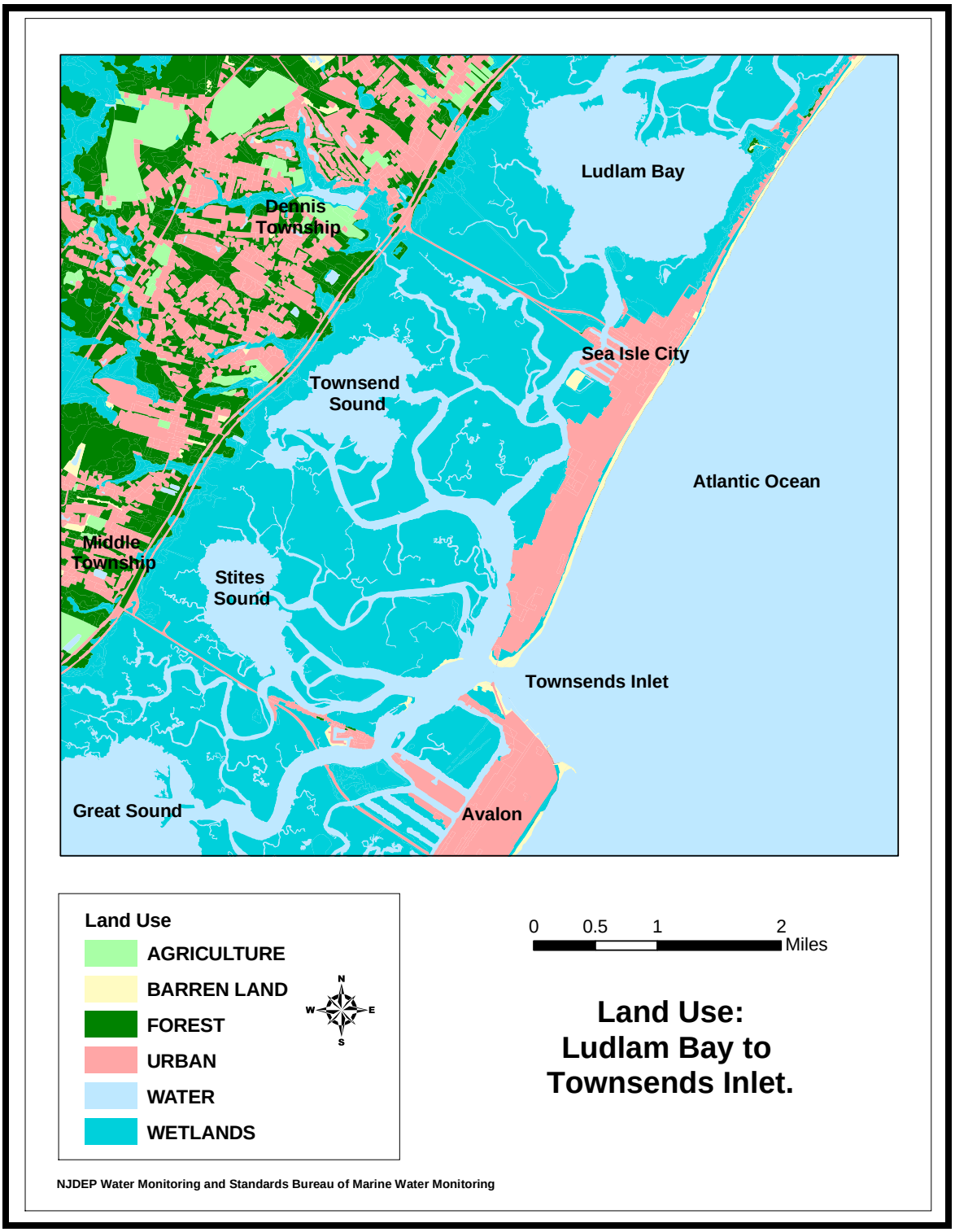


FIGURE 10: LAND USE PATTERNS FOR SHELLFISH GROWING AREA SE-5.

EVALUATION OF BIOLOGICAL RESOURCES

This growing area has a wide diversity of biological resources. Hard clams (*Mercenaria Mercenaria*) exist in high densities and are privately and commercially harvested (Morris, 1975, Gosner, 1978). The shellfish landings for hard clams in New Jersey from 2001 to 2008 can be seen in Table 3 (NJDEP, 2007, NMFS, 2007).

The total shellfish landings for New Jersey from 2001 to 2008 can be seen in Table 4 (NJDEP, 2007, NMFS, 2007). 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 2009 or 2010 at the time this reappraisal report was written.

TABLE 3: NEW JERSEY HARD CLAM LANDINGS - 2001 TO 2008 (NJDEP, 2010).

NEW JERSEY HARD CLAM LANDINGS 2001 to 2008		
YEAR	POUNDS OF MEAT (millions)	$ VALUE (exvessel)
2001	1,357,128	$5,636,397
2002	1,542,445	$6,402,616
2003	1,259,832	$5,228,319
2004	1,518,949	$6,303,638
2005	1,852,108	$7,555,885
2006	1,843,991	$7,614,520
2007	239,733	968,308
2008	1,529,231	$6,306,220

TABLE 4: NEW JERSEY SHELLFISH LANDINGS - 2001 TO 2008 (NMFS, 2010).

NEW JERSEY SHELLFISH LANDINGS 2001 to 2008		
YEAR	POUNDS OF MEAT (millions)	$ VALUE (exvessel)
2001	88,611,198	$83,523,782
2002	90,768,652	$88,136,826
2003	88,296,314	$94,873,590
2004	88,760,756	$139,182,589
2005	77,368,183	$131,261,937
2006	82,570,024	$107,701,202
2007	84,766,901	$120,767,607
2008	74,319,008	$144,736,585

Blue crabs (*Callinectes sapidus*) are also harvested in this area. Ludlam Bay, Townsend Sound, Stites Sound, and Townsends Inlet are also utilized for fishing, boating, and other marine activities. Many species of finfish can be found in the waters of this shellfish growing area. The important finfish species caught by marine recreational anglers are Bluefish (*Pomatomus saltatrix*), Striped Bass (*Morone saxatillis*), Weakfish (*Cynoscion regalis*), Winter Flounder (*Pseudpleuronectes americanus*), Summer Flounder (Fluke) (*Paralichthys dentatus*), Tautog (*Tautoga onitis*), Scup (Porgy) (*Stenotomus chrysops*), Black Sea Bass (*Centropristus striata*), Northern Searobin (*Prionotus carolinus*), Northern Puffer (*Spheroides maculatus*), Atlantic Silverside (*Menidia menidia*) and Mummichog (killies, minnows) (*Fundulus heteroclitus*) (The Richard Stockton College of New Jersey, 2002). In 1991, the Striped Bass (*Morone saxatillis*) was classified as a gamefish in New Jersey, and this status prevents the commercial harvest or sale of this first coastal saltwater species designated as such in New Jersey (Bochenek, 2000).

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 Townsend Sound and potential contributors to water quality in Stites Sound and Townsends Inlet. 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 small areas of bulkheads, erodable shorelines, and beaches composing the remainder of the shoreline. Bulkheads are located along the east and west shorelines of the upper and middle sections of Ludlam Thorofare, along the east shoreline of the lower section of Townsend Channel, along the south shoreline of South Channel, and along the east and west shorelines of Ingram Thorofare. Areas with an erodable shoreline include the northeast shoreline of Ludlam Bay, a small section of the northeast shoreline of Ludlam Thorofare, and along the east and west shorelines of the middle section of Ingram Thorofare. The Townsends Inlet area is almost completely surrounded by beaches. The shore structures and shore types for this area are shown in Figure 11.

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, 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. Townsends Inlet is bordered on the north shore with sandy developed beaches and on the south shore with tidal sand flats. Vegetated salt marshes and tidal waters primarily border Ludlam Bay, Townsends Sound, and Stites Sound. The marsh types and vegetation for this area are shown in Figure 12.

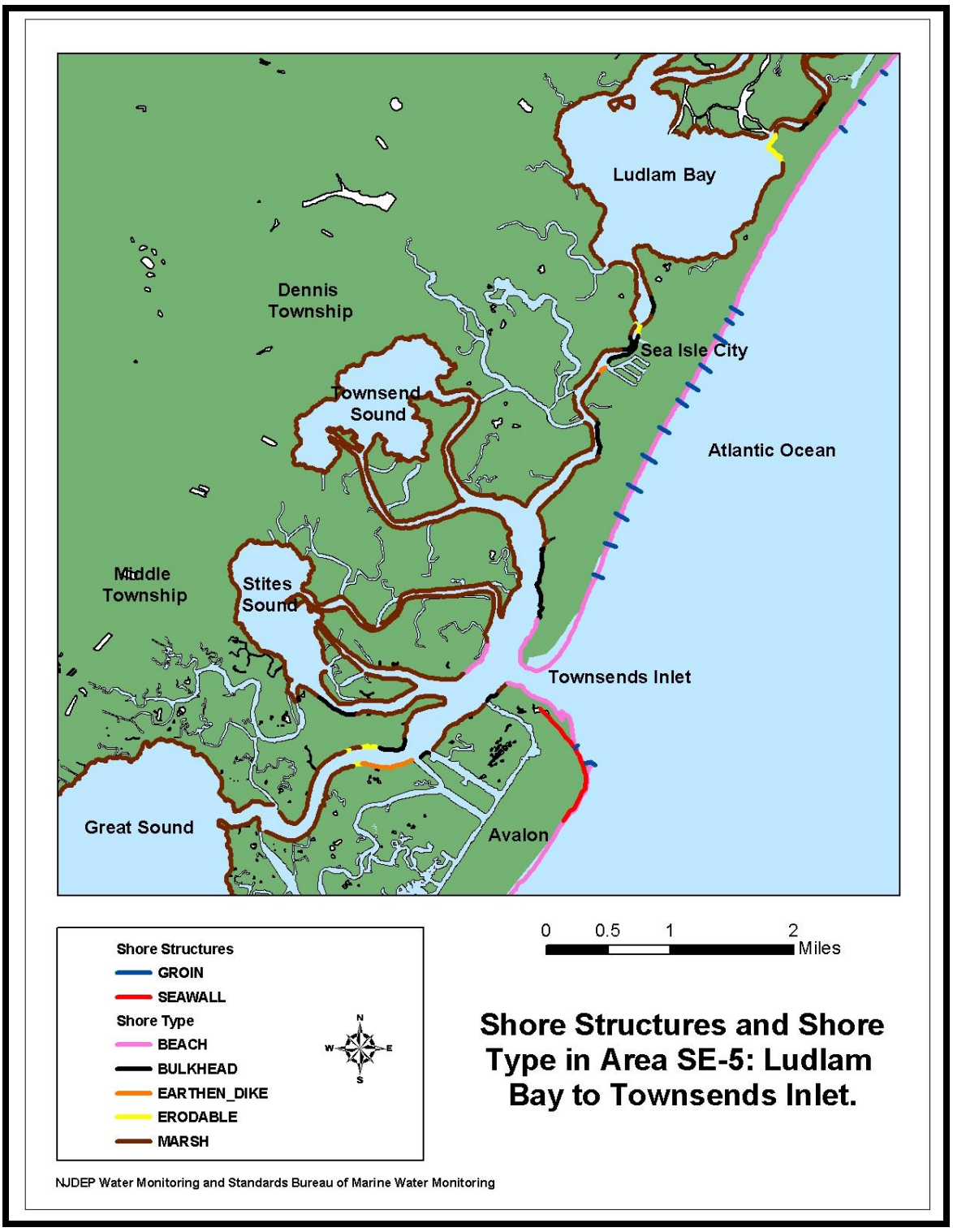


FIGURE 11: SHORE STRUCTURES AND SHORE TYPE IN SHELLFISH GROWING AREA SE-5.

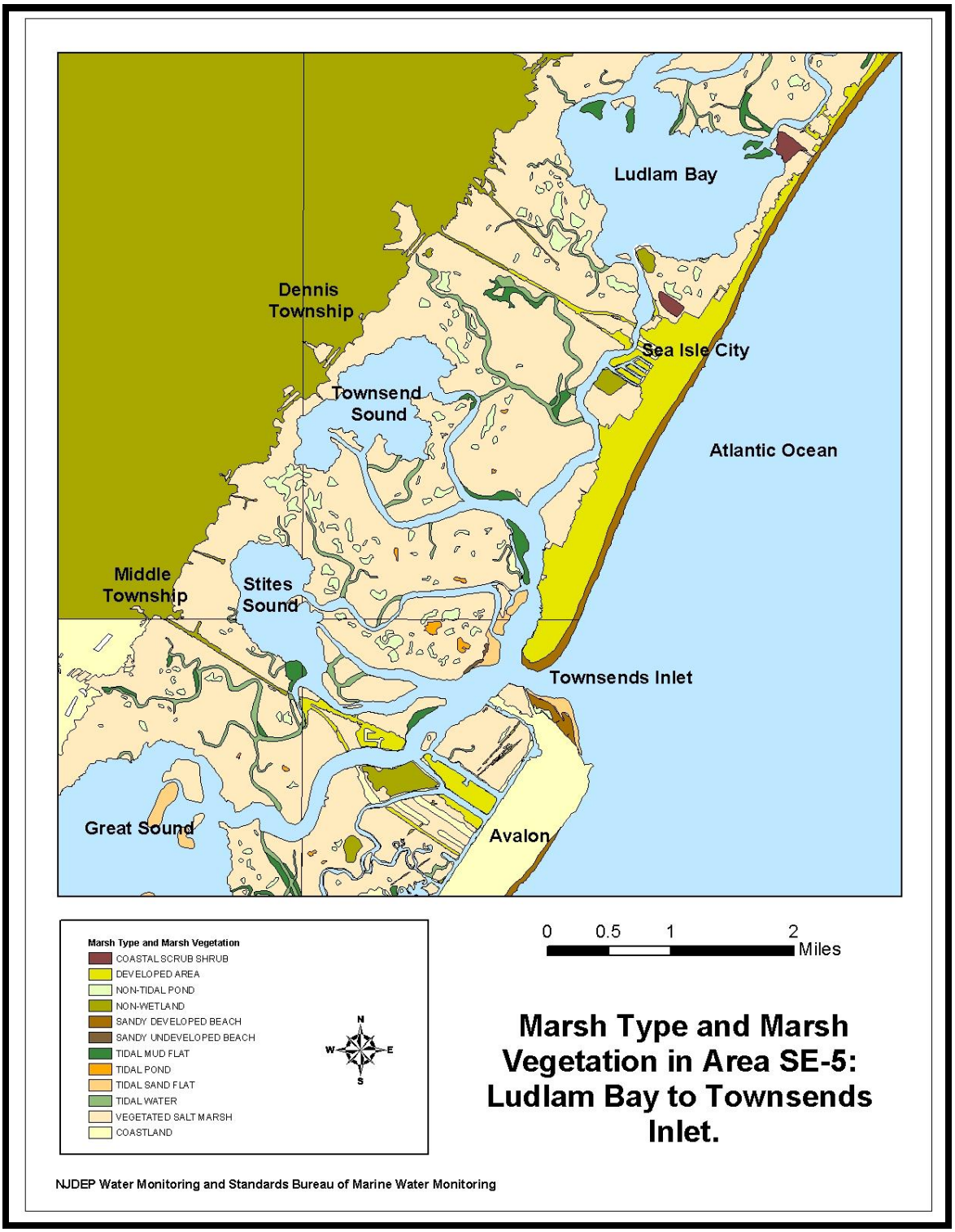


FIGURE 12: MARSH TYPE AND MARSH VEGETATION IN SHELLFISH GROWING AREA SE-5.

IDENTIFICATION AND EVALUATION OF POTENTIAL POLLUTION SOURCES

There are several potential indirect discharge points, several known contaminated sites, and two solid waste landfills located adjacent to this shellfish growing area (see Figures 13, 14, and 15). However, there is no evidence that they currently impact the shellfish growing water quality in this area (APHA, 1995).

Since there is a potential for pollutant inputs from these indirect sources to get into these shellfish growing waters, it is important to continue monitoring the water quality of these areas to determine the presence or absence of these indirect sources of pollution (APHA, 1995).

POTENTIAL INDIRECT DISCHARGES

There are several potential indirect discharge points to both surface and ground water located adjacent to this shellfish growing area and they are located to the west in Middle Township, to the northwest in Dennis Townships, and to the southeast in Avalon (see Figure 13).

This shellfish growing area also has several known contaminated sites located in the adjacent areas (see Figure 14). The major concentrations of these known contaminated sites are located to the northwest in Dennis Township, to the west in Middle Township, and to the east in Sea Isle City. The primary causes of these known contaminated sites are from leaking underground storage tanks. Most of these known contaminated sites are now closed.

There are two solid waste landfills located adjacent to this shellfish growing area (see Figure 15). These landfills are the Dennis Township Sanitary Landfill, which is located in Dennis Township, and the Sea Isle City Landfill, which is located in Sea Isle City. The Dennis Township Sanitary Landfill was closed in 1984 and the Sea Isle City Landfill was closed in 1980.

The several potential indirect discharge points, the currently active known contaminated sites, and the closed solid waste landfills have the potential to impact the water quality of this shellfish growing area. Therefore, the water quality in the Ludlam Bay to Townsends Inlet area is constantly monitored to determine the presence or absence of these contaminants.

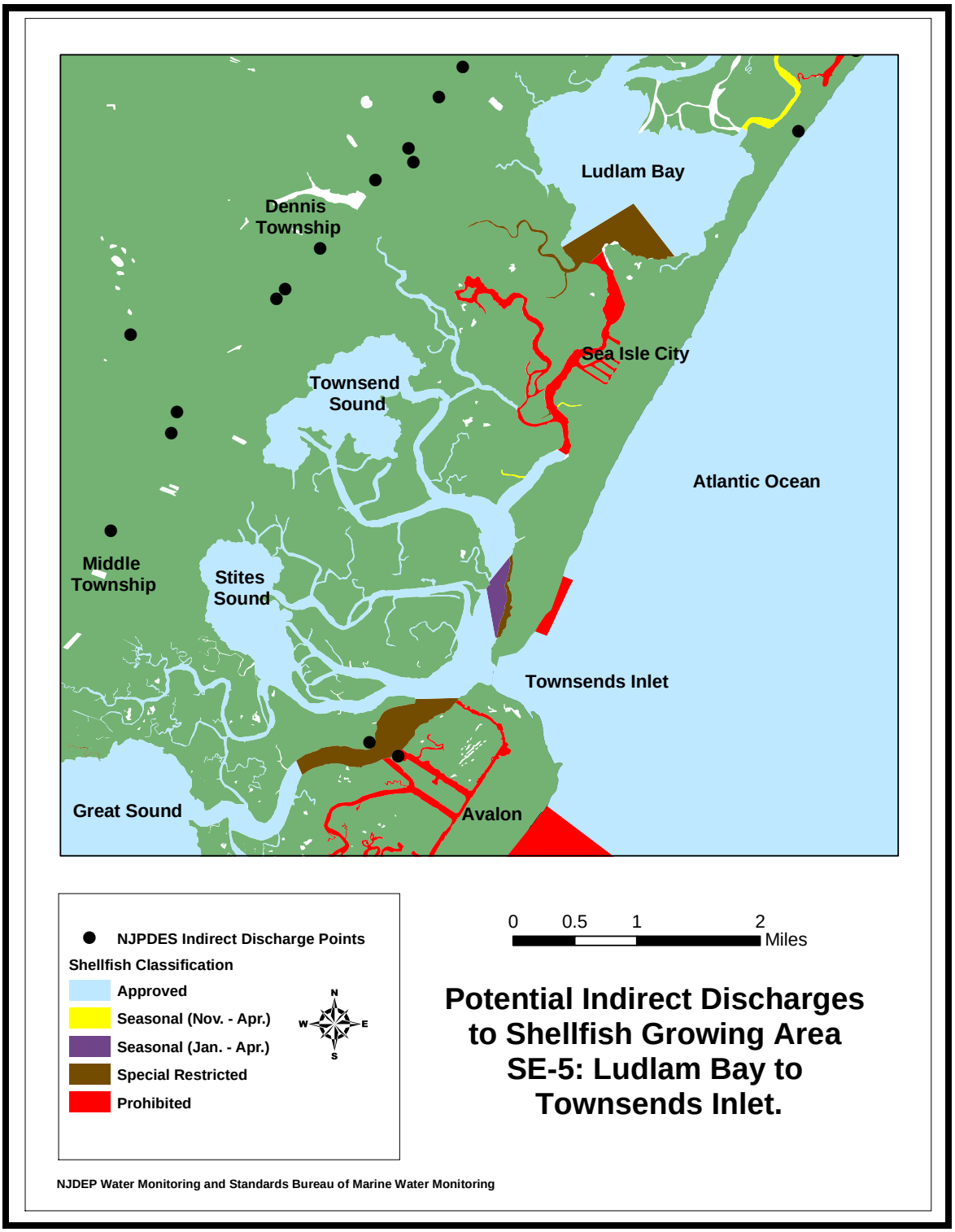


FIGURE 13: POTENTIAL INDIRECT DISCHARGES TO THE WATERS OF SHELLFISH GROWING AREA SE-5.

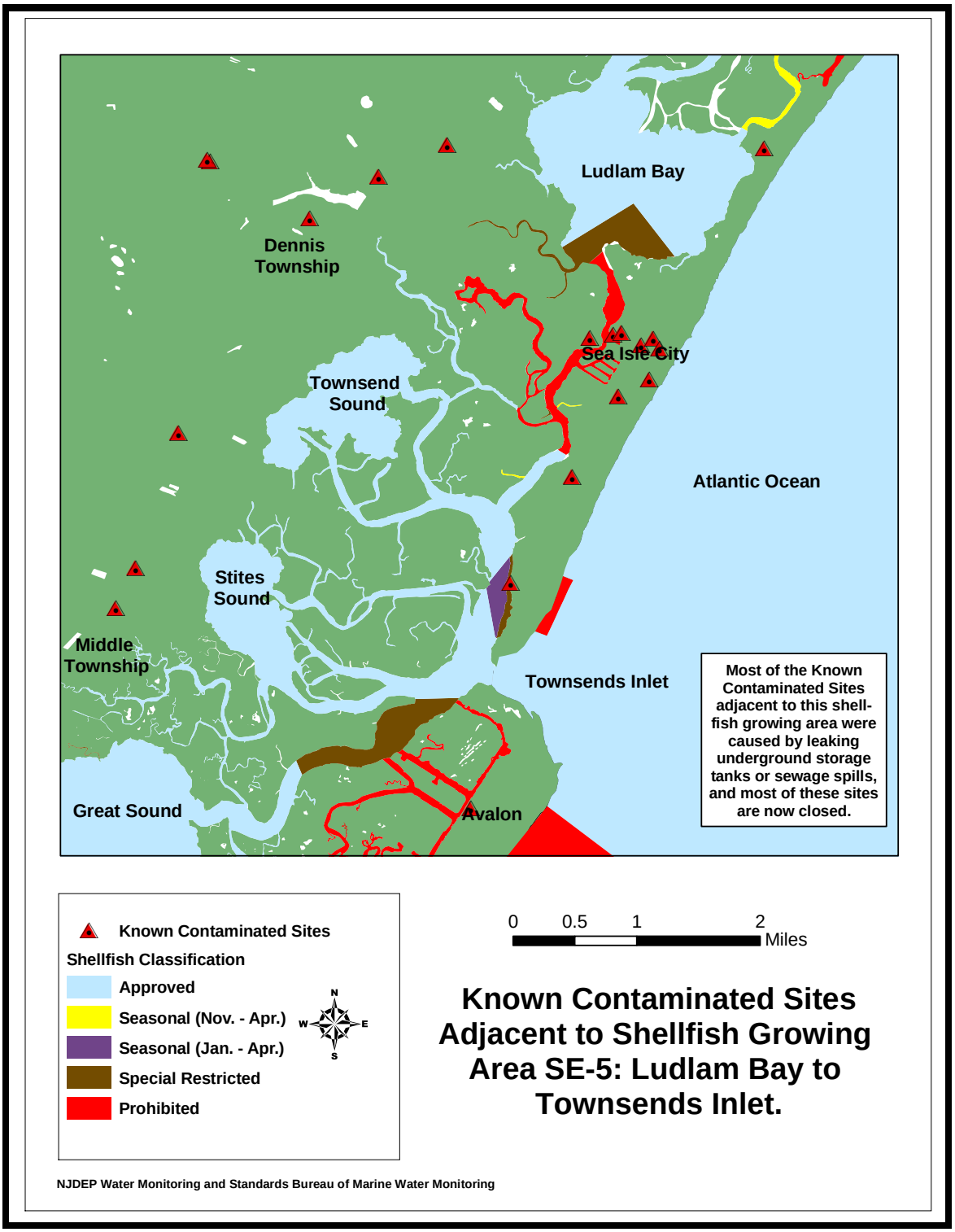


FIGURE 14: LOCATION OF KNOWN CONTAMINATED SITES ADJACENT TO SHELLFISH GROWING AREA SE-5.

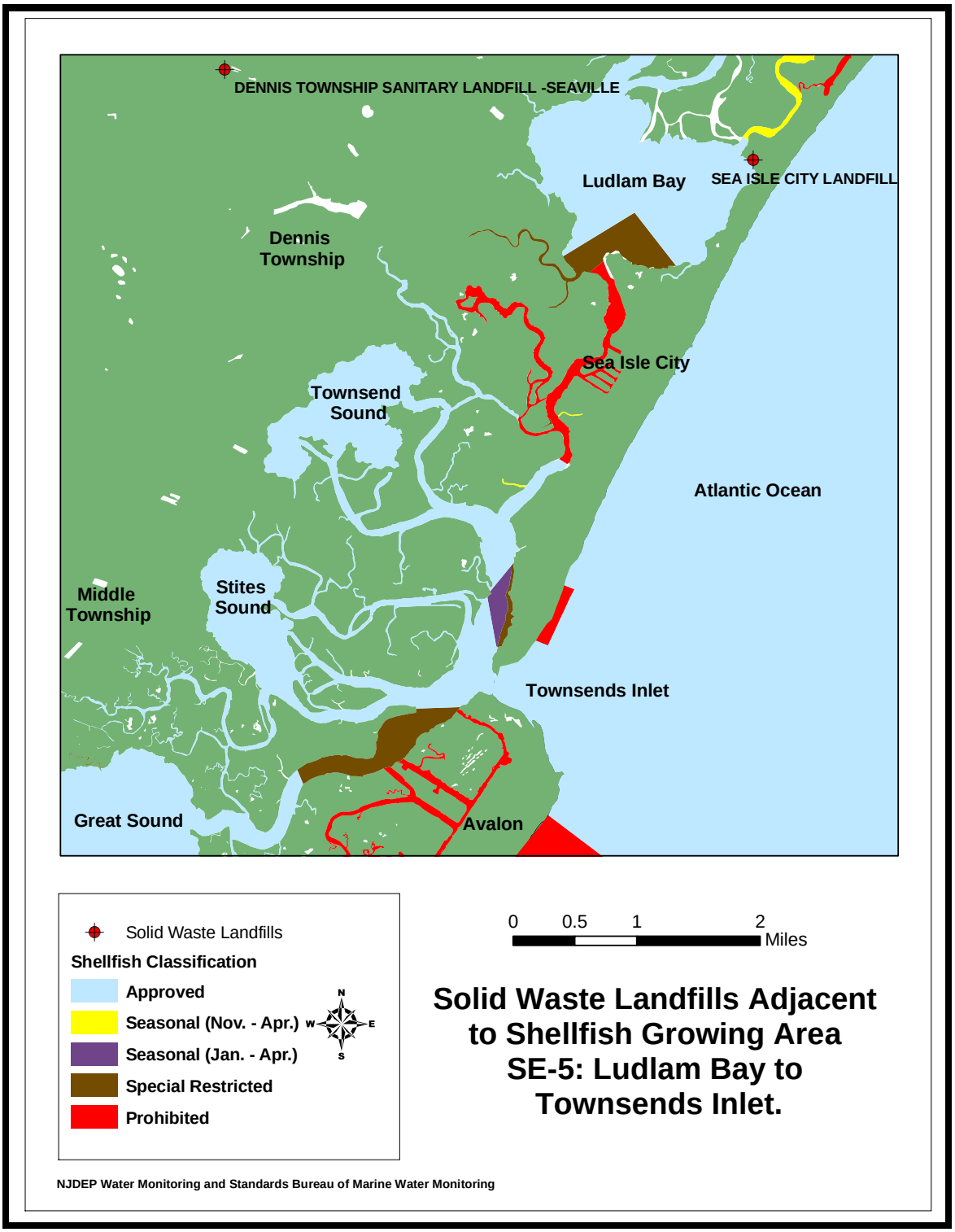


FIGURE 15: LOCATION OF SOLID WASTE LANDFILLS ADJACENT TO SHELLFISH GROWING AREA SE-5.

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 24 marinas in area SE-5: Ludlam Bay to Townsends Inlet, as shown in Table 5 and Figure 16. 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 Table 5. Figures 17 and 18 show the locations of some of the marinas in Sea Isle City and Avalon.

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

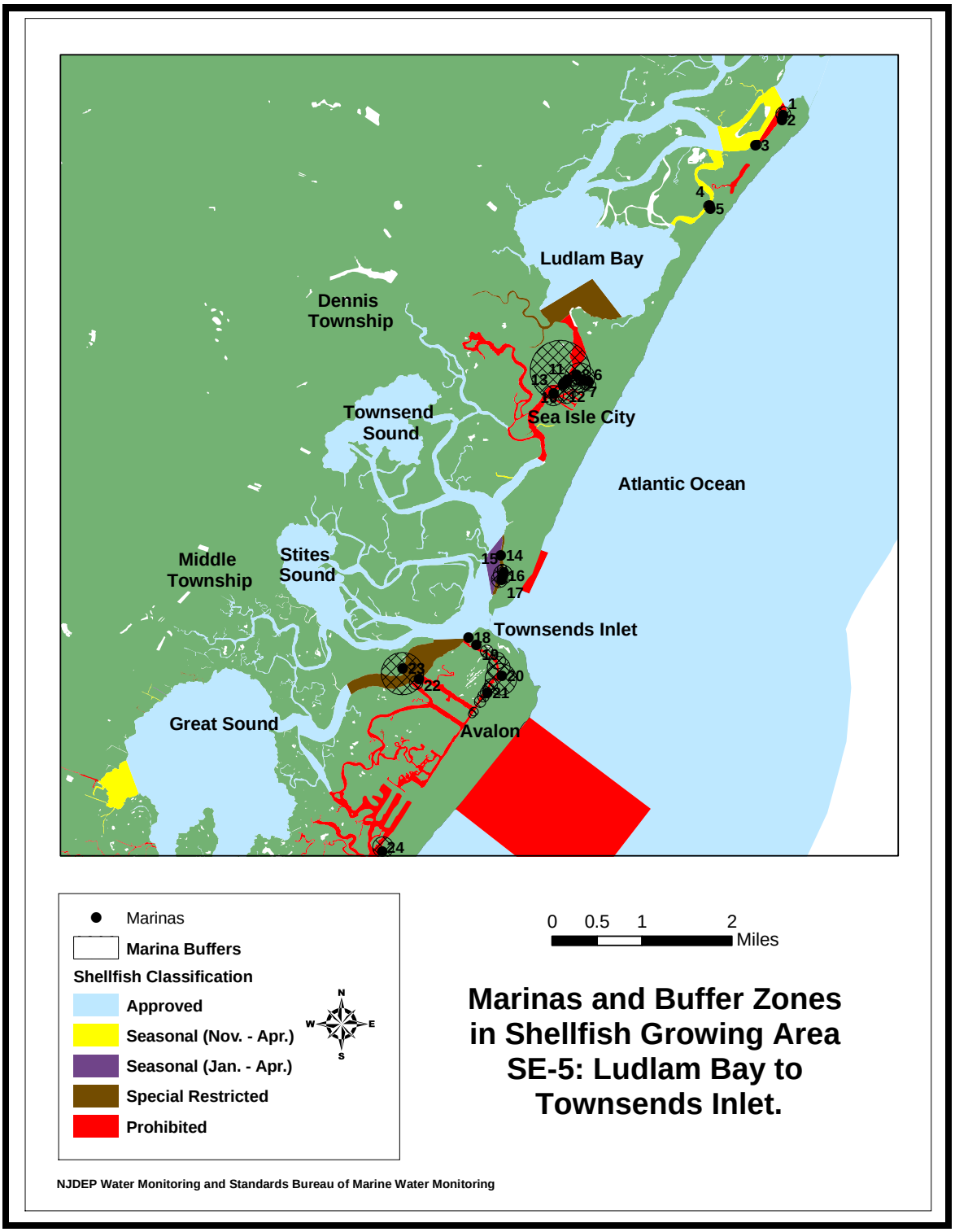


FIGURE 16: MARINA FACILITIES LOCATED IN SHELLFISH GROWING AREA SE-5.

TABLE 5: MARINA FACILITIES LOCATED IN SHELLFISH GROWING AREA SE-5.

Map Key	Marina Name	Location	# of Wet Slips Total/Boats > 24ft.	Size of Buffer Area (radius; feet)	Average Water Depth (ft)	Pumpout Facility
1	Deauville Inn Docks	Upper Township	26/12	457	6	No
2	Frank's Boat Yard	Upper Township	20/20	517	6	No
3	Corsons Inlet Marina	Upper Township	25/25	578	6	No
4	Jersey Cape Boat Salvage	Upper Township	10/10	366	6	No
5	Whale Creek Marina	Upper Township	62/4	505	6	No
6	Party Boat Dockage	Sea Isle City	4/4	231	6	No
7	Capt. Bob's Commercial	Sea Isle City	4/4	231	6	No
8	Sea Isle City Marina	Sea Isle City	72/33	760	6	No
9	Minmar Marine Basin	Sea Isle City	115/20	773	6	Yes
10	Capt. Robbins Deep Sea Fishing Marina	Sea Isle City	40/40	732	6	No
11	Larsens Boat Rental	Sea Isle City	56/0	441	6	No
12	Larsens Marina	Sea Isle City	16/0	236	6	No
13	Sea Isle City Yacht Club	Sea Isle City	18/18	491	6	No
14	U.S. Coast Guard Station	Sea Isle City	1/1	116	6	No
15	Sunset Pier Marina	Sea Isle City	25/6	383	6	No
16	Yacht Club of Townsends	Sea Isle City	82/82	1283	4	No
17	Pier 88 Marina	Sea Isle City	75/75	1002	6	No
18	Avalon Yacht Club	Avalon	25/25	578	6	No
19	South Jersey Ship	Avalon	15/15	448	6	No
20	Commodore Bay Club M.	Avalon	110/110	1213	6	No
21	Avalon Sport Fishing /Public Marina	Avalon	15/15	448	6	No
22	Avalon Anchorage	Avalon	15/15	448	6	No
23	Avalon Pointe Marina	Avalon	105/105	1185	6	Yes
24	54th & Bay Park Marina	Stone Harbor	30/30	317	24	No

FIGURE 17: LOCATION OF SUNRISE MARINA, SUNRISE DRIVE, AVALON.

FIGURE 18: LOCATION OF PIER 88 MARINA WEST OF 88TH STREET NEAR TOWNSEND CHANNEL IN SEA ISLE CITY.

SPILLS OR OTHER UNPERMITTED DISCHARGES

On June 8, 2005, a spill of a corrosive liquid was reported for the area of Avalon Boulevard in Middle Township. According to the report sent to the NJDEP, Bureau of Marine Water Monitoring, an unknown amount of a corrosive cleaning agent was washed into the storm drain by a contractor, and one of the workers was reported to have been injured from contact with the corrosive liquid. Stites Sound is located approximately 604 feet north of this spill, and the shellfish classification for Stites Sound is *Approved* to shellfish harvesting. However, this spill was reported as terminated and the cleanup of the area was completed at the time this report was received.

On July 19, 2004, a sewage spill was reported for the area of 76th Street and Central Avenue in Sea Isle City. According to the report sent to the NJDEP, Bureau of Marine Water Monitoring, approximately 100 gallons of sewage leaked when the collapse of a sewer line caused an overflow of the system, and a bypass system was installed to divert the leaking sewage around the collapsed sewer line to facilitate repairs. Townsend Channel is located approximately 938 feet west of this spill, and the shellfish classification for this part of Townsend Channel is *Approved* to shellfish harvesting. However, this sewage spill was reported as terminated and the cleanup of the area was completed at the time this report was received.

On July 19, 2003, a sewage spill was reported for the area of 376 41st Street in Avalon. According to the report received by the Bureau of Marine Water Monitoring, approximately 1,000 gallons of raw sewage leaked onto the road from an overflowing manhole in the sidewalk, and was reported to be flowing down 41st Street. Long Reach is located west of this spill and the shellfish classification of these waters is *Prohibited* to shellfish harvesting. The nearest shellfish harvesting water is Ingram Thorofare, which is classified as *Approved* and located approximately 1.0 miles west of the site of the sewage spill. However, this sewage spill was reported as terminated and the cleanup of the area was completed at the time this report was received.

On September 14, 2002, a sewage spill was reported on 42nd Street in Avalon. According to the report sent to the NJDEP, Bureau of Marine Water Monitoring, approximately 100 gallons of sewage leaked into a storm drain when a pump bypass hose broke during the repair of the sewer main. The sewage from the storm drain flowed into the waters immediately west of Avalon and towards Gravens Thorofare, Whale Harbor, Bluefish Harbor, Yale Harbor, and Long Reach, which are classified as *Prohibited* to shellfish harvesting. The nearest shellfish harvesting water is Ingram Thorofare, which is classified as *Approved* and located approximately 0.6 miles west of the site of the sewage spill. This sewage spill was reported as terminated and the repairs were completed.

The locations of all reported spills to the area adjacent to this shellfish growing area can be seen in Figure 19.

There were no emergency closures of shellfish waters in this area for the time period from May 2001 to April 2010.

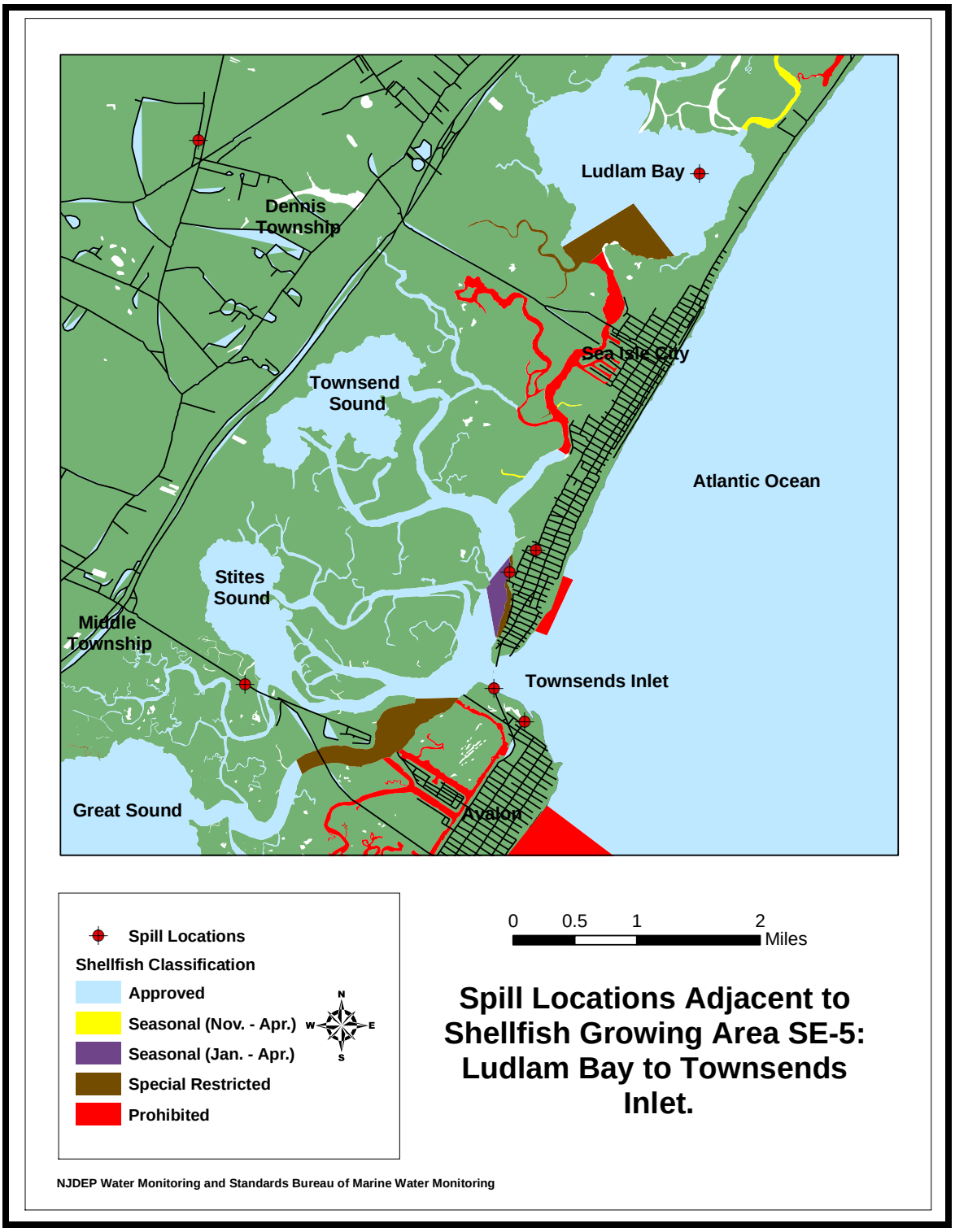


FIGURE 19: SPILL LOCATIONS ADJACENT TO SHELLFISH GROWING AREA SE-5.

STORM WATER INPUT

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 Ingram Thorofare, Gravens Thorofare, Princeton Harbor, Pennsylvania Harbor, Cornell Harbor, Leonard Thorofare, Townsends Inlet, Townsend Channel, Ludlam Thorofare, and Ludlam Bay (see Figures 20 and 21). There are also some stormwater outfalls located to the west of this area in Middle and Dennis Townships near the Garden State Parkway and Route 9 (see Figure 20).

These stormwater outfalls have the potential to impact the water quality of the south part of this shellfish growing area, which is why these waters are sampled using the Adverse Pollution Condition (APC) strategy. 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.

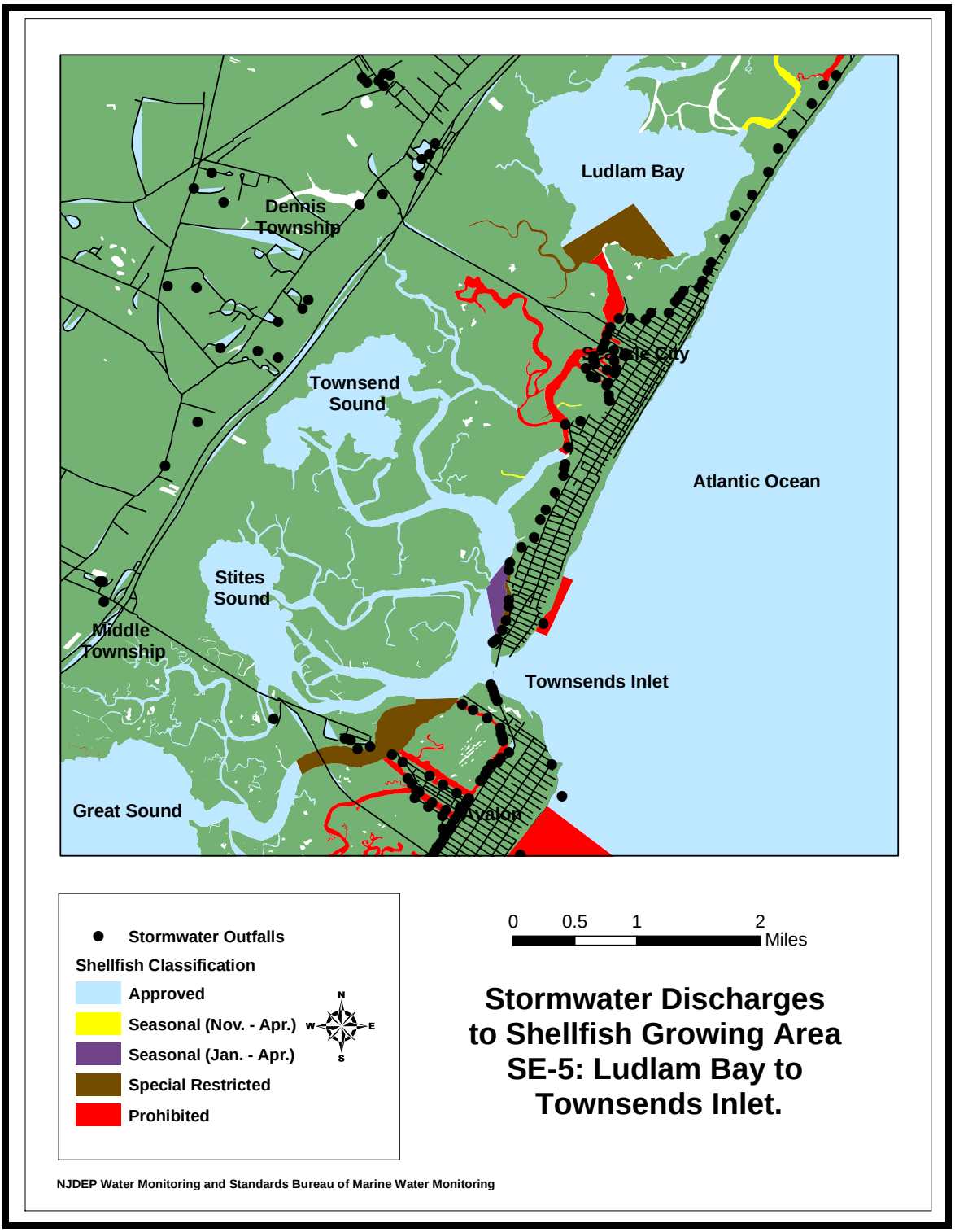


FIGURE 20: STORMWATER DISCHARGES TO SHELLFISH GROWING AREA SE-5: LUDLAM BAY TO TOWNSENDS INLET.

FIGURE 21: STORMWATER OUTFALL PIPE EXTENDING TOWARDS LUDLAM THOROFARE AT THE WEST END OF 58TH STREET IN SEA ISLE CITY.

HYDROLOGY AND METEOROLOGY

PATTERNS OF PRECIPITATION

Precipitation patterns in the coastal areas of New Jersey are typical of the Mid-Atlantic coastal region (see table of Average Mid-Atlantic Storm Event Information in the *Shellfish Growing Area Report Guidance Document*, 2007). Typical summer storms are localized storms associated with thunderstorms. Winter storms are frequently associated with northeasters. Hurricanes can occur during the summer and early fall.

Precipitation inputs to this area for the period 2001 through 2010 are shown in Table 7. There have been no significant changes in hydrography since the last reappraisal report was written in 2007. The rainfall data retrieval for this area was provided by NOAA. The two NOAA weather stations for this area are located: 1) northwest of Sea Isle City in Dennis Township, Cape May County, and 2) west of Avalon in Middle Township, Cape May County (see Table 6). The precipitation inputs to this area are an average of the rainfall amounts at prior 24-hour cumulative, prior 48-hour cumulative, and prior 72-hour

cumulative for all of these two weather stations on a specific sampling date.

TABLE 6: TABLE OF NOAA WEATHER STATIONS IN AREA SE5.

NOAA Weather Station:	Location:	Township:	County:
RA030	Northwest of Sea Isle City	Dennis Township	Cape May County
RA031	West of Avalon	Middle Township	Cape May County

TABLE 7: PRECIPITATION DATA

Rainfall data provided by NOAA

Sampling Date	Precipitation in Inches			Wind		Temperature	
	Prior 24-hour Cumulative	Prior 48-hour Cumulative	Prior 72-hour Cumulative	Direction	Velocity mph	Water ºC	Air ºC
01/06/2005	0.08	0.09	0.09	30	3	5.6	6.1
02/23/2005	0.01	0.20	0.43	0	6	4.4	0.6
03/01/2005	0.40	0.40	0.40	300	10	3.3	-1.1
03/02/2005	0.00	0.42	0.42	340	15	2.2	-0.6
04/06/2005	0.00	0.00	0.00	160	6	6.7	8.9
04/14/2005	0.00	0.00	0.00	50	6	10.6	6.7
06/21/2005	0.00	0.00	0.00	200	2	18.9	14.4
07/19/2005	0.00	0.10	0.39	270	5	26.7	26.7
08/09/2005	0.00	0.03	0.04	230	5	23.9	22.2
10/18/2005	0.00	0.00	0.00	260	8	16.7	18.3
10/19/2005	0.00	0.00	0.00	0	0	15.6	18.9
11/03/2005	0.00	0.00	0.14	210	10	13.3	6.7
12/13/2005	0.00	0.00	0.00	300	8	5.6	-8.3
01/19/2006	0.77	0.80	0.80	300	6	5.0	4.4
02/28/2006	0.00	0.00	0.00	330	8	3.3	-1.7
03/03/2006	0.13	0.13	0.13	320	18	3.9	0.6
04/25/2006	0.00	0.43	2.17	180	1	14.4	11.7
05/26/2006	0.00	0.00	0.00	184	2	16.7	17.8
06/16/2006	0.02	0.03	0.03	320	6	20.0	21.1
06/28/2006	0.43	0.43	2.12	200	12	20.0	21.7
07/12/2006	0.00	0.00	0.00	220	6	14.4	20.0
07/14/2006	0.01	0.07	0.07	N	N	N	N
07/25/2006	0.00	0.00	0.66	180	4	23.3	20.6
07/26/2006	0.00	0.01	0.01	0	0	22.8	21.1
08/21/2006	0.02	0.02	0.02	340	10	23.9	20.0
10/03/2006	0.00	0.18	0.18	200	6	18.3	18.9
10/04/2006	0.00	0.00	0.16	210	4	19.4	18.9
11/02/2006	0.00	0.00	0.00	0	6	13.3	13.9
12/04/2006	0.07	0.07	0.07	310	18	9.4	3.9
01/04/2007	0.00	0.00	1.55	240	8	7.2	6.7
02/23/2007	0.00	0.00	0.22	0	25	1.7	2.8
02/28/2007	0.00	0.00	1.10	330	6	1.1	0.0
03/07/2007	0.00	0.00	0.00	90	8	0.6	-6.1
03/15/2007	0.00	0.00	0.00	190	6	4.4	10.0
03/21/2007	0.00	0.00	0.00	60	10	3.9	2.8
03/28/2007	0.00	0.00	0.00	60	6	8.9	10.0
05/03/2007	0.00	0.00	0.00	60	12	12.2	10.6
05/11/2007	0.00	0.00	0.00	N	N	N	N
07/13/2007	0.00	0.03	0.03	260	2	18.3	25.0
08/23/2007	0.00	0.59	1.27	20	4	21.1	18.9
10/23/2007	0.00	0.00	0.00	180	4	20.0	19.4

Sampling Date	Precipitation in Inches			Wind		Temperature	
	Prior 24-hour Cumulative	Prior 48-hour Cumulative	Prior 72-hour Cumulative	Direction	Velocity mph	Water ºC	Air ºC
10/25/2007	0.91	1.16	1.16	60	19	19.4	15.0
12/26/2007	0.00	0.00	1.19	50	9	3.9	3.9
01/08/2008	0.00	0.00	0.03	240	6	4.4	6.7
01/22/2008	0.00	0.00	0.05	180	6	1.1	1.7
02/05/2008	0.02	0.02	0.02	180	6	3.9	6.7
03/25/2008	0.00	0.00	0.00	40	8	6.1	0.6
03/26/2008	0.00	0.00	0.00	240	9	6.7	10.0
04/04/2008	0.86	0.86	1.04	240	6	8.9	11.7
05/06/2008	0.00	0.00	0.01	320	9	14.4	15.6
06/03/2008	0.00	0.00	0.76	240	4	14.4	20.6
07/31/2008	0.09	0.10	0.15	N	N	N	N
08/14/2008	0.00	0.00	0.00	220	2	21.1	20.0
08/18/2008	0.01	0.03	0.03	270	4	22.2	22.8
09/04/2008	0.01	0.01	0.01	140	6	25.6	23.9
10/15/2008	0.00	0.00	0.00	45	6	17.8	17.8
12/31/2008	0.00	0.00	0.00	330	12	4.4	7.2
01/15/2009	0.00	0.00	0.00	320	8	-1.7	-2.2
02/26/2009	0.00	0.00	0.00	220	6	3.9	3.9
03/11/2009	0.00	0.00	0.00	210	6	5.6	4.4
03/23/2009	0.00	0.00	0.06	30	6	3.9	0.0
04/06/2009	0.00	0.00	0.19	180	14	8.9	10.0
04/08/2009	0.00	0.78	0.78	240	14	7.8	3.3
05/04/2009	0.86	0.89	0.93	60	14	12.2	8.9
05/07/2009	0.14	0.59	0.70	210	10	11.7	13.3
06/05/2009	0.22	0.97	0.99	90	12	17.8	14.4
06/23/2009	0.12	0.44	1.13	330	6	19.4	18.3
06/25/2009	0.12	0.30	0.36	70	5	19.4	21.7
07/06/2009	0.00	0.00	0.00	260	4	21.1	23.9
07/24/2009	0.09	0.09	0.30	60	4	21.7	20.0
08/31/2009	0.00	0.32	4.45	0	4	23.3	16.1
10/19/2009	0.12	0.38	0.38	320	8	12.8	3.9
10/27/2009	0.29	0.29	1.16	60	12	13.9	14.4
03/04/2010	0.07	0.19	0.19	330	8	2.8	4.4
03/17/2010	0.00	0.29	0.72	280	2	5.0	5.0
04/13/2010	0.00	0.00	0.00	60	9	9.4	11.1

N: No data

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 total coliform MPN values from water samples collected during wet weather to water samples collected during dry weather from 5/1/2001 to 4/30/2010. 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 0.3 inches of rain. Any rainfall amounts above 0.3 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, 19 sampling stations showed an impact from rainfall for this shellfish growing area from 5/1/2001 to 4/30/2010 (see Table 8 and Figure 22).

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.

TABLE 8: STATIONS IMPACTED BY RAINFALL (5/1/2001 - 4/30/2010).

Station	Status	t-Statistic Probability	Wet Count	Wet Geo Mean	Dry Count	Dry Geo Mean	Wet/Dry Difference
3133	*Approved*	0.009	3	42.6	36	6.8	-36
3133A	*Approved*	0.003	3	108.3	36	8.4	-100
3135	*Special Restricted*	0.011	3	39.0	36	6.7	-32
3135A	*Special Restricted*	0.003	3	93.1	36	8.3	-85
3136	*Special Restricted*	0.026	3	71.7	36	10.0	-62
3136B	*Special Restricted*	0.015	3	53.6	36	8.9	-45
3137	*Special Restricted*	0.030	3	40.6	36	8.0	-33
3138	*Prohibited*	0.019	3	59.2	36	9.0	-50
3202	*Approved*	0.000*	3	40.2	35	5.3	-35
3203A	*Approved*	0.001	3	29.6	36	4.8	-25
3206	*Approved*	0.021	3	31.5	36	6.3	-25
3206E	*Approved*	0.015	3	22.9	36	5.9	-17

Station	Status	t-Statistic Probability	Wet Count	Wet Geo Mean	Dry Count	Dry Geo Mean	Wet/Dry Difference
3207B	*Approved*	0.009	3	31.4	36	6.1	-25
3207C	*Prohibited*	0.013	3	31.7	36	6.2	-25
3208D	*Approved*	0.048	3	16.0	36	5.5	-11
3209	*Approved*	0.002	3	39.8	36	6.1	-34
3209A	*Approved*	0.000*	3	50.3	36	5.6	-45
3210	*Approved*	0.000*	3	69.2	36	5.3	-64
3220B	*Approved*	0.041	3	40.6	34	8.3	-32

* Value of t-Statistic Probability very close to, but not zero.

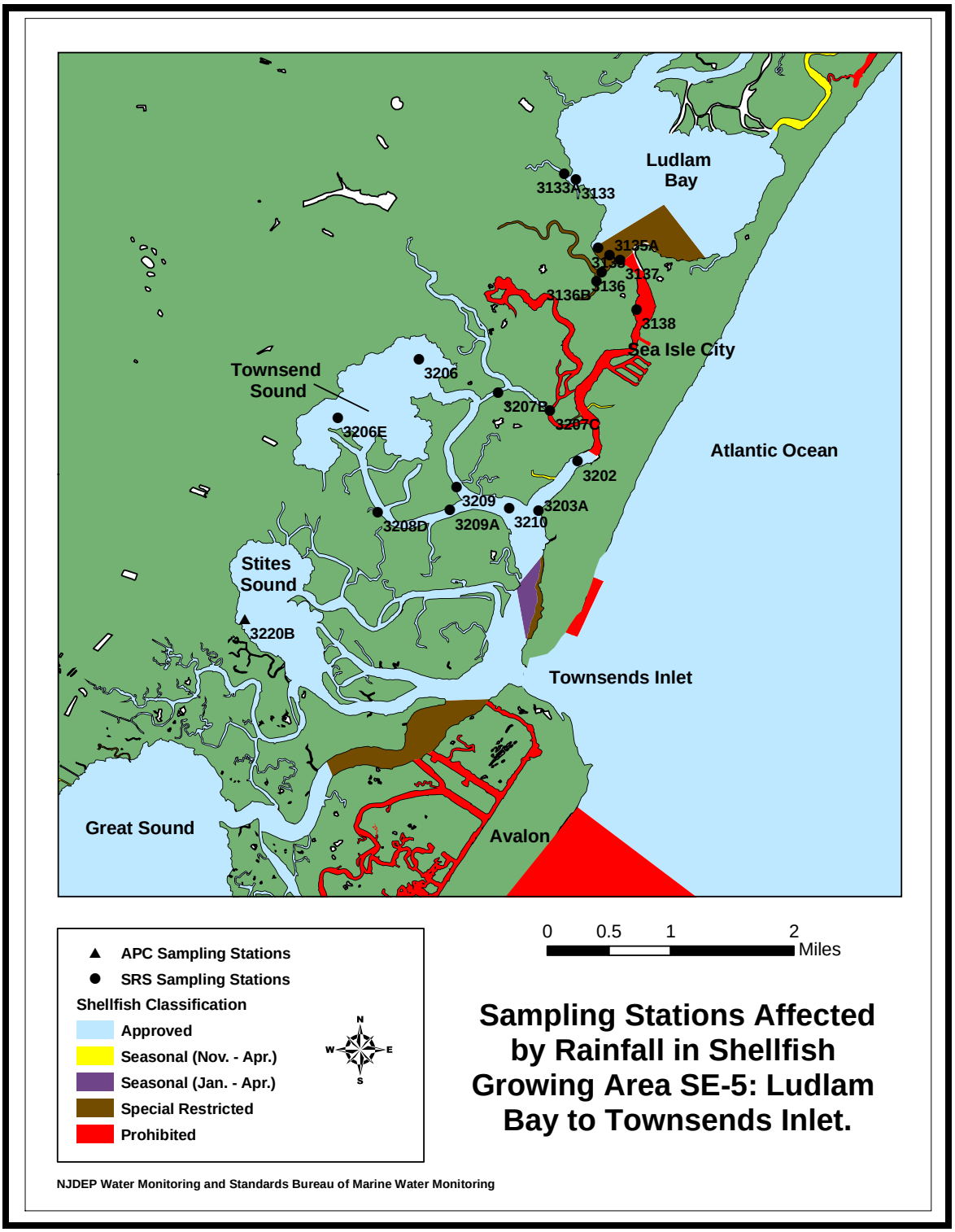


FIGURE 22: SAMPLING STATIONS AFFECTED BY RAINFALL.

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 total coliform values for summer versus winter data. Table 9 lists the sampling stations in this shellfish growing area that showed a relationship between seasonal effects and water quality. Figure 23 shows the locations of these sampling stations. All of these seasonal sampling stations showed a higher total 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. This shellfish growing area was sampled with no seasonal preference.

TABLE 9: SEASONAL EFFECTS

Station	Total Coliform Geometric Mean MPN		Probability>[T]	Location	Classification
	Summer	Winter			
3128D	9.8	5.1	0.042	In Ludlam Bay	*Special Restricted*
3130B	13.7	4.6	0.003	In Ludlam Bay	*Approved*
3134A	12.0	5.4	0.029	In Ludlam Bay	*Special Restricted*
3135A	16.0	6.3	0.038	In Ludlam Bay	*Special Restricted*
3136B	15.9	6.7	0.030	In Little Elder Creek	*Special Restricted*
3138	18.2	6.2	0.011	In Ludlam Thorofare	*Prohibited*
3202	9.6	4.0	0.007	In Ludlam Thorofare	*Approved*
3203A	7.9	3.9	0.019	In Townsend Channel	*Approved*
3205	15.6	5.6	0.008	In Mill Creek	*Approved*
3206	10.5	4.9	0.042	In Townsend Sound	*Approved*
3206B	19.6	4.4	0.000*	In Townsend Sound	*Approved*
3207	8.7	4.3	0.020	In Townsend Sound	*Approved*
3207B	11.8	4.1	0.001	In Ware Thorofare	*Approved*
3207C	10.6	4.7	0.022	In Ware Thorofare	*Prohibited*
3208	7.9	4.4	0.021	In Townsend Sound	*Approved*
3211A	6.4	4.3	0.007	In Townsend Channel	*Seasonal(Jan-Apr)*
3212	30.0	7.9	0.017	In Townsend Channel	*Seasonal(Jan-Apr)*
3212A	7.0	3.8	0.047	In Townsend Channel	*Seasonal(Jan-Apr)*
3216	34.2	4.5	0.000*	In North Channel	*Approved*
3217	7.8	3.8	0.030	In North Channel	*Approved*
3219A	59.8	9.3	0.000*	In Middle Thorofare	*Approved*
3219C	52.6	9.0	0.001	In Middle Thorofare	*Approved*
3220	13.9	5.7	0.014	In Stites Sound	*Approved*
3220A	14.4	5.8	0.006	In Stites Sound	*Approved*
3221B	7.6	4.0	0.007	In Stites Sound	*Approved*
3222	7.9	3.6	0.003	In South Channel	*Approved*

Station	Total Coliform Geometric Mean MPN		Probability>[T]	Location	Classification
	Summer	Winter			
3300	20.3	7.4	0.024	In Leonard Thorofare	*Approved*
3302	8.5	3.9	0.002	In Ingram Thorofare	*Approved*
3303A	10.0	3.9	0.002	In Long Reach	*Approved*
3303B	14.2	4.7	0.001	In Long Reach	*Prohibited*

* Value of t-Statistic Probability very close to, but not zero.

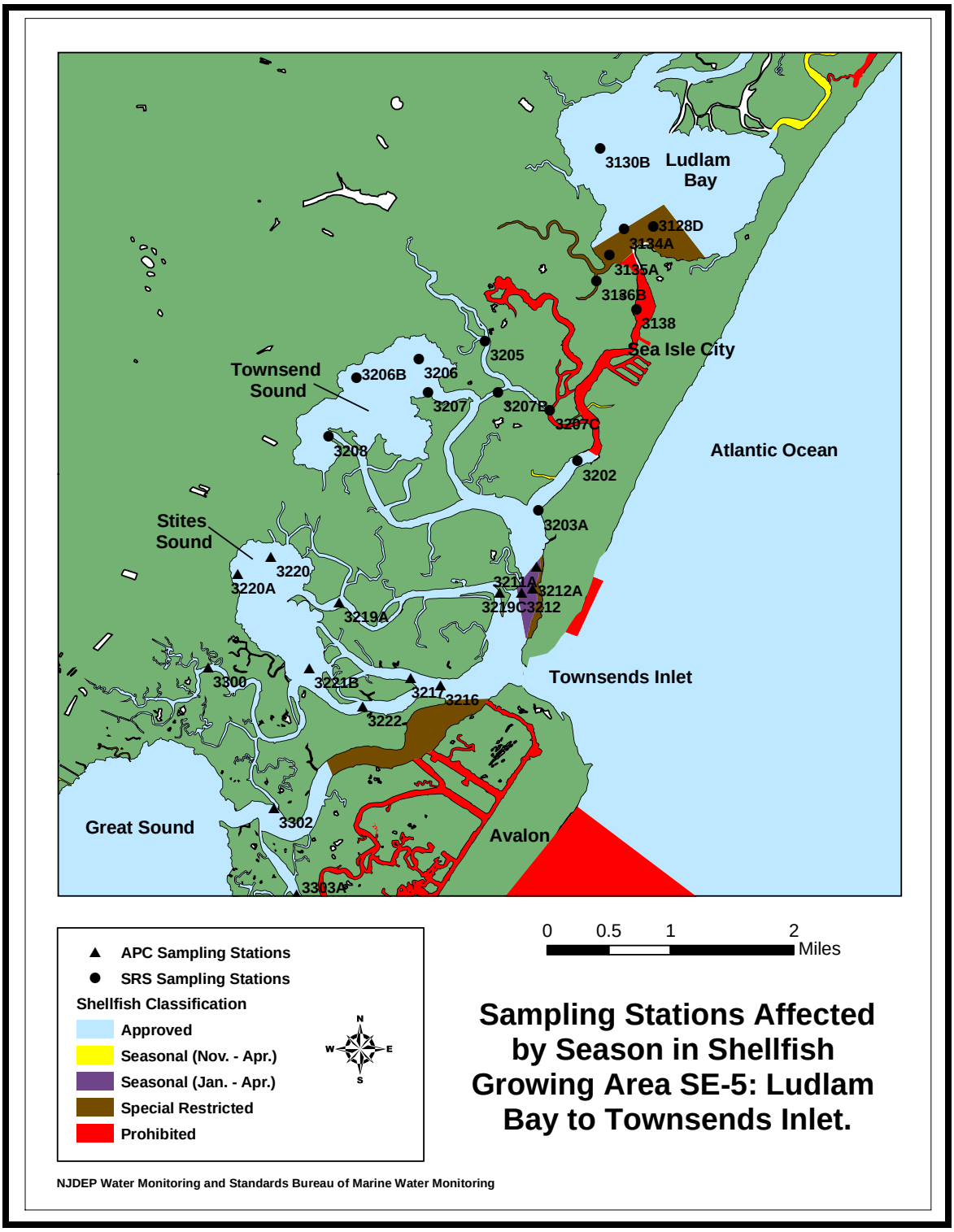


FIGURE 23: SAMPLING STATIONS AFFECTED BY SEASON.

WATER QUALITY STUDIES

BACTERIOLOGICAL QUALITY

The statistical summaries for the areas sampled according to Systematic Random Sampling (SRS) Strategy and Adverse Pollution Condition (APC) Strategy are listed in Tables 10 and 11.

This shellfish growing area is composed of two assignment areas, Assignment 247 (Ludlam Bay and Townsend Sound) and Assignment 287 (Townsends Inlet to Great Sound). Assignment 247 is sampled using SRS sampling strategy year-round and Assignment 287 is sampled using APC sampling strategy year-round, with a water sample taken once a month from January to April and two times from May to October. Figures 8 and 9 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. There were no stations that exceeded the NSSP criteria applicable to the classification of these waters (see Table 1 and Table 2 for the applied criteria) (USPHS, 2003 Revision).

TABLE 10: WATER QUALITY SUMMARY :SRS STATIONS (5/1/2001 - 4/30/2010)

Station	Status	Year Round			Summer			Winter		
		Geo. Mean	Est. 90th	N	Geo. Mean	Est. 90th	N	Geo. Mean	Est. 90th	N
3117	A	8.0	29.1	39	8.0	30.3	19	8.0	29.0	20
3117B	A	6.9	25.6	39	7.0	22.3	19	6.7	29.6	20
3126	A	7.7	36.3	39	10.5	52.1	19	5.8	24.2	20
3126A	A	5.8	21.2	39	5.4	14.8	19	6.3	29.2	20
3126B	A	7.7	39.9	39	7.2	29.0	19	8.3	54.0	20
3126C	A	7.3	33.9	39	7.5	47.9	19	7.1	23.9	20
3127B	A	6.8	33.6	38	6.0	20.2	19	7.8	53.0	19
3127C	A	7.0	26.2	39	8.9	40.0	19	5.6	16.4	20
3127D	SR	5.7	17.4	39	5.7	17.9	19	5.8	17.5	20
3128B	A	7.9	41.4	39	7.1	23.2	19	8.7	66.6	20
3128C	SR	6.8	31.4	39	8.7	41.1	19	5.4	23.7	20
3128D	SR	7.0	25.0	39	9.8	41.1	19	5.1	13.4	20
3129A	A	5.8	20.3	39	7.1	28.3	19	4.8	14.3	20
3129B	A	7.4	32.6	39	9.8	55.2	19	5.7	17.9	20
3130	A	5.9	20.0	39	7.6	34.4	19	4.7	10.2	20
3130B	A	7.8	35.7	39	13.7	70.8	19	4.6	12.8	20
3130C	A	5.8	23.1	38	7.4	44.2	18	4.7	10.6	20
3133	A	7.9	36.3	39	8.8	53.7	19	7.1	24.4	20
3133A	A	10.2	69.5	39	15.3	169.4	19	6.9	22.3	20
3134	A	9.9	55.6	39	14.1	81.4	19	7.0	35.8	20
3134A	SR	8.0	35.1	39	12.0	55.4	19	5.4	19.5	20
3134C	SR	6.9	27.5	39	9.5	51.3	19	5.0	12.5	20
3135	SR	7.7	34.8	39	7.9	41.1	19	7.5	30.7	20
3135A	SR	9.9	59.9	39	16.0	124.9	19	6.3	23.5	20
3136	SR	11.6	78.2	39	17.2	131.8	19	8.0	43.4	20
3136B	SR	10.2	51.2	39	15.9	77.3	19	6.7	29.5	20

Station	Status	Year Round			Summer			Winter		
		Geo. Mean	Est. 90th	N	Geo. Mean	Est. 90th	N	Geo. Mean	Est. 90th	N
3137	SR	9.1	45.5	39	13.4	63.7	19	6.2	29.5	20
3138	P	10.4	59.4	39	18.2	95.2	19	6.2	29.6	20
3202	A	6.2	23.1	38	9.6	45.8	19	4.0	7.8	19
3203A	A	5.5	18.7	39	7.9	34.9	19	3.9	7.8	20
3205	A	9.2	45.1	39	15.6	92.3	19	5.6	16.4	20
3206	A	7.1	32.0	39	10.5	57.3	19	4.9	15.5	20
3206B	A	9.1	53.5	39	19.6	154.4	19	4.4	8.0	20
3206E	A	6.6	22.0	39	7.9	30.5	19	5.5	15.7	20
3207	A	6.0	20.6	39	8.7	34.1	19	4.3	10.5	20
3207B	A	6.9	27.3	39	11.8	54.2	19	4.1	9.3	20
3207C	P	7.0	29.3	39	10.6	58.2	19	4.7	11.6	20
3208	A	5.9	16.2	39	7.9	24.4	19	4.4	9.4	20
3208B	A	6.3	20.3	39	7.7	25.1	19	5.2	16.2	20
3208D	A	6.0	19.0	39	6.8	24.1	19	5.3	15.1	20
3209	A	7.1	27.4	39	9.1	36.6	19	5.6	19.9	20
3209A	A	6.6	26.0	39	7.3	34.7	19	6.0	19.7	20
3210	A	6.4	30.3	39	8.6	64.1	19	4.9	11.3	20

TABLE 11: WATER QUALITY SUMMARY :APC STATIONS (5/1/2001 - 4/30/2010)

Station	Status	Year Round			Summer			Winter		
		Geo. Mean	% > 330	N	Geo. Mean	% > 330	N	Geo. Mean	% > 330	N
3211	A	5.2	0.0%	37	6.4	0.0%	19	4.3	0.0%	18
3211A	S(J-A)	6.2	0.0%	37	9.3	0.0%	19	4.0	0.0%	18
3212	S(J-A)	15.7	10.8%	37	30.0	21.1%	19	7.9	0.0%	18
3212A	S(J-A)	5.2	0.0%	37	7.0	0.0%	19	3.8	0.0%	18
3213	A	4.5	0.0%	37	5.4	0.0%	19	3.7	0.0%	18
3214B	A	5.0	0.0%	36	6.0	0.0%	18	4.2	0.0%	18
3215A	A	6.8	5.6%	36	10.6	11.1%	18	4.4	0.0%	18

Station	Status	Year Round			Summer			Winter		
		Geo. Mean	% > 330	N	Geo. Mean	% > 330	N	Geo. Mean	% > 330	N
3216	A	12.7	5.4%	37	34.2	10.5%	19	4.5	0.0%	18
3216B	SR	12.3	5.4%	37	20.1	5.3%	19	7.4	5.6%	18
3217	A	5.5	0.0%	37	7.8	0.0%	19	3.8	0.0%	18
3217A	A	5.2	0.0%	37	6.6	0.0%	19	4.0	0.0%	18
3218	A	5.4	0.0%	37	7.0	0.0%	19	4.1	0.0%	18
3219	A	9.2	0.0%	37	10.1	0.0%	19	8.4	0.0%	18
3219A	A	24.2	5.4%	37	59.8	10.5%	19	9.3	0.0%	18
3219C	A	22.3	5.4%	37	52.6	10.5%	19	9.0	0.0%	18
3220	A	9.0	0.0%	37	13.9	0.0%	19	5.7	0.0%	18
3220A	A	9.2	0.0%	37	14.4	0.0%	19	5.8	0.0%	18
3220B	A	9.4	0.0%	37	11.7	0.0%	19	7.5	0.0%	18
3221	A	10.2	0.0%	37	14.5	0.0%	19	7.0	0.0%	18
3221B	A	5.6	0.0%	37	7.6	0.0%	19	4.0	0.0%	18
3222	A	5.4	0.0%	37	7.9	0.0%	19	3.6	0.0%	18
3224	SR	5.8	0.0%	37	7.5	0.0%	19	4.5	0.0%	18
3225	SR	5.6	0.0%	37	6.0	0.0%	19	5.2	0.0%	18
3225A	SR	6.8	0.0%	37	7.3	0.0%	19	6.4	0.0%	18
3300	A	12.4	0.0%	37	20.3	0.0%	19	7.4	0.0%	18
3300B	A	19.1	0.0%	37	26.8	0.0%	19	13.4	0.0%	18
3300D	A	12.8	2.7%	37	12.1	0.0%	19	13.5	5.6%	18
3301	SR	5.0	0.0%	37	6.0	0.0%	19	4.2	0.0%	18
3301C	A	6.3	0.0%	37	6.4	0.0%	19	6.1	0.0%	18
3302	A	5.8	0.0%	37	8.5	0.0%	19	3.9	0.0%	18
3303A	A	6.3	0.0%	37	10.0	0.0%	19	3.9	0.0%	18
3303B	P	8.3	0.0%	37	14.2	0.0%	19	4.7	0.0%	18

COMPLIANCE WITH NSSP *APPROVED* CRITERIA

All of the sampling stations in this shellfish growing area meet the *Approved* shellfish classification criteria (see Figure 24). However, 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. There were no 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.

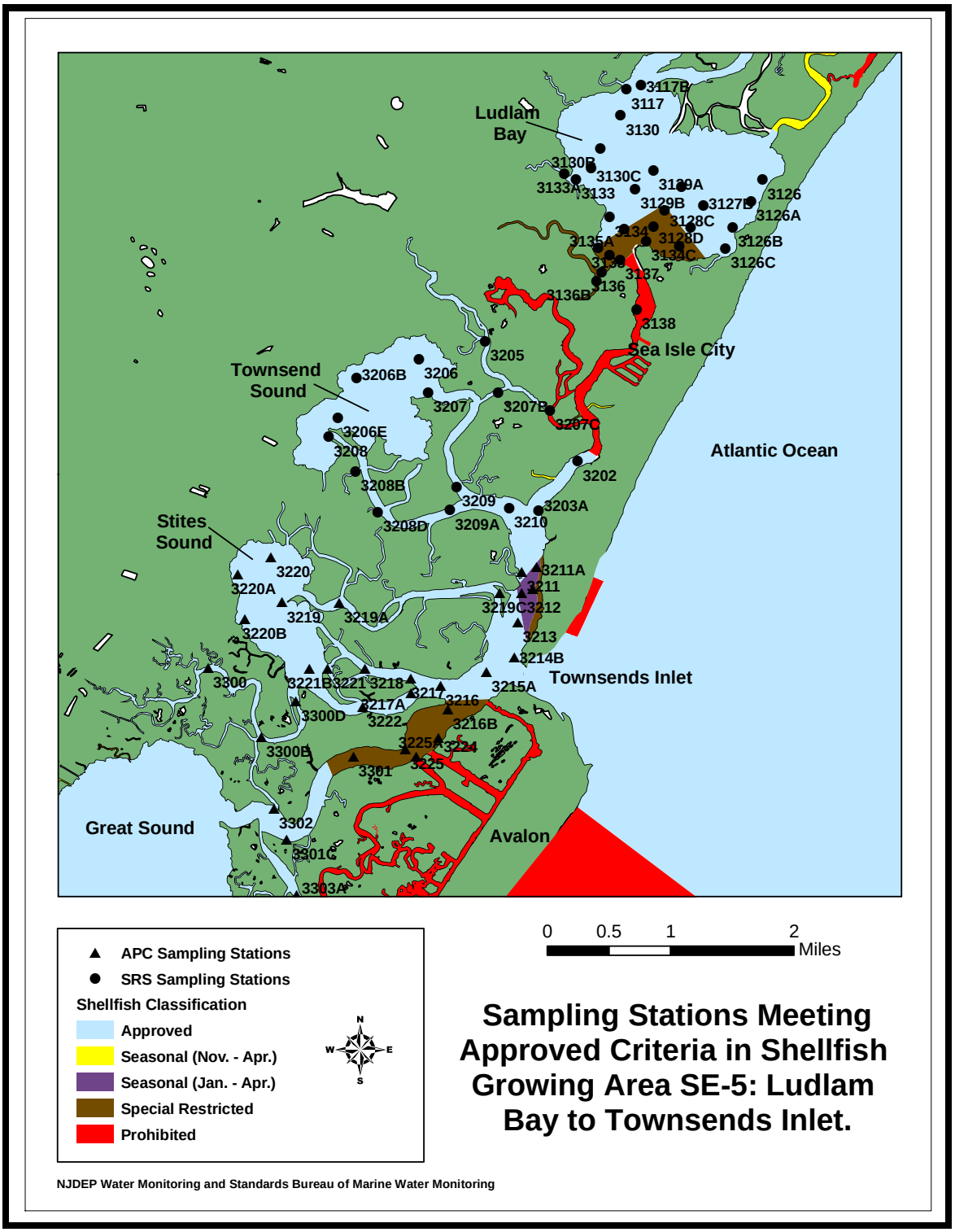


FIGURE 24: SAMPLING STATIONS MEETING APPROVED CRITERIA IN SHELLFISH GROWING AREA SE-5.

INTERPRETATION AND DISCUSSION OF DATA

BACTERIOLOGICAL

Criteria for bacterial acceptability of shellfish growing waters are provided in the National Shellfish Sanitation Program (NSSP) *Guide for the Control of Molluscan Shellfish* (USPHS, 2003 Revision). Each state must adopt either the total coliform criteria or fecal coliform criteria for growing water classifications. New Jersey bases growing water classifications on the total coliform criteria.

While New Jersey does make corresponding fecal coliform determinations for each total coliform determination in specific growing areas, these data are viewed as adjunct information and are not directly used for classification. Therefore, the data analysis is based on the total coliform results.

For the Systematic Random Sampling (SRS) strategy, the total coliform median or geometric mean MPN (most probable number) for the *Approved* shellfish water classification shall not exceed 70/100 mL and the estimated 90th percentile shall not exceed an MPN of 330/100 mL for the three tube decimal dilution test (see Table 2) (USPHS, 2003 Revision). Also, the total coliform median or geometric mean MPN for the *Special Restricted* shellfish water classification shall not exceed 700/100 mL and the estimated 90th percentile shall not exceed an MPN of 3300/100mL, where the three tube decimal dilution test is used for the Systematic Random Sampling (SRS) strategy (see Table 2) (USPHS, 2003 Revision).

For the Adverse Pollution Condition (APC) strategy, the data analysis is based on the total coliform results in which the total coliform median or geometric mean MPN (most probable number) for the *Approved* shellfish water classification shall not exceed 70/100 mL and not more than 10 percent of the sample shall exceed an MPN of 330/100 mL for the three tube decimal dilution test (see Table 1) (USPHS, 2003 Revision). Also, the total coliform median or geometric mean MPN (most probable number) for the *Special Restricted* shellfish water classification shall not exceed 700/100 mL and not more than 10 percent of the sample shall exceed an MPN of 3,300/100 mL, where the three tube decimal dilution test is used for the Adverse Pollution Condition (APC) strategy (see Table 1) (USPHS, 2003 Revision).

Figure 24 shows the sampling stations that meet the *Approved* total coliform criteria for water quality after being sampled with the Systematic Random Sampling (SRS) strategy and the Adverse Pollution Condition (APC) strategy. All of the sampling stations in this shellfish growing area meet the *Approved* criteria for water quality. However, some of the sampling stations

in this shellfish 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 growing area. Therefore, these shellfish growing waters are classified accordingly, based on the potential impact by these sources of pollution.

Based on a significant correlation between total coliform MPN values from wet/dry data for 5/1/2001 to 4/30/2010, an impact from rainfall was found to occur at 19 sampling stations in this shellfish growing area (see Figure 22 and Table 8). These APC and SRS sampling stations are located throughout this shellfish growing area, in *Approved*, *Special Restricted*, and *Prohibited* shellfish waters. The Wet/Dry Statistics were calculated based on an impact time of 24 hours prior to the day of sampling and a wet/dry cutoff of 0.3 inches of rain. All of these sampling stations showed a higher total coliform geometric mean during wet than dry conditions. However, the total coliform levels still meet the existing *Approved*, *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish classification criteria for these shellfish waters. Since the water quality in this shellfish growing area is slightly impacted by rainfall but not enough to affect the shellfish classification, this area will continue to be sampled using the Systematic Random Sampling (SRS) and Adverse Pollution Condition (APC) strategies. In the 2008 Annual Review of this shellfish growing area, 20 sampling stations showed a correlation between total coliform MPN and rainfall (NJDEP, 2009).

There were 30 sampling stations that showed a seasonal component for water quality in this shellfish growing area (see Figure 23 and Table 9). These APC and SRS sampling stations are located throughout this shellfish growing area, in *Approved*, *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish waters. Seasonal effects were assessed using a t-test to compare log-transformed total coliform values for summer versus winter data. All of these sampling stations showed a higher total 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. However, the total coliform levels still meet the existing *Approved*, *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish classification criteria for these shellfish waters. Since the water quality in this shellfish growing area is slightly impacted by seasonal effects but not enough to affect the shellfish classification of this area, this shellfish growing area will continue to be sampled using the Systematic Random Sampling (SRS) and Adverse Pollution Condition (APC) strategies. In the 2008 Annual Review, 25 of these 30 sampling stations also showed a seasonal component for water quality in this area (NJDEP, 2006). However, all of these 25 sampling stations met the existing *Approved*, *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish classification.

RELATED STUDIES

NUTRIENTS

According to the 2009-2010 Marine Water Sampling Assignments Schedule for Assignments 247 and 287, there are four (4) stations in Shellfish Growing Area SE-5 that are sampled under the estuarine monitoring program for chemical parameters including nutrients. These nutrient stations include sampling stations **3127C**, **3201**, **3214B**, and **3215A**, and they are located in Ludlam Bay, Ludlam Thorofare, and Townsend Channel to the west of Townsend Inlet, respectively (see Figure 25).

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 four (4) nutrient stations in this shellfish growing area are consistent with the water results found throughout the State. For detailed information concerning dissolved oxygen and nutrient levels, see the NJDEP Estuarine Monitoring Reports which are available electronically at: www.nj.gov/dep/bmw.

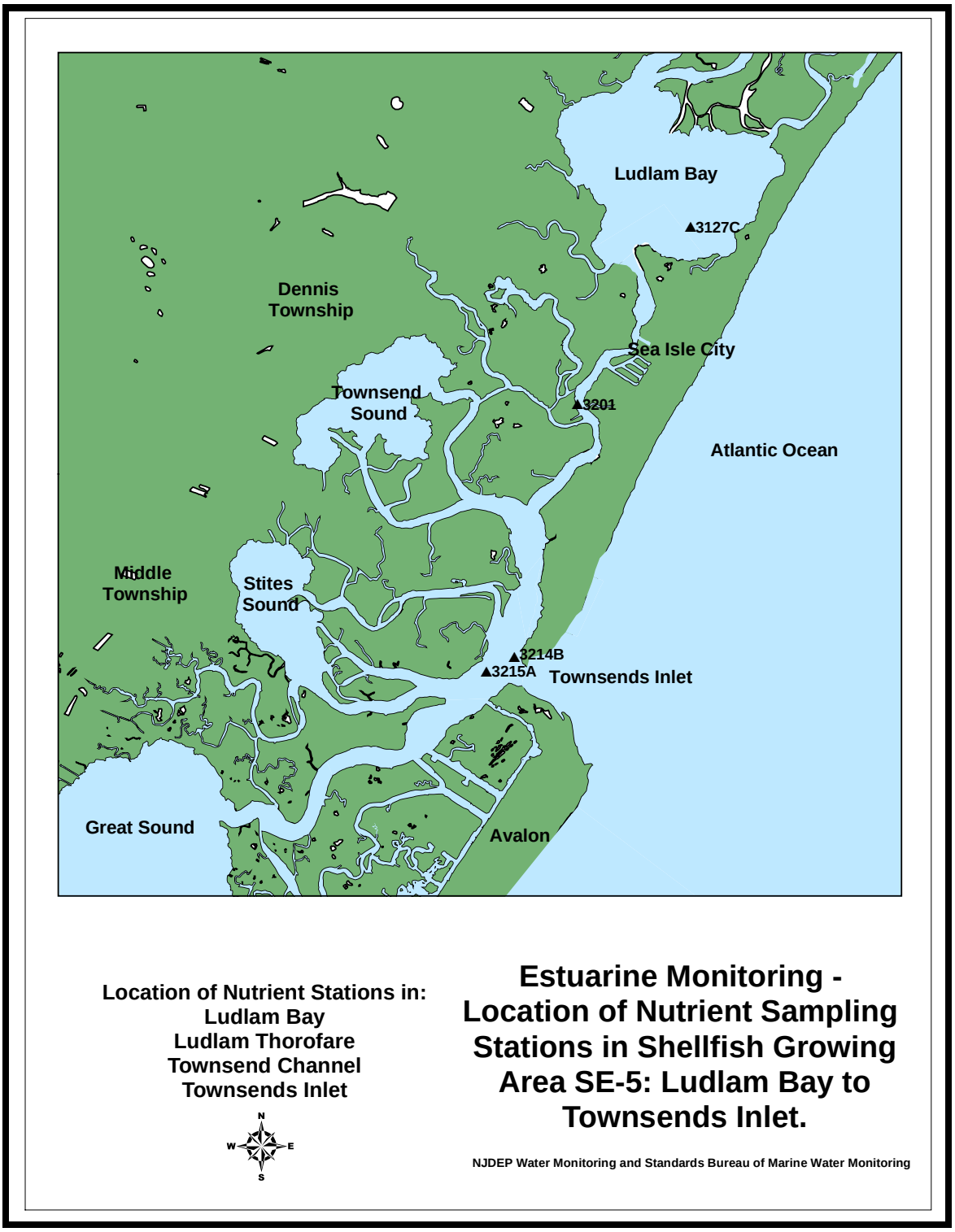


FIGURE 25: SAMPLING SITES WHERE ADDITIONAL DATA HAVE BEEN COLLECTED FOR NUTRIENTS IN SHELLFISH GROWING AREA SE-5.

MARINE BIOTOXINS

There are no phytoplankton sampling stations located in this shellfish growing area.

TOXICS

There are two (2) National Coastal Assessment (NCA) sampling stations and two (2) BMWM EMPACT sampling stations in this shellfish growing area and they are located in Ludlam Bay, Ludlam Thorofare, Townsend Channel west of Townsends Inlet, and Cornell Harbor west of Avalon (see Figure 26).

A review of the toxics data from 2001 to 2010 for these sampling stations showed that the levels of the contaminants and pesticides in the sediment sampled did not exceed the ERM limits. For additional information on NJ's participation in NCA, see: www.nj.gov/dep/bmw.

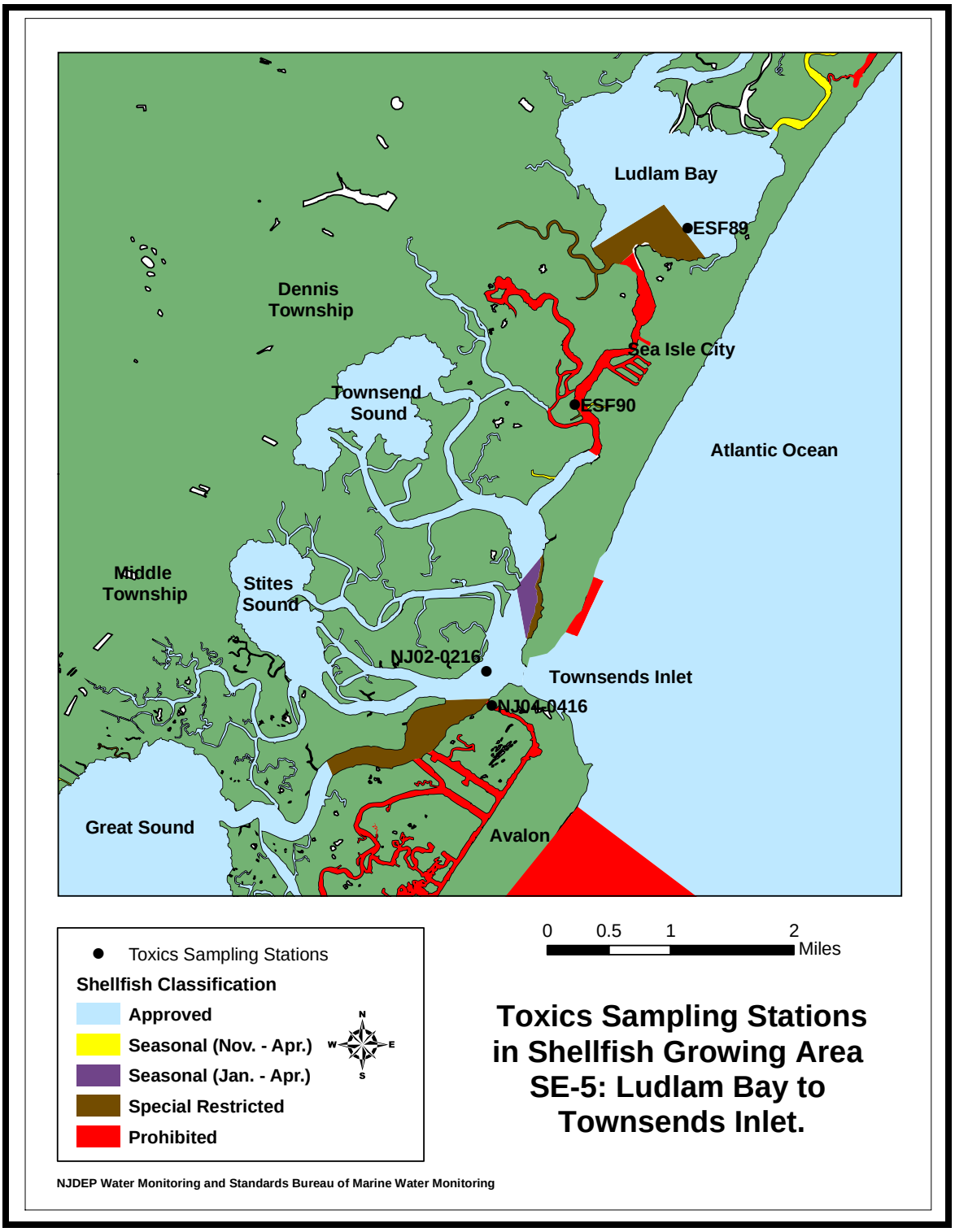


FIGURE 26: LOCATION OF TOXICS SAMPLING STATIONS IN SHELLFISH GROWING AREA SE-5.

BATHING BEACH DATA

There were thirteen (13) bathing beach sampling stations listed for this shellfish growing area from 2001 to 2005 and only two (2) bathing beach sampling stations currently listed for this shellfish growing area. These two bathing beach sampling stations (**CCMPCC0025** and **CCMPCC0094**) are located in Ludlam Thorofare near Sea Isle City, and in Ingram Thorofare near Avalon (see Figure 27). A review of the bathing beach data for these two sampling stations showed that the geometric mean levels for these stations generally meet the enterococcus criteria. The water quality sample results for these two (2) bathing beach sampling stations have been posted on the beach web site at www.njbeaches.org under Ocean Beach Information.

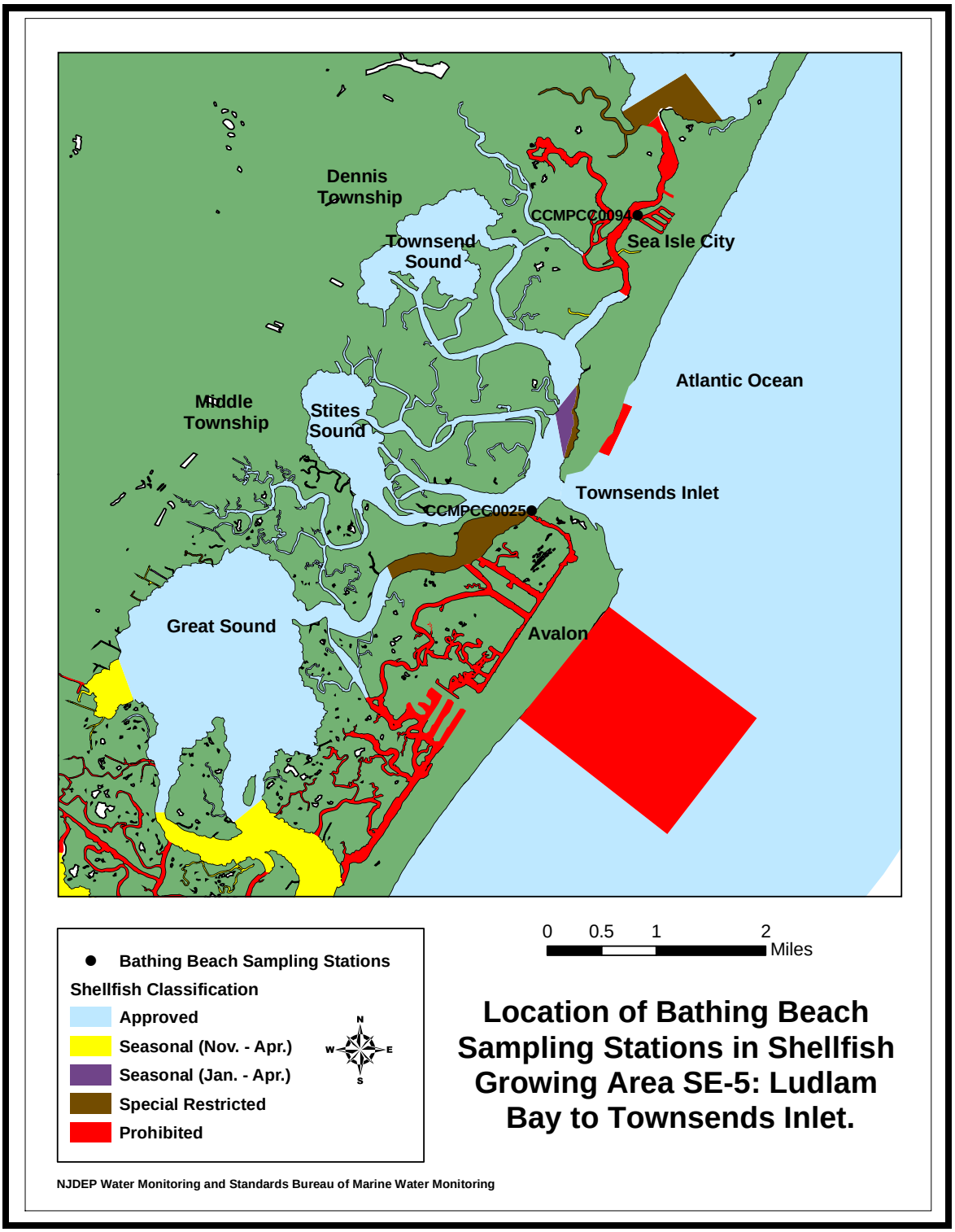


FIGURE 27: LOCATION OF BATHING BEACH SAMPLING STATIONS IN SHELLFISH GROWING AREA SE-5.

CONCLUSIONS

BACTERIOLOGICAL EVALUATION

Water quality in Shellfish Growing Area SE-5, Ludlam Bay to Townsends Inlet, continues to be good, with all of the sampling stations in compliance with the requirements of the *Approved*, *Seasonally Approved (November to April)*, *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* shellfish classification for the waters in this area, based on NSSP total coliform criteria. This area was sampled using the Systematic Random Sampling (SRS) and the Adverse Pollution Condition (APC) strategies, because this shellfish growing area has a north part (Ludlam Bay and Townsend Sound) with no direct impacts from point sources (SRS strategy) and a south part (Townsends Inlet to Great Sound) with many direct and indirect impacts from point sources of pollution, such as marinas and storm water outfalls in the Avalon area (APC strategy).

Shellfish Growing Area SE-5, Ludlam Bay to Townsends Inlet, is correctly classified as *Approved*, *Seasonally Approved (November to April*, *Seasonally Approved (January to April)*, *Special Restricted*, and *Prohibited* as currently described in *N.J.A.C. 7:12*. 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

SHELLFISH WATER CLASSIFICATION

RECOMMENDED CHANGES IN MONITORING SCHEDULE

No changes, continue sampling using the existing Systematic Random Sampling (SRS) Strategy for Assignment 247 and the existing Adverse Pollution Condition (APC) Strategy for Assignment 287.

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