FINAL REPORT

for

Shellfish Pathogen TMDLs for 27 303(d)-listed Waters

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Oceans and Coastal Protection Division

and

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1.0 INTRODUCTION

1.1 Background

Section 303(d) of the Clean Water Act (CWA) as amended by the Water Quality Act of 1987, Public Law 100-4, and the United States Environmental Protection Agency's (USEPA/EPA) Water Quality Planning and Management Regulations (40 CFR, Part 130) requires each state to identify those waters within its boundaries not meeting water quality standards for any given pollutant applicable to the water's designated uses. Total Maximum Daily Loads (TMDLs) are required to be developed for all pollutants violating or causing violation of applicable water quality standards for each impaired water body. A TMDL determines the maximum amount of pollutant that a water body is capable of assimilating while continuing to meet the existing water quality standards. Such loads are established for all the point and nonpoint sources of pollution that cause the impairment at levels necessary to meet the applicable standards with consideration given to seasonal variations and margin of safety. Therefore, TMDLs provide the framework that allows states to establish and implement pollution control and management plans with the ultimate goal indicated in Section 101(a)(2) of the CWA: "water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water, wherever attainable" (USEPA, 1991).

On the state's 2006 303(d) list, the New York State Department of Environmental Conservation (NYSDEC) listed 71 Class SA[1] water bodies as pathogen-impaired and, therefore, categorically impaired for shellfishing. In 2006, 25 separate embayments and tributaries in the Peconic Bay estuary were included in a TMDL analysis (Battelle, 2006). Of the 46 remaining water bodies, 27 are analyzed in this TMDL report (Table 1-1). The shellfish closure areas in each water body are divided into zones that relate to the characteristics of their open/closure status which are further described in Section 2. TMDLs are developed for those zones that are either uncertified/conditionally certified or seasonally certified for shellfish harvesting. See below for the definitions of the various types of shellfish area closures/certifications.

The NYSDEC maintains several types of shellfish area closure classifications. Closed shellfish areas can be categorized as *administrative closures* or *water quality closures*. *Administrative closures* are permanently off limits to shellfishing and include areas surrounding actual or potential sources of pathogens (e.g., sewage treatment plant outfalls, marinas, or high density mooring locations). *Water quality closures* include areas that have failed to meet the National Shellfish Sanitation Program's (NSSP) standards for open shellfish areas. The NSSP is the federal/state cooperative program recognized by the U.S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC) for the sanitary control of shellfish produced and sold for human consumption. In 1984, the FDA entered into a Memorandum of Understanding (MOU) with the ISSC as the primary voluntary national organization of State shellfish regulatory officials that provide guidance and counsel on matters for the sanitary control of shellfish. The ISSC has adopted formal procedures for state representatives to review shellfish sanitation issues and develop regulatory guidelines. These guidelines are published in the NSSP Model Ordinance which provides guidelines to ensure that the shellfish produced in States are

[1] Class SA waters are surface saline waters. The best usages of Class SA waters are shellfishing for market purposes, primary and secondary contact recreation, and fishing. See New York State Codes, Rules, and Regulations (NYCRR) Title 6, Chapter X, §701.

safe and sanitary. New York State has adopted the NSSP guidelines in the development of water quality standards associated with the designated use of shellfish harvesting in Class SA waters.

Water quality closures can be divided into three sub-categories:

- **Year-round closures:** These areas do not meet the NSSP standards at any time of the year and are closed to shellfishing.
- **Seasonal closures:** These areas do not meet NSSP standards during a certain time of year (usually during the warmer months) and therefore are only open to shellfishing during specific times of the year.
- **Conditional closures:** These areas are usually classified as uncertified, but may be certified by NYSDEC generally from mid-December through mid-April when nonpoint source pollution is reduced. Before an uncertified shellfishing area can be designated as conditionally certified, NYSDEC performs water quality evaluations to determine the amount of rainfall and runoff an area can receive and still meet water quality standards for shellfishing. When the daily rainfall threshold amount is exceeded, the area is closed for a period of seven days and re-opened (certified) on the eighth day if the daily rainfalls during the closed period do not exceed the threshold amount. The fact that the threshold rainfall for many of the New York water bodies with conditional certification has typically been around 0.25 inches demonstrates how sensitive water quality in these areas is to the effects of bacteria-laden storm water runoff in combination with other potential sources that are not associated with storm events (e.g., failing on site disposal systems, boater waste, direct waterfowl inputs). Since conditionally certified areas are actually closed areas whose designation can change from year-to-year, for the purposes of this TMDL report, any sampling station located within a conditionally certified area is treated as being in a closed area.

There are 19 additional Class SA water bodies on the 303(d) list that are exceeding for pathogens that are neither covered in this report nor in Battelle (2006). These 19 water bodies are not evaluated here for a variety of reasons. Seven of them (New Rochelle Harbor; Long Island Sound Westchester County waters; Manhasset Bay; Dosoris Pond; Beach/Island Ponds; Phillips Creek; and Woodmere Channel) did not have readily available fecal or total coliform data with which to characterize the water body. For ten of them (Long Island Sound, Nassau County waters; Long Island Sound, Westchester County waters; Nicoll Bay; Great Cove; South Oyster Bay; East Bay; Middle Bay; Reynolds Channel East; Hempstead Bay; and East Rockaway Inlet), there were scale issues and complex physics within the systems that would not have been compatible with the chosen modeling approach. Two of the 18 water bodies (Forge River and Woodmere Channel) are not listed as SA by the New York Codes, Rules, and Regulations (NYCRR) and, therefore, are not designated as suitable for shellfishing regardless of their water quality. One of them (Raritan Bay) is under administrative closure (pers comm., Joshua Thiel, NYSDEC) and is approved for shellfishing only under NYSDEC's shellfish relay program[2]. Finally, one of them (Quogue Canal) is not included because it is within the physical conduit between two impaired water bodies and is adjacent to yet another. Establishing a clear boundary between this impaired water body and its neighbors poses a difficult challenge. It is therefore assumed in this case that establishing TMDLs for the three adjacent systems will result in the compliance of Quogue Canal due to the nature of the system's geomorphology and relative positions and areas of potential contributing watersheds.

[2] NYSDEC's relay program allows shellfish harvested from Raritan Bay to be moved to certified areas of Long Island for a cleansing period of at least 21 days prior to consumption.

The scope of this study is limited to 27 Class SA shellfishing waters that are listed in the New York 2006 303(d) list as impacted by pathogens. The Class SA waters included in this study are further described in Section 2, accompanied by maps depicting water quality station locations, shellfish closure areas, Class SA water boundaries, and sewage treatment plant (STP) locations (if any). The locations of water quality stations as well as the shellfish closure areas were made available by the NYSDEC. The Class SA waters GIS datalayer was created from information provided in the NYCRR. STP locations were determined using information available from EPA's EnviroFacts data warehouse.

Table 1-1. 303(d)-Listed Water Bodies Covered in this TMDL Report.

Priority Water body List (PWL) Number	Water body
1702-0022	Hempstead Harbor, north, and tidal tributaries
1702-0018	Cold Spring Harbor, and tidal tributaries
1702-0228	Huntington Harbor
1702-0229	Centerport Harbor
1702-0230	Northport Harbor
1702-0047	Stony Brook Harbor and West Meadow Creek
1702-0015	Port Jefferson Harbor, North, and tributaries
1702-0091	Conscience Bay and tidal tributaries
1702-0242	Setauket Harbor
1702-0019	Mt. Sinai Harbor and tidal tributaries
1702-0020	Mattituck Inlet/Creek, Low, and tidal tributaries
1702-0026	Goldsmith Inlet
1702-0046	West Harbor, Fishers Island
1701-0145	Georgica Pond
1701-0146	Sagaponack Pond
1701-0034	Mecox Bay and tributaries
1701-0294	Heady and Taylor Creeks and tributaries
1701-0298	Penny Pond
1701-0111	Weesuck Creek and tidal tributaries
1701-0300	Penniman Creek and tidal tributaries
1701-0302	Ogden Pond
1701-0042	Quantuck Bay
1701-0371	Quantuck Canal/Moneybogue Bay
1701-0309	Harts and Seatuck Coves
1701-0318	Narrow Bay
1701-0320	Bellport Bay
1701-0326	Patchogue Bay

2.0 PROBLEM IDENTIFICATION

2.1 Problem Definition

The designated use for the 27 New York State water bodies described in this TMDL report is shellfish harvesting. Molluscan shellfish, such as oysters and clams, are suspension feeders. They effectively filter the water around them to feed on microscopic organisms and other particulates suspended in the water column. If the waters are polluted, pathogens (e.g., viruses or bacteria) that are harmful to humans can potentially be retained in the shellfish. Oysters and clams are often eaten raw or partially cooked. If they are harvested from waters that are polluted, they have the potential to cause serious illness or death to shellfish consumers. Since pathogens in a shellfish area may be present in low numbers and difficult to identify, other, more plentiful yet non-harmful bacteria that are commonly associated with pathogens are monitored instead. The detection of these pathogen indicators is assumed to be a reliable sign that dangerous pathogens themselves may also be present. Bacteria associated with human and animal waste (e.g., total and fecal coliforms) are often monitored as pathogen indicators in shellfish growing areas.

In addition to water bodies within the Peconic estuary system (which have been addressed in Battelle [2006]) and the additional 19 impaired water bodies described in Section 1.1, there are 27 Class SA pathogen-impaired water bodies covered in this TMDL report. Table 2-1 further provides a crosswalk between the priority water body list (PWL) name and number, shellfish growing area (SGA), and the NYCRR references. Throughout this report, the water bodies will be referred to by their PWL name and number, and they will be addressed in the same order as presented in Table 2-1. This section provides brief characterizations of shellfish harvesting conditions in each water body with figures that depict New York state Class SA waters, the certification category (e.g., seasonal, closed) for these waters, and the locations of NYSDEC and Suffolk County Department of Health Services (SCDHS) water quality sampling stations. Since conditionally open areas change designation based on various factors such as storm events and other conditions, they are included within the 'closed' sections. The GIS coverages depicted in the following figures are based on the best information available as of the writing of this report and should not be used as the sole reference. Local, county, and state agencies should be consulted for the most current information.

2.2 Water Body Descriptions and Maps

Hempstead Harbor, north, and tidal tributaries (1702-0022)

Moving from west to east, the first water body covered in this TMDL report on the north shore is Hempstead Harbor (not to be confused with Hempstead Bay, which is located on the south shore) (Figure A-1, Attachment A). Hempstead Harbor's orientation tapers down dramatically from mouth to head, and provides a natural shelter from storms and winds. The Manhasset Neck peninsula and the city of Glen Cove bound the Harbor on the west and east, respectively, and the Harbor is almost bisected by Bar Beach near its southerly end. According to the Hempstead Harbor Management Plan (Hempstead Harbor Protection Committee, 2004), land use surrounding the Harbor is dominated (81.7%) by public open space and recreational uses, followed in decreasing amounts by residential, private recreation, unutilized, general commercial, industrial/institutional, and marine commercial.

Table 2-1. Crosswalk Table of the 27 Selected New York 303(d) Waters with Shellfish Growing Areas and the NYCRR.

Priority Water Body List (PWL)		Shellfish Growing Area (SGA)		New York State Codes, Rules, and Regulations (NYCRR)			
Name	**Number**	**Name**	**Number**	**Part**	**Item #**	**Class**	**Reference Map**
Hempstead Harbor, north, and tidal tribs	1702-0022	Hempstead Harbor	50	885	30	SA	R-25sw
Cold Spring Harbor and tidal tribs	1702-0018	Cold Spring Harbor	48	885	70 & 71	SA	R-26sw R-26nw
Huntington Harbor	1702-0228	Huntington Harbor	46	925	16 & 17	SA	R-26nw
Centerport Harbor	1702-0229	Centerport Harbor	43	925	23	SA	R-26ne R-26nw
Northport Harbor	1702-0230	Northport Harbor	42	925	27	SA	R-26ne
Stony Brook Harbor and West Meadow Creek	1702-0047	Stony Brook Harbor	37	925	60	SA	R-27nw
Port Jefferson Harbor, North, and tidal tribs	1702-0015	Port Jefferson Harbor	33	925	68 & 69	SA	R-27ne
Conscience Bay and tidal tribs	1702-0091			925	73	SA	R-27ne R-27nw
Setauket Harbor	1702-0242			925	71	SA	R-27ne
Mt. Sinai Harbor and tidal tribs	1702-0019	Mt. Sinai Harbor	32	925	79	SA	R-27ne
Mattituck Inlet/Creek, Low, and tidal tribs	1702-0020	Mattituck Creek	30	924	5 & 6	SA	Q-29se R-29ne
Goldsmith Inlet	1702-0026	Goldsmith Inlet	67	924	12	SA	Q-30sw
West Harbor, Fishers Island	1702-0046	Fishers Island Sound	51	924	180	SA	P-32sw Q-31nw Q-32sw
Georgica Pond	1701-0145	Georgica Pond	68	924	199	SA	R-31nw
Sagaponack Pond	1701-0146	Sagaponack Pond	69	924	202	SA	R-30ne

Table 2–1. Crosswalk Table of the 27 Selected New York 303(d) Waters with Shellfish Growing Areas and the NYCRR.

Priority Water Body List (PWL)		Shellfish Growing Area (SGA)		New York State Codes, Rules, and Regulations (NYCRR)			
Name	Number	Name	Number	Part	Item #	Class	Reference Map
Mecox Bay and tribs	1701-0034	Mecox Bay	11	923	3	SA	2
Heady and Taylor Creeks and tribs	1701-0294	Shinnecock Bay	10	923	30 & 31	SA	3
Penny Pond	1701-0298			923	38	SA	3
Weesuck Creek and tidal tribs	1701-0111			923	43	SA	3
Penniman Creek and tidal tribs	1701-0300			923	51	SA	3
Ogden Pond	1701-0302	Quantuck Bay	9	923	53	SA	3
Quantuck Bay	1701-0042			923	54	SA	3
Quantuck Canal/Money-bogue Bay	1701-0371			923	65	SA	3
Harts and Seatuck Coves	1701-0309	Moriches Bay	8	920	38, 39, 41, 42, 47, 48	SA	2
Narrow Bay	1701-0318			920	1 & 2	SA	2
Bellport Bay	1701-0320	Bellport Bay	7	922	30	SA	2
Patchogue Bay	1701-0326	Patchogue Bay	6	922	3	SA	2

Waters located south of Bar Beach are not classified as SA. North of Bar Beach, virtually the entirety of the Harbor is Class SA waters, with the exception of the waters surrounding Mosquito Cove and Glen Cove Creek on the easterly side. The non-SA designation of these waters is due to discharge coming from the City of Glen Cove STP into the creek and eventually the cove. All of the SA waters within the Harbor are closed year-round to shellfishing. Two NYSDEC water quality stations are located within Hempstead Harbor waters, near the mouth of the water body. Three beach monitoring stations, sampled by the New York State Department of Health, are also sited in the Harbor, although the latitude and longitude data for these three stations were not available at the time of publication. They are generally located near Bar Beach.

Cold Spring Harbor and tidal tributaries (1702-0018)

Cold Spring Harbor (Figure A-2, Attachment A) is yet another long, narrow water body along the north shore of Long Island, bounded on the west by Cove Neck, Center Island, and the Oyster Bay Harbor complex and on the east by West Neck and Lloyd Neck. The Harbor is bisected lengthwise by the Nassau-Suffolk county line and, similar to Hempstead Harbor, is nearly bisected widthwise near its southerly tip by Cold Spring Bar Beach. The Harbor in its entirety (with the exception of some tributaries) is designated as Class SA and virtually all of it is open year-round for shellfishing, with the exception of the Harbor's head in the vicinity of Bar Beach, which is closed year-round. The land bordering this closed portion is relatively densely developed and extensive boating facilities are located there. The NYSDEC maintains 19 water quality stations within the Harbor.

Huntington Harbor (1702-0228)

Located entirely within Suffolk County, Huntington Harbor (Figure A-3, Attachment A) is a relatively small and narrow inlet off of the much larger Huntington Bay. The Harbor is surrounded by West and East Necks and a narrow inlet opens the Harbor to the greater Bay. Extremely popular with boaters, several marinas and mooring fields dot the water body and the entire Harbor is an approved No Discharge Zone (NDZ), meaning that no vessel-derived treated human waste may be discharged into the Harbor at any time. The Huntington STP discharges into the Harbor near the southerly end. The entire Harbor has been designated as Class SA and is closed year-round to shellfishing. Fourteen NYSDEC water quality stations are located within the Harbor, as are four SCDHS stations.

Centerport Harbor (1702-0229)

Like Huntington Harbor, Centerport Harbor (Figure A-4, Attachment A) opens onto the larger Huntington/Northport Bay Complex and is surrounded by East Neck on the west and Little Neck on the east. The southerly end of the Harbor is called Mill Pond, since it is almost separated from the main Harbor by Mill Dam Road crossing the width of the water body. According to the New York Codes, Rules, and Regulations (NYCRR), only the southerly section of Centerport Harbor is designated as Class SA waters, with the boundary occurring at the landspit on the east side of the Harbor. The vast majority of the Harbor's SA waters are closed year-round to shellfishing, with the exception of a small area around the landspit. This area is open seasonally, from November 1 until April 30. Centerport Harbor is also an approved NDZ. Four NYSDEC water quality stations and two SCDHS stations are located within the Harbor's SA waters.

Northport Harbor (1702-0300)

Moving east from Centerport Harbor, Northport Harbor (Figure A-5, Attachment A) is located in the southeast of the Huntington/Northport Bay complex and the entire water body has been designated as Class SA. Little Neck forms the west coast of the Harbor while the east coast is comprised of the village of Northport. Like Huntington Harbor, Northport Harbor is popular with boaters and has been approved as a designated NDZ. The Northport STP discharges into the Harbor from the southeast end and the entire water body is closed year-round to shellfishing. Fifteen NYSDEC and four SCDHS water quality stations dot the Harbor.

Stony Brook Harbor and West Meadow Creek (1702-0047)

Stony Brook Harbor (Figure A-6, Attachment A) is a very shallow west-to-east oriented inlet on the north shore of Long Island with an extremely narrow outlet to Long Island Sound. An elaborate system of tidal flats and marshes dominates the Harbor, which is fed by West Meadow Creek at the north and the smaller Stony Brook Creek from the east. The land surrounding the Harbor is predominantly residential, with some undeveloped woodlands. The north-to-south oriented West Meadow Creek is bordered on the east by the hamlets of Stony Brook and Setauket. The entirety of the Harbor has been classified as SA and the vast majority is open year round for shellfishing. Inner Stony Brook Harbor, Stony Brook Creek, and West Meadow Creek are all closed year-round to shellfishing while the waters surrounding Smithtown Long Beach Marina and Stony Brook Yacht Club are only open from November 1 until May 14. Thirty-nine stations are monitored by NYSDEC and nine stations by SCDHS in the Harbor.

Port Jefferson Harbor, North, and tidal tributaries (1702-0015)

Located nearly at the midpoint on Long Island's north shore, Port Jefferson Harbor (Figure A-7, Attachment A) is the largest water body within the Port Jefferson Complex (which also includes the following two water bodies). The Harbor is wide and serves as the busy port for the ferry that shuttles between Connecticut and Long Island. Given its status as one of the busiest north shore ports, Port Jefferson Harbor has been approved as an NDZ. On the Harbor's western shore is the Port Jefferson STP, which discharges into the Harbor; this discharge, combined with the heavy traffic, has resulted in a large section near the head of the water body not being designated as Class SA. However, the remainder of the Harbor is Class SA. The inner portion of the Harbor is closed year-round to shellfishing, although the outer section (around the outlet to Long Island Sound) is open to shellfishing from November 1 until April 30. Another section of the Harbor known as The Narrows lies to the north of Strong's Neck and connects the Harbor to Conscience Bay. The Narrows is designated as a holiday closure and is closed to shellfishing every year in and around the July 4th and Labor Day holidays, due to the large numbers of boats. Within the Harbor's SA waters, the NYSDEC maintains 19 water quality stations while SCDHS samples at nine.

Conscience Bay and tidal tributaries (1702-0091)

Conscience Bay (Figure A-8, Attachment A) is located within the Port Jefferson Harbor Complex, all of which has been designated as an NDZ. The Bay lies at the western end of the Complex, where a narrow inlet leads to a relatively spacious, yet shallow, bay which is entirely designated as SA waters. At the southeastern tip of the Bay, a small creek feeds in. Surrounded by Strong's Neck to the east and the village of Old Field to the west, Inner Conscience Bay is closed year-round to shellfishing while the outer portion of the Bay is open from November 1 to April 30. Thirteen NYSDEC and three SCDHS stations are located in the Bay.

Setauket Harbor (1702-0242)

Rounding out the collection of water bodies making up the Port Jefferson Harbor Complex is Setauket Harbor (Figure A-9, Attachment A), a relatively small inlet surrounded by Strong's Neck to the north and west and the hamlets of Setauket and East Setauket to the south and east. The Harbor is designated as an NDZ as well as being entirely classified as SA waters. The inner Harbor is closed year-round to shellfishing while the outer portion before it empties into the Narrows is open from November 1 until April 30. The NYSDEC monitors thirteen water quality stations within the Harbor while the SCDHS samples at five.

Mt. Sinai Harbor and tidal tributaries (1702-0019)

Mt. Sinai Harbor (Figure A-10, Attachment A) is a large water body on Long Island's north shore. Dominated by an extensive tidal marsh system, the Harbor is separated from Long Island Sound by the narrow Cedar Beach barrier, at the end of which is a narrow inlet. On the Harbor side, Cedar Beach is lined with numerous docks and a marina, indicating that boating traffic can be high during the summer season. Land use surrounding the Harbor is low density and much of the area is undeveloped woodlands. A handful of tidal creeks feed into the Harbor from the south shore. The entire water body has been designated as SA waters. One section of the Harbor at its southerly extent is closed year-round to shellfishing and a handful of other portions are open from November 1 until April 30, including almost the entirety of the southern half of the Harbor. Another seasonally open section runs along the Harbor-side of Cedar Beach, where shellfishing can take place between November 1 and May 14. The remainder of the Harbor is open year-round to shellfishing. The Harbor has 22 NYSDEC and 12 SCDHS water quality stations.

Mattituck Inlet/Creek, Low, and tidal tributaries (1702-0020)

Located on the north shore of Long Island's North Fork, Mattituck Creek (Figure A-11, Attachment A) is a narrow, winding creek that reaches about two-and-a-half miles inland to the hamlet of Mattituck. Numerous creeks feed into the Creek from the east, west and south and, despite its small size, the density of recreational boats and private docks is high. The entire Creek is classified as SA waters and is closed year-round to shellfishing. The NYSDEC maintains fifteen water quality stations while the SCDHS monitors four.

Goldsmith Inlet (1702-0026)

Goldsmith Inlet (Figure A-12, Attachment A) is a tiny water body to the east of Mattituck Inlet and is the last north shore water body covered under this TMDL. The entire Inlet is classified as SA waters and is surrounded on the east by forested land and on the west by a residential area. The Inlet is a non-navigable water body and is closed year-round in its entirety to shellfishing. Six NYSDEC and one SCDHS stations are located within the Inlet.

West Harbor, Fisher's Island (1702-0046)

One of the two main harbors on Fishers Island, West Harbor (Figure A-13, Attachment A) is located on the island's north shore. Fisher's Island in general has very low residential density and the area surrounding the Harbor is not heavily developed, either commercially or residentially. Parts of the Harbor have a large number of docks and a handful of marinas dot the water body. The inner section of the Harbor is known as Pirate's Cove and is closed year-round to shellfishing while the outer section is open to shellfishing from October 1 until May 14. The entire Harbor is classified as SA and the NYSDEC monitors ten water quality stations within the water body.

Georgica Pond (1701-0145)

Georgica Pond (Figure A-14, Attachment A) is a coastal lagoon found along the south shore of Long Island's South Fork. The Pond is fed by numerous creeks from the east, west, and north, and the large Georgica's Cove at the southeastern corner is connected to the Pond via a narrow channel. The barrier beach separating the Pond from the Atlantic Ocean is thin, although with the southern exposure, the tidal inlet connecting the two water bodies frequently gets filled with sediment during winter storms and must be reopened in the spring to allow flushing and boat passage. The entire Pond is classified as SA and is closed to shellfishing year-round. The NYSDEC samples at twelve water quality stations at the Pond.

Sagaponack Pond (1701-0146)

Just west of Georgica Pond lies Sagaponack Pond (Figure A-15, Attachment A), a tadpole-shaped water body reaching approximately two miles inland to the Montauk Highway. Similarly to Georgica, Sagaponack Pond has a very narrow inlet to the Atlantic Ocean, one that likely must be cleared at the close of every winter. At the north of the Pond is Sagg Swamp, which borders the hamlet of Bridgehampton. Very few, if any, of the houses along the Pond have private docks and there are no marinas; the inlet's habit of closing up likely prevents much boat traffic from entering the Pond. The entire water body is classified as SA and is closed year-round to shellfishing. There are five NYSDEC water quality stations located within the Pond.

Mecox Bay and tributaries (1701-0034)

Mecox Bay (Figure A-16, Attachment A) is a large, angular shallow coastal bay located on the south shore of Long Island's South Fork, just west of Sagaponack Pond. Creeks and ponds are connected to the main part of the Bay on all sides, ranging from the large Hayground Cove at the northeast to the smaller Burnett Creek on the western shore. Light to medium residential development surrounds the Bay. As is typical of many of these Long Island water bodies, the inlet connecting the Bay with the Atlantic Ocean is very small and likely needs to be maintained to remain open during the summer months. Neither marinas nor private docks are present in the Bay. The entire main section of the Bay is classified as SA, although several of the tributaries are not, including Hayground Cove, Channel Pond, and Sam's Creek. The northern portion of the Bay, including Mill Creek, is closed year-round to shellfishing while the southern three-quarters (with the exception of the tributaries) is open to shellfishing from December 1 until April 30. The NYSDEC has fourteen water quality stations in the Bay.

Heady and Taylor Creeks and tributaries (1701-0294)

Located in the town of Southampton, Heady and Taylor Creeks (Figure A-17, Attachment A) are tributaries entering the large Shinnecock Bay system at the eastern end of the Bay. The open connection with Shinnecock Bay is relatively narrow and the Creeks themselves are shallow. The western shore of Heady Creek (where the Shinnecock Indian Reservation is located) is less intensely developed than the Creek other shorelines. There are no marinas found in either creek and there are only a handful of docks along the shoreline, indicating that vessel traffic within the system is likely to be light. Both creeks are classified as SA waters and are open to shellfishing between December 1 and April 30. The NYSDEC maintains four total water quality stations that fall within the SA boundaries of the water bodies, two in each creek.

Penny Pond (1701-0298)

Penny Pond (Figure A-18, Attachment A) can also be found within the Shinnecock Bay system, entering the Bay from the north close to the center. Despite its small size, Penny Pond contains evidence of heavy boat use. Penny Pond is classified entirely as SA waters and is closed year-round to shellfishing. NYSDEC's single station covering Penny Pond is actually found outside of the Pond's mouth.

Weesuck Creek and tidal tributaries (1701-0111)

In the western section of Shinnecock Bay, Weesuck Creek (Figure A-19, Attachment A) originates from far inland and enters the Bay from the north. Much of the eastern shore of the Creek is woodland, with moderate residential development beyond while the western coast is dominated by commercial and residential land use. At least one marina is located within the Creek and several private docks are scattered along the shorelines. Only about half of the Creek is classified as SA waters, with all waters north of where Bay Avenue leads right up to the water's edge being designated as not suitable for shellfishing. All of the Creek's SA waters are closed year-round to shellfishing. The NYSDEC monitors the water quality at two stations in the Creek, one close to the mouth and one further upstream near the SA water boundary.

Penniman Creek and tidal tributaries (1701-0300)

Penniman Creek (Figure A-20, Attachment A) can be found along the western Shinnecock Bay shoreline, the last water body to enter the Bay before Quogue Canal. Penniman Creek has a wide mouth that quickly tapers to a point at its headwaters. Tidal marshes, woodland, and light residential development dominate the Creek's north shore, while light residential development lines the south shore. Several docks are located along the Creek. The entire Creek is classified as SA waters, although it is closed year-round to shellfishing. The NYSDEC and SCDHS each have one station right at the Creek's mouth.

Ogden Pond (1701-0302)

Ogden Pond (Figure A-21, Attachment A) is a small inlet off of the north shore of Quogue Canal, which connects western Shinnecock Bay with Quantuck Bay. The Pond is surrounded by light residential development and a few docks along its shoreline indicate some boat use. A channel has been dug leading into the Pond. The entirety of the Pond is SA waters and the NYSDEC has one water quality station within it and one at the inlet. However, the entire Pond is closed year-round to shellfishing.

Quantuck Bay (1701-0042)

Quantuck Bay (Figure A-22, Attachment A) is a fairly large, shallow water body fed by two major rivers from the north: the Aspatuck River and Quantuck Creek. The Bay is also flushed by the two canals that feed into its southern portion: Quogue Canal at the east and Quantuck canal at the west. Most of the Bay is Class SA, with the exception of the headwater sections of both rivers. All of the Bay's SA waters are open to shellfishing from December 15 until March 31. Within the water body's SA waters, the NYSDEC has seven water quality stations and the SCDHS has one.

Quantuck Canal/Moneybogue Bay (1701-0371)

Quantuck Canal and Moneybogue Bay (Figure A-23, Attachment A) are located to the west of Quantuck Bay, with the Canal connecting the two bays. Moneybogue Bay is significantly smaller that Quantuck Bay, but has a significant number of private docks and at least one marina. Bounded to the north by primarily tidal marsh and to the south by residential homes, the Canal is relatively short and boasts several docks. All of the Canal and most of Moneybogue Bay is classified as SA waters, with the exception of the major tributary entering the Bay from the north and the minor canals and creeks that feed into the Canal and Bay. Both the Canal and Bay's SA waters are open to shellfishing between December 15 and March 31. NYSDEC monitors water quality at four stations within the Bay's and Canal's SA waters while the SCDHS has one station within the Bay.

Harts and Seatuck Coves (1701-0309)

These two coves (Figure A-24, Attachment A) are large water bodies located within the Moriches Bay system on its north shore. Seatuck is the larger and is fed by several creeks originating far inland. Harts Cove has a round shape and fewer freshwater inputs than Seatuck. Each of the Coves has an open connection with the larger Moriches Bay and Seatuck contains numerous docks and marinas. The Coves are both classified as SA waters and there are a total of ten NYSDEC water quality stations and two SCDHS stations within the water bodies. The inner portions of Harts and Seatuck Coves are closed year-round to shellfishing. The outer parts of Harts and Seatuck Coves (i.e., waters southeast of an imaginary line connecting Havens Point to each of the opposite shorelines—Fish Creek to the east and off Moriches Avenue to the west) are open to shellfishing from December 1 until April 30.

Narrow Bay (1701-0318)

Narrow Bay (Figure A-25, Attachment A) is about three-and-a-half miles long and approximately one-and-a-half miles wide at its widest point and connects Moriches Bay in the east with Bellport Bay in the west. The land mass between Smith and Forge Points forms the Bay's northern shore and several creeks, canals, and ponds flow into the Bay from this land mass. The southern boundary of the Bay is the Fire Island National Seashore barrier beach. Most of the Bay is classified as SA, from Smith Point to Forge Point. From Smith Point nearly to Pattersquash Island, the Bay is closed to shellfishing year-round while the eastern portion of the Bay is open from January 1 to April 14. The NYSDEC maintains eleven water quality stations with the Bay while the SCDHS samples at two.

Bellport Bay (1701-0320)

Bellport Bay (Figure A-26, Attachment A) is located at the far eastern end of the Great South Bay and is fed from the north by Carman's River (which reaches eleven miles inland almost to the center of Long Island) and the much smaller Beaverdam Creek. The Bay is bounded on the east by Smith Point in Shirley and on the west by the hamlet of Bellport; a significant amount of tidal wetlands border the northern portions of the Bay, with residential development along the eastern and western shores. Most of the marina activity is located in Carman's River. The entire Bay, with the exception of the upper reaches of Carman's River and the entirety of Beaverdam Creek, is classified as SA. The majority of the open parts of the Bay are open year-round to shellfishing, while the areas at the mouths of the two creeks are closed year-round. A small area adjacent to the Beaverdam Creek closed portion as well as a larger area at Fireplace Neck is open seasonally to shellfishing: from December 15 until May 14. Eleven NYSDEC stations and two SCDHS stations are located in the Bay.

Patchogue Bay (1701-0326)

Patchogue Bay (Figure A-27, Attachment A) is a large embayment immediately to the west of Bellport Bay. It has a wide open connection with the rest of Great South Bay and is fed from the north by numerous streams and canals, including the Patchogue River, Swan River, and Mud Creek. Nearly the entire Bay is surrounded by moderate to heavy residential, commercial, and industrial land use. The Bay is heavily used by boat traffic, particularly within the Patchogue River, and the Patchogue Village STP discharges to the River from approximately one mile upstream from its connection with the greater Bay. Patchogue Bay, between Blue Point and Howell's Point is classified as SA waters, with the exception of the tributaries and creeks entering from the north. The entire inner portion of the Bay is closed year-round to shellfishing. One small section surrounding the mouth of Hedges Creek in the eastern part of the Bay is open to shellfishing between December 15 and April 30. Another wedge-shaped area is open year-round to shellfishing. Eighteen NYSDEC water quality stations dot the Bay.

3.0 APPLICABLE WATER QUALITY STANDARDS

3.1 National Shellfish Sanitation Program Standards

New York State participates in the National Shellfish Sanitation Program (NSSP) which recommends strict bacteriological water quality standards for shellfish harvesting areas to be designated as approved, or certified, for the harvest of shellfish for human consumption [Note: New York State's water quality standards for certified shellfish lands are specified in 6 NYCRR, Part 47, "Certification of Shellfish Lands."]

The standards are developed for specific indicator organisms, which are assumed to indicate the presence of pathogenic organisms associated with fecal material from warm blooded animals. NSSP guidelines (2003) allow either total or fecal coliform standards for growing area classification. Two sampling strategies, adverse pollution condition (APC) and systematic random sampling (SRS) are acceptable per NSSP guidelines for total or fecal coliform determination. For APC sampling, a minimum of the 15 most recent samples collected under APC (with at least five samples taken per year) are required to classify growing areas. These sampling stations are to be established adjacent to actual or potential sources of pollution. For SRS sampling, a minimum of the 30 most recent samples (with a minimum of six annually), collected under various environmental conditions during the certified period, are required to classify growing areas affected by pollution sources. Remote areas are required to have a minimum of 15 samples (with a minimum of two samples collected annually) to classify growing areas. In the transition between APC and SRS sampling programs, a maximum of 15 APC samples can be integrated with SRS data to determine compliance for a term of up to 3 years. As additional SRS samples are collected, these random samples replace chronologically the samples collected under APC (e.g., sample 31 replaces sample 1).

Prior to June 1998, NYS used both total and fecal coliforms as indicator organisms for classifying shellfish harvest areas. Between June 1998 and January 2001, however, only total coliforms were used as indicators, due to laboratory staffing shortages. After January 2001, the laboratory resumed testing for both fecal and total coliforms, but as of February 13, 2003, the lab has only been testing for fecal coliforms. Table 3-1 tabulates these temporal changes in the indicator organisms used by New York State.

Table 3-1. Changes in Indicator Organisms Used for Classification of Harvest Areas.

	Total Coliforms	Fecal Coliforms
Before June 1998	X	X
June 1998-January 2001	X	
January 2001-February 2003	X	X
February 2003-present		X

The type of sampling applied to test NYS shellfish harvesting areas has also changed over the years. Prior to January 1997, NYS used APC sampling for determining whether the embayments and tributaries met NYS and NSSP standards for certified areas. APCs were considered to exist when rainfall is greater than 0.25 inches but less than 3.0 inches in one or more of the days during the 96 hours (4 days) prior to sampling. APC sampling was conducted only during outgoing tides. Although APC sampling was primarily phased out in 1997 (in favor of SRS sampling, as described below), some limited APC sampling is still done in areas uncertified for shellfish harvesting. APC sampling is targeted to limited post-rainfall (0.05" - 1.5") conditions. It is performed in those areas in which the local Towns have requested that NYSDEC perform a water quality study to determine if the area is suitable for a rainfall related conditional harvesting program. If the results of this limited APC sampling are acceptable, the shellfishing area may be opened to harvesting on a conditional basis.

Beginning in 1998, NYS began to utilize SRS to test the waters of shellfish harvesting areas. SRS sampling events are scheduled randomly in advance (also only during outgoing tides) to develop a collection of data that includes water quality during different weather conditions.

Thresholds to determine harvest area compliance with coliform standards listed in the NSSP are calculated using geometric mean (MPN, or $X_{geomean}$) and 90th percentile values (X_{90}). A geometric mean is used versus an average or typical mean to dampen the effect of very high or low values which often occurs in fecal sampling; levels can vary anywhere from 10 to 10,000 fold over a given period. The 90th percentile takes into account the variability factor which assumes 90 percent of the samples were collected under uniform conditions (variability only due to the test procedure and the additional allowance for some additional variability arising from changing conditions in the water being sampled). This statistical method assumes no more than 10 percent of the samples derived under uniform conditions will exceed the MPN standards. Some shellfish water sampling data may be collected following intermittent pollution events which increases the variability when combined with data collected under normal conditions. As variability is increased, the 90th percentile will reflect this and will protect against the potential public health problems that may result when consumed shellfish are harvested from growing waters that are adversely affected by intermittent pollution events and improperly classified.

The standards for when APC-sampled water bodies and SRS-sampled water bodies are designated as certified for shellfish harvesting are shown in Table 3-2. APC data collected between 1987 and 1996 at all the water bodies, and being collected now at selected water bodies, are reviewed and analyzed based on the standards in Table 3-2. NSSP standards listed in the table below apply to each station.

Table 3-2. NSSP Standards for Shellfish Harvesting Areas Affected by Point and Nonpoint Pollution Sources.

Sampling Technique	Indicators	NSSP Standards* *Note: values are based on a 3-tube, decimal dilution test.	
APC Sampling	**Total coliform**	The median of samples shall not exceed 70 MPN/100ml	Not more than 10% of the samples may exceed 330 MPN/100ml
	Fecal coliform	The median of samples shall not exceed 14 MPN/100ml	Not more than 10% of the samples shall exceed 49 MPN/100ml
SRS Sampling	**Total coliform**	Geometric mean of samples shall not exceed 70 MPN/100ml	The estimated 90th percentile (X90) value shall not exceed 330 MPN/100ml
	Fecal coliform	Geometric mean of samples shall not exceed 14 MPN/100ml	The estimated 90th percentile (X90) value shall not exceed 49 MPN/100ml
Remote Classification*	**Total Coliform**	Geometric mean of samples shall not exceed 70 MPN/100ml	Not more than 10% of the samples shall exceed 330 MPN/100ml

Sampling Technique	Indicators	NSSP Standards* *Note: values are based on a 3-tube, decimal dilution test.	
	Fecal Coliform	Geometric mean of samples shall not exceed 14 MPN/100ml	Not more than 10% of the samples shall exceed 49 MPN/100ml

- A shellfish growing area that is classified as remote has no human habitation and is not impacted by any actual or potential pollution sources. Remote areas must be sampled at least twice annually.

$X_{geomean}$ and X_{90} are calculated as below:

$$X_{geomean} = Anti\log[(\sum_{i=1}^{n} \log(X_i)) / n]$$

where X_1, ... X_n are the coliform concentrations from the SRS sampling. The estimated 90th percentile is computed as:

$$X_{90} = \mathrm{Anti}\log[(S_{\log})*1.28 + XAVG_{\log}]$$

where $S_{\log}$ is the standard deviation of the logarithms of the MPN values and $XAVG_{\log}$ is the mean of the logarithms of the MPN values comprising the data set (also known as the log mean or the arithmetic average of the logarithms - the geometric mean is the antilog of $XAVG_{\log}$). $S_{\log}$ is calculated as follows:

$$S_{\log} = \sqrt{\sum_{i=1}^{n} (\log(X_i) - XAVG_{\log})^2 / (n-1)}$$

Although the NYS water quality standard for Class SA is expressed as a median value of 70 MPN/100ml, the same numerical value is used as geometric mean criterion for SRS data. According to NSSP guidelines (NSSP, 2003), these two are equivalent in terms of public protection.

3.2 NYSDEC Water Quality Regulations

NYSDEC maintains water quality regulations for surface water and groundwater as NYCRR Title 6, Chapter X, §§700-706, last amended August 4, 1999. Contained within these regulations are standards for coliform (§703.4). The New York Commissioner of Environmental Conservation determines which waters are acceptable for shellfish harvesting. Water quality closures (year-round, conditional and seasonal) are defined in Section 1.1.

The determination of conformance is based on whether the waters meet appropriate standards. The standard for total coliform in SA waters as outlined in Title 6, Chapter X, Section 703.4: the median most probable number (MPN) value in any series of representative samples shall not be in excess of 70. However, since 2003, the NYSDEC shellfish sanitation program classifies shellfish harvest areas based on fecal coliform standards. Fecal coliform standards are not currently addressed within NYSDEC water quality regulations. The NSSP has developed the following guidelines regarding fecal coliform: for an area to be certified, the geometric mean should not exceed 14 FC/100ml and the 90th percentile value should not exceed 49 FC/100ml. These standards apply to each station. A station on a closure line should also meet certified criteria.

3.3 Standard Used for Shellfish TMDLs

The NSSP program standards are used by the state's shellfish program to determine whether or not shellfish waters are open for harvesting. Since shellfish harvesting is the designated use for the 27 water bodies covered in this report, the standards used to determine the usability of the shellfish harvesting waters are used in this TMDL report. As noted in Section 3-1, the NYS shellfish standard of "a median value of 70MPN/100ML" is equivalent to NSSP standards of a geometric mean criterion for SRS data. Therefore, the NSSP standards are used as the endpoint in achieving acceptable water quality in the water bodies.

Since NYSDEC's shellfish sanitation program now only analyzes water samples for fecal coliform bacteria, in the future the assessment of the effectiveness of achieving the TMDLs will have to be based on fecal coliform data.

4.0 WATER QUALITY AND WATERSHED CHARACTERIZATION

A wide range of data and information were used to characterize the New York water bodies and their corresponding watersheds. The categories of data used include physiographic data that describe the physical conditions of the watershed, environmental monitoring data that identify potential pollution sources and their contributions, and ambient water quality monitoring data. Table 4-1 summarizes the various data types and data sources used in this characterization. Some of these data types are described in the subsequent sections.

Table 4-1. Summary of Data Types and Sources Used in Water Quality and Watershed Characterization.

Description	Data Source(s)
Water Quality Monitoring Data	NYSDEC; SCDHS
Rainfall Data	NYSDEC
Land Use Parcels	EPA; Suffolk County Department of Planning (SCDP)
Stream Flow Data	USGS

4.1 Water Quality Data

4.1.1 NYSDEC Data

Fecal coliform, total coliform, and rainfall data from NYSDEC were received for all 27 water bodies. The NYSDEC shellfish sanitation program has typically collected 8 to 16 samples per year since 1986 at ambient water quality monitoring stations throughout the state's coastal waters. Since 1986, NYSDEC has examined water samples for total and fecal coliform bacteria, although not necessarily simultaneously (see Table 3-1). The datasets provided by NYSDEC lacked fecal coliform measurements from mid-1998 through 2000 and total coliform data after 2003. As described in Section 3.1, prior to 1997, samples were collected using APC sampling. Since January 1997, NYSDEC samples have been collected using the SRS method. As would be expected using the SRS sampling method, stations were sometimes sampled during heavy rainfall (i.e., essentially APC conditions). In some of the datasets (but not all of them), the sampler would note when the sample was taken during heavy rainfall and the NYSDEC would not include those coliform values in any of its analyses. To maintain consistency with NYSDEC practices, if a dataset indicated that samples were taken during excess rainfall conditions (defined as a continuous rainfall event in excess of 3 inches that occurs within a period of 36 hours or less), those measurements were excluded from the analyses.

For each of the stations within the 27 water bodies, the entire SRS (i.e., post-1997) dataset was used to calculate the geometric mean and 90th percentile for fecal and total coliform. For those stations that had fewer than the NSSP-recommended 30 SRS observations, APC (i.e., pre-1997) data were included until the sample size reached 30. For those stations located in areas that are seasonally opened for shellfishing activity, only those data collected during the time of year when the area is closed to shellfishing were considered in the statistical calculations[3]. There were a

[3] As described in Section 1.1, any sampling station that was located within a conditionally certified area at the writing of this report is treated as being within a closed area.

handful of stations which did not have the requisite sample size of 30, even after including APC data. The geomean and 90th percentile values were still calculated for these stations, although the results are not considered fully compliant with NSSP guidelines. Additionally, some stations only had APC data (the stations are no longer being sampled by NYSDEC). Despite the age of these data, the statistics were still run although these results are also non-compliant with NSSP.

The NYSDEC total coliform data is generally constrained by a minimum detection limit of 3 MPN/100mL and a maximum detection limit of 2,400 MPN/100mL. In the NYSDEC dataset, sample results below the sensitivity of the MPN procedure are reported as <3 MPN/100ml while sample results above the sensitivity are reported as >2,400 MPN/100ml. To allow for data analysis, NYSDEC converts these types of values to 2.9 MPN/100ml and 2,501 MPN/100ml, respectively. Some sampling dates had a ‘0’ entered as the coliform measurement, indicating that no sample was taken. These ‘0’s were treated identically to blank entries and were not included in the statistical analyses.

The statistical analyses indicated which stations within each water body possessed coliform values that exceeded state standards for shellfish harvesting areas. Although these water bodies may be subject to further study (e.g., load reduction analysis, more robust source modeling, etc.), these are the water bodies included in this TMDL report.

4.1.2 Suffolk County Data

Of the 27 water bodies included in this TMDL report, 25.5 are located in Suffolk County[4]. SCDHS has conducted long-term monitoring for both total and fecal coliform dating back to 1976 and, of the 27 water bodies covered in this TMDL report, 16 of them had SCDHS coliform data. As opposed to the NYSDEC data, the SCDHS reported a variety of detection minimums and maximums in their dataset, using values like ‘<3’, ‘<10’ ‘<30’, ‘>16000’. Given this range of reported detection minimums and maximums (and the lack of guidance from SCDHS indicating how they may treat data reported in this manner), any result that was reported as a minimum or maximum was not included in the statistical analyses. Because the actual value is unknown, using an assumed value may artificially inflate or deflate the statistical results.

Unlike the NYSDEC data, the SCDHS has no record of a change in sampling methodology (i.e., from APC to SRS); therefore, all available data were used to calculate the geomean and 90th percentile values for the county stations.

4.1.3 Nassau County Data

Of the 27 water bodies included in this TMDL report, 1.5 are located in Nassau County (Hempstead Harbor and half of Cold Spring Harbor). Requests for bacterial data were made to Nassau County Department of Health (NCDOH). In response to requests for data, NCDOH replied that they would be able to share twenty years of fecal coliform data. Electronic versions of these data were never provided despite repeated attempts to follow-up.

4.1.4 New York State Department of Health Data

Bacterial data from the New York State Department of Health (NYDOH) beach monitoring program were obtained for five beaches in Hempstead Harbor from EPA’s STORET database. Two of the five beaches (Sea Cliff Beach and Morgan Beach) were not located within SA waters and therefore were not considered further. Data from the remaining three beaches (Bar Beach, Hempstead Harbor Beach Park and Tappan Beach) were statistically analyzed and used to

[4] Cold Spring Harbor is located in both Nassau and Suffolk counties.

characterize the existing conditions in the Harbor. Latitude and longitude data for the three stations located within SA waters were not available at the time of publication. The stations are generally located near Bar Beach.

4.1.5 Data Review and Analysis

The data from NYSDEC, SCDHS, and NYDOH were screened for relevance and acceptability. In order to be included in the statistical analyses, the stations must have met the following rules:

- Sampling stations must be located within Class SA waters.
- If a station had 30 or more samples taken during the SRS period (1997-present), then all of those SRS samples were used to calculate exceedances.
- If a station had fewer than 30 samples taken during the SRS period, then samples taken during the APC period (pre-1997) were included in the calculations, until a sample size of 30 was reached.
- If a station had fewer than 30 samples taken overall (i.e., during *both* the SRS and APC periods), then all of the samples, regardless of whether they were APC or SRS, were used in the calculations.
- At both state and county stations that were located in seasonally certified shellfish areas, the exceedances were calculated using only data taken during the closed period of the year. This was to ensure that critical periods of impairment were sufficiently addressed.
- At both state and county stations that were located in uncertified shellfish areas, the exceedances were calculated using data taken throughout the year, regardless of season.
- Some SCDHS sampling data were expressed as '<20', '<2', '<10', or '>16000' (among others) indicating the detection minimum. Since the actual measurement is not known and choosing one would be random and arbitrary, these data were not included in exceedance calculations for county stations

Following these rules, geometric mean and 90th percentile values were calculated on all relevant NYSDEC, SCDHS, and NYDOH fecal and total coliform data. The 90th percentile value for fecal coliform measurements exceeded the NSSP thresholds most often, and was therefore, determined to be the most sensitive indicator for this study. According to the NYSDEC, closures of shellfish lands are usually based on a station's water quality failing to meet the 90th percentile standard criteria, which means that water quality at the station is more variable than the inherent variability of the MPN method used for examining samples. Table 4-2 lists the 27 water bodies covered in this TMDL report and the stations within them (if any) that exceeded for either the geomean or 90th percentile NSSP criteria for fecal and total coliform. Those stations that exceeded the 90th percentile criteria of 49 MPN/100mL for fecal coliform are most noteworthy. Ultimately, the water bodies that possess one or more stations that indicate impairment (i.e., total or fecal coliform levels in excess of state standards) are selected for further analysis in accordance with the TMDL process.

Table 4-2. Summary of the Stations that Exhibit Exceedances for Fecal and/or Total Coliform

Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Station ID	Geomean	90th percentile	n	Station ID	Geomean	90th percentile	n
Hempstead Harbor, north, and tidal tribs	HeH-1	NY565139-01	56.828	500	137	NY565139-01	200.659	1300	59
	HeH-1	NY972763-01	57.752	500	137	NY972763-01	255.782	2300	59
	HeH-1	NY905795-01	85.693	800	139	NY905795-01	299.820	1330	58
Cold Spring Harbor and tidal tribs	CSH-2	48-5		93	57				
	CSH-1	48-11	14.438	93	67				
	CSH-1	48-12	14.342	93	67				
	CSH-1	48-13	23.843	240	63	48-13		460	58
	CSH-1	48-13A	22.535	225.3	62	48-13A		460	57
	CSH-1	48-14	28.696	460	61	48-14		460	56
	CSH-1	48-15	29.185	240	61	48-15		460	56
Huntington Harbor	HuH-1	46-2*	22.83	262	30	46-2		664.1	30
	HuH-1	46-6	17.344	98.7	30	46-6	82.979	1100	30
	HuH-1	46-7	17.96	98.7	30	46-7	79.728	1240.1	30
	HuH-1	46-8	17.851	107.7	30	46-8		460	30
	HuH-1	46-8A	19.403	93	30	46-8A		1100	30
	HuH-1	46-8B	23.344	240	30	46-8B		460	30
	HuH-1	46-9	18.399	107.7	30				
	HuH-1	46-9A	12.235	75	30				
	HuH-1	46-10		93	30				
	HuH-1	010160	30.744	293	42	010160		680	62
	HuH-1	010170	19.265	334.4	9	010170			11
	HuH-1	010080	36.767	266	68	010080	119.819	1630	78
	HuH-1	010090	87.627	540	77	010090	283.989	3600	78
Centerport Harbor	CH-2	43-1	24.694	216	49	43-1	71.243	460	45
	CH-2	43-2	20.589	150	57	43-2		460	60
	CH-2	43-3		150	60				
	CH-1	43-4	34.607	231	32				
	CH-2	010040	123.556	800	75	010040	252.125	3000	41
	CH-2	010270	47.236	380	67	010270	76.407	500	72
Northport Harbor	NH-1	42-3		93	30				
	NH-1	42-B		93	30				
	NH-1	42-C		75	30				
	NH-1	42-D	15.95	93	30				
	NH-1	42-E	17.107	107.7	30				
	NH-1	42-F	17.999	98.7	30				

Table 4–2. Summary of the Stations that Exhibit Exceedances for Fecal and/or Total Coliform, continued

Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Station ID	Geomean	90th percentile	n	Station ID	Geomean	90th percentile	n
	NH-1	42-G	45.434	262	30	42-G	191.733	2501	30
	NH-1	42-H	36.672	240	30	42-H	80.712	1100	30
	NH-1	42-I	25.134	150	30	42-I		460	30
	NH-1	42-J	18.075	240	30				
	NH-1	42-STP	43.837	240	30	42-STP	108.7	524	30
	NH-1	010280	21.034	80	36				
	NH-1	010300	55.501	300	107	010300	87.774	800	126
Stony Brook Harbor and West Meadow Creek	SBH-4	37-1		73	55				
	SBH-2	37-2A	16.445		30				
	SBH-6	37-11		93	45				
	SBH-1	37-13	50.039	328	57	37-13	188.67	2501	59
	SBH-6	37-13A		55.8	57				
	SBH-1	37-13B		93	57				
	SBH-1	37-14	57.734	460	57	37-14	167.165	1100	59
	SBH-1	37-14A	19.845	150	57	37-14A		460	60
	SBH-1	37-14B		93	58				
	SBH-1	37-14C	237.114	2501	30	37-14C	834.064	2501	30
	SBH-3	030010	38.566	89	28				
	SBH-3	030020	38.137	130	24				
	SBH-4	030030	509.828	2380	32	030030	1296.39	6000	31
	SBH-4	030040	342.548	1650	16	030040	913.328	4000	16
	SBH-6	030120	27.692	86	49				
	SBH-6	030140	22.92		57				
	SBH-2	030150	27.216	95	26				
	SBH-6	030180	21.238	70	36				
	SBH-3	37-H	29.992	93	12				
	SBH-3	37-H1	18.942	88	12				
	SBH-3	37-J	35.704	216.3	12	37-J	92.255	466.1	10
	SBH-3	37-J1	32.577	421.5	12				
	SBH-3	37-J2	210.148	1460	12	37-J2	838.197	4800	10
	SBH-3	37-J3	125.319	883	12	37-J3	245.404	2640.9	10
	SBH-3	37-J4	196.587	2180	12	37-J4	584.926	2680.9	10
	SBH-3	37-K	20.426	93	12	37-K	75.589	844	10
	SBH-3	37-M	21.641	150	11	37-M	73.004	460	9
	SBH-3	37-M1	29.976	93	12	37-M1	90.081		10
	SBH-3	37-M2	54.533	306	8	37-M2	101.023		8
	SBH-3	37-M3	21.617	137.1	8	37-M3		460	8

Table 4-2. Summary of the Stations that Exhibit Exceedances for Fecal and/or Total Coliform, continued

Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Station ID	Geomean	90th percentile	n	Station ID	Geomean	90th percentile	n
Port Jefferson Harbor, North, and tidal tribs	PJH-2	33-V		76.8	30				
	PJH-1	040140	15.411		23				
	PJH-2	040290	28.603	195	56				
	PJH-2	040300	22.28	88	53				
	PJH-2	040305	43.374	339	48	040305	88.974	5400	70
	PJH-2	040310	77.866	500	81	040310	191.480	2240	89
	PJH-2	040320	205.149	2320	85	040320	654.342	5400	80
Conscience Bay and tidal tribs	CB-2	33-13		107.7	30				
	CB-2	33-14		93	30				
	CB-2	33-15	14.227		30				
	CB-2	33-15A		93	30				
	CB-1	33-16	21.44	181	30	33-16		460	35
	CB-1	33-17		93	30				
	CB-2	33-17A		88.5	30				
	CB-1	33-18	47.788	460	30	33-18	113.834	1100	35
	CB-1	33-18A	104.613	524	30	33-18A	317.441	2501	30
	CB-1	33-19	19.745	262	30				
	CB-2	040180	35.264	130	45				
Setauket Harbor	SH-2	33-3	17.224	93	30	33-3		460	30
	SH-1	33-3A	14.931	93	30				
	SH-2	33-4		93	30				
	SH-1	33-9S	14.682		30				
	SH-1	33-10S	167.347	2501	30	33-10S	558.823	2501	30
	SH-1	33-11N	183.509	2501	30				
	SH-1	33-11S	168.167	2501	30	33-11S	903.191	2501	30
	SH-1	33-12S	15.461	93	30				
	SH-1	33-13S	16.179	150	30				
	SH-1	33-14S		107.7	30				
	SH-2	040220	31.661	166	39	040220	75.656		42
	SH-1	040230	27.26	82	69				
	SH-1	040050	388.682	2580	38	040050	2216.91	16000	37
Mt. Sinai Harbor and tidal tribs	MSH-4	32-7A	18.861	107.7	30				
	MSH-4	32-8	17.591	75	32				
	MSH-1	32-8A	32.922	240	32	32-8A		908	34
	MSH-2	32-9	63.799	460	58	32-9	196.611	1100	52
	MSH-1	32-10	30.657	438	32	32-10		908	34
	MSH-1	32-11	19.108	93	32				
	MSH-1	32-12	23.349	240	31	33-12		972	33

Table 4-2. Summary of the Stations that Exhibit Exceedances for Fecal and/or Total Coliform, continued

Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Station ID	Geomean	90th percentile	n	Station ID	Geomean	90th percentile	n
	MSH-4	32-15	35.033	240	30				
	MSH-5	050120	19.951		24				
	MSH-5	050150	27.992	80	29				
	MSH-5	050170	28.941	83	50				
	MSH-4	050190	27.385	128	23				
Mattituck Inlet/Creek, Low, and tidal tribs	MC-1					30-5		438	42
	MC-1	30-6.1		93	45	30-6.1		460	38
	MC-1	30-6.2	15.49	93	46	30-6.2	111.7	2501	38
	MC-1	30-6.3		85.8	45				
	MC-1	30-8	16.863	93	46	30-8		652	38
	MC-1	055300	79.799	720	39	055300	168.231	2400	41
	MC-1	055310	71.629	710	14	055310	99.214	1300	18
	MC-1	055320	38.640	340	9				
	MC-1	055330	74.738	249	4	055330		576	9
Goldsmith Inlet	GI-1	67-A1	17.336	240	30	67-A1	95.198	524	30
	GI-1	67-B	14.544	213	30	67-B	99.541	1100	30
	GI-1	67-C		53.7	30	67-C		1100	30
	GI-1					67-D		460	30
	GI-1	056100	194.518	686	3	056100	179.58	1060	4
West Harbor, Fishers Island	No exceedances								
Georgica Pond	GP-1	68-A	40.028	438	22	68-A	278.547	2501	22
	GP-1	68-B	31.586	394	24	68-B	261.112	1100	24
	GP-1	68-C	15.4	151.8	27	68-C	82.9	716	27
	GP-1					68-E		460	27
	GP-1	68-F	30.47	392	25	68-F	121.602	1684.6	25
	GP-1	68-F1	14.221	93	27	68-F1	71.939		27
	GP-1	68-G	16.992	166.5	26	68-G		460	26
	GP-1	68-H		151.8	27	68-I1	166.161	1100	27
	GP-1	68-I1	24.736	460	27	68-J	990.538	2501	21
	GP-1	68-J	193.639	2501	21				
Sagaponack Pond	SP-1	69-A	291.204	1240.1	30	69-A	834.63	2501	30
	SP-1	69-B	49.875	240	30	69-B	193.404	2501	30
	SP-1					69-C		780	26
	SP-1	69-D	15.519	240	30	69-D	91.824	2501	30
	SP-1	69-E	21.6	262	30	69-E	98.441	2501	30
Mecox Bay and tribs	MB-2	11-1		93	41				
	MB-2	11-2	15.19	76.8	40				

Table 4-2. Summary of the Stations that Exhibit Exceedances for Fecal and/or Total Coliform, continued

Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Station ID	Geomean	90th percentile	n	Station ID	Geomean	90th percentile	n
	MB-1	11-3	20.798	93	30	11-3		460	30
	MB-1	11-4	15.942	76.8	30				
	MB-1	11-5		76.8	30				
	MB-1	11-6	15.799	93	30				
	MB-1	11-7	19.475	159	30	11-7		1100	30
	MB-1	11-8	15.534	262	30	11-8		1100	30
	MB-1	11-9	14.208	240	30	11-9		524	30
	MB-1	11-10	19.101	93	30				
	MB-3	11-11		240	37	11-11		524	30
	MB-2	11-12		78.6	47				
	MB-2	11-13		55.8	40				
Heady and Taylor Creeks and tribs	HTC-1	10E-40	19.029	262	30	10E-40		524	30
	HTC-2	10E-42		76.8	30				
Penny Pond	No exceedances								
Weesuck Creek and tidal tribs	WCr-2	10W-15.1		49.4	49				
Penniman Creek and tidal tribs	PeC-1	070190		50	125				
Ogden Pond	OP-1					9-9.1		460	41
Quantuck Bay	QB-3	9-6		93	30				
	QB-3	9-6.1		93	30	9-6.1		460	30
	QB-3	9-7	22.999	262	30	9-7		460	30
	QB-4	080200	19.799	80	113				
Quantuck Canal/ Moneybogue Bay	QC-1	080191	24.363	80	42				
Harts and Seatuck Coves	HST-4					8-6		460	30
	HST-3	8-37B		132.9	74				
	HST-3	8-37C	27.895	460	71	8-37C	107.541	2501	58
	HST-2	080160		50	86				
	HST-3	080170	30.283	270	96				
Narrow Bay	NaB-1	8-2		58	58				
	NaB-1	8-2A		53	59				
	NaB-2	8-3		93	59				
	NaB-2	8-3A		49.4	59				
	NaB-2	8-5A		84	36				
	NaB-2	080100		80	95				
	NaB-1	090100	28.927	134	59	090100		444	72

Table 4-2. Summary of the Stations that Exhibit Exceedances for Fecal and/or Total Coliform, continued.

Water Body Name	Zone	Fecal Coliform (MPN/100 ml) Geomean ≥ 14 MPN 90th Percentile ≥ 49 MPN				Total Coliform (MPN/100 ml) Geomean ≥ 70 MPN 90th Percentile ≥ 330 MPN			
		Station ID	Geomean	90th percentile	n	Station ID	Geomean	90th percentile	n
Bellport Bay	BB-2	7-5		93	52				
	BB-3	7-5A	15.341	76.8	30	7-5A	32.967	460	30
	BB-4	7-5B	49.541	460	49	7-5B	174.54	2501	48
	BB-2					7-6A		416	53
	BB-1	7-7A		93	49	7-7A		460	48
	BB-2	7-8		58	48				
	BB-4	090110	38.179	300	201	090110	73.85	876	227
	BB-1	095037	49.5	89	8	095037	108.048	640	14
Patchogue Bay	PB-1					6-A		868.2	39
	PB-1	6-M	15.967	93	28	6-M		1100	37
	PB-1	6-SW	17.671	240	27	6-SW	70.541	1100	37
	PB-1	6-X		53	39				

* As of publication, no latitude/longitude information was available for this station. However, based on known locations for the other stations in this water body, Battelle has assumed that this station is located in SA waters.

4.2 Land Use Data

Analysis of land use information is necessary to determine the likely sources of pathogens to receiving waters. The relative magnitude of pathogen transport from sources within the watershed can be assessed by evaluating land uses within specific contributing zones. For this study, land use information is used in a watershed model (Section 6) to determine relative pathogen loads to each impaired water body.

Watersheds and subwatersheds were delineated for each water body that is listed in Table 4-2. In some cases the contributing watersheds are associated with the entire SA classified portion of the water body. But in many cases subembayments were further characterized based on available data (i.e., locations of monitoring stations and data values), geomorphology, and the relative distribution of potentially significant sources of fecal and total coliforms. Subdelineated watersheds were also based on the design of the tidal prism model calculation areas and these factors are described in Section 6.1.1. Land use summaries below correspond directly to these watershed and subwatershed delineations.

Land use data in two separate forms were analyzed. We received 1999 parcel-based land use data from the towns of Riverhead, Southampton, Easthampton, and Southold. These land use data are based on aggregations of parcel attributes originally developed for the Suffolk County Real Estate Tax Map and provided by the Suffolk County Department of Planning (SCDP). The categories available within the SCDP GIS maps were aggregated into 15 general land use categories as part of an effort to establish accurate GIS data at the tax map scale (SCDP, 2000) (Table 4-3). For those remaining towns where parcel-based land use was not made available, 2001 National Land Cover Data (NLCD) was used. NLCD is derived from images acquired by Landsat's Thematic Mapper (TM) sensor, as well as a number of ancillary data sources, and is available online from the Multi-Resolution Land Characteristics (MRLC) Consortium. Twenty-one classifications are included in NLCD land use data.

Table 4-3. Fifteen Land Use Categories Associated with the Suffolk County Department of Planning (SCDP) Land Use.

Cat. #	Category Name	Description
1	Low Density Residential	≤ 1 dwelling unit (d.u.)/acre
2	Medium Density Residential	> 1 to <5 d.u./acre
3	High Density Residential	≥ 5 d.u./acre
4	Commercial	Hotels, retail and office buildings, sports areas, marinas
5	Industrial	Storage/warehouse facilities, mining/quarrying operations, gas or water pipelines
6	Institutional	Schools, churches, hospitals, government offices, military installations, jails
7	Recreation/Open Space	Golf courses, parks, conservation land, camps, cemeteries
8	Agriculture	Livestock, field crops, orchards, poultry farms
9	Vacant	Vacant lots, abandoned agricultural land, private forest lands
10	Transportation	Roads, highways, tunnels, railroad
11	Utilities	Power generation facilities, water supply, communication infrastructure, utility pipelines
12	Waste Handling & Management	Landfills, sewage treatment
13	Surface Waters	Oysterlands, private or government owned land under water
14	Not documented	Probably open coastal waters
15	Not documented	Probably forested land

Table 4-4 summarizes the land use area for each contributing watershed in the study areas based on the SCDP data.

Table 4-4. Watershed Land Use Based on SCDP Data.

Water Body or Water Body Segment	HECTARES														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Low Density	Medium Density	High Density	Commercial	Industrial	Institutional	Recreation/ Open Space	Agriculture	Vacant	Transportation	Utilities	Waste Handle. and Mgmt.	Surface Waters	Unknown	Unknown
Georgica Pond	415.47	190.77	2.23	28.24	0.18	22.74	320.90	126.96	241.98	213.14	8.84	0.00	98.83	0.00	0.00
Georgica Cove	183.27	70.02	0.56	7.75	1.72	21.90	9.89	92.69	35.94	40.06	8.42	0.00	19.37	0.00	0.00
Lower Georgica	22.79	5.15	0.05	0.00	0.00	0.00	1.08	10.39	1.27	3.34	0.00	0.00	2.62	0.00	0.00
Upper Georgica	75.51	41.73	0.00	22.85	31.17	36.61	185.77	0.00	108.35	163.61	27.43	0.00	4.32	0.00	0.00
Goldsmith Inlet	49.00	22.61	2.31	0.94	1.42	0.00	18.66	89.84	50.01	14.03	1.44	0.00	9.54	0.00	18.45
Heady Creek	103.44	89.64	26.37	39.93	9.57	57.54	10.52	51.79	91.09	51.21	2.33	0.16	2.02	70.36	0.00
Mattituck Inlet	228.96	189.05	3.26	25.45	12.01	11.22	52.66	438.50	80.19	87.69	8.82	0.00	65.13	0.00	178.59
Mecox Bay	1157.73	373.86	1.98	64.13	23.44	24.87	198.79	1917.67	872.91	320.94	24.49	0.00	552.24	103.92	0.00
Ogden Pond	29.94	34.63	0.24	1.68	0.00	3.62	2.00	0.00	10.72	12.75	0.00	0.00	0.59	0.00	0.00
Penniman Creek	81.16	16.54	0.00	0.27	0.00	0.58	2.60	0.00	22.66	15.11	0.00	0.00	1.72	0.00	0.00
Penny Pond	8.26	48.63	0.69	4.20	0.00	0.10	0.09	0.00	6.39	11.06	0.00	0.00	0.79	0.00	0.00
Pirates Cove	4.54	5.91	0.59	0.27	0.00	0.00	0.00	0.00	3.55	1.53	0.00	0.00	0.00	0.00	0.00
Pirates Cove - Inner	5.36	0.58	0.13	0.08	0.00	0.00	0.00	0.00	5.59	0.93	0.00	0.00	0.00	0.00	0.00
Quantuck Canal/Moneybogue Bay	27.07	52.57	1.67	16.66	0.00	5.12	16.66	0.00	14.30	20.56	0.66	0.00	2.51	0.01	0.00
Quantuck Creek	135.44	93.55	3.08	17.51	6.34	3.94	545.23	6.68	254.73	469.74	43.41	0.00	2.80	0.00	0.00
Sagaponack Pond	285.78	133.32	1.17	3.99	0.00	8.67	183.40	325.26	141.60	88.95	2.74	0.00	85.13	16.75	0.00
Taylor Creek	77.56	33.01	0.16	0.00	0.00	0.77	11.44	0.80	8.70	14.31	0.86	0.00	1.45	0.00	0.00
Weesuck Creek	83.92	117.20	1.52	53.17	44.96	1.64	175.80	143.50	365.31	79.78	6.03	0.00	2.48	0.00	0.00
West Harbor - Darby Cove	4.43	0.34	0.08	0.11	0.00	0.00	0.00	0.00	3.46	0.25	0.00	0.00	0.00	0.00	0.00
West Harbor - West	14.71	7.43	0.87	2.48	2.30	3.39	2.08	0.00	11.18	5.82	0.14	0.00	0.00	0.00	0.00

The 21 categories of NLCD land use are summarized in Table 4-5.

Table 4-5. Categories of NLCD Land Use.

Cat. #	Description
11	Open Water
21	Low Intensity Residential
22	High Intensity Residential
23	Commercial/Industrial/Transportation
31	Bare Rock/Sand/Clay
32	Quarries/Strip Mines/Gravel Pits
41	Deciduous Forest
42	Evergreen Forest
43	Mixed Forest
81	Pasture/Hay
82	Row Crops
85	Urban/Recreation Grasses
91	Woody Wetlands
92	Emergent Herbaceous Wetlands

Table 4-6 summarizes the 2001 NLCD land use areas (in hectares) for each contributing watershed in the study areas.

Table 4-6. Watershed Land Use Based on NLCD Data.

Water Body or Water Body Segment	HECTARES													
	11	21	22	23	31	32	41	42	43	81	82	85	91	92
	Open Water	Low Intensity Residential	High Intensity Residential	Commercial/ Industrial/Transportation	Bare Rock/ Sand/ Clay	Quarries/ Strip Mines/ Gravel Pits	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Urban/Recreational Grasses	Woody Wetlands	Emergent Herbaceous Wetlands
Bellport Bay – Beaverdam Creek	5.36	369.90	25.47	120.92	0.00	10.55	74.97	213.65	265.33	28.03	0.00	19.44	23.41	75.21
Bellport Bay East – West Cove	81.88	4205.56	214.56	530.93	21.80	234.89	507.45	1266.02	3561.53	474.27	95.59	345.46	221.38	197.83
Cold Spring Harbor - Eel Creek	0.48	21.34	0.00	5.84	0.00	0.00	3.95	3.58	21.91	0.89	0.71	1.73	0.00	0.00
Cold Spring Harbor - Inner	11.45	1409.87	225.57	123.30	0.00	0.00	65.81	326.76	513.25	9.64	0.09	254.87	1.05	0.88
Conscience Bay	16.67	844.05	135.67	85.93	36.84	0.20	19.32	127.19	215.16	7.20	0.99	87.52	0.09	0.24
Hart Cove	1.78	132.66	5.44	17.73	0.00	0.00	10.32	10.44	74.93	66.18	17.21	20.95	2.20	13.28
Hempstead Harbor	26.20	2067.35	519.93	303.43	0.00	186.21	373.86	331.17	735.88	28.96	0.00	565.08	5.22	6.04
Huntington Harbor	14.73	1417.09	243.76	80.03	0.00	0.00	15.22	211.66	138.50	13.10	1.60	89.71	3.09	4.89
Centerport Harbor	5.37	415.38	65.67	5.83	0.52	0.00	4.76	74.24	33.53	0.00	0.46	14.16	0.18	0.54
Northport Harbor	6.83	645.22	141.23	15.08	0.88	0.00	10.55	107.02	68.10	0.00	1.63	31.41	0.24	2.12
Stony Brook Harbor - Inner	1.84	123.04	8.74	13.63	0.47	0.00	2.35	45.07	86.21	2.74	0.00	14.02	0.18	0.09
Mt. Sinai Harbor - Crystal Brook	0.51	293.06	36.80	9.67	0.00	0.00	4.77	36.81	91.26	0.12	0.82	23.61	1.37	0.00
Mt. Sinai Harbor - Inner	0.61	145.78	32.38	3.44	0.00	0.00	4.47	13.61	50.57	0.00	3.07	20.33	0.00	0.00
Mt. Sinai Harbor - Pipe Stave	0.00	97.85	18.16	1.51	0.00	0.00	0.37	11.32	13.23	0.00	0.64	0.36	0.00	0.00
Narrow Bay	8.68	908.13	108.92	113.09	0.00	2.32	106.35	48.93	187.49	10.13	0.00	16.49	17.74	87.75
Patchogue Bay - Mud Creek	7.90	597.42	45.65	134.61	0.00	0.78	28.25	190.15	184.54	25.40	0.00	21.78	1.69	20.95
Patchogue Bay - Swan River	5.37	1655.38	112.48	219.76	0.00	2.14	48.21	178.51	302.00	26.43	0.00	36.78	2.36	32.16
Port Jefferson Harbor	2.06	18.19	3.75	1.75	0.02	0.00	0.60	21.60	17.41	0.00	0.00	0.09	0.00	0.00
Port Jefferson - Head	1.21	280.34	117.31	22.57	0.26	0.06	15.71	59.68	62.52	0.00	0.83	7.79	0.09	0.00
Seatuck Cove	1.40	49.77	5.34	0.94	0.73	0.00	1.38	8.69	17.88	2.11	0.00	0.81	0.00	0.00
Setauket Harbor - East Setauket	0.91	377.99	61.54	27.94	5.35	1.54	11.47	23.94	26.70	2.47	0.02	3.18	0.00	0.70
Setauket Harbor - Little Bay	0.92	39.84	5.62	0.22	0.18	0.00	1.16	10.09	14.39	1.19	0.00	0.27	0.00	0.00
Setauket Harbor - Poquott	0.55	53.08	19.84	4.32	0.21	0.00	1.90	5.63	6.99	1.47	0.00	0.09	0.00	0.00

Table 4-6. Watershed Land Use Based on NLCD Data.

Water Body or Water Body Segment	HECTARES													
	11	21	22	23	31	32	41	42	43	81	82	85	91	92
	Open Water	Low Intensity Residential	High Intensity Residential	Commercial/ Industrial/Transportation	Bare Rock/ Sand/ Clay	Quarries/ Strip Mines/ Gravel Pits	Deciduous Forest	Evergreen Forest	Mixed Forest	Pasture/Hay	Row Crops	Urban/Recreational Grasses	Woody Wetlands	Emergent Herbaceous Wetlands
Stony Brook Creek	3.65	171.69	38.22	17.88	4.89	0.00	9.44	35.99	117.49	10.71	0.00	15.65	0.71	1.40
Stony Brook Yacht Club	0.40	47.93	14.00	0.50	0.00	0.00	0.08	6.75	2.49	0.00	0.00	0.35	0.00	0.37
West Meadow Creek	11.56	243.07	69.55	4.79	13.35	0.00	13.32	35.62	10.18	0.09	0.00	1.98	0.00	31.39

4.3 Rainfall Data

The official climatic data from the National Climatic Data Center recorded since January 1971 were available from Riverhead Research Farm and Bridgehampton, New York (Station Numbers: 307134 and 300889, respectively), as well as from Brookhaven National Laboratory (BNL). The Riverhead and Bridgehampton stations are located at the western and eastern ends of the Peconic Bay area and should be somewhat representative of conditions at most of the water bodies within the study area. BNL is located in Upton, NY. Table 4-7 summarizes the annual precipitation sums for each station, and the average of them, throughout the period of record that is coincident with the water quality data analysis.

Table 4-7. Precipitation Data (in inches) from the Brookhaven National Laboratory, the Riverhead Research Farm, and in Bridgehampton, New York.

Year	Brookhaven National Laboratory	Riverhead Research Farm	Bridgehampton	Average
1997	40.04	38.38	47.47	41.96
1998	56.61	42.89	55.79	51.76
1999	51.72	48.58	43.91	48.07
2000	54.37	43.19	43.29	46.95
2001	45.55	46.59	49.27	47.14
2002	52.07	46.50	52.50	50.36
2003	63.11	57.50	60.10	60.24
2004	35.86	44.34	53.46	48.90

4.4 Watershed Contributing Zones

Total and fecal coliform delivery to each of the water bodies in this study is believed to be primarily driven by storm water transport. High rates of surface water infiltration of surface waters and the recharge of groundwater acts as a net sink for pathogens due to the attenuating properties of groundwater flow on bacteria. However, precipitation landing on impervious surfaces such as rooftops, parking lots, and roads is often routed through storm water infrastructure to either infiltration beds or directly to receiving water bodies. Infiltration beds are effective in upper watersheds where the distance between the land's surface and the water table (vadose zone) can be significant. However, in urbanized coastal areas, storm water systems are often designed to discharge into tidal creeks and estuaries to avoid the risk of flooding due to the relatively lower infiltration capacity.

Watershed and subwatershed boundaries were delineated off of the 11-digit HUC (USGS) which was downloaded from the NYS GIS Clearinghouse. Delineations of these watersheds were based on USGS 1:24,000 quadrangle topographic maps which were rectified and provided as TIFF files from EPA Region 2. Hand delineation was believed to be as, or perhaps more, accurate than employing DEM modeling through ESRI Spatial Analyst due to the sizes of most of the watersheds in the area; the relatively small subwatersheds would be at risk of greater error if 30 x 30 x 10 m raster grids were used to delineate.

5.0 SOURCE ASSESSMENT

This section identifies the potential sources of fecal coliforms in the study area discharging into the water bodies within the study area. Sources of information include GIS data and literature provided by EPA Region 2, NYSDEC, and the Peconic Estuary Program (PEP). The Brown Tide Comprehensive Assessment and Monitoring Program (BTCAMP) study conducted by the Suffolk County Department of Health (1992), and previously summarized by HydroQual (2003), also assisted in characterizing the relationship between point and nonpoint source loadings and in-stream responses at the monitoring stations located throughout the Peconic Bay study area.

Point sources of pollution are those that discharge flows and pollutant loads to a water body from a fixed location or through a single point of entry such as a discrete pipe or ditch. The major point sources in the study area include: (1) STPs that receive and treat domestic/commercial/industrial wastewater; (2) commercial and industrial plants whose discharges are permitted such as duck farms; and (3) urban storm water from permanent drainage areas such as those with Phase 1 or Phase 2 storm water permits.

Non-point sources encompass those pollution sources that have no single identifiable point of entry for the contamination. One example is wildlife which is often a major source of bacterial contamination to the surface waters with large open spaces/forests and wildlife population. Other potential nonpoint sources include contributions from poorly designed, or failing, septic systems and cesspools; marinas; boating activities; and limited bacterial contamination from ground water. Storm water from municipalities not covered by Phase 1 or Phase 2 storm water permits is considered a nonpoint source for this study.

The following sections summarize the likely point and nonpoint sources of pollution to the water bodies in the study area.

5.1 Point Sources

Sewage Treatment Plants
There are six STPs with surface water discharges regulated by NYSDEC through State Pollution Discharge Elimination System (SPDES) that contribute directly to a handful of the 28 water bodies covered in this TMDL report. Table 5-1 lists the STPs along with some pertinent characteristics. Several of the STPs in Table 5-1 have recently had or are currently having upgrades:

The Huntington STP, the Lawrence STP, and the Port Jefferson STP are all currently undergoing planning or construction to convert existing chlorine-based disinfection treatment into ultraviolet (UV) treatment systems (Interstate Environmental Commission [IEC], 2006).
During Port Jefferson STP's UV upgrading process, its flow capacity will be increased to 1 million gallons per day (mgd) (IEC, 2006).

Construction to increase the State University of New York (SUNY) Stony Brook's STP capacity to 2.75 mgd is scheduled to begin in August 2007 (IEC, 2006).

Table 5-1. Characteristics of Sewage Treatment Plants with Outfalls in the Water Bodies Covered in this TMDL Report.

STP Name	Location	Facility Design Flow (mgd)	Water Body that Discharge Enters	Disinfection Method(s)
City of Glen Cove WWTP	Glen Cove, NY	5.5	Hempstead Harbor	Ultraviolet
Huntington STP	Huntington, NY	2.5	Huntington Harbor	Hypochlorite-contact tank
Northport STP	Northport, NY	0.45	Northport Harbor	Ultraviolet
Patchogue Village	Patchogue, NY	0.5	Patchogue Bay	Chlorine gas-contact tank
Port Jefferson STP*	Port Jefferson Village, NY	0.85	Port Jefferson Harbor	Hypochlorite
SUNY, Stony Brook*	Stony Brook, NY	2.5	Port Jefferson Harbor	Hypochlorite

* Share a common outfall
Sources: NYSDEC, 1999; personal communication, Paul Harding (NYSDEC Division of Water, Region 1); EPA Envirofacts data warehouse

For every STP in Nassau and Suffolk counties, the effluent must not exceed the limits provided in Table 5-2.

Table 5-2. Fecal and Total Coliform Effluent Limits for STPs in Nassau and Suffolk Counties.

Parameter	Effluent Limit (MPN/100mL)	Statistical Base
Fecal Coliform	200	30 day geometric mean
Fecal Coliform	400	7 day geometric mean
Total Coliform	700	Monthly median

Sources: EPA Envirofacts data warehouse; personal communication, Paul Harding (NYSDEC Division of Water, Region 1)

There are no combined sewers[5] that discharge into any of the 27 water bodies covered in this TMDL report. A vast majority of Nassau County (>90%) is serviced by sewers. Battelle has recently received limited spatial coverage of Suffolk County sewer districts but has not had the opportunity to analyze these data.

Municipal Separate Storm Sewer Systems

With the exceptions of Mattituck Creek, Goldsmith's Inlet, West Harbor, and Georgica Pond, all the study area water bodies are located in towns regulated under the EPA's Phase II Stormwater Program, as are the New York State Department of Transportation and the Suffolk County Department of Public Works, within these towns. As of March 2003, municipal separate storm

[5] Combined sewers are historic sewer systems designed to contain stormwater and sanitary sewage in the same pipe. Under normal weather conditions, combined sewers transport the wastewater directly to a treatment plant. However, during periods of heavy precipitation, these systems are designed to occasionally overflow and discharge the stormwater and raw sewage directly into nearby water bodies.

sewer systems (MS4s) were required to have a NPDES permit and a management plan that prevents pollutant-laden stormwater from being discharged into nearby water bodies and impacting water quality. The outfalls from these MS4s are considered point sources to the water body to which they discharge.

The extent and intensity of storm water runoff was investigated by the Long Island 208 Wastewater Management Treatment Plan (LIRPB, 1978). The Long Island Segment of the Nationwide Urban Runoff Program (LI NURP) further explored the problem of storm water runoff as it relates to local groundwater and surface water quality (LIRPB, 1982). Both the 208 and LI NURP studies identified storm water runoff as the major source of bacterial loadings to surface waters in Suffolk County.

Duck Farms

In the past, duck farm runoff contributed significantly to surface water coliform pollution in Long Island water bodies. However, in recent years, the number of duck farms on Long Island has decreased and the pollution control requirements placed on the remaining farms have become more stringent. Currently, there are six duck farms on all of Long Island, producing an approximate total of 2.5 million ducks annually. In accordance with 40 CFR 412.25, duck farms which began operations after 1974 may not discharge process wastewater into state surface waters. The one discharge exception is for 25-year, 24-hour rainfall events, during which the facilities designed to hold all wastewater overflow. Two of the six duck farms currently operating on Long Island discharge into study area water bodies during these heavy rainfall events. Both the Massey Duck Farm and the Cornell International Duck Research Cooperative are located in Eastport, NY and would discharge into Seatuck Cove (pers. comm., Joseph Gergela, Long Island Farm Bureau).

5.2 Non-Point Sources

The nonpoint sources that typically contribute pathogens into estuarine systems include failing on-site sewage disposal (septic) system; storm water runoff from developed areas not covered by Phase 1 or Phase 2 Stormwater permits; runoff from agricultural areas and open space/forest; direct waterfowl/wildlife inputs; and boats and marinas. Relative contributions from each type of source are significantly site-specific in nature, particularly in localized areas of study.

5.2.1 Agricultural Sources

Although county-wide data on estimated livestock abundance has been compiled, no site-specific data have been analyzed. Table 5-3 summarizes the Nassau and Suffolk County agricultural data, as estimated from the most recent USDA census in 2002. Site-specific information on livestock populations (i.e., representative of individual contributing areas) is not available which makes estimating these sources with any specificity difficult.

5.2.2 Marine Vessels and Marinas

Increased development throughout the coastal zone in conjunction with increasing demand for recreational marina facilities has created the need to protect sensitive coastal environments while enhancing multiple uses of valuable coastal resources.

Table 5-3. Summary of Nassau and Suffolk County Agricultural Data.

Type of Livestock	1997 Number	2002 Number
NASSAU COUNTY		
Total Cattle and Calves	not available	not available
Total Hogs and Pigs	not available	not available
Poultry		
Layers 20 weeks or older	not available	24
Broilers	not available	not available
Pullets	not available	not available
Turkeys	not available	4
Horses and Ponies	not available	182
Sheep and Lambs	not available	8
Total Number of Farms (crops and livestock)	71	65
SUFFOLK COUNTY		
Total Cattle and Calves	188	232
Total Hogs and Pigs	553	175
Poultry		
Layers 20 weeks or older	3,719	3,544
Broilers	not available	not available
Pullets	not available	1,146
Turkeys	not available	270
Horses and Ponies	not available	1,391
Sheep and Lambs	392	182
Total Number of Farms (crops and livestock)	721	651

Source: USDA, 2002

Under the Clean Water Act, §312, no untreated sewage may be discharged from a vessel within three miles from shore; therefore, it can be assumed that the vast majority of human waste coming from vessels within the 27 water bodies is treated using a marine sanitation device (MSD). There are three major types of MSDs, two of which (Types I and II) treat the sewage before expelling it into the water column and one (Type III) that must have its contents held on the vessel until the tank can be pumped out at the appropriate facility. Type I MSDs can be found on vessels up to 65 feet in length, while Type II MSDs are typically installed in larger boats. Type III MSDs can be found on any size boat. According to the New York Clean Vessel Assistance Program (CVAP), there are concentration standards for effluent discharged via Type I and Type II MSDs (Table 5-4).

Table 5-4. Fecal Coliform Standards for MSDs.

MSD	Fecal coliform standard
Type I	No greater than 1000 MPN/100 mL
Type II	No greater than 200 MPN/100mL

Source: New York CVAP

No Discharge Zones
Six of the water bodies covered by this TMDL support document have been designated as Vessel Waste No Discharge Zones (NDZs) by the EPA. The Greater Huntington—Northport Bay Complex (including Huntington Harbor, Northport Harbor, and Centerport Harbor) was officially approved as a NDZ in June 2000 (65 FR 37385) and the Port Jefferson Complex (which includes Port Jefferson Harbor, Conscience Bay, and Setauket Harbor) was approved in October 2001 (66 FR 51954). While a vessel is inside a NDZ, the discharge valve of a Type I or Type II MSD must be visibly closed, preventing wastes from being discharged into surrounding waters. A Type III MSD has a holding tank and is permitted in an NDZ as long as land-based or mobile pumpout facilities are used to empty the tank.

According to the Federal Register (FR) Notice of Final Affirmative Determination for designating the Greater Huntington—Northport Bay Complex as an NDZ, the maximum daily vessel population for the Complex is approximately 3900 vessels, with 3200 of these being docked or moored in the Complex and 700 accessing the Complex via boat ramps. Additionally, at the time of the NDZ approval in 2000, there were ten land-based pumpout facilities and two mobile pumpout boats available to service vessels using the Complex. The resulting ratio (assuming conservatively that every vessel had an MSD) is 325 vessels per pumpout, which is on the low end of the EPA's standard guidelines of between 300 and 600 vessels per pumpout. Given the NDZ designation of the Complex and the low vessel-to-pumpout ratio, it has been assumed that vessel-derived human waste is not a major source of coliform bacteria in Huntington, Centerport, and Northport Harbors.

Similarly, according to the FR Notice of Final Affirmative Determination for designating the Port Jefferson Harbor Complex as an NDZ, the maximum daily vessel population for the Complex is approximately 900 docked or moored vessels. Two land-based and two mobile pumpout facilities are available to vessels using the Complex, resulting in a low ratio of 300 vessels per pumpout. Given these facts, for Port Jefferson and Setauket Harbors and Conscience Bay, it has been assumed that vessel-derived human waste is not a major source of coliform bacteria.

In March 2007, the Towns of Brookhaven and Islip in cooperation with Peconic Baykeeper launched an initiative to have the entire South Shore Estuary designated an NDZ. The South Shore Estuary includes eleven of the 27 water bodies[6] covered by this TMDL report and, if the effort for NDZ designation proves successful, the amount of vessel-derived coliform contributions will likely decrease significantly for these systems. However, because this NDZ has not yet been approved, it has been assumed that the aforementioned coliform concentration

[6] The South Shore Estuary includes Patchogue Bay; Bellport Bay; Narrow Bay; Harts and Seatuck Coves; Quantuck Canal and Moneybogue Bay; Quantuck Bay; Ogden Pond; Penniman Creek; Weesuck Creek; Penny Pond; and Heady and Taylor Creeks.

from vessels for these twelve (and all the other water bodies apart from the six already-designated NDZs) in its TMDL analysis.

Embayment Use Information

Data on vessel numbers and pumpout facilities for the 21 non-NDZ water bodies covered in this TMDL report came from a variety of sources and are shown in Table 5-5. In March 1999, an embayment use study was conducted by the New York Department of State (DOS) during the preparation of the South Shore Estuary Comprehensive Management Plan. Some of the embayment's vessel numbers were estimated by sub-basin and not by individual water body, although approximate vessel numbers for Patchogue and Bellport Bays were given. The HHPC (2007) estimated the number of vessels using the Harbor during their NDZ application process. Approximate vessel numbers for other embayments (e.g., were also estimated from boat slip and mooring data compiled and have been periodically updated by New York Sea Grant (NYSG) (1999). The Town of Southold Planning Department developed a Local Waterfront Revitalization Plan (LWRP) (2004) and tallied boat slip and mooring numbers for the water bodies within the town (Mattituck Creek, Goldsmith Inlet, and West Harbor).

Table 5-5. Estimated Peak Season Vessel Numbers, Moorings, and Boat Slips in Each Non-NDZ Water Body.

Non-NDZ Water Body	Estimated Peak Season Vessel Numbers/Slip & Mooring Numbers	Source
Hempstead Harbor	1,350 vessels	HHPC, 2007
Cold Spring Harbor	N/A	
Stony Brook Harbor	525 slips & moorings	NYSG, 2004
Mt. Sinai Harbor	865 slips & moorings	Pers. comm.., Brookhaven Planning Dept.
Mattituck Inlet	477 slips & moorings	Town of Southold, 2004
Goldsmith Inlet	0 slips & moorings	Town of Southold, 2004
West Harbor	179 slips & moorings	Town of Southold, 2004
Georgica Pond	N/A	
Sagaponack Pond	N/A	
Mecox Bay	N/A	
Heady and Taylor Creeks	N/A	
Penny Pond	100 slips[1]	NYSG, 2004
Weesuck Creek	60 slips	NYSG, 2004
Penniman Creek	N/A	
Ogden Pond	N/A	
Quantuck Bay	N/A	
Quantuck Canal/Moneybogue Bay	363 vessels	NYDOS, 1999
Harts and Seatuck Coves	440 slips[2]	Pers. comm.., Brookhaven Harbormaster
Narrow Bay	0 slips & moorings	
Bellport Bay	336 vessels	NYDOS, 1999
Patchogue Bay	2814 vessels	NYDOS, 1999

N/A= not available
[1] The number of slips at Penny Pond includes the number from Smith's Creek. A summed value was provided by the source.
[2] The number of slips at Harts and Seatuck Coves includes the number from Tuthill.

5.2.3 Urban/Residential Sources

Urban and residential sources of fecal and total coliform bacteria are dependent upon a few primary factors. These include residential density and the associated impervious surface area within a contributing zone, domestic pet populations, wildlife populations, and the effectiveness of onsite wastewater disposal systems. The modeling approach (Watershed Treatment Model [WTM]) applied in this study assumes default values of "urban" or "residential" source and runoff coefficients to yield a bulk annual fecal coliform load to each receiving water in the study. These default values are based on extensive literature review and comparative studies within the U.S. (Caraco, 2001). See Section 6.0 for further information on the WTM and its default values.

5.2.3.1. Pet Waste

Pet feces can contribute a fairly substantial amount of fecal coliform to a watershed. USEPA (1993) has estimated that two to three days of accumulated dog waste from approximately 100 dogs within a 20 square mile watershed could contribute enough coliform to close the receiving waters to swimming and other contact activities. Outside of Seattle, microbial source tracking studies have shown that approximately 20% of bacteria isolates that could be matched with host animals were matched up with dogs (Trial, 1993). A single gram of dog feces can contain up to 23 million fecal coliform bacteria (Van der Wel, 1995) and the daily fecal production rate for an average sized dog is approximately 450 grams (MapTech, 2002), giving a total daily average fecal coliform production figure of $1.0*10^{10}$ per dog. Surveys conducted in the Chesapeake Bay have indicated that approximately 40% of people do not pick up their dog's waste (Swann, 1999); however, without Long Island-specific data, and to be more protective, this analysis does not consider the number of dog owners that remove their dog's waste from the watershed. Without specific bacterial source tracking data, it is impossible to estimate how much dog waste is actually reaching any given water body, but the magnitudes of the fecal concentration and the production amount suggest that efforts to curb the amount of abandoned dog waste may be fruitful.

Using the SCDP and NLCD data on residential areas, along with the delineated watershed boundaries, the approximate number of households in the contributing watersheds surrounding each of the 42 water bodies or water body segments was calculated. In its 2004-2005 Statistical Abstract, the United States Census Bureau made a national estimate that about 36% of households have dogs, and each household has an average of 1.6 dogs (U.S. Census Bureau, 2004). From these estimates, the number of dogs per watershed was approximated (Table 5-6).

Table 5-6. Approximate Number of Dogs within the Watershed of each Water Body or Water Body Segment.

Water Body or Water Body Segment	Approximate Number of Households within Watershed	Estimated Number of Dogs Per Watershed*
Hempstead Harbor	11533	6643
Cold Spring Harbor	6271	3612
Cold Spring Harbor-Eel Creek	53	31
Huntington Harbor	6514	3752
Centerport Harbor	1838	1059
Northport Harbor	3339	1923
Stony Brook Harbor-Inner	284	164
Stony Brook Harbor-Stony Brook Creek	896	516
Stony Brook Harbor-Stony Brook Yacht Club	291	168
West Meadow Creek	1460	841
Port Jefferson Harbor	2142	1234
Conscience Bay	3762	2167
Setauket Harbor-Little Bay	168	97
Setauket Harbor-East Setauket	1694	976
Setauket Harbor-Poquott	376	217
Mt. Sinai Harbor-Crystal Brook	1179	679
Mt. Sinai Harbor-Inner Harbor	760	438
Mt. Sinai Harbor-Pipe Stave Hollow	466	268
Mattituck Inlet	1267	730
Goldsmith Inlet	191	110
West Harbor, Fishers Island-Head of Pirate's Cove	19	11
West Harbor, Fishers Island-Darby Cove	9	5
Georgica Pond-Upper	266	153
Georgica Pond-Lower	81	47
Georgica Pond-Georgica Cove	579	334
Sagaponack Pond	1015	585
Mecox Bay	2874	1655
Heady Creek	793	457
Taylor Creek	350	202
Penny Pond	429	247
Weesuck Creek	786	453
Penniman Creek	207	119
Ogden Pond	240	138
Quantuck Bay-Quantuck Creek	550	317
Quantuck Canal/Moneybogue Bay	435	251
Seatuck Cove	1707	983
Harts Cove	395	228
Narrow Bay	3590	2068
Bellport Bay-Beaverdam Creek	1229	708
Bellport Bay-West Cove	13043	7513
Patchogue Bay-Swan River	5480	3156
Patchogue Bay-Mud Creek	2040	1175

*This assumes that 36% of households have dogs and, of that 36%, each house has 1.6 dogs.

5.2.4 Waterfowl

Large waterfowl populations are present in the study area water bodies during the migration and winter seasons, while smaller numbers of waterfowl are present throughout the year. For an estuary in Buzzards Bay, Massachusetts, Weiskel *et al*. (1996) and Valiela et al. (1991) estimated that approximately 67% and 82%, respectively, of the annual waterfowl loading to the estuary occurred between December and March. Valiela et al. (1991) also pointed out that coliform concentrations resulting from waterfowl are unlikely to impact the closure of areas to shellfishing because (1) most of the loading occurs in the winter, (2) the rate of coliform loss in marine waters is high, and (3) decisions regarding closures are made during the warmer months.

Horsely and Witten (2003) developed a method for determining waterfowl coliform loading in Peconic Bay that can be applied to the water bodies covered in this report. They multiplied the water body's area by an "occupancy rate" of 0.3 waterfowl per acre of surface water (estimated based on aerial photo analysis) and again by the estimated fecal coliform load associated with waterfowl waste generation (an average of 10^8 FC/day/bird [Weiskel et al, 1996]). To standardize the units throughout this TMDL report, this occupancy rate was converted, resulting in 0.741 birds per hectare of surface water. Table 5-7 shows the 42 water body segments within the 27 PWL water bodies covered by this TMDL report and the estimated coliform loading based on the Horsely and Witten (2003) method. This methodology does not represent event-driven or locally-specific (i.e., feeding or breeding areas) abundances of fecal coliform in these water bodies. Based on personal communication with local scientists and managers, the paucity of waterfowl and other wildlife data suggest that further research in this area is necessary to reduce uncertainties in relative magnitudes of these load sources (Dr. Robert Nuzzi, personal communication).

5.2.5 Beach Wrack

Beach wrack is the mat of organic material that often lines recent high tide lines along the coastal zone. These mats largely consist of resident aquatic vegetation that has either died or been pruned by tidal, storm, or animal disturbance. Wrack mats can harbor bacterial populations and can also provide environments for growth and redistribution of bacteria. Weiskel *et al*. (1996) estimated that wrack yielded approximately 1.25×10^6 FC/kg. However, no site-specific data on the abundance, or variability, of wrack biomass is currently available and literature values are extremely variable. For example, Dugan et al. (2003) reported observations of 1,200 to 2,179 kg/m/year of kelp wrack in South Africa and 473 kg (wet) of macrophyte wrack per meter per year in a California coastal zone. These values are clearly not applicable to the study area, but demonstrate the wide variability in wrack production and deposition. In a recent analysis of several embayments in Peconic Bay, Horsely and Witten (2003) reported a general lack of information on wrack deposition rates; however, they surmised that this could be an important source of bacteria. Therefore, more analysis is required to establish the spatial and temporal contributions of beach wrack as a source of bacteria in the study area water bodies.

5.2.6 Marine Sediment Resuspension

The resuspension of bacteria present in coastal sediments can potentially be a significant source to shallow, localized areas. However, the resuspension is highly variable (Weiskel et al., 1996) and can be quite difficult to predict due to a variety of confounding factors. Rates reported by Valiela et al. (1991) range from 7 to 18 FC/100 mL seawater.

Table 5-7. Estimated Waterfowl Numbers and Coliform Loading by Water Body or Water Body Segment.

Water Body or Water Body Segment	Water Body Area (ha)	Estimated Number of Wintering Waterfowl (0.741/ha)	Total Daily Fecal Coliform Load to Water Body from Waterfowl*
Hempstead Harbor	599.91	444.5	$4.45*10^{10}$
Cold Spring Harbor	91.38	67.7	$6.77*10^{9}$
Cold Spring Harbor-Eel Creek	0.39	0.3	$2.89*10^{7}$
Huntington Harbor	160.61	119.0	$1.19*10^{10}$
Centerport Harbor	52.88	39.2	$3.92*10^{9}$
Northport Harbor	194.17	143.9	$1.44*10^{10}$
Stony Brook Harbor-Inner	28.05	20.8	$2.08*10^{9}$
Stony Brook Harbor-Stony Brook Creek	2.68	2.0	$1.99*10^{8}$
Stony Brook Yacht Club	6.77	5.02	$5.02*10^{8}$
West Meadow Creek	22.32	16.5	$1.65*10^{9}$
Port Jefferson Harbor	164.93	122.2	$1.22*10^{10}$
Conscience Bay	125.84	93.2	$9.32*10^{9}$
Setauket Harbor-Little Bay	24.68	18.3	$1.83*10^{9}$
Setauket Harbor-East Setauket	8.8	6.5	$6.52*10^{8}$
Setauket Harbor-Poquott	2.18	1.6	$1.62*10^{8}$
Mt. Sinai Harbor-Crystal Brook	11.73	8.7	$8.69*10^{8}$
Mt. Sinai Harbor-Inner Harbor	4.87	3.6	$3.61*10^{8}$
Mt. Sinai Harbor-Pipe Stave Hollow	0.4	0.3	$2.96*10^{7}$
Mattituck Inlet	65.72	48.7	$4.87*10^{9}$
Goldsmith Inlet	9.16	6.8	$6.79*10^{8}$
West Harbor, Fishers Island-Head of Pirate's Cove	1.66	1.2	$1.23*10^{8}$
West Harbor, Fishers Island-Darby Cove	3.53	2.6	$2.62*10^{8}$
Georgica Pond-Upper	3.22	2.4	$2.39*10^{8}$
Georgica Pond-Lower	2.29	1.7	$1.70*10^{8}$
Georgica Pond-Georgica Cove	14.55	10.8	$1.08*10^{9}$
Sagaponack Pond	63.43	47.0	$4.70*10^{9}$
Mecox Bay	446.6	330.9	$3.31*10^{10}$
Heady Creek	22.27	16.5	$1.65*10^{9}$
Taylor Creek	19.59	14.5	$1.45*10^{9}$
Penny Pond	4.33	3.2	$3.21*10^{8}$
Weesuck Creek	17.23	12.8	$1.28*10^{9}$
Penniman Creek	24.83	18.4	$1.84*10^{9}$
Ogden Pond	5.3	3.9	$3.93*10^{8}$
Quantuck Bay-Quantuck Creek	48.18	35.7	$3.57*10^{9}$
Quantuck Canal/Moneybogue Bay	36.77	27.2	$2.72*10^{9}$
Seatuck Cove	142.24	105.4	$1.05*10^{10}$
Harts Cove	111.61	82.7	$8.27*10^{9}$
Narrow Bay	512.01	379.4	$3.8*10^{10}$
Bellport Bay-Beaverdam Creek	87.38	64.7	$6.47*10^{9}$
Bellport Bay-West Cove	44.77	33.2	$3.32*10^{9}$
Patchogue Bay-Swan River	18.83	14.0	$1.40*10^{9}$
Patchogue Bay-Mud Creek	12.78	9.5	$9.47*10^{8}$

*Total daily fecal coliform load to water body from waterfowl= water body area * 0.741 * 10^{8}

5.3 Summary of Pollution Sources

Based on the review of past studies conducted by NYSDEC and SCDHS, the 27 PWL water bodies (further expanded to a total of 42 embayments and watersheds) covered in this TMDL report are primarily affected by urban storm water runoff (including pet waste) and direct waterfowl and wildlife inputs, followed by STPs, failing septic systems, and boater waste. In the absence of quantifiable and accurate data on many of these sources, limited data reported in literature from previous studies and experience gained from similar nation-wide studies were used to develop reasonable estimates of pollutant loads. These assumptions are discussed throughout the following section on modeling approach.

6.0 MODELING APPROACH

The most critical component of TMDL development is the establishment of the relationship between source loadings and the impacts on the receiving water body. This relationship will assist in the screening and selection of appropriate watershed management options that will eventually achieve the desired water quality goals.

Some of the core principles in selecting modeling approaches for the New York State water bodies include: (1) the TMDL must be based on scientific analysis and reasonable and acceptable assumptions. All major assumptions must have been based on available data and experience gained from similar studies; (2) the TMDL must use the best available data. All available data in the appropriate water bodies and watersheds were reviewed and used in the assessment wherever possible; and (3) methods should be clear and as simple as possible to facilitate explanation to stakeholders. All methods and major assumptions used here are described in detail and presented in a format accessible to a wide range of audiences.

To achieve these objectives, two modeling approaches have been applied to the water bodies in this study. The first one, a steady-state tidal prism model, uses information on the water body itself, including fecal and/or total coliform data, to determine what loading rates should be responsible for the observed data. This approach has been applied in several similar TMDL analyses (e.g., Urbanna Creek [VA], Hassle Island [USVI]). Because coastal systems are physically dynamic, information that supports the characterization of volumetric exchanges is coupled with existing bacterial concentrations and assumed decay (or "die off") rates over an average tidal cycle (12.42 hours). When existing conditions are compared to target or "allowable" conditions, a percent load reduction can be successfully calculated. This process is described in more detail below and in Attachment A. The tidal prism model calculation is applied to 26 PWL water bodies in New York. However, additional subdivision of embayments and contributing zones produced a total of 42 tidal prism model calculations. Each water body had to have appropriate physical and data qualities for this approach to be applied.

After tidal prism calculations were performed, the Watershed Treatment Model (WTM; Caraco 2001) was applied to each contributing zone for estimating the relative distribution of watershed loads (not including attenuation and transformation processes between source and receiving waters). This approach relies on general fecal coliform loading rates attributed to specific land uses. Load reductions for two water bodies, Narrow Bay (PWL 1701-0318) and the subembayment associated with the Stony Brook Yacht Club (PWL 1702-0047), were calculated through the statistical rollback method due to complexities that precluded the application of the tidal prism model approach.

6.1 Steady-State Tidal Prism Model

The TMDL analysis utilizes a tidal prism model in order to account for the tidal influences in each estuarine system. The transport of fecal coliform is most influenced by the tide and the amount of freshwater discharge into the shellfish harvesting areas. The steady state tidal prism method assumes that freshwater input, tidal range, and the first-order decay rate of fecal coliform are all constant. The given or known parameters are: tidal period, fecal coliform decay rate, tidal range, freshwater discharge flow rate, ocean tidal exchange ratio (estimated from salinity data where possible), embayment volume, fecal coliform concentration and water quality criterion. These values are used to derive the TMDL (i.e., using the water quality criterion) and the current load (i.e., using the current geometric mean and 90^{th} percentile concentrations). The differences between these loads are used to compute the percentage load reductions that are required to meet the TMDL.

The steady-state tidal prism model calculates fecal coliform load using the following equation:

$$Load = [C_c(Q_b + kV) - Q_o C_o] \times C_f$$

Where:
Load = fecal coliform load (counts per day);
C_c = mean fecal coliform concentration (MPN/100ml) within the embayment;
k = the fecal coliform removal/decay rate (per day);
C_o = the fecal coliform concentration (MPN/100ml) at the ocean or embayment boundary;
Q_o = the quantity of water that enters the embayment on the flood tide through the ocean boundary that did not flow out of the embayment on the previous ebb tide (m3 per tidal cycle);
Q_b = the quantity of mixed water that leaves the embayment on the ebb tide that did not enter the embayment on the previous flood tide (m3 per tidal cycle);
V = the mean volume of the embayment (m3); and
C_f = a unit conversion factor.

Attachment B of this TMDL support document is a memorandum providing a description of the steady state tidal prism model and calculations. In cases where this approach has been applied, sensitivity analyses report the most sensitive parameter in the model algorithm is bacterial decay rate. In fact, in an analysis of the TPM applied to the TMDLs in this report, altering bacterial decay rates (k), tidal range, and return ratio (B) by 20% resulted in insignificant changes to the calculated load reductions (all under 1% change). The most sensitive parameter is the actual fecal coliform value and in cases where this is significantly greater than the standard it is the primary factor driving the load reduction calculation.

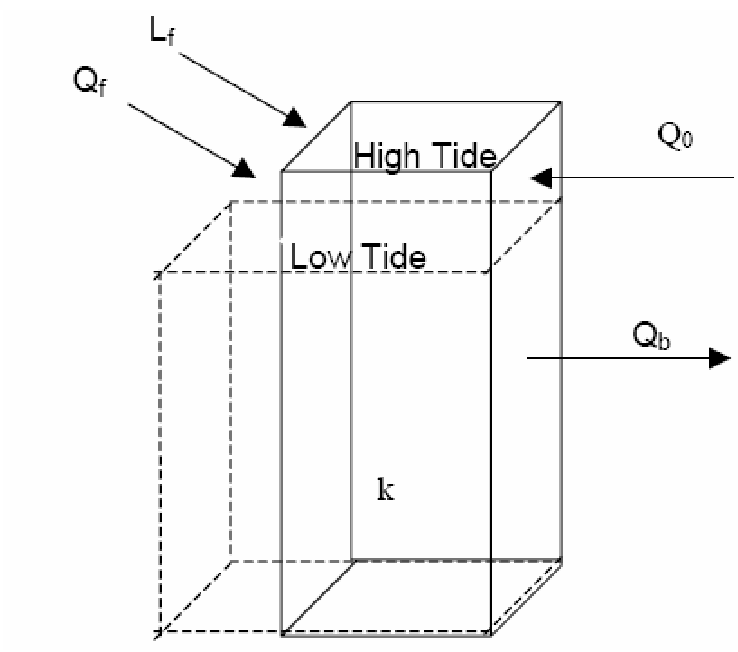

Figure 6-1. Conceptual diagram of the tidal prism model.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which typically have low frequencies of occurrence. In specifying critical conditions in the water body, an attempt is made to use a reasonable worst-case scenario condition. This analysis is modeling the 90th percentile current load and allowable load. The 90th percentile concentration is that which one would expect to see exceeded no more than 10 percent of the time. The actual 90th percentile concentration from the most recent data set is used in these calculations, thereby incorporating the critical condition. Further, this analysis is comparing the 90th percentile and geometric mean TMDLs to determine which value represented the critical condition and to determine the basis for the critical condition. Greater reductions in the geometric mean TMDL suggest that, on average, water column concentrations are very high with limited variation. Greater reductions in the 90th percentile TMDL suggest a less frequent occurrence of high fecal coliform concentrations due to the variation of hydrological conditions.

Seasonal variations involve changes in flow as a result of hydrologic and climatological patterns. Generally, water column data for fecal coliform may sometimes exhibit seasonal trends. For example, bacteria levels tend to be lower during the colder months in some areas, but this is not always the case. In order to account for seasonal variation and inter-annual variability, New York State and coastal counties' shellfish monitoring program collects samples on a regular SRS basis and in most cases a minimum data set of 30 samples over five years is used. The monitoring design and the statistical analysis used to evaluate water quality attainment therefore implicitly includes the effect of seasonality. Further, New York's water quality standard itself reflects the need to account for seasonal variation in assigning both a geometric mean (i.e., average condition) criterion and 90th percentile criterion (i.e., to account for fluctuations around the geometric mean).

The requirement for a Margin of Safety (MOS) is intended to add a level of conservatism to the modeling process in order to account for uncertainty. Based on EPA guidance, the MOS can be achieved through two approaches. One approach is to reserve a portion of the loading capacity as a separate term, and the other approach is to incorporate the MOS as part of the design conditions. There are several places to include conservative assumptions. In the tidal prism model, an implicit MOS can be incorporated to account for the uncertainty of certain model parameters. For example, the decay rate has been determined to be the most sensitive parameter, and can be therefore, set at the conservative end of its known range (i.e., 0.36 per day) for the TMDL calculation.

Assumptions and Limitations

- Observed streamflow data were used where available and otherwise input as zero.
- The watersheds were delineated based on topographic data from USGS 1:24,000 scale quadrangle maps.
- Regeneration of fecal coliform bacteria within embayments is not considered to be a significant additional source.
- The rate of decay for fecal coliform bacteria was assumed to be $0.36d^{-1}$ based on the low end of published values in the region ($0.36 – 0.7\ d^{-1}$). This end of the range was chosen for conservative purposes.

- Bacteria concentrations estimated by the tidal prism model are calculated under the assumption that embayment volumes are fully-mixed, and that bacteria concentrations are horizontally and vertically-averaged.
- In most cases, the highest fecal coliform value was chosen to represent exceedance conditions for conservative purposes.
- Where possible, subembayments were chosen for TMDL analyses where factors such as geomorphology, concentrated sources, or data limitation made it appropriate to do so.
- For monitoring stations located in seasonally closed areas, geometric mean and 90th percentile values were taken from those closed periods to increase the emphasis on critical conditions.
- Estuarine exchange ratio coefficient was set at 0.5 due to the lack of available data to determine site-specific values. The model results are relatively insensitive to this parameter.
- Default fecal coliform values of 14 and 49 MPN/100ml were applied to C_c and C_o in calculating the allowable load in all cases, including those water bodies not exhibiting exceedance. This conservative approach results in a more protective load reduction in cases where water bodies are not impaired, but close to impairment.

Data utilized in the tidal prism model calculations and their sources included the following:

Bathymetry

Bathymetry data is used to calculate estuarine volumes. The National Ocean Service (NOS) Hydrographic Data Base (NOSHDB), maintained by NGDC in conjunction with NOS, provides extensive survey coverage of the coastal waters and Exclusive Economic Zone (EEZ) of the United States and its territories. The NOSHDB contains data digitized from smooth sheets of hydrographic surveys completed between 1851 and 1965, and from survey data acquired digitally on NOS survey vessels since 1965. (http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html)

Where NOS data was missing or partial, additional review of NOS nautical charts was performed. In some limited cases where these data were not available, best estimates of elevations were performed.

Boundary Delineation

In most cases the existing New York State Class SA boundaries were sufficient to characterize water bodies, define contributing zones, and run tidal prism analyses. In other cases, the spatial scale was narrowed to focus on specific subembayments thought to be either primarily responsible for fecal coliform exceedances or due to the distribution of monitoring station data.

Areas, Volumes

Areas of each water body were calculated through simple GIS analysis. Volumes were calculated by multiplying area by mean depth. Mean depth was based on NOS elevations (relative to mean low water [MLW]) and corrected by mean tidal range which was provided by NOAA Co-Ops.

Freshwater Discharge

Where possible, freshwater discharge records were obtained from USGS. In many cases there was no documented discharge information.

Tidal Ranges

Tide characteristics, including mean tidal range, were obtained from NOAA Co-Ops for stations in and near many of the water bodies in this study. However, there are some water bodies for which immediate NOAA tide data are not available. In these cases values from the nearest station were used.

6.1.1 Tidal Prism Characteristics

This section describes how the tidal prism model calculations were arranged for each water body where it was applied. Information on fecal coliform monitoring station positions and exceedance values aided in selecting the most appropriate scales of model application.

Table 6-1. Primary physical characteristics for tidal prism model calculations.

Water Body	PWL No.	Area (m^2)	Mean Volume (m^3)	Mean Depth (m)	Mean Tidal Range (m)
Hempstead Harbor, north, and tidal tribs	1702-0022	5,999,116.58	102,404,920	17.07	2.22
Cold Spring Harbor and tidal tribs	1702-0018	913,780.18	2,846,425	3.12	2.23
Cold Spring Harbor - Eel Creek	1702-0018	3,891.73	2,277	0.59	2.23
Huntington Harbor	1702-0228	1,606,147.00	5,894,559	3.67	2.14
Centerport Harbor	1702-0229	528,835.08	883,155	1.67	2.14
Northport Harbor	1702-0230	1,941,653.26	4,873,550	2.51	2.22
Stony Brook Harbor - Inner	1702-0047	280,455.53	503,418	1.80	2.13
Stony Brook Harbor - Stony Brook Creek	1702-0047	26,847.17	36,646	1.37	2.13
West Meadow Creek	1702-0047	223,157.84	296,354	1.33	2.13
Port Jefferson Harbor, North, and tidal tribs	1702-0015	1,649,270.08	5,978,604	3.63	2.01
Conscience Bay and tidal tribs	1702-0091	1,258,432.77	509,665	0.41	2.01
Setauket Harbor - Little Bay	1702-0242	246,782.98	215,935	0.88	2.13
Setauket Harbor - East Setauket	1702-0242	87,982.31	92,821	1.06	2.13
Setauket Harbor - Poquott	1702-0242	21,799.17	20,310	0.93	2.13
Mt. Sinai Harbor - Crystal Brook	1702-0019	117,308.25	267,463	2.28	1.96
Mt. Sinai Harbor - Inner Harbor	1702-0019	48,657.12	42,088	0.87	1.96
Mt. Sinai Harbor - Pipe Stave Hollow	1702-0019	3,990.00	3,910	0.98	1.96
Mattituck Inlet/Creek, Low, and tidal tribs	1702-0020	657,208.00	1,495,148	2.28	1.55
Goldsmith Inlet	1702-0026	91,577.00	140,571	1.54	1.55
West Harbor, Fishers Island - Head of Pirates Cove	1702-0046	16,622.68	32,497	1.96	0.71
West Harbor, Fishers Island - Darby Cove	1702-0046	35,325.56	28,790	0.82	0.71
Georgica Pond - Upper	1701-0145	32,152.56	44,531	1.39	0.77
Georgica Pond - Lower	1701-0145	22,895.43	31,710	1.39	0.77
Georgica Pond - Georgica Cove	1701-0145	145,491.64	201,506	1.39	0.77
Sagaponack Pond	1701-0146	634,299.91	878,505	1.39	0.77
Mecox Bay and tribs	1701-0034	4,465,953.00	6,185,345	1.39	0.77
Heady Creek and tribs	1701-0294	222,664.00	303,936	1.37	0.73

Table 6–1. Primary physical characteristics for tidal prism model calculations, continued.

Water Body	PWL No.	Area (m^2)	Mean Volume (m^3)	Mean Depth (m)	Mean Tidal Range (m)
Taylor Creek and tribs	1701-0294	195,857.00	267,345	1.37	0.73
Penny Pond	1701-0298	43,252.28	15,787	0.37	0.73
Weesuck Creek and tidal tribs	1701-0111	172,251.64	252,349	1.47	0.73
Penniman Creek and tidal tribs	1701-0300	248,259.87	338,875	1.37	0.73
Ogden Pond	1701-0302	53,014.00	51,689	0.98	0.73
Quantuck Bay - Quantuck Creek	1701-0042	481,813.00	904,468	1.88	1.73
Quantuck Canal/Moneybogue Bay	1701-0371	367,678.46	645,276	1.76	1.73
Seatuck Cove	1701-0309	1,422,403.00	1,764,125	1.24	0.73
Harts Cove	1701-0309	1,116,149.00	1,439,078	1.29	0.73
Bellport Bay - Beaverdam Creek	1701-0320	873,795.00	1,219,395	1.40	0.73
Bellport Bay - West Cove	1701-0320	447,656.98	513,127	1.15	0.73
Patchogue Bay - Swan River	1701-0326	188,280.57	164,745	0.88	0.73
Patchogue Bay - Mud Creek	1701-0326	127,764.88	111,794	0.88	0.73

Table 6-2 Tidal prism model bacteria "existing conditions" input values for each water body.

Water Body	PWL No.	Exceedance Condition			Offshore Condition		
		Station No.	Geometric Mean	90^{th} Percentile	Station No.	Geometric Mean	90^{th} Percentile
Hempstead Harbor, north, and tidal tribs	1702-0022	34-21	86	800	34-24	4	11
Cold Spring Harbor and tidal tribs	1702-0018	48-14	29	460	48-9	7	23
Cold Spring Harbor - Eel Creek	1702-0018	48-5	12	93	48-6	4	15
Huntington Harbor	1702-0228	46-2	23	262	46-11	9	48
Centerport Harbor	1702-0229	43-1	25	216	43-6	10	43
Northport Harbor	1702-0230	010300	56	300	42-1	7	23
Stony Brook Harbor - Inner	1702-0047	37-14.3	237	2,501	37-12	12	43

Table 6–2. Tidal prism model bacteria "existing conditions" input values for each water body, continued.

Water Body	PWL No.	Exceedance Condition			Offshore Condition		
		Station No.	Geometric Mean	90th Percentile	Station No.	Geometric Mean	90th Percentile
Stony Brook Harbor - Stony Brook Creek	1702-0047	030030	510	2,380	37-15	7	23
West Meadow Creek	1702-0047	37-J	197	2,180	37-3	7	23
Port Jefferson Harbor, North, and tidal tribs	1702-0015	33-V	78	500	33-U	9	43
Conscience Bay and tidal tribs	1702-0091	18-A	105	524	33-12	6	23
Setauket Harbor - Little Bay	1702-0242	33-14S	11	108	33-9S	15	48
Setauket Harbor - East Setauket	1702-0242	33-12S	15	93	33-8S	11	43
Setauket Harbor - Poquott	1702-0242	33-10S	167	2,501	33-7S	9	43
Mt. Sinai Harbor - Crystal Brook	1702-0019	32-15	35	240	32-7.1	19	108
Mt. Sinai Harbor - Inner Harbor	1702-0019	32-9	64	460	32-8.1	33	240
Mt. Sinai Harbor - Pipe Stave Hollow	1702-0019	32-12	23	240	32-17	11	72
Mattituck Inlet/Creek, Low, and tidal tribs	1702-0020	30-6.2	15	93	30-1	4	48
Goldsmith Inlet	1702-0026	67-A1	17	240	67-A	6	23
West Harbor, Fishers Island - Head of Pirates Cove	1702-0046	51-9.3	8	43	51-9.2	8	31
West Harbor, Fishers Island - Darby Cove	1702-0046	51-5.1	9	43	51-9	4	10
Georgica Pond - Upper	1701-0145	68-A	40	438	68-C	15	152
Georgica Pond - Lower	1701-0145	68-1L	25	460	68-H	12	152
Georgica Pond - Georgica Cove	1701-0145	68-F	30	392	68-F1	14	93
Sagaponack Pond	1701-0146	69-B	50	240	65E-5	5	9
Mecox Bay and tribs	1701-0034	11-8	16	262	65E-4	5	15
Heady Creek and tribs	1701-0294	10E-40	19	262	10E-39	7	48
Taylor Creek and tribs	1701-0294	10E-42	14	77	10E-41	8	43

Table 6–2. Tidal prism model bacteria "existing conditions" input values for each water body, continued.

Water Body	PWL No.	Exceedance Condition			Offshore Condition		
		Station No.	Geometric Mean	90th Percentile	Station No.	Geometric Mean	90th Percentile
Penny Pond	1701-0298	10W-24	5	23	10W-23.3	4	6
Weesuck Creek and tidal tribs	1701-0111	10W-15.1	7	49	10EW-14	4	9
Penniman Creek and tidal tribs	1701-0300	070190	11	50	9-10	5	20
Ogden Pond	1701-0302	9-9.1	20	460	9-9	23	460
Quantuck Bay - Quantuck Creek	1701-0042	9-7	23	262	9-8	7	43
Quantuck Canal/Moneybogue Bay	1701-0371	080191	24	80	9-3	8	43
Seatuck Cove	1701-0309	8-37C	28	460	8-29	5	36
Harts Cove	1701-0309	080160	13	50	8-4	10	43
Bellport Bay - Beaverdam Creek	1701-0320	7-5B	50	460	7-5C	8	35
Bellport Bay - West Cove	1701-0320	7-7B	39	460	7-7A	8	35
Patchogue Bay - Swan River	1701-0326	6-SW	18	240	6-Z	6	25
Patchogue Bay - Mud Creek	1701-0326	6-M	16	93	6-Z1	6	25

Hempstead Harbor, north, and tidal tribs

Stations 34-22 and 34-21 are the only NYDEC WQ stations in this SA water body and they do not exhibit exceedances of NSSP water quality standards. However, three New York Department of Health bathing beach sampling data sets were collected and downloaded from STORET. Although the monitoring positions were inaccurately provided, descriptions of their locations were available. Tappan Beach indicated the highest fecal coliform values which were 85.7 and 800 MPN/100 ml for the geometric mean and 90th percentile, respectively. Offshore concentration values are based on station 34-24 which has geometric mean and 90th percentile values of 3.6 and 11 MPN/100 ml, respectively.

Hempstead Harbor has two distinct sections: a relatively broad outer estuary and a well-defined inner estuary which is formed by a pinching off of this section by land, resulting in a relatively narrow opening. The SA classified section of Hempstead Harbor comprises the larger, outer area and it is at the most seaward end of this section where fecal coliform data exist. For the purposes of this TMDL analysis, the entire estuary and its watershed is included because it is highly likely that water quality within the outer estuary is influenced by that of the inner estuary, and vice versa. Future water quality monitoring in the vicinity of Glen Cove, including Mosquito Cove, and further south within the inner estuary would improve assessment of more local influences on this SA classified estuary. Future analysis might draw subwatershed boundaries associated with these areas for dose-response linkages. However, the lack of any water quality data in these regions of the estuary preclude such analyses at this time and the entire estuary is being considered in the tidal prism model and the associated source assessment.

Cold Spring Harbor and tidal tribs

Cold Spring Harbor is the eastern section of the Cold Spring Harbor/Oyster Bay estuarine complex. Like Hempstead Harbor, there are distinct outer and inner estuarine areas. The outer estuary is relatively open and adjoins both Oyster Bay and Long Island Sound. The inner estuary is partially closed by a sand spit that extends about 600 meters (90%) of the way across the estuary. Fecal coliform exceedances within the inner estuary exist at stations 48-11, 48-12, 48-13, 48-13A, 48-14, and 48-15. The only exceedance in the outer estuary is at station 48-5 which is located in Eel Creek, a small salt marsh dominated subestuary in the Cove Neck area. This exceedance is only associated with the 90th percentile. The Eel Creek watershed is mixed in levels of development and includes the Sagamore Hill National Historical Site and an unidentified, more recent commercial development, both located at the head of the creek. These sites may possess impervious surfaces sufficient to result in runoff events that could potentially deliver fecal coliform to the creek in abundant concentrations.

The tidal prism analysis of inner Cold Spring Harbor will focus on assessing the load reduction necessary from the inner harbor watershed based on its highest 90th percentile exceedance value observed at station 48-14. Offshore fecal coliform data is based on station 48-9. Freshwater discharge is recorded at a USGS gaging station located about 140 m upstream of the limit of SA class estuarine waters. Representative salinity data are not available.

The tidal prism analysis of station 48-5 at Eel Creek will use station 48-6 as the offshore concentration. There are no data on freshwater discharge rates, bathymetry, or salinity in Eel Creek. Therefore, it is assumed that no significant, regular freshwater discharge occurs and that the depth is approximately 0.6 m.

Huntington Harbor

Huntington Harbor is a semi-enclosed, relatively narrow estuary with a wastewater treatment facility located at its southern extreme. Exceedances of fecal coliform standards are prevalent throughout the entire length of the estuary’s longitudinal axis. The tidal prism model analysis is based upon the station with the highest 90th percentile exceedance (station 46-2) and station 46-11 represents offshore fecal coliform conditions. As of the publication date, there was no latitude/longitude information available for station 46-2; however, based on the known locations of other stations in Huntington Harbor, Battelle has assumed that this station is located within SA waters.

Centerport Harbor

The Centerport Harbor SA classified waters includes an inner portion of Centerport Harbor and Mill Pond which forms the head of this estuary. Mill Pond, located at the extreme southern area of the estuary, is severely restricted by an impoundment (Mill Pond Road), which limits tidal exchange. It is also tidal flat, meaning that the bottom is typically exposed at low tide. Fecal coliform exceedances run throughout the entire inner Centerport Harbor (SA) estuary, with very high concentrations observed in Mill Pond. The 90th percentile value at county Station #010040, is alarmingly high compared to several state monitoring stations within the same area. Further research on this discrepancy is required. By weight of evidence the highest state monitoring station value is being considered (station 43-1) and offshore values are taken from stations 43-6.

Northport Harbor

Northport Harbor's SA waters extend from its mouth to Long Island Sound to the extreme southern end. Eleven state and 2 county monitoring stations show exceedances of fecal coliform along its entire length. The estuary is surrounded by a relatively dense suburban community which is serviced by the Northport STP which has an outfall located immediately south of a large marina at the head of the estuary.

The tidal prism analysis is based on values taken from county station 010300 which exhibits the greatest 90th percentile value and is located centrally in this estuary. Offshore values taken from state station 42-1 (Note: need to acquire data from SGA-41, specifically station 41-5).

Stony Brook Harbor

Stony Brook Harbor is part of a complex estuarine system exhibited by narrow, deep sandy channels that are flanked by salt marsh and marsh islands. An analysis of fecal coliform data indicates that exceedances are grouped into three primary areas: (1) Inner Stony Brook Harbor, (2) Stony Brook Creek, and (3) Stony Brook Yacht Club (immediately within the vicinity of the basin). Tidal prism model calculations are made for Inner Stony Brook Harbor and Stony Brook Creek, but due to the geomorphology of the estuarine section comprising Stony Brook Yacht Club, the application of tidal prism becomes problematic. For this reason, a statistical rollback analysis is run for the Yacht Club contributing zone, which combined with reduction calculations for adjacent Stony Brook Creek and Inner Stony Brook Harbor, should result in sufficient protective measures (see Section 6.2).

Stations representing current fecal coliform conditions include 37-14.3, 030030, and 030150 for Inner Stony Brook Harbor, Stony Brook Creek, and Stony Brook Yacht Club, respectively. Offshore values for Inner Stony Brook Harbor and Stony Brook Creek are stations 37-12 and 37-15, respectively.

West Meadow Creek (Stony Brook Harbor)

West Meadow Creek runs northeastward from the mouth of Stony Brook Harbor for approximately 3 km to its terminus at the Old Field Club. It is a narrow channel (approx. 70 m wide) flanked by extensive salt marsh and it branches to the east at about 1.2 km in the vicinity of state monitoring station 37-J. The channel in West Meadow Creek is shallow for most of its length, ranging from nearly 0 to 1.2 m deep, except for the two dredged areas: the northern, which is as deep as 6.1m in spots, and Aunt Amy's Creek, dredged irregularly to 0.9 to 2.4 m.

Water quality data collected from 10 state stations show that exceedances of fecal coliform are widespread in APC years and in more recent SRS years. Extremely high exceedances exist in the east branch of the creek where the severely constricted and narrow water body is adjacent to a relatively dense residential area and acres of salt marsh. In fact, geometric means along a gradient from the mouth to the head of the creek are fairly consistent but exhibit a distinct spike in the vicinity of the east branch (station 37-J) and within the east branch (stations 37-J1, J2, and J3). This suggests that this branch of the creek is a significant source to the rest of West Meadow.

Despite its fairly significant tidal range (2.13 m) volumetric exchange between West Meadow Creek and the primary system inlet with Stony Brook Harbor and Long Island Sound is likely limited by its narrow, winding features and substantial salt marshes. This environment is conducive to high bacterial populations due to high water residence times, high watershed-to-estuary ratios, and salt marsh environments. This will estimate the load reductions necessary for all sources to the entire water body, but implementation should be focused on Aunt Amy's Creek and at the head of the creek (Old Field Club) to ensure compliance in these local areas. The offshore condition is represented by station 37-3 in Stony Brook Harbor.

Port Jefferson Harbor

Port Jefferson Harbor class SA waters are within a complex estuarine system that is shared by Conscience Bay and Setauket Harbor. The harbor is relatively deep and well flushed. And despite the amount of urbanization, including the continual discharge from the Port Jefferson STP, only one monitoring station (33-V) exhibits a 90th percentile exceedance. Most stations have fecal coliform concentrations in the moderate range (e.g., geometric means and 90th percentiles near 5 and 25 MPN/100 ml). The station indicating the exceedance is located quite close to the eastern shore of the harbor which may account for the elevated values compared to the others which are located in deeper waters.

A review of the data within the head of Port Jefferson Harbor that is under administrative closure due to the existence of an STP, suggest that the elevated values at station 33-V coincide with extremely high values at stations 33-Y, 33-Z, and STP at the head of the estuary, adjacent to the STP discharge. Although this area is not classified as SA, it is most likely the dominant influence on fecal coliform dynamics in adjacent SA waters. Station 33-V might also likely receive a greater signal from the head of the estuary due to estuarine circulation properties (coriolis) which could drive ebb currents along the eastern side of the harbor. Therefore, the tidal prism model calculations are run on this particular segment, using station 33-U as representative offshore concentrations. Under this scenario, it is assumed that STP and other sources within the urbanized areas of Port Jefferson, coupled with relatively high water residence times, provide the primary influence on fecal coliform exceedances in Port Jefferson Harbor class SA waters. The assumption is that load reductions that would result in compliance at county station 040310 would have beneficial cascading effects within the SA waters and result in compliance at stations currently showing exceedances in the main harbor.

Conscience Bay

The SA classified waters of Conscience Bay form the western portion of the Port Jefferson/Setauket/Conscience estuarine complex. Conscience Bay monitoring stations indicate widespread fecal coliform exceedances, with the highest elevations within and near the head of the inner bay where a dammed freshwater pond discharges into a narrow, constricted tidal portion. Here, 90th percentile exceedances reach 524 MPN/100 ml (station 33-18A). The Conscience Bay watershed is primarily residential with some light commercial. The bay is relatively poorly-flushed due to its length and geomorphologic characteristics. It is also quite shallow and the upper portion regularly goes dry during low tides. This, coupled with observed high densities of waterfowl in upper reaches and contributing ponds in downtown Setauket, exacerbates the fecal coliform exceedance problem.

The tidal prism model is applied to the entire area of Conscience Bay due to the widespread distribution of fecal coliform exceedances. In addition, due to the relatively shallow depths within the inner bay, applying the model calculations to the entire bay area will result in a more accurate assessment of volumetric exchanges. Offshore fecal coliform values from Port Jefferson Harbor station 33-12 will be applied.

Setauket Harbor

Setauket Harbor is a "J" shaped estuary that is connected to the main section of Port Jefferson Harbor. It has several small subembayments within it which are characterized by fecal coliform exceedances while some monitoring stations within the main channel do not exhibit significant impairment. Inner Setauket Harbor consists of three shallow subembayments, the most southwestern of these, Little Bay, is semi-enclosed and dries at mean low water.

A review of water quality data suggest that the majority of impairment occurs within these three subembayments within Inner Setauket Harbor. Therefore, tidal prism model calculations resulting in load reductions in these three embayments will likely result in fecal coliform compliance throughout the remaining of Inner Setauket Harbor and the outer section that is adjacent to Port Jefferson Harbor. The three subembayments are:

- Little Bay
- East Setauket
- Poquott

Stations representing current fecal coliform conditions for these subembayments are 33-14S, 33-12S, and 33-10S for Little Bay, East Setauket, and Poquott, respectively. Offshore conditions are based on values of the 90th percentile of fecal coliform at stations 33-9S correspond to Little Bay, station 33-8S for East Setauket, and 33-7S for Poquott.

Mt. Sinai Harbor

Mt. Sinai Harbor is a semi-enclosed lagoonal estuarine system. Cedar Beach Marina dominates the northern third of the estuary and is a dredged/deepwater anchorage and marina. The mid-section of the estuary is dominated by marshisland and there are three small, open subembayments along the southern margin of the estuary.

A review of water quality data suggests that fecal coliform exceedances associated with these three subembayments are likely contributing sources to the remainder of Mt. Sinai Harbor and that TMDLs derived for these will most likely result in overall compliance with standards. For the Crystal Brook subembayment, station 32-15 represents the exceedance condition and station 32-7.1 represents its offshore fecal coliform concentration. In the Inner Mt. Sinai Harbor subembayment, station 32-9 represents the exceedance condition and station 32-8.1 represents its offshore concentration. In the Pipe Stave Hollow subembayment, station 32-12 represents the exceedance condition and station 32-17 represents its offshore concentration.

Mattituck Creek

All of Mattituck Creek is classified as SA. Tidal exchange in this creek-estuarine system is significantly influenced by its narrow inlet and sinusoidal characteristics. Agriculture and residential development comprises the majority of the land use in its watershed. Fecal coliform exceedances exist along its entire length, although there are some questionable contrasts between state and county values as the state sampling is consistently lower than the county sampling. Potential sources to Mattituck Creek include agriculture and urban runoff, marina sources, and waterfowl and other wildlife. Relatively poor tidal exchange compounds the effects of these potential sources.

Four state and three county stations exhibit fecal coliform exceedances. However, the county data are consistently an order of magnitude greater than the state data. Also, the number of observations is higher in the state data. Therefore, the state data are used to characterize exceedance conditions in Mattituck Creek. The state data are also consistent in their values. Station 30-6.2 is used in the tidal prism calculations. Offshore fecal coliform concentrations are represented by station 30-1.

Goldsmith Inlet
Goldsmith Inlet is a very small lagoon estuary that is connected to Long Island Sound through a narrow, ephemeral inlet. The inlet travels about 260 m over shallow, shifting sand until it meets with the main portion of the lagoon. There is no appreciable freshwater source to Goldsmith.

The watershed is primarily residential with some light commercial properties. The water quality data indicate fecal coliform exceedances with state data reporting relatively low 90th percentile values (85 to 95 MPN/100 ml) while Suffolk County reports statistics greater by an order of magnitude (n=3). Exceedances span from the inside of the inlet to the southeastern head of the lagoon. State stations 67-A1 and 67-B are located on each end of the lagoon and exhibit exceedances that are nearly identical. Therefore, station 67-A1 represents exceedance conditions for the tidal prism model calculation station 67-A represents offshore fecal coliform concentration.

West Harbor
West Harbor and Pirates Cove are located on Fishers Island. Pirates Cove is the innermost section of West Harbor. Both estuaries have very small watersheds and no fecal coliform exceedances. The greatest fecal coliform values in this estuary are at stations 51-9.3 and 51-5.1 where 90th percentiles are 43 MPN/100 ml. Station 51-9.3 is at the head of Pirates Cove and station 51-5.1 is in a small, shallow finger embayment on the east side of West Harbor called Darby Cove. These two stations will be used to determine TMDLs for their specific areas with offshore concentrations applied from stations 51-9.2 and 51-9, respectively.

Georgica Pond
Georgica Pond is connected to the Atlantic Ocean through a very narrow, ephemeral inlet. This inlet is periodically filled by coastal sediment transport and excavated by humans to return tidal exchange to the estuary.

There are several subembayments within Georgica Pond and these exhibit exceedances based on pre-1997 data. These are the only data available and monitoring followed APC protocol during this period which suggests that adverse conditions were consistently measured as opposed to random sampling. Nevertheless, TMDLs based on these data are calculated for three subembayments of Georgica Pond. The assumption is that reduced fecal coliform loads to these subembayments will likely result in overall compliance as these are the inner “hot spots” within the estuary.

Station 68-A represent exceedance conditions for Upper Georgica with corresponding offshore fecal coliform concentrations at station 68-C. Station 68-1L represents exceedance conditions for Lower Georgica with corresponding offshore concentrations at station 68-H. Lastly, exceedance conditions for Georgica Cove are represented by station 68-F with corresponding offshore values taken from station 68-F1.

Sagaponack Pond
Sagaponack Pond is similar in nature to Georgica Pond in that its inlet is periodically closed. This tidal pond is relatively narrow and shallow. Its watershed is mixed residential, forest, and agriculture. Exceedances for fecal coliform exist along its entire length and are notably high at station 69-A which is located at the head of the pond where freshwater discharge from Poxabogue Pond occurs. Part of the town of Bridgehampton is within its watershed where there is potential for more urban runoff to reach receiving estuarine waters. Station 69-C does not show

exceedance for fecal coliform, but does for total coliform. The remaining stations (69-B, D, and E) all exhibit similar magnitudes of exceedance for fecal coliform.

Due to the nature of this embayment the exceedance condition has been estimated from station 69-B as the 90th percentile value is equivalent to 69-D and 69-E. Corresponding offshore conditions are taken from station 65E-5[7].

Mecox Bay

Mecox Bay is a broad, square-shaped estuary with a series of finger creek subembayments along its interior perimeter. All 13 state monitoring stations exhibit fecal coliform exceedances. Interestingly, however, the greatest exceedances occur near the inlet to the Atlantic Ocean. The watershed is a mix of agriculture, residential, and forest covers.

Most of the fecal coliform 90th percentile values center around 75 MPN/100 ml, except for those stations that hug the southern barrier beach in the vicinity of the ephemeral inlet to the Atlantic Ocean. Station 11-8 is used to represent exceedance conditions in the bay with 65-E4[1] representing offshore conditions.

Heady and Taylor Creeks

Heady and Taylor Creeks are located at the eastern side of Shinnecock Bay. Each creek has one station that represents exceedance conditions; station 10E-40 in Heady Creek and station 10E-42 in Taylor Creek. Stations 10E-39 and 10E-41 correspond to offshore fecal coliform concentration for Heady and Taylor Creeks, respectively. Although station 10E-41 is slightly within Taylor Creek SA waters, it is the most proximate representative station.

Penny Pond

Penny Pond is a subembayment within Shinnecock Bay. Based on the data available, there are no known exceedances of fecal or total coliform. There is one state monitoring station at the mouth of Penny Pond (10W-24). Data from this station was used in a tidal prism model calculation to determine TMDLs. Station 10W-23.3 is used to characterize offshore fecal coliform concentration.

Weesuck Creek

Weesuck Creek is a subembayment within Shinnecock Bay. There are two stations within the SA classified area of this estuary, 10W-15 and 10W-15.1. Only 10W-15.1 indicates an exceedance of fecal coliform (90th percentile) and by only a slight margin (49.4 MPN/100 ml). For the purposes of TMDL development, this station will be used to characterize the nature of fecal coliform exceedance in the creek and station 10EW-14 will be used for offshore fecal coliform concentration.

Penniman Creek

Penniman Creek is located on the extreme eastern side of Shinnecock Bay and is a relatively open-mouthed estuary that is likely influenced by both Shinnecock Bay and Quogue Canal. There is one county station (070190) that exhibits an exceedance in fecal coliform. This station is located at the outer margin of Penniman's SA classified waters and will be used to represent fecal coliform conditions within the creek. State station 9-10 will be used to characterize offshore conditions.

[7] Data unavailable at time of this draft report. Values estimated.

Ogden Pond
Ogden Pond is a small embayment, budding off of Quogue Canal. There are two state monitoring stations in the vicinity of Ogden Pond. Station 9-9.1 is located at the head of the pond and station 9-9 is located in Quogue Canal, just outside Ogden Pond's SA boundary. Neither of these stations indicates exceedance in fecal coliform, although their 90th percentile values are elevated (both are 43 MPN/100 ml). However, both exhibit 90th percentile **total** coliform exceedances of 460 MPN/100 ml. The nearest station, 9-9, will be used for offshore total coliform concentration.

Quantuck Bay
Quantuck Bay is a relatively enclosed, round bay along Long Island's south shore. It has multiple inlets: Quogue Canal to the east and Quantuck Canal to the west. There are two subembayments along its northern shore: Aspatuck Creek and Quantuck Creek. There are also several small canals that connect intertidal marsh areas along the shoreline. Quantuck Bay's hydraulic characteristics are complex relative to the application of a steady-state tidal prism model. This is due to the multiple inlet/outlet situation. However, tidal prism calculations can be made on Quantuck Creek where fecal coliform data are available.

There is one exceedance within Quantuck Bay and that is associated with county station 080200. Likewise, there are exceedances at stations 9-7, 9-6.1, and 9-6 within Quantuck Creek SA waters and station 9-5.1 in non-SA headwaters of Aspatuck Creek. However, this 90th percentile exceedance (150 MPN/100 ml) is within constricted pond water and stations lower in the estuary show no fecal coliform exceedances. Aspatuck is also small compared to Quantuck Creek. Therefore, tidal prism calculations for Quantuck Creek will result in fecal coliform load reductions that will likely correspond to sufficient load reductions to Quantuck Bay for water quality compliance. Station 9-7 is used to characterize current fecal coliform conditions and station 9-8, within Quantuck Bay, will represent offshore fecal coliform conditions.

Quantuck Canal/Moneybogue Bay
Moneybogue Bay is a small embayment located between Quantuck Bay and Moriches Bay, along Quantuck Canal. There are three state monitoring stations within the bay that all exhibit fecal coliform values below NSSP standards (no exceedances). However, there is one county station (080191) that exhibits 90th percentile fecal coliform exceedance (80 MPN/100 ml). Based on this, a tidal prism model calculation is conducted with this value as representing the bay's condition. State station 9-3 is applied to offshore conditions as it is in the vicinity of the bay's SA classified boundary. It is assumed that TMDLs determined for Quantuck Bay (above) and Moneybogue Bay will result in protective measures associated with Quantuck Canal.

Harts and Seatuck Coves
These two coves are subembayments with relatively open connections to Moriches Bay on the south shore of Long Island.

Harts Cove has two stations within SA classified waters: county station 080160 and state station 8-1. Only county station 080160 exhibits exceedance conditions for fecal coliform. For offshore conditions, data from state station 8-4 is used.

Seatuck Cove has a series of 5 state stations and 1 county station. Two state stations (8-37B, 8-37C) and the county station (080170) exhibit fecal coliform exceedance conditions. State station 8-6, located on the SA boundary does not exhibit fecal coliform exceedance, but exceeds total coliform. State station 8-37C represents exceedance conditions and station 8-29 is the offshore fecal coliform condition.

The broad, open water portion of Moriches Bay that represents SA, seasonally certified classification is in direct communication with both Harts and Seatuck Coves. Thus, load reductions in both coves are assumed to result in water quality compliance in this adjacent water body.

Narrow Bay

Due to the complex physical configuration of Narrow Bay, including two large inlet/outlet systems, tidal prism model calculations will not be applied. A statistical rollback analysis based on the WTM will be applied instead (see Section 6.2).

Bellport Bay

Bellport Bay is located in the northeast area of Great South Bay and includes two subembayment areas: the mouth of Beaverdam Creek and West Cove. For the purposes of this TMDL analysis, load reductions calculated for both of these subembayments are assumed to result in compliance of water quality standards throughout the main section of Bellport Bay.

Beaverdam Creek is adjacent to several state and county monitoring stations. State stations 7-5A and 7-5B indicate exceedances of fecal coliform as does county station 095037. Data from Station 7-5B are used to characterize fecal coliform exceedance conditions. State station 7-5C is used as the offshore condition.

West Cove is not an SA classified water body; however, as stated above, it is a likely contributor of fecal coliform to Bellport Bay. State station 7-7B is used to represent West Cove's fecal coliform concentration and state station 7-7A is applied as the offshore condition.

Patchogue Bay

Patchogue Bay is a half-crescent, open bay along the north shore of Great South Bay. Water quality stations are distributed throughout the embayment and exceedances for fecal coliform occur at state stations 6-M, 6-SW, and 6-X. The bay is lined by several creek systems on its north shore. These creeks extend into densely populated residential land use and one creek receives wastewater effluent from the Patchogue Village STP. However, no state or county monitoring stations exist within these creeks, which are also SA classified. Rather a series of are positioned near the mouths of the following creeks:

- Swan River (6-SW)
- Mud Creek (6-M)

Only one fecal coliform exceedance is found in the open area of the bay (6-X) and this exceedance is relatively low in magnitude (53 MPN/100 ml). The approach employed in determining a TMDL for this water body is to focus on the likely sources from which fecal coliform is loaded to the entire system. Thus, the data associated with Swan River and Mud Creek are used to generate tidal prism model calculations of load reductions necessary to result in water quality compliance from these sources. The assumption is that reductions in these loads will bring the entire area of Patchogue Bay into compliance (notably, station 6-X) although it is noted that additional data collection and future modeling work could more accurately determine additional load reductions along the eastern side of this embayment.

The offshore conditions for Swan River and Mud Creek will be represented by stations 6-Z and 6-Z1, respectively.

6.2 Statistical Rollback

The statistical rollback method (Ott, 1995) was applied as a method to estimate the reductions in fecal coliform load necessary to meet the water quality standards of 14 MPN/100 mL (50^{th} percentile) and 49 MPN/100 mL (90^{th} percentile). This method is appropriate when the observed data follow a lognormal distribution (i.e., most observed values are relatively low while a few are significantly higher) which is the case with bacteria population distributions in aquatic environments. Compliance with the most restrictive of the dual fecal coliform criteria determines the reduction necessary. The method compares the observed 50^{th} and 90^{th} percentile values to the corresponding water quality standards. The reduction needed for each target value to be reached is determined by calculating the rollback factor ($f_{rollback}$). For example, the method for determining the 50^{th} percentile rollback factor follows:

$$F_{rollback} = (\text{Observed } 50^{th} \text{ percentile} - \text{standard value})/(\text{Observed } 50^{th} \text{ percentile})$$

The same method is applied for the 90^{th} percentile values and standards and the most restrictive of the two (i.e., the greatest percent reduction required) is chosen as the target reduction.

6.2.1 Watershed Treatment Model

The Watershed Treatment Model (WTM) was applied to all watersheds in the study for source assessment purposes and specifically to Narrow Bay (PWL #1701-0316) for the purposes of running a statistical rollback (due to the incompatible nature of its physical features with regard to the tidal prism model).

The application of the WTM is simple yet detailed enough in terms of pollution source characterization. A series of spreadsheets quantifies the loading of fecal coliform bacteria (it does not consider total coliform) based on land use, precipitation, and fate and transport information, where available. The model is designed as a planning level tool for watersheds that do not have sufficient data or resources necessary for complex modeling applications. The WTM has several tiers of data specificity; however, this general model has the capacity to be modified to accommodate site-specific characteristics or variable data quantity and quality. In most cases, fecal coliform loading estimates can be produced using readily available land use data. The spreadsheets calculate an annual fecal coliform load through the application of a series of algorithms that are based on statistical relationships associated with the fate and transport of bacteria from sources to receiving waters. These algorithms are based on empirical relationships and comparative studies over a wide array of watershed/water body systems (Caraco, 2001). Inputs into the model are aggregated into primary and secondary sources, described below.

Primary sources in WTM include general land use categories that are assigned either a coefficient that is then multiplied by an annual runoff volume to calculate an annual load (e.g., urban land uses) or an annual unit load that is applied as a function of land use (e.g., rural land uses). These coefficients were chosen based upon research that is summarized in WTM's user manual (Caraco, 2001). Secondary sources represent a more refined set of model inputs and can include more specific information such as combined sewer overflows or the presence of livestock and wildlife within a watershed. Similar to the primary source calculations, the secondary sources are assigned a loading coefficient based on the extent of the land use activity. Depending on data availability, specific data for point source discharges may be placed in this section of the model as well as head counts for various livestock animals. Watershed areas with specific data on watershed management strategies can use the model to calculate load reductions that are 'discounted' based on the extent and success of implementation. The presence of Best Management Practices

(BMPs) such as detention basins or buffer strips, or the use of public education regarding the management of animal waste can be accounted for in existing and future loading scenarios.

The goal of applying WTM is to characterize all the point and non-point sources of fecal coliform and to determine their relative annually averaged contributions to the receiving waters. The derived loading values will serve as the reference point from which reductions could be made toward the TMDL target. Since flow and water quality data for creeks and storm water were not available, the point and non-point sources, including storm water (including urban and residential sources) and waterfowl are assessed based on available information. Additional potential non-point sources do exist (beach wrack, marine sediment resuspension) but the lack of site-specific or even regional data preclude their consideration at this scale of study. Site-specific studies of local conditions may be necessary to elucidate the potential for these additional sources, particularly if DNA source-tracking studies indicate strong evidence for these sources.

Percent reductions required to achieve the water quality goals are derived by analyzing the water quality data using the statistical rollback method (Ott, 1995). Once the targeted reductions for point and non-point sources are derived, specific and general management strategies can be identified for the watersheds of interest.

6.2.2 Modeling of Sources (WTM)

A land use analysis was performed for the drainage areas to the selected New York State water bodies and described in Section 4 of this report. The overall land use map was intersected with the drainage areas for each of the water bodies under current TMDL consideration, and land use distribution within these water bodies were determined. Wetlands and surface water areas were omitted from the analysis because the spreadsheet model considers these land uses as non-contributing sources of pathogens.

The WTM requires an annual rate of precipitation for the study areas. Precipitation data from the National Climatic Data Center were available for the Riverhead Research Farm and Bridgehampton stations (Station Numbers: 307134 and 300889, respectively). As described in Section 4, the Riverhead and Bridgehampton stations assumed to be adequately representative of conditions at most of the water bodies within the study area.

Primary source inputs required by the WTM include the following:

- Residential
    - LDR (<1du/acre)
    - MDR (1-4 du/acre)
    - HDR (>4 du/acre)
    - Multifamily
- Commercial
- Roadway
- Industrial
- Forest
- Rural
- Open Water
- Vacant Lots
- Annual Rainfall (inches)

Battelle received partial parcel based land use coverage within Suffolk County which cover Riverhead, Southold, Southampton, and Easthampton. These data exist for the remainder of Suffolk County and for Nassau County, but were not made available at the time of this draft report. In cases where parcel scale data were not available, National Land Cover Data (NLCD) land use, obtained from MRLC was used.

As stated above, the Suffolk County land use data is based on a tax assessor parcel scale. The individual tax assessor codes have been aggregated into 13 more general land use categories (Table 4-4). Further aggregation of some of these categories was performed to adequately meet the input requirements of the WTM model.

Table 6-3. Aggregation scheme between Suffolk County land use and WTM inputs.

WTM Classification	County Parcel Land Use Class (BTCAMP)
Residential	
LDR (<1du/acre)	1
MDR (1-4 du/acre)	2
HDR (>4 du/acre)	3
Commercial	4, 6
Roadway	10
Industrial	5, 11, 12
Forest	7, 14
Rural	8
Vacant Lots	9

Institutional is grouped with Commercial and Industrial contains Utilities and Waste Handling & Management classes. Two unclassified categories (14 and 15) were not documented in the Suffolk County land use report and were found to be infrequent in the study area. However, when these unclassified categories (BTCAMP codes) were encountered they were found to often occur as open coastal waters or forested areas. The open water areas were omitted for reasons explained above, and the forested areas were incorporated into the WTM input values where necessary.

Federal land use/land cover data were applied where county parcel-based land use were not available. Multi-Resolution Land Characteristics (MRLC) Consortium, a group of federal agencies, produced a comprehensive land cover database for the nation called the National Land Cover Database (NLCD) and 2001 data were downloaded and applied to the study area.

6.2.3 Load Characterization

The primary and secondary sources listed above were applied to the WTM to determine their relative distribution within each of the water bodies.

The WTM uses default values for source loadings where the user does not have site-specific data. Default values for terrestrial loading were set at 20,000 MPN/100 mL of surface runoff and influenced by additional factors such as land uses and their relative areas, precipitation and impervious surfaces. Rates of pet and waterfowl loads, and loads that are not yet quantifiable (e.g., wrack), are described in Section 5.

6.3 Load Reductions

Load reductions were calculated for 42 specific embayments among the 26 PWL-listed water bodies through the use of the tidal prism model. Load reductions for 2 additional embayments (one additional PWL) were calculated through the application of the statistical rollback method.

Table 6-4 provides a summary of all load reductions associated with both the geometric mean and 90th percentile statistics for those waters analyzed under the tidal prism model. Table 6-5 summarizes statistical rollback reductions for Narrow Bay and Stony Brook Yacht Club. In all cases where water quality exceedances existed, the load reductions associated with the 90th percentile are greater than those referring to geometric means. This is typical where event-driven exceedances due to hydrological and seasonal cycles strongly influence pollutant loading rates (e.g., storm events). Negative load reductions are due to non-exceedance conditions and indicate the relative percentage of increase in pollutant load the system could withstand prior to exceedance conditions. Total coliform was analyzed for reductions in one water body, Ogden Pond (1701-0302) due to non-exceedance for fecal coliform but exceedance in total coliform. TMDLs calculated in Section 7 are based on 90th percentile load reductions.

Table 6-4. Load reductions calculated using the Tidal Prism Model

Water Body	PWL No.	Geomean % Reduction	90th Percentile% Reduction
Hempstead Harbor, north, and tidal tribs	1702-0022	86%	95%
Cold Spring Harbor and tidal tribs	1702-0018	72%	95%
Cold Spring Harbor - Eel Creek	1702-0018	72%	90%
Huntington Harbor	1702-0228	58%	89%
Centerport Harbor	1702-0229	72%	91%
Northport Harbor	1702-0230	88%	92%
Stony Brook Harbor - Inner	1702-0047	98%	99%
Stony Brook Harbor - Stony Brook Creek	1702-0047	99%	99%
West Meadow Creek	1702-0047	98%	99%
Port Jefferson Harbor, North, and tidal tribs	1702-0015	89%	94%
Conscience Bay and tidal tribs	1702-0091	98%	99%
Setauket Harbor - Little Bay	1702-0242	-10,273%	84%
Setauket Harbor - East Setauket	1702-0242	50%	79%
Setauket Harbor - Poquott	1702-0242	98%	99.5%
Mt. Sinai Harbor - Crystal Brook	1702-0019	74%	88%

Table 6–4. Load reductions calculated using the Tidal Prism Model, continued

Water Body	PWL No.	Geomean % Reduction	90th Percentile% Reduction
Mt. Sinai Harbor - Inner Harbor	1702-0019	91%	96%
Mt. Sinai Harbor - Pipe Stave Hollow	1702-0019	76%	93%
Mattituck Inlet/Creek, Low, and tidal tribs	1702-0020	47%	64%
Goldsmith Inlet	1702-0026	59%	91%
West Harbor, Fishers Island - Head of Pirates Cove	1702-0046	-73%	0%
West Harbor, Fishers Island - Darby Cove	1702-0046	6%	41%
Georgica Pond - Upper	1701-0145	76%	93%
Georgica Pond - Lower	1701-0145	59%	93%
Georgica Pond - Georgica Cove	1701-0145	67%	92%
Sagaponack Pond	1701-0146	84%	88%
Mecox Bay and tribs	1701-0034	41%	89%
Heady Creek and tribs	1701-0294	50%	88%
Taylor Creek and tribs	1701-0294	23%	52%
Penny Pond	1701-0298	-31%	31%
Weesuck Creek and tidal tribs	1701-0111	-64%	37%
Penniman Creek and tidal tribs	1701-0300	14%	32%
Ogden Pond	1701-0302	-327%	28%
Quantuck Bay - Quantuck Creek	1701-0042	68%	91%
Quantuck Canal/Moneybogue Bay	1701-0371	70%	62%
Seatuck Cove	1701-0309	70%	94%
Harts Cove	1701-0309	1%	12%
Bellport Bay - Beaverdam Creek	1701-0320	82%	94%
Bellport Bay - West Cove	1701-0320	79%	94%
Patchogue Bay - Swan River	1701-0326	56%	90%
Patchogue Bay - Mud Creek	1701-0326	50%	71%

Table 6-5. Load reductions calculated using the Statistical Rollback Method.

Water Body	PWL No.	Geomean % Reduction	90th Percentile% Reduction
Narrow Bay	1701-0318	N/A	16
Stony Brook Yacht Club	1702-0047	49	48

7.0 LOAD ALLOCATIONS

7.1 Background

The objective of a TMDL plan is to allocate allowable loads among the various pathogen sources so that the appropriate management actions can be taken to achieve the desired water quality results. The specific objective of the TMDLs for the water bodies in this study is to determine the required reductions in fecal coliform loadings from various nonpoint and point sources in order to meet the two water quality standards of 14 MPN/100mL as geometric mean and a 90^{th} percentile value of less than 49 MPN/100mL. In cases where fecal coliform data were limited, total coliform data were applied, if possible. Total coliform exceedance statistics were also used in cases where no exceedance occurred in fecal coliform, but did for total coliform. The incorporation of different sources into the TMDL is defined in the following equation (USEPA, 1999):

TMDL = WLA + LA + MOS

where:

WLA = waste load allocation (point sources)
LA = load allocation (nonpoint sources), and
MOS = margin of safety.

In addition, the selection of critical conditions that increase the overall protectiveness of the TMDL is an important element in the TMDL development process, along with consideration of seasonal variation and a margin of safety. These elements are described in the following sections.

7.2 Seasonal Variations and Critical Conditions

Fecal coliform bacteria concentrations can vary on a seasonal basis in some parts of the study area. The seasonality of shellfish bed closures reflects the cyclical nature of fecal coliform loads to receiving waters. Therefore, the closure periods (typically from May 1 through October 31) were chosen for analysis with the expectation that the pollution management plans developed for this period will protect the water body during the winter period (typically from November 1 through April 30). Although the May 1-October 31 timeframe was examined here, the shellfish area closure schedules in some of the water bodies may vary slightly from these dates (see Section 2.0 for discussion on the specific closure dates for individual water bodies).

In addition to being the period in which SRS sampling data are available, the 1997-2005 period contains a mix of wet years (above the long-term average) and average years.

7.2.1 Margin of Safety

The margin of safety (MOS) is included in the TMDL development process to account for any uncertainty on loadings and the fate and transport of fecal coliform in the watershed. There are two basic approaches for incorporating the MOS (USEPA, 1999):

- Implicit incorporation of MOS using conservative model assumptions to develop allocations, or
- Explicit incorporation of MOS as a portion of the total TMDL and the remainder is used for the allocations.

The MOS was included in this study as implicit. A series of implicit approaches to increase the conservative (protective) nature of this analysis include the following:

- Use of seasonal data instead of the annual data for conservative assessment of water quality conditions in seasonally certified water bodies.
- Use of most conservative tidal prism model coefficients.

7.3 Allocation Scenario

As described in Section 3, the geometric mean (14 MPN/100mL) and the 90th percentile (49 MPN/100mL) criteria must be met in order to designate the water body for shellfish harvest. New York state standards set no averaging period (but specifies a minimum number of samples to be used for calculation of geometric mean and 90th percentile values) on which to calculate these values from the historic water quality data for comparison with the standards. The SRS data and the data compiled by NYSDEC in the past have shown that the geometric mean criterion is usually met and the 90th percentile criterion is often the difficult target to meet.

However, the estimated 90th percentile of the fecal coliform standards does not indicate that fecal coliform values at certified shellfishing areas are allowed to exceed the criteria ten percent of the time. Rather, the 90th percentile is a measure of water quality variation at a particular station compared to the variability inherent in the multiple-tube, multiple-dilution MPN method for examining water samples. When the variability of actual station data exceeds the inherent variability of the MPN procedure, there are likely to be some environmental factors (e.g., pollution sources) affecting water quality at that station that make the area unsuitable for shellfishing certification.

Two approaches were applied to evaluate load reductions necessary to attain water quality standards. First, a tidal prism model was used to determine existing and allowable loads based on state and county water column fecal and total coliform data. This approach factors in general physical and biological processes (tidal exchange, bacterial die-off). A second approach applied is the statistical rollback method (Ott, 1995) describes a way to use the statistical characteristics of a set of water quality parameter results to estimate the distribution of future results after abatement processes are applied to sources (applied to Narrow Bay and Stony Brook Yacht Club water bodies only). The method relies on basic dispersion and dilution assumptions and their effect on the mean and standard deviation of bacteria sample results at a monitoring site downstream from a source. The rollback method then provides a statistical estimate of the new population after a chosen reduction factor is applied to the existing pathogen source. In this load allocation process, compliance with the most restrictive of the dual fecal coliform criteria will determine the bacteria reduction needed. The target reductions developed for the New York estuarine systems are provided in the following sections. These sections contain two tables for each water body: (1) loads of fecal coliform from watershed and waterfowl sources as determined through the application of the WTM and waterfowl occupancy and loading rates derived from Horsely and Witten (2003); and (2) summary of load reductions based on both the tidal prism model and the rollback method.

The load from urban stormwater determined through the application of WTM is to be attributed to MS4s. This is recognized to be an overestimation of the load through these facilities, but is within the order of uncertainty associated with the models. Without specific storm sewer information, there is inadequate basis to estimate the portion of the stormwater load that flows directly from private property to the watercourse.

There are several STPs within the study area (see Section 5). Maximum estimated loads were assigned to waste load allocations for STPs based on maximum permitted flow rates and the target monthly geometric mean fecal coliform concentration of 200 MPN/100 ml. Load reductions were not assigned to STPs because each is operating well within their permitted discharge volumes and concentrations.

Consistent with the recommendations in EPA's November 15, 2006 memo, "Establishing TMDL "Daily" Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in Friends of the Earth, Inc. v. EPA, et al., No. 05-5015, (April 25, 2006) and Implications, for NPDES Permits," the TMDLs/WLAs/LAs have also been expressed as daily loads. As noted in the guidance, "EPA does not believe that the Friends of the Earth decision requires any changes to EPA's existing policy and guidance describing how a TMDL's wasteload allocations are implemented in NPDES permits." Water quality-based effluent limits (WQBELs) in NPDES permits that implement wasteload allocations in approved TMDLs must be "consistent with the assumptions and requirements of any available wasteload allocation for the discharge" 122.44(d)(1)(vii)(B). These provisions do not require that effluent limits in NPDES permits be expressed in a form that is identical to the form in which the wasteload allocation for the discharge is expressed in a TMDL. The permit writer has the flexibility to express the effluent limitation using a time frame appropriate to the water body, pollutant, and the applicable water quality standard. In addition, allocations based on monthly, seasonal or annual timeframes may be used to guide management measures and implementation plans because they are related to the overall loading capacity of the water body, while the daily expressions represent day to day snapshots of the total loading capacity based on ambient conditions.

The summary tables included in the following sections contain total maximum daily loads expressed in both daily and annual concentrations.

7.3.1 Hempstead Harbor (1702-0022)

Table 7-1. WTM Fecal Coliform Loads to Hempstead Harbor

SOURCES	Billion FC/year
POINT SOURCES	
City of Glen Cove WWTP	15,198
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	26,066,697
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	57,249
Forest	42,728
Waterfowl	16,233
TOTAL LOAD (Billions)	**26,198,105**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 24,246,979 billion FC/year.

Table 7-2. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Hempstead Harbor

	Condition	Hempstead Harbor	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	116,210	-	-
	Permitted Point Source Contributions--STPs	15,198	-	-
	Permitted Point Source Contributions—MS4s	26,066,697	-	-
	Total Existing Loads	26,198,105	-	-
TMDL (billion FC/day)	LA	16	302	95
	WLA—STPs	42	0	0
	WLA—MS4s	3571	67,845	95
	MOS	-	-	-
	TMDL	3,629	68,147	95
TMDL (billion FC/yr)	LA	5,811	110,400	95
	WLA—STPs	15,198	0	0
	WLA—MS4s	1,303,335	24,763,362	95
	MOS	-	-	-
	TMDL	1,324,344	24,873,762	95

7.3.2 Cold Spring Harbor– Inner (1702-0018)

Table 7-3. WTM Fecal Coliform Loads to Cold Spring Harbor–Inner.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	14,012,663
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	25,500
Forest	28,860
Waterfowl	2,473
TOTAL LOAD (Billions)	**14,069,496**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 13,184,150 billion FC/year.

Table 7-4. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Cold Spring Harbor--Inner.

	Condition	Cold Spring Harbor (Inner)	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**56,833**	**-**	**-**
	Permitted Point Source Contributions--STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**14,012,663**		
	Total Existing Loads	**14,069,496**	**-**	**-**
TMDL (billion FC/day)	**LA**	**8**	**148**	**95**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,919**	**36,471**	**95**
	MOS	**-**	**-**	**-**
	TMDL	**1,927**	**36,619**	**95**
TMDL (billion FC/yr)	**LA**	**2,842**	**53,991**	**95**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**700,633**	**13,312,030**	**95**
	MOS	**-**	**-**	**-**
	TMDL	**703,475**	**13,366,021**	**95**

7.3.3 Cold Spring Harbor – Eel Creek (1702-0018)

Table 7-5. WTM Fecal Coliform Loads to Cold Spring Harbor – Eel Creek.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	127,212
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	321
Forest	873
Waterfowl	11
TOTAL LOAD (Billions)	**128,417**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 111,427 billion FC/year.

Table 7-6. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Cold Spring Harbor—Eel Creek.

	Condition	Cold Spring Harbor (Eel Creek)	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**1,205**	**-**	**-**
	Permitted Point Source Contributions--STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**127,212**	**-**	**-**
	Total Existing Loads	**128,417**	**-**	**-**
TMDL (billion FC/day)	**LA**	**0**	**3**	**90**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**35**	**314**	**90**
	MOS	**-**	**-**	**-**
	TMDL	**35**	**317**	**90**
TMDL (billion FC/yr)	**LA**	**121**	**1,084**	**90**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**12,721**	**114,491**	**90**
	MOS	**-**	**-**	**-**
	TMDL	**12,842**	**115,575**	**90**

7.3.4 Huntington Harbor (1702-0228)

Table 7-7. WTM Fecal Coliform Loads to Huntington Harbor

SOURCES	Billion FC/year
POINT SOURCES	
Huntington STP	6,908
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	14,475,938
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	10,062
Forest	10,835
Waterfowl	4,346
TOTAL LOAD (Billions)	**14,508,089**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 13,695,034 billion FC/year.

Table 7-8. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Huntington Harbor

	Condition	Huntington Harbor	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**25,243**	**-**	**-**
	Permitted Point Source Contributions—STPs	**6,908**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**14,475,938**	**-**	**-**
	Total Existing Loads	**14,508,089**	**-**	**-**
TMDL (billion FC/day)	**LA**	**8**	**62**	**89**
	WLA—STPs	**19**	**0**	**0**
	WLA—MS4s	**4,363**	**35,297**	**89**
	MOS	**-**	**-**	**-**
	TMDL	**4,390**	**35,359**	**89**
TMDL (billion FC/yr)	**LA**	**2,777**	**22,466**	**89**
	WLA—STPs	**6,908**	**0**	**0**
	WLA—MS4s	**1,592,353**	**12,883,585**	**89**
	MOS	-	-	-
	TMDL	**1,602,038**	**12,906,051**	**89**

7.3.5 Centerport Harbor (1702-0229)

Table 7-9. WTM Fecal Coliform Loads to Centerport Harbor

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	4,063,247
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	1,409
Forest	3,337
Waterfowl	1,431
TOTAL LOAD (Billions)	**4,069,424**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 3,864,211 billion FC/year.

Table 7-10. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Centerport Harbor

	Condition	Centerport Harbor	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**6,177**	**-**	**-**
	Permitted Point Source Contributions--STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**4,063,247**	**-**	**-**
	Total Existing Loads	**4,069,424**	**-**	**-**
TMDL (billion FC/day)	**LA**	**1**	**15**	**91**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,002**	**10,130**	**91**
	MOS	**-**	**-**	**-**
	TMDL	**1,003**	**10,145**	**91**
TMDL (billion FC/yr)	**LA**	**556**	**5,621**	**91**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**365,692**	**3,697,555**	**91**
	MOS	**-**	**-**	**-**
	TMDL	**366,248**	**3,703,176**	**91**

7.3.6 Northport Harbor (1702-0230)

Table 7-11. WTM Fecal Coliform Loads to Northport Harbor

SOURCES	Billion FC/year
POINT SOURCES	
Northport STP	1,244
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	7,368,615
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	3,184
Forest	5,506
Waterfowl	5,254
TOTAL LOAD (Billions)	**7,383,803**

[1]"Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 7,019,914billion FC/year.

Table 7-12. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Northport Harbor

	Condition	Northport Harbor	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**13,944**	**-**	**-**
	Permitted Point Source Contributions--STPs	**1,244**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**7,368,615**	**-**	**-**
	Total Existing Loads	**7,383,803**	**-**	**-**
TMDL (billion FC/day)	**LA**	**3**	**35**	**92**
	WLA—STPs	**3**	**0**	**0**
	WLA—MS4s	**1,615**	**18,573**	**92**
	MOS	**-**	**-**	**-**
	TMDL	**1,621**	**18,608**	**92**
TMDL (billion FC/yr)	**LA**	**1,116**	**12,828**	**92**
	WLA—STPs	**1,244**	**0**	**0**
	WLA—MS4s	**589,489**	**6,779,126**	**92**
	MOS	**-**	**-**	**-**
	TMDL	**591,849**	**6,791,954**	**92**

7.3.7 Stony Brook Harbor (1702-0047)

Table 7-13. WTM Fecal Coliform Loads to Stony Brook Harbor--Inner

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	677,961
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	4,166
Forest	5,054
Waterfowl	759
TOTAL LOAD (Billions)	**687,940**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 597,082 billion FC/year.

Table 7-14. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Stony Brook Harbor - Inner

	Condition	Stony Brook Harbor (Inner)	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**9,979**	**-**	**-**
	Permitted Point Source Contributions--STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**677,961**	**-**	**-**
	Total Existing Loads	**687,940**	**-**	**-**
TMDL (billion FC/day)	**LA**	**0**	**27**	**99**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**19**	**1,839**	**99**
	MOS	**-**	**-**	**-**
	TMDL	**19**	**1,866**	**99**
TMDL (billion FC/yr)	**LA**	**100**	**9,879**	**99**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**6,780**	**671,181**	**99**
	MOS	**-**	**-**	**-**
	TMDL	**6,880**	**681,060**	**99**

Table 7-15. WTM Fecal Coliform Loads to Stony Brook Creek

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	2,004,493
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	2,540
Forest	4,831
Waterfowl	73
TOTAL LOAD (Billions)	**2,011,937**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 1,883,750 billion FC/year.

Table 7-16. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Stony Brook Harbor – Stony Brook Creek

	Condition	Stony Brook Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	7,444	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	2,004,493	-	-
	Total Existing Loads	2,011,937	-	-
TMDL (billion FC/day)	LA	0	20	99
	WLA—STPs	0	0	0
	WLA—MS4s	55	5,437	99
	MOS	-	-	-
	TMDL	55	5,457	99
TMDL (billion FC/yr)	LA	74	7,370	99
	WLA—STPs	0	0	0
	WLA—MS4s	20,045	1,984,448	99
	MOS	-	-	-
	TMDL	20,119	1,991,818	99

Table 7-17. WTM Fecal Coliform Loads to Stony Brook Yacht Club.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	639,413
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	33
Forest	277
Waterfowl	183
TOTAL LOAD (Billions)	**639,906**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 611,798 billion FC/year.

Table 7-18. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Stony Brook Yacht Club.

	Condition	Stony Brook Yacht Club	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**493**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**639,413**	**-**	**-**
	Total Existing Loads	**639,906**	**-**	**-**
TMDL (billion FC/day)	**LA**	**1**	**1**	**48**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**911**	**841**	**48**
	MOS	**-**	**-**	**-**
	TMDL	**912**	**842**	**48**
TMDL (billion FC/yr)	**LA**	**256**	**237**	**48**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**332,495**	**306,918**	**48**
	MOS	**-**	**-**	**-**
	TMDL	**332,751**	**307,155**	**48**

Table 7-19. WTM Fecal Coliform Loads to Stony Brook Harbor -- West Meadow Creek

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	3,231,550
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	199
Forest	1,753
Waterfowl	604
TOTAL LOAD (Billions)	**3,234,106**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 3,069,504 billion FC/year.

Table 7-20. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Stony Brook Harbor – West Meadow Creek

	Condition	West Meadow Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**2,556**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**3,231,550**	**-**	**-**
	Total Existing Loads	**3,234,106**	**-**	**-**
TMDL (billion FC/day)	**LA**	**0**	**7**	**99**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**89**	**8,765**	**99**
	MOS	**-**	**-**	**-**
	TMDL	**89**	**8,772**	**99**
TMDL (billion FC/yr)	**LA**	**26**	**2,530**	**99**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**32,315**	**3,199,235**	**99**
	MOS	**-**	**-**	**-**
	TMDL	**32,341**	**3,201,765**	**99**

7.3.8 Port Jefferson Harbor (1702-0015)

Table 7-21. WTM Fecal Coliform Loads to Port Jefferson Harbor

SOURCES	Billion FC/year
POINT SOURCES	
Port Jefferson STP	*2,349*
SUNY, Stony Brook	*6,908*
Total STP	**9,257**
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	4,721,980
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	831
Forest	4,090
Waterfowl	4,463
TOTAL LOAD (Billions)	**4,740,621**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 4,503,341 billion FC/year.

Table 7-22. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Port Jefferson Harbor

	Condition	Port Jefferson Harbor	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**9,384**	**-**	**-**
	Permitted Point Source Contributions—STPs	**9,257**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**4,721,980**	**-**	**-**
	Total Existing Loads	**4,740,621**	**-**	**-**
TMDL (billion FC/day)	**LA**	**2**	**24**	**94**
	WLA—STPs	**25**	**0**	**0**
	WLA—MS4s	**776**	**12,161**	**94**
	MOS	**-**	**-**	**-**
	TMDL	**803**	**12,185**	**94**
TMDL (billion FC/yr)	**LA**	**563**	**8,821**	**94**
	WLA—STPs	**9,257**	**0**	**0**
	WLA—MS4s	**283,319**	**4,438,661**	**94**
	MOS	**-**	**-**	**-**
	TMDL	**293,139**	**4,447,482**	**94**

7.3.9 Conscience Bay (1702-0091)

Table 7-23. WTM Fecal Coliform Loads to Conscience Bay

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	8,478,575
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	9,223
Forest	10,725
Waterfowl	3,405
TOTAL LOAD (Billions)	**8,501,928**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 7,909,229 billion FC/year.

Table 7-24. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Conscience Bay

	Condition	Conscience Bay	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**23,353**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**8,478,575**		
	Total Existing Loads	**8,501,928**	**-**	**-**
TMDL (billion FC/day)	**LA**	**1**	**63**	**99**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**232**	**22,997**	**99**
	MOS	**-**	**-**	**-**
	TMDL	**233**	**23,060**	**99**
TMDL (billion FC/yr)	**LA**	**234**	**23,119**	**99**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**84,786**	**8,393,789**	**99**
	MOS	**-**	**-**	**-**
	TMDL	**85,020**	**8,416,908**	**99**

7.3.10 Setauket Harbor (1702-0242)

Table 7-25. WTM Fecal Coliform Loads to Setauket Harbor – Little Bay

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	371,461
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	140
Forest	760
Waterfowl	668
TOTAL LOAD (Billions)	**373,029**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 353,203 billion FC/year.

Table 7-26. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Setauket Harbor – Little Bay

	Condition	Setauket Harbor – Little Bay	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	1,568	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	371,461	-	-
	Total Existing Loads	373,029	-	-
TMDL (billion FC/day)	LA	1	4	84
	WLA—STPs	0	0	0
	WLA—MS4s	163	855	84
	MOS	-	-	-
	TMDL	164	859	84
TMDL (billion FC/yr)	LA	251	1,317	84
	WLA—STPs	0	0	0
	WLA—MS4s	59,434	312,027	84
	MOS	-	-	-
	TMDL	59,685	313,344	84

Table 7-27. WTM Fecal Coliform Loads to Setauket Harbor – East Setauket

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	3,787,055
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	546
Forest	1,842
Waterfowl	238
TOTAL LOAD (Billions)	**3,789,681**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 3,561,466 billion FC/year.

Table 7-28. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Setauket Harbor – East Setauket

	Condition	Setauket Harbor – East Setauket	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	2,626	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	3,787,055	-	-
	Total Existing Loads	3,789,681	-	-
TMDL (billion FC/day)	LA	2	6	79
	WLA—STPs	0	0	0
	WLA—MS4s	2,178	8,196	79
	MOS	-	-	-
	TMDL	2,180	8,202	79
TMDL (billion FC/yr)	LA	551	2,075	79
	WLA—STPs	0	0	0
	WLA—MS4s	795,282	2,991,773	79
	MOS	-	-	-
	TMDL	795,833	2,993,848	79

Table 7-29. WTM Fecal Coliform Loads to Setauket Harbor – Poquott

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	830,347
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	150
Forest	431
Waterfowl	59
TOTAL LOAD (Billions)	**830,987**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 790,502 billion FC/year.

Table 7-30. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Setauket Harbor - Poquott

	Condition	Setauket Harbor – Poquott	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**640**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**830,347**	**-**	**-**
	Total Existing Loads	**830,987**	**-**	**-**
TMDL (billion FC/day)	**LA**	**0**	**2**	**99.5**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**11**	**2,263**	**99.5**
	MOS	**-**	**-**	**-**
	TMDL	**11**	**2,265**	**99.5**
TMDL (billion FC/yr)	**LA**	**3**	**637**	**99.5**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**4,152**	**826,195**	**99.5**
	MOS	**-**	**-**	**-**
	TMDL	**4,155**	**826,832**	**99.5**

7.3.11 Mt. Sinai Harbor (1702-0019)

Table 7-31. WTM Fecal Coliform Loads to Mt. Sinai Harbor – Crystal Brook.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	2,619,442
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	2,366
Forest	3,939
Waterfowl	317
TOTAL LOAD (Billions)	**2,626,064**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 2,478,730 billion FC/year.

Table 7-32. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Mt. Sinai Harbor – Crystal Brook.

	Condition	Mt. Sinai Harbor – Crystal Brook	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**6,622**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**2,619,442**	**-**	**-**
	Total Existing Loads	**2,626,064**	**-**	**-**
TMDL (billion FC/day)	**LA**	**2**	**16**	**88**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**861**	**6,315**	**88**
	MOS	**-**	**-**	**-**
	TMDL	**863**	**6,331**	**88**
TMDL (billion FC/yr)	**LA**	**795**	**5,827**	**88**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**314,333**	**2,305,109**	**88**
	MOS	**-**	**-**	**-**
	TMDL	**315,128**	**2,310,936**	**88**

Table 7-33. WTM Fecal Coliform Loads to Mt. Sinai Harbor – Inner Harbor.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	1,676,734
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	2,255
Forest	2,036
Waterfowl	132
TOTAL LOAD (Billions)	**1,681,157**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 1,597,824 billion FC/year.

Table 7-34. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Mt. Sinai Harbor – Inner Harbor.

	Condition	Mt. Sinai Harbor – Inner Harbor	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**4,423**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**1,676,734**	**-**	**-**
	Total Existing Loads	**1,681,157**	**-**	**-**
TMDL (billion FC/day)	**LA**	**0**	**12**	**96**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**184**	**4,410**	**96**
	MOS	**-**	**-**	**-**
	TMDL	**184**	**4,422**	**96**
TMDL (billion FC/yr)	**LA**	**177**	**4,246**	**96**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**67,069**	**1,609,665**	**96**
	MOS	**-**	**-**	**-**
	TMDL	**67,246**	**1,613,911**	**96**

Table 7-35. WTM Fecal Coliform Loads to Mt. Sinai Harbor – Pipe Stave Hollow.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	1,028,714
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	97
Forest	739
Waterfowl	11
TOTAL LOAD (Billions)	**1,029,561**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 979,718 billion FC/year.

Table 7-36. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Mt. Sinai Harbor – Pipe Stave Hollow.

	Condition	Mt. Sinai Harbor – Pipe Stave Hollow	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	847	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	1,028,714		
	Total Existing Loads	1,029,561	-	-
TMDL (billion FC/day)	LA	0	2	93
	WLA—STPs	0	0	0
	WLA—MS4s	197	2,621	93
	MOS	-	-	-
	TMDL	197	2,623	93
TMDL (billion FC/yr)	LA	59	788	93
	WLA—STPs	0	0	0
	WLA—MS4s	72,010	956,704	93
	MOS	-	-	-
	TMDL	72,069	957,492	93

7.3.12 Mattituck Creek (1702-0020)

Table 7-37. WTM Fecal Coliform Loads to Mattituck Creek

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	2,830,962
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	17,102
Forest	632
Waterfowl	1,778
TOTAL LOAD (Billions)	**2,850,474**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 2,663,741 billion FC/year.

Table 7-38. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Mattituck Creek

	Condition	Mattituck Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**19,512**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**2,830,962**	**-**	**-**
	Total Existing Loads	**2,850,474**	**-**	**-**
TMDL (billion FC/day)	**LA**	**19**	**34**	**64**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**2,792**	**4,964**	**64**
	MOS	**-**	**-**	**-**
	TMDL	**2,811**	**4,998**	**64**
TMDL (billion FC/yr)	**LA**	**7,024**	**12,488**	**64**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,019,146**	**1,811,815**	**64**
	MOS	**-**	**-**	**-**
	TMDL	**1,026,170**	**1,824,303**	**64**

7.3.13 Goldsmith Inlet (1702-0026)

Table 7-39. WTM Fecal Coliform Loads to Goldsmith Inlet

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	425,546
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	3,504
Forest	224
Waterfowl	248
TOTAL LOAD (Billions)	**429,522**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 401,558 billion FC/year.

Table 7-40. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Goldsmith Inlet

	Condition	Goldsmith Inlet	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**3,976**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**425,546**	**-**	**-**
	Total Existing Loads	**429,522**	**-**	**-**
TMDL (billion FC/day)	**LA**	**1**	**10**	**91**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**105**	**1,061**	**91**
	MOS	**-**	**-**	**-**
	TMDL	**106**	**1,071**	**91**
TMDL (billion FC/yr)	**LA**	**358**	**3,618**	**91**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**38,299**	**387,247**	**91**
	MOS	**-**	**-**	**-**
	TMDL	**38,657**	**390,865**	**91**

7.3.14 West Harbor, Fishers Island (1702-0046)

Table 7-41. WTM Fecal Coliform Loads to West Harbor – Head of Pirates Cove

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	41,540
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	0
Forest	0
Waterfowl	45
TOTAL LOAD (Billions)	**41,585**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 39,946 billion FC/year.

Table 7-42. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in West Harbor –Head of Pirates Cove

	Condition	Head of Pirates Cove	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	45	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	41,540	-	-
	Total Existing Loads	41,585	-	-
TMDL (billion FC/day)	LA	0	0	0
	WLA—STPs	0	0	0
	WLA—MS4s	114	0	0
	MOS	-	-	-
	TMDL	114	0	0
TMDL (billion FC/yr)	LA	45	0	0
	WLA—STPs	0	0	0
	WLA—MS4s	41,540	0	0
	MOS	-	-	-
	TMDL	41,585	0	0

Table 7-43. WTM Fecal Coliform Loads to West Harbor – Darby Cove

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	19,859
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	0
Forest	0
Waterfowl	96
TOTAL LOAD (Billions)	**19,955**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 18,922 billion FC/year.

Table 7-44. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in West Harbor – Darby Cove

	Condition	Darby Cove	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	96	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	19,859	-	-
	Total Existing Loads	19,955	-	-
TMDL (billion FC/day)	LA	0	0	41
	WLA—STPs	0	0	0
	WLA—MS4s	32	22	41
	MOS	-	-	-
	TMDL	32	22	41
TMDL (billion FC/yr)	LA	56	39	41
	WLA—STPs	0	0	0
	WLA—MS4s	11,717	8,142	41
	MOS	-	-	-
	TMDL	11,773	8,181	41

7.3.15 Georgica Pond (1701-0145)

Table 7-45. WTM Fecal Coliform Loads to Georgica Pond - Upper

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	758,232
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	0
Forest	2,229
Waterfowl	87
TOTAL LOAD (Billions)	**760,548**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 559,238 billion FC/year.

Table 7-46. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Georgica Pond - Upper

	Condition	Georgica Pond - Upper	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**2,316**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**758,232**	**-**	**-**
	Total Existing Loads	**760,548**	**-**	**-**
TMDL (billion FC/day)	**LA**	**1**	**6**	**93**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**145**	**1,932**	**93**
	MOS	**-**	**-**	**-**
	TMDL	**146**	**1,938**	**93**
TMDL (billion FC/yr)	**LA**	**162**	**2,154**	**93**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**53,076**	**705,156**	**93**
	MOS	**-**	**-**	**-**
	TMDL	**53,238**	**707,310**	**93**

Table 7-47. WTM Fecal Coliform Loads to Georgica Pond - Lower

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	176,835
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	405
Forest	13
Waterfowl	62
TOTAL LOAD (Billions)	**177,315**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 170,294 billion FC/year.

Table 7-48. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Georgica Pond - Lower

	Condition	Georgica Pond - Lower	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	480	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	176,835	-	-
	Total Existing Loads	177,315	-	-
TMDL (billion FC/day)	LA	0	1	93
	WLA—STPs	0	0	0
	WLA—MS4s	34	451	93
	MOS	-	-	-
	TMDL	34	452	93
TMDL (billion FC/yr)	LA	34	446	93
	WLA—STPs	0	0	0
	WLA—MS4s	12,378	164,457	93
	MOS	-	-	-
	TMDL	12,412	164,903	93

Table 7-49. WTM Fecal Coliform Loads to Georgica Pond – Georgica Cove

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	1,308,926
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	3,615
Forest	119
Waterfowl	394
TOTAL LOAD (Billions)	**1,313,054**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 1,217,290 billion FC/year.

Table 7-50. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Georgica Pond – Georgica Cove

	Condition	Georgica Pond – Georgica Cove	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	4,128	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	1,308,926	-	-
	Total Existing Loads	1,313,054	-	-
TMDL (billion FC/day)	LA	1	10	92
	WLA—STPs	0	0	0
	WLA—MS4s	287	3,299	92
	MOS	-	-	-
	TMDL	288	3,309	92
TMDL (billion FC/yr)	LA	330	3,798	92
	WLA—STPs	0	0	0
	WLA—MS4s	104,714	1,204,212	92
	MOS	-	-	-
	TMDL	105,044	1,208,010	92

7.3.16 Sagaponack Pond (1701-0146)

Table 7-51. WTM Fecal Coliform Loads to Sagaponack Pond

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	2,273,162
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	12,685
Forest	2,402
Waterfowl	1,716
TOTAL LOAD (Billions)	**2,289,965**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 2,133,936 billion FC/year.

Table 7-52. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Sagaponack Pond

	Condition	Sagaponack Pond	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**16,803**	**-**	**-**
	Permitted Point Source Contributions--STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**2,273,162**	**-**	**-**
	Total Existing Loads	**2,289,965**	**-**	**-**
TMDL (billion FC/day)	**LA**	**6**	**41**	**88**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**747**	**5,480**	**88**
	MOS	**-**	**-**	**-**
	TMDL	**753**	**5,521**	**88**
TMDL (billion FC/yr)	**LA**	**2,016**	**14,787**	**88**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**272,780**	**2,000,382**	**88**
	MOS	**-**	**-**	**-**
	TMDL	**274,796**	**2,015,169**	**88**

7.3.17 Mecox Bay (1701-0034)

Table 7-53. WTM Fecal Coliform Loads to Mecox Bay

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	6,583,359
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	74,789
Forest	3,633
Waterfowl	12,084
TOTAL LOAD (Billions)	**6,673,865**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 6,042,298 billion FC/year.

Table 7-54. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Mecox Bay

	Condition	Mecox Bay	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	90,506	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	6,583,359	-	-
	Total Existing Loads	6,673,865	-	-
TMDL (billion FC/day)	LA	27	221	89
	WLA—STPs	0	0	0
	WLA—MS4s	1,984	16,052	89
	MOS	-	-	-
	TMDL	2,011	16,273	89
TMDL (billion FC/yr)	LA	9,956	80,550	89
	WLA—STPs	0	0	0
	WLA—MS4s	724,169	5,859,190	89
	MOS	-	-	-
	TMDL	734,125	5,939,740	89

7.3.18 Heady and Taylor Creeks (1701-0294)

Table 7-55. WTM Fecal Coliform Loads to Heady Creek

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	1,812,020
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	2,020
Forest	970
Waterfowl	603
TOTAL LOAD (Billions)	**1,815,613**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 1,667,203 billion FC/year.

Table 7-56. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Heady Creek.

	Condition	Heady Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**3,593**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**1,812,020**	**-**	**-**
	Total Existing Loads	**1,815,613**	**-**	**-**
TMDL (billion FC/day)	**LA**	**1**	**9**	**88**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**596**	**4,369**	**88**
	MOS	**-**	**-**	**-**
	TMDL	**597**	**4,378**	**88**
TMDL (billion FC/yr)	**LA**	**431**	**3,162**	**88**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**217,443**	**1,594,577**	**88**
	MOS	**-**	**-**	**-**
	TMDL	**217,874**	**1,597,739**	**88**

Table 7-57. WTM Fecal Coliform Loads to Taylor Creek

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	764,398
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	31
Forest	137
Waterfowl	530
TOTAL LOAD (Billions)	**765,096**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 735,840 billion FC/year.

Table 7-58. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Taylor Creek.

	Condition	Taylor Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**698**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**764,398**	**-**	**-**
	Total Existing Loads	**765,096**	**-**	**-**
TMDL (billion FC/day)	**LA**	**1**	**1**	**52**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,005**	**1,089**	**52**
	MOS	**-**	**-**	**-**
	TMDL	**1,006**	**1,090**	**52**
TMDL (billion FC/yr)	**LA**	**335**	**363**	**52**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**366,911**	**397,487**	**52**
	MOS	**-**	**-**	**-**
	TMDL	**367,246**	**397,850**	**52**

7.3.19 Penny Pond (1701-0298)

Table 7-59. WTM Fecal Coliform Loads to Penny Pond

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	924,234
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	0
Forest	1
Waterfowl	117
TOTAL LOAD (Billions)	**924,352**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 901,930 billion FC/year.

Table 7-60. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Penny Pond

	Condition	Penny Pond	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**118**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**924,234**	**-**	**-**
	Total Existing Loads	**924,352**	**-**	**-**
TMDL (billion FC/day)	**LA**	**0**	**0**	**31**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,747**	**785**	**31**
	MOS	**-**	**-**	**-**
	TMDL	**1,747**	**785**	**31**
TMDL (billion FC/yr)	**LA**	**81**	**37**	**31**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**637,722**	**286,512**	**31**
	MOS	**-**	**-**	**-**
	TMDL	**637,803**	**286,549**	**31**

7.3.20 Weesuck Creek (1701-0111)

Table 7-61. WTM Fecal Coliform Loads to Weesuck Creek

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	1,804,375
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	5,596
Forest	2,110
Waterfowl	466
TOTAL LOAD (Billions)	**1,812,547**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 1,652,486 billion FC/year.

Table 7-62. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Weesuck Creek

	Condition	Weesuck Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**8,172**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**1,804,375**	**-**	**-**
	Total Existing Loads	**1,812,547**	**-**	**-**
TMDL (billion FC/day)	**LA**	**14**	**8**	**37**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**3,114**	**1,829**	**37**
	MOS	**-**	**-**	**-**
	TMDL	**3,128**	**1,837**	**37**
TMDL (billion FC/yr)	**LA**	**5,148**	**3,024**	**37**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,136,756**	**667,619**	**37**
	MOS	**-**	**-**	**-**
	TMDL	**1,141,904**	**670,643**	**37**

7.3.21 Penniman Creek (1701-0300)

Table 7-63. WTM Fecal Coliform Loads to Penniman Creek

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	460,817
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	0
Forest	31
Waterfowl	672
TOTAL LOAD (Billions)	**461,520**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 435,197 billion FC/year.

Table 7-64. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Penniman Creek.

	Condition	Penniman Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**703**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**460,817**	**-**	**-**
	Total Existing Loads	**461,520**	**-**	**-**
TMDL (billion FC/day)	**LA**	**1**	**1**	**32**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**859**	**404**	**32**
	MOS	**-**	**-**	**-**
	TMDL	**860**	**405**	**32**
TMDL (billion FC/yr)	**LA**	**478**	**225**	**32**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**313,356**	**147,461**	**32**
	MOS	**-**	**-**	**-**
	TMDL	**313,834**	**147,686**	**32**

7.3.22 Ogden Pond (1701-0302)

Table 7-65. WTM Fecal Coliform Loads to Ogden Pond

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	528,455
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	0
Forest	24
Waterfowl	143
TOTAL LOAD (Billions)	**528,623**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 504,576 billion FC/year.

Table 7-66. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Ogden Pond

	Condition	Ogden Pond	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**167**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**528,455**	**-**	**-**
	Total Existing Loads	**528,622**	**-**	**-**
TMDL (billion FC/day)	**LA**	**0**	**0**	**28**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,042**	**405**	**28**
	MOS	**-**	**-**	**-**
	TMDL	**1,042**	**405**	**28**
TMDL (billion FC/yr)	**LA**	**120**	**47**	**28**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**380,488**	**147,967**	**28**
	MOS	**-**	**-**	**-**
	TMDL	**380,608**	**148,014**	**28**

7.3.23 Quantuck Bay (1701-0042)

Table 7-67. WTM Fecal Coliform Loads to Quantuck Bay – Quantuck Creek

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	1,560,945
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	260
Forest	6,543
Waterfowl	1,304
TOTAL LOAD (Billions)	**1,569,052**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 1,156,320 billion FC/year.

Table 7-68. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Quantuck Bay – Quantuck Creek

	Condition	Quantuck Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	8,107	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	1,560,945	-	-
	Total Existing Loads	1,569,052	-	-
TMDL (billion FC/day)	LA	2	20	91
	WLA—STPs	0	0	0
	WLA—MS4s	385	3,892	91
	MOS	-	-	-
	TMDL	387	3,912	91
TMDL (billion FC/yr)	LA	730	7,377	91
	WLA—STPs	0	0	0
	WLA—MS4s	140,485	1,420,460	91
	MOS	-	-	-
	TMDL	141,215	1,427,837	91

7.3.24 Quantuck Canal/Moneybogue Bay (1701-0371)

Table 7-69. WTM Fecal Coliform Loads to Quantuck Canal/Moneybogue Bay

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	958,548
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	0
Forest	200
Waterfowl	995
TOTAL LOAD (Billions)	**959,743**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 914,544 billion FC/year.

Table 7-70. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Quantuck Canal/Moneybogue Bay

	Condition	Quantuck Canal/MoneyBogue Bay	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	1,195	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	958,548	-	-
	Total Existing Loads	959,743	-	-
TMDL (billion FC/day)	LA	1	2	62
	WLA—STPs	0	0	0
	WLA—MS4s	998	1,628	62
	MOS	-	-	-
	TMDL	999	1,630	62
TMDL (billion FC/yr)	LA	454	741	62
	WLA—STPs	0	0	0
	WLA—MS4s	364,248	594,300	62
	MOS	-	-	-
	TMDL	364,702	595,041	62

7.3.25 Harts and Seatuck Coves (1701-0309)

Table 7-71. WTM Fecal Coliform Loads to Seatuck Cove.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	3,973,142
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	82,626
Forest	94,723
Waterfowl	3,849
TOTAL LOAD (Billions)	**4,154,340**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 3,588,797 billion FC/year.

Table 7-72. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Seatuck Cove.

	Condition	Seatuck Cove	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**181,198**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**3,973,142**	**-**	**-**
	Total Existing Loads	**4,154,340**	**-**	**-**
TMDL (billion FC/day)	**LA**	**30**	**467**	**94**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**653**	**10,232**	**94**
	MOS	**-**	**-**	**-**
	TMDL	**683**	**10,699**	**94**
TMDL (billion FC/yr)	**LA**	**10,872**	**170,326**	**94**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**238,389**	**3,734,753**	**94**
	MOS	**-**	**-**	**-**
	TMDL	**249,261**	**3,905,079**	**94**

Table 7-73. WTM Fecal Coliform Loads to Harts Cove.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	905,218
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	10,056
Forest	2,838
Waterfowl	3,020
TOTAL LOAD (Billions)	**921,132**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 830,448 billion FC/year.

Table 7-74. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Harts Cove.

	Condition	Harts Cove	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	Nonpoint Sources	15,914	-	-
	Permitted Point Source Contributions—STPs	0	-	-
	Permitted Point Source Contributions—MS4s	905,218	-	-
	Total Existing Loads	921,132	-	-
TMDL (billion FC/day)	LA	38	5	12
	WLA—STPs	0	0	0
	WLA—MS4s	2,182	298	12
	MOS	-	-	-
	TMDL	2,220	303	12
TMDL (billion FC/yr)	LA	14,004	1,910	12
	WLA—STPs	0	0	0
	WLA—MS4s	796,592	108,626	12
	MOS	-	-	-
	TMDL	810,596	110,536	12

7.3.26 Narrow Bay (1701-0318)

Table 7-75. WTM Fecal Coliform Loads to Narrow Bay.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	8,106,355
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	2,566
Forest	10,164
Waterfowl	13,854
TOTAL LOAD (Billions)	**8,132,939**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 7,547,616 billion FC/year.

Table 7-76. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Narrow Bay.

	Condition	Narrow Bay	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**26,584**	**-**	**-**
	Permitted Point Source Contributions--STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**8,106,355**	**-**	**-**
	Total Existing Loads	**8,132,939**	**-**	**-**
TMDL (billion FC/day)	**LA**	**61**	**12**	**16**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**18,656**	**3,553**	**16**
	MOS	**-**	**-**	**-**
	TMDL	**18,717**	**3,565**	**16**
TMDL (billion FC/yr)	**LA**	**22,331**	**4,253**	**16**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**6,809,338**	**1,297,017**	**16**
	MOS	**-**	**-**	**-**
	TMDL	**6,831,669**	**1,301,270**	**16**

7.3.27 Bellport Bay (1701-0320)

Table 7-77. WTM Fecal Coliform Loads to Bellport Bay – Beaverdam Creek.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	2,921,970
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	4,575
Forest	16,426
Waterfowl	2,364
TOTAL LOAD (Billions)	**2,945,335**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 2,583,850 billion FC/year.

Table 7-78. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Bellport Bay – Beaverdam Creek.

	Condition	Bellport Bay – Beaverdam Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**23,365**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**2,921,970**	**-**	**-**
	Total Existing Loads	**2,945,335**	**-**	**-**
TMDL (billion FC/day)	**LA**	**4**	**60**	**94**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**480**	**7,525**	**94**
	MOS	**-**	**-**	**-**
	TMDL	**484**	**7,585**	**94**
TMDL (billion FC/yr)	**LA**	**1,402**	**21,963**	**94**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**175,318**	**2,746,652**	**94**
	MOS	**-**	**-**	**-**
	TMDL	**176,720**	**2,768,615**	**94**

Table 7-79. WTM Fecal Coliform Loads to Bellport Bay – West Cove.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	30,159,236
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	88,212
Forest	158,200
Waterfowl	1,211
TOTAL LOAD (Billions)	**30,406,859**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 27,421,603 billion FC/year.

Table 7-80. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Bellport Bay – West Cove.

	Condition	Bellport Bay – West Cove	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**247,623**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**30,159,236**	**-**	**-**
	Total Existing Loads	**30,406,859**	**-**	**-**
TMDL (billion FC/day)	**LA**	**41**	**638**	**94**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**4,957**	**77,670**	**94**
	MOS	**-**	**-**	**-**
	TMDL	**4,998**	**78,308**	**94**
TMDL (billion FC/yr)	**LA**	**14,857**	**232,766**	**94**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,809,554**	**28,349,682**	**94**
	MOS	**-**	**-**	**-**
	TMDL	**1,824,411**	**28,582,448**	**94**

7.3.28 Patchogue Bay (1701-0326)

Table 7-81. WTM Fecal Coliform Loads to Patchogue Bay – Swan River.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	12,489,863
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	6,092
Forest	15,678
Waterfowl	510
TOTAL LOAD (Billions)	**12,512,142**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 11,521,152 billion FC/year.

Table 7-82. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Patchogue Bay – Swan River.

	Condition	Patchogue Bay – Swan River	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**22,280**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**12,489,863**	**-**	**-**
	Total Existing Loads	**12,512,143**	**-**	**-**
TMDL (billion FC/day)	**LA**	**6**	**55**	**90**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**3,422**	**30,797**	**90**
	MOS	**-**	**-**	**-**
	TMDL	**3,428**	**30,852**	**90**
TMDL (billion FC/yr)	**LA**	**2,228**	**20,052**	**90**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,248,986**	**11,240,877**	**90**
	MOS	**-**	**-**	**-**
	TMDL	**1,251,214**	**11,260,929**	**90**

Table 7-83. WTM Fecal Coliform Loads to Patchogue Bay – Mud Creek.

SOURCES	Billion FC/year
POINT SOURCES	
Sewage Treatment Plant	0
RESIDENTIAL/URBAN LAND[1,2]	
MS4 Contribution	4,724,422
Non-MS4 Contribution	0
OTHER NONPOINT SOURCES	
Rural Land	4,547
Forest	11,948
Waterfowl	346
TOTAL LOAD (Billions)	**4,741,263**

[1] "Urban land" is a combination of residential land, commercial land, industrial land, and roadways.
[2] This source includes the load from domestic pets of 4,288,896 billion FC/year.

Table 7-84. Summary of Current Fecal Coliform Loads and Percent Reductions Necessary to Meet Target TMDL Loads in Patchogue Bay – Mud Creek.

	Condition	Patchogue Bay – Mud Creek	Load Reduction	Load Reduction (%)
Existing Conditions (billion FC/yr)	**Nonpoint Sources**	**16,841**	**-**	**-**
	Permitted Point Source Contributions—STPs	**0**	**-**	**-**
	Permitted Point Source Contributions—MS4s	**4,724,422**	**-**	**-**
	Total Existing Loads	**4,741,263**	**-**	**-**
TMDL (billion FC/day)	**LA**	**13**	**33**	**71**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**3,754**	**9,190**	**71**
	MOS	**-**	**-**	**-**
	TMDL	**3,767**	**9,223**	**71**
TMDL (billion FC/yr)	**LA**	**4,884**	**11,957**	**71**
	WLA—STPs	**0**	**0**	**0**
	WLA—MS4s	**1,370,082**	**3,354,340**	**71**
	MOS	**-**	**-**	**-**
	TMDL	**1,374,966**	**3,366,297**	**71**

8.0 IMPLEMENTATION PLAN

One of the critical factors in the successful development and implementation of TMDLs is the identification of potential management alternatives, such as best management practices (BMPs) and load reduction from point sources, and screening and selection of final alternatives in collaboration with the involved stakeholders. Extensive care must be exercised to identify any naturally-occurring pathogen loads not associated with or exacerbated by human activities, and if they are significant in comparison to the controllable point and nonpoint sources of pollution, the option of prohibiting shellfish harvesting through administrative closures may be explored.

All the ongoing watershed protection efforts, e.g., watershed characterization, restoration, and volunteer monitoring, must be identified for the TMDL development and implementation process. Coordination of this process with state agencies, federal agencies, local governments, and stakeholders such as the general public, environmental interest groups, and representatives from the point and nonpoint pollution sources will ensure that the proposed management alternatives are technically and financially feasible.

As an example, New York's Suffolk County conducted the Brown-Tide Comprehensive Assessment and Management Program (BTCAMP) in the Peconic Estuary between 1988 and 1992. This program's final report was used as a primary source for the Peconic Estuary Program (PEP) Nomination Report (the PEP commenced in 1993) and acts as the initial Brown Tide characterization for the PEP. The ambient water quality conditions in Flanders Bay, located at the mouth of the Estuary, have been monitored extensively by the County to support the development of a comprehensive hydrodynamic/water quality model for assessment of nutrient fate and transport. Total and fecal coliforms are among the parameters monitored by the County. In addition, EPA Region 2 has funded microbial source tracking studies in the Estuary conducted by Cornell Cooperative Extension of Suffolk County. Findings from these studies may assist in the assessment of sources and potentially the allocation of loads, i.e., development of targeted pollution reductions for all the point and nonpoint sources that contribute pathogen loads to the Estuary.

The 27 water bodies covered by this TMDL report are affected by several major generators of nonpoint source pollution:

- Direct contributions from waterfowl and wildlife to surface waters
- Domestic pets, livestock, and wildlife wastes on the landscape
- The potential for localized effects associated with failing septic systems (presently undocumented).
- Marinas and boating

Storm water runoff is an important transmission vehicle for those pathogen wastes deposited on the landscape, including flows from lawns, driveways, and roads. Appropriate management practices to mitigate these environmental impacts range from management, to housekeeping measures, to structural approaches. The implementation plan is discussed in the following sections with the specific management plans for the respective sources of pollution.

8.1 Nonpoint Source Reduction

The most effective mechanism for reducing nonpoint source pathogen loads to the study area's water bodies will focus on both reducing pathogen wastes itself and reducing stormwater volumes that reach surface waters. The following recommendations are applicable to all lands including those owned or managed as private residences, businesses, non-profit institutions, and governmental entities. They are also applicable to year-round and seasonal residents, employees, and visitors.

- Protect or establish a buffer (100 meters wide, if possible) around all creeks, ponds, and bays.
- Minimize impervious surfaces on properties. Remove unused portions of driveway and outdoor concrete and replace them with shrubs and trees.
- Disconnect impervious surface conduits. For example, a downspout from a roof leading to a driveway sends stormwater directly to the road and a storm drain. Move downspouts a few inches to lawns or a rain garden and allow stormwater to infiltrate naturally.
- Create a rain garden. Rain gardens are designed to collect and infiltrate stormwater with moisture tolerant native plantings.
- Pick up pet waste, and dispose of it in the trash.
- Don't feed waterfowl or create unnatural conditions where they congregate (e.g., lawns that extend to the water's edge). Non-migratory Canada geese are especially a problem.
- Keep curbsides clean and free of leaves, grass clippings, sand, and litter that will wind up in catch basins or surface waters.

Livestock may be an emerging issue in some watersheds and owners should comply with all local requirements and best management practices and take steps to insure that livestock wastes are managed properly and do not impact surface or groundwaters. Habitat restoration projects may also be an effective means of reducing pathogen loads and direct stormwater contributions to surface waters, particularly in near shore areas. A particular focus for habitat restoration projects may be in areas where wetlands have been extensively grid ditched for mosquito control purposes, potentially leading to the "short-circuiting" of stormwaters to coastal waters without the benefit of the filtering capacity of these wetland systems.

8.2 Urban Storm Water

In order to reduce or eliminate the loading of coliform bacteria to surface waters through storm water, the runoff can be treated with a variety of structural BMPs that can remove bacteria at different levels of effectiveness. Most management strategies designed to treat storm water runoff structurally will artificially introduce environments or chemicals that encourage bacteria decay. Other management strategies will not necessarily kill bacteria, but can seclude them from sensitive areas such as shellfish harvesting beds. Selection of individual BMPs or combinations of BMPs will depend upon continued evaluation of the subwatershed characteristics, the priorities of various stakeholders, and the available funding for implementing the remedial projects. In general, strategies for bacteria removal will operate in three possible ways:

- Detention of storm water
- Infiltration of storm water
- Filtration with wetland vegetation

The use of any of these three strategies can produce favorable results depending on the characteristics of a contributing watershed. Further enhanced treatment can also be achieved by using more than one technique at a single site. The management strategies chosen for a site will depend on several factors including:

- size of the drainage area;

- amount of space available for treating runoff;
- complexity and costs associated with permitting;
- potential for harmful environmental effects from installing a particular treatment structure
- desired removal rate for bacteria and other pollutants;
- cost of construction;
- resources necessary for proper maintenance; and
- expected longevity of the structure.

Storm water mitigation structures may be feasible with minimal disruption to the existing landscape, although they are without utility unless properly maintained. The implementation of such a program must include at least twice-yearly inspections of the facilities, preferably before and after the wettest season, and preparations for annual maintenance. Such work is likely to include cleaning, some replanting, and general refurbishment. If such a program is in place, the annual work load should remain rather light, and the BMP's effectiveness will be at a maximum.

In addition to the above maintenance program, a monitoring program should be included to determine the level of impact and reduction of pathogen inflow from the various tributaries that discharge to the study areas. A single station located downstream of each implemented BMP would be sufficient. Samples taken weekly, plus additional samples after storm events will be ideal. These data will supplement other sampling programs taken in the water bodies included in the study area. The monitoring program should begin before construction of the discharge BMPs so that the impact/improvement can be correctly gauged. Examples of urban BMPs are listed here for consideration:

Enhanced Extended Detention Basins – these are dry basins where storm water is temporarily collected and retained during significant wet weather events. The main components of these basins are a sediment forebay for trapping suspended solids and a micropool connected by a riprap channel to aid bacterial decay.

Wet Retention Ponds - these ponds utilize a permanent pool of water as the primary catchment for storm water runoff. A shallow marsh or sediment forebay may be used in conjunction with the wet retention pond to slow runoff velocity and enhance the overall settlement of sediments. If the turbidity can be managed, high levels of bacteria decay could be expected from exposure to sunlight.

Constructed Wetlands - these are artificially designed wetland systems that facilitate the settling of sediments from runoff, the retention of potentially large amounts of runoff, and the uptake of pollutants by wetland vegetation. These wetlands may be used in conjunction with other storm water BMPs for enhanced mitigation. Different types of constructed wetlands such as shallow marsh systems, pond systems, and pocket wetlands offer distinct advantages, and the watershed managers can determine which is best suited to the local conditions.

Water Quality Swales - these BMPs differ from drainage channels in that they provide pollution attenuation in addition to safe runoff conveyance. These are generally categorized into three types: dry swales, wet swales and grassed or biofilter swales.

8.3 Waterfowl

The deposits of fecal matter by resident and migrating waterfowl has an exacerbated impact on some of the water bodies in the study area, particularly those embayments with reduced flushing and open space for congregating birds. A particular problem of some local significance is migratory waterfowl that have become resident (Canada geese) and invasive species (mute swans). Several general waterfowl management measures can be considered within the study area. These include:

- Elimination of open lawns along the water's edge that are inviting to roosting waterfowl;
- Placement of noise generators at roosting or nesting sites to discourage birds from landing;
- The firing of blank cartridges over a period of time to make a roosting or nesting site inhospitable;
- Destruction of nesting areas;
- Public education efforts to discourage people from feeding wild waterfowl; and
- The shooting of birds.

Bird mitigation programs must be tailored to specific regions, and will have varying levels of success. In addition, some species of waterfowl may be protected by law from harassment and/or hunting and these legal determinations should be examined carefully on a site-by-site basis. Many options are available short of hunting local fowl, which may be objectionable in settled areas.

8.4 Septic Systems

The actual occurrence of failing septic systems in the study watersheds is thought to be small, and the need to pursue new or extensions of sewering may not be necessary. New development and extensive redevelopment requires onsite disposal systems to comply with stringent siting and operational requirements overseen by Nassau and Suffolk Counties.

8.5 Marinas/Transient Boats

In June 2002, the Peconic Estuary was officially approved as a designated Vessel Waste No Discharge Zone (NDZ) by the EPA (67 FR 39720). An ongoing public education plan was designed to inform boaters that discharging raw or treated sewage within the NDZ is illegal and that all sewage must be held onboard the vessel until a pumpout facility or specialized boat can empty the holding tank. For violations of the NDZ law, section 33-e of New York State’s Navigation Law provides for fines of up to $500 for a first discharge offense and $1,000 for further violations. Vessel-derived human waste is, therefore, not likely to be a major source of coliform bacteria in the Estuary’s waters. However, some boaters may be unaware of or refuse to comply with the NDZ designation. Pollution originating from these vessels as well as from marinas can be further reduced by adopting appropriate mitigation techniques including:

- more extensive public awareness campaigns on illicit dumping of wastewater;
- introduction of local ordinances to penalize wastewater dumping;
- the inclusion of NDZ areas on nautical charts;
- enhancement of public toilet facilities near the shore so that boat owners would minimize the use of their onboard toilet; and

- expansion of current pump-out programs including mobile and on-shore pump-out facilities.

8.6 Zoning Enhancements

In addition to the measures described above, the adoption and implementation of enhanced local zoning requirements may successfully address some of the problems associated with pathogens and excess stormwater. An example already exists in the Town of East Hampton, which has established a Harbor Protection Overlay District. The requirements imposed in this overlay district are in the CODE OF THE TOWN OF EAST HAMPTON, NEW YORK, v22 Updated 01-20-2006, PART II GENERAL LEGISLATION, Chapter 255, ZONING, ARTICLE III, Overlay Districts, § 255-3-70. Harbor Protection Overlay District. [Added 10-6-1995 by L.L. No. 12-1995 and also at http://www.town.east-hampton.ny.us/]. As stated in this Town Code, among other provisions, the Harbor Protection Overlay District will help prevent the entry of stormwater runoff into the Town's waters; gradually require the upgrading of out-moded or inoperable septic systems; and preserve important indigenous vegetation. This overlay district includes all properties that are immediately adjacent to surface waters. The other municipalities in the Peconic Estuary watershed should be encouraged to adopt similar local legislation.

The most applicable sections of this regulation are included here.

§ 255-3-75. Regulations. [Added 10-6-1995 by L.L. No. 12-1995]

In addition to any other provisions of this chapter which may apply to them, lots, lands, buildings, structures, uses and activities within the Harbor Protection Overlay District shall be subject to the following restrictions and regulations:

A. Control of stormwater runoff. The following regulations shall apply to structures or activities which produce or contribute to stormwater pollution of the Town's surface waters:

(1) No parking lot or private driveway shall hereafter be constructed unless it has either an unimproved surface (e.g., dirt, crushed shells) or an improved surface consisting of one or more of the following materials: poured concrete, hot plant mix asphalt, rapid-curing cut-back asphalt or quartz gravel.

(2) No road, private driveway or parking lot with an improved surface shall hereafter be constructed unless all stormwater generated by said structure is directed into one or more catchment basins. Said catchment basin or basins shall have a combined volume (in cubic feet) equal to the surface area of the road, driveway and/or parking area (in square feet), divided by six.

(3) Any road, private driveway or parking lot which is hereafter constructed with an improved surface shall be maintained so that all stormwater generated by said structure is actually directed into the catchment basin or basins required by the preceding subsection. Any catchment basin required by the preceding subsection shall be kept clean and maintained so that it recharges stormwater into the ground without overflowing.

(4) No pipe, culvert, drain or similar conduit may hereafter be constructed or installed which discharges stormwater into wetlands (including surface waters).

(5) Every principal building or addition to a principal building which is hereafter constructed or erected shall be furnished with gutters and leaders to direct stormwater from roofs into one or more catchment basins. Said catchment basin or basins shall have a combined volume (in cubic feet) equal to the surface area of the roof (in square feet), divided by six.

(6) During construction work the disturbance of natural vegetation and land contours shall be minimized to the maximum extent practicable. Project-limiting fencing, siltation mesh,

strawbales or similar devices for limiting land disturbance and retarding erosion and siltation shall be used during construction work and during any land clearing or grading in preparation for or associated with construction work.

B. New sanitary septic systems. The following regulations shall govern the installation of all septic systems after this date, except for septic systems, which are installed to replace legally preexisting septic systems:

(1) No such septic system shall be installed or constructed unless it is set back a minimum of 200 feet from the surface waters of Acabonac Creek, Fort Pond (including the arm of Fort Pond north of Industrial Road), Georgica Pond, Great Pond (Lake Montauk), Hog Creek, Napeague Harbor, Northwest Creek, Northwest Harbor, Steppingstones Pond, Three Mile Harbor, Tuthill Pond and/or Wainscott Pond and from the upland boundary of any wetlands contiguous to the foregoing bodies of water. To the extent that any provision of Article IV imposes a lesser wetland setback for septic systems, the requirements of this subsection shall be controlling with respect to lands within the Harbor Protection Overlay District.

(2) No septic system leaching pool shall hereafter be installed unless the bottom of the leaching pool is situated a minimum of four feet above the groundwater table.

C. Existing sanitary septic systems. Any septic system which legally exists on a residential property on January 1, 1996, shall be replaced or upgraded in the following circumstances and to the following extent:

(1) Every septic system regulated by this subsection shall be replaced or upgraded if:

(a) A natural resources special permit is required for work to be performed on the lot or parcel containing the septic system;

(b) The work to be performed will increase the habitable floor area of a principal building on the lot or will increase the number of bathrooms within a building on the lot; and

(c) The septic system in question does not meet the minimum requirements of the Suffolk County Department of Health Services for vertical separation to groundwater, for setback to surface waters or for septic system capacity, or in that it lacks a septic tank.

(2) Where this subsection requires that an existing septic system be replaced or upgraded, the new or upgraded septic system shall meet the following requirements:

(a) It shall comply with the requirements of the Suffolk County Department of Health Services for new septic systems and shall be installed under the supervision of the Sanitation Inspector; and

(b) It shall be set back a minimum of 150 feet from the upland boundary of all tidal wetlands (including tidal surface waters) or, if that is not feasible, it shall be set back the maximum practicable distance from the surface waters of Accabonac Creek, Fort Pond (including the arm of Fort Pond north of Industrial Road) Georgica Pond, Great Pond (Lake Montauk), Hog Creek, Napeague Harbor, Northwest Creek, Northwest Harbor, Steppingstones Pond, Three Mile Harbor, Tuthill Pond and/or Wainscott Pond and from the upland boundary of any wetlands contiguous to the foregoing bodies of water, taking into consideration such factors as the physical constraints of the site and the location of nearby water supply wells.

D. Limited clearing of lots or parcels of land within the Harbor Protection Overlay District shall be further restricted as set forth herein. [Amended 11-6-1998 by L.L. No. 36-1998; 6-8-2004 by L.L. No. 15-2004]

(1) The total area of a lot which may be cleared of indigenous natural vegetation shall not exceed the following amounts for any lot located wholly or partly within the overlay district:

Lot Area (square feet)	Maximum Clearing Permitted (square feet)
Residence Districts:	
Up to and including 39,999	10,000 or 35% of lot area, whichever is greater
From 40,000 to and including 280,000	10,000 + (lot area * 12.5%)
Greater than 280,000	45,000
Commercial Districts:	
All lots	10,000 or 50% of lot area, whichever is greater

In calculating the amount of clearing permitted by this subsection on a flag lot or a lot which is burdened by a common driveway easement or access easement, the area of any flag strip or any common driveway easement or access easement shall be excluded from lot area. Likewise, any clearing for driveway purposes within the flag strip or within the common driveway easement or access easement shall not be counted into the permissible amount of clearing.

(2) Clearing in excess of 45,000 square feet on any lot in a residence district is prohibited unless the following requirements are met:
(a) The area of the lot, excluding the area of any flag strip but otherwise determined as set forth in § 255-1-20 hereof, exceeds 300,000 square feet; and
(b) Site plan approval and a special permit have been first obtained from the Planning Board.

9.0 REASONABLE ASSURANCE FOR IMPLEMENTATION

This TMDL is for 27 water bodies located on Long Island, NY (Table 1-1). The major sources currently identified are the point sources of urban storm water and domestic pets. The remaining loadings are not being targeted for reductions under the individual areas, but BMPs should be used to reduce discharges to the maximum extent feasible as further described below.

The City of Glen Cove WWTP, Huntington STP, Northport STP, Patchogue Village STP, Port Jefferson STP, and the SUNY, Stony Brook STP are covered by NYSDEC's existing SPDES permits. These permits are reviewed and re-issued at regular intervals. These STPs should be maintained and operated in conformance with their State Pollutant Discharge Elimination System (SPDES) permits and minimize the amount of pathogens discharged to levels required by technology standards or water quality based limits.

As indicated in Section 5.2.1, Nassau and Suffolk Counties have livestock but no site-specific data were available. It is also indicated that Suffolk County has 651 farms and Nassau County has 65 farms which house cattle and calves, hogs and pigs, poultry (pullets, turkeys, etc.), horses and ponies, sheep and lambs, and other livestock.

All farms and individual horse owners should be educated regarding manure best management practices. Horses produce large amounts of manure that can threaten local water quality, especially when receiving waters are shallow and poorly flushed. Good housekeeping practices for horses are similar to those applied successfully to small dairy farm operations, and involve the close control of manure, limiting the use of spreading, careful construction of composting areas, preventing horse traffic or grazing over small streams, and similar measures. The practices need not impose any large cost on the affected parties, and often involve more careful use of existing facilities or adjustment of common practices. In addition, levels of coliform bacteria may be reduced through waterfowl mitigation programs and through storm water management mitigation strategies. If these types of areas are located within municipalities, they should be addressed through their implementation of the Phase II stormwater program.

9.1 Follow-Up Monitoring

The NYSDEC will continue the shellfish monitoring program to ascertain the suitability of New York State waters for shellfishing. Water quality frequently monitored by Nassau and Suffolk Counties will continue to be used in conjunction with the NYSDEC data to evaluate reductions in pathogen loads and the effectiveness of the TMDL in attaining and maintaining the water quality standards for shellfish harvesting. The above data, along with any other data provided to NYSDEC will be used in NYSDECs assessment of the water quality for these water bodies during the development of the NYSDEC 303(d) list of impaired waters. The review of these data for the 303(d) report will be the tracking mechanism to determine if the TMDL is moving water quality in the direction necessary to open the waters to shellfishing. (NOTE: As of February 2003, NYSDEC began examining its water samples for shellfish harvest area classification with A-1 medium which only gives fecal coliform results)

The NYSDEC will establish compliance of the TMDL(s) and applicable water quality criteria through monitoring prior to opening shellfish areas consistent with the National Shellfish Sanitation Program's (NSSP) guidelines, and the NYS regulations and criteria.

9.2 No Discharge Zone

Six of the water bodies covered by this TMDL report (Huntington Harbor, Centerport Harbor, Northport Harbor, Port Jefferson Harbor, Setauket Harbor, and Conscience Bay) have been designated by EPA as No-Discharge Zones (NDZs). In addition, other water bodies are currently in the process of seeking NDZ designation (e.g., all South Shore Estuary water bodies [see Section 5.2.2]), which, if the NDZ designation is approved, will presumably lead to a reduction in vessel-derived waste. For those water bodies that are not designated as NDZs, pollution from marinas and boat mooring areas should be further reduced using appropriate mitigation techniques such as:

- Public awareness campaigns on illicit dumping of wastewater,
- Enhancement of onshore public toilet facilities minimizing the use of on-boat facilities, and
- Expansion of current pumpout programs including the mobile and on-shore pumpout facilities.

9.3 Implementation of Phase II Stormwater Regulations

NYSDEC has expanded its permitting program to include a new federally mandated program to control stormwater runoff and protect waterways.

According to the federal law, commonly known as Stormwater Phase II, permits will be required for stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas and for construction activities disturbing one or more acres. To implement the law, the NYSDEC has developed two general SPDES permits, one for MS4s in urbanized areas and one for construction activities. Operators of regulated small MS4s seeking authorization to discharge stormwater in compliance with the federal Clean Water Act are required to apply for and secure coverage under the SPDES General Permit for Municipal Separate Storm Sewer Systems. Operators of regulated MS4s and construction activities must obtained either a SPDES or a general permit no later than March 10, 2003 or prior to the commencement of construction.

The MS4 municipalities are required to develop, implement and enforce a stormwater management program (SWMP). The SWMP must describe the BMPs for each of the minimum control measures:

1. Public education and outreach program to inform the public about the impacts of the stormwater on the receiving water quality.
2. Public involvement and participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control program for sites disturbing one or more acres.
5. Post-construction runoff control program for new development and redevelopment sites disturbing one or more acres.
6. Pollution prevention and good housekeeping operation and maintenance program.

Existing operators must have developed the initial SWMP prior to March 10, 2003 and have provided adequate resources to fully implement the SWMP no later than five years from the issuance date of the MS4 permit. Operators newly required to have a permit will likely be subject to deadlines included in the renewal permit. Renewal of GP-02-02 is expected in January 2008. Each of the regulated MS4s in this TMDL (see table below) has developed an initial SWMP and has coverage under the general permit (GP 02-02). An MS4 may modify its SWMP at any time, although any changes to a SWMP shall be reported to the NYSDEC in the MS4's annual report. MS4s are required to make steady progress toward full implementation.

Table 9-1. MS4 Permittees within the Study Area.

Permittee	SPDES #	Date NOI Submitted
Town of Riverhead	NYR20A020	03/04/2003
Town of Southampton	NYR20A454	03/04/2003
Village of Sag Harbor	NYR20A095	02/27/2003
Village of North Haven	NYR20A500	12/15/2003
Town of Brookhaven	NYR20A411	02/28/2003
Town of Islip	NYR20A172	03/06/2003
Town of Huntington	NYR20A292	03/10/2003
Town of Babylon	NYR20A043	03/04/2003
Town of Smithtown	NYR20A277	03/10/2003
Town of N. Hempstead	NYR20A318	03/05/2003
Nassau County	NYR20A022	03/04/2003
Suffolk County	NYR20A180	03/25/2003
New York State Dept. of Transportation	NYR20A288	03/10/2003
Glen Cove	NYR20A100	02/26/2003
Sea Cliff	NYR20A075	03/03/2003
Port Washington	NYR20A438	03/04/2003
Lloyd Harbor	NYR20A299	03/05/2003
Huntington Bay	NYR20A292	03/10/2003
Laurel Hollow	NYR20A441	03/04/2003
Cove Neck	NYR20A440	03/04/2003
Center Island	NYR20A415	03/01/2003
Northport	NYR20A303	03/05/2003

Table 9–1. MS4 Permittees within the Study Area, continued.

Permittee	SPDES #	Date NOI Submitted
Nissequogue	NYR20A351	03/05/2003
Head of the Harbor	NYR20A353	03/03/2003
Poquott	NYR20A337	03/05/2003
Old Field	NYR20A407	03/10/2003
Quogue	NYR20A455	03/04/2003
West Hampton Beach	NYR20A457	03/04/2003
Bellport	NYR20A363	03/01/2003
Bayville	NYR20A304	04/03/2003

NOI = Notice of Intent

A SWMP is designed to reduce the discharge of pollutants to the maximum extent practicable (MEP) to protect water quality and to satisfy the appropriate water quality requirements of the Environmental Conservation Law and the Clean Water Act. MEP is a technology-based standard established by Congress in the Clean Water Act. Since no precise definition of MEP exists, it allows for maximum flexibility on the part of MS4 operators as they develop their programs. If stormwater is being discharged to a 303(d)-listed segment of a water body, the SWMP must ensure there is no resulting increase in the pollutant of concern to the receiving waters. Where required to meet water quality standards, NYSDEC enforces additional requirements based on WLAs determined through a TMDL. The MS4 must review the applicable TMDL to see if it includes requirements for control of stormwater discharges. If an MS4 is not meeting the TMDL stormwater allocations, it must, within six (6) months of the TMDL's approval, modify its SWMP to ensure that reduction of the pollutant of concern specified in the TMDL is achieved. Modifications must be considered for each of the six minimum measures. The revised management program must include an updated schedule for implementation.

NYSDEC will continue to work with the municipalities listed in Table 9-1 to identify funding sources and to evaluate locations and designs for stormwater control BMPs throughout the watershed. Through an application process to the State's Environmental Protection Fund (EPF), $10.8 million was made available in 2005 and $5.5 million in 2006 to assist communities in implementing the Stormwater Phase II regulations and for non-agricultural nonpoint source abatement and control projects.

The Towns of East Hampton and Southold would become additionally designated areas upon approval of this TMDL by EPA under Criterion 1 of NYSDEC's additional designation criteria (January 2003). The water bodies covered under this TMDL that are located in these towns are as follows:

A. East Hampton:
    1. Georgica Pond

B. Southold:

1. Mattituck Creek
2. Goldsmith's Inlet
3. West Harbor, Fishers Island

This TMDL does not invoke additional requirements set forth in the SPDES General Permit for Stormwater Discharges from Construction Activity, Permit No. GP-02-01, applicable to facilities satisfying Condition A of Part III.A.1.b.(1) for construction sites discharging to these water bodies.

9.3.1 Additional Requirements Based on This TMDL

Under the SPDES General Permit for Stormwater Discharges from MS4s, Permit No. GP-0-02-02, the MS4 dischargers must provide controls beyond the six minimum measures, such that economically feasible programs are developed and implemented to reduce known pathogens sources to a level which will meet the pathogen standards necessary to open the waters to shellfishing based on NSSP standards.

Once sampling is obtained which meets the NSSP standards for this area, and if the sampling indicates that the shellfish waters continue to violate shellfish standards, additional measures will be required such that pathogens are reduced to the extent necessary to meet the allocation set forth in this TMDL. As an alternative to additional measures, if shellfishing waters continue to violate shellfish standards after economically feasible programs have been put in place, the towns may perform a Use Attainability Analysis to determine if the area's designated use can be changed to eliminate shellfishing.

10.0 PUBLIC PARTICIPATION

NYSDEC and U.S. EPA Region 2 have worked together to prepare this total maximum daily load (TMDL) document to meet the requirements of Section 303(d) of the Clean Water Act. NYSDEC will make this document available to the public, local agencies, and stakeholders for their review and feedback. The stakeholders will include, but are not limited to, the following municipal, government, and non-government organizations: the Towns of Riverhead, Southampton, East Hampton, Southold, Brookhaven, Huntington, Islip, and Smithtown; City of Glen Cove, Huntington, Northport, Patchogue Village, Port Jefferson, and SUNY Stony Brook STPs; local Audubon Societies; marina operators and boaters associations; the Suffolk County Departments of Health and Public Works; the Nassau County Departments of Health and Public Works; and the New York State Department of Transportation.

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Attachment A

Water Body Maps

Attachment B

Memorandum describing the assumptions and methods for determining fecal coliform loads based on the tidal prism model approach.