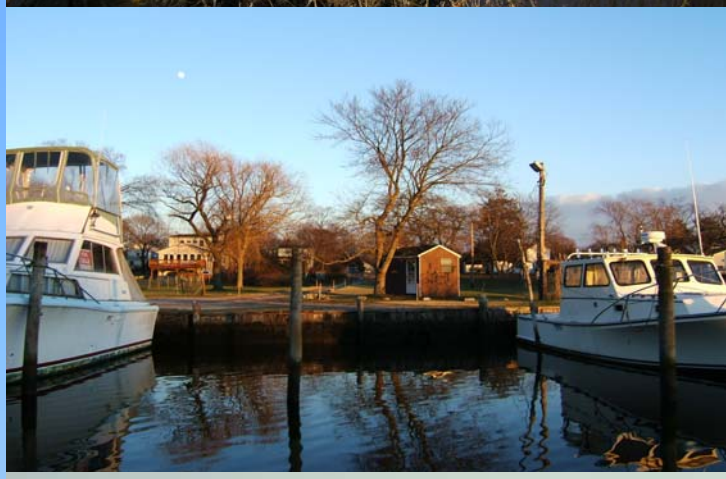
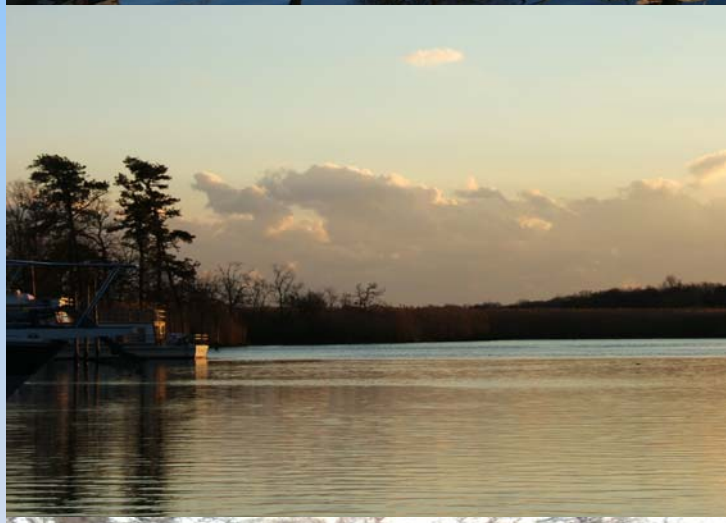
Town of Brookhaven

SWAN RIVER WATERSHED MANAGEMENT PLAN

MARCH 2007





Cashin Associates, P.C.

Town of Brookhaven

FINAL

SWAN RIVER
WATERSHED MANAGEMENT PLAN

Submitted to:
TOWN OF BROOKHAVEN

Prepared by:
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March 2007

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LIST OF ABBREVIATIONS AND ACRONYMS

ASMFC	Atlantic States Marine Fisheries Commission
ATV	all-terrain vehicle
BCA	Bird Conservation Area
BMP	best management practice
Brookhaven	Town of Brookhaven
CA	Cashin Associates, P.C.
CAC	Conservation Advisory Committee
CBI	catch basin insert
CEA	Critical Environmental Area
CF	cubic feet
CMP	Coastal Management Plan
Council	Long Island South Shore Estuary Reserve Council
County	Suffolk County
CR	County Road
CRC	Coastal Resources Coordinator
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DCR	NYSDOS Department of Coastal Resources
DDT	dichloro-diphenyl-trichloroethane
DGE	Detailed Geomorphic Evaluation
DO	dissolved oxygen
DPW	Department of Public Works
EPF	Environmental Protection Fund
ESC	erosion and sedimentation control
F Coli	fecal coliform
FEMA	Federal Emergency Management Agency
FGR	Focused Geomorphic Reconnaissance
FMP	Fishery Management Plan
GIS	Geographical Information System
GPS	Global Positioning System
Guidebook	SCPC Subdivision Guidebook
IDDR	Illicit Discharge Detection and Response
Inventory	Stormwater Inventory for the South Shore Bays
IPC	Invasive Plant Council
IPM	Integrated Pest Management
LIPA	Long Island Power Authority
LIRR	Long Island Rail Road
LISSERC	Long Island South Shore Estuary Reserve Council
LWRP	Local Waterfront Revitalization Program
MF	media filter
MS4	Municipal Separate Storm Sewer System
MTBE	methyl tertiary-butyl ether
NEMO	Nonpoint Education of Municipal Officials
NEPA	National Environmental Protection Act
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NSTCC	Nassau Suffolk Transportation Coordinating Committee

NWI	National Wetlands Inventory
NYCRR	New York Code of Rules and Regulations
NYNHP	New York Natural Heritage Program
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOS	New York State Department of State
NYSDOT	New York State Department of Transportation
NYSSMDM	NYS Stormwater Managers Design Manual
OMWM	Open Marsh Water Management
PCB	polychlorinated biphenyl
Plan	Watershed Management Plan (WAP)
R-O-W	right-of-way
Rte.	Route
SC	Suffolk County
SCDHS	Suffolk County Department of Health Services
SCDP	Suffolk County Department of Parks
SCDPW	Suffolk County Department of Public Works
SCFWH	Significant Coastal Fish and Wildlife Habitat
SCPC	Suffolk County Planning Department
SCWA	Suffolk County Water Authority
SPDES	State Pollution Discharge Elimination System
SRLF	State Revolving Loan Fund
SSER	South Shore Estuary Reserve
SSERC	South Shore Estuary Reserve Council
SUNY	State University of New York
SVAP	Stream Visual Assessment Protocol
SWCD	Soil and Water Conservation District
SWMP	Stormwater Management Program
SWPP	Stormwater Pollution Prevention Plan
TEA-21	Transportation Enhancement Act for the 21st Century
tiff	tagged image file format
TN	total nitrogen
Town	Town of Brookhaven
TP	total phosphorus
TSS	total suspended solids
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
VLF	vertical linear feet
WAC	Watershed Advisory Committee
WMP	Watershed Management Plan (Plan)
WQI	Water Quality Inlet
WQSE	Water Quality Storm Event

EXECUTIVE SUMMARY

This Watershed Management Plan (WMP) focuses on Swan River in the Town of Brookhaven, Suffolk County, New York. Swan River is a tributary to the Great South Bay and is included in the South Shore Estuary Reserve (SSER). The WMP characterizes the natural resources, habitats and environment of the watershed, identifies water quality and living resource impairments, recommends actions to protect the watershed from further degradation, and develops a strategy to restore the watershed.

The overall goal of this WMP is the restoration, enhancement, and improved protection of Swan River. For the Swan River corridor, the specific goals that will aid in achieving the overall goal are to:

- Create a vision for the corridor that identifies and prioritizes projects and opportunities to help achieve restoration, enhancement, and improved protection of Swan River.
- Improve the biological integrity and values of the river corridor.
- Protect the natural and open space values of the river corridor for public enjoyment and preservation of community character.
- Where practical, restore habitats and living resources within the corridor.
- Improve the quality of the water discharged into the Great South Bay to protect water quality in the bay, and potentially reduce the extent of the area closed to shellfish harvesting.
- Provide a comprehensive framework and guide by which government entities, citizens, and non-governmental organizations can restore, manage, and preserve the river corridor.
- Identify means to improve education and outreach methods and opportunities in the watershed.
- Make recommendations on methods to improve legal jurisdiction to control non-point source pollution.
- Provide a process to measure the river corridor restoration progress.

Section 2, *Watershed Characterization,* includes review of the geographic setting, examination of the water quality classifications, identification of the existing drainage infrastructure and connectivity and an outline of the municipal jurisdictions within the watersheds. Section 3, *Protection and Management Recommendations,* includes recommendations and actions that can improve watershed habitat, increase community watershed knowledge, and reduce pollutant sources and levels. Section 4, *Pollutant Load Analysis and Restoration Actions,* includes analysis of pollutant loads from surface runoff at each outfall, recommendations for improvements and identification of specific target projects and actions. The final section, *Implementation Strategies,* identifies coordination efforts required, new codes, revisions to existing policies and programs, and sources of funding necessary to implement the proposed actions and recommendations.

In order to advance the WMP's goals and objectives, this document recommends undertaking a number of measures. These recommendations are summarized as follows:

- *Habitat protection and management recommendations* including wetland and fish habitat restoration measures such as dredge spoils removal; tidal flow improvements; invasive species removal; hydrologic improvements; riparian buffers reestablishment; improvements to fish passage, instream habitat, and shoreline; and trout population research.
- *Educational and outreach recommendations* including developing materials that increases knowledge of pollution impacts to homeowners, boaters, and commercial establishments such as brochures and a Swan River web page; expanding tributary identification signage and providing interpretive exhibits; and expanding school watershed educational programs.
- *Point and nonpoint source pollution management and control recommendations* including developing management programs such as stormwater monitoring and illicit discharge detection programs; implementing drainage area-wide structural stormwater controls; implementing non-structural programs for road maintenance, pest

management and sanitary system review; and modifying land use through property acquisition and preservation, and strengthening laws, regulations and enforcement.

- *Institutional recommendations* including establishing task forces and collaborative efforts with school and stakeholder organizations.

Several priority actions and target projects have been identified as having the greatest potential individual impacts on the water quality in the watershed. The priority actions and target projects include:

- improvements to infrastructure maintenance programs,
- fertilizer and pesticide use reduction through development of Integrated Pest Management (IPM) plans,
- land acquisition of sensitive parcels whose development would negatively impact the waterbodies; and,
- installation of drainage infrastructure that will capture and recharge or treat and release the water quality storm event (WQSE).

The greatest mitigation can be realized by focusing on sub-watersheds identified as contributing the largest loads. The recommended target project sub-watersheds include:

- Seven locations under Town jurisdiction (Circle Drive, Gina Court, Swan Lake Drive/Schoenfeld Boulevard, Debbie Lane, Pine Neck boat ramp, First Avenue, and Patricia Lane) with an estimated construction cost to implement the proposed improvements of $500,000 to $1,000,000.
- Three projects under Suffolk County jurisdiction (Montauk Highway, Sunrise Highway, and Woodside Avenue) with an estimated construction cost to implement the proposed improvements of $370,000 to $520,000.

1.0 INTRODUCTION

Watershed Management Plans (WMPs) guide the long-term management of a community's land and water resources with the ultimate goal of protecting and improving both water quality and living resources. This WMP for Swan River, a tributary of the South Shore Estuary Reserve (SSER), is consistent with the objectives of the SSER Comprehensive Management Plan (CMP) completed in 2001. The SSER CMP identified nonpoint source pollution entering the estuary's tributary creeks and rivers from stormwater runoff as a primary issue. Preparation of this WMP implements a specific CMP recommendation to develop watershed management plans for priority SSER tributaries. In addition, the WMP addresses CMP recommendations related to nonpoint source pollution reduction, habitat protection and restoration, and education, outreach and stewardship.

A watershed can be defined as the area of land that drains to a particular point along a river or stream. Each river has its own watershed. Topography is the key element affecting this area of land. The boundary of a watershed is defined by the highest elevations surrounding the stream. A drop of water falling outside of the boundary would theoretically drain to another watershed (provided that it does not infiltrate into the ground). Development activities in the watershed can change surface cover and topography, limiting the surface area of the watershed that drains to the stream and, at the same time, can increase the quantity of runoff into the river. In recent years, watersheds have become a focal point for community-based environmental conservation. Through the collaborative efforts of watershed groups – consisting of the people living and working within each watershed – major improvements in water quality, fisheries enhancement, wildlife habitat, and overall quality of life have been accomplished.

Swan River and its watershed are located along the south shore of Long Island in the western section of the Town of Brookhaven and is a tributary to the Great South Bay portion of the SSER. Swan River is a four-mile long system of stream, impounded lake and estuary. The river supports a diversity of plants and animals and in a variety of habitats. Development surrounding the Swan River corridor has adversely influenced the river and the riparian corridor. Conditions

of the river are closely tied to the Great South Bay ecosystem, where inflow from the tributaries along the south shore mainland affects the water quality and ecosystem of the bay.

The WMP is necessary because there is evidence that the natural resources of the river corridor have been impaired. The WMP characterizes the natural resources, habitats, and environment of the watersheds, identifies water quality and living resource impairments, recommends actions to protect the watersheds from further degradation, and develops a strategy to restore the watersheds. The plan also forms a framework to guide future decisions and provides a point of reference by which progress can be measured.

The final document will guide long-term development of the Swan River watershed's land and water resources to improve water quality in the river and subsequently the Great South Bay portion of the SSER.

1.1 GOALS AND OBJECTIVES

The overall goal of this WMP is the restoration, enhancement, and improved protection of Swan River. For the Swan River corridor, the specific goals that will aid in achieving the overall goal are to:

- Create a vision for the corridor that identifies and prioritizes projects and opportunities to help achieve restoration, enhancement, and improved protection of Swan River.
- Improve the biological integrity and values of the river corridor.
- Protect the natural and open space values of the river corridor for public enjoyment and preservation of community character.
- Where practical, restore habitats and living resources within the corridor.
- Improve the quality of the water discharged into the Great South Bay to protect water quality in the Bay, and potentially reduce the extent of the area closed to shellfish harvesting.
- Provide a comprehensive framework and guide by which government entities, citizens, and non-governmental organizations can restore, manage, and preserve the river corridor.

- Identify means to improve education and outreach methods and opportunities in the watershed.
- Make recommendations on methods to improve legal jurisdiction to control non-point source pollution.
- Provide a process to measure the river corridor restoration progress.

The following project objectives served as the framework for the WMP and its subsequent implementation. The objectives are organized in three main categories.

Stormwater Management

- Map drainage infrastructure including catch basins, outfalls, drainage swales and other locations where stormwater runoff enters the river.
- Delineate subwatershed areas for contributions to non-point source pollution.
- Determine priorities for remediation work and devise plans for improvements using grant funds such as Clean Water/Clean Air Bond Act funds.

Habitat Improvement

- Assess the Swan River watershed for diadromous fish habitat suitability.
- Recommend improvements to habitat for diadromous fish utilizing Clean Water/Clean Air Bond Act funds, such as the recently approved Fish Habitat Restoration Project.
- Assess Swan River watershed for other habitat improvements and/or restoration efforts.
- Develop recommendations for control of invasive species.
- Evaluate the potential for small-scale riparian restoration.

Education and Outreach

- Target potential areas for non-point source pollution for education efforts.
- Assess local interest in protection efforts. Consider developing a stewardship program.
- Provide opportunities for involvement of Patchogue-Medford schools in stormwater management and habitat improvement objectives.
- Develop a permanent website dedicated to reporting on and support of WMP implementation recommendations and other watershed activities.

1.2 SOUTH SHORE ESTUARY RESERVE

The SSER and its Council of Stakeholders were created by Article 46 of the State Executive Law titled the *Long Island South Shore Estuary Reserve Act* (Act). The Act declared it to be in the public interest to protect and manage the estuary as a single integrated system, and in furtherance of that goal, directed the SSER Council to prepare a management plan for the estuary identifying actions to protect and enhance the region's natural, cultural and recreational resources and its water-based economy.

The SSER encompasses major embayments including the Hempstead Bays, South Oyster Bay, Great South Bay, Moriches Bay, Quantuck Bay, and Shinnecock Bay, and their 326 square mile watershed in Nassau and Suffolk counties. The SSER extends approximately 75 miles from the Nassau/Queens county border at East Rockaway Inlet to the eastern shoreline of Shinnecock Bay at Heady Creek in the Village of Southampton. The SSER is bounded by the barrier islands to the south and the upland limits of the Reserve's watershed to the north.

The SSER Council is chaired by the New York State Secretary of State and represents the interests of multiple state agencies with estuary management responsibilities, Nassau and Suffolk Counties, south shore municipal governments, and recreation, business, academic, conservation, and citizens groups. With technical support from the New York State Department of State (NYSDOS) Division of Coastal Resources, the SSER Council prepared and adopted the CMP in 2001. Subsequent to CMP adoption, the SSER Council has operated as an information-sharing platform among key estuary stakeholders, investigated emerging management issues, and facilitated new partnerships to advance CMP implementation.

2.0 WATERSHED CHARACTERIZATION

The characterization of the watershed examines the existing conditions of the watersheds, including the natural and built environments of the watershed. Significant changes in the character of the Swan River watershed have occurred over the past half century. Following World War II, the area experienced residential and commercial development, resulting in the loss of native vegetation and increase in extensive impermeable surfaces. The watershed's character and water quality were impacted by development and road construction. Runoff from developed lands increases stormwater input to the river. That runoff carries pollutant-laden sediments from developed lands and the built environment.

The watershed characterization describes the following aspects of the study area:

- watershed boundaries through delineation of the lands that drain to the surface waters;
- geographic setting including physical conditions, habitats, land use, and cultural characteristics;
- water quality characterization through review of existing records and data;
- stormwater drainage infrastructure from existing mapping and field assessments;
- inter-municipal jurisdiction and agreements through review of municipal boundaries and responsible authorities; and
- land and water use regulations and laws from local codes and regulations.

2.1 WATERSHED STUDY AREA DELINEATION

The Swan River is the westernmost watershed located entirely within the Town of Brookhaven. The river is a perennial groundwater-fed freshwater stream and pond system that receives large inputs of stormwater runoff during significant storm events. The Swan River drainage system is located entirely within the glacial outwash plain that extends south to the Great South Bay shoreline. The river is freshwater from its headwater south to the dam located north of Montauk Highway. Below the dam the river is tidal. The watershed limits are shown on aerial photography on Figure SR 2.1.1.

The Swan River watershed, as defined in the SSER CMP, encompasses a total of 5441 acres or 8.5 square miles. In its current form, the river headwaters originate north of Woodside Avenue, and the river terminates at Patchogue Bay that is part of the Great South Bay. Swan River has a single large lake, known as Swan Lake, located immediately north of Montauk Highway. The river is approximately 4 miles in total length, with 2.5 miles in length along the lower tidal reach and 1.5 miles along the upper freshwater reach. The freshwater reach length can vary depending on seasonal fluctuations in groundwater levels, prevailing weather patterns, and resultant stormwater inputs.

Field evaluation of the watershed determined alterations to the natural drainage pattern that limit the amount of surface runoff that may be expected to enter the river. The surface drainage boundary is the limit of the drainage area from direct surface runoff or drainage through infrastructure that may outfall into the river. Runoff from the area between the surface drainage boundary and the watershed boundary is collected in drainage structures that infiltrate to groundwater. The watershed limits and the surface drainage boundary are indicated on Figure 2.2.3.

2.2 GEOGRAPHIC SETTING

The geographic setting of the watershed includes descriptions of the watershed topography, hydrology, soils, climate, land use, development patterns, parks and public lands, natural resources, and cultural and historic resources. In addition, this section includes an analysis of the surface areas that drain to the Swan River, a description of the reaches of the river and the subwatershed limits of each outfall.

2.2.1 Topography

Long Island is located on the eastern edge of the Atlantic Coastal Plain. The Coastal Plain is part of a landform that extends underwater to become the Continental Shelf. The plain and shelf combination is about 300 kilometers wide and stretches from Florida to Newfoundland, Canada. It is bounded by higher ground surface to the west and by the underwater Continental Slope to

the east. Long Island is a glacial, depositional landform marking the southernmost limit of the last advance of the Laurentide ice sheet during the Wisconsinan Stage of the Pleistocene Epoch, about 22,000 years ago.

The upper Pleistocene deposits, which form the uppermost principal geologic unit on Long Island, include glacial morainal sediments, till, outwash, and glaciolacustrine sediments that were deposited during the Wisconsinan glaciation of the Pleistocene series. This unit consists mostly of moderately to well-sorted sand and fine gravel, which is highly permeable in most places but locally contains fine-grained, poorly permeable layers of silt or clay. The saturated part of the upper Pleistocene deposits forms the Upper Glacial Aquifer, which contains the water table throughout most of Long Island and is the source of stream headwaters. It is also the aquifer where private wells are typically located. Public potable water supply wells are generally located in the Magothy Aquifer.

Long Island is composed of two end moraines, the Harbor Hill Moraine to the north and the Ronkonkoma Moraine to the south, and their outwash plains. The Ronkonkoma Moraine extends along the south shore forming the South Fork and is fronted by the Atlantic Ocean to the south. The land grades from higher elevations at the watershed's northern limits to sea level at the bay. The Swan River watershed is located in the central portion of the Ronkonkoma Moraine's outwash plain. Topography for the watershed is shown on Figure 2.2.1.

In general, the western shoreline of the river is steeper than the eastern shoreline. The original topography for the area shows several small tributaries extending northeast from the main river. Road and subdivision development has altered the drainage pattern. It now appears that with the exception of the tributary located north on Montauk Highway in Reach 2 these areas no longer surface drain to the river. Reach 2, which is described in Section 2.2.3 Surface Drainage Areas, Reaches and Subwatersheds, is defined as the river section from Montauk Highway to south of Sunrise Highway.

2.2.2 Hydrology

The hydrology of the watershed includes a description of the methods used to determine the surface drainage area of each watershed, groundwater flows, and sanitary disposal systems and issues.

2.2.2.1 Surface Hydrology

Preparation of this Plan included identification of accessible drainage infrastructure and connectivity, along with the locations of topographic high points, to determine the limits of the drainage areas contributing runoff to the river or to infrastructure that discharges to the river. Following data collection and input, sub-watershed areas were delineated identifying the actual area that is contributing to each outfall. The delineation is discussed further in Section 2.4 Stormwater Drainage Infrastructure.

Development in the watershed has altered the pattern of runoff and the limits of the surface runoff reaching Swan River. In a number of areas, the runoff directly discharges to the river from street ends, boat ramps, lawns and landscaped areas, and over bulkheads. However, surface runoff from most of the drainage area does not flow overland to surface waters but is conveyed through stormwater drainage structures and piping or groundwater flow. Stormwater drainage structures collect runoff and deliver it to the river through numerous outfall pipes.

2.2.2.2 Flood Zones

The flood zones are shown on Figure 2.2.2. The 100 years flood zone extends to the dam north of Montauk Highway.

2.2.2.3 Groundwater Flow

Large areas of the watershed no longer drain to Swan River but are intercepted by drainage structures that either leach to groundwater or convey the runoff to recharge basins for infiltration. This runoff may eventually reach the river in the form of

groundwater flow. Due to the filtering action of the soils, this flow will have substantially lower pollutant levels than the surface flow that reaches the river and Bay.

According to Suffolk County Department of Health Services (SCDHS) Water Table Contours Mapping dated March 2002, the depth to groundwater ranges from sea level at the Bay to approximately 25' at the river headwaters and 50' at the northern limits of the watershed.

According to the Suffolk County Hydrogeologic Zones Map, the Swan River watershed is located within Hydrogeologic Zone VI that extends from the bay north to approximately Southaven Avenue. The area north of Southaven Avenue is within the western portion of Hydrogeologic Zone III. According to Hydrogeologic zone descriptions included in the *Special Ground-water Protection Area Project* (LIRPB, 1986), Zone VI is characterized by shallow flow that discharges streamflow and underflow to the Great South Bay and Moriches Bay. The Great South Bay receives up to 11% of its freshwater input directly from groundwater flows. Zone III is characterized as a major deep recharge zone that contributes water to the middle and lower portions of the Magothy Aquifer. Zone III includes a major portion of the Long Island Pine Barrens and the groundwater contained in this zone is reported to be of excellent quality in the Upper Glacial, Magothy, and Lloyd aquifers. However, in the western portion of the Upper Glacial aquifer, development is more extensive and some contamination occurs. The contamination appears to be associated with the impacts of development, including sewage discharges from treatment plants and on-site systems.

2.2.2.4 Sanitary Waste Disposal

Sanitary sewage disposal in the watershed is through individual septic systems or cesspools. Homes built prior to the 1970's were generally built with cesspools. Cesspools are leaching structures that do not have septic tanks to remove solids prior to infiltration. In the 1970's, development regulations were modified to require installation of sanitary disposal systems that include a septic tank and leaching pools. Waste enters the septic

tank from which the liquid effluent goes into leaching pools or fields, while the heavier solids settle to the bottom of the tank where they are gradually decomposed by bacteria.

No on-site sewage disposal systems were identified within the Swan River drainage area. Large developments with on-site sewage disposal systems may be located within the watershed boundary but would account for only a small fraction of the entire watershed area. The impacts from these systems would not be significant when weighed against the impacts from the individual septic systems and cesspool of the properties in close proximity to the river.

Further treatment of wastewater occurs in the soil beneath the leaching pool or field. Effluent filters out of the tank and into the soil, and the soil filters the effluent as it passes through the pore spaces where chemical and biological processes treat the effluent. This filtering process provides the final treatment and disposal of the effluent. After the effluent has passed into the soil, most of it percolates downward and outward, eventually entering the groundwater. The process works best where the soil is dry and permeable, and contains oxygen several feet below the leaching pools. Shallow depth to groundwater and saturated conditions reduce the treatment ability of the soils.

Cesspools, the earlier form of disposal system, lack the septic tank that separates the wastes and prevents solids from entering the flow to groundwater. This increases the potential for pollutants to enter groundwater and subsequently reach the river and Bay.

The most serious problem with cesspools and improperly functioning septic tank systems is the introduction of nitrates into groundwater. Housing densities of 1 to 2 dwellings per acre are necessary to maintain nitrate levels below the USEPA standard limit of less than 10 mg per liter. (Source: SUNY Stony Brook). Long Island streams are groundwater-fed, and streams can be impacted due to contamination of the groundwater. There are currently no USEPA standard limits in place that address the impacts of nitrates on ecosystem health, as opposed to impacts on public health.

A secondary concern of on-site sanitary systems is the potential for improper disposal of organic compounds including paint thinners, petroleum products, grease cutters and household chemicals that can leach into groundwater and subsequently discharge to surface waters.

The Town and SCDHS approve the design and siting of all septic systems and have plumbing codes that require practices that are compatible with properly functioning systems. There is no government regulation that mandates annual or periodic inspections of individual on-site septic and cesspool systems to ensure proper function, and there is no enforcement of maintenance standards. Brookhaven includes in its Town Code provisions that address new and replacement systems in special flood areas and that establish required design criteria for systems in high coastal hazard areas.

2.2.2.5 Water Supply

Suffolk County Water Authority (SCWA) provides all of the public water supply wells within the watershed. Service to this region is administered through the Authority's central regional office. SCWA states that the majority of the water served to SCWA customers is pumped from the Magothy aquifer. As stated in Section 2.2.2.3, the groundwater in the Magothy aquifer is reported to be of excellent quality in the deep recharge zone. The majority of private wells are located in the Upper Glacial aquifer. Development in the western portion of that aquifer has been impacted by development.

2.2.3 Surface Drainage Areas, Reaches and Subwatersheds

The watershed boundary that defines the study area limit was identified in the SSER CMP. The watershed boundary was defined using topographic data of the area natural drainage pattern. It did not account for the topographic and drainage modifications of development in the area. The SSER CMP watershed boundary is shown in Figure 2.2.3.

Field evaluation of the watershed area identified changes to the natural drainage pattern, including topographic changes and the installation of drainage structures, piping and recharge basins. Mapping of these changes redefined the watershed area that can be expected to drain to the river. This area is defined as the surface drainage area and is shown on Figure 2.4.1. These are the limits of the area where pollutants from roads and properties can be expected to wash into the waterbodies either from direct surface runoff or through drainage infrastructure. Runoff from the area between the surface drainage boundary and the watershed boundary is generally collected into drainage structures, such as recharge basins or leaching wells, that have no direct connection to the river and infiltrate to groundwater.

For the purpose of this plan, the storm drainage infrastructure reviewed was limited to those structure and surface areas that are connected to a system that directly drains to Swan River. The drainage area identified as contributing surface runoff directly to Swan River is 891 acres.

The reaches were defined to provide general delineation of areas to target recommendations. The reaches are shown on Figure 2.2.3 and have been defined as follows:

- Reach 1 - Great South Bay to the dam at Montauk Highway.
- Reach 2 – Montauk Highway to south of Sunrise Highway.
- Reach 3 – Sunrise Highway to south of Woodside Avenue.
- Reach 4 – Woodside Avenue north.

The southern reach, Reach 1, is tidal and extends from the bay to the dam located just south of Montauk Highway. Reach 1 includes several marinas and bulkheaded shoreline sections. The Town and Suffolk County have preserved several large parcels of land in Reach 1. Reach 2, is freshwater and extends north through Swan Lake to south of Sunrise Highway. The land use around Reach 2 includes older residential developments without significant drainage infrastructure. A small tributary extends east from Swan Lake. In Reach 3, the river is narrow and the dominant surrounding land use is newer residential developments, most with drainage infrastructure and recharge basins. In Reach 4, the river headwaters begin a short distance north of Woodside Avenue.

The drainage area was further defined by identifying the sub-watersheds. This was completed by reviewing the drainage infrastructure connected to each outfall, the road drainage patterns and the elevation high points. Each sub-watershed directs runoff to the river either by surface or structural means, or to locations adjacent to the river where the existing drainage infrastructure does not appear adequate to provide storage capacity for a 1.2-inch rainfall, although no outfall location was identified. (A 1.2-inch rainfall is the NYSDEC defined water quality storm volume (WQSE) as discussed in Section 2.4 Stormwater Drainage Infrastructure.) The limits of each subwatershed are shown the Figures titled "Drainage Structures" within this document. The areas of each subwatershed are described in Section 2.4.3 Swan River Reaches.

2.2.4 Soils

In general, soils in the study area are similar to those found throughout the south shore of Long Island and are relatively young geologically. Soil associations are landscapes having distinctive general soil properties. Each association is named for the major soils it contains, and normally consists of one or more major soil type and at least one minor soil. Figure SR 2.2.4 shows the soil map for the watershed.

Based upon information obtained in the Soil Survey of Suffolk County, New York (U.S. Soil Conservation Service, April 1975), and with a general exception of the immediate river corridors, the majority of the watershed area soils are characterized as Riverhead Sandy loam, Riverhead and Haven soils, Carver and Plymouth sands and Plymouth loamy sand(Rd, Rh, Cp Pl). The Riverhead, Plymouth and Haven series soils are generally deep, well drained, medium to moderately coarse textured soils. Permeability is moderately rapid to rapid with low fertility. Native vegetation associated with these soils consists of black oak, white oak, red oak, scrub oak, and pitch pine. Carver Series soils are generally, deep, excessively drained, coarse textures soils with rapid permeability. These soils have low available moisture and low natural fertility. Native vegetation included white oak, black oak, scrub oak and pitch pine.

Soils along the Swan River corridor in Reach 1 include extensive areas of tidal marsh (Tm) along both shorelines with filled land of dredge material at the mouth of the river (FD). Tidal marshes are level areas of poorly drained organic soils and wet areas. Filled land of dredge material is disturbed land filled from dredging operations. There are small areas of sandy soils near the river including Atsion sands (At), Deerfield sand (Df), and Wareham loamy sand (We). The Atsion soils are found along the immediate river corridor at margins of river and tidal marshes and generally consist of deep, poorly drained, coarse-textured soils. Native vegetation associated with these soils includes red maple, pitch pine, white oak, black gum, and highbush blueberry. These soils are found where there is a water table ranging from at the surface to 18" below grade. Wareham and Deerfield series soils are deep coarse textured soils found between poorly drained soils, such as tidal marshes, and well-drained upland soils. Native vegetation includes white pine, pitch pine, white oak, red oak, huckleberry, red maple, black gum and highbush blueberry.

Extending north of Montauk Highway to Sunrise Highway (Reach 2), the river channel is Berryland Mucky sands (Bd) with steep side slopes of cut and fill material (Cu) along with small areas of Plymouth gravelly sandy loam. Cut and fill lands are areas that have been regraded during development and the soil profile altered. The Berryland sands are found along the immediate river corridor at margins of river and generally consist of deep, poorly drained, coarse-textured soils. Native vegetation associated with these soils includes red maple, pitch pine, white oak, black gum, and highbush blueberry. These soils are found where there is a water table ranging from at the surface to 18" below grade.

North of Sunrise Highway in Reaches 3 and 4 the river channel continues to be Berryland mucky sand (Bd) with small adjacent areas of Atsion Sand (At), cut and fill soils (Cu), and Haven loam (Ha). The soils map clearly shows naturally occurring drainage swales extending northeast from the river channel that are predominantly Carver and Plymouth sands.

2.2.5 Climate

Temperatures in Suffolk County in the winter average 32.4 degrees Fahrenheit, compared to summer average of 71.9 degrees. Suffolk County area receives total annual precipitation of 42-

inches. A portion of that falls as snow. The average annual snow depth for Suffolk County is 30.0-inches.

2.2.6 Land Use and Cover

The land use and cover section of the WMP includes a description of the predominant land uses in the watershed and the role that impervious cover plays in the generation of stormwater runoff and pollutant load calculations.

2.2.6.1 Land Use

Land uses and activities often play an important role in surface water usage and the quality of those waters. For that reason, land use is a consideration in the development of a WMP. For example, lands that provide recreational access to the surface waters, such as marinas and boat ramps, require location on the shoreline; yet these uses have the potential to impact the quality of surface waters. Additionally, certain land uses and practices, such as filling of wetlands and the discharge of stormwater, can adversely affect surface waters and natural resources.

Predominant land uses in the Swan River watershed are single-family detached housing, parks and preserves, and commercial businesses including marinas and retail. There are limited industrial uses and community uses, such as schools, in the watershed. Land use is shown on Figure 2.2.6.

According to Town tax assessment records, the watershed is 41% residential with the majority designated as single-family residences. Vacant, recreational and wild, forested and conservation lands comprise 45% of the watershed. The watershed is 8% commercial land with the remaining small percentages comprising industrial, agricultural, community and public service uses.

Within the drainage area, the predominant land use is single-family residential. There is limited marine and water-dependent commercial use along the lower river. The marine

and other water-dependent commercial uses are located at the southern end of the watershed. Marine use includes one public and two commercial marinas. The public marina facilities include dry storage space, fueling stations, boat repair and sales, and automotive parking areas, and a restaurant. Along Montauk Highway, the land use is commercial with a small amount of industrial. There are several large vacant parcels within the drainage area.

The Swan River navigational channel within Reach 1 is maintained by the Suffolk County Department of Public Works, which dredged the mouth of the channel in late 2005. The dredged material was placed on Town property at the southwestern mouth of the river.

There are several property owners who have large land holdings along the river. These include Suffolk County, which owns a total of 57.2 acres along Swan River, and the Town of Brookhaven, which owns 27.8 acres. The Town ownership includes a marina along the east shore of the river.

2.2.6.2 Impervious Cover

The conversion of land underlain by permeable soils to impervious surfaces, such as streets, sidewalks, roofed areas and parking lots, significantly reduces on-site infiltration of precipitation to groundwater and creates large volumes of surface runoff. Runoff from impervious surfaces flows either to surface water or to drainage infrastructure systems that may discharge to surface waters or to groundwater. Runoff from impervious surfaces that reaches surface waters has several hydrologic consequences. Stormwater does not replenish the ground-water system, and peak stream discharges during individual storms are larger and more variable than discharges from undeveloped areas. The ratio of surface runoff to base flow in streams that receive street runoff is increased. Pollutants that wash off lawn and landscaped areas and from impervious surfaces are carried directly into surface waters.

In order to predict pollutant loads in stormwater draining to Swan River, a calculation entitled the "Simple Method" (Schueler, 1987) was used. An explanation of the "Simple Method" calculation is included in the *New York State Stormwater Management Design Manual (2001)*. The calculations for the Swan River watershed are presented in Section 4.0 Pollutant Load Analysis and Restoration Actions. Impervious cover is one of the factors considered in the analysis of pollutant loading. Even where vegetation exists, compaction and siltation can reduce the grounds ability to infiltrate significant amounts of runoff.

In Section 3.0 Protection and Management Recommendations, the estimated impervious surface of highways and large commercial roads is assumed to be 100%. For the residential areas, where lawns and ornamentally landscaped front yards dominate, the impervious surface is assumed to be 70%. It should be noted that for the design of drainage infrastructure systems the actual impervious percentage will be based on the actual project limits and area and may vary from the impervious percentages used for planning purposes in this document.

2.2.7 Development Trends

The development trends section of this report includes a description of the zoning in place in the watershed and the population of the communities where the watershed is located.

2.2.7.1 Zoning

Land use in the watershed is predominantly residential and zoned accordingly. According to a Town Zoning Map dated 2003, residentially zoned, single-family parcels (Zones A1 and A2) predominate in the watershed and within the drainage area. There are limited locations of higher-density, single-family residential (Zones B, D, HF) and multi-family residential (Zones MF 1, MF2, NH, PRC). Individual multi-family parcels are adjacent to Swan Lake and the Reach 2 tributary. Commercial zones (Zones J1- J4) are found along Montauk Highway and along the south side of Sunrise Highway. There are only two commercially zoned parcels (Zone J2) along the river in Reach 1, which are the existing

marina sites. Industrial zones (Zones L1 - L3) are located along the LIRR tracks south of Montauk Highway and further north along the Long Island Expressway and Railroad Avenue. Zoning is shown on Figure 2.2.7

2.2.7.2 Population

The following population data was taken from the Long Island Power Authority Population Survey of 2004. Long Island was home to about 2.81 million people with Suffolk County accounting for about 1.47 million of them. The Town of Brookhaven had 472,425 residents in 154,909 residences. The watershed area is within the hamlet of East Patchogue. East Patchogue had 21,452 residents or 4.5% of the Town population.

2.2.8 Parks, Preserves and Recreational Opportunities.

Over 5,000 acres of land are held in public ownership within the Swan River watershed, providing areas for active and passive recreation, as well as access to the waterfront. Some of the publicly owned properties provide indirect environmental benefits, such as recharge basins that receive stormwater, and spoil receiving areas, that accommodate sediments dredged from the waterways. Municipally-owned parks and preserved parcels are included on Figure 2.2.8. Publicly Owned Lands which also shows other parcels in public ownership. The park and preserved lands include:

2.2.8.1 Town of Brookhaven

- A 23-acre parcel located along the southwest shoreline of the river is owned by the Town and serves as a location for dredge spoil disposal. Dredge spoils have been deposited at this location as recently as the 2005 river dredging operation conducted by Suffolk County.
- Pine Neck Launching Ramp and Fishing Pier is a 4.3-acre Town facility located on the southeast shoreline of the river. The facility provides a fishing pier, a boat ramp and restroom facilities. User fees are charged from May to November.
- Several small park parcels that are part of residential developments. These are either undeveloped or contain playground equipment and passive recreational space.

- A 17.8 acre parcel along the eastern side of the river south of Woodside Avenue is currently in the process of being acquired and preserved by the Town.

2.2.8.2 Suffolk County

- Suffolk County owns parcels along Swan River totaling 57 acres. The parcels are mainly along the eastern shoreline south of Montauk Highway, along the southern shoreline of Swan Lake, and at several of the road ends along the eastern shoreline in Reach 2 north of Swan Lake. The majority of these lands are preserved lands and are not actively managed. The lands at the south end of Swan Lake provide passive recreational space.

2.2.8.3 Private Lands

- A 7.4-acre parcel along the western shoreline north of Barton Avenue is designated open space. This land was preserved when the adjacent land was developed for single-family residential housing.

2.2.8.4 Recreational Opportunities

Swan River offers recreational fishing opportunities of countywide significance but has limited formal access to these fishing opportunities. The recreational fishing opportunities are recognized to be of countywide significance because of the presence of native brook trout; one of only six known locations on Long Island. The Town's Pine Neck facility, located along the west shore at the mouth of the river, contains a fishing pier used for recreational fishing of snappers and crabs and a boat ramp for daily launching. This facility also offers kayak users river access via the dock and boat ramp. User fees are in effect from May through November at this facility. Recreational fishing is available from the shoreline of Swan Lake. The NYSDEC annually stocks the lake with trout.

2.2.9 Natural Resources

The natural resources section of this report includes descriptions of the wetland habitats, living resources, and endangered species within the watershed and the land use impairments, habitat losses, and invasive species that affect the natural resources.

2.2.9.1 Wetland Habitats

Wetlands can be considered a transitional habitat that occurs between upland and aquatic environments where water is the primary controlling factor of the associated plant and wildlife. According to the USEPA, there are four general traditional wetland categories found in the United States: marshes, swamps, bogs, and fens. Two types of traditional wetlands found in the Swan River watershed are marshes and swamps. The National Wetland Inventory (NWI) has further classified the traditional wetlands categories as discussed below. Figure 2.2.9 shows the limits of NYSDEC delineated wetland areas.

According to the NWI, two classifications of wetlands are found along the Swan River. The first is the estuarine system which consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly unobstructed or sporadic access to the open ocean in which ocean water is at least occasionally diluted by freshwater runoff from the land. The estuarine system includes both estuaries and lagoons that are affected by tides, precipitation, and freshwater runoff from land areas, evaporation and wind. The subsystems include sub-tidal systems where the substrate is continuously submerged, and inter-tidal systems where the substrate is exposed and flooded by tides. Classes within the subsystems that are found along the Swan River include sub-tidal systems with an unconsolidated bottom, and intertidal systems with emergent wetland vegetation that is irregularly flooded. In one location near Chapel Street, the intertidal system is artificially flooded by a created impoundment.

The second wetland classification found along the Swan River is the Palustrine System, which consists of non-tidal wetland dominated by trees, shrubs, and persistent emergents, and all wetlands where salinity due to ocean-derived salts is below 0.5%. The Palustrine systems group vegetated wetlands are traditionally called marsh, swamp, bog, fen or prairie; and include shallow permanent or intermittent waterbodies called ponds. Palustrine wetlands are situated along the shore of lakes, river channels, or estuaries. Classes within the Palustrine system found along the Swan River include unconsolidated

bottom, emergent, broad-leaved deciduous scrub-shrub and broad-leaved deciduous forested land. The water regime in these wetland ranges include permanently flooded, semi-permanently flooded, seasonally flooded and saturated.

Marshes – Marshes fall within the NWI Estuarine and Palustrine systems. The USEPA describes marshes as periodically saturated, flooded, or ponded with water and characterized by herbaceous (non-woody) vegetation adapted to wet soil conditions. Marshes are further characterized as tidal marshes and non-tidal marshes.

Tidal Marshes – These are marshes that occur along coastlines and are influenced by tides and often by freshwater from runoff, river, or groundwater. Salt marshes are the most prevalent types of tidal marshes and are characterized by salt-tolerant plants such as smooth cordgrass (*Spartina alterniflora*), saltmeadow cordgrass (*Spartina patens*), saltgrass (*Distichlis spp*.), and Virginia glasswort (*Salicornia virginica*). Salt marshes have one of the highest rates of primary productivity among wetland ecosystems because of the inflow of nutrients and organics from surface and/or tidal waters.

Systematic grid ditching of the tidal wetlands along Reach 1 of the Swan River for mosquito control altered the water movement in the wetlands. Other examples of alterations that effect water movement and, as a result, marsh habitat diversity include navigation ditches to private residences and dikes on the marsh. The ditching reduced marsh habitat diversity and allowed invasive species, particularly *Phragmites australis*, to establish over extensive areas of the marsh. Suffolk County Department of Public Works, (SCDPW) Division of Vector Control currently conducts mosquito spraying in the area of Swan River in accordance with their Integrated Pest Management (IPM) program. Suffolk County is currently reassessing its mosquito control policy and these findings will be published in the *Suffolk County Vector Control and Wetlands Management Long Term Plan*. Both technical and citizen advisory committees are assisting in the environmental review of this plan, which will

include consideration of public health benefits as well as ecological impacts of mosquito spraying. Further discussion of the SCDPW Vector Control Division and the *Long Term Plan* are included in Sections 2.5.4.1 Suffolk County Department of Public Works and Section 2.5.4.2. Suffolk County Department of Health Service

Tidal freshwater marshes are located upstream of estuaries. Tides influence water levels but the water is fresh. The lack of salt stress allows a greater diversity of plants to thrive. Cattails (*Typha latifolia*), wild rice (*Zizania spp*.), pickerelweed (*Pontederia cordata*), and arrowhead (*Sagittaria spp*.) are common and help support a large and diverse range of birds, fish and other wildlife.

As shown in Figure 2.2.9, the lower section of Swan River has extensive areas of dredge spoils. Tidal high marsh is located along the mid-section of Reach 1 along both shorelines. North of that the wetlands are freshwater tidal marsh. Between Sweezy Avenue and the Long Island Railroad is a segment of formerly connected tidal wetlands. *Phragmites australis*, an invasive species, appears to be the predominant plant species in these areas.

Freshwater wetlands line the river from the lower reach north to Woodside Avenue. In addition, there is an area of freshwater wetland along the lower end on Pine Neck Avenue.

Non-tidal Marshes – These marshes are dominated by herbaceous plants and frequently occur in poorly drained depressions, floodplains, and shallow water areas along the edges of lakes and rivers. Non-tidal freshwater marshes are characterized by periodic or permanent shallow water, little or no peat deposition, and mineral soils. They typically derive most of their water from surface waters (including floodwater and runoff), groundwater and precipitation. The upper limits of Swan River contain areas of freshwater marsh as shown in Figure 2.2.9.

Swamps – The USEPA describes swamps as fed primarily by surface water inputs and dominated by trees and shrubs. Swamps fall within the NWI Palustrine system. Swamps occur in either freshwater or saltwater floodplains. They are characterized by very wet soils during the growing season and standing water during certain times of the year. Swamps are classified as forested, shrub, or mangrove. The Palustrine scrub-shrub and forested classifications that are located north of Swan Lake and near Pine Neck Avenue would traditionally be called swamps.

Submerged Aquatic Vegetation- According to NYSDOS mapping titled SSER Estuarine Fish Habitats, there is no submerged aquatic vegetation or intertidal marsh on the river

2.2.9.2 Living Resources

Many fish and wildlife live in tributaries and the surrounding riparian areas. Each of the waterbodies of the Swan River watershed provides a unique habitat that relates directly to the species diversity found within the watershed. Habitats along Swan River represent a rich diversity of ecotypes typical of these valuable tributary corridors. These run the spectrum from the brackish lower reaches to the nearly pure freshwater seeps that provide groundwater inputs in the upper reaches. A host of representative animal species still frequents these habitats.

Avian suites include waterfowl, wading birds, raptors, and a wide variety of migrating and nesting passerines (songbirds) during different seasons. Waterfowl include both puddle ducks, such as black ducks, as well as diving ducks, such as buffleheads. Wading birds include great blue, green backed, and black crowned night herons. Raptors include osprey and red-tailed hawk. The use of Swan Lake by actual wild species of waterfowl (as opposed to Canada Geese, mute swans and mallards) is significant. In winter, Swan Lake holds hundreds, perhaps upwards of 1,000, wild birds, predominantly lesser scaup, gadwall, ringneck ducks, widgeon, and at least 10 other species. These species are migratory in nature, staying from September - April in varying degrees,

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According to the map entitled *SSER: Shorebird Concentration Areas*, there are no known concentrations of shorebirds in the vicinity of Swan River. According to the map entitled *SSER: Waterfowl Use Areas*, diving ducks use the Bay in the vicinity of Swan River. According to the SSER CMP, the Bay south of Swan River had a high feeding habitat value for diving ducks. *The New York State Breeding Bird Atlas (2000-2005)* identified 60 species of bird sited in the vicinity of Swan River. The majority of species had a NYS legal status of Protected. Six (6) were listed Game Species, three (3) as Unprotected, and two (2) the Cooper's hawk (*Accipiter cooperii*) and osprey (*Pandion haliaetus*) as Protected - Special Concern. Tidal wetland parcels within the SSER have been designated Bird Conservation Areas (BCA) by the NYSDEC. The BCA represents a concentration site that supports a wide diversity of wetland-dependent and upland species of waterfowl, shorebirds and wading birds including at risk species such as northern harrier, common tern, osprey, seaside sparrow, clapper rail and short-eared owl. The BCA's provides management guidance and recommendations to improve habitats, reduce impacts and increase educational efforts.

Mammalian inhabitants include muskrat and other small mammals such as meadow vole. Reptiles and amphibians, including eastern painted turtle, snapping turtle, green frog, northern water snake, and others, represent a particularly important suite. They have perhaps suffered greater population losses due to watershed degradation, yet they can still be found along the river.

Water-based insects such as striders, dragonflies, and numerous other insect species are dependent upon these varied habitats and provide an important food source for trout and other fish species.

The diversity of the fisheries located within the watersheds has been influenced by factors such as fish-stocking programs, invasive and non-native fish releases, native and introduced predators, flow rates in the river, structures, aquatic vegetation changes,

siltation of the lakes and varying water quality. The species present in the Swan River watershed can be divided into three different categories: naturally reproducing, stocked, and introduced/alien.

The concentrations of trout in the Swan River support a recreational fishery of countywide significance. According to the NYSDOS map entitled South Shore Estuary Reserve Council (SSERC): Stream Water Quality, the NYSDEC has designated the Swan River with a water quality classification sufficient to support trout spawning. In waters suitable for trout spawning, the dissolved oxygen (DO) concentration shall not be less than 7.0 mg/L from other than natural conditions. In water suitable to support trout, the minimum daily average for DO shall not be less that 6.0 mg/L and at no time shall the concentration be less than 5.0 mg/L.

There are a number of diadromous species native to Long Island waters, meaning they either spend most of their life in brackish/freshwater and migrate out to sea to spawn (catadromous) or spend most of their life in the sea and travel into brackish/freshwater to spawn (anadromous). According to the *SSER Technical Report Series: Diadromous Fishes* downstream of the Swan River dam (Reach 1) there are historic records of anadromous fish run for alewives (herring) and salmonids (trout). This finding is based on the 1938 state survey of biological resources on Long Island. Sea-run brown trout use Reach 1 for fall spawning. The dam and other barriers prevent the fish from using the full length of the river for spawning. The only catadromous species common to the south shore tributaries is the American eel (*Anguilla rostrata*). Reach 1, the tidal segment of the river, is used for commercial trap fishing for eels and baitfish.

A naturally reproducing brook trout (*Salvelinus fontinalis*) population is found in Reach 2 above Swan Lake and that segment provides year-round habitat for the species. This location is one of only six known locations on Long Island. According to the USFWS Significant Habitat Complex 14 description, the river also contains a population of regionally rare pirate perch.

According to a NYSDEC representative, fish species that have been recorded to be naturally reproducing within Swan Lake are large mouthed bass, pumpkinseed, yellow perch and brown bullhead. No information was obtained for other segments of Swan River, although electrofishing has been reported to have been conducted along the Swan River by the NYSDEC. The largemouth bass (*Micropterus salmoides*) species is considered of high recreational value. The United States Geological Survey (USGS) National Water Quality Assessment (NAWQA) conducted fish community sampling in the Swan River in July 1997. All collected fish sample species were identified and their relative abundance noted. The fish identified, with their abundance in parenthesis, are as follows: American eel (363), pirate perch (3), pumpkinseed (1), largemouth bass (1), redfin pickerel (52), brown bullhead (4), American brook lamphrey (2), rainbow trout (4), brown trout (19), brook trout (1) and eastern mud minnow (52).

The NYSDEC stocked Swan Lake with 500 rainbow trout (*Oncorhynchus mykiss*) and 250 brown trout in April 2006. The NYSDEC stocked the tidal water of Swan River south of the dam with 250 brown trout in May 2005 and another 200 brown trout in November 2006. Swan Lake is one of the few lakes on Long Island that provides year-round trout habitat. Trout stocked by the NYSDEC hold over and grow. However, the NYSDEC reports that by summer growth of aquatic plants in Swan Lake impedes fishing.

The underwater lands of the Great South Bay south of Swan River have been identified by the Town as productive beds for harvesting oysters and hard clams. However, the Swan River and the bay shoreline near the river are closed for shellfishing because of pollutant loads in those waters.

2.2.9.3 Rare, Threatened and Endangered Species (RTE)

New York State Natural Heritage Program (NYNHP) suggested that their records indicate one (1) rare plant occurrence in the vicinity of the Swan River. The occurrence

was reported in 1990 for evening primrose (*Oenothera oakesiana*) in a location immediately south of Sunrise Highway. The location of the occurrence was at the edge of pine and cherry vegetation along the banks of the river in an extremely disturbed habitat. Evening primrose is ranked in New York State as imperiled with a global rank of G4G5Q (apparently secure to demonstrably secure, with question as to taxonomic entity). This area was and continues to be used for ATV activity and dumping which has destroyed most vegetation in the immediate area.

2.2.9.4 Living Resource Use Impairments

Impairments to water bodies can often be described in terms of their effects on the fish population of the water bodies. The New York State Department of Health (NYSDOH) issues health advisories concerning the consumption of sport fish caught in New York State waters. The NYSDOH has issued no specific advisories for Swan River. There are NYSDOH general advisories issued for marine striped bass, bluefish and American eel in the waters along the south shore of Long Island. The contaminant of concern is PCB's, and the NYSDOH recommendation is to eat no more than one meal per week of the species included in the advisory. The NYSDOH also issued general advisories for the consumption of fat, liver and eggs from snapping turtles, with child-bearing women and children not eating any portion; and the consumption of waterfowl including a recommendation to not eat mergansers and limiting other waterfowl species to no more than 2 meals per month. In addition, the NYSDOH has issued advisories that include Long Island South Shore Waters for the consumption of liver or tomalley (soft green substance) from crabs and lobsters. The contaminants of concern include cadmium, PCB's, mirex, chlordane, and DDT.

Table 2.2.9.4 includes a table of the use impairment, pollution sources and types of pollution types. Table items in **bold type** were identified in *SSER CMP Technical Report: Status and Trends*. Shellfish restrictions are discussed in Section 2.3.1. The ability of finfish to survive and propagate is discussed in Section 2.2.9.2. Additional fishing restrictions were included based on advisories issued by the NYSDOH. Dam

impairments are included based on discussions with representatives from Trout Unlimited.

Table 2.2.9.4 Swan River Use Impairments

Waterbody	Use Impairments	Pollution Source	Pollution Type
Swan River	**- Fish Survival** - Shellfishing Restrictions -Finfish Consumption	**-Stormwater** -Storm sewers -Waterfowl -Dams	-Nutrients -Silts -Physical Impairments
Great South Bay East	**-Shellfishing – seasonal restrictions** -Fish Survival -Fishing -Fish Consumption -Bathing -Fish Propagation	**-Stormwater** -Boats/marina -Industry/Activity Specific	**-Pathogen Indicators** **-Nutrients** **-Water level** **-Silt** **-Metals** **-Thermal changes**

2.2.9.5 Habitat Loss

Habitat loss can be attributed to a number of conditions. Construction during development of the area included filling of wetlands to increase buildable land, and shoreline hardening through the construction of bulkheads and revetments to reduce erosion and stabilize lands. Population increase since the early 1900's has strained infrastructure and local resources. Local groundwater supplies have been contaminated by development activities. Groundwater levels decrease with demand and affect stream flow, and untreated stormwater is released directly into surface waters. Ditching of marshes, discussed in Section 2.2.9.1, as a control for mosquitoes drained wetlands allowing invasive species such as phragmites to infiltrate and dominate the wetland vegetation and decreased marsh habitat diversity. Filling along the shoreline for construction purposes also reduced the wetland habitat.

2.2.9.6 Invasive Species

Invasive plants may include exotics, or genetic variants of species otherwise considered native that have developed adaptive strategies to compete successfully with local native populations for limited habitat resources. Exotics include any non-native species that may have been released directly into the watershed area or have expanded populations in the surrounding area and eventually entered into the watershed. Invasive species are of concern due to their potential to displace indigenous species and threaten native local populations.

Several species identified as invasive by the Invasive Plant Council of New York (IPC) were observed along the river corridors. These species include common reed (*Phragmites australis*), garlic mustard (*Alliaria petiolata*), honeysuckle (*Lonicera sp*.), Japanese knotweed (*Polygonum cuspidatum*), multiflora rose (*Rosa multiflora*), Norway maple (*Acer platanoides*), Oriental bittersweet (*Celastrus orbiculatus*), and porcelain-berry (*Ampelopsis brevipedunculata*). Phragmites is the dominant invasive species along the river. Extensive areas in Reach 1 south of Sweezy Avenue have been infested with this species, in addition to smaller areas between Sweezy Avenue and the dam.

Additional species identified as invasive by the IPC include black locust (*Robinia pseudoacacia*), black swallow-wort (*Cynanchum sps*.), buckthorn (*Rhamnus sps*.), curly pondweed (*Potamogeton crispus*), autumn or Russian olive (*Elaeagnus sps*.), Eurasian water milfoil (*Myriophyllum spicatum*), Japanese barberry (*Berberis thunbergii*), Japanese Stiltgrass (*Microstegium vimineum*), purple loosestrife (*Lythrum salicaria*), knapweed (*Centaurea maculosa*), and water chestnut (*Trapa natans*). Although these species were not specifically identified as present in the watershed, they can be expected to be found within the watershed based on their known abundance and distribution.

2.2.10 Valued Features and Critical Areas

The valued features and critical areas section of this report includes descriptions of designations assigned to the Swan River area that recognize the environmental importance and value of the

natural resources of the watershed including the unique geological features, habitats, living resources, and rare species within the watershed.

2.2.10.1 Critical Environmental Areas

Portions of the Swan River have been designated as a Critical Environmental Area by the Town of Brookhaven. Reaches 1 and 2 fall within the Brookhaven Coastal Zone Area CEA as shown on Figure 2.2.9. The town designated this area because of its natural resource values, including woodland and open space, flora and fauna, wetlands, groundwater, unique geological features and/or aesthetic and scenic quality. Designation as a CEA aids in the protection of valuable resources within the Town by requiring a more stringent environmental review of proposed development.

2.2.10.2 Significant Coastal Fish and Wildlife Habitats

The entire length of Swan River has been designated a Significant Coastal Fish and Wildlife Habitat (SCFWH) by the United States Fish and Wildlife Service (USFWS). Swan River is recognized as an irreplaceable small but rare ecological region of New York with a regionally significant occurrence of naturally reproducing brook trout. The SCFWH assessment describes the freshwater river segment (Reach 2-4) as a relatively clean, spring-fed, cold, freshwater river generally less that 15' wide with a sandy substrate in a relatively natural state but with encroachments from residential development. The tidal segment is described as bordered by undeveloped marshland and limited boat docking facilities. Swan River is described as one of the few free-flowing streams on Long Island that has remained in a relatively natural state with habitat conditions suitable for natural reproduction of brook trout. The river supports one of six known wild brook trout populations on Long Island. The wild brook trout and the concentrations of sea-run brown trout that occur in the tidal segment during their fall spawning period support a recreational fishery of countywide significance.

Great South Bay – East, which includes the mouth of Swan River, has also been designated a SCFWH. This area was deemed an "irreplaceable rare ecological region" of

New York. Several factors increase the rarity of the ecosystem, including the identification of rare or threatened species residing in the region, the statewide significance of the commercial hard clam industry and sportfishing and waterfowl hunting of countywide significance. Great South Bay – East supports one of the largest wintering waterfowl concentrations in New York State and has high populations of diving ducks. The bay serves as a major spawning nursery and foraging area for winter flounder, kingfish, bluefish, blue claw crab, and forage fish species including Atlantic silverside, striped killifish, mummichog, northern pipefish and sticklebacks. Much of the bay is certified for shellfishing, the commercial and recreational harvest of hard clams and American Oysters.

2.2.10.3 Significant Habitat Complex of the New York Bight Watershed.

The Great South Bay, including the major rivers, creeks and marshes draining into the Great South Bay, has been designated as Significant Habitat Complex #14 of the New York Bight Watershed by the U.S. Fish and Wildlife Service (USFWS). As described in the narrative for Complex #14, the Swan River is one of six groundwater-fed waterbodies that provide the majority of the flow to the Great South Bay. The bay receives up to 11% of its freshwater input directly from groundwater flow. The Swan River was also one of several wetland parcels recognized by the USFWS as a priority wetland under the Emergency Wetlands Resources Act of 1986. The river is described as a free-flowing, spring-fed stream habitat that supports both a native brook trout population and a sea-run population of brown trout. In addition, the river is reported to contain a population of regionally rare pirate perch. The Great South Bay complex supports regionally significant populations of marine and estuarine fish, migrating and wintering waterfowl, rare plants, and other species associated with open water marshes, barrier beaches, and estuarine watersheds.

2.2.11 Prior Studies

This section describes studies that have been undertaken that identified the need for the WMP or that provided direct background data to the development of the plan.

2.2.11.1 Long Island South Shore Estuary Reserve Comprehensive Management Plan (SSER CMP)

The SSER CMP was adopted in 2001 to provide a blueprint for the long-term health of the Reserve's bays and tributaries, tidal wetlands, wildlife, tourism and economy. The SSER CMP identifies future actions that, when implemented, will ensure the long-term health of the estuary and its tributaries as a natural and cultural treasure, and as the foundation of the local economy.

The CMP identifies nonpoint source pollution from stormwater runoff as the primary water quality impairment in the SSER. Nutrients, sediments, and bacteria are identified as the key pollutants that stormwater runoff carries from the surface areas, into tributaries, and subsequently into the bay. High nutrient and sediment loads in surface waters threaten fish propagation and fish survival. Vessel waste discharges and waterfowl also contribute to the coliform bacterial load, which is in turn responsible for closure of the bays shellfish beds. The CMP also identifies shoreline hardening and other habitat modifications as activities that are detrimental to fish.

In *Chapter 7: Implementation*, the SSER CMP identifies several actions related to Swan River, including actions to reduce nonpoint source pollution, restore habitat, acquire open space and increase public access. Included in these recommendations is the development of WMPs. The SSER CMP identified Swan River and the adjacent Bay as priority areas for the following implementation actions:

Patchogue Bay

- Priority area for construction of stormwater abatement projects in significant nonpoint source contributing areas associated with closed shellfish beds, impaired living resources

Swan River

- Priority areas for stormwater remediation

- Sites for potential public access and recreation expansion
- Potential wetland restoration sites
- Sites for potential open space acquisition

2.2.11.2 Stormwater Inventory for South Shore Bays (Inventory)

The *Stormwater Inventory for South Shore Bays* (Inventory) was completed by Charles Voorhis & Associates, Inc. for the Town of Brookhaven in August 1996. The Inventory was funded through a grant from the New York State Department of State, Coastal Management Program. The report includes a Town-wide inventory of stormwater discharges, including discharges to tributary creeks and river, that direct runoff to the SSER. The Inventory also included an assessment of contributing upland drainage areas and land uses and recommendations for mitigation measures for stormwater impact abatement.

2.3 WATER QUALITY CHARACTERIZATION

Available monitoring data was reviewed for parameters that relate to the Swan River water quality. The primary objective of most water quality monitoring programs in New York State is to prevent human health impacts from exposure to pathogenic bacteria and viruses (e.g., the hepatitis and Norwalk viruses, and Salmonella bacteria). Pathogen exposure can result from either direct contact with contaminated water or the consumption of tainted shellfish. Water quality testing for these pathogens typically entails testing for the presence of coliform bacteria, which are generally non-pathogenic, but are relatively easy to measure. Because coliform bacteria co-exist with the pathogens of primary concern mentioned above, the coliform bacteria serve as an indicator of the possible presence of pathogens.

Alterations in stream and stormwater system discharge occur as a result of seasonal and yearly fluctuations in precipitation, seasonal changes in groundwater levels, and increased urbanization. The Swan River waterbody is for the most part a “gaining system,” primarily replenished by groundwater. Therefore, localized variations in the water budget (the water flow in the system) may result in changes to surface water volume, groundwater levels, and the rate at which the

waterbody and stormwater flow. Removal of vegetation, compaction of soils, and construction of impervious surfaces are examples of human activities that can significantly impact normal hydrologic processes. These activities can cause waters to become stagnant or turbulent, decrease soil permeability, cause erosion and soil deposition, improve or aggravate flooding conditions, increase or decrease water and pollutant residence times, and affect natural water quality functions such as the settling of soil particles. Waterbodies that are classified with a best usage that allows greater human contact, such as water supply for drinking, food processing, contact recreation, fish propagation and shellfishing, must meet a higher standard than waters that are classified for lesser human contact, such as fish survival.

2.3.1 Water Quality Classifications/Designated Uses

Table 2.3.1 summarizes the Swan River and Patchogue Bay NYSDEC general water quality classifications in terms of their best usage.

The NYSDEC has designated Swan River a priority waterbody with its aquatic life known to be impaired. A priority waterbody is water body determined by NYSDEC staff, with public input, to have their uses precluded, impaired, stressed or threatened. See Table 2.2.9.4 Swan River Use Impairment. The causes of this impairment have been identified as nutrients, silt and sediments caused by urban street runoff and storm sewer outfalls. Swan River and Patchogue Bay are also NYSDEC uncertified shellfishing areas. Uncertified shellfishing areas are lands where the NYSDEC has prohibited shellfishing harvesting for food uses in accordance with NYSDEC regulation 6 NYCRR Part 41. Other lands of the Great South Bay are certified and remain open for shellfish harvest or can be seasonally certified for limited time periods.

While Table 2.3.1 identifies “best usages”, the actual usage of the waters is dependent upon the impairments to the quality of the waters. The numerous parameters that commonly characterized water quality include taste, color, suspended solids, oils, refuse, thermal discharges, phosphorus, nitrogen and dissolved solids. A common example of this is Class “B” waters that have a best usage for primary recreational contact (swimming) but are closed because of impacts to the water

quality from high bacteria levels. This is what happens when Town and County beaches are closed after a rainfall that causes high bacteria levels in those waters.

Table 2.3.1 NYSDEC Water Quality Classifications (6 NYCRR Part 922)**.**

Waterbody	Water Classification	Best Usage
Swan River - Upper and tributaries freshwater	C (TS)	The best usage of Class C waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes. (TS) – Designated waters are suitable for trout spawning and that the dissolved oxygen specification for trout spawning waters shall apply.
Swan Lake	B(T)	The best usage of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival. (T) – Designated waters are suitable for trout that the dissolved oxygen specification for trout waters shall apply.
Swan River - saline	SC	The best usage of Class SC waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
Patchogue Bay	SA	The best usages of Class SA waters are shell fishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Two major water quality parameters for Class "C" waters are dissolved oxygen (DO) and coliform bacteria concentrations. Adequate DO is essential to the growth and reproduction of finfish and shellfish. DO is also important for the natural decomposition of organic wastes. Current public health standards call for low coliform bacteria concentrations as the presence of such bacteria is regarded to be an indication of potentially pathogenic contamination from human or animal wastes. The actual water quality may not be suitable for the best usage based on water quality parameters discussed herein. Section 3.0 Protection and Management Recommendations provides analysis of potential pollutant loads that may be impacting the river.

2.3.2 Issues and Impairments

The United States Geological Survey (USGS) has a single sampling location at the south end of Swan Lake (USGS 01305500) with collected data available from the USGS National Water-Quality Assessment Program. Based on 2004 USGS data, the average streamflow for Swan River ranged from 9.87 ft^3/s to 15.5 ft^3/s. Review of the available data determined no clear annual mean streamflow trend over the past 58 years. However, data does show an increase in the peak streamflow trend over the past 58 years. Monthly streamflow statistics show a slight increase in streamflow during the spring months. There was no testing of total coliform, fecal coliform, total suspended solids, total dissolved solids, or hydrocarbons. Review of the available USGS sampling data revealed the following:

Nutrients

All samples tested below applicable standards except for the detection of elevated levels of phosphorus at concentrations exceeding NYSDEC standards. No trend was apparent over the 58 years of testing.

Minor and Trace Inorganics

There were no detections above applicable standards in the 1990's. However, iron exceeded standards until 1990, with low detections thereafter.

Major Organics

There were high levels of silicon detected. There is currently no NYSDEC standard established for this compound.

Organics

Organics were generally found to be at low levels below NYSDEC standards. There were several single hit elevated detections of chemicals, including pesticides, in 1997. Later samples were tested and all were found to be below standards. The single hit detections included:

Chemical	Sample Level	NYSDEC Standard
1,2 dichloroethane d4	107 mg/l	< 0.6 ug/l
Toluene - d8	97 mg/l	<0.5 ug/l
1-Bromo 4 flourobenzene	100 mg/l	No NYSDEC level
Diazinon –d10 (pesticide)	97.5 mg/l	<0.7 ug/l
Terbuthylazine (pesticide)	115 mg/l	No NYSDEC level - Known to bioaccumulate in fish
Alpha-HCH –d6	Unknown	No NYSDEC level - Found in pesticides and slightly bioaccumulates in fish

From 1991 to 2000, the Town of Brookhaven Division of Waste Management conducted sampling and testing of the Swan River to serve as a baseline for review of testing being conducted at a nearby stream (unpublished data). Four locations on Swan River were sampled over the testing period for varied constituents. No elevated concentrations exceeding NYSDEC standards were found. All tested parameters, including DO were acceptable for trout waters. There were salts detected that are typical of shallow groundwater discharges and anthropological inputs (ammonia, nitrates, phosphate) detected may be from nearby septic uses.

According to the USGS (telephone communication, 2005) MTBE (methyl tertiary-butyl ether) was detected in a sample from north of RTE 27A. MTBE is a ubiquitous water quality contaminant in the United States. MTBE is an ingredient that was added to gasoline to increase oxygen content; however, it is now being phased-out due to its known impacts on the environment. During the past decade, MTBE was used in increasing quantities in order to meet the standards set forth under the Federal Reformulated Gasoline and Oxyfuels programs developed by Congress and incorporated into the 1990 amendments to the Clean Air Act.

The pollutants of concern for Class “C” waters, where usage includes fishing, shellfishing, boating, recreation and aesthetic values, are described below. Some of these pollutants are included in the monitoring results discussed in the prior paragraphs of this section. Other pollutants of concern, including total coliform, fecal coliform, total suspended solids, total

dissolved solids and hydrocarbons, are typically related to the residential and roadway land uses predominant in this watershed, but to date no systematic monitoring of these constituents has been undertaken.

Toxic Substances – Toxic substances encompass a broad range of materials that can have adverse impacts on the environment or human health. These substances include oil, organic and metallic chemical residues from manufacturing, anthropogenic (human-made) chemicals, and agricultural and horticultural pesticides. Many of these toxic substances are a result of human development and activity.

Pathogens and Pathogen Indicating Organisms – Pathogens can cause human illnesses such as hepatitis A. Common pathogens and pathogen indicator organisms include bacteria such as *E. coli* and protozoa such as *Giardia lamblia* and *Cryptosporidium sp*. (the later two in freshwater only). *E. coli* is an enteric (intestinal) bacterium, usually not harmful in and of itself. *E. coli* is easily detected and its presence is used to indicate the possible presence of pathogens that are both more serious and more difficult to detect. The suspected causes of this impairment are stormwater runoff and waterfowl.

Nutrients –The primary nutrients of concern are phosphorus and nitrogen, two elements that are necessary for plant growth. Nonpoint sources of nitrogen and phosphorus are the recognized causes of water quality degradation in many water bodies. In freshwater systems, phosphorus is usually a limiting factor for the growth of algae. In marine systems, the limiting factor is nitrogen. Phosphorus discharge regulations are set through the National Pollutant Discharge Elimination System (NPDES). In excess, phosphorus and nitrogen cause cultural eutrophication, characterized by rampant algal and plant growth and diminished water quality. When accumulated plant mass decomposes, it causes a bloom of bacteria that feeds on the plant mass. This bloom extracts oxygen from the water, reducing the level of dissolved oxygen in the water. Oxygen deprivation can cause mobile animals to leave an area, which is one reason areas low in oxygen (hypoxic) often have low numbers of fish. In cases that are more serious and for species that cannot flee, hypoxia can stunt growth or kill.

Oxygen Demanding Wastes – Oxygen demanding wastes include pollutants that require oxygen for decomposition such as sewage. By stripping oxygen from the water column, these materials induce hypoxia. In extreme cases, when all oxygen has been removed from an environment, anaerobic conditions prevail. The organisms that flourish in such conditions are very different from those in aerobic conditions, and much of the chemistry of the system changes. Stormwater runoff containing animal feces from local resident pets and waterfowl are the major contributors to this impairment.

Floatables – Besides the obvious negative aesthetic effects, trash can affect aquatic life through either ingestion or entanglement. Marine mammals, turtles, birds, fish and crustaceans have been affected by entanglement in or ingestion of debris. Entanglement can cause wounds, loss of limbs, strangulation and loss of ability to swim. Ingestion can block intestinal tracts and sharp items can damage mouths, intestinal tracts and stomachs. Buoyant floatables, which are transported through the waterbody into the marine environment, and items manufactured from synthetics, which persistent in the environment for long periods of time, tend to be more harmful than settleable elements and materials that biodegrade quickly.

Elements of floatable trash that represent significant threats to human health include items which contain toxic substances, discarded medical wastes, broken glass and human or pet wastes. The dumping of larger trash such as furniture, appliances automobiles, and shopping carts can create physical barriers to the stream flow and increase shoreline erosion. Human actions are a major contributing factor to floatables pollution.

Silt and Sediment – Silt and sediment can cause water quality problems in several ways. Sediments can alter the composition of bottom substrate. Such shifts may affect the viability of ecological communities in a given area. Mechanical covering of immobile organisms can also be a problem. Increased turbidity from silt and sediment entering a water system, impacts the biota through light attenuation or smothering and burial. Turbidity also has economic impacts by

reducing recreational use (closing of beaches because of turbidity) and increasing the need for maintenance dredging. The major contributors to this impairment are road runoff and erosion.

2.4 STORMWATER DRAINAGE INFRASTRUCTURE

As described in Section 2.1, the original watershed was delineated using surface topography. Stormwater drainage systems installed to collect storm runoff from the network of roads and large-scale development has substantially altered the drainage patterns within the watershed.

2.4.1 Existing Information

The 1996 Inventory Report discussed in Section 2.2.11.2 of this document identified sizes, types and locations of Town-wide stormwater discharge points, analyzed pollutant potential, prioritized actions and provided best management practice recommendations. The discharge points identified in the Inventory Report included five locations along the Swan River. Two of the discharge points are boat ramps located on either side of the southern river, the third a piped discharge of road runoff at Carmen Street, and the final two are pipe discharges associated with road runoff from Sweezy Avenue.

2.4.2 Infrastructure Survey and Mapping Methodology

The Town of Brookhaven is currently in the process of mapping the drainage structures and outfalls within the Town. The mapping effort is conducted as a component of the SPDES Phase II Stormwater Management Program that is described in Section 5.5 Phase II Stormwater Permit Compliance. According to the Town, heads-up digitization and Global Positioning System (GPS) field collection are used to identify the locations of the drainage assets. Heads-up digitization involves researching and collecting the historic drainage maps for the watershed. The drainage maps that contain the drainage attributes are scanned as images in Tagged Image File Format (.tiff maps) and rectified in ESRI ArcGIS 9. Using geo-rectification, these images are referenced to the correct alignment and location in a coordinate system.

The second method utilized to collect drainage data in the field is GPS field collection. Structures are field located by visual reconnaissance. Upon locating structures, the field team

uses a GPS tracking device (Trimble GeoXM Pocket PC with Windows CE and ERSI ArcPad 6.3) to collect the GPS position for those assets. This method enables the determination of the location of drainage structures that either were installed prior to the Town requirement for filed development drainage maps or were added individually over the years to resolve specific drainage issues. Town Geographic Information System (GIS) personnel download the GPS collected data to ArcGIS 9, add the points to the geodatabase and assign structure identification numbers. The Town data collection has thus far resulted in a database containing nearly 1,700 assets.

The Town expects to complete its town-wide mapping effort by 2008. Preliminary GIS drainage information described above was used as the base map to conduct further field inspection of the structures. In January 2006, the structures were reviewed by Cashin Associates, P.C. field personnel. Each accessible structure was visually inspected to determine which upgradient structures were contributing surface runoff to Swan River. The inspection included a determination of the sizes and connectivity of the structures and analysis of the surrounding topography. The size and connectivity of the drainage structures were determined by inspecting the interior of the accessible structures to observe existing piping and direction of flows. The surface area that contributes runoff to each outfall was determined by locating and mapping road high points. In addition, the condition of the interior of each opened structure was noted to include the collection of sediments or standing water if observed. Locations where road runoff flows to surface waters or wetlands were also identified. All locations were mapped using a hand-held GPS device and the information downloaded to the GIS program upon return to the office. The collected data was documented on log sheets and entered into tables that are associated with the mapping data. The findings are discussed under the specified reaches described below. During this field inspection, 12 additional outfalls were identified. There are 20 additional locations where surface flow from roads and parking lots enters the river and five locations where the runoff is directed to recharge basins that allow overflow to the river. Where structures could not be opened or where sediment and standing water were found, connectivity could not be positively determined leading to nine locations where infrastructure flow could not be determined. Newly identified structures were assigned identification numbers.

Available Suffolk County Department of Public Works plans for Montauk Highway were reviewed. A copy of the Town GIS data file was modified to include the coordinates for all field-identified structures and the drainage information from mapping and plans. Figures 2.4.3 and the associated detailed maps show the results of this work. Structures located outside of the surface drainage boundary were determined not to contribute surface runoff to the river, and no additional data was collected.

Each drainage structure has an assigned identification number as described above. The outfalls are listed by those numbers (i.e., Outfall 343) on Table 2.4, on Table 4.2, in Section 4.4 Target Projects and Priority Actions and on the Report Figures. Where an outfall was assigned an identification number in the earlier Inventory report that identification number is noted on Table 2.4. Figure symbols associated with road run-off denote either a road end or area that drains directly to open water or to wetland along side the pavement areas.

The drainage area was calculated for each sub-watershed area. The linear length of street contributing area was measured and multiplied by a typical right-of-way (R-O-W). A 50' R-O-W was used for the residential streets. A 75' R-O-W was used for Montauk Highway and a 100' R-O-W was used for Woodside Avenue. For Sunrise Highway, it was assumed that the width of the west bound lanes drains over the road shoulder and into the river.

2.4.3 Swan River Reaches

In order to aid in the assessment of impairments associated with the watershed, this section divides the river watersheds by the reaches defined in Section 2.2.3. Table 2.4 is also divided by reach and contains a detailed description of each subwatershed area including location and type of discharge (i.e. outfall, surface, none, or unknown), along with street location, system description, land use, and contributing area.

Swan River
Watershed Management Plan
Existing Drainage Sub-Watershed Description
Reach 1
Table 2.4

Structure ID Number	Street Location	Type of Discharge	System Structure	Land Use	Road Length	Width	Subwatershed Contributing Area		Impervious Area	Notes
			Quantity (I.D. #'s)		LF	LF	SF	Acres	%	
Reach 1 - West Shore, South to North										
15	**Grove**	**Outfall**	**3 (15,16,17)**	**res/road**	**600**	**50**	**30,000**	**0.69**	**70**	
	Grove/Clifton	None	0	res/road	550	50	27,500	0.63	70	
13/14	Grove	None	2	res/road, undev.	500	50	25,000	0.57	70	
12	Grove	None	1	res/road, undev.	1100	50	55,000	1.26	70	
1400-1402	Grove	None	3	res/road	400	50	20,000	0.46	70	
5347-5348	**Conklin**	**Unknown**	**2**	**res/road**	**550**	**50**	**27,500**	**0.63**	**70**	
	Grove	**Surface**	**0**	**marina**			**74,051**	**1.70**	**100**	**9,SR-2**
	Swan River	**Surface**	**0**	**res/road**	**600**	**50**	**30,000**	**0.69**	**70**	
	Bolton	**Surface**	**1 (11)**	**res/road**	**1400**	**50**	**70,000**	**1.61**	**70**	
11	**Carman**	**Outfall**	**2**	**res/road**	**300**	**50**	**15,000**	**0.34**	**70**	**9, SR-3**
5400-5402	Conklin /Jones	None	3	res/road	1200	50	60,000	1.38	70	
	River/Pitts	**Surface**	**0**	**res/road**	**1300**	**50**	**65,000**	**1.49**	**70**	
5398-5399	Pitts	None	2	res/road	350	50	17,500	0.40	70	
31	**Sweezy**	**Outfall**	**3 (31,7,8)**	**road**	**1400**	**25**	**35,000**	**0.80**	**70**	**1, SR-4**
5274	**Sweezy**	**Outfall**	**5(9,10, 5276,5275,5274)**	**road**	**1400**	**25**	**35,000**	**0.80**	**70**	**1, SR-5**
Reach 1 - East Shore, South to North										
	Pine Neck	**Surface**	**1(5267)**	**marina**			**100,200**	**2.30**	**100**	**2, SR-1**
	Pine Neck	**Surface**	**0**	**res/road**	**200**	**50**	**10,000**	**0.23**	**70**	
5375	**Pine Neck**	**Outfall**	**3 (25,5375,5283)**	**east side res/road**	**1400**	**25**	**35,000**	**0.80**	**70**	**3**
	Pine Neck	**Surface**	**0**	**west side res/road**	**1400**	**25**	**35,000**	**0.80**	**70**	**4**
5344	Pine Neck /Moor	None	3 (5343,5344,5378)	res/road	850	50	42,500	0.98	70	
52-53	**Dipper Pt Rd (Haven)**	**Unknown**	**3 - 52,53, 74**	**res/road, undev.**	**950**	**50**	**47,500**	**1.09**	**70**	**5**
21-22	Pine Neck/Glenwood	None	2	res/road	800	50	40,000	0.92	70	
5382	Pine Neck	None	3 (5282,5383, 18)	res/road	1000	50	50,000	1.15	70	

Swan River
Watershed Management Plan
Existing Drainage Sub-Watershed Description
Reach 1
Table 2.4

Structure ID Number	Street Location	Type of Outfall	System Structure	Land Use	Road Length	Road Width	Contributing Area		Impervious Area	Notes
			Quantity (I.D. #'s)		LF	LF	SF	Acres	%	
Reach 1 - East Shore, South to North - Continued										
	Elm	None	0	res/road	900	50	45,000	1.03	70	6
	Spruce	**Surface**	**0**	**res/road**	**600**	**50**	**30,000**	**0.69**	**70**	
23	Chapel/Cedar	None	3(23,24,5397)	res/road	300	**50**	15,000	0.34	70	
5393	Chapel	None	3 (5393,5394,5395)	res/road	200	**50**	10,000	0.23	70	
5392	Chapel s of First	None	1	res/road	250	**50**	12,500	0.29	70	
5272	Chapel/First	None	1	res/road	400	**50**	20,000	0.46	70	
	First	**Surface**	**0**	**parking lot**			**43,560**	**1.00**	**100**	**7**
5273	Chapel n of First	None	0	res/road	350	50	17,500	0.40	70	
5386	Pine Neck	None	7 (5384-5388,19,20)	res/road	950	50	47,500	1.09	70	
5389	Pine Neck	None	4 (5389-5391, 5271)	res/road	800	50	40,000	0.92	70	
26	**Montauk - south side**	**Outfall, #**	**5 (26,27,28, 28,29)**	**comm. parking lot**			**120,000**	**2.75**	**100**	**8**

NOTES:

General: Location shown in **bold** on this figure are included in Table 4.2 Annual Pollutant Loading Estimates. Locations not in bold are not anticipated to contribute to surface flow and are not included in annual pollutant loading estimates on Table 4.2.

See Legend sheet 6 of 6 for abbreviations and descriptions.

1. Side streets plus 1/2 of crowned road. Designated as SR-4 and SR-5 in 1996 Stormwater Inventory.
2. Parking lot overflow assumed after structure is full. Lot was flooded after .25" rainfall 05-10-06. Designated as SR-1 in 1996 Stormwater Inventory.
3. Road is crowned, roadside swale has no outfall evident.
4. Road is crowned with no drainage structures, swale extends to mosquito ditch at north of marina.
5. West side of road is undeveloped. Drainage structure at road easement, undetermined if drains to river.
6. Drains to road end. No structures found. Appears to infiltrate to groundwater, not surface flow to river.
7. Restaurant parking lot, no structures found, surface overflows to river.
8. According to resident - second pipe outfall exists, could not be field observed.
9. Designated as SR-2 and SR-3 in 1996 Stormwater Inventory.

Swan River
Watershed Management Plan
Existing Drainage Sub-Watershed Description
Reach 2
Table 2.4

Structure ID Number	Street Location	Type of Discharge	System Structure	Land Use	Road Length	Width	Subwatershed Contributing Area		Impervious Area	Notes
			Quantity (I.D. #'s)		LF	LF	SF	Acres	%	
Reach 2 - West Shore, South to North										
54	Montauk /Schoenfeld	None	2(54,55)	res/road	300	75	22,500	0.52	100	
	Schoenfeld/Montauk	**Surface**	**0**	**restaurant parking**			**75000**	**1.72**	**70**	
	Schoenfeld at Beatrice	**Surface**	**unknown**	**nursing home parking**			**75000**	**1.72**	**70**	
1344	**Schoenfeld/Beatrice**	**Outfall, unknown**	**2 (1344,1347)**	**res/road**	**1800**	**50**	**90,000**	**2.07**	**70**	
1331	**Swan Lake Dr.**	**Unknown**	**6(1330-1335)**	**res/road**	**1800**	**50**	**90,000**	**2.07**	**70**	
1327	**Swan Lake Dr.**	**Unknown**	**6 min(1327,1328)**	**res/road**	**1800**	**50**	**90,000**	**2.07**	**70**	
1323	**Swan Lake Dr.**	**Outfall - 36"**	**5 min(1322-1324,1378-1379)**	**res/road**	**4800**	**50**	**240,000**	**5.51**	**70**	
1321	**Swan Lake Dr.**	**Outfall**	**2 min(1320-1321)**	**res/road**	**2400**	**50**	**120,000**	**2.75**	**70**	
Reach 2 - East Shore, South to North										
63	**Montauk at culvert**	**Outfall**	**63**	**Comm. road**	**200**	**50**	**10,000**	**0.23**	**100**	
67	**Montauk Outfall**	**Outfall - 24"**	**8 (58-62,64-66)**	**Comm. road**	**2,400**	**75**	**180,000**	**0.06**	**100**	
	Lake Drive	**Surface**	**none**	**res/road**	**1,900**	**50**	**95,000**	**0.04**	**70**	**1**
33	**Lake Drive**	**Outfall**	**1**	**res/road**	**200**	**50**	**10,000**	**0.23**	**70**	
	East tributary	**Outfall/Surface**	**0**	**undev.**			**1350000**	**30.99**	**10**	**2**
56	**Rose**	**Surface**	**56**	**res/road**	**400**	**50**	**20,000**	**0.46**	**70**	**3**
	Celia	**Surface**	**none**	**res/road**	**600**	**50**	**30,000**	**0.69**	**70**	
	Florence	**Surface**	**none**	**res/road**	**550**	**50**	**27,500**	**0.63**	**70**	
	Roberta	**Surface**	**none**	**res/road**	**550**	**50**	**27,500**	**0.63**	**70**	
	Bertha	**Surface**	**none**	**res/road**	**450**	**50**	**22,500**	**0.52**	**70**	
	Alice	**Surface**	**none**	**res/road**	**600**	**50**	**30,000**	**0.69**	**70**	
	Ethel	**Surface**	**none**	**res/road**	**550**	**50**	**27,500**	**0.63**	**70**	
	Kathryn	**Surface**	**none**	**res/road**	**800**	**50**	**40,000**	**0.92**	**70**	
	Lake	**Surface**	**none**	**res/road**	**1000**	**50**	**50,000**	**1.15**	**70**	

NOTES:

General: Location shown in **bold** on this figure are included in Table 4.2 Annual Pollutant Loading Estimates. Locations not in bold are not anticipated to contribute to surface flow and are not included in annual pollutant loading estimates on Table 4.2.

See Legend sheet 6 of 6 for abbreviations and descriptions.

1. Surface runoff from road travels over slope and into lake.
2. Eastern tributary to river is within preserved section of residential development. Piped from preserve through easement and road to lake.
3. Structure is located in groundwater with no storage capacity.

Swan River
Watershed Management Plan
Existing Drainage Sub-Watershed Description
Reach 3
Table 2.4

Structure ID Number	Street Location	Type of Discharge	System Structure	Land Use	Road Length	Width	Subwatershed Contributing Area		Impervious Area	NOTES
			Quantity (I.D. #'s)		LF	LF	SF	Acres	%	
Reach 3 - West Shore, South to North										
	Sunrise Highway	**Surface**	**0**	**comm. road**	**2000**	**100**	**200,000**	**4.59**	**100**	
	Sunrise Highway	RB	unknown	comm. road	unknown	unknown	unknown		100	9
41	**Swan View**	**Outfall**	**7(35-41)**	**res/road**	**1400**	**50**	**70,000**	**1.61**	**70**	
1436	**Swan Ct**	**Outfall**	**7 (42-47,50)**	**res/road**	**1000**	**50**	**50,000**	**1.15**	**70**	
	Whippoorwill (Arthur)	**Unknown**	**1**	**res/road**	**500**	**50**	**25,000**	**0.57**	**70**	**1**
	Hallock	None	4 (68-71)	res/road	500	50	25,000	0.57	70	
35	**Barton**	**Outfall**	**3 (35-37)**	**road**	**1300**	**50**	**65,000**	**1.49**	**70**	**2**
40	**Nicole Ct**	**Unknown**	**3 (38-40)**	**res/road**	**600**	**50**	**30,000**	**0.69**	**70**	**3**
11	**Lucy Ct**	**Outfall**	**5 (10-14)**	**res/road**	**300**	**50**	**15,000**	**0.34**	**70**	
1116	**Patricia, Bambie**	**Outfall**	**9 (1108-1116)**	**res/road**	**2100**	**50**	**105,000**	**2.41**	**70**	**4**
1117	**Theresa**	**Outfall**	**4 (1117-1120)**	**res/road**	**900**	**50**	**45,000**	**1.03**	**70**	**5**
Reach 3 - East Shore, South to North										
387	Yale	None	7 (383-389)	res. Road	400	50	20,000	0.46	70	
66	**Gina, Russell, Gale, Cheryl**	**RB/Overflow**	**17(51-68)**	**res/road**	**5400**	**50**	**270,000**	**6.20**	**70**	**6**
1298	**Debbie, Sharon, Patricia**	**Unknown**	**3 (1298-1300)**	**res/road**	**3400**	**50**	**170,000**	**3.90**	**70**	**7**
257	**Circle Drive , Valley, Roslyn**	**RB/Overflow**	**19(251-269)**	**res/road**	**7000**	**50**	**350,000**	**8.03**	**70**	**8**

NOTES:

General: Location shown in **bold** on this figure are included in Table 4.2 Annual Pollutant Loading Estimates. Locations not in bold are not anticipated to contribute to surface flow and are not included in annual pollutant loading estimates on Table 4.2.

See Legend sheet 6 of 6 for abbreviations and descriptions.

1. Drainage structure with piping leading through private property. Outfall not identified.
2. Pipe appears to discharge to river. RB south of road inflow and possible overflow not determined.
3. Could not determine where pipe leads. Assume possible overflow.
4. Street structures discharge to RB that has outfall to river.
5. Street structures discharge to same RB, as Patricia, that has outfall to river.
6. Drainage structures piped to recharge basin, possibly overflow to river.
7. Drainage system not determined. Three structures found provide inadequate capacity for runoff generated.
8. RB storage capacity unknown, appears inadequate for drainage area, possible river overflow not determined.
9. Runoff from Sunrise south lanes is collected in structures and directed out of drainage area to RB at Hewlett Street

Swan River
Watershed Management Plan
Existing Drainage Sub-Watershed Description
Reach 4

Table 2.4

Structure ID Number	Street Location	Type of Discharge	System Structure	Land Use	Road Length	Width	Subwatershed Contributing Area		Impervious Area	Notes
			Quantity (I.D. #'s)		LF	LF	SF	Acres		%
Reach 4 - West Shore, South to North										
73	**Woodside**	**Outfall**	**4 (41-44)**	**comm. road**	**2200**	**100**	**220,000**	**5.05**	**70**	**1**
92	**First, Park**	**RB/Overflow**	**11 (92-99, 7629, 102,105)**	**res. road**	**2200**	**50**	**110,000**	**2.53**	**70**	**2**
Reach 4 - East Shore, South to North										
NO INPUTS IDENTIFIED										

NOTES:

General: Location shown in **bold** on this figure are included in Table 4.2 Annual Pollutant Loading Estimates. Locations not in bold are not anticipated to contribute to surface flow and are not included in annual pollutant loading estimates on Table 4.2.

See Legend sheet 6 of 6 for abbreviations and descriptions.

1. Drainage structures appear to discharge to Suffolk County RBs either side river, no info provided by Suffolk County on system or overflow.
2. Drainage structures appears to discharge to RB. RB not accessible. In aerial photo, RB appears empty with ATV tracks.

Swan River
Watershed Management Plan
Existing Drainage Sub-Watershed Description
Legends
Table 2.4

TYPE OF DISCHARGE LEGEND:	
None	No direct discharge to waterbody
Outfall, #	Pipe, headwall or grate inlet to waterbody, outfall diameter (inches)
Overflow	Structure allow discharge from holding structure (RB)
RB	Drainage discharges to recharge basin
Surface	Surface disharge to waterbody, either sheet flow or concentrated
Unknown	Discharge location not be positively identified. Requires further investigation

LAND USE LEGEND:	
comm. road	paved road, heavy traffic, no to little fertilized lawn adjacent
marina	Boat storage, vehicle parking, boat ramp
parking lot	Commercial site
res./road	Paved road, light traffic, adjacent residential with fertilized lawn
road	Paved road, mid to heavy traffic, fertilized lawn adjacent

2.4.3.1 Reach 1 – Great South Bay to dam at Montauk Highway

This tidally influenced river segment ranges from 200' to 500' in width at its southern end. Bulkheading is generally limited to the locations of marinas, commercial and most residential properties. Many of the residential properties have manicured lawns that extend to the bulkhead and facilities for boat dockage. There are several large parcels with natural shoreline, totaling 71 acres, that are municipally owned and have been preserved from future development. There are also several privately held large, undeveloped parcels. The topography is generally low and flat with phragmites-dominated tidal wetlands along the undeveloped sections of both shorelines. The river section from Sweezy Avenue north narrows significantly and the predominate land uses are industrial and commercial. The river passes under the Long Island Railroad (LIRR) tracks and appears to have been redirected around the perimeter of the commercial property before extending north to the dam. A vehicle junkyard is located just south of the LIRR tracks on the west side of the river. The Long Island Power Authority (LIPA) has extensive facilities on the west side of the river between the LIRR tracks and Montauk Highway. Town mapping identified an extensive system of drainage structures in place on the LIPA properties. There is significant refuse and debris dumping along both shorelines from Sweezy Street north to Montauk Highway.

In Reach 1, storm runoff enters the river via six piped outfalls, two swales and two boat ramps. Surface runoff from four roads and a parking lot reaches the river. In two locations, no outfalls were located but piping observed in upgradient drainage structures appears to direct drainage toward the river. In numerous locations, the existing drainage structures infiltrate to groundwater. Table 2.4-Reach 1 includes all drainage areas reviewed for the WMP.

The rivers east shoreline is predominantly natural with a large number of Town- and County-owned preserved properties. A Town boat ramp and fishing pier is located on the southern parcel. Development along the shoreline is a limited number of single-family residences and two commercial properties, White Water Marina on southern Pine Neck

Avenue and a restaurant/marina on First Street. Boat dockage is limited to White Water Marina, the parcels between First Street and of Sweezy Avenue and a private bulkheaded area at the end of Elm Street. There are no piped discharges or headwalls. Concentrated storm flows enter the wetland via a mosquito swale at the southern end of Pine Neck Avenue, at the Town-owned boat ramp property, and at several street ends. Along Pine Neck Avenue and Chapel Avenue, sub-drainage areas collect storm runoff into drainage structures that infiltrate to groundwater. Based on visual inspection of the structures, it does not appear that the number and capacity is adequate to contain the WQSE described in Section 2.2.3 and in Section 4.2 Surface Runoff and Pollutant Loading. During large storm events, the structures may reach capacity and the excess runoff potentially drains to the river as overland flow. These sub-drainage areas are included in the surface drainage boundary shown on Figure 2.4.3.

The rivers west shoreline is natural south of Morgan's Swan River Marina, with single-family residential development north of the marina. At the rivers southern end, Town land is used for dredge spoil disposal. The most recent river dredging disposal operation was conducted in late 2005. The marina and residential properties are generally bulkheaded with dock space. Five piped outfalls were identified. The outfall locations include the south end of Grove Street into the Bay, Carman Avenue, Sweezy Avenue south side, Sweezy Avenue north side, and the commercial property fronting on Montauk Highway. Concentrated overland storm flows enter the river via the Morgan's Marina boat ramp, an eroded swale at the south end of River Road, and from the Bolton Avenue and Swan River Avenue road ends. Along Conklin Avenue and Grove Avenue, sub-drainage areas collect storm runoff into drainage structures that infiltrate to groundwater. Based on visual inspection of the structures, it does not appear that the number and capacity is adequate to contain the WQSE. During large storm events, the structures may reach capacity and the excess runoff potentially drains to the river as overland flow. These sub-drainage areas have been included in the drainage area shown on Figure 2.4.3.

2.4.3.2 Reach 2 –Dam at Montauk Highway to south of Sunrise Highway

This freshwater river reach extends north from the dam at Montauk Highway to Sunrise Highway. Commercial and industrial use is located along Montauk Highway. The remainder of the surrounding land use is predominantly single-family residential. Swan Lake, a 30-acre lake with a maximum depth of seven feet, is located north of Montauk Highway. County parkland along Montauk provides public access to the Lake. Montauk Highway is under the jurisdiction of Suffolk County. Road drainage from Montauk Highway east of the river is collected in a piped system that outfalls into the east side of the river immediately south of the road. There is a grate in the culvert that drains road runoff directly into the river. The river extends north from the lake with a small tributary extending northeast. The river north of the lake averages approximately 25' in width narrowing as it meanders north. At the northern limit of this reach, there are several large, vacant, commercially zoned properties. These properties have been damaged by ATV use that has disturbed on-site vegetation and is causing soil erosion into the river. In addition, dumping is evident in this area.

The residential development along the east side of the river was constructed on a lot-by-lot basis with limited road drainage infrastructure or curbing in place. There are eight roads ends, one piped outfall, and the Lake Avenue road shoulder that drain storm runoff into the river. Runoff from each of the eight road ends (Rose, Celia, Florence, Roberta, Bertha, Alice, Ethel, and Kathryn Streets) and the adjacent yards are carried to the west end of each street. This runoff filters through varied widths of existing vegetation prior to reaching the surface water. A small tributary stream extends east at the lakes northern limit. The tributary is piped under Lake Avenue and between residences before it daylights behind the residences. There is one inlet from Lake Avenue into the piped section. The tributary drains the undisturbed portion of the apartment complex located east of Lake Avenue. Storm drainage from the apartment complex is contained in an on-site recharge basin. No other piped outfalls to the lake, river or tributary were observed along the eastern shoreline. Runoff from the southern length of Lake Avenue drains over the narrow, minimally vegetated, sloped shoreline into Swan Lake. The community

building property located on Lake Avenue is bulkheaded with lawn extending to the bulkhead. In areas constructed prior to the 1970's the existing sanitary systems may not have septic tanks installed increasing the likelihood that sanitary waste may leach into the soil and be carried in the shallow groundwater flow into the waterbodies.

The community along the west shoreline is a residential subdivision that has drainage infrastructures and curbing in place. One piped outfall and one location of surface flow into the river were positively identified. Field investigation of the drainage systems identifies a 36" pipe that discharges into the river west of Bertha Street. Due to lack of access on private properties and inability to access some drainage structures, the complete connectivity of the structures on the western side of the river could not be determined. Based on the piping observed in accessible upgradient structures and the connectivity of systems that were identified, there are potentially several other locations where storm flow is discharging from drainage infrastructure into the lake or river. Drainage from the parking area and the vacant area of the commercial property at the southwest corner of the lake flows to the lake. The drainage pattern and infrastructure on the Patchogue Nursing Center property located north of the above property could not be confirmed. This area requires additional investigation through review of Town records and field reconnaissance to identify additional discharge points within this segment. The rear yards of the properties along the west shoreline slope toward the wetlands and water. Many of the properties have manicured lawns that drain fertilizer and pesticide-laced runoff into the water during storm events.

2.4.3.3 Reach 3 – Sunrise Highway to south of Woodside Avenue

This freshwater river reach extends north from Sunrise Highway to Woodside Avenue. This section of the river is narrow and bordered by undeveloped lands or residential properties. The surrounding uses and heavy vegetation limit public views of the river to the three cross streets. Land use in this area is almost entirely single-family residential subdivision development. The subdivision drainage infrastructure generally includes catch basins, manholes, leaching wells, piping and recharge basins. Recharge basins are

also located along Barton Avenue and Woodside Avenue. Six recharge basins were located in this reach with five of these located immediately adjacent to the river. The location of recharge basins immediately adjacent to the river raises concerns regarding the available storage capacity and function of the basins because of the shallow depth to groundwater. In addition, overflow piping was observed at one basin and shown on mapping at a second. During development of at least one of the subdivisions, the land along the river was preserved. In addition, there are several other large undeveloped properties in this reach. Approximately three hundred feet south of Woodside the river was realigned through three concrete pipe culverts.

Sunrise Highway is under the jurisdiction of the NYSDOT. According to the NYSDOT Stormwater Management Program 2005 Annual Report (discussed further in Section 2.5.3.4 New York State Department of Transportation), the State has not completed drainage infrastructure mapping in Region 11 – Nassau and Suffolk Counties. The river flows in a culvert under Sunrise Highway. No outfalls from Sunrise Highway to the river were identified and no drainage structures were observed in the north and south lanes of the Highway. Storm runoff from a section of the north lanes is surface water flowing north over the grassed shoulder and into the river. This runoff has created several eroded channels from the road shoulder to the river. Drainage structures were observed along the South Service Road of Sunrise Highway and a NYSDOT recharge basin is located along the South Service Road at Hewlett Avenue.

The majority of the residential development in this reach was constructed as subdivision development and included the installation of storm drainage infrastructure, recharge basins and curbing. Several locations were identified where the drainage system allows a portion of the storm runoff to outfall into the river without separating and containing the WQSE. Pipes extending toward the river were observed in the last structure in systems on Whippoorwill Lane, Nicole Court, and Swan View Court. An outfall pipe to the river was observed from the southern system on Swan View Court. Pipes entering the river from the other three locations were not located or not observed due to lack of access. Road

runoff is directed to recharge basins on Bambie Lane, Theresa Court, and Circle Drive. The recharge basin that collects drainage from Bambie Lane and Theresa Court runoff has an outfall pipe (#72) allowing the basin to outflow to the river. The outfall pipe requires further investigation to determine if the existing structure is designed to contain the WQSE in the basin and bypasses the only larger storm events. The Circle Drive recharge basin does not appear adequate for the street area that contributes runoff. A river outfall was not located. Additional investigation is required to determine if the WQSE is contained and if larger storm events can bypass the basin. On Debbie Drive, three structures collect drainage from 3,400 linear feet on road. An outfall was not identified, but the existing structures are not adequate to contain the storm runoff. Additional investigation is required to determine if runoff from this area drains directly to the river or to the Barton Avenue recharge basin discussed below. The drainage systems on Gina Drive and Lucy Court may have adequate capacity, but should be reviewed and additional investigation completed as they have the potential to overflow to the river.

Drainage on Barton Avenue, a Town road, is collected in a storm drainage system. The river passes under Barton Avenue in two parallel, corrugated metal pipes. A third pipe is angled east toward a drainage structure on Barton Avenue. A recharge basin is located in the southeast corner of Barton Avenues intersection with the river. The contributory area for this basin was not determined. Either Barton Avenue runoff or the Debbie Street runoff discussed above is directed to this location. The basins side slopes have been bermed alongside the river to provide storage capacity. The basin may not function properly as it was observed to be holding water. Additional investigation is required to determine the drainage area for the flow entering the recharge basin and for the flow entering the river at Barton Avenue.

2.4.3.4 Reach 4 – Woodside Avenue north to river headwaters

This freshwater river segment extends north from Woodside Avenue to the river headwaters. Immediately north of Woodside Avenue the river flows in a channel between two residences. North of the residences, a large recharge basin receives runoff from the

drainage system on First, Park, Oregon, and Richmond Avenues. The recharge basin is surrounded by residences and was not physically accessed or observed. Review of aerial photography shows a dry basin with ATV tracks and little evidence of runoff collection. Perennial river flow was not observed from this point north. Based on review of the topography and drainage infrastructure on Oregon and Pennsylvania Avenues it appears that the existing topography slopes toward the riverbed and surface storm runoff from the area may eventually drain to the river.

2.4.4 Watershed Quality Improvement Projects and Studies

This section discusses water quality improvement educational efforts that have been undertaken and projects that are planned by both the Town and Suffolk County.

2.4.4.1 Prior Educational Efforts.

This section includes descriptions of efforts undertaken by the Town to reduce non-point source pollution through educational efforts.

Stormwater Management Program Website

The NYSDEC State Pollution Discharge Elimination System (SPDES) Phase II Stormwater Management Program requires public educational and outreach efforts that target reduction of non-point source pollution from stormwater runoff. As part of this effort, the Town of Brookhaven established the Stormwater Management Program website (http://www.brookhaven.org/StormwaterManagementProgram/tabid/138/Default.aspx). Information on the requirements of the program, links to related stormwater information on the NYSDEC and USEPA internet sites, the Town of Brookhaven Annual Report, and other stormwater related information can be found here.

2.4.4.2 Planned Improvement Projects and Studies

This section includes descriptions of planned efforts by the Town in collaboration with other watershed partners to improve habitat along the river and reduce non-point source pollution.

Water Quality Improvement Projects

The NYSDEC awarded the Town of Brookhaven funds to pursue two water quality improvement projects in the Swan River watershed. The Town was awarded $83,000.00 to construct leaching catch basins and an infiltration system at the Pine Neck Boat Ramp to reduce the amount of silt, sediment and pathogens entering the Swan River. The Town was also awarded $150,000 to construct stormwater drainage improvements to collect stormwater and mitigate stormwater impacts on Swan Lake.

Fish Habitat Restoration Project

This project is a ten-year plan to return fish to 30 miles of river habitat along the south shore of Long Island. The project proposes to restore access to the habitat by mitigating the impacts of the dams by installing fish ladders at up to 30 dam locations. The initial focus is to install fish ladders on Swan River, Carmans River and Mud Creek. Dam removal is also being explores as a possible comprehensive restoration technique. Ladders installation or dam removal will aid in restoring the migratory patterns of fish, such as alewives and eels. This project is a partnership between Brookhaven Town, Suffolk County, SSER, Environmental Defense and Trout Unlimited. New York State 1996 Clean Air/Clean Water Bond Act funds have been awarded to Suffolk County and Brookhaven for passage projects at five dams on three tributaries including one to install a fish passage structure on the Swan Lake dam. Additional funding for the overall project has been obtained from other sources, including NOAA and NYSDOT, with added funding likely obtained from additional sources in the future. Further work under this project will include research to identify locations where alewives are attempting to swim upstream, a comprehensive survey of barriers including dams, culverts and other obstacles.

Barrier Assessment

NYSDOS Division of Coastal Resources and the SSER have hired a consultant to conduct an assessment of physical barriers to fish passage along the Swan River and five

other Reserve tributaries. The consultant will develop assessment protocol in conjunction with an advisory group. The assessment is expected to take place in the spring of 2007, and recommendations for barrier mitigation will be made following the assessment.

2.5 INTER-MUNICIPAL JURISDICTION AND AGREEMENTS

Jurisdiction of the Swan River waterway, the watershed and the shoreline is shared at multiple levels of government. Although the Town of Brookhaven exercises the primary authority over land use decisions pertaining to these waters, there are a number of Federal, State, County, and local private entities that have responsibilities concerning the management and uses in this area.

The following sections provide a brief description of the roles played by public agencies that could be involved in implementing the recommendations of this Plan.

2.5.1 Jurisdictional Boundaries

The watershed is located completely within the Town of Brookhaven. Suffolk County owns land totaling approximately 57 acres along the shoreline of the river. Suffolk County has jurisdiction over Montauk Highway (CR 80) and Woodside Avenue (CR 99). In addition, Suffolk County has dredging responsibility for Swan River. New York State has jurisdiction over Sunrise Highway and the Long Island Expressway. The underwater lands of Swan Lake and of the river from the lake north to approximately the vicinity of Franklin Street are public lands.

2.5.2 Federal

2.5.2.1 United States Environment Protection Agency (USEPA)

USEPA's mission is to safeguard human health by protecting the integrity of the environment. USEPA pursues this goal by developing legislation and national environmental protection programs and by administering funding to states and municipalities for the development and implementation of environmental plans, policies, projects, and programs. USEPA sponsors a number of programs that advocate the protection of natural resources such as surface water quality, including various Clean Water Act (CWA) programs, and publishes a variety of environmental protection and

planning guidance documents to provide technical support and educational assistance to the public. These actions may impact activities undertaken along the Swan River.

2.5.2.2 United States Army Corp of Engineers (USACE)

USACE's mission with regards to the waters of the United States is to provide services for planning, design, building, and operating water resources and other civil works projects including navigation and dredging, flood control, environmental protection and disaster response. The USACE reviews and permits projects proposed in navigational waters to ensure compliance with federal environmental laws

2.5.3 New York State

2.5.3.1 New York State Department of Environmental Conservation (NYSDEC)

The NYSDEC manages the State's recreational and commercial fisheries, tidal and freshwater wetlands, and other natural resources common to the coastal environment. NYSDEC is responsible for the preservation of water quality throughout New York State, especially through the administration of the permit program under the State Pollution Discharge Elimination System (SPDES). The recent expansion of SPDES (Phase II) covers municipal stormwater systems and construction sites greater than one acre in area, and oversight of spill remediation activities. NYSDEC also oversees the implementation of the requirements of the National Shellfish Sanitation Program, including enforcement activities with regard to the illegal taking of shellfish from uncertified waters.

NYSDEC's role within the Swan River watershed includes establishing and implementing natural resource protection programs, including environmental permitting programs; enforcing the State's environmental laws; freshwater fish stocking and licensing; resource management and planning; conducting site inspections, scientific research, and water quality testing; and providing technical assistance to private entities and municipalities.

2.5.3.2 New York State Department of State (NYSDOS), Division of Coastal Resources (DCR)

NYSDOS DCR provides technical and financial assistance to governments, businesses, and private organizations for the improvement of waterfronts, and specifies policies on issues that affect coastal areas. The DCR is responsible for administering the mandates of the Federal Coastal Zone Management Act of 1972 and the State Waterfront Revitalization Act of 1981, including its responsibility for reviewing Local Waterfront Revitalization Programs (LWRP), Harbor Management Plans (HMP), and various coastal projects for consistency with the State's Coastal Management Plan.

NYSDOS has been involved in numerous coastal planning initiatives in the State and has dedicated a wealth of technical expertise and financial assistance to these projects. NYSDOS DCR also provides technical assistance to the SSER Council and Office. NYSDOS has provided the funding to undertake this plan and has provided funding for other proposed projects and studies discussed in Section 2.2.11 and 2.4.4.

2.5.3.3 New York State Department of Health (NYSDOH)

NYSDOH identifies water-bodies that have compromised water quality that may have adversely affected the suitability of fish for human consumption, including Swan River. See Section 2.2.9.4 for specific advisories.

2.5.3.4 New York State Department of Transportation (NYSDOT)

The NYSDOT designs and maintains state roads and the corresponding drainage infrastructure. Sunrise Highway is under NYSDOT jurisdiction. The NYSDOT employs a trained environmental staff that ensures that the department actions comply with various state policies, laws and regulations enacted to protect the environment. The NYSDOT employs environmentally sound techniques while performing its duties; including maintaining roads and bridges, and requiring erosion and sedimentation control practices for every project. The NYSDOT is a regulated small Municipal Separate Storm Sewer System (MS4) within a Designated Urbanized Area identified by the NYSDEC.

As a designated MS4 under State Pollution Discharge Elimination System (SPDES) Phase II, the NYSDOT was required to develop and implement a Stormwater Management Program (SWMP). The NYSDOT is the third year of implementing the SWMP. Annual reports issued for 2004 and 2005 identify the work completed on implementation of the SWMP. The NYSDOT SWMP identifies several activities that overlap with the WMP and the Town SWMP including public education, municipal coordination and stormwater infrastructure mapping. To date the NYSDOT has not completed the infrastructure mapping in Region 10 - Nassau and Suffolk Counties.

2.5.4 Suffolk County

2.5.4.1 Suffolk County Department of Public Works (SCDPW)

SCDPW is the agency responsible for maintaining the County roadways and corresponding drainage infrastructure in the watershed. County roads include Montauk Highway (County Route (CR) 80) and Woodside Avenue (CR 99). In addition, the County is responsible for maintenance of the Sunrise Highway service roads. The manner in which the County plans, engineers, constructs, and maintains its stormwater infrastructure and roads can have significant and lasting effects on local water quality.

Suffolk County (SC) is a regulated small Municipal Separate Storm Sewer System (MS4) within a Designated Urbanized Area defined by the NYSDEC. As a designated MS4 under State Pollution Discharge Elimination System (SPDES) Phase II, SC was required to develop and implement a Stormwater Management Program (SWMP). SCDPW has been charged with managing the SC SWMP and has contracted with Cornell Cooperative Extension to provide the services. SC is in the third year of implementing the SWMP. The annual report issued in 2006 identifies the work completed on implementation of the SWMP. The SC SWMP identifies several activities that overlap with the WMP and the Town SWMP including public education, municipal coordination and stormwater infrastructure mapping. As of the Annual Report issued in 2006, the SCDPW has completed the infrastructure mapping of 75% of County roads and 35% of County

properties. SCDPW expects to have completed the County roads and an additional 35% of County properties for the annual report issued in 2007.

A division of the SCDPW is Vector Control. Vector Control is responsible for controlling mosquito infestations that are of public health importance. This work is performed under the authority of the New York State Public Health Law - Article 15, Sections 1500, 1501 and 1502, Suffolk County Local Law - Number 16 and the Suffolk County Charter - *Section 8*. Vector Control employs an integrated pest management (IPM) program to minimize pesticide use that consists of water management, biological control, larval control and, when determined to be the only practical option for high mosquito populations, adult control. Due to the public health concerns of high level of mosquitoes, Vector Control conducts spraying near Swan River when mosquitoes reach unacceptable levels. Swan River has been sprayed for adult mosquito control during the 2006 season.

2.5.4.2 Suffolk County Department of Health Services (SCDHS)

SCDHS conducts a sampling program during the summer season to monitor total and fecal coliform bacteria levels that determine whether the waters at public bathing beaches are suitable for swimming. Samples are collected twice weekly, from mid-April to the end of September of each year. There are no public bathing beaches along the Swan River. The County samples and tests the water quality for the mainland beach facilities located west of Swan River in the Village of Patchogue including Shorefront Park and Sandspit Park. These beach facilities have been closed when test results indicate that bacteria levels exceed State bathing beach standards.

SCDHS, in cooperation with the SCDPW, Division of Vector Control (Vector Control), is guiding the development and implementation of a Suffolk County-wide *Vector Control and Wetlands Management Long Term Plan.* The goals of this plan are to develop an effective mosquito control program with a comprehensive wetlands management component, minimization of pesticide usage while protecting public health, and the preservation and restoration of wetlands managed by Vector Control. The *Long Term*

Plan is currently undergoing environmental quality review to assess the public health and ecological impacts of mosquito spraying. The technical advisory committee charged with providing environmental quality review of the draft document is composed of the following voting members: The Nature Conservancy, USEPA, Citizens Campaign for the Environment, Council on Environmental Quality, Fire Island National Seashore, American Mosquito Control, Association, New York Sea grant, NYSDOS, SC SWCD, State University of New York - Stony Brook Marine Sciences Research Center, SSERC, USGS, USACE, and USFWS.

2.5.4.3 Suffolk County Planning Commission (SCPC)

The SCPC has discretionary approval authority over subdivision applications in accordance with the provisions in the SCPC Subdivision Guidebook (Guidebook). The SCPC is authorized to review and comment upon all proposed subdivisions that lie wholly or partly within 500 feet of:

1) The boundary of any village or town.
2) The boundary of any existing or proposed county, state, or federal park or other recreation area.
3) The right-of-way of any existing or proposed county or state parkway, thruway, expressway, road or highway.
4) The existing or proposed right-of-way of any stream or drainage channel owned by the county or for which the county has established channel lines.
5) The existing or proposed boundary or any other county, state or federally owned land, held or to be held for governmental use.
6) The Atlantic Ocean, Long Island Sound, any Suffolk County bay, or the estuary of any of the foregoing bodies of water.

The SCPC's General Statement of Policy regarding shoreline development states, *"The shoreline of Suffolk County is one of its prime economic, aesthetic, and environmental assets. It is the objective of the Commission to encourage the preservation of this resource through the prevention of the degradation of any body of water, the use of*

adequate setbacks to offset the affect of erosion, the discouragement of those activities that will hasten erosion and disturb the ecological balance of the area, and the preservation of the aesthetic attributes of the shoreline".

The Guidebook contains specific guidelines for subdivision development at locations on tidal streams, rivers, wetlands, and other tidal bodies in the area. The guidelines include requirements for shoreline setback for structures and sanitary disposal facilities, conservation buffers, and tree removal. The Guidebook also contains SCPC policy and guidelines on stormwater in subdivisions. In addition, SCPC is responsible for conducting planning and research, and preparing regional/county-wide plans.

If large vacant properties along the Swan River were proposed for residential subdivision, the SCPC would review the application for conformance to the requirements of the guidebook.

2.5.4.4 Suffolk County Parks, Recreation and Conservation (SCDP)

The SCDP is responsible for County-owned park and preserve facilities. County preserved lands within the watershed include 57 acres along the river. The Suffolk County Pesticide Phase-Out Comprehensive Integrated Pest Management Program prohibits the application of any pesticide on County property including parklands and reserved lands except for those materials and locations that have been exempted in the code or by emergency measure.

2.5.5 Town of Brookhaven

The Town has the authority to regulate land use activities in its respective unincorporated communities. The Town also regulates the use of underwater lands and the placement of structures on underwater lands within its respective boundary.

2.5.5.1 Town Board – Supervisor and Councilmen

The Town Board is the legislative, appropriating, governing and policy-determining body of the Town of Brookhaven. The Board has the final responsibility for all matters pertaining to the operation of the Town. It exercises this authority in the form of local laws, ordinances and resolutions.

2.5.5.2 Department of Planning, Environment and Development

The Department of Planning, Environment and Development oversees planning activities related to new building and site developments, protection and enhancement of environmental resources, and assists in obtaining environmental permits and grants for Town departments. The Department also develops, implements, and coordinates programs for water conservation, marine environment and marine life preservation, and wetlands protection. The Department contains three divisions.

The Division of Building administers and enforces the zoning laws and other applicable laws and codes of the Town and State.

The Division of Planning's main function is to provide for the orderly growth of the Town of Brookhaven. The Division reviews proposals for subdivision, land division, site plans, road improvements and changes of use to ensure that the projects incorporate best planning practices. The Division also conducts various zoning and land use studies and makes recommendations on updating and improving the Town of Brookhaven's Master Plan. The Planning Division also provides planning and land use recommendations to the Planning Board, Town Board, and Board of Zoning Appeals. The Planning Review Board is empowered to review applications for residential or commercial subdivision maps and/or site plan proposals and applications and recommends approval or disapproval of proposed plans to the Town Board. Development proposals or applications are subject to a public hearing, conducted by the Board, which provides an opportunity for members of the community to comment on the development proposal.

The powers and duties of the Division of Environmental Protection include protection of the environment of the Town from all activities which in any way impair, damage, destroy, infringe or hinder the enjoyment of the natural resources of the town, and to administer all local laws of the Code of the Town of Brookhaven assigned to the Department of Environmental Protection. This division manages a shellfish program, runs educational programs, reviews projects before the Town of Brookhaven Town Board and Planning Board concerning matters affecting the environment and other natural resources of the Town, and insures compliance with the New York State Environmental Quality Review Act.

2.5.5.3 Board of Zoning Appeals

The Board of Zoning Appeals issues variances and exemptions from Town zoning ordinances and conducts public hearings on such requests. The Board of Zoning Appeals responsibility is to entertain applications at public hearings for variances, minor subdivisions, special permits, use variances and interpretations of the Building and Zoning Code. Factors that the Board takes into consideration when making a decision include: conformity to surrounding areas, impact to the environment, and benefit to the applicant as weighed against the detriment to the health, safety and welfare of the community.

2.5.5.4 Highways Department

The Highways Department plays a critical role in stormwater and pollutant control, infrastructure system maintenance, and the preservation of surface water quality. Its responsibilities include supervision of the design and construction of Town roads and drainage projects, road maintenance and repair, street sweeping, and snow removal on all Town roads and public parking lots. The Superintendent of Highways is charged with improvement and maintenance of all 2,100 miles of roadway in the Town of Brookhaven. Maintenance of town roadways includes the repair of potholes and sweeping of all roadways. Other major community improvement responsibilities include drainage

projects, road resurfacing, tree trimming and tree removals, maintenance of recharge basins (sumps), and installing and maintaining catch basins.

2.5.5.5 Department of Parks, Recreation and Sports, and Cultural Resources

The Town's Department of Parks, Recreation and Sports, and Cultural Resources is responsible for operating and maintaining Town-owned parks, ballfields, playgrounds, beaches and pools; docks and marinas; boat launching ramps, and community centers. Town park facilities within the Swan River drainage area include the Town boat ramp on Pine Neck Avenue, and several small neighborhood parks located in the northern subdivisions. In addition, the department's responsibilities include recreational and sports programs; the Bald Hill Amphitheatre and Gallery; and work with the Long Island Cultural Center and the Brookhaven Arts and Humanities Council to develop the Cultural Center and provide arts and humanities programming throughout the Town.

2.5.5.6 Department of Engineering

The powers and duties of the Department of Engineering include the two following divisions that have relationship to the Town's river and bays. The Division of Special Districts oversees all matters pertaining to the operations of various water and beach erosion control. The Division of Engineering administers and directs all matters pertaining to implementation of capital projects and other technical matters with the Town.

2.5.5.7 Department of Public Safety

The Department of Public Safety administers activities determined to be potentially detrimental to the safety of the public. The Division of Local Law Enforcement/Security is responsible for enforcement of the provisions of the Town Code with regard to use of parks, and waters. Bay Constables enforce laws pertaining to boating, fishing, shellfishing and waterways.

2.5.5.8 Department of Waste Management

The Department of Waste Management oversees Town waste management facilities; including the landfill, materials recovery facility, STOP building, transfer station, and drop-off sites. The Department manages the residential collection contracts, special collections for bulk items, roadside clean-up and abandoned building demolition. The Department provides public information on waste reduction and recycling and code enforcement as it applies to waste management.

2.5.5.9 Open Space Advisory Committee

This volunteer committee is comprised of representatives of different portions of the Town. The Committee's duties are to make recommendations to the Town Board regarding the acquisition of open space.

2.5.5.10 Conservation Advisory Committee (CAC)

The CAC has engaged in many environmental projects including open space purchase, open space management, stormwater abatement, and wetland restoration. The chair of the CAC represents the CAC on the Town's Open Space Advisory Committee and the Suffolk County Council on Environmental Quality.

2.5.6 Citizen/Civic Groups

In addition to federal, state, county and local governmental agencies, a variety of private organizations have been created to oversee, protect and preserve significant environmental features that are important to their region or municipality. Private organizations that may have interest in the Swan River watershed include: Focus East Patchogue, Swan Lake Parks Association, Eastern Long Island Audubon Society, The Nature Conservancy, Sierra Club – Long Island Chapter, South Shore Estuary Reserve (SSER), The Peconic Baykeeper, Citizens Campaign for the Environment, Ducks Unlimited, Trout Unlimited, Environmental Defense, Long Island Sierra Club, and various civic groups and local property owner associations.

2.6 LAND AND WATER USE REGULATIONS AND CONTROLS

The following is a description of applicable Town regulations and programs that can have an effect of the use of the lands and waters of the Swan River watershed.

2.6.1 Regulations

Bay and Harbor Bottoms. (Chapter 8, Code of the Town of Brookhaven). This chapter prohibits any person from keeping any boat, barge, scow, raft, float or other object upon any Town-owned bay or harbor bottom for more than seven consecutive days without having first obtained the written consent of the Town Board of the Town of Brookhaven, or without having first obtained the written consent of the Trustees of the Freeholders and Commonalty of the Town of Brookhaven, in the event that the title to said bottom is vested in said Trustees.

Beaches (Chapter 9, Code of the Town of Brookhaven). The Town prohibits motor vehicles on beaches. No motor vehicle of any type whatsoever shall be operated upon the Great South Beach except through special permit from the Town Clerk of the Town of Brookhaven. This chapter also prohibits overnight camping on beaches.

Parks and Recreation Areas (Chapter 10, Code of the Town of Brookhaven). This law limits the use of Town parks to residents and/or owners of taxable real property and nonresidents as authorized in the Town of Brookhaven; makes it unlawful for any person to permit or allow any boat to be anchored, moored, tied or otherwise confined in or at a town marina or designated mooring area without a valid permit. The Town Clerk assigns seasonal slips and dock space by permit. Transient permits are issued by the Commissioner of Parks, Recreation and Human Resources.

Boat Control (Chapter 13, Code of the Town of Brookhaven). This chapter provides that every person operating a boat shall at all times operate it in a careful and prudent manner and at such a rate of speed as not to disturb the reasonable comfort or endanger the property of another or the life or limb of any person or so as to interfere with the free and proper use of the navigable waters within the Town of Brookhaven. This chapter sets speed limits and controls mooring and

sanitation. Discharging of toilets or oil is prohibited in areas designated as boat basin, anchorage or bathing area.

Houseboats (Chapter 14, Code of the Town of Brookhaven). According to this chapter, no floating home or residential houseboat shall be occupied, used, moored or anchored within the Town of Brookhaven or secured to any dock, piling or shore within the Town of Brookhaven, and no floating home marina shall be permitted in any zoning classification within the Town of Brookhaven.

Building Construction Administration (Chapter 16, Code of the Town of Brookhaven). This chapter applies the NYS Uniform Fire Prevention and Building Code to all buildings and construction in the Town of Brookhaven. Under §16-2A, the administration of the code rests with the Building Division of the Town of Brookhaven. The Division is charged with the enforcement of the code relating to the erection, repairing, remodeling, altering, moving and inspection of buildings.

Docks (Chapter 22, Code of the Town of Brookhaven). The Town prohibits bathing and swimming at any dock, pier, bulkhead or jetty owned by or under the control of the Trustees of the Freeholders and Commonalty of the Town of Brookhaven or owned by or under the control of the Town of Brookhaven.

Dumps and Disposal Areas (Chapter 24, Code of the Town of Brookhaven). This chapter provides that no municipality or private person other than the Town of Brookhaven shall establish or maintain a garbage dump, disposal area or sanitary landfill operation for the disposition and deposition of litter, as defined by §45-2 of the Code of the Town of Brookhaven.

Economic Development Zone (Chapter 25, Code of the Town of Brookhaven). This chapter targets areas for economic and human resource development programs in order to stimulate private investment, private business development and job creation.

Fish Nets (Chapter 32, Code of the Town of Brookhaven). No person shall at any time use or cause to be used a net or combination of nets in excess of two hundred fifty (250) fathoms in length for the purpose of taking fish of any kind from waters in the Town of Brookhaven in Great South Bay, the Narrow Bay or Moriches Bay. No person shall use any net, pot or trap for the purpose of taking fish or crabs of any kind whatsoever from waters within the Town of Brookhaven in Great South Bay, the Narrow Bay or Moriches Bay unless said person shall have actually and continuously resided within the Town of Brookhaven for a period of at least six (6) months immediately preceding the date of the use of such net. No person, firm, corporation or association shall at any time take fish by use of net or nets from waters in the Town of Brookhaven.

Fire Prevention (Chapter 30, Code of the Town of Brookhaven). This chapter prescribes regulations consistent with nationally recognized good practice for the safeguarding of life and property from the hazards of fire and explosion arising from the storage, handling and use of hazardous substances, materials and devices and from conditions hazardous to life or property in the use or occupancy of buildings or premises.

Flood Damage Prevention (Chapter 33, Code of the Town of Brookhaven). This chapter regulates uses, which are dangerous to health and safety; controls uses vulnerable to floods; controls the alteration of natural floodplains, stream channels and natural protective barriers; controls filling, grading, dredging and other development that may increase erosion or flood damages; and regulates the construction of flood barriers.

Grading (Chapter 35, Code of the Town of Brookhaven). This chapter regulates and controls the regrading of land throughout the Town to prevent serious and irreparable damage to our natural resources, to minimize and retard the erosive effects of wind and water, to prevent the depreciation of property values, to prevent the removal of lateral support for abutting streets, lands and structures, to prevent damage to natural watersheds, to provide adequate drainage for surface water runoff, and to protect persons and property from the hazards of periodic flooding.

Recycling (Chapter 46, Code of the Town of Brookhaven). This chapter establishes a solid waste management plan for the Town.

Sanitary Code of the Town of Brookhaven (Chapter 45, Code of the Town of Brookhaven). The Sanitary Code designates the Commissioner of the Department of Waste Management of the Town of Brookhaven to enter, at reasonable times, upon any private property for the purpose of inspecting and investigating conditions relating to the enforcement of the provisions of this chapter to ensure that private property is free of litter; prevent the deposit of litter from vehicles; and regulate the commercial collection of solid and liquid waste.

Sand and Gravel Pits; Excavation; Removal of Topsoil (Chapter 53, Code of the Town of Brookhaven). The purpose and intent of this chapter is to restrict the removal of sand and gravel to those instances where it is absolutely essential to remove said raw materials from a site in connection with the residential, commercial or industrial development of the premises, and to encourage development which utilizes existing slope contours wherever possible so that drainage patterns and existing vegetation will be subjected to the least disturbance as is practicable.

Shellfish (Chapter 57, Code of the Town of Brookhaven). This chapter sets forth the privileges reserved to Town residents and establishes rules and standards for taking shellfish, including oysters, hard clams, soft or steamer clams, mussels and bay scallops. The chapter authorizes commercial permits, outlines the restrictions on a commercial permit holder and sets forth general and specific regulations for the protection of shellfish. Under §57-24, no person shall operate as a commercial buyer of shellfish or shall buy, sell, possess or otherwise deal with shellfish for commercial purposes unless such person has obtained a commercial buyer's permit from the Town Clerk.

Vegetation on Beach Areas (Chapter 76, Code of the Town of Brookhaven). This Chapter prohibits removal or destruction of any grass or vegetation from any lands in the Town of Brookhaven on the Great South Beach without a permit from the Chief Building Inspector.

Nature Preserves (Chapter 77, Code of the Town of Brookhaven). This law designates areas as Nature Preserves to be managed and protected in their existing natural or as near to natural state as possible for the benefit of present and future Town residents. This chapter places the management of Town Nature Preserves under the Division of Environmental Protection with assistance from the Town's Conservation Advisory Committee; sets up standards for maintenance and preservation and permits Town Nature Preserves to be designated on lands not owned by the Town.

Water Resources (Chapter 78, Code of the Town of Brookhaven). The Board of Trustees have been entrusted with title to all subterranean waters within the boundaries of the Town of Brookhaven and are vested with the duty and obligation to protect these valuable waters as a source of safe drinking water. This chapter prohibits any person from discharging any industrial waste within the Town of Brookhaven without a permit from the Town Board

Critical Environmental Areas; State Environmental Quality Review Act Implementation (Chapter 80, Code of the Town of Brookhaven). This chapter designates critical environmental areas and implements the provisions of the New York State Environmental Quality Review Act to protect the valuable resources of the Town of Brookhaven. Areas within the Town of Brookhaven designated CEAs by resolution of the Town Board include Route 25A Corridor CEA in Middle Island, Yaphank CEA; Brookhaven Coastal Zone Area CEA.

Wetlands and Waterways (Chapter 81, Code of the Town of Brookhaven). This ordinance places lands defined as wetlands or waterways, under the protection of the Town Board pursuant to the authority conferred upon the Town through the Dongan Patent of 1686 and the authority conferred to the Town by various New York State laws and regulations including but not limited to Articles 24, and 8, of the Environmental Conservation Law (Freshwater Wetlands, and Environmental Review) and regulations, Town Law and the Municipal Home Rule Law which impact wetlands or waterways.

Zoning (Chapter 85, Code of the Town of Brookhaven). This chapter establishes the zoning ordinance for the Town of Brookhaven, the zoning map, zoning districts and regulations, including Great South Beach in the Fire Island National Seashore District, and excluding any lands that lie within the boundaries of incorporated villages. In order to promote the health, safety and welfare of residents and visitors of the Town of Brookhaven on the barrier beach known as "Fire Island," the Town Board of the Town of Brookhaven has enacted this article to protect said barrier beach from development, which is inconsistent with prudent resource management and its ecological capabilities.

Wetlands Overlay District. In 2003, the Town of Brookhaven implemented a Wetland Overlay District to provide additional protection of property in areas identified as wetlands, surface waters and adjacent buffer areas. The goal of the zoning district includes:

1) protection and improvement of fresh and salt water quality,
2) prevent destruction of wetland and adjacent buffers,
3) preserve and protect natural drainage ways and to reduce and prevent flooding and stormwater runoff associated with adjoining properties, and open space and aesthetic appreciation, erosion control;
4) to reduce stormwater runoff and it's associated contaminants into Town's lakes, streams, harbors, and bys; and,
5) to regulate new construction in environmentally sensitive areas.

The Overlay district includes all lands determined to be wetland including but not limited to the areas as delineated by the NYSDEC and shown on Figure 2.2.9 of this report. The requirement of this district include a minimum 100' buffer landward of wetland or surface waters, a minimum lot area of 20,000 SF for residences, a minimum 40,000 SF lot area for non-residential properties, no development with the wetlands or underwater lands, and reductions in yield and floor area ratios based on wetland areas.

Subdivision Regulations. Chapter SR of the Code of the Town of Brookhaven includes the following requirements for development of property for a subdivision with regards to existing watercourses and drainage ways:

- According to SR-15A(7), where existing brooks, water bearing ditches and dry streambeds giving evidence to seasonal run-off use are encountered, such areas shall be maintained for drainage purposes or other adequate means for providing for such drainage shall be installed at developer's expense. A right-of-way or drainage easement of sufficient minimum width to include a 12-foot access strip in addition to the width of the ditch, brook, or streambed as measured from bank top to bank top shall be offered to the Town for drainage purposes. Such right-of-way or easement shall be shown on the final plan with property bearings and distances.
- According to SR-15B(1), recharge basins shall be required to contain a five (5) inch rainfall, with coefficient of runoff based on runoff characteristics, where a positive overflow is provided.

2.6.2 Programs

The following Town programs are related to reducing pollutants that can potentially reach the river and increasing resident stewardship of waterbodies in their communities.

S.T.O.P. Stop Throwing Out Pollutants. This program is a household hazardous waster collection program that is run through the Department of Waste Management.

CURBY. The Town has established a curb-side recycling program that accepts #1 and #2 plastics, aluminum, glass and metal (confined to grocery store type).

Battery Collection Program. Collection of household batteries, button batteries, and 6-volt batteries is carried out by the Department of Waste Management.

Leaf and Mulch Program. Brown bags are provided to residents to drop off leaves. Free mulch is provided to residents

Commercial Cardboard Pick-Up. This service is provided through the Department of Waste Management.

Adopt-A-Preserve Program. This program encourages community stewardship in conjunction with the Nature Preserve Program.

Stormwater Management Program: This permit program has been implemented in accordance with the requirements of the NYSDEC SPDES Phase II Stormwater Management Program. The program includes state mandated programs and practices in public education and outreach, public participation and involvement, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction stormwater management in new development and redevelopment projects, and pollution prevention/good housekeeping for municipal operations. This program is discussed further in Section 5.5 Phase II Stormwater Permit Compliance, which includes descriptions of the Town efforts to implement this program.

3.0 PROTECTION AND MANAGEMENT RECOMMENDATIONS

Protection and management recommendations focus on measures that stakeholders of the Swan River can implement to aid in reducing pollutant loads to the water bodies. These recommendations include proactive measures that can be undertaken by community members, municipal employees and local organizations to reduce the pollutant loads generated on the lands within the watershed, thereby reducing the need to for intensive structural pollutant removal measures. The protection and management recommendations described in this section are organized as follows:

- *Habitat protection and management recommendations* including wetland and fish habitat restoration measures such as 1) dredge spoils removal, 2) tidal flow improvements, 3) invasive species removal, 4) hydrologic improvements, 5) riparian buffers reestablishment, 6) improvements to fish passage, instream habitat, and shoreline; and 7) trout population research.
- *Educational and outreach recommendations* including developing materials that increase knowledge of pollution impacts to homeowners, boaters, and commercial establishments. These include 1) brochures and a Swan River web page, 2) tributary identification signage and interpretive exhibits, and 3) school watershed educational programs.
- *Point and nonpoint source pollution management and control recommendations* including 1) stormwater monitoring and illicit discharge detection management programs, 2) drainage area-wide structural stormwater controls, 3) non-structural road maintenance, pest management and sanitary system review programs, 4) land use changes through property acquisition and regulation modification.
- *Institutional recommendations* including 1) establishing task forces and 2) collaborative efforts with school and stakeholder organizations.

The management recommendations as they relate to the watershed areas are shown on Figure 3.0.

3.1 HABITAT PROTECTION AND MANAGEMENT RECOMMENDATIONS

The SSER CMP recommends the following actions to achieve the objective of "*Coastal habitats protected and restored to support shellfish, finfish and coastal bird populations"* (Outcome 4 of the SSER CMP).

- Restoration of tidal wetlands (SSER CMP Implementation Action 4-1)
- Coordination of wetland restoration efforts (SSER CMP Implementation Action 4-2)
- Restoration of anadromous fish (SSER CMP Implementation Action 4-3)
- Habitat restoration in tributaries (SSER CMP Implementation Action 4-4)

The Swan River WAC identified improvement of river water quality as the overall goal of the WMP. It is important to consider a coordinated approach between water quality improvement and habitat restoration and protection since the two are inextricably linked. Healthy habitat is dependent on adequate water quality, and water quality is influenced by the presence and biological integrity of wetland and riparian habitats.

3.1.1 Wetland Restoration Recommendations

Based on previous, ongoing, and proposed wetland restoration projects in other Long Island locations, the following restoration principles can be included as potentially feasible for application in this watershed. Further monitoring and analysis is necessary to determine suitable restoration opportunities and feasibility. These recommendations identify where in the watershed certain restoration principles may have applicability. As described in earlier sections, the reaches as for Swan River have been defined follows:

- Reach 1: Great South Bay north to dam north of Montauk Highway
- Reach 2: Dam north to south of Sunrise Highway
- Reach 3: Sunrise Highway north to south of Woodside Avenue.
- Reach 4 : Woodside Avenue north to headwaters

3.1.1.1 Dredge Spoil Removal Recommendations

Wetland function in the watershed has been lost due to the conversion of both tidal and fresh water wetlands through filling of upland areas. Filling results primarily from channel dredging but can also be a result of residential or commercial land use activities. Reclaiming wetland acres through removal of dredge spoil enables the restoration of wetland functions, resulting in a net gain of wetlands.

Specific Actions:

- Determine the intended future use of dredge spoil disposal sites on the east and west sides of Swan River in Reach 1. The southwestern site received dredge spoil from late 2005 Swan River dredging operation conducted by Suffolk County. The potential for remediation of spoils sites hinges on their intended use. While dredging is often in the public interest, it cannot proceed without disposal sites. Prior to dredge materials removal, alternative disposal sites must be identified and be able to accommodate the future cycle of dredging expected in Swan River.
- If spoils relocation is feasible, identify sites where dredge spoil can be transported and the permit requirements, costs, and responsibility for the relocation. To reduce future spoil materials indiscriminate dredging practices should be discouraged.
- Determine the potential for remediation of several smaller spoils sites that resulted from bulkheading and construction of personal boat docking slips that exist along the eastern shoreline of the Reach 1.

3.1.1.2 Tidal Restriction Removal and Tidal Flow Improvement Recommendations

Natural tidal movement that previously existed in the watershed has been altered by human activities including, but not limited to, road construction, shoreline hardening, and filling of wetlands. Restriction of tidal movement degrades vegetative communities and wildlife habitat.

Specific Actions:

- Investigate the potential for connection improvements to restore tidal flow in Reach 1, including:
  - Connection to salt marsh remnants adjacent to the dredge spoil site along the eastern shoreline of Reach 1.
  - Connection to wetlands north of Sweezy Avenue.
- Identify dam structures and other barriers along the river constructed by adjacent landowners. Work with Suffolk County and NYSDEC to remove the barriers and restore the shoreline while providing educational information to the property owners.

3.1.1.3 Invasive Species Removal Recommendations

The removal of invasive species in the watershed is principally aimed at invasive plants, but this should also include control of invasive animal organisms, such as alien or introduced fish species that threaten natural biodiversity (See 3.1.2.4 Trout Population Research and Improvement Projects). The most widespread and visibly notable plant threats are *Phragmites australis*, purple loosestrife, Japanese knotweed, and others. Norway maples *(Acer platanoides)*, an upland invasive, were identified on many of the vacant parcels in the watershed. Invasive aquatic plant species, including fanwort (*Cabomba carolina*) and curly pondweed (*Potamogeton crispus*) are becoming prevalent in ponds on Long Island. Although invasive aquatic plant species were not reported to occur in Swan River or Swan Lake at the time of preparation of this plan, aquatic growth is known to affect the fishing in the lake. Control methods will vary greatly based on numerous factors but there is general recognition that invasive species threats are increasingly widespread, and deleterious to natural vegetation and wetland functions. Ducks Unlimited and other partners are developing a phragmites removal and *Spartina* restoration plan for Beaverdam Creek with the goal to restore natural tidal marshes and provide a model for additional marsh restoration on Long Island.

Specific Actions:

- A survey of the extents of the invasive species should be prepared to aid in identifying locations where eradication has the potential for success. GPS can be used to identify and record locations of invasive species.
- Address extensive monocultures of *Phragmites australis.* Phragmites should be controlled prior to attempts to restore native brackish marsh vegetation.
  - Both sides of Swan River are heavily inundated with phragmites in Reach 1. The phragmites tends to convert the area to a marginally functioning wetland at best.
  - Phragmites occurs in some isolated locations in Reach 2 and may be treatable.
- Investigate potential remediation of additional invasive species.
  - Additional invasive species such as Norway maple, Japanese knotweed and Asiatic bittersweet are abundant in the upland areas in all Reaches.
- The Swan River Task Force should investigate successful local and regional initiatives for the removal of invasive species from sensitive sites such as the Beaverdam Creek tidal marsh restoration effort discussed above.
- Monitor other submerged aquatic alien invasives for detection and early control action.

3.1.1.4 Altered Hydrologic Landscape Improvements

The most prevalent alteration of water movement in tidal systems stems from systematic grid ditching for mosquito control. Other examples of alterations that effect water movement include navigation ditches to private residences and dikes on the marsh. The altered hydrologic landscape is being addressed in the current *Suffolk County Vector Control and Wetlands Management Long Term Plan*. The *Long Term Plan* will include recommendations for salt marsh management best management practice procedures and projects to restore grid-ditched wetlands, improve marsh habitat diversity and limiting invasive species.

Specific Actions:

- The Swan River Task Force should review the final recommendations of the *Long Term Plan* for applicability to the Swan River management efforts.
- Address the impacts of the grid ditching for past mosquito control attempts on the east side of Reach 1. Some of these ditches drain road sections and may be able to be converted to filtering swales.

3.1.1.5 Riparian Buffers Improvements/ Stewardship Opportunities

Re-establishment or conversion of the interface of the wetland community and residential and/or other uses can be improved with the use of native vegetative plantings that restore wetland functions.

Specific Actions:

- The interface with residential properties can be suitable for riparian buffer habitat restoration. Opportunities to reduce lawn areas that extend to the waterfront predominate in Reaches 1 and 2.
- The eastern and southern shoreline of Swan Lake provides excellent opportunities to restore a shoreline buffer that can filter runoff, reduce waterfowl use, and increase aesthetics. The restoration effort can be coordinated with areas civic groups, such as programs the Swan Lake Civic Association, and school programs. This restoration can be used in the effort to educate residents to the importance of maintaining buffers.

3.1.1.6 River Clean –Up Events

Indiscriminate disposal of waste products and debris along the river corridor damage vegetation, affect wildlife and impact aesthetics. In addition to general amounts of paper, bottles and cans, at several locations long the river large debris including shopping carts, tires and old chairs were identified.

Specific Action:

- Work with area groups to undertake annual events to remove dumped debris and litter from the river. Brookhaven can encourage volunteer efforts by providing the heavy equipment with operators, dumpsters and disposal components necessary for a clean-up event.
- Target specific sites along the river that have been identified as having large amounts of debris including Montauk Highway south to Sweezy Avenue and south of Sunrise Highway. Natural vegetation, such as branches that have fallen into the river should not be removed unless the material completely blocks the river.
- GPS can be used to track locations where large amount of debris are identified, clean up dates and quantities of materials removed.

3.1.2 Diadromous Fish Habitat Restoration

Diadromous fish habitat restoration recommendations include improvements to allow fish greater access to the length of the river by modification to impediments, improving the instream habitat, stabilizing eroding streambanks, and conducting research into trout populations and management improvements.

3.1.2.1 Fish Passage Improvement

Improving the natural life cycle of diadromous fish can be accomplished through the removal of physical barriers to migration, using fish ladders when necessary, the restoration of the river corridor, and other modifications that favor improved fish habitat. Passage requirements vary among species and solutions should address the requirements of all the diadromous species using the river. The Town, in partnership with Suffolk County, SSER, Environmental Defense and Trout Unlimited, has begun planning for these improvements with the Fish Habitat Restoration Project discussed in Section 2.4.4.3.

Specific Actions:

- Investigate current impediments to fish passage in the watershed.

- Examine culverts and bridges for the applicability of fish habitat improvement strategies, using the recently approved passage enhancement at Carman's River as a model.
- Conduct a feasibility study for the removal of homeowner constructed dams in Reach 2.

3.1.2.2 Instream Habitat Improvements

Natural streambeds have been altered by numerous human activities. Channel functions have been degraded by dredging and filling for residential and commercial uses. Physical improvements can be undertaken to increase dissolved oxygen level and improve aquatic communities. Restoration to a natural, stable channel and improvement of stream flow can restore ecosystem function and protect property and infrastructure while reducing maintenance costs.

Specific Actions:

- Conduct a Stream Visual Assessment Protocol (SVAP). SVAP was developed by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and is a broad-based analysis protocol that provides an overall picture of the stream corridor and surrounding riparian ecosystem and integrates major stream quality indicators in a semi-qualitative, visual manner (geomorphic/hydrologic, fisheries, water quality, and invertebrate). The SVAP has been developed to be reliable and easy to use. The data collection necessary for the SVAP can be carried out through collaboration between Trout Unlimited and local high school environmental programs or other volunteers.
- Conduct a Focused Geomorphic Reconnaissance (FGR). An FGR is a simple adaptation of Rosgen's geomorphic assessment methods that includes analysis and inventory of specific stream reaches (problem reaches and reference reaches) to identify stream reaches requiring habitat improvement or restoration.
- Conduct a Detailed Geomorphic Evaluation (DGE). The results of the SVAP and FGR studies should be used to identify the need for more detailed studies. A DGE

is completed by obtaining available existing information from agencies and identifying and filling informational gaps through agency partnerships or independent fieldwork. Examples of the fieldwork required to complete a DGE include geomorphic surveying or invertebrate and water sampling using approved methods with processing by an agency or lab. A DGE should verify agreement with or document deviations from optimum reference values previously estimated by rapid methods.

- Identify and implement instream habitat improvement projects based on information obtained through the above studies.
- Coordinate the studies and improvement projects recommended in this section with the water quality baseline results and water quality sampling and monitoring program results developed discussed in Section 3.3.1.1 Water Quality Sampling and Monitoring Programs.

3.1.2.3 Streambank Stabilization

Stabilization of streambanks helps to prevent erosion and sediment loading, thereby contributing to improved water quality. Stabilization projects can often be successfully combined with trail and other access enhancements.

Specific Actions:

- Use the SVAP, FGR and DGE discussed in 3.1.2.2 to identify locations where the shoreline is eroding and plant materials have been impacted. Implement slope stabilization and wetland plant restoration projects in the areas where the erosion has been identified.
- Use the SVAP to identify locations where the formation of trails has begun to impact stability of the shoreline. Prepare and implement trail stabilization plans. Preliminarily, trails appear to have begun to erode soils along the shoreline in vacant parcels on the south west shoreline in Reach 1, the vacant parcels south of Sunrise Highway in Reach 2, immediately south of Woodside Avenue in Reach 3

where concrete culverts have been installed to allow a trail to traverse the river, and in the recharge basin north of Woodside Avenue in Reach 4.

- Identify and acquire shoreline properties as discussed in Section 3.3.4.1 Property Acquisition and Land Preservation.

3.1.2.4 Trout Population Research and Improvement Projects

Further research into the types of fish currently found in the river, along with a review of the habitats, followed by fish and habitat management improvements can increase the populations of native fish in the river.

Specific Actions:

- Review existing information on fish populations in the river including historical NYSDEC electro-fishing survey results, non-native fish stocking programs and SSER alewives location survey.
- Conduct a more extensive ichthyology study to determine the population density of trout in both the saltwater and freshwater portions of the river. Surveys should be conducted in Reaches 1 and 2 in the spring. Studies should be carried out through collaborative efforts between the Town, Suffolk County, NYSDEC, SSER, Trout Unlimited and local high school environmental programs.
- Develop recommendations to enhance or re-establish native fish runs based on the available information and study results. Consider ending fish stocking programs to protect native tout populations and establish an exclusive brook trout stream. See Section 3.1.1.3 Invasive Species Removal Recommendations.
- Based on the alewife survey results, recommend enhancing or re-establishing a run with the long-term goal of maintaining a thriving alewife run by the following measures:
    - Install a fish ladder at Swan Lake dam using NYS Bond Act award to Town of Brookhaven
    - Evaluate potential for either of the existing hatcheries to use local spawners to produce young to be stocked in Swan River or elsewhere on south shore.

  - Evaluate potential to import spawners from other sites into Swan Lake to produce young that will imprint on the lake and river.
- Develop an Alewife Fishery Management Plan (FMP) in advance of restoration of alewife habitat so that management measures are in place. At present, there are no regulations from the State or Atlantic States Marine Fisheries Commission (ASMFC) regarding management of alewife harvest as exists for eel and trout fishing.

3.1.2.5 Environmental Management Coordination

Communication between varied municipal agencies and private groups undertaking efforts to restore habitats along the Swan River should be coordinated to reduce duplication of efforts and to maximize the use of the available funds.

Specific Actions:

- Review SSER CMP, NYS Comprehensive Wildlife Conservation Strategy and other relevant plans to reinforce and build upon elements of those, and to identify partners and supporters.
- Communicate with The Nature Conservancy and partners preparing an ecosystem management land for the Great South Bay (Swan River is a tributary) under the direction of the NYSDOS and the NYSDEC.

3.2 EDUCATION AND OUTREACH RECOMMENDATIONS

Education of watershed residents about the potential environmental impacts of their actions is essential to improved stewardship of valuable watershed resources. Brookhaven has begun educational efforts through literature distribution and website development under the educational component of the Town-wide Phase II Stormwater Management Program required under the USEPA National Pollutant Discharge Elimination System (NPDES) stormwater program.

The SSER CMP recommends the following actions to achieve the objective of *heightened public awareness of the estuary* (SSER CMP Outcome 10):

- Working with outreach partners to promote estuary-related education, stewardship and outreach activities (Implementation Action 10-5)
- Creation of a homeowner certification program for nonpoint source pollution reduction efforts (Implementation Action 10-13)

3.2.1 Community Outreach Materials

Educational materials that are developed for different community groups, each with varied impacts and effects on the watersheds, can be used to increase knowledge of the interrelationship between land use and water quality.

3.2.1.1 Homeowner Outreach Materials

- The Town has developed and distributed outreach materials as part of the requirements of the Town SPDES permit. Subsequent outreach material could focus on issues and opportunities identified throughout the WMP recommendations and not contained in prior mailings. Additional topics may include:
  - Wetlands and the impacts of waste dumping.
  - Invasive ornamental plant species used in residential landscaping and native species substitution.
  - The impacts of shoreline hardening and hydromodifications.
  - Continued educational efforts to reduce waste disposal into roadway drainage basins.
  - Proper function of septic systems.
  - Pesticide and fertilizer usage, associated stormwater runoff and habitat impacts, and best management practices (BMPs) and integrated pest management (IPM) methods to reduce reliance.
  - Habitat damage implications of ATV use.
  - Pet waste control in conjunction with the adoption of a Town regulation.

- The outreach material should include definitions of the key terms including *watershed* and *nonpoint source pollution*; maps of the watershed; discussion of the WMP; and guidelines for the implementation of the included recommendations. The material should be distributed to watershed residents and made available at public locations such as libraries.
- Develop informational sources to direct residents and businesses to such sources as the New York State IPM Program website developed by Cornell University (www.nysipm.cornell.edu) and The Nature Conservancy Invasive Species Task Force.
- Increase awareness of Town Stormwater Management Program website and SSER website, which include information and additional resources related to improving water quality.

3.2.1.2 Boating Outreach Material

Outreach material focused on recreational and commercial boating should also be developed. It should be patterned after the homeowner materials and include information about boater and marina BMPs. This material should be distributed during boat registration and at local marinas and marine retail stores. The Town should also require distribution of the materials with rental of boat slips. Alternatively, this information could be incorporated into the above homeowner outreach materials.

The marina outreach effort should include an educational program for marina owners on the impacts of boat discharges, fuels and oil spills and clean up, storm runoff, pervious and impervious surfaces and BMPs that mitigate these impacts. Recommendations should include providing regular inspection of pump-out facilities to ensure proper operation; constructing exterior tanks and maintenance areas in self-contained and roofed locations, in interior locations, or on solid pads with separate drainage structures; posting spill contingency plan at fueling stations; and. using phosphorus-free detergents for boat washing. The information could also suggest that marina owners consider installation of stormwater treatment systems, as has been done at a private marina in Freeport.

3.2.1.3 Commercial Outreach Material

Local plant nurseries, home and garden centers, and lawn care businesses provide point-of-sale opportunities to educate residents in Integrated Pest Management (IPM) techniques and the different vegetative maintenance products available. Encourage businesses to carry informational materials and alternative products or offer seminars on IPM and BMP's and the effects of indiscriminant and overuse of fertilizers and pesticides on the watershed, river and bay.

3.2.1.4 Swan River Watershed Webpage

Develop a webpage to track the implementation and success of measures to improve water quality within the Swan River watershed. The site can either be developed at a Town-wide level and tied to the existing Stormwater Management webpage with additional rivers and watersheds added as WMP's are completed or at the scale of the SSER utilizing their website and tied to the greater watershed of the entire SSER.

3.2.2 Expand and Develop Signage

Signage that provides information on the identity of the tributaries and a discussion of the importance of the waterbodies can aid in public awareness of the significance of their actions on the health of the waters.

3.2.2.1 Tributary Identification

Signs identifying the location of the Swan River at road overpasses will build public awareness of their proximity to the river and its watershed. There is an existing tributary identification sign near where the river passes under Montauk Highway.

Specific Actions

Expand the SCDPW tributary identification program. The County and the Town should work together, with assistance from local schools, the SSER, Citizens Advisory Committee, and other local organizations to expand the system of signs identifying the

river at road crossings. In addition to signage, consider increasing views to the River at major cross streets including Woodside Avenue, Barton Avenue, Sunrise Highway, and Sweezy Avenue through measures such as plant pruning and vine removal and replacement of chain link fences with guide rails.

3.2.2.2 Interpretive Exhibits

Strategically located signs, interpreting the historical, ecological, and recreational value of Swan River will build public awareness, appreciation, and stewardship of the river and its watershed.

Specific Actions

- Identify feasible and appropriate locations for interpretive exhibits. Consider as potential locations the Town boat ramp at the southeast end of the river, the County lands at the south end of Swan Lake and the community lands along the east shore of Swan Lake.
- Identify relevant interpretive themes for the historical, ecological, and recreational value of Swan River, such as the native trout populations.
- Coordinate with the SSER Office and NYSDOS Division of Coastal Resources to create and install interpretive exhibits following New York State Coastal Resources Interpretive Program (NYSCRIP) guidelines as part of the South Shore Bayway to build public awareness, appreciation, and stewardship of the river and the watershed.

3.2.3 Homeowner Stewardship Recognition Program

The SSER CMP recommends development of a homeowner stewardship recognition program for nonpoint source pollution prevention. Initiating a program to recognize homeowners who employ best management practices (BMP's) and Integrated Pest management (IPM) methods in their landscaping and housekeeping activities will promote awareness and stewardship among watershed residents. Local high school students, community organizations and/or civic

associations can work together, with guidance from the Town and the SSER Office, to develop a homeowner stewardship recognition program based on the following:

- Develop a set of criteria for recognition, including implementation of BMP's for stormwater runoff control and nonpoint source pollution prevention, and use of native landscaping principles.
- Create a simple application package explaining the recognition program, criteria, and application process. The package should also include background information about BMP's and native landscaping.
- Distribute the application package to watershed residents, following distribution of initial outreach materials discussed in Section 3.2.1. Promote the program and solicit applications, with help from the SSER Office and Citizens Advisory Committee.
- Review applications and identify accepted applicants. Present recognized homeowners with certification of their recognition, in a format that can be displayed in a front yard or window to promote program visibility. Publicize the program and recognized homeowners in the newspaper and on appropriate websites, including the SSER website or the potential website developed for the Swan River.

3.2.4 School Watershed Education Programs

A cooperative arrangement between the Town of Brookhaven and Patchogue-Medford Schools could provide significant mutual benefits and serve as an important mechanism for local involvement in protecting the Swan River Watershed. Cooperation could be applied in a variety of projects, depending upon the needs of the school district and the interests of its teachers and students, and could range from civic-minded involvement to more academically oriented research projects.

3.2.4.1 School Data Collection

There are numerous academic areas that could provide the opportunity for the practical application of scientific principles, while advancing environmental protection. These could be integrated into the curriculum in a directed research class or an advanced

science class. Ecological surveys, water quality studies, and the effects of pollution are examples of topic areas that could be explored. The Town of Brookhaven could supply technical support, mapping resources (Geographic Information Systems, Global Positioning Systems), background information, or contacts with individuals or agencies with expertise. The recently designated "Fish Thicket Preserve" (see Section 5.4.4.3 Open Space Bond Acts) could serve as area for field study. An organized research program involving competitive projects could attract monetary awards to help perpetuate the program.

3.2.4.2 Civic Stewardship Projects

Such activities as storm-drain stenciling, tributary clean ups, or perhaps other civic-type projects designed and implemented by students, might be suited to ecology or civic clubs or organizations. These activities could induce environmental stewardship by students, or promote leadership and enable the students themselves to foster stewardship within the community. The Town of Brookhaven could provide such support as disposal following clean up activities, drainage infrastructure maps, or other logistics.

3.3 POINT AND NONPOINT SOURCE MANAGEMENT AND CONTROL RECOMMENDATIONS

Stormwater enters Swan River from many of the streets, parking lots, driveways and other impervious surfaces of the drainage area with little or no treatment. Present point sources include storm pipes that discharge directly into the lake and river. At other locations, non-point source pollution enters the river from the impervious areas that drain indirectly into wetlands and the river as overland flow.

Strategies to minimize point and non-point control will require an integrated approach involving management and operational measures, structural control techniques, non-structural control actions and land use modifications. Management programs and educational actions focus on the education of community members to identify water quality issues within their community, and on measures to track improvements. Structural control actions include recommendations on

methods to implement the stormwater improvements and target projects included in Section 4 Pollutant Load Analysis and Restoration Actions. Non-structural control actions include programs to reduce pollutant generation and continued mapping of pollutant sources. Land use improvements include recommendations for preserving natural vegetation, modification of laws and regulations, and water quality improvement activities.

3.3.1 Management Programs and Educational Actions

Management programs and educational actions focus on the education of community members to identify water quality issues within their community and on measures to track improvements.

3.3.1.1 Water Quality Sampling and Monitoring Programs

Programs to assess and establish the baseline water quality for the river and lake should be established. Monitoring should be established for each reach to determine the actual pollutant loads in the river and to identify improvements in the water quality over time. To ensure data consistency and allow for comparative evaluation, a water quality sampling and monitoring program that establishes consistent standard protocols for water sampling, water testing and data recording should be established by a responsible agency, such as the NYSDEC, for all tributaries to the SSER. The existing monitoring data can serve as a starting point, with new monitoring data including testing for the pollutants typically associated with point and nonpoint sources from roads, suburban neighborhoods and parks such as suspended solids, hydrocarbons, nitrogen, phosphorus, and fecal coliform.

Specific Actions:

- Available existing water quality data including data available from the SCDHS and the USGS gauging station should be reviewed and used to establish a potential baseline if applicable.
- Testing methods, protocols and location selection should follow standard protocols identified for all tributaries within the SSER for comparison purposes.

- Sampling and monitoring programs should be managed by qualified individuals who can oversee the program and insure that standard protocols are followed. The following publications describe standard procedures and practices that should be followed by volunteers to ensure consistency and future value of the data. The USEPA publication *Volunteer Stream Monitoring: A Methods Manual (EPA 841-B47-003,)* details practices of quality assurance, quality control and quality assessment measures for water quality conditions of stream flow, dissolved oxygen, temperature, pH, turbidity, phosphorus, nitrates, total solids, conductivity, total alkalinity, and fecal bacteria. A second USEPA publication, *Volunteer Lake Monitoring: A Methods Manual (EPA 440-4-91-00*), includes standard procedures for monitoring water quality conditions in lakes including algae, aquatic vegetation, dissolved oxygen, and sedimentation.
- Establish a central database to maintain the inventory of testing results.

3.3.1.2 Town Personnel Educational Programs

Town personnel, including those in the field and those charged with developing and implementing Town operations and policies that can affect the watershed, should receive regular education on the impacts of non-point source pollution and mitigation methods.

Specific Actions:

- Establish an educational program for Town employees including personnel from the departments such as Highways, Engineering, Parks, Planning, Environment and Development, and Public Safety. New York State Sea Grant operates a program entitled Nonpoint Education of Municipal Officials (NEMO) - Water Quality Education that can be used to develop this program. As local governments control the vast majority of land use decisions that affect water quality, the goal of the NEMO program is to introduce the concept of nonpoint source pollution to local officials, and to provide local governments with tools for improving water quality. New York Sea Grant's NEMO program is modeled after the highly successful University of Connecticut Cooperative Extension NEMO program. NEMO

operates in over 20 states nationwide with workshops tailored to local communities.

- Educate town inspectors and field personnel to identify and respond to spills in the watershed and on the proper notification procedures required.

3.3.1.3 Illicit Discharge Detection and Response (IDDR) Pilot Program

An Illicit Discharge Detection and Response (IDDR) Program identifies additional discharges to streams that are not composed entirely of stormwater. Sources of illicit discharges can include sanitary wastewater, effluent from septic tanks, commercial car wash wastewaters, oil disposal, radiators flushing, laundry wastewater, spills from road accidents, and improper disposal of automobile and household toxics.

Specific Actions:

- Develop an IDDR Pilot Program in accordance with the requirements of State Pollution Discharge Elimination System (SPDES) Phase II for regulated municipal separate storm sewer systems (MS4's). The IDDR Program components include:
  - Background information on stormwater infrastructure and the importance of protection against illicit discharges.
  - Inclusion of illicit discharge information onto the Town's Stormwater Remediation web page.
  - A web-based reporting system that solicits information from the public regarding the precise location and specific nature of reported illicit discharges.
  - A decision matrix to deal with various categories of discharges and identifies the appropriate response, including appropriate referrals for investigation and/or enforcement.
  - Modify and update, as necessary, Town Code sections dealing with illicit discharges to the Town's stormwater infrastructure, wetlands, or surface waters.

- Establish inter-municipal partnership agreements with government agencies, including Villages within the Town's boundaries, Suffolk County, and NYSDEC for reporting, investigating and enforcing of illicit discharges.

3.3.2 Structural Control Actions

Structural control actions include recommendations on methods to implement the stormwater improvements and target projects included in Section 4 Pollutant Load Analysis and Restoration Actions.

3.3.2.1 Water Quality Storm Event (WQSE) Control

The pollutant load in storm runoff has been identified as being contained in the initial 90% of the average annual stormwater runoff volume. That average annual volume is identified as the water quality storm event (WQSE) volume. The ability to either capture and infiltrate or treat and release this volume of runoff will significantly reduce the pollutant load contributed to waterbodies. NYSDEC requires that the water quality goals for stormwater treatment target the removal of 80% of the suspended organic and inorganic material and 40% of total phosphorus.

Specific Actions:

- During road reconstruction, install drainage structures as described in Section 4.0 Pollutant Load Analysis and Restoration Actions to contain the WQSE.
- Road reconstruction shall require an analysis of the existing WQSE runoff quantity and the discharge overflow rate to the river. When a project is proposed where existing drainage infrastructure is in place, the Town should review the capacity of existing structures and recharge basins to determine if additional capacity is required or if additional storm runoff can be piped and discharged to the basins.
- The Town should develop a program that will monitor the success of the structural control measures in meeting the NYSDEC water quality goals. Data collection should include analysis of improvements to water quality and hydrology. Sampling

and testing of water quality prior to implementation of improvements will provide background data that is currently sparse for each of the waterbodies and provide a level of comparison to assess improvements.

- At road ends that direct drainage to creeks, develop vegetated swales and infiltration trenches to filter WQSE. Where erosion is apparent these measures may be inadequate. When erosion is encountered, implement control measures that will prevent further erosion from the WQSE and from larger storms events and restore the eroded area.

3.3.3 Non-Structural Control Actions

Non-structural control actions include programs to reduce pollutant generation and continued mapping of pollutant sources.

3.3.3.1 Drainage Structure Maintenance Program

Cleaning and inspection of drainage structures and WQI's should be conducted on a regular basis. Lack of maintenance can allow pollutants to overflow into the waterbody, resulting in flooding and increased erosion.

Specific Actions:

- Inspect drainage structures to determine if reduced capacity exists because structures are debris-filled or due to changes in the drainage system.
- Develop a systematic maintenance program to clean debris from all drainage structures in the watershed. Eventually this program will need to be implemented throughout the Town. Sufficient dedicated resources and funding will be required to achieve the goals of this WMP and the larger SSER CMP.
- Identify funding sources for equipment purchases and personnel increases. Suffolk County should be encouraged to do the same for their roadway maintenance programs. Review the feasibility of developing a maintenance agreement with between the County and Town.

- Develop a system for mapping all newly installed drainage structures in the Town GIS system database. Detailed information on structure location, size, depth and connectivity is necessary for the development of a maintenance program.
- Develop a program to use the Town GIS mapping to track cleaning schedules and identify areas that require maintenance. As the program is implemented, a pattern of areas that require varied schedules should merge and the maintenance schedules modified accordingly.
- Review the street sweeping program and determine if modifications are necessary, such as focusing on roads that drain to the river, and conducting road sweepings in early spring and following major winter storm events to remove sediments prior to entering the river in stormwater runoff.

3.3.3.2 Drainage Infrastructure Investigations

Provide further investigation of locations where the presence of storm systems has not been confirmed including additional field investigation, review of historic documents, interviews with Town road personnel and residents, and conducting testing programs such as ink-dye testing.

Specific Actions:

- Investigate the west side of Reach 2 to determine connectivity of the existing infrastructure and existence of additional outfalls.
- Investigate Debbie Court drainage infrastructure and the Barton Avenue recharge basin and drainage infrastructure to distinguish between runoff that enters the river and runoff that is contained in the recharge basin, and determine the recharge basin capacity.
- Investigate the Gina Street recharge basin to determine if an overflow pipe to the river exists.
- Investigate Circle Street recharge basin to determine if adequate capacity exists and if a river overflow exists.

3.3.3.3 Integrated Pest Management (IPM) Programs

The Town should work with landowners in the watershed to develop programs and measures to reduce reliance on fertilizers and pesticides in the watershed including developing Integrated Pest Management (IPM) programs to reduce the use of pesticides and fertilizers on lawn and landscaped areas. IPM programs are useful for all property owners including single-family residents but can be especially useful at Town and County parks and school properties where large expanses of lawn are typical. The Suffolk County Pesticide Phase-Out Community Advisory Committee has already developed a Comprehensive Integrated Pest Management Program as an educational resource. Suffolk County Cornell Cooperative Extension, in collaboration with this Advisory Committee, offers education and training in pest management practices to all departments of County staff. This program can serve as the basis of the Town educational program. The County program prohibits the application of any pesticide on County property except for those materials and locations that have been exempted in the code or by emergency measure.

Specific Actions:

- The Town Parks and Recreation department should develop an IPM program for all their facilities. The IPM program can be modified to address athletic facilities, which have more specific requirements for turf grass quality than passive recreational park.
- The Town should encourage residents to use Town compost to reduce the needs for fertilizers. Educational materials can inform residents of the Town compost facility, gardens installed using composted materials and educational programs on home composting. The composting facility also has locations for disposal of recyclable materials.

3.3.3.4 Impervious Surfaces Reduction

Reducing the amount of paved surface within the watershed allows additional precipitation to infiltrate to groundwater and reduces concentrated flow volumes into the river.

Specific Actions:

- Develop recommendations on ways to decrease impervious surface in the watershed. Recommendations could include gravel surfaces, planted islands that contain runoff, planting the centers of cul-de-sacs, and use of pervious pavements.
- Identify locations to install and test various pervious pavements. Location selection should focus on lower elevations in the watershed where depth to groundwater precludes structural infiltration practices and on those areas with less intensive usage during inclement weather including marinas and recreational facility parking lots. Inspect and evaluate the products for further use.
- Acquire environmentally sensitive undeveloped parcels to reduce future development and the associated increase in impervious surfaces in the watershed.

3.3.3.5 Sanitary System Function Review

Improperly functioning cesspools and septic systems contribute bacteria and nitrates to surface waters. This is a pertinent issue in aging and densely populated communities where infrastructure may be deteriorating and housing densities are in excess of recommended levels to maintain nitrate levels below USEPA standard limits. Suffolk County approves the initial installation of septic systems but there are currently no requirements for the regular inspection of these systems at either the County or Town level to ensure their proper operation.

Specific Actions:

- Investigate adoption of a sanitary system inspection program with Suffolk County Department of Health Services. The inspection requirement could be on a 5-year schedule or required when a property is sold. Inspection and certification can be provided to property owners by licensed private businesses. Implementation of an inspection program will require dedicated resources and funding to achieve the goals of this WMP and of the larger SSER CMP.

- As an initial step, provide educational materials to homeowners on methods to identify improperly functioning systems and procedures for having a system inspected, cleaned, repaired or reconstructed. As a further step, the Town can investigate the potential to develop a homeowner septic tank upgrade incentive program for properties within the watersheds targeting areas with high groundwater tables.

3.3.3.6 Shoreline Filter Restoration

Identify lawn and pavement areas that allow surface runoff to wash off the ground surface directly into the river and work with property owners to install native vegetation that can act as a filter to reduce pollutant loads from entering the river.

Specific Actions:

- Encourage homeowners whose lawns drain directly to the river and lake to plant filter strips of tall grass species or other appropriate native plant species that will provide filtering of sediments from runoff.
- See Section 3.1.1.5 Riparian Buffers/Stewardship Opportunities for additional discussion of buffers.

3.3.4 Land Use Improvement Recommendations

The SSER CMP recommends the "acquisition of open space" to achieve the objective of "*Open space preserved to sustain community character and protect water quality and habitat"* (Outcome 5 of the SSER CMP). This section identifies measures such as acquiring property, changing use regulations and modifying allowable uses that impact land uses and subsequently mitigate effects on the river.

3.3.4.1 Property Acquisition and Land Preservation

Continue negotiations for parcels whose acquisition will prevent additional increases in storm runoff. Specific parcels should include privately owned, undeveloped parcels such as the 22.5-acre parcel (Tax Map # 982.50-4-3) on the west shoreline of the river in

Reach 1. Where parcels cannot be acquired for preservation, the Town should increase the buffer requirements for future development along the river and wetlands, and require riparian buffer restoration plans that include removal of invasive species and planting of appropriate native materials as part of the site plan approval documents. In additional to the parcel noted above, the Town Open Space Advisory Committee has identified numerous parcels along the Swan River that could potentially be acquired for preservation.

3.3.4.2 Law and Regulation Enforcement

Enforce existing Town laws and regulations to reduce negative impacts on the watershed. Laws that require greater enforcement efforts include the ban on ATV use on Town properties and littering and dumping laws. Identify funding sources to adequately staff the Town Public Safety and Code Enforcement Departments that oversee code enforcement to allow for the increase of surveillance efforts.

3.3.4.3 Modification of Existing Laws and Regulations

Update Town laws and regulations related to watershed quality to reflect current BMP's and most recent expertise on the subject. Additional information on modifications to existing laws and regulations are included in Section 5.2 Revisions to Laws, Regulations, and Ordinances.

3.3.4.4 Approval Processes Modification

The Town should adopt additional requirements for subdivision and land development regulations including:

- A requirement to separate the WQSE storage volume from the larger storage volume if the potential for overflow to a waterway exists.
- A requirement that the eight (8) inch rainfall storage capacity for recharge basins not be reduced to a five (5) inch rainfall with a positive overflow to a waterway ***unless*** extended detention to maintain an acceptable discharge rate into the waterway can be achieved.

3.3.4.5 Inter- Municipal Implementation Effort Coordination

The Town should work with New York State and Suffolk County to identify mitigation measures and locations where actions to reduce roads runoff from state and county roads can be implemented. Additional inter-governmental coordination efforts are included in Section 5.1 Implementation Coordination.

3.4 INSTITUTIONAL DEVELOPMENT RECOMMENDATIONS

Institutional recommendations include recommendations for groups and programs that can be developed to increase the planning and analysis efforts that are being conducted in the watersheds.

3.4.1 Task Force

A consortium of agencies and groups should be assembled to begin planning for a comprehensive approach to addressing the management issues. The task force should include state, county, and local government representatives, local concerned citizens, business owners, and environmental groups. The current WAC Committee could serve in this capacity. A successful prototype for this task force is the Beaverdam Creek Wetland Restoration Task Force. Establishment of a task force will in turn lead to significant funding opportunities from a variety of programs with the mutual goal of restoring wetlands in the river and SSER. The task force can also interface with the Nature Conservancy, who at the request of the NYSDEC and NYSDOS is preparing an Ecosystem Management Plan for the Great South Bay.

3.4.2 High School Program Collaboration

In addition to the cooperative arrangement with the Town of Brookhaven discussed in Section 3.2.4, the high school program can also work with stakeholder organizations such as the Swan River Task Force, Trout Unlimited, Ducks Unlimited, Eastern Long Island Audubon Society, SSER, NYSDOS, Brookhaven and Suffolk County Parks Departments, and Brookhaven Planning Department. A collaboration effort can be employed for a variety of projects,

depending upon the needs of the school district and the interests of its teachers and students, and could range from civic-minded involvement to more academically oriented research projects.

4.0 POLLUTANT LOAD ANALYSIS AND RESTORATION ACTIONS

Pollutant load analysis enables the prioritization of restoration actions by quantifying stormwater runoff pollutants that are discharged to watersheds and subwatersheds. Restoration recommendations should consider both the degree of pollution reduction that can be achieved, and the cost of the restoration or mitigation actions. These can include both non-structural and structural measures. This section includes a discussion of:

- pollutant sources, runoff and loads,
- pollutant loading including a methodology to quantify and rank the loads
- stormwater improvement and implementation strategies including structural best management strategies, implementation recommendations and outfall ranking, and;
- waterbody target projects and priority actions.

4.1 POLLUTION

The primary pollutants identified in the Swan River watershed are silt and sediments (total suspended solids), pathogens (fecal coliform) toxic substances (hydrocarbons), nutrients (nitrogen and phosphorus) and floatables (litter and debris). The major sources of these pollutants include sediments deposited on streets, waste from waterfowl, waste from pets, improperly operating septic systems and cesspools, and fertilizer runoff from lawns and improperly disposed of waste materials. Additional pollution sources include sediment erosion from construction sites and unstable river shorelines, nutrients from disposal of landscape refuse in the river, toxic substances from marinas, and motor oil disposal into drainage systems. These nonpoint sources of pollution are carried into the river by storm drainage infrastructure piping systems or overland flow.

4.1.1 Pollution Sources

The watershed's surfaces accumulate and convey many of the pollutants found in the river. Silts and sediments, waterfowl and animal waste, hydrocarbons from vehicle oil

and grease, nutrients, pesticides, vegetative matter, litter and debris all accumulate either on the road surface or on the properties adjacent to the road. When a rainfall event generates runoff it allows the accumulated pollutants to be picked up in the runoff and carried into the river. A rainfall can wash up to 90% of the pollutants accumulated on the street and adjacent area into the river.

Activities in the watershed can influence the amount of pollutants that accumulate on the surface and in drainage systems. As neighborhoods grow older, the extent of impervious surface tends to increase as new additions, decks, driveways, road improvements and infill developments are constructed. This increases the area that generates runoff. Expansive lawn areas at parks, golf courses and other locations have provided Canada geese with an abundant food source. This has enabled the goose population to reach nuisance levels and has resulted in increased fecal loads to the watershed surface area. Failure of aging septic systems and cesspools may cause wastes to overflow, thus contributing bacteria and nutrient loads to the surface of the ground. Additionally, inadequate design of sanitary systems can contribute pollutant loads if they have insufficient soil filtration capacity, either vertically to groundwater, or horizontally to surface waters. Other factors that can allow pollutants to accumulate on the ground surface or in drainage structures include inadequate erosion control measures at construction sites, dumping of oils and wastes into storm structures, application of excessive amounts of fertilizer and pesticides to lawns and gardens, failure to remove pet wastes from streets and adjacent areas, and application of excessive amounts of salts and sands to roads in winter. All of these activities allow waste materials to accumulate on the ground surface and to be washed into the river in the runoff resulting from rainfall.

Sediments (suspended or dissolved solids) represent the largest component of pollution. Each year, enormous amounts of soil are transported from streets, parking lots, and construction sites, via sheet wash, rill erosion, and runoff. Mineral and organic sediment is generally considered the largest surface water pollutant by mass and volume. The

eroded material is either captured within manufactured drainage infrastructure or discharged directly to receiving waters.

Typically, water turbidity in a river is at its highest during and immediately after the completion of the "first flush" of a storm event as a result of increased stormwater and pollutant load discharge. The "first flush" is also referred to as the water quality storm event (WQSE). The "first flush" or WQSE refers to the runoff volume from initial 1.2 inch rainfall event. That runoff from the WQSE washes the majority of the surface pollutant deposits into the waterbodies. Pollutant loading is further exacerbated by the adsorption of other pollutants such as oil, bacteria, metals, and organic chemicals to the soil particles. Dissolved or suspended solids may carry oxygen-dependent substances, which can contribute to the depletion of dissolved oxygen in water and harm aquatic organisms.

Large-scale deposition of soil can inhibit natural pollutant attenuation processes, silt-up stream channels and wetlands, decrease flood storage capacity, reduce the effectiveness of stormwater pollution treatment devices, and inhibit the natural functions of water bodies. These modifications to natural functions can impact fish and wildlife that use the stream corridor for feeding, breeding, and cover. In addition, mineral soil particulate matter, organic debris, and man-made pollutants can act in concert to increase the level of turbidity in streams, rivers and shallow, low-energy coastal systems. The resultant decrease in water clarity diminishes sunlight penetration and inhibits the process of photosynthesis in submerged aquatic vegetation. Finally, when solids settle in low-energy/low flow environments, they can bury benthic flora and fauna, including aquatic plant life and invertebrates.

4.1.2 Runoff and Loadings

Land development alters stormwater drainage characteristics within a watershed, which can have a profound effect on water quality of adjacent waterbodies. Development results

in the replacement of permeable natural land surfaces (i.e., woodlands, meadows, etc.) with impervious surfaces such as roadways, buildings, walkways and pavements. Even in areas cleared for development that are subsequently replaced with landscaping, the planted vegetation generally has a lower capacity for absorbing rainwater that the native vegetation; this is especially true with respect to turf areas. The overall consequence of these conditions is that development generally increases the amount of runoff generated on a given parcel of land. The augmented volume of runoff from developed properties results in an increase of pathogens, nutrients and other deleterious substances carried from the land surface to receiving waters.

4.2 SURFACE RUNOFF AND POLLUTANT LOADING

In order to quantify and rank pollutant loading from the outfalls and surfaces identified as subwatershed areas of the Swan River drainage area, a planning-level method to estimate these loads was utilized. Pollutant loading calculations were developed using the "Simple Method" outlined in *New York State Stormwater Management Design Manual* (NYSSMDM) Appendix A dated October 2001. "Simple Method" calculations estimate the volume of the water quality storm event (WQSE) or "first flush" for each subwatershed drainage area. The WQSE is estimated to carry 90% of the pollutant load. Capturing and infiltrating or detaining and filtering these runoff quantities will significantly reduce the pollutants reaching the surface waters. Actual final design criteria and calculations used to determine mitigation measures and pollution removal rates will depend on the types of pollutants found in the runoff and a detailed analysis of the land use, impervious cover, soil types, hydrology and topography of the site.

Water quality storm events (WQSE) were sized using the NYSSMDM Sizing Criteria 90 % rule where as:

$$WQv = ((P)\ (Rv)\ (A))/12$$

WQv = water quality volume (in acre feet)

Rv = 0.05+0.009(I)

I = impervious Cover (Percent)

P = 90% rainfall event number per chart = 1.2 inches on Long Island

A = site area in acres

Pollutant loading calculations were calculated using the NYSSMDM 2001 "Simple Method". The Simple Method estimates pollutant loads for chemical components as a product of annual runoff volume and pollutant concentration where as:

$L = 0.226*R*C*A$

L = Annual Load (lbs)

R = Annual Runoff (inches) (See below)

C = Pollutant Concentration (mg/l) (see below)

A = Area (Acres)

0.226 = Unit Conversion factor

The Simple Method estimates pollutant loads for bacteria with a different unit conversion factor to account for different units where as:

$L = 103*R*C*A$

L = Annual Load (Billion Colonies)

R = Annual Runoff (inches) (See Below)

C = Pollutant Concentration (mg/l) (see below)

A = Area (Acres)

103 = Unit Conversion factor

Pollutant loading calculation results are shown on Table 4.3. The pollutant concentrations for 'C', as taken from NYSSMDM Table A.1 - National Median Concentrations for Chemical Constituents in Stormwater, are: Total Suspended Solids (TSS) - 54.5 mg/l; Total Phosphorus (TP) - 0.26 mg/l; Total Nitrogen (TN) - 2.00 mg/l; and Fecal Coliform (F Coli) - 1.5(1,000 col/ml.), Zinc (Zn) - 0.129 mg/l and Lead (Pb) - 0.0507 mg/l.

Annual runoff was calculated as $R = P*Pj*Rv$

R = Annual Runoff (inches)

P = Annual Rainfall (Inches) (42" for Long Island)

Pj = Fraction of annual rainfall events that produce runoff (typ. 0.9)

Rv = Runoff coefficient

Rv = 0.05+0.9(Ia)

Ia = impervious fraction (100% for commercial street, 70% for residential streets)

Based on the Simple Method calculations and the locations where surface runoff had the potential to reach the river the annual pollutant loads for the Swan River are estimated to be 1,140 lbs of Total Nitrogen (TN), 31,077 lbs Total Suspended Solids (TSS), 148 lbs Total Phosphorus (TP) and 389,824 billion colonies Fecal Coliform (F Coli). The totals are shown on Table 4.2 along with the calculations for each subdrainage area identified. The subdrainage areas were ranked by sediment export, with a rank of one representing the greatest potential exports. The ranking does not consider any existing mitigation measures in place that reduce pollutants loads from entering the river. Where subwatershed areas may have existing mitigating measures in place, they are discussed in Section 4.3.2 Implementation Recommendations and Section 4.4 Target Projects and Priority Actions sections that follow.

4.3 STORMWATER IMPROVEMENT AND IMPLEMENTATION STRATEGIES

This section includes a description of best management practices (BMP) including infiltration practices, filtering systems, and water quality inlets, and implementation recommendations for each outfall in the watersheds. Addressing the impacts of stormwater also meets the requirements of the SPDES Phase II Stormwater Management Program that is described in Section 5.5 Phase II Stormwater Permit Compliance of this report.

4.3.1 Best Management Practices for Pollutant Removal Benefits – Structural Measures

The structural measures described below have been selected based on the site characteristics of a developed urban/suburban area with an extensive road system and landscaped properties, where retrofit and reconstruction will be required for the majority of measures installed. The actual BMPs selected are dependent upon the pollutants of concern. Road runoff with heavy sediment and hydrocarbon loads requires different solutions than residential areas with fewer roadways and reduced traffic volumes, but increased soluble pollutant loads of phosphorus, nitrogen and fecal bacteria. Recommended practices have been selected in accordance with the *New York State Stormwater Management Design Manual (2001)*.

4.3.1.1 Stormwater Infiltration Practices

Infiltration practices are designed to capture, temporarily store, and then infiltrate runoff through the soil layer where pollutant removal processes occur. Infiltration practices have moderate to high removal capabilities for particulate and soluble urban pollutants. Design parameters can enhance the removal rates but particles can rapidly clog some infiltration methods. A means to remove the accumulated sediments should be addressed prior to installation. Infiltration in leaching wells, leaching basins, and recharge basins can be utilized in urban and developed areas to provide the capacity needed for treating the WQSE. Porous pavements provide an alternative infiltration practice generally restricted to smaller areas of low-volume parking areas or rooftops, particularly where depth to groundwater precludes other infiltration practices.

4.3.1.2 Stormwater Filtering Systems

Filtering practices are designed to detain and filter stormwater through porous materials, such as sand, soil, or organic materials. During the filtering process, sediment particles and attached pollutants, such as hydrocarbons, are removed.

Removal of soluble pollutants, such as nitrogen and phosphorus, is limited by the filtration period and filtering material. Filtering systems for larger areas include bioretention basins, sand or organic filters, dry swales and wet swales that can filter and release the WQSE. Grass filter strips can be used to filter small areas.

4.3.1.3 Constructed Ponds and Wetlands

Constructed stormwater ponds and wetlands provide moderate to high soluble and particulate pollutant removal capacity through both settling and biological uptake. Wetlands and ponds require significant dedication of land.

4.3.1.4 Water Quality Inlets/Emerging Technologies

With the increased awareness of the effect of storm runoff on the surrounding waterbodies, the development of numerous technologies to deal with pollutant removal has ensued. Many of the new technologies are designed for retrofit of existing stormwater structures and are best suited for ultra-urban areas and road right-of-ways where sediment and hydrocarbons are of greatest concern. Locations where soluble pollutants, such as fertilizers and pesticides, are prevalent may not be suited to many of these devices. Many of these technologies have not been in existence for sufficient periods to demonstrate a proven ability to meet the NYSDEC pollutant removal standards over an extended period. The devices should be selected for the pollutants of concern for each location and consider the NYSDEC requirements for pollutant removal rates and the maintenance requirements of each. Some of these technologies may provide an interim measure to reduce pollutant levels in the waterbodies until long-term solutions can be implemented. The general categories of new technology are:

- *Catch Basin Inserts*. Catch Basin Inserts (CBI) contain a pollutant removal medium that is suspended in existing basins, and stormwater is treated as it passes through the insert. These devices are suitable for small drainage areas and ultra -urban retrofit sites. The type of pollutant removed varies by specific

insert and include both particulate and soluble pollutants. These devices have recently come on the market and require monitoring to determine the actual pollutant removal capabilities.

- *Hydrodynamic Separators*. These devices, called water quality inlets (WQI), remove sediments and attached hydrocarbons using a swirl concentrator or other means of separation. These systems can allow a high flow storm event to bypass the swirl. These devices are suitable for ultra -urban retrofit sites and have the longest history of use of the emerging technologies.
- *Media Filters*. Media Filters (MF) consist of filter cartridges that are enclosed in a concrete vault. The filter cartridges can be a variety of materials including organic medium, sand, or charcoal that can trap particulates and soluble pollutants dependent on the filtration period.

4.3.2 Implementations Recommendations

Outfalls have been ranked by the size of the WQSE. Where WQSE's were equal, the outfalls were ranked equally. The ability to improve the water quality structurally at an outfall is based on the ability to site a mitigation technique in the area. Recommendations for each outfall are preliminary in nature. Consideration for the available land area, land use, and the requirements of currently available technologies were included in the decision to recommend a specific measure. When final design plans for road improvements and drainage systems are completed, a detailed analysis of the area drainage should be included. The pollutant calculations for subwatershed areas that drain to surface waters via piped outfalls or surface runoff are contained in Table 4.3.

4.3.2.1 Reach 1 – Great South Bay to dam north of Montauk Highway

This tidally influenced river reach has a mix of bulkheaded and natural shoreline sections. The bulkheaded sections are located at the area marinas and residentially developed properties. A large number of the undeveloped waterfront parcels along the western shoreline are owned by either the Town or County and have

Swan River
Watershed Management Plan
Water Quality Storm Event (WQSE) Runoff
Annual Pollutant Loading Estimates
TABLE 4.3

Outfall Structure ID#	Street	Type of Discharge	Adjacent Land Use	Contributory Area	Contributory Area	Impervious Area	Water Quality Storm Event Volume	Water Quality Storm Event Volume	Annual Rainfall	Annual Runoff	Total Nitrogen-TN 2.0 mg/l	Total Suspended Solids-TSS 54.5 mg/l	Total Phosphorus-TP 0.26 mg/l	Fecal Coliform 1000col/ml	Rank*
				SF	Acres	%	WQv-acre-feet	WQv-Cubic Feet	inches	inches	lbs	lbs	lbs	billion colonies	
Reach 1 - West Shore, South to North											**ESTIMATED AVERAGE ANNUAL LOAD**				
15	Grove	Outfall	res/road	30,000	0.69	70	0.047	2,040	42	25.70	8.00	218.04	1.04	2,735.03	35
5347-5348	Conklin	Unknown	res/road	27,500	0.63	70	0.043	1,870	42	25.70	7.33	199.87	0.95	2,507.11	41
	Grove	Surface	marina	74,051	1.70	100	0.161	7,035	42	35.91	27.59	751.91	3.59	9,431.63	14
	Swan River	Surface	res/road	30,000	0.69	70	0.047	2,040	42	25.70	8.00	218.04	1.04	2,735.03	35
	Bolton	Surface	res/road	70000	1.61	70	0.109	4,760	42	25.70	18.67	508.76	2.43	6,381.74	21
11	Carman	Outfall,	res/road	15000	0.34	70	0.023	1,020	42	25.70	4.00	109.02	0.52	1,367.52	48
	River/Pitts	Surface	res/road	65000	1.49	70	0.101	4,420	42	25.70	17.34	472.42	2.25	5,925.90	23
31	Sweezy	Outfall	road	35000	0.80	70	0.055	2,380	42	25.70	9.34	254.38	1.21	3,190.87	31
5274	Sweezy	Outfall	road	35000	0.80	70	0.055	2,380	42	25.70	9.34	254.38	1.21	3,190.87	31
Reach 1 - East Shore, South to North											**ESTIMATED AVERAGE ANNUAL LOAD**				
	Pine Neck	Surface	marina	100,200	2.30	100	0.219	9,519	42	35.91	37.34	1,017.42	4.85	12,762.15	8
	Pine Neck	Surface	res/road	10000	0.23	70	0.016	680	42	25.70	2.67	72.68	0.35	911.68	51
5375	Pine Neck	Outfall	east side res/roa	35000	0.80	70	0.055	2,380	42	25.70	9.34	254.38	1.21	3,190.87	31
	Pine Neck	Surface	west side res/roa	35000	0.80	70	0.055	2,380	42	25.70	9.34	254.38	1.21	3,190.87	31
52-53	Dipper Pt Rd (Haven)	Unknown	res/road, undev.	47500	1.09	70	0.074	3,230	42	25.70	12.67	345.23	1.65	4,330.47	27
	Spruce	Surface	res/road	30000	0.69	70	0.047	2,040	42	25.70	8.00	218.04	1.04	2,735.03	35
	First Street	Surface	parking lot	43560	1.00	70	0.068	2,962	42	25.70	11.62	316.60	1.51	3,971.27	29
26	Montauk -South Side	Outfall	comm. parking lo	120000	2.75	70	0.187	8,160	42	25.70	32.01	872.17	4.16	10,940.13	9
Reach 2 - West Shore, South to North											**ESTIMATED AVERAGE ANNUAL LOAD**				
	Shoenfeld/Montauk	Surface	comm. Parking l	75,000	1.72	100	0.164	7,125	42	35.91	27.95	761.54	3.63	9,552.51	13
	Shoenfeld at Phyllis	Surface	comm. parking lo	75,000	1.72	70	0.117	5,100	42	25.70	20.00	545.10	2.60	6,837.58	20
1344	Shoenfeld/Phyllis	Outfall, unknown	res/road	90,000	2.07	70	0.140	6,120	42	25.70	24.00	654.12	3.12	8,205.10	17
1331	Swan Lake Dr.	Unknown	res/road	90,000	2.07	70	0.140	6,120	42	25.70	24.00	654.12	3.12	8,205.10	17
1327	Swan Lake Dr.	Unknown	res/road	90,000	2.07	70	0.140	6,120	42	25.70	24.00	654.12	3.12	8,205.10	17
1323	Swan Lake Dr.	Outfall - 36	res/road	240,000	5.51	70	0.375	16,320	42	25.70	64.01	1,744.33	8.32	21,880.26	5
1321	Swan Lake Dr.	Outfall	res/road	120,000	2.75	70	0.187	8,160	42	25.70	32.01	872.17	4.16	10,940.13	9
Reach 2 - East Shore, South to North											**ESTIMATED AVERAGE ANNUAL LOAD**				
63	Montauk at culvert	Outfall	Comm. road	10,000	0.23	100	0.022	950	42	35.91	3.73	101.54	0.48	1,273.67	50
67	Montauk Outfall	Outfall - 24"	Comm. road	180,000	4.13	100	0.393	17,100	42	35.91	67.07	1,827.70	8.72	22,926.01	4
	Lake Drive	Surface	res/road	95,000	2.18	70	0.148	6,460	42	25.70	25.34	690.46	3.29	8,660.94	16
33	Lake Drive	Outfall	res/road	10,000	0.23	70	0.016	680	42	25.70	2.67	72.68	0.35	911.68	51
	East tributary	Outfall/Surface	undev.	1,350,000	30.99	0	0.155	6,750	42	1.89	26.48	721.46	3.44	9,049.74	15
56	Rose	Surface	res/road	20,000	0.46	70	0.031	1,360	42	25.70	5.33	145.36	0.69	1,823.36	47
	Celia	Surface	res/road	30,000	0.69	70	0.047	2,040	42	25.70	8.00	218.04	1.04	2,735.03	35

Swan River
Watershed Management Plan
Water Quality Storm Event (WQSE) Runoff
Annual Pollutant Loading Estimates
TABLE 4.3

Outfall Structure ID#	Street	Type of Outfall	Adjacent Land Use	Contributory Area	Contributory Area	Impervious Area	Water Quality Storm Event Volume	Water Quality Storm Event Volume	Annual Rainfall	Annual Runoff	Total Nitrogen-TN 2.0 mg/l	Total Suspended Solids-TSS 54.5 mg/l	Total Phosphorus-TP 0.26 mg/l	Fecal Coliform 1000col/ml	Rank*
				SF	Acres	%	WQv-acre-feet	WQv-Cubic Feet	inches	inches	lbs	lbs	lbs	billion colonies	
Reach 2 - East Shore, South to North, Continued											**ESTIMATED AVERAGE ANNUAL LOAD**				
	Florence	Surface	res/road	27,500	0.63	70	0.043	1,870	42	25.70	7.33	199.87	0.95	2,507.11	41
	Roberta	Surface	res/road	27,500	0.63	70	0.043	1,870	42	25.70	7.33	199.87	0.95	2,507.11	41
	Bertha	Surface	res/road	22,500	0.52	70	0.035	1,530	42	25.70	6.00	163.53	0.78	2,051.27	46
	Alice	Surface	res/road	30,000	0.69	70	0.047	2,040	42	25.70	8.00	218.04	1.04	2,735.03	35
	Ethel	Surface	res/road	27,500	0.63	70	0.043	1,870	42	25.70	7.33	199.87	0.95	2,507.11	41
	Kathryn	Surface	res/road	40,000	0.92	70	0.062	2,720	42	25.70	10.67	290.72	1.39	3,646.71	30
	Lake	Surface	res/road	50,000	1.15	70	0.078	3,400	42	25.70	13.34	363.40	1.73	4,558.39	25
Reach 3 - West Shore, South to Nor											**ESTIMATED AVERAGE ANNUAL LOAD**				
	Sunrise Highway	Surface	comm. road	200,000	4.59	100	0.436	19,000	42	35.91	74.52	2,030.78	9.69	25,473.35	2
41	Swan View	Outfall	res/road	70,000	1.61	70	0.109	4,760	42	25.70	18.67	508.76	2.43	6,381.74	21
1436	Swan Ct	Outfall	res/road	50,000	1.15	70	0.078	3,400	42	25.70	13.34	363.40	1.73	4,558.39	25
	Whippoorwill (Arthur)	Unknown	res/road	25,000	0.57	70	0.039	1,700	42	25.70	6.67	181.70	0.87	2,279.19	45
35	Barton	Outfall	road	65,000	1.49	70	0.101	4,420	42	25.70	17.34	472.42	2.25	5,925.90	23
40	Nicole Ct	Unknown	res/road	30,000	0.69	70	0.047	2,040	42	25.70	8.00	218.04	1.04	2,735.03	35
11	Lucy Ct	Outfall	res/road	15,000	0.34	70	0.023	1,020	42	25.70	4.00	109.02	0.52	1,367.52	48
1116	Patricia, Bambie	Outfall	res/road	105,000	2.41	70	0.164	7,140	42	25.70	28.01	763.15	3.64	9,572.62	12
1117	Theresa	Outfall	res/road	45,000	1.03	70	0.070	3,060	42	25.70	12.00	327.06	1.56	4,102.55	28
Reach 3 - East Shore, South to North											**ESTIMATED AVERAGE ANNUAL LOAD**				
66	Gina, Russell, Gale, Ch	RB/Overflow	res/road	270,000	6.20	70	0.421	18,360	42	25.70	72.01	1,962.37	9.36	24,615.30	3
1298	Debbie, Sharon, Patricia	Unknown	res/road	170,000	3.90	70	0.265	11,560	42	25.70	45.34	1,235.57	5.89	15,498.52	7
257	Circle Drive , Valley, Ro	RB/Overflow	res/road	350,000	8.03	70	0.546	23,800	42	25.70	93.35	2,543.82	12.14	31,908.72	1
Reach 4 - West Shore, South to North											**ESTIMATED AVERAGE ANNUAL LOAD**				
73	Woodside	Outfall	comm. road	220,000	5.05	70	0.343	14,960	42	25.70	58.68	1,598.97	7.63	20,056.91	6
92	First Avenue, Park	RB/Overflow	res. road	110,000	2.53	70	0.172	7,480	42	25.70	29.34	799.49	3.81	10,028.45	11

SWAN RIVER SURFACE DRAINAGE AREA TOTAL ANNUAL POLLUTANT LOAD ESTIMATES	**1,128.45**	**30,750.35**	**146.70**	**385,721.34**

"C" Valve Source; NYSDEC Stormwater Management Design Manual, Table A.1, October 2001
* Rank based on WQSE volume, some outfalls have recharge basins or leaching structures that infiltrate portions of the runoff volume.

LEGEND:
com. road - paved road, heavy traffic, no to little fertilized lawn adjacent
road - paved road, mid to heavy traffic, little fertilized lawn adjacent
res/ road - paved road light traffic, adjacent residential with fertilized lawn
mar. lot - boat storage, vehicle parking
overflow - structures hold storm flow
surface - surface runoff to creek, no structures
open cul - open grate drops runoff directly into culvert

REDUCTION VOLUME	**648.35**	**17,667.66**	**84.29**	**221,616.78**
PERCENT REDUCTION - TSS		**45.96**		
PERCENT REDUCTION - TP			**22.98**	

been preserved from development. Several undeveloped parcels are privately owned including a 22.5-acre parcel (0200-982.50-4-3) along the lower western shoreline. Residential properties generally have paved driveways and landscaped lots. Many of the residential properties have lawns immediately adjacent to the river or drain to the roads allowing pesticides and fertilizers to wash off into the river and subsequently the bay. Marinas offer vehicle parking for the boat owners and boat storage during the winter months that may increase hydrocarbon loads. At the northern limit of this reach, there are commercial- and industrial-zoned properties along the railroad tracks and Montauk Highway. A vehicle junkyard is located south of the LIRR tracks along the eastern shoreline.

Thirty-four subwatershed areas were identified in Reach 1. The outfall locations and the subwatersheds are shown on Figures 2.4.3.1 and 2.4.3.2. Of the subwatershed areas, seventeen locations discharge or are suspected to discharge runoff directly to the river. These locations include five outfall structures, eight surface runoff locations, two boat ramps, and two undetermined discharge locations where no outfalls were located but observed piping appears to direct drainage toward the river. The majority of the existing infrastructure are individual leaching basins with no or minimal connectivity. There are no recharge basins in this reach. The remaining seventeen subwatershed areas consist of areas that drain to leaching basins that infiltrate to groundwater. Based on the subwatershed area, structure quantity and groundwater depth; it is suspected that these areas may flood during storm events overflowing to subwatershed areas that drain to the river. These locations should be reviewed for the existing storm volume generated and the existing structures capacity. Additional leaching basins should be installed to collect and infiltrate the WQSE.

Two locations in this reach are identified to have the greatest potential to contribute significant pollutants loads based on the parameters discussed above

and contained in Table 4.2. The locations are the Pine Neck Boat Ramp site (surface runoff, ranked 7) and the commercial property along the south side on Montauk Highway (Outfall 26, ranked 13) along the west shoreline of the river. At the Town boat ramp, a single drainage inlet exists in the asphalt parking area. Several inches of water was observed covering the structure following a minor rainfall event. Excess runoff may drain either to the river from the boat ramp or over the sand shoreline to the bay. At the commercial property on the west shoreline, a pipe outfall collects runoff from the asphalt pavement and carries it to the river. Recommendations for drainage improvements for these two locations are contained in Section 4.4 Target Projects and Priority Actions. The additional subwatershed areas discharge locations include four outfalls, seven surface runoff locations, one boat ramp and two undetermined but suspected discharge locations.

Outfalls – Additional piped outfalls exist at four locations including two at Sweezy Street (Outfalls 31 and 5274), one at Carmen Street (Outfall 11) and one at Grove Avenue (Outfall 5) that discharges to the bay. These roads are under Town jurisdiction. Sweezy Avenue is a busy roadway with adjacent developed residential properties. Potential mitigation measures for the Sweezy Street outfalls include installation of upgradient leaching basins to collect and infiltrate storm runoff or installation of WQI. The WQI can be installed in the roadway to treat the WQSE for the sediments and hydrocarbons associated with roadways. The WQI will not mitigate the pesticide and fertilizer loads associated with residential property runoff. The use of either upgradient leaching basins or CBI's in the drainage structures would reduce the fertilizer and pesticides loads. Carman Street is a residential street with minimal traffic. Potential mitigation measures include installing upgradient leaching structures to collect and mitigate the WQSE volume or acquisition of the property on the north side on Carman Street that appears to be vacant (cleared, no structure) to construct a bioretention basin to filter the WQSE volume and bypass the

larger storm events. The Grove Street outfall discharges road runoff directly to the bay. Pollutant loads can be mitigated by installing upgradient leaching basins to collect and infiltrate the WQSE volume.

Surface Runoff - Surface runoff enters the water at seven locations including the street ends at Swan River Street, Bolton Drive, Pitts Road/River Court, Spruce Street, and the southern end of Pine Neck Avenue. Runoff has eroded a swale into the shoreline at the southern limit of Pitts Road and River Court. Surface runoff from the road shoulder of Pine Neck Avenue enters a ditch that carries the runoff to the river. The First Street commercial property's asphalt parking area surface drains to the river. No drainage structures were observed. In general, installation of upgradient leaching structures on these roads and parking areas could capture and infiltrate the WQSE and would mitigate the fertilizer and pesticide-laden runoff from lawn areas. Where feasible, the construction of infiltration trenches or vegetated swales at the road ends would detain and filter runoff prior to discharging to the wetlands or river. The existing eroded swale carrying Pine Neck Avenue runoff to the river should be revegetated with native grasses or reconstructed as a filtration trench to filter the runoff. For the revegetation efforts to be successful phragmites that dominates the wetlands needs to be removed.

Other - Two boat ramps exist along the river. Boat ramps allow surface runoff to enter the river from the marina or boat yard parking area. The Brookhaven Town boat ramp on Pine Neck Road is discussed further in Section 4.4 Target Projects and Priority Action. The second boat ramp is located at Morgan's Marina on the west shoreline of the river. The marina appears to have an existing recharge basin. This basin should be constructed to contain the WQSE at a minimum and allow excess flows to bypass. Educational efforts that address implementation of BMP's for marinas and for boat owners should

be provided at this marina, at the Town boat ramp and at the second commercial marina (White Water Marina).

Undetermined - There are two locations (Conklin Avenue and Dipper Point Road) where the termination location of piping extending from the drainage structures could not be determined. Further investigation to identify the pipe destination should be conducted including review of Town site plan approval records, interviews with Town Highway Department personnel or pipe dye testing. After system determination is completed, additional mitigation measures including upgradient leaching wells or CBI's can be addressed.

4.3.2.2 Reach 2 –Montauk Highway to south of Sunrise Highway

This freshwater reach has commercial land use along Montauk Highway and Sunrise Highway, and the remainder of the reach has residential land use. Swan Lake is located immediately north of Montauk Highway. Several Town- and County-owned parkland parcels are located along the southern end of the lake. A small tributary extends east from the upper lake through a swale and pipe to an undeveloped, wooded portion of a residential apartment complex. The residential properties along the river and lake have high maintenance lawns and limited vegetated buffers allowing fertilizers and pesticides to wash into the waterbodies.

Twenty-two subwatershed areas are identified in Reach 2. The outfall locations and area of the subwatersheds are shown on Figures 2.4.3.2 and 2.4.3.3. Of the subwatershed areas, twenty-one locations discharge, or are suspected to discharge, runoff directly to the river. These locations include seven outfall locations, twelve surface runoff locations, and two undetermined discharge locations. At the undetermined locations, no outfalls were located but observed piping appears to direct drainage toward the river. There are no recharge basins within the Reach 2 drainage area. The remaining subwatershed area, at the northern corner of

Schoenfeld Boulevard and Montauk Highway, drains to leaching basins that infiltrate to groundwater. Based on the subwatershed area, number of structures, depth to groundwater, and observed flooding during a rainfall event, it is suspected that this area may overflow to another subwatershed area that drains to the river. This location should be investigated for the existing storm volume generated and structure capacity. If it is overflowing to another subwatershed, the WQSE in excess of the existing basin capacity should be included in the calculations for the overflow subwatershed. Alternately, additional leaching basins should be installed to collect and infiltrate the entire WQSE.

Two locations in this reach were ranked as having a greater potential to contribute significant pollutants loads to the river based on the parameters discussed above and contained in Table 4.2. These locations are the piped drainage system from Montauk Highway located near the existing dam (Outfall #67, ranked 4) and the storm drainage infrastructure on Shoenfeld Boulevard, Phyllis Drive, and Swan Lake Drive (ranked 8, includes five subwatershed areas that may be interconnected – Outfall 34 and structures 1321, 1327, 1331, 1344). The Montauk Highway system extends east on Montauk Highway and South Country Road from Outfall #67. The outfall discharges at the east shoreline of the river immediately south of Montauk Highway. This drainage system is under the jurisdiction of Suffolk County who provided mapping of the existing system. At the second location, an extensive Town drainage infrastructure system exists. The system includes five outfall, or potential outfall, locations that have been included as a single system for this discussion. The complete system could not be accessed for mapping, but the system is suspected to either discharge at Outfall #34, a 36" pipe located on the east shoreline west of Bertha Street or though several additional pipes that could not be physically identified. Drainage improvement recommendations for these locations are contained in Section 4.4 Target Projects

and Priority Actions. Additional subwatershed areas and recommended mitigation measures based on discharge type are discussed below.

Outfalls – Additional outfalls exist at two locations, a grate inlet at the Montauk Highway culvert (Outfall 63) and a pipe that carries the east tributary flow under Lake Avenue and Rose Street into Swan Lake. Outfall 63 is under the jurisdiction of Suffolk County. The Town should encourage the County to mitigate this outfall. Recommended mitigation for the Montauk Highway inlet includes removing the inlet and redirecting the flow to the eastern collection system discussed above and in Section 4.4 Target Projects and Priority Actions. The east tributary piping is not expected to contribute significant pollutant loads to the river, as the tributary area is undeveloped and wooded. An inlet structure exists on Lake Avenue that collects road runoff from a small area of Lake Avenue and Rose Street. Installation of upgradient leaching basins to collect and infiltrate the WQSE or CBI's in the existing basin will filter the pollutant load from the runoff.

Surface Runoff - Twelve locations were identified where the road or pavement surface drains to the wetlands, lake or river. No drainage structures were observed at the two commercial properties (a restaurant and a nursing home) on the southwestern shoreline of the lake. Both properties are currently occupied. If these properties are redeveloped, the Town should require review and upgrade of the storm drainage system as necessary to meet current Town and State requirements for storage capacity. The upgraded systems should be designed to contain the WQSE at a minimum, and to bypass larger storm events.

The remaining ten surface runoff locations are the streets along the east shoreline of the reach. These include the Lake Drive road shoulder and the

road ends extending from Rose Street north to Kathryn Street. Runoff from the road shoulder of Lake Drive flows over the uncurbed road edge and down the slope into the lake. Revegetation of the slope with native grass species will slow the runoff allowing pollutants to filter out and create a barrier that will dissuade waterfowl from congregating in the area. When the road is reconstructed, upgradient leaching basins should be installed to collect and infiltrate the WQSE. The road ends drain directly to the river and wetlands north of the lake. Upgradient leaching wells should be installed where the depth to groundwater is adequate and vegetated swales or infiltration trenches constructed at each road end to filter the remaining runoff prior to entering the waterbody.

Undetermined – At two locations, no outfalls were field located but are assumed to exist. They are either unidentified pipe outfalls or they are piped to existing Outfall # 36 west of Bertha Street. These locations are assumed part of the Shoenfeld Boulevard, Phyllis Drive, and Swan Lake Drive area discussed above and in detail in Section 4.4 Target Projects and Priority Actions.

4.3.2.3 Reach 3 – Sunrise Highway to south of Woodside Avenue

This freshwater reach of the river is narrower that the southern reaches and surrounded by residential land use and undeveloped land. There are commercially-zoned undeveloped parcels along Sunrise Highway. Barton Street is a busy, two-lane through road. There are several large undeveloped parcels along the river limiting the number of residential properties, and as a result, the lawn areas that immediately back the river. Several of these parcels have been identified for acquisition by the Town Open Space Advisory Committee.

Fifteen subwatershed areas are identified in Reach 3. The outfall locations and area of the subwatersheds are shown on Figures 2.4.3.3 and 2.4.3.4. Of the subwatershed areas, twelve locations discharge or are suspected to discharge runoff directly to the river. These locations include eight outfall locations, one surface runoff location, and three undetermined discharge locations where no outfalls were located but observed piping appears to direct drainage toward the river. There are several recharge basins either immediately adjacent to the river or with piping to the river within this reach. One of the basins has been positively identified to have an overflow structure to the river. This is suspected to be the case with several others as well. Of the remaining three subwatershed areas, runoff from the Sunrise Highway southbound lanes is collected in a piped system that carries the runoff to a recharge basin outside of the drainage area, and the Hallock Road and Yale Court storm runoff is collected in leaching basin systems.

Based on the parameters discussed above and contained in Table 4.2, five locations in this reach were ranked to have the greatest potential to contribute significant pollutants loads to the river. These locations are the Sunrise Highway northbound lanes (surface runoff, ranked 2) where road runoff surface flows over the north shoulder into the river, eroding the existing slope. The drainage system on Debbie Lane (Structure 1298, ranked 6) consisted of three structures for 3400 linear feet of road. The existing infrastructure does not have adequate infiltration capacity. No recharge basin or additional piping was observed and a connection to an outfall was not identified. Investigation should examine the possibility that the Debbie Street runoff is piped to the recharge basin on Barton Avenue. The three others ranked locations are Circle Drive (Outfall 257, ranked 1), Gina Court (Outfall 66, ranked 3), and Patricia Lane (Outfall 1116, ranked 15). These locations all direct road runoff to recharge basins but may allow the runoff to overflow out of the basins to the river. Investigation is required to determine if these basins contain the runoff and if the WQSE volume, at the minimum, is

separated from the overflow and infiltrated to groundwater. Recommendations for drainage improvements for these locations are contained in Section 4.4 Target Projects and Priority Actions. Additional subwatershed areas and recommended mitigation measures based on the discharge type are discussed below.

Outfalls – Additional piped outfalls exist at five locations including Barton Avenue (Outfall 35), Theresa Court (Outfall 1117), Swan View Court (Outfall 41), Swan Court (Outfall 1436), and Lucy Court (Outfall 11). These roads are under Town jurisdiction. Barton Avenue is a busy roadway with adjacent developed residential properties. The river is piped under the road bed through two pipe sections, a third pipe angles to the existing road drainage basins. A Town recharge basin exists immediately adjacent to the rivers east shoreline. The contributing area for this basin and the existence of an overflow structure could not be determined. Further investigation of the Barton Avenue drainage system is required to determine the flow volume going directly to the river verses the flow volume to the recharge basin. If all road drainage from the subwatershed area is determined to flow directly to the river, mitigation measures include installation of upgradient leaching basins to collect and infiltrate storm runoff or installation of WQI. The WQI can be installed in the roadway to treat the WQSE for the sediments and hydrocarbons associated with roadways. The WQI does not mitigate the pesticide and fertilizer loads associated with residential property runoff. The installation of appropriate CBI's in the upgradient drainage structures would reduce the fertilizer and pesticides loads. Theresa Court runoff is directed to the same recharge basin as the Patricia Lane runoff discussed in the prior paragraph. The recommendations for improvements to this recharge basin are included in Section 4.4 Target Projects and Priority Actions and will need to address the runoff volume from Theresa Court. The drainage systems on Swan View, Swan, and Lucy Courts consist of series of interconnected drainage structures

with a pipe identified leaving the last structure in each of these systems. As no outfall locations at the river were identified, further investigation of the system is required. Mitigation of the WQSE may include alteration of the existing system to allow the upgradient structures to capture and infiltrate the WQSE prior to overflowing to the final structure for overflow to the river. Educational efforts to reduce fertilizer and pesticide usage levels will also reduce pollutants loads in the river.

Undetermined - There are two locations (Nicole Court and Whippoorwill Court) where the termination location of piping extending from the drainage structures could not be determined. Further investigation should be conducted to identify the pipe destination, including review of Town site plans approval records, interviews with Town DPW personnel or pipe dye testing, Following system determination, recommendations for mitigation measures including upgradient leaching wells or CBI's can be addressed.

4.3.2.3 Reach 4 – Woodside Avenue north to the river headwaters

The river headwaters are located north of Woodside Avenue. Woodside Avenue is a main thoroughfare under Suffolk County jurisdiction surrounded by residential land use. Suffolk County has two recharge basins located on either side of the river along the south side of the road. There is a large Town recharge basin located north of Woodside that collects runoff from several adjacent streets and is near the river headwaters.

Two subwatershed areas are identified in Reach 4. The subwatershed areas discharge or are suspected to discharge runoff directly to the river. Three recharge basins within the drainage area of this reach are immediately adjacent to the river. The surrounding area contains subwatershed areas that drain to leaching basins or recharge basins that infiltrate to groundwater. Based on the subwatershed areas,

numbers of structures, depths to groundwater and surrounding lot parcel sizes, these areas are not anticipated to contribute runoff to the river.

The two subwatershed areas in this reach were both identified to have a high potential to contribute significant pollutants loads to the river based on the parameters discussed above and contained in Table 4.2. The subwatershed areas are Woodside Avenue (Outfall 73, ranked 5) and the recharge basin on First Avenue (Outfall 92, ranked 14). Suffolk County did not provide information on the piping system or recharge basins for Woodside Avenue. The river appears to have been channelized and basins bermed to contain the storage volume. The First Avenue recharge basin collects runoff from several surrounding streets. Aerial photography of the basin showed no standing water but extensive ATV tracking was evident. The headwaters are reported to be in this location but were not field located. Recommendations for drainage improvements for these locations are contained in Section 4.4 Target Projects and Priority Actions.

No additional discharge locations were identified in Reach 4.

4.4 TARGET PROJECTS AND PRIORITY ACTIONS

The projects and actions discussed below are designated target projects or priority actions because they are estimated to contribute or have the potential to contribute the greatest average annual pollutant loads into the Swan River and Great South Bay. The non-structural measures represent actions to reduce the pollutant loads without construction of additional infrastructure and methods to ensure the highest function of the existing infrastructure. Structural mitigation at the target projects locations will provide a significant reduction in the pollutant loads. Of the eleven projects identified, six are under Town jurisdiction, two are located on roads with Suffolk County jurisdiction, one is under New York State jurisdiction, and one is located on private commercial property. Target projects and priority actions are shown on Figure 4.4.

The target projects represent the projects that are ranked to have the greatest pollutant loads. As additional factors may influence the order in which the projects are implemented, general recommendations for mitigation actions for each type of outfall are described in Section 4.2. The target projects recommendations are conceptual and the implemented measures may vary from these. The order in which projects and actions are initiated should be based on several key components including but not limited to:

1) severity of the problem;
2) goals and objectives of the project and the assumed or known effectiveness of the project or action;
3) technical feasibility;
4) timing;
5) planned or necessary road reconstruction work;
6) availability of funding; and
7) other planned local and regional planning efforts and implementation projects.

4.4.1 Non-Structural Priority Actions

Several of the recommendations included in Section 3.0 are identified as priority actions that should receive special focus due to their ability to reduce pollutant loads into the waterbodies.

In subwatersheds dominated by residential properties such as all of the reaches of Swan River, the runoff from lawns and landscaped area carries significant fertilizer and pesticide loads. Methods to reduce these type of loads at a point source prior to entering the stream exist but generally require significant land area not found in developed neighborhoods, long detention periods, significant funding and continued maintenance. The additional costs of land acquisition, construction and maintenance can influence tax rates, particularly when similar actions may be required on a town–wide basis. A focused effort to reduce pesticide and fertilizer use into the watershed will be the most cost

effective means to reduce these pollutant levels in the watershed. Several fertilizer and pesticide use reduction actions and recommendations have been included in Section 3.0, including in Section 3.4 Education and Outreach Recommendations.

A Drainage Structure Maintenance Program should be developed as discussed in Section 3.3.3.1. The success of structural drainage solutions is dependent on the ability to maintain maximum pollutant removal capacities of the structures. A successful maintenance program is based on the capacity to fund the long-term labor and equipment requirements of such a program.

Land acquisition will preserve habitats, reduce potential impervious surfaces and provide opportunities to install structural measures to mitigate polluted runoff. Several properties are identified for acquisition in this report, specifically in Section 3.3.4.1. In addition, the Town Open Space Council targets parcels for acquisition and has identified a number of parcels in the Swan River watershed. As the watershed is largely developed, it is important to actively identify and acquire those parcels deemed important to the health of the river and bay.

4.4.2 Town Target Projects

Of the top eleven structural projects identified, seven fall under the jurisdiction of the Town of Brookhaven. Of the seven Town target projects, four are recharge basins. The basins appear to have overflow mechanisms to the river. This determination is based on review of subdivision acreages, existing piping systems, recharge basin size and location. These locations require further investigation to identify the overflow and to determine a method to reroute or reconfigure the overflow. The recharge basins should contain the WQSE, at a minimum, up to the maximum capacity of the recharge basin and allow the larger storm event to bypass the basins. The remaining three Town target locations include a surface runoff location, a location where the drainage system could not be

determined but the area being drained is significant, and Outfall #34 where a 36" outfall pipe exists but the drainage area and potential other outfalls could not be identified.

Average construction costs for recommended structural measures are estimated to provide conceptual construction costs and a basis for comparison of the implementation actions. For leaching basins, it is assumed that a 10' diameter structure with a 5' effective depth and a capacity of 68.42 CF per foot of effective depth will be installed. This structure, installed with required pavement and curb restoration, averages $4500.00 per structure based on review of 2006 bid records. Costs for bioretention basins are expected to average about $11.00 per cubic foot of bioretention storage area according to Stormwater Resource Managers Center bioretention fact sheets. Water Quality Inlets (WQI) costs vary based on size and site conditions, and an average cost of $40,000 is assumed for systems that do not exceed the runoff volume from a 4-acre road area. The USEPA estimates the cost of swirl separators (a typical form of WQI) at $5,000-$10,000 per impervious acre (http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index). Vegetative filter strips are estimated to cost approximately $60.00 per linear foot for a 15' wide strip with 3:1 side slopes. Catch Basin Insets (CBI's) are estimated to cost $1000 per insert when installed as part of a Town program and if no alternation to the basin structure is required. Where necessary, costs are adjusted to 2006 construction dollars based on an average annual inflation rate of 5%. Land acquisition, engineering design, and undetermined consequential construction costs such as utility relocation or unsuitable materials replacement, are not included in the estimates. The estimated total construction costs to implement the Town target projects discussed herein range from $350,000 to $1,000,000. These projects, once implemented, will require inclusion in a Town maintenance program to maintain the pollutant removal capacities of the design.

Ranked 1 - Circle Drive - #257 Recharge Basin Overflow

The WQSE volume is estimated to be 23,800 CF. This subwatershed is a residential area where lawn fertilizers, pesticides and road runoff are the primary pollutants of

concern. As soluble pollutants are a concern, infiltration of the WQSE is the preferred solution. The existing drainage infrastructure system collects storm runoff and carries it to a recharge basin. A perfunctory analysis of the basin capacity, using .3 runoff coefficient, 5" rainfall depth, the entire drainage area acreage (50 acres) and an assumed 5' basin storage depth, determined that the basin capacity does not appear to contain 5" of runoff (277,200 CF). According to Town Regulations, a 5" storage volume requires an overflow mechanism. A detailed investigation of the system should be conducted to determine the existing basin capacity and the existence of an overflow structure. If the overflow is identified, the configuration and components should be investigated. If the overflow structure does not separate the overflow volume from the storage volume, the structure should be reconfigured to filter the overflow volume or to have the overflow volume completely bypass the basin. Standing water was observed in this basin. The recharge basin floor should be inspected to determine if silt build-up has reduced the infiltration capacity of the basin thereby increasing the overflow volume. This recommendation will require installation of several drainage structures and new piping to allow the larger storm events to bypass the basin and excavate silt material from the basin floor. The anticipated construction cost for this improvement is $40,000.

Ranked 3 - Gina Court – #66 Recharge Basin Overflow

The WQSE volume is estimated to be 18,360 CF. This subwatershed is a residential area where lawn fertilizers, pesticides and road runoff are the primary pollutants of concern. As soluble pollutants are a concern, infiltration of the WQSE is the preferred solution. The existing drainage infrastructure system collects storm runoff and carries it to a recharge basin. A perfunctory analysis of the basin capacity using .3 runoff coefficient, 5" rainfall depth, the subwatershed acreage (27.5 acres) and an assumed 5' basin storage depth, determined that the basin may contain 5" of runoff (144,000 CF). According to Town Regulations, a 5" storage volume requires an overflow mechanism. A detailed investigation of the system should be conducted to determine

the existing basin capacity and the existence of an overflow structure. If the overflow is identified, the configuration and components should be investigated. If the overflow structure does not separate the overflow volume from the storage volume, the structure should be reconfigured to filter the overflow volume or to have the overflow volume completely bypass the basin. In addition, the Town should review the condition of the recharge basin floor to determine if silt build-up has reduced the infiltration capacity of the basin. This recommendation will require the installation of several drainage structures and new piping to allow the larger storm events to bypass the basin and excavation of silt material from the basin floor. The anticipated construction cost for this improvement is $40,000.

Ranked 5 – Swan Lake Drive - #34 - 36" Pipe Outfall

Ranked 9 - Swan Lake Drive - #1321 Unknown

Ranked 17- #1344, #1331, & #1327 Swan Lake Dr./Schoenfeld Blvd - Unknown

These subwatersheds are residential areas where lawn fertilizers, pesticides, and road runoff are the primary pollutants of concern. As soluble pollutants are a primary concern, infiltration of the WQSE is the preferred solution. This drainage area, located along the west shoreline of Reach 2 between Montauk Highway and Sunrise Highway, requires additional investigation to determine the actual outfall locations and volumes. The total area includes 13,000 liner feet of road and 56 acres of land. The structures shown on the maps were field located using the GPS device discussed in Section 2.4.2. Subsequent field investigation included accessing structures to inspect the structures type, diameter and depth, and piping diameter and direction. Standing water and inaccessible covers prevented interior inspection of some structures. The existing drainage system includes a series of inter-piped catch basins along Swan Lake Drive, Schoenfeld Boulevard, and Phyllis Drive. Upgradient, predominantly along Phyllis Drive, there are a series of unconnected leaching basins. The single field-identified outfall in this area is a 36-inch diameter pipe outfall (Outfall #34). The outfall pipe extends from structure #1322 on Swan Lake Drive

through a 30' wide Town parcel to the river. Structures #1344 and #1321 have pipes from the structure extending toward the Lake, but the outfall locations were not field located. An additional two locations (#1327 and #1331) may have pipes that outfall to the river or are connected to catch basins that have pipe outfalls to the river.

Based on the drainage area size and the existing drainage system, it is anticipated that the majority of the storm runoff flows through the piped system directly to the river. Although further investigation is necessary to verify the number and locations of outfalls, individual drainage areas and flow volume at each outfall, it is apparent that these subwatersheds are contributing a significant pollutant load to the river.

For analysis purposes, the area was divided into the five potential subwatershed areas as stated in the heading. Further investigation should determine the extent of interconnection of these areas. Taken as a whole, the entire WQSE volume is 45,900 CF, which would make this the largest single subwatershed.

Investigation of the existing drainage system along Swan Lake Drive is necessary to determine if there are additional outfalls or if the piping system is interconnected to the 36" outfall. Based on the finding of this investigation the appropriate mitigation measures can be determined. Existing shoreline topography and a lack of vacant land to locate alternative measures appears to preclude the use of measures such as wetlands or bioretention basins. Based on a review of the existing conditions, it appears that the measures most likely to be suitable for this area include installing additional upgradient leaching basins to infiltrate the WQSE and installing WQIs on each outfall pipe to remove additional sediments and hydrocarbons. As this is a residential neighborhood with landscaped properties and manicured lawns, the existing catch basins should be fitted with CBI's suitable for soluble pollutant removal and a focused effort to reduce fertilizer and pesticide use pursued. The total vertical feet of storage is 723 VLF requiring 145 5'-depth structures. Sixteen

structures already exist, requiring an additional 129 structures be installed. The construction cost to install leaching wells to capture and infiltrate the total WQSE volume of 49,500 CF is estimated to be $600,000.

A preliminary construction cost estimate to treat the entire WQSE volume through WQIs is $150,000. This cost is based on the estimated construction cost of $10,000 per impervious acre and impervious area of 15 acres. While the leaching basins provide soluble pollutant removal capacity, the WQIs do not, so a secondary method is necessary. The cost to install suitable CBI's in the 22 catch basins is $22,000. The final design may be a combination of these methods and would result in an intermediate cost.

Ranked 7 – Debbie Lane - #1298 Unknown

The WQSE volume is estimated to be 11,560 CF. This subwatershed is a residential area where lawn fertilizers, pesticides and road runoff are the primary pollutants of concern, therefore, infiltration of the WQSE is the preferred solution. Three drainage structures were identified near the Debbie Lane and Sharon Drive intersection. Additional investigation is required to determine the discharge location of these structures. Based on the storage capacity required for a subwatershed of this size the three structures are inadequate. The structures discharge either directly to the river or to the existing recharge basin on Barton Avenue. If drainage is directed to the recharge basin, the system must be investigated. A perfunctory analysis of the Barton Avenue recharge basin capacity using .3 runoff coefficient, 5" rainfall depth, the Debbie Lane subwatershed acreage (16.5 acres) and an assumed 5' basin storage depth, determined that the basin may contain 5" of runoff (90,700 CF). According to Town Regulations, a 5" storage volume requires an overflow mechanism. A detailed investigation of the system should be conducted to determine the existing basin capacity and the existence of an overflow structure. If the overflow is identified, the configuration and components should be investigated. If the overflow structure does

not separate the overflow volume from the storage volume, the structure should be reconfigured to filter the overflow volume or to have the overflow volume completely bypass the basin. In addition, the Town should review the condition of the recharge basin floor to determine if silt build-up has reduced the infiltration capacity of the basin. The construction cost to install a bypass piping system should be similar to Gina Court or Circle Drive and is estimated to be $40,000.

If the system is determined to discharge directly to the river, the Town should acquire the adjacent vacant parcel to develop a bioretention basin. The estimated cost of a bioretention basin is $130,000 based on the WQSE volume of 11,560 CF and a bioretention basin unit cost of $11.00 CF. The undisturbed portion of the parcel should be preserved as open space. The parcel (0200-925-6-18.1) is an 11.2-acre parcel, previously identified by the Town Open Space Advisory Committee for possible acquisition.

If vacant land cannot be obtained, install upgradient leaching basins in the street to capture and infiltrate the WQSE volume prior to overflowing to the outfall structure. The total vertical feet of storage required is 170 VLF, requiring 34 structures. The construction cost to install upgradient leaching wells to capture and infiltrate the 11,560 CF WQSE is $160,000.

Ranked 8 - Pine Neck Boat Ramp-Surface Runoff

The WQSE volume is estimated to be 9,519 CF. This location is a Town boat ramp facility with adjacent 1-acre asphalt parking area. The single drainage structure identified in the parking area was observed to be holding water with several inches of flooding above. Runoff from the parking area may overflow to the river via the boat ramp. Shoreline erosion to the bay near the southwest corner of the parking lot was evident in aerial photography that also showed ATV tracks through the sandy shoreline area. The recommendation is to increase the leaching capacity of the

parking area by installing additional leaching structures to contain the WQSE and create a vegetated filter strip for overflow volumes. The total vertical feet of storage volume required to contain the WQSE is 140 VLF, requiring 28 structures. As 5' storage depth may not be available at this location, alternate leaching structures should be investigated. The vegetated filter strip is estimated to cost approximately $60.00. per linear foot for a 200' length by 15 foot wide swale with 3:1 side slopes planted with native grass plugs and netting. The construction cost for this improvement is $140,000. The shallow depth to groundwater and less extensive use period during inclement weather make this site a candidate for alternative measures, such as pervious pavement.

Ranked 11 - First Avenue – #92 Recharge Basin Overflow

The First Avenue subwatershed WQSE volume is estimated to be 7,480 CF. This subwatershed is a residential area where lawn fertilizers, pesticides and road runoff are the primary pollutants of concern, therefore, infiltration of the WQSE is the preferred solution. Further investigation is necessary to verify the function of the existing recharge basin at the east end of First Avenue. The basin was not accessed but aerial photography was reviewed. Aerial photography shows the basin to be dry with extensive ATV tracks. If the basin is properly functioning with no overflow and provides the Town required 8" of storage for the contributory area, no additional work is required. If the recharge basin was sized for a 5" storm with an overflow or improper construction is allowing drainage to pass through the basin to the river, the basin should be reconstructed to contain and infiltrate the Town required 5" storm event. The overflow mechanism should be reconstructed to bypass the larger volume storms. Assuming the required modification requires installation of several drainage structures and new piping for the overflow system, the construction cost is $30,000.

Ranked 12 – Patricia Lane – #1116 Recharge Basin Overflow

The Patricia Lane subwatershed WQSE volume is estimated to be 7,140 CF. An overflow pipe (#72) exists from this basin to the river. The recharge basin also collects runoff from Theresa Court subwatershed, which has an estimated WQSE volume of 3060 CF. The subwatersheds are residential areas where lawn fertilizers and pesticides and road runoff are the primary pollutants of concern. As soluble pollutants are a concern, infiltration of the WQSE is the preferred solution. The existing drainage infrastructure systems collect storm runoff and discharge it to the recharge basin. A perfunctory analysis of the basin capacity using .3 runoff coefficient, 5" rainfall depth, the combined Patricia Lane and Theresa Court subwatershed acreage (22 acres) and an assumed 5' basin storage depth, determined that the basin may contain 5" of runoff (117,000 CF). According to Town regulations, a 5" storage volume capacity requires an overflow mechanism. A detailed investigation of the system should be conducted to determine the existing basin capacity and the configuration of an overflow structure. If the overflow structure does not separate the overflow volume from the storage volume, the structure should be reconfigured to filter the overflow volume or to have the overflow volume completely bypass the basin. In addition, the condition of the recharge basin floor should be inspected to determine if silt build-up has reduced the infiltration capacity of the basin. This recommendation will require the installation of several drainage structures and new piping to allow the larger storm events to bypass the basin and excavate silt material from the basin floor. The construction cost for this improvement is $30,000.

4.4.3 Multi-jurisdictional Target Projects

Of the top ranked projects, three are located on roads that are under the jurisdiction of Suffolk County or New York State. Roads with heavy commercial traffic represent the highest priority projects with regards to total suspended solids and hydrocarbon pollutants. Except if noted herein, the construction costs are estimated using the unit costs included in Section 4.4.2 Town Target Projects. The estimated construction costs to

implement the multi-jurisdictional target projects discussed herein are $370,000 to $520,000. These projects will also require inclusion in maintenance programs to maintain effective pollutant removal capacities.

Ranked 2 - Sunrise Highway - Surface Runoff

The WQSE volume is estimated to be 19,000 CF for this section of Sunrise Highway, which is under the jurisdiction of the NYSDOT. The north pavement lanes surface drain to the river over the north shoulder and embankment. No drainage inlets were observed. This drainage pattern is causing on-going slope erosion and carrying the soil sediments and road pollutants to the river. Existing drainage infrastructure on the south lanes of Sunrise Highway collects storm runoff from the south lanes and the South Service Road and carries it to an existing NYSDOT recharge basin located east of the watershed on Hewlett Street. Several alternative means can be employed to intercept surface runoff and prevent erosion. If the existing recharge basin has excess capacity, a catch basin and piping system can be installed along the north lanes and connected to the south system for discharge to the existing basin. Alternatively, the State can acquire a vacant parcel north of the Highway (0200-955-2-36 or 0200-955-3-28) to construct a filtering system, such as a bioretention basin or constructed wetland, and pipe the road runoff to that system. If land acquisition is not possible and basin capacity does not exist, the state can install a piped system that includes a WQI prior to river outfall. Construction costs will vary significantly depending on the final design. Costs for bioretention basins are expected to average about $11.00 per cubic foot and assuming the need for four drainage structures and connection piping, the estimated cost for the bioretention basin is $250,000. A piping system to the existing recharge basin may reduce construction costs while constructed wetlands would generally increase the construction cost. Land acquisition costs, professional design fees and coincidental construction costs are not included in the estimates.

Ranked 4 - Montauk Highway – Outfall 67

The WQSE volume from this drainage subwatershed is estimated to be 17,100 CF. Montauk Highway is under the jurisdiction of SCDPW, which provided plans of the drainage infrastructure at this location. Runoff from this commercial road section is collected in a piped system and discharges directly into the river south of the highway. Commercial roads generally have the greatest pollutant loads from suspended sediments and hydrocarbons. Acquisition of the vacant parcel of land south of Montauk (0200-977.60-4-14.1) on the east shoreline of the river provides an opportunity to install a filtering system, such as a bioretention basin, if site conditions including groundwater depth and surface areas are adequate. If the land cannot be acquired or the parcel's condition is not adequate, a WQI can be installed in the road shoulder. Construction costs will vary significantly dependant on the final design. The estimated cost for the bioretention basin is $200,000. WQI costs vary based on size and site conditions. A construction cost of $50,000 is estimated. Land acquisition costs, design fees and coincidental construction costs are not included for either measure. If land acquisition nets additional space, a larger storm event can be detained and slowly-released reducing the heavy flows into the river from major storm events.

Additionally, the culvert grate (outfall 63) on the south side of Montauk Highway should be removed and the drainage redirected to the proposed Montauk Highway drainage system discussed above.

Ranked 6 - Woodside Avenue – Recharge Basin Overflow

The WQSE volume is estimated to be 14,960 CF. Woodside Avenue is under the jurisdiction of SCDPW. No drainage infrastructure mapping was received for this location. Two recharge basins exist on the south side of Woodside Avenue, one on either side of the river. Further investigation of the piping system is required to determine the volume of flow that enters the recharge basin and the volume that

discharges directly to the river. The recharge basin and the piping system may be able to be reconfigured to contain the WQSE, at minimum, in the recharge basins while allowing storm volumes in excess of the basin capacity to bypass directly to the river. In addition, the recharge basin floor should be inspected to determine if silt has reduced the infiltration capacity of the basin, requiring material excavation This recommendation will require the installation of several drainage structures and new piping to allow the larger storm events to bypass both basins and excavation of silt material from the basin floors. The anticipated construction cost for this improvement is $70,000.

4.4.4 Private Parcel Target Projects

Ranked 9 - Private Commercial Site on Montauk Highway – Outfall 26

The WQSE volume is estimated to be 8,160 CF. This commercially developed site is currently vacant. One outfall was observed discharging to the river from on-site drainage structures in the parking area. During field investigation, a local resident stated that a second outfall from this property exists immediately south of the observed outfall. This outfall could not be field verified. The WQSE volume herein assumes the entire site is discharging through the outfall #26. Redevelopment of the parcel should require that the existing drainage system be upgraded. Town regulations require that 2" of storage be provided in on-site leaching wells. The groundwater depth provides an opportunity to utilize new storage technologies that provide a shallow storage depth. An overflow structure should be designed to allow larger storm events to flow into the river without eroding the shoreline and carrying pollutants from the parking lot. The cost to implement these improvements would be borne by the land owner and are not addressed in this report.

Implementation of these projects along major roads in the study area will significantly reduce the sediment and hydrocarbon pollutant loads into both waterbodies. These projects will require acquisition of Town regulated lands to install recharge basins

and bioretention basins where space and depth to groundwater is adequate. While the Town cannot construct these projects, they can work with the County and State to identify locations for installation of these structural measures and provide opportunities for public input and education on the need for these measures. Applications for funding for these projects should be prepared as joint applications to reflect the bipartisan effort that is being made to improve the water quality of the river, bay and SSER.

5.0 IMPLEMENTATION STRATEGIES

Implementation strategies address the methods and means by which the protection recommendations, management actions, target projects, and priority actions identified in the prior sections can be implemented. These strategies include coordination between various municipal agencies, identification of code and ordinance modifications, development of new programs and policies, sources of funding for program and project development, and procedures for monitoring and assessing results.

5.1 IMPLEMENTATION COORDINATION

Improvement of the water quality in Swan River, and subsequently the bay, requires coordination between many levels of government, civic groups, and involved citizens. The Town will need to work closely with all of these groups to reach the goals and objectives set forth in this Plan.

SPDES Phase II regulations require the Town, County, and State to reduce the impact of nonpoint source pollutants to waterbodies, including the Swan River. These entities should consider the formation of a coalition of interrelated agencies similar to the Nassau County Storm Water Coalition, to facilitate awareness of the actions undertaken by the various agencies. While this intermunicipal coordination would be on a countywide basis, it would also provide a conduit to exchange information and coordinate projects for individual watersheds such as the Swan River. Intermunicipal coordination for Phase II implementation is highly encouraged by the State and can be financially beneficial to the municipalities involved. The task force could include municipal personnel charged with responsibility for drainage infrastructure and roads, planning personnel, GIS staff, and other agency personnel who influence municipal resources that effect surface waters. GIS information sharing can lead to mapping of the entire drainage infrastructure in the Town and County. Greater coordination of County and Town efforts to implement pollution control measures should be investigated. Joint efforts can include design of infrastructure for both Town and County road runoff, Town support of the County in acquiring

properties for recharge structures, infrastructure maintenance agreements, and utilization of County funds - such as the Save Open Space Fund - to preserve sensitive Town lands from development.

A Swan River Task Force should be assembled to begin planning for a comprehensive approach to addressing the management issues as discussed in Section 3.4.1. The task force should be a consortium of agencies and groups including state, county, and local government representatives, local concerned citizens, business owners, and environmental groups. The current WAC could serve in this capacity. A successful prototype for this task force is the Beaverdam Creek Wetland Restoration Task Force. Establishment of a task force could facilitate significant funding from a variety of programs with the goal of restoring habitats in the river and SSER. The task force could also partner with the Nature Conservancy, who under the direction of the NYSDEC and NYSDOS is preparing an Ecosystem Management Plan for the Great South Bay. The SSERC and NYSDOS DCR are important resources for the Town, and should be included as part of the Task Force. They can provide information on the development of educational, outreach and stewardship materials as well as information regarding the activities throughout the SSER that relevant to the recommendations of this plan. SSERC work groups, such as the Diadromous Fish Work Group, could be valuable partners in implementation efforts, and its members should be considered candidates for task force membership.

Additional government agencies, including Suffolk County Cooperative Extension, New York Sea Grant, and the SC SWCD, have information and educational materials at their disposal that relate to many of the subjects discussed in this Plan including best management practices (BMP), integrated pest management (IPM) and erosion and sediment control (ESC). These groups also provide educational sessions for Town personnel and residents.

Acquisition of funds available through federal and state programs discussed in Section 5.4 Sources of Funding can reduce local costs of implementation measures. Environmental permits

for waterfront projects and projects that drain to waterbodies may be required from NYSDEC, NYSDOS and USACOE.

School groups and other volunteers interested in monitoring and researching the river should partner with the Town in the development of a data bank of information on such topics as water quality and species presence.

5.2 REVISIONS TO CODES, REGULATIONS, AND ORDINANCES

The Town has implemented many of the codes and regulations recommended to reduce pollutant loads including regulations for on site clearing and land grading (Chapter 35 – Grading), ATV use (Chapter 37 - All-Terrain Vehicles) and hazardous substances regulations (Chapter 30 - Fire Prevention). In addition, the Town has adopted a Wetland Overlay District for wetlands, surface waters, adjacent buffer areas, and additional watercourse and drainage way setback requirements in the subdivision regulations. The Town should focus on the enforcement of current codes and regulations that reduce pollutants to ensure that the highest levels of compliance are met.

The Town should adopt a pet waste disposal law requiring pet owners to clean-up pet wastes from public roads, sidewalks and areas that drain to waterways. A draft Pet Waste Disposal Law is included as Appendix A to this report. The Town should also adopt an Erosion and Sedimentation Control law requiring that all development submissions include a plan for the control of unvegetated earth and drainage during and following construction.

The Town should consider modifying sections of the existing code to provide appropriate references to implementation of BMP's for marinas, storm drainage systems and sanitary systems that are referenced in this Plan.

5.3 PROGRAMS AND POLICIES

The programs and policies discussed below have been developed from the recommendations contained in Section 3.0 of this report and focus on initiatives that the Town can undertake to reduce pollutant loads to the waterway. These programs and policies can be adopted by the Town, but will generally require coordination with other municipal agencies and civic groups.

On-site Wastewater Treatment System Outreach and Education

Discharges from improperly functioning individual sanitary systems have been identified as a conduit by which pollutants are discharged and eventually impact surface waterbodies. There is currently no outreach program to educate homeowners and commercial businesses about the proper use of on-site septic systems and the need for periodic maintenance for effective operation.

Initially, the Town can establish an educational program to increase voluntary inspection and maintenance. The educational program can focus on neighborhoods near surface waters, with high groundwater tables, or older areas where septic tanks may not be installed. A more effective approach should be considered, such as the establishment of a program requiring periodic inspection and recommendations for system pump-out. One method of approach would be to require pump out, inspection and necessary maintenance and repairs be performed at the time of real property transfers or major redevelopment. This approach would most likely need to be developed and overseen by Suffolk County as they currently approve installation of sanitary systems and licensed installers. Inspections can be performed by licensed private inspectors. The SCDHS can institute additional training programs to license private system installers to conduct system inspections and certify system operations.

The Town should enforce the Town Code provision that addresses new and replacement sanitary systems in special flood areas and that establish design criteria for systems in coastal high hazard areas. The County should consider permitting the use of alternative on-site systems in new

development or redevelopment in areas where proper function of standard septic systems is precluded by high water tables.

The State of Massachusetts has implemented a program for sanitary system inspection and has developed a program to approve alternative sanitary system designs. These programs can serve as prototypes for actions that can be taken on Long Island.

Operation and Maintenance

The Town Highway Department should evaluate its local operating procedures for conformance with SPDES Phase II requirements and NYSDOT design and guidance documents, standard specifications and procedural manuals that relate to stormwater runoff abatement and control during and following construction. The Town should develop and adopt an internal review manual that outlines the relevant procedures. The Town should evaluate its street sweeping program to improve frequency and location of street sweeping in the watershed. As discussed in Section 4.4, the Town will need to develop and enact a drainage infrastructure maintenance program to ensure the proper operation of drainage infrastructure.

The Town should evaluate its system of inspecting drainage structures and determine a schedule for and frequency of inspection that will ensure that the drainage infrastructure function is maintained at the highest level of pollution capture. The Town should determine their additional needs in terms of funding, manpower and equipment that will be necessary to maintain the storm drainage structures that are installed.

A storm drain stenciling program should be implemented for the entire watershed. School and community groups may be able to assist with installation. The Town should develop a procedure for volunteer groups to follow to identify and record the locations of the stenciling on Town GIS records and for SPDES Phase II reporting.

The Town should implement an integrated pest management (IPM) program as a management measure for municipal lands including parks, schools and grounds. IPM information is available through cooperative extension programs. The IPM program can be extended to provide training to lawn and garden center personnel, lawn care companies, and large landowners. Lawn and garden center personnel and lawn care companies provide a majority of the lawn care information disseminated to consumers. An IPM educational program developed with Suffolk County cooperative extension programs or SC SWCD could be offered at Town facilities. IPM educational flyers can be developed that are distributed through these centers and lawn care companies.

Municipal Official Education

The Town should establish a non-point source pollution educational program for Town employees including personnel from Highways, Engineering, Parks, Planning, Environment and Development, and Public Safety. New York Sea Grant operates a program entitled Nonpoint Education of Municipal Officials (NEMO) - Water Quality Education that can be used to develop this program. The educational effort should include reviewers, inspectors, property managers, maintenance crews and field workers to ensure that the regulations and practices pertaining to nonpoint source management are uniformly understood and enforced.

5.4 SOURCES OF FUNDING

This section identifies sources of funding that can provide a means to finance the development of programs and implementation of improvements for the Swan River watershed.

5.4.1 Federal

5.4.1.1 National Oceanic and Atmospheric Administration (NOAA)

NOAA is responsible for providing technical assistance through the Resource Conservation and Assessment/Coastal Resources Coordinator (CRC) program. The CRC program was established to restore coastal and marine environments affected by hazardous waste releases through the development of plans and projects to address the

elimination of waste sources and the decontamination of affected sites. The CRC program offers technical assistance from a variety of professionals having expertise in evaluating ecological risk, the potential types and sources of pollutants, development and implementation of techniques for evaluating the magnitude and consequences of environmental degradation, assessment of the cost-effectiveness of strategies for remediation, and the design of monitoring protocol.

NOAA also has a Community-based Restoration Program (CRP). The NOAA CRP applies a grass-roots approach to restoration by actively engaging communities in on-the-ground restoration of fishery habitats around the nation. The CRP emphasizes partnerships and collaborative strategies built around restoring NOAA trust resources and improving the environmental quality of local communities. The Program provides seed money and technical expertise to help communities restore degraded fishery habitats, develops strong partnerships to accomplish sound coastal restoration projects, promoting significant community support and volunteer participation, instills stewardship and an abiding conservation ethic, and leverages resources through national, regional, and local partnerships. The CRP is a source of funding to implement the projects and recommendations included in Section 3.0 such as habitat restoration projects for wetland, riparian buffers and fish passage (Section 3.1) and stewardship opportunities (Section 3.2).

5.4.1.2 Federal Clean Water Act (CWA), Section 319

In 1987, Congress amended the Federal CWA by adding Subsection 319, entitled the *Nonpoint Source Management Program*. The purpose of the amendment was to provide guidance and monetary support to state and local governments for the development and implementation of non-point source initiatives.

The USEPA is authorized under subsection 319 of the CWA to distribute federal grants to states for use in state stormwater control programs and projects that have been subject

to USEPA review and approval. Grants are available for a number of non-point source ventures including financing, procurement of technical expertise, educational instruction, technology transfer, implementation of pilot projects, and the monitoring of particular non-point source projects. NYSDEC implements many of the environmental programs developed at the federal level and is responsible for distributing some federal funds to local communities. The funds can be used for both the implementation and the monitoring of the drainage improvements projects in Section 3.0

5.4.2 New York State

5.4.2.1 Coastal Zone Management Act (CZMA)

The CZMA has been instrumental in providing resources for community redevelopment initiatives such as feasibility studies, planning, engineering, and site plan development. Section 306A of the CZMA provides financial resources to coastal states for the acquisition of land for providing public access to coastal areas. NYSDOS oversees many of the State's coastal protection programs and is responsible for distributing federal funds to local communities. These funds can be used for the acquisition and preservation of lands will increase public access to the Swan River that as discussed in Section 3.3.4.1.

5.4.2.2 Transportation Equity Act for the 21st Century (TEA-21)

The Nassau Suffolk Transportation Coordinating Committee (NSTCC) is authorized to administer the initiatives of TEA-21. TEA-21 provides funding for a number of transportation-related projects including stormwater control projects that are proposed for improving environmental quality. The TEA-21 funds can be used to implement the drainage improvement projects discussed in Section 3.3.2 and detailed in Section 4.4

5.4.2.3 Clean Water Act (CWA) State Revolving Loan Fund (SRLF)

The primary purpose of the CWA SRLF is to promote water quality by funding proactive, reactive, and restoration projects and programs to protect water resources. Low-interest loans for water quality control improvements are offered to communities under the Federal government's CWA SRLF. The SRLF was initially seeded by funds provided by federal grants and the matching funds of states to finance non-point pollution sources projects that are developed in accordance with the State's *Nonpoint Source Management Plan*. Projects considered eligible for funding include acquisition of environmentally sensitive land, water body and wetland restoration projects, and erosion and sedimentation control projects. As SRLFs are amortized, the loan fund is replenished, and funds become available for dispersal to other entities for their projects. The self-sustaining nature of revolving loan programs is essential in ensuring the availability of future funding resources and the perpetuation of adequate stormwater treatment control. The SRLF grants can be used to implement the projects and recommendations included in Section 3.0 such as land acquisition as discussed in Section 3.4.1 and habitat restoration projects as discussed in Section 3.1. Although funding may be used for a variety of reasons, the fund has often been used for projects that prevent and remediate contamination from MTBE as discussed in Section 2.3.2.

5.4.2.4 New York State Environmental Protection Fund (EPF)

The EPF was created in 1993 to provide funding for environmental protection initiatives. The types of projects assisted by EPF grants have included:

- waterfront redevelopment including both planning and implementation of construction initiatives providing public access and environmental enhancements,
- development or effectuation of inter-municipal water management plans such as undertaking non-point stormwater control projects and restoration of aquatic habitats;
- projects involving the creative use of dredge spoil,
- coastal education programs, and tourism development; and,

- development and effectuation of Local Waterfront Revitalization Programs (LWRP) or other similar local initiatives.

NYSDOS DCR has the authority to issue EPF Local Waterfront Revitalization Plan grants. EPF funds are also provided to the NYSDEC for Water Quality Improvement grants for projects including those for stormwater mitigation, and the NYS Office of Parks, Recreation and Historic Preservation for grants for the acquisition and preservation of land to be included as public parklands under Title 7. The EPF grants can be used to implement the projects and recommendations included in Section 3.0 such land acquisition (Section 3.4.1), stormwater mitigation (Section 3.3), habitat restoration projects (Section 3.1), dredge spoils (Section 3.1.1.1), and education (Section 3.2).

5.4.2.5 New York Clean Water/Clean Air Bond Act

The NY Clean Water/Clean Air Bond Act provides funding for a variety of environmental improvements. Of particular relevance to the WMP is the funding available for addressing water quality issues stemming from failing septic systems, direct discharge of sewage effluent, insufficient wastewater treatment, non-point source pollution, and aquatic ecosystem degradation. Funding is available for and applicable to the WMP recommendations for water quality improvements, habitat restoration, and open space preservation. The program has specifically allocated over 30 million dollars in funding for implementing the water quality initiatives of the comprehensive conservation and management plans for the SSER and Peconic Estuary. Only municipalities and the Soil and Water Conservation Districts are eligible for this funding. Eligibility to submit funding applications is based on the following criteria:

- the anticipated effectiveness of the proposed project for meeting the goals of the respective resource management plan, project or program;
- the relative importance of the proposed project relative to others proposed under the same program or plan;
- the ability of the applicant to provide matching funds (where applicable); and,

- the necessity for using Bond Act Funds due to insufficient alternative funding sources.

The amount of State financial assistance is contingent upon the nature of the project. For example, a maximum of 85 percent of the costs would be provided for improving wastewater facilities; up to 50 percent may be allocated toward aquatic habitat restoration, pollution mitigation and abatement projects such as non-agricultural non-point source pollutant mitigation; and 75 percent for agricultural non-point pollution control projects with no owner/operator contribution and a maximum of 90 percent funding when the owner/operator contributes.

5.4.2.6 Waterfront Redevelopment

NYSDOS DCR, in cooperation with the Empire State Development Corporation and other involved state agencies, offers funding and technical support to local governments for preparing and administering waterfront development plans for derelict and underutilized waterfronts, property and structures which present a potential for redevelopment by being located within or in proximity to a business district that is served by adequate utilities and transportation infrastructure, and where development will:

- result in the creation of public access opportunities between commercial districts and the waterfront;
- significantly revitalize economic vitality in existing business districts;
- promote and expand the recreational, cultural and economic opportunities of the waterfront; and
- augment the protection of environmental resources in project areas.

Funding and technical guidance is provided for necessary planning, design, feasibility analyses, marketing, institution of economic development programs, and project completion.

Candidates for funding are chosen based upon demonstration of community leadership, the ability to develop effective partnerships with the public and governmental agencies, a willingness of the community at-large to endorse project objectives, and a reasonable expectation of economic success. Though a specific project is not currently identified for this funding, the Montauk Highway business district is located within the Swan River watershed.

5.4.3 Suffolk County

5.4.3.1 Suffolk County Water Quality Protection and Restoration Program

The County collects funds for implementation of projects that will result in the protection and/or restoration of surface water quality throughout Suffolk County through a ¼% sales tax. The program is approved though December 31, 2013. Eligible project types include nonpoint source pollution abatement and control, aquatic habitat restoration, and pollution prevention initiatives. Educational and outreach programs and projects that implement vessel waste no-discharge zones are also eligible. A major emphasis of the program is to implement recommendations of the SSER CMP. Information regarding the program and application forms is available on the Suffolk County's website. These funds can be used to implement the projects and recommendations included in Section 3.0 such stormwater mitigation (Section 3.3), habitat restoration projects (Section 3.1) and education (Section 3.2).

5.4.3.2 Suffolk County Land Acquisition Programs

The County has a total of twelve programs that provide mechanisms through which the County acquires properties for the following purposes: preserving environmentally sensitive habitats; protecting important groundwater aquifers; preserving tidal and freshwater wetlands and their associated stream corridors; providing access to the bay, sound, and ocean shorelines and beaches; developing active recreation sites for County

residents; and acquisition of farmland development rights to retain agricultural use. These programs can be used for land acquisition as discussed in Section 3.4.1.

5.4.4 Brookhaven Town

5.4.4.1 Town Capital Improvement Funding/Municipal Bonds

The Town can fund stormwater infrastructure projects, such as those discussed in Section 3.3, Section 4.3 and Section 4.4, through a variety of standard municipal financing mechanisms such as the use of Town Capital Improvement Funds and General Obligation Bonds (Municipal Bonds).

Although towns are eligible to receive lower interest rates than most other entities when they pledge the full faith and credit of their taxing authority to guarantee payment, bonding of less than one million dollars usually does not meet the minimum requirements for cost-effective underwriting and, as a result, can be prohibitively expensive to issue. One way to fund projects such as stormwater control programs is to create a multi-jurisdictional alliance that can integrate its plans and financial needs and consolidate the debt incurred by the funding process.

Consolidation of debt may include the following:

- development of a project-specific, multi-jurisdictional district;
- utilization of regional or State funding resources to finance projects; and
- consolidation of bonds of a number of local municipal entities to have one joint issue.

5.4.4.2 Joseph Macchia Environmental Preservation Capital Reserve Fund

The Town of Brookhaven has a local funding initiative that was established in memory of a former local council member, Joseph Macchia. This fund is supported by Town-collected fees and other revenues and is dedicated to the purchase of environmentally sensitive lands. The environmentally sensitive, undeveloped lands within designated areas of the Town include stream corridors of the SSER (including the Swan River), the

central pine barrens, Special Groundwater Protection Areas, and freshwater and saltwater wetland areas.

5.4.4.3 Open Space Bond Acts

The Town of Brookhaven has been engaged in an aggressive campaign to preserve open space and to protect environmentally sensitive properties using bond act funds. This strategy has been supported by voter-approved bonds of 10 million dollars in 1999, 20 million dollars in 2002, and 100 million dollars in 2004. The Town accepts nominations from the Town of Brookhaven Open Space Advisory Committee and utilizes bond act funds to negotiate for the purchase or for the development rights of properties owned by willing sellers. Among the recent acquisitions within the Swan River watershed resulting from this program are the following:

- 17.4 acres adjacent to the already Town-owned and recently designated preserve known as “Fish Thicket Preserve”.
- 5 acres of lands adjacent to other Town and County owned open space north of Fire Road in Medford.
- 18.4 acres in the northern reach of Swan River watershed. This proposed subdivision, previously known as “Heather Knolls” is situated on the Ronkonkoma Moraine.

Approximately 285 acres of property still in private ownership within the Swan River watershed have received an Open Space Committee recommendation for public acquisition, and could be targeted for acquisition negotiations. However, only 5 percent of the bond act funds remain for open space purchases. The Town of Brookhaven is currently considering promoting a Community Preservation Fund, which could provide a new revenue stream for open space acquisitions, through the imposition of a real estate transfer tax, which would be levied during certain real estate transactions. This proposal would be placed before the public for a ballot referendum.

5.4.5 Non-governmental Sources of Funding

5.4.5.1 New York State Marine Education Association South Shore Estuary Learning Facilitator Program

The New York State Marine Education Association (NYSMEA,) has received a grant for the "South Shore Estuary Learning Facilitator Program (SSELF)" from The ERM Group Foundation, Inc. Environmental Resource Management (ERM,) is a globally active environmental consulting firm. Under this $8,000 grant for the 2007 calendar year, NYSMEA, in cooperation with the SSER Office, will provide guidance to several schools and/or environmentally oriented groups on stewardship projects within the SSER. Lou Siegel, SSER Science Coordinator, will be the Estuary Learning Facilitator (ELF) coordinating activities carried out under the grant. This funding source can help facilitate high school program collaboration discussed in Sections 3.3.4 and 3.4.2.

5.5 PHASE II STORMWATER PERMIT COMPLIANCE

In 1990, EPA promulgated rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) stormwater program. The Phase I program for MS4s required operators of medium and large MS4s, that is, those that generally serve populations of 100,000 or greater, to implement a stormwater management program as a means to control polluted discharges from these MS4s. The Stormwater Phase II Rule extends coverage of the NPDES stormwater program to certain small MS4s but takes a slightly different approach to how the stormwater management program is developed and implemented. NYSDEC acts as the NPDES permit-issuing authority for the state and has issued requirements for two SPDES general permits for stormwater runoff.

Polluted stormwater runoff is often transported to municipal separate storm sewer systems (MS4s) and ultimately discharged into local surface waters without treatment. The EPA's Stormwater Phase II Rule establishes an MS4 stormwater management program that is intended to improve the Nation's waterways by reducing the quantity of pollutants that stormwater picks up and carries into storm sewer systems during storm events. When these pollutants are

deposited into nearby waterways, they can impair the waterways, thereby discouraging recreational use of the resource, contaminating drinking water supplies and interfering with the suitability of habitat for fish, other aquatic organisms, and wildlife. The EPA established six minimum measures outlining the Phase II program:

- **Public Education and Outreach**: Distributing educational materials and performing outreach to inform citizens about the impacts polluted stormwater runoff discharges can have on water quality. As of *the 2005 Stormwater Management Program Annual Report,* Brookhaven has developed educational programs for presentation at its Nature Center and for temporary display, designed and distributed a stormwater brochure, created stormwater posters, distributed stormwater related press releases and expanded their stormwater page on the Town website.
- **Public Participation/Involvement**: Providing opportunities for citizens to participate in program development and implementation, including effectively publicizing public hearings and/or encouraging citizen representatives on a stormwater management panel. As of the *2005 Stormwater Management Program Annual Report*, Brookhaven has created specific resident advisory committees for WMP's and Harbor Management Plans in addition to the broader scaled Conservation Advisory Committee that discusses Town-wide environmental issues. The Town is planning to implement storm-drain stenciling and "adopt a stream" programs.
- **Illicit Discharge Detection and Elimination**: Developing and implementing a plan to detect and eliminate illicit discharges to the storm sewer system, including developing a system map and informing the community about hazards associated with illegal discharges and improper disposal of waste). As of the *2005 Stormwater Management Program Annual Report*, Brookhaven is planning an expanded Town-wide program to identify and map all outfall structures, input structures such as catch basins, manholes and leaching wells, connectivity, and illicit discharges. Public education efforts and revisions to Town Codes will be considered when mapping is completed.
- **Construction Site Runoff Control**: Developing, implementing, and enforcing an erosion and sediment control program for construction activities that disturb one or more acres of

land (controls could include silt fences and temporary stormwater detention ponds). As of the *2005 Stormwater Management Program Annual Report*, Brookhaven has begun to review the Town Code chapters that will require revision to comply with Phase II Stormwater Program Standards including Grading (Chapter 35), Building Permits and Certificate of Occupancy (Article III of Chapter 85), Site Plan Review (Article VI of Chapter 85), and Subdivision Regulations (Chapter SR) to address the development of Stormwater Pollution Prevention Plans (SWPP) and inspection and enforcement efforts during and after construction.

- **Post-Construction Runoff Control**: Developing, implementing, and enforcing a program to address discharges of post-construction stormwater runoff from new development and redevelopment areas. Applicable controls could include preventative actions such as protecting sensitive areas (e.g., wetlands) or the use of structural BMPs such as grassed swales or porous pavement. As of the *2005 Stormwater Management Program Annual Report*, Brookhaven will address post-construction runoff control in the construction phase controls discussed above
- **Pollution Prevention/Good Housekeeping**: Developing and implementing a program with the goal of preventing or reducing pollutant runoff from municipal operations. The program must include municipal staff training on pollution prevention measures and techniques (e.g., regular street sweeping, reduction in the use of pesticides or street salt, or frequent catch basin cleaning). As of the *2005 Stormwater Management Program Annual Report*, Brookhaven has continued improvements to stormwater infrastructure through retrofits and installation of new drainage structures. Eighty-eight new structures were installed in 2004 and a catch basin filtration inserts were installed at Lake Ronkonkoma. In addition, the Town is undertaking identification and mapping of all drainage infrastructure connected to outfalls. The mapping will be used to enhance municipal maintenance procedures. Employee training sessions are planned on pollution prevention and good housekeeping procedures.

The WMP overlaps all of the measures included in the SPDES Phase II implementation. The most significant overlaps are with regards to public outreach and education, illicit discharge detection and elimination, and pollution prevention/good housekeeping. The WMP provides

recommendations for educational opportunities, includes infrastructure system mapping of surface water discharges, and identifies priority actions and target projects where municipal agencies resources can produce pollution reduction solutions.

5.6 MONITORING AND ASSESSMENT

Monitoring methodologies should be developed to determine the degree to which the goals, objectives, standards, and management practices discussed in the WMP are being implemented and to assess the implementation success with regards to pollution reduction and habitat health. All monitoring programs should be required to address methods to ensure quality control and quality assurance. The use of the GIS to integrate the collected data into the Town system will allow the non-graphical data (e.g. inspection dates, maintenance, materials, etc.) to be analyzed with regards to the graphical data (e.g. drainage structure and outfall locations, topography, land use, etc.). The USEPA's *Better Assessment Science Integrating Point and Nonpoint Sources (BASINS)* program integrates GIS, national watershed data, and environmental assessment and modeling tools in a single package. GIS provides the ability to analyze the collected data, which, in turn, can improve data collection methods, systems tracking, and program evaluation. The main components of the WMP that can be monitored and assessed include water quality, habitat restoration efforts and nonpoint pollution control implementation.

As discussed in Section 3.3.1.1, water quality testing procedures should be in accordance with the established protocols. *Volunteer Stream Monitoring: A Methods Manual (EPA 841-B47-003 and Volunteer Lake Monitoring: A Methods Manual (EPA 440-4-91-00*) provide protocols and procedures for programs conducted by volunteers. Testing protocols and results should be reviewed by qualified professionals for quality control and quality assurance and to ensure that the data meets standards that allow for comparison to prior results or to data from other watershed. Testing methods, protocols and location selection should follow standard protocols identified for all tributaries within the SSER for comparative analysis.

Stream restoration projects should be monitored and evaluated in accordance with the USDA *Stream Corridor Restoration: Principles, Processes and Practices, Chapter 6B*. Post construction protocols should be tailored for the specific river segment and project. The monitoring should include at a minimum a work plan outlining the general objectives, and the evaluation tools and criteria that are necessary for the type of project implemented. The plan should include monitoring procedures and performance criteria, monitoring parameters, methods duration, periods evaluating procedures, and directions for alternative actions and adaptive management measures when required. Similar programs can be developed for upland restoration projects.

Wetland restoration projects should be monitored in accordance with the *NYS Salt Marsh Restoration and Monitoring Guidelines* protocols. The post-construction protocols should be tailored for the specific project and include, at a minimum, a work plan outlining monitoring parameters and activities, project transects, quadrats and fixed point photo stations locations, establishment of a reference site location, vegetative species occurrences, soil properties, benthic invertebrates in quadrats, invasive species and macro fauna. Standard reporting forms should be developed for recording the monitoring data and results. Similar programs can be developed for freshwater wetland restoration projects.

Monitoring the implementation of nonpoint source control measures should be in accordance with the USEPA publications *Techniques for Tracking, Evaluating, and Reporting the Implementation of Nonpoint Source Control Measures – Urban* (2001) and *Monitoring Guidance for Determining the Effectiveness of Nonpoint Source Controls* (1997). Monitoring plans should include at a minimum an inspection program, maintenance oversight, and implementation confirmation. The inspection program should include a system to inspect all drainage structures in the drainage areas and data recording to establish a pattern of maintenance requirements. Maintenance oversight should include a centralized system to record monitoring results and maintenance information (a GIS-based system connected to drainage structure mapping is recommended), standards forms to complete for each inspection and cleaning event, and

management team to administer, coordinate and schedule the maintenance program. Implementation confirmation should include a record of the recommendations enacted, the success of each, their effectiveness in improving water quality and identification of modifications. Data management is important to the success of the monitoring effort. The system used should address quality control and quality assurance for handling and storage of data.

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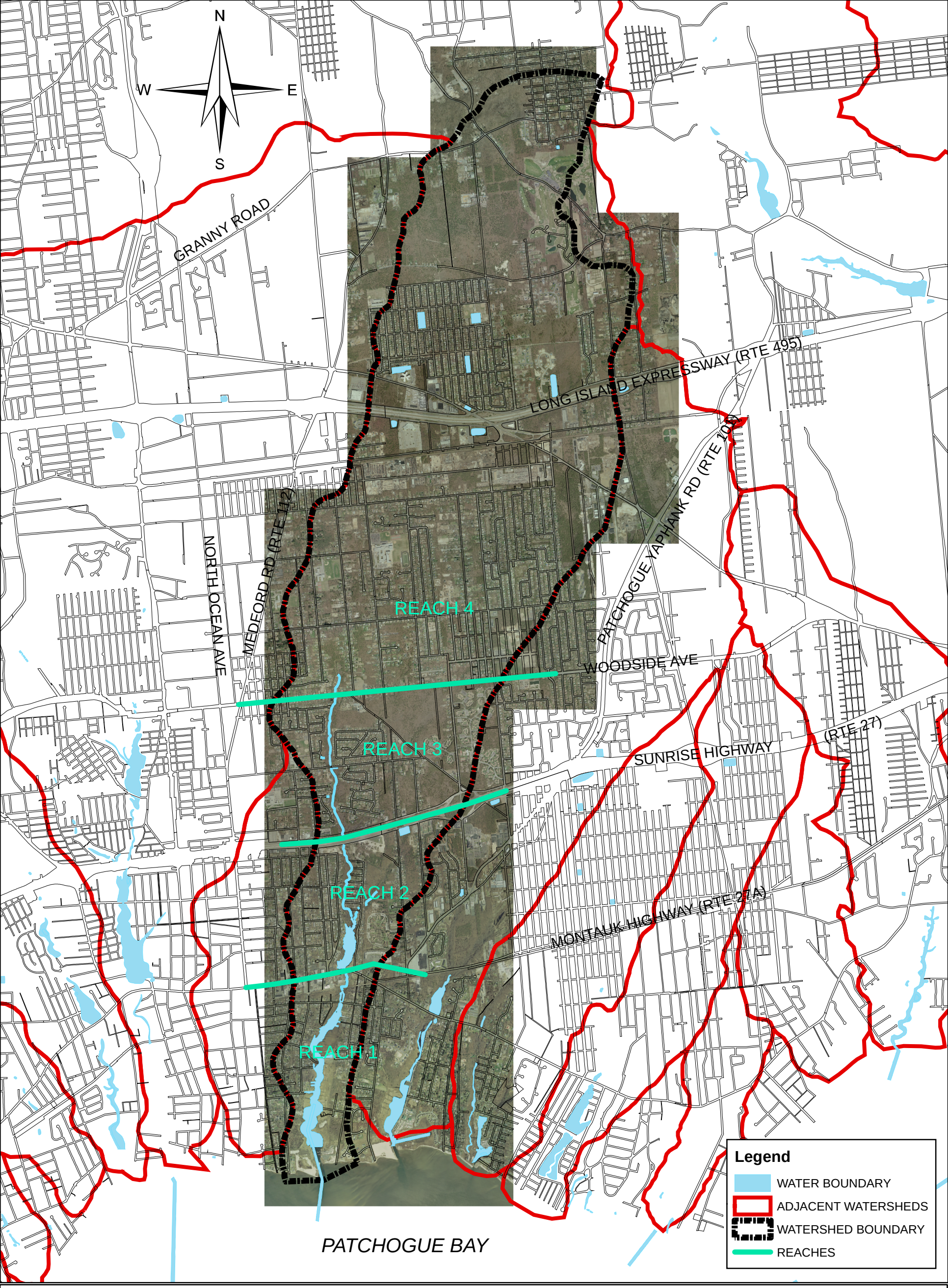
Swan River
Watershed Management Plan
Figures



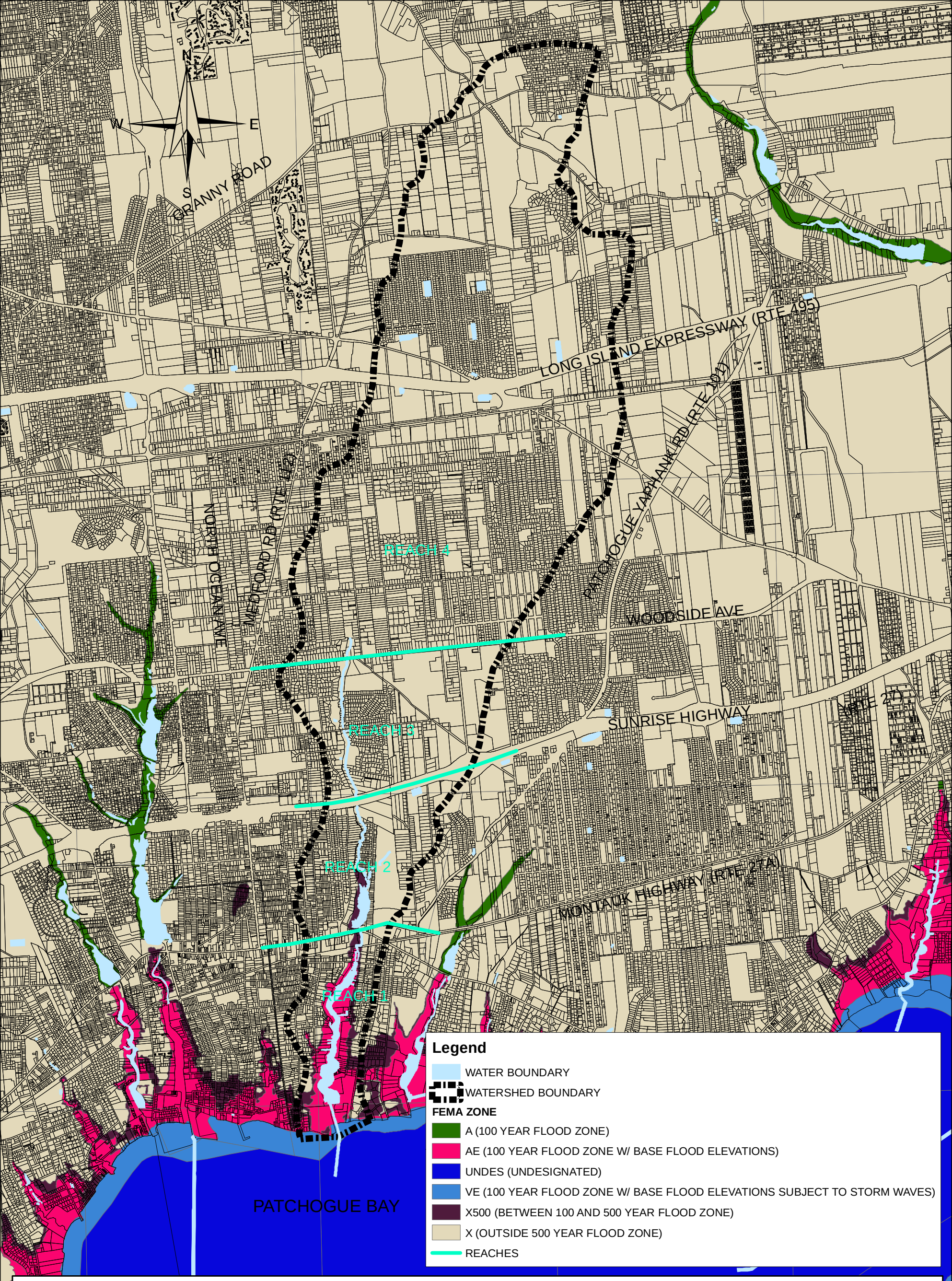
Cashin Associates

SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR
AERIAL PHOTOGRAPHY: NYS GIS CLEARINGHOUSE (2004)

0 1,250 2,500 5,000 7,500 10,000 Feet

0 0.25 0.5 1 1.5 2 Miles

FIGURE 2.1
SWAN RIVER
WATERSHED MANAGEMENT PLAN
AERIAL WATERSHED BOUNDARY



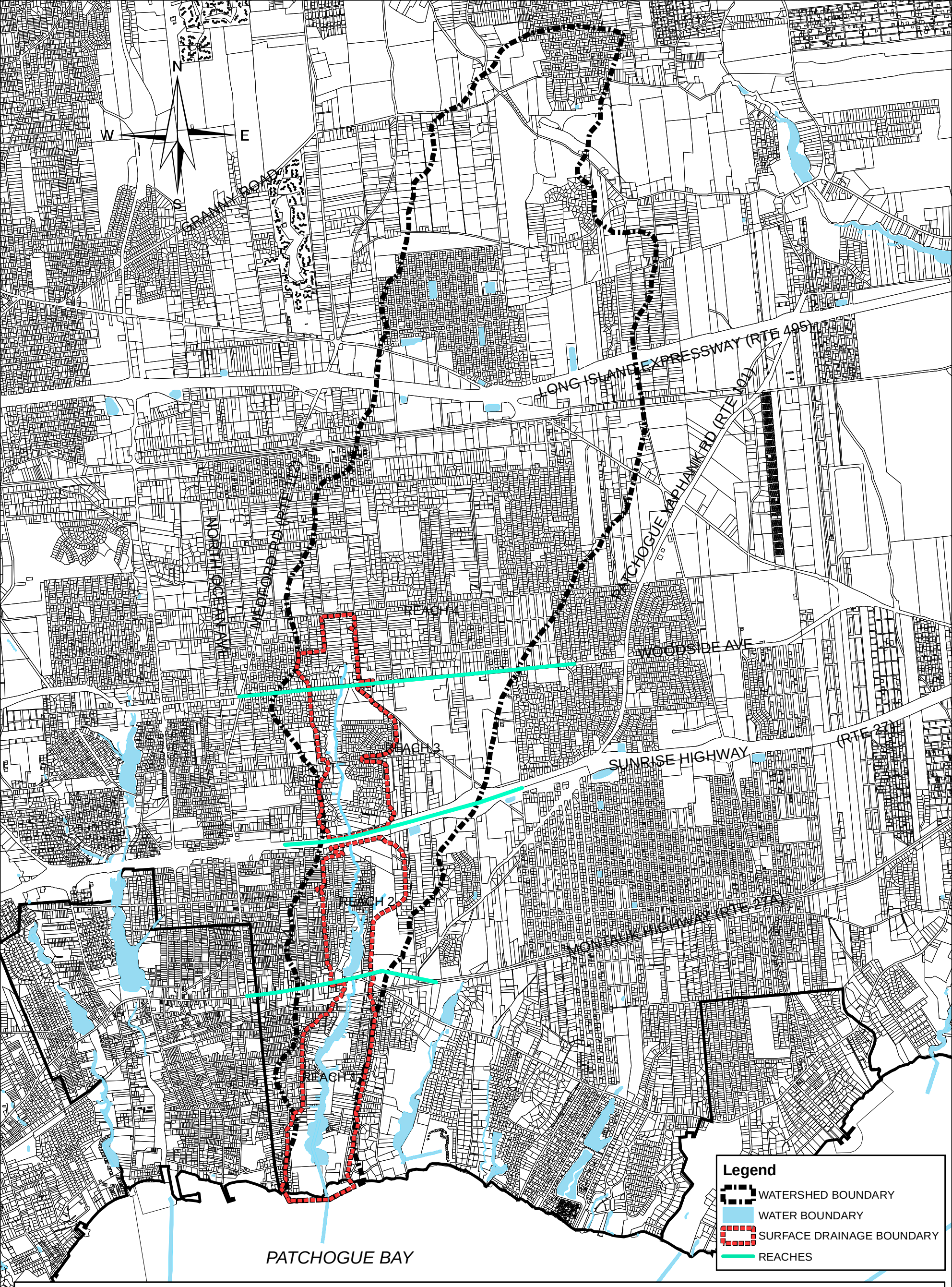
Cashin Associates

SOURCES:
WATERSHED BOUNDARY: NYSDOS DCR
FLOOD ZONES: FEDERAL EMERGENCY MANAGEMENT AGENCY

0 1,250 2,500 5,000 7,500 10,000 Feet

0 0.25 0.5 1 1.5 2 Miles

FIGURE 2.2.2
SWAN RIVER WATERSHED MANAGEMENT PLAN FLOOD ZONES



SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

0 1,250 2,500 5,000 7,500 10,000 Feet

0 0.25 0.5 1 1.5 2 Miles

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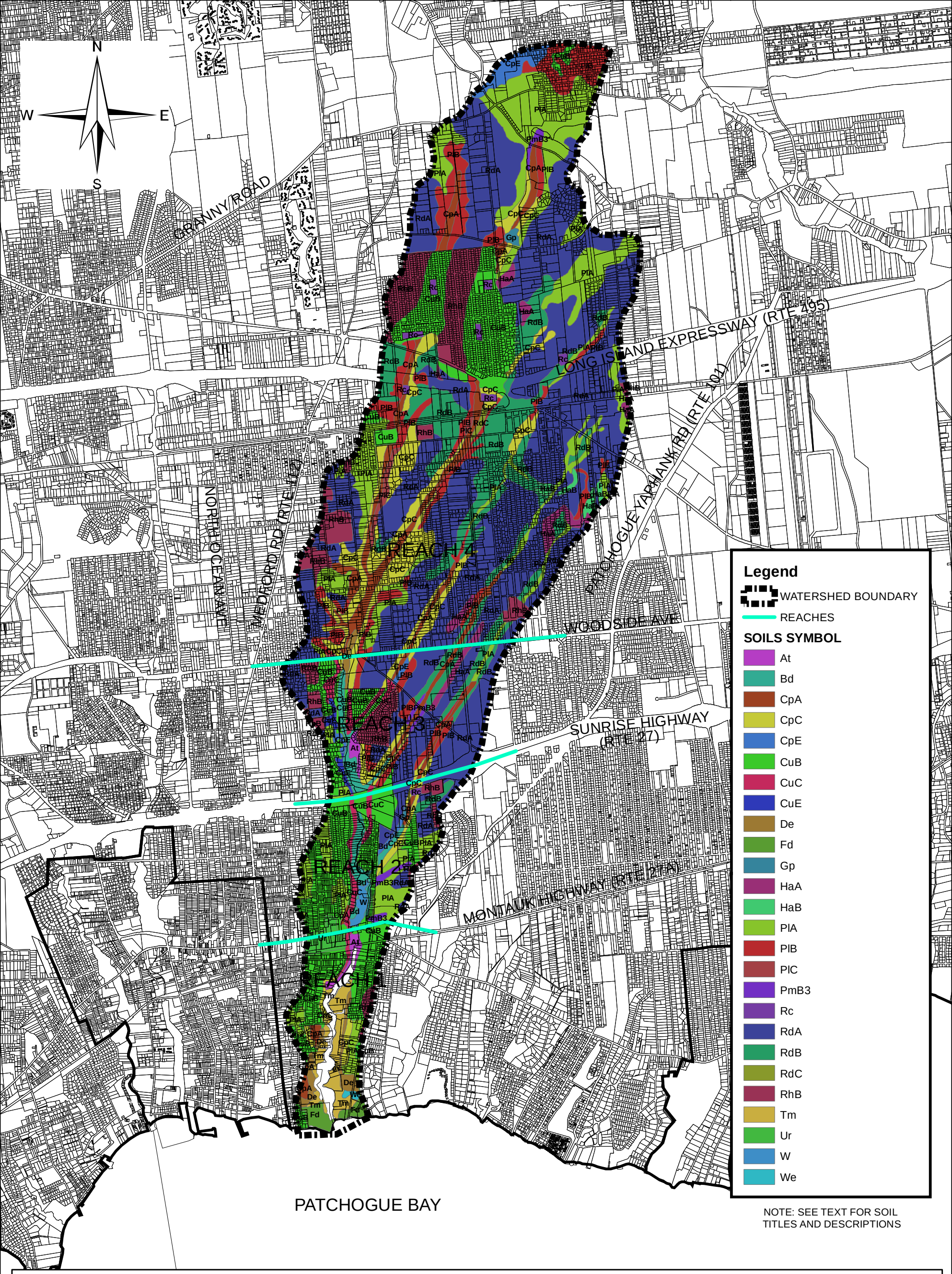
FIGURE 2.2.3
SWAN RIVER
WATERSHED MANAGEMENT PLAN
SURFACE DRAINAGE BOUNDARY
AND REACHES



NOTE: SEE TEXT FOR SOIL TITLES AND DESCRIPTIONS

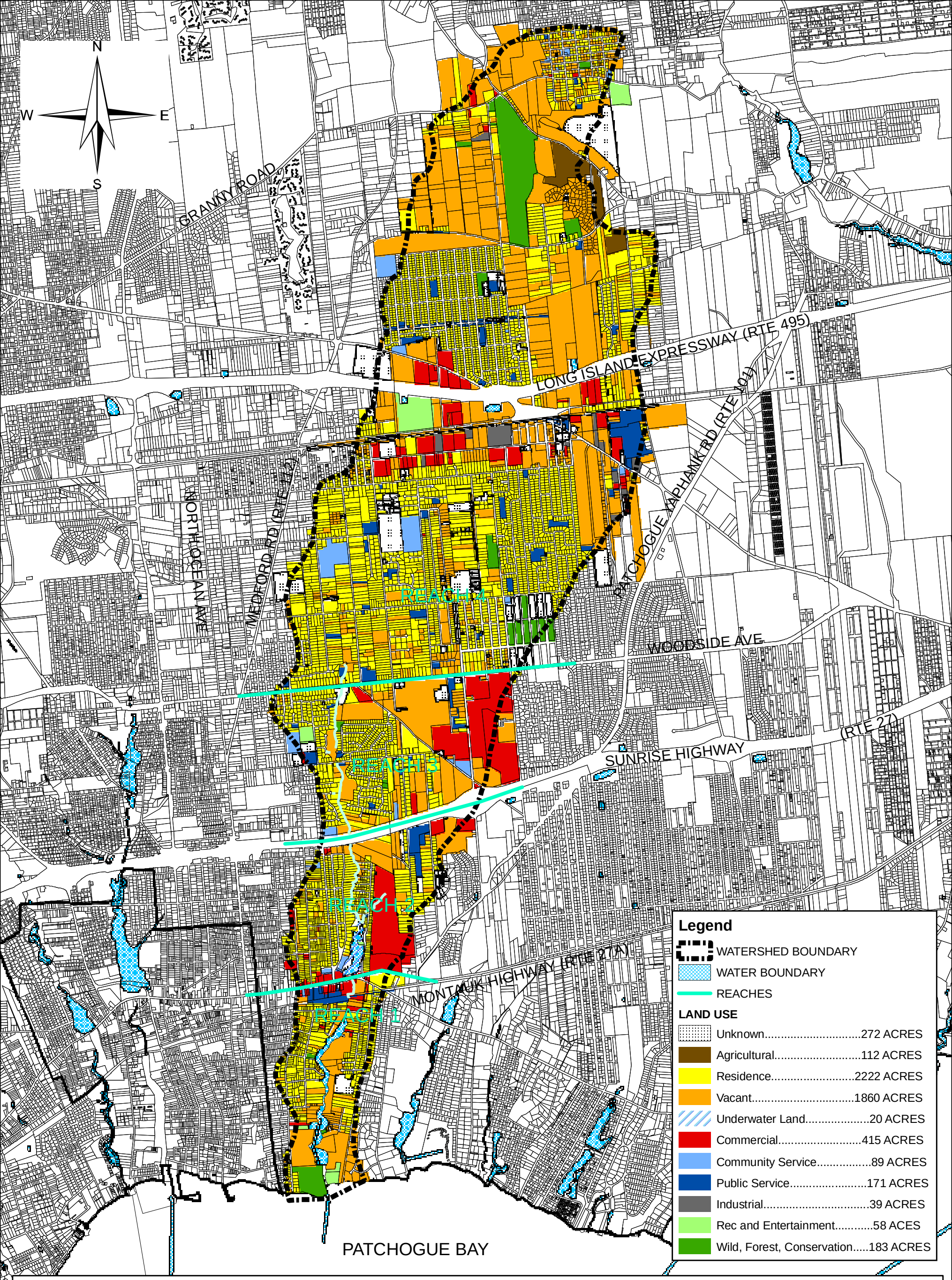
Cashin Associates

SOURCES:
WATERSHED BOUNDARY: NYSDOS DCR
SOILS: SUFFOLK COUNTY SOIL SURVEY, USDA

0 1,250 2,500 5,000 7,500 10,000 Feet

0 0.25 0.5 1 1.5 2 Miles

FIGURE 2.2.4
SWAN RIVER WATERSHED MANAGEMENT PLAN SOILS



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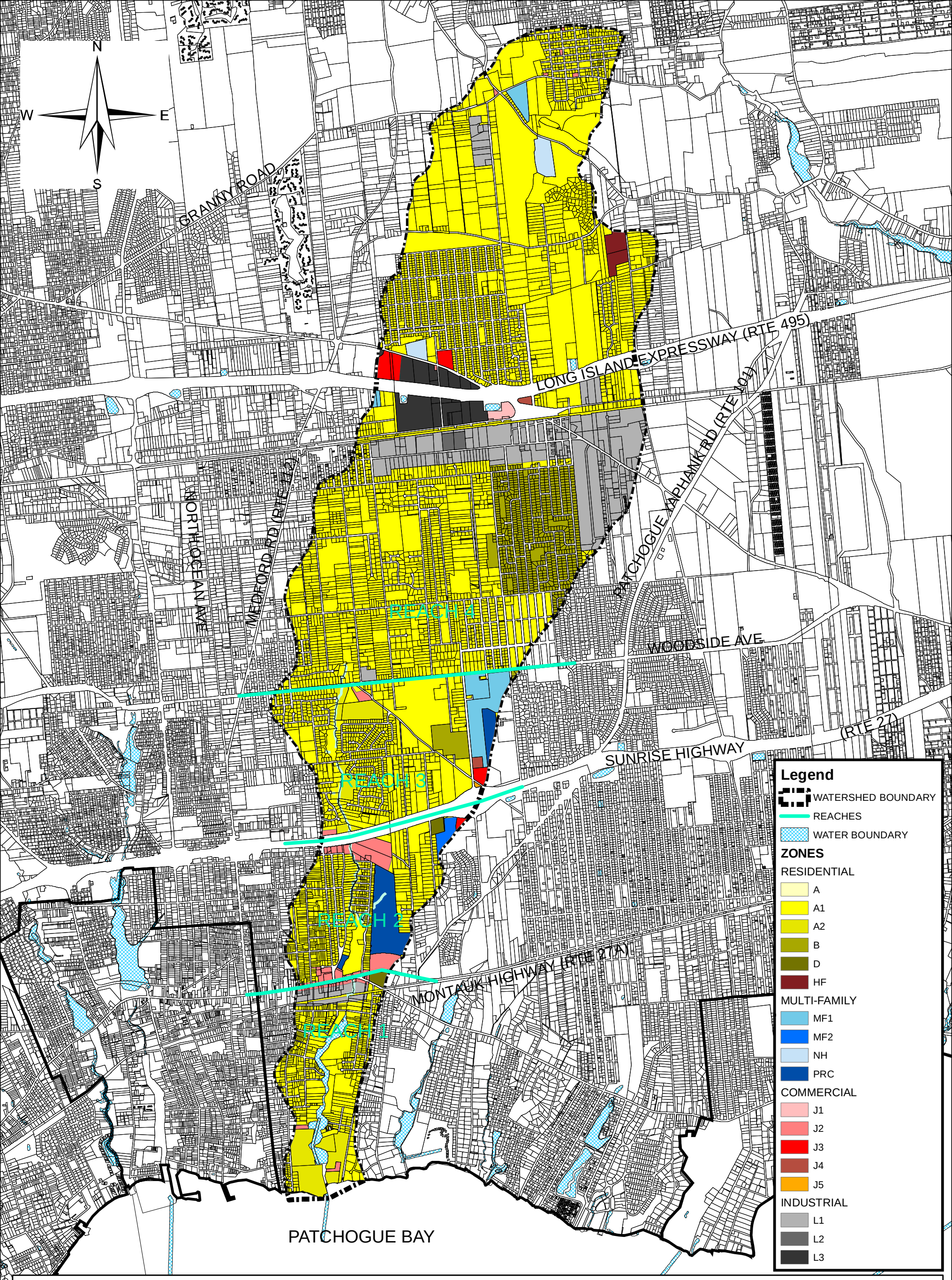
SOURCES:
WATERSHED BOUNDARY: NYSDOS DCR
LAND USE: TOWN OF BROOKHAVEN GIS

LAND USE ON THIS FIGURE IS FOR THE SOLE USE OF THIS PLAN. OFFICIAL LAND USE MAP IS LOCATED AT TOWN HALL.

0 1,250 2,500 5,000 7,500 10,000 Feet

0 0.25 0.5 1 1.5 2 Miles

FIGURE 2.2.6
SWAN RIVER WATERSHED MANAGEMENT PLAN LAND USE



Cashin Associates

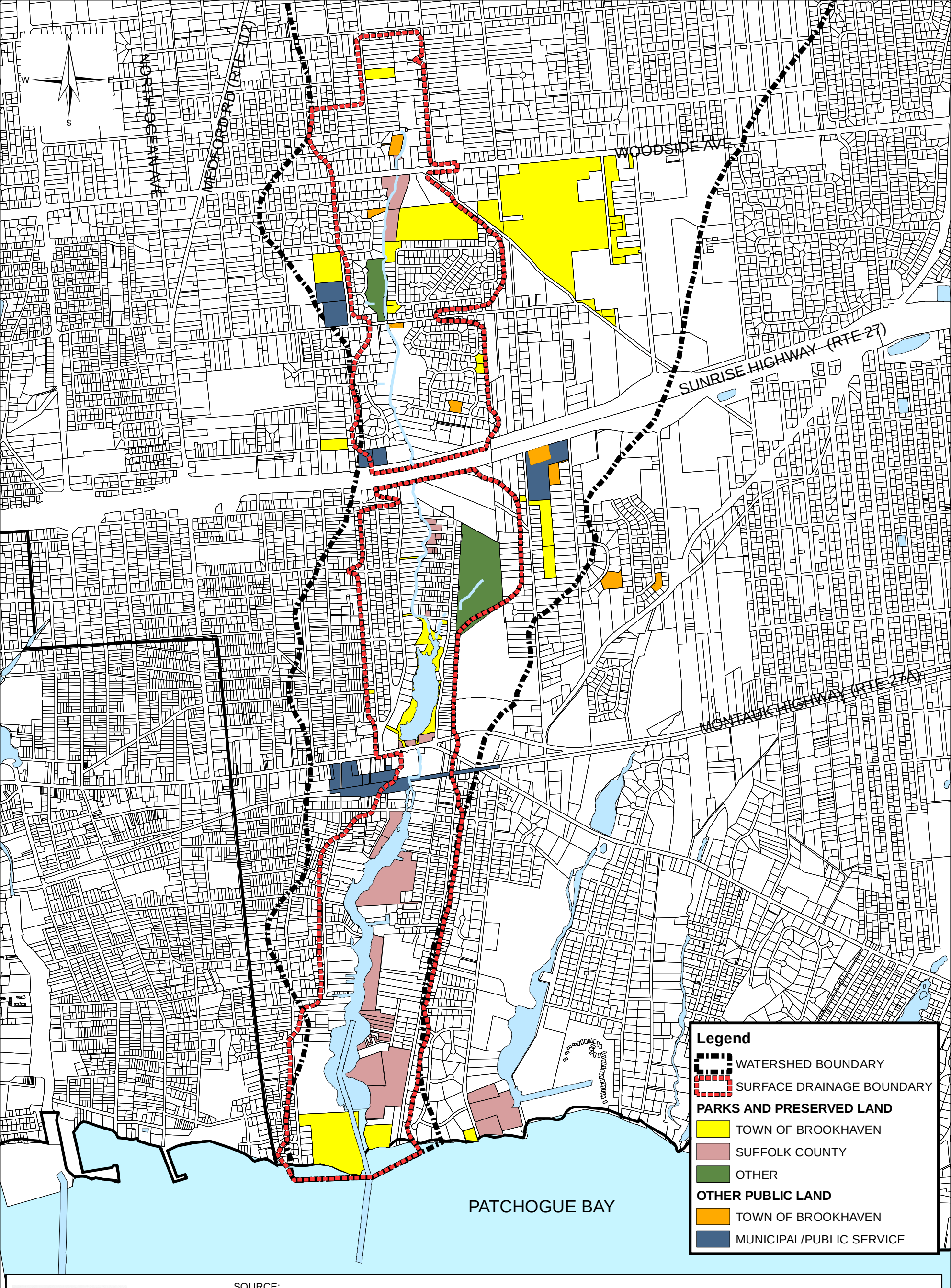
SOURCES:
WATERSHED BOUNDARY: NYSDOS DCR
LAND USE: TOWN OF BROOKHAVEN GIS (2003)

ZONING ON THIS FIGURE IS FOR THE SOLE USE OF THIS PLAN. OFFICIAL ZONING MAP IS LOCATED AT TOWN HALL.

0 1,250 2,500 5,000 7,500 10,000 Feet

0 0.25 0.5 1 1.5 2 Miles

FIGURE 2.2.7
SWAN RIVER WATERSHED MANAGEMENT PLAN ZONING



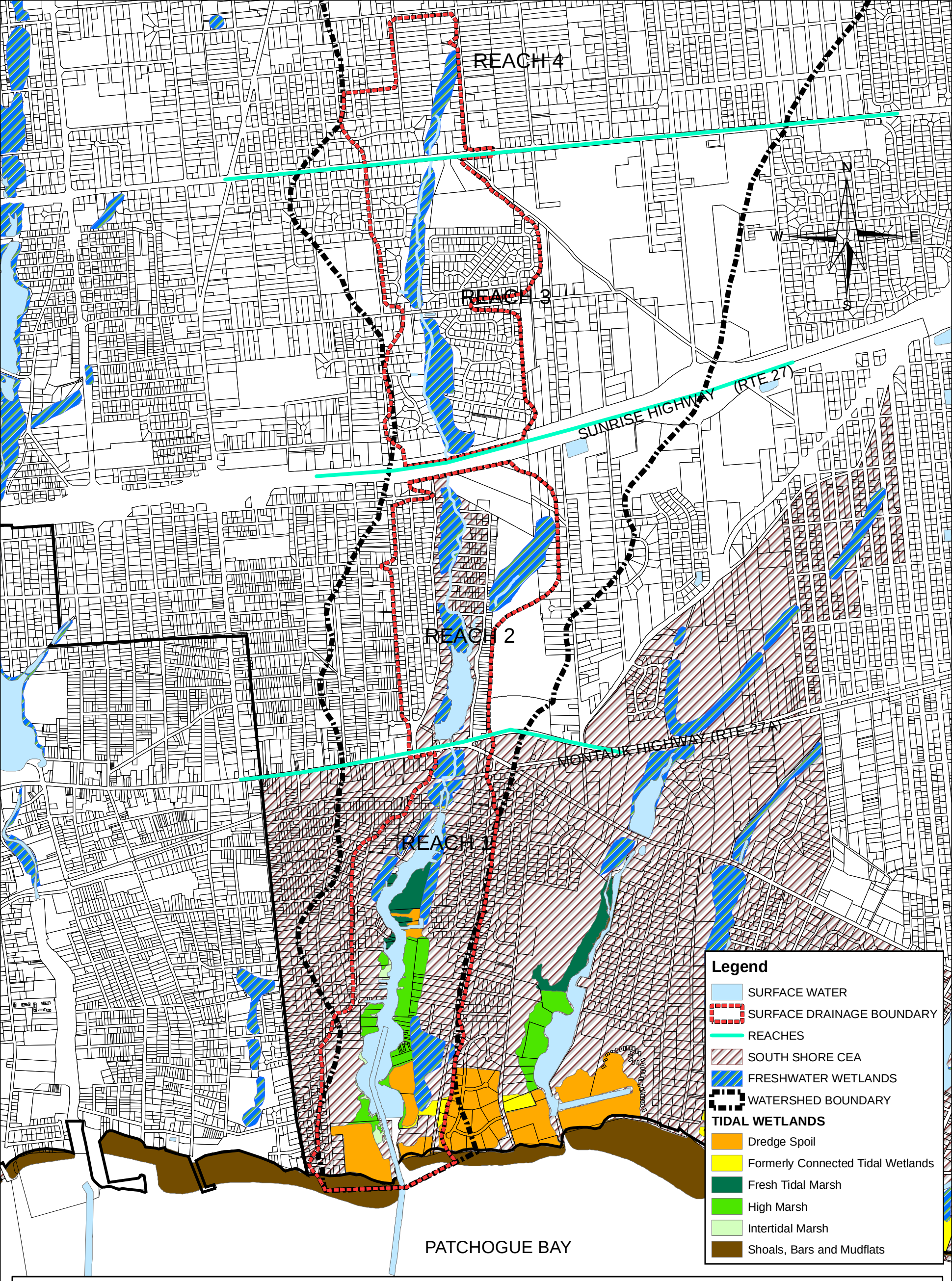
Cashin Associates

SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

0 500 1,000 2,000 3,000 4,000 Feet

0 0.125 0.25 0.5 0.75 1 Miles

FIGURE 2.2.8
SWAN RIVER
WATERSHED MANAGEMENT PLAN
PUBLICLY OWNED LANDS



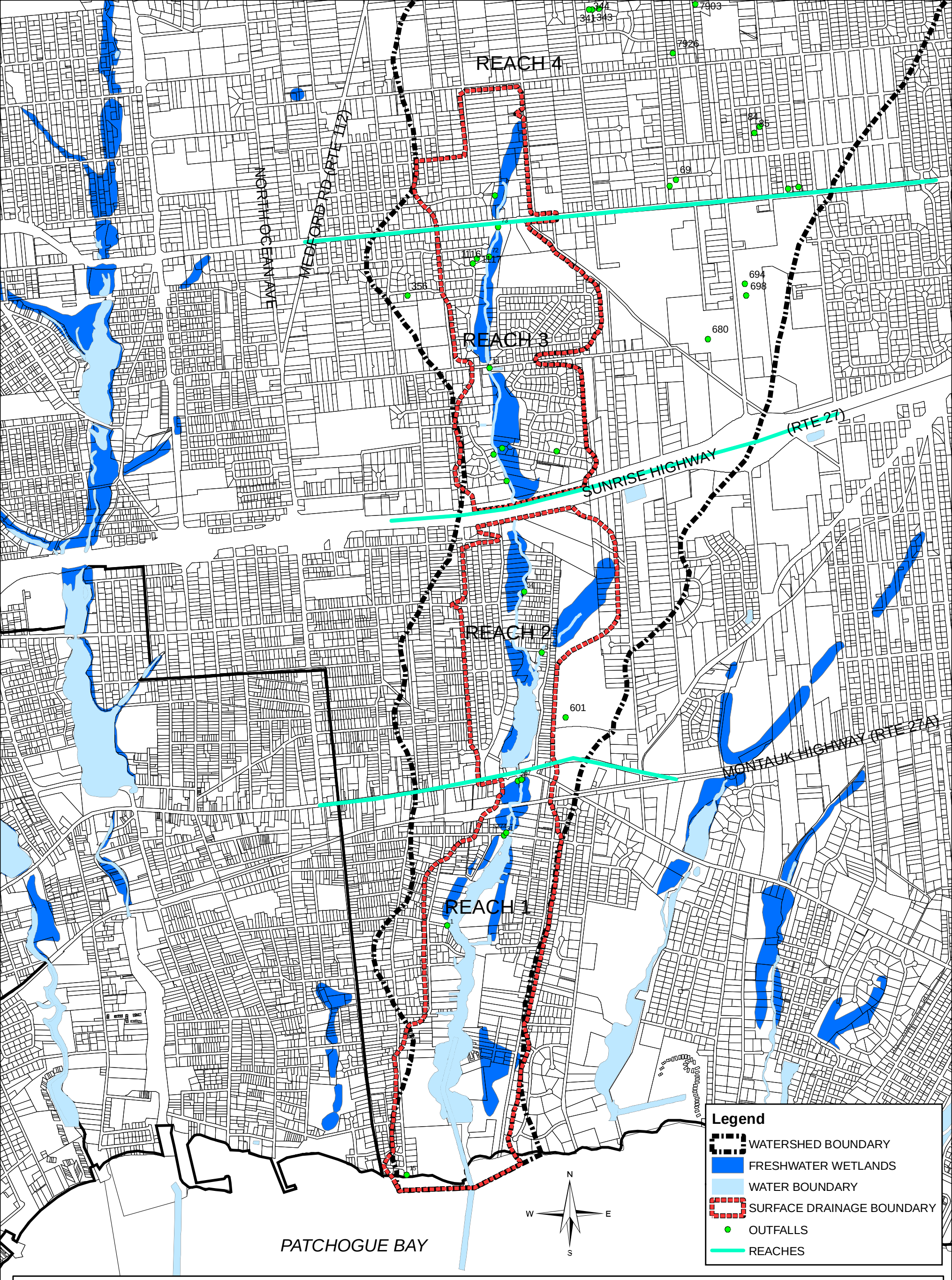
Cashin Associates

SOURCES:
WATERSHED BOUNDARY: NYSDOS DCR
WETLANDS: NYSDEC
CEA: NYSDEC

0 500 1,000 2,000 3,000 4,000 Feet

0 0.125 0.25 0.5 0.75 1 Miles

FIGURE 2.2.9
SWAN RIVER
WATERSHED MANAGEMENT PLAN
CRITICAL ENVIRONMENTAL AREA
AND TIDAL / FRESHWATER WETLANDS



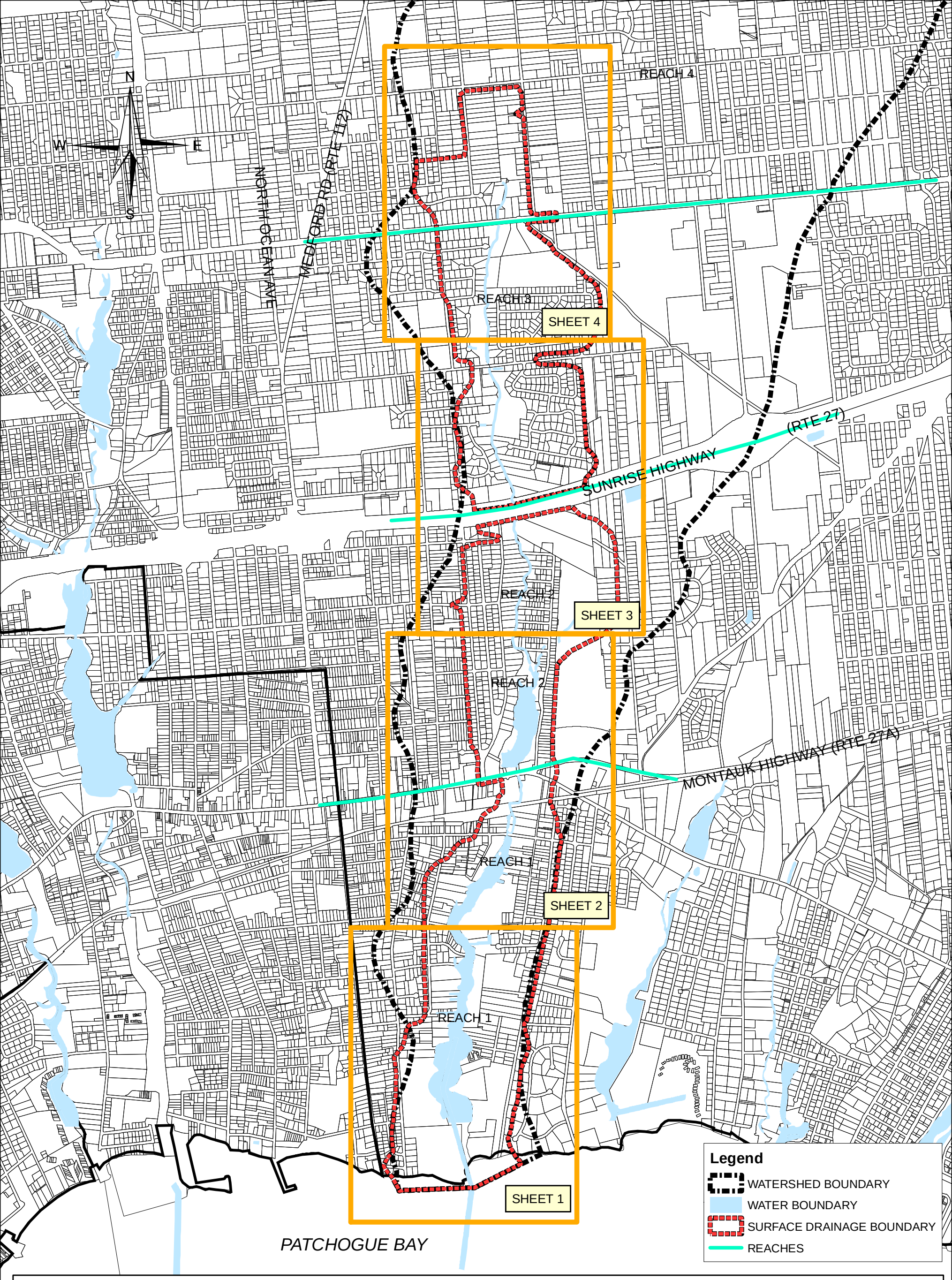
SOURCE:
WATERSHED BOUNDARY : NYSDOS DCR

0 500 1,000 2,000 3,000 4,000 Feet

0 0.125 0.25 0.5 0.75 1 Miles

Cashin Associates

FIGURE 2.4.1
SWAN RIVER
WATERSHED MANAGEMENT PLAN
OUTFALL LOCATION MAP



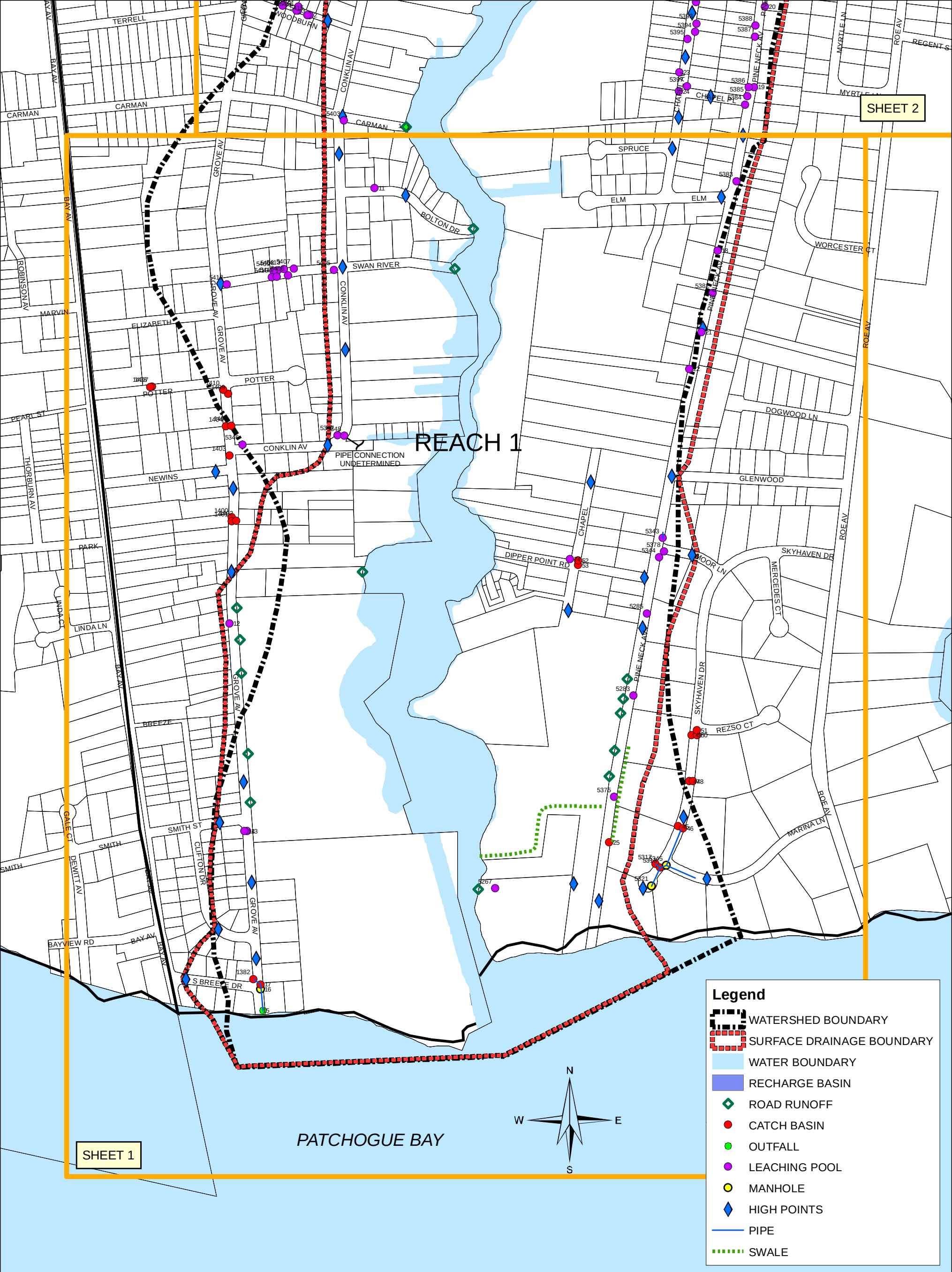
SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

0 550 1,100 2,200 3,300 4,400 Feet

0 0.125 0.25 0.5 0.75 1 Miles

Cashin Associates

FIGURE 2.4.3
SWAN RIVER
WATERSHED MANAGEMENT PLAN
DRAINAGE STRUCTURE
KEY MAP



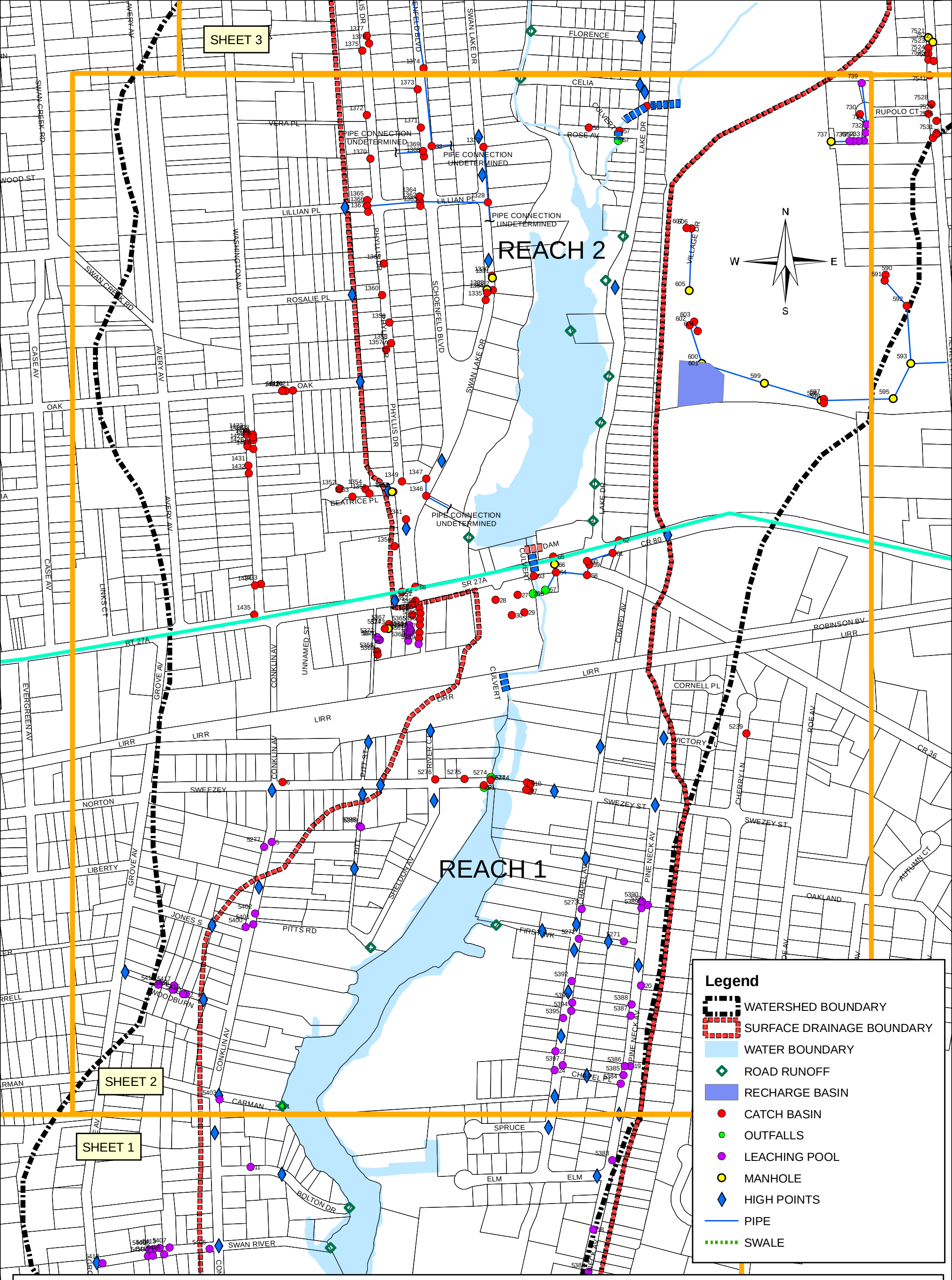
Cashin Associates

SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

0 250 500 1,000 1,500 2,000 Feet

0 0.05 0.1 0.2 0.3 0.4 Miles

FIGURE 2.4.3.1
SWAN RIVER
WATERSHED MANAGEMENT PLAN
DRAINAGE STRUCTURES 1



Legend

- WATERSHED BOUNDARY
- SURFACE DRAINAGE BOUNDARY
- WATER BOUNDARY
- ROAD RUNOFF
- RECHARGE BASIN
- CATCH BASIN
- OUTFALLS
- LEACHING POOL
- MANHOLE
- HIGH POINTS
- PIPE
- SWALE

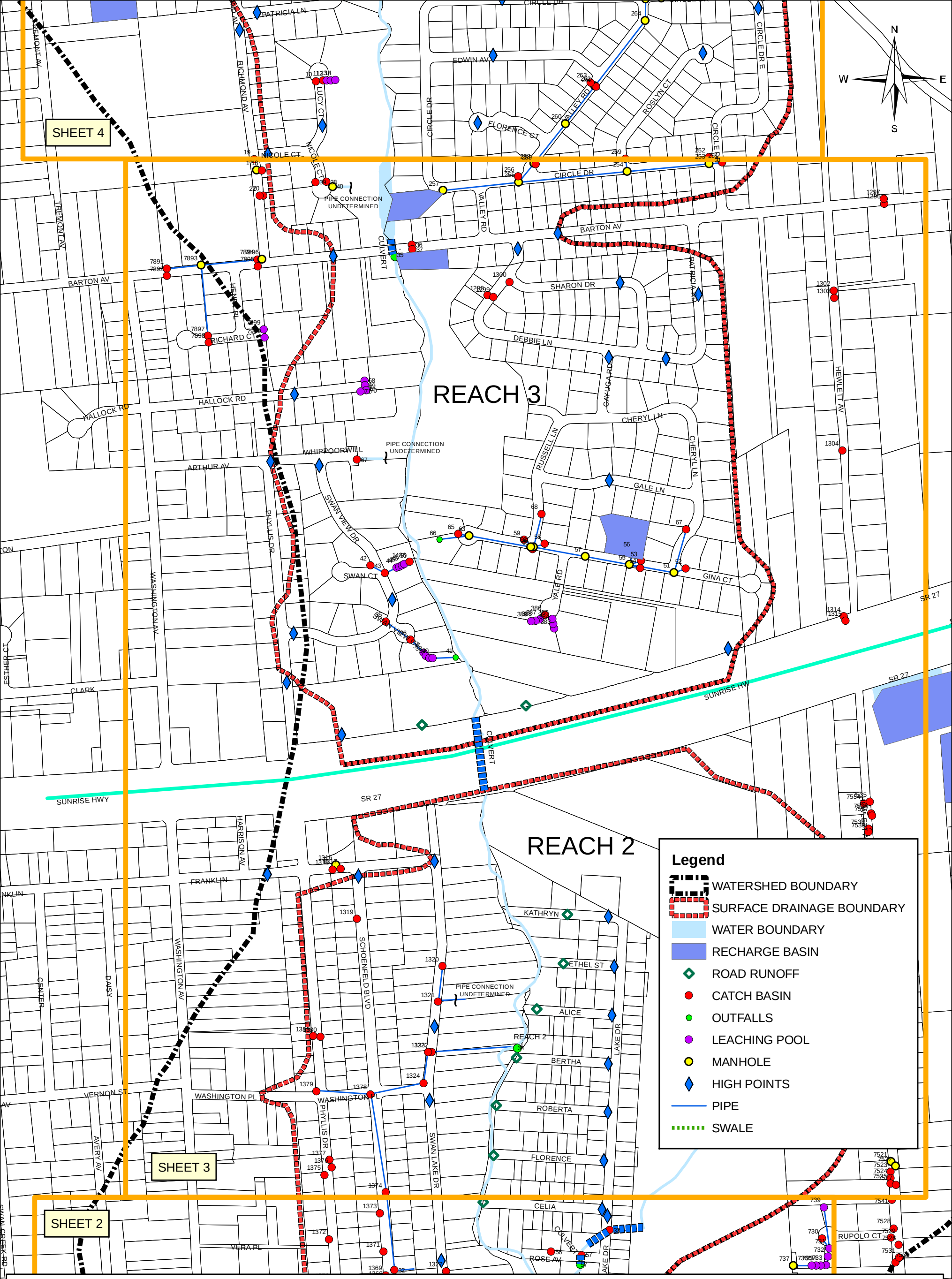
SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

Cashin Associates

0 250 500 1,000 1,500 2,000 Feet

0 0.05 0.1 0.2 0.3 0.4 Miles

FIGURE 2.4.3.2
SWAN RIVER
WATERSHED MANAGEMENT PLAN
DRAINAGE STRUCTURES 2



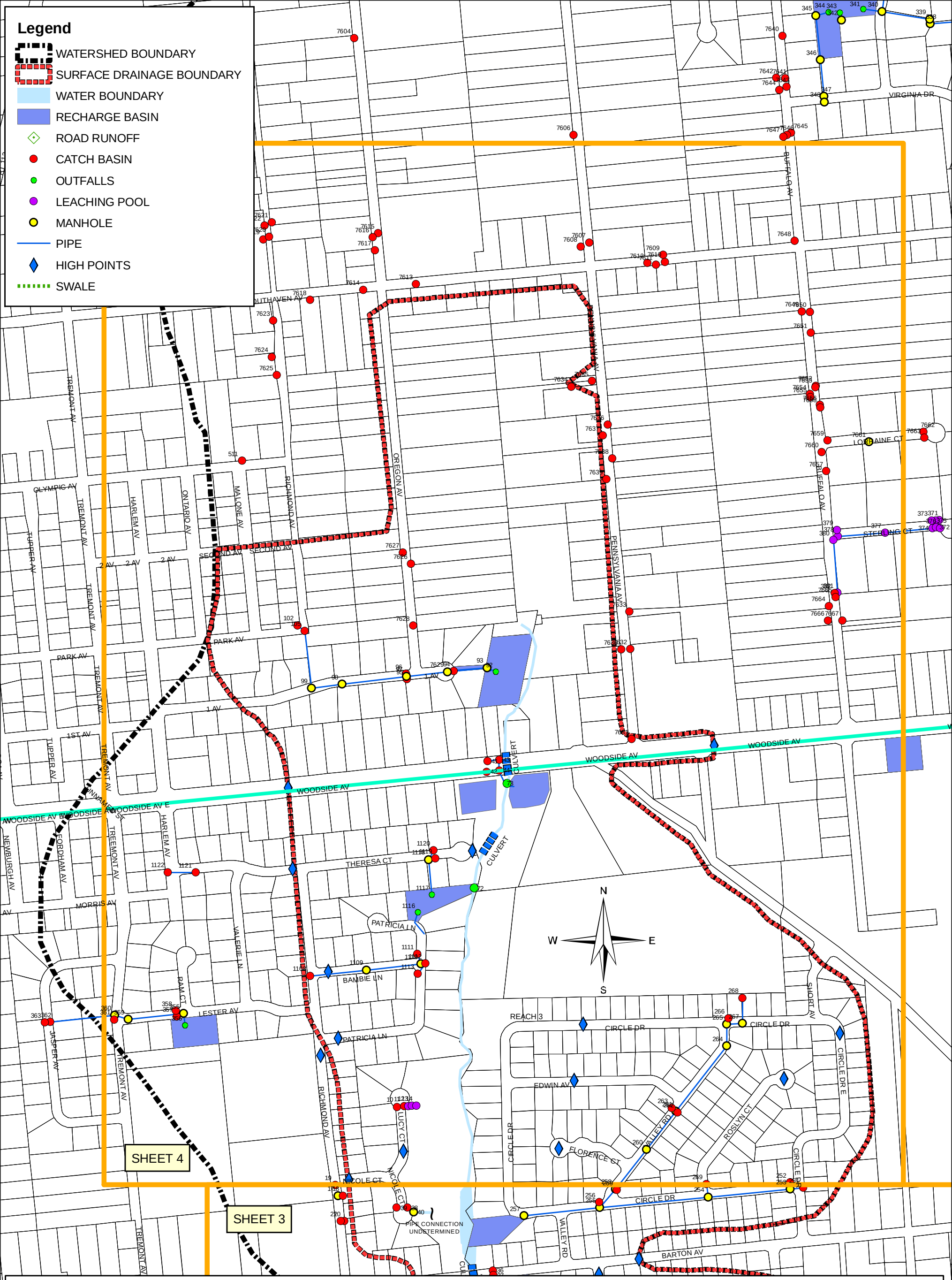
SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

Cashin Associates

0 250 500 1,000 1,500 2,000 Feet

0 0.05 0.1 0.2 0.3 0.4 Miles

FIGURE 2.4.3.3
SWAN RIVER
WATERSHED MANAGEMENT PLAN
DRAINAGE STRUCTURES 3



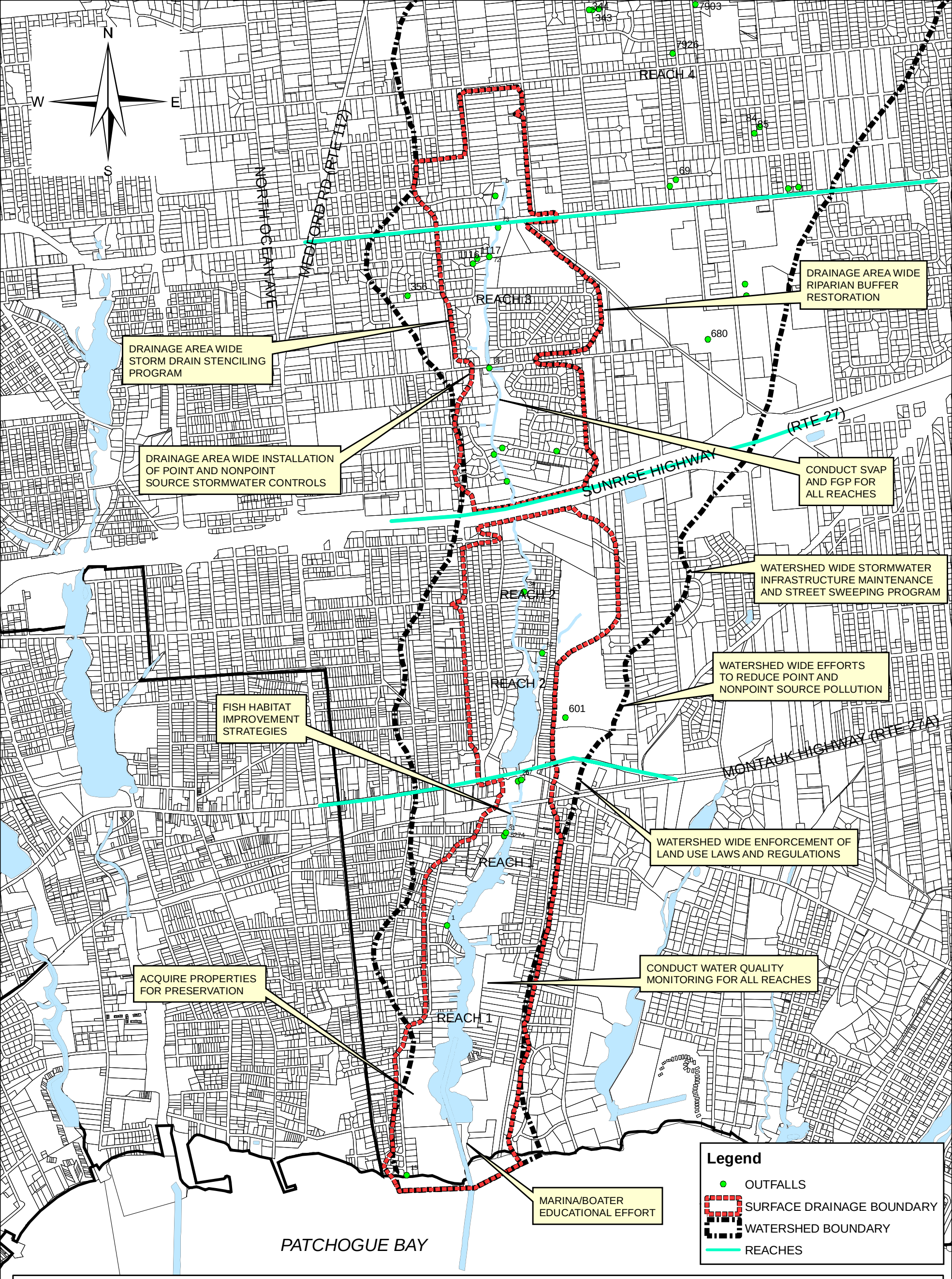
SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

0 250 500 1,000 1,500 2,000 Feet

0 0.05 0.1 0.2 0.3 0.4 Miles

Cashin Associates

FIGURE 2.4.3.4
SWAN RIVER
WATERSHED MANAGEMENT PLAN
DRAINAGE STRUCTURES 4



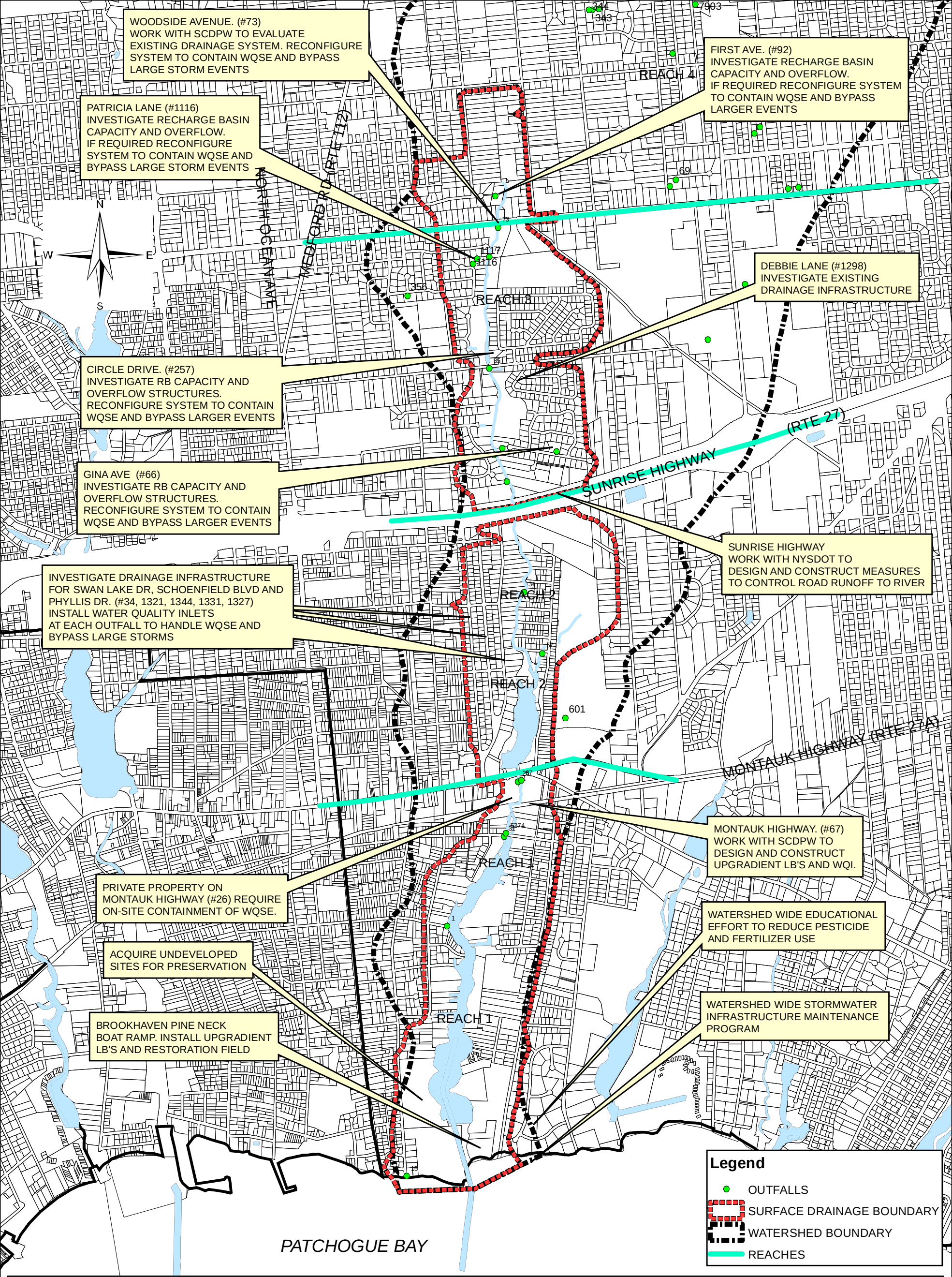
Cashin Associates

SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

0 500 1,000 2,000 3,000 4,000 Feet

0 0.125 0.25 0.5 0.75 1 Miles

FIGURE 3.0
SWAN RIVER WATERSHED MANAGEMENT PLAN MANAGEMENT RECOMENDATIONS



SOURCE:
WATERSHED BOUNDARY: NYSDOS DCR

0 500 1,000 2,000 3,000 4,000 Feet

0 0.125 0.25 0.5 0.75 1 Miles

Cashin Associates

FIGURE 4.4
SWAN RIVER WATERSHED MANAGEMENT PLAN TARGET PROJECT AND PRIORITY ACTIONS

Swan River
Watershed Management Plan
APPENDIX A
Pet Waste Control Law

Chapter
Pet Waste Disposal

SECTION ##-1. Purpose.

An ordinance to establish requirements for the proper disposal of pet solid waste in the Town of Brookhaven, so as to protect public health, safety and welfare, and to prescribe penalties for failure to comply.

SECTION ##-2. Definitions.

For the purpose of this ordinance, the following terms, phrases, words and their derivations shall have the meanings stated herein unless their use in the text of this Chapter clearly demonstrates a different meaning. When not inconsistent with the context, words used in the present tense include the future, words used in the plural number include the singular number, and words used in the singular number include the plural number. The word "shall" is always mandatory and not merely directory.

A. Immediate - shall mean that the pet solid waste is removed at once, without delay.

B. Owner/Keeper - any person who shall possess, maintain, house or harbor any pet or otherwise have custody of any pet, whether or not the owner of such pet.

C. Person - any individual, corporation, company, partnership, firm, association, or political subdivision of this State subject to municipal jurisdiction.

D. Pet - a domesticated animal (other than a disability assistance animal) kept for amusement or companionship.

E. Pet solid waste - waste matter expelled from the bowels of the pet; excrement

F. Proper disposal - placement in a designated waste receptacle, or other suitable container, and discarded in a refuse container which is regularly emptied by the municipality or some other refuse collector; or disposal into a system designed to convey domestic sewage for proper treatment and disposal. Disposal into a storm drain or stormwater system is strictly prohibited.

SECTION ##-3. Requirement for Disposal.

All pet owners and keepers are required to immediately and properly dispose of their pet's solid waste deposited on any property, public or private, not owned or possessed by that person. On any property owned or possessed by that person, all pet owners and keepers are required to properly dispose of their pet's solid waste at a frequency of at least weekly or more frequently if necessary to prevent a public health nuisance.

SECTION ##-4. Exemptions.

Any owner or keeper who requires the use of a disability assistance animal shall be exempt from the provisions of this section while such animal is being used for that purpose.

SECTION ##-5. Enforcement.

The provisions of this Article shall be enforced by the Brookhaven Town Code Enforcement and/or Brookhaven Town Animal Control.

SECTION ##-6. Violations and Penalty.

Any person violating any provision of this Section shall be liable to a fine not less than Fifty Dollars ($50.00) for a first offense nor more than Five Hundred Dollars ($500.00) for each subsequent offense.

SECTION ##-7. Severability.

Each section, subsection, sentence, clause and phrase of this Ordinance is declared to be an independent section, subsection, sentence, clause and phrase, and the finding or holding of any such portion of this Ordinance to be unconstitutional, void, or ineffective for any cause, or reason, shall not affect any other portion of this Ordinance.

SECTION ##-8. Effective date.

This Ordinance shall be in full force and effect from and after its adoption and any publication as may be required by law.

Swan River
Watershed Management Plan
APPENDIX B
Minutes of Public Meeting

APPENDIX B

MINUTES OF PUBLIC MEETING

March 1, 2007 – 7:30 PM

Swan River Watershed Management Plan
Meeting Location: Swan Lake Civic Association Clubhouse

The Swan River Watershed Management Plan Public Meeting was conducted by the following individuals:

Timothy P. Mazzei, Councilman - Town of Brookhaven (TM)
Alan Svoboda, Director of Planning - Town of Brookhaven (AS)
Nancy Lenz, Project Manager - Cashin Associates, P.C. (NL)

The Meeting began with introductions by Councilman Mazzei and Planning Director Svoboda. Nancy Lenz provided an overview of the Swan River Watershed Management Plan (Plan) with a Power Point presentation. Following the presentation the meeting was opened to public questions and comments. The comments and questions received are as follows:

Comment 1: Resident stated that a brochure identifying low impact fertilizer and pesticide products by name should be developed so homeowners can identify which products they should purchase. The resident also questioned where such products could be purchased.
Response: This could be a potential educational effort.

Comment 2: Who is responsible to clean up dumping of construction materials that has existed from the 1960's. The dumped materials consist of concrete rubble and other similar materials on top of which the existing asphalt parking lot was constructed. The rubble forms the edge of the river.
Response: The type of materials and the location was clarified. This issue requires investigation to determine the clean-up effort is required or possible.

Comment 3: A question was raised requesting information on identifying who owns the river and the river bottom. Can someone navigate the river in a vessel if it is on private property? What limits are on the person who owns the river?
Response: The ownership of the river and allowable access changes dependent of property line location and river cross section.

Comment 4: A resident asked for clarification of the question of alewives being in the river.
Response: The alewife occurrence discussed is historical. A representative from Trout Unlimited stated that a recent limited-scope survey had identified a single alewife.

Comment 5: A resident questioned how to address the drainage problem on Phyllis Drive. A structure at that location floods during rain events.
Response: The DPW agency with jurisdiction should be notified. There is a question as to the municipal jurisdiction of the structure. AS stated he would determine the correct municipal jurisdiction.

Comment 6: Several residents spoke of low impact products they use in their yards including "Canadian Green" lawn seed which requires no fertilizers or Town compost. A resident identified sources of

environmentally friendly products as the Cauliflower Society in Riverhead and Greenhouse Supply stores. A resident stated that International ISO 9000 contains a list of environmental products.
Response: No response required.

Comment: An audience member commented on the need to put legal restrictions on the use of fertilizers, as they did not believe educational efforts would provide adequate use reduction.
Response: No response required.

Mr. Svoboda concluded the meeting with a statement that this Plan will set the groundwork for funding priorities and programs. Councilman Mazzei closed the meeting with a statement confirming the Town of Brookhaven's commitment to improving the water quality and living resources of the Town surface waters and, subsequently, the Great South Bay.