New Jersey Department of Environmental Protection
Land Use Management
Water Monitoring and Standards
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Water Monitoring Project

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PARTIAL SANITARY SURVEY OF

SHELLFISH GROWING AREA AO SOUTH

THE ATLANTIC OCEAN FROM

CAPE MAY POINT TO ABSECON INLET

1999 – 2003

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PARTIAL SANITARY SURVEY OF SHELLFISH GROWING AREA AO SOUTH THE ATLANTIC OCEAN FROM CAPE MAY POINT TO ABSECON INLET

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New Jersey Department of Environmental Protection
BRADLEY M. CAMPBELL
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EXECUTIVE SUMMARY

Shellfish Growing Area AO South is located in the southeastern part of New Jersey, from Cape May Point in Cape May County, north to Absecon Inlet in Atlantic County, which includes approximately 46 miles of coastline and extends offshore to the three mile jurisdictional limit. The primary classification of this shellfish growing area is *Approved* or *Prohibited,* and the approximate size of this shellfish growing area is 93,373 acres. The water quality data presented in this Partial Sanitary Survey of Shellfish Growing Area AO South, the Atlantic Ocean from Cape May Point to Absecon Inlet, was collected between October 1999 and September 2003. This shellfish growing area is sampled using the Adverse Pollution Condition (APC) strategy, because there are six wastewater treatment facilities connected to four discharge pipes that extend into the Atlantic Ocean in this shellfish growing area. The wastewater treatment facilities are: 1) the Atlantic County Utilities Authority – Wastewater Treatment Facility, 2) the Cape May County Utilities Authority – Ocean City Region Wastewater Treatment Facility, 3) the Cape May County Utilities Authority – Seven Mile/ Middle Region Wastewater Treatment Facility, and 4) the Cape May County Municipal Authority – Wildwood Lower Regional Wastewater Treatment Facility, which also shares the same discharge pipe with 5) the Cape May County Utilities Authority – Cape May Regional Wastewater Treatment Facility and 6) the Lower Township Municipal Utilities Authority – Wastewater Treatment Facility. The wastewater from these facilities is discharged into the ocean to four safety buffer zones that are classified as *Prohibited* to shellfish harvesting. For the most part, the water quality of this shellfish growing area continues to be good and most of the sampling stations are in compliance with the *Approved* and *Prohibited* shellfish classification for this area as specified by the National Shellfish Sanitation Program (NSSP) criteria (USPHS, 1999 Revision). However, one of the sampling stations (Ocean Surface Sampling Station AX75A1) in this shellfish growing area was out of compliance with the existing shellfish growing water classification criteria. As such, approximately 257 acres of shellfish waters around Ocean Surface Sampling Station AX75A1, which is located along the northeast coast of Atlantic City, will need to be downgraded from the *Approved* to the *Prohibited* shellfish classification.

INTRODUCTION

PURPOSE

This report is part of a series of studies having a dual purpose. The first and primary purpose 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.

The second purpose is to provide input to the Integrated Water Quality Monitoring and Assessment Report,

which is prepared pursuant to Sections 305(b) and 303(d) of the Federal Clean Water Act (P.L. 95-217). The information contained in the growing area reports is used for the 305b portion of the Integrated Report, which provides an assessment to Congress every two years of current water quality conditions in the State's major rivers, lakes, estuaries, and ocean waters. The reports provide valuable information for the 305(b) portion of the Integrated Report, which describes the waters that are attaining state designated water uses and national clean water goals; the pollution problems identified in surface waters; and the actual or potential sources of pollution. Similarly, the reports utilize relevant information contained in the 305(b) portion of the Integrated Report, since the latter assessments are based on instream monitoring data (temperature, oxygen, pH, total and fecal coliform bacteria, nutrients, solids, ammonia and metals), land-use profiles, drainage basin characteristics and other pollution source information.

From the perspective of the Shellfish Classification Program, the reciprocal use of water quality information from reports represent two sides of the same coin: the growing area report focuses on the estuary itself, while the 305(b) portion of the report describes the watershed that drains to that estuary.

The Department participates in a cooperative National Environmental Performance Partnership System (NEPPS) with the USEPA which emphasizes ongoing evaluation of issues associated with environmental regulation, including assessing impacts on waterbodies and measuring improvements in various indicators of environmental health. The shellfish growing area reports are intended to provide a brief assessment of the growing area, with particular emphasis on those factors that affect the quantity and quality of the shellfish resource. The shellfish growing area reports provide valuable information on the overall quality of the saline waters in the most downstream sections of each major watershed. In addition, the reports assess the quality of the biological resource and provide a reliable indicator of potential areas of concern and/or areas where additional information is needed to accurately assess watershed dynamics.

HISTORY

As a brief history, the NSSP developed from public health principles and program controls formulated at the original conference on shellfish sanitation called by the Surgeon General of the United States Public Health Service in 1925. This conference was called after oysters were implicated in causing over 1500 cases of typhoid fever and 150 deaths in 1924. The tripartite cooperative program (federal, state and shellfish industry) has updated the program procedures and guidelines through workshops held periodically until 1977. Because of concern by many states that the NSSP guidelines were not being enforced uniformly, a delegation of state shellfish officials from 22 states met in 1982 in Annapolis, Maryland, and formed the ISSC. The first annual meeting was held in 1983 and continues to meet annually at various locations throughout the United States.

The NSSP *Guide for the Control of Molluscan Shellfish* sets forth the principles and requirements for the sanitary control of shellfish produced and shipped in interstate commerce in the United States. It provides the basis used by the Federal Food and Drug Administration (FDA) in evaluating state shellfish sanitation programs. The five major points on which the state is evaluated by the FDA include:

1. The classification of all actual and potential shellfish growing areas as to their suitability for shellfish harvesting.
2. The control of the harvesting of shellfish from areas that are classified as restricted, prohibited or otherwise closed.
3. The regulation and supervision of shellfish resource recovery programs.
4. The ability to restrict the harvest of shellfish from areas in a public health emergency, and
5. Prevention of the sale, shipment or possession of shellfish that cannot be identified as being produced in accordance with the NSSP and have the ability to condemn, seize or embargo such shellfish.

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 Marine Water Monitoring (BMWM), under the authority of N.J.S.A. 58:24, classifies the shellfish growing waters and administers the special resource recovery programs. Regulations delineating the growing areas are promulgated at N.J.A.C. 7:12 and are revised annually. Special Permit rules are also found at N.J.A.C. 7:12 and are revised as necessary.

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 BMWM, administers 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 certifications 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.

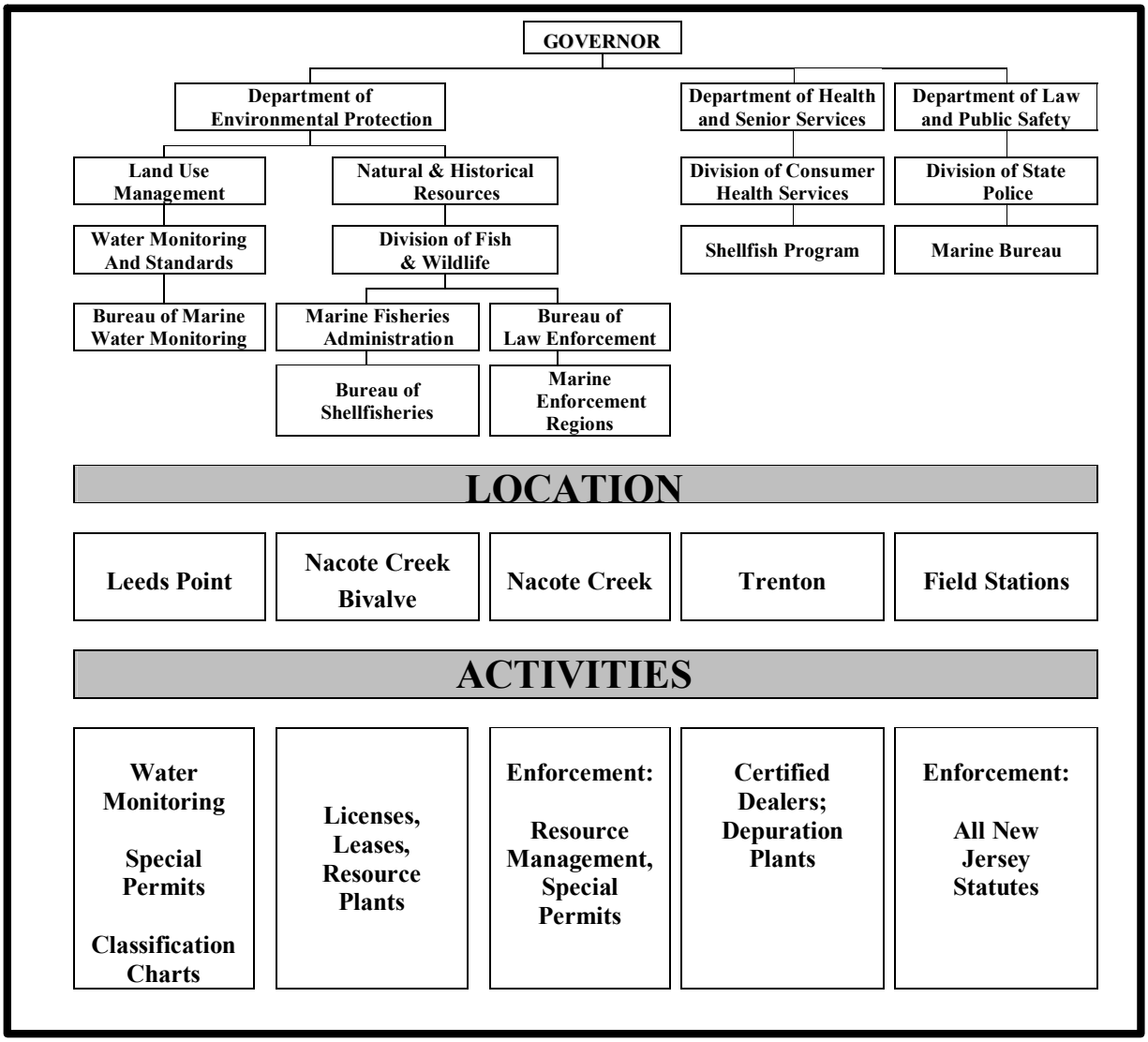

FIGURE 1: STATE OF NEW JERSEY SHELLFISH AGENCIES

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 three year reappraisal. Additionally, a partial shoreline survey was completed for the purpose of downgrading and reclassifying a portion of the shellfish growing waters of Shellfish Growing Area AO South: The Atlantic Ocean from Cape May Point to Absecon Inlet.

GROWING AREA PROFILE

LOCATION AND DESCRIPTION

Shellfish Growing Area AO South is located in the southeastern part of New Jersey, from Cape May Point in Cape May County, north to Absecon Inlet in Atlantic County (see Figures 2 and 3). This shellfish growing area includes approximately 46 miles of coastline from Cape May Point in the south to Absecon Inlet in the north, and offshore to the three mile jurisdictional limit (the word "miles" in this report refers to "nautical miles", and is equal to 6,076 feet). The primary classification of this shellfish growing area is *Approved* or *Prohibited,* and the approximate size of this shellfish growing area is 93,373 acres. This shellfish growing area has 82,550 acres of *Approved* shellfish waters, and 10,823 acres of *Prohibited* shellfish waters. The *Prohibited* classification applies to the shellfish growing waters located around the four wastewater discharge pipes connected to the six wastewater treatment facilities in this area, and the shellfish growing waters located off the beaches near the storm water outfalls.

The *Approved* classification applies to the rest of the ocean waters located in this shellfish growing area. The ocean waters of this shellfish growing area are bordered on the west by Atlantic City, Ventnor, Margate, Longport, Ocean City, Strathmere (Upper Township), Sea Isle City, Avalon, Stone Harbor, North Wildwood, Wildwood, Wildwood Crest, Lower Township, Cape May City, and Cape May Point. The locations of the adjacent municipalities are shown in Figures 2 and 3, and the population statistics for the adjacent municipalities are shown in Table 1.

Absecon Inlet, Great Egg Harbor Inlet, Corsons Inlet, Townsends Inlet, Hereford Inlet, and Cape May Inlet drain into this shellfish growing area (see Figures 4, 5, 6, 7, and 8). This area can be found on Charts 7, 8, and 9 of the "2004 State of New Jersey – Shellfish Growing Water Classification Charts". Figures 9 and 10 show the current classification of this shellfish growing area.

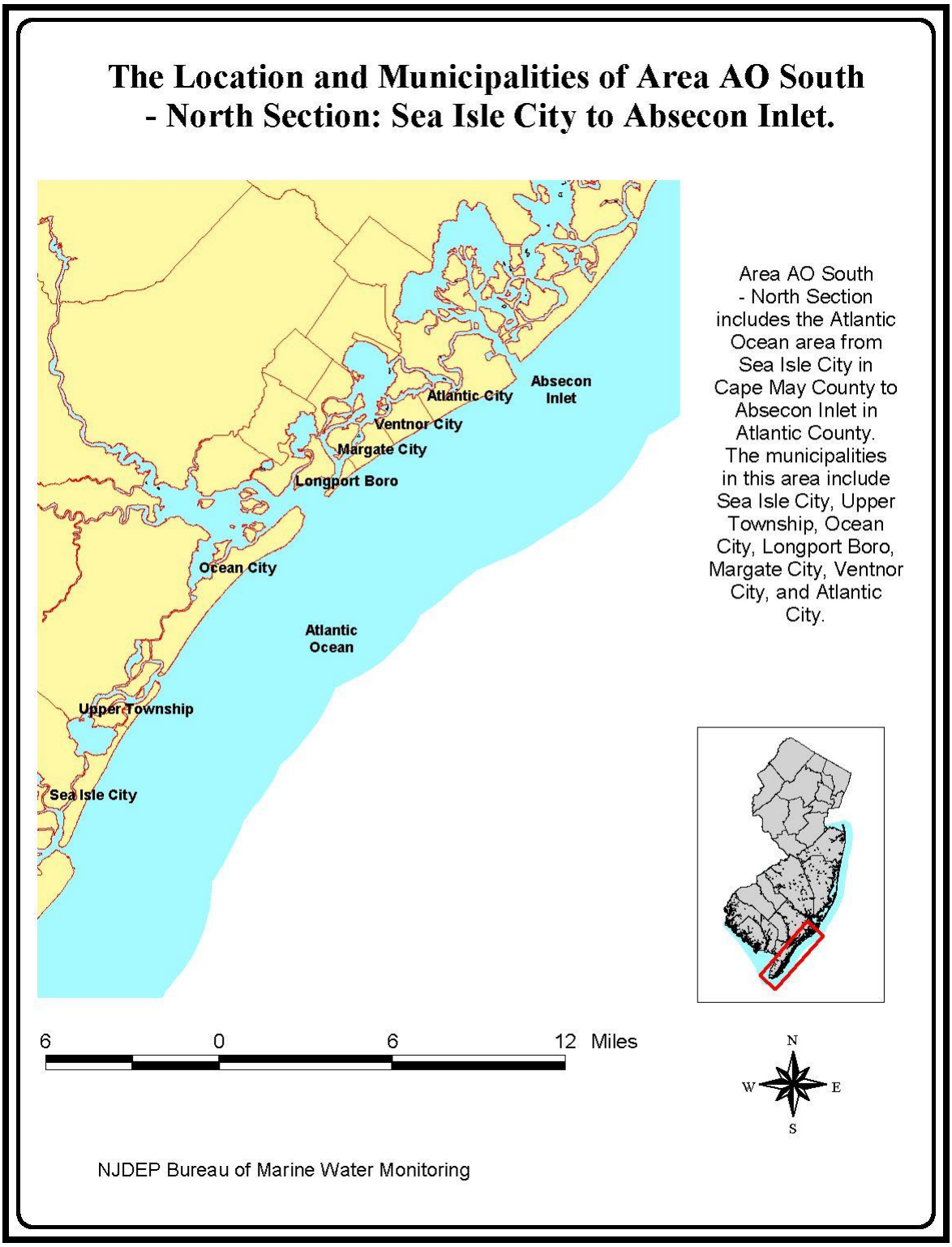

FIGURE 2: LOCATION AND MUNICIPALITIES ADJACENT TO SHELLFISH GROWING AREA AO SOUTH - NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

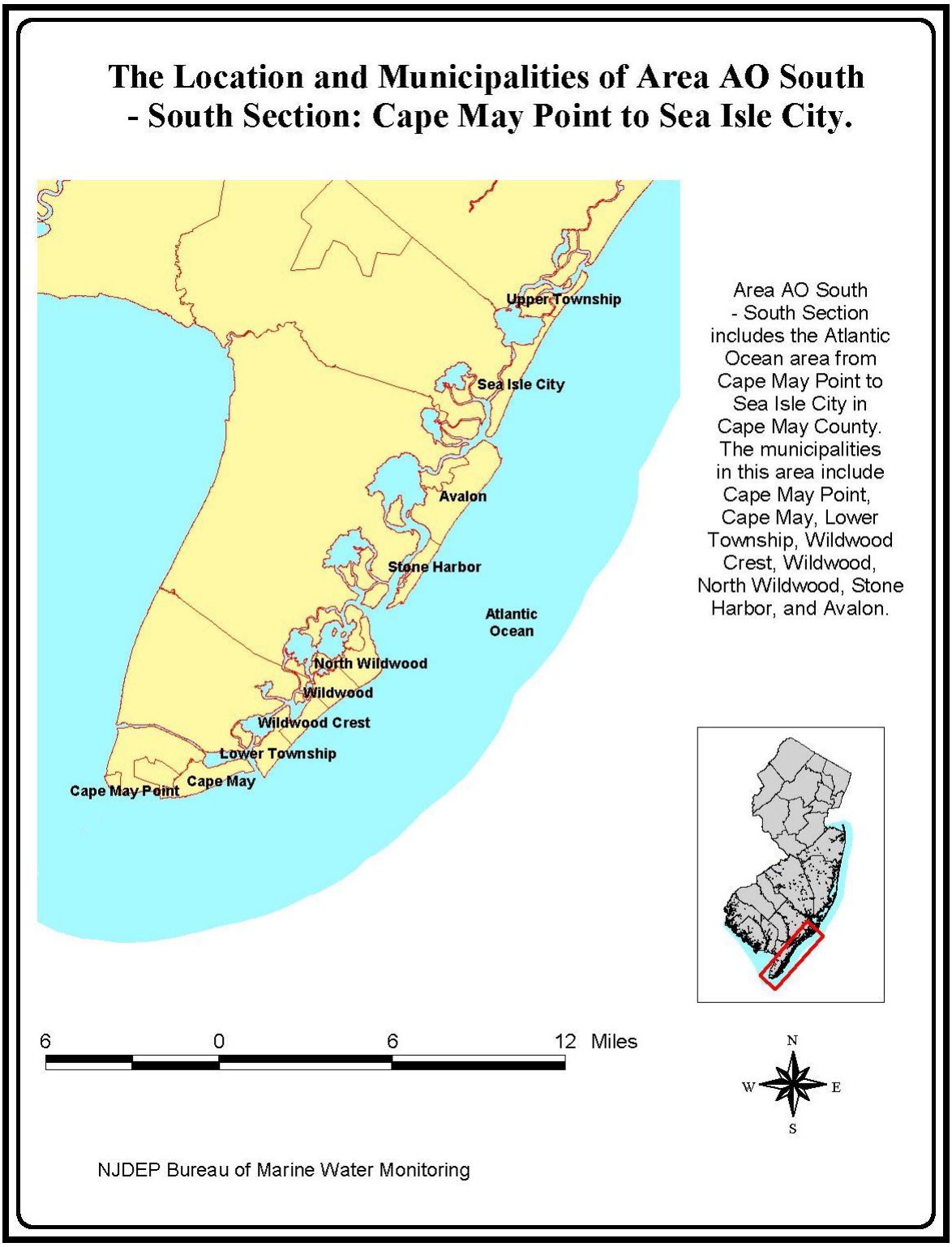

FIGURE 3: LOCATION AND MUNICIPALITIES ADJACENT TO SHELLFISH GROWING AREA AO SOUTH - SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

TABLE 1: POPULATION INFORMATION FOR MUNICIPALITIES ADJACENT TO SHELLFISH GROWING AREA AO SOUTH: CAPE MAY POINT TO ABSECON INLET.

Community	Area (sq. mi.)	Population		Population Change 1990 to 2000		Population Density	
		2000	1990	Number	Percent	2000	1990
Atlantic City	15.73 sq.mi.	40,517	37,986	2,531	6.7%	2,576	2,415
Ventnor City	2.53 sq.mi.	12,910	11,005	1,905	17.3%	5,103	4,350
Margate City	1.63 sq. mi.	8,193	8,431	-238	-2.8%	5,026	5,172
Longport Boro	0.57 sq.mi.	1,054	1,224	-170	-13.9%	1,849	2,147
Ocean City	11.41 sq.mi.	15,378	15,512	-134	-0.9%	1,348	1,359
Upper Township	68.48 sq.mi.	12,115	10,681	1,434	13.4%	177	156
Sea Isle City	2.59 sq.mi.	2,835	2,692	143	5.3%	1,095	1,039
Avalon	4.90 sq.mi.	2,143	1,809	334	18.5%	437	369
Stone Harbor	2.15 sq.mi.	1,128	1,025	103	10.0%	525	477
North Wildwood	2.43 sq.mi.	4,935	5,017	-82	-1.6%	2,031	2,065
Wildwood	1.43 sq.mi.	5,436	4,484	952	21.2%	3,801	3,136
Wildwood Crest	1.43 sq.mi.	3,980	3,631	349	9.6%	2,783	2,539
Lower Township	31.21 sq.mi.	22,945	20,820	2,125	10.2%	735	667
Cape May City	2.61 sq.mi.	4,034	4,668	-634	-13.6%	1,546	1,788
Cape May Point Boro	0.328 sq.mi.	241	248	-7	-2.8%	735	756

FIGURE 4: LOCATION OF GREAT EGG HARBOR INLET.

FIGURE 5: LOCATION OF CORSONS INLET.

FIGURE 6: LOCATION OF TOWNSENDS INLET.

FIGURE 7: LOCATION OF HEREFORD INLET.

FIGURE 8: LOCATION OF CAPE MAY INLET.

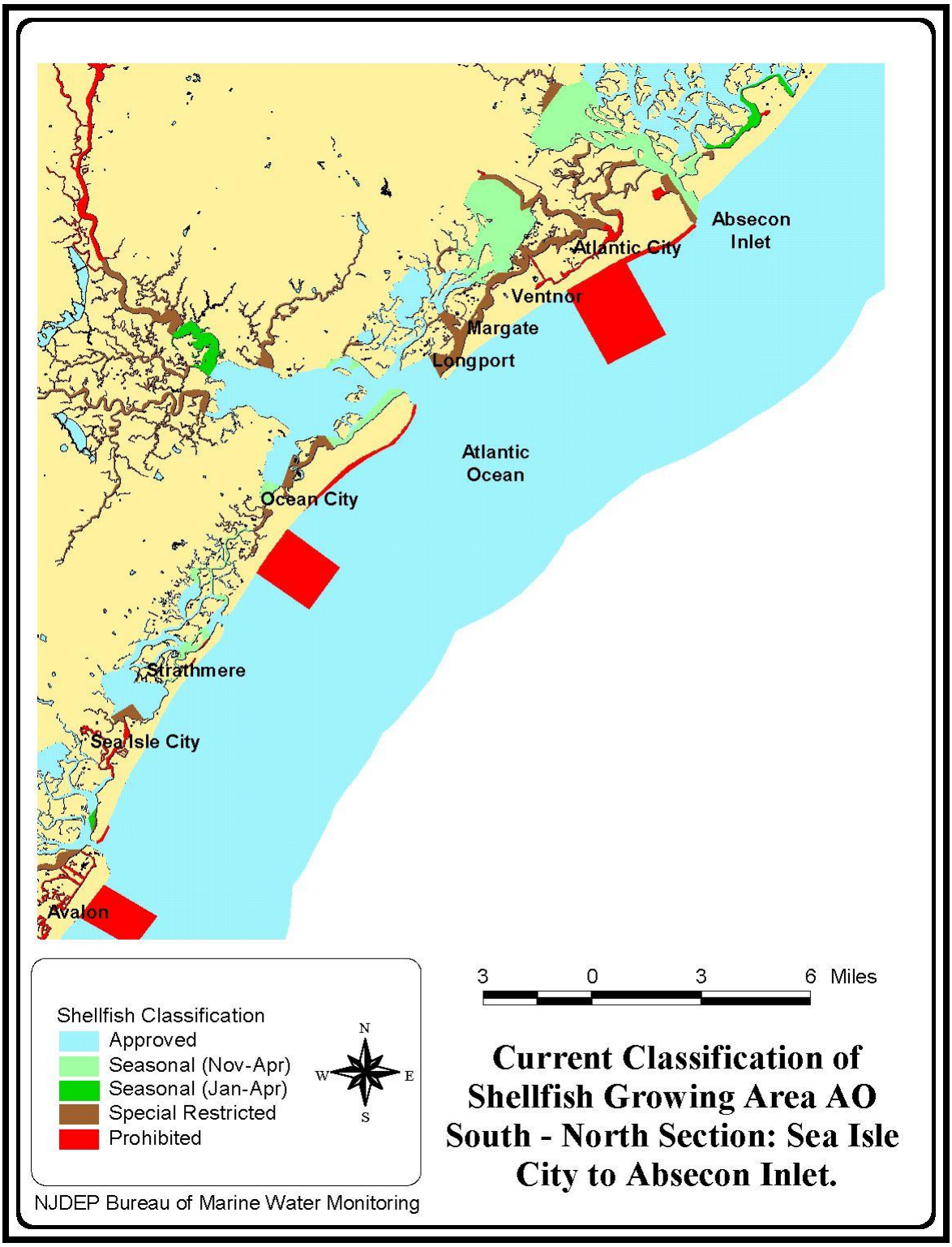

FIGURE 9: CURRENT CLASSIFICATION OF SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

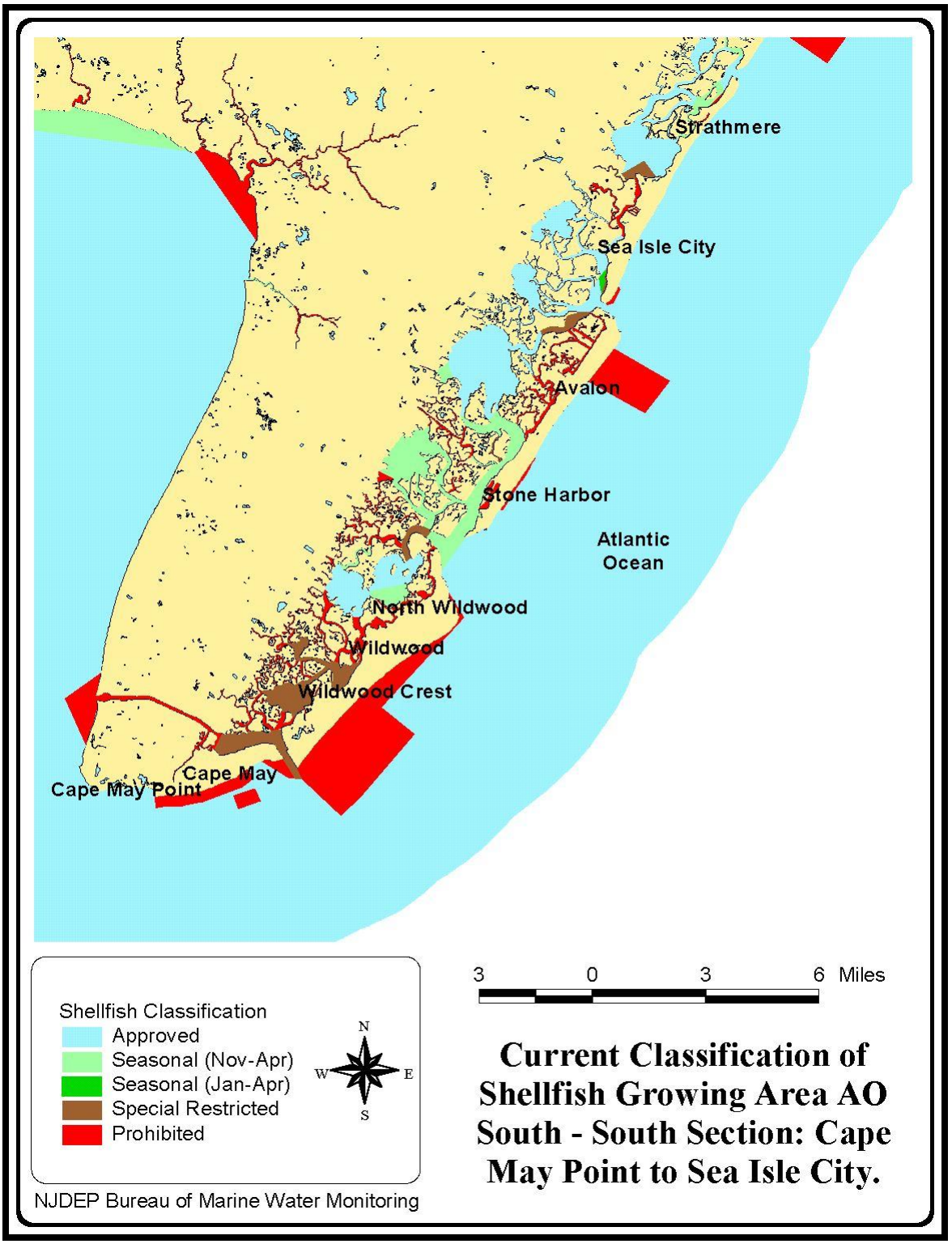

FIGURE 10: CURRENT CLASSIFICATION OF SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

HISTORY OF GROWING AREA CLASSIFICATION

In 1999, New Jersey harvested 76,789,849 pounds of shellfish meat, with an exvessel value of $61,136,981. For New Jersey, the 2000 shellfish landings total were 84,723,999 pounds of shellfish meat for an exvessel value of $75,087,167, the 2001 shellfish landings total were 88,611,198 pounds of shellfish meat for an exvessel value of $83,523,782, and the 2002 shellfish landings total were 90,768,652 pounds of shellfish meat for an exvessel value of $88,136,826. These shellfish species include blue crabs (*Callinectes sapidus*), blue crabs – peelers, hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), mussels (Family: Mytilidae), bay scallops (*Aequipecten irradians*), oysters (*Crassostrea virginica*), ocean quahogs (*Arctica islandica*), surf clams (*Spisula solidissima*), and sea scallops (*Placopecten magellanicus*) (NMFS, 2004, NJDEP, 2003, Morris, 1975, Gosner, 1978). Surf clams (*Spisula solidissima*), ocean quahogs (*Arctica islandica*), and hard clams (*Mercenaria mercenaria)* are the primary shellfish resource that is commercially harvested in this ocean shellfish growing area. Table 2 shows the 1999 to 2002 Shellfish Landings for surf clams, ocean quahogs, and hard clams (NJDEP, 2004).

TABLE 2: 1999 TO 2002 SHELLFISH LANDINGS FOR SURF CLAMS, OCEAN QUAHOGS, AND HARD CLAMS (NJDEP, 2004).

SHELLFISH LANDINGS FOR 1999 TO 2002						
	SURF CLAMS		OCEAN QUAHOGS		HARD CLAMS	
Year	**POUNDS OF MEAT (millions)**	**VALUE (exvessel)**	**POUNDS OF MEAT (millions)**	**VALUE (exvessel)**	**POUNDS OF MEAT (millions)**	**VALUE (exvessel)**
1999	49,317,308	$25,382,162	16,814,590	$7,163,664	1,880,327	$7,363,453
2000	58,047,629	$31,371,354	14,810,080	$6,394,288	1,622,221	$6,757,227
2001	52,872,341	$29,326,676	21,027,780	$11,865,975	1,357,128	$5,636,397
2002	53,614,421	$29,184,923	20,358,290	$10,631,701	1,542,445	$6,402,616

The waters of this shellfish growing area are primarily classified as *Approved* and *Prohibited* (see page 6 for description of shellfish classification of this area). The *Prohibited* shellfish classification also applies to the ocean waters immediately off the coast of Atlantic City, the north coast of Ocean City, the southern tip of Sea Isle City, the north coast of Stone Harbor, the entire coast of North Wildwood, Wildwood, and Wildwood Crest, and the City of Cape May (see Figures 9 and 10). These areas are classified as *Prohibited* because they have many storm water outfalls located on their coastal beaches (see Figures 31 and 32). A small rectangle of *Prohibited* waters is also located off the coast of the City of Cape May in the 'Cold Spring Inlet Hopper and Bucket Dredge Disposal Area'. This area is used to dispose of the dredge spoils related to beach replenishment. Since these dredge spoils could contain shellfish that are not from *Approved* waters, this area is classified as a Prohibited buffer zone to prevent the harvesting of these shellfish.

A Reappraisal of the Atlantic Ocean from Cape May Point to Absecon Inlet was written in April 2002 and included water quality data from 1996 to 2001 (Wesighan, 2002). In this report, all of the sampling stations in this shellfish growing area met the existing shellfish classification criteria as specified by the NSSP, and no classification change was recommended for this area.

A Sanitary Survey for the Atlantic Ocean, Peck Beach to Brigantine, was written in April 2000 and included water quality data from 1995 to 1999 (Peters, 2000). In this report, all of the sampling stations in this shellfish growing area met the existing shellfish classification criteria, and 1,264 acres of *Prohibited* waters around the Atlantic County Utilities Authority – Wastewater Treatment Facility discharge pipe were upgraded to the *Approved* classification. Sampling Stations **B76A Surface** and **B76B Surface** were also added to the *Prohibited* waters surrounding the Atlantic County Utilities Authority discharge pipe for additional monitoring of the water quality of these shellfish waters.

In the 1997 Sanitary Survey of Shellfish Growing Area 42, Stone Harbor to Sea Isle City, 2,148 acres of *Prohibited* waters surrounding the Cape May County Utilities Authority – Seven Mile/ Middle Region Wastewater Treatment Facility discharge pipe were upgraded to *Approved* waters due to a lengthy history of acceptable water quality and the wastewater treatment facility operating in an efficient and reliable manner (Suoninen, 1997).

In the 1997 Sanitary Survey of Shellfish Growing Area 43, Sea Isle City to Peck Beach, 1,460 acres of *Prohibited* waters surrounding the Cape May County Utilities Authority – Ocean City Region Wastewater Treatment Facility discharge pipe were upgraded to *Approved* waters due to a lengthy history of acceptable water quality and the wastewater treatment facility operating in an efficient and reliable manner (Suoninen, 1997). The last Sanitary Survey for Shellfish Growing Areas AO1: the Atlantic Ocean from Cape May Point to Stone Harbor was written in 1997.

In the 2003 Annual Review of Shellfish Growing Area AO South, Sampling Station **AX75A1** Surface exceeded the *Approved* fecal coliform criteria, year-round and in the summer. Since this sampling station is located in *Approved* shellfish waters northeast of *Prohibited* shellfish waters off the north coast of Atlantic City, the shellfish waters of this sampling station were downgraded to the *Prohibited* shellfish classification in 2005 (NJDEP, 2003).

METHODS

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

Approximately 1,553 water samples were collected for total and fecal coliform bacteria between 1999 and 2003 and analyzed by the three-tube MPN method until 2000, according to APHA (1970). After 2000, the water samples were analyzed using the 12-tube method, because the ocean areas show very little variability in the data, with many results being below the detection level, and the 12-tube method gives a lower detection limit than the 3-tube method. Figures 35 and 36 show the shellfish growing water quality monitoring stations in this area.

Approximately 62 ocean surface stations and 22 ocean bottom stations are monitored during each year in Shellfish Growing Area AO South. Water quality sampling, shoreline and watershed surveys are conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish,* 1999 Revision (USPHS, 1999 Revision).

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

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,* 1999 Revision (USPHS, 1999 Revision).

SAMPLING STRATEGY

The State Shellfish Control Authority has the option of choosing one of two water monitoring sampling strategies for each growing area.

The Adverse Pollution Condition (APC) strategy requires that a minimum of five samples be collected each year under conditions that have historically resulted in elevated coliforms in the particular

growing area. The results must be evaluated by adding the individual station sample results to the preexisting bacteriological sampling results to constitute a data set of at least 15 samples for each station. The adverse pollution conditions usually are related to tide, and rainfall, but could be from a point source of pollution or variation could occur during a specific time of the year (Connell, 1991).
The Systematic Random Sampling (SRS) strategy requires that a random sampling plan be in place before field sampling begins. This strategy can only be used in areas that are not affected by point sources of contamination. A minimum of six samples per station are to be collected each year and added to the database to obtain a sample size of 30 for statistical analysis.

The Atlantic Ocean from Cape May Point to Absecon Inlet is sampled using the Adverse Pollution Condition strategy year-round for all sampling stations in this area (Assignments 401, 421, 431, and 441). The Adverse Pollution Condition is the four direct point source discharges from the wastewater treatment facility discharge pipes that drain into this shellfish growing area.

NSSP CRITERIA

Each shellfish producing state is directed to adopt either the total coliform criterion, or the fecal coliform criterion. For ocean shellfish waters, New Jersey has and continues to base growing water classifications on the fecal 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 as the percentage that exceeds the variability criteria (see Table 3). For the Systematic Random Sampling Strategy, variability is expressed as the 90^{th} percentile (see Table 4).

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 3: CRITERIA FOR ADVERSE POLLUTION CONDITION SAMPLING STRATEGY (3-TUBE DECIMAL DILUTION TEST).

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

TABLE 4: CRITERIA FOR SYSTEMATIC RANDOM SAMPLING STRATEGY (3-TUBE DECIMAL DILUTION TEST).

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

TABLE 5: CRITERIA FOR ADVERSE POLLUTION CONDITION SAMPLING STRATEGY (12-TUBE SINGLE DILUTION TEST).

	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric mean (MPN/100 mL)	**No more than 10% of sample can exceed (MPN/100 mL)**	**Geometric mean (MPN/100 mL)**	**No more than 10% of sample can exceed (MPN/100 mL)**
Approved Water Classification	70	140	14	28

SHORELINE SURVEY

CHANGES SINCE LAST SURVEY

The partial shoreline survey for Shellfish Growing Area AO South was done on July 22, 2004. There have been minor changes to this area since the 2002 Reappraisal of Shellfish Growing Area AO South - the Atlantic Ocean from Cape May Point to Absecon Inlet. The construction of storm water outfall pipes is being done on the Atlantic City Beach, west of the end of Illinois Avenue.

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 Figures 11 and 12). The developed urban areas are located on the barrier islands along the coast, and include Atlantic City, Ventnor, Margate, Longport, Ocean City, Strathmere, Sea Isle City, Avalon, Stone Harbor, North Wildwood, Wildwood, and Wildwood Crest. Cape May and Cape May Point are also urban areas, and are located in an area that could be considered a barrier island (the Cape May Canal separates these municipalities from the mainland, and creates a barrier island that extends from the Atlantic Ocean into the Delaware Bay). These urban areas also have recreational bathing beaches bordering this shellfish growing area.

Atlantic City, in the north section of this shellfish growing area, is a major urban area with a large resident population. Almost all of Atlantic City has been heavily developed, with a very high population density. The urban area of Atlantic City also extends into Ventnor, Margate, and Longport. The presence of the multi-million dollar casino and entertainment industry has been directly responsible for the expanding urban development to the Atlantic City area, and this area is reaching saturation levels of urban land use.

The remaining communities along the New Jersey coast are known for their recreational bathing beaches, the summer tourism industry, and the seasonal boating and fishing activities. These areas are more urban-residential communities, with some commercial businesses. The populations in these areas fluctuate greatly, especially during the summer months. Population pressures during the summer months can have an impact on the water quality of the coastal waters in this shellfish growing area. However, since surf clams are only harvested during the winter months, these summer activities would not have a significant impact to the water quality of this shellfish growing area.

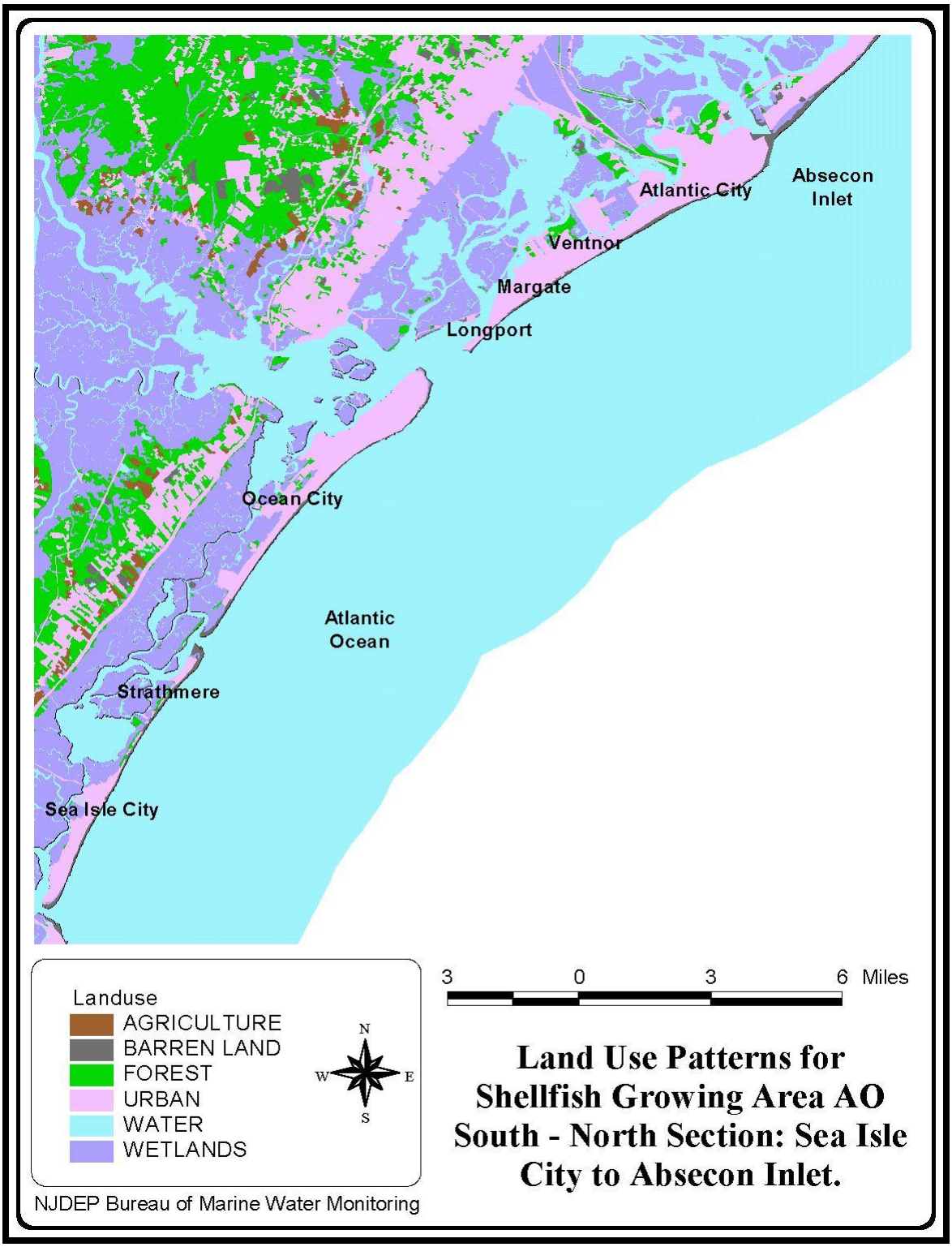

FIGURE 11: LAND USE PATTERNS FOR SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

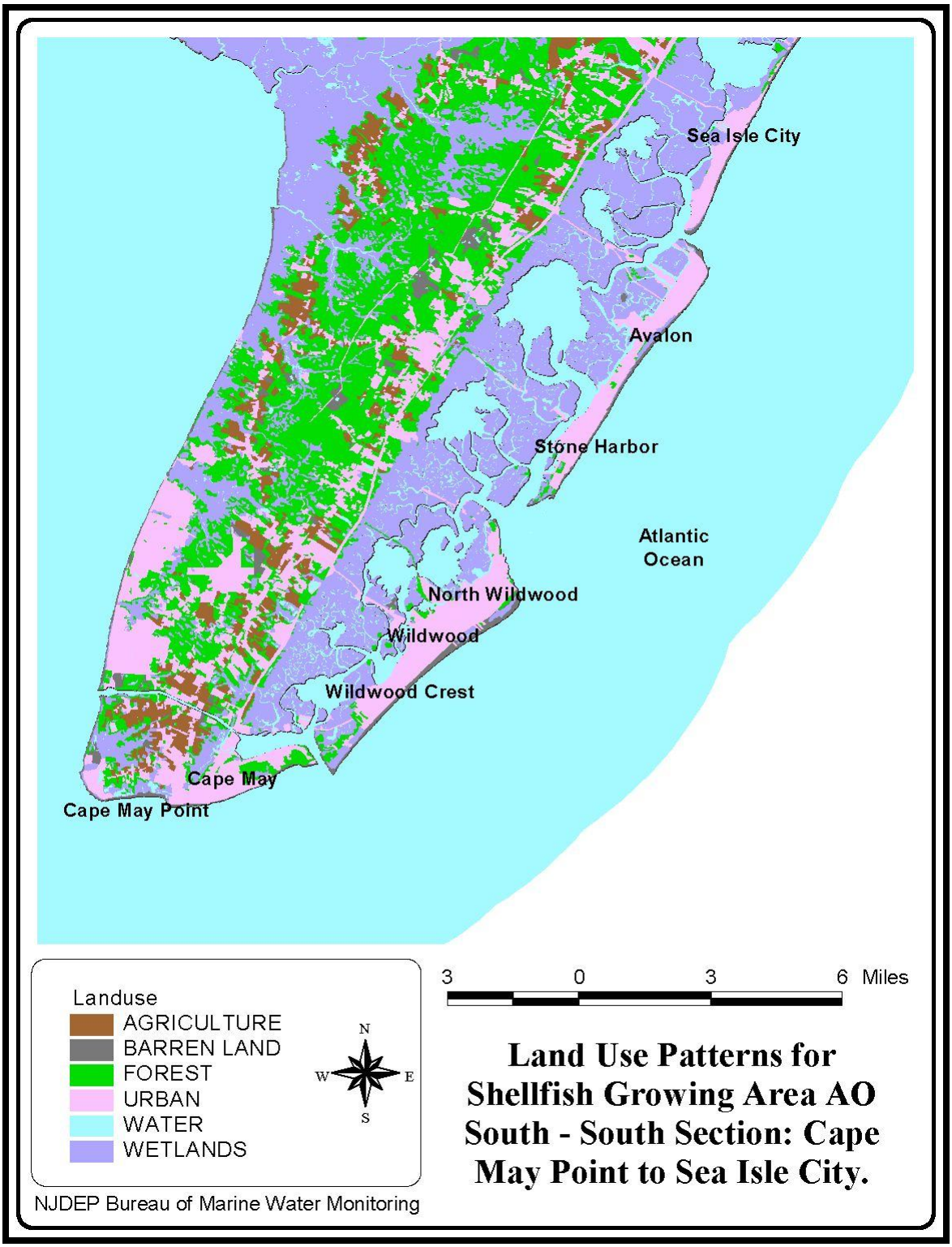

FIGURE 12: LAND USE PATTERNS FOR SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

EVALUATION OF BIOLOGICAL RESOURCES

This growing area has a wide diversity of biological resources. As stated previously, the major shellfish species harvested in this shellfish growing area include hard clams (*Mercenaria mercenaria*), surf clams (*Spisula solidissima*), ocean quahogs (*Arctica islandica*), and sea scallops (*Placopecten magellanicus*), The species of ocean shellfish found in this shellfish growing area also supports a large local shellfish processing industry, and this shellfish processing industry produces products that are consumed nation –wide (Flimlin and Tweed, 2000).

This shellfish growing area is also utilized for fishing and boating. Many species of finfish can be found in the ocean waters of this shellfish growing area. The important finfish species caught by marine recreational anglers are bluefin, yellowfin, and bigeye tuna; white and blue marlin; winter and summer flounder (fluke); striped bass; bluefish; sharks; little tunny; Atlantic bonito; black sea bass; tautog (blackfish); mackerel; gray sea trout (weakfish) and cod (Weinstein, 2001). In 1991, the striped bass 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).

Wildlife populations of birds and animals could have an impact on the water quality of this shellfish growing area. However, they are not known to be actual contributors to the water quality in the Atlantic Ocean from Cape May Point to Absecon Inlet. Birds sometimes may accumulate around the groins, jetties, seawalls, and bulkheads on the coast of this ocean shellfish growing area, and fecal matter from these birds could affect the water quality. The shore structures and shore types for this area are shown in Figures 13 and 14.

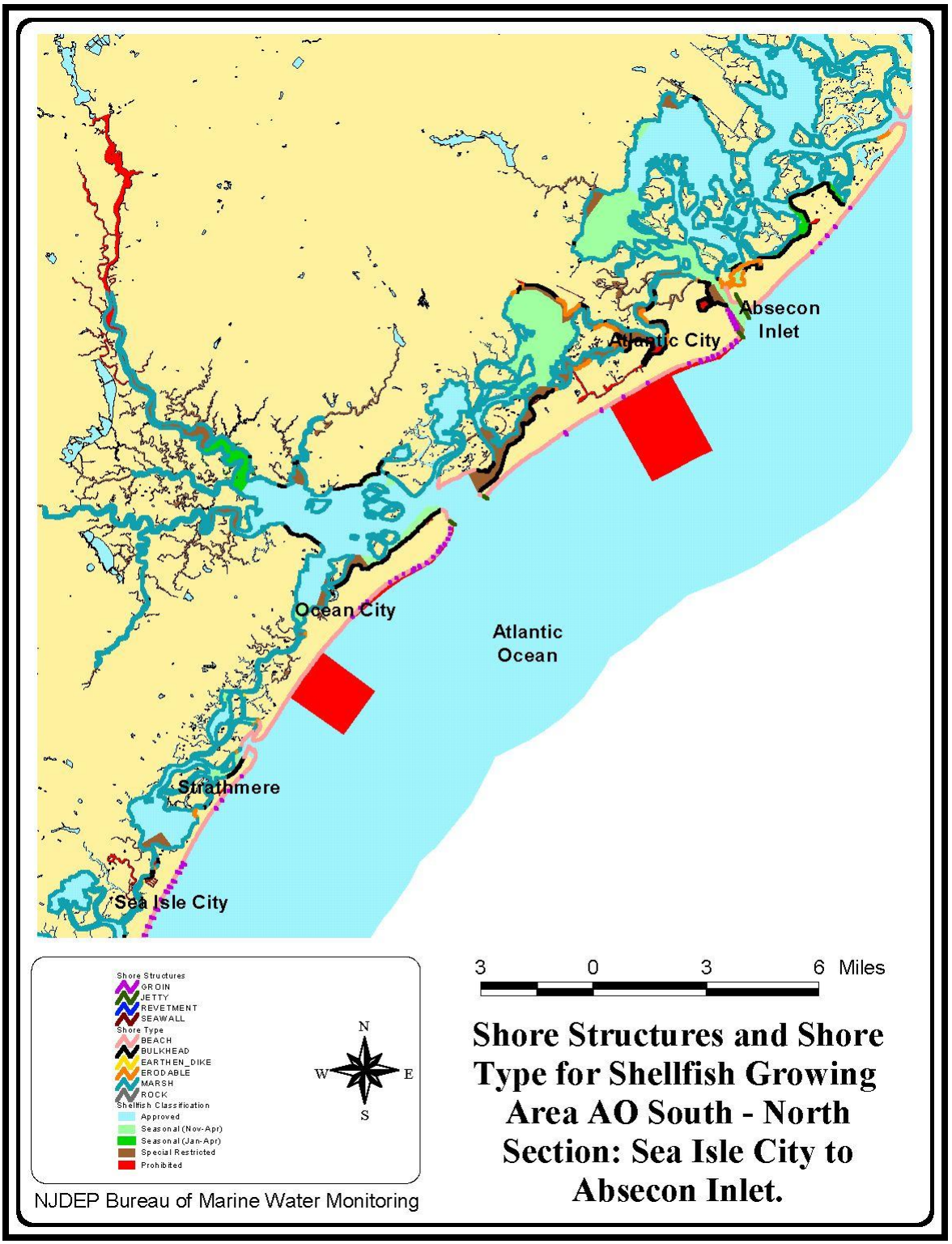

FIGURE 13: SHORE STRUCTURES AND SHORE TYPE IN SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

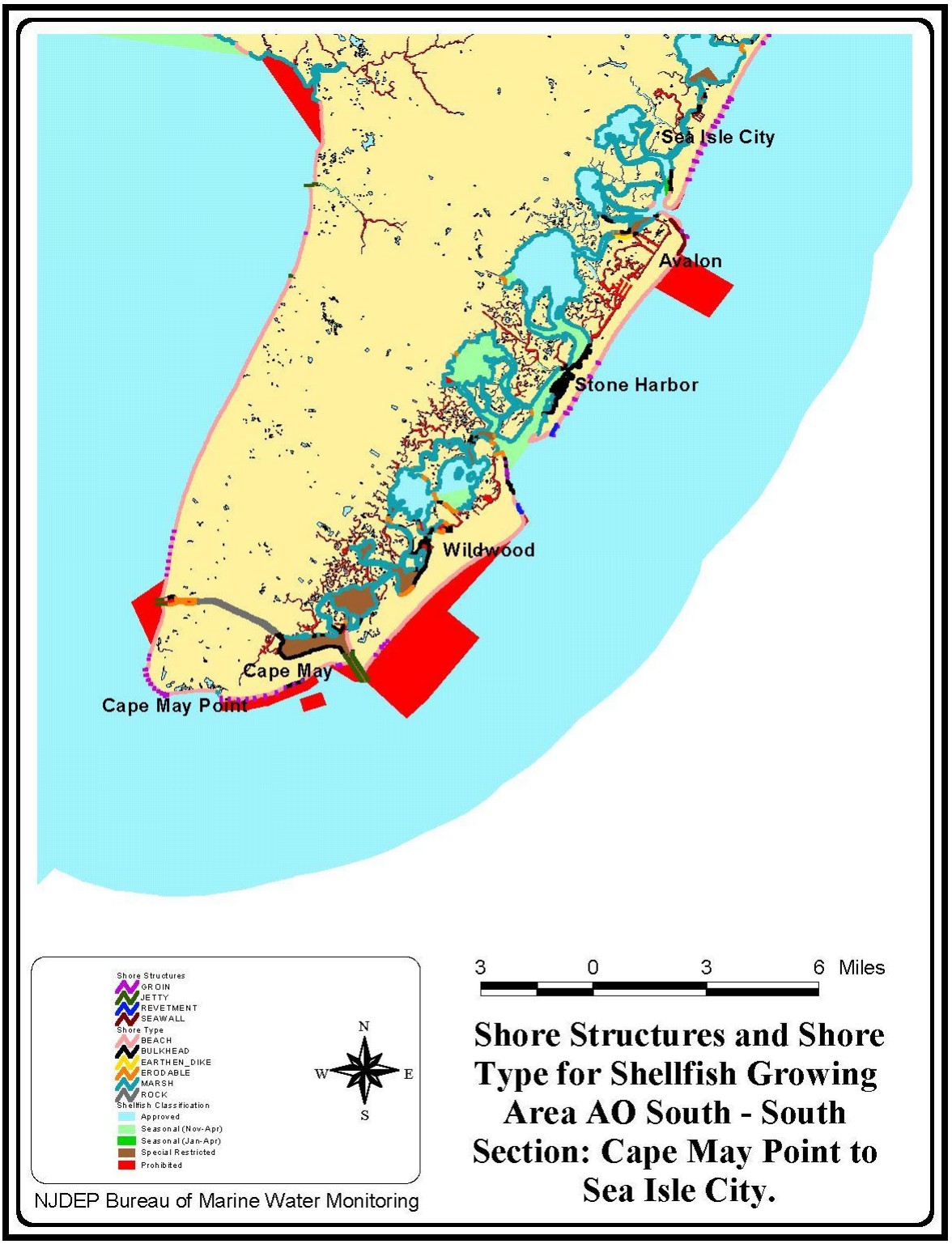

FIGURE 14: SHORE STRUCTURES AND SHORE TYPE IN SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

IDENTIFICATION AND EVALUATION OF SOURCES

There are four permitted municipal point source discharges in Area AO South (Cape May Point to Absecon Inlet) and they are: 1) the Atlantic County Utilities Authority – Wastewater Treatment Facility Discharge Pipe, 2) the Cape May County Utilities Authority – Ocean City Region Wastewater Treatment Facility Discharge Pipe, 3) the Cape May County Utilities Authority – Seven Mile/ Middle Region Wastewater Treatment Facility Discharge Pipe, and 4) the Cape May County Municipal Authority – Wildwood Lower Regional Wastewater Treatment Facility Discharge Pipe, which includes the discharges from the Cape May County Utilities Authority – Cape May Regional Wastewater Treatment Facility and the discharges from the Lower Township Municipal Utilities Authority – Wastewater Treatment Facility (see Table 6 and Figures 15, and 16).

There are several indirect ground water discharges, known contaminated sites, and solid waste landfills located in this shellfish growing area (see Figures 25, 26, 27, 28, 29, and 30). However, there is no evidence that they currently impact the shellfish growing water quality (APHA, 1995).

WASTEWATER TREATMENT FACILITIES

The Atlantic County Utilities Authority – Wastewater Treatment Facility uses an activated sludge system to provide secondary treatment to effluent, and the wastewater discharge pipe extends approximately 8,700 feet offshore of Raleigh Avenue in Atlantic City. The Cape May County Utilities Authority – Ocean City Region Wastewater Treatment Facility uses rotating biological contactors to provide secondary treatment to effluent, and the discharge pipe extends approximately 6,081 feet offshore of 46th Street in Ocean City.

The Cape May County Utilities Authority - Seven Mile/ Middle Region Wastewater Treatment Facility also uses rotating biological contactors for secondary treatment of effluent, and the discharge pipe extends approximately one mile offshore of Avalon. The Cape May County Municipal Authority – Wildwood Lower Regional Wastewater Treatment Facility also uses rotating biological contactors to treat effluent. The Cape May County Utilities Authority – Cape May Regional Wastewater Treatment Facility uses rotating biological contactors to provide secondary treatment to effluent, and the Lower Township Municipal Utilities Authority - Wastewater Treatment Facility uses an activated sludge system to provide secondary treatment to effluent. All three of these wastewater treatment facilities share the same discharge pipe and the discharge pipe extends approximately 5,500 feet offshore of Jefferson Avenue in Wildwood Crest. This discharge pipe is

42 inches in diameter and becomes a 30 inch straight diffuser for the last 1040 feet (the last 1040 feet of the discharge pipe has 104 ports).

TABLE 6: DIRECT WASTEWATER DISCHARGES TO SHELLFISH GROWING AREA AO SOUTH: CAPE MAY POINT TO ABSECON INLET.

Map Key	Discharge	Waste Type	Waste Quantity (MGD)
1	Atlantic County Utilities Authority – Wastewater Treatment Facility	Residential Wastewater	40.0
2	Cape May County Utilities Authority – Ocean City Region Wastewater Treatment Facility	Residential Wastewater	8.2
3	Cape May County Utilities Authority – Seven Mile/ Middle Region Wastewater Treatment Facility	Residential Wastewater	7.67
4	Cape May County Municipal Authority – Wildwood Lower Regional Wastewater Treatment Facility, including the flows from:	Residential Wastewater	14.18
	Cape May County Utilities Authority – Cape May Regional Wastewater Treatment Facility	Residential Wastewater	3.0
	Lower Township Municipal Utilities Authority – Wastewater Treatment Facility	Residential Wastewater	4.0

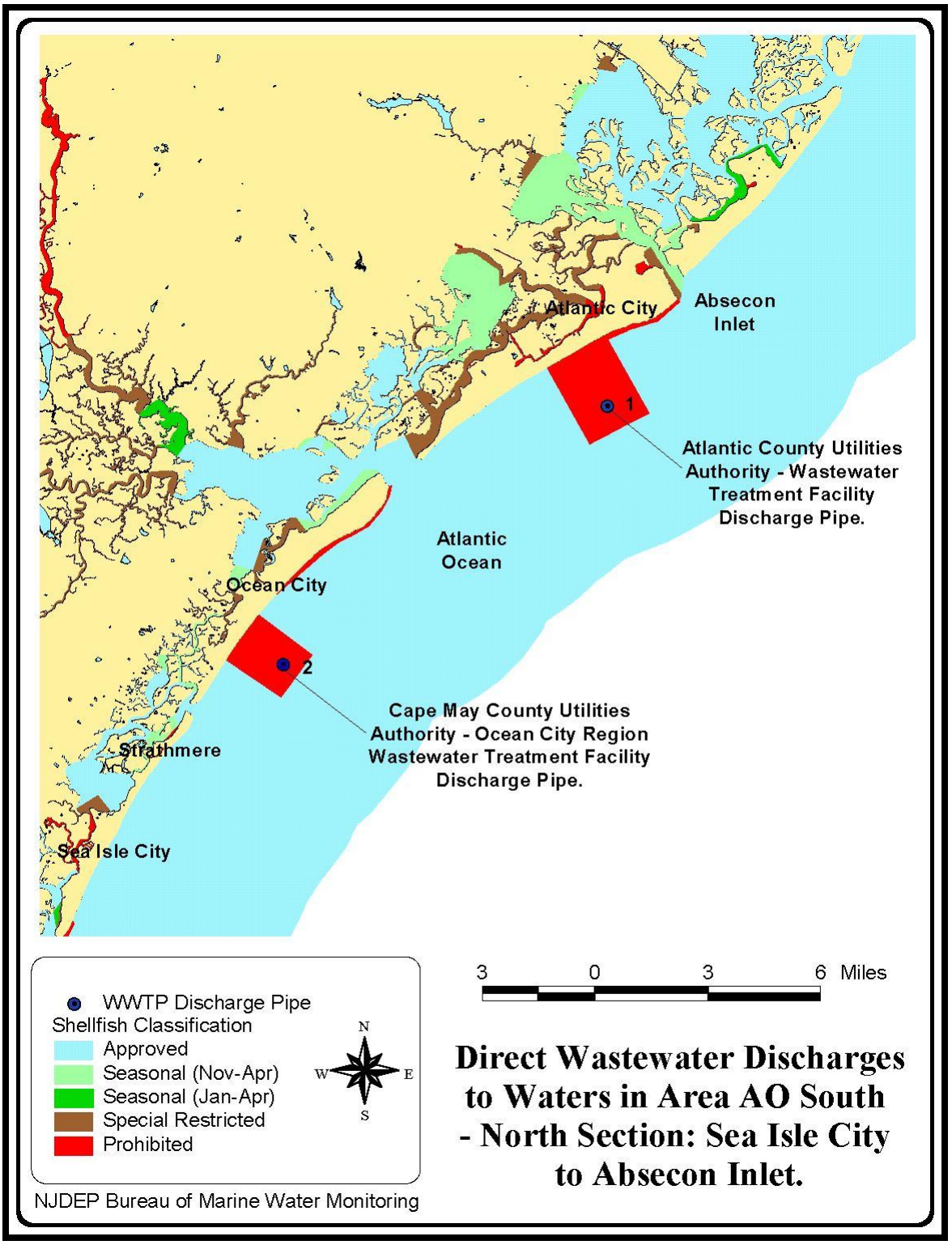

FIGURE 15: DIRECT WASTEWATER DISCHARGES TO WATERS IN SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

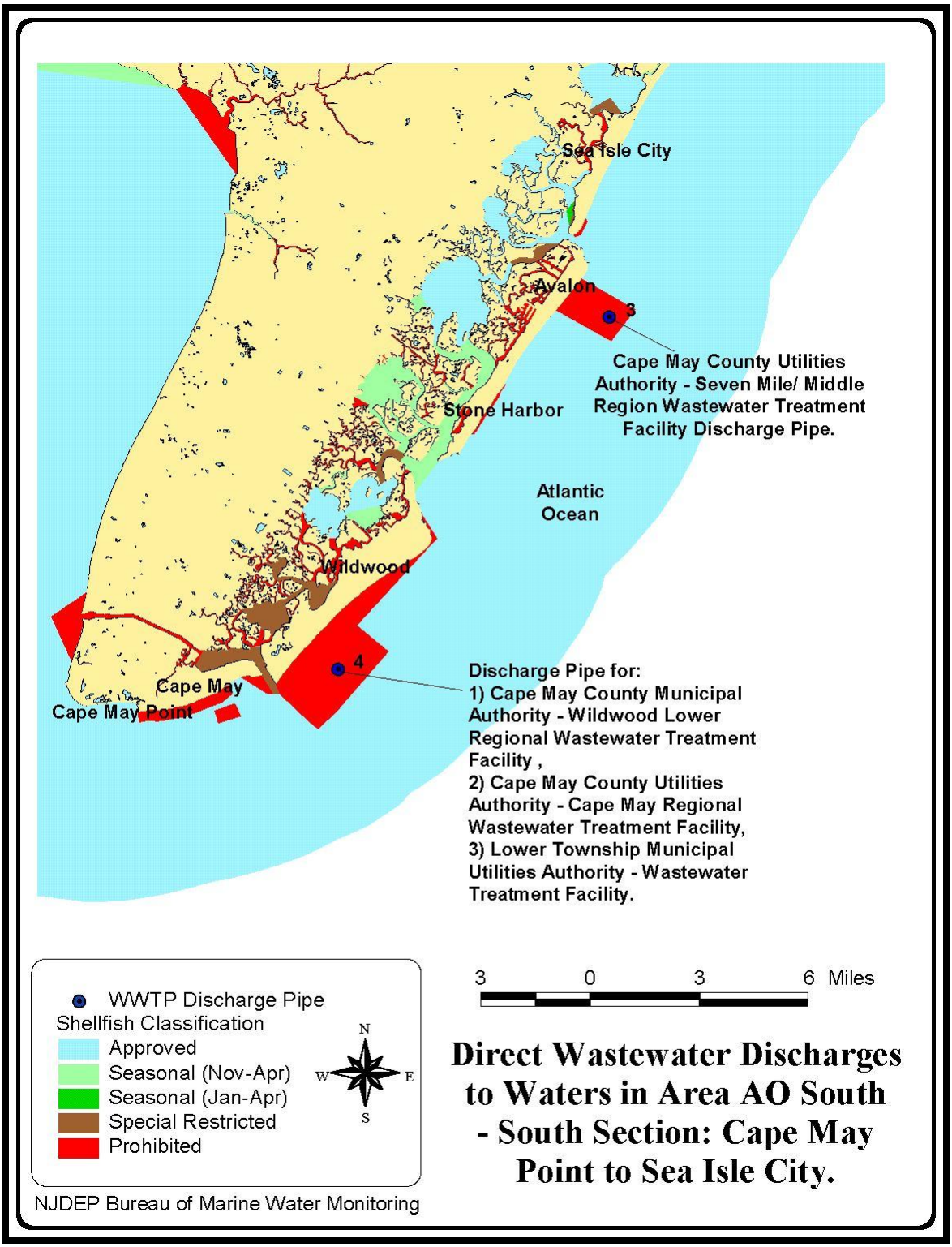

FIGURE 16: DIRECT WASTEWATER DISCHARGES TO WATERS IN SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

Atlantic County Utilities Authority – Wastewater Treatment Facility

This facility is located at 1701 Absecon Boulevard in Atlantic City (see Figure 17). The facility came online on September 18, 1978, and utilizes an activated sludge system to provide secondary treatment for wastewater. The influent is primarily composed of sanitary waste with no significant inputs from industrial sources. The facility serves the communities of Absecon, Atlantic City, Brigantine, Egg Harbor City, Egg Harbor Township, Galloway Township, Hamilton Township, Linwood, Longport, Margate, Mays Landing, Northfield, Pleasantville, Somers Point and Ventnor.

This facility is designed to treat 40.0 million gallons per day (MGD) of sewage, but the average flows that enter the facility are 32.0 MGD for summer and 27.0 MGD for the winter months (see Table 8). An estimated inflow and infiltration from sewer lines could add 25.0 to 30.0 MGD to flows entering the facility during storm conditions (Peters, 2000). Atlantic City, Brigantine, Egg Harbor City, Ventnor, and Margate are believed to be the largest contributors to inflow and infiltration in the sewer lines. The individual municipalities address repairs to sewer lines to prevent inflow and infiltration. Atlantic County Utilities Authority encourages individual municipalities to adopt plans to repair and replace their own sewer lines. However, each individual municipality makes decisions about the maintenance of the infrastructure of the sewer lines in their municipality.

There are numerous pump stations connected to the treatment facility. They are located in Absecon (3), Brigantine (3), Linwood (3), Longport (3), Margate – Ventnor (3), Northfield (3), Oceanville (Galloway) (2), Seaview (Galloway) (2), Somers Point (3), and Smithville (2). The pump stations have dual pumps and automatic alarms for high water, power failures, and breakdowns. The alarm goes to the operators' panel in the treatment facility, which is manned 24 hours per day. The treatment facility itself also has automatic alarms for power failures and breakdowns that are routed to the same place. Several of the force mains connecting these pump stations to the wastewater treatment facility run under the waters of the back bays adjacent to this area.

The peak flows for this wastewater treatment facility are 26.0 MGD during dry weather and 70.0 MGD during wet weather (see Table 8). The effluent from the treatment plant had a five-day Biological Oxygen Demand of 5.0mg/L for the summer months (June, July, and August) and 11.0mg/L for the winter months (December, January, and February). The amount of suspended solids in the effluent was 17.0mg/L for the summer months (June, July, and August) and 20.0mg/L for the winter months (December, January, and February). The average effluent fecal coliform levels are 5.5 MPN counts per 100mL for the summer months (June, July, and August) and 5.5 MPN counts per 100mL for the winter months (December, January, and February) (see Table 7). This facility meets the State of New Jersey Effluent Standards for five-day Biological Oxygen Demand, Suspended Solids, and Fecal Coliform Organisms (see Tables 19 and 20).

Disinfection is achieved through a continuous manual feed of sodium hypochlorite. Three 12,000-gallon tanks feed sodium hypochlorite, with an average daily feed rate of 800 gallons per day of sodium hypochlorite in the summer and winter. There are automatic alarms for low effluent chlorine residual, malfunction of the chlorinator or recorder, and chlorine container depletion. Chlorine residual is monitored continuously, with an average residual around 1.5 PPM. The discharge pipe releases to the Atlantic Ocean, 8,700 feet offshore of Raleigh Avenue in Atlantic City (see Figures 15 and 18). Effluent bacterial testing is performed year round with one sample per day. There are no chlorine contact tanks at this facility, chlorine contact occurs in the pipe running to the discharge outlet. Chlorine contact time averages between one to two hours.

TABLE 7: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR ATLANTIC COUNTY UTILITIES AUTHORITY – WASTEWATER TREATMENT FACILITY.

	SUMMER MONTHS (June, July, August)	**WINTER MONTHS** (December, January, February)
BOD_5 (mg/L)	5.0	11.0
Suspended Solids (mg/L)	17.0	20.0
Effluent Fecal Coliform (MPN Counts/100mL)	5.5	5.5

TABLE 8: METEOROLOGICALLY AND SEASONALLY RELATED FLOWS FOR ATLANTIC COUNTY UTILITIES AUTHORITY – WASTEWATER TREATMENT FACILITY.

	Summer Months	**Winter Months**	**Dry Weather**	**Wet Weather**
Average Daily Flow (MGD)	32.0	27.0	N/A	N/A
Peak Hourly Flow (MGD)	N/A	N/A	26.0	70.0

FIGURE 17: LOCATION OF ATLANTIC COUNTY UTILITIES AUTHORITY – WASTEWATER TREATMENT FACILITY IN ATLANTIC CITY. PHOTOGRAPH WAS TAKEN ON APRIL 3, 2002 AT 8:53 A.M.

FIGURE 18: AREA OF THE ATLANTIC CITY BEACH AT THE END OF RALEIGH AVENUE WHERE ATLANTIC COUNTY UTILITIES AUTHORITY - WASTEWATER TREATMENT FACILITY DISCHARGE PIPE EXTENDS INTO THE ATLANTIC OCEAN. PHOTOGRAPH WAS TAKEN ON APRIL 3, 2002 AT 11:05A.M.

Cape May County Utilities Authority – Ocean City Region Wastewater Treatment Facility

This facility is located at 45th Street and West Avenue in Ocean City (see Figure 19). The facility came online on January 12, 1982, and utilizes rotating biological contactors to provide secondary treatment for sanitary sewage from Ocean City. It is designed to accept 8.24 million gallons per day (MGD) of sewage, but the average flows that enter the facility are 5.5 MGD for the summer months and 2.5 MGD for the winter months (see Table 10). Operators at the facility have stated that the amount of inflow and infiltration has been decreasing because the sewage infrastructure had been repaired and improved. However, a large increase in flow coming into the facility can occur during large storms.

There are four pump stations connected to this wastewater treatment facility. They are located in Ocean City at 3rd Street, 20th Street and Bay Avenue, 32nd Street and West Avenue, and 46th Street. All of the pump stations have dual pumps and automatic alarms for high water, power failures, and breakdowns. The alarm goes to the operator's panel in the wastewater treatment facility, and when the facility is closed, a page is sent to on-call personnel. The treatment facility also has automatic alarms for power failures and breakdowns that are routed to the same place.

The peak flows for this wastewater treatment facility are 8.0 MGD during the summer and between 5.0 and 6.0 MGD during the winter (see Table 10). The effluent from the treatment plant had a five-day Biological Oxygen Demand of 22.0 to 23.0mg/L for the summer months (June, July, and August) and 15.0 to 20.0 mg/L for the winter months (December, January, and February). The amount of suspended solids in the effluent was 20.0mg/L for the summer months (June, July, and August) and 15.0 mg/L for the winter months (December, January, and February). The average effluent fecal coliform levels are less than 1.0 MPN counts per 100 mL for the summer months (June, July, and August) and less than 1.0 MPN counts per 100mL for the winter months (December, January, and February)(see Table 9). This facility meets the State of New Jersey Effluent Standards for five-day Biological Oxygen Demand, Suspended Solids, and Fecal Coliform Organisms (see Tables 19 and 20).

Disinfection is achieved through a continuous manual feed of 15 percent sodium hypochlorite. Two 3,750-gallon tanks and two 4,000-gallon tanks feed sodium hypochlorite, with an average daily feed rate of 250 gallons per day of sodium hypochlorite in the winter. There are automatic alarms for low effluent chlorine residual and chlorine container depletion. Chlorine residual is monitored with three samples per day, with an average chlorine residual less than 2.0 PPM. The outfall pipe releases to the Atlantic Ocean, 6,081 feet offshore of 46th Street in Ocean City (see Figure 15). Effluent bacterial testing is performed year round with eight samples per month. Average effluent fecal coliform levels were identified by use of membrane filtration method bacterial testing. There are no chlorine contact tanks at this facility, chlorine contact

occurs in the pipe running to the discharge outlet. Chlorine contact time averages about one hour in the pipe.

TABLE 9: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR CAPE MAY COUNTY UTILITIES AUTHORITY – OCEAN CITY REGION WASTEWATER TREATMENT FACILITY.

	SUMMER MONTHS (June, July, August)	**WINTER MONTHS** (December, January, February)
BOD_5 (mg/L)	22.0 – 23.0	15.0 – 20.0
Suspended Solids (mg/L)	20.0	15.0
Effluent Fecal Coliform (MPN Counts/100mL)	Less than 1.0	Less than 1.0

TABLE 10: SEASONALLY RELATED FLOWS FOR CAPE MAY COUNTY UTILITIES AUTHORITY – OCEAN CITY REGION WASTEWATER TREATMENT FACILITY.

	Summer Months	**Winter Months**
Average Daily Flow (MGD)	5.5	2.5
Peak Hourly Flow (MGD)	8.0	5.0 – 6.0

FIGURE 19: LOCATION OF CAPE MAY COUNTY UTILITIES AUTHORITY – OCEAN CITY REGION WASTEWATER TREATMENT FACILITY ON 45TH STREET AND WEST AVENUE IN OCEAN CITY. PHOTOGRAPH WAS TAKEN ON NOVEMBER 8, 2001 AT 10:33 A.M.

Cape May County Utilities Authority – Seven Mile/ Middle Region Wastewater Treatment Facility

This facility is located at 1306 Moore Road, Cape May Court House in Middle Township (see Figure 20). The facility came online on August 1987, and utilizes rotating biological contactors to provide secondary treatment for sanitary sewage from Sea Isle City, Avalon, Avalon Manor, Stone Harbor, Stone Harbor Boulevard, Stone Harbor Manor, and parts of Middle Township. It is designed to accept 7.67 million gallons per day (MGD) of sewage, but the average flows that enter the facility are from 5.2 to 6.6 MGD for the summer months and 2.7 MGD for the winter months (see Table 12). The influent is primarily composed of sanitary waste with no significant inputs from industrial sources. However, this facility also accepts 42,000 gallons of leachate and 32,000 gallons of sewage per day from the Cape May County Landfill.

There are ten pump stations connected to this wastewater treatment facility. They are located in Sea Isle City, Avalon, Stone Harbor, Crest Haven, and Middle Township. All of the pump stations have full and complete automatic alarms for high water, power failures, and breakdowns, and automatic diesel generators for standby power. The alarms for the pump stations go to the wastewater treatment facility, and when the facility is closed, a pager calls the on-call personnel in the event of a problem.

The facility handles average daily flows between 2.7 and 6.6 MGD (see Table

15). Storm flooding caused by tidal inflow and infiltration (I/I) into the collection system, especially from Sea Isle City and Avalon's low areas, substantially increase the hydraulic loading to the facility. The effluent from the treatment plant has a five-day Biological Oxygen Demand of 16.0 to 18.0mg/L for the summer months (June, July, and August) and 9.0 to 11.0mg/L for the winter months (December, January, and February). The amount of suspended solids in the effluent is 16.0 to 18.0mg/L for the summer months (June, July, and August) and 9.0 to 11.0mg/L for the winter months (December, January, and February). The average effluent fecal coliform levels are less than 1.0 MPN counts per 100mL for the summer months (June, July, and August) and less than 1.0 MPN counts per 100mL for the winter months (December, January, and February) (see Table 11). This facility meets the State of New Jersey Effluent Standards for five-day Biological Oxygen Demand, Suspended Solids, and Fecal Coliform Organisms (see Tables 19 and 20).

Disinfection is achieved through continuous chlorination with 15 percent sodium hypochlorite solution. Two 6000-gallon tanks supply the chlorinating agent. An average of 500 gallons per day of sodium hypochlorite is used in the summer, and an average of 200 gallons per day of sodium chlorite is used in the winter. There are alarms for low effluent chlorine residual, malfunction of the chlorinator, and chlorine container depletion. Chlorine residual is monitored continuously and averages less than 2 mg/L in the effluent. The outfall pipe releases to the Atlantic Ocean, approximately one mile offshore of 30th Street in Avalon (see Figure 16 and Figure 21). Effluent bacterial testing, utilizing the membrane filtration method, is performed once per week. Chlorine contact occurs inside the effluent pipe with an average contact time of two hours in the pipe.

TABLE 11: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR CAPE MAY COUNTY UTILITIES AUTHORITY – SEVEN MILE/ MIDDLE REGION WASTEWATER TREATMENT FACILITY.

	SUMMER MONTHS (June, July, August)	**WINTER MONTHS** (December, January, February)
BOD_5 (mg/L)	16.0 – 18.0	9.0 – 11.0
Suspended Solids (mg/L)	16.0 – 18.0	9.0 – 11.0
Effluent Fecal Coliform (MPN Counts/100mL)	Less than 1.0	Less than 1.0

TABLE 12: METEOROLOGICALLY AND SEASONALLY RELATED FLOWS FOR CAPE MAY COUNTY UTILITIES AUTHORITY – SEVEN MILE/ MIDDLE REGION WASTEWATER TREATMENT FACILITY.

	Summer Months	Winter Months
Average Daily Flow (MGD)	5.2–6.6	2.7
Peak Hourly Flow (MGD)	N/A	N/A

FIGURE 20: LOCATION OF CAPE MAY COUNTY UTILITIES AUTHORITY - SEVEN MILE/ MIDDLE REGION WASTEWATER TREATMENT FACILITY AT 1306 MOORE ROAD, CAPE MAY COURT HOUSE IN MIDDLE TOWNSHIP. PHOTOGRAPH WAS TAKEN ON APRIL 19, 2002 AT 2:03 P.M.

FIGURE 21: AREA OF THE AVALON BEACH AT THE END OF 30TH STREET WHERE CAPE MAY COUNTY UTILITIES AUTHORITY – SEVEN MILE/ MIDDLE REGION WASTEWATER TREATMENT FACILITY DISCHARGE PIPE EXTENDS INTO THE ATLANTIC OCEAN. PHOTOGRAPH WAS TAKEN ON APRIL 19, 2002 AT 11:35 A.M.

Cape May County Municipal Authority – Wildwood Lower Regional Wastewater Treatment Facility

This facility is located on Route 47, Rio Grande, in Middle Township (see Figure 22). The facility came online on May 1, 1988, and utilizes rotating biological contactors to provide secondary treatment for sanitary sewage from North Wildwood, Wildwood, West Wildwood, Wildwood Crest, Rio Grande (Middle Township) and Shawcrest (Lower Township). This facility's effluent disinfecting equipment and discharge conveying system also accepts the secondary treated effluent from the Cape May Regional Wastewater Treatment Facility and the Lower Township Wastewater Treatment Facility. It is designed to accept 14.18 million gallons per day (MGD) of sewage, but the average flows that enter the facility are 7.0 MGD for the summer months and 4.0 MGD for the winter months (see Table 14).

There are seven pump stations connected to this wastewater treatment facility. They are located in Wildwood, North Wildwood (2), West Wildwood, Wildwood Crest, Shawcrest, Rio Grande, and Lower Township. One (1) effluent pump station from the Lower Township Municipal Utilities Authority – Wastewater Treatment Facility pumps the effluent from the facility to the Wildwood Lower Regional Wastewater Treatment Facility. All of the pump stations have full and complete automatic alarms for high water, power failures, and breakdowns, and have

standby automatic diesel generators. The alarms for the pump stations go to the wastewater treatment facility, and when the facility is closed, a pager calls the on-call personnel in the event of a problem.

The peak flows for this wastewater treatment facility are 10.0 MGD during the summer and 6.5 MGD during the winter (see Table 14). The facility is designed for a flow of 14.18 MGD. The effluent from the treatment plant has a five-day Biological Oxygen Demand of 6 to 8 mg/L throughout the year. The amount of suspended solids in the effluent is 2 to 10 mg/L throughout the year. The average effluent fecal coliform levels are less than 1 MPN counts per 100mL throughout the year (see Table 13). This facility meets the State of New Jersey Effluent Standards for five-day Biological Oxygen Demand, Suspended Solids, and Fecal Coliform Organisms (see Tables 19 and 20).

Disinfection is achieved through continuous chlorination with chlorine gas. Two 2,000-pound tanks are attached at a time. There are six pumps that feed 1,000 pounds per day of chlorine in the summer and 400 pounds per day of chlorine in the winter to disinfect the effluent. There are alarms for low effluent chlorine residual, malfunction of the chlorinator, and chlorine container depletion. Chlorine residual is monitored continuously and averages from 1.0 to 2.0 PPM in the effluent. The outfall pipe releases to the Atlantic Ocean, approximately 5,500 feet offshore of Jefferson Avenue in Wildwood Crest (see Figure 16). Effluent bacterial testing, utilizing the membrane filtration method, is performed three times per week. Chlorine contact occurs inside the effluent pipe with an average contact time of nine hours in the pipe.

TABLE 13: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR CAPE MAY COUNTY MUNICIPAL AUTHORITY – WILDWOOD LOWER REGIONAL WASTEWATER TREATMENT FACILITY.

	SUMMER MONTHS (June, July, August)	**WINTER MONTHS** (December, January, February)
BOD_5 (mg/L)	6.0 – 8.0	6.0 – 8.0
Suspended Solids (mg/L)	2.0 – 10.0	2.0 – 10.0
Effluent Fecal Coliform (MPN Counts/100mL)	Less than 1.0	Less than 1.0

TABLE 14: METEOROLOGICALLY AND SEASONALLY RELATED FLOWS FOR CAPE MAY COUNTY MUNICIPAL AUTHORITY – WILDWOOD LOWER REGIONAL WASTEWATER TREATMENT FACILITY.

	Summer Months	Winter Months	Dry Weather	Wet Weather
Average Daily Flow (MGD)	7.0	4.0	N/A	N/A
Peak Hourly Flow (MGD)	10.0	6.5	6.5	N/A

FIGURE 22: LOCATION OF CAPE MAY COUNTY MUNICIPAL AUTHORITY – WILDWOOD LOWER REGIONAL WASTEWATER TREATMENT FACILITY ON ROUTE 47 IN LOWER TOWNSHIP. PHOTOGRAPH WAS TAKEN ON APRIL 11, 2005.

Cape May County Utilities Authority – Cape May Regional Wastewater Treatment Facility

This facility is located on Sunset Boulevard in Cape May Point (see Figure 23). The facility came online on February 1984, and utilizes rotating biological contactors to provide secondary treatment for sanitary sewage from Cape May, Cape May Point, and West Cape May. This facility is designed to accept 3.0 million gallons per day (MGD) of sewage, but the average flows that enter the facility are 2.5 MGD for the summer months and 1.0 MGD for the winter months (see Table 16).

There are three pump stations connected to this wastewater treatment facility. They are located at Madison Avenue, Cape May City, Claghorn Place, Cape May City, and Coral Avenue, Cape May Point. All of these pump stations have full and complete automatic alarms for high water, power failures, and breakdowns, and have standby automatic diesel generators. The alarms for the pump stations go to the wastewater treatment facility, and when the facility is closed, a pager calls the on-call personnel in the event of a problem.

The facility handles average daily flows between 1.0 and 2.5 MGD, with an estimated peak flow of 3.0 MGD, after a significant rainfall (see Table 16). The effluent from the treatment plant has a five-day Biological Oxygen Demand of 9.0mg/L for the summer months (June, July, and August) and 12.0mg/L for the winter months (December, January, and February). The amount of suspended solids in the effluent is 10.0mg/L for the summer months (June, July, and August) and 12.0mg/L for the winter months (December, January, and February). The average effluent fecal coliform levels are less than 1.0 MPN counts per 100mL for the summer months (June, July, and August) and less than 1.0 MPN counts per 100mL for the winter months (December, January, and February) (see Table 15). This facility meets the State of New Jersey Effluent Standards for five-day Biological Oxygen Demand, Suspended Solids, and Fecal Coliform Organisms (see Tables 19 and 20).

Disinfection is achieved through continuous chlorination with 15 percent sodium hypochlorite solution. Three (3) 4000-gallon tanks supply the chlorinating agent. An average of 30 gallons per day of sodium hypochlorite is used in both the summer and the winter. There are alarms for low effluent chlorine residual, malfunction of the chlorinator, and chlorine container depletion. Chlorine residual is monitored continuously and averages 1.2 PPM in the effluent. The outfall pipe also releases to the Atlantic Ocean, approximately 5,500 feet offshore of Jefferson Avenue in Wildwood Crest (see Figure 16). Effluent bacterial testing, utilizing the membrane filtration method, is performed once per week. Chlorine contact occurs inside the effluent pipe with an average contact time of one hour in the pipe.

TABLE 15: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR CAPE MAY COUNTY UTILITIES AUTHORITY –CAPE MAY REGIONAL WASTEWATER TREATMENT FACILITY.

	SUMMER MONTHS (June, July, August)	**WINTER MONTHS** (December, January, February)
BOD_5 (mg/L)	9.0	12.0
Suspended Solids (mg/L)	10.0	12.0
Effluent Fecal Coliform (MPN Counts/100mL)	Less than 1.0	Less than 1.0

TABLE 16: METEOROLOGICALLY AND SEASONALLY RELATED FLOWS FOR CAPE MAY COUNTY UTILITIES AUTHORITY – CAPE MAY REGIONAL WASTEWATER TREATMENT FACILITY.

	Summer Months	**Winter Months**	**Dry Weather**	**Wet Weather**
Average Daily Flow (MGD)	2.5	1.0	N/A	N/A
Peak Hourly Flow (MGD)	N/A	N/A	1.0	3.0

FIGURE 23: LOCATION OF CAPE MAY COUNTY UTILITIES AUTHORITY – CAPE MAY REGIONAL WASTEWATER TREATMENT FACILITY ON SUNSET BOULEVARD IN CAPE MAY POINT. PHOTOGRAPH WAS TAKEN ON APRIL 23, 2002 AT 12:07 P.M.

Lower Township Municipal Utilities Authority – Wastewater Treatment Facility

This facility is located at 2900 Bayshore Road in the Villas, Lower Township (see Figure 24). The facility was built in 1970 and was upgraded in January 1991. It utilizes activated sludge in order to provide secondary treatment for sanitary sewage from Lower Township and Del Haven. This facility is designed to accept 4.0 million gallons per day (MGD) of sewage, but the average flows that enter the facility are 2.4 MGD for the summer months and 1.9 MGD for the winter months (see Table 18).

There are 26 pump stations connected to this wastewater treatment facility. They are located throughout the service area. All of these pump stations have full and complete automatic alarms for high water, power failures, and breakdowns. The alarms for the pump stations go to the wastewater treatment facility, and when the facility is closed, a pager calls the on-call personnel in the event of a problem. Only two of the pump stations have standby power, supplied by portable generators.

The facility handles average daily flows between 1.9 and 2.4 MGD (see Table 18). The effluent from the treatment plant has a five-day Biological Oxygen Demand of from 4.0 to 5.0mg/L throughout the year. The amount of suspended solids in the effluent is from 4.0 to 5.0mg/L throughout the year. The average effluent fecal coliform levels are less than 10.0 MPN counts per 100mL throughout the year (see Table 17). This facility meets the State of New Jersey Effluent Standards for five-day Biological Oxygen Demand, Suspended

Solids, and Fecal Coliform Organisms (see Tables 19 and 20).

Disinfection is achieved through continuous chlorination with 15 percent sodium hypochlorite solution. Two (2) 9000-gallon tanks supply the chlorinating agent. An average of 76 gallons per day of sodium hypochlorite is used in the summer and 42 gallons per day of sodium chlorite is used in the winter. Chlorine residual is monitored twice per day and averages 1.5 PPM in the effluent. The outfall pipe also releases to the Atlantic Ocean, approximately 5,500 feet offshore of Jefferson Avenue in Wildwood Crest (see Figure 16). Effluent bacterial testing, utilizing the membrane filtration method, is performed four times per month. Chlorine contact occurs inside the effluent pipe with an average contact time of 30 minutes in the pipe.

TABLE 17: SEASONAL AVERAGES FOR FIVE DAY BIOLOGICAL OXYGEN DEMAND, SUSPENDED SOLIDS, AND EFFLUENT FECAL COLIFORM FOR LOWER TOWNSHIP MUNICIPAL UTILITIES AUTHORITY – WASTEWATER TREATMENT FACILITY.

	SUMMER MONTHS (June, July, August)	**WINTER MONTHS** (December, January, February)
BOD_5 (mg/L)	4.0 – 5.0	4.0 – 5.0
Suspended Solids (mg/L)	4.0 – 5.0	4.0 – 5.0
Effluent Fecal Coliform (MPN Counts/100mL)	Less than 10.0	Less than 10.0

TABLE 18: METEOROLOGICALLY AND SEASONALLY RELATED FLOWS FOR LOWER TOWNSHIP MUNICIPAL UTILITIES AUTHORITY –WASTEWATER TREATMENT FACILITY.

	Summer Months	**Winter Months**	**Dry Weather**	**Wet Weather**
Average Daily Flow (MGD)	2.4	1.9	N/A	N/A
Peak Hourly Flow (MGD)	N/A	N/A	3.5	N/A

FIGURE 24: LOCATION OF LOWER TOWNSHIP MUNICIPAL UTILITIES AUTHORITY –WASTEWATER TREATMENT FACILITY AT 2900 BAYSHORE ROAD IN THE VILLAS, LOWER TOWNSHIP. PHOTOGRAPH WAS TAKEN ON APRIL 23, 2002 AT 12:43 P.M.

TABLE 19: STATE OF NEW JERSEY SECONDARY TREATMENT EFFLUENT STANDARDS (MINIMUM LEVEL OF EFFLUENT QUALITY) FOR FIVE-DAY BIOLOGICAL OXYGEN DEMAND AND SUSPENDED SOLIDS.

	Monthly average value	Weekly average value	Monthly average value for percent removal
BOD_5 (mg/L)*	**Shall not exceed 30.0**	**Shall not exceed 45.0**	**Shall not be less than 85.0%**
Suspended Solids (mg/L)**	**Shall not exceed 30.0**	**Shall not exceed 45.0**	**Shall not be less than 85.0%**

* N.J.A.C. 7:14A-12.2(b) 1,2, and 3

** N.J.A.C. 7:14A-12.2(e) 1,2, and 3

TABLE 20: STATE OF NEW JERSEY EFFLUENT STANDARDS FOR FECAL COLIFORM ORGANISMS.

	Monthly	Weekly
Effluent Fecal Coliform (MPN Colonies/100mL)*	**Shall not exceed 200.0**	**Shall not exceed 400.0**

* N.J.A.C. 7:14A-12.5(b) 1 and 2

INDIRECT DISCHARGES

There are many indirect ground water discharges located in this shellfish growing area (see Figures 25 and 26). The major concentrations of these indirect ground water discharges are located in Atlantic City and Longport in Atlantic County, and in the north part of Ocean City and Wildwood in Cape May County.

This shellfish growing area, which extends from Cape May Point in Cape May County to Absecon Inlet in Atlantic County, has several known contaminated sites located in the adjacent areas (see Figures 27 and 28). The major concentrations of these known contaminated sites are located in Atlantic City, Ventnor, Margate, and Longport in Atlantic County, and in Ocean City, Upper Township, Sea Isle City, Avalon, North Wildwood, Wildwood, Wildwood Crest, Lower Township, Cape May, and Cape May Point in Cape May County. 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 four solid waste landfills located adjacent to this shellfish growing area (see Figures 29 and 30). These landfills are the Atlantic City SLF, which is located in Atlantic City in Atlantic County, the Sea Isle City LF, which is located in the north part of Sea Isle City in Cape May County, the Anglesea Beach Colony SWDA, which is located in North Wildwood in Cape May County, and the Harbison – Walker LF, which is located in Lower Township in Cape May County. The Atlantic City SLF was closed in 1975, the Sea Isle City LF was closed in 1980, the Anglesea Beach Colony SWDA was closed in 1974, and the Harbison - Walker LF was closed in 1975. However, there is always the possibility of leachate from these landfills indirectly flowing into the waters of this shellfish growing area.

The indirect ground water discharges, the currently active known contaminated sites, and the solid waste landfills have the potential to impact the water quality of this shellfish growing area. Therefore, the water quality in the Atlantic Ocean from Cape May Point to Absecon Inlet is constantly monitored to determine the presence or absence of these contaminants (APHA, 1995).

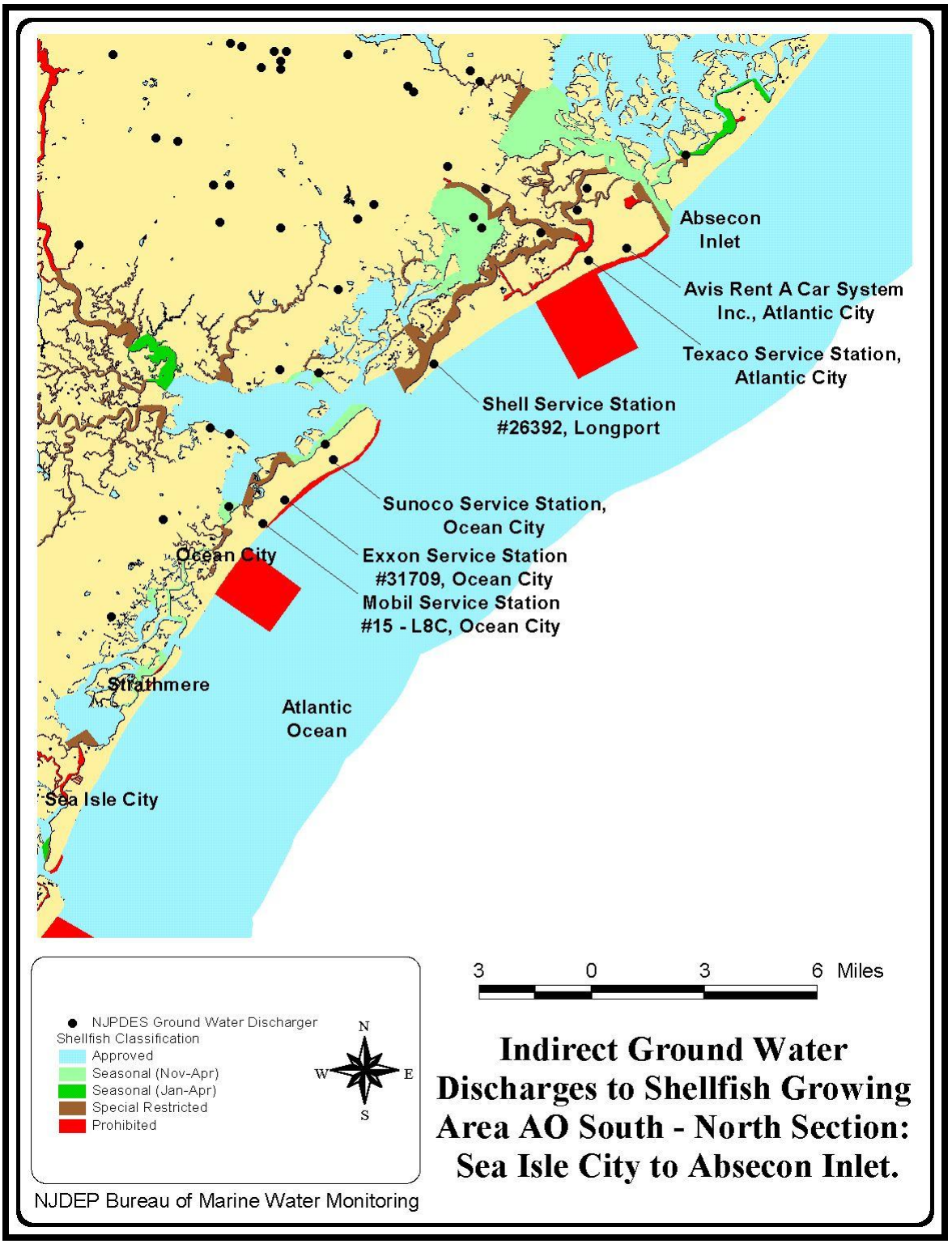

FIGURE 25: INDIRECT GROUND WATER DISCHARGES TO THE WATERS OF SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

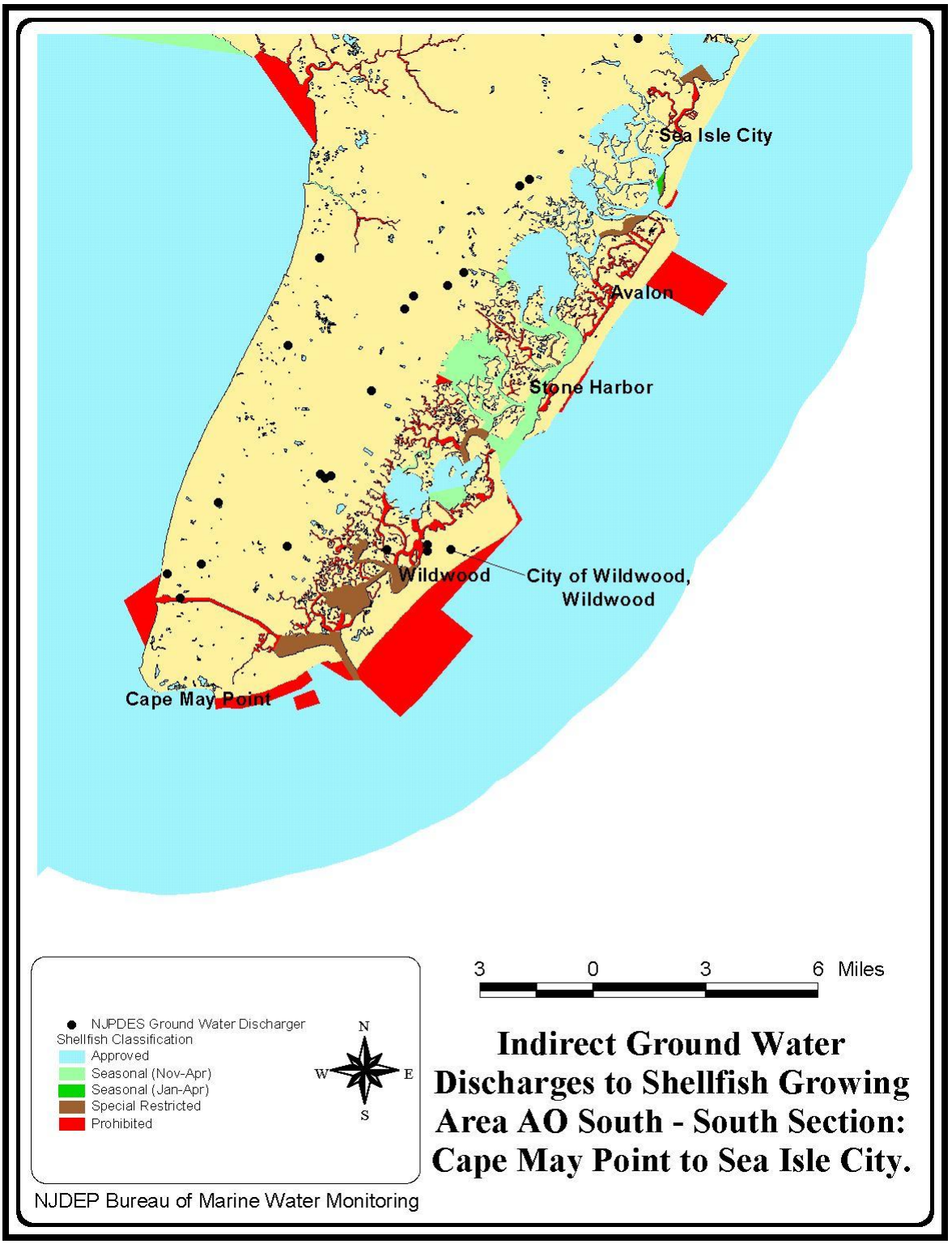

FIGURE 26: INDIRECT GROUND WATER DISCHARGES TO THE WATERS OF SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

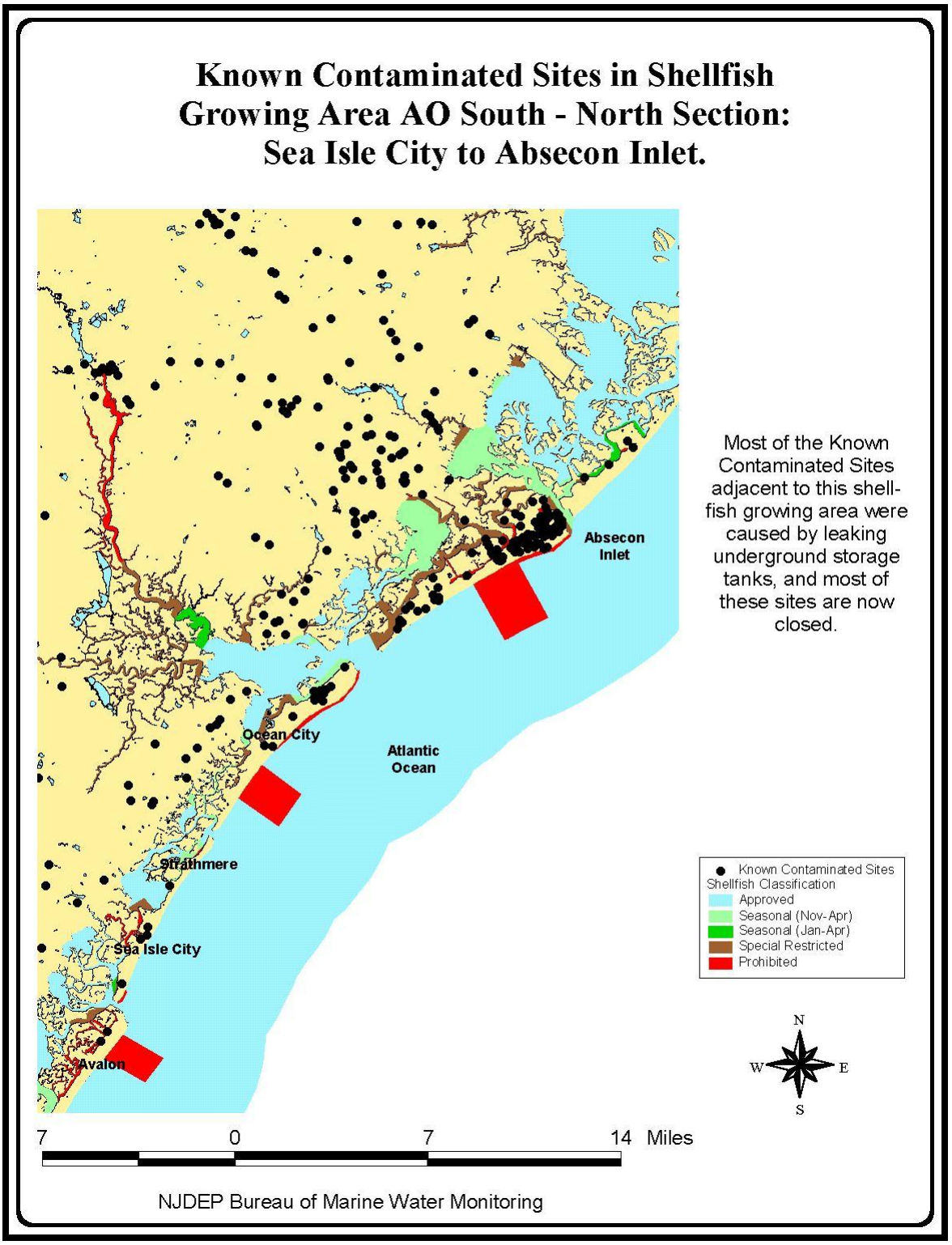

FIGURE 27: KNOWN CONTAMINATED SITES IN SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

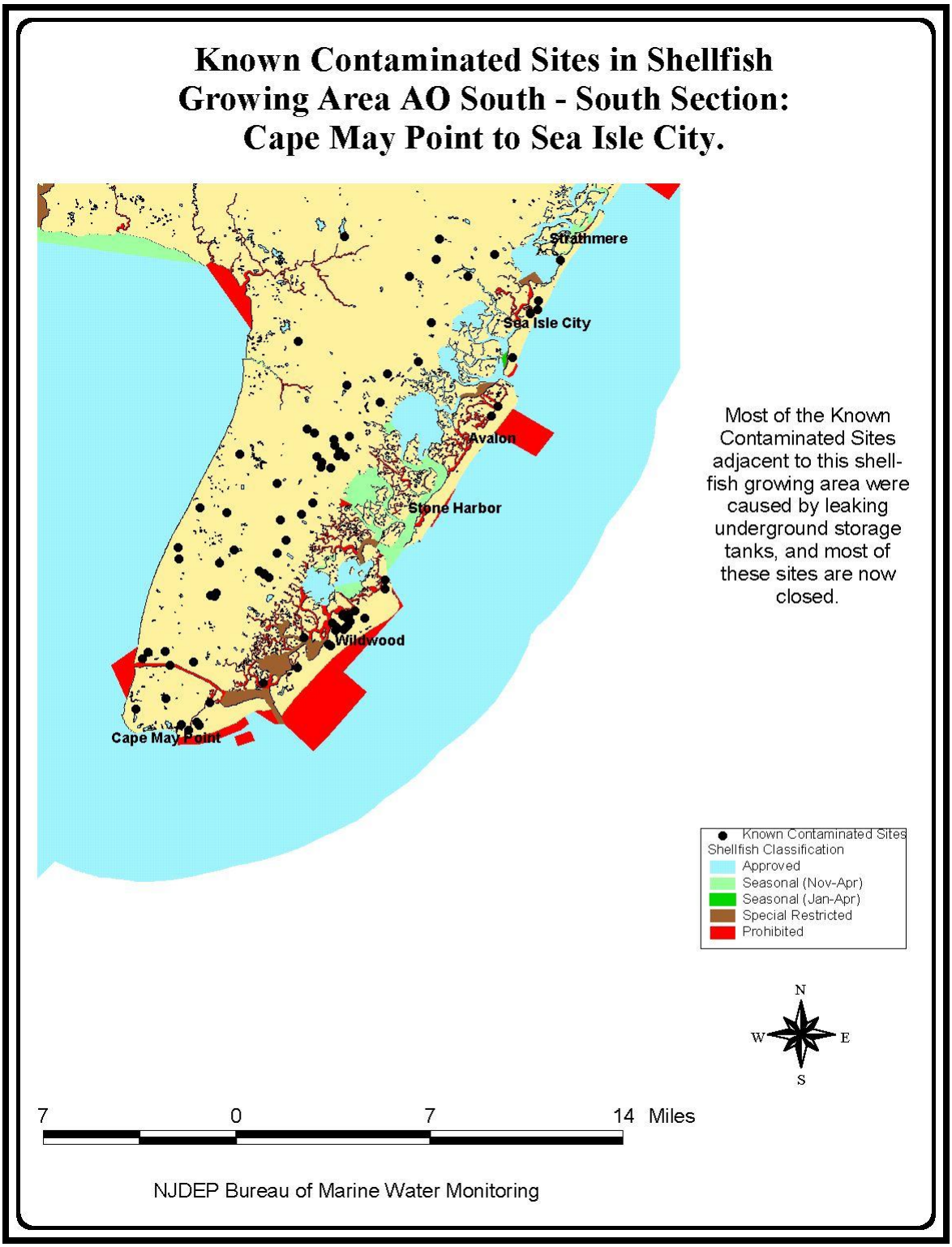

FIGURE 28: KNOWN CONTAMINATED SITES IN SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

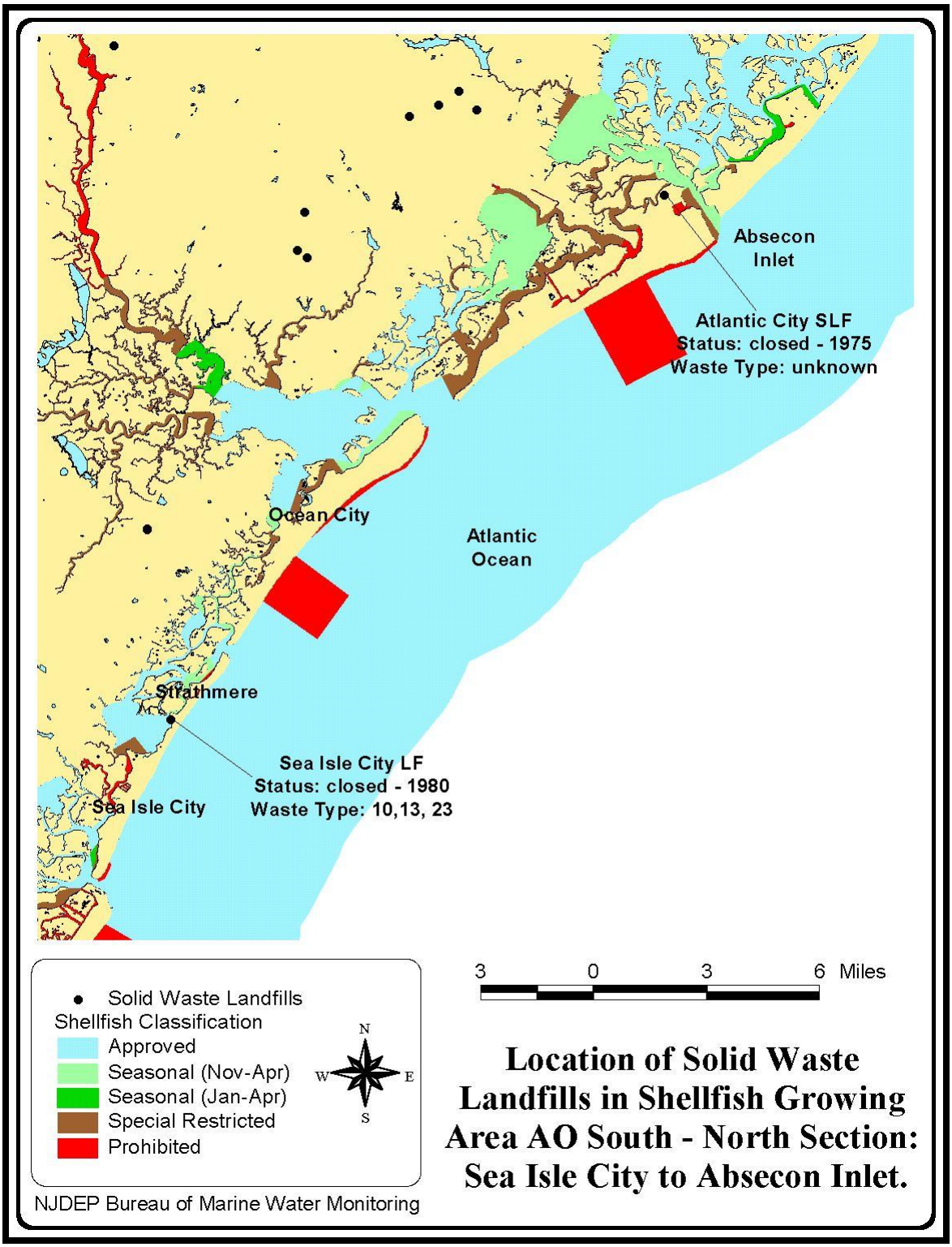

FIGURE 29: SOLID WASTE LANDFILLS IN SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

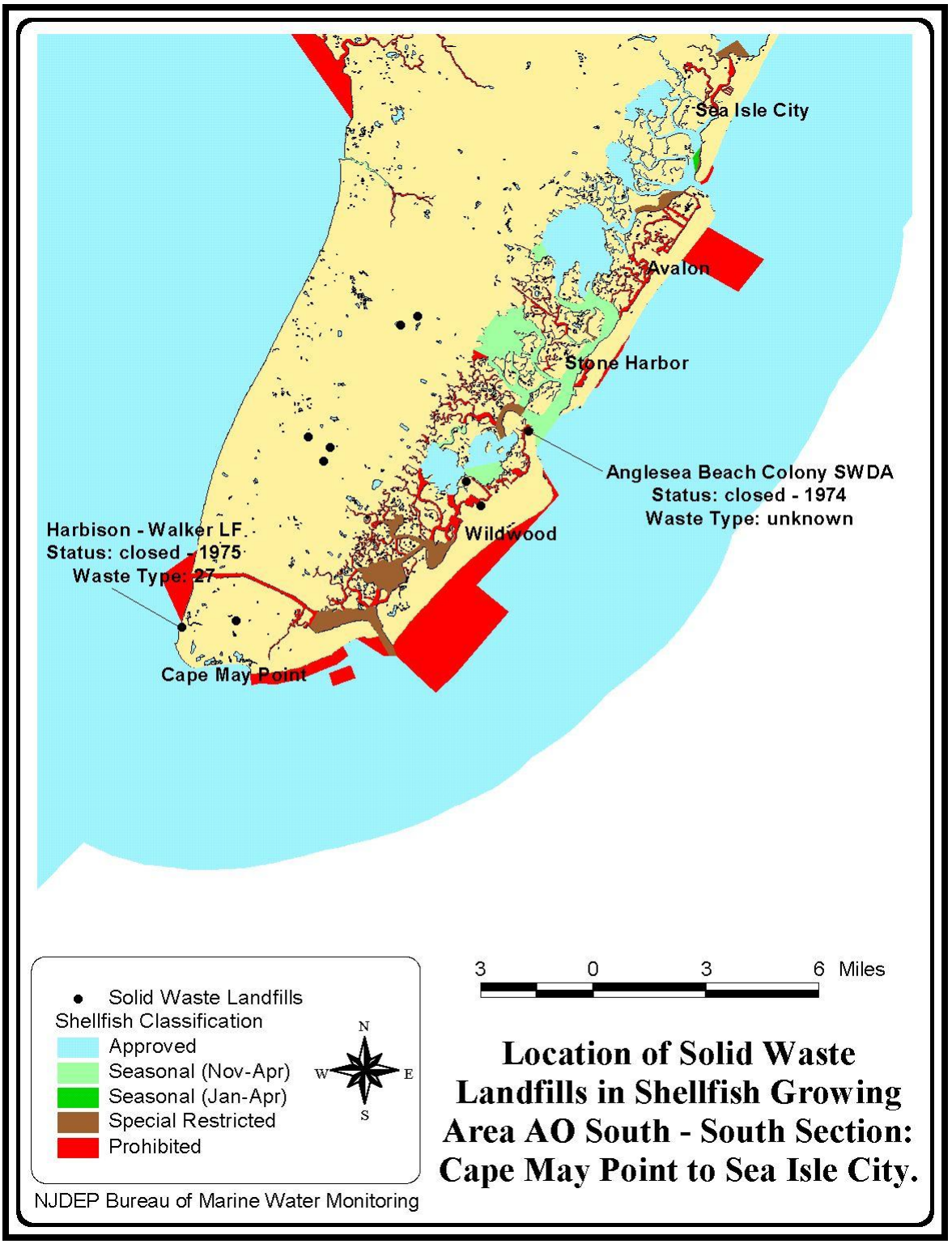

FIGURE 30: SOLID WASTE LANDFILLS IN SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

STORM WATER INPUTS

The storm water 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, being collected on top of impervious surfaces, such as parking lots, rooftops, and roadways; or temporarily collected in detention basins; and then 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. Runoff from these sources can sometimes cause floodwaters to rise, stream banks to erode, critical aquatic and terrestrial habitats to be affected, and water quality to decline (Van Rossum, 2001).

There are many storm water outfalls located along the coastline that borders this shellfish growing area. Most of these storm water outfalls are located along the coastal beaches of Atlantic City, Ventnor, Margate, Longport, Ocean City, Strathmere, Sea Isle City, Avalon, Stone Harbor, North Wildwood, Wildwood, Wildwood Crest, Cape May, and Cape May Point (see Figures 31, and 32). *Prohibited* shellfish zones are located along the coastal beaches of these municipalities to minimize the impacts of these storm water outfalls to 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 storm water outfalls.

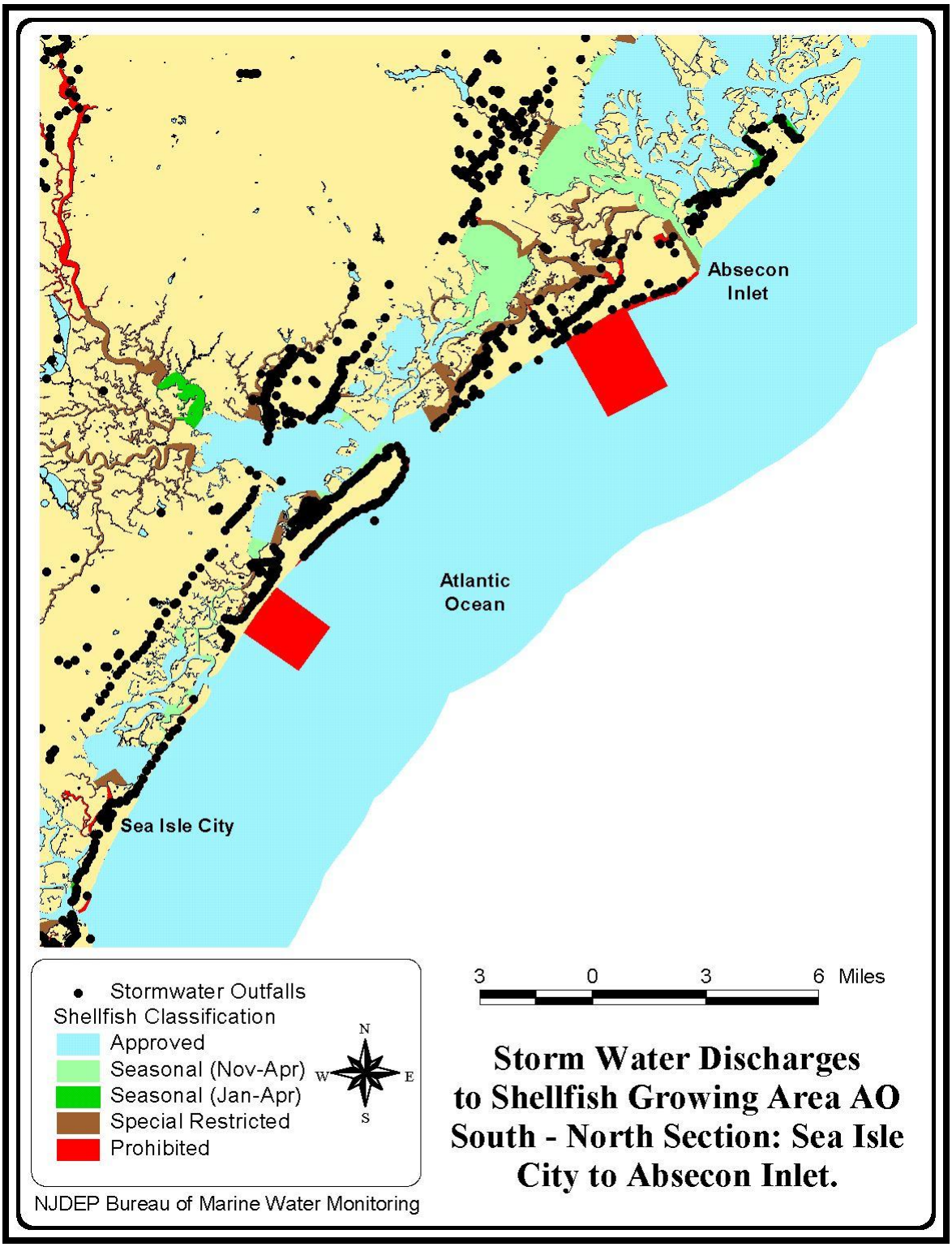

FIGURE 31: STORM WATER DISCHARGES TO SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

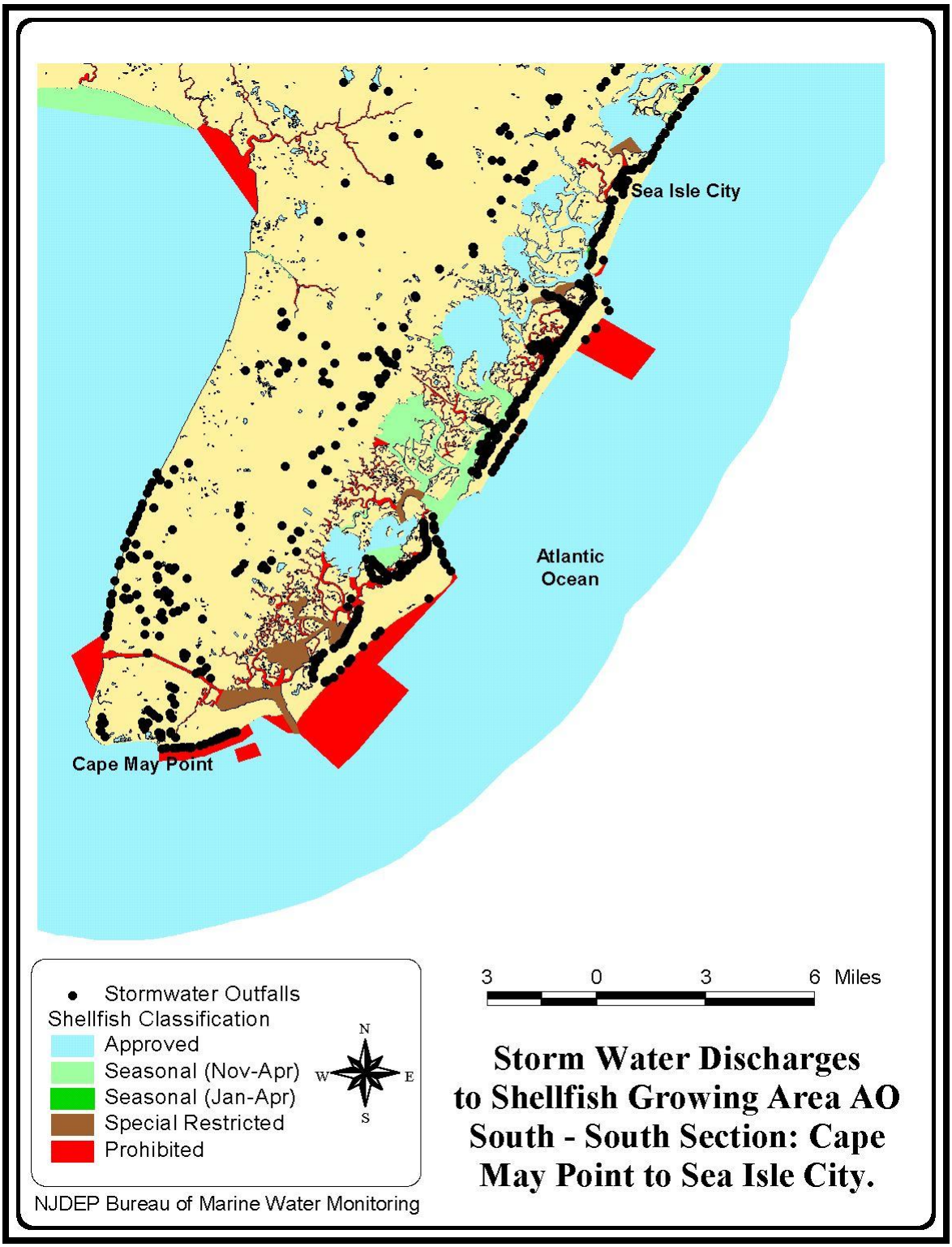

FIGURE 32: STORM WATER DISCHARGES TO SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

SPILLS OR OTHER UNPERMITTED DISCHARGES

A sewage spill from the forced main sewer pipe that extended across Middle Thorofare, north of the Cape May Canal and Harbor, was originally identified on March 14, 2000. This sewer line is located under the Bascule Bridge that extends along Ocean Drive from Wildwood Crest to Lower Township. The sewage spill was occurring at a place on the sewage pipe where the pipe was previously repaired with a patch, and the patch failed to hold. The extent of time and amount of the sewage that spilled into Middle Thorofare was unknown. An area of ocean shellfish growing waters outside the Cape May Inlet was closed to shellfish harvesting on March 14, 2000 (see Figure 33).

On March 15, 2000, it was determined that the sewage pipe was leaking and the leak was occurring from the middle section of the pipe that extended under the bridge. A large area of ocean shellfish growing waters near the Cape May Inlet was temporarily closed to shellfish harvesting. Another attempt to fix the sewage pipe occurred on March 21, 2000, but this repair also did not work. As a result, trucks were used to transport the sewage that would have run through the pipe, in order to cease the discharge of raw sewage.

After collecting water samples in the Sunset Lake to Cape May Harbor area for a study of the water quality during the tidal cycle, the Bureau of Marine Water Monitoring determined that the sewer line was leaking sewage into Middle Thorofare (Schuster and Hayek, 2002). Water samples collected near this area on July 31, 1999 and September 24, 2001 showed elevated fecal coliform levels in the Middle Thorofare area.

The forced main sewer pipe was finally sleeved, tied in and fully operational on November 30, 2001. Water samples collected by the Bureau of Marine Water Monitoring near this area on February 6, 2002 showed that the fecal coliform levels were within accepted standards and it was believed that the sewer line was no longer leaking sewage into Middle Thorofare (Schuster and Hayek, 2002). The waters of Middle Thorofare are classified as *Prohibited* to shellfish harvesting. The Cape May Canal and the Cape May Harbor are classified as *Special Restricted*, and the ocean shellfish waters outside the Cape May Canal are classified as *Prohibited*.

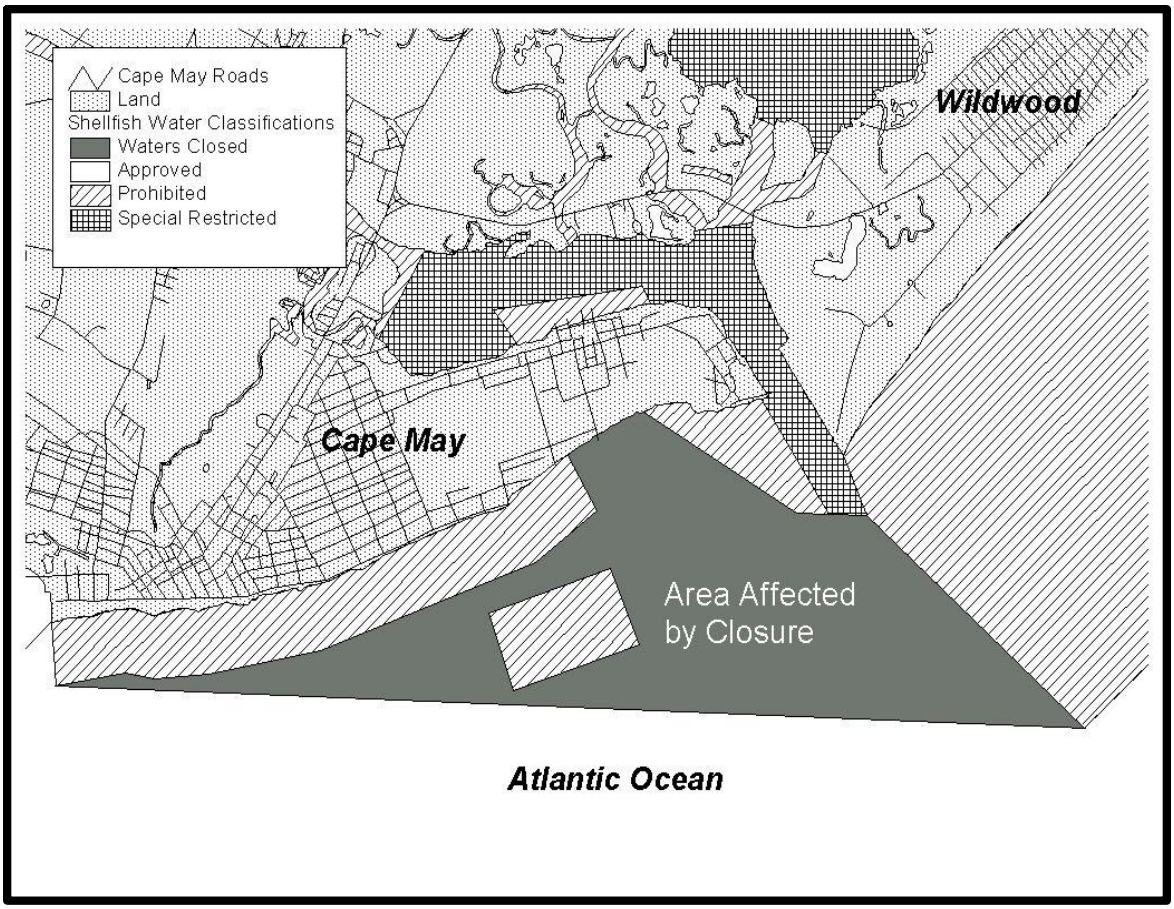

FIGURE 33: AREA OF OCEAN SHELLFISH GROWING WATERS NEAR THE CAPE MAY INLET CLOSED TO SHELLFISH HARVESTING BY SEWAGE SPILL IN MARCH 2000.

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 21). 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.

TABLE 21: AVERAGE MID-ATLANTIC STORM EVENT INFORMATION. (SOURCES: USEPA; US DEPARTMENT OF COMMERCE).

Annual Average Number of Storms	60
Average Storm Event Duration	10 hours
Average Storm Event Intensity	0.08 – 0.09 inches/hour
Average Storm Event Volume	0.65 inches

Although the average storm event lasts approximately 10 hours, with an accumulation of 0.65 inches, it is not unusual for an individual storm volume to be 2 to 3 inches. Note the data below that shows the 2-year return 6-hour storm event to be between two (2) and three (3) in inches, while the 2-year 24-hour return volume varies between three (3) and four (4) inches (see Table 22). Storm volumes greater than approximately 3.5 to 4.0 inches are much less frequent.

TABLE 22: STORM EVENT VOLUME FOR 2-YEAR STORM EVENT RECURRENCE. (SOURCE: USGS**).**

Location	2-Year, 1-Hour Rainfall	2-Year, 6-Hour Rainfall	2-Year, 24-Hour Rainfall
Millville	1.33	2.33	3.02
Cape May	1.33	2.41	3.10
Atlantic City	1.47	2.67	3.65
Long Branch	1.55	3.02	4.15
Newark	1.21	2.34	3.25
Sandy Hook	1.37	2.73	3.68

The duration and volume of storm events can also be depicted as frequency histograms. This graphical depiction (shown below in Figure 34 for Shellfish Growing Area AO South with measurements taken at NOAA's Atlantic City International Airport Station for the time period from 1999 to 2003) provides insight into the frequency of cumulative precipitation of a given size.

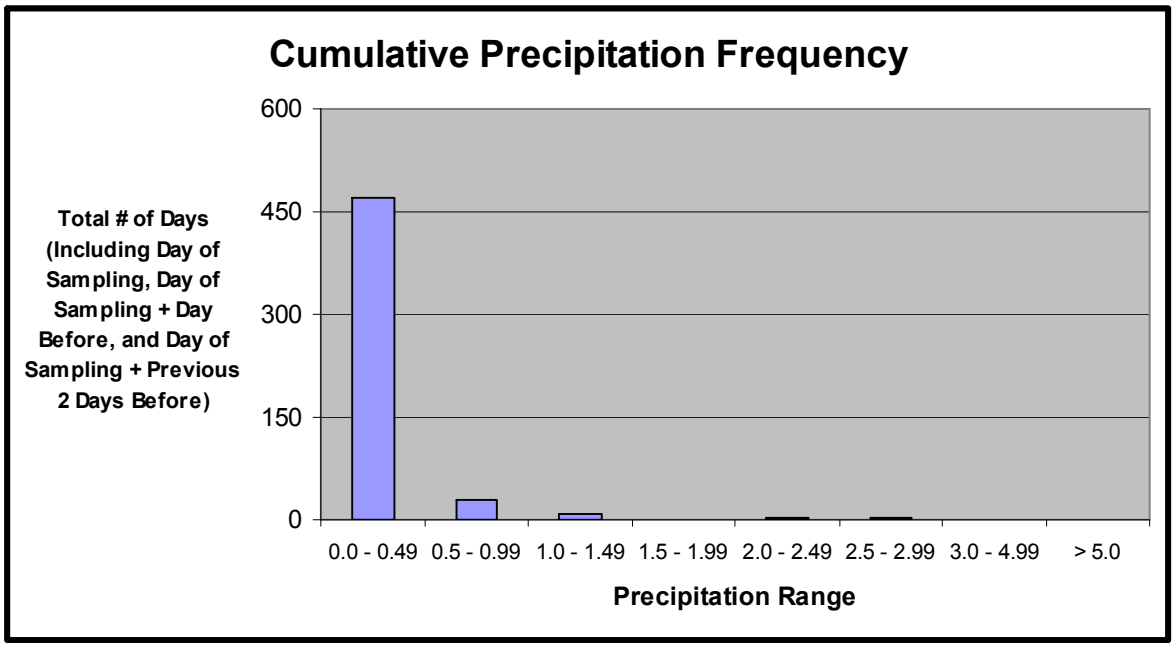

FIGURE 34: STORM EVENT FREQUENCY HISTOGRAM (1993-2003). (SOURCE: NOAA CLIMATIC DATA).

HYDROLOGY

This shellfish growing area is bordered to the west by an extensively developed urban area that has coastal beaches that are used for recreational bathing. These urban areas are located on the barrier islands along the New Jersey coast. In this shellfish growing area, the barrier islands are: 1) Atlantic City, Ventnor, Margate, and Longport; 2) Ocean City and Peck Beach; 3) Strathmere (Upper Township), Whale Beach (Upper Township), Ludlam Beach (Upper Township), and Sea Isle City; 4) Avalon, Seven Mile Beach, and Stone Harbor; and 5) North Wildwood, Wildwood, Wildwood Crest, and Two Mile Beach (Lower Township). In the south part of this area, the Cape May Canal, which separates part of Lower Township, the City of Cape May, and Cape May Point from the mainland, extends from the Delaware Bay through the Cape May Harbor, and into the Cape May Inlet.

The mean range of tide is 4.3 feet for the part of this shellfish growing area that extends from Cape May Point to Cape May, 4.4 feet for the part of this shellfish growing area that extends from Cape May Inlet to North Wildwood, 4.1 feet for the part of this shellfish growing area that extends from North Wildwood to

Stone Harbor, and 4.0 feet for the part of this shellfish growing area that extends from Stone Harbor to Absecon Inlet (see Table 23). The tidal cycle is semidiurnal, with two high tides and two low tides in a 24 hour, 50 minute period. The tides around the Atlantic Ocean occur twice a day (two high and two low) and have essentially the same range, or vertical distance from high to low water. Absecon Inlet, the Great Egg Harbor Inlet, Corsons Inlet, Townsends Inlet, Hereford Inlet, and the Cape May Inlet drain into this shellfish growing area.

This shellfish growing area was sampled with no tidal preferences. Ebb and flood tides describe the horizontal motions associated with the fall and rise of the tide in restricted regions along the coast. Tidal currents can affect the water quality of a shellfish growing area because hydrographic and meteorological characteristics, such as tidal amplitude and type, water circulation patterns, depth, salinity, stratification characteristics, rainfall patterns and intensity, and prevailing winds may affect the distribution of pollutants in a specific area. This is why an evaluation of pollution sources and hydrographic characteristics are used to evaluate the water quality in a shellfish growing area.

Precipitation inputs to this area for the period 1999 through 2003 are shown in Table 25, and the Storm Event Frequency Histogram for this area from 1993 through 2003 is shown in Figure 34. There have been no significant changes in hydrography since 2002. A hurricane struck the northern and western sections of New Jersey in 1999. However, there was no evidence from a review of water quality and bathing beach data that the storm affected the fecal coliform levels within this shellfish growing area.

The NOAA primary and secondary weather stations for this ocean shellfish growing area are shown in Table 24. The secondary station data are used when data from the primary station are incomplete.

TABLE 23: TABLE OF MEAN RANGE OF TIDES FOR THE SHORELINES SURROUNDING AREA AO SOUTH: THE ATLANTIC OCEAN FROM CAPE MAY POINT TO ABSECON INLET.

Location:	Township:	County:	Mean Range of Tide (MLW)
From: Cape May Point	Cape May Point	Cape May	4.3 feet
To: Cape May	Cape May	Cape May	
From: Cape May Inlet	Cape May	Cape May	4.4 feet
To: North Wildwood	North Wildwood	Cape May	
From: North Wildwood	North Wildwood	Cape May	4.1 feet
To: Stone Harbor	Stone Harbor	Cape May	
From: Stone Harbor	Stone Harbor	Cape May	4.0 feet
To: Absecon Inlet	Atlantic City	Atlantic	

TABLE 24: LIST OF NOAA PRIMARY AND SECONDARY WEATHER STATIONS FOR SHELLFISH GROWING AREA AO SOUTH (THE ATLANTIC OCEAN FROM CAPE MAY POINT TO ABSECON INLET).

Shellfish Growing Area Location	NOAA Primary Weather Station	NOAA Secondary Weather Station
Atlantic Ocean from Cape May Point to Stone Harbor (old area AO1)	Cape May (Station Number 1351)	Atlantic City International Airport (Station Number 311)
Atlantic Ocean from Stone Harbor to Sea Isle City (old area AO2)	Belleplain State Forest (Station Number 690)	Atlantic City International Airport (Station Number 311)
Atlantic Ocean from Sea Isle City to Peck Beach (old area AO3)	Atlantic City International Airport (Station Number 311)	Belleplain State Forest (Station Number 690)
Atlantic Ocean from Peck Beach to Absecon Inlet (old area AO4)	Atlantic City International Airport (Station Number 311)	Atlantic City Marina (Station Number 325)

TABLE 25: CLIMATOLOGICAL DATA

Rainfall Recorded at NOAA's Atlantic City International Airport Station in Pomona, NJ.

Sampling Date	Precipitation in Inches			NOAA Weather Station
	Day of Sampling	Day of Sampling + Day Before	Day of Sampling + Previous 2 Days Before	
12/22/1999	0.040	0.090	0.440	311
01/06/2000	0.000	0.030	0.780	311
02/28/2000	0.230	0.240	0.240	311
03/01/2000	0.000	0.000	0.230	311
03/29/2000	0.000	0.080	0.590	311
04/07/2000	0.000	0.005	0.005	311
04/12/2000	0.030	0.090	0.090	311
06/08/2000	0.000	0.005	0.495	311
06/09/2000	0.000	0.000	0.005	311
07/10/2000	0.005	0.005	0.005	311
07/12/2000	0.000	0.000	0.005	311
08/16/2000	0.005	0.015	1.025	311
08/17/2000	0.000	0.005	0.015	311
09/18/2000	0.000	0.000	0.000	311
09/20/2000	0.005	0.465	0.465	311
09/29/2000	0.000	0.00	0.010	311
10/10/2000	0.000	0.000	0.000	311
10/12/2000	0.000	0.000	0.000	311
11/20/2000	0.000	0.000	0.000	311
12/01/2000	0.000	0.190	0.190	311
05/01/2001	0.000	0.000	0.000	311
05/08/2001	0.000	0.000	0.000	311
08/16/2001	0.010	0.010	0.020	311
08/23/2001	0.150	0.150	0.150	311
08/27/2001	0.000	0.000	0.010	311
08/28/2001	0.000	0.000	0.000	311
08/29/2001	0.000	0.000	0.000	311
08/31/2001	0.000	0.000	0.000	311
09/04/2001	0.005	0.005	0.005	311
09/10/2001	0.005	0.005	0.005	311
09/11/2001	0.000	0.005	0.005	311
09/17/2001	0.000	0.000	0.000	311
09/18/2001	0.000	0.000	0.000	311
09/19/2001	0.000	0.000	0.000	311
01/03/2002	0.000	0.000	0.000	311
02/25/2002	0.000	0.000	0.000	311
03/07/2002	0.000	0.000	0.000	311
04/04/2002	0.000	0.270	0.270	311
05/21/2002	0.000	0.000	0.000	311
05/22/2002	0.000	0.000	0.000	311

Sampling Date	Precipitation in Inches			NOAA Weather Station
	Day of Sampling	Day of Sampling + Day Before	Day of Sampling + Previous 2 Days Before	
06/18/2002	0.000	0.000	0.000	311
06/20/2002	0.010	0.060	0.060	311
06/26/2002	0.000	0.010	0.060	311
08/01/2002	0.000	0.000	0.000	311
08/02/2002	0.110	0.110	0.110	311
08/08/2002	0.000	0.000	0.000	311
08/13/2002	0.000	0.000	0.000	311
08/14/2002	0.000	0.000	0.000	311
08/15/2002	0.000	0.000	0.000	311
08/22/2002	0.000	0.000	0.000	311
08/27/2002	0.000	0.000	0.010	311
09/19/2002	0.000	0.000	0.000	311
09/25/2002	0.010	0.010	0.010	311
09/30/2002	0.010	0.020	0.110	311
12/18/2002	0.000	0.000	0.005	311
12/23/2002	0.000	0.000	0.000	311
1/10/2003	0.000	0.000	0.005	311
3/11/2003	0.005	0.005	0.005	311
3/13/2003	0.070	0.070	0.075	311
06/06/2003	0.000	0.150	0.660	311
07/29/2003	0.490	0.560	0.565	311
08/21/2003	0.000	0.000	0.000	311
09/26/2003	0.000	0.000	0.000	311
09/30/2003	0.000	0.000	0.510	311

WATER QUALITY STUDIES

BACTERIOLOGICAL QUALITY

The statistical summary for this area, sampled according to Adverse Pollution Condition (APC) Strategy, is listed in Table 26. This shellfish growing area is composed of four assignment areas: Assignment 401 (the Atlantic Ocean from Cape May Point to Stone Harbor), Assignment 421 (the Atlantic Ocean from Stone Harbor to Sea Isle City), Assignment 431 (the Atlantic Ocean from Sea Isle City to Peck Beach), and Assignment 441 (the Atlantic Ocean from Peck Beach to Absecon Inlet). These areas are sampled using APC sampling strategy year-round. The adverse pollution condition is related to the four direct point source discharges from the wastewater treatment facility discharge pipes that drain into this shellfish growing area. Figures 35 and 36 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 in the Appendix. The water quality of this shellfish growing area continues to be good and most of the sampling stations are in compliance with the *Approved* and *Prohibited* shellfish classification for this area as specified by the National Shellfish Sanitation Program (NSSP) criteria (USPHS, 1999 Revision). However, one of the sampling stations (Ocean Surface Sampling Station AX75A1) in this shellfish growing area was out of compliance with the existing shellfish growing water classification criteria and approximately 257 acres of shellfish waters around Ocean Surface Sampling Station AX75A1, along the northeast coast of Atlantic City, will need to be downgraded from the *Approved* to the *Prohibited* shellfish classification.

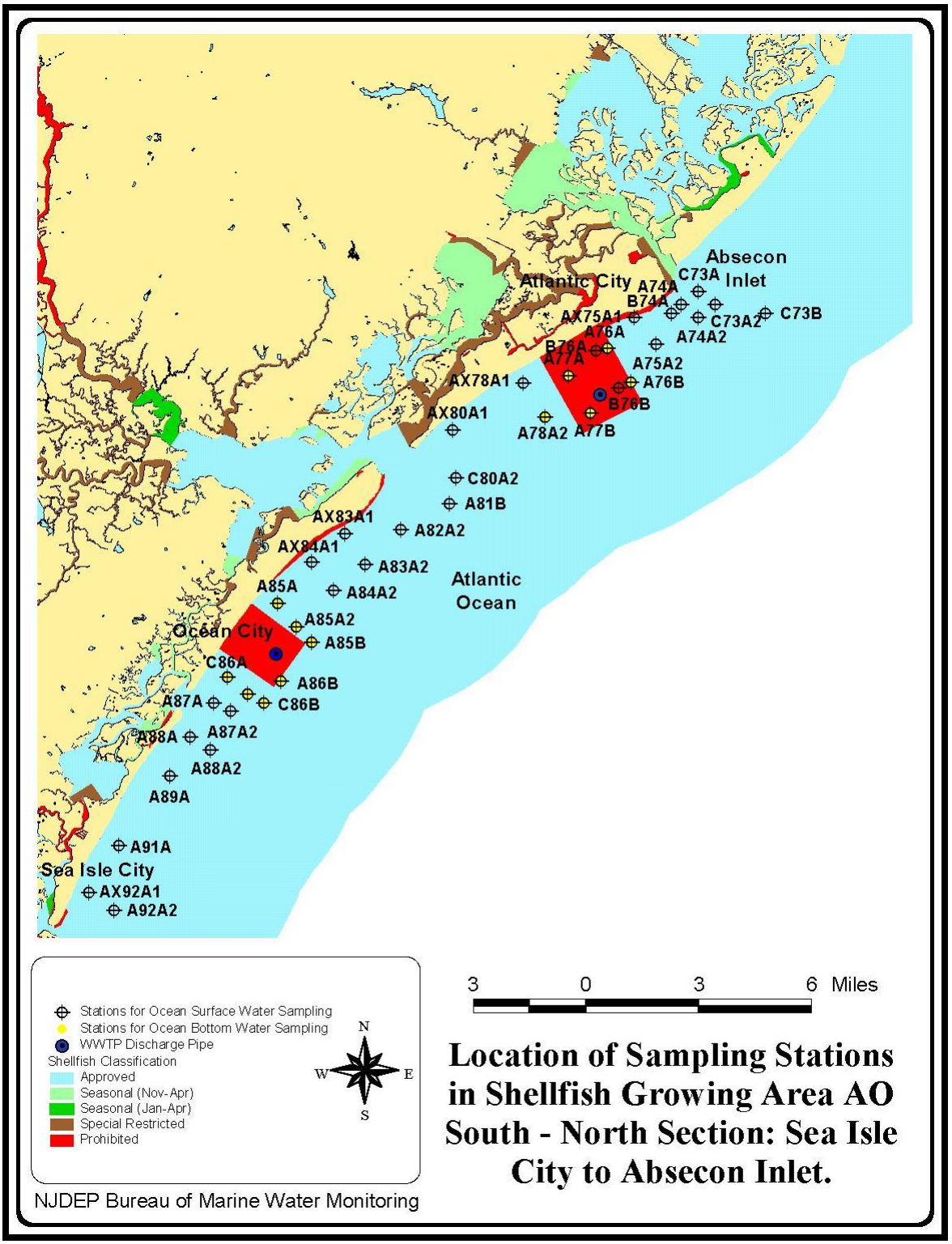

FIGURE 35: SAMPLING STATIONS IN SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

FIGURE 36: SAMPLING STATIONS IN SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

TABLE 26 : WATER QUALITY SUMMARY: APC STATIONS (10/01/99 – 9/30/03)

Station	Depth	Status	Year Round			Summer			Winter		
			Geo. Mean	%>330	N	Geo. Mean	%>330	N	Geo. Mean	%>330	N
A100A2	Surface	A	2.7	5.3%	19	2.3	0.0%	8	3.0	9.1%	11
A101A	Surface	A	2.4	0.0%	19	2.6	0.0%	8	2.2	0.0%	11
A102A	Surface	A	2.2	0.0%	19	2.3	0.0%	8	2.1	0.0%	11
A103A	Surface	A	2.0	0.0%	19	2.0	0.0%	8	2.1	0.0%	11
A104A2	Bottom	P	2.1	0.0%	18	2.0	0.0%	8	2.2	0.0%	10
A104A2	Surface	P	2.1	0.0%	19	2.0	0.0%	8	2.1	0.0%	11
A104B	Bottom	A	2.0	0.0%	18	2.0	0.0%	8	2.1	0.0%	10
A104B	Surface	A	2.2	0.0%	19	2.0	0.0%	8	2.3	0.0%	11
A105B	Bottom	A	2.1	0.0%	18	2.2	0.0%	8	2.1	0.0%	10
A105B	Surface	A	2.4	2.7%	19	2.0	0.0%	8	2.8	9.1%	11
A106A2	Bottom	P	2.3	0.0%	18	2.4	0.0%	8	2.2	0.0%	10
A106A2	Surface	P	2.7	0.0%	19	2.7	0.0%	8	2.6	0.0%	11
A106B	Bottom	P	2.0	0.0%	18	2.0	0.0%	8	2.1	0.0%	10
A106B	Surface	P	2.1	0.0%	19	2.3	0.0%	8	1.9	0.0%	11
A108A	Surface	P	2.0	0.0%	19	2.2	0.0%	8	1.9	0.0%	11
A109A	Surface	A	2.2	0.0%	19	2.0	0.0%	8	2.4	0.0%	11
A110A	Surface	A	2.2	0.0%	18	2.0	0.0%	8	2.4	0.0%	10
A74A	Surface	A	4.4	5.0%	20	4.6	5.3%	19	1.9	0.0%	1
A74A2	Surface	A	3.9	0.0%	20	4.0	0.0%	19	1.9	0.0%	1
A75A2	Surface	A	2.5	5.0%	20	2.6	5.3%	19	1.9	0.0%	1
A76A	Bottom	P	3.7	5.1%	19	3.7	11.1%	18	4.0	0.0%	1
A76A	Surface	P	2.8	2.6%	20	2.8	5.3%	19	1.9	0.0%	1
A76B	Surface	P	2.5	4.2%	20	2.5	5.3%	19	1.9	0.0%	1
A77A	Surface	P	2.4	0.0%	20	2.4	0.0%	19	1.9	0.0%	1
A77B	Bottom	P	2.8	2.6%	19	2.9	5.6%	18	2.0	0.0%	1

Station	Depth	Status	Year Round			Summer			Winter		
			Geo. Mean	%>330	N	Geo. Mean	%>330	N	Geo. Mean	%>330	N
A77B	Surface	P	2.8	2.6%	20	2.8	5.3%	19	1.9	0.0%	1
A78A2	Bottom	A	3.2	2.9%	15	3.3	7.1%	14	1.9	0.0%	1
A78A2	Surface	A	2.2	0.0%	20	2.3	0.0%	19	1.9	0.0%	1
A81B	Surface	A	3.0	0.0%	20	3.0	0.0%	19	2.0	0.0%	1
A82A2	Surface	A	2.3	0.0%	20	2.3	0.0%	19	1.9	0.0%	1
A83A2	Surface	A	2.7	0.0%	20	2.8	0.0%	19	1.9	0.0%	1
A84A2	Surface	A	2.1	0.0%	19	2.1	0.0%	18	1.9	0.0%	1
A85A	Bottom	A	3.2	2.6%	19	3.3	5.6%	18	1.9	0.0%	1
A85A	Surface	A	2.2	0.0%	19	2.2	0.0%	18	1.9	0.0%	1
A85A2	Bottom	A	2.1	0.0%	19	2.2	0.0%	18	1.9	0.0%	1
A85A2	Surface	A	2.2	0.0%	19	2.2	0.0%	18	1.9	0.0%	1
A85B	Bottom	A	2.5	0.0%	19	2.5	0.0%	18	1.9	0.0%	1
A85B	Surface	A	2.1	0.0%	19	2.1	0.0%	18	1.9	0.0%	1
A86B	Bottom	A	2.7	2.8%	18	2.7	5.9%	17	1.9	0.0%	1
A86B	Surface	A	2.3	0.0%	18	2.3	0.0%	17	1.9	0.0%	1
A87A	Surface	A	2.3	0.0%	18	2.3	0.0%	17	1.9	0.0%	1
A87A2	Surface	A	3.1	5.6%	18	3.2	5.9%	17	1.9	0.0%	1
A88A	Surface	A	2.4	0.0%	18	2.5	0.0%	17	1.9	0.0%	1
A88A2	Surface	A	2.5	0.0%	18	2.5	0.0%	17	1.9	0.0%	1
A89A	Surface	A	2.8	0.0%	18	2.9	0.0%	17	1.9	0.0%	1
A91A	Surface	A	2.1	0.0%	18	2.2	0.0%	10	1.9	0.0%	8
A92A2	Surface	A	2.1	0.0%	18	2.1	0.0%	10	2.1	0.0%	8
A93A2	Surface	A	3.4	5.6%	18	3.1	0.0%	10	3.7	12.5%	8
A93B	Surface	A	2.2	0.0%	18	2.0	0.0%	10	2.4	0.0%	8
A94A	Bottom	P	2.1	0.0%	18	2.0	0.0%	10	2.2	0.0%	8

Station	Depth	Status	Year Round			Summer			Winter		
			Geo. Mean	%>330	N	Geo. Mean	%>330	N	Geo. Mean	%>330	N
A94A	Surface	P	2.0	0.0%	18	2.0	0.0%	10	1.9	0.0%	8
A94A2	Bottom	P	2.0	0.0%	18	2.0	0.0%	10	2.1	0.0%	8
A94A2	Surface	P	2.0	0.0%	18	2.0	0.0%	10	2.1	0.0%	8
A94B	Bottom	A	2.3	0.0%	18	2.3	0.0%	10	2.3	0.0%	8
A94B	Surface	A	2.3	0.0%	18	2.2	0.0%	10	2.3	0.0%	8
A95A	Bottom	A	2.1	0.0%	18	2.2	0.0%	10	1.9	0.0%	8
A95A	Surface	A	2.0	0.0%	18	2.0	0.0%	10	1.9	0.0%	8
A95A2	Bottom	A	2.2	0.0%	18	2.4	0.0%	10	1.9	0.0%	8
A95A2	Surface	A	2.0	0.0%	18	2.1	0.0%	10	1.9	0.0%	8
A95B	Bottom	A	2.3	0.0%	18	2.5	0.0%	10	2.2	0.0%	8
A95B	Surface	A	2.4	0.0%	18	2.0	0.0%	10	3.0	0.0%	8
A98A	Surface	A	2.1	0.0%	18	2.0	0.0%	7	2.2	0.0%	11
A99A	Surface	A	2.7	0.0%	19	3.1	0.0%	8	2.4	0.0%	11
AX75A1	Surface	A	5.6	15.0%	20	5.7	15.8%	19	4.0	0.0%	1
AX78A1	Surface	A	2.2	0.0%	20	2.2	0.0%	19	1.9	0.0%	1
AX80A1	Surface	A	2.2	0.0%	20	2.2	0.0%	19	2.0	0.0%	1
AX83A1	Surface	A	2.5	0.0%	20	2.6	0.0%	19	1.9	0.0%	1
AX84A1	Surface	A	2.6	2.9%	19	2.7	0.0%	18	1.9	0.0%	1
AX92A1	Surface	A	2.4	0.0%	18	2.6	0.0%	10	2.1	0.0%	8
B74A	Surface	A	2.4	0.0%	19	2.4	0.0%	18	1.9	0.0%	1
B76A	Surface	P	3.0	6.3%	16	3.1	6.7%	15	1.9	0.0%	1
B76B	Surface	P	2.8	6.3%	16	2.9	6.7%	15	1.9	0.0%	1
C106A1	Surface	A	2.1	0.0%	18	2.0	0.0%	7	2.2	0.0%	11
C73A	Surface	A	4.5	0.0%	20	4.7	0.0%	19	2.0	0.0%	1
C73A2	Surface	A	3.8	5.0%	20	3.9	5.3%	19	1.9	0.0%	1

Station	Depth	Status	Year Round			Summer			Winter		
			Geo. Mean	%>330	N	Geo. Mean	%>330	N	Geo. Mean	%>330	N
C73B	Surface	A	2.2	0.0%	20	2.2	0.0%	19	1.9	0.0%	1
C80A2	Surface	A	3.2	0.0%	20	3.2	0.0%	19	1.9	0.0%	1
C86A	Bottom	A	3.7	0.0%	19	3.8	0.0%	18	2.0	0.0%	1
C86A	Surface	A	2.4	0.0%	19	2.4	0.0%	18	2.0	0.0%	1
C86A2	Bottom	A	2.8	2.7%	19	2.9	5.6%	18	1.9	0.0%	1
C86A2	Surface	A	2.1	0.0%	18	2.1	0.0%	17	1.9	0.0%	1
C86B	Bottom	A	2.6	2.6%	19	2.7	5.6%	18	1.9	0.0%	1
C86B	Surface	A	2.3	0.0%	19	2.3	0.0%	18	1.9	0.0%	1

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.

Data comparing the difference between coliform levels measured after rainfall with those during dry periods from 1998 to 2002 for this shellfish growing area were compared to generate Table 27 and Figures 37 and 38. Rainfall impacts were assessed by correlating fecal coliform MPN values with cumulative rainfall on the day of sampling, 24 hours prior to the day of sampling, and 48 hours prior to the day of sampling. A relationship between rainfall amounts and fecal coliform levels is suggested if the rainfall correlation coefficient is greater than 0.6.

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.

It should be noted that a particular short-term data set might not indicate significant rainfall effects even if the historical data indicate that a significant effect occurs in a particular area. This is

due to one or more of the following factors:

- Data during the short term may consist of primarily rainfall data or dry weather data. In this case, if there are insufficient data points in each category, the test for significance can not be done.
- Data collected after rainfall in the normal sampling regime may miss the effects of the 'first flush'.
- Rainfall data are based on the closest established NOAA station. Since rainfall patterns along the coastline, particularly during the summer months, tend to include locally heavy rainfall, the rainfall amounts recorded at the NOAA station may not accurately reflect the rainfall at the sampling station(s).

TABLE 27: CORRELATION OF TOTAL COLIFORM VALUES WITH CUMULATIVE RAINFALL

Station	Correlation of Total coliform with rainfall			Number of Observations
	Day of Sampling	24 hours prior	48 hours prior	
A76A Bottom	0.094	0.639	0.247	19
A77A Surface	0.694	0.520	0.308	20
A78A2 Surface	0.882	0.705	0.465	20
AX78A1 Surface	0.465	0.384	0.914	20
AX80A1 Surface	0.315	0.776	0.597	20
AX83A1 Surface	0.810	0.823	0.670	20
A93B Surface	-0.159	-0.119	0.601	18
A104A2 Bottom	0.966	0.202	-0.012	18
A105B Bottom	0.602	0.079	0.545	18
A106A2 Surface	0.717	0.113	0.199	19

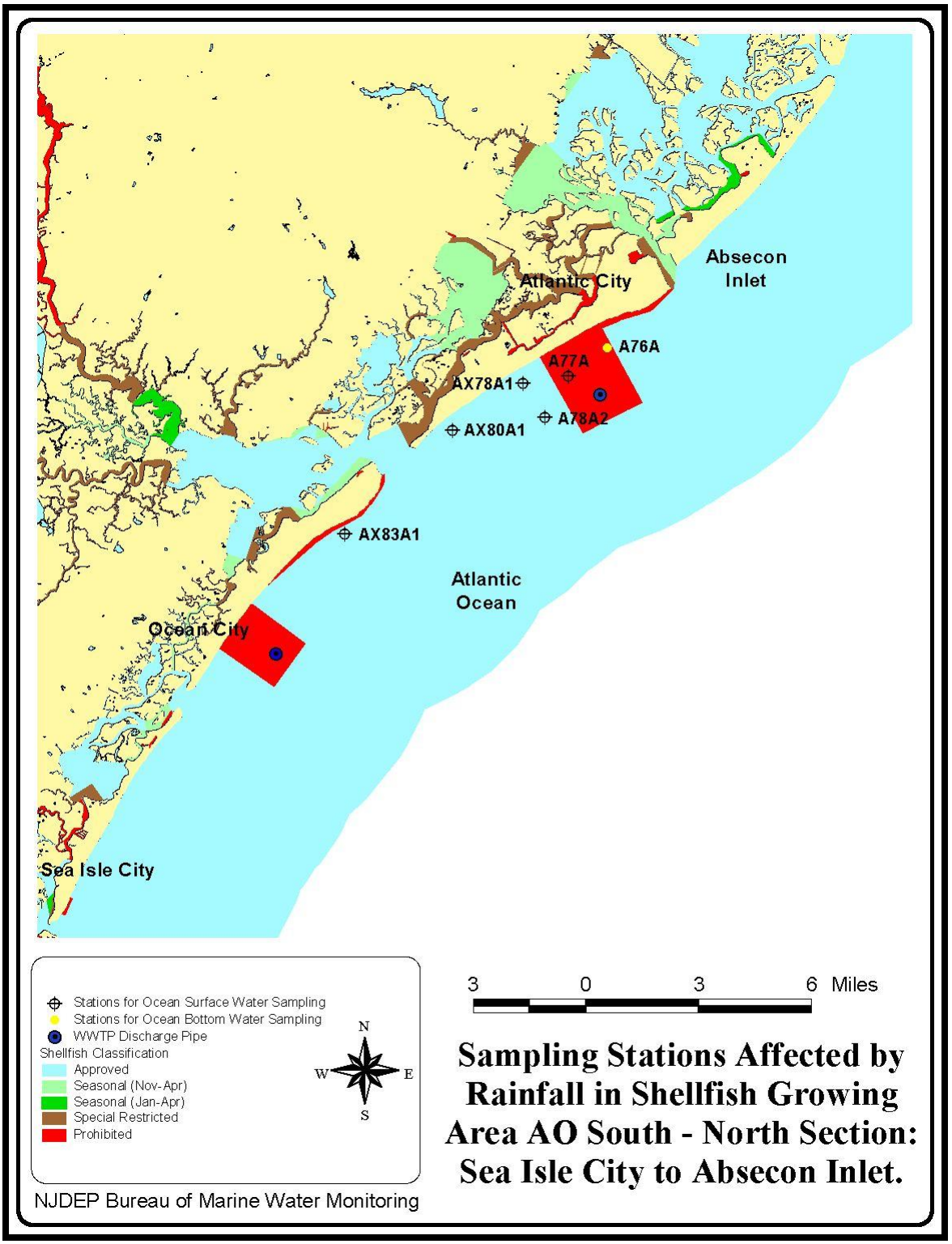

FIGURE 37: SAMPLING STATIONS AFFECTED BY RAINFALL IN SHELLFISH GROWING AREA AO SOUTH – NORTH SECTION: SEA ISLE CITY TO ABSECON INLET.

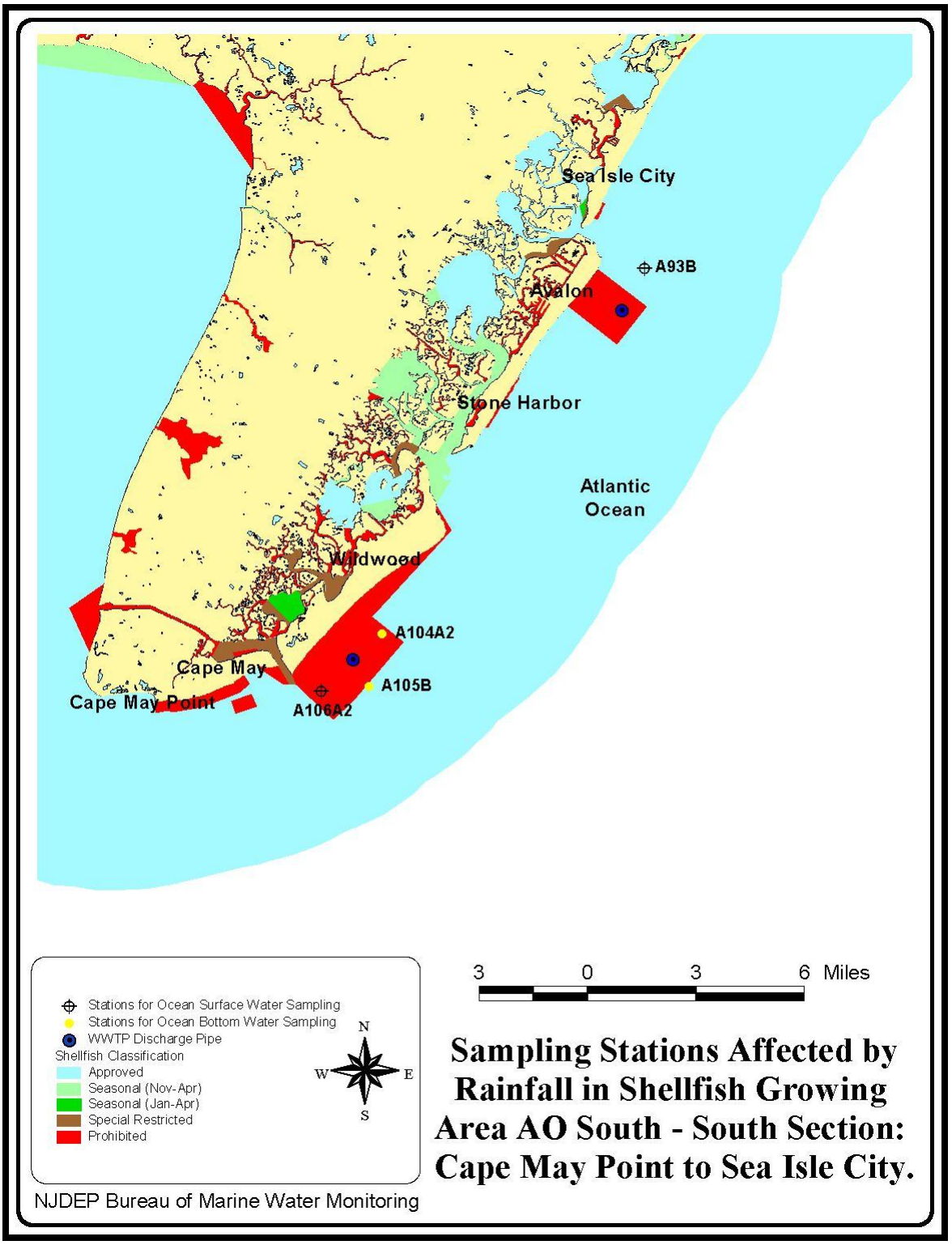

FIGURE 38: SAMPLING STATIONS AFFECTED BY RAINFALL IN SHELLFISH GROWING AREA AO SOUTH – SOUTH SECTION: CAPE MAY POINT TO SEA ISLE CITY.

SEASONAL EFFECTS

In the hydrologic cycle, the motion of all water is controlled by the sun's energy, tides, the motion of the earth, and the differing densities of water masses. The basic component of the hydrologic cycle is the energy of the sun, which moves water by evaporation, convection, and precipitation. As the earth experiences variations in the tilt of its axis and its revolution around the sun, it goes through seasonal phases of summer, spring, autumn, and winter. These seasonal phases have much variation on the atmosphere of the earth, causing changes in weather patterns. Since the atmosphere and the hydrosphere are intimately related, any variation to the atmosphere has an effect on the hydrosphere. Temperature, precipitation, wind, and the general circulation of the atmosphere have seasonal variations that also 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 and 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 (Ingmanson and Wallace, 1989).

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 or 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. Table 28 lists the sampling station in this shellfish growing area that showed a correlation between seasonal effects and water quality. Figure 39 shows the location of this sampling station.

TABLE 28: SEASONAL EFFECTS

Station	Total Coliform Geometric Mean		Probability > [T]
	Summer	Winter	
A95B Surface	2.0	3.0	0.028

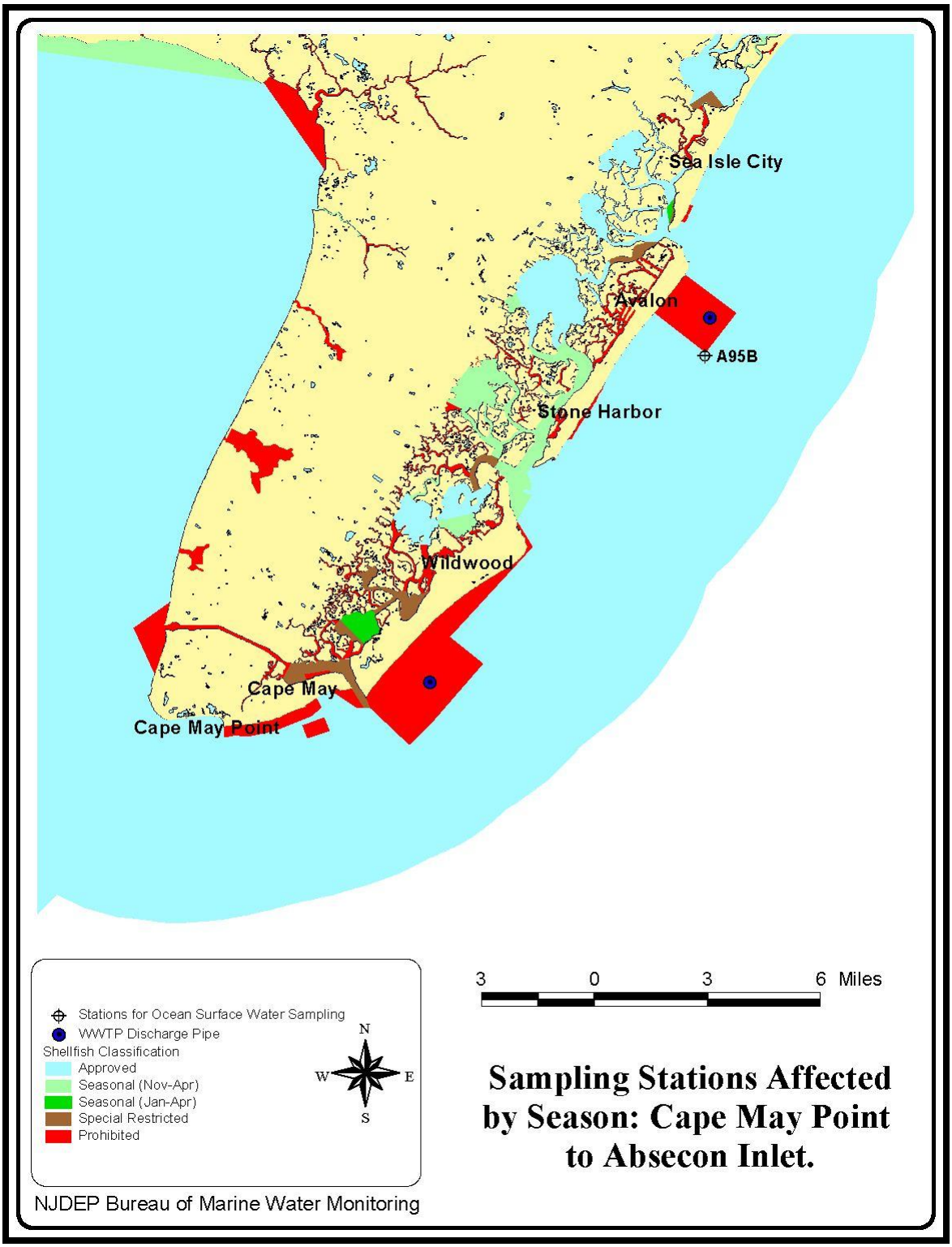

FIGURE 39: SAMPLING STATIONS AFFECTED BY SEASON: CAPE MAY POINT TO ABSECON INLET.

INTERPETATION AND DISCUSSION OF DATA

BACTERIOLOGICAL

Criteria for bacterial acceptability of shellfish growing waters are provided in the National Shellfish Sanitation Program *Guide for the Control of Molluscan Shellfish* (USPHS, 1999 Revision). Each state must adopt either the total coliform criteria or fecal coliform criteria for growing water classifications. For ocean shellfish waters, New Jersey has and continues to base growing water classifications on the fecal coliform criteria.

For the Adverse Pollution Condition (APC) strategy, the data analysis for ocean shellfish waters before 2000 was based on the fecal coliform results in which the fecal coliform median or geometric mean MPN (most probable number) for the *Approved* shellfish water classification shall not exceed 14/100 mL and not more than 10 percent of the sample shall exceed an MPN of 49/100 mL for the three tube decimal dilution test (see Table 3) (USPHS, 1999 Revision). After 2000, the data analysis for ocean shellfish waters was based on the fecal coliform results in which the fecal coliform median or geometric mean MPN (most probable number) for the *Approved* shellfish water classification shall not exceed 14/100 mL and not more than 10 percent of the sample shall exceed an MPN of 28/100 mL for the 12-tube single dilution test (see Table 5) U.S. Food and Drug Administration, 1997).

Figure 40 shows the sampling station (Sampling Station **AX75A1 Surface**) that exceeded the *Approved* fecal coliform criteria for water quality after being sampled as Adverse Pollution Condition (APC) Strategy. This sampling station is located in *Approved* ocean waters east of the *Prohibited* buffer area off the northeast coast of Atlantic City. Sampling Station **AX75A1 Surface** exceeded the fecal coliform criteria year-round and in the summer for shellfish waters that are classified as *Approved.* Since this sampling station exceeded the existing *Approved* shellfish classification year-round and during the summer when shellfish are harvested in this area, the *Prohibited* buffer zone off the northeast coast of Atlantic City will need to be extended to include Sampling Station, **AX75A1 Surface** and approximately 257 acres of shellfish waters around this sampling station will need to be downgraded from the *Approved* to the *Prohibited* shellfish classification. The rest of the sampling stations in this shellfish growing area meet the *Approved* fecal coliform criteria for water quality. However, some of these sampling stations are located in shellfish waters which are part of the *Prohibited* shellfish zones around the wastewater treatment facility discharge pipe or near the storm water outfalls in this area, and these sampling stations meet the NSSP

classification criteria for these shellfish areas.

A significant correlation between fecal coliform MPN and rainfall was found to occur at 10 out of 84 of the stations sampled in this shellfish growing area (see Figures 37 and 38, and Table 27). These sampling stations are located throughout this shellfish growing area in *Approved* and *Prohibited* ocean waters. Six of these sampling stations (Sampling Stations **AX83A1 Surface, A104A2 Bottom, A105B Bottom, A106A2 Surface, A77A Surface,** and **A78A2 Surface)** showed a rainfall correlation on the day of sampling, four of these sampling stations (Sampling Stations **AX83A1 Surface, A76A Bottom, A78A2 Surface,** and **AX80A1 Surface**) showed a rainfall correlation 24 hours prior to the day of sampling, and three of these sampling stations (Sampling Stations **AX78A1 Surface, AX83A1 Surface,** and **A93B Surface)** showed a rainfall correlation 48 hours prior to the day of sampling. However, the fecal coliform levels still meet the existing *Approved* 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 of this area, this shellfish growing area will continue to be sampled using the Adverse Pollution Condition (APC) strategy.

There was one sampling station (Sampling Station **A95B Surface**) that showed a seasonal component for water quality in this shellfish growing area (see Figure 39 and Table 28). Sampling Station **A95B Surface** is located to the south of the *Prohibited* Area surrounding the Cape May County Utilities Authority Seven Mile/ Middle Region Wastewater Treatment Facility Discharge Pipe, in *Approved* shellfish waters. This sampling station showed a higher fecal coliform geometric mean during the winter than during the summer. The higher fecal coliform geometric mean during the winter could be from the impact of wild bird populations to this area. However, the fecal coliform levels still met the existing *Approved* 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 existing Adverse Pollution Condition (APC) strategy.

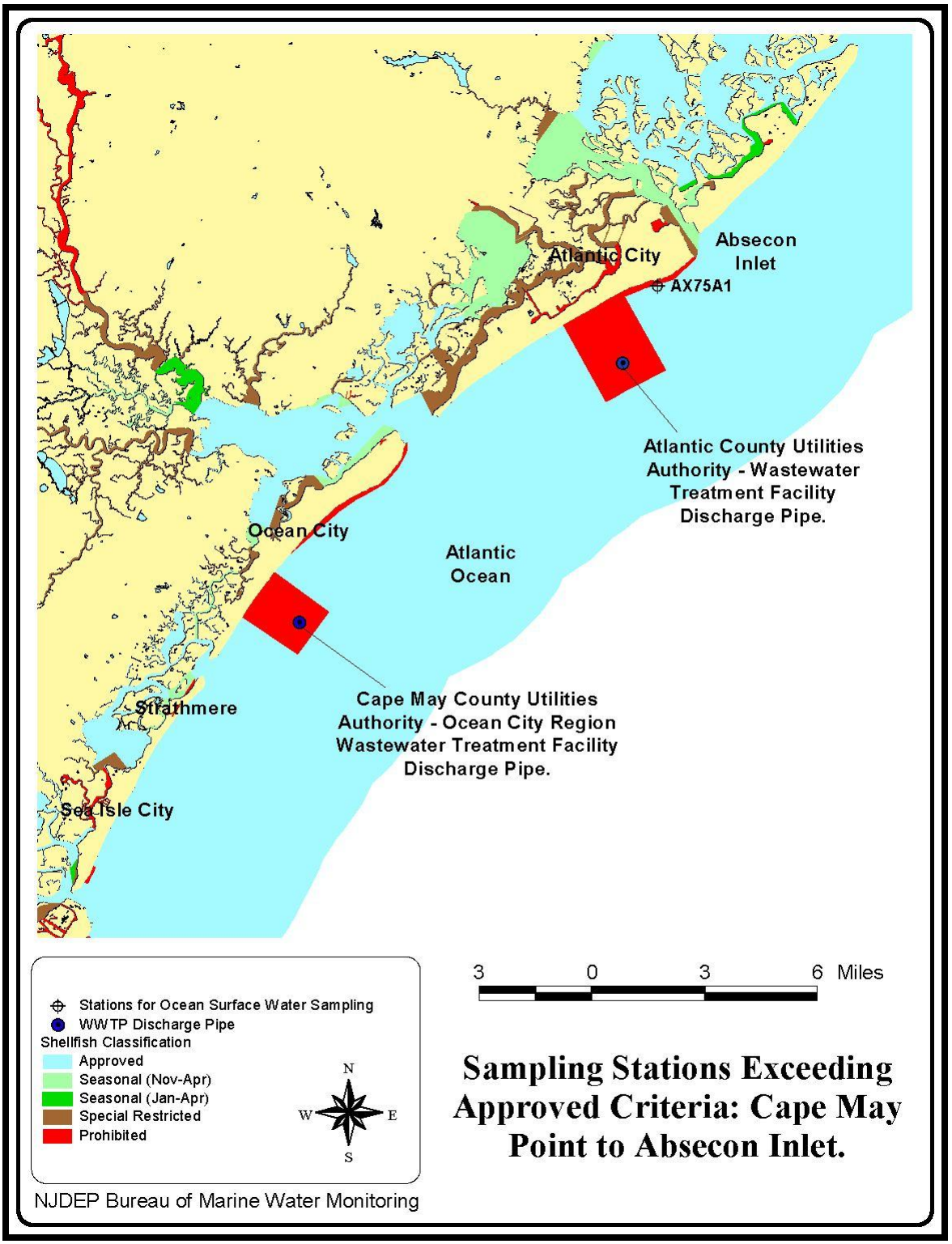

FIGURE 40: SAMPLING STATIONS EXCEEDING APPROVED CRITERIA: CAPE MAY POINT TO ABSECON INLET.

RELATED STUDIES

NUTRIENTS

According to the 2002-2003 Marine Water Sampling Assignments Schedule for Assignments 401 (the Cape May Inlet and Hereford Inlet areas), 421 (the Townsend Inlet area), 431 (the Corsons Inlet area), and 441 (Absecon Inlet and the Great Egg Harbor Inlet areas), there are 11 stations in Shellfish Growing Area AO South that are sampled under the estuarine monitoring program for chemical parameters including nutrients. These nutrient stations include sampling stations **A110B**, **C106A1**, **A105A2**, **A101A**, **A94A2**, **A93A2**, **A87A**, **A85A2**, **A81B**, **A77B**, and **A74A**. (see Figures 41 and 42 for the locations of these nutrient stations).

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, 2000, Zimmer, 2001).

Water quality at the 11 nutrient stations in this shellfish growing area is 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 latest report (New Jersey Ambient Monitoring Program: Report on Marine and Coastal Water Quality - 2000) is available from the Bureau of Marine Water Monitoring electronically at:
www.state.nj.us/dep/wmm/bmw.

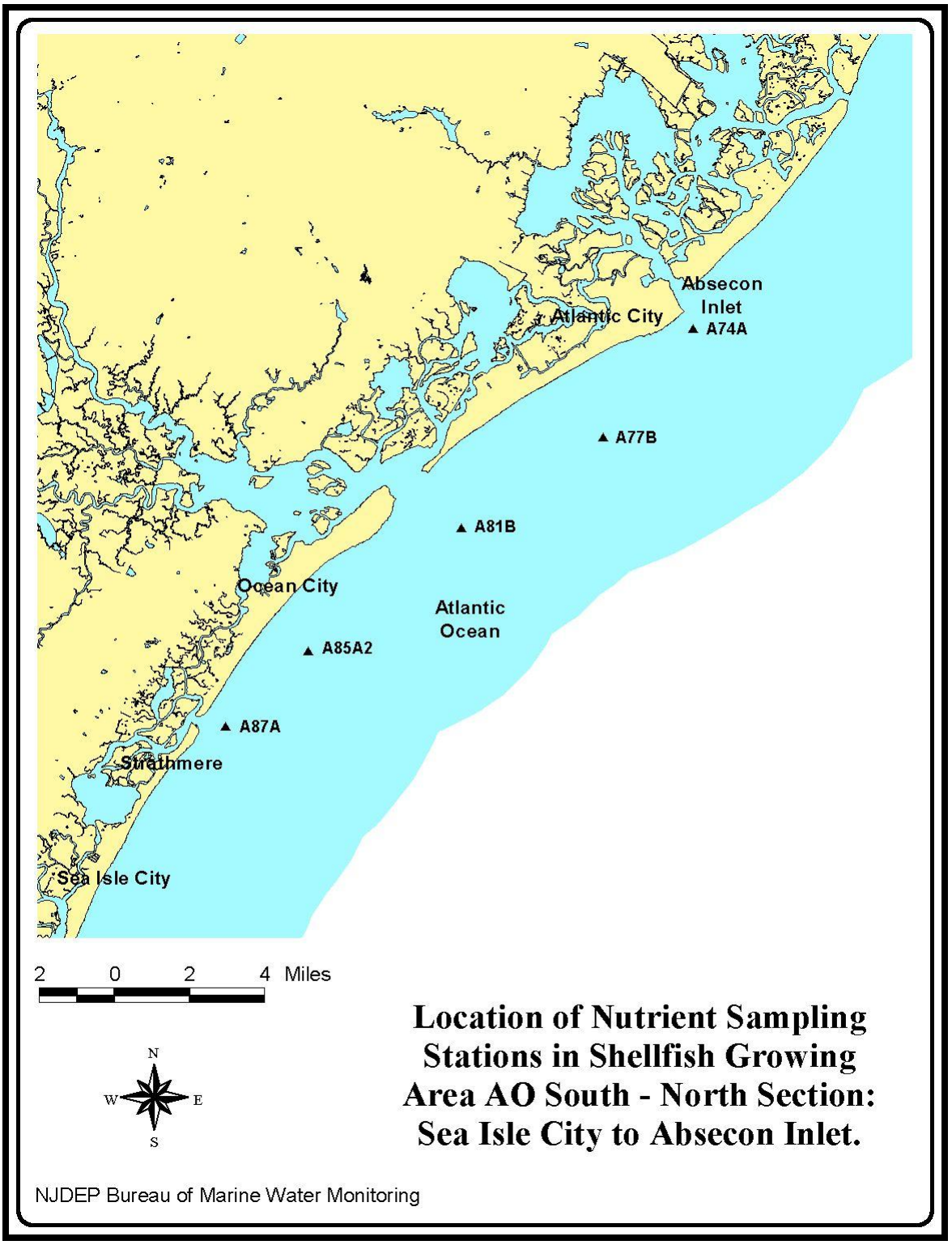

FIGURE 41: SAMPLING STATIONS WHERE ADDITIONAL DATA HAVE BEEN COLLECTED FOR NUTRIENTS: SEA ISLE CITY TO ABSECON INLET.

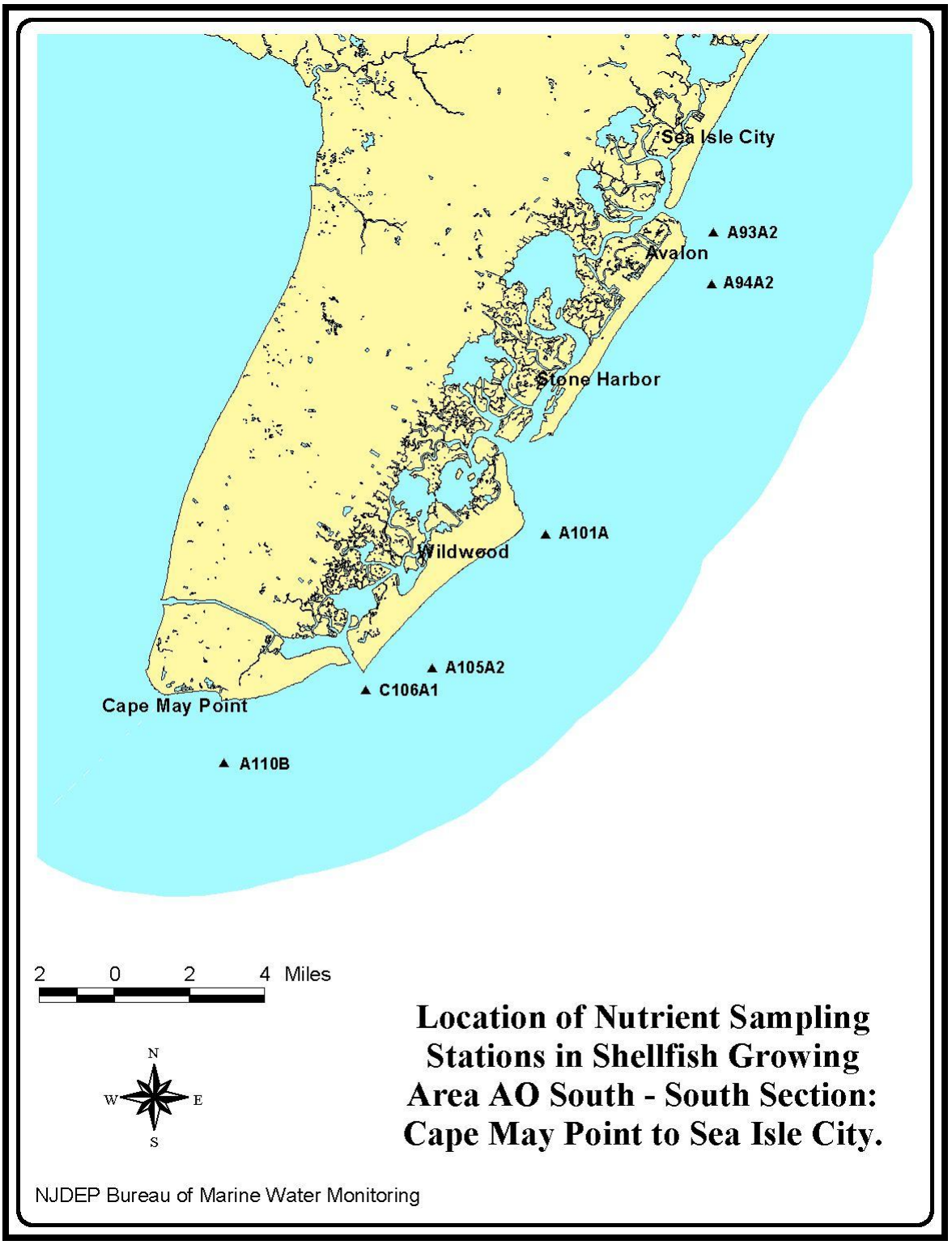

FIGURE 42: SAMPLING STATIONS WHERE ADDITIONAL DATA HAVE BEEN COLLECTED FOR NUTRIENTS: THE ATLANTIC OCEAN FROM CAPE MAY POINT TO SEA ISLE CITY.

MUSSEL WATCH SAMPLING STATIONS

The NOAA Mussel Watch Program is a program that monitors the levels of toxins and metals in coastal waters (National Oceanic and Atmospheric Administration, 1998). The blue mussel, *Mytilus edulis*, occurs worldwide, and effectively takes up toxins and metals from seawater and sediment, and concentrates the toxins and metals in their living tissues. Assays from the living tissues of this shellfish can be made easily and cheaply. The Mussel Watch Program monitors metals such as mercury, lead, zinc, nickel, cadmium, copper, chromium, aluminum, silicon, manganese, iron, arsenic, selenium, tin, antimony, thallium, and silver. The program also monitors toxins such as the synthetic organic compounds that are widely used in pesticides, solvents, flame-retardants, and other products. Figure 43 shows the locations of the 15 NOAA Mussel Watch Sampling Stations in New Jersey. There is one NOAA Mussel Watch Sampling Station located in this shellfish growing area, and it is AIAC (Absecon Inlet – Atlantic City). A review of the data from 1999 to 2003 for this station showed no exceedances of the FDA criteria (Nguyen, 2005). Information about this station is available electronically at: http://nsandt.noaa.gov.

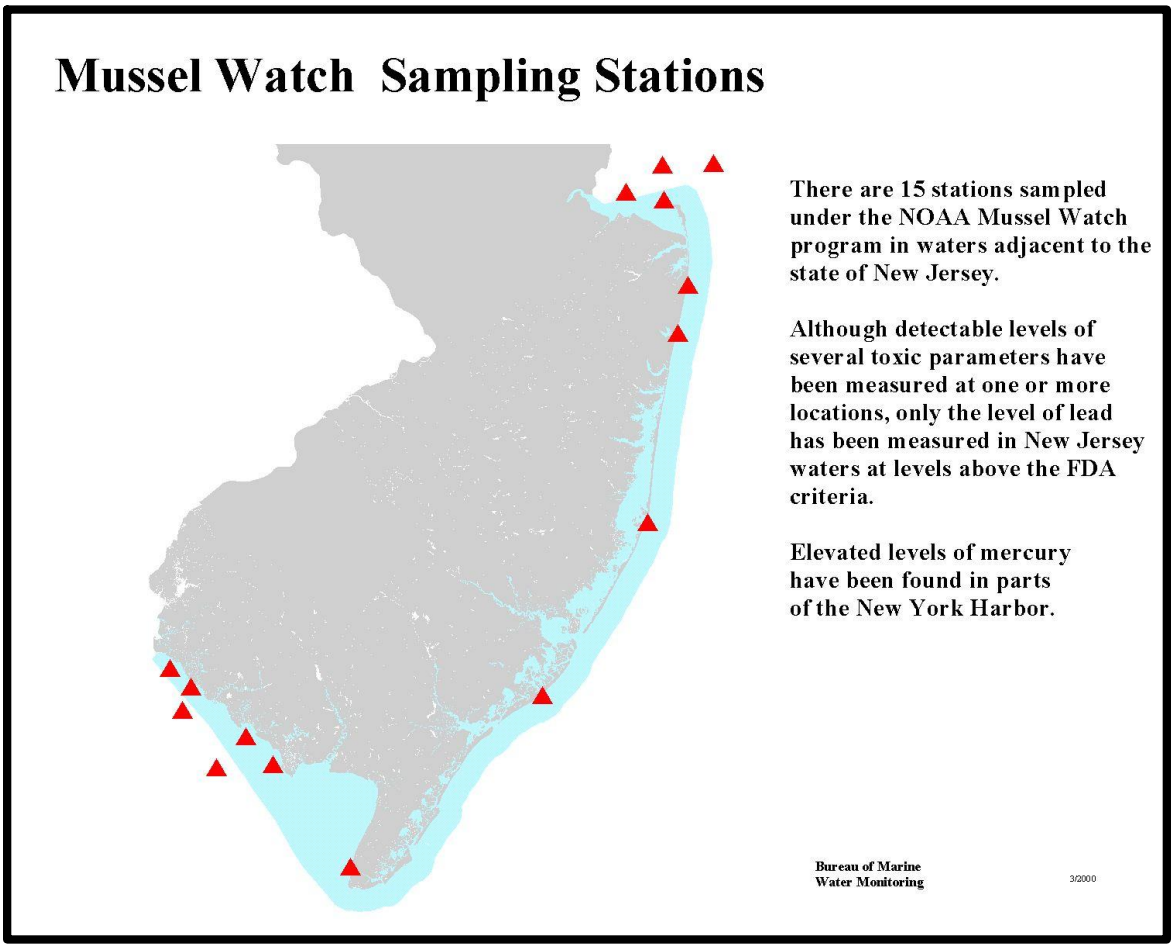

FIGURE 43: SAMPLING SITES WHERE NOAA MUSSEL WATCH DATA HAVE BEEN COLLECTED

MARINE BIOTOXINS

The Department collects samples at regular intervals throughout the summer to determine the occurrence of marine algae that produce biotoxins. However, there are no Phytoplankton sampling stations located in this shellfish growing area.

CONCLUSIONS

BACTERIOLOGICAL EVALUATION

Water quality in Shellfish Growing Area AO South - the Atlantic Ocean from Cape May Point to Absecon Inlet continues to be mostly good, with most of the sampling stations in compliance with the shellfish classification for this area, based on NSSP fecal coliform criteria. However, Sampling Station **AX75A1 Surface** was out of compliance with the existing shellfish growing water classification criteria and exceeded the *Approved* total coliform classification criteria year-round and during the summer. This sampling station is located in *Approved* ocean waters east of the *Prohibited* buffer area off the northeast coast of Atlantic City and exceeded the existing shellfish classification criteria during the summer when shellfish are harvested from these waters. Therefore, 257 acres of shellfish growing waters in the Atlantic Ocean northeast of Atlantic City will need to be downgraded to the *Prohibited* shellfish classification.

RECOMMENDATIONS

BACTERIOLOGICAL EVALUATION

RECOMMENDED CLASSIFICATION CHANGES

It is recommended that 257 acres of shellfish waters, which are currently classified as *Approved* and located east of the *Prohibited* buffer area off the northeast coast of Atlantic City will be downgraded to the *Prohibited* shellfish classification. This area will be added to the 2,903 acres of *Prohibited* shellfish

growing waters off the northeast coast of Atlantic City. The area to be reclassified is shown in Figures 44 and 45.	The New Jersey Administrative Code (N.J.A.C. 7:12) Shellfish Water Classification & Special Permit Rules need to be revised to show the change in this shellfish water classification.

LEGAL DESCRIPTION FOR RECOMMENDED CHANGES:

IN NEW JERSEY ADMINISTRATIVE CODE 7:12-2.1 SHELLFISH GROWING WATER CLASSIFICATION – PROHIBITED

(a) The following shellfish growing waters are classified Prohibited:

20. Atlantic Ocean:

i. (No Change)

ii. (No Change)

iii. (No Change)

iv. (No Change)

v. All the ocean waters inshore of a line beginning al the light charted as Fl G 4 sec 29 ft 6M (7) at the end of Absecon Inlets southwest jetty and bearing approximately 230 degrees T for **[**0.68**]** **2.26** nautical miles **[**towards the northeast corner of Steel Pier that has coordinates of latitude 39 degrees 21 minutes 22.97 seconds North, longitude 74 degrees 25 minutes 4.65 seconds West; thence in a southwesterly direction to the southwest corner of Steel Pier; thence 0.71 nautical miles in a southwesterly direction bearing approximately 255 degrees T toward the northeastern corner of the "Ocean 1 Mall Pier" that has coordinates of latitude 39 degrees 21 minutes 9.94 seconds North, longitude 74 degrees 25 minutes 59.04 seconds West: thence in a southwesterly direction to the southwestern corner of the Ocean 1 Mall Pier; thence approximately 0.46 nautical miles in a southwesterly direction bearing approximately 245 T**]** until it intersects a line bearing approximately 155 degrees T from the northeast corner of Trop World Casino (Brighton Avenue and the Boardwalk, Atlantic City) at a point located approximately **[**0.17**]** **0.64** nautical miles offshore with the coordinates of latitude 39 degrees, 20.0 minutes **[**58.2**]** **32.32** seconds North, longitude 74 degrees, 26 minutes **[**33.2**]** **22.62** seconds West; thence in a southeasterly direction bearing approximately **[**153**]** **148** degrees T for approximately **[**1.91**]** **1.75** nautical miles to a point with the coordinates of latitude 39 degrees 19 minutes 15.4 seconds North, longitude 74 degrees 25 minutes 20.0 seconds West; then proceeding in a southwesterly direction parallel to the coastline,

approximately 242 degrees T, for approximately 1.57 nautical miles to a point with the coordinates of 39 degrees 18 minutes 32.2 seconds North, longitude 74 degrees, 27 minutes 7.6 seconds West; thence 2.05 nautical miles in a northwesterly direction bearing approximately 335 degrees T toward the southwestern corner of a brown apartment building (Oxford Avenue and the beach, City of Ventnor) to a point with the coordinates of latitude 39 degrees, 20 minutes 18.1 seconds North, longitude 74 degrees, 28 minutes 23.9 seconds West and terminating.

vi. (No Change)

vii. (No Change)

viii. (No Change)

ix. (No Change)

x. (No Change)

xi. (No Change)

xii. (No Change)

xiii. (No Change)

xiv. (No Change)

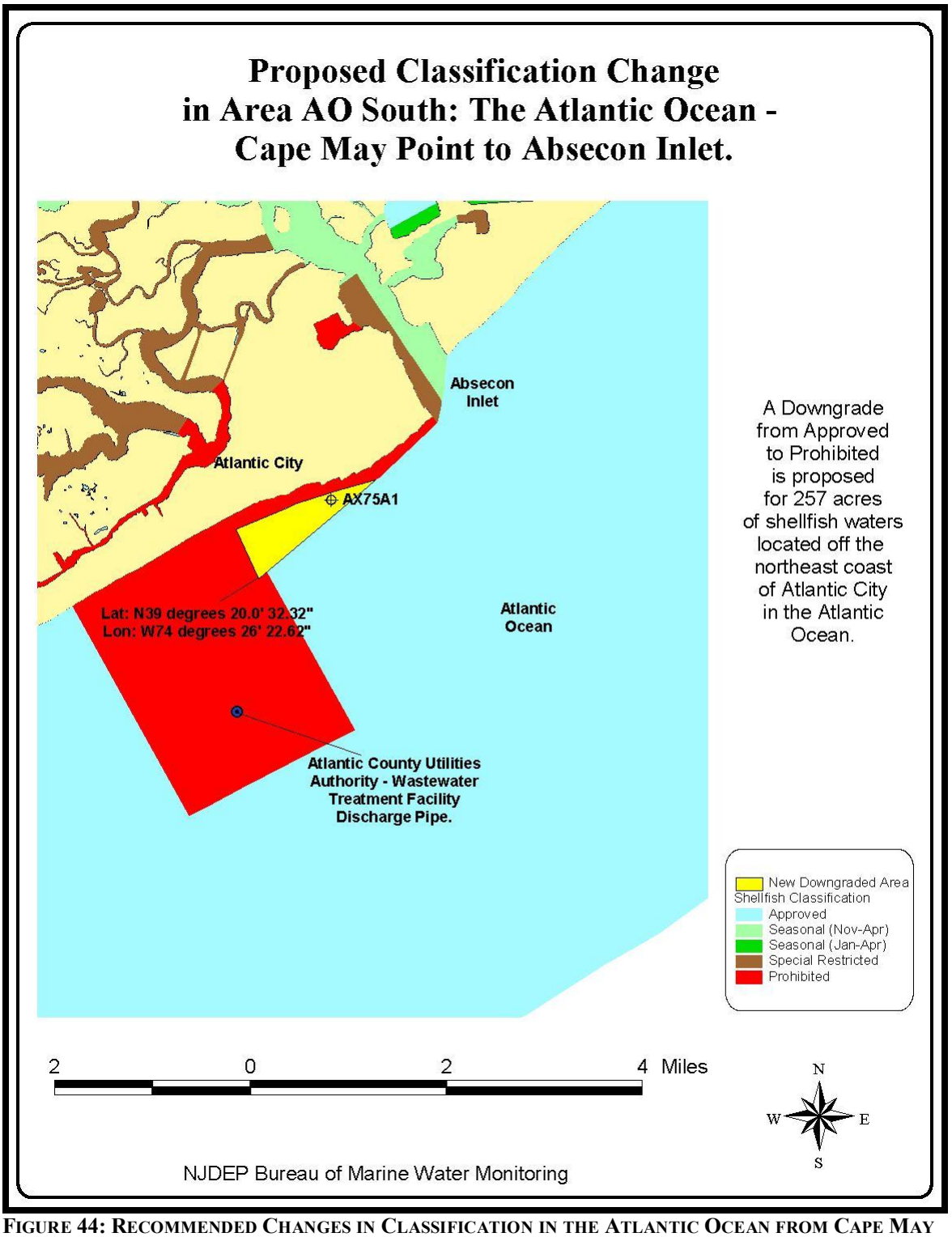

FIGURE 44: RECOMMENDED CHANGES IN CLASSIFICATION IN THE ATLANTIC OCEAN FROM CAPE MAY POINT TO ABSECON INLET.

FIGURE 45: LOCATION OF THE DOWNGRADED AREA IN THE ATLANTIC OCEAN OFF THE NORTHEAST COAST OF ATLANTIC CITY. PHOTOGRAPH WAS TAKEN ON JULY 22, 2004 AT 9: 50 A.M.

RECOMMENDED CHANGES IN MONITORING SCHEDULE

Continue sampling using the existing Adverse Pollution Condition (APC) strategy for Assignments 401, 421, 431, and 441. Water samples for Sampling Stations C73A Surface through A89A Surface (Assignments 431 and 441) need to be collected during the winter months. Reduce the number of runs collected per year from 6 to 5 for Assignment 401 (Cape May Inlet and Hereford Inlet Areas), Assignment 421 (Townsend Inlet Area), Assignment 431 (Corsons Inlet Area), and Assignment 441 (Absecon Inlet and Great Egg Harbor Inlet Areas).

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APPENDICES

A. Statistical Summaries

- Year-round
- Winter Only
- Summer Only

B. Seasonal Evaluation

C. Precipitation

- Rainfall Correlation
- Cumulative Rainfall
- Wet Weather Statistical Summary
- Dry Weather Statistical Summary

D. Tidal Evaluation

E. Data Listing- 1999 through 2003