TOWN OF SHELTER ISLAND WATERSHED MANAGEMENT PLAN

WATERSHED AND WATERBODY INVENTORY REPORT

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TABLE OF CONTENTS

		Page
COVER SHEET		i
TABLE OF CONTENTS		ii
1.0	**INTRODUCTION**	1
2.0	**WATERSHED STUDY AREA & SUBWATERSHED DELINEATION**	1
3.0	**GEOGRAPHIC SETTING & FEATURES**	1
3.1	Topography	1
3.2	Geology	2
3.3	Hydrography	3
3.3.1	Surface Water	3
3.3.2	Groundwater	4
	Hydrogeology	4
	Groundwater Elevation and Flow	4
	Water Table Response to Precipitation	6
	Sub-watersheds	6
	Groundwater Contributing Areas (to Surface Waters) and Time of Travel Zones	7
	Depth of Fresh Water	8
	Water Use and Quantity	11
3.4	Flood Zones	14
3.5	Soils & Erosion	15
3.6	Precipitation & Climate	18
3.7	Infrastructure	19
3.7.1	Transportation	19
3.7.2	Stormwater	20
3.7.3	Sanitary	21
3.7.4	Potable Water	22
4.0	**LAND USE & LAND COVER**	22
	Land Use and Land Cover	22
	Publicly Owned Land	25
	Marinas, Yacht Clubs & Ferries	25
	Town Landfill	26
5.0	**HUMAN & SOCIOECONOMIC RESOURCES**	26
5.1	Zoning	26
5.2	Demographics	28
6.0	**NATURAL RESOURCES**	28
6.1	Wetlands	28
	Freshwater Wetlands	28
	Tidal Wetlands	32
6.2	Living Resources	33

6.3 Habitats 34
NYSDOS Significant Coastal Fish & Wildlife Habitat 34
Eel Grass Beds & Submerged Aquatic Vegetation 35
NYNHP Significant Natural Communities 36
Wintering Harbour Seals 39
PEP Critical Natural Resource Areas 39
Peconic Bay Waterfowl Focus Area 39
7.0 WATER QUALITY 39
7.1 Surface Water Quality Classifications 39
7.2 Water Quality Data 41
Groundwater Quality 41
Stormwater 47
Surface Water Quality 48
7.3 Known Impairments 53
NYS 303(d) List 53
Shellfish Closure Areas 55
GP 0-10-002 Pathogen Impaired Watersheds 55
Harmful Algal Blooms 56
8.0 REFERENCES 58

TABLES

		Page
Table 1	FEMA Flood Zones	14
Table 2	Soil Types & Abundance	17
Table 3	State & County Owned Roadways	20
Table 4	Land Use – Shelter Island	23
Table 5	Land Cover – Shelter Island	24
Table 6	Zoning – Shelter Island	27
Table 7	NYSDEC Freshwater Wetlands	31
Table 8	Rare Species Identified by the NYNHP	34
Table 9	Shelter Island Significant Natural Communities	37
Table 10	NYSDEC Surface Water Quality Classifications	40
Table 11	SCDHS 2009 to 2011 Groundwater Quality Data	45
Table 12	Surface Water Quality Results	50
Table 13	Surface Water Quality Evaluation Criteria	51
Table 14	NYS 303(d) List	54

GRAPHS

		Page
Graph 1	Annual Rainfall, 1930 - 2011	18
Graph 2	Average Monthly Rainfall, 1930 - 2011	19

FIGURES

Figure 1	Shelter Island Surface Subwatersheds
Figure 2	Topography
Figure 3	Geologic Cross Sections
Figure 4	Water Table Contour Map
Figure 5	Major Groundwater Subwatersheds
Figure 6	Groundwater Contributing Areas Travel Times
Figure 7	FEMA Flood Zone Map
Figure 8	SLOSH Map
Figure 9	General Soil Types
Figure 10	Soils Map
Figure 11	Stormwater Infrastructure
Figure 12	Water Districts and Well Locations
Figure 13	Land Use
Figure 14	Land Cover
Figure 15	Publicly Owned Lands
Figure 16	Zoning
Figure 17	Population
Figure 18	Wetlands
Figure 19	Significant Natural Habitats
Figure 20	Resource Management Areas
Figure 21	Surface Water Quality Classifications & Sampling Stations
Figure 22	Saltwater Encroachment and Upconing
Figure 23	Interpolated Nitrate Levels
Figure 24	Known Impairments

APPENDICES

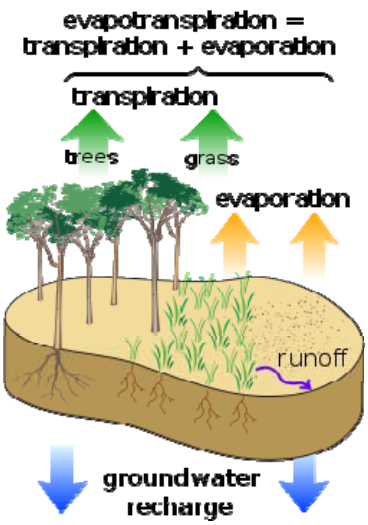
Appendix A	Parcels Targeted For Acquisition
Appendix B	NYSDOS Significant Coastal Fish & Wildlife Habitat Assessments
Appendix C	NYNHP Significant Natural Community Descriptions
Appendix D	SCDHS Bathing Beach Data
Appendix E	STP Outfall Data
Appendix F	NYSDEC Shellfish Closure Area Regulations

1.0 Introduction

A watershed is defined as "…the total area of land draining to a body of water such as a stream, river, wetland, estuary, or aquifer" **(NYSDOS, 2009)**. Watershed management is of vital importance for the protection of the resources that exist both within the watershed itself and within the water bodies that the watershed drains to. In order to identify the management needs of the watershed and the most efficient opportunities for addressing the identified needs, the physical and biological resources within the watershed must first be characterized. This report serves to define the overall watershed and sub-watershed areas of Shelter Island, and provides a characterization of the resources found within these watershed areas.

2.0 Watershed Study Area and Subwatershed Delineation

Shelter Island is a glacial sand deposition feature that is surrounded by marine waters. Shelter Island is underlain with a fresh water aquifer that floats atop saline waters. Of the precipitation that falls on the land, that which is not subject to evapotranspiration[1], becomes either runoff (overland flow) or recharge (water returned downward into the aquifer). Key elements of the hydrologic water budget (water cycle) are illustrated in the embedded figure. As Shelter Island consists of an isolated island system, the entirety of the Island comprises the overall surface watershed. In order to further define areas of stormwater runoff, sub watersheds were delineated utilizing the Suffolk County Light Detecting and Ranging (LiDAR) data collected in 2007. A total of 64 subwatershed areas were defined within Shelter Island ranging from approximately 2.7 acres in size to over 240 acres in size (**Figure 1**)[2]. In total, the subwatersheds represent the individual drainage areas that are present on the 11.8 square mile Island.



3.0 Geographic Setting and Features

3.1 Topography

The topography of Shelter Island generally trends from higher elevations in the center of the Island to lower elevations along the shoreline. **Figure 2** illustrates the LiDAR (Light Detecting and Ranging) topography generated from data collected by Suffolk County in 2007. The highest elevation of 182 feet above sea level (asl) occurs in the northwest

[1] Evapotranspiration (ET) is a term used to describe the sum of evaporation and plant transpiration from the Earth's land surface to atmosphere. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and waterbodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapor through stomata in its leaves. Evapotranspiration is an important part of the water cycle as pictured above. http://en.wikipedia.org/wiki/Evapotranspiration

[2] All referenced figures are included at the end of this report section.

portion of the Island in the vicinity of Shelter Island Heights. This area is subject to erosion as the high elevation declines rapidly at the coastline forming bluffs. The northern peninsula on the Island exhibits greater elevations in the central portion of the peninsula with a maximum elevation of approximately 80 feet asl. Ram Island and Little Ram Island exhibit varying topographic relief with maximum elevations of 80 feet and 53 feet asl, respectively. A topographically low area exists between the southwest corner of Coecles Inlet and the south-central peninsula of the Island. Elevations within this area range from 0 to 30 feet asl. Mashomack Preserve located in the southeast peninsula of the Island exhibits greater relief in the north-central portion of the peninsula with elevations reaching approximately 95 feet asl. Finally, topography in the southwestern portion of the Island is generally flat and exhibits a maximum elevation of approximately 30 feet asl.

It should be noted that the Island generally exhibits slopes of less than 10%. Shelter Island Heights is one notable exception, as this area exhibits slopes of up to 45%. Small areas in the vicinity of Smith's Cove, Ram Island and Little Ram Island also exhibit steep slopes. Additional information on soils and erosion is contained in **Section 3.5**.

3.2 Geology

Shelter Island is a sedimentary sand formation deposited as a result of glacial history, lying atop bedrock and other geologic units. The geology underlying Shelter Island **(see Figure 3**) is comprised of six geologic units. The first and deepest is comprised of crystalline bedrock, which is found at an elevation of approximately 700 to 1,000 feet below sea level (bsl). Above this bedrock lie the sedimentary deposits which form the three major water-bearing units that underlie the Island **(Simmons, 1986; Jensen and Soren, 1974)**.

Lying immediately atop the bedrock is the Raritan formation, which is comprised of the Lloyd sand layer and an overlying clay layer. The Lloyd sand lies at an elevation of approximately 510 to 800 feet bsl, indicating a thickness of approximately 190 to 200 feet. This deposit is comprised of coarse quartz sand, gravel and sandy clay with isolated layers of clay dispersed throughout. The overlying clay layer is encountered at an elevation of 400 to 625 feet bsl, indicating a thickness of 110 to 175 feet and consists of gray, clay to silty clay with some sandy layers.

Directly above the Raritan formation is the Magothy formation. This formation is found at an elevation of 300 feet bsl, indicating a thickness of 100 to 325 feet. The Magothy formation is comprised of fine to medium sand mixed with silt and clay and some beds of coarse sand and gravel.

Exploratory drilling revealed the presence of an overlying clay layer formed by two distinct units comprised of an upper unit of marine origin and a lower unit of non-marine origin. The marine clay is encountered at elevations ranging from 60 to 100 feet bsl with

a representative thickness ranging from 50 to 95 feet. This unit was found to consist of a gray-green to dark gray clay containing many large shell fragments as well as some laminae and thin beds of sand and granule gravel. The top of the non-marine clay is encountered at elevations ranging from approximately 160 to 180 feet bsl. The thickness of this unit has been noted to be approximately 120 feet in borings installed on Shelter Island; however, it was not fully penetrated in others. The lower non-marine unit consists of brown and reddish brown clay, as well as, some laminae and thin beds of silt and fine sand.

Due to limited boring information, the full horizontal extent of each of these units could not be completely ascertained. However, the referenced literature indicates that the marine unit probably extends under all of Shelter Island and the underlying non-marine unit probably extends under a majority of the Island **(Simmons, 1986)**.

The uppermost unit underlying Shelter Island consists of the surficial deposits that comprise the Upper Glacial formation. This layer is encountered throughout Shelter Island at the land surface, which ranges from 180 feet above sea level (asl) at the bluffs along the western part of Shelter Island to approximately 40 feet bsl in isolated depressions encountered across the Island. The thickness of the Upper Glacial formation ranges from 120 to 360 feet. These deposits consist primarily of stratified and unstratified sand and gravel interspersed with clay and isolated beds of clay.

Shelter Island's water supply is contained entirely within the Upper Glacial aquifer which floats atop the more dense saline waters contained in the lower and surrounding Upper Glacial aquifer and deeper geologic deposits. Hydrogeology is discussed in more detail in **Section 3.3.2** (Groundwater).

3.3 Hydrography

3.3.1 Surface Water

Shelter Island is surrounded by marine surface waters consisting of an interconnected network of harbors, coves, sounds and bays.

There is no significant freshwater stream network present on Shelter Island; however, there are several saltwater creeks, marshes and bays located along the coastline. In addition, there are a number of small kettle hole ponds located within the interior of the Island created by past glacial events. Freshwater and tidal wetland habitats are further discussed in **Section 6.1**.

3.3.2 Groundwater

Hydrogeology

The major water-bearing units beneath Shelter Island are of geologic origin as described in **Section 3.2** and include the Upper Glacial aquifer, the Magothy aquifer, and the Lloyd aquifer. Fresh groundwater used for water supply purposes is derived from water contained within the upper part of the Upper Glacial aquifer, principally above an underlying clay layer. Groundwater contained within the lower part of the Upper Glacial aquifer, as well as the Magothy and Lloyd aquifers is saline and is unsuitable for consumption or irrigation (**Soren, 1978**). Two cross-sections illustrating the major water bearing units, and the vertical dimension flow components are provided in **Figure 3**.

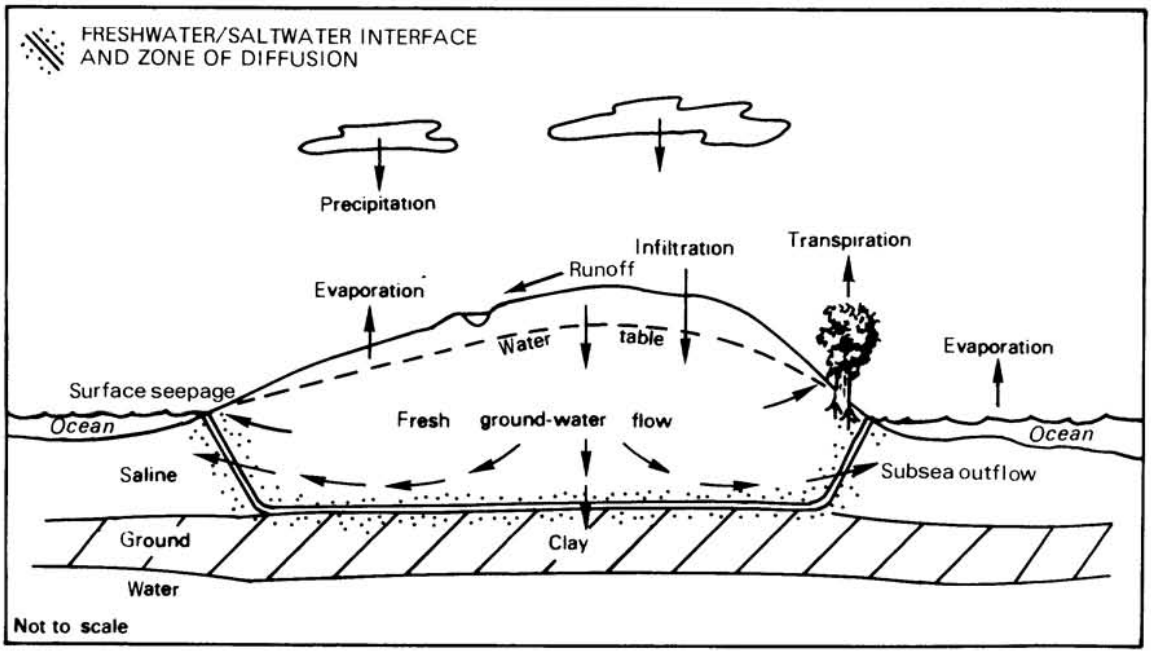
Groundwater Elevation and Flow

Groundwater on the Shelter Island is derived from precipitation. Rainfall and meltwater entering the ground ("recharge") passes downward through the unsaturated zone to a level below which all porous layers are saturated. The upper surface of this level is referred to as the "water table". Groundwater is a mild expression of topography and consequently, the water table coincides with sea level along the shoreline of Shelter Island, and rises in elevation towards its center and western bluffs where topographic elevations increase.

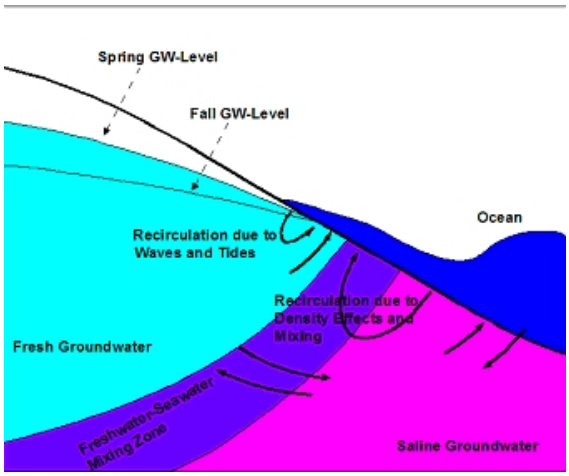
The elevation of groundwater underlying Shelter Island ranges from 8 feet above mean sea level (msl) in the northwest part of the Island, to zero (0) at the above ground surface in areas of wetlands and surface water. Differences in groundwater elevation create a hydraulic gradient, which causes groundwater to flow downward perpendicular to contours of equal elevation. High points formed by the water table create "groundwater divides", such that groundwater flows radially away from mounds in the water table elevations. The illustration below shows the basic components of the hydrologic cycle and groundwater flow beneath Shelter Island. The fresh groundwater is illustrated above the marine clay deposits, separated by the freshwater/saltwater interface.[3]

In general, groundwater flows from the 4 foot elevation mound in the center of the Island toward the north, south, east and west. A secondary mound of groundwater forms in the northwest, higher elevation parts of the Island, such that the high points of these two groundwater mounds form a watershed divide between groundwater that flows generally toward the north or toward the south. **Figure 4** illustrates the water table elevations underlying Shelter Island from which the inferred directions of groundwater flow may be determined. As noted, groundwater underlying Shelter Island flows radially outward toward surface water perpendicular to the contours of equal groundwater elevation. Additional groundwater subwatersheds are formed in the peninsula areas around Shelter Island as will be discussed in greater detail below.

[3] Illustration from Simmons, 1986; Figure 4, Hydrologic cycle and pattern of ground-water movement on Shelter Island.



As groundwater migrates away from areas of higher elevation toward the shore, it eventually discharges to surface water as a result of surface seepage and subsea (or subsurface) outflow[4]. Near the shore, water entering the system tends to flow horizontally along a shallow flow system and is discharged from the subsurface into streams or marine surface waters. Water that enters the system farther inland and along the western end of the Island generally flows vertically downward deeper into the Upper Glacial aquifer before flowing toward the shores where it is discharged as subsurface outflow.



The rate of groundwater flow in the aquifer is dependent on the hydraulic conductivity which describes the ease with which water is transmitted through the saturated pore space of an aquifer. Based on published information, the horizontal hydraulic conductivity of the Upper Glacial aquifer on Shelter Island ranges from 200 to 272 feet per day (ft/day) (**Schubert, 1999**) with a vertical hydraulic conductivity of approximately 27 feet per day (**Franke & Cohen, 1972**) resulting in an anisotropic ratio of approximately 10:1. The anistotropic condition that is created by differences in horizontal and vertical hydraulic

[4] Illustration shows spring/fall groundwater levels, fresh-salt water mixing zone and outflow at shoreline.

conductivities is likely due to variations in stratigraphy within the Upper Glacial aquifer. Groundwater flow is also influenced by porosity of the aquifer sediments and is defined as the ratio of void space to a volume of a soil. In the case of the Upper Glacial aquifer on Shelter Island the porosity is estimated to be 0.30.

While hydraulic conductivity and porosity convey the ability of an aquifer to transmit water, the rate of movement is expressed as groundwater velocity. This can be used to estimate groundwater travel times within an aquifer which is important in relation to contamination and discharge. Published literature (**Soren, 1978**) place estimates of groundwater velocity in the Upper Glacial aquifer on Shelter Island as ranging from 0.5 to 1 ft/day.

Water table fluctuations occur in response to changes in the hydrologic water budget (precipitation, evapotranspiration, runoff and recharge) and resultant changes in recharge. Seasonal fluctuations in the water table occur such that the water table rises during the early part of the year, and declines from the beginning of summer through late fall. Water table fluctuations also occur as a result of longer term climatic conditions such as droughts and periods of high rainfall. Groundwater pumpage also affects water table elevations on a more localized basis, dependent upon pumpage rates and well placement.

Water Table Response to Precipitation

Data obtained from the United States Geological Survey (USGS) from the early 1970's to 2012 illustrate the annual variation in water levels. Recharge of groundwater mainly occurs during late winter to early spring as a result of precipitation. Review of the high and low precipitation rates from 1970 to 2012 during the month of March generally correlate with hydrograph data provided by the USGS. Specifically, the high rate of precipitation during this time period typically results in above average increases in groundwater levels. In contrast the lowest rates of precipitation were observed to typically result in significant decreases in groundwater levels below average. This is specifically illustrated in 2010 which is considered to have been a flood year where 13.25 inches of precipitation was recorded to have fallen during the month of March. In contrast, during 2006, a year generally considered a drought year, only 0.85 inches of precipitation was noted to have fallen during the month of March. **Section 3.6** (Precipitation and Climate) provides a description of long-term precipitation and monthly averages, as well hydrographs.

Sub-watersheds

As noted, the water table configuration on Shelter Island is characterized by one principal water table mound that contains two (2) local areas of relatively high water table altitude each of which are located within the western and central portions of the Island (**Schubert, 1999**). **Figure 4** (previously referenced) provides an illustration of the configuration of the water table beneath Shelter Island. Based on the configuration of the water table, the freshwater flow system of Shelter Island can be further divided into seven (7) separate sub-watersheds, each of which correspond to the area contributing groundwater to an individual coastal embayment (**Schubert, 1999**). These sub-

watersheds are separated from each other by local groundwater divides that extend inland from the coast and converge toward the respective water table mounds. A general description of each sub-watershed area is presented below and illustrated on **Figure 5**:

- **Greenport Harbor contribution area** – The area is located along the northwestern coast of Shelter Island and extends from the center of the Island to Jennings Point in the west and Hay Beach Point in the north. Freshwater flow from this area discharges to the surface waters of Dering and Greenport Harbors.

- **Gardiners Bay contribution area** – This area is located along the northeastern coast of Shelter Island and extends from the Hay Beach Point, across the central spine of the land area which connects the mainland with Ram Island, to the Reel Point. Freshwater flow from this area discharges to the northern area of Gardiners Bay.

- **Coecles Inlet contribution area** – This area is located on the eastern side of Shelter Island and is comprised of an area that nearly encircles Coecles Inlet. This area extends east from the central spine of Shelter Island to Reel and Sungic Points. Freshwater flow from this area discharges to the surface waters of Coecles Inlet, Congdons Creek, Cedar Cove Island and Shanty Bay.

- **Shelter Island Sound/Gardiners Bay contribution area** – This area is located on the southeastern side of Shelter Island and is comprised of an area which discharges freshwater to Smith Cove, Majors Harbor, eastern portion of Shelter Island Sound and the southern portion of Gardiners Bay. This area extends along the central axis of the Nature Conservancy's Mashomack Preserve from Sungic Point to the terminal end of South Ferry Road.

- **West Neck Harbor/Shelter Island Sound contribution area** – This area is located within the south central section of Shelter Island and is comprised of an area which discharges freshwater to Menantic Creek, Dickerson Creek, Fresh Pond, West Neck Harbor and the central portion of Shelter Island Sound. This area extends from the approximate center of Shelter Island south to the Montclair Avenue and the terminal end of South Ferry Road.

- **West Neck Bay contribution area** – This area surrounds and contributes to freshwater discharge to West Neck Bay, West Neck Creek and West Neck Harbor. This area begins at the topographic high in the vicinity of the intersection of Serpentine Drive and Sunnyside Avenue and extends south to West Neck Point and Montclair Avenue.

- **Southold Bay/Shelter Island Sound contribution area** – This area is located on the southwestern side of Shelter Island and extends along the central axis of West Neck from Jennings Point to West Neck Point. Freshwater from this area is contributed to the surface waters of Southold Bay and the western end of Shelter Island Sound.

Groundwater Contributing Areas (to Surface Waters) and Time of Travel Zones

As discussed previously, groundwater continuously flows from high areas of the water table toward the perimeter of the Island and discharges to the inlets, coves, bay surrounding the Island as well as the streams and surface water ponds within the Island. In 2009, CDM on behalf of the SCDHS prepared a computer model simulation to

delineate groundwater contributing areas to each stream and embayment for 2 years, 5 years, 10 years, 25 years and 50 years. The travel time for this discharge varies, but was found to generally decrease from the center and elevated portions of the Island down towards the coastal and stream shoreline areas. Specifically, the results of the model run estimated travel times ranging from 25 to 50 years from the center of the Island which decrease to 0 to 2 years along the Island's coastal areas. The groundwater contributing area time of travel is illustrated in **Figure 6**.

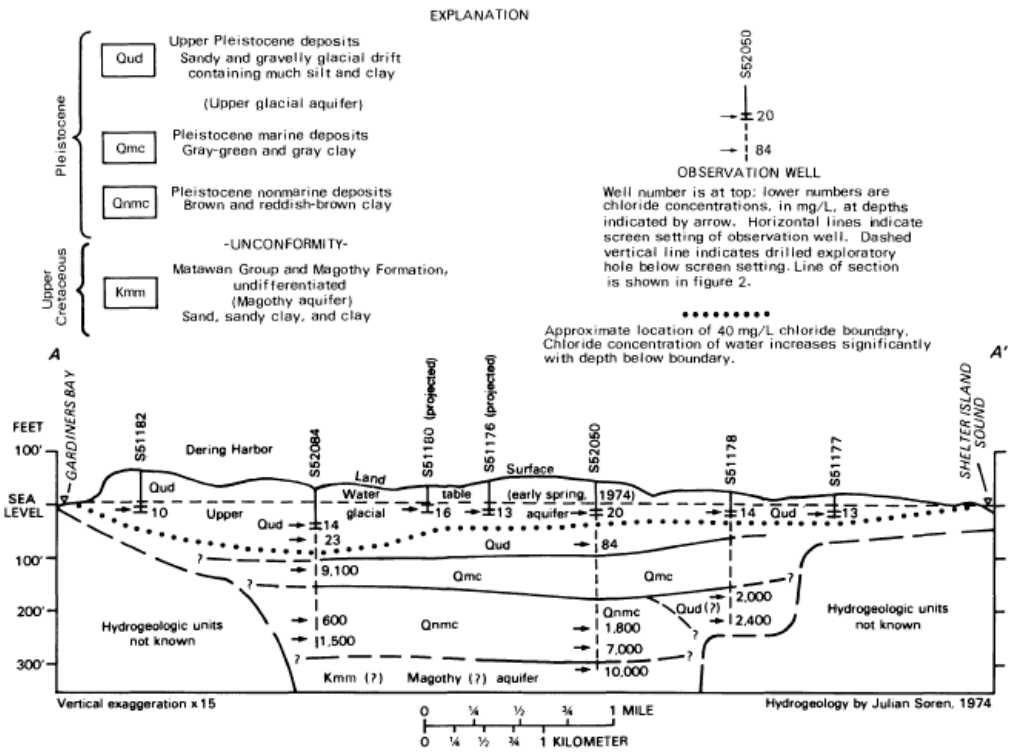
Depth of Fresh Water

In coastal marine environments, the thickness and position of freshwater may be influenced by saltwater intrusion. Generally, since the specific gravity of freshwater is less than that of the underlying salt water, the freshwater tends to "float" on the salt water within the boundaries of a watershed area. However, this interface between fresh and saline groundwater is not a sharp boundary but a zone of diffusion in which the chloride concentration of the freshwater gradually increases with horizontal and vertical distance from the Island until it equals the salinity of the surrounding bays. In most situations involving the interaction of fresh and saline groundwater the interface between the two is governed by the Ghyben-Herzberg Relationship, which results in freshwater extending 40 feet below sea level for each foot it extends above sea level. Ultimately, this will result in a "salt water wedge" which extends from the coastline inland **(Simmons, 1986).**

However, the interaction of fresh and saline groundwater underlying Shelter Island varies from the ratio predicted by the Ghyben-Herzberg relationship due to the presence of the marine clay underlying the deposits of the Upper Glacial aquifer. Due to this clay unit, intrinsically low hydraulic conductivity saline groundwater is confined beneath it and retards its mixing with the freshwater above. In addition, lateral movement of saline groundwater from shoreline areas, inland is enhanced by the nearly horizontal arrangement of the marine clay. This ultimately results in the infiltration of saline water into the aquifer from coastal areas and limits the amount of freshwater that can be stored between the clay and the water table. What generally results is a thicker than expected zone of saline groundwater which results in an increase in freshwater discharge to coastal regions of Shelter Island **(Schubert, 1999)**.

The boundary between fresh and saline groundwater was estimated by Dale Simmons in the USGS Water-Resources Investigations Report 85-4165, "Geohydrology and Ground-Water Quality on Shelter Island, Suffolk County, New York 1983-84" **(1986)**. This document involved well monitoring to determine the chloride concentration at various depths below Shelter Island. Chloride is <10 mg/l in native fresh groundwater. The drinking water standard for chloride is 250 mg/l and the chloride concentration in seawater approaches or exceeds 19,000 mg/l. A chloride concentration of 40 milligrams per liter (mg/l) was determined to be indicative of the uppermost boundary of the fresh-saltwater mixing zone. Well monitoring found that the mixing zone, or zone of diffusion where elevated chlorides were detected, was above the marine clay unit. Chloride concentrations were found to increase with depth below the 40 mg/l chloride boundary. In the nearshore areas, the concentration of chloride exceeded 250 mg/l at depths of 20-

30 feet **(Simmons, 1986; Table 4)**; however, in central parts of the Island concentrations above the drinking water standard were not detected in the Upper Glacial aquifer above the marine clay. Based on these data, the above hydrogeologic cross section was prepared illustrating the geologic units and the 40 mg/l chloride boundary as a "dotted" line (see also **Figure 3**).[5]



The water table elevation, which ranges from zero (0) to eight (8) feet with an average of approximately 3 feet, would predict a much deeper freshwater lens based on the Ghyben-Herzberg Relationship of 40 to 1 of freshwater depth for every one (1) foot of groundwater elevation above sea level. The data derived from chloride sampling of wells by Simmons **(1986)** indicates the effect of the marine clay and resultant change in the fresh-saltwater mixing zone.

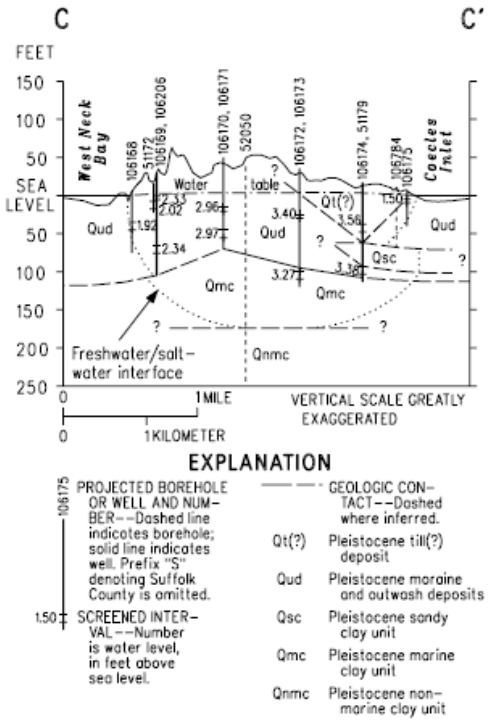
The depth of the marine clay varies from about 75 feet bsl beneath the south part of Shelter Island to about 110 feet bsl beneath the north part of the Island **(Simmons, 1986; SCCWRMP, 2011)**. The depth of freshwater above the 40 mg/l chloride boundary varies from zero (0) at the shorelines to approximately 80-90 feet below sea level beneath the north part of the Island (where the water table elevation is the highest) and 50 feet bsl or less beneath the south part of the Island. Schubert **(1999)** prepared an east-west cross section across Shelter Island from Coecles Inlet to West Neck Bay and approximated the depth of the freshwater/saltwater interface into the marine clay unit based on very limited

[5] Illustration from Simmons, 1986; Figure 3, Hydrogeologic section through Shelter Island.

well data[6]. The reduced hydraulic conductivity in the marine clay limits the water supply yield of this geologic unit. As a result, the depth of useable freshwater in the aquifer is limited by the extent of clay.

The Simmons report includes several references to the vulnerability of Shelter Island with respect to withdrawal and use of groundwater for water supply. Simmons reports that:

- The island depends entirely on this aquifer for public water supply; thus, the quantity and quality of fresh groundwater is a matter of local concern.
- Increased withdrawal of fresh ground water in nearshore areas will cause further landward movement of saline ground water; in other areas, excessive pumping may cause upconing.



Simmons also notes that higher summer populations cause an increased demand for water (which is highest during the summer, when recharge is lowest) and increases the stress on the system, which in turn may result in upconing and intrusion of saline ground water. A further description of the relationship of aquifer pumping and effect on the freshwater/saltwater interface is noted as follows:

> "Under natural conditions, recharge and discharge are in equilibrium, so that the freshwater/saltwater interface is maintained in a relatively constant position. When water is pumped from the aquifer, however, the flow of fresh ground water toward the zone of diffusion is decreased, which allows landward movement of the interface and reduces the volume of fresh ground water in storage." (p. 12)

The information Simmons derived from monitoring wells in 1983-84, were representative of conditions at that time. It is noted that differences in aquifer recharge between water years and seasons will influence the depth and landward-seaward migration of the fresh-saltwater interface. During drought years and seasons with low precipitation, the elevation of the water table decreases thus reducing the volume of freshwater and increasing the landward and upward migration of the fresh-saltwater interface (salt water encroachment). During high precipitation years and rainfall seasons, the elevation of the

[6] Illustration from Schubert, 1999; Figure 4C. Vertical section C-C' showing hydro-geologic units, freshwater/saltwater interface, boreholes and wells screened with interfaces, and water-table altitude with ground-water levels on Marcy 17-20, 1995 in the West Neck Bay study area, eastern Suffolk County, N.Y.

water table increases with a corresponding increased depth and seaward migration of the fresh-saltwater interface. Likewise, significant well pumping (withdrawal) will reduce the volume of freshwater in the aquifer with a corresponding response in migration of the fresh-saltwater interface. Simmons **(1986)** estimated that annual pumpage was approximately 6 percent of the annual recharge (and not all pumpage was used consumptively as a result of sanitary system recharge and irrigation at that time). As a result, it was estimated that 94 percent of recharge was available to maintain the position of the fresh-saltwater interface. Simmons further indicates the following with respect to the relationship of water use and salt water encroachment:

> "From an islandwide perspective, significant landward movement of saline ground water would be unlikely under these conditions. However, the geographic distribution of pumping wells is a critical factor. Excessive withdrawal of fresh ground water in nearshore areas will undoubtedly cause a local disturbance of the freshwater-saltwater equilibrium that will result in locally increased chloride concentrations in water near the pumping well. The degree of saltwater encroachment is dependent on the distance of the well from the shore, the amount of pumping, and the local characteristics of the aquifer. In other areas, excessive ground-water withdrawals may result in upconing of the saline groundwater into the freshwater lens." (p.13)

As a result, the relationship of aquifer recharge and withdrawal must be carefully considered in order to ensure that salt water encroachment and upconing do not adversely affect the ability of the Island to sustain an adequate water supply for its residents and visitors.

Water Use and Quantity

Water quantity is a function of recharge to the aquifer, discharge from the aquifer, and water in storage within the aquifer. Total annual recharge and pumpage were estimated by Simmons **(1986)** to be 4,380 million gallons (Mgal) and 260 Mgal, respectively. This results in daily recharge and water use estimates of 12 million gallons per day (mgd) and 0.7 mgd, respectively.

Estimates have since been updated as part of the Suffolk County Comprehensive Water Resource Management Plan Update. Current estimates indicate that the total recharge to the Upper Glacial aquifer underlying Shelter Island is 17.6 million gallons per day (mgd), of which 3.8 mgd is discharged directly to tidal streams, harbors and embayments and 13.7 mgd is discharged directly to coastal areas (i.e., areas of open water). The remaining 0.1 mgd consists of the total water demand related to water supply withdrawals from community supply sources (i.e., water districts) resulting in an estimated public water supply consumption of 92 gallons per capita per day and 241 gallons per capita per household per day (**SCCWRMP, 2011**).

Other sources of water supply that exist on the Island consist of non-community sources (i.e. schools, public buildings, parks, etc.) and private wells. It is estimated that 0.033

mgd is removed by non-community sources and 0.45 mgd is withdrawn by private wells. Thus, total water use is estimated to be 0.58 mgd as a result of the combination of community supply wells, non-community sources and private wells. Not all of this water is used consumptively as much is eventually recharged back into the underlying aquifer through sanitary effluent and irrigation (minus loss by evapotranspiration) (**SCCRWMP, Task 7.6/7.7, 2010**). Of the water withdrawn it is estimated that approximately 0.35 mgd is used for irrigation purposes while 0.05 mgd is used for sanitary discharge, with the remainder being consumptive loss.

Fresh groundwater is stored in the Upper Glacial aquifer deposits beneath Shelter Island. The quantity of fresh water varies with the water year and/or seasonal conditions, primarily due to precipitation, which results in changes in the position of the freshwater/saltwater interface. As described, the zone of diffusion is the mixing area between fresh and saline groundwaters; this zone is defined by increased chloride concentrations which increase with depth until chloride concentrations are consistent with the chloride concentration of seawater. Low precipitation years and seasons reduce the elevation of the water table, thus causing a landward and upward migration of the fresh-saltwater interface and thus reducing the quantity of fresh groundwater in storage. The nearshore areas are most susceptible to changes in water table elevations influencing the position of the interface.

A review of literature pertaining to hydrogeology of Shelter Island did not produce any referenced estimates of the quantity of water in storage in the aquifer. A chronology of pertinent references that were consulted is provided as follows:

- Soren, J., 1978. "Hydrogeologic Conditions in the Town of Shelter Island, Suffolk County, Long Island, New York." USGS Water Resource Investigations 77-77.
- Simmons, Dale. 1986. "Geohydrology and Ground Water Quality on Shelter Island." USGS Water Resource Investigations Report 85-4165.
- Schubert, C. E., 1998. "Areas Contributing Ground Water to the Peconic Estuary, and Ground-water Budgets for the North and South Forks and Shelter Island, Eastern Suffolk County, New York." USGS Water Resource Investigations Report 97-4136.
- Schubert, C. E., 1999. "Ground-Water Flow Paths and Traveltime to Three Small Embayments within the Peconic Estuary, Eastern Suffolk County, New York." USGS Water Resource Investigations Report 98-4181.
- Suffolk County Comprehensive Water Resource Management Plan, 2011. Sections 3, 4 and 5, Tasks 4.4 and 7.6/7.7 of SCCWRMP prepared by SCDHS with CDM, Yaphank, NY.

Several agencies and consultants were also contacted for information during the course of this investigation. Personal communication with Chris Schubert of USGS, Ron Paulsen and Andy Rapiejko of SCDHS, and Mary Ann Taylor of CDM did not identify any further information other than what is referenced in the literature.

Simmons **(1986)** was a seminal document that addressed overall hydrogeology and water quality of Shelter Island, with later documents addressing specific aspects of groundwater

contribution to surface water of the Peconic Estuary, creation of a Shelter Island groundwater flow model and updates of the water balance for Shelter Island. Although documentation does not provide an estimate of freshwater contained in the aquifer, there are references of the need to maintain water levels in order to maintain the position of the freshwater/saltwater interface that defines the separation between salty groundwater and freshwater.

Based on the land area of Shelter Island, the depth of freshwater and the porosity of the aquifer, there is a large amount of freshwater in storage. However, this water is limited vertically as a result of the marine clay and limited horizontally as a result of the surrounding and interior surface waters of Shelter Island (i.e., Flanders Bay, Gardiners Bay, Coecles Inlet and West Neck Bay. In addition, freshwater must remain in storage in order to maintain the equilibrium conditions that affect the position of the fresh-saltwater interface. Nearshore areas are most susceptible to pumpage and water table fluctuations as a result of changes in recharge; thus making these areas most susceptible to salt water encroachment and upconing. Other parts of the Island are less sensitive to changes; however, withdrawal must be considered in connection with seasonal fluctuations in the water table (i.e., water demand is greatest during the summer when the water table is typically lower in elevation), changes in recharge (drought versus flood years), salt water encroachment and upconing, water supply and demand, water quality, and long-term water management.

In addition, the depth of freshwater is of concern, given the chloride concentrations detected in monitoring wells observed by Simmons **(1986)** which indicate that the freshwater-saltwater interface is relatively shallow beneath Shelter Island and does not follow the principles of the Ghyben-Herzberg relationship due to the presence of the marine clay. Simmons observed chloride concentrations above 40 mg/l at 50 feet or less where the depth of the marine clay is approximately 75 feet bsl in the southern portions of Shelter Island. This is a limited vertical reserve, particularly in consideration of private water system standards for Suffolk County which recommend that private wells be installed to a depth of 40 feet into the water table. As a result, water conservation is a prudent course of action, with extreme caution regarding groundwater withdrawal in the nearshore areas.

While groundwater resources and groundwater management are of extreme importance to Shelter Island, this document is not a water supply report for Shelter Island. Rather, this document is a watershed management plan directed primarily toward stormwater management and maintaining surface water quality in the embayments of the Peconic Estuary. Groundwater conditions are part of the characterization of existing resources needed to understand the watershed and provide stormwater management recommendations. It is beyond the scope of this study to determine the future water supply needs of Shelter Island and particularly to set policy regarding conservation of water resources. Information contained herein is the best available at the time of this study, and is intended to provide increased understanding of the groundwater resources of Shelter Island. Further investigation may be warranted to assist the Town and Village

address future specific water supply management needs.

3.4 Flood Zones

The Federal Emergency Management Agency (FEMA) has prepared Flood Insurance Rate Maps (FIRM) which identify zones as well as the frequency which areas may be subject to flooding. In particular, there are four (4) flood zones which have been identified particularly along the coastal areas of Shelter Island. **Table 1** provides a summary and description of each of these flood zones. The location of each flood zone is illustrated in **Figure 7**.

Table 1
FEMA FLOOD ZONES

FLOOD ZONES	Description of Flooding Conditions
Zone X	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level
0.02% Change Annual Flood Hazard	"500-year flood" - has a 0.02 percent chance of a flood occurring in any year.
Zone AE	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. The base floodplain where base flood elevations are provided.
Zone AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
Zone VE	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.

Source: Federal Emergency Management Agency (FEMA)

As illustrated, the majority of areas susceptible to flooding occur within the low-lying areas along the coast of the Island. Additional inland areas subject to flooding include the causeway leading to Little Ram Island, portions of Little Ram Island, the lands immediately east of Coecles Harbor, the southern portion of Mashomack Preserve, and areas within the southwestern peninsula of the Island.

Additionally, Sea, Lake and Overland Surge from Hurricanes (SLOSH) data was reviewed to determine potential flooding areas from hurricanes (**Figure 8**). This dataset was developed by the National Weather Service to estimate potential surge heights from each hurricane category. As illustrated, the majority of the low lying areas in the southern portion of the island would be vulnerable to Category 1 and 2 hurricanes. Additional inland areas, particularly in the lands immediately east of Coecles Harbor, the

southeastern peninsula of the island and Little Ram Island become vulnerable from Category 3, 4 and 5 hurricanes.

Generally, both data sets illustrate similar key areas susceptible to flooding during major storm events, indicating that flooding on Shelter Island would be mainly the result of low topographic elevation.

Additionally, areas of localized flooding currently occur during regular storm events at several locations within the Island. Locations of localized regular flooding include:

- Congdon Road (between SR 114 and North Cartwright Road)
- Dogwood Lane (near the intersection with SR 114)
- Shore Road (near the Sunset Beach Hotel)
- Bridge Street
- Ram Island Drive causeways
- West Neck Road (various locations)

A variety of factors contribute to flooding within these areas, including proximity to surface water, depth to groundwater, inadequate drainage for catchment area, and high tide. More specifically, in areas with shallow groundwater, very little soil depth exists for stormwater leaching and as a result, the soil void space temporarily reaches capacity during large storm events and thus water ponds on the surface. Similarly, in areas in close proximity to the shore that are low in elevation and have a large tidal range, high tide can bring an influx of water that fills soil void space and drains preventing immediate dissipation of water.

In areas with adequate depth to groundwater, flooding can occur as a result of inadequate capacity of drainage structures for the land area draining to said structures. Areas with larger amounts of impervious surfaces require more drainage capacity, and as a result, the more impervious surfaces within a catchment area, the greater the drainage capacity needed for that area.

3.5 Soils & Erosion

The USDA Soil Survey of Suffolk County, New York provides a complete categorization, mapping and description of the soil types found in Suffolk County. Soils are classified by similar characteristics and depositional history into soil series, which are in turn grouped into associations. A soil association is a landscape that has a distinctive proportional pattern of soils; it normally consists of one or more major and at least one minor soil series.

The soil survey identifies Shelter Island as lying within an area characterized entirely by Montauk-Haven-Riverhead Association soils (**see Figure 9**). This association contains the minor soil groups of Carver, Plymouth, Montauk, Walpole, Atsion and Berryland

soils. Soils of this association are characterized as deep, nearly level to strongly sloping, well-drained to moderately well-drained soils, having moderately coarse-textured and medium-textured soils on moraines. It is noted that Montauk soils within this association has a fragipan or compact layer that ranges from two to 20 feet in thickness. In general, these soils are well-suited to farming, but the more sloping areas are subject to erosion. Because these soils generally have a deep root zone, the productive potential for trees on the soils in this association is one of the best in all of Suffolk County. Montauk soils within this association present moderate to severe limitations for housing development, due to slow infiltration in the fragipan (low permeability) layer, and excavation may be difficult in places where this layer is several feet thick.

The predominant soil types located on Shelter Island (**Figure 10**) include MfB and MfC (Montauk fine sandy loam) which are generally well drained to moderately well drained. Significant quantities of CpE (Carver and Plymouth sand), PlB and PlC (Plymouth loamy sand) and RdB (Riverhead sandy loam) are also located in the watershed. These soils are generally excessively drained to well drained. A small portion of the island consists of poorly drained soils (At – Atsion sand, Bd – Berryland mucky sand, Mu – Muck, Ra – Raynham loam, Tm – Tidal marsh, W – Water and Wd – Walpole sandy loam) which are primarily located in proximity to surface waterbodies and known freshwater and tidal wetlands. As illustrated in **Figure 10**, a variety of other soils types comprise the remainder of the watershed. **Table 2** below provides a quantification of each soil type within the watershed in addition to the drainage category the soil type falls within.

Table 2
SOIL TYPES AND ABUNDANCE

WELL DRAINED SOILS		
Soil Type	**Area (Acres)**	**Percent**
Bc	228.41	3.00%
BgA	119.97	1.57%
BgB	224.67	2.95%
BhB	58.11	0.76%
Bm	6.72	0.09%
CpA	32.31	0.42%
CpC	15.69	0.21%
CpE	514.08	6.74%
CuB	8.99	0.12%
De	15.58	0.20%
Du	93.46	1.23%
Es	34.27	0.45%
Fd	86.87	1.14%
Gp	12.59	0.17%
HaA	258.62	3.39%
HaB	297.37	3.90%
HaC	48.31	0.63%
He	113.09	1.48%
MfA	93.96	1.23%
MfB	1243.58	16.31%
MfC	824	10.81%
MkA	5.26	0.07%
MkB	351.18	4.61%
MkC	36.8	0.48%
MnA	18.89	0.25%
MnB	154.98	2.03%
MnC	360.41	4.73%
PlA	149.96	1.97%
PlB	411.93	5.40%
PlC	472.88	6.20%
PmB3	4.57	0.06%
PsA	55.98	0.73%
PsB	4.9	0.06%
RdA	60.4	0.79%
RdB	389.48	5.11%
RdC	325.8	4.27%
RhB	15.57	0.20%
SdA	2.5	0.03%
Su	18.69	0.25%
Subtotal	*7,170.83*	*94.06%*
POORLY DRAINED SOILS		
Soil Type	**Area (Acres)**	**Percent**
At	5.93	0.08%
Bd	39.68	0.52%
Mu	92.53	1.21%
Ra	17.63	0.23%
Tm	218.65	2.87%
W	70.92	0.93%
Wd	7.58	0.10%
Subtotal	*452.92*	*5.94*
TOTAL	**7623.75**	**100.00%**

Source: Suffolk County Soil Survey; Wulforst, 1975; NCRS SSURGO Database; see Figure 9

Erosion is caused by unconsolidated soils becoming subject to overland transport as a result of weathering conditions such as wind and rain. Since the surface of Shelter Island is comprised of glacial sand deposits, unstabilized surfaces are subject to erosion. Natural erosion exists in areas where the topographic elevation declines rapidly toward the coastline causing bluff features. The most pronounced example of this is the area of Shelter Island Heights in the northwest corner of the island, though smaller bluffs exist sporadically around Shelter Island. Erosion can also be caused by increased impervious surfaces resulting in channelized runoff that causes scouring and sediment transport, as

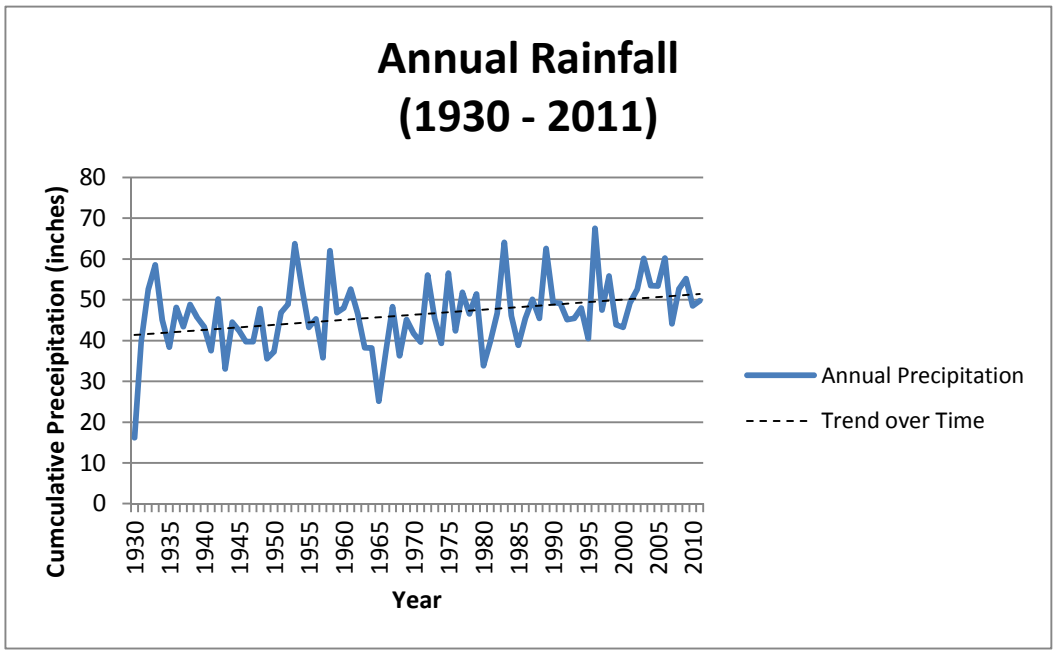
well as removal of vegetation that stabilizes surface soils. Erosion and sediment transport throughout Shelter Island should be managed through proper grading and drainage practices incorporating sound engineering principles and erosion control measures.

3.6 Precipitation and Climate

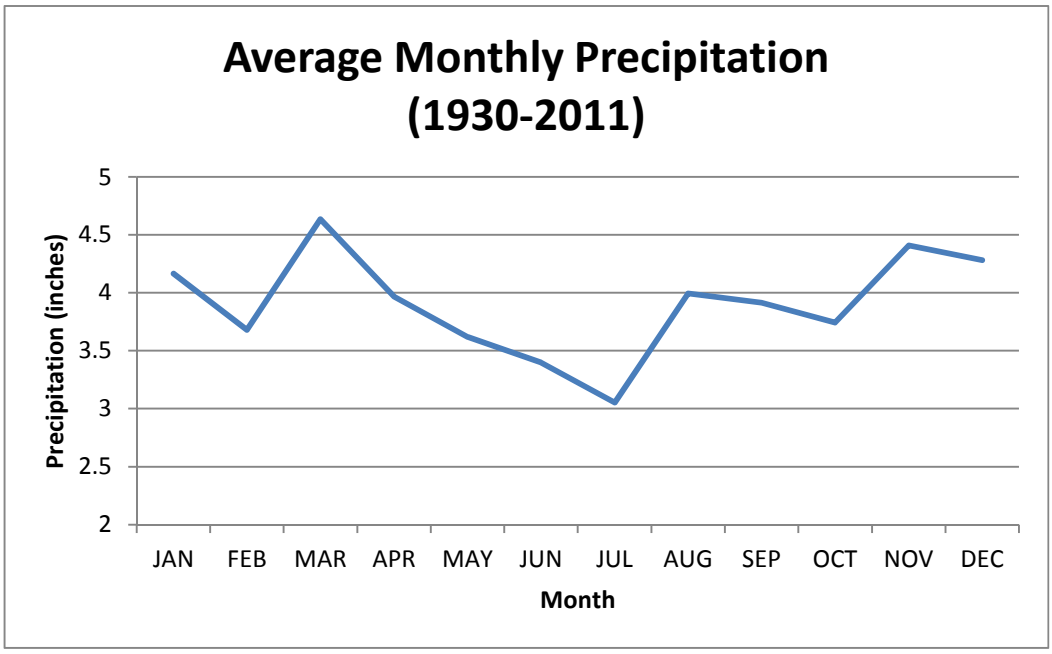
Primarily due to its latitude and proximity of the Atlantic Ocean, Shelter Island has a predominantly temperate marine climate. Temperatures are moderate and precipitation is abundant during the fall, winter and spring. A brief dry spell commonly occurs during the summer. Data in the vicinity of Shelter Island collected by NOAA (National Oceanic and Atmospheric Administration) indicates that the average annual temperature of the region is 56 degrees Fahrenheit.

More specific precipitation data for the region was obtained from the Northeast Regional Climate Center (NRCC) who maintains a precipitation measurement station in Bridgehampton. Data from this provider indicates that average annual precipitation is approximately 42.4 inches per year. As illustrated in **Graph 1** below, there has been a steady increase in annual precipitation since the station began collecting measurements in 1930. Data from the NRCC also illustrates the seasonal precipitation trends. **Graph 1B** below displays the average monthly precipitation for the period of 1930 to 2011.

Graph 1A
ANNUAL RAINFALL, 1930 - 2011



Graph 1B
AVERAGE MONTHLY RAINFALL, 1930 - 2011



As illustrated, the wettest season is late winter/early spring when Shelter Island (and Long Island) receives seasonal rains. The dry period for the island peaks in July, and precipitation tends to increase by late August. As indicated in **Section 3.3**, this precipitation trend is reflected in the island's groundwater levels, which fluctuate as a function of precipitation input to the island.

3.7 Infrastructure

Infrastructure on Shelter Island includes the road system, stormwater infrastructure, waste treatment facilities and water supply. The north and south private ferry companies provide transportation to and from Shelter Island; however, there are no rail or bus transit systems on the Island.

3.7.1 Transportation

Although Shelter Island is relatively small in size, it contains approximately 85 miles in roadways. Within this network, one roadway (SR 114) is State maintained, while five are County owned and maintained. It is noted that the portion of SR 114 in the vicinity of the North Ferry terminal is owned by the Shelter Island Heights Property Owners Corporation (SIHPOC) and has an easement for the State. A majority of the roads located in Shelter Island Heights are privately owned and maintained by the Shelter Island Heights Property Owners Corporation. The remaining roads are either owned and maintained by

the Town or are privately owned/maintained. **Table 3** below summarizes the State and County roadways found on the Island. It is noted that State and County roadways comprise approximately 9.5 miles of the 85 miles of roadways, or approximately 11% with the rest being Town or private roads.

Table 3
STATE AND COUNTY OWNED ROADWAYS

Roadway Designation	Roadway Name	Jurisdiction	Approximate Length
SR 114	North Ferry Road/ South Ferry Road Summerfield Place/Clinton Avenue/Cedar Avenue/Grand Avenue/Chase Avenue	State (easement) State (easement), maintained by SIHPOC	4.5 Miles
CR 42	Rocky Shore Road	County	1.2 Miles
CR 69	North Cartwright Avenue	County	1.4 Miles
CR 115	West Neck Road	County	0.6 Miles
CR 116	North Menantic Road/Smith Street	County	1.4 Miles
CR 117	Burns Road	County	0.4 Miles

3.7.2 Stormwater

As illustrated in **Figure 11**, a network of stormwater and drainage infrastructure currently exists throughout the Shelter Island; these installations are primarily located within the network of roadways described above. The data illustrated in **Figure 11** was collected from a variety of sources, including the Peconic Estuary Program, data collected by Cashin Associates under a contract to the Town, as well as data collected by the Town's Highway Department, the West Neck Bay Watershed Management plan, the Dering Harbor Subwatershed Assessment and field data collected by NP&V. It is noted that the data collected by Cashin Associates provides the locations of drainage structures; however no data was collected on structure type, connections, or structure conditions. Additionally, while the data provided by the PEP is useful, the dataset is older (data collected in 2000) and requires verification and updating.

Field inspections and meetings with the Town Highway Superintendent indicate that much of the drainage infrastructure on Shelter Island consists of leaching catch basins which recharge stormwater directly to groundwater, however, a large quantity of direct outfalls to either the bays or freshwater wetlands exist as well.

Field inspections by NP&V resulted in the identification of several direct outfalls and areas of overland flow, which were incorporated into the overall drainage infrastructure map provided in **Figure 11**.

Stormwater information from the West Neck Bay Watershed Management plan indicated that all stormwater infrastructure surrounding West Neck Bay consisted of leaching catch basins as the Town requires all drainage infrastructure to recharge to groundwater. No direct outfalls or areas of overland flow were noted in this plan.

The Dering Harbor Subwatershed Assessment is currently in progress; however, available data was obtained and reviewed for the assessment study area. Although specific drainage infrastructure data was not available during the time of review, four "stormwater hotspot" areas were identified within the Dering Harbor assessment area. Hotspot areas include the Gardiners Bay Country Club, the Bridge Street gas station, the Yacht Club, and the alley behind Chequitt Inn/Pharmacy. The Gardiners Bay Country Club is considered a hotspot due to the potential large quantities of nutrients that would runoff from the golf course. The remaining three hotspot locations were identified as such due to the presence of gas, oils and grease that are present and exposed at each site, thus running off into the harbor during storm events.

3.7.3 Sanitary

Sanitary infrastructure within Shelter Island is comprised both of a sewer system and associated Sewage Treatment Plant (STP) located in Shelter Island Heights and individual sanitary systems located within the remainder of the island.

The Shelter Island Heights STP was originally permitted by the EPA in May of 1974 and serves the same area as the Shelter Island Heights water district. The STP is currently permitted a flow rate of ≤53,000 gpd of treated sanitary effluent. Review of EPA data reveals that discharge violations occurred on only two dates within the past two years; these violations include high total and fecal coliform counts in July 2011 and a high level of total coliform in May 2009. No other discharge violations have been reported during this time period.

Individual sanitary systems serve the majority of residents and visitors on Shelter Island and are comprised of installations with a wide variety of age, functionality, and depth to groundwater characteristics. Generally, sanitary systems in the northern portion of the Island and in the vicinity of Little Ram Island are considered to be newer as development within these areas occurred primarily in the 1970's. Systems throughout the remainder of the island are in varying states of age, as some have been replaced through necessity while others have not. Systems located in areas of lower elevation (i.e., less than 10 feet asl) are more

likely to have either a very shallow depth to groundwater or may intersect groundwater and as a result, may not meet current design standards or have full function in terms of waste handling.

3.7.4 Potable Water

The majority of Shelter Island residents utilize private wells to obtain potable water; however, three water districts exist and are located in the northwest portion of the Island. These water districts include the West Neck Water District, which is owned and operated by the Town for approximately 56 residential and commercial users; the Village of Dering Harbor Water District, which is operated for approximately 23 residential users; and a private water district, operated by the Shelter Island Heights Property Owners Corporation for approximately 160 residential and commercial customers. A depiction of the water district boundaries and the location of supply wells is provided in **Figure 12**. Water quality results from the water districts and available private well data are provided in **Section 7.2**.

4.0 Land Use & Land Cover

Quantifying and identifying land use and land cover within a watershed are one of the most important tasks in characterizing a watershed. Land use and land cover provide a reflection of the impervious surfaces within a watershed, which generally contribute the greatest quantity of pollutants running off into surface waterbodies during rain events. By identifying the areas with the greatest quantity of impervious surfaces, improvement projects targeted at either reducing these surfaces or capturing and treating runoff from these surfaces can be identified. Additionally, industrial and commercial uses generally contain the greatest quantity of impervious surfaces, and also have the potential to contribute harsher pollutants (chemical solvents, by products of industrial processes, etc.) to stormwater runoff. As a result, these uses are often appropriate targets for stormwater improvements. Both land use and land cover within Shelter Island are described in further detail below.

<u>Land Use & Land Cover</u>

Shelter Island is approximately 7,600 acres in size, the majority of which is occupied by Low Density Residential (34.64%) and Open Space & Parkland (32.26%) uses (**Table 4**). Vacant Land also occupies a significant portion of the island, as it currently comprises 14.51% of lands. Although Roadway/Highway Yard/Parking Lot (6.10%) and Parks & Recreation (5.28%) occupy a much smaller portion of the island, these uses represent the remainder of the major uses that occupy lands. All other uses within the island occupy less than 2% of the overall land mass (**Figure 13**).

Table 4
LAND USE – SHELTER ISLAND

Land Use	Area (Acres)	Percent
Agriculture/Nursery/Farm	105.46	1.39%
Commercial	105.42	1.38%
High Density Residential	19.51	0.26%
Industrial	10.85	0.14%
Institutional	102.15	1.34%
Landfill	26.77	0.35%
Low Density Residential	2637.20	34.64%
Marina	10.81	0.14%
Medium Density Residential	149.20	1.96%
Parks & Open Space	2455.50	32.26%
Parks & Recreation	401.61	5.28%
Roadway/Highway Yard/Parking Lot	464.09	6.10%
Surface Water	17.62	0.23%
Utilities	1.86	0.02%
Vacant	1104.54	14.51%
TOTAL	**7612.60**	**100.00%**

Land cover data represents the biophysical use of the surface of the earth. Land cover data for Shelter Island was obtained from the 2006 USGS National Land Cover Dataset (NLCD). This dataset is generated from 30 meter resolution Landsat imagery that classifies land cover based on the color bands provided by the Landsat imagery. A depiction of the 2006 NLCD data is provided in **Figure 14**, and coverage quantities are provided in **Table 5** below.

Table 5
LAND COVER – SHELTER ISLAND

Land Cover Category	Area (Acres)	Percent
Open Water	154.10	2.02%
Developed, Open Space	1323.09	17.35%
Developed, Low Intensity	686.83	9.01%
Developed, Medium Intensity	219.17	2.87%
Developed, High Inensity	18.57	0.24%
Barren Land (Rock, Sand, Clay)	180.04	2.36%
Deciduous Forest	3621.22	47.49%
Evergreen Forest	184.20	2.42%
Mixed Forest	27.82	0.36%
Shrub/Scrub	66.49	0.87%
Grassland/Herbaceous	147.83	1.94%
Pasture/Hay	392.76	5.15%
Cultivated Crops	56.39	0.74%
Woody Wetlands	121.33	1.59%
Emergent Herbaceous Wetlands	425.23	5.58%
TOTAL	**7625.05**	**100.00%**

As illustrated in **Table 5**, the majority of Shelter Island is occupied by deciduous forest (3621.22 acres or 47.19%). This generally reflects the large quantity of trees that comprise the surface of the island. The second greatest land cover that occupies the island is categorized as Developed, Open Space (17.35%) which generally represents roadways and pathways that traverse the island in addition to large areas of lawn/landscaped areas. Other major land cover categories include Developed, Low Intensity (9.01%), Pasture/Hay (5.15%), and Emergent Herbaceous Wetlands (5.58%). The Developed, Low Intensity category primarily reflects residential areas and some associated roadways, while the Pasture/Hay category represents large mowed areas or large areas of tall grasses. Emergent Herbaceous Wetlands primarily represent the vegetated tidal wetlands on the island. It should be noted that there is a slight discrepancy in the acreage total between the Land Use and Land Cover tables. This is a result of the Land Use quantities being parcel based and the Land Cover quantities being area based and not delimited by parcel boundaries.

Generally, these two sets of data indicate that Shelter Island is primarily comprised of Parks and Open Space and Low Density Development; few areas of higher intensity development currently exist within the Island.

Publicly Owned Land

Publicly owned lands within the watershed are an important factor in understanding the current status of protected land and lands used for municipal purposes. Depending on location of public land, needs of the watershed, and ability to make use of identified holdings, these lands may also provide opportunities for improvements (such as stormwater detention and/or treatment) which would ultimately improve handling or water quality of stormwater runoff.

Figure 15 depicts the publicly owned land within Shelter Island. As illustrated, the Town owns the majority of the publicly owned parcels, in addition to the Mashomack Preserve which is owned by The Nature Conservancy. Several smaller parcels of land are owned by the State, Suffolk County, the Village of Dering Harbor and the Peconic Land Trust and are interspersed throughout the Island.

More specifically, NYS owned land is mostly comprised of the underwater lands' surrounding the Island; however, the State owns two parcels of land just north of Mashomack Preserve that primarily consist of vacant wooded land. Suffolk County owns 22 parcels of land on the Island, two of which are roadways within developments. The majority of County owned lands consist of vacant wooded parcels; however, one of the larger County owned parcels is a former airstrip located in the northeast portion of the Island, west of North Cartwright Road. Town owned lands are interspersed throughout the Island and include vacant wooded land, the Town landfill, portions of Sylvestor Manor, former agricultural land, a portion of the airstrip located west of North Cartwright Road and the golf course located in Shelter Island Heights. A total of 2,820 acres (or 37%) of the Island is in public ownership.

The Town Community Preservation Project Plan (adopted in 2008) identifies parcels targeted for acquisition for the purpose of conservation. A list of the target parcels is provided as **Appendix A**. It is noted that a portion of the Fiske Estate and Klen's Airstrip have been acquired at this time. It is also noted that the Town purchases development rights to targeted parcels where deemed appropriate when funds permit.

Marinas, Yacht Clubs and Ferries

There are three marina facilities located within Shelter Island; the Shelter Island Yacht Club, located on the north shore of the Island in Dering Harbor, Coecles Harbor Marina & Boatyard, located on the eastern shore of the Island in Coecles Harbor, and Island Boatyard located on the south shore of the island in Menantic Creek. Both the Coecles Harbor Marina and Island Boatyard are full service marinas offering boat repair, maintenance, storage, pump out and fueling. Additionally, Island Boatyard permits boat owners to wash and paint vessels within the marina facility.

Two ferries provide access to the Island: one is located on the north shore with a terminal at S.R. 114/Summerfield Place while the other is located at south shore terminal at S.R. 114/South Ferry Road. The North ferry is owned and operated by the Shelter Island Heights Property Owner's Corporation while the South ferry is owned and

operated by the South Ferry Company. Both services have multiple ferries operating on a constantly rotating schedule.

Town Landfill

The Town landfill is located on the east side of North Menantic Road, immediately to the west of an existing sand mine and masonry facility. The landfill processed and buried material from the 1940's to 1991, when the landfill was closed and capped. Three groundwater monitoring wells are located at the Town facility and are sampled twice a year for pollutants identified in 6 NYCRR Part 360 for baseline and routine sampling events. Results from 2009 and 2011 sampling events were reviewed and have indicated both high levels of metals and ammonia within the wells. The high levels of metals have been attributed to high turbidity levels within one of the monitoring wells, while the ammonia levels may indicate contamination from the landfill. Additional information on water quality, including the landfill well monitoring is contained in **Section 7.3**.

5.0 Human and Socioeconomic Resources

5.1 Zoning

As illustrated on the Zoning Map (**Figure 16)** zoning within Shelter Island is primarily residential, with a small area of commercial zoning located in the central portion of the Island. Shelter Island has six zoning categories in total, four of which are residential and two of which are commercial.. Additionally, Shelter Island has a Near Shore and Peninsular Overlay district for those properties located along the shoreline. As illustrated in **Table 6** below, Shelter Island requires a minimum lot size of 40,000 SF in any zoning district, and permits a maximum impervious lot coverage of 40% with the exception of the business districts, which are permitted a maximum lot coverage of 75%.

Table 6
ZONING – SHELTER ISLAND

Zone	Minimum Lot Size	Maximum Impervious Lot Coverage	Total Area (Acres)	Percent of Island
A Residential	40,000 SF	40%	1188.85	16.37%
AA Residential	80,000 SF	40%	4501.75	62.00%
B Business	40,000 SF	75%	168.31	2.32%
B1 Restricted Business	40,000 SF	75%	6.1	0.08%
C Residential	40,000 SF	40%	1302.22	17.94%
Causeway District	80,000 SF	*	93.33	1.29%
TOTAL	--	--	7260.56	100.00%

* Based on lot size, as follows:
- >200,000 SF Lot: 1,800 SF building plus a 25' radius surrounding the building
- 40,000 SF - 200,000 SF Lot: 1,800 SF building plus a 25' radius surrounding the building
- <40,000 SF Lot: 1,000 SF plus a 25' radius surrounding the building

As less than 3% of the Island is zoned for business uses, these uses will have minimal impacts in terms of impervious lot coverage. Conversely, as the majority of Shelter Island is permitted for residential uses, these uses will provide the largest component of impervious surfaces on the Island.

It is noted that the Causeway District was incorporated into Town zoning code recently (December 2, 2011) in order to further protect the scenic causeway located within the Ram Island and Little Ram Island peninsula. It was recognized that this area was subject to frequent flooding and as such, maintenance of existing natural vegetation within this area was imperative in protecting both the scenic quality and stabilization of the bluffs within the district.

Additionally, Shelter Island has a Near Shore and Peninsular Overlay District. The overlay district was created to protect the aquifer in the most sensitive areas of Shelter Island, where depletion of potable water and salt water intrusion are most likely. Generally, this Overlay District applies to the most sensitive areas of the Island where one or more of the following criteria apply:

1. The freshwater table is close to sea level and risk of salt water intrusion exists or has occurred through consumptive use of available potable water.
2. The land surface is close to the level of the freshwater table, increasing the risk of pollution of the aquifer.
3. The land drains toward creek or bay waters, increasing potential pollution from surface or below-ground drainage.
4. Density of development and anticipated future development threaten the ecologically sensitive areas.

5. The land drains toward freshwater ponds which are hydraulically connected to outcroppings of the freshwater table which may result in pollution of the freshwater table.

New subdivisions which are located within the Near Shore and Peninsular Overlay District require a shoreline vegetative buffer, park or recreation area requirement, contiguous area and acreage averaging.

5.2 Demographics

Data from the 2010 census was utilized to determine the population of Shelter Island. 2010 census data reveals that the population of Shelter Island is 2,392 persons, which represents an increase of 164 people or 7.36% over the 2000 population (2,228 persons). As illustrated in **Figure 17**, despite the increase in population, the relative population density on the Island has not changed significantly since the 2000 census.

There is a prominent seasonal population that inhabits Shelter Island in the summer season. Data from the 2010 census indicates that 1,459 of the 2,755 households on Shelter Island are seasonal (52.96%) suggesting that the Island experiences a significant population increase in the summer months. A 1986 Water Resources Investigation Report reported that the population increased to 10,000 during summer months **(Simmons, 1986)**.

6.0 Natural Resources

6.1 Wetlands

Freshwater Wetlands

The freshwater wetlands (i.e., ponds and marshes) are located primarily within the inland portions of Shelter Island and are particularly concentrated in the southern half of the Island. These features were formed during the retreat of the Laurentide Ice Sheet, when fresh meltwater collected in the kettle holes and depressions formed previously during glacial advance. These areas are of critical importance to the watershed underlying Shelter Island since they are major conduits of groundwater recharge in the region and represent ecologically sensitive resources.

The NYSDEC has identified 63 surface water bodies as freshwater wetlands within the Town of Shelter Island; these areas comprise approximately 314.3 acres of wetlands. These freshwater wetlands are all catalogued by the NYSDEC on the Greenport United States Geological Survey (USGS) 7.5-minute quadrangle and are illustrated in **Figure 18**. NYSDEC classifies freshwater wetlands into four categories, which are described in §664.5 of the NYSDEC regulations. Class I wetlands are considered the most pristine and therefore the most valuable, while Class IV wetlands lack characteristics which

would give the wetland a high value. The definitions of each class category, as provided by the NYSDEC, are listed below.

Class I wetlands:
A wetland shall be a Class I wetland if it has any of the following seven enumerated characteristics:

Ecological associations
(1) it is a classic kettlehole bog
Special features
(2) it is resident habitat of an endangered or threatened animal species
(3) it contains an endangered or threatened plant species
(4) it supports an animal species in abundance or diversity unusual for the state or for the major region of the state in which it is found
Hydrological and pollution control features
(5) it is tributary to a body of water which could subject a substantially developed area to significant damage from flooding or from additional flooding should the wetland be modified, filled, or drained
(6) it is adjacent or contiguous to a reservoir or other body of water that is used primarily for public water supply, or it is hydraulically connected to an aquifer which is used for public water supply or
Other
(7) it contains four or more of the enumerated Class II characteristics. The department may, however, determine that some of the characteristics are duplicative of each other, therefore do not indicate enhanced benefits, and so do not warrant Class I classification.

Class II wetlands:
A wetland shall be a Class II wetland if it has any of the following seventeen enumerated characteristics:

Covertype
(1) it is an emergent marsh in which purple loosestrife and/or reed (*Phragmites*) constitutes less than two-thirds of the covertype
Ecological association
(2) it contains two or more wetland structural groups
(3) it is contiguous to a tidal wetland
(4) it is associated with permanent open water outside the wetland
(5) it is adjacent or contiguous to streams classified C(t) or higher under article 15 of the environmental conservation law
Special features
(6) it is traditional migration habitat of an endangered or threatened animal species
(7) it is resident habitat of an animal species vulnerable in the state
(8) it contains a plant species vulnerable in the state
(9) it supports an animal species in abundance or diversity unusual for the county in which it is found
(10) it has demonstrable archaeological or paleontological significance as a wetland
(11) it contains, is part of, owes its existence to, or is ecologically associated with, an unusual geological feature which is an excellent representation of its type
Hydrological and pollution control features
(12) it is tributary to a body of water which could subject a lightly developed area, an area used for growing crops for harvest, or an area planned for development by a local

planning authority, to significant damage from flooding or from additional flooding should the wetland be modified, filled, or drained
(13) it is hydraulically connected to an aquifer which has been identified by a government agency as a potentially useful water supply
(14) it acts in a tertiary treatment capacity for a sewage disposal system
Distribution and location
(15) it is within an urbanized area
(16) it is one of the three largest wetlands within a city, town, or New York City borough or
(17) it is within a publicly owned recreation area

Class III wetlands:
A wetland shall be a Class III wetland if it has any of the following fifteen enumerated characteristics:

Covertypes
(1) it is an emergent marsh in which purple loosestrife and/or reed (Phragmites) constitutes two-thirds or more of the covertype
(2) it is a deciduous swamp
(3) it is a shrub swamp
(4) it consists of floating and/or submergent vegetation
(5) it consists of wetland open water
Ecological associations
(6) it contains an island with an area or height above the wetland adequate to provide one or more of the benefits described in section
Special features
(7) it has a total alkalinity of at least 50 parts per million
(8) it is adjacent to fertile upland
(9) it is resident habitat of an animal species vulnerable in the major region of the state in which it is found, or it is traditional migration habitat of an animal species vulnerable in the state or in the major region of the state in which it is found
(10) it contains a plant species vulnerable in the major region of the state in which it is found
Hydrological and pollution control features
(11) it is part of a surface water system with permanent open water and it receives significant pollution of a type amenable to amelioration by wetlands
Distribution and location
(12) it is visible from an interstate highway, a parkway, a designated scenic highway, or a passenger railroad and serves a valuable aesthetic or open space function
(13) it is one of the three largest wetlands of the same covertype within a town
(14) it is in a town in which wetland acreage is less than one percent of the total acreage or
(15) it is on publicly owned land that is open to the public

Class IV wetlands:
A wetland shall be a Class IV wetland if it does not have any of the characteristics listed as criteria for Class I, II or III wetlands. Class IV wetlands will include wet meadows and coniferous swamps which lack other characteristics justifying a higher classification.

Table 7 below lists each wetland, their approximate size, and the NYSDEC classification.

Table 7
NYSDEC FRESHWATER WETLANDS

NYSDEC Wetland ID	Wetland Classification	Area (Acres)	NYSDEC Wetland ID	Wetland Classification	Area (Acres)	NYSDEC Wetland ID	Wetland Classification	Area (Acres)
GP-3	3	16.1	GP-31	2	4.4	GP-52	3	0.5
GP-4	3	19.6	GP-32	2	1.2	GP-53	3	1.4
GP-5	3	85	GP-33	2	4	GP-54	3	0.5
GP-6	2	46.2	GP-34	3	0.6	GP-55	2	3.6
GP-7	2	24.4	GP-35	3	1.4	GP-56	3	1.2
GP-8	2	19.8	GP-36	3	2.8	GP-57	3	0.9
GP-12	2	0.8	GP-37	3	0.7	GP-58	3	4.6
GP-15	2	1.5	GP-38	3	1.1	GP-59	3	0.6
GP-17	2	2.8	GP-39	3	0.8	GP-60	3	2.4
GP-18	3	4.4	GP-40	3	1	GP-61	3	2.9
GP-19	1	3.8	GP-41	3	0.4	GP-62	3	0.8
GP-20	3	0.7	GP-42	2	1	GP-63	3	2.3
GP-21	2	0.7	GP-43	3	2.7	GP-64	3	1
GP-22	2	0.6	GP-44	3	0.7	GP-65	2	3.1
GP-23	3	1.8	GP-45	3	0.7	GP-66	2	4.1
GP-24	3	0.6	GP-46	3	0.3	GP-67	3	1.7
GP-25	2	13.9	GP-47	3	0.3	GP-68	3	1
GP-26	2	2.9	GP-48	3	0.8	GP-69	3	1.3
GP-27	3	0.6	GP-49	2	1.8	GP-70	2	0.9
GP-28	2	0.5	GP-50	3	1.4	GP-74	2	1.4
GP-29	2	0.3	GP-51	2	0.8	**TOTAL**		**314.3**
GP-30	3	2.2						

As illustrated in **Table 7** above, only one freshwater wetland on Shelter Island is a Class I wetland, while the majority of the wetlands are Class II (23 wetlands) and III (39 wetlands). This indicates the generally compromised quality of freshwater wetlands encountered on Shelter Island. It is noted that the largest freshwater wetland, GP-5, occurs in the south central portion of the Island and is approximately 85 acres in size. This wetland is generally of poor quality as it is a Class III wetland. The Class I wetland (GP-19) is located immediately to the south of Chase Creek in the northwest portion of the Island.

Tidal Wetlands

The Town's tidal wetlands are located where the coastline is bounded by tidal waters. These wetlands contain saline waters, which originate from the ocean-fed surface waters surrounding Shelter Island. These features are formed by coastal processes and, with the exception of formerly connected tidal wetlands, are subject to tidal influence. These areas are not only vital to the ecological systems to which they serve, but also function to control storm surges during flood and major storm events which may impact sensitive watershed areas. The NYSDEC maintains a series of tidal wetlands maps which document the location and type of tidal wetlands within New York State and includes a complete inventory for the area of Shelter Island. Tidal wetlands surrounding Shelter Island are illustrated in **Figure 18**. The NYSDEC classifies tidal wetlands into fourteen distinct categories. Definitions for those categories present within Shelter Island are provided below.

SM - Coastal Shoals, Bars and Mudflats: The tidal wetland zone that at high tide is covered by saline or fresh tidal waters, at low tide is exposed or is covered by water to a maximum depth of approximately one foot, and is not vegetated.

LZ - Littoral Zone: The tidal wetland zone that includes all lands under tidal waters which are not included in any other category. There shall be no LZ under waters deeper than six feet at mean low water.

FC - Formerly Connected: The tidal wetlands zone in which normal tidal flow is restricted by man-made causes. *Phragmites sp*. is the dominant vegetation.

IM - Intertidal Marsh: The vegetated tidal wetland zone lying generally between average high and low tidal elevation in saline waters. The predominant vegetation in this zone is low marsh cord grass, *Spartina alterniflora*.

HM - High Marsh: The normal upper most tidal wetland zone usually dominated by salt meadow grass, *Spartina patens*; and spike grass, *Distichlis spicata*. This zone is periodically flooded by spring and storm tides and is often vegetated by low vigor, *Spartina alterniflora* and Seaside lavender, *Limonium carolinianum*. Upper limits of this zone often include black grass, *Juncus gerardi*; chairmaker's rush, *Scirpus sp.*; marsh elder, *Iva frutescens*; and groundsel bush, *Baccharis halimifolia*.

DS - Dredged Spoil All areas of fill material.

The majority of the shoreline along the western portion of the Island is dominated by LZ, indicating few areas of tidal wetlands vegetation and greater areas of hardened shorelines. The eastern portion of Shelter Island contains larger areas of SM, suggesting fewer areas of hardened shorelines. Vegetated tidal wetlands (HM and IM) exist within tidal inlets and areas along the shoreline that receive lesser amounts of natural disturbance and greater sediment deposition, allowing for the establishment of tidal wetland vegetation. In particular, Coecles Harbor, West Neck Creek and Mashomack Preserve exhibit the greatest quantity of vegetated tidal wetlands on the island. The quality of these wetland

areas will depend heavily on the amount of anthropogenic disturbance and influence the wetland areas receive.

6.2 Living Resources

Living resources include the significant flora and fauna that are present on the Island. While significant natural communities are discussed in **Section 6.3** below, this section focuses on the significant plants and animals known to occur within the bays and harbors of Shelter Island. These resources should be considered in water quality improvements as the habitat of each species should be protected to ensure the continuance of the species. The NYNHP has identified two rare fish, a rare damselfly, a rare beetle, one rare plant, six threatened plants and one endangered plant as either presently or historically occurring on the island. It is noted that the island does not support any anadramous fish populations as the island contains no freshwater streams. **Table 8** below provides a summary of the species identified by habitat type as it provides an indication of where the species would be expected since the NYNHP does not provide specific locations due to the sensitivity of the information.

Table 8
RARE SPECIES IDENTIFIED BY THE NYNHP

Habitat Type		NYS Legal Status (Endangered, Threatened, Rare, Special Concern)	Year Last Documented
TIDAL RIVER		--	--
Species Common Name	**Species Scientific Name**	--	--
Inland Silverside	*Menidia beryllina*	Unlisted	1980
Atlantic Silverside	*Menidia menidia*	Unlisted	1980
SUCCESSIONAL FIELD/GRASSLAND/CLEARING		--	--
Species Common Name	**Species Scientific Name**	--	--
White Milkweed	*Asclepias variegata*	Endangered	2010
Little-leaf Tick-trefoil	*Desmodium ciliare*	Threatened	1923
Oakes' Evening-primrose	*Oenothera oakesiana*	Threatened	1996
Whip Nutrush	*Scleria triglomerata*	Threatened	1996
TIDAL WETLANDS/SALT MARSH		--	--
Species Common Name	**Species Scientific Name**	--	--
Marsh Fimbry	*Fimbristylis castanea*	Threatened	1996
Rambur's Forktail	*Ischnura ramburii*	Unlisted	1994
Seaside Plantain	*Plantago maritima var. juncoides*	Threatened	2010
Seabeach Knotweed	*Polygonum glaucum*	Rare	2005
Dwarf Glasswort	*Salicornia bigelovii*	Threatened	2010
PINE BARRENS		--	--
Species Common Name	**Species Scientific Name**	--	--
New Jersey Pine Barrens Tiger Beetle	*Cicindela patruela consentanea*	Unlisted	1946

6.3 Habitats

A variety of important habitats exist on Shelter Island or within the coastal waters of the Island. In total, six different categories of significant habitats occur within the Island or along the coast. Each of these habitats is described in further detail below and is depicted in **Figures 19** and **20**.

<u>NYSDOS Significant Coastal Fish & Wildlife Habitat</u>
NYSDOS has designated three Significant Coastal Fish & Wildlife Habitats on the island which are identified as Shell Beach, Shelter Island Eastern Shallows and Mashomack Preserve Shelter Island. These areas are designated due to the presence of rare, threatened or endangered species and populations of waterfowl which use the area, the rarity of the ecosystem, the availability of sport fishing, and the irreplaceability of the

ecosystem. The habitat narratives which describe the reasoning behind the SCFWH designation for each habitat is provided in **Appendix B**.

As discussed in the habitat narrative, the three habitat areas were designated a SCFWH for the following reasons:

Shell Beach:

- Shell Beach is a small segment of sand and pebble beach, subject to human disturbance; not rare in Suffolk County.
- Shell Beach provides nesting sites for Least Tern (threatened species) and Piping Plover (Federal and State endangered species).
- There are no significant fish or wildlife related human uses of the area.
- The concentrations of piping plover utilizing Shell Beach is significant in Suffolk County.
- The habitat at Shell Beach may be replaced through independent processes within two years.

Shelter Island Eastern Shallows:

- Shelter Island Eastern Shallows contains eelgrass beds of State importance.
- Atlantic ridley (endangered species) and loggerhead turtles (threatened species) have been identified in this habitat.
- The Eastern Shallows has a bay scallop fishery of recreational and commercial significance in the State of New York.
- The bay scallop population is at a level of significance between the State of New York and the Mid-Atlantic region of the United States.
- The habitat is irreplaceable.

Mashomack Preserve Shelter Island:

- Mashomack Preserve is an undeveloped marine coastal ecosystem that is rare in New York State.
- Mashomack Preserve hosts Osprey (Special Concern species) nesting and feeding, Piping plover (Federal and State endangered species) nesting and occasional least tern (threatened species) nesting.
- Mashomack Preserve provides recreational and educational uses important to residents of Long Island.
- Mashomack Preserve provides the second largest concentration of nesting osprey in the State of New York.
- Mashomack Preserve is irreplaceable.

It is noted that a restoration and replanting plan for Shell Beach is currently in preparation as part of a habitat restoration initiative by the Peconic Estuary Program.

<u>Eel Grass Beds & Submerged Aquatic Vegetation</u>

Eel grass (*Zoster marina*) is a significant habitat vital to the establishment and success of shellfish, finfish and other marine organisms present in Peconic Bay. Two surveys were performed to locate existing patches of eel grass and submereged aquatic vegetation (SAV) in Peconic Bay, the first in 1994 and the second in 2000. The 1994 eel grass bed

locations were delineated by Cashin Associates who utilized aerial photography and field surveys to determine the extent of each bed. In 2000 Cornell Cooperative Extension utilized similar methodology to determine the location of SAV (both macroalgae and eel grass) within Peconic Bay, the difference of which is displayed in **Figure 19**. As illustrated, eel grass beds were reduced in some areas while other areas exhibited bed expansion. Overall, there appears to have been a net loss in SAV in the vicinity of Shelter Island between 1994 and 2000. Data regarding eel grass has not been collected since 2000, however, a survey update is scheduled for 2012.

NYNHP Significant Natural Communities

Shelter Island hosts a total of nine NYNHP recognized significant natural communities, all of which are associated with Mashomack Preserve or the immediate surrounding area. The communities present include Coastal oak-beech forest, Coastal oak-hickory forest, Coastal salt pond, Highbush blueberry bog thicket, Marine eelgrass meadow, Maritime beach, Maritime post oak forest, Saltwater tidal creek, and Successional maritime forest. Each of these communities was deemed significant due to their quality, age, or rarity within New York State. **Table 9** below summarizes each community, the approximate size, and the reason for the community designation. A full description of each community type as defined by **Edinger** (**2002**) is provided as **Appendix C**.

Table 9
SHELTER ISLAND SIGNIFICANT NATURAL COMMUNITIES

Community Name	Community Location	Size (Acres)	EO Rank[1]	Global Rank[2]	State Rank[3]	Description
Coastal Oak-Beech Forest	Mashomack Preserve	219	A	G4	S3	This is an oak-beech codominated forest on a moraine in the interior of an island peninsula in the Peconic Estuary of Long Island. The forest is associated with coastal oak-hickory forest in a mosaic forming a matrix forest and includes several small vernal pools. It is part of a relatively large intact landscape for the coastal region consisting of 1450 acres of mostly continuous forest cover and 2000 acres of natural cover lacking paved roads.
Coastal Oak-Hickory Forest	Mashomack Preserve	446	A	G4	S3	This is an oak-hickory codominated forest in the interior of an island peninsula in the Peconic Estuary of Long Island. The community is associated with coastal oak-beech forest as part of a matrix forest, and may include several small vernal pools in kettlehole depressions. The forest grades into maritime post oak forest closer to the salt spray influenced island shoreline. Successional maritime forest is associated in more heavily disturbed areas to the west. The forest is part of a landscape relatively intact for the coastal zone which is about 1450 acres generally with continuous forest cover and 2000 acres of natural cover lacking paved roads.
Coastal Salt Pond	Cedar Cove Pond	0.56	C	G4	S1S2	Small polyhaline pond complex centered on a small point in a small cove of a polyhaline tidal bay on an island in the middle of the Peconic Estuary of eastern Long Island. The pond occurs along a narrow band of marine intertidal shore and is separated from the subtidal waters of the adjacent bay by a narrow terrace. A salt marsh complex with pools similar to coastal salt ponds is situated nearby along the intertidal shore. The adjacent upland is a regionally large complex of maritime and coastal oak forests with about 2000 acres of mostly contiguous natural cover and 1443 acres lacking paved roads.
Coastal Salt Pond	Plum Pond	31	BC	G4	S1S2	Mesohaline to oligohaline pond complex behind a barrier beach on a large island in the middle of the Peconic Estuary of eastern Long Island. The pond is separated from the polyhaline to euhaline subtidal waters of an adjacent tidal bay by a 4 m tall barrier dune. It is one of a chain of several pond complexes on the southeast part of a large peninsula. There is no direct outlet to the bay, but an artificial connection (estuarine ditch) to a tidal creek to the west has been made. The adjacent upland is a regionally large complex of maritime and coastal oak forests with about 2000 acres of mostly contiguous natural cover and 1443 acres lacking paved roads.
Highbush Blueberry Bog Thicket	Mashomack Preserve	28	AB	G4	S3	The community is a series of small patches in a northwest to southeast orientation straddling Route 114. At the edges of the kettles, the swamp grades into a narrow wet mucky moat like area dominated by Decodon verticillatus. The kettles are bordered by coastal oak-hickory forest. The swamp complex is at the west edge of Mashomack Preserve. Residences occur to the north. south, and west.
Marine Eelgrass Meadow	Gardiner's Bay, Shelter Island	330	AB	G5	S3	Eelgrass-dominated patches in a mosaic of densely to sparsely vegetated nearshore subtidal shoal associations at the head of a large open part of a bay with semi-diurnal tides and at the outlet of a narrow sound at the interface of the middle and the outer portions of the Peconic Estuary of eastern Long Island. Associated subtidal associations include macroalgae beds variously dominated by Polysiphonia spp., Sargassum filipendula and Codium fragile, as well as sparsely vegetated sand. Landward the community is borderd by intact marine intertidal areas and strips of forested to open canopy maritime uplands, including a complex of coastal oak forests and an unconsolidated maritime bluff formed from headward erosion. One tidal creek empties into the sound.
Maritime beach	Mashomack	59	B	G5	S3S4	The community follows the shoreline of Mashomack peninsula for approximately 11.4 miles below low maritime dune ridges or eroding till bluffs and above mean high tide which separates it from marine intertidal gravel/sand beach. Approximately 20% of the community is bordered by development including docks and houses.
Maritime post oak forest	Mashomack	571	A	G3G4	S2S3	This is an oak-dominated maritime strand forest on an island peninsula in the Peconic Estuary of Long Island. Seaward, the forest abuts marine, estuarine and maritime communities (marine beaches, maritime beach, salt marshes, and salt shrub). Inland, the forest grades into interior coastal oak forests (oak-hickory, oak-beech). Successional maritime forest is associated in more heavily disturbed areas to the west. The forest is part of a landscape relatively intact for the coastal zone with about 2000 acres of natural cover with no paved roads and 1450 acres with generally continuous forest cover.
Saltwater tidal creek	Fan Creek	4	B	G4	S3	Small, tidally influenced creek in a small salt marsh emptying into a small cove of a large inlet adjacent to a large polyhaline to euhaline tidal bay in the outer Peconic Estuary of eastern Long Island. The creek is bordered by intact, unditched low and high salt marsh. Intact maritime post oak forest surrounds the salt marsh with a small watershed of about 20 acres. The mouth of the creek cuts across a small intertidal barrier beach with a small delta deposited in the adjacent tidal bay. Semidiurnal tides enter the creek from the bay. The adjacent upland is a regionally large complex of maritime and coastal oak forests with about 2000 acres of mostly contiguous natural cover and 1443 acres lacking paved roads.
Saltwater tidal creek	Miss Annies Creek	15	B	G4	S3	This is a tidally influenced creek in a small salt marsh emptying into a small cove of a narrow sound connecting two polyhaline to euhaline tidal bays in the outer Peconic Estuary of eastern Long Island. The creek is bordered by intact low and high salt marsh with only a few small historical ditches. Intact maritime post oak forest borders the salt marsh landward with a small watershed of about 60 acres. The mouth of the creek cuts across a small barrier beach and dune with a small delta deposited in the adjacent tidal bay. Semidiurnal tides enter the creek from the bay. The adjacent upland is a regionally large complex of maritime and coastal oak forests with about 2000 acres of mostly contiguous natural cover and 1443 acres lacking paved roads.
Saltwater tidal creek	Bass Creek	26	AB	G4	S3	This is a tidally influenced creek in a moderately small salt marsh emptying into a narrow sound connecting two polyhaline to euhaline tidal bays in the outer Peconic Estuary of eastern Long Island. The creek is bordered by mostly intact low and high salt marsh. Intact maritime post oak forest borders the salt marsh landward with a small watershed of about 200 acres. The mouth of the creek cuts across a small barrier beach and dune with a moderate-sized subtidal delta of coarse sediments deposited in the adjacent tidal bay. Semidiurnal tides enter the creek from the bay. The adjacent upland is a regionally large complex of maritime and coastal oak forests with about 2000 acres of mostly contiguous natural cover and 1443 acres lacking paved roads.
Saltwater tidal creek	Mashomack Creek	22	AB	G4	S3	This is a tidally influenced creek in a moderate-sized salt marsh emptying into a narrow sound connecting two polyhaline to euhaline tidal bays, on a peninsula of an island in the outer Peconic Estuary of eastern Long Island. The creek is bordered by mostly intact low and high salt marsh. Intact maritime post oak forest borders the salt marsh towards the interior of the peninsula with a small watershed of about 100 acres. The mouth of the creek cuts across a small barrier beach and dune with a

Community Name	Community Location	Size (Acres)	EO Rank[1]	Global Rank[2]	State Rank[3]	Description
						moderate-sized subtidal delta of coarse sediments deposited in the adjacent tidal bay. Semidiurnal tides enter the creek from the bay. The adjacent upland is a regionally large complex of maritime and coastal oak forests with about 2000 acres of mostly contiguous.
Successional maritime forest	Mashomack	187	BC	G4	S3S4	This is a successional forest at the edge of an island peninsula in the Peconic Estuary of Long Island. The forest is associated to the east with mature oak forests (oak-hickory, oak-beech, and maritime post oak). Developed lands to the west limit natural connections to the rest of the island. Several small pine barrens shrub swamps are embedded in the forest. It is part of a landscape relatively intact for the coastal region with 1450 acres generally with continuous forest cover and 2000 acres of natural cover lacking paved roads.

1. EO RANK

A = excellent quality and viability
B = good quality and viability
C = fair quality and viability
D = poor quality and viability
E = verified extant (with insufficient information to rank A D)
F = failed to find during most recent surveys (but may still be present)
H = historical with no recent information
X = extirpated (no longer exists) from that location (most often due to destruction of habitat)

2. GLOBAL RANK:

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences), or very few remaining acres, or miles of stream) or especially vulnerable to extinction because of some factor of its biology.
G2 = Imperiled globally because of rarity (6 - 20 occurrences, or few remaining acres, or miles of stream) or very vulnerable to extinction throughout its range because of other factors.
G3 = Either rare and local throughout its range (21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range (e.g., a physiographic region), or vulnerable to extinction throughout its range because of other factors.
G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GH = Historically known, with the expectation that it might be rediscovered.
GX = Species believed to be extinct.
GU = Status unknown.

3. STATE RANK

S1 = Typically 5 or fewer occurrences, very few remaining individuals, acres, or miles of stream, or some factor of its biology making it especially vulnerable in New York State.
S2 = Typically 6 to 20 occurrences, few remaining individuals, acres, or miles of stream, or factors demonstrably making it very vulnerable in New York State.
S3 = Typically 21 to 100 occurrences, limited acreage, or miles of stream in New York State.
S4 = Apparently secure in New York State.
S5 = Demonstrably secure in New York State.
SH = Historically known from New York State, but not seen in the past 15 years.
SX = Apparently extirpated from New York State.
SE = Exotic, not native to New York State.
SR = State report only, no verified specimens known from New York State.
SU = Status unknown.

Wintering Harbour Seals

Harbour seals (*Phoca vitulina*) utilize the easternmost portion of the Peconic Estuary as wintering habitat. Wintering habitat is important for many species as it provides sustenance for species between breeding seasons. As described on the Costal Research and Education Society of Long Island (CRESLI), "Harbor seals, like most other seal species, migrate southward every winter, returning to New England and Canada in the summer. On Long Island, a large influx of these seals arrive in November and remain through mid-May, although some are thought to stay throughout the year." The USF&WS identified two locations on Shelter Island that serve as sites for wintering harbour seals, one of which is located on the north side of Ram Island and one of which is located at the southern tip of Mashomack Preserve.

PEP Critical Natural Resource Areas

In 1996, the PEP identified areas within the estuary that provided ecologically significant habitat to a variety of species that utilize the estuary. These areas were delineated by the PEP in order to provide a focus for habitat protection. One such area was designated on the eastern shore of Shelter Island, and encompasses the entirety of Mashomack Preserve, Ram Island, Little Ram Island and the associated coastal waters.

Peconic Bay Waterfowl Focus Area

The bay area and associated coastal waters located on the western shore of Shelter Island serves as the waterfowl focus area for both the roseate tern, which utilizes the habitat for foraging, and the common tern which utilizes the habitat for nesting. The waterfowl focus area is defined by the Atlantic Coastal Joint Venture (ACJV) which focuses on habitat conservation for native avian species. Although no specific recommendations are made for the Long Island South Shore Complex, the ACJV seeks to provide quality waterfowl habitat wherever feasible.

7.0 Water Quality

7.1 Surface Water Quality Classifications

The NYSDEC classifies surface waters into several categories, depending on whether the water body is freshwater or tidal. As indicated by the NYSDEC, "All waters of the state are provided a class and standard designation based on existing or expected best usage of each water or waterway segment." Descriptions of these classifications are provided in **Table 10** below, and classifications for waters within and along the coast of Shelter Island are provided in **Figure 21**.

Table 10
NYSDEC SURFACE WATER QUALITY CLASSIFICATIONS

Freshwater Classification	Best Usage
AA	Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. Suitable for fish, shellfish and wildlife propagation and survival.
A	Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. Suitable for fish, shellfish and wildlife propagation and survival.
B	Primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.
C	Suitable for fish, shellfish and wildlife propagation and survival. Also, for primary and secondary contact recreation, although other factors may limit the use for these purposes.
D	Due to such natural conditions as intermittency of flow, water conditions not being conducive to propagation of game fishery, or unsuitable stream bed conditions, the waters will not support fish propagation. Suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

Marine Water Classification	Best Usage
SA	Shellfishing for market purposes, primary and secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.
SB	Primary or secondary contact recreation and any fishing. Suitable for fish, shellfish and wildlife propagation and survival.
SC	Suitable for fish, shellfish and wildlife propagation and survival. Also, suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
I	Secondary contact recreation and fishing. Suitable for fish, shellfish and wildlife propagation and survival.
SD	Suitable for fish, shellfish and wildlife survival. This classification may be given to those waters that cannot meet the requirements for primary and secondary contact recreation and fish propagation for reasons of natural or man-made conditions.

Source: 6NYCRR Parts 700-705, Water Quality Regulations for Surface Waters and Groundwaters, effective September 1, 1991.
Note: Examples of Primary contact recreation include swimming, diving, and surfing. Examples of Secondary contact recreation include fishing and boating.

As previously indicated, there are no freshwater streams located on Shelter Island; however, there are several small fresh ponds scattered throughout the Island. All of these ponds have received a classification of C, indicating that these ponds are primarily suitable as fish and wildlife habitat. These ponds are appropriate for recreation; however, other factors affecting the ponds (e.g. size, invasive species) may not make them the most appropriate locations for recreation.

The open, tidal waters surrounding Shelter Island are classified SA, while the tidal creeks, ponds and narrow embayments are classified SC. As classified, the open waters surrounding the Island are appropriate as habitat, for recreation, and for shellfishing for human consumption. The small embayments are most appropriately utilized as fish and wildlife habitat, and may be utilized for recreational purposes, however, other factors (e.g. size, invasive species) may limit their use for recreation. Generally, both fresh and tidal waters within Shelter Island are suitable for both fish and wildlife habitat and for recreational purposes.

7.2 Water Quality Data

A variety of surface and groundwater quality data is available for Shelter Island and its harbors. Groundwater quality data was obtained and reviewed from USGS and the SCDHS. Surface water quality data was obtained and reviewed from NYSDEC, SCDHS, and the EPA.

Groundwater Quality

Shelter Island derives its water supply from groundwater stored in the aquifer beneath the Island. Protection of groundwater quality and maintaining an adequate supply of fresh groundwater is therefore of paramount importance to ensure availability of water supply for human consumption.

Because freshwater floats atop saline groundwater in a lens that is used for water supply on Shelter Island, the concentration of chloride is of interest with respect to water quality. Elevated chloride concentrations result from the wide zone of diffusion where freshwater mixes with salty groundwater and from salt water intrusion and upconing as a result of low precipitation years/seasons and groundwater withdrawal. **Section 3.3** describes the sensitivity of Shelter Island's water supply and provides some information with respect to freshwater and chloride concentrations in groundwater as a result of natural conditions and man-induced changes to the equilibrium conditions that determine the position of the freshwater/saltwater interface. These conditions are an overarching factor in the availability of freshwater for water supply on Shelter Island. The potential impact of upconing due to well withdrawal and salt water encroachment are illustrated in **Figure 22**. Other water quality factors include activities that take place on the land surface that result in recharge or discharge of pollutants that impair groundwater quality.

This subsection identifies available water quality information for Shelter Island, with a focus on nitrogen as a primary contaminant of concern resulting from land use density and fertilization. An overview of sanitary discharge limitations and water quality with respect to nitrogen is provided. Further information on Shelter Island water quality is available from local water purveyor well sampling, USGS reports, SCDHS private well database results and Shelter Island landfill data.

As noted, nitrogen is a primary water quality constituent of concern. Nitrogen is a component of sanitary waste disposal and fertilizer application. There is one sewage

treatment plant on Shelter Island (Shelter Island Heights) that treats sanitary waste and discharges to marine surface waters (Dering Harbor). The remainder of Shelter Island uses on-site sanitary disposal systems. Such systems, when properly designed and installed, use a septic tank for solids removal and leaching pools placed above groundwater that allow ammonium (NH_{4+}) in sewage to be converted to nitrite (NO_2) and nitrate (NO_3). This process drives off some nitrogen as a gas and recharges wastewater effluent with elevated nitrogen concentrations. Sanitary systems that do not have adequate unsaturated leaching depth below the leaching pool discharge do not allow for sufficient conversion of ammonia to nitrate and therefore have a greater groundwater impact (and surface water impact when placed in areas proximate to surface water) than properly functioning sanitary systems.

In 1978, the Long Island Regional Planning Board completed the Comprehensive Waste Treatment Management Study (known as the 208 study funded under Section 208 of the Water Pollution Control Act) that established a basis for control of density of development to maintain water quality. In 1980, SCDHS promulgated Article 6 of the Suffolk County Sanitary Code (SCSC) that identified groundwater management zones (GMZ's) and lot sizes for residential development. Lot sizes ranged from 20,000 SF (approximate equivalent of 2 units per acre) in zones other than deep aquifer recharge areas and areas that contribute to water quality of the Long Island south shore bays, to 40,000 SF (approximate equivalent of 1 unit per acre) for long term water supply aquifer recharge areas and areas that do contribute to water quality of south shore bays.

Shelter Island lies in GMZ IV, which is the less stringent zone in terms of development densities (20,000 SF per dwelling or about 2 units per acre). Developments at densities of 2 units per acre are expected to result in nitrogen concentrations elevated above natural conditions, but are also expected to ensure that nitrogen in groundwater will remain below the drinking water standard of 10 mg/l. Development at densities above 2 units per acre may result in elevated nitrogen above the drinking water standard, depending on the density.

Nitrogen exists in groundwater due to historic high density residential development areas in the central and south-central parts of the Island. Current modeling for existing development shows a discharge of nearly 30,000 kg/year through on-site disposal systems and lawn fertilizer (**SCCWRMP, 2011**). In addition, a nitrate trend analysis (1980–2002) prepared for Shelter Island showed an expected increase from 2.22 mg/l to 3.85 mg/l on average and a 0.4 mg/l increase in the Mashomack Preserve.

The basis for the nitrate trend analysis is a database maintained by SCDHS for private well data for Suffolk County. These data result from private homeowner requests for the Department of Health Services to test their wells to ensure safe drinking water quality. The database is proprietary as it involves names and addresses of the homes that are sampled; however, it provides useful information on the spatial distribution of contaminants detected in the wells. The database is limited in the fact that the depth of wells is not typically known, so that the horizontal distribution of contaminants is not available. SCDHS (Ronald Paulsen) prepared a review of private well data for Shelter

Island approximately 10 years ago, and generated a map of nitrate concentrations across the Island based on these data. This map is included as **Figure 23**. This analysis shows that existing groundwater in many parts of the central and south-central parts of the Island is compromised as a result of elevated concentrations of nitrogen. Ensuring proper density of development, proper sanitary system maintenance and minimization of fertilizer use are important factors with respect to nitrogen in groundwater.

An overview of contaminants of concern in Shelter Island groundwater is provided in review of water quality reports from local water purveyors. As noted in **Section 3.7.4**, three water districts exist and are located in the northwest portion of the Island. These water districts include: the West Neck Water District (which is owned and operated by the Town) which serves approximately 56 residential and commercial users; the Village of Dering Harbor Water District, which is operated for approximately 23 residential users; and a private water district, operated by the Shelter Island Heights Property Owners Corporation for approximately 160 residential and commercial customers. In order to comply with State regulations, each water district issues an annual report to inform residents of the quality of their drinking water and involves analysis of a variety of organic and inorganic compounds (metals) as well as total coliform, nitrate, nitrite, total trihalomethanes (disinfection by-products) and synthetic organic compounds. The most recent available reports available for review were from 2010.

Review of the results presented in the West Neck Water District report detected varying concentrations of several analyzed constituents which included coliform bacteria, nitrate chloroform, total trihalomethane, bromodichloromethane, chlorodibromide, bromoform, lead, copper and iron. Concentrations for all of these compounds were found to be within their respective groundwater standard limits except for coliform bacteria and iron but both were attributed to be natural environmental sources.

Review of the results presented in the Village of Dering Harbor Water District Report detected varying levels of several analyzed constituents which included iron, sodium chloride, sulphate lead, copper, trihalomethane, bromoform and Radium 228. Concentrations for all of these compounds were found to be within their respective groundwater standard limits.

Review of the results presented in the Shelter Island Heights Property Owners Corporation Report detected varying levels of several analyzed constituents which included barium, chlorides, iron, sodium, sulphate, nitrate, zinc, trihalomethane, chlorine, MTBE, Dinoseb, Gross Alpha and Radium 228. Concentrations for all of these compounds were found to be within their respective groundwater standard limits except for MTBE which is a gasoline additive attributed to releases from gasoline storage tanks.

A summary of the detection results for key inorganic parameters was compiled from 2010 Annual Water Quality Reports (regulatory groundwater standards in parenthesis):

Chloride	15-22.9 mg/l (250 mg/l)
Sulphate	8.5-15 mg/l (250 mg/l)
Iron	0.01-0.41 mg/l (0.3 mg/l)
Nitrate	0.5-6.4 mg/l (10 mg/l)
Sodium	10-35.2 mg/l (NA)
Lead	0.0022-.0067 mg/l (0.015 mg/l)
Copper	0.13-0.69 mg/l (1.3 mg/l)

Based on water quality reports from local water purveyors, iron is the only constituent that exceeded drinking water standards. Iron is typically a natural contaminant present as a result of leaching of the metal from geologic deposits, particularly as a result of the low pH of water recharging and in storage in the aquifer. Iron is primarily an aesthetic parameter that can result in discoloration of water with minimal health concerns in the relatively low concentrations detected. Lead and copper tend to result from corrosion of household plumbing and sulfate and sodium are naturally occurring compounds. Nitrate and chloride are discussed earlier in this subsection.

Other references that address Shelter Island groundwater conditions include USGS reports and particularly Simmons (1986); as noted previously, this was a seminal document in understanding groundwater conditions of Shelter Island. Groundwater results from the Simmons report were from 1983-1984 and indicated the following with respect to groundwater quality for Shelter Island:

Chloride	Generally chloride concentrations were below 40 mg/l and ranged from 7.8 mg/l to 310 mg/l. Only one (1) sample exceeded the 250 mg/l regulatory standard. Sample results from nearshore wells during previous or subsequent sample events revealed large fluctuations in concentration indicating large and rapid fluctuations in response to increased pumpage, reduced recharge or reduced precipitation.
Iron	Concentrations ranged from non-detect to 5 mg/l and were generally less than the 0.3 mg/l. 20% of the samples exceeded 0.3 mg/l, the result of natural influences most typical to Long Island.
Manganese	Detections ranged from non-detect to 3 mg/l and 33% of the samples exceeded 0.05 mg/l.
pH	Ranged from 5.1 to 7.2 and 85% of the values were less than 6.
Dissolved Solids	Detections ranged from 40 to 585 mg/l with over 95% of the samples recording detections less than 250 mg/l. Samples detected above 250 mg/l were the direct result of proximity to the freshwater/saltwater interface as well as high concentrations of chloride and ions associated with seawater.
Nitrate	Detections ranged from non-detect to 9.1 mg/l and 85% were below 5 mg/l. Presence of nitrate was attributed to cesspool and septic tank effluent.

The SCDHS private well database includes sampling for other parameters in addition to nitrogen. Data from 2009 to 2011 for private wells on Shelter Island was obtained from SCDHS and reviewed. As noted above, the data is considered sensitive, and therefore, specific names and addresses were not provided. It should also be noted that the dataset

is biased toward elevated concentrations of constituents since those residents that call SCDHS for well sampling, typically expect a problem. Problems may be identified by odors detected in water supply, nearby uses of concern, spills, shallow wells or other issues causing a resident to seek water quality information on their well source. Consequently, the data should be considered in view of these factors. Available data does provide an indicator of local water quality problems related to land use activity. **Table 11** provides a comparison of each contaminant, the concentration of the contaminant, the maximum permissible concentration of the contaminant, and the common use of each contaminant.

Table 11
SCDHS 2009 TO 2011 GROUNDWATER QUALITY DATA

Contaminant	Concentration Range Above Maximum Allowable Concentration	Maximum Allowable Concentration (NYSDEC TOGS 1.1.1)	Common Contaminant Use
MTBE	5.2 to 67 µg/L	10 µg/L	Fuel additive in motor gasoline
Chlordane	0.56 to 1.8 µg/L	0.05 µg/L	Pesticide
Bis (2-ethylhexyl) phthalate	11 µg/L	5 µg/L	Plasticizer used in the making of PVC
1,2,4-Trimethylbenzene	7.1 µg/L	5 µg/L	Gasoline additive
Benzene	5.7 µg/L	1 µg/L	Gasoline component
Ethylbenzene	6.9 to 14 µg/L	5 µg/L	Solvent
Naphthalene	17 to 34 µg/L	10 µg/L	SVOC; Chemical intermediate
Total Xylenes	40 to 55 µg/L	5 µg/L	Gasoline component
2-Butanone (MEK)	71 to 366 µg/L	50 µg/L	Solvent
Tetrahydrofuran	35 to 90 µg/L	50 µg/L	Solvent
Chloroform	5 to 87 µg/L	7 µg/L	Solvent

Note: SVOC is, semi-volatile organic compound, typically associated with oils.

Occurrences of gasoline additives and components and oil-related compounds were detected in localized areas based on private well data. The detections are the result of tank storage, spills and discharges. Solvents are used in households and other commercial activities and may be discharged to the ground or potentially through sanitary systems. Chlordane is a pesticide typically applied around foundations to control termites. These detections are localized and based on requests by homeowners for private well sampling by SCDHS. These matters should be addressed on a case-by-case basis to ensure health protection of water supply sources.

The Town of Shelter Island has operated a municipal solid waste landfill since the early 1940's. This landfill has received municipal solid waste as well as construction and demolition debris exclusively from Shelter Island throughout its active life.

On July 1, 1991, the Town entered into a Consent Order with the NYSDEC that required the landfill to cease accepting municipal solid waste by October of 1991; the facility was permitted to continue to accept construction and demolition debris to for grade adjustments and final elevation for landfill closure. In June of 1997, the NYSDEC approved the Closure Plan for the facility which required semi-annual groundwater monitoring of one upgradient (MW-1R) and two downgradient monitoring wells (MW-2SR and MW-2DR). Groundwater samples collected during each monitoring event are analyzed for a variety of field parameters as well as leachate indicators and inorganic (metal) constituents.

Review of available quarterly groundwater monitoring data from December of 2005 to June of 2011 indicate exceedances of groundwater quality standards for several of the monitoring parameters. Specifically, results from the upgradient monitoring well has historically exhibited exceedances for pH (5.19 to 6.9), turbidity (34 to 1,061 NTUs) and total phenolics (0.00232 to 0.004 mg/l). In addition, several inorganic constituents have also been detected in groundwater upgradient of the landfill and consist of iron (0.754 to 191 mg/l), chromium (0.061 to 0.089 mg/l), manganese (0.646 to 26.2 mg/l) and zinc (0.37 mg/l).

Results for groundwater samples collected downgradient of the landfill have also historically exhibited exceedances of groundwater quality standards for several parameters. Review of groundwater sample results obtained from the shallower of the downgradient monitoring well (MW-2SR) revealed exceedances for pH (5.77 to 6.6), turbidity (9.24 to 845 NTUs), ammonia (2.12 to 5.91 mg/l), color (25 to 300 Pt Co Units), total phenolics (0.0028 to 0.264 mg/l) and dissolved solids (510 to 535 mg/l). In addition, several inorganic constituents have also been detected in groundwater downgradient of the landfill and consist of arsenic (0.28 to 0.034 mg/l), iron (0.977 to 240 mg/l), lead (0.055 to 0.11 mg/l), chromium (0.062 to 0.095 mg/l), manganese (0.646 to 53.9 mg/l), sodium (20.7 to 48.0 mg/l) and zinc (0.55 to 1.0 mg/l).

Review of results for groundwater samples collected from the deeper downgradient monitoring well (MW-2DR) have historically revealed exceedances for pH (5.9 to 6.7), turbidity (10.3 to 344 NTUs), ammonia (2.6 to 6.22 mg/l), total phenolics (0.0136 mg/l) and color (60 to 330 Pt Co Units). In addition, several inorganic constituents have also been detected in groundwater downgradient of the landfill and consist of iron (0.4 to 114 mg/l), manganese (8.08 to 47.1 mg/l) and sodium (20.1 to 49.1 mg/l).

Elevated levels of naturally occurring inorganic constituents (iron, manganese, sodium and zinc) are typical in groundwaters of Shelter Island and may be the result of elevated turbidity levels. This may be the case with the downgradient monitoring wells which were replaced in January of 2006 following a landslide that destroyed the original downgradient monitoring wells. However, elevated levels of arsenic, lead and ammonia may indicate potential contamination emanating from the landfill but a clear conclusion to this assumption may be premature.

Many of the exceedances summarized above have been consistent over the monitoring history of the landfill and have exhibited a generally decreasing trend with the respective mean concentration of each constituent.

In summary, chloride is of concern in nearshore areas due to a thin freshwater lens. Equilibrium conditions must be maintained to ensure that the position of the freshwater/saltwater interface is maintained. Nitrogen is present in varying concentrations across Shelter Island, dependent upon development densities. Historically more dense development in the central and south parts of the Island have experienced nitrate of 7-10+ mg/l. Water quality data from water suppliers reported in 2010 is very good, with nearly all constituents consistently meeting drinking water standards. Minor exceptions were iron and bacteria detections were noted in the West Neck Water District and the Shelter Island Heights Property Owners Corporation Report identified MTBE. Localized elevated contaminant concentrations are noted in review of private well data; however, these samples are typically collected when an issue is suspected. The landfill is also a localized source of contamination that is subject to ongoing monitoring. Groundwater is Shelter Island's source of water supply, and as a result, water quality needs to be managed with continued monitoring, source control and preventive actions to ensure that the resource is not adversely affected.

Stormwater

In 1982, the Long Island Regional Planning Board prepared the L.I. Segment of the Nationwide Urban Runoff Program (NURP Study).

The NURP Study attempted to address, among other things, the following:

- the actual proportion of the total pollutant loading that can be attributed to stormwater runoff, given the presence of other point and non-point sources and conditions within the receiving waters;

The purpose of the NURP Study, carried out by the US Geological Survey (USGS), was to determine:

- the source, type, quantity, and fate of pollutants in stormwater runoff routed to recharge basins, and
- the extent to which these pollutants are, or are not attenuated as they percolate through the unsaturated zone.

In order to accomplish this, five recharge basins, located in areas with distinct land use types, were selected for intensive monitoring during and immediately following storm events. Five recharge basins, three in Nassau and two in Suffolk, were chosen for the study on the basis of type of land use from which they receive stormwater runoff. The following is a listing and description of each drainage area:

Site Location	Land Use
Centereach	Strip Commercial

Huntington	Shopping Mall, Parking Lot
Laurel Hollow	Low Density Residential (1 acre zoning)
Plainview	Major Highway
Syosset	Medium Density Residential (1/4 acre zoning)

Based on the sampling program, the NURP Study reached the following relevant findings and conclusions:

Finding: Stormwater runoff concentrations of most of the inorganic chemical constituents for which analyses were performed were generally low. In most cases, they fell within the permissible ranges for potable water; however, there were two notable exceptions:

- median lead concentrations in stormwater runoff samples collected at the recharge basin draining a major highway (Plainview) consistently exceeded the drinking water standards;
- chloride concentrations in stormwater runoff samples generally increase two orders of magnitude during the winter months.

Conclusion: In general, with the exception of lead and chloride, the concentrations of inorganic chemicals measured in stormwater runoff do not have the potential to adversely affect groundwater quality.

Finding: The number of coliform and fecal streptococcal indicator bacteria in stormwater range from 10^0 MPN (most probable number) to 10^{10} MPN per acre per inch of precipitation.

Conclusion: Coliform and fecal streptococcal indicator bacteria are removed from stormwater as it infiltrates through the soil.

Surface Water Quality

Surface water quality data for Shelter Island is available from three sources: SCDHS, NYSDEC for fecal coliform levels in Dering Harbor and EPA for the STP discharge. SCDHS maintains surface water quality sampling stations in the embayments surrounding Shelter Island. Nine stations are located in the waters surrounding Shelter Island, and one additional station monitors the outfall from Shelter Island Heights STP (**Figure 21**). Stations have been monitored for varying time periods and varying parameters, depending on the sampling year. Generally, each sample was monitored for one or several of the following parameters:

- Secchi disc clarity
- Temperature
- Dissolved Oxygen
- Salinity
- pH
- Total Coliform
- Fecal Coliform
- NH3 (Ammonia)
- NO2 (Nitrite)
- NO3 (Nitrate)
- NOx (Nitrite + Nitrate)
- Urea
- Total Kjeldahl Nitrogen
- Total dissolved Kjeldahl Nitrogen
- Total Nitrogen

- Total dissolved Nitrogen
- Total Phosphate
- Total dissolved Phosphate
- Ortho-phosphate
- Total Phosphorous
- Total dissolved Phosphorous
- Total Organic Carbon
- Dissolved Organic Carbon
- Dissolved Silicate
- Total Suspended Solids
- Total chlorophyll-α
- Fractionated chlorophyll-α
- Aureococcus anophagefferens (brown tide)

Table 12 below presents a summary of results for each sampling station for which data was collected by the SCDHS. Shaded cells represent values which exceed the threshold for impairment established by the NYSDEC Consolidated Assessment Listing Methodology (CALM) for analysis of waters. Parameters assessed in **Table 12** include those that were sampled for that have established thresholds for water quality standards for Class SA marine waters in which all sampling stations were located. Standards utilized included those outlined in NYSDEC Part 703, the NYS CALM and total nitrogen standards established by the Peconic Estuary Program. **Table 13** below provides the each analyte, the applicable threshold, and the regulations that established the threshold. It is noted that several parameters sampled for do not include regulatory thresholds and as a result, a comparison of these parameters is not possible.

Table 12
SURFACE WATER QUALITY RESULTS

Station Location	Station Number	Data Collection Data Range	Total Time Period of Data Collection (Years)	Total Number of Samples Collected	Secchi Disc Clarity		Total Coliform		Fecal Coliform		Chlorophyl-α		Dissolved Oxygen		Total Nitrogen (and Total Kjeldahl Nitrogen)*		Ammonia	
					Count of Samples Below Clarity Threshold (<6.6 feet)	Percent of Samples Below Clarity Threshold	Count of Samples Above 70 colonies per 100 ml	Percent of Samples Above 70 colonies per 100 ml	Count of Samples Above 70 colonies per 100 ml	Percent of Samples Above 70 colonies per 100 ml	Count of Samples above 8 µg/L	Percent of Samples above 8 µg/L	Count of Samples Below Minimum D.O. Threshold (4.8 mg/L)	Percent of Samples Below D.O. Threshold	Count of Samples Above 0.45 mg/L	Percent of Samples Above 0.45 mg/L	Count of Samples Above 0.035 mg/L	Percent of Samples Above 0.035 mg/L
Paradise Point	060114	03/17/1986 - 11/16/2010	25.35	757	207	27.34%	5	0.66%	0	0.00%	59	7.79%	0	0.00%	98	12.95%	30	3.96%
Gardiner's Bay West	060116	06/02/1987 - 11/16/2010	24.68	704	131	18.61%	6	0.85%	1	0.14%	58	8.24%	0	0.00%	79	11.22%	37	5.26%
West Neck Bay	060119	07/19/1985 - 11/16/2010	23.47	728	314	43.13%	32	4.40%	13	1.79%	171	23.49%	5	0.69%	175	24.04%	41	5.63%
Coecles Harbor	060122	08/11/1992 - 11/16/2010	18.28	468	174	37.18%	9	1.92%	3	0.64%	21	4.49%	1	0.21%	88	18.80%	18	3.85%
West Neck Harbor Entrance	060123	09/17/1995 - 09/20/1995	3 days	9	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
West Neck Harbor	060124	09/28/1994 - 11/16/2010	16.15	332	84	25.30%	3	0.90%	0	0.00%	14	4.22%	0	0.00%	55	16.57%	12	3.61%
West Neck Creek	060125	09/17/1995 - 09/20/1995	3 days	9	8	88.89%	0	0.00%	0	0.00%	4	44.44%	0	0.00%	5	55.56%	0	0.00%
Major's Harbor	060143	06/05/1997 - 02/10/1999	1.68	32	10	31.25%	0	0.00%	0	0.00%	0	0.00%	1	3.13%	11	34.38%	0	0.00%
Cornelius Point	060144	06/10/1997 - 02/10/1999	4.28	62	3	4.84%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	9	14.52%	0	0.00%

*TKN was collected up until 2000, when TN was collected and TKN was no longer utilized.

Table 13
SURFACE WATER QUALITY EVALUATION CRITERIA

Analyte	Established Threshold	Regulating Authority
Clarity – Secchi Disc	Visibility is less than 6.6 feet	NYS Section 305(b) CALM Methodology – Public Bathing Use Assessment Criteria
Total Coliform	70 colonies/100ml	6 NYCRR §703.4
Fecal Coliform	70 colonies/100ml	6 NYCRR §703.4
Chlorophyl-α	>8 µg/L	NYS Section 305(b) CALM Methodology – Recreation Use Assessment Criteria
Dissolved Oxygen	<4.8 mg/L	6 NYCRR §703.3
Total Nitrogen	>0.45 mg/L	Peconic Estuary Program
Ammonia	>0.035 mg/L	6 NYCRR §703.5

As illustrated, clarity, chlorophyll-α and nitrogen exceeded applicable thresholds more than 25% of the time in various waters. None of the other parameters sampled exceeded applicable thresholds more than 25% of the time; however, chlorophyll-α and nitrogen both are approaching 25% for West Neck Harbor.

Although the data collected illustrates that clarity within the majority of the waters surrounding Shelter Island is frequently reduced. Reduced water clarity may be representative of wind driven storms, fast moving currents and resulting turbidity associated with the open waters surrounding the Island. Other causes of reduced clarity can occur as a result of the presence of algal blooms. As the data do not indicate the apparent cause of reduced clarity, definitive statements regarding the implications of these results cannot be made.

The elevated levels of chlorophyll-α in West Neck Creek and West Neck Bay suggest a problem in the West Neck Creek complex due to algal blooms. Further information regarding known harmful algal blooms is provided in **Section 7.3** below; however, anecdotal evidence from Town staff and residents indicate a continuing problem with algal blooms in West Neck Creek, which is supported by the data collected by SCDHS. It is noted that the data for West Neck Creek is biased based on its short collection period; however, the data in West Neck Bay has been collected for over 23 years with elevations of chlorophyll-α occurring almost 25% of the time, providing a more comprehensive dataset for the area.

Similarly, elevated concentrations of total nitrogen within West Neck Creek and West Neck Bay are indicative of a problem with nitrogen inputs to the creek and bay. As with the chlorophyll-α dataset, data for West Neck Creek is biased due to the very short collection period; however, data from West Neck Bay is more representative of the area and indicates that nitrogen is accumulating within the creek, bay and harbor. The excess

in nitrogen may be directly related to algal blooms as further described in **Section 7.3** below.

Elevated concentrations of nitrogen also occur in Major's Harbor, which is located on the southeast side of Mashomack Preserve. This is a State regulated boat anchorage area that is characterized by a U-shaped harbor lined by natural habitat associated with the preserve. As such, no obvious anthropogenic inputs of nitrogen exist within the vicinity of the harbor. Increased nitrogen levels may be related to boat anchorage; however, no data exists to confirm or refute this as a source. As a result, contributing factors to high nitrogen levels in Major's Harbor are unknown.

SCDHS also collects pathogen data for bathing beaches. Ten sampling stations are located on Shelter Island, which include the following beaches (**Figure 21**):

- Camp Quinipet (ST-1)
- Pridwin Hotel (ST-2)
- Crescent Beach (ST-3)
- Wades Beach (Tuthill Beach) (ST-4)
- Shelter Island Heights Beach Club (ST-6)
- Perlman Music Camp (ST-10)
- Fresh Pond (ST-11)
- Shell Beach (right) (ST-12)
- Shell Beach (left) (ST-12A)
- Menhaden Landing (ST-13)

Data was reviewed from 2001 through August 2012. All stations were sampled for *Enterococci*, with the exception of Fresh Pond, which was also sampled for *E.coli*. Review of the data illustrates few occurrences of pathogen exceedances for the beaches analyzed. No beach had more than three occurrences of exceedances within the eleven year sampling period. The majority of the exceedances do not correlate with significant rain events (rainfall of greater than one inch) suggesting other factors as a cause for increased pathogens. The majority of the exceedances occur along Crescent Beach, with the exception of ST-4, which is located on West Neck Harbor. Sampling protocols and data results are provided in **Appendix D.**

As the STP located in Shelter Island Heights has a direct outfall to Dering Harbor, the NYSDEC maintains three monitoring stations in Dering Harbor to measure fecal coliform. As indicated in **Section 7.**1, Dering Harbor is designated SA and as such is considered appropriate for public bathing use. The NYSDEC Consolidated Assessment Listing Methodology (CALM) assessment criteria for surface waters indicates that fecal coliform should not exceed 200 per 100 ml sample per month, on average. Data was provided by the NYSDEC for fecal coliform levels for Dering Harbor for the period of 1/10/2007 to 11/08/2011. Review of the data indicates that Station 5.2 had a fecal coliform exceedance in September 2007 (460 per 100 ml) and Stations 5.1 and 5.2 exhibited fecal coliform exceedances in October 2010 (240 and 1,100 per 100 ml, respectively). As these incidents are isolated occurrences that display no definitive pattern, it can be surmised that the Shelter Island Heights STP is not generating fecal coliform exceedances in Dering Harbor and is functioning as designed.

Both the EPA and SCDHS collected data from the STP outfall. SCDHS collected data from 2000 to 2005, while the last three years of data (2009-2011) were obtained from the EPA. As the STP discharges to a surface waterbody, no standard for nitrogen removal exists. EPA regulatory standards exist for pH, flow, total suspended solids, settleable solids, chlorine, fecal coliform, total coliform, and BOD (biochemical oxygen demand). The parameter of greatest concern for a surface water STP discharge is total and fecal coliform. EPA standards for coliform require less than 200 colonies/mL for fecal coliform colonies in the discharge and less than 2,400 colonies/mL for total coliform; however, the NYS standard for total coliform in Class SA waters is 70 colonies/mL. As a result, the STP discharge exceeded EPA standards a total of seven times and NYS standards and additional fourteen times during the time period data is available for. Of the days that coliforms exceeded standards, eight of those samples only exceeded standards for total coliform. Coliform exceedances were noted only from March through September; coliform levels did not exceeded EPA or State parameters October through February. A copy of the data from both the EPA and SCDHS is provided as **Appendix E**.

7.3 Known Impairments

Several known impairments are located within Shelter Island and the coastal waters. These impairments include waterbodies listed on the NYS 303(d) list and shellfish closure areas. It is noted that no Federal or State listed superfund sites occur on Shelter Island. The following details each impairment identified within the watershed.

<u>NYS 303(d) List</u>

The Federal Clean Water Act requires states to periodically assess and report on the quality of waters in their state. Section 303(d) of the Act also requires states to identify impaired waters, where designated uses are not fully supported. For these impaired waters/pollutants, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting water body uses, in order to restore and protect such uses. The water body/pollutant listings in the Section 303(d) List are segmented into a number of categories. The various categories, or Parts, of the list include:

- Part 1 - Individual Waterbodies with Impairment Requiring a TMDL
- Part 2 - Multiple Segment/Categorical Impaired Waterbodies - Includes (a) Acid Rain Waters, (b) Fish Consumption Waters, and (c) Shellfishing Waters
- Part 3 - Waterbodies for which TMDL Development May Be Deferred - Includes (a) Waters Requiring Verification of Impairment, (b) Waters Requiring Verification of Cause/Pollutant, and (c) Waters Where Implementation/Evaluation of Other Restoration Measures is Pending

The Draft NYS 2012 Section 303(d) List was issued by the NYSDEC in January 2012. **Table 14** identifies the single waterbody within Shelter Island which is included on that list (Fresh Pond).

Not all impaired waters of the state are included on the Section 303(d) List. By definition, the List is limited to impaired waters that require development of a Total Maximum Daily Load (TMDL). A list entitled "Other Impaired Water body Segments Not Listed (on 303(d) List) Because Development of a TMDL is Not Necessary" is also available and was reviewed. The purpose of this supplemental list is to provide a more comprehensive inventory of waters that do not fully support designated uses and that are considered to be impaired. There are three (3) categories of justification for not including an impaired water body on the Section 303(d) List:

- Category 4a Waters – TMDL development is not necessary because a TMDL has already been established for the segment/pollutant.
- Category 4b Waters – A TMDL is not necessary because other required control measures are expected to result in restoration in a reasonable period of time.
- Category 4c Waters – A TMDL is not appropriate because the impairment is the result of pollution, rather than a pollutant that can be allocated through a TMDL.

In addition, 43 state waterbodies fall under the "B" category, which the NYSDEC defines as follows:

> "It is widely accepted that morphology and other natural conditions may contribute to periodic dissolved oxygen depletion at lower depths in significant numbers of thermally stratified waters. However bottom water conditions are not necessarily representative of the water body as a whole and aquatic life and other uses are often fully supported in these waters. Although NYS water quality standards may not be met at times in these waters, the USEPA policy of independent applicability allows for resolving differences in assessment results by weighing the higher quality or more representative data set more favorably in the attainment decision."

No waterbodies on Shelter Island were identified as Category 4 or Category B waters.

Table 14
NYSDEC 303(d) LIST

Part/ Category	Inventory Number	Water body Name	WI/WPL Number	Water body Type	Water Quality Classification	Pollutant	Pollutant Source	Year
1	(MW6.3d) GS-SIS-SI-WNH-P458	Fresh Pond	1701-0241	Lake	C	Phosphorous	Urban/Storm Runoff	2012

Data utilized for the inclusion of Fresh Pond on the 2012 303(d) list was obtained from the NYSDEC. Sampling of Fresh Pond was conducted on four occasions in June, July, August and September of 2009. Both surface and bottom samples were collected on each

occasion for each analyte. Results indicated that Fresh Pond was exceeding the State phosphorous guidance value of 20 µg/L, as sampled values ranged from 25 to 41 µg/L for surface samples. Bottom samples had significantly higher values of phosphorous, which ranged from 294 to 457 µg/L. The NYSDEC indicated that the high levels of phosphorous was the likely cause of the high levels of chlorophyll, low levels of clarity and anoxic conditions found within the lake during the sampling period, thus, supporting the inclusion of Fresh Pond on the 303(d) list.

Shellfish Closure Areas

Shellfish Closure Areas are depicted in **Figure 24**. Shellfish Closure Areas are defined by 6 NYCRR Part 41 and regulated by the New York State Department of Environmental Conservation (NYSDEC), which will permanently, seasonally, or temporarily close shellfish harvesting areas due to poor sanitary conditions in the waters surrounding the shellfish beds. State regulations are promulgated through the US FDA's National Shellfish Sanitation Program (NSSP) which provides regulations for the sanitary control of shellfish produced and sold for human consumption. A portion of the NYSDEC regulation is included as **Appendix F** of this document, which defines the closure areas within the Town of Shelter Island. Shellfish harvesting areas are monitored and regulated by the NYSDEC Bureau of Marine Resources. In addition to permanently closed areas, the NYSDEC monitors Conditional Shellfish areas, which are open to shellfish harvesting at certain times of the year dependent upon water quality (which is directly dependent upon the volume of rainfall or snow melts, i.e. stormwater runoff).

Shellfish closure areas within Shelter Island include the entirety of Shelter Island Sound North, which is permanently closed, and the Coecles Harbor Marina and Island Boat Yard and Marina which are seasonally closed (from May 15th to October 31st each year). The closure within Shelter Island Sound North is associated with the discharge from the Shelter Island Heights STP, while the closure for both Coecles Harbor Marina and Island Boat Yard are associated with the seasonal use of boats in these areas. It is noted that the closure associated with Dering Harbor was expanded in area and changed to a permanent closure in 2004, after a dye test performed by the USFDA and the NYSDEC determined that a discharge from the Shelter Island Heights STP could potentially impact a much larger area than previously delineated. As the Dering Harbor closure is considered an administrative closure due to the location of the Shelter Island Heights STP outfall, only the removal of the outfall would result in Dering Harbor's closure status being re-evaluated.

Pathogen Impaired Watersheds

Small Municipal Separate Storm Sewer Systems (MS4s) are defined as all separate storm sewer systems that are "Owned or operated by the United States, a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States (**40 CFR**

122.26(b)(16)." MS4s are currently regulated under NYSDEC SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (GP-0-10-002). The Town of Shelter Island and Village of Dering Harbor are both recognized MS4s. As a result of pathogen impairments in the Peconic Estuary, a TMDL was developed for the pathogen impaired waterbodies, which included Dering Harbor. Data analysis within the TMDL indicated that while pathogen levels did not exceed standards within Dering Harbor, levels were close to the exceedance threshold. As such, a 10% reduction goal in pathogens was set for Dering Harbor. In 2012, the NYSDEC determined that the Village and the Town are not subject to additional pathogen reduction requirements for Dering Harbor as part of their Stormwater Management Programs. While not a regulatory requirement, efforts towards pathogen reduction should continue to be pursued for the overall health of this waterway.

Harmful Algal Blooms

Harmful Algal Blooms (HAB's) are occurrences of large quantities of algae that when present at high concentrations present a threat to humans and shellfish. Two types of HAB's have been noted in the waters off of Shelter Island: Brown Tide (*Aureococcus anophagefferens*) and a type of Red Tide (*Cochlodinium polykrikoides*). Both occurrences of these HAB's were primarily noted in West Neck Bay.

The Harmful Algal Event Database (www.haedat.iode.org) has compiled data regarding HAB events in the United States. The available dataset was reviewed and information regarding the 1985-1987 brown tide bloom in the Peconic Estuary (including West Neck Bay) was included in the dataset. Details provided in the dataset are as follows:

> "The bloom was present throughout the entire Peconic system from 1985 through 1987, with densities occasionally exceeding 1,000,000 cells/ml. Cell numbers declined through 1988 and 1989, and were generally undetectable during 1990 with the exception of those from West Neck Bay. During 1991, densities of up to 2,000,000 cells/ml occurred in Flanders Bay and West Neck Bay. During 1992, numbers approached 850,000 cells/ml in Coecles Harbor and 1,000,000 cells/ml in West Neck Bay. It occurred briefly in May of 1994 in Flanders Bay (up to 14,000) cells/ml) and in Great Peconic Bay (11,000 cells/ml). During 1995 concentrations exceeded 1,000,000 cells/ml at 12 of 31 stations sampled, with a peak value of 1,700,000) recorded in July. During 1997, concentrations ranged from 1,600 to 380,000."

As indicated, West Neck Bay was the most heavily impacted by the brown tide bloom. In 2002, brown tide events began to be replaced with a red tide known as *Cochlodinium polykrikoides. C. polykrikoides* has been known to cause fish kills in Asia, impact the growth of oyster larvae, and may eventually cause mortality in both oysters and scallops (**Gobler et. al., 2008**) and as a result is of concern for the waters surrounding Shelter Island. Data suggests that the first bloom in West Neck Bay occurred in 2002 (**Nuzzi,**) but was not fully identified until 2004, when a second bloom occurred in late September through early October. Bloom events also occurred in 2005 and 2006 which extended through Peconic Bay (**Gobler et. al., 2008**) and continued to occur in 2007 and 2008.

Research by **Gobler** (**2010**) indicates that this species thrives on organic forms of nitrogen (i.e., amino acids or more specifically glutamic acid) and that blooms may be limited by high concentrations of ammonium and nitrate. It is important to note that although the species prefers organic forms of nitrogen, it can adapt and thrive on forms of inorganic nitrogen when necessary (**Gobler, 2010**).

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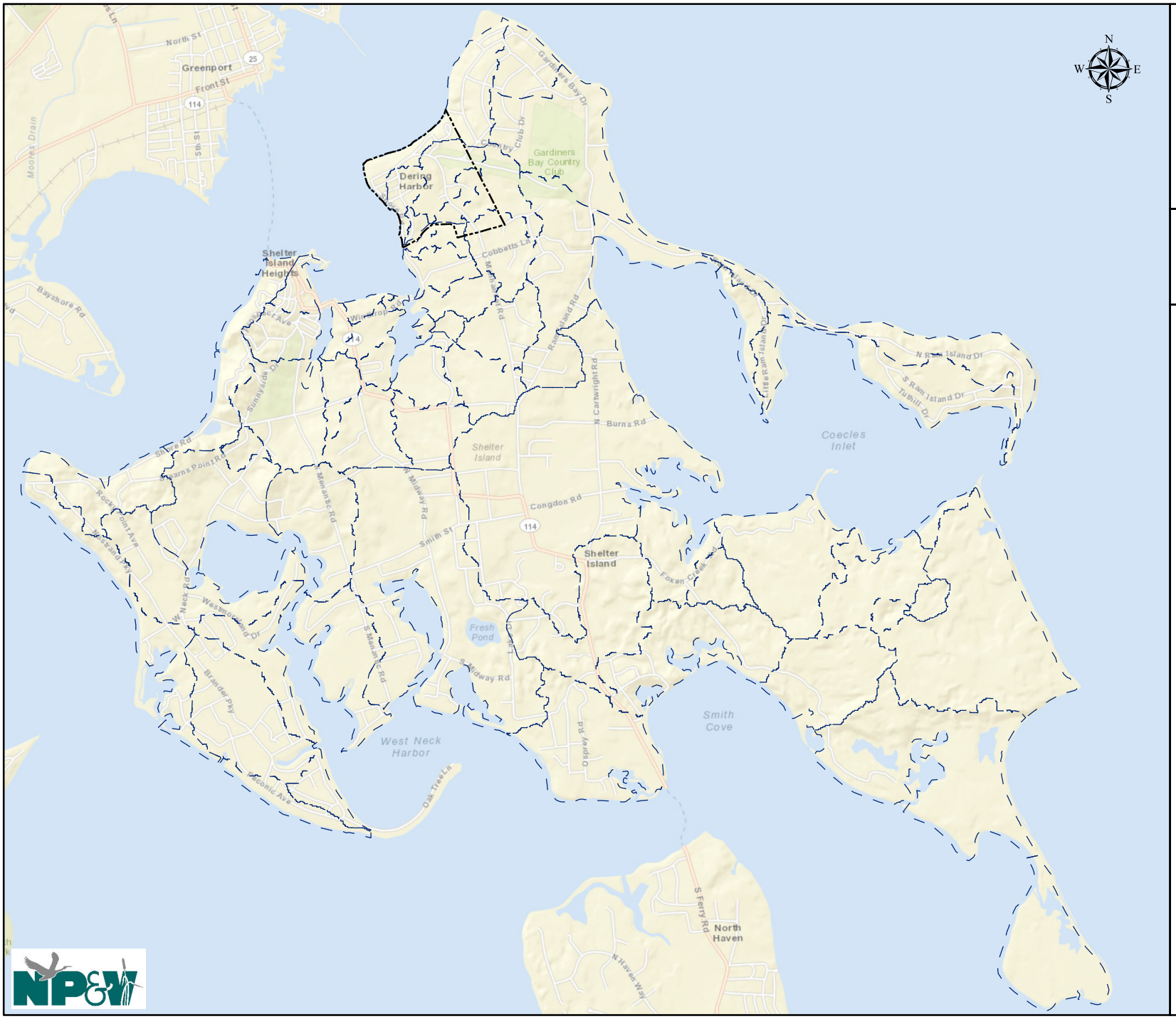
FIGURES



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 1
Shelter Island Surface Subwatershed Boundaries

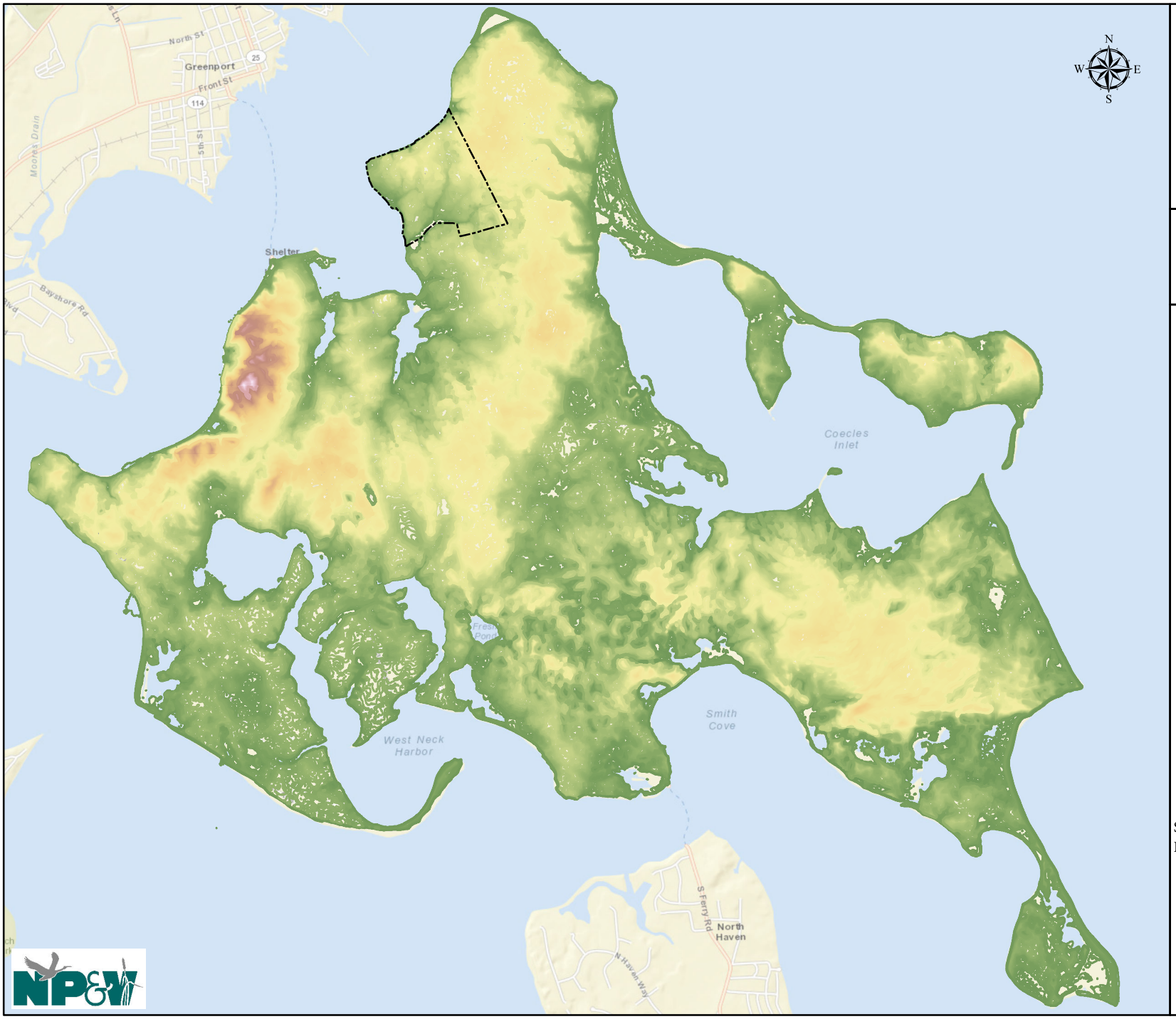
Legend

- Village of Dering Harbor
- Subwatersheds

Source: ESRI WMS; NYSDOS; Suffolk County GIS; Shelter Island GIS; Peconic Estuary Program

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 2

Topography

Legend

Village of Dering Harbor

Elevation (feet asl)

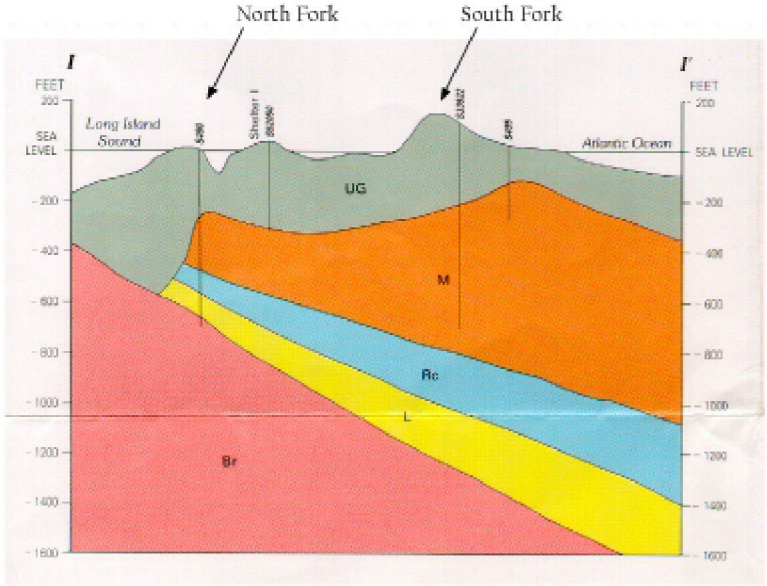
182

0

Source: ESRI WMS; Suffolk County LiDAR, 2007

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



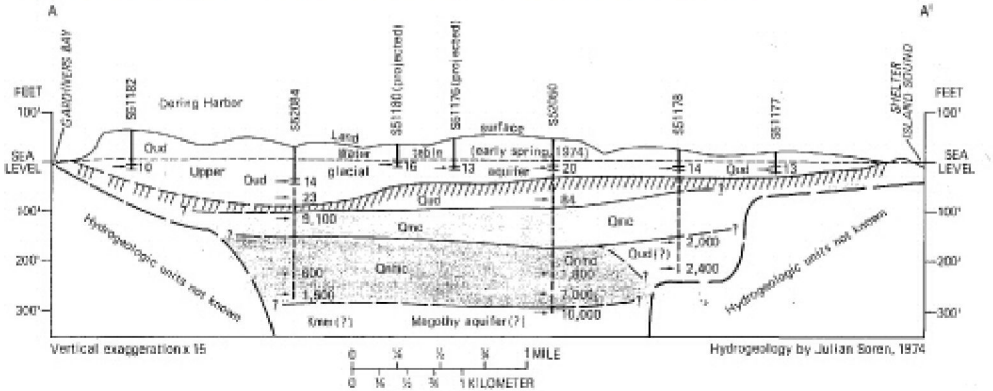
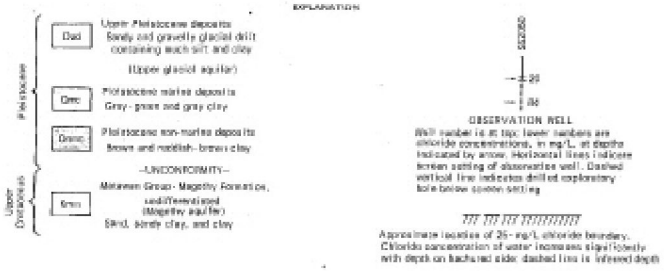


Figure 3.--Hydrogeologic section through Shelter Island.

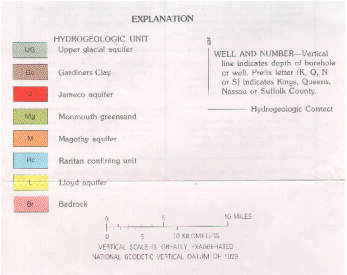


Town of Shelter Island
and
New York Department of State

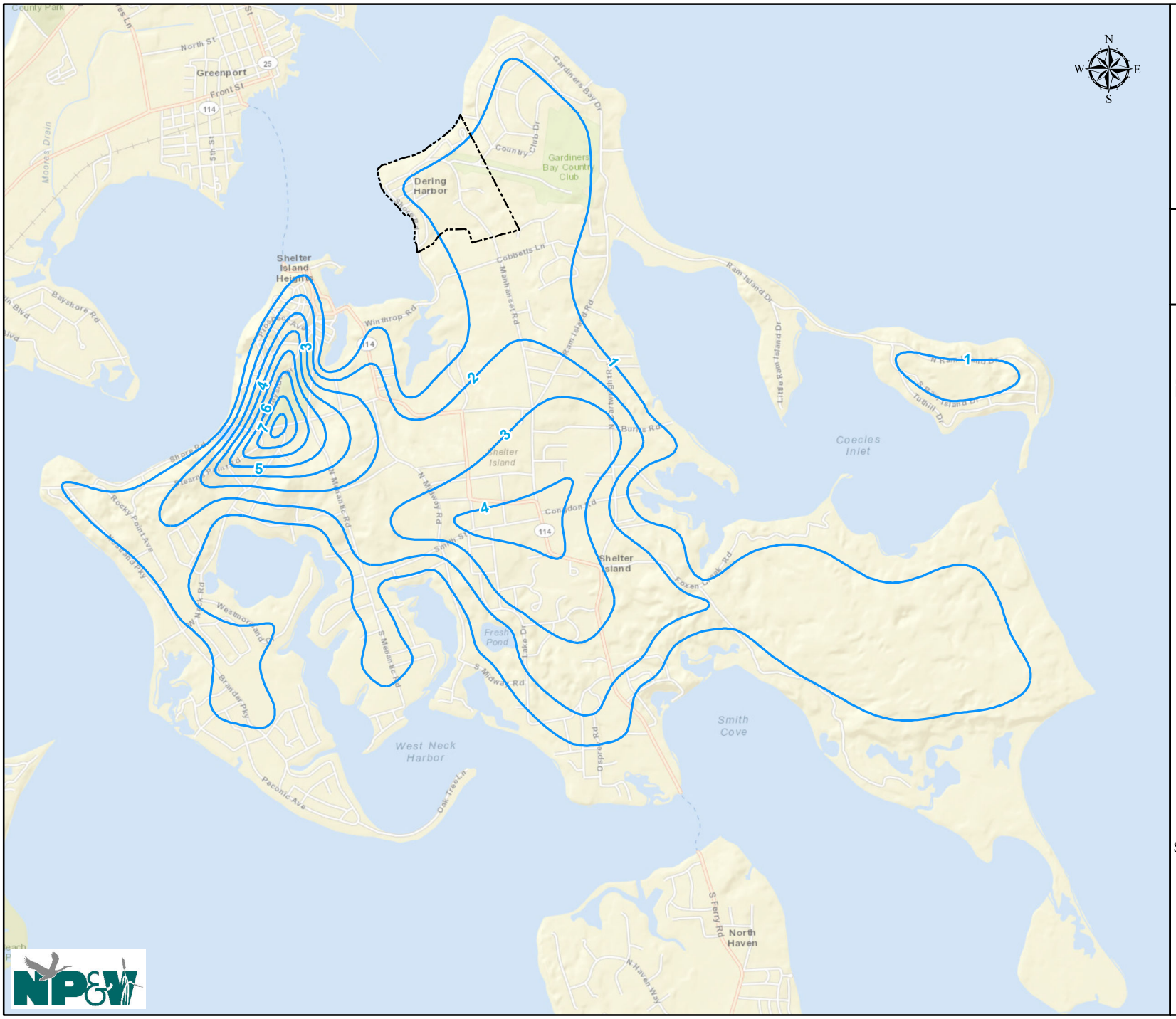
Watershed Management Plan

FIGURE 3
Geologic Cross Sections

Legend



Source: Jensen & Soren; Soren
Scale: Not to Scale



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 4
Water Table Contour Map

Legend

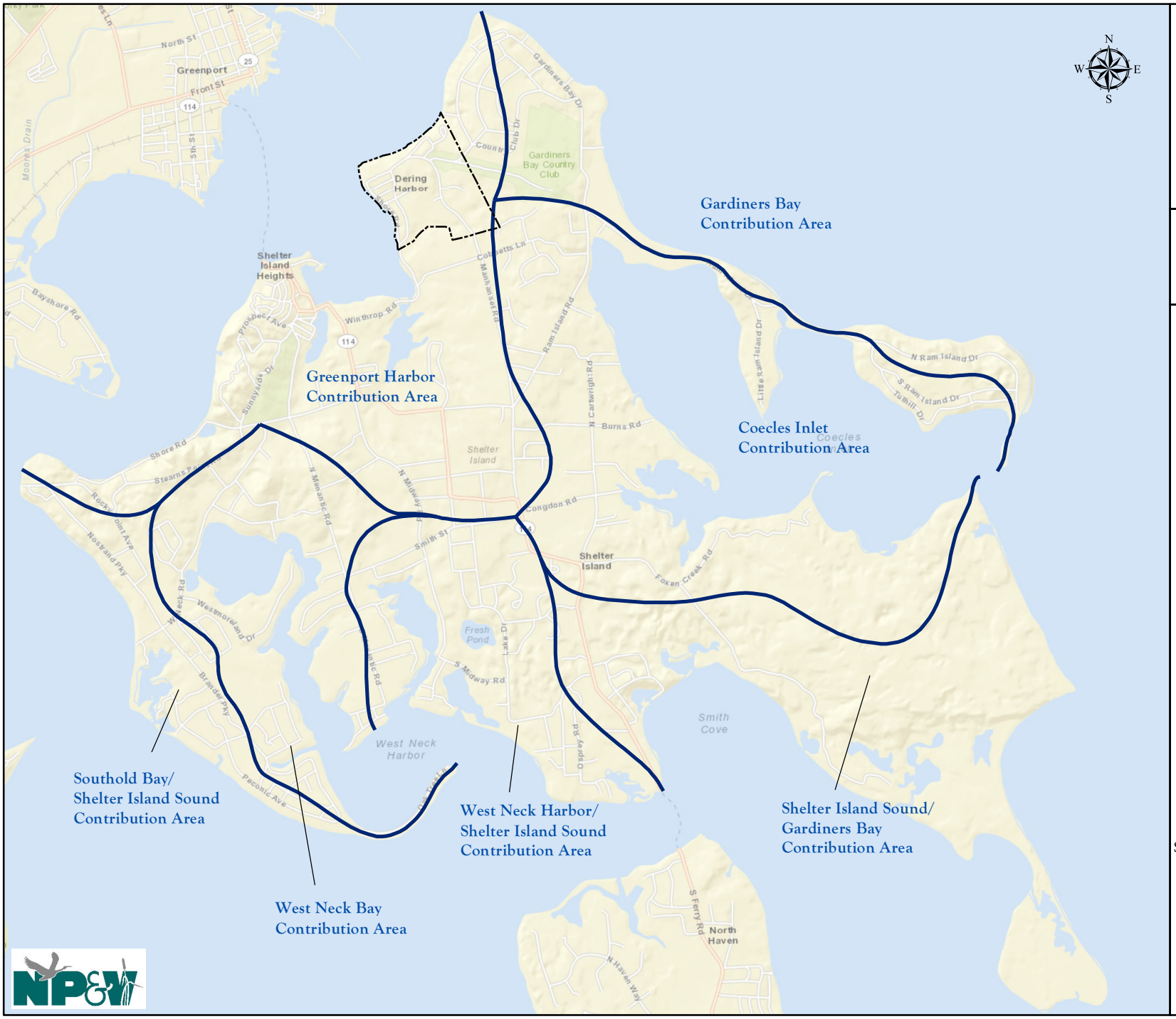
Village of Dering Harbor

Water Table Contour (feet asl)

Source: ESRI WMS; USGS

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island and New York Department of State

Watershed Management Plan

FIGURE 5
Major Groundwater Subwatersheds

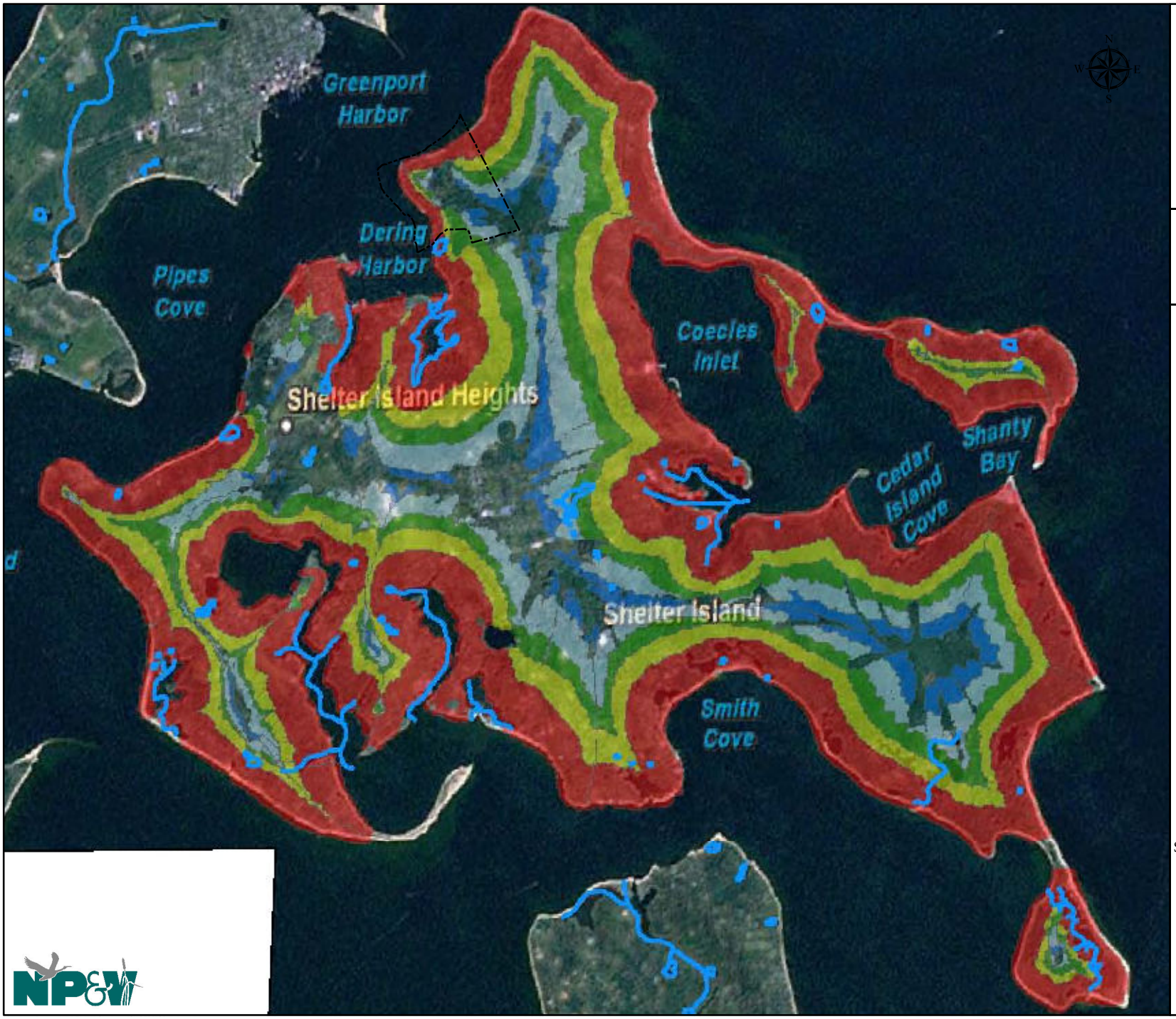
Legend

- Village of Dering Harbor
- Groundwater Divide

Source: ESRI WMS; NYSDOS; NYSDEC

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 6
Groundwater Contributing Area Time of Travel

Legend

Village of Dering Harbor

Legend

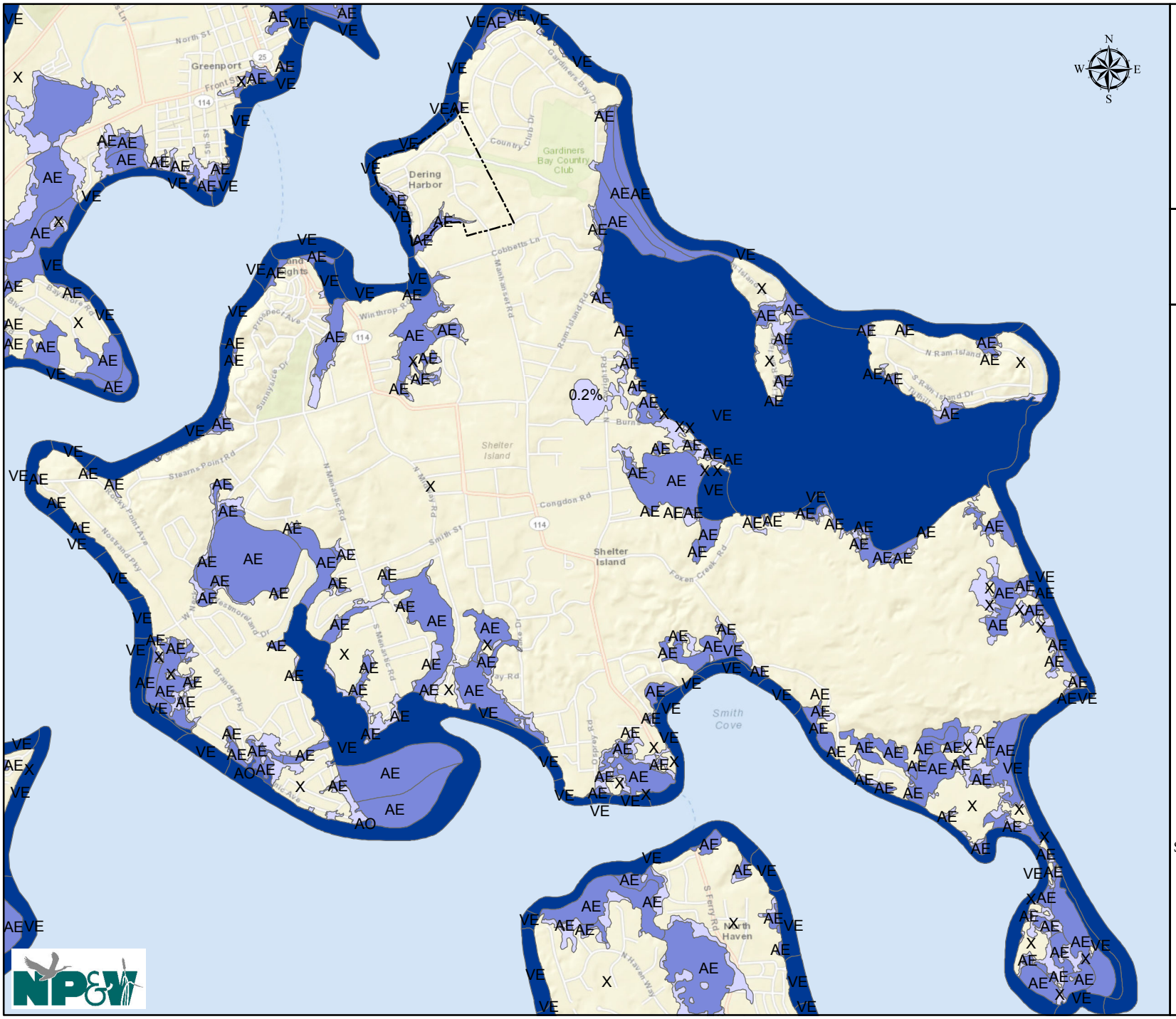
Groundwater Contributing Area Time of Travel (Years)

- >25 - 50 Years
- >10 - 25 Years
- >5 - 10 Years
- >2 - 5 Years
- 0 - 2 Years
- Water Body

Source: SCCWRMP, 2011

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 7

FEMA Flood Map

Legend

- Village of Dering Harbor

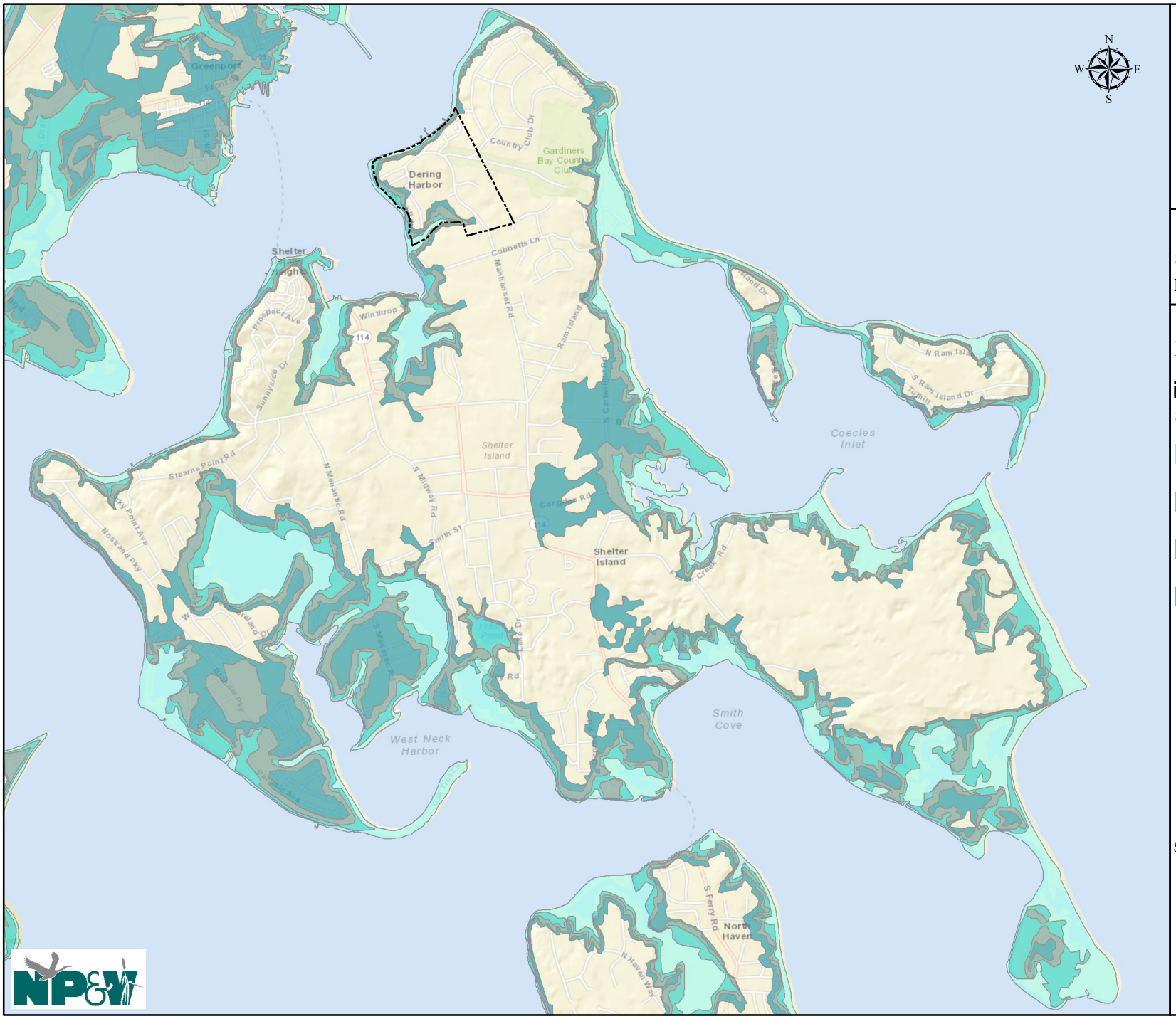
FEMA Flood Zone

- 0.2% Annual Chance of Flood
- AE - 100 Year Flood Zone, Base Flood Elevation Determined
- AO - Subject to 100 Year Shallow Flooding
- VE - 100 Year Flood Zone, Velocity Hazard
- X - Outside of the 500 Year Flood Zone

Source: ESRI WMS; FEMA, 2010

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed
Management Plan

FIGURE 8
Sea, Lake, And Overland Surge From Hurricanes (SLOSH) Map

Legend

Village of Dering Harbor

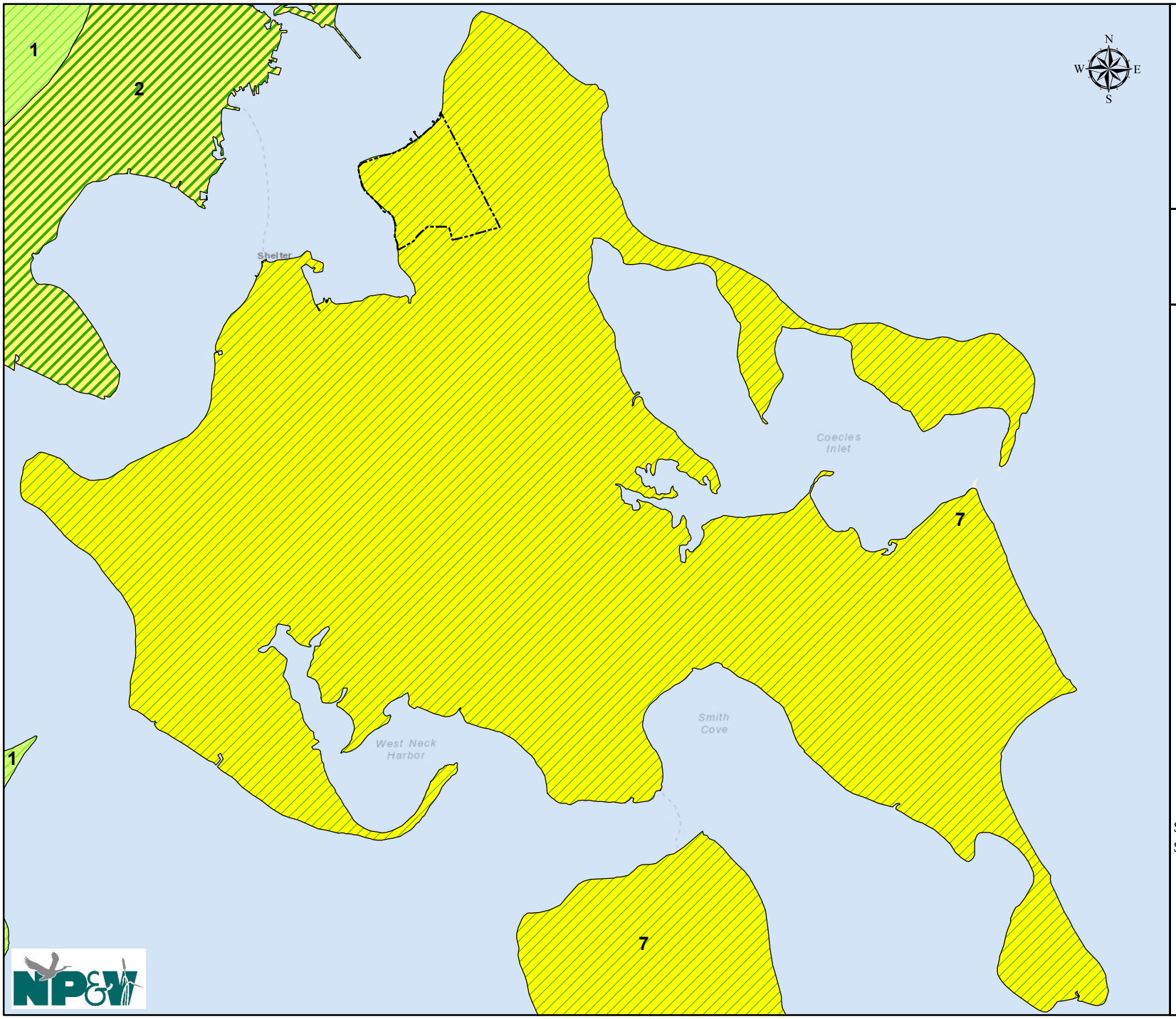
SLOSH ZONE

- 1 - Vulnerable from Category 1 to 5 Hurricanes
- 2 - Vulnerable from Category 2 to 5 Hurricanes
- 3 - Vulnerable from Category 3 to 5 Hurricanes
- 4 - Vulnerable from Category 4 to 5 Hurricanes

Source: ESRI WMS; USACE

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 9

Soil Types

Legend

Village of Dering Harbor

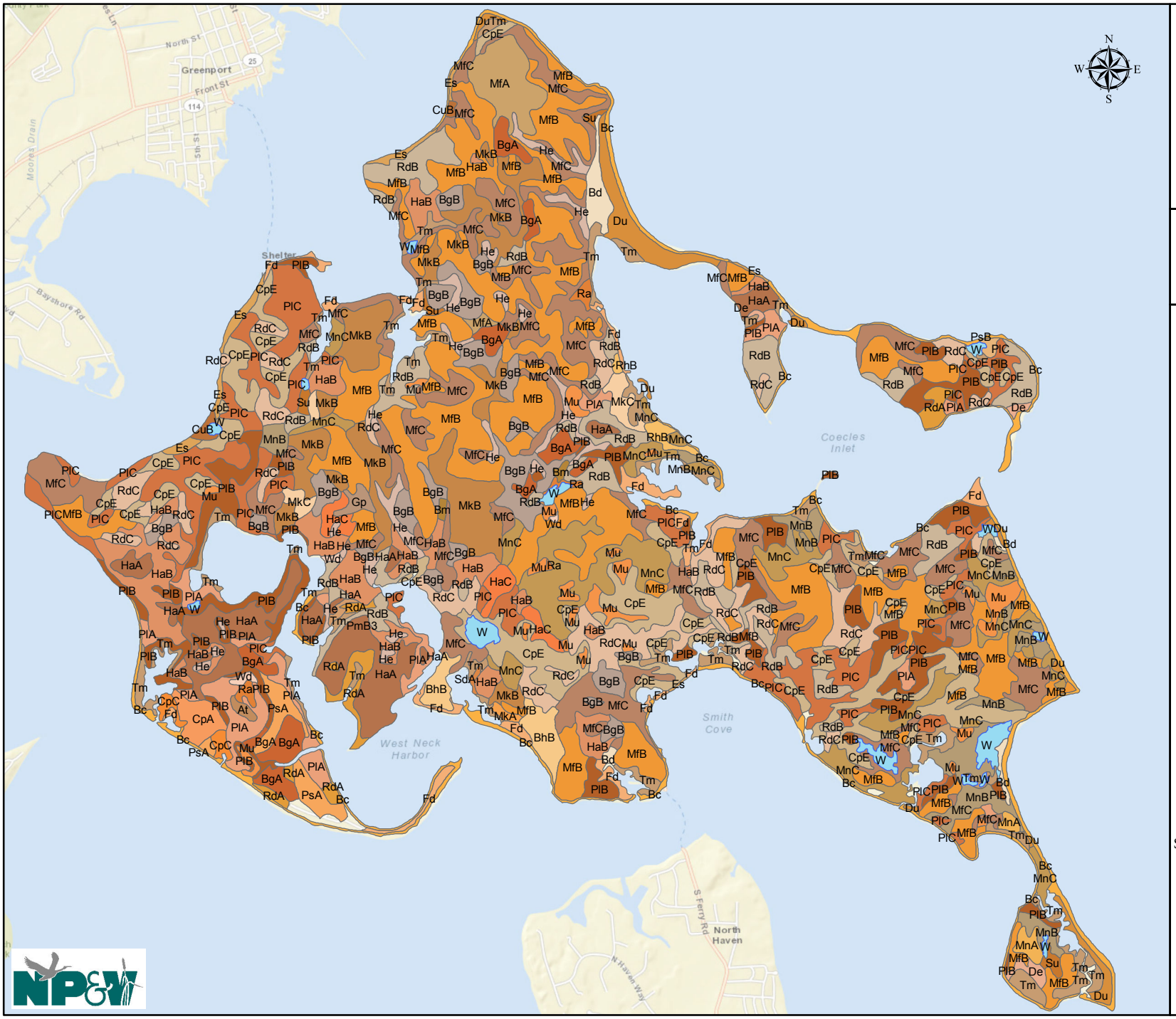
Soil Type

- Carver-Plymouth-Riverhead association: Deep, rolling, excessively drained and well-drained, coarse textured and moderately coarse textured soild on moraines
- Haven-Riverhead association: Deep, nearly level to gently sloping, well-drained, medium-textured and moderately coarse textured soils on outwash plains
- Plymouth-Carver association, rolling and hilly:Deep, excessively drained, coarse-textured soils on moraines
- Dune land-Tidal marsh-Beaches association: Sand dunes, tidal marshes, and beaches of the barrier beach and south shore
- Montauk-Haven-Riverhead association: Deep, nearly level to strongly sloping, well drained to moderately well drained, moderately coarse textured and medium-textured soils on moraines
- Montauk, sandy variant-Plymouth association: Deep, rolling and hilly, excessively drained, coarse-textured soils on moraines

Source: USDA Soil Conservation Services

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



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Watershed Management Plan

FIGURE 10

Soils Map

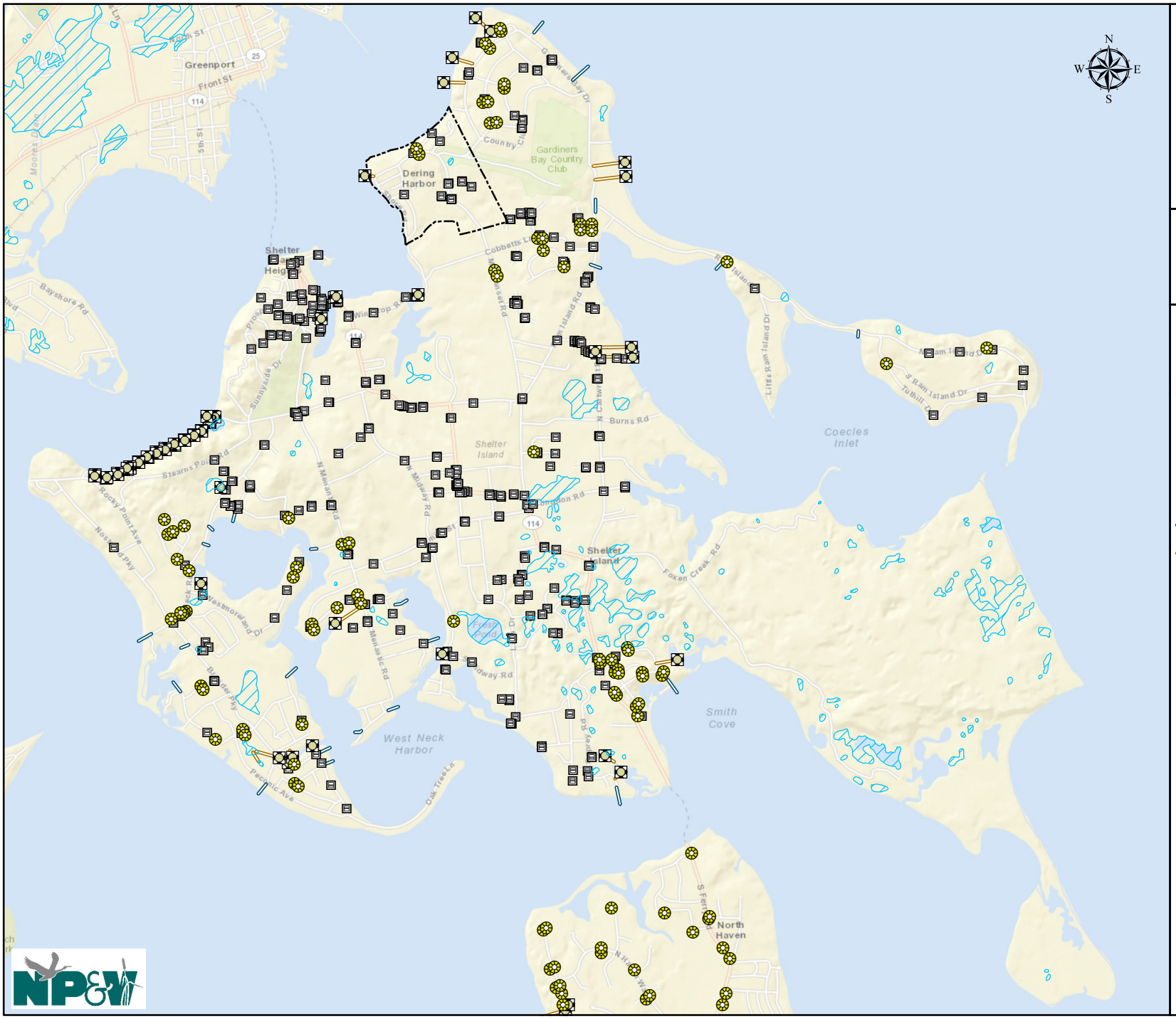
Legend

Soil Type		
At	Gp	PlB
Bc	HaA	PlC
Bd	HaB	PmB3
BgA	HaC	PsA
BgB	He	PsB
BhB	MfA	Ra
Bm	MfB	RdA
CpA	MfC	RdB
CpC	MkA	RdC
CpE	MkB	RhB
CuB	MkC	SdA
De	MnA	Su
Du	MnB	Tm
Es	MnC	W
Fd	Mu	Wd
	PlA	

Source: ESRI WMS; NYSDOS; NRCS SSURGO Database

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
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New York Department of State

Watershed Management Plan

FIGURE 11

Stormwater Infrastructure

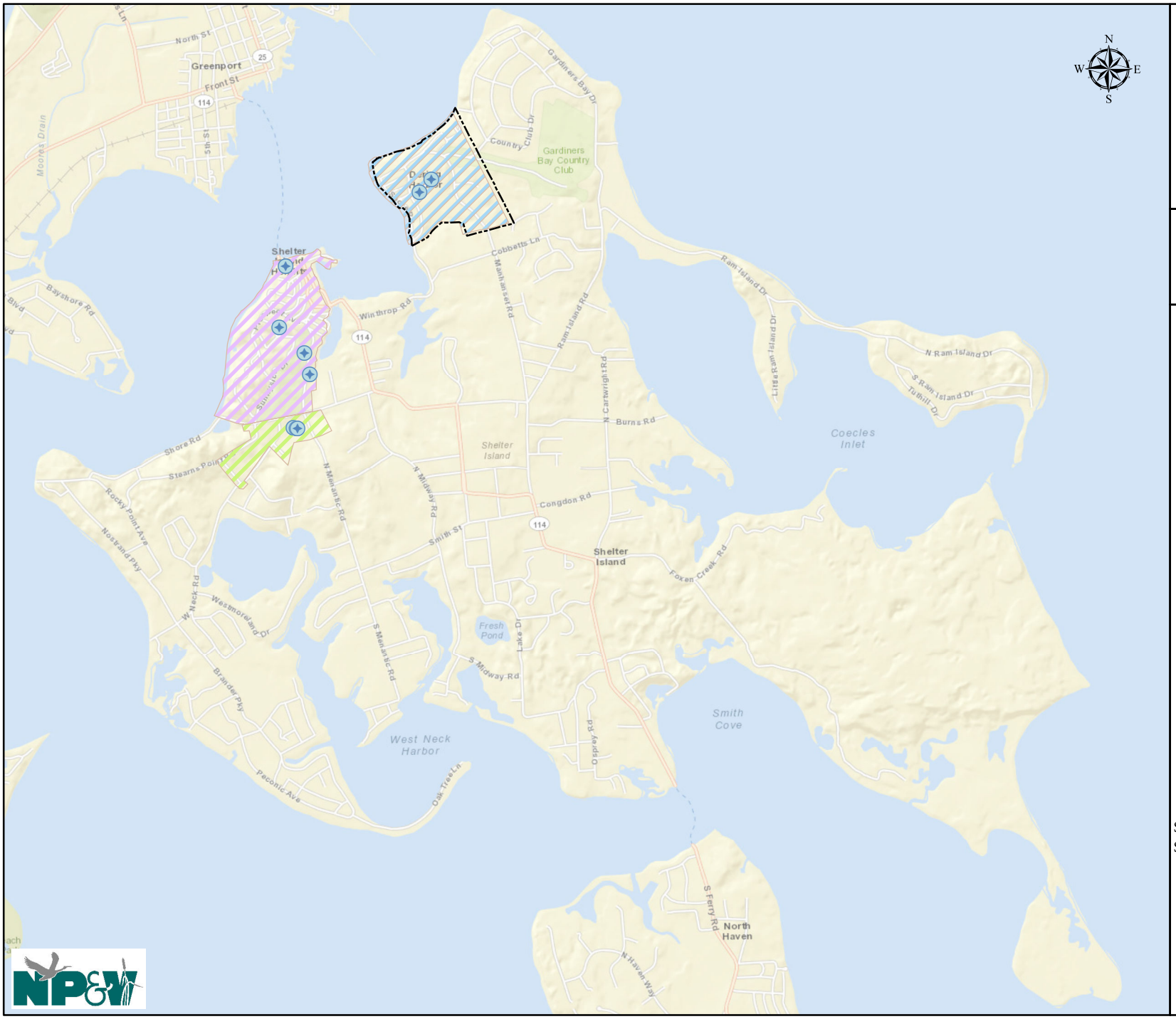
Legend

- Village of Dering Harbor
- NYSDEC Freshwater Wetlands
- Drywells/Leaching Catch Basins
- Outfalls
- Catch Basins
- Road Ends/Direct Overland Flow
- Direct Discharge Pipe

Source: ESRI WMS; NYSDOS; Suffolk County GIS; Shelter Island GIS; Peconic Estuary Program

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 12
Water Districts & Well Locations

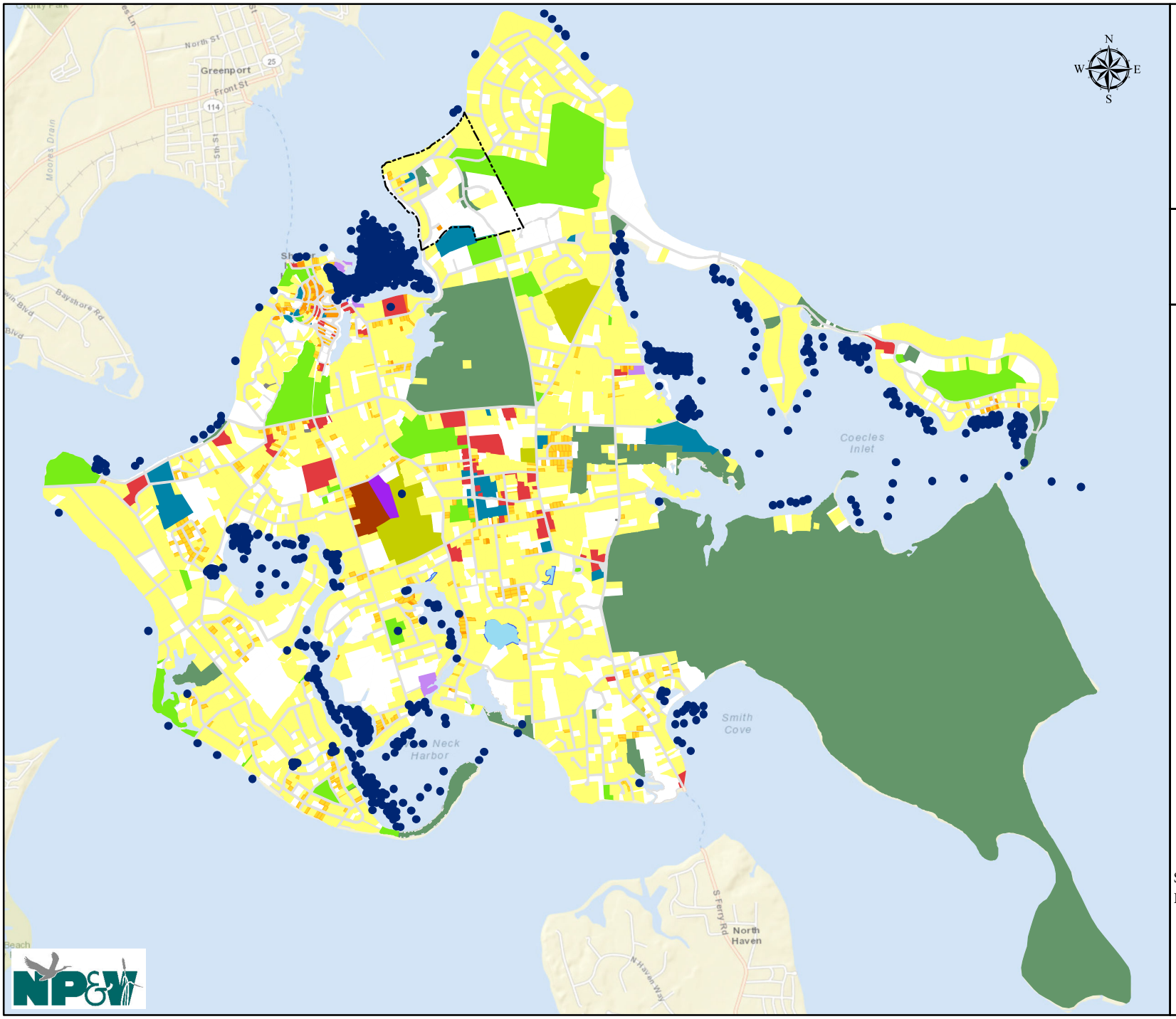
Legend

- Village of Dering Harbor
- Wells
- Dering Harbor Water District
- Shelter Island Heights Water District
- West Neck Water District

Source: ESRI WMS; Town of Shelter Island

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 13

Land Use

Legend

- Village of Dering Harbor
- Town Regulated Moorings

Land Use

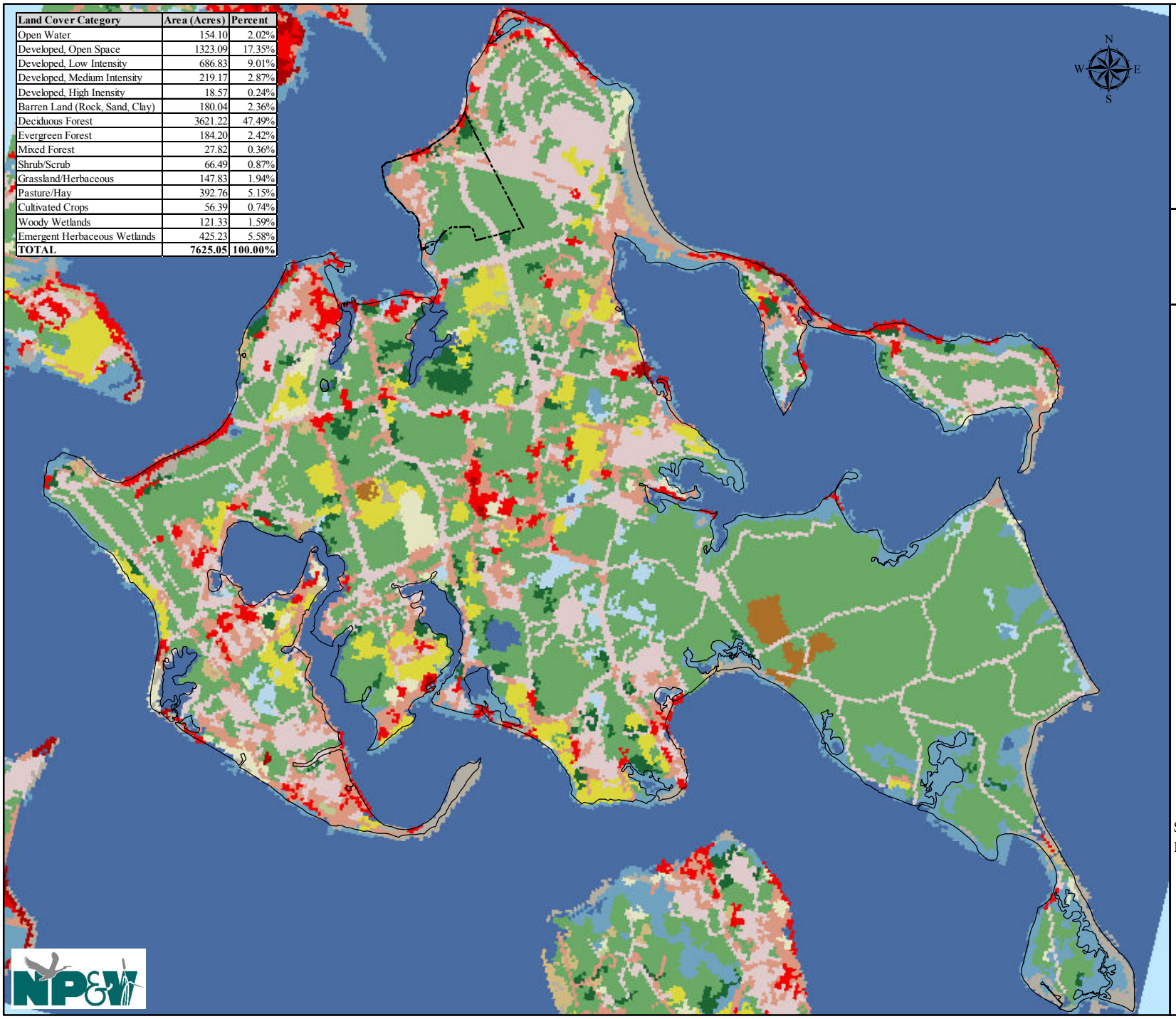
- Agriculture/Nursery/Farm (1.39%)
- Commercial (1.38%)
- High Density Residential (0.26%)
- Industrial (0.14%)
- Institutional (1.34%)
- Landfill (0.35%)
- Low Density Residential (34.64%)
- Marina (0.14%)
- Medium Density Residential (1.96%)
- Parks & Open Space (32.26%)
- Parks & Recreation (5.28%)
- Roadway/Parking Lot (6.10%)
- Surface Water (0.23%)
- Utilities (0.02%)
- Vacant (14.51%)

Source: ESRI WMS; Suffolk County Real Property

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet

Land Cover Category	Area (Acres)	Percent
Open Water	154.10	2.02%
Developed, Open Space	1323.09	17.35%
Developed, Low Intensity	686.83	9.01%
Developed, Medium Intensity	219.17	2.87%
Developed, High Inensity	18.57	0.24%
Barren Land (Rock, Sand, Clay)	180.04	2.36%
Deciduous Forest	3621.22	47.49%
Evergreen Forest	184.20	2.42%
Mixed Forest	27.82	0.36%
Shrub/Scrub	66.49	0.87%
Grassland/Herbaceous	147.83	1.94%
Pasture/Hay	392.76	5.15%
Cultivated Crops	56.39	0.74%
Woody Wetlands	121.33	1.59%
Emergent Herbaceous Wetlands	425.23	5.58%
TOTAL	**7625.05**	**100.00%**



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 14

Land Cover

Legend

Village of Dering Harbor

NLCD Land Cover Classification Legend

- 11 Open Water
- 12 Perennial Ice/ Snow
- 21 Developed, Open Space
- 22 Developed, Low Intensity
- 23 Developed, Medium Intensity
- 24 Developed, High Intensity
- 31 Barren Land (Rock/Sand/Clay)
- 41 Deciduous Forest
- 42 Evergreen Forest
- 43 Mixed Forest
- 51 Dwarf Scrub*
- 52 Shrub/Scrub
- 71 Grassland/Herbaceous
- 72 Sedge/Herbaceous*
- 73 Lichens*
- 74 Moss*
- 81 Pasture/Hay
- 82 Cultivated Crops
- 90 Woody Wetlands
- 95 Emergent Herbaceous Wetlands

* Alaska only

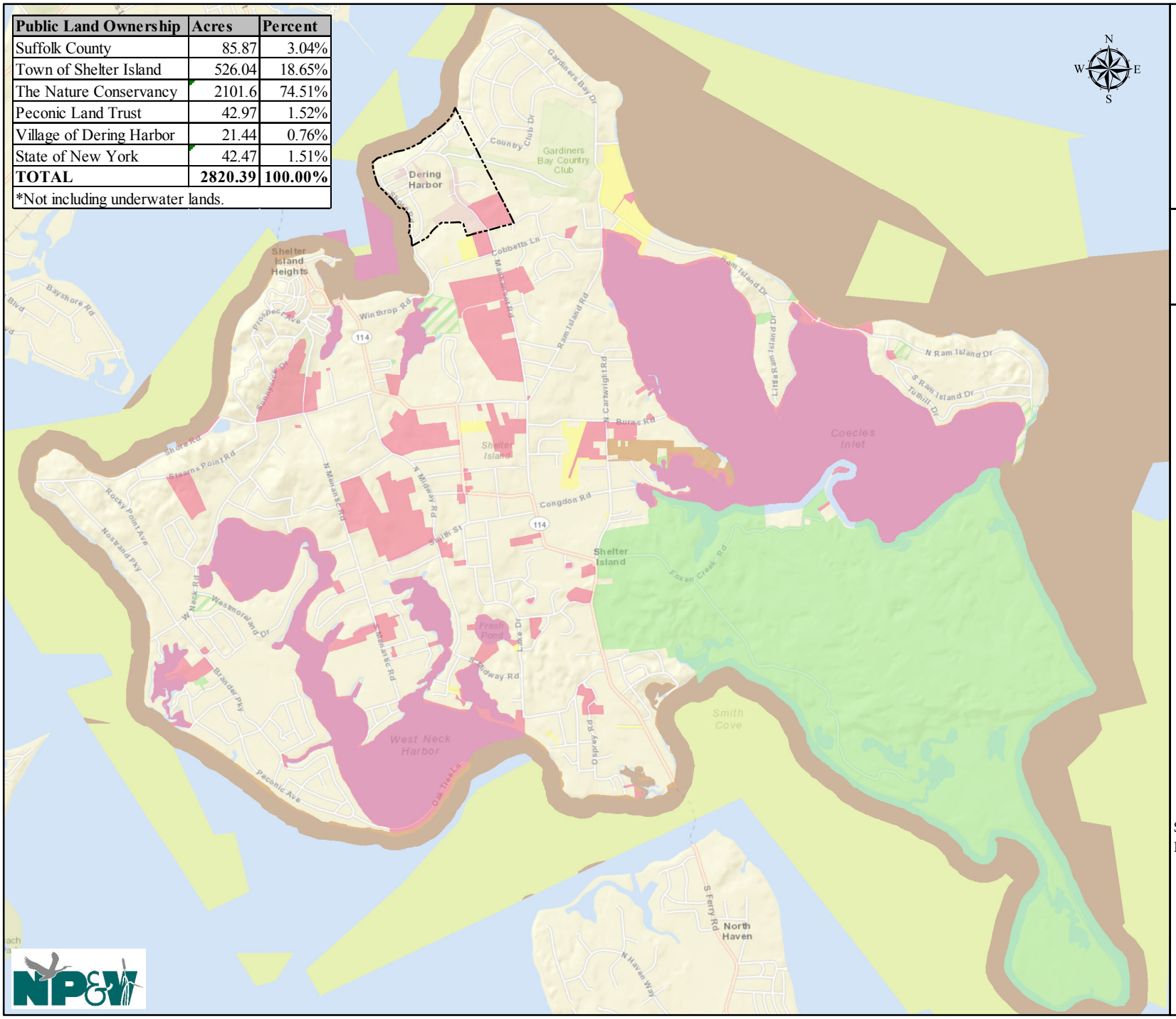
Source: USGS National Land Cover Database, 2006

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet

Public Land Ownership	Acres	Percent
Suffolk County	85.87	3.04%
Town of Shelter Island	526.04	18.65%
The Nature Conservancy	2101.6	74.51%
Peconic Land Trust	42.97	1.52%
Village of Dering Harbor	21.44	0.76%
State of New York	42.47	1.51%
TOTAL	**2820.39**	**100.00%**

*Not including underwater lands.



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 15

Publicly Owned Lands

Legend

Village of Dering Harbor

Publicly Owned Lands

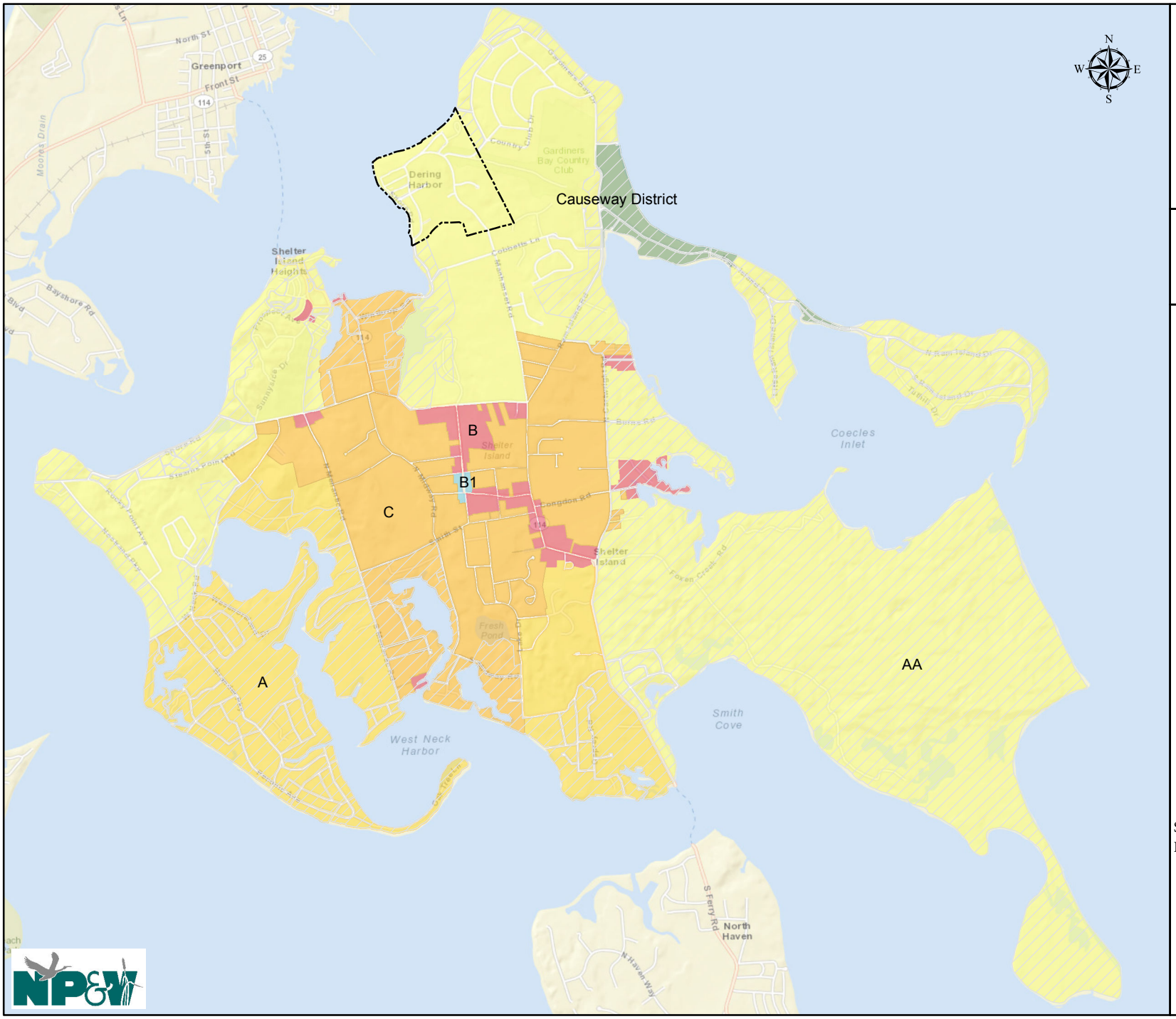
Ownership

- Suffolk County
- Village of Dering Harbor
- The Nature Conservancy
- Peconic Land Trust
- Town of Shelter Island
- State of New York

Source: ESRI WMS; Suffolk County Real Property

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 16

Zoning

Legend

- Village of Dering Harbor
- Near Shore Overlay District

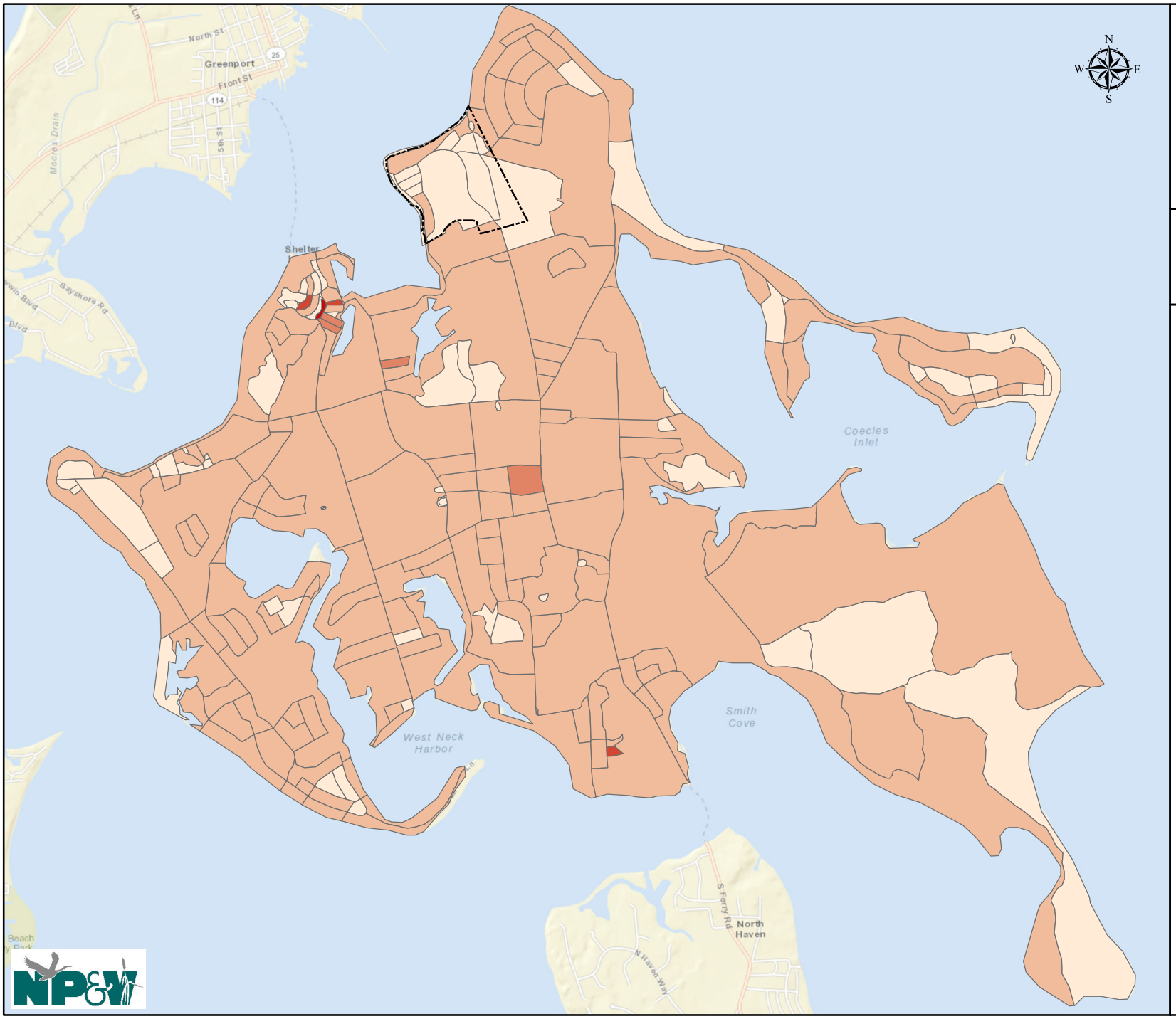
Zoning

- A - Residential (16.37%)
- AA - Residential (62.00%)
- B - Business (2.32%)
- B1 - Restricted Business (0.08%)
- C - Residential (17.94%)
- Causeway District (1.29%)

Source: ESRI WMS; Suffolk County Real Property

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 17

Population

Legend

Village of Dering Harbor

2010 Census Blocks

Population Density (an Index)

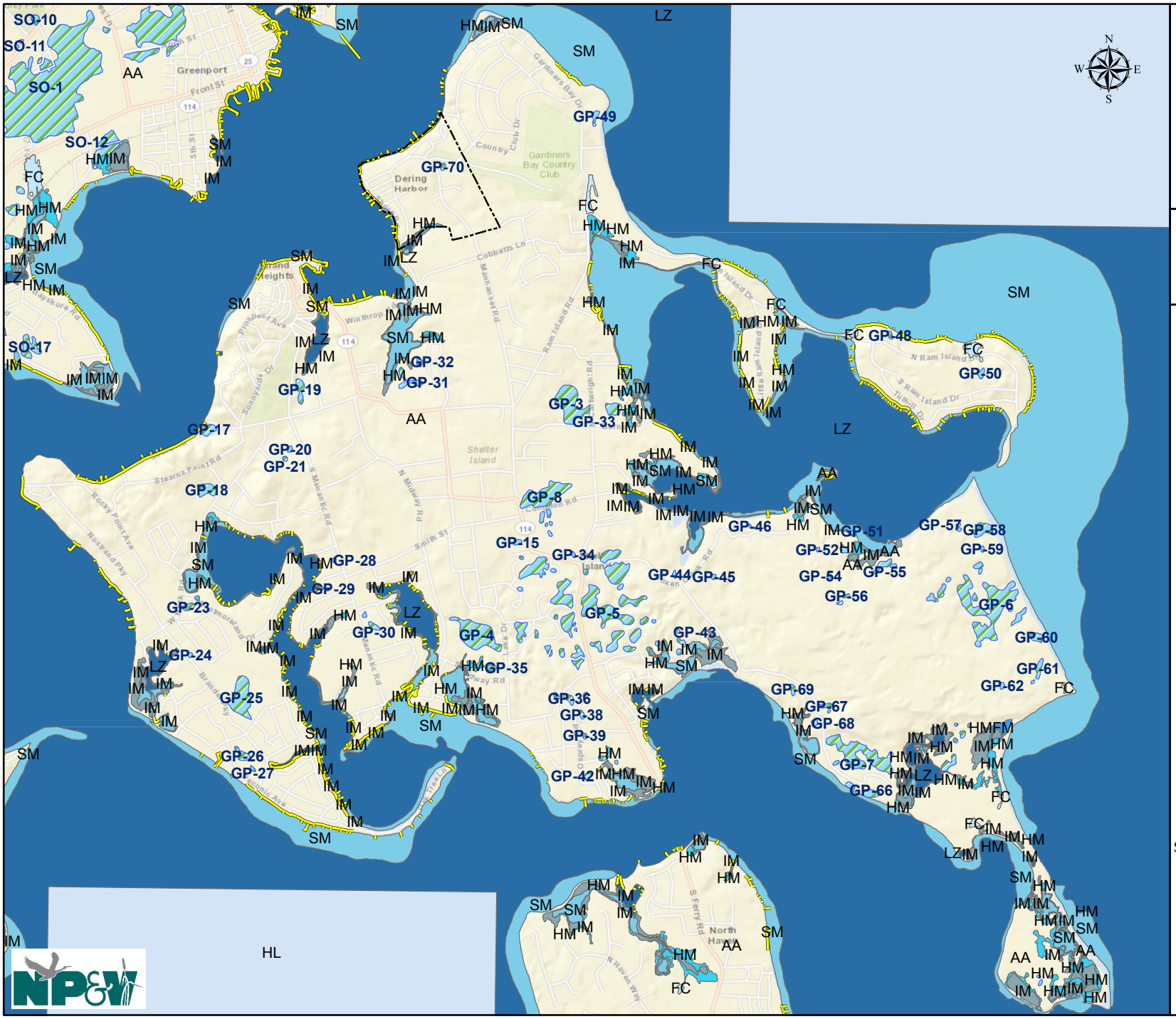
- 0.000000
- 0.000001 - 2.000000
- 2.000001 - 4.000000
- 4.000001 - 6.000000
- 6.000001 - 8.000000

Census Sum
total 2010: 2392
total 2000: 2228
total 1990: 2263

Source: ESRI WMS; NYSDOS; American Fact Finder; Suffolk County GIS

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 18

Wetlands

Legend

- Village of Dering Harbor
- PEP Hardened Shorelines & Docks (2000)
- NYSDEC Freshwater Wetlands

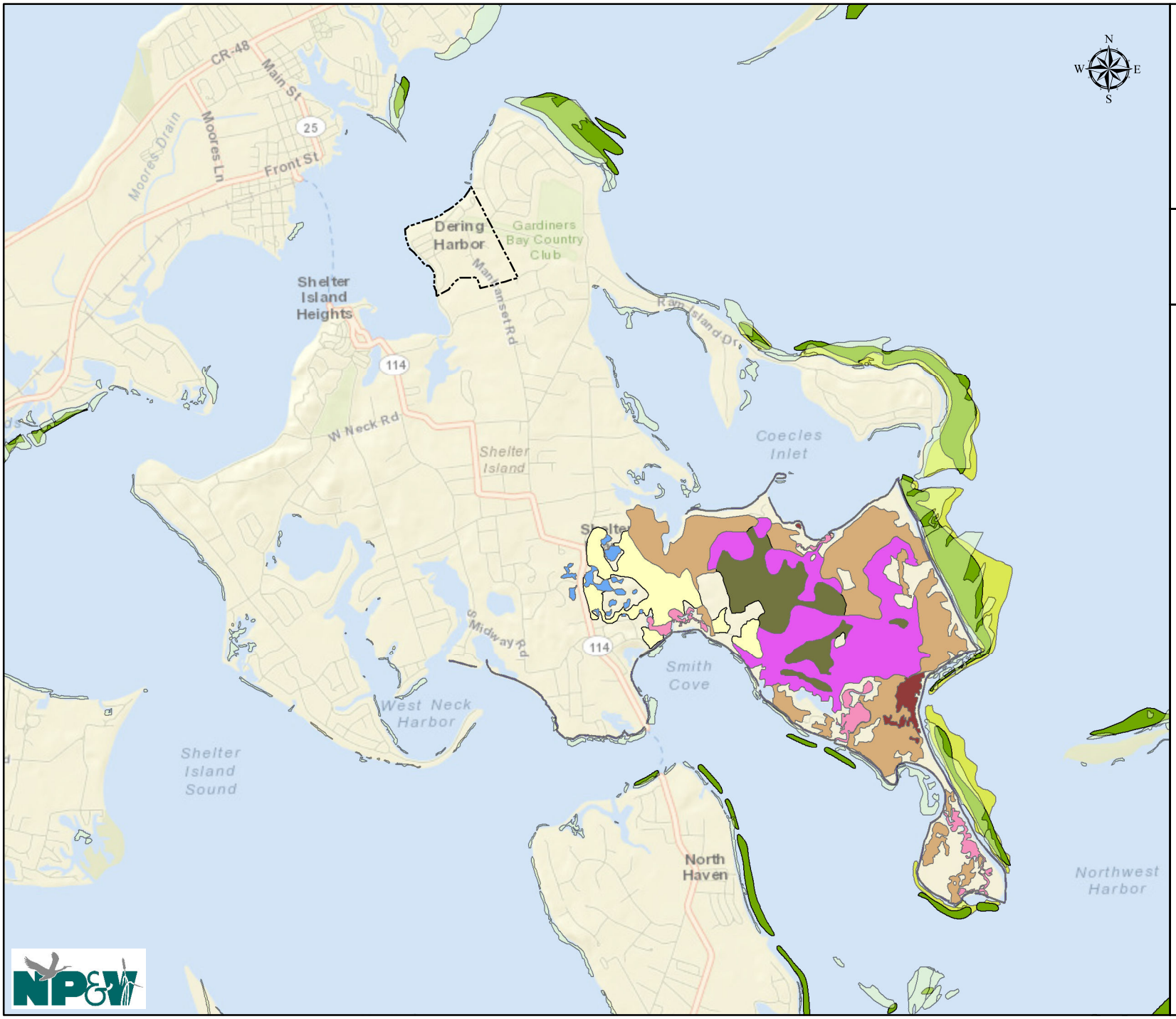
NYSDEC Tidal Wetlands

- DS - Dredge Spoil
- FC - Formerly Connected
- FM - Fresh Marsh
- HM - High Marsh
- IM - Intertidal Marsh
- LZ - Littoral Zone
- SM - Shoals, Bars & Mudflats

Source: ESRI WMS; NYSDOS; NYSDEC

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island and New York Department of State

Watershed Management Plan

FIGURE 19
Significant Natural Habitats

Legend

- Village of Dering Harbor
- Submerged Aquatic Vegetation (2000)
- 1994 Eelgrass Beds

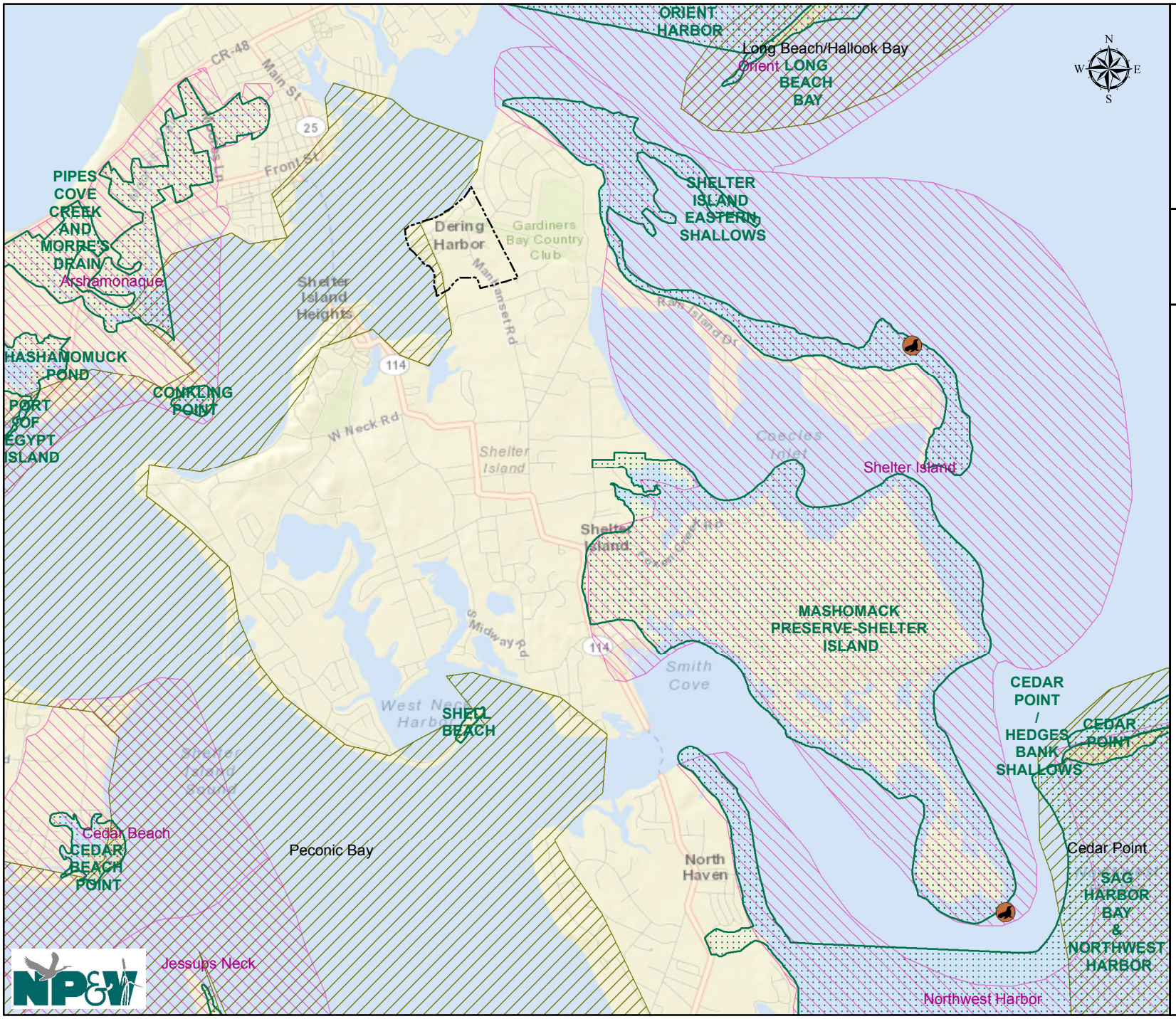
NYNHP Significant Natural Communities

- Coastal oak-beech forest
- Coastal oak-hickory forest
- Coastal salt pond
- Highbush blueberry bog thicket
- Marine eelgrass meadow
- Maritime beach
- Maritime post oak forest
- Saltwater tidal creek
- Successional maritime forest

Source: ESRI WMS; NYSDOS; NYSDEC; PEP, USF&WS

0 5,000 Feet

1 inch = 5,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 20
Resource Management Areas

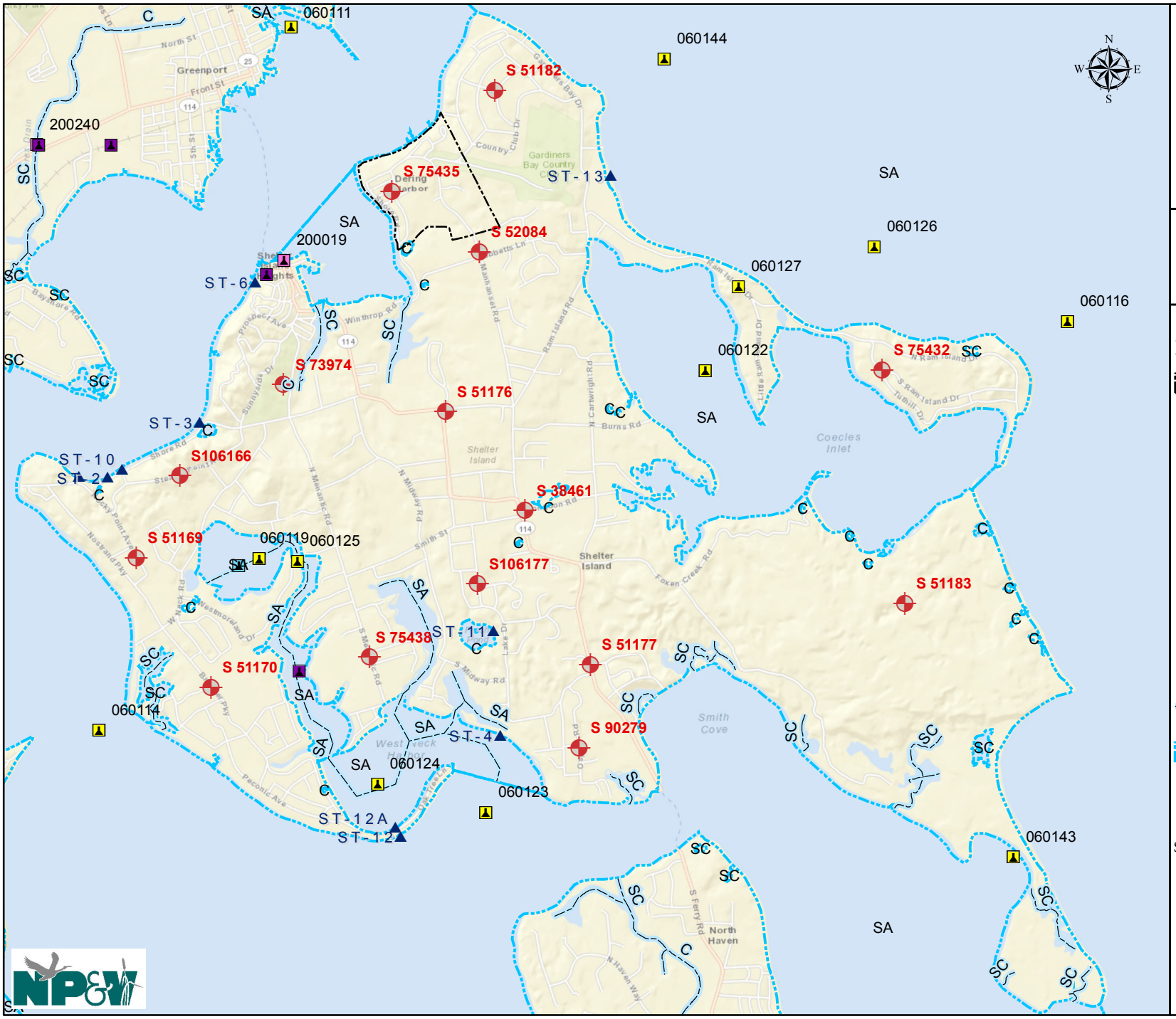
Legend

- Village of Dering Harbor
- Wintering Harbour Seal Sites
- NYS Significant Fish & Wildlife Habitat
- PEP Critical Natural Resource Areas
- Colonial Waterbird Use Area

Source: ESRI WMS; NYSDOS; NYSDEC; PEP, USF&WS

0 — 5,000 Feet

1 inch = 5,000 feet



Town of Shelter Island and New York Department of State

Watershed Management Plan

FIGURE 21
Surface Water Quality Classifications & Sampling Stations

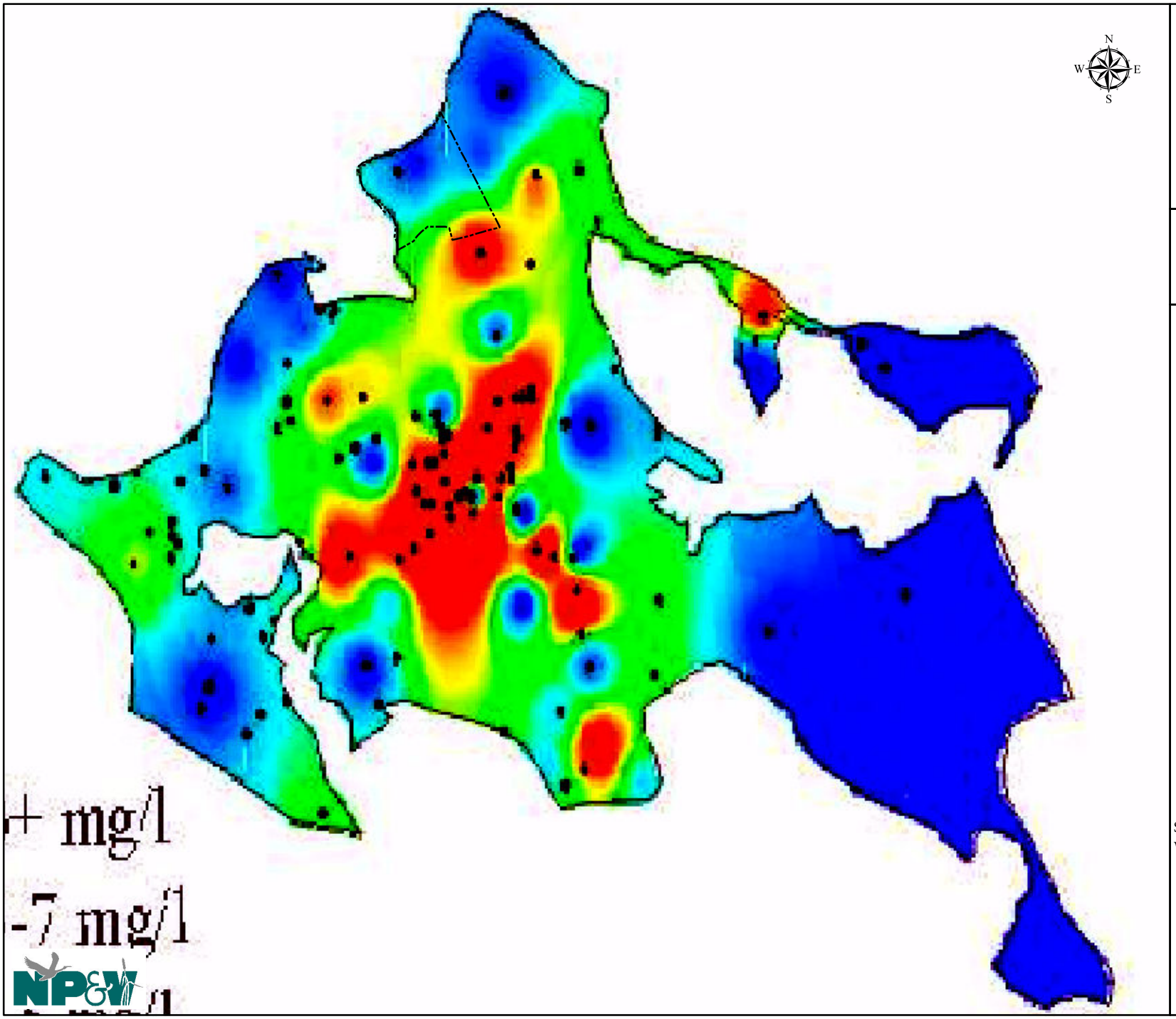
Legend

- Village of Dering Harbor
- SCDHS Bathing Beach Sample Stations
- USGS Groundwater Monitoring Wells
- SCDHS Water Quality Monitoring Stations
- Water Quality Monitoring Stations - 2010
- Shelter Island Water Quality Monitoring Station
- SCDHS Point Source Water Quality Monitoring Station
- NYS Water Classification - Streams
- NYS Water Classification - Estuaries, Lakes & Ponds

Source: ESRI WMS; NYSDOS; NYSDEC

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed
Management Plan

FIGURE 22
Interpolated
Nitrate Levels

Legend

Village of Dering Harbor

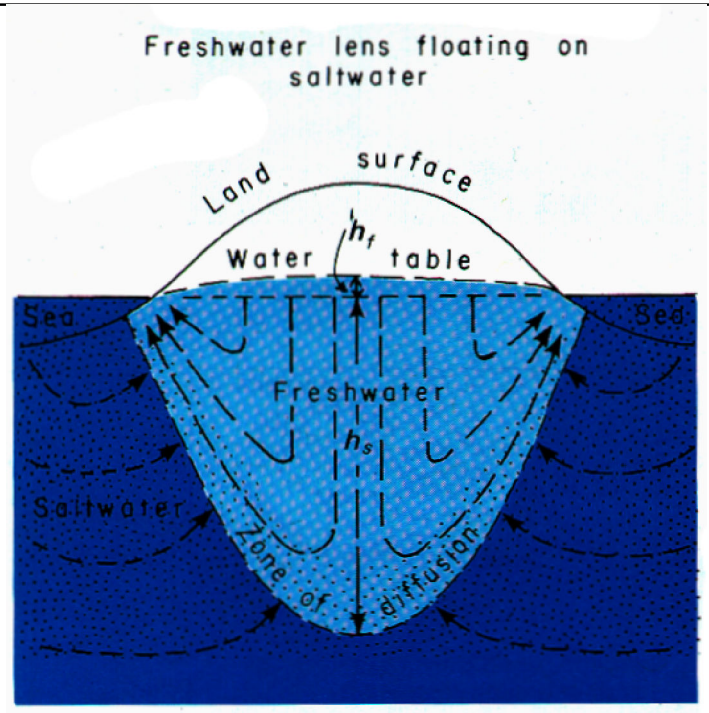
Poor: › 10 ppm
Marginal: 6-10 ppm
Good: 1-6 ppm
Ambient: ‹1 ppm

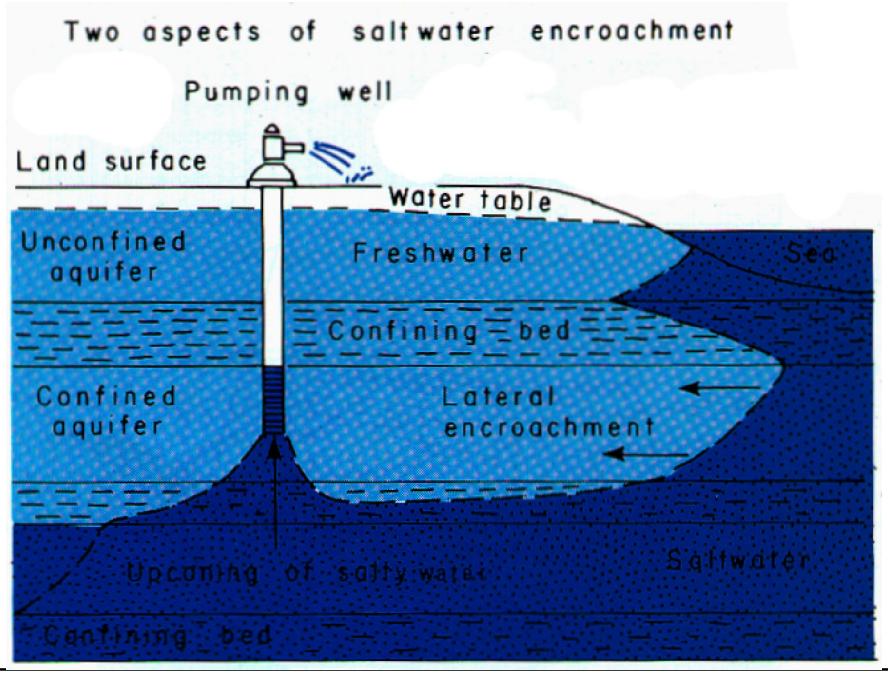
Red 7-10+ mg/l
Yellow 5-7 mg/l
Green 2-5 mg/l
Blue ‹ 2 mg/l

Source: Suffolk County Office of Water Resources, CDM

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet





N
W
E
S

Town of Shelter Island
and
New York Department of State

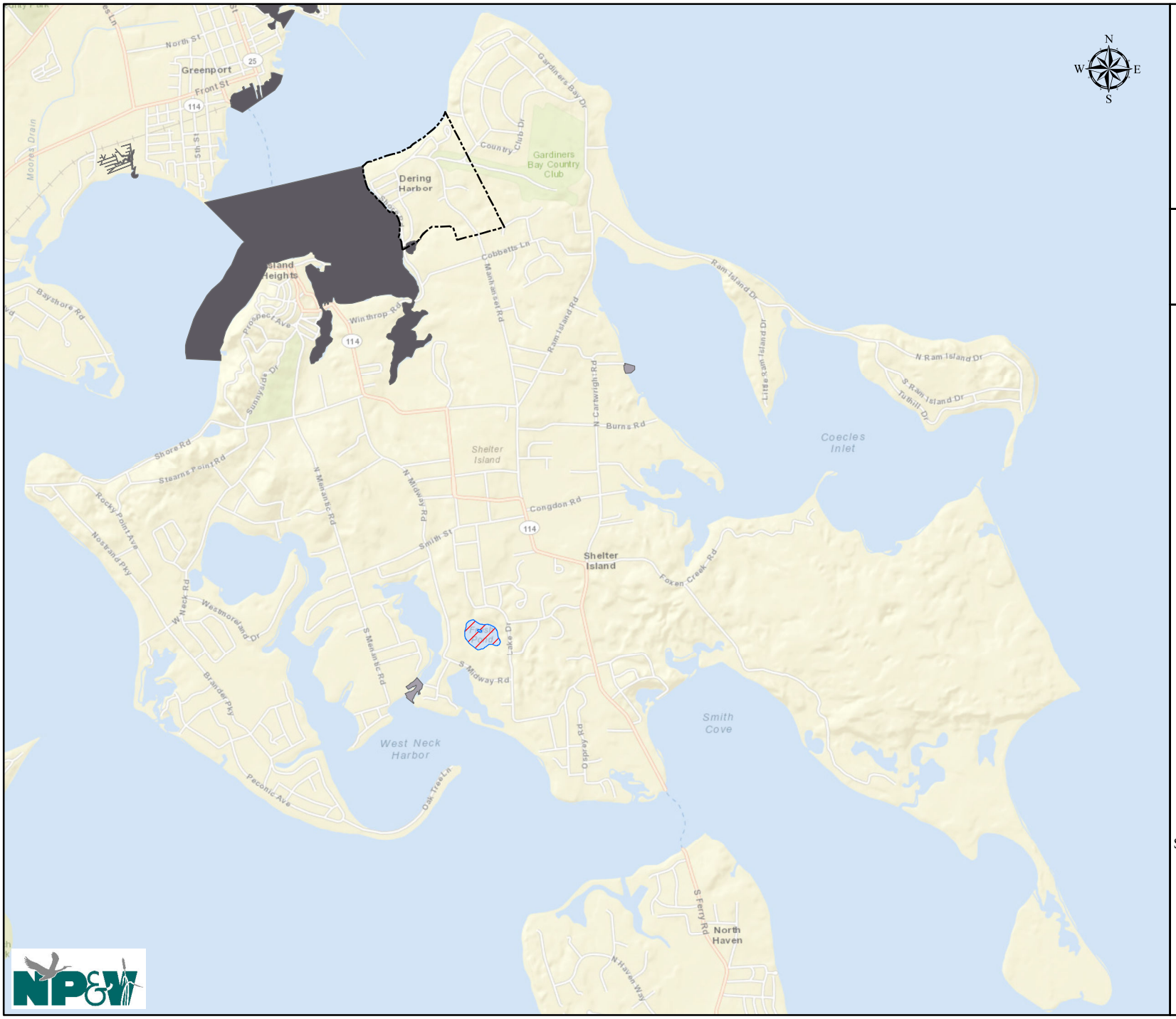
Watershed Management Plan

FIGURE 23
Saltwater Encroachment & Upconing

Source: R. Heath, 1998, USGS

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet



Town of Shelter Island
and
New York Department of State

Watershed Management Plan

FIGURE 24

Known Impairments

Legend

- Village of Dering Harbor
- NYS 303 (d) Impaired Waterbodies
- Fresh Pond
- Shellfish Closure Areas
  - Closed
  - Holiday
  - Seasonal

Source: ESRI WMS; NYSDEC; NYS 2012 303(d) List

0 1,000 2,000 3,000 4,000 Feet

1 inch = 4,000 feet

APPENDIX A

Parcels Targeted for Acquisition

Town of Shelter Island Community Preservation Project Plan
List of Targeted Property/Parcel Acquisitions (All Properties/Parcels are located in the Town of SI, Suffolk County)

Locally Accepted Name	Category	Tax Map Parcel	Type of Acquisition	Water Body Impacted	Summary of Water Quality Benefits	Acreage	Recreational Activities Existing	Recreational Activities Proposed
1. Fiske Estate	1	0700 08-1-5.2	Purchase/Easement	Gardiners Creek	~ half of Gardiner's Creek shoreline borders the site. Fresh/tidal wetlands. Important aquifer protection.	241	Several colonial homes	No change
2. Klen's Airstrip	1	0700 015-4-102	Under Contract T/C	Island's Main Aquifer	Long-term protection of water supply.	41.5	Grass airstrip/ no fuel/mechanical	No change
3. Perlitz Daniel Lord	1	0700 018-2-19	Purchase/Easement	W. Neck Bay Aquifer	Salt water wetlands, over large aquifer	22.5	One home	No change
4. Nicklin	1	0700 008-3-43.5	Purchase/Easement	Main Aquifer/Fresh WW	Protect quality/quantity of Island waters	13.4	Open space	No change
5. McDonell S. Midway	1	0700 23-1-30 33.1; 33.2; 34	Purchase/Easement	Dickerson Creek	Uplands & wetlands, 40% of Dicerson Creek shoreline Near Wades Beach.	30	Two home, beach, wetlands	No change
6. Dorsey	1	0700-07-04-78	In Contract	Gardiners Creek		3.7		
7. Fallert	1	0700 13.1-14.1 13-1; 15-2	Purchase	Aquifer	Protection of aquifer	62.5	Open space	No change
8. St. Gabes Remainder	1	0700 16-1-5 15-4-117 15-4-118.1 15-4-118.2	Purchase/Easement	Coecles Harbor Congdon Creek	Wetland/Aquifer Protection	34	Several buildings Open space	No change
9. Brush-Ram Is Rd	1	0700 8-3-17.2	Purchase/Easement	Coecles Harbor Congdon Creek	Coecles Harbor/Wetlands	10.25	One home, woods	No change
10. Wendy Murdoch Cartwright Rd	1	0700 19-2-98	Purchase/Easement	Main Aquifer	Over portions of main aquifer	16.8	Open space	No change
11. Dietrich, Ram Is Causeway	1	0700 4-1-7	Purchase/Easement	Wetland/Beach Coecles Harbor	Wetland & Beach on Coecles Harbor	9.6	Beach recreation	No change
12. Norton Cartwright	1	0700 15-4-108	Purchase/Easement	Aquifer	Over Main Aquifer	13.7	Open space	No change
13. Lang (next to Ryan)	1	0700 18-3-4	Purchase/Easement	Aquifer	Water sensitive area of Island	11.7	Private club	Same or open space
14. Perlman open space	1	0700 13-2-32.1	Purchase/Easement	Aquifer	Water sensitive area of Island	20.3	Open space	No change
15. Island Boatyard undeveloped	1	0700 22-2-23.3	PDR	Menantic Creek Aquifer	Menantic Creek & water sensitive part of Island	12	Boat yard/marina	No change
16. Zeuschner 2 Cobbets Lane	2	0700 7-7-31	PDR	Deering Harbor Wetlands	Pond & wetland on property On Deering Harbor	2	Open space	Open space with gazebo
17. Stiber	2	0700 18-3-10	Conservation Easement	Main Aquifer	Mostly vacant land over main Aquifer	9.2	One dwelling	Same
18. Harms Cobbets Lane Fire House	1	0700-3-2-49.1	Purchase	Aquifer		10.5		
19. Chiamante	1	0700-23-2-10	Purchase	Aquifer		10.7		
20. Polonecki Hilo	1	0700-14-2-12	Purchase	Aquifer		17.8		

SCHEDULE 1

21. Brush Crescent Beach	I	0700-14-1-11	Purchase	Peconic Estuary	10.5

APPENDIX B

NYSDOS Significant Coastal Fish &
Wildlife Habitat Assessments

COASTAL FISH & WILDLIFE HABITAT ASSESSMENT FORM

Name of Area:	**Mashomack Preserve - Shelter Island**
Designated:	**March 15, 1987**
Date Revised:	**May 15, 2002**
County:	**Suffolk**
Town(s):	**Shelter Island**
7½' Quadrangle(s):	**Greenport, NY**

Assessment Criteria

Ecosystem Rarity (ER)--the uniqueness of the plant and animal community in the area and the physical, structural, and chemical features supporting this community.

ER assessment: Undeveloped marine coastal ecosystem is rare in New York State. 64

Species Vulnerability (SV)--the degree of vulnerability throughout its range in New York State of a species residing in the ecosystem or utilizing the ecosystem for its survival.

SV assessment: Osprey (SC) nesting and feeding. Piping plover (E,T-Fed) nesting. Occasional least tern (T) nesting. Calculation: 36 + (25/2) + (16/4) = 52.5

Human Use (HU)-- the conduct of significant, demonstrable commercial, recreational, or educational wildlife-related human uses, either consumptive or non-consumptive, in the area or directly dependent upon the area.

HU assessment: Recreational and educational uses important to residents of Long Island. 25

Population Level (PL)--the concentration of a species in the area during its normal, recurring period of occurrence, regardless of the length of that period of occurrence.

PL assessment: The second largest concentration of nesting osprey in the State of New York. 16

Replaceability (R)--ability to replace the area, either on or off site, with an equivalent replacement for the same fish and wildlife and uses of those same fish and wildlife, for the same users of those fish and wildlife.

R assessment: Irreplaceable. 1.2

Habitat Index = [ER + SV + HU + PL] = 157.5 **Significance = HI x R = 189.0**

NEW YORK STATE
SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT
NARRATIVE

MASHOMACK PRESERVE

LOCATION AND DESCRIPTION OF HABITAT:

Mashomack Preserve is located between the north and south forks of Long Island in the Town of Shelter Island, Suffolk County (7.5' Quadrangle: Greenport, NY). The area consists of approximately 2,200 acres of land owned by the Nature Conservancy and some adjacent lands located on the southeastern peninsula of Shelter Island. The New York State Department of Environmental Conservation owns approximately 40 acres of this area on the north side of Congdon's Creek. The habitat includes eelgrass beds, coastal marshes, freshwater wetlands, ponds, beaches, dunes, bluffs, and a large relatively undisturbed forest, including excellent examples of coastal oak-beech, coastal oak-hickory, and maritime post oak communities.

FISH AND WILDLIFE VALUES:

Mashomack Preserve is a rare and outstanding example of undeveloped marine coastal ecosystems in New York. Large tracts of undisturbed habitat such as the Mashomack Preserve are essential for the survival of many species of wildlife. The large forested area (predominantly oak, hickory, and beech), approximately 1,200 acres, is significant for its size alone. Such areas of mature deciduous forest are rare on Long Island. The extensive tidal, freshwater, and brackish wetlands, as well as the high quality upland habitats, support many species of wildlife. The shallows to the east of Mashomack support important eelgrass beds.

Mashomack Preserve contains the second largest concentration of nesting osprey (SC) in New York State. In 1983, 17 pairs of osprey were reported nesting in the area. There is potential for a larger population to exist here if the area remains relatively undisturbed. Piping plover (E, T-Fed) nested at Mashomack Point and Gibson's Beach sporadically between 1985 and 1992; from 1992-1996 this species has been documented each breeding season, ranging in concentration from 2-5 pairs. Gibson's Beach occasionally provides nesting grounds for least tern (T) and is an important feeding area for nearby colonies of glossy ibis, herons and egrets. Diamondback terrapin utilize the tidal areas and lay eggs in the sandy creek banks throughout the area. This area may provide important breeding habitat for horseshoe crab, but additional documentation is required.

The tidal marsh area, and adjacent open waters, are used extensively by wintering waterfowl. An average concentration of 98 mallard, 1090 American black duck, 128 merganser, and smaller numbers of goldeneye, bufflehead, Canada goose, and old squaw occur annually. Other species that have occasionally been observed by winter aerial surveys include American widgeon, scoters, and scaup. Nearshore bay waters also support large numbers of wintering common loon (SC) as well as a few harbor seals. The freshwater wetlands provide habitat for nesting wood ducks, and the first

record of hooded merganser nesting on Long Island came from the Mashomack Preserve in 1980. Two freshwater ponds at Mashomack support populations of the rare damselfly Rombur's forktail (*Ischnura ramburii*). The large tracts of forest land on the Mashomack Preserve are necessary for the continued nesting of such species as great-horned owl, red-tailed hawk, and wild turkey.

One of the largest deer herds on eastern Long Island also exists here. This deer population has been carefully managed by the Department of Environmental Conservation, including an annual controlled deer hunt for over 12 years.

The New York Natural Heritage Program has documented occurrences of white milkweed (T), seabeach knotweed (*Polygonum glaucum*), dwarf glasswort (*Salicornia bigelovii*), seaside plantain (*Plantago maritima* ssp *juncoides*), whip nutrush, slender beadgrass, marsh fimbry (*Fimbristylis castanea*, T), and Oake's evening primrose at Mashomack.

Mashomack Preserve and Turtle Cove on Congdon's Creek are owned and operated by the Nature Conservancy and receive a great deal of controlled human use by residents of Long Island. Educational and recreational activities include nature study, birdwatching and big game hunting. There is an important historical and archeological site at Sungic Point. The Mashomack marshes also help maintain an important local fishing and shellfishing industry. Congdons Creek is an important staging area for commercial and recreational fishing and shellfishing.

IMPACT ASSESSMENT:

Any activity that significantly disturbs or destroys a portion of the habitat, including human use, could cause the loss of some species, reducing the fish and wildlife resource value of the Mashomack Preserve. Such disturbances could include activities that degrade the water quality in or around Mashomack Preserve, adversely affecting the biological productivity of this area. All species of fish and wildlife would be affected by water pollution, such as chemical contamination (including food chain effects resulting from bioaccumulation), oil spills, excessive turbidity, and waste disposal (including boat wastes). Alteration of tidal patterns in or around the Preserve would have major impacts on the fish and wildlife communities present.

Unrestricted use of motorized vessels including personal watercraft in the protected, shallow waters of bays, harbors, and tidal creeks can have adverse effects on aquatic vegetation and fish and wildlife populations. Use of motorized vessels should be controlled (*e.g.*, no wake zones, speed zones, zones of exclusion) in and adjacent to shallow waters and vegetated wetlands.

Elimination or degradation of salt marsh and intertidal areas, through loss of tidal connection, ditching, excavation, or filling, would directly impact the valuable habitat in this area. Construction of shoreline structures, such as docks, piers, bulkheads, or revetments, especially in areas such as Mashomack Preserve that are not previously disturbed by development, may result in the loss of productive areas supporting fish and wildlife resources. Alternative strategies for the protection of shoreline property should be examined, including innovative, vegetation-based approaches. Control of invasive nuisance plant species, through a variety of means, may improve fish and wildlife species use of the area and enhance overall wetland values.

Nesting shorebirds inhabiting Mashomack Preserve are highly vulnerable to disturbance by humans, especially during the nesting and fledging period (March 15 through August 15). Diamondback terrapin inhabiting the beach are vulnerable to disturbance by humans from April 1 through August 15. Significant pedestrian traffic or recreational vehicle use of the beach could easily eliminate the use of this site as a breeding area and should be minimized during this period. Recreational activities (*e.g.*, boat and personal watercraft landing, off-road vehicle use, picnicking) in the vicinity of bird nesting areas should be minimized during this period. Predation of chicks and destruction of eggs or nests by unleashed pets (*e.g.*, dogs, cats) and natural predators may also occur, and predator control should be implemented where feasible. Fencing and/or continued annual posting of shorebird nesting areas should be provided to help protect these species. Control of vegetative succession, through beneficial use of dredged material or other means may improve the availability of nesting habitat in this area.

The various habitats of the Mashomack Preserve, due to their undisturbed condition and large size, may be appropriate for use as reference habitats for habitat restoration projects and research in the Peconics.

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Significant Coastal Fish and Wildlife Habitats

Mashomack Preserve-Shelter Island
Shell Beach

Cedar Point/ Hedges Bank Shallows (In part)
Cedar Point Peninsula (In part)
Sag Harbor Bay & Northwest Harbor (In part)
Shelter Island Eastern Shallows (In part)

New York State Department of State

Division of Coastal Resources

COASTAL FISH & WILDLIFE HABITAT ASSESSMENT FORM

Name of Area:	**Shell Beach**
Designated:	**March 15, 1987**
Date Revised:	**May 15, 2002**
County:	**Suffolk**
Town(s):	**Shelter Island**
7½' Quadrangle(s):	**Greenport, NY**

Assessment Criteria

Ecosystem Rarity (ER)--the uniqueness of the plant and animal community in the area and the physical, structural, and chemical features supporting this community.

ER assessment: Small segment of sand and pebble beach, subject to human disturbance; not rare in Suffolk County. 0

Species Vulnerability (SV)--the degree of vulnerability throughout its range in New York State of a species residing in the ecosystem or utilizing the ecosystem for its survival.

SV assessment: Least tern (T) and piping plover (E, T-Fed) nesting.
Calculation: 36 + (25/2) = 48.5

Human Use (HU)-- the conduct of significant, demonstrable commercial, recreational, or educational wildlife-related human uses, either consumptive or non-consumptive, in the area or directly dependent upon the area.

HU assessment: No significant fish or wildlife related human uses of the area. 0

Population Level (PL)--the concentration of a species in the area during its normal, recurring period of occurrence, regardless of the length of that period of occurrence.

PL assessment: Concentrations of piping plover significant in Suffolk County. 4

Replaceability (R)--ability to replace the area, either on or off site, with an equivalent replacement for the same fish and wildlife and uses of those same fish and wildlife, for the same users of those fish and wildlife.

R assessment: Habitat may be replaced through independent processes within two years. 0.4

Habitat Index = [ER + SV + HU + PL] = 52.5 **Significance = HI x R = 21.0**

NEW YORK STATE
SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT
NARRATIVE

SHELL BEACH

LOCATION AND DESCRIPTION OF HABITAT:

Shell Beach is located in West Neck Harbor, in the southwest portion of the Town of Shelter Island, Suffolk County (7.5' Quadrangle: Greenport, NY). The fish and wildlife habitat is an approximate 8 acre area of sparsely vegetated sand and pebble beach, located at the eastern end of the Shell Beach peninsula. This area has been used for disposal of dredged material, and is subject to human disturbances, such as off-road vehicle use and pedestrian traffic.

FISH AND WILDLIFE VALUES:

Shell Beach is a relatively small segment of unvegetated, and heavily disturbed, sand and pebble beach. Areas such as this are not rare in Suffolk County. However, Shell Beach is an important nesting site for least terns (T) and piping plovers (E, T-Fed), with both species present since at least 1983. The tern population attained peak concentrations of 119 and 248 pairs in 1986 and 1987, respectively; however, since that time the population has been documented only sporadically and in concentrations ranging from 9 to 42 pairs. Concentrations of piping plover increased during the 1986-1996 period; peak concentrations of 5-7 pairs nested at Shell Beach between 1994-1996. There are no significant human use activities associated with the wildlife resources at Shell Beach.

The New York Natural Heritage Program has documented seabeach knotweed (*Polygonum glaucum*) at Shell Beach.

IMPACT ASSESSMENT:

Nesting shorebirds inhabiting Shell Beach are highly vulnerable to disturbance by humans, especially during the nesting and fledging period (March 15 through August 15). Significant pedestrian traffic or recreational vehicle use of the beach could easily eliminate the use of this site as a breeding area and should be minimized during this period. Recreational activities (*e.g.*, boat and personal watercraft landing, off-road vehicle use, picnicking) in the vicinity of bird nesting areas should be minimized during this period. Predation of chicks and destruction of eggs or nests by unleashed pets (*e.g.*, dogs, cats) and natural predators may also occur, and predator control should be implemented where feasible. Fencing and/or continued annual posting of shorebird nesting areas should be provided to help protect these species. Control of vegetative succession, through beneficial use of dredged material or other means may improve the availability of nesting habitat in this area.

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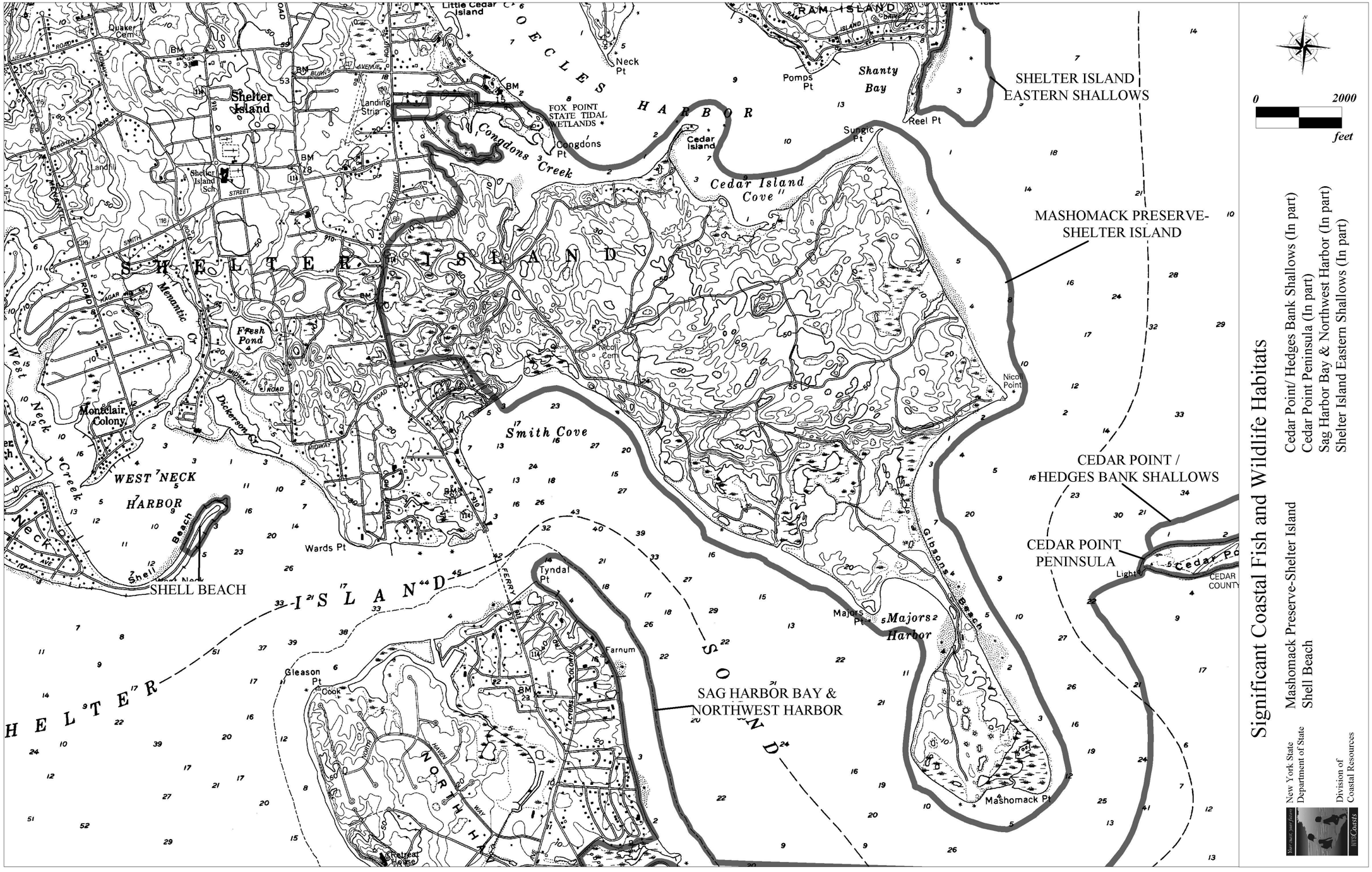

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COASTAL FISH & WILDLIFE HABITAT ASSESSMENT FORM

Name of Area:	**Shelter Island Eastern Shallows**
Designated:	**May 15, 2002**
County:	**Suffolk**
Town(s):	**Shelter Island**
7½' Quadrangle(s):	**Greenport, NY**

Assessment Criteria

Ecosystem Rarity (ER)--the uniqueness of the plant and animal community in the area and the physical, structural, and chemical features supporting this community.

ER assessment: Eelgrass beds of state importance. 64

Species Vulnerability (SV)--the degree of vulnerability throughout its range in New York State of a species residing in the ecosystem or utilizing the ecosystem for its survival.

SV assessment: Atlantic ridley (E) and loggerhead (T) turtles have been documented at this habitat. Calculation: 36 + (25/2) = 48.5

Human Use (HU)-- the conduct of significant, demonstrable commercial, recreational, or educational wildlife-related human uses, either consumptive or non-consumptive, in the area or directly dependent upon the area.

HU assessment: Bay scallop fishery of recreational and commercial significance in the State of New York. 16

Population Level (PL)--the concentration of a species in the area during its normal, recurring period of occurrence, regardless of the length of that period of occurrence.

PL assessment: Bay scallop population of significance at a level in between the State of New York and the Mid-Atlantic region of the United States. Calculation: $\sqrt{(16 \times 25)}$ = 20

Replaceability (R)--ability to replace the area, either on or off site, with an equivalent replacement for the same fish and wildlife and uses of those same fish and wildlife, for the same users of those fish and wildlife.

R assessment: Irreplaceable. 1.2

Habitat Index = [ER + SV + HU + PL] = 148.5 **Significance = HI x R = 178.2**

NEW YORK STATE
SIGNIFICANT COASTAL FISH AND WILDLIFE HABITAT
NARRATIVE

SHELTER ISLAND EASTERN SHALLOWS

LOCATION AND DESCRIPTION OF HABITAT:

The Shelter Island Eastern Shallows are located off the eastern shore of Shelter Island, NY (7.5" Quadrangle: Greenport, NY) stretching from Hay Beach Point southeastward to Reel Point on Ram Island. The habitat consists of marine shallows and submerged aquatic vegetation (SAV) on muddy and gravelly sand substrates approximately within the twelve foot bathymetric contour. Between Hay Beach Point and Cornelius Point, SAV covers 90% of the bottom, dominated almost exclusively by eelgrass (*Zostera marina*). Some green fleece (*Codium fragile*) and rockweed (*Fucus* spp.) are also present. Along the shore of Little Ram Island to Reef Point on Ram Island submerged aquatic vegetation accounts for 20-50% of bottom cover, consisting of medium-density eelgrass beds, rockweed, knotted wrack (*Ascophyllum nodosum*), and banded weeds (*Ceramium* spp.).

FISH AND WILDLIFE VALUES:

The Shelter Island Eastern Shallows habitat is one of only a few remaining eelgrass meadows in the State of New York. Eelgrass habitats are among the most productive ecosystems in the world and and play a critical role in supporting coastal food webs.

Eelgrass meadows provide critical habitat for a variety of aquatic species, including reacreationally and commercially important bay scallop (*Argopecten irradians*) populations. Juvenile bay scallops use the canopy for refuge from predators. Adult bay scallops settle at the base of the shoots. The Shelter Island Eastern Shallows support an important population of bay scallop, and the bay scallop fishery in this area is of statewide importance.

Lobsters have been observed in the northeastern portion of the area. Mud crabs, which congregate preferentially in beds of submerged aquatic vegetation, have been documented in the Shelter Island Eastern Shallows, along with hermit crab, spider crab, and whelk (locally called conch). Spider crabs are an important prey item for juvenile Atlantic ridley (E) and loggerhead sea turtles (T), and these turtle species have been documented in the Shelter Island Eastern Shallows area. Horseshoe crabs also forage in eelgrass beds. This species itself is prey for juvenile loggerhead turtles, crabs, whelks, and sharks.

Other species found in eelgrass meadows include shellfish such as hard clam and juvenile finfish such as tautog (also called blackfish) and oyster toadfish. Many finfish species with demersal eggs use eelgrass meadows for spawning and nursery areas. Atlantic silversides spawn in the eelgrass beds of the Peconic Bays. The eggs of this species are an important food source for sea birds, waterfowl, and blue crab. Adult Atlantic silversides are an important prey species for bluefish,

summer flounder, rainbow smelt, white perch, Atlantic bonito, and striped bass. Brant, a goose frequently found overwintering in embayments of the Peconics region feeds directly on eelgrass.

IMPACT ASSESSMENT:

Any activity that would substantially degrade water quality in the Shelter Island Eastern Shallows would affect the biological productivity of this area. Eelgrass beds are particularly sensitive to alterations in water quality parameters including temperature, salinity, light penetration, organic matter concentration, and the presence of pollutants. All species of fish and wildlife would be affected by water pollution, such as chemical contamination (including food chain effects resulting from bioaccumulation), oil spills, excessive turbidity, and waste disposal. It is essential that high water quality be maintained in the area to protect the eelgrass meadows and bay scallop fishery.

Unrestricted use of motorized vessels including personal watercraft in the protected, shallow waters of bays, harbors, and tidal creeks can have adverse effects on aquatic vegetation and fish and wildlife populations. Use of motorized vessels should be controlled (*e.g.*, no wake zones, speed zones, zones of exclusion) in and adjacent to shallow waters and vegetated wetlands.

Construction of shoreline structures, such as docks, piers, bulkheads, or revetments, in areas not previously disturbed by development, may result in the loss of productive areas which support the fish and wildlife resources of the Shelter Island Eastern Shallows. Alternative strategies for the protection of shoreline property should be examined, including innovative, vegetation-based approaches. Docks may be detrimental to nearshore eelgrass beds because of shading, and review of any proposed new docks in the Shelter Island Eastern Shallows area should be conducted with potential impacts to eelgrass beds fully considered. Restoration opportunities for eelgrass may exist if water quality parameters are appropriate. Aerial photography conducted in 1969, 1984, and 1994 shows a decrease in area of the eelgrass meadows off Hay Beach and Cornelius Points. These meadows once extended southeast off Cornelius Point. Evidence of former eelgrass beds (observations of dead, loose eelgrass) have been documented.

Thermal discharges, depending on time of year, may have variable effects on use of the area by marine species, such as sea turtles and overwintering waterfowl. Installation and operation of water intakes could have a significant impact on juvenile (and adult, in some cases) fish concentrations, through impingement or entrainment.

Dredging to maintain existing boat channels in the area should be scheduled between September 15 and December 15 to minimize potential impacts on aquatic organisms, and to allow for disposal when wildlife populations are least sensitive to disturbance. Dredged material disposal in this area would be detrimental.

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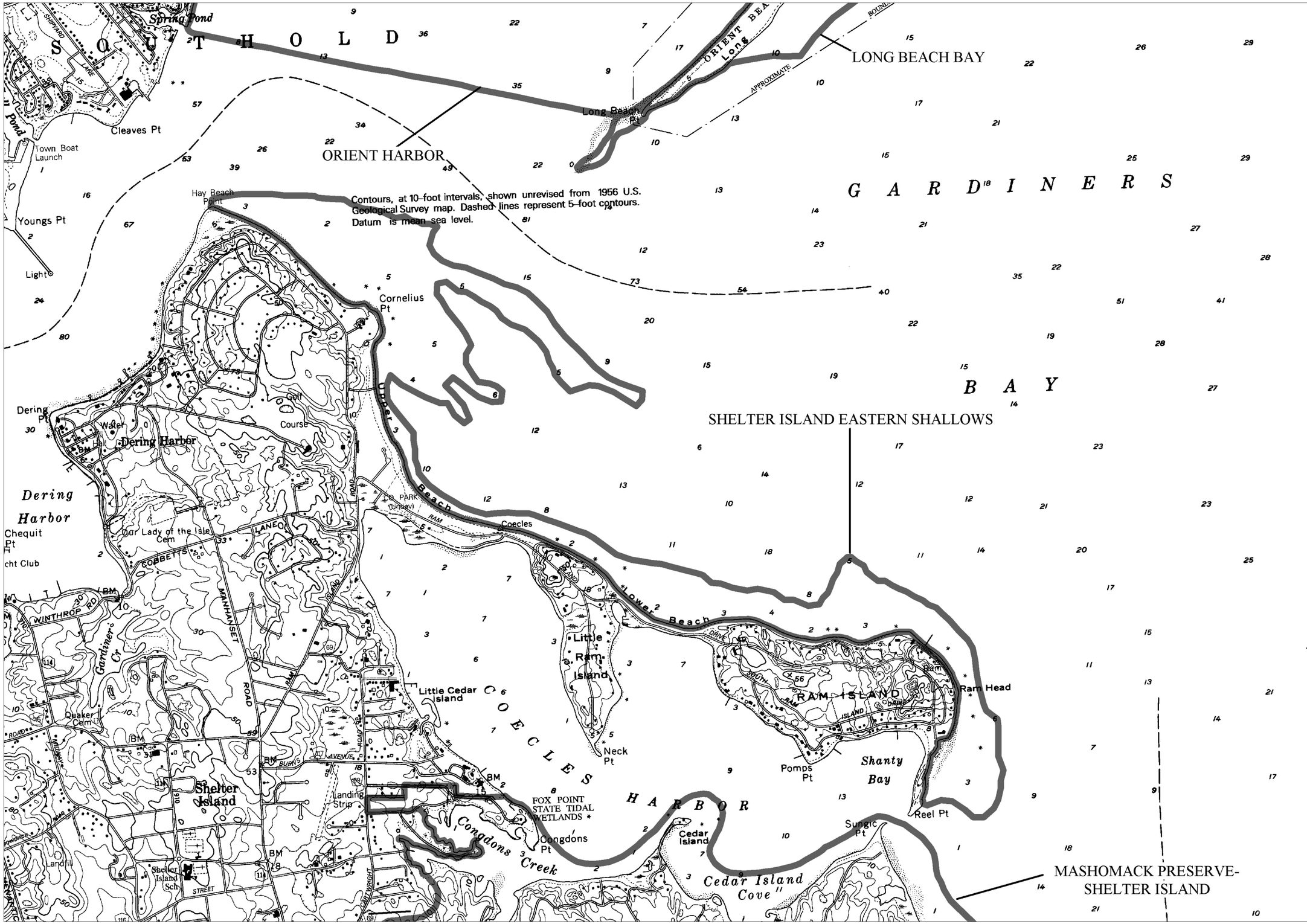


Significant Coastal Fish and Wildlife Habitats

Shelter Island Eastern Shallows
Long Beach Bay (In part)
Mashomack Preserve-Shelter Island (In part)
Orient Harbor (In part)

New York State Department of State
Division of Coastal Resources

APPENDIX C

NYNHP Significant Natural
Community Descriptions

(*Quercus montana*) is also a common associate. Pitch pine (*Pinus rigida*) and trees of other genera, if present, typically occur at less than 1% cover each in the canopy. American chestnut (*Castanea dentata*) may have been a common associate in these forests prior to the chestnut blight; chestnut sprouts are still found in some stands. The shrublayer is well-developed typically with a low nearly continuous cover of dwarf heaths such as blueberries (*Vaccinium pallidum, V. angustifolium*) and black huckleberry (*Gaylussacia baccata*).

The herbaceous layer is very sparse; characteristic species are bracken fern (*Pteridium aquilinum*), wintergreen (Gaultheria procumbens), and Pennsylvania sedge (*Carex pensylvanica*). Herb diversity is greatest in natural and artificial openings with species such as frostweed (*Helianthemum canadense*), false-foxlglove (*Aureolaria* spp.), bearberry (*Arctostaphylos uva-ursi*), goat's-rue (*Tephrosia virginiana*), bush-clovers (*Lespedeza* spp.), and pinweeds (*Lechea* spp.).

Characteristic animals include eastern towhee (*Pipilo erythrophthalamus*) and white-tailed deer (*Odocoileus virginianus*). This community can occur with several types of barrens and woodland communities as part of the broadly defined ecosystem known as the Pine Barrens.

Distribution: Restricted to the interior portions of Coastal Lowlands Ecozone, concentrated on outwash plains and possibly knolls and mid to upper slopes of moraines. Known examples range from Hither Hills and Montauk Mountain west probably to the morainal hills of northwestern Suffolk County. Numerous examples occur in the central portion of this range (the periphery of the Long Island Pine Barrens) south of the Ronkonkoma Moraine (Greller 1977). Occurrences are more sparse in the eastern and western portions of the range. The community range possibly extends westward into eastern Nassau County on the end moraine of western Long Island and has been reported from a narrow strip of outwash on the north shore of Long Island.

Rank: G4 S3 *Revised:* 2001

Examples: Long Pond Greenbelt, Hither Woods, Suffolk County.

Sources: Brodo 1968; Greller 1977; Sneddon et al. 1998; NYNHP field surveys.

6. Coastal oak-hickory forest: a hardwood forest with oaks (*Quercus* spp.) and hickories(*Carya* spp.) codominant that occurs in dry well-drained, loamy sand of knolls, upper slopes, or south-facing slopes of glacial moraines of the Atlantic Coastal Plain. The forest is usually codominated by two or more species of oaks, usually white oak (*Q. alba*), black oak (*Quercus velutina*) and chestnut oak (*Q. montana*). Scarlet oak (*Quercus coccinea*) is also a common associate. Mixed with the oaks, usually at moderate densities, are one or more of the following hickories: pignut (*Carya glabra*), mockernut (*C. tomentosa*), and sweet pignut (*C. ovalis*). These hickories can range from nearly pure stands to as little as about 25% cover. There is typically a subcanopy stratum of small trees and tall shrubs including flowering dogwood (*Cornus florida*) and highbush blueberry (*Vaccinium corymbosum*). The shrublayer and groundlayer flora may be diverse. Common low shrubs include maple-leaf viburnum (*Viburnum acerifolium*), blueberries (*Vaccinium angustifolium, V. pallidum*) and huckleberry (*Gaylussacia baccata*).

Characteristic groundlayer herbs are Swan's sedge (*Carex swanii*), panic grass (Panicum dichotomum), poverty grass (*Danthonia spicata*), cow-wheat (*Melampyrum lineare*), spotted wintergreen (*Chimaphila maculata*), rattlesnake weed (*Hieracium venosum*), white wood aster (*Aster divaricatus*), false Solomon's seal (*Smilacina racemosa*), Pennsylvania sedge (*Carex pensylvanica*), and white goldenrod (*Solidago bicolor*).

Characteristic animals include eastern towhee (*Pipilo erythrophthalamus*), vireos (*Vireo* spp.), woodpeckers, and white-tailed deer (*Odocoileus virginianus*). Two or more topoedaphic variants are possible.

Distribution: Restricted to the interior portions of Coastal Lowlands Ecozone, concentrated on knolls and mid to upper slopes of the moraines. Known examples range from Mashomack west to the morainal hills of northwestern Suffolk County. Numerous examples occur in the western portion of this range while occurrences are sparse in the eastern portion. The community range possibly extends westward into northeastern Nassau County and on the end moraine of western Long Island (Greller 1977).

Rank: G4 S3 *Revised:* 2001

Examples: Mashomack, Wildwood State Park, Caleb Smith State Park, Suffolk County.

Sources: Greller 1977; Rosza and Metzer 1982; Sneddon et al. 1998, NYNHP field surveys.

7. Coastal oak-beech forest: a hardwood forest with oaks (*Quercus* spp.) and beech (*Fagus grandifolia*)

codominant that occurs in dry well-drained, loamy sand of morainal coves of the Atlantic Coastal Plain. Some occurrences are associated with maritime beech forest. Beech can range from nearly pure stands to as little as about 25% cover. The forest is usually codominated by two or more species of oaks usually black oak (*Quercus velutina*) and white oak (*Q. alba*). Scarlet oak (*Quercus coccinea*) and chestnut oak (*Q. montana*) are common associates. Red oak (*Quercus rubra*) may be present at low density and is a key indicator species along with sugar maple (*Acer saccharum*) and paper birch (*Betula papyrifera*).

There are relatively few shrubs and herbs. Characteristic groundlayer species are Swan's sedge (*Carex swanii*), Canada mayflower (*Maianthemum canadense*), white wood aster (*Aster divaricatus*), beech-drops (*Epifagus virginiana*), and false Solomon's seal (*Smilacina racemosa*). Typically there is also an abundance of tree seedlings, especially of beech; beech and oak saplings are often the most abundant 'shrubs' and small trees.

Characteristic fauna include white-tailed deer (*Odocoileus virginianus*).

Distribution: restricted to interior portions of Coastal Lowlands Ecozone, concentrated on north-facing slopes on the moraines. Known examples range from Montauk Point (Brodo 1968) west to the Big Woods along the south shore of Long Island and from Route 48 Southold to Camp Baiting Hollow along the north shore of Long Island. Numerous examples occur in the Riverhead portion of the north shore. The community is also reported from necks of Long Island Sound (Greller 1977). It may occur in small patches farther west on Long Island to western Suffolk, Nassau and eastern Queens Counties (cf. Greller 1977). The community was also apparently reported from New York City by Harper (1917) (cf Brodo 1968).

Rank: G4 S3 *Revised:* 2001

Examples: Mashomack, Friars Head, Wildwood State Park, Suffolk County.

Sources: Brodo 1968; Greller 1977; Rosza and Metzler 1982; Sneddon et al. 1998; Taylor 1923; NYNHP field surveys.

8. Coastal oak-laurel forest: a large patch low diversity hardwood forest with broadleaf canopy and evergreen subcanopy that typically occurs on dry well-drained, sandy and gravelly soils of morainal hills of the Atlantic Coastal Plain. This forest is similar to the chestnut oak forest of the Appalachian Mountains; it is distinguished by lower abundance of chestnut oak (*Quercus montana*) and absence of red oak (*Quercus rubra*), probably correlated with the difference between the sand and gravel of glacial moraines versus the bedrock of mountains.

The dominant tree is typically scarlet oak (*Quercus coccinea*). Common associates are white oak (*Q. alba*), black oak (*Q. velutina*), and chestnut oak.

The shrub layer is well-developed typically with a tall, often nearly continuous cover of the evergreen heath, mountain laurel (*Kalmia latifolia*). Other characteristic shrubs include black huckleberry (*Gaylussacia baccata*) and blueberry (*Vaccinium pallidum*).

The herbaceous layer is very sparse; characteristic species are bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and Pennsylvania sedge (*Carex pensylvanica*).

Characteristic animals include white-tailed deer (*Odocoileus virginianus*). This forest is often associated with coastal oak-heath forest forming a forest complex on morainal hills.

Distribution: Restricted to interior portions of Coastal Lowlands Ecozone, concentrated on knolls and mid to upper slopes of moraines. Known examples range from Hither Hills west possibly to the morainal hill of northwestern Suffolk County. Several examples occur along the eastern half of the Ronkonkoma Moraine. The community range possibly extends westward into eastern Nassau County on the end moraine of western Long Island.

Rank: G3G4 S3 *Revised:* 2001

Examples: Hither Woods, Suffolk County.

Sources: Greller 1977; Sneddon et al. 1998; Thompson 1997; NYNHP field surveys.

9. Coastal oak-holly forest: a semi-deciduous to mixed deciduous-evergreen broadleaf forest that occurs on somewhat moist and moderately well drained silt and sandy loams in low areas on morainal plateaus. The elevation afforded by the raised plateau protects these areas from overwash and salt spray. In New York State this forest is best developed on the narrow peninsulas of eastern Long Island. The trees are usually not stunted, and are far enough removed from the pruning effects of severe salt spray. The canopy of a mature stand is usually up to about 65 ft (20 m) tall.

The dominant canopy trees are black oak (*Quercus velutina*), black gum (*Nyssa sylvatica*), red maple (*Acer rubrum*) and beech (*Fagus grandifolia*). Holly (*Ilex opaca*) is abundant in the subcanopy and tall shrub layers. Other characteristic trees at lower density

Coastal Lowlands and Manhattan Hills ecozones. Low salt marsh is well-developed on the south shore of Long Island, and within the small basins of the north shore where it is the dominant community type. Although it is very degraded, about one-half of the total marsh acreage at Jamaica Bay on the south shore is low salt marsh.

Rank: G4 S3S4 *Revised:* 2001

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Creek, Suffolk County; Lloyd Neck Marsh, Suffolk County; Nissequogue River, Suffolk County; Westhampton Island-Tiana Beach, Suffolk County; Flax Pond, Suffolk County; Hempstead Bay Wetlands, Nassau County.

Sources: Clark 1985, 1986a; Conard 1935; Dreyer and Niering 1995; Houghton and Woodwell 1980; Joneja 1981; MacDonald and Edinger 2000; Niedowski 2000; Nixon 1982; Redfield 1972; Spinner 1969; Teal 1986; US ACE 1995, 1999; NYNHP field surveys.

6. Coastal salt pond: A community inhabiting marine shoreline lakes or ponds formed by sandspits that close off a lagoon or bay. The water typically averages brackish or slightly brackish over long periods of time, but may range rapidly from fresh to saline. Occasionally the barrier beach is broken by hurricanes and the pond becomes saline until the sandspit closes the pond again. Some ponds have permanent (natural or artificial) inlets. Two community microhabitats are typically encountered within one pond complex: 1) the "pond" or aquatic portion of the complex and 2) the "shore" or the non-aquatic part of the complex. These two microhabitats are likely to warrant separate communities and may soon be distinguished in a future version of the state community classification: the former retaining the name "coastal salt pond," the latter designated as a "coastal salt pond shore."

Dominant plants of the pond can vary considerably with the frequency of exchange of marine waters. Typical ponds are dominated by the submergent vascular plant widgeon grass (*Ruppia maritima*) and the marine red algae tubed weed (*Polysiphonia* spp.). Other characteristic plants of the pond include the marine green algae *Cladophora* spp. Marine algae are often less frequent in more saline examples. Needle spikerush (*Eleocharis acicularis*) is typical of temporarily flooded edges of ponds. Brackish ponds may contain flora typical of brackish subtidal aquatic beds including sago pondweed (*Potamogeton pectinatus*), clasping-leaved pondweed (*Potamogeton perfoliatus*), and horned pondweed (*Zannichellia palustris*). Four pond associations have been listed by Thorne-Miller (1983) including widgeon grass beds, marine green algae beds, tubed weed beds and sago pondweed beds.

Characteristic pond fauna include multiple species of grass shrimp (e.g., *Palaemonetes* spp.), and the estuarine minnows mummichog (*Fundulus heteroclitus*), sheepshead minnow (*Cyprinodon variegatus*), silversides (*Menidia* spp.), and various killifish. Coastal waterbirds in the heron family (Ardeidae) including great blue heron (*Ardea herodias*) and egrets feed on the fish.

The pond shore typically consists of an assemblage of up to several narrow zones floristically resembling other estuarine community types. Along a wet to dry moisture gradient and low to high elevation gradient, these community types may include: intertidal mudflats, low salt marsh, high salt marsh, salt panne, salt shrub and brackish meadow. Similar zones resembling palustrine communities may occur in examples with freshwater.

Characteristic species of the pond shore are dwarf spikerush (*Eleocharis parvula*), switchgrass (*Panicum virgatum*), salt-meadow grass (*Spartina patens*), cordgrass (*Spartina alterniflora*), reedgrass (*Phragmites australis*), saltmarsh fleabane (*Pluchea odorata*), three-square (*Scirpus americanus*), rose-mallow (*Hibiscus moscheutos*), pigweeds (*Chenopodium* spp.), mock bishop's-weed (*Ptilimnium capillaceum*), spikegrass (*Distichlis spicata*), saltmarsh-elder (*Iva frutescens*), and groundsel-tree (*Baccharis halimifolia*). Abundant pondshore fauna include saltmarsh mosquitoes (*Aedes* spp.). Other characteristic pondshore fauna include green-headed fly (*Tabanus nigrovittatus*) and planthoppers (*Prokelisia marginata*).

Distribution: along the seacoast in the Coastal Lowlands ecozone.

Rank: G4 S1S2 *Revised:* 2001

Examples: Oyster Pond, Suffolk County; Tobaccolot Pond, Suffolk County.

Source: Harlin et al. 1995; Thorne-Miller et al. 1983; NYNHP field surveys.

7. Brackish interdunal swales: temporarily tidally flooded temperate marshes in interdunal swales dominated by halophytic graminoids. Individual swales occur as small patches positioned between fore-, primary and secondary dunes in a maritime dunes system, typically on barrier islands. Swales experience dynamic fluctuations in water levels and salinity. Water levels are highest after infrequent and sporadic overwash that occurs when tides or waves overtop the

this moss forms a nearly pure carpet in some areas of the bog, and it is common on the hummocks (strings). Other common mosses include *Sphagnum cuspidatum* and *S. majus* in hollows (flarks).

Characteristic herbs of the flarks include pod-grass (*Scheuchzeria palustris*), white beakrush (*Rhynchospora alba*), sedges (*Carex exilis, C. oligosperma*), cottongrass (*Eriophorum vaginatum* ssp. *spissum*), and pitcher-plant (*Sarracenia purpurea*). Characteristic species of the strings include sedges (*Carex pauciflora, C. limosa*), false Solomon's-seal (*Maianthemum trifolium*), meadow-sweet (*Spiraea alba* var. *latifolia*), lowbush blueberry (*Vaccinium angustifolium*), black chokeberry (*Aronia melanocarpa*), black spruce (*Picea mariana*), and tamarack (*Larix laricina*). The trees on the bog mat are stunted and are usually widely spaced on hummocks or strings. Low ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), Labrador tea (*Rhododendron groenlandicum*), bog laurel (*Kalmia polifolia*), sheep laurel (*Kalmia angustifolia*), and bog rosemary (*Andromeda glaucophylla*) are common in the strings, as well as in the flatter, unpatterned portions of the bog. Data on characteristic animals are needed.

Distribution: only known from the Western Adirondack Foothills ecozone.

Rank: G3G4 S1 *Revised:* 1990

Example: Bay Pond Bog, Franklin County, Spring Pond Bog, Franklin County.

Source: Worley 1982; NYNHP field surveys.

15. Dwarf shrub bog: an ombrotrophic or weakly minerotrophic peatland dominated by low-growing, evergreen, ericaceous shrubs and peat mosses (*Sphagnum* spp.). The surface of the peatland is typically a mosaic of hummock/hollow microtopography. The hummocks tend to have a higher abundance of shrubs than the hollows; however, these bogs have more than 50% cover of low-growing shrubs. Water is usually nutrient-poor and acidic.

The dominant shrub is often leatherleaf (*Chamaedaphne calyculata*), which may have more than 50% cover. Shrubs are typically taller than the herb layer which is usually graminoid, and generally the shrub heights are 1 m or less. Other prominent shrubs and herbs are sheep laurel (*Kalmia angustifolia*), bog laurel (*K. polifolia*), Labrador tea (*Rhododendron groenlandicum*), cranberry (*Vaccinium oxycoccos, V. macrocarpon*), the sedge *Carex trisperma*, and tawny cottongrass (*Eriophorum virginicum*).

Other characteristic, but less common plants are round-leaf sundew (*Drosera rotundifolia*), pitcher plant (*Sarracenia purpurea*), bog rosemary (*Andromeda glaucophylla*), huckleberry (*Gaylussacia baccata*), black chokeberry (*Aronia melanocarpa*), highbush blueberry (*Vaccinium corymbosum*), water-willow (*Decodon verticillatus*), meadow sweet (*Spiraea alba* var. *latifolia, S. tomentosa*),, marsh St. John's-wort (*Triadenum virginicum*), and the sedges *Carex canescens, Carex pauciflora,* and *Rhynchospora alba*. Scattered stunted trees may be present, including black spruce (*Picea mariana*), tamarack (*Larix laricina*), and red maple (*Acer rubrum*).

Characteristic peat mosses that form a nearly continuous carpet under the shrubs include *Sphagnum magellanicum, S. rubellum, S. fallax, S. fuscum, S. papillosum*, and *S. angustifolium*.

Characteristic animals include common yellowthroat (*Geothlypis trichas*), song sparrow (*Melospiza melodia*), savannah sparrow (*Passerculus sandwichensis*), masked shrew (*Sorex cinereus*), meadow jumping mouse (*Zapus hudsonius*), southern bog lemming (*Synaptomys cooperi*), and wood frog (*Rana sylvatica*).

A dwarf shrub bog may form a floating mat around a bog lake or along the banks of an oligotrophic stream; it may also occur as a large or small mat completely filling a basin. A dwarf shrub bog may grade into a highbush blueberry bog thicket, inland poor fen, or a black spruce-tamarack bog..

Distribution: occurs throughout upstate New York north of the Coastal Lowlands ecozone.

Rank: G4 S3 *Revised:* 2001

Examples: Bay Pond Bog, Franklin County; Massawepie Mire, St. Lawrence County; Sunday Swamp, Lewis County; Rome Sand Plains, Oneida County, Little Cedar Pond, Orange County.

Sources: Andrus 1980; Bray 1921; Damman and French 1987; Johnson 1985; Karlin and Andrus 1986; Karlin and Lynn 1988; Sperduto and Cogbill 1999; Sperduto et al. 2000; Sperduto and Nichols 2000; Sperduto 2000; NYNHP field surveys.

16. Highbush blueberry bog thicket: an ombrotrophic or weakly minerotrophic peatland dominated by tall, deciduous, ericaceous shrubs and peat mosses (*Sphagnum* spp.); the water is usually nutrient-poor and acidic.

The dominant shrub is usually highbush blueberry (*Vaccinium corymbosum*). At least three regional variants may be recognized in New York. The first is found throughout central and western New York, the second is primarily a northern variant, and the third is a

southern variant with coastal plain species.

Species characteristic of all three varieties, and typical of the central and western New York examples, include highbush blueberry, winterberry (*Ilex verticillata*), cinnamon fern (*Osmunda cinnamomea*), marsh fern (*Thelypteris palustris*), and *Sphagnum* spp. Stunted trees may be present at a low density and with less than 50% cover; red maple (*Acer rubrum*) occurs in many bog thickets. Other characteristic shrubs and herbs include black huckleberry (*Gaylussacia baccata*), false Solomon's-seal (*Smilacina trifolia*), and pitcher plant (*Sarracenia purpurea*).

Additional characteristic species in northern examples include mountain holly (*Nemopanthus mucronatus*) which may be codominant, sedge (*Carex trisperma*), and calla (*Calla palustris*). Scattered small small trees include larch (*Larix laricina*), black spruce (*Picea mariana*), and white pine (*Pinus strobus*).

The southern New York variant of this community contains substantially fewer northern taxa and numerous coastal indicator species such as swamp azalea (*Rhododendron viscosum*) which may become codominant, red chokeberry (*Aronia arbutifolia*), male-berry (*Lyonia ligustrina*), fetterbush (*Leucothoe racemosa*), sweet pepperbush (*Clethra alnifolia*), water willow (*Decodon verticillatus*), buttonbush (*Cephalanthus occidentalis*), marsh St. John's-wort (*Triadenum virginicum*), sedges (*Carex trisperma, C. striata*), three way sedge (*Dulichium arundinaceum*), and Virginia chain fern (*Woodwardia virginica*). Scattered small trees may include pitch pine (*Pinus rigida*) or Atlantic white cedar (*Chamaecyparis thyoides*) (MacDonald and Edinger 2000; Damman and French 1987).

Communities on Long Island with similar vegetation (i.e., dominated by tall shrubs such as *Vaccinium corymbosum*, *Leucothoe racemosa*, *Clethra alnifolia*, and *Chamaedaphne calyculata*) with shallow peat deposits (<20 cm) are treated as pine barrens shrub swamps. The two natural communities are separated by the fact that highbush blueberry bog thicket maintains a persistent hydrological regime, supports peat development, and often lacks "edge species" that are found in pine barrens shrub swamp, such as *Lyonia mariana*, *Ilex glabra*, and *Myrica pensylvanica*.

Characteristic peat mosses for all variants include *Sphagnum magellanicum*, *S. centrale*, *S. nemoreum*, and *S. fimbriatum*. Characteristic animals include common yellowthroat (*Geothlypis trichas*), swamp sparrow (*Melospiza georgiana*), song sparrow (*Melospiza melodia*), meadow jumping mouse (*Zapus hudsonius*), masked shrew (*Sorex cinereus*), southern red-backed vole (*Clethrionomys gapperi*), and green frog (*Rana clamitans*).

Distribution: occurs throughout New York State.

Rank: G4 S3 *Revised:* 2001

Examples: Brayton Marsh, Warren County; Sears Bellows Wetlands, Suffolk County; Protection Bog, Erie County; Harriman, Rockland County.

Source: Damman and French 1987; MacDonald and Edinger 2000; NYNHP field surveys.

C. FORESTED MINERAL SOIL WETLANDS

This subsystem includes seasonally flooded forests, and permanently flooded or saturated swamps. These forests and swamps typically have at least 50% canopy cover of trees. For the purposes of this classification, a tree is defined as a woody plant usually having one principal stem or trunk, a definite crown shape, and characteristically reaching a mature height of at least 16 ft (5 m) (Driscoll et al. 1984).

1. Floodplain forest: a hardwood forest that occurs on mineral soils on low terraces of river floodplains and river deltas. These sites are characterized by their flood regime; low areas are annually flooded in spring, and high areas are flooded irregularly. Some sites may be quite dry by late summer, whereas other sites may be flooded again in late summer or early autumn (these floods are caused by heavy precipitation associated with tropical storms). This is a broadly defined community; floodplain forests are quite variable and may be very diverse.

The most abundant trees include silver maple (*Acer saccharinum*), ashes (*Fraxinus pensylvanica, F. nigra, F. americana*), cottonwood (*Populus deltoides*), red maple (*Acer rubrum*), box elder (*Acer negundo*), elms (*Ulmus americana, U. rubra*), hickories (*Carya cordiformis, C. ovata, C. laciniosa*), butternut and black walnut (*Juglans cinerea, J. nigra*), sycamore (*Platanus occidentalis*), oaks (*Quercus bicolor, Q. palustris*), and river birch (*Betula nigra*). Other less frequently occurring trees include hackberry (*Celtis occidentalis*), tulip tree (*Liriodendron tulipifera*), basswood (*Tilia americana*), and sugar maple (*Acer saccharum*). Introduced trees, such as white willow (*Salix alba*) and black locust (*Robinia pseudo-acacia*), have become established in some floodplain forests.

The most abundant shrubs include spicebush (*Lindera benzoin*), ironwood (*Carpinus carolinianus*), bladdernut (*Staphylea trifoliata*), speckled alder (*Alnus incana* spp. *rugosa*), dogwoods *(Cornus sericea, C. foemina* spp. *racemosa, C. amomum*), viburnums (*Viburnum cassinoides, V. prunifolium, V. dentatum, V. lentago*), and sapling canopy trees. Invasive exotic shrubs that may be locally abundant include shrub honeysuckles (*Lonicera tatarica, L. morrowii*), and

I. MARINE SYSTEM

The marine system consists of open ocean overlying the continental shelf, the associated coastline that is exposed to wind and waves, and shallow coastal bays that are saline because they lack significant freshwater inflow. The limits extend from mean high water seaward, beyond the limits of rooted vascular vegetation. Salinity is greater than 18.0 parts per thousand (ppt) ocean-derived salts.

A. MARINE SUBTIDAL

This subsystem includes the area below the lowest tide that is permanently flooded with tidal water.

1. Marine deepwater community: a broadly-defined community that includes both quiet and rough waters of the open ocean below the lowest tide level and beyond the seaward limits of rooted vascular vegetation. This community includes all *benthic* substrate types (ranging from rock bottom to unconsolidated bottom), as well as the overlying water column, or *pelagic* component.

Fish typical of the nearshore zone of the Atlantic Ocean include Atlantic menhaden (*Brevoorita tyrannus*), weakfish (*Cynoscion regalis*), striped bass (*Morone saxatilis*), winter flounder (*Pleuronectes americanus*), summer flounder (*Paralichthys dentatus*), bluefish (*Pomatomus saltatrix*), tautog (*Tautoga onitis*), Atlantic mackerel (*Scomber scombrus*), black sea bass (*Centropristis striata*), Atlantic croaker (*Micropogonias undulatus*), northern kingfish (*Menticirrhus saxatilis*), spot (*Leiostomas xanthurus*), American sandlance (*Ammodytes americanus*), and silversides (*Menidia menidia*). Large quantities of surf clam (*Spisula solidissima*) inhabit the nearshore benthos. Marine sea turtles that use the nearshore zone during migration include Atlantic (Kemp's) ridley turtle (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), and loggerhead sea turtles (*Caretta caretta*). The nearshore zone provides winter habitat for harbor seal (*Phoca vitulina*), and gray seal (*Halichoerus grypus*). Other frequently observed marine mammals include finback (*Balaenoptera physalus*), minke (*B. acutorostrata*), and humpback (*Megaptera novaeangliae*) whales. Several dolphin species, including common (*Delphinus delphis*), bottle-nosed (*Tursiops truncatus*), white-sided (*Lagenorhynchus acutus*), and striped (*Stenella coerulealba*), as well as pilot whales (*Globicephala melaena*), are often encountered. Ocean quahog (*Artica islandica*) is the dominant species in the deeper silty-sand area, and other dominant taxa include echinoderms, annelids, and arthropods (USFWS 1996).

Distribution: in the open ocean surrounding Long Island, in the Coastal Lowlands ecozone.

Rank: G5 S5 *Revised:* 2001

Source: Brown 1993; Cowardin et al. 1979; USFWS 1996; Waller 1996.

2. Marine eelgrass meadow: a community of subtidal aquatic beds dominated or codominated by eelgrass (*Zostera marina*) and typically occurring in quiet shallow polyhaline (18 to 30 ppt salinity) waters of temperate tidal embayments below the lowest tide level where fluctuations in salinity are minor.

Characteristic associated plants include a diverse array of attached (rooted and epiphytic) and unattached (suspended) marine algae. Rooted red algae are especially common including graceful red weed (*Gracilaria tikvahiae*), tubed weed (*Polysiphonia denudata*), Grinnell's pink leaf (*Grinnellia americana*), Agardh's red weed (*Agardhiella subulata*), *Rhodomela confervoides*, pod weed (*Chondria baileyana*), *Spyridia filamentosa*, banded weed (*Ceramium* sp.), and rough tangle weed (*Stilophora rhizoides*). Abundant and characteristic epiphytic marine algae include barrel weed (*Champia parvula*), tubed weed (*Polysiphonia stricta*), *Cladophora sericea* and *Pneophyllum fragile*. Other associated marine algae include the green algae sea lettuce (*Ulva lactuca*), hollow green weed (*Enteromorpha* spp.), *Cladophora gracilis*, and the brown algae gulfweed (*Sargassum filipendula*). A common exotic species is the marine green algae, green fleece (*Codium fragile*).

Characteristic animals include fish such as fourspine stickleback (*Apeltes quadracus*), mummichog (*Fundulus heteroclitus*), northern pipefish (*Syngnathus fuscus*), threespine stickleback (*Gasterosteus aculeatus*), silversides (*Menidia* spp.), naked goby (*Gobiosoma bosci*), menhaden (*Brevoortia tyrannus*), winter flounder (*Pseudopleuronectes americanus*), and northern puffer (*Sphoeroides maculatus*), marine mollusks such as bay scallop (*Aequipecten irradians*), common Atlantic slippershell (*Crepidula fornicata*), and northern quahog (*Mercenaria mercenaria*), crustaceans such as nine-spine spider crab (*Libinia emarginata*), mud crabs (e.g., *Dyspanopeus sayi*, *Panopeus herbstii* and *Rithropanopeus harrisii*), and broken-back shrimp (*Hippolyte pleurocantha*), and other marine invertebrates such as short-spine brittle star (*Ophioderma brevispina*), bamboo worms (Polychaeta), and counterclockwise coiled worm (*Spirobis spirillum*). Comb jellies (*Beroe* sp., *Mnemiopsis leidyi*) are common plankton species. Waterfowl known to extensively feed on eelgrass include brant (*Branta bernicla*) and American black duck (*Anas rubripes*) (Good et al. 1978). Plant species

and common hairgrass (*Deschampsia flexuosa*). In more natural settings this association occurs mostly on the moderately stabilized dune crests and occasionally in swales and on secondary dunes. This association may be split out as a new community (e.g., "Great Lakes dune shrubland") in future versions of this classification.

The third association is an open forest canopy dominated by red oak (*Quercus rubra*) and (*Acer rubrum*). Other characteristic species of the forested dunes sugar maple (*Acer saccharum*), striped maple (*Acer pensylvanicum*), shad bush (*Amelanchier* spp.), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), chokecherry (*Prunus virginiana*), blackberry (*Rubus allegheniensis*), red raspberry (*Rubus idaeus*), nannyberry (*Viburnum lentago*), arrowwood (*V. recognitum*), wild sarsparilla (*Aralia nudicaulis*), and wreath goldenrod (*Solidago caesia*). In more natural settings this association occurs on very stabilized secondary dunes and the leeward side of the last high dune. This association may be split out as a new community (e.g., "Great Lakes dune woodland") in future versions of this classification.

A fourth association dominated by speckled alder (*Alnus incana* ssp. *rugosa*) that is often found in wet dune swales is tentatively included under shrub swamp. See the appropriate palustrine communities for the classification of other wetland swales found within Great Lakes dunes. More data the physiognomic variants of this community are needed.

Distribution: only known from the eastern shore of Lake Ontario, in the Eastern Ontario Plain subzone of the Great Lakes Plain ecozone.

Rank: G3G4 S1S2 *Revised:* 2001

Examples: Southwick Beach, Jefferson County; El Dorado Beach, Jefferson County; Lakeview Wildlife Management Area, Jefferson County; Deer Creek Dunes, Oswego County.

Source: Bonano 1998; Significant Habitat Unit files; NYNHP field surveys.

3. Maritime beach: a community with extremely sparse vegetation that occurs on unstable sand, gravel, or cobble ocean shores above mean high tide, where the shore is modified by storm waves and wind erosion.

Characteristic species include beachgrass (*Ammophila breviligulata*), sea-rocket (*Cakile edentula* ssp. *edentula*), seaside atriplex (*Atriplex patula*), seabeach atriplex (*A. arenaria*), seabeach sandwort (*Honkenya peploides*), salsola (*Salsola kali*), seaside spurge (*Chamaesyce polygonifolia*), and seabeach knotweed (*Polygonum glaucum*).

This community is an important nesting ground for birds such as piping plover (*Charadrius melodus*), least tern (*Sterna antillarum*), common tern (*S. hirundo*), and roseate tern (*S. dougallii*).

Distribution: along the seacoast of the Coastal Lowlands ecozone.

Rank: G5 S5 *Revised:* 1990

Examples: Fire Island National Seashore, Suffolk County; Napeague Beach, Suffolk County; Orient Beach, Suffolk County.

Sources: Art 1976; Johnson 1985; Significant Habitat Unit files, NYNHP field surveys.

4. Maritime dunes: a community dominated by grasses and low shrubs that occurs on active and stabilized dunes along the Atlantic coast. This community consists of a mosaic of vegetation patches. This mosaic reflects past disturbances such as sand deposition, erosion, and dune migration. The composition and structure of the vegetation is variable depending on stability of the dunes, amounts of sand deposition and erosion, and distance from the ocean.

Characteristic species of the active dunes, where sand movement is greastest, include beachgrass (*Ammophila breviligulata*), dusty-miller (*Artemisia stelleriana*), beach pea (*Lathyrus japonicus*), sedge (*Carex silicea*), seaside goldenrod (*Solidago sempervirens*), and sand-rose (*Rosa rugosa*).

Characteristic species of stabilized dunes include beach heather (*Hudsonia tomentosa*), bearberry (*Arctostaphylos uva-ursi*), beachgrass (*Ammophila breviligulata*), cyperus (*Cyperus polystachyos* var. *macrostachyus*), seaside goldenrod (*Solidago sempervirens*), beach pinweed (*Lechea maritima*), jointweed (*Polygonella articulata*), sand-rose (*Rosa rugosa*), bayberry (*Myrica pensylvanica*), beach-plum (*Prunus maritima*), poison ivy (*Toxicodendron radicans*), and the lichens *Cladina submitis* and *Cetraria arenaria*). Seabeach amaranth (*Amaranthus pumilus*) is a federally threatened plant that is found on the dynamic foredune of some maritime dunes. A few stunted pitch pines (*Pinus rigida*) or post oaks (*Quercus stellata*) may be present in the dunes.

Distribution: along the seacoast of the Coastal Lowlands ecozone.

Rank: G4 S3 *Revised:* 2001

Examples: Napeague Dunes, Suffolk County; Fire

(*Fraxinus americana*) and black walnut (*Juglans nigra*).

Shrubs and groundlayer vegetation are similar to a successional old field; in some stands the groundcover consists of a nearly pure stand of non-native bluegrasses such as *Poa compressa* and *P. pratensis*.

A characteristic bird is the prairie warbler (*Dendroica discolor*).

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

Examples: Champlain Valley Essex, Essex County; Crown Point, Essex County; Beaver Brook Valley, Essex County; NY State Thruway at Cauterskill, Greene County.

Source: NYNHP field surveys.

C. FORESTED UPLANDS

This subsystem includes upland communities with more than 60% canopy cover of trees; these communities occur on substrates with less than 50% rock outcrop or shallow soil over bedrock.

Maritime forests: areas generally in immediate proximity to marine communities. Heavily influenced by coastal processes including strong salt spray, high winds and dune deposition, shifting and overwash processes. Forests generally contain stunted "salt pruned" trees with contorted branches and wilted leaves plus usually have a dense vine layer. Communities often occur as narrow bands under 50 meters wide. Greller (1977) has referred to maritime forests as "strand forest."

1. Maritime post oak forest: an oak-dominated forest that borders salt marshes or occurs on exposed bluffs and sand spits within about 200 meters of the seacoast. The trees may be somewhat stunted and flat-topped because the canopies are pruned by salt spray and exposed to winds.

The forest is usually dominated by two or more species of oaks. Characteristic canopy trees include post oak (*Quercus stellata*), black oak (*Q. velutina*), scarlet oak (*Q. coccinea*) and white oak (*Q. alba*). A small number of eastern red cedar (*Juniperis virginiana*) may be present.

The understory usually contains a dense shrub thicket dominated by bayberry (*Myrica pensylvanica*) and black huckleberry (*Gaylussacia baccata*), with saplings of black cherry (*Prunus serotina*) as a common associate. In most stands the understory is a dense thicket of catbrier (*Smilax rotundifolia*). The presence of catbrier is not well understood. They are likely to be favored from natural disturbances of exposure to salt spray and windthrow. However, other less natural disturbances such as insect infestations, heavy browsing by deer, clear-cutting and fires may produce similar effect. Other vines are common including poison ivy (*Toxicodendron radicans*), summer grape (*Vitis aestivalis*), and Virginia creeper (*Parthenocissus quinquefolia*). The sparse groundlayer under this shrub and vine thicket is dominated by common hairgrass (*Deschampsia flexuosa*).

Characteristic animals include eastern towhee (*Pipilo erythrophthalamus*) and white-tailed deer (*Odocoileus virginianus*).

Three topoedaphic variants of this community are known. The typical post oak-catbrier forest variant, experiencing the most extreme degree of salt spray, is most widespread. A post oak-basswood variant on windswept sands forming dunes on top of morainal bluffs is known along Long Island Sound (Lamont 1997). A post oak-blackjack oak variant on reddish sandy clay loam ridges is known from Staten Island.

Distribution: apparently restricted to eastern Long Island and islands in Block Island Sound, in the Coastal Lowlands ecozone.

Rank: G3G4 S2S3 *Revised:* 2001

Examples: Mashomack Preserve, Suffolk County; Barcelona Neck, Suffolk County; Jessup's Neck, Suffolk County.

Sources: Greller 1977; Lamont 1997; Rosza and Metzler 1982; Taylor 1923; NYNHP field surveys.

2. Maritime beech forest: A hardwood forest with beech (*Fagus grandifolia*) dominant that usually occurs on north-facing exposed bluffs and the back portions of rolling dunes in well-drained fine sands. Black oak (*Quercus velutina*) and red maple (*Acer rubrum*) may be present at low density. Occurrences are often associated with coastal oak-beech forest. Wind and salt spray cause the trees to be stunted (average height 4 m to 15 m) and multiple-stemmed with contorted branches, especially on the exposed bluffs. Trees are notably taller on the more protected dunes. Shrub, vine, and herb layers are not well developed. A characteristic vine is greenbrier (*Smilax rotundifolia*).

Characteristic herbs are wild sarsaparilla (*Aralia nudicaulis*), and beech drops (*Epifagus virginiana*). The non-vascular layer may or may not be well developed.

II. ESTUARINE SYSTEM

The estuarine system consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semienclosed but have open, partly obstructed, or sporadic access to open ocean or tidal fresh waters, and in which ocean water is at least occasionally diluted by freshwater runoff. The limits extend from the upstream limit of tidal influence seaward to an imaginary line closing the mouth of a river or bay. Salinity is usually less than 30.0 parts per thousand (ppt) ocean-derived salts.

A. ESTUARINE SUBTIDAL

This subsystem includes the area below the lowest tide; the substrate is permanently flooded with tidal water; it is continuously submerged.

1. Tidal river: the aquatic community of continuously flooded substrates that support no emergent vegetation. Within the river there are two zones; the deepwater zone includes areas where substrates are usually over 2 m (6 ft) deep at low tide, the shallow zone includes submerged areas less than 2 m (6 ft) deep at low tide that lack rooted aquatic vegetation. In the river there is a vertical salinity gradient, with a surface layer of fresh water (salinity less than 0.5 ppt) floating over a deeper layer of brackish water (salinity between 0.5 and 18.0 ppt). Salinities at any one place in the river may fluctuate as the tides flow in and out because the "salt wedge" of brackish water alternately rises and falls with the tides.

Characteristic fishes include year-round residents as well as seasonal migrants or anadromous species that enter the river as adults to spawn and return to the ocean afterwards. The progeny of these anadromous fishes occupy the river as a nursery area for the remainder of the year or longer. Characteristic fishes of the deepwater include Atlantic tomcod (*Microgadus tomcod*), hogchoker (*Trinectes maculatus*), and rainbow smelt (*Osmerus mordax*). Rare deepwater species of the Hudson River include sturgeon (*Acipenser brevirostrum*, and *A. oxyrhynchus*). Characteristic fishes of the shallows include striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), banded killifish (*Fundulus diaphanus*), spottail shiner (*Notropis hudsonius*), tesselated darter (*Etheostoma olmstedi*), and pumpkinseed (*Lepomis gibbosus*). Fishes that occur in both deepwater and shallows include bay anchovy (*Anchoa mitchilli*), blueback herring (*Alosa aestivalis*), white perch (*Morone americana*), and alewife (*Alosa pseudoharengus*).

Smaller tidal rivers on Long Island flow into “tidal bays,” or “backbarrier lagoons,” before reaching the ocean. Backbarrier lagoons are bodies of water that are protected from oceanic forces by barrier islands. Wave action is less significant in these enclosed water bodies than on the ocean beach, and the primary influences on backbarrier sediment are the rise and fall of the tides and activities of organisms (Leatherman 1979). Tidal bays and backbarrier lagoons may include various marine and estuarine communities, such as marine eelgrass meadow, marine intertidal mudflats, and salt marshes. More data on tidal bays and backbarrier lagoons are needed.

Distribution: in the Hudson Valley and Coastal Lowlands ecozones.

Rank: G4 S3 *Revised:* 2001

Example: the Hudson River, from New York City to Troy.

Source: Gladden et al. 1988; Leatherman 1979; Oertel 1985; Oertel et al. 1992.

2. Tidal creek: the aquatic community of a shallow, continuously semidiurnally tidally flooded creek with submerged areas averaging less than 2 m (6 ft) deep at low tide. The water is typically brackish to saline, but the community can range from freshwater (0 to 0.5 ppt salinity), to brackish (0.5 to 18 ppt), to saline (18 to 30 ppt or greater). Varying depth zones and flow microhabitats often result in a diverse array of ecological associations. Water levels fluctuate with the tides and two community depth zones are typically encountered: 1) the subtidal, permanently flooded, portion of the creek and 2) the intertidal portion including banks and midchannel bars or terraces exposed at low tide. Typical flow microhabitats in a fully-developed creek include abundant slow-flowing pools connected by runs with localized turbulent, fast-flowing riffles. Typical examples drain the waters of semidiurnally tidally flooded marshes and most of these marshes are coastal salt marshes of the back barrier or finger marsh type. Most tidal creeks flow in a very sinuous (i.e., meandering) pattern through a salt marsh. Although the vertical banks of the creek are regularly eroded and slump into the creek bottom, the position of the creek bed in the marsh is fairly stable and oxbows are rare. The sinuous meanders of the creek are not formed by recent erosion of the marsh, rather they are thought to be relicts of the drainage channels that were active in the tidal flats when the salt marsh grasses first became established.

Widgeon-grass (*Ruppia maritima*) is abundant in brackish to saline tidal creeks. Common epiphytic plants include the marine red algae tubed weed

(*Polysiphonia stricta*) and banded weed (*Ceramium strictum*). Other characteristic plants are the marine red algae tubed weed (*Polysiphonia denudata*), graceful red weed (*Gracilaria tikvahiae*), and *Spyridia filamentosa* and several cyanobacteria including *Hydrocoleum lyngbaceum*, *Anabaena torulosa*, and *Agmenellum quadruplicatum*.

Fauna in tidal creeks are diverse. Several fishes that are resident in brackish to saline tidal creeks at low tide also use the low salt marsh when it is flooded by high tide. Characteristic fishes that have this distribution pattern include Atlantic silverside (*Menidia menidia*), mummichog (*Fundulus heteroclitus*), striped killifish (*Fundulus majalis*), sheepshead minnow (*Cyprinodon variegatus*), fourspine stickleback (*Apeltes quadracus*), threespine stickleback (*Gasterosteus aculeatus*), and American eel (*Anguilla rostrata*). Brackish to saline tidal creeks are also utilized as nursery areas for several important marine fishes, including winter flounder (*Pseudopleuronectes americanus*), black sea bass (*Centropristis striata*), bluefish (*Pomatomus saltatrix*), and striped bass (*Morone saxatilis*). Great blue heron (*Ardea herodias*) and egrets commonly feed on the fish. Comb jellies (*Beroe* spp., *Mnemiopsis* spp.) are common plankton species. Common benthic epifauna include eastern mud snail (*Nassarius obsoletus*), daggerblade grass shrimp (*Palaemonetes pugio*), longwrist hermit crab (*Pagurus longicarpus*), and common Atlantic slippershell (*Crepidula crepidula*). Common benthic infauna include northern quahog (*Mercenaria mercenaria*), softshell clam (*Mya arenaria*), razor clam (*Ensis directus*), and bamboo worms (Polychaeta). Other characteristic marine invertebrates include blue crab (*Callinectes sapidus*), hairy sea cucumber (*Sclerodactyla briareus*), Atlantic horseshoe crab (*Limulus polyphemus*), acorn worm (Hemichordata) and terrebelid worm (*Amphitrite* spp.).

Tidal creek pools have silty substrate with abundant beds of widgeon grass and tubed weed and the characteristic fauna hairy sea cucumber, American eel, grass shrimp, and eastern mud snail. Runs have sandy to gravelly substrate supporting the marine algae species tubed weed, graceful red weed, and green fleece (*Codium fragile*), a common exotic marine green algae, benthic marine fish such as naked goby (*Gobiosoma bosci*) and northern pipefish (*Syngnathus fuscus*), and many marine mollusks. Riffles have gravelly to cobbly bottoms with macroalgae beds of hollow green weed (*Enteromorpha* spp.), benthic marine fish such as naked goby and marine mollusks such as common Atlantic slippershell. Intertidal peaty banks of creeks in salt marshes, especially in pools and runs, are characterized by abundant ribbed mussel (*Modiolus demissus*), mummichog, and killifish.

Freshwater variants of tidal creeks, that drain freshwater tidal marshes, such as those found along the Hudson River, are included here. More data on this community variant are needed.

Distribution: in salt marshes along the seacoast in the Coastal Lowlands ecozone, and along the Long Island Sound in the Manhattan Hills ecozone.

Rank: G4 S3S4 *Revised:* 2001

Examples: Bass Creek, Suffolk County; Hubbard Creek Marsh, Suffolk County; Mashomack Creek, Suffolk County.

Sources: Kiviat and Stevens 2001; Redfield 1972; Teal 1986; Webber 1967.

3. Brackish subtidal aquatic bed: the aquatic community of continuously flooded substrates with rooted aquatic vegetation. The water is brackish (salinity between 0.5 and 18.0 ppt) and the water is usually less than 2 m (6 ft) deep at low tide.

Characteristic species are sago pondweed (*Potamogeton pectinatus*), horned pondweed (*Zannichellia palustris*), waterweed (*Elodea nuttallii*), coontail (*Ceratophyllum demersum*), naiad (*Najas guadalupensis*), and widgeon grass (*Ruppia maritima*). A common weedy exotic is Eurasian milfoil (*Myriophyllum spicatum*).

As salinity increase downstream brackish subtidal aquatic beds may grade into marine eelgrass meadows dominated by eelgrass (*Zostera maritima*) (Macomber et al. 1979).

Distribution: along the Hudson River from New York City to Newburgh, in the Hudson Valley and Triassic Lowlands ecozones; may also occur in the Coastal Lowlands ecozone.

Rank: G4 S3S4 *Revised:* 2001

Examples: Piermont Marsh, Rockland County; Carmans River, Suffolk County.

Sources: Kiviat and Stevens 2001; Macomber et al. 1979; Metzler and Rosza 1982; Muenscher 1937; Senerchia-Nardone et al. 1985.

4. Freshwater subtidal aquatic bed: the aquatic community of continuously flooded substrates with rooted aquatic vegetation. The water is fresh (salinity less than 0.5 ppt) and the water is usually less than 2 m (6 ft) deep at low tide.

Characteristic species are tapegrass, or wild celery

elm (*U. rubra*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), box elder (*Acer negundo*), silver maple (*A. saccharinum*), sassafras (*Sassafras albidum*), gray birch (*Betula populifolia*), hawthorns (*Crataegus* spp.), eastern red cedar (*Juniperus virginiana*), and choke-cherry (*Prunus virginiana*). Certain introduced species are commonly found in successional forests, including black locust (*Robinia pseudo-acacia*), tree-of-heaven (*Ailanthus altissima*), and buckthorn (*Rhamnus cathartica*). Any of these may be dominant or codominant in a successional southern hardwood forest. Southern indicators include American elm, white ash, red maple, box elder, choke-cherry, and sassafras. This is a broadly defined community and several seral and regional variants are known.

A characteristic bird is chestnut-sided warbler (*Dendroica pensylvanica*).

Distribution: primarily in the southern half of New York, south of the Adirondacks.

Rank: G5 S5 *Revised:* 2001

Example: Chippewa Creek Plains, St. Lawrence County.

Sources: Eyre 1980; NYNHP field surveys.

28. Successional maritime forest: a successional hardwood forest that occurs in low areas near the seacoast. This forest is a variable type that develops after vegetation has burned or land cleared (such as pastureland or farm fields). The trees may be somewhat stunted and flat-topped because the canopies are pruned by salt spray. The forest may be dominated by a single species, or there may be two or three codominants.

Characteristic canopy trees include black oak (*Quercus velutina*), post oak (*Quercus stellata*), shadbush (*Amelanchier canadensis*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), black gum (*Nyssa sylvatica*), sassafras (*Sassafras albidum*), and red maple (*Acer rubrum*). A small number of eastern red cedar (*Juniperus virginiana*) may be present.

Vines that are common in the understory and subcanopy include riverbank grape (*Vitis riparia*), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and greenbrier (*Smilax* spp.).

Shrublayer and groundlayer dominants are variable. Bayberry (*Myrica pensylvanica*) is a common shrub. Certain introduced species are commonly found in this forest, including black locust (*Robinia pseudoacacia*), privet (*Ligustrum* spp.), Asiatic bittersweet (*Celastrus orbiculatus*), Japanese honey suckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), and wineberry (*Rubus phoenicolasius*). Any of these may be dominant or codominant in a successional maritime forest.

Characteristic animals include gray gatbird (*Dumetella carolinensis*), eastern towhee (*Pipilo erythrophthalamus*) and white-tailed deer (*Odocoileus virginianus*). This forest represents an earlier seral stage of other maritime forests, such as maritime post oak forest, maritime holly forest, maritime red cedar forest, and probably others. Soil and moisture regime will usually determine which forest type succeeds from this community. A few disturbance-climax examples occur, maintained by severe and constant salt spray.

Distribution: in the Coastal Lowlands ecozone, in low areas near the coast of Long Island.

Rank: G4 S3S4 *Revised:* 2001

Example: Montauk Point, Suffolk County; William Floyd Estate (Fire Island National Seashore), Suffolk County.

Sources: Clark 1986b; Greller 1977; NYNHP field surveys.

D. TERRESTRIAL CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical conformation of the substrate, or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence.

1. Cropland/row crops: an agricultural field planted in row crops such as corn, potatoes, and soybeans. This community includes vegetable gardens in residential areas.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

2. Cropland/field crops: an agricultural field planted in field crops such as alfalfa, wheat, timothy, and oats. This community includes hayfields that are rotated to pasture. Characteristic birds include grasshopper sparrow (*Ammodramus savannarum*), vesper sparrow (*Pooecetes gramineus*), bobolink (*Dolichonys*

APPENDIX D

SCDHS Bathing Beach Data

Suffolk County Department of Health Services
Bathing Beach Water Quality Monitoring Program

- In an effort to protect public health, the Suffolk County Department of Health Services Office of Ecology conducts a comprehensive bathing beach water quality monitoring program from mid-May through mid-September at approximately 190 beaches.
- The frequency of sampling is determined using a tiered, risk-based approach, with more testing conducted at beaches that have historically demonstrated periods of poor water quality or are potentially at risk because of their proximity to pollution sources. Sampling at these beaches is typically performed at least twice per week. Lower risk beaches (such as those on the Atlantic Ocean) are typically sampled on a less frequent basis.

Waterbody	No. of Beaches Monitored
Atlantic Ocean	52
Long Island Sound	43
North Shore Bays & Harbors	32
Peconic Estuary	28
South Shore Bays	27
Lakes	8

- To evaluate beach water quality, levels of "indicator organisms" are used as an estimate of fecal contamination. Indicator organisms are microbes that are found in the intestinal tract of humans and other warm-blooded animals, and although harmless, may indicate when detected that fecal contamination and, possibly, disease causing organisms are present.
- In accordance with recommendations from the USEPA under the BEACH Act, and with requirements of the New York State Sanitary Code for Bathing Beaches, Suffolk County uses ***Enterococci*** as an indicator organism for marine beaches and ***E.coli*** as an indicator organism for freshwater beaches.
- Suffolk County has significantly expanded its beach monitoring program in recent years, primarily as a result of grant funding obtained through the BEACH Act. The average number of samples collected increased from approximately 520 per year from 2000-2002, to more than 4,000 in 2011.
- Sample results are assessed in relation to established water quality criteria for individual samples as well as for the average of all samples collected in a 30-day period. Single-sample limits are 104 cfu/100 ml for *Enterococci* (***EN***) and 235 cfu/100 ml for *E.coli* (***EC***). Limits for 30-day geometric means are 35 cfu/100 ml for *Enterococci* and 126 cfu/100 ml for *E.coli*.
- Decisions regarding beach closures are based on sample results as well as various beach specific factors, including knowledge of potential sources of contamination in the beach watershed, historic water quality data, past criteria exceedances, weather, and area flushing characteristics.
- Both *Enterococci* and *E.coli* bacteria can be introduced to recreational waters from a variety of sources, including stormwater runoff, resident waterfowl populations, failing or poorly operating septic systems, sewage spills, boats and marinas, floatable debris, and from bathers themselves.
- At marine and coastal beaches in Suffolk County, stormwater runoff is the predominant source of bacteria-laden water. The effects of the runoff on water quality are site specific, and are influenced by a number of factors, including the type of land use, area topography, and the degree of tidal flushing.
- At freshwater lake beaches, resident waterfowl and other wildlife are principal sources of bacterial contaminants, although at lakes located in more densely developed areas, inputs from stormwater runoff and area septic systems may also be significant.
- An increase in the number of beaches involved in advisories and in the number of advisory (closure) days is a direct result of the beach programs expansion (advisories were first initiated in 2003) and an increased level of diligence by the SCDHS; not an indication of increasing levels of contamination.

- Notifications of all closures and advisories are communicated directly to the beach manager, or the appropriate town or county representative in the case of municipal beaches, in addition to issuing a press release and posting a message on the Department's Website and Beach Hotline. In July 2008, an interactive map-based website was launched that enables the public to get current updates on beach water quality, as well as pertinent educational and procedural information. The web application also facilitates data management, identifies criteria exceedances, and enhances our level of public notification and education concerning health issues at beaches.
- http://www.suffolkcountyny.gov/Departments/HealthServices/EnvironmentalQuality/Ecology/BeachMonitoringProgram.aspx

Summary of SCDHS Bathing Beach Sampling Data, 2001 - 2012

Sample Date	Monitoring Station									
	ST1	ST2	ST3	ST4	ST6	ST10	ST11	ST12	ST12A	ST13
6/29/2001										
7/12/2001			0		0					
7/23/2001	0	0	80	0	0					
7/30/2001	20	20	0	500	0					
7/10/2002	0	0	0		0					
7/15/2002					0					
5/21/2003			0	20	0					
6/2/2003			6	40	6					
6/16/2003	20	0	0	20	0					
6/23/2003	20	0	0	80	0	0				
7/2/2004	0	40	0	1700	0	0				
7/30/2004	20	8	4	36	0	0				
8/6/2004			2	12	38	8				
7/14/2005	28	0	4	0	0	4				
7/22/2005	4	0	0	0	0	0				
8/3/2005	8	8	4	12	0	0				
6/6/2006	24	8	0	8	0	4				
7/27/2006	12	0	4	0	0	0				
8/18/2006	0	0	316	0	0	0				
8/25/2006	0	0	0	8	0	0				
6/8/2007		8	0	0	8	12				
6/14/2007	316	92	24	64	4	8				
6/21/2007	8	16	0	0	12	0				
6/25/2007	4	0	0	0	0	0				
7/27/2007	0	0	0	0	4	0				
8/17/2007	0	0	0	8	0	0				
9/12/2007	8	100	40	424	0	560				
6/3/2008	0	0	0	76	0	0				
6/20/2008	4	16	0	4	4	0				
7/3/2008	4			24	4	4				
7/10/2008	12			0	0	0				
7/24/2008	0			0	4	256				
8/8/2008	16			24	4	64				
8/15/2008	4			52	0	0				
8/25/2008	0			12	4	0				
6/22/2009	320	224	120	4	4	136				
7/15/2009	12	0	4	4	8	0				
7/27/2009	20	56	0	4	16	0				
8/14/2009	4	8	0	0	0	4				
8/28/2009	4	0	0	0	0	0				
5/28/2010	0	0	0	4	0	0				
6/1/2010	24	0	0	4	0	0				
6/22/2010	0	0	0	0	0	0				
7/1/2010	8	136	0	0	0	0				
7/6/2010	0	4	0	0	0	0				
7/15/2010	0	68	0	0	0	4				
7/20/2010	4	36	8	12	4	8				
7/28/2010	0	8	4	0	0	0				
8/5/2010	0	0	0	0	0	4				
8/16/2010	8	4	4	0	0	0				
8/25/2010	8	8	4	4	0	4				
6/20/2011	4	0	0	0	4	0				

Summary of SCDHS Bathing Beach Sampling Data, 2001 - 2012

Sample Date	Monitoring Station									
	ST1	ST2	ST3	ST4	ST6	ST10	ST11	ST12	ST12A	ST13
7/1/2011	12	4	0	0	0	0				
7/8/2011	4	0	4	0	0	0				
7/12/2011	8	0	4	12	0	0				
7/15/2011	8	0	0	0	8	0				
7/18/2011	0	4	0	0	0	0				
8/5/2011	0	12	0	0	0	0				
8/9/2011	0	0	0	0	0	0				
8/15/2011	124	124	0	4	4	96				
8/17/2011	0	0								
6/8/2012	12	0	4	0	4	0	4.1			
6/19/2012	0	4	8	0	0	0		4	0	0
6/29/2012	4	32	56	36	0	0	20.3	16	0	0
7/6/2012	48		0	0	0	0				
7/10/2012	0	0	0	0	0	0	2	0	0	0
7/17/2012	8	0	0	0	0	0				
8/3/2012	0	0	0	8	0	0				
8/7/2012	0	0	0	0	0	0				
Number of Exceedances	**3**	**3**	**2**	**3**	**0**	**3**	**0**	**0**	**0**	**0**

APPENDIX E

STP Outfall Data

SCDHS STP OUTFALL DATA

Date	Time	Station	Temp	Total Coliform	Fecal Coliform	NH3	NO2	NO3	NOx	TKN	DKN	TN	TDN	TPO4	TP	o-PO4	TSS	Flow Inst	Flow 24
5/30/95	13:12	200019	17.7	< 20	< 20	6.9	< 0.02	< 0.2		8.50				1.4			< 0.1	0.001	0.028
6/12/95	11:17	200019	19.5	< 20	< 20	9.7	0.028	0.400		10.4				1.3			2	< 0.001	0.027
6/28/95	12:14	200019	20.2	230	< 20	2.5	0.570	0.600		4.90				1.2			12	< 0.001	0.021
7/13/95	10:01	200019	22.1	< 20	< 20	< 0.02	< 0.02	2.2		1.98				0.776			3		0.025
7/24/95	11:47	200019	23.9	< 20	< 20	8.9	< 0.02	< 0.2		13.6				2.3			< 1.0	< 0.001	0.036
8/9/95	10:41	200019	23.3	< 20	< 20	2.0	0.540	1.8		4.00				0.474			< 0.1	< 0.001	0.028
8/24/95	10:02	200019	23.3	20	< 20	8.6	< 0.002	< 0.005		13.0				1.1			< 0.1	0.009	0.092
9/13/95	10:17	200019	22.3	40	40	7.9	0.220	< 0.005		11.0				0.572			13	0.130	0.017
9/26/95	12:37	200019	20.2	40	< 20	1.6	0.970	0.700		3.40				0.675			24	< 0.001	0.017
10/30/95	8:00	200019	17.5	40	< 20	< 0.005	< 0.002	< 0.005		1.40				1.4			11	< 0.001	0.017
11/20/95	10:43	200019	13.1	300	< 20	< 0.005	< 0.002	5.2		0.78				3.2			11	< 0.001	0.018
12/11/95	11:34	200019	10.3	80	< 20	1.0	< 0.002	3.2		2.30				3.9			1	0.005	0.012
2/7/96	11:22	200019	5.6	< 20	< 20	< 0.005	< 0.002	5.3		0.49				2.7			1	< 0.001	0.030
2/26/96	9:18	200019	7.5	< 20	< 20	< 0.005	< 0.002	4.0		0.50				3.6			< 0.1	< 0.001	0.016
3/11/96	10:57	200019	6.3	< 20	< 20	< 0.005	< 0.002	5.8		0.87				3.3			< 0.1	< 0.001	0.017
3/25/96	10:32	200019	8.8	< 20	< 20	0.070	< 0.002	3.0		1.40				2.9			2	< 0.001	0.017
4/22/96	9:57	200019	12.0	130	< 20	0.060	< 0.002	1.8		1.50				1.6			2	< 0.001	0.025
5/6/96	9:24	200019	13.1	< 20	< 20	< 0.005	< 0.002	0.900		0.92				0.919			5	< 0.001	0.029
5/20/96	9:08	200019	16.6	< 20	< 20	0.230	< 0.002	2.8		1.10				0.280			6	< 0.001	0.033
6/3/96	8:47	200019	16.6	< 20	< 20	< 0.005	< 0.002	3.0		1.40				0.339			4	< 0.001	0.040
6/18/96	9:04	200019	20.6	16,000	1,700	< 0.005	< 0.002	0.650		1.10				0.329			10	< 0.001	0.038
8/12/96	11:09	200019	23.4	> 16000	3,000	8.6	0.050	< 0.2		11.1				1.0			42	0.248	0.068
9/9/96	11:42	200019	23.1	1,300	130	0.650	0.020	1.4		2.00				1.8			7	< 0.001	0.042
9/30/96	9:14	200019	19.4	500	80	0.080	< 0.002	1.7		1.30				3.0			51	< 0.001	0.036
11/12/96	11:10	200019	13.0	< 20	< 20	0.081	< 0.002	4.7		0.64				3.5			5	< 0.001	0.021
12/9/96	9:59	200019	9.7	90	< 20	0.070	< 0.002	6.9		0.71				1.5			5	< 0.001	0.034
3/10/97	10:43	200019	8.1	< 20	< 20	0.160	< .002	2.2		1.10				1.1			5	< .001	0.030
5/27/97	11:14	200019	16.4	40	< 20	0.183	< .02	0.800									7	< 0.001	0.044
6/23/97	8:44	200019	20.8	< 20	< 20					2.30				0.283			7	0.001	0.037
9/29/97	11:07	200019	20.5	5,000	140	0.674	< .02		2.680	3.50				1.5			5	0.184	0.034
11/17/97	10:46	200019	12.6	< 20	< 20	< .02	< .02		4.600	0.81				2.4			2	0.210	0.028
12/15/97	11:42	200019	10.1	< 20	< 20	1.5	< .02		1.400	3.20				1.6			4	0.001	0.020
1/12/98	10:28	200019	9.9	< 20	< 20	< 0.02	< 0.02		2.700	0.94				1.4				0.000	0.026
2/17/98	9:24	200019	8.8	20	20	< 0.02			0.660	1.10				0.199				0.000	0.029
3/12/98	11:07	200019	7.1	< 20	< 20	0.210	< 0.02		2.800	0.84				1.3				0.000	0.035
4/27/98	13:12	200019	16.0	3,000	300	1.1	< 0.02		3.700	2.50				1.9				0.005	0.025
9/8/98	13:40	200019	24.5	16,000	800	6.4	< 0.02		< 0.2	13.0				2.4			17	0.158	0.044
11/23/98	9:02	200019	13.4	< 20	< 20	< 0.02	< 0.02		3.800	2.10				4.5			10	< 0.001	0.016
2/3/99	12:48	200019	9.5	40	< 20	0.780	< 0.02		2.200	1.00				0.548			1	0.137	0.018
3/4/99	13:46	200019	9.1	< 20	< 20	2.1	0.038		2.020	5.20				2.3			2	< 0.001	0.017
4/15/99	13:27	200019	12.3	< 20	< 20	1.1	< 0.02		2.210	3.70				2.1			8	< 0.001	0.020
5/13/99	10:58	200019	17.2	800	40	0.154	< 0.02		1.600	1.64				2.4			4	0.366	0.017
6/15/99	10:53	200019	21.5	40	< 20	0.025	< 0.02		0.750	2.50				1.7			13	0.177	0.024
10/7/99	10:43	200019	17.0	20	< 20	0.154			5.390	2.10				13.0			52	< 0.001	0.190
11/8/99	12:40	200019	14.7	20	< 20					3.40				2.4			32	< 0.001	0.016
12/9/99	13:03	200019	12.7	< 20	< 20	< 0.02	< 0.02		8.840	2.60				4.4			< 0.1	< 0.001	0.010
3/21/00	12:57	200019	9.0	9,000	170	6.4	0.453		4.090	8.90				4.4			47	0.001	0.015
4/3/00	10:59	200019	13.6	220	80	2.3	0.130	1.7		4.20				0.966			4	0.001	0.015
6/7/00	9:35	200019	18.5	< 20	< 20	< 0.02	< 0.02	2.0		1.10				1.1			15	0.000	0.020
9/27/00	9:00	200019	19.5	20	< 20	0.548	0.029	0.984				2.20			1.37	1.00	6	0.173	0.021

EPA STP OUTFALL DATA

DATE	Temperature	Flow rate	pH	Nitrogen, total mg/L	Nitrite total mg/L	Nitrate, total mg/L	Kjeldahl N mg/L	NH3 mg/L	Chlorine mg/L	Fecal coliform	Fecal Coliform 2	Total Coliform	TSS Percent Removal
20090131	50.2	9924	6.71	4.94	0.1	1.07	2.49	1.97	1.96	7	10	10	95
20090228	49.2	9017	7.11	6.98	1	4.51	1.97	0.62	1.94	2	2	4	96.1
20090331	51.2	9765	7.11	13.5	0.1	2.01	7.63	12	1.96	2	2	4	97.4
20090430	57.5	10770	7.02	8.45	0.1	1.71	6.19	5.72	1.96	2	2	2	94.7
20090531	65.1	17541	7	32.5	0.1	0.29	23.9	17.7	1.92	2	2	1001	98.3
20090630	70.5	31613	7.02	4.87	0.1	1.09	3.36	2.04	1.96	2	2	2	99.1
20090731	75.2	35834	7.09	31.6	0.13	0.16	29.4	20.3	1.84	2	2	12	98.6
20090831	78.1	34484	7.02	40.7	0.1	0.27	38.9	27.2	1.92	8	8	65	96.3
20090930	74.3	24531	7.06	34.5	0.1	0.18	26.95	17.6	1.96	42	80	45	90.2
20091031	70.1	14227	6.9	18	0.1	0.56	15.95	12.3	1.96	2	2	2	96.4
20091130	62	11644	6.44	7.55	0.17	3.7	2.3	0.38	1.96	2	2	2	97.2
20091231	58.6	10903	6.7	5.82	0.1	2.29	2.8	0.93	1.96	2	2	2	98.2
20100131	51.6	9782	6.94	8.89	0.1	1.75	5.74	3.46	1.96	2	2	2	98.4
20100228	47.8	8264	7.03	7.19	0.1	3.77	2.84	0.68	1.61	2	2	2	99.1
20100331	52.8	12641	6.54	5.65	0.1	3.28	1.8	0.42	1.96	2	2	333	97.5
20100430	55.9	10983	6.65	19.2	0.13	1.98	13.14	17.3	1.96	2	2	121	98
20100531	67.4	15264	6.85	22.3	0.1	0.23	19.15	20.5	1.93	2	2	5	99.5
20100630	74.1	21179	6.76	19.6	0.13	0.14	18.65	15	1.98	2	2	2	99.7
20100731	80.4	36615	6.98	30.3	0.1	0.12	25.9	25.6	1.92	2	2	2	97.7
20100831	77.5	35595	7	38.6	0.1	0.1	37.8	28.9	1.94	4.8	4.8	21	97.8
20100930	77.5	20666	7.08	37.1	0.1	0.1	34.4	30.7	1.94	2	2	3	99.5
20101031	74.3	17530	6.94	19.7	0.13	20.5	20.3	0.18	1.99	2	2	2	98.7
20101130	62.2	12140	7.08	0.2	1.07	2.67	1.54	0.13	1.97	2	2	2	96.7
20101231	57.2	12472	7.05	0.45	3.94	5.36	1.42	0.1	1.96	4	4	11	99
20110131	50.7	11146	7.15	19.1	1.26	15.84	14.52	0.12	1.96	3	4	13	99
20110228	47.4	8569	6.99	7.35	0.1	2.67	3.71	1.75	1.97	2	2	3	98.6
20110331	51	9749	6.8	18.3	0.11	1.39	10.04	13.1	1.99	2	2	11	97.7
20110430	57.4	8337	7.19	22.1	0.1	0.63	18.5	15	1.96	2	2	4	98.6
20110531	67.6	17523	7.02	41.4	0.1	0.1	33.45	18.3	1.97	2	2	16	99.4
20110630	71.6	23632	7.01	32.9	0.1	0.11	28.25	17.8	1.96	3	4	8	98.5
20110731	78.8	35492	6.91	33.1	0.1	0.1	29.8	13.2	1.8	8001	16000	8001	94.9
20110831	76.9	31412	6.75	32.6	0.1	0.2	31.75	17	1.96	3.15	4.3	14	96.7
20110930	75.9	18210	6.7	18.4	0.1	0.28	15.5	12.5	1.96	73.5	130	240	96.1
20111031	72.4	15178	7.03	3.76	0.1	1.41	1.6	0.16	1.96	2	2	2	98.6
20111130	62.6	12446	7.1	8.76	0.1	1.17	4.28	5.79	1.96	2	2	2	99.4
20111231	60.8	10214	7.04	22.1	0.1	0.95	11.59	16	1.98	3	4	5	99.4

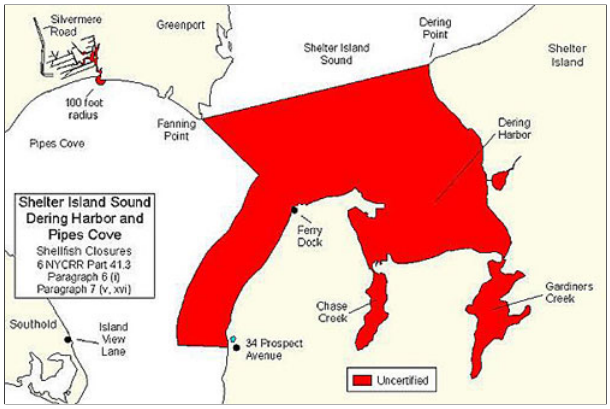
APPENDIX F

NYSDEC Shellfish Closure Area Regulations

(6) Town of Shelter Island.

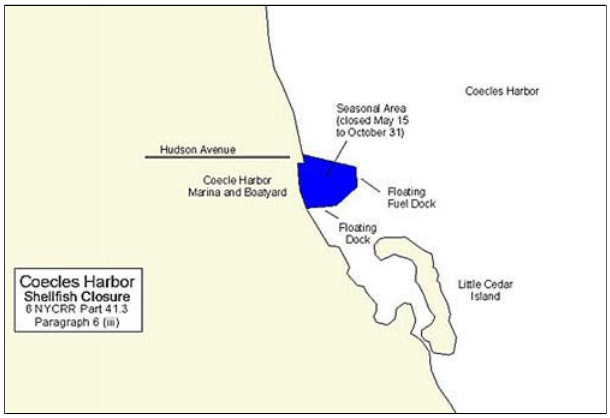
Shelter Island Sound and Dering Harbor
Coecles Harbor
Menantic Creek

(i) Shelter Island Sound and Dering Harbor. All that area of Shelter Island Sound and Dering Harbor south and east of a line extending southwesterly from the westernmost point of land at Dering Point, Shelter Island to the southernmost point of land at Fanning Point, Southold and continuing southeasterly to the westernmost corner of the ferry dock at Shelter Island; and all that area of Shelter Island Sound extending seaward 1000 feet from mean high water from the ferry dock to a line extending westerly from the yellow house at 34 Prospect Avenue, Shelter Island to the foot of Island View Lane, Southold (local names, local landmarks).

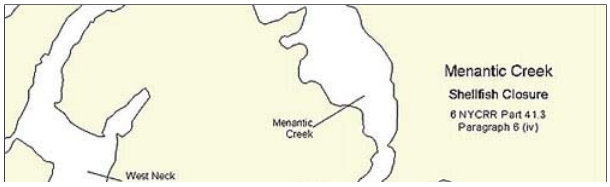


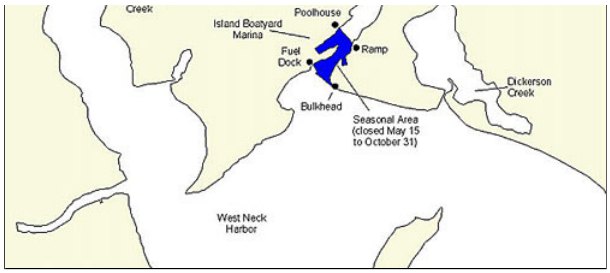
***(also see: Dering Harbor Conditional Program) That portion of Dering Harbor designated as a conditional area remains uncertified when there is no conditional program in effect, and during any period when the conditional program is in the "closed" status.

(ii) Coecles Harbor. During the period May 15 through October 31, both dates inclusive, all that area of Coecles Harbor lying south of a line extending easterly from the eastern end of Hudson Avenue (local name, local landmark) to the northeasternmost corner of the fueling dock at the Coecles Harbor Marina and Boatyard (local name, local landmark) and west of a line extending southerly along the easternmost side of said fueling dock and thence continuing to the southeasternmost corner of the southernmost floating dock at said marina and north of a line extending westerly from the southeasternmost corner of said floating dock to the shoreline.



(iii) Menantic Creek. During the period May 15 through October 31, both dates inclusive, all that area of Menantic Creek lying south of a line extending southeasterly from the northernmost corner of the shingled poolhouse immediately adjacent to the swimming pool located at the Island Boatyard Marina (local name, local landmark) to the western end of Tarkettle Road, which terminates in a town boat launching ramp, (local name, local landmark) and north of a line extending southeasterly from the southernmost point of the Island Boatyard Marina fuel dock to the southwesternmost point of the wooden bulkhead on the eastern side of the mouth of Menantic Creek. Special Note: Menantic Creek is a tributary of West Neck Harbor.





Note: All reference points, except local names and local landmarks, in the Town of Shelter Island are taken from NOAA Nautical Chart No. 12358, 16th Ed., dated May 12, 1990.