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West Neck Bay Watershed Management Plan

July, 2006

Prepared for:

The Peconic Estuary Program

WEST NECK BAY
WATERSHED MANAGEMENT PLAN

July 2006

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Prepared for:
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i EXECUTIVE SUMMARY

In 2001, the Peconic Estuary Program (PEP) adopted a final Comprehensive Conservation and Management Plan (CCMP) for the Peconic Estuary and its watersheds. The plan identifies four priority management areas: control of pathogens, nitrogen, toxins, and enhancement of habitat and living resources. In 2003, Horsley Witten Group (HW) completed a regional stormwater assessment and management project for the Peconic Estuary Program that focused on developing a regional, storm-event-based, pollutant loading model to help prioritize management efforts for four pilot watersheds within the greater Peconic Estuary system based on the contributions of pathogens and nitrogen from each watershed. The West Neck Bay watershed in the Town of Shelter Island was one of the watersheds studied, and general recommendations were made to establish remediation and preventive measures for managing stormwater.

The development of this Watershed Management Plan for the West Neck Bay watershed is the next phase of that initial project. This plan focuses on improved management of stormwater pollutants, including the primary stressors (nitrogen, phosphorous, suspended solids, and bacteria) and secondary stressors (metals and hydrocarbons) that are negatively impacting West Neck Bay. In addition, this plan identifies important remaining wildlife habitat areas within the West Neck Bay watershed and provides guidance on which parcels are most valuable for protection of critical habitats. The planning process included a rapid field assessment for stormwater management and habitat value throughout the watershed. The stormwater assessment was used to identify likely stormwater pollutant sources as well as areas where best management practices (BMPs) could be installed to improve the management and treatment of stormwater in the watershed. Successful implementation of this plan is expected to help reduce stormwater runoff pollution; maintain or improve overall water quality conditions, shellfish harvesting capacity, eelgrass habitat, and degraded marsh areas; and protect critical open space habitat areas.

This Watershed Management Plan was developed as a pilot plan, along with three other pilot plans (Hashamomuck Pond in the Town of Southold, Reeves Bay in the Town of Southampton, and Meetinghouse Creek in the Town of Riverhead) to serve as a model for other areas of the Peconic Estuary system. The goal is to eventually develop targeted management plans by towns and interested groups for small embayments and watersheds throughout the larger Peconic Estuary system.

The Plan is broken down into five sections and a set of appendices covering the following major topics: an introduction and review of management objectives; a characterization of the watershed; a pollutant loading estimate under build-out conditions in the watershed; recommendations for improved programmatic stormwater management throughout the watershed; a detailed stormwater management assessment in which potential sites and BMPs are identified and conceptual designs are presented for each recommended site; and a habitat protection assessment.

Stormwater Programmatic Assessment and Recommendations

An assessment of various stormwater management programmatic opportunities in the West Neck Bay watershed was performed. Regular inspections and maintenance are a top priority to ensure long-term function of the stormwater infrastructure. The review process for new and redevelopment projects could be improved by adopting a pre-approved list of effective BMPs and requiring certain site design techniques to reduce pollutant loading. In addition, several public education focus areas and programs can help improve the health of the watershed - outreach campaigns should be tailored to target the specific issues in various neighborhoods throughout the watershed including pet and waterfowl waste, as well as lawn management. Inter-municipal and agency coordination on these program recommendations can reduce costs and improve effectiveness. These programs and recommendations are discussed in more detail in Section 3.

Stormwater Assessment and Recommendations

An assessment of stormwater management and treatment in the West Neck Bay watershed was performed in order to identify problem areas and potential sites for the installation of stormwater BMPs. The goal of these BMPs is to improve the removal of pollutants before the stormwater runoff reaches West Neck Bay. Based on a prioritization process, two locations were selected for BMP implementation; a site on the corner of Community Drive and Hilo Drive, and another site on Terry Drive. Stormwater BMPs proposed for these two sites include a grass channel, a bioretention system, a dry swale, an oil/water separator, and a micro-bioretention inlet. Estimated costs for these BMPs range from $74,500 to $88,500 for design, permitting, and construction. The proposed BMPs and the methodology used to select locations and practices are described in detail in Section 4. In addition, assessments are provided that investigate nonpoint pollution sources in the upland area and recommended actions to improve watershed conditions. These are known as "Neighborhood Source Assessments," "Hotspot Site Investigations," "Pervious Area Assessments," and "Streets and Storm Drains Assessments" and are also discussed in Section 4.

Habitat Assessment and Recommendations

The goal of the habitat assessments was to identify parcels of land, or portions of those parcels, that exhibited a higher relative ecological value than others. This value is based upon readily observable site attributes pertaining to wildlife habitat that could be observed during a single site visit. Parcels with high ecological value are recommended for long-term protection through conservation measures or acquisition by the town, a land trust, or another similar conservation organization.

Field assessment locations were identified based on data from aerial photographs of the watershed and geographic information system (GIS) data layers (e.g. GIS-identified wetland parcels and undeveloped parcels). Sites were selected for on-site review if they were undeveloped, primarily forested, contained upland areas with residential development potential, and were not mapped as “Protected Land” according to information provided by The Nature Conservancy (TNC) and/or Suffolk County. Once the rapid field habitat assessment was performed, the areas were prioritized based on habitat complexity criteria, level of habitat disturbance, proximity to existing development and protected area, evidence of ongoing land management activities, and observable evidence of wildlife.

Three groups of parcels in the West Neck Bay watershed were identified to be the subject of a field habitat assessment. These included, in order of priority, three contiguous and relatively small, undeveloped parcels on Hilo Drive near its intersection with West Neck Road; a parcel that abuts the eastern shoreline of West Neck Bay and appears to be the sole undeveloped parcel near the end of Westmoreland Drive; and two undeveloped parcels on Hillside Drive located several hundred feet from north shoreline of West Neck Bay. These parcels are discussed further in Section 5.

1.0 INTRODUCTION

1.1 The Peconic Estuary

The Peconic Estuary is located on the eastern end of Long Island, New York between the North and South Forks. Its waters cover approximately 158,000 acres with 450 miles of shoreline and support a wide array of wildlife. There are several smaller bays recognized throughout the greater Peconic Estuary including Flanders Bay, Great Peconic Bay, Shelter Island Sound, Gardiners Bay, and Little Peconic Bay. Bordering this estuary are the towns of East Hampton, Southampton, Brookhaven, Riverhead, Southold, and Shelter Island (Figure 1-1). The region is popular for vacationing and supports a wide variety of both recreational and natural resources. Boating, swimming and sunbathing are a few of the many recreational activities that draw thousands of people to this region. Fishing and shellfishing are two of the predominant local industries that are directly dependent upon the water quality of the estuary. Economic studies of the overall Peconic Estuary region have estimated that those businesses and industries directly tied to the estuary produce upwards of $450 million of annual income within the region (PEP CCMP, 2001).

The shellfishing industry in the Peconic region has relied on abundant fisheries resources to continuously harvest several mollusk species including hard clams (littlenecks, cherrystones, and chowders), oysters and scallops. Although all of the 158,000 acres of bay floor are recognized by state agencies as shellfishing areas, the majority of yield comes from the shallower rivers and embayments that line the estuary. Estimates have varied as to how much of the bay is highly productive with figures ranging from 8,000 acres (Lewis et al., 1997) to 20,880 (PEP CCMP, 2001). The harvesting in these areas is highly concentrated due to the fact that these beds comprise only six to eighteen percent of the entire shellfishing area (Lewis et al., 1997). The clustering of these shellfish in the smaller embayments demonstrates that estuarine environments with secluded shallower areas are highly productive.

The shellfishing beds in the Peconic Estuary have been monitored for several decades by the New York State Department of Environmental Conservation (NYSDEC) in order to assess the safety of these shellfish for consumption. High levels of coliform bacteria have resulted in the closure, either periodic or year-round, of much of the more productive beds in the estuary. Coliform bacteria, specifically fecal coliform (FC), are produced in the intestinal tracts of warm-blooded animals and are present in high concentrations in their fecal matter. FC bacteria are used as an indicator for the presence of other, potentially harmful pathogens.

Efforts to lower bacterial loading to the Peconics have been ongoing for many years and have developed concurrently with federal legislation such as the Clean Water Act (CWA). In 1987, the CWA was amended to include the National Estuary Program. Under Section 320, the CWA allows individual States to nominate estuaries for funding

Long Island Sound
Hashamomuck Pond
West Neck Bay
Shelter Island
Southold
Little Peconic Bay
Great Peconic Bay
East Hampton
Riverhead
Meetinghouse Creek
Flanders Bay
Reeves Bay
Southampton
Brookhaven
Atlantic Ocean
Legend
Watersheds Chosen for Assessment
N
0
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The Peconic Estuary Region Vicinity Map
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Figure 1-1

toward the development of a CCMP. Once an estuary receives funding from the National Estuary Program, the CCMP is developed to address the unique environmental needs of that specific region. Under the CCMP of the Peconic Estuary Program, activities related to shellfishing are a primary focus of ongoing research.

To date, those studies that have investigated the incidence of coliform bacteria in the Long Island region have concluded that the predominant source of this pollutant is stormwater runoff (NURP 1983). For this reason, the CCMP prepared by the Peconic Estuary Program focuses heavily upon assessing and ultimately eliminating pollutant loads that result from runoff. One section of the CCMP, the "Pathogens Management Plan," states that a primary objective is to "maintain the current status of certified (seasonally and year-round) shellfish beds and re-open uncertified beds as long as these do not conflict with the need to protect human health nor with the need to protect and enhance natural resources" (PEP 2001).

Within the CCMP, non-point source pollution, including stormwater runoff, is given the highest priority for remedial efforts. Stormwater runoff not only transports potentially high levels of bacteria to the bay, but also other pollutants that can be significant stressors, such as sediments, nutrients, hydrocarbons, and metals. Another specific priority within the CCMP is limiting nitrogen loading as excessive nitrogen loading can damage estuarine ecosystems and cause potentially harmful algal blooms. In areas where lawns and agricultural areas are regularly fertilized, stormwater runoff can deliver significant amounts of nitrogen to a receiving embayment. A well-designed stormwater management plan could therefore reduce several pollutants that potentially contribute to water quality problems simultaneously. Carefully planned and implemented strategies can successfully limit loadings of both FC bacteria and nitrogen. These strategies would therefore work to help accomplish several of the goals outlined within the Peconic CCMP including reopening shellfishing areas, reducing overall nitrogen loading, and decreasing the occurrence of brown tide.

1.2 Project Background

Horsley Witten Group (HW) completed a regional stormwater assessment and management project for the PEP in 2003 (Peconic Estuary Stormwater Assessment and Planning Tool; hereon referenced as HW, 2003). The goal of the assessment was to prioritize management efforts for four pilot watersheds within the greater Peconic Estuary system based on the contributions of pathogens and nitrogen from each subwatershed within each pilot watershed, using results from a regional, storm-event-based, pollutant loading model. The body of information previously compiled for these four watersheds was used as the starting point and baseline of information for the four pilot management plans completed as part of this project. The four pilot watersheds for which a management plan has been developed are the following:

- Hashamomuck Pond (Southold),
- West Neck Bay (Shelter Island),
- Reeves Bay (Southampton), and
- Meetinghouse Creek (Riverhead).

This West Neck Bay Watershed Management Plan was developed using a rapid watershed planning approach, consisting of following three major phases:

1) A watershed assessment stage;
2) An evaluation of management strategies, including a planning level analysis of their costs and benefits; and
3) Recommendations for implementation of management actions.

This plan was developed using previous studies together with aerial photography and a geographic information system (GIS), as well as significant field reconnaissance to ground truth land use and drainage information, evaluate habitat, identify potential stormwater pollutant sources, and provide specific management recommendations. A significant effort was focused on evaluating management alternatives including structural best management practices, regulatory and land use changes, and public education. Two meetings with local watershed stakeholders and information provided by local municipalities were integral to the execution of this project.

The main focus of this plan is to improve management of stormwater-derived pollutants that are negatively impacting West Neck Bay by both effectively addressing pollution prevention and implementing a variety of appropriate stormwater best management practices (BMPs) in key areas. In addition, this plan identifies important remaining wildlife habitat areas within the West Neck Bay watershed and provides guidance on which parcels are most valuable for protection of critical habitats. The planning process included a rapid field assessment for stormwater management and habitat value throughout the watershed. The following goals of the Peconic Estuary CCMP will be at least partially achieved through the successful implementation of this watershed management plan.

For Pathogens:

- Maintain current level of lands available to shellfish harvesting and re-open closed shellfish beds;
- Reduce overall stormwater runoff pollution; and
- Attain a zero discharge of untreated stormwater runoff from new development.

For Nitrogen:

- Decrease total nitrogen concentration in the western estuary to 0.45 mg/L;
- Ensure that total nitrogen levels in shallow waters remain at or below 0.4 mg/L in order to maintain and improve eelgrass habitat;
- Improve or maintain existing total nitrogen levels in Flanders Bay;
- Develop a nitrogen allocation strategy for the entire estuary, with an initial goal to reduce fertilizer nitrogen loading by 10-25%;
- Ensure that there is no substantial net increase in nitrogen loading to areas east of Flanders Bay; and
- Continue to acquire open space.

For Habitat and Living Resources:

- Protect the high quality habitats in Critical Natural Resource Areas;
- Maintain current eelgrass acreage and increase acreage by 10% over 10 years;
- Maintain and increase tidal and freshwater marsh acreage, restore degraded areas; and
- Enhance shellfish resources.

For Toxins:

- Improve the quality of the ambient environment where there is evidence that human inputs of toxins impair or threaten these resources;
- Comply with hazardous waste disposal and remediation regulations;
- Decrease overall emission of toxins;
- Eliminate holdings of banned pesticides and hazardous substances;
- Decrease overall pesticide applications in the five east end towns; and
- Eliminate, to the maximum extent possible, pesticide applications on turf grass on all publicly held land.

1.3 Organization of the Plan

This Watershed Management Plan is broken down into five sections and a set of appendices. Section 2 depicts a characterization of the watershed including a land use assessment, a pollutant loading assessment, a discussion of the existing local review process for land development in the watershed, a discussion of the existing stormwater infrastructure, and a pollutant loading estimate under build-out conditions in the watershed. Section 3 presents recommendations for improved programmatic stormwater management throughout the watershed. These recommendations cover suggested modifications to the existing land development review process, possible improvements for maintenance of stormwater infrastructure, and improved stormwater management public education. This is followed in Section 4 by a subwatershed-specific stormwater management assessment in which potential sites and best management practices are identified, and conceptual designs are presented for each recommended site. Section 4 also includes assessments provided to quantify impacts from land uses with high pollutant loading potential (known as "hotspots") and the drainage systems themselves. These are known as "Neighborhood Source Assessments," "Hotspot Site Investigations," "Pervious Area Assessments," and "Streets and Storm Drains Assessments." These assessments were all performed in the field to identify other opportunities to improve watershed conditions, target outreach efforts, and reduce pollutant loads. In addition, a stormwater management site ranking system is presented, and the field reconnaissance methods are described. Section 5 presents habitat protection sites and methods used to identify and rank them. The appendices include the methodologies, the stormwater retrofit conceptual plans, the stormwater field data sheets, and the habitat field data sheets.

2.0 WATERSHED CHARACTERISTICS

2.1 Land Use Watershed Characterization

West Neck Bay is located on the southwestern edge of Shelter Island. This 100-acre body of water lies at the northernmost point of West Neck Creek, a 2.5-mile long slender inlet opening into Shelter Island Sound (Figure 2-1). The tidal range within West Neck Bay is approximately three feet. Land use surrounding this embayment is primarily a mixture of low-density residential use and open space (Table 2-1 and Figure 2-2). Residential areas constitute the highest coverage at 67% of the overall contributing drainage area, which is just 99 acres. A small network of roads covering 11 acres connects the residential areas. Approximately 30 homes line the shore of West Neck Bay, most of which are within 150 feet of the water.

Table 2-1. West Neck Bay Watershed Existing Land Use Summary

Land Use Category	West Neck Area (Ac)	West Neck Area % of Total
Low Density Residential	26.4	27%
Medium Density Residential	25.6	26%
High Density Residential	13.8	14%
Commercial	0	0%
Industrial	0	0%
Institutional	0	0%
Open Space	22.5	23%
Agriculture	0	0%
Vacant	0	0%
Transportation	10.6	11%

The New York State Department of Environmental Conservation (NYSDEC) has designated this embayment as “growing area 20” for shellfish and collects samples from a station, Station 4, regularly according to National Sanitary Shellfish Program (NSSP) standards. Although historic data show levels of bacteria periodically exceeding standards for shellfishing, these exceedances are rare, and West Neck Bay does not experience seasonal, conditional, or year-round closures.

As required by Section 305(b) of the Clean Water Act, the NYSDEC Division of Water updated its Priority Waterbodies List (PWL) in 2002 which catalogues surface waters with known or suspected water quality problems, and identifies impacts and pollution sources. West Neck Harbor (PWL #1701-1032), which includes West Neck Bay, experiences recreational and fish consumption limitations caused by excessive nutrients and pathogens originating from stormwater/urban runoff and boat pollution.

Legend

West Neck Bay Watershed

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Aerial Photograph of
West Neck Bay

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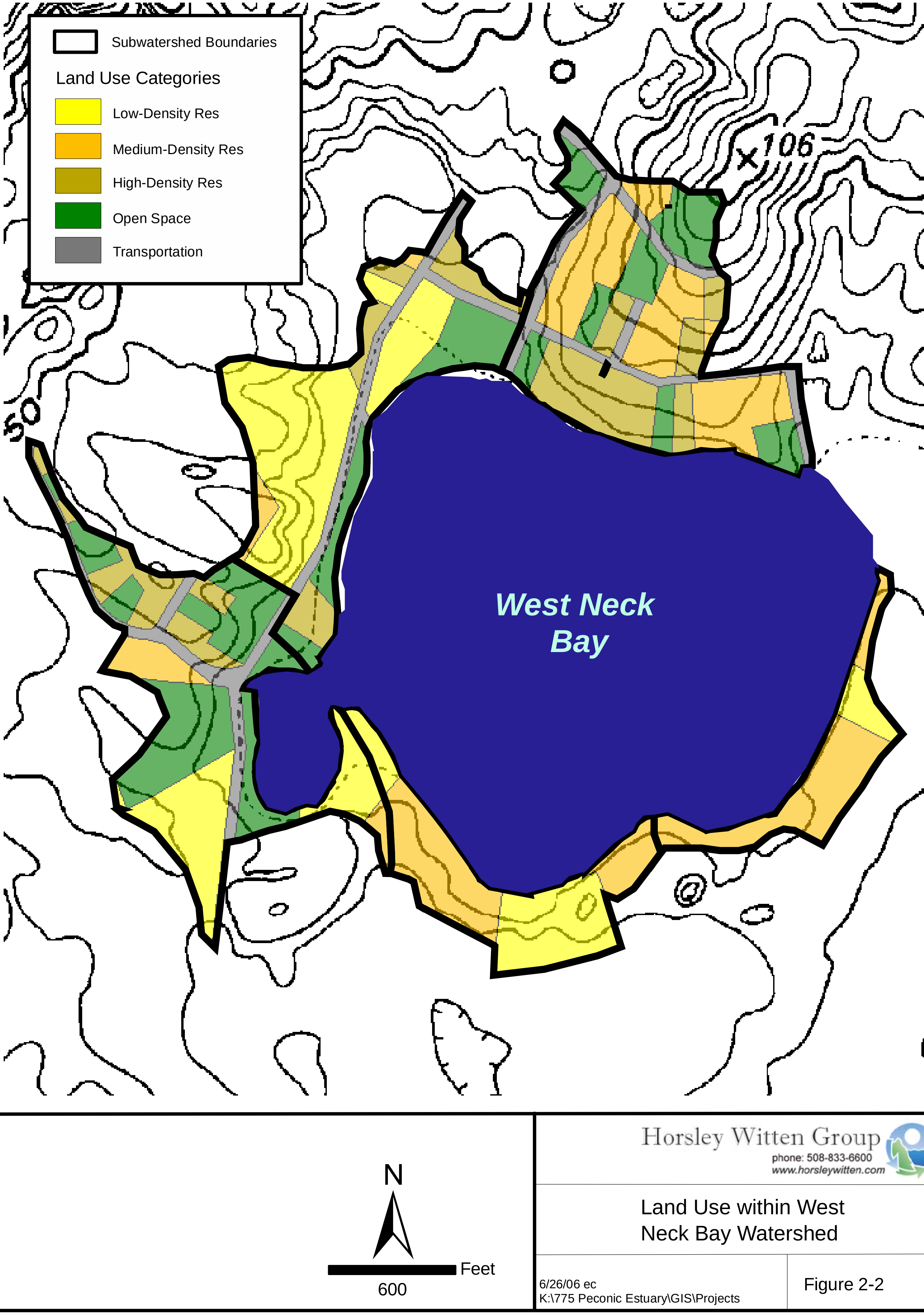
Figure 2-1



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Land Use within West Neck Bay Watershed

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Figure 2-2

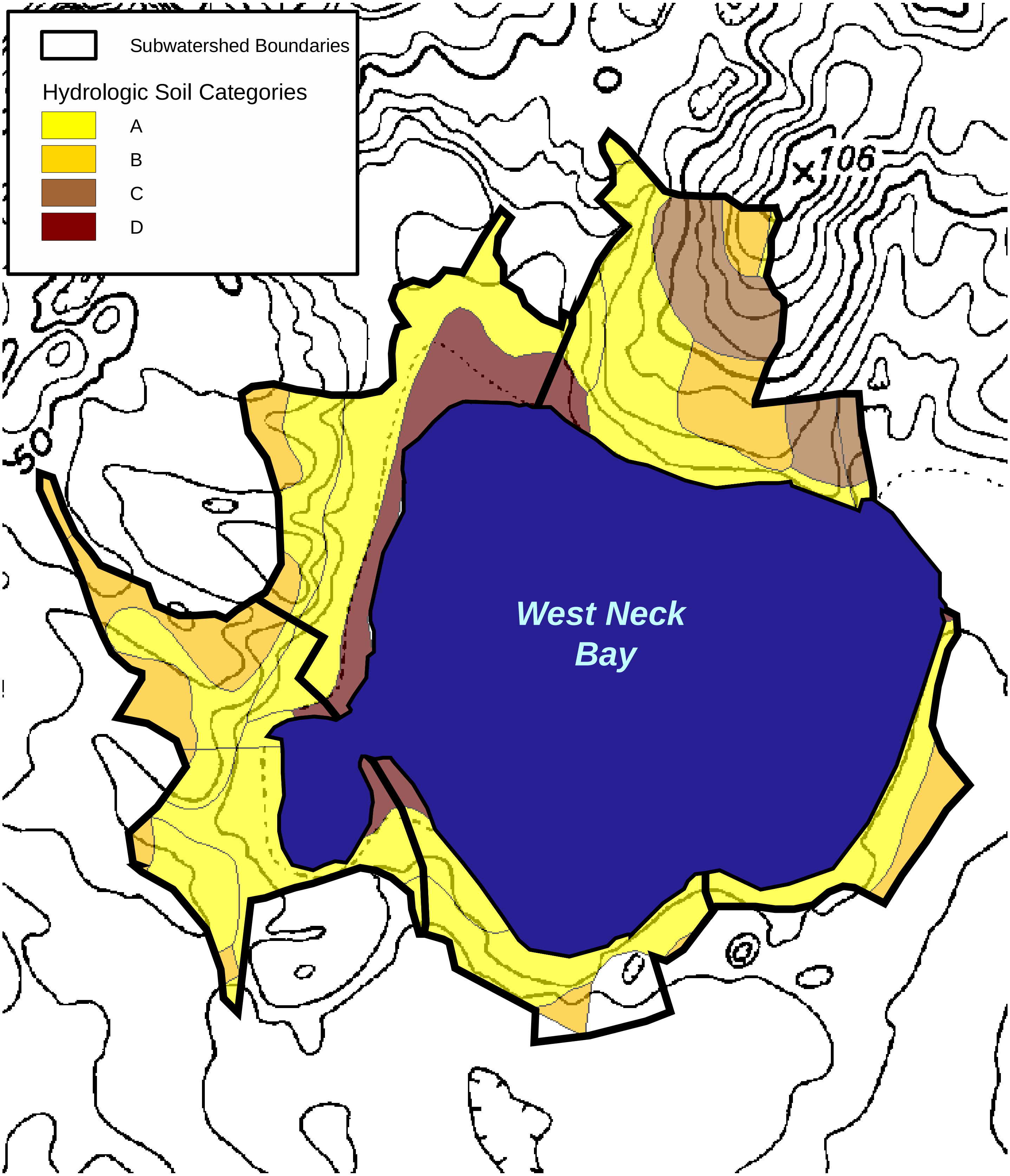
Each of the four hydrologic soil groups (“A” through “D”) is present within the West Neck Bay watershed (Figure 2-3). Hydrologic soil groups are used to generally group different soil types based upon their relative ability to infiltrate versus runoff water. “A” soils are the most permeable and generate the least amount of stormwater runoff while “D” soils are the least permeable and generate the most runoff. Hydrologic soil type “A” covers most of the drainage area and stretches from one end of the watershed to the other. This hydrologic soil category is highly permeable and, under natural conditions, is conducive to recharge. Small pockets of type “B” soils line the outer edge of the watershed and constitute other areas that will allow for significant amounts of recharge. Type “C” soils are found only in the northeast corner of the watershed in small amounts. A thin area of type “D” soils stretches along the western bank of the embayment where tidal marsh areas are present. Type “C” and “D” soils constitute areas where stormwater runoff potential is higher than in areas with “A” or “B” soils.

2.2 Pollutant Loading Assessment

In our initial study (HW, 2003), pollutant loading potential was evaluated under existing conditions in order to help prioritize areas generating higher pollutant loads and to target future management recommendations. That evaluation was conducted using an interactive model to perform two fundamental calculations: runoff volume and total pollutant load by watershed (HW, 2003). The overall West Neck Bay watershed was divided into even smaller subwatershed areas for assessment based on a field survey performed by the Peconic Baykeeper. The volume of runoff is calculated in the model using the U.S. Department of Agriculture - Natural Resource Conservation Service (USDA-NRCS) TR-55 method. To determine the total pollutant load, this volume is then multiplied by a series of FC bacteria and nitrogen loading coefficients. Each coefficient is expressed as a concentration of the specified pollutant within a fixed amount of runoff that is specific to the land use categories listed in Table 2-1.

Currently, there are no actual runoff data for any of the subwatersheds contributing runoff to West Neck Bay. As a result, HW designed the preliminary bacteria model to provide results for a range of loading values taken from scientific literature and sampling in other areas of Long Island. The values available to the user are a minimum, maximum and average value adapted from this research. Research in the area of nitrogen loading coefficients reveals a much more consistent set of values in the literature. As a result, it was not necessary to model a range of nitrogen loading coefficients.

Loading calculations were performed for the West Neck Bay watershed using three target storm events: the 0.25-inch, 0.6-inch and 1.3-inch. The 0.25-inch storm was chosen to potentially isolate the first-flush effect where pollutants are preferentially concentrated in the initial flush of runoff; the 0.6-inch rain event was chosen as the mean of the precipitation data set recorded by NYSDEC in conjunction with their water quality sampling, and the 1.3-inch storm was chosen as the approximate 90th percentile precipitation event, since approximately 90% of the precipitation events, according to



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Hydrologic Soil Groups within West Neck Bay Watershed

Figure 2-3

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NYSDEC data, fall below 1.3 inches. The resulting average concentration in the embayment was calculated assuming a mean low tide depth of 10 feet, a tidal range of 3 feet, and a waterfowl population of 30. A summary of the results for the 0.6-inch precipitation event is provided below in Tables 2-2 and 2-3. A more detailed description of the loading model and associated assumptions can be found in HW's initial stormwater assessment for the Peconic Estuary (HW, 2003).

Table 2-2. Summary of GIS-Based Bacteria and Nitrogen Loading Model for West Neck Bay Under Existing Conditions for the Mean, 0.6-Inch Precipitation Event

Subwatershed	Modified Curve Number*	Runoff Volume (liters)	Bacteria Load (millions of orgs)	Nitrogen Load (pounds)
1	85	89,046	28,380	0.44
2	86	88,556	24,580	0.43
3	79	4,193	1,180	0.02
4	85	33,351	7,680	0.15
5	85	20,830	5,030	0.09

*Modified for small storm hydrology based on research and methodology by Pitt (1987) as described in the Peconic Estuary Stormwater Assessment and Planning Tool (HW, 2003).

Table 2-3. Comparison of Average Embayment Bacteria Concentrations Predicted by the Model Under Existing Conditions with Measured Concentrations in West Neck Bay

Range of Wet Weather Measurements (orgs/100 mL)	Geometric Mean of Wet Weather Measurements (orgs/100 mL)	Modeled Concentration from Minimum Coefficients* (orgs/100 mL)	Modeled Concentration from Average Coefficients* (orgs/100 mL)	Modeled Concentration from Maximum Coefficients* (orgs/100 mL)
2.9 – 240	6.9	1.4	4.7	8.1

orgs = Number of Organisms
mL = Milliliters ($1x10^{-3}$ Liters)
*Coefficients based on the minimum, average and maximum values found in literature review.

2.3 Existing Land Development Review Process

Proposed development of land in the Town of Shelter Island is governed by the Code of the Town of Shelter Island, New York (the Code), which includes provisions regulating the subdivision of land, development within flood hazard areas, and development within wetlands or within 100 feet a wetland. In addition, specific types of development projects such as major subdivisions, parking areas, or hotels that are designated Type I projects under the NY State Environmental Quality Review Act (SEQRA) and the Code are required to go through an environmental quality review process. These land development requirements of the Town of Shelter Island are described in more detail below.

Projects involving the subdivision of land are required to go through a permit approval process with the Town Planning Board. Minor subdivisions are those that create two to four lots, and major subdivisions involve creation of five or more lots. Wetlands and waterways within the subdivision plan must be shown on the preliminary and final permit submittals. Preliminary and final drainage plans and calculations are required for both types of subdivision submittals. These plans include proposed stormwater management provisions for any roads created in the subdivisions and any public parks required as part of the approval process. All stormwater is required to be recharged into the ground with no direct discharge to surface waters or salt marsh. Ecologically sound alternative designs will be accepted as recommended by the Highway Department. A maintenance bond is required of the developer to cover upkeep, workmanship and materials for all required improvements, including stormwater management systems, for a minimum of one year from the release of the performance bond by the Town, and then annually until the Town acquires the public improvement.

Stormwater plans and calculations for subdivisions do not account for on-lot impervious surfaces and grading on individual lots since lots may be developed individually and/or may follow the development of road plans. Therefore, drainage on each individual lot is reviewed only by the building inspector in accordance with a set of informal general policies of the building department. For lots located within the Near Shore and Peninsular Overlay District, which includes a majority of the land within the West Neck Bay watershed, a 75-foot shoreline vegetative buffer must be maintained when it is already present along all bay, creek, estuary and other shorelines; and septic systems must be at least two feet above seasonal high groundwater, or as directed by Suffolk County Department of Health Service, and at least 100 feet from the edge of wetlands. Driveways and parking areas must be of permeable material, unless the slope is greater than 15%. In those cases where hard materials are used, drainage must be maintained and infiltrated onsite. Roof runoff must be collected and recharged through a dry well.

Runoff and sedimentation must also be controlled during the construction phase, in accordance with building inspector requirements and inspections. Construction phase controls must use infiltration as much as possible, and if not possible, then vegetative filter strips, catch basins and other methods can be used.

Wetlands are protected from adverse impacts of construction through the wetlands protection permit procedure, which regulates work within a 100-foot area adjacent to a wetland, including a 75-foot buffer area. This process is implemented by the Planning Board and monitored by the Wetlands Officer. In addition, certain undeveloped coastal barrier areas are protected from development, unless approved with special consideration by the Zoning Board, under the Undeveloped Coastal Barrier Overlay Zoning District.

Projects requiring construction in the flood hazard areas, as mapped by FEMA on the Flood Insurance Rate Maps for Shelter Island, require a floodplain development permit, the purpose of which is to protect human health and welfare, and property. Applications are reviewed and projects are monitored by the building inspector.

In accordance with the Code and SEQRA, certain projects must complete an Environmental Quality Review process. Projects that fall into the category of Type I actions are required to file an environmental assessment form (EAF). The Town of Shelter Island has added several types of projects to the list of Type I projects outlined in the SEQRA rules and regulations at Section 12 of Part 617 of the New York Codes, Rules and Regulations. These include, generally, motels, hotels and apartment complexes greater than 3 units; new sand, gravel and beach mining activities; parking facilities for 20 or more cars; projects that will make possible new homes or facilities for human occupation or habitation in the flood hazard areas; major subdivisions; marinas; restaurants seating more than 20 people; and "any operation which may degrade or despoil any freshwater or tidal wetland." This is an initial review of larger scale projects, and if the proposed project is deemed environmentally significant, the applicant will be required to prepare a full Environmental Impact Statement (EIS).

There is currently no specific land development control mechanism that would require a project proponent to assess or mitigate for potential nitrogen loading from stormwater runoff from a proposed project. However, revegetation of a buffer area to a wetland must be with native vegetation and without the use of fertilizers and pesticides. It is widely accepted that sources of nitrogen on a site may include septic systems, fertilizers on lawns, stormwater runoff, domesticated animals, or wildlife. Traditional on-site septic systems, even those sited properly according to code, still contribute nitrogen to the groundwater and, ultimately, to the bay.

2.4 Existing Stormwater Infrastructure and Maintenance

The existing stormwater infrastructure found in the West Neck Bay watershed is limited to infiltrating catch basins along roadways. There does not appear to be any other types of drainage infrastructure in this watershed. According to the Shelter Island Highway Department, stormwater management systems must be designed to recharge to groundwater. Therefore, the town is virtually free of detention basins, and most roadway and large parking lot drainage is ultimately recharged using leaching catch basins. Drainage from individual lots is generally captured in a cistern and/or infiltrated using a drywell. According to a representative from the Highway Department, the town has no designated schedule for the maintenance of the public stormwater infrastructure. In fact, the Highway Department does not list stormwater maintenance as a service provided to the community on its website, denoting the fact that this service is not a major focus of the department. If a drainage problem is identified due to heavy rain, clogging, or other malfunction of the system, the Highway Department will tend to the problem.

2.5 Pollutant Loading Assessment – Future, Buildout Conditions

The model developed for HW's initial stormwater assessment for the Peconic Estuary Program (HW, 2003) used the most current available GIS-based land use data. These model results therefore provide an estimate of pollutant loading to the embayment under existing conditions. As part of continued assessment of West Neck Bay, HW developed an approach to examine potential changes in land use patterns based on applicable local regulations. The original nitrogen and fecal coliform bacteria loading model runs were updated to include estimates for future land development. Using the 2001 Suffolk County Land Use database as the foundation for this exercise, HW used two essential pieces of information to update the model. First, local Zoning Codes were consulted to determine the allowable uses throughout each watershed and the minimum lot sizes associated with these uses. Second, HW used wetland coverages from 1994 in conjunction with aerial imagery to determine the extent of wetlands on buildable area. The following assumptions were employed to determine buildout conditions.

1. Wetland coverages were used to eliminate portions of existing parcels that are undevelopable.
2. Minimum lot sizes from existing Zoning Codes were used to eliminate non-conforming undeveloped parcels from the future use analysis.
3. Areas identified as "open space" by the Suffolk county land use database are protected as open space and therefore not developable in the future.
4. Remaining areas of existing "Agriculture" were identified that show potential for development. These areas were cross-referenced with the Suffolk County Planning Department's *2001 Land Available for Development, Long Island Sound Study, Suffolk County North Shore Watershed Management Program*.
5. Existing aerial photography was reviewed to identify any existing features or structures that show the land as already developed. This portion of the analysis also included a qualitative assessment of whether a parcel is reasonably accessible.

After this five-step process, the remaining Agriculture use in each watershed was assumed to be developable. According to the existing Zoning Codes, the land use codes of these developable tracts were changed to their most likely future use, and the model was run again. Where significant tracts of wetland covered a portion of a developable lot, these areas were omitted from the future development profile.

Under build-out conditions, land use within the West Neck Bay watershed is expected to continue to be a mixture of residential use and open space (Table 2-4). Under existing conditions low density residential land use covers the widest area, but at build-out, medium density residential development is expected to dominate the West Neck Bay watershed.

Table 2-4. Future Change in Land Use - West Neck Bay Watershed

Land Use Category	Existing Area (Ac)	Future Area (Ac)	Percent Change
Low Density Residential	26.4	24.1	-9%
Medium Density Residential	25.6	28.6	12%
High Density Residential	13.8	13.8	0%
Commercial	0	0.0	0%
Industrial	0	0.0	0%
Institutional	0	0.0	0%
Open Space	22.5	21.8	-3%
Agriculture	0	0.0	0%
Vacant	0	0.0	0%
Transportation	10.6	10.6	0%

Future loading calculations were performed for the West Neck Bay watershed also using the three target storm events (0.25-inch, 0.6-inch, and 1.3-inch events). Similar to the original parameters, the resulting average concentration in the embayment was calculated assuming a mean low tide depth of 10 feet, a tidal range of three feet, and a waterfowl population of 30. A summary of the results for the 0.6-inch rain event is provided below in Table 2-5. Subwatersheds 3, and 4 demonstrated the most significant increase in bacteria loading, and subwatershed one demonstrated a slight decrease. There were no significant increases or decreases in nitrogen loading.

Table 2-5. Summary of GIS-Based Future Bacteria and Nitrogen Loading Model for West Neck Bay for the Mean, 0.6-Inch Precipitation Event

Subwatershed	Modified Curve Number*	Runoff Volume (liters)	Bacteria Load (millions of orgs)	Change in Bacteria Load from Existing (millions of orgs)	Nitrogen Load (pounds)	Change in Nitrogen Load from Existing (pounds)
1	85	88,913	28,340	-40	0.43	0
2	86	88,556	24,580	0	0.42	0
3	79	7,026	1,990	810	0.03	0
4	85	34,106	7,950	270	0.15	0
5	85	20,830	5,030	0	0.09	0

*Modified for small storm hydrology based on research and methodology by Pitt (1987) as described in the Peconic Estuary Stormwater Assessment and Planning Tool (HW, 2003).

As part of the modeling of both existing and future conditions, HW identified the three subwatersheds that contributed the highest levels of pollution. Figure 2-4 and 2-5 illustrate the highest contributors of fecal coliform bacteria and nitrogen for both existing and future conditions. Based on potential land use development, the model shows that the northernmost subwatersheds are the highest contributors of both fecal coliform and nitrogen under both scenarios. Due to the unavailability of developable tracts of land within the West Neck Bay watershed, the change in loading under buildout conditions is not significantly different than existing conditions.

Figure 2-4. West Neck Bay watershed – highest priority subwatersheds for fecal coliform loading under existing and future conditions.

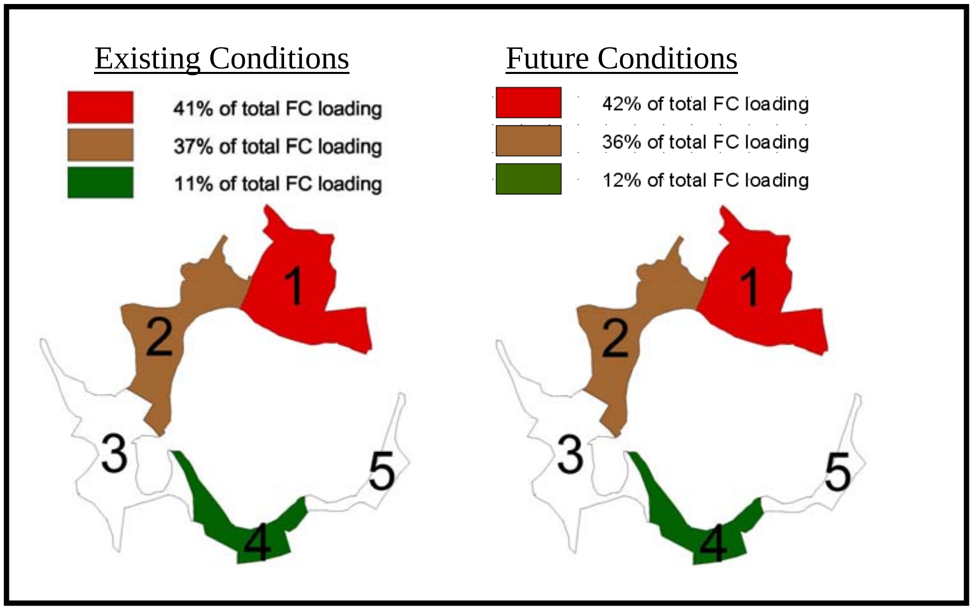
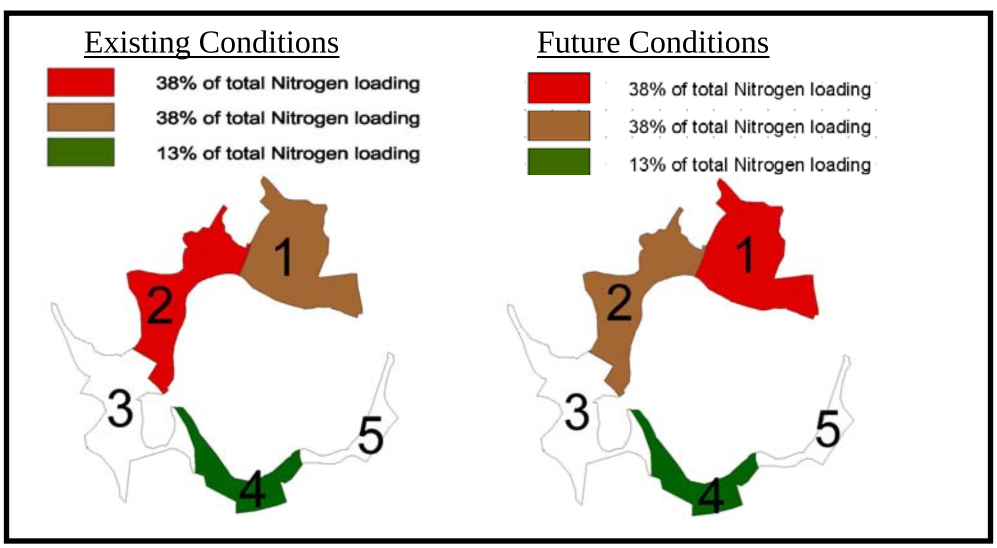


Figure 2-5. West Neck Bay watershed – highest priority subwatersheds for nitrogen loading under existing and future conditions.



In order to control potential future loading from Subwatersheds 1, 2, and 4, it is recommended that stormwater management controls be employed that allow for enhanced nitrogen and bacterial removals. Using infiltration of stormwater runoff (with pre-treatment) from all impervious and pervious surfaces, buffers between lawns and water resources, and other best management practices (BMPs) described further in sections 3 and 4 can reduce future loads by 50% for total nitrogen and 90% for fecal coliform.

3.0 STORMWATER MANAGEMENT PROGRAMMATIC OPPORTUNITIES

3.1 Recommendations for Modifications to Land Development Review Process

The land development review process can be improved to reduce potential impacts to the water quality in the bay by implementing the use of comprehensive and uniform stormwater standards for new development and redevelopment. These standards can be revised to include explicit stormwater treatment requirements to reduce nutrient loading as well as suspended solids, bacteria and other toxics to the groundwater and bay, as well as erosion control. The Planning Board could use this set of standards as a uniform reference to improve consistency in stormwater design and management throughout the Peconic region. These standards could be incorporated directly into the language of the subdivision regulations or as a separate policy document that can be referenced by the subdivision regulations. This second option allows more flexibility to update the policy as technologies advance and conditions change, without having to formally update the subdivision regulations.

A pre-approved list of appropriate stormwater best management practices can be provided by the Planning Board to the public, along with design guidelines for proper siting, sizing, installation and maintenance of the practices. As a starting point, specific sections of the New York State Stormwater Management Design Manual (NYS DEC, August 2003) should be used as the general reference for stormwater design. This manual provides a set of approved stormwater practices, sizing criteria and performance criteria, and describes in detail the proper design, limitations, and effectiveness of a host of practices. Those practices that are more effective than others for nitrogen and bacteria removal (e.g., bioretention and constructed wetlands are better than swales) should be promoted or required by the town versus the use of other practices. For example, some research studies have shown that catch basin inserts (proprietary BMPs gaining popularity in some areas due to easy and low-cost installation) have low removal rates for nitrogen, high maintenance burdens for communities, and should be implemented sparingly. Catch basin inserts also have not been sufficiently studied to estimate bacteria removal, but their operation characteristics are such that it is highly unlikely that bacteria will be reduced at significant levels. See Appendix A for more details and some references for these findings. BMPs with high nitrogen and bacteria removal capabilities that should be promoted include constructed wetlands, bioretention facilities, organic/sand filters, and infiltration practices.

The New York manual also provides useful landscaping and site layout techniques to reduce pollutant loading to receiving waters, which may be useful to include in the town's list of practices and standards. These site layout techniques include buffer standards for separating development from surface waters. Buffers are effective for controlling nitrogen-containing runoff from turf areas as well as discouraging nuisance geese populations.

Recommendations:

- Adopt a short, pre-approved list of BMPs effective at nitrogen and bacteria removal.
- Require appropriate landscaping and site layout techniques.

3.2 Recommendations for Maintenance of Stormwater Infrastructure

In the Town of Shelter Island, ownership of stormwater infrastructure is shared by the Town and individual land-owners. Roadway drainage is collected into a municipal infrastructure that generally terminates with infiltration into the groundwater through leaching catch basins and infiltration basins. When a new subdivision road is constructed and accepted by the Town, the responsibility for the drainage infrastructure also passes to the Town. The drainage infrastructure that collects and treats stormwater on each individual lot is the responsibility of the land-owner to inspect and maintain.

In order to function as designed over the long term, stormwater infrastructure must be maintained regularly. This is particularly important with structures designed for infiltration, such as leaching catch basins, which may receive stormwater that has not been pre-treated and therefore contains oils, greases, organic matter, and suspended sediment that can clog the system. Depending on the land use, inadequate pretreatment may allow for dissolved pollutants to enter groundwater and lead to both health and environmental threats. On individual properties, runoff from rooftops and driveways that is not properly infiltrated into dry wells or other onsite structures could back up into basements, cause nuisance puddling, and in some cases, lead to surface discharges and erosion rather than infiltration.

The following is a set of recommendations to improve the system by which maintenance is performed, and ensured, on stormwater practices and infrastructure in the West Neck Bay watershed and the Town of Shelter Island.

Recommendations:

- Adopt a regular municipal stormwater inspection and maintenance schedule for municipally-owned stormwater infrastructure. Regular inspections should be performed twice per year, once in the early spring, prior to the spring rains but after the winter snow melt, which transports winter sands and salts form the roads; and once in the fall, after the large release of organic matter such as leaves and debris. Cleanouts of leaching catch basins and other sedimentation practices are recommended to be performed every year, but at a minimum of every 2-3 years, and on an additional as-needed basis. This will help reduce clogging of infiltration devices and sediment transport through scouring and resuspension during larger spring rains.

- Maintain a 'working' map of all municipally-owned stormwater practices. If maintained in a GIS or other database, the database can also be used to track when maintenance was performed and to document when certain structures experienced problems.

- Public works and engineering departments should formally review and approve all stormwater maintenance plans for subdivisions that are planned for acceptance by the Town, and then adopt those plans into their regular inspection and maintenance schedule.

- Develop a brief Landowner's Guide for Maintenance of Stormwater Structures. This guide could focus on inspection and maintenance of on-lot stormwater practices for both residential and commercial/industrial sites. It can also describe things that local landowners can do to assist the Town in maintaining public infrastructure, such as cleaning off debris from around nearby catch basins and reporting stormwater infrastructure malfunctions and flooding problems. The Town of Shelter Island already has a great Homeowner's Guide to the Environment, which includes a brief section about stormwater and drainage.

3.3 Public Education and Outreach – Recommended Focus Areas

An education and outreach campaign can be used to target specific audiences to try to positively influence human behaviors in the watershed with potential ecologic impact. At the same time, the program can reach out to a broad audience to raise awareness that land use and human activity within the watershed has a direct effect on the health and quality of the coastal resources. The theory is that if people understand the connection between their individual activities and the coastal resource, they will be more apt to alter their behavior. Many of the behaviors assessed during the field inventories discussed in Section 4 (Neighborhood Source Assessment, Streets and Storm Drain Assessment, and Hot Spot Inventory) can be positively influenced by public education. The key public education issues in the Peconic watersheds that will help address the key goals of the CCMP (see Chapter 1) are:

- waterfowl management;
- lawn management;
- pet waste management;
- stormwater management; and
- septic system maintenance.

These focus areas are described below, followed by a description of recommended education and outreach programming techniques. These techniques are intended to be a menu of possible strategies that can be employed in various combinations depending on time, budget and target watershed audience.

3.3.1 Waterfowl Management

There are a handful of methods that are used in various situations to reduce the populations of waterfowl in and around a waterbody, thereby reducing nutrient and bacteria loads to that area. These include habitat modification, frightening, exclusion, discontinuation of feeding, live capture, hunting, and egg addling. Some of these methods require changes in practices by the landowners in the area, and some require professional or third-party assistance. For example, habitat modification refers to the modification of large expanses of open grassed areas that are often mowed directly to the water's edge. These areas are attractive to waterfowl such as geese, swans and ducks that like to have a clear sight line and open access to the water. Modifying these open spaces to allow for a vegetated buffer along the water edge makes the area much less attractive to these waterfowl. A 50-foot vegetated buffer, with vegetation growth up to 3-4 feet high, makes a large impact in deterring geese and swans by breaking up the open lawn space from the open water. Creation of this buffer, however, often depends on the will of the land owner to convert mowed area to vegetated area. This is where public education comes into play.

Public education implementation tools include: mailers, television and radio advertisements, newspaper articles and signage. One common public education method is the implementation of a demonstration project. If there are publicly owned properties along the waterfront, or areas owned by a willing owner, a buffer area of open mowed lawn could be allowed to revegetate, forming at least a 50-foot wide buffer along the water's edge. Photographs and information about the former presence of waterfowl and depicting the look of the former vegetation versus the revegetated area relays important information to a wider audience about both the goal of the program as well as something that they can visualize. Signage describing the area as a waterfowl management buffer could be placed in public view, and then an explanation of the site could be presented in mailers or brochures for others to see. Often it is easier for people to implement something once they know what it will look like, and they can have reasonable expectations about whether it will be effective.

An added bonus from allowing mowed and manicured lawn areas to revegetate is that maintenance is significantly lower and less fertilizer or other lawn chemicals would be used. This leads into the next area of focus for public education in the Peconic region, which is lawn management.

Other methods of waterfowl management include live capture of the birds, egg addling, and hunting. Egg addling is a method used to control the hatching of eggs. The eggs in a nest are shaken, making them nonviable, and then replaced in the nest. These methods require permits from the US Fish and Wildlife Service and may require state or local permits as well. In some cases, these methods may face local opposition; but in severe situations of uncontrolled waterfowl populations, a local municipality may opt for these more direct methods.

3.3.2 Lawn Management

Many Peconic area lawns are maintained over the majority of the available lot area, irrigated with potable water, and treated with fertilizers and herbicides. Some lawns consist of non-native grasses. Public education can be used to help change these practices and teach homeowners about alternative lawn care practices. Smaller lawns are easier to maintain and allow room for larger more diverse and colorful vegetation. The use of native grasses and compost folded into the soil can reduce the need for additional pesticides and herbicides and will provide a more drought-resistant groundcover, which will in turn require less irrigation. In cases where irrigation is still required or preferred, the homeowner can use a variety of methods to reduce irrigation demand, including rain barrels or cisterns to catch rooftop runoff for irrigation, or programmed irrigation systems to water their lawns only during early morning or late evening hours.

Providing this guidance to homeowners and other landowners within the watersheds requires an effective public outreach plan. This can be done through a media campaign, which could be a combined effort with the other focus areas. It could also benefit from a demonstration project site that would show other homeowners what a smaller, more natural lawn and yard with more diverse landscaping can look like. A demonstration site could be a mechanism to provide information about cost savings and time savings due to lower maintenance requirements, and to collect information about any increase in song birds, decrease in nuisance species, etc.

There are several example programs in the northeast that promote healthy and sustainable lawn management. The Rhode Island Cooperative Extension GreenShare Program (http://www.uri.edu/ce/ceec/greenshare.html) and the URI Nonpoint Education for Municipal Officials (NEMO) Healthy Landscapes program (http://www.uri.edu/ce/healthylandscapes/index.html) provide guidance on sustainable gardening and lawn maintenance to promote the use of native vegetation that is suitable for the soil and site conditions.

A program such as the Bayscapes Program in the Chesapeake Bay Watershed is a good example. This program provides guidance to homeowners and landowners within the Chesapeake Bay Watershed about developing and installing "Bayscapes," which are landscapes other than turf that are elected to reduce irrigation demand, improve habitat, reduce non-point pollution, and reduce erosion, while also appealing to gardeners. This program uses a website (http://www.fws.gov/chesapeakebay/bayscapes.htm), fact sheets and examples to provide information.

In Westchester County, New York, the Grassroots Healthy Lawn Program was an initiative of the county government and a non-profit organization called Grassroots Environmental Education, based in Port Washington on Long Island. The goal of this initiative was to promote healthy lawn management by reducing the use of pesticides and other toxins on lawns throughout the county. The program provided training to landscapers, provided public outreach services, served as a liaison between manufacturers and retailers, and developed a list of natural lawn care product suppliers for public distribution (http://www.ghlp.org/).

3.3.3 Pet Waste Management

Pet waste can be a nuisance to the public in addition to contributing bacteria and nutrients to a water body when it gets washed off the ground surface by rain fall and stormwater runoff. For those people that have pets, picking up after your dog can also be a nuisance. However, more and more people are realizing the aesthetic and environmental health benefits of cleaning up pet waste from public areas and their own back yards, and in many communities throughout the country now there are “pooper-scooper” laws requiring people to clean up. While the idea of picking up after your dog may seem absurd at first, a few pooper-scooper signs, some pooper scooper bags, and the risk of being seen not picking up after your dog can go a long way. A media campaign can easily be created with a sense of humor to get the message across, and signage at public open spaces and along walking trails can bolster the message. Once the signage is up, people can learn a new message.

3.3.4 Stormwater Management

Homeowners and the general public in a watershed can play an important role in looking after the systems on a day-to-day basis. This is particularly true in subdivision settings, where the stormwater management practices may be slightly off the beaten track for the local Public Works Department and where some small stormwater management practices may be dispersed throughout the subdivision or even on individual lots. After all, a failure in the stormwater management system could mean a flooding situation or could create a sedimentation problem at the discharge location that directly affects local residents.

A stormwater awareness program developed and implemented through the local municipality can be a very useful tool in promoting effective and sustainable stormwater management. Mailings and inserts with local billings and other municipal communications to residents can raise awareness and inspire vigilance among local residents. Residents can help to monitor swales, leaching systems, catch basins and discharge locations to see that they are functioning properly. They can act as a first defense against failures and can report problems to the public works department. In the fall, residents can help by clearing leaves and debris from the catch basin grates and by not throwing leaves and debris into drainage swales, onto roadways, or into other stormwater pathways. In the winter, the same goes for snow that is shoveled and plowed off driveways and sidewalks. They can also help by not washing vehicles excessively often, which can use large volumes of potable water, and by not washing them in their driveways, which can contribute phosphorus from the soap into the stormdrain system. Instead, residents should use modern commercial car washing facilities that are outfitted with a wash water collection and treatment system, and opt for environmentally friendly soaps if possible.

Residents can also install on-site retrofits to improve the stormwater management on an individual house lot. These can include installation of rain barrels to collect water from rooftops through roof leaders. Rain barrels that are properly fitted with tightly closed solid tops or a mesh screen at the top should alleviate mosquito concerns as these precautions will prevent mosquito larvae from hatching out and leaving the barrel. A rain barrel program could be established through the municipalities or a local non-profit organization, in conjunction with a rain barrel distributor, to sell rain barrels at a discounted price to community members. In addition, other on-site retrofits may include installation of a dry well to collect and infiltrate roof runoff and overflow from the rain barrels, if they have been installed. These and a number of other potential best management practices that could be used to retrofit a site are described in more detail in Section 4.4.

3.3.5 Septic System Maintenance

Septic systems require regular maintenance and inspection, and require that homeowners are actively aware of the location and operational characteristics of the system. Most systems require that the septic tank be pumped out approximately every 3-7 years (depending upon the input to the system and the size of the settling tank) to remove the solids that have accumulated over that time period.

There are many septic system maintenance additives marketed to reduce the accumulation of solids and the frequency of pumping of the septic tank. However, these additives can frequently be harmful to the system, particularly when used inappropriately, by impairing the microbial community responsible for much of a system's treatment ability, by reducing the effectiveness of the leach field, and by contributing chemical contaminants to the underlying groundwater. This is particularly important in coastal areas characterized by sandy soils where groundwater movement to receiving waters can be very rapid. A properly designed, installed, and maintained septic system should not need chemical additives to function properly. It is important for homeowners to be aware of what they put into their septic system and what the potential effects may be. Without proper maintenance, the system can lose significant treatment capacity and can clog up. This can cause a failure where the system's leach field fails to leach and the leachate breaks out at the ground surface. Alternatively, it could back up into the household. Both of these scenarios cause a public health concern as well as a threat to local water resources.

A public mailing from the municipality can promote septic system maintenance by reminding residents of maintenance needs. The New York Onsite Wastewater Training Network at the State University of New York at Delhi provides trainings throughout the state and is a wealth of information about septic systems, including proper siting, design and maintenance. While that program's training is geared primarily at engineers and practitioners, the New York State Department of Health website provides information and a printable pamphlet aimed at residents that describes proper septic system operation and maintenance. This pamphlet could be updated to include references to local water resources and connect the need for septic system maintenance to the local resources that may be threatened or experiencing poor water quality. The Rhode Island Cooperative Extension has developed a number of helpful fact sheets aimed at homeowners with information about septic system maintenance, ways to prolong the life of the system, ways to upgrade the system to provide better treatment, the effects of additives, and other useful information.

The Suffolk County Department of Health Services has also produced a brochure entitled, "Home Sewage Disposal Systems in Suffolk County," which describes a septic tank and cesspool system that is typical of Suffolk County. This brochure, last updated in 2004, could be improved upon at the county or local level to provide additional information about how to upgrade or improve on-site wastewater treatment through innovative wastewater design. This would be useful for homeowners, especially those with aging systems (25-30 years old) and in need of significant repair or replacement.

3.4 Public Education and Outreach – Recommended Programs

The following provides a menu of activities that could be undertaken as part of a watershed-wide or town-wide outreach and education program to address the environmental health of the coastal water resources of the Peconic Estuary. These activities are designed so that they could focus on one or a combination of the five areas discussed above. These activities could be implemented by each municipality, in conjunction with the Peconic Estuary Program, Suffolk County, homeowners' associations, local schools, or other active citizens groups.

3.4.1 Watershed Awareness Day

Hold a watershed awareness day, perhaps associated with an Earth Day program. The towns and/or villages in the watershed could organize a watershed awareness day to take place along the shore or at an open space within the watershed. This could include educational booths, games related to water quality, demonstrations of innovative technologies, sales of rain barrels and native grass seed, a swim or kayak race, a road race through the watershed, and/or an afternoon or evening clambake. This is a great way to get people outside, making the visual and experiential connection between the coast they love and the watershed in which they live and play.

3.4.2 Media Campaigns

A host of media campaigns could be developed with specific messages regarding applicable management strategies such as residential septic system maintenance, repair or replacement; residential fertilizer management; shoreline vegetation management; car washing; or pet waste management. These campaigns can include fliers and brochures to be distributed at community events or mailed out with utility bills, as well as posters to be distributed and posted in municipal offices, public libraries, schools, and other highly visible areas. Articles, or a series of articles, can be developed for the local newspaper to focus people on watershed management. Television advertisements or stories on local television stations or the local cable access stations can be devoted to homeowner activities that impact the watershed. Brochures related to pet waste clean up could be handed out with dog licenses and distributed by local veterinarians. These efforts could be tied to the public outreach and education requirements of the State Pollutant Discharge Elimination System (SPDES) permits that may be required for some municipalities regulated as separate storm sewer system communities.

3.4.3 Institution of an "Adopt-a-Watershed" Organization

Such an organization would be tasked with cleaning up litter, monitoring storm drain outfalls, or promoting watershed stewardship. This type of organization can make a big difference just by being aware of the activities within the watershed and along the pond shores. Monitoring of storm drain outfalls can be done with the use of simple water quality kits in conjunction with observations. This activity serves as education, but also as a means to gauge any significant changes that may be occurring in the watershed. This is also a great way to get children involved.

3.4.4 Demonstration Projects

Projects that can be used to illustrate a vegetated buffer, alternative stormwater management techniques, or a low-maintenance lawn can be invaluable in an education campaign. These are typically done on publicly-owned land or on a private individual lot, if there is an enthusiastic and willing home owner. Demonstration projects are helpful because they allow people to see a work in progress and a finished product, so they can know what to expect and they can evaluate the outcome realistically. They can also involve members of the general public in the planning and implementation of the demonstration project, which serves as a great educational experience. Once a project has been undertaken, the development and implementation phases can be documented in photographs which can be used in mailers, brochures, posters, and a media campaign. They can serve as a centerpiece for a local news story as well. Signage about the project can be placed at the edge of the site to catch the attention of passersby and provide educational information and a place to go for more information to anyone who is interested.

One example of a successful demonstration project took place at Long Lake in Littleton, MA. Long Lake was in a deteriorated state due to nutrient loading from nonpoint source pollution. The town used a grant to work with a consultant to retrofit a portion of the Long Lake watershed by installing rain gardens, grassed swales, rain barrels and a constructed wetland park with walkways for the public to enjoy the area and learn about the stormwater management practices. A description of the project, with project design information and photographs, is posted on the state Executive Office of Environmental Affairs website and serves to inform other interested people about the project.

3.4.5 Watershed Clean-up Days

A community or community organization can coordinate a watershed clean-up day to bring volunteers together to pick up litter and solid waste debris throughout the watershed. These events can be fun, and allow people to see water bodies and areas of the watershed that they may not be familiar with. They help to give people a sense of ownership and stewardship for the watershed beyond the single clean-up event.

3.4.6 School Watershed Science Programs

Science and humanities programs in local schools can help to educate young people on the various themes of watershed management, and the connection between human land uses and the water quality in the Peconic Estuary. Hands-on school programs related to the environment may include water quality monitoring, gardening, recycling, and composting. These programs can serve as a terrific vehicle to teach students about watershed management and stewardship.

3.5 Summary of Programmatic Recommendations

While this section introduced several programmatic opportunities, regular inspections and maintenance of the stormwater infrastructure should be the top priority. Without a long-term inspection/maintenance program in place, any new or existing stormwater BMPs implemented in the watershed will eventually lose effectiveness over time. Even the best BMPs are only as effective as their maintenance plan. Next, the review process for new and redevelopment could be amended to require developers to utilize specific BMPs and alternative site design techniques right from the beginning of a development project, reducing potential water quality impacts. Finally, the various public education focus areas and programs presented above can be very effective in improving the health of the watershed. No one outreach campaign will be effective for all neighborhoods – they should be tailored to target the specific issues in various areas throughout the watershed based on demographics, density, age of the neighborhood, current lawn care methods, etc. Older, more established neighborhoods with mature trees and smaller yards tend to have a lower impact on water quality than new subdivisions with large, cleared lots and highly manicured yards, and different outreach programs would be needed for each.

Programmatic costs can pose a problem for some communities. One way to reduce these costs and improve program effectiveness is to pool resources with other municipalities and agencies. Such coordination could be useful for purchasing shared maintenance equipment such as street sweepers and implementing area-wide educational campaigns.

4.0 STORMWATER MANAGEMENT ASSESSMENT

This stormwater management assessment addresses stormwater runoff as a source of pollutant loading in the West Neck Bay watershed and helps to identify problem areas and potential areas for the installation of stormwater best management practices (BMPs) to reduce the load of stormwater pollutants to the bay. The results of this assessment are then used to recommend site specific stormwater management implementation projects in key locations throughout the watershed. By identifying and prioritizing the most cost-effective retrofit and public outreach opportunities, the town has a reasonable set of specific management options to help achieve many of the goals stated in the CCMP. Successful implementation of the identified opportunities is expected to help reduce stormwater runoff pollution, improve overall water quality conditions, and maintain or improve critical habitat areas.

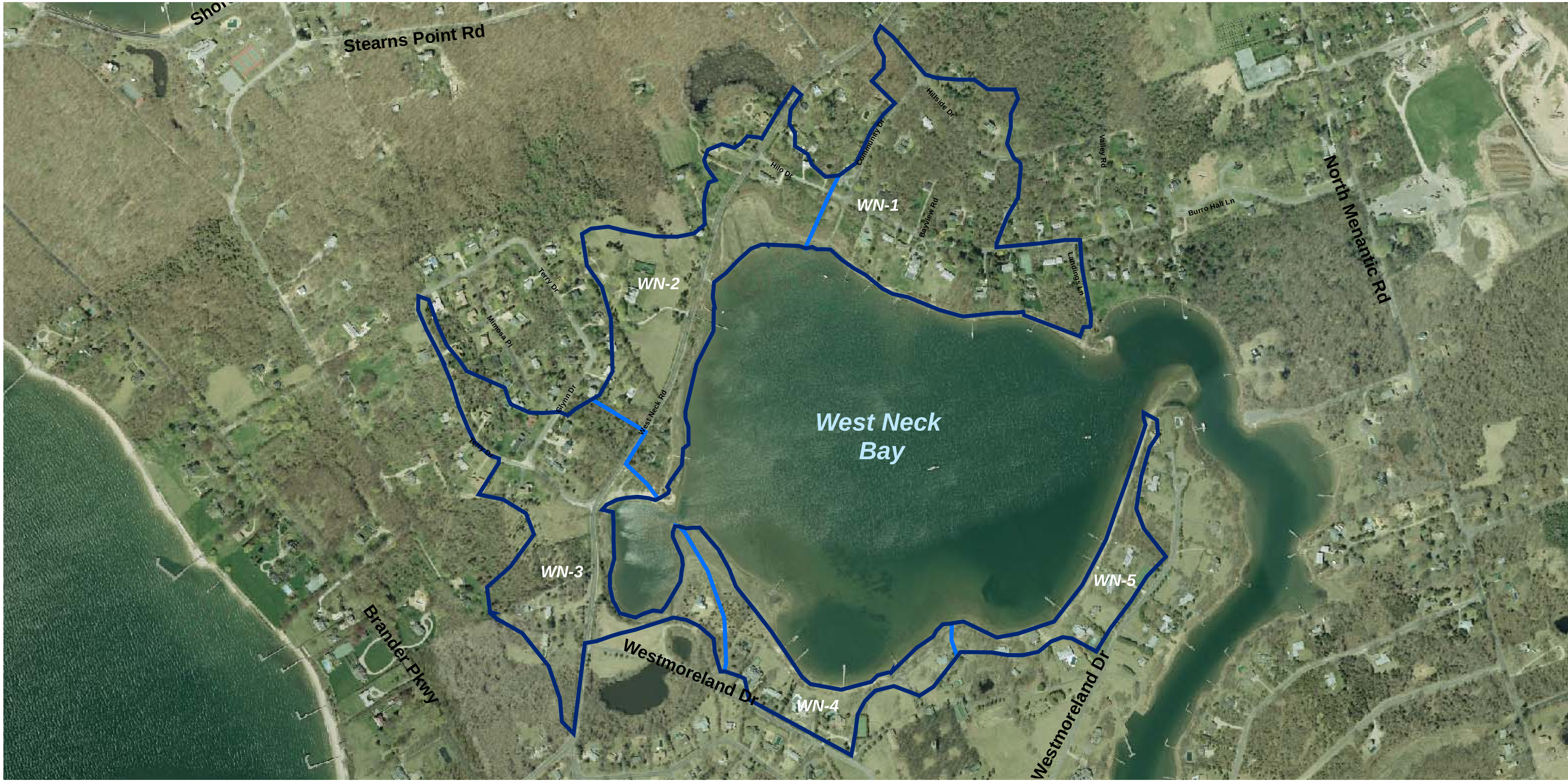
The existing stormwater management program in the West Neck Bay watershed mainly consists of infiltrating catch basins along roadways. No evidence of any other types of drainage infrastructure was observed in this watershed. Drainage from individual lots is generally captured in a cistern and/or infiltrated using a drywell. Based on this watershed assessment, proposed stormwater BMPs were selected to retrofit the existing drainage system to better manage and treat stormwater before it reaches West Neck Bay.

Potential pollutants and restoration sites for upland areas were also investigated at the same time using the Unified Subwatershed and Site Reconnaissance (USSR) procedure, described in Section 4.7. These upland areas can have significant impacts to the water quality of the receiving bodies. The USSR assessments can identify non-point pollutants of concern for different areas, which can help direct public education efforts and community action, as described in Section 3.

4.1 Assessment Methodology

Results from the "Peconic Estuary Stormwater Assessment and Planning Tool" (HW, 2003) were used in the stormwater management assessment to help direct investigation to the areas where pollutant loading was the greatest. The discreet drainage areas with all the identified drainage structures and outlets within the watershed were overlaid onto the orthophotographs of the area. This provided an opportunity to pre-select sites for investigation based on outlet locations and areas that are open (space for BMPs), publicly owned, and/or untouched (natural wooded land). The watershed and subwatersheds are shown and labeled in Figure 4.1.

A rapid and focused field reconnaissance effort in the West Neck Bay watershed was conducted. Reconnaissance inventory forms were filled out at each site location. These forms were later used to rank sites, highlight potential hotspot locations, assess varying types of neighborhoods and large pervious areas, and inventory various streets and storm drains. For example, if there were evidence of too much lawn maintenance in an area,



Legend

West Neck Bay Watershed

West Neck Bay Subwatersheds

✱ Source: Aerial Photo, NYS Office of Cyber Security & Critical Infrastructure Coordination, Spring 2004

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Feet

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Horsley Witten Group
phone: 508-833-6600
www.horsleywitten.com

Drainage Area & Subwatershed Map
West Neck Bay
Shelter Island

6/27/06 EC
J:\4094 Peconic Bay Estuary\GIS\watershed_westneck.mxd

Figure 4-1

the recommended actions would include a targeted public education campaign or collaboration with local landscaping companies. If there were many hotspots in a watershed, site specific investigations and potential clean-ups would be recommended. All of the investigated sites were numbered accordingly and discussed in this report. See Figure 4-2 for the site locations. A Watershed Assessment Guide has been included in Appendix B, which includes more details on how to conduct a watershed assessment.

4.2 Storm Drainage Assessment and Mapping

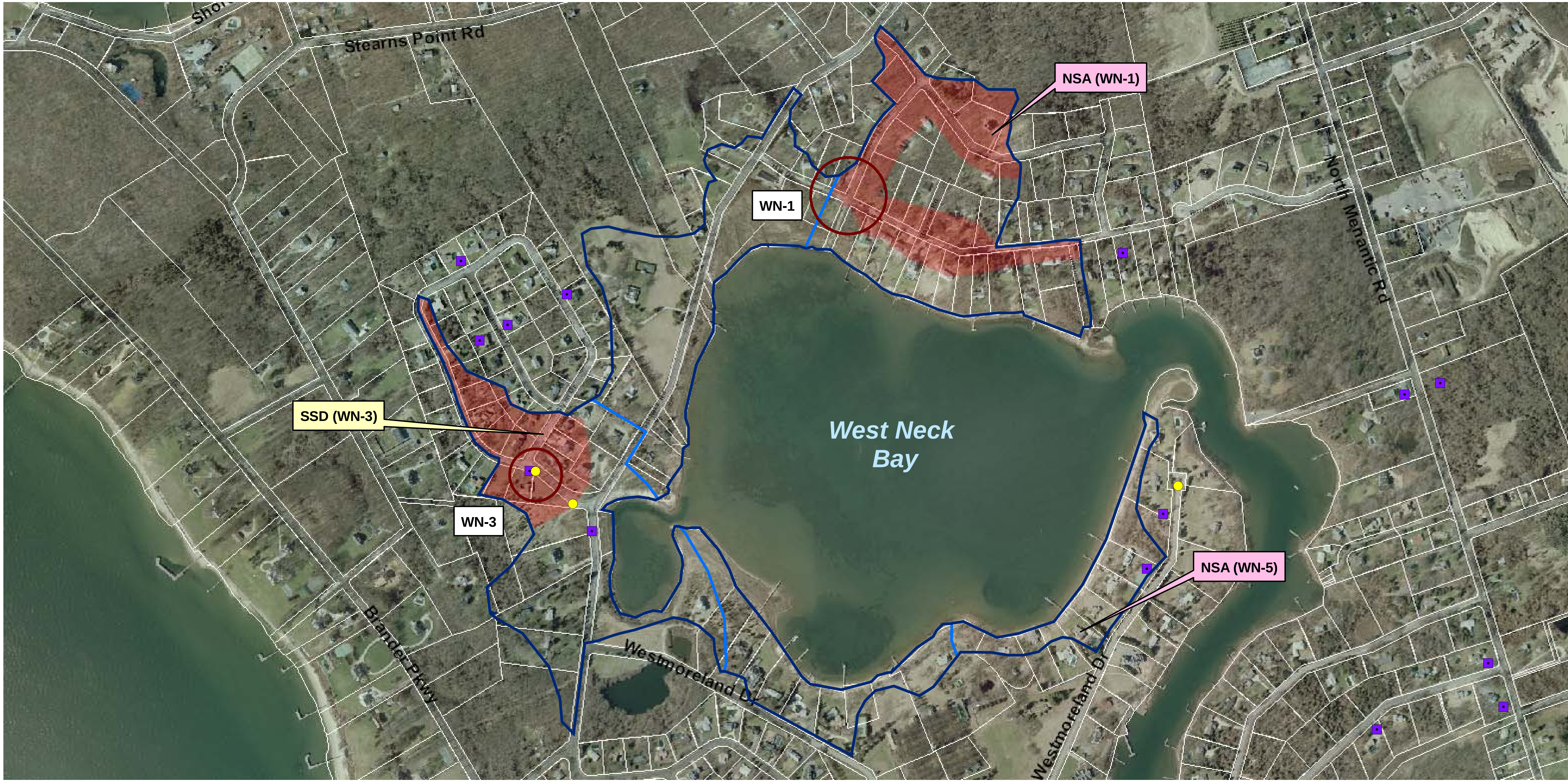
Preliminary drainage areas were first delineated through the use of topographic maps. Topographic maps allow for a reasonable watershed delineation under natural conditions. However, construction of impervious surfaces, the use of stormdrain systems, and grading of land surfaces to accommodate different site designs can significantly alter the overall size and shape of the watershed. Due to these factors, a field survey is required for accurate drainage delineation. In an effort for a more accurate drainage delineation, the Peconic Baykeeper was subcontracted to perform field survey delineations for the four priority embayments within the Peconic region (West Neck Bay, Hashamomuck Pond, Reeves Bay, and Meetinghouse Creek). These delineations included discreet watersheds that were determined through a combination of natural topography and observed structural drainage. The field surveys conducted by the Peconic Baykeeper were then digitized into GIS and overlaid onto basemaps provided by the Peconic Estuary Program (PEP). The storm drainage investigation and mapping exercise were conducted in 2000, and the results of that program were used in this stormwater management assessment.

4.3 Potential Sites and Best Management Practices Selection

Prior to the field visits for the stormwater assessment, HW reviewed the existing stormwater assessment data (HW, 2003) and identified potential locations for the installation of stormwater BMPs based on land use, parcel ownership (publicly-owned land was targeted as a priority), outfall locations, potential conflicts with existing utilities, effective stormwater capture area, and pollutant source locations.

A stormwater field reconnaissance team then investigated all potential BMP locations. In addition to the stormwater field team, a habitat protection field team was deployed at the same time to identify potential habitat protection locations in the watershed (discussed in more detail in Section 5.0 of this report). All field work was conducted the week of September 12, 2005.

Two sites were selected from the potential locations for further stormwater investigations based on field assessments of site conditions, physical constraints, and retrofit feasibility (see Table 4-1). Site WN-1 is located in subwatershed WN-1 and is situated at the corner of Community and Hilo Drive. The drainage area for this site includes a portion of the roadway from Hillside Drive in addition to Community and Hilo Drive. The drainage



Legend

- West Neck Bay Watershed
- West Neck Bay Subwatersheds
- Infiltration Catch Basin
- PEP Drywells
- Proposed BMP Locations
- Proposed BMP Drainage Areas
- H-9 Proposed BMP Drainage Area ID
- NSA Neighborhood Source Assessment
- SSD Street & Storm Drain

* Source: Aerial Photo, NYS Office of Cyber Security & Critical Infrastructure Coordination, Spring 2004

N

550 Feet

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Field Inventory Locations West Neck Bay Watershed Shelter Island

6/27/06 EC
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Figure 4-2

Table 4-1. Summary of Proposed Best Management Practices for the West Neck Bay Stormwater Drainage Area, Long Island, New York

BMP Site #	Location[1]	BMP Concept	D.A. Captured		BMP Design Criteria[2]	BMP	Estimated Pollutant Removal Efficiency (%)						Estimated Costs (for Planning Purposes only)			
			Total Area (ac)	Imp. Area (ac)			*Fecal Coli.*[3]	*Total N*[3]	*Total P*[3]	*TSS*[4]	*Metals*[4] *(Cd, Cu, Pb, Zn)*	*Hydro-carbons*[4]	*Capital Cost*	*Design, Permitting, Contingency*[5]	*Total*	*Annual Routine Maintenance*[6]
WN-1	Community Drive & Hilo Drive	Grass channel to pre-treat and convey surface drainage from the roadway to a bioretention system for a portion of the roadway. A dry swale for treatment for the other portion of roadway. Runoff from the bioretention and dry swale will collect into an oil/grit separator and discharge into West Neck Bay.	30.1	3.84	Treatment for the 90% of average annual stormwater runoff volume.	Grass Channel, Bioretention System, Dry Swale, Oil/Grit Separator	0 - 98	15 - 70	9 - 75	41 - 99	10 - 99	62	$57,300	$17,190	$74,500	5% - 7%
WN-3	Terry Drive	A micro-bio inlet at an existing low point to treat the roadway runoff prior to dischage into the existing leaching catch basin.	9.14	1.79	Treatment for the 90% of average annual stormwater runoff volume.	Micro-Bio Inlet	98	60-70	65-75	80-99	42-99	62	$68,100	$20,430	$88,500	5% - 7%

D.A. = Drainage Area

1 Note: Site #'s refer to preselected sites. Based upon actual field visits, some sites were removed from further consideration.
2 Note: Because this project is a retrofit of an existing stormwater system and is not being developed as the direct result of a new construction project, the proposed BMPs are not subject to the full suite of stormwater management standards in the New York Stormwater Management Design Manual.
3 Source: Center for Watershed Protection. 1998. Cost and Benefits of Storm Water BMPs, Final Report 9/14/98. Prepared for: Parsons Engineering Science under EPA Contract 68-C6-0001. WA 2-15. Task 6.
4 Source: Schueler, T. 1997. Comparative Removal Capability of Urban BMPs: A Reanalysis. Watershed Protection Techniques, 2(4): 515-520.
5 Note: This cost is estimated to be 30% of the Capital Cost. Source: Center for Watershed Protection. 1998. Cost and Benefits of Storm Water BMPs, Final Report 9/14/98. Prepared for: Parsons Engineering Science under EPA Contract 68-C6-0001. WA 2-15. Task 6.
6 Note: This cost is estimated to be a percentage of the Capital Cost. Source: Center for Watershed Protection. 1998. Cost and Benefits of Storm Water BMPs, Final Report 9/14/98. Prepared for: Parsons Engineering Science under EPA Contract 68-C6-0001. WA 2-15. Task 6.
NA = not applicable. ND = not able to be determined from the available data.

area is approximately 15 acres of which 18% of it is impervious. The second site is located in subwatershed WN-3 in a residential subdivision on Terry Drive. The drainage area is approximately 9 acres of which 20% is impervious. Section 4.6 describes the results of the in-depth investigations. For each site, detailed field notes, inventory forms, and photos were collected and can be found in Appendix D.

4.4 Description of Proposed Best Management Practices

The potential BMPs considered for each of the candidate locations were selected and designed with the goal of improving the overall water quality of the stormwater discharging to the subject watersheds of the Peconic Estuary. The primary pollutants of concern for this area are nitrogen and bacteria. However, the effectiveness for structural BMPs to remove bacteria is limited; controlling the source of bacteria through public education is arguably the most effective method for bacteria reduction. Thus, the most appropriate and effective BMPs were selected for each retrofit location with an emphasis on nitrogen removal. If a particular BMP that has high nitrogen removal capability was not feasible due to site constraints, alternative BMPs were considered to provide removal for other types of stormwater pollutants such as total suspended solids (TSS), metals or hydrocarbons.

Based on the New York State Stormwater Management Design Manual (NYSSMDM), potential BMPs were sized to capture and treat 90% of the average annual stormwater runoff volume (Water Quality Volume, WQ_v). As a result, potential BMPs were sized to capture and treat the 1.2-inch storm event runoff from the contributing impervious areas to the maximum extent practicable. However, because this watershed management plan is proposing retrofits to the existing stormwater system, site constraints sometimes limited the available area for BMP construction, and the proposed BMPs at certain locations were, therefore, sized smaller than the WQ_v. Catch basin inserts were not considered due to their low removal rates for nitrogen and bacteria and high maintenance burdens. See Appendix A for more information on catch basin inserts.

All BMP recommendations occur under the conservative assumption that no other BMP is being implemented simultaneously. The pollutant removal efficiency estimated for each BMP is based on the assumption that each BMP is implemented independently of all others. However, it is recommended that a combination of BMPs be implemented jointly to address as large an area as possible within the study area to achieve a greater cumulative pollutant reduction at the outfall.

The BMPs proposed for West Neck Bay include bioretention systems, micro-bioretention inlets, dry swales, grass channels, and oil/grit separators. See Appendix C for a detailed description of each, including schematics, design guidelines, and maintenance requirements.

4.5 Retrofit Ranking System

Watershed planning recommendations generally come in two categories: (1) regulatory and programmatic actions or (2) restoration and protection projects. Regulatory and programmatic actions include changes to local codes, ordinances and programs that are derived from an audit of local government capacity to protect the watershed. Examples of regulatory actions include adopting a stream buffer ordinance, encouraging or dictating conservation-oriented design of land development projects, and establishing stringent stormwater criteria. Hiring watershed coordinators, erosion and sediment control (ESC) inspectors, and executing a municipal street sweeping program are considered programmatic actions. Priority protection and restoration projects require implementation of important on-the-ground projects. Protection objectives generally involve land acquisition or applying conservation easements. Restoration projects include stream restoration, stormwater retrofits, and riparian reforestation, etc.

Since most communities will not be able to implement all the recommended actions or projects identified, it is important to go through a ranking process to identify priority sites. Not all recommendations are equal when it comes to implementation. Some recommendations, such as regulatory changes or land acquisition, may be more time sensitive than restoration projects, particularly in areas expecting significant development pressures in the short-term. Many large-scale stormwater retrofit projects require detailed planning and permitting which takes time, while buffer planting or trash cleanups are easy projects that can be completed in a few days.

Ranking candidate projects allows restoration sites to be compared together on a common basis to find the most cost-effective and feasible projects in the watershed. One of the key decisions in project ranking is whether to evaluate similar projects with the same basic purpose (e.g., stormwater retrofits vs. shoreline erosion control) or evaluate all different types of projects together; there are pros and cons to each approach. In general, it is probably preferable to assess all groups of projects at the same time, as long as the ranking factors can be arranged to compare the relative merits of each project. In this case, however, since the primary focus of this project is to evaluate stormwater management implementation, we compared stormwater retrofits in the ranking system.

Each selected site was ranked based on a Retrofit Ranking System. The proposed retrofit ranking system includes the following major factors:

1. Pollutant Removal Potential
    - Impervious area treated
    - Percent of water quality target volume treated
    - Pollutant load reduction
2. Project cost
3. Implementation feasibility based on ownership, wetland impact/permitting, access, maintenance, and utilities
4. Supplemental benefits such as habitat and public benefit

The ranking is based on a 100-point scoring system. The basic concept is to evaluate the relative merit of proposed retrofit sites by assigning points to a site based on its ability to meet various criteria under each of the four major factors cited above. Summing the assigned points for each of the factors gives an overall site score. Sites with the highest score represent the best overall candidates for implementation from a stormwater management vantage point.

The ranking system places an emphasis on (by weighting more heavily) the pollutant reduction potential. Specifically, 45% of the total points have been allocated to this category (impervious area treated, water quality volumes treated, and pollutant reduction). Another 45% of the points have been allocated to project cost and implementation. The cost estimates are based on a combination of compiled data in "Costs and Benefits of Stormwater BMPs" (Center for Watershed Protection, 1998) and best professional judgment based on experience. The exact costs will vary from these estimates based on final engineering design, permitting and contingencies. Design, permitting and contingency costs can be generally estimated at approximately 30-35% of the base construction costs (CWP, 1998). The remaining 10% of the points is divided between supplemental environmental and public benefits.

The rationale for the emphasis on the area and volume of water treated as well as the cost and feasibility of a project is two-fold. First, one goal of the retrofit approach is to manage a large percentage of the untreated impervious area runoff, in order to maximize water quality benefits to receiving waters. Therefore, those retrofit sites that are able to capture and effectively treat a larger area of impervious surface are deemed to be more important and valuable and thus assigned higher point values. Second, the feasibility of a proposed retrofit, in terms of both cost and implementation is important. Simply put, there are frequently "fatal flaws" for proposed retrofits in the form of capital costs, utility conflicts, private ownership, and access (to name a few). There is little point in proceeding with a retrofit design concept if there is a high probability that an existing constraint cannot be overcome. Therefore, proposed retrofits where these types of constraints are minimal or non-existent will be awarded higher point values. Specifics of the ranking are included in Table 4-2 and results are summarized in Section 4.6 below.

4.6 Investigated Sites and Selected BMP Descriptions

The following are descriptions of the two selected BMP sites identified in the West Neck Bay watershed. Figure 4-2 illustrates the locations of the potential BMP sites. Inventory forms, detailed sketches, maps, site photos, conceptual design plans, and calculations for each site are provided in Appendix D. BMPs were chosen to match site characteristics with recommended design criteria. The main characteristics that determine the type of BMP chosen include depth to groundwater, watershed area, available land space, and drainage system or other infrastructure constraints. The primary pollutant of concern for this study is nitrogen; however, at a selected site, if a particular BMP that has high

Table 4-2 West Neck Bay Retrofit Ranking Summary

Stormwater Retrofit Technical Feasibility	Site WN-1 Hilo Dr. & Community Dr.	Site WN-3 Terry Dr. & Glynn Dr.
1a. Impervious Area Treated $=A_{site}/A_{total}$ *30	17.94	12.06
1b. % of Water Quality Volume Treated $= WQV_{req}/WQV_{design}$ *7.5	3.13	7.50
1c. Pollutant Load Reduction Based on type of facility and ability to remove total nitrogen (eff. *7.5)	3.00	4.35
1. Pollutant Removal Potential (Total Possible Points 45)	**24**	**24**
2. Project Cost (Total Possible Points 15)	**7**	**1**
3a. Ownership Private Land = 0, Public Land = 15	10	10
3b. Wetland Impact / Permiting Yes = 0, No = 5	0	5
3b. Access Poor = 0, Good = 3	3	3
3c. Maintenance High = 0, Low = 3	2	2
3d. Utilities Major = 0, No Impacts = 4	4	2
3. Implementation (Total Possible Points 30)	**19**	**22**
4a. Habitat Provides = 5, Does Not Provide = 0	0	0
4d. Public Benefit Benefits another habitat = 1 Public/Education Program = 2 Constructed or Maintaned by Volunteers = 1 No Permenent Loss of Recreational Features = 1	4	3
4. Supplemental Benefits (Total Possible Points 10)	**4**	**3**
Total Score (Maximum Score = 100)	**54**	**50**
	Highest Ranking	**Lowest Ranking**

nitrogen removal is not feasible due to site constraints, alternative BMPs were considered to provide removal for other types of stormwater pollutants.

4.6.1 Site WN-1 – Community Drive & Hilo Drive

Site WN-1 is located in subwatershed WN-1 and is situated at the corner of Community and Hilo Drive. There are no existing drainage structures at this site. All runoff appears to run down both roadways to the intersection of Community and Hilo Drive, ultimately flowing down the private landing into West Neck Bay. The drainage area for this site includes a portion of the roadway from Hillside Drive in addition to Community and Hilo Drive. The drainage area is approximately 15 acres of which 18% is impervious.

The selected BMPs for this site include a series of dry swales for the northeast corner of Community and Hilo Drive. For the southwest corner of this intersection, a grass channel leading to a bioretention system is recommended. The overflow from both of these BMPs will drain to an oil/grit separator prior to being discharged into West Neck Bay. This intersection is ideal for public education due to its location in a boat landing area. This site had the higher rank of the two potential BMP sites selected in this watershed. The governing factor between these two sites is the project cost. This site had a lower relative cost per drainage area than Site WN-3. Even though there is limited public space for the bioretention facility (thus, the sizing was restricted and treatment volume was reduced), this site still ranked slightly higher than Site WN-3. The conceptual layout and all associated forms and site photos can be found in Appendix D-1.

4.6.2 Site WN-3 – Terry Drive

This site is located in subwatershed WN-3 in a residential subdivision on Terry Drive. The existing drainage feature on this site is an infiltrating catch basin. The drainage area is approximately 9 acres of which 20% of it is impervious. This site is an ideal spot for a micro-bio inlet to provide water quality treatment prior to being infiltrated. The existing catch basin is located adjacent to a privately owned property. The required land area of a micro-bio inlet is small, and it can generally fit within the road right-of-way (ROW). However, depending on the specific ROW width, a minor easement may be required to place the proposed micro-bio inlet. This site ranked the slightly lower than Site WN-1, mostly because it has a higher project cost per drainage area. The conceptual layout and all associated forms and site photos can be found in Appendix D-2.

4.7 Unified Subwatershed and Site Reconnaissance

The Unified Subwatershed and Site Reconnaissance (USSR) procedure was created by the Center for Watershed Protection (2004). The USSR is a rapid field survey that helps identify potential pollution sources and restoration opportunities in the upland areas of a watershed. It is a fast and economical approach to characterizing pollutant contributions over a wide range of urban conditions and identifying stakeholders that can help with the restoration planning process. By performing the USSR, water managers can gain a greater understanding of the issues facing a watershed. The USSR is comprised of four major components: Neighborhood Source Assessments, Hotspot Site Investigations, Pervious Area Assessments, and Streets and Storm Drains. A separate field form is used for each assessment component.

The USSR approach was used in the West Neck Bay watershed as a part of the watershed assessment field reconnaissance. The data collected on the upland areas of the watershed helped identify potential pollution sources that were not apparent from GIS data analyses, and in general, helped to characterize the watershed as a whole. This data framework will help target effective homeowner and commercial education programs, as well as future restoration projects. In addition, this information forms a baseline to which future assessments can be compared in order to determine rate of change in the watershed (i.e., where pollution problems have increased over time or where education programs have been successful in modifying certain behaviors).

In general, the neighborhoods in the watershed have medium to high lawn management characteristics, meaning that they most likely are a significant source of nitrogen. A targeted public education campaign on low-impact lawn care in the watershed is recommended, as well as on-site retrofits such as rain gardens. There were no hotspots identified, and no pervious areas were assessed. The leaching pits investigated were in good condition. More information on the USSR results is found in the following sections, which summarize each component of the USSR and describe the specific sites assessed in the West Neck Bay watershed. See the Field Inventory Locations Map (Figure 4-2) for the locations of each assessment.

4.7.1 Neighborhood Source Assessment (NSA)

The NSA is used to evaluate pollutant-generating behaviors in individual neighborhoods and identify potential restoration opportunities. Field forms are completed on topics including neighborhood characterization; yard and lawn conditions; driveways, sidewalks, and curbs; rooftops; common areas; and initial neighborhood assessment and recommendations. Three lots are chosen at random to provide an average sample for the neighborhood. At the end of the assessment, a pollution severity index is assigned, and the overall restoration potential is assessed for each neighborhood. Two neighborhoods were analyzed in the West Neck Bay vicinity (Figure 4-2) and are summarized below. Please see Appendix E for the completed NSA field forms and site photos.

<u>NSA WN-1</u>

NSA WN-1 is located in subwatershed WN-1 along Hillside, Community, and Hilo Drives. The neighborhood is over 30 years old and is comprised of mostly half-acre lots of single-family homes with garages and full basements. Most of the lots have medium turf and landscape management practices. The neighborhood has no sidewalks, curbs, or gutters. The neighborhood’s stormwater runs down the edge of pavement in the roadway, where a series of infiltrating catch basins collect and dispose of the stormwater. Roughly half of the neighborhood directs their downspouts to an impervious surface such as a driveway.

The pollution severity and restoration opportunity indices were both moderate. Recommended actions include education on better lawn/landscaping practices and rain gardens for roof runoff.

NSA WN-5

NSA WN-5 is very different in characteristics than WN-1. This neighborhood is also over 30 years old with mature trees lining the streets; however, the lot size averages more than an acre, with most lots exhibiting extensive landscaping practices, tennis courts and/or swimming pools, and multiple car garages. Approximately 80% of the neighborhood has medium turf and landscape management practices. There are no sidewalks, curbs, or gutters present. There were limited numbers of catch basins in the roadway, but all were leaching catch basins. As with NSA WN-1, roughly half of the neighborhood directs their downspouts to an impervious surface such as a driveway.

The initial assessment of this neighborhood shows a moderate pollution severity and restoration opportunity index. Recommended actions include public education on lawn and landscape practices and the introduction of rain gardens for roof runoff.

4.7.2 Hotspot Site Investigation (HSI)

Stormwater hotspots are land uses or activities that produce runoff with relatively high concentrations of pollutants. There are two types of hotspots: those regulated by Federal or State law and those that are unregulated. The following land uses and activities are considered stormwater hotspots as listed in the New York State Stormwater Management Design Manual (2003):

- Vehicle salvage yards and recycling facilities*
- Vehicle fueling stations
- Vehicle service and maintenance facilities
- Vehicle and equipment cleaning facilities*
- Fleet storage areas (bus, truck, etc.)*
- Industrial sites*
- Marinas (service and maintenance)*
- Outdoor liquid container storage
- Outdoor loading/unloading facilities
- Public works storage areas
- Facilities that generate or store hazardous materials*
- Commercial container nurseries
- Other land uses and activities as designated by an appropriate review authority

* indicates that the land use/activity is currently regulated

The HSI creates an inventory of storm water hotspots, including regulated and non-regulated sites, and assesses the severity of each hotspot with regard to its potential to generate storm water runoff or illicit discharges. The HSI is also used to propose appropriate follow-up actions for each hotspot, including recommendation for rapid enforcement and the feasibility of onsite stormwater retrofits. Field forms are completed on topics including site data and basic classification, vehicle operations, outdoor materials, waste management, physical plant, turf/landscaping areas, stormwater infrastructure, and initial hotspot status-index results. Hotspot status for each site is broken down into four categories: not a hotspot, potential hotspot, confirmed hotspot, and severe hotspot.

There were no hotspot sites identified in the West Neck Bay watershed.

4.7.3 Pervious Area Assessment (PAA)

The PAA evaluates the existing condition of natural area remnants and open spaces, identifies their potential management needs, and also helps to determine the reforestation opportunities for large pervious areas. Field forms are completed on topics including parcel description, current vegetative cover, impacts, and initial recommendations.

There were no large pervious areas identified to assess as a part of the USSR. See section 5 for the results of the habitat assessment and protection recommendations of six undeveloped parcels in the West Neck Bay watershed.

4.7.4 Streets and Storm Drains (SSD)

The SSD estimates the severity of pollutant buildup on roads and within storm drain systems and rates the practicability of four municipal maintenance strategies (street sweeping, storm drain stenciling, catch basin cleanouts, and parking lot retrofits). SSD assessments are usually associated with either NSA or HSI sites. Field forms are completed on topics including location, street conditions, storm drain inlets and catch basins, non-residential parking lots, and municipal pollutant reduction strategies. One to two catch basins are analyzed per NSA/HSI.

One storm drain was assessed in the West Neck Bay watershed (Field Inventory Locations Map – Figure 4-2) and is summarized below. Please see Appendix E for the completed SSD field form and site photos.

<u>SSD WN-3</u>

This neighborhood had very few visible catch basins for the entire area. The storm drain assessed in the SSD inventory is a leaching catch basin near the intersection of Terry Drive and Glynn Drive. It appears to be in relatively good condition with no debris and only a small amount of sediment observed at the inlet. Street sweeping and catch basin clean out, if necessary, are recommended at this location.

5.0 HABITAT PROTECTION OPPORTUNITIES

HW identified and observed conditions at four separate areas of undeveloped land within the West Neck Bay watershed and evaluated these areas for existing habitat attributes. These four areas, which are within three of the West Neck Bay subwatersheds, are comprised of a total of six individual parcels of land. A general description of each habitat with respect to observed land and water features and current status according to the different mapping resources that HW utilized as part of the assessment are provided below. The information collected enabled us to provide a suggested ranking of these parcels and a rationale for acquisition priority. Figure 5-1 shows the locations of the potential habitat sites investigated. Table 5-1 provides a summary of site observations and information collected from conservation mapping for each area of land habitat within the West Neck Bay watershed. Each area is identified by parcel ID number(s) from the Suffolk County GIS parcel layer and grouped by subwatershed.

Parcels 2037 and 1980 (Subwatershed WN1)

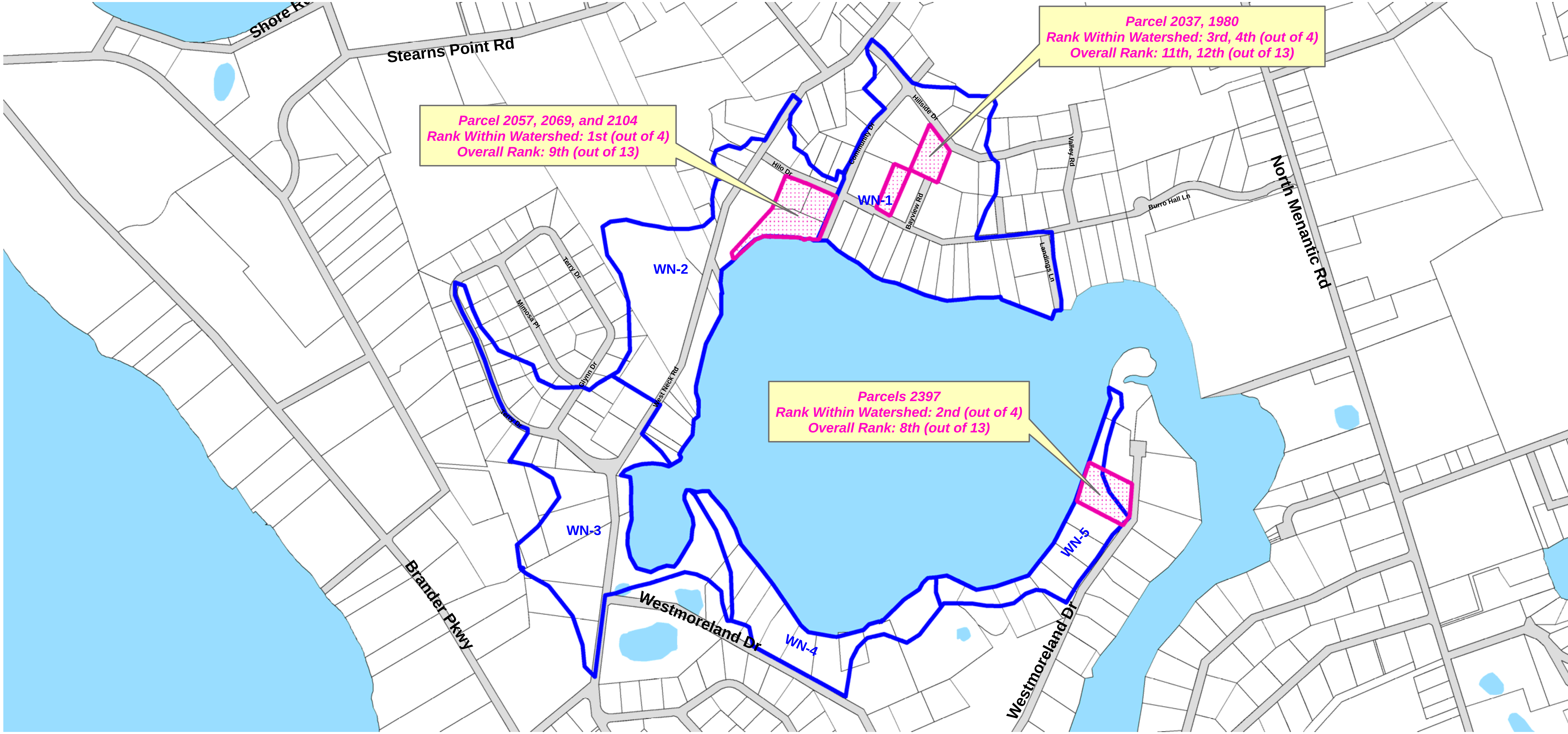
These are two undeveloped parcels on Hilo and Hillside Drives, respectively, located several hundred feet from the north shoreline of West Neck Bay. These parcels, which are relatively small, are abutted by existing residential development. Both contain wooded uplands and no wetlands. Invasive woody plants are in abundance on both parcels. Each is identified as Vacant and Community Preservation Fund Parcels.

These parcels are ranked lower than others due to their relatively small size, the presence of surrounding development, unvaried habitat type, and their distance from the bay. While development potential for these parcels could be considered relatively high due to their locations and existing ease of access, the narrow width of parcel 2037 and the steep slope on parcel 1980 could make development difficult or not practical. For these reasons, acquisition priority for either of these parcels should probably be lower than other parcels within this watershed.

Parcels 2037 and 1980 met two PEP Critical Lands Protection Plan (CLPP, 2004) environmental criteria, but did not meet the CLPP priority criteria used to further identify parcels for protection.

Parcels 2057, 2069, and 2104 (Subwatershed WN2)

The field assessment area consists of three contiguous and relatively small, undeveloped parcels on Hilo Drive near its intersection with West Neck Road. This area abuts the northwest corner of West Neck Bay. All three parcels are Community Preservation Fund Parcels and two of the three are Priority Vacant Lands. The two parcels abutting Hilo Drive lack a woody understory and are maintained by mowing, but have an overstory of mature cherry trees.



Legend

★ Hot Spots*

Habitat Assessment Areas

Subwatersheds with ID Number

Parcels

Transportation

Surface Water

Streams

* There are NO Hot Spots in the West Neck Bay Watershed

N

Feet 600

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Habitat Assessment
West Neck Bay
Subwatersheds

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West_Neck_Bay_Habitat.mxd

Figure 5-1

TABLE 5-1 PARCEL SUMMARY TABLE – WEST NECK BAY

							Land Use, Location, and Conservation Information for Parcel(s) (Mapping Source: The Nature Conservancy - Long Island)														
Parcel(s) Identifier	**Subwatershed Identifier(s)**	**Relative Size of Entire Parcel(s)**	**Approx. % of Parcel(s) Area within Watershed**	**Abuts Relatively Dense or is Isolated by Residential Development**	**Abuts Significantly Large Parcel of Protected Land**	**Directly Abuts Water**	**Vacant Land**	**Developed and Agricultural Land**	**Developed but Subdividible Land**	**Priority Vacant Land**	**Priority Developed, Subdividible Land**	**Parcel is Within PEP CNR Boundary**	**CPF Parcel(s)**	**All or Majority of Parcel is Within 1000' Shoreline Buffer**	**Habitat Types Present within Watershed Boundary**	**Approximate % of Wetland Habitat within Subwatershed**	**Approximate % of Upland Habitat within Subwatershed**	**Significant Amounts of Invasive Plant Species**	**Development Potential w/in Watershed Portion**	**In-watershed Rank based upon Observed Habitat Attributes**	**Comments** (more comprehensive discussion of each assessed area is attached)
2057 2069 2104	WN2	small	100			●				●		●	●	●	Phrag-PEM, TFo	30	70	●	high	**1**	The parcel directly abutting the water consists entirely of wetland habitat and therefore has no development potential. Other two parcels could be developed.
2397	WN5	med	70			●	●						●	●	TFo, TSS, CBank, SL, SM	0	100	●	high	**2**	Parcel was likely cleared for development at one time.
2037 1980	WN1	small	100	●			●						●	●	TFo	0	100	●	high	**3 & 4**	These separate parcels are similar with respect to habitat attributes and development potential.

Key to abbreviations: PFo (Palustrine Forested), PSS (Palustrine Scrub-shrub), PEM (Palustrine Emergent Marsh), Phrag-PEM (*Phragmites*-dominant emergent marsh), TFo (Terrestrial Forested), TSS (Terrestrial Scrub-Shrub), OMdw (Open Meadow), SM (Salt Marsh), SL (Shoreline), PVP (Potential Vernal Pool), Agri (Areas actively managed for agricultural use), Stm (Stream), CBank (Coastal Embankment)

Due to the size of these two parcels, proximity to major roadways, and a lack of understory vegetation, the habitat value on these two parcels is relatively low, while the development potential for these two parcels is considered high due to their desirable location, amount of available upland area, and ease of road access to this area. The parcel located between these two parcels and the shoreline is predominantly, if not entirely, a wetland habitat consisting of a dense shrub thicket and *Phragmites*-dominant marsh and therefore has minimal development potential. For these reasons, acquisition priority for the two smaller parcels should probably be higher than the third parcel and other parcels within this watershed.

Parcel 2104 and parcel 2057 met three PEP CLPP environmental criteria as well as at least one priority criteria. Priority criteria were used in the PEP Critical Protection Plan to highlight specific parcels for protection. Parcel 2069 met two PEP CLPP environmental criteria but did not meet any CLPP priority criteria.

Parcel 2397 (Subwatershed WN5)

This parcel, which abuts the eastern shoreline of West Neck Bay, appears to be the sole undeveloped parcel near the end of Westmoreland Drive. The upland habitats consist of a scrub-shrub community and a strip of relatively mature oak-dominant forest measuring approximately 70 feet wide along the top of a steep coastal embankment at the bay margin. The area of scrub-shrub habitat, which at one time was likely cleared in preparation for residential development, is relatively dense and contains an abundance of invasive plants. A relatively narrow strip of salt marsh occurs along the bay margin at the toe of the coastal embankment, which forms the parcel’s western boundary. All adjacent properties are developed. This parcel is identified as Vacant and is a Community Preservation Fund Parcel.

This parcel is ranked higher than others due to the multiple habitat types it contains and because it is adjacent to the embayment. We rank this parcel lower than others due to the presence of an abundance of invasive plant species over much of the upland areas and the presence of surrounding development. Development potential for this parcel is considered high due to its desirable location, the amount of available upland area, and ease of road access to this area.

Parcel 2397 met two PEP CLPP environmental criteria but did not meet any CLPP priority criteria, criteria used to further identify parcels for protection.

6.0 REFERENCES

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APPENDIX A

Catch Basin Insert – Performance Data

CATCH BASIN INSERT – PERFORMANCE DATA

Catch basin inserts are attractive retrofit BMPs to some communities due to their relatively easy and low-cost installation. However, in the end, their cost effectiveness is determined by their water quality benefit and the maintenance frequency required. Studies have demonstrated that for many applications, frequent maintenance is necessary to prevent clogging and stormwater flows bypassing the BMP, as well as the resuspension of previously captured material. In addition, the water quality treatment provided is variable, and typically, much lower than many other BMPs. The table below shows removal data from three different studies on a variety of catch basin inserts available on the market. Total suspended solids (TSS) removal varies from 3-82%, with generally lower removals of nutrients. Bacteria removals were not tested as a part of these studies.

Selection of inserts should take into account many factors, such as: predicted flow rates, pollutants of concern, predicted pollutant concentrations, sediment particle size distribution, maintenance requirements, maintenance capability, and the current design of the inserts. Catch basin inserts are not practical for large drainage areas or for areas with high levels of organic debris. Public education and outreach regarding illegal dumping into storm drains could decrease maintenance requirements for these BMPs and help avoid clogging and any subsequent flooding. In addition, regular scheduled inspections and maintenance could result in more effective removals.

Technology	Pollutant Removals (%)					
	TSS	Nitrogen			Total Phosphorus	Bacteria
		TKN	*Nitrate*	*Nitrite*		
StormFilter® with Perlite Filter Media [1] Stormwater Mangement, Inc.	50	24	-13	36	50	ND
Hydro-Kleen™ Filtration System [1] Hydro Compliance Management, Inc.	46-75	0*	0*	0*	0*	ND
Vortechs® System, Model 1000 [1] Vortechnics, Inc.	35	ND	ND	ND	21	ND
CrystalStream™ Water Quality Vault Model 1056 [1] Practical Best Management of Georgia, Inc.	21	13	25	50**	40	ND
Arkal Pressurized Stormwater Filtration System [1] Zeta Technology, Inc.	82	26	-76	-76	55	ND
AbTech Ultra Urban Filter[2] AbTech Industries	45	ND	ND	ND	ND	ND
AquaShield™ [2] AquaShield, Inc.	10	ND	ND	ND	ND	ND
DrainPac™ [2] GeoMarine, Inc.	22	ND	ND	ND	ND	ND
HydroCartridge™ [2] PacTec, Inc.	40	ND	ND	ND	ND	ND
StreamGuard™ [3] Bowhead Manufacturing Co. LLC	3	ND	ND	ND	ND	ND
FossilFilter™ [3] KriStar Enterprises, Inc.	14	ND	ND	ND	ND	ND

ND = No data
* Study indicated that technology was "ineffective" at removal of these constituents
**Study indicated that removal rate may not be accurate due to low influent concentrations

[1] US EPA - Environmental Technology Verification Program for Stormwater Source-Area Treatment Devices http://www.epa.gov/etv/verifications/vcenter9-9.html Studies completed between 2003-2005.
[2] Civil Engineering Research Foundation's Verification Report of the Low-cost Stormwater BMP Study http://www.mackblackwell.org/research/finals/arc2018/MBTC%202018.htm#_Toc53367774
[3] CalTrans BMP Retrofit Pilot Program, Chapter 11 Drain Inlet Inserts, January 2004. http://www.dot.ca.gov/hq/env/stormwater/

APPENDIX B

Watershed Assessment Guide

Watershed Assessment Guide:

A Handbook for Water Managers in the Peconic Estuary Region

1.0 Introduction

The Peconic Estuary is located on the east end of Long Island, New York. This ecosystem has been designated by U.S. Environmental Protection Agency as an "Estuary of National Significance." Development pressures in an area typically characterized by open space and agriculture are forcing water managers to plan wisely now in order to preserve and enhance the water quality and wildlife habitat of the estuary.

Watershed assessments should be performed in order to plan effectively. A watershed assessment addresses pollutant loading sources and restoration opportunities within subject watersheds. The assessment has four main elements: data preparation, field reconnaissance, restoration prioritization, and watershed plan development.

2.0 Data Preparation

Thorough data preparation and review of existing conditions can save time out in the field later on. Watershed managers should gather as much information as possible about the area of concern. Geographic Information System (GIS) data are extremely helpful in a watershed assessment. GIS data layers and water quality data are available for the Peconic Estuary region through the development of the regional stormwater project[1]. Available data include coastline boundaries, topographical contours, critical habitats, existing land use, water quality parameters monitored through the Peconic Estuary Program (PEP), shellfish habitat and closings, and field-identified stormwater discharge locations. In addition to these data, zoning maps, ordinances and regulations for each town within a study area; aerial photography; analysis of aerial photos by US Fish and Wildlife Service (USFWS) for eelgrass beds, macroalgae and shoreline hardening extent; population data; information on swimming beach water quality and closures; number of boats utilizing the embayment from the Vessels Waste No Discharge Zone application to the US Environmental Protection Agency (USEPA); and other studies related to the water quality, hydrology, habitat, flushing, etc., specific to the particular embayment may also be collected and reviewed.

Based on the above data collection effort, drainage basins (watersheds) can be identified for the receiving body of concern, as well as discreet drainage areas (subwatersheds) within the drainage basins. Sites for further investigations can be pre-selected based on outlet locations, available open space (space for retrofits), public ownership, and/or undisturbed lands (i.e., natural wooded land). Once all sites have been pre-selected, a field reconnaissance can be initiated. A field reconnaissance serves many purposes such as verifying existing condition information,

[1]Peconic Estuary Stormwater Assessment and Planning Tool. Horsley Witten Group, October 2003. Prepared for Peconic Estuary Program.

conducting formal investigations for stormwater retrofits, potential pollution sources and restoration opportunities in upland areas, and inventorying potential habitat protection areas. Depending on the breadth of the watershed assessment scope, all or some of these investigations can be included in the field reconnaissance.

Prior to any field work, reconnaissance teams should be prepared with the right tools, forms and maps necessary for the assessment. A checklist should be prepared. **Table 1** includes a sample checklist used in a previous field reconnaissance.

Table 1. Example of Field Reconnaissance Checklist

Watershed Stormwater Retrofit and Upland Non-point Source Assessment

Equipment/Data Needs

- ☐ Watershed Maps (Aerial photography, soils, land use, street maps, USGS quads, habitat maps)
- ☐ 1 digital camera per team
- ☐ 1 calculator per team
- ☐ Field forms, clipboard (waterproof, if possible), pencils (waterproof, if possible)
- ☐ 1 pry bar per team (to pop Manhole/Catch Basin rims)
- ☐ 1 screwdriver per team (to help pop Manhole/Catch Basin rims and assess soil compaction)
- ☐ 1 flashlight per team
- ☐ 1 pair of binoculars per team
- ☐ 1 tape measure per team (25 ft ok, 100 ft, if available)
- ☐ Safety equipment (first aid kit, sun screen, insect repellent)
- ☐ Snacks, water bottle
- ☐ Rain gear (plus umbrella for covering camera/field forms)
- ☐ Authorization letter from client (describes nature of project for potential access to properties)
- ☐ Parking display cards (for dashboards of vehicles)
- ☐ 1 pair of water boots per team (for shallow water access)
- ☐ Cell phones with team member #s (plus client, other local government contacts)
- ☐ Personal items (appropriate clothing, sunglasses, hat, gloves, etc)

3.0 Field Reconnaissance

Field reconnaissance is a must when performing a watershed assessment. The data gathered in the office must be field-verified. For example, there may be physical constraints at a site that appeared promising for restoration on GIS, but the data were either outdated or incomplete. Only out in the field can a manager get the full picture of an area. In addition, local residents met in the field may be able to provide additional information about a site that could sway the ranking of a project.

3.1 Stormwater Retrofit Reconnaissance Inventory

The goal of a stormwater outfall and retrofit inventory is to determine potential stormwater best management practice (BMP) retrofits in a watershed to better manage and treat stormwater runoff before it enters the receiving waters. Potential locations for the installation of stormwater BMPs should be pre-selected based on land use, parcel ownership (publicly-owned land simplifies implementation), potential conflicts with existing utilities, effective stormwater capture area, and pollutant source locations. Examples of BMPs include the following: sediment forebays, water quality swales (dry or wet), bioretention systems, constructed wetlands, infiltration basins, etc. A field crew shall visit and evaluate each site and fill out separate field forms for each potential BMP retrofit. A sample field form is included in the attachment.

Data collected in the field and compiled afterwards should include the inventory forms, detailed sketches of the site, several site photos, conceptual design plans, and calculations for each site. BMPs should be chosen based on site characteristics that match BMP design criteria. Some characteristics that determine the type of BMP chosen include depth to groundwater, watershed area, available land space, and drainage system or other infrastructure constraints. The pollutants of concern for the study may vary by watershed and could include nitrogen, phosphorus, total suspended solids (TSS), bacteria, metals or hydrocarbons.

The results of this assessment are then used to recommend site specific stormwater management implementation projects in key locations throughout the watersheds.

3.2 Unified Subwatershed and Site Reconnaissance

The Unified Subwatershed and Site Reconnaissance (USSR) procedure was prepared by the Center for Watershed Protection (2004). The USSR is a rapid field survey that helps identify potential pollution sources and restoration opportunities in the upland areas of a watershed. It is a fast and economical approach to characterizing pollutant contributions over a wide range of urban conditions and identifying stakeholders that can help with the restoration planning process. By performing the USSR, water managers can gain a greater understanding of the issues facing a watershed. The data collected on the upland areas of a watershed help to identify potential pollution sources that are not apparent from GIS data analyses, and in general, to characterize the watershed as a whole. This data framework will help managers target effective homeowner and commercial education programs, as well as future restoration projects. In addition, this information forms a baseline to which future assessments can be compared in order to determine rate of change in the watershed (i.e., where pollution problems have increased over time or where education programs have been successful in modifying certain behaviors).

The USSR is comprised of four major components: Neighborhood Source Assessments, Hotspot Site Investigations, Pervious Area Assessments, and Streets and Storm Drains. Separate field forms are used for each assessment component, which are included in the attachment.

Neighborhood Source Assessment (NSA)
The NSA is used to evaluate pollutant-generating behaviors in individual neighborhoods and identify potential restoration opportunities. Field forms are completed on topics including neighborhood characterization; yard and lawn conditions; driveways, sidewalks, and curbs; rooftops; common areas; and initial neighborhood assessment and recommendations. Three lots are chosen at random to provide an average sample for the neighborhood. At the end of the assessment, a pollution severity index is assigned, and the overall restoration potential is assessed for each neighborhood.

Hotspot Site Investigation (HSI)
Stormwater hotspots are land uses or activities that produce higher concentrations of pollutants. There are two types of hotspots, those regulated by federal or state law and those that are unregulated. The following land uses and activities are considered stormwater hotspots as listed in the New York State Stormwater Management Design Manual (2003):

- Vehicle salvage yards and recycling facilities*
- Vehicle fueling stations
- Vehicle service and maintenance facilities
- Vehicle and equipment cleaning facilities*
- Fleet storage areas (bus, truck, etc.)*
- Industrial sites*
- Marinas (service and maintenance)*
- Outdoor liquid container storage
- Outdoor loading/unloading facilities
- Public works storage areas
- Facilities that generate or store hazardous materials*
- Commercial container nurseries
- Other land uses and activities as designated by an appropriate review authority

* indicates that the land use/activity is currently regulated

The HSI creates an inventory of storm water hotspots, including regulated and non-regulated sites, and assesses the severity of each hotspot with regard to its potential to generate storm water runoff or illicit discharges. The HSI is also used to propose appropriate follow-up actions for each hotspot, including recommendation for rapid enforcement and the feasibility of onsite stormwater retrofits. Field forms are completed on topics including site data and basic classification, vehicle operations, outdoor materials, waste management, physical plant, turf/landscaping areas, stormwater infrastructure, and initial hotspot status-index results. Hotspot status for each site is broken down into four categories: not a hotspot, potential hotspot, confirmed hotspot, and severe hotspot.

Pervious Area Assessment (PAA)
The PAA evaluates the existing condition of natural area remnants and open spaces, identify their potential management needs, and also helps to determine the reforestation opportunities for large pervious areas. Field forms are completed on topics including parcel description, current vegetative cover, impacts, and initial recommendations.

Streets and Storm Drains (SSD)
The SSD estimates the severity of pollutant buildup on roads and within storm drain systems and rates the practicability of four municipal maintenance strategies. SSD assessments are usually associated with either NSA or HSI sites. Field forms are completed on topics including location, street conditions, storm drain inlets and catch basins, non-residential parking lots, and municipal pollutant reduction strategies.

The results of these investigations are used to target specific watershed actions that may include public education, regulatory code reform, and/or targeted inspections.

3.3 Habitat Reconnaissance Inventory

Areas should be selected for on-site review if they are undeveloped, primarily forested, appear to contain a significant amount of upland with residential development potential, and are not mapped as "Protected Land" according to existing information provided by The Nature Conservancy (TNC) and/or Suffolk County. These areas can be either stand-alone properties or areas comprised of a number of abutting properties. Field assessments should generally only occur within the portions that are mapped within the subwatershed boundary of concern. In certain instances, you may discover that development is underway on selected parcels; and therefore, an on-site assessment of habitat features should not be performed. In addition, if an area is posted with "No Trespassing" signs, the area should not be entered for assessment without prior premission.

The field data should constitute the answers to habitat assessment questions and other observations. Some attributes to consider for assessing watershed habitat include the following:

1) Habitat complexity

- number of plant layers,
- condition of plant layer coverage,
- spatial pattern of shrubs and/or trees,
- number of cover types in each plant layer,
- ratio of cover types,
- degree of cover type interspersion,
- the presence of undesirable species,
- percent open water,
- degree of vegetation/water interspersion,
- shape of the wetland/upland edge, and
- wildlife attractors

2) Features which reduce habitat value

- disturbance of wildlife habitat
- observable contamination

In addition to the above, other habitat attributes to consider include:

- the proximity of the subject area to residential or commercial development;

- the proximity of the subject area to protected land;
- evidence of land management activities (such as mowing and debris disposal); and
- wildlife species or wildlife habitat use evidence encountered.

4.0 Prioritizing Restoration Options

Watershed recommendations generally come in two categories: (1) regulatory and programmatic actions, or (2) as restoration and protection projects. Regulatory and programmatic actions include changes to local codes, ordinances and programs that are derived from the audit of local government capacity to protect the watershed. Examples of regulatory actions include adopting a stream buffer ordinance, encouraging conservation-oriented design of land development project, and establishing stringent stormwater criteria. Hiring watershed coordinators, ESC inspectors, or building a municipal street sweeping program are considered programmatic actions. Priority protection and restoration projects require implementation of priority, on-the-ground projects. Protection objectives generally involve land acquisition or applying conservation easements. Restoration projects include stream restoration, stormwater retrofits, and riparian reforestation, etc.

Since most communities will not be able to implement all the recommended actions or projects identified, it is important to go through a ranking process to identify priority sites. Not all recommendations are equal when it comes to implementation. Some recommendations, such as regulatory changes or land acquisition, may be more time sensitive than restoration projects, particularly in areas expecting significant development pressures in the short-term. Many large-scale stormwater retrofit or stream restoration projects require detailed planning and permitting which takes time, while buffer planting or trash cleanups are easy projects that can be completed in a few days.

Project ranking allows restoration projects to be compared together on a common basis to find the most cost-effective and feasible projects in the watershed. One of the key decisions in project ranking is whether to evaluate projects within the same group (e.g., stormwater retrofits) or evaluate all different types of projects together. There are pros and cons to each approach. In general, it is preferable to assess all groups of projects at the same time, as long as the ranking factors are compatible among the groups.

A proposed retrofit ranking system could include the following major factors:

1. Pollutant Removal Potential
    - Impervious area treated
    - Percent of water quality target volume treated
    - Pollutant load reduction
2. Project cost
3. Implementation feasibility based on ownership, wetland impact/permitting, access, maintenance, and utilities
4. Supplemental benefits such as habitat and public benefit

Ranking systems can vary by watershed based on what the specific needs are. The basic concept is to evaluate the relative merit of proposed retrofit sites by assigning points to a site based on its ability to meet various criteria under each of the four major factors cited above. A ranking system can place an emphasis on (by weighting more heavily) a particular factor. For example, if the pollutant removal potential is most important, a larger percentage of the total points can be allocated to that category. Summing the assigned points for each of the factors gives an overall site score. Sites with the highest score represent the best overall candidates for implementation from a stormwater management vantage point.

The cost estimates can be based on a combination of compiled data in "Costs and Benefits of Stormwater BMPs" (Center for Watershed Protection, 1998) and best professional judgment based on experience. The cost estimate found in the CWP 1998 resource should be modified to account for elapsed time plus the incurred cost of implementing retrofits versus new construction. This provides for a more realistic, if not more conservative, cost estimate. The exact costs will vary from these estimates based on final engineering design, permitting and contingencies. Design, permitting and contingency costs can be generally estimated at approximately 30-35% of the base construction costs (CWP, 1998).

5.0 Watershed Plan Development

Once the restoration projects have been ranked, the above information should be compiled into a watershed plan, complete with all the relevant maps, forms, and other collected data. This plan can be used to justify specific improvement projects and should be updated if additional information becomes available or if priorities change. A good watershed plan is an excellent reference to have in order to select appropriate improvement projects when funding becomes available. It also will contain much of the supporting data and rationale necessary to secure grant funding with specific guidelines. The completion of an effective watershed plan indicates that a community or organization has thought through its watershed and strengths, weakness, and priorities and is prepared to move forward with organized corrective activities.

Attachment: Field Forms

1. Stormwater Retrofit Reconnaissance Inventory
2. Neighborhood Source Assessment
3. Hotspot Site Investigation
4. Pervious Area Assessment
5. Streets and Storm Drains

Stormwater Retrofit Reconnaissance Inventory

1. Site Number: ____________________

2. Location (Address and/or Parcel ID) ____________________

3. Description (preliminary assessment of most likely retrofit-quality, quantity, or both):

4. Unique elements of retrofit (e.g., method of conveyance or stormwater diversion):

5. Date of Preliminary Survey: ____________________

6. Property Ownership (public or private): ____________________

7. Drainage Area: ____________________

8. Approximate imperviousness (%): ____________________

9. Adjacent Land Use (Possible conflicts): ____________________

10. Conflicts with Existing Utilities: ____________________

11. Construction and Maintenance Access:

12. Wetlands Present? ☐ Yes ☐ No

If yes, describe: ____________________

13. Retrofit Volume Computations: ____________________

14. Photo #____________

15. Additional Notes and/or Sketch Information:

16. Site Candidate for Further Investigation: ☐ Yes ☐ No

WATERSHED:	**SUBWATERSHED:**	**UNIQUE SITE ID:**	
DATE: ___/___/_____	**ASSESSED BY:**	**CAMERA ID:**	**PIC#:**

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: ____ Neighborhood Area (acres) _______

If unknown, address (or streets) surveyed:

____

Homeowners Association? ☐ Y ☐ N ☐ Unknown If yes, name and contact information: __________________________

Residential *(circle average single family lot size):* __________________________

☐ Single Family Attached (Duplexes, Row Homes) <⅛ ⅛ ¼ ⅓ ⅓ acre ☐ Multifamily (Apts, Townhomes, Condos)

☐ Single Family Detached <¼ ¼ ½ 1 >1 acre ☐ Mobile Home Park

Estimated Age of Neighborhood: _____ years	Percent of Homes with Garages: _____% With Basements ____%		**INDEX***
Sewer Service? ☐ Y ☐ N			○
Index of Infill, Redevelopment, and Remodeling ☐ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%			○
Record percent observed for each of the following indicators, depending on applicability and/or site complexity	**Percentage**	**Comments/Notes**	
B. YARD AND LAWN CONDITIONS			
B1. % of lot with impervious cover			
B2. % of lot with grass cover			○
B3. % of lot with landscaping (e.g., mulched bed areas)			◇
B4. % of lot with bare soil			○
*Note: B1 through B4 must total 100%			
B5. % of lot with forest canopy			◇
B6. Evidence of permanent irrigation or "non-target" irrigation			○
B7. Proportion of total neighborhood turf lawns with following management status:	High: ____		○
	Med: ____		
	Low: ____		
B8. Outdoor swimming pools? ☐Y ☐N ☐ Can't Tell Estimated # ____			○
B9. Junk or trash in yards? ☐ Y ☐ N ☐ Can't Tell			○
C. DRIVEWAYS, SIDEWALKS, AND CURBS			
C1. % of driveways that are impervious ☐ N/A			
C2. Driveway Condition ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☐ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☐ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer			◇ ○
D2. Downspouts are directed to impervious surface			
D3. Downspouts discharge to pervious area			
D4. Downspouts discharge to a cistern, rain barrel, etc.			
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☐ Y ☐N			◇
E. COMMON AREAS			
E1. Storm drain inlets? ☐ Y ☐ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty			◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: ________________			○
E2. Storm water pond? ☐ Y ☐ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre			◇
E3. Open Space? ☐ Y ☐ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N			○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N			
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS			
Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply*) ☐ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other ________________			○

Recommended Actions

Specific Action

- ☐ Onsite retrofit potential?
- ☐ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ________________________

Describe Recommended Actions:

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☐ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☐ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

NOTES:

Watershed:	Subwatershed:		Unique Site ID:
Date:	Assessed By:	Camera ID:	Pic#:
Map Grid:	Lat ___°_____'_____" Long ___°_____'____"		LMK #

A. Site Data and Basic Classification

Name and Address:

____

____

SIC code (if available): ___________

NPDES Status: ☐ Regulated ☐ Unregulated ☐ Unknown

Category: ☐ Commercial ☐ Industrial Miscellaneous
☐ Institutional ☐ Municipal ☐ Golf Course
☐ Transport-Related ☐ Marina
☐ Animal Facility

Basic Description of Operation:

____

	INDEX *
B. Vehicle Operations ☐ **N/A (Skip to part C)** **Observed Pollution Source?**	☐
B1. Types of vehicles: ☐ Fleet vehicles ☐ School buses ☐ Boats ☐ Other: ____________	
B2. Approximate number of vehicles:	
B3. Vehicle activities (circle all that apply): Maintained Repaired Recycled Fueled Washed Painted Stored	○
B4. Are vehicles stored and/or repaired outside? ☐ Y ☐ N ☐ Can't Tell Are these vehicles lacking runoff diversion methods? ☐ Y ☐ N ☐ Can't Tell	○
B5. Is there evidence of spills/leakage from vehicles? ☐ Y ☐ N ☐ Can't Tell	○
B6. Are uncovered outdoor fueling areas present? ☐ Y ☐ N ☐ Can't Tell	○
B7. Are fueling areas directly connected to storm drains? ☐ Y ☐ N ☐ Can't Tell	○
B8. Are vehicles washed outdoors? ☐ Y ☐ N ☐ Can't Tell Does the area where vehicles are washed discharge to the storm drain? ☐ Y ☐ N ☐ Can't Tell	○
C. Outdoor Materials ☐ **N/A** *(Skip to part D)* **Observed Pollution Source?**	☐
C1. Are loading/unloading operations present? ☐ Y ☐ N ☐ Can't Tell If yes, are they uncovered *and* draining towards a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell	○
C2. Are materials stored outside? ☐ Y ☐ N ☐ Can't Tell If yes, are they ☐ Liquid ☐ Solid Description: _______ Where are they stored? ☐ grass/dirt area ☐ concrete/asphalt ☐ bermed area	○
C3. Is the storage area directly or indirectly connected to storm drain (circle one)? ☐ Y ☐ N ☐ Can't Tell	○
C4. Is staining or discoloration around the area visible? ☐ Y ☐ N ☐ Can't Tell	○
C5. Does outdoor storage area lack a cover? ☐ Y ☐ N ☐ Can't Tell	○
C6. Are liquid materials stored *without* secondary containment? ☐ Y ☐ N ☐ Can't Tell	○
C7. Are storage containers missing labels or in poor condition (rusting)? ☐ Y ☐ N ☐ Can't Tell	○
D. Waste Management ☐ **N/A** *(Skip to part E)* **Observed Pollution Source?**	☐
D1. Type of waste *(check all that apply)*: ☐ Garbage ☐ Construction materials ☐ Hazardous materials	○
D2. Dumpster condition (*check all that apply)*: ☐ No cover/Lid is open ☐ Damaged/poor condition ☐ Leaking or evidence of leakage (stains on ground) ☐ Overflowing	○
D3. Is the dumpster located near a storm drain inlet? ☐ Y ☐ N ☐ Can't Tell If yes, are runoff diversion methods (berms, curbs) lacking? ☐ Y ☐ N ☐ Can't Tell	○
E. Physical Plant ☐ **N/A** *(Skip to part F)* **Observed Pollution Source?**	☐
E1. Building: Approximate age: _yrs. Condition of surfaces: ☐ Clean ☐ Stained ☐ Dirty ☐ Damaged Evidence that maintenance results in discharge to storm drains (staining/discoloration)? ☐ Y ☐ N ☐ Don't know	○ ○

*Index: ○ denotes potential pollution source; ☐ denotes confirmed polluter (evidence was seen)

E2. Parking Lot: Approximate age __yrs. Condition: ☐ Clean ☐ Stained ☐ Dirty ☐ Breaking up Surface material ☐ Paved/Concrete ☐ Gravel ☐ Permeable ☐ Don't know	○
E3. Do downspouts discharge to impervious surface? ☐ Y ☐ N ☐ Don't know ☐ None visible Are downspouts directly connected to storm drains? ☐ Y ☐ N ☐ Don't know	○
E4. Evidence of poor cleaning practices for construction activities (stains leading to storm drain)? ☐ Y ☐ N ☐ Can't Tell	○
F. Turf/Landscaping Areas ☐ **N/A** *(skip to part G)*	**Observed Pollution Source?** ☐
F1. % of site with: Forest canopy ___ % Turf grass ____% Landscaping ____% Bare Soil-___%	○
F2. Rate the turf management status: ☐ High ☐ Medium ☐ Low	○
F3. Evidence of permanent irrigation or "non-target" irrigation ☐ Y ☐ N ☐ Can't Tell	○
F4. Do landscaped areas drain to the storm drain system? ☐ Y ☐ N ☐ Can't Tell	○
F5. Do landscape plants accumulate organic matter (leaves, grass clippings) on adjacent impervious surface? ☐ Y ☐ N ☐ Can't Tell	○
G. Storm Water Infrastructure ☐ **N/A** *(skip to part H)*	**Observed Pollution Source?** ☐
G1. Are storm water treatment practices present? ☐ Y ☐ N ☐ Unknown If yes, please describe:	○
G2. Are private storm drains located at the facility? ☐ Y ☐ N ☐ Unknown Is trash present in gutters leading to storm drains? If so, complete the index below.	○

Index Rating for Accumulation in Gutters

	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

G3. Catch basin inspection – Record SSD Unique Site ID here: _________ Condition: ☐ Dirty ☐ Clean

H. Initial Hotspot Status - Index Results

☐ Not a hotspot (fewer than 5 circles and no boxes checked) ☐ Potential hotspot (5 to 10 circles but no boxes checked)
☐ Confirmed hotspot (10 to 15 circles and/or 1 box checked) ☐ Severe hotspot (>15 circles and/or 2 or more boxes checked)

Follow-up Action:

☐ Refer for immediate enforcement
☐ Suggest follow-up on-site inspection
☐ Test for illicit discharge
☐ Include in future education effort
☐ Check to see if hotspot is an NPDES non-filer
☐ Onsite non-residential retrofit
☐ Pervious area restoration; complete PAA sheet and record
Unique Site ID here: _____________________
☐ Schedule a review of storm water pollution prevention plan

Notes:

WATERSHED:	**SUBWATERSHED:**	**UNIQUE SITE ID:**

DATE: ___/___/_____	**ASSESSED BY:**	**CAMERA ID:**	**PIC #:**
MAP GRID:	**LAT** ___°_____'_____" **LONG** ___°_____'_____"		**LMK #**

A. PARCEL DESCRIPTION

Size: ___acre(s) Access to site (*check all that apply*): ☐ Foot access ☐ Vehicle access ☐ Heavy equipment access
Ownership: ☐ Private ☐ Public Current Management: ☐ School ☐ Park ☐ Right-of-way ☐ Vacant land
☐ Other (please describe) ____________________
Contact Information: ____________________
Connected to other pervious area? ☐ Y ☐ N If yes, what type? ☐ Forest ☐ Wetland ☐ Other ____________
Estimated size of connected pervious area: ____ acre(s) Record Unique Site ID of connected fragment: __________

PART I. NATURAL AREA REMNANT

FOREST

B. CURRENT VEGETATIVE COVER

B1. Percent of forest with the following canopy coverage:
Open _____% Partly shaded _____% Shaded _____%
**Note – these should total 100%*
B2. Dominant tree species: ____________________
____
B3. Understory species: ____________________
____
B4. Are invasive species present? ☐ Y ☐ N
☐ Unknown
If yes, % of forest with invasives: _______
Species: ____________________

C. FOREST IMPACTS

C1. Observed Impacts (*check all that apply*): ☐ Animals ☐ Clearing/encroachment ☐ Trash and dumping ☐ Storm water runoff ☐ Other

D. NOTES

WETLAND

B. CURRENT VEGETATIVE COVER

B1. % of wetland with following vegetative zones:
Aquatic: __________
Emergent: __________
Forested: __________
**Note – these should total 100%*
B2. Dominant species: ____________________
____
B3. Are invasive species present? ☐ Y ☐ N
☐ Unknown
If yes, % of wetland with invasives: _______
Species: ____________________

C. WETLAND IMPACTS

C1. Observed Impacts (*check all that apply*): ☐ Animals ☐ Clearing/encroachment ☐ Trash and dumping ☐ Storm water runoff ☐ Hydrologic impacts ☐ Other

D. NOTES

E. INITIAL RECOMMENDATION

☐ Good candidate for conservation/protection
☐ Potential restoration candidate
☐ Poor restoration or conservation candidate

PART II. OPEN PERVIOUS AREAS

A. CURRENT VEGETATIVE COVER

A1. Percent of assessed surface with:
Turf _____% Other Herbaceous _____% None (bare soil) _____% Trees _____% Shrubs ____ % Other _____%
(please describe): ____ **Note – these should total 100%*

A2. Turf: Height: _____ inches Apparent Mowing Frequency: ☐ Frequent ☐ Infrequent ☐No-Mow ☐ Unknown
Condition (*check all that apply*): ☐ Thick/Dense ☐ Thin/Sparse ☐ Clumpy/Bunchy ☐ Continuous Cover

A3. Thickness of organic matter at surface: _______ inches

A4. Are invasive species present? ☐ Y ☐ N ☐ Unknown If yes, % of site with invasives: _____
Species:____

B. IMPACTS

B1. Observed Impacts (*check all that apply*): ☐ Soil Compaction ☐ Erosion ☐ Trash and Dumping
☐ Poor Vegetative Health ☐ Other (describe): ______________________________________

C. REFORESTATION CONSTRAINTS

C1. Sun exposure: ☐ Full sun ☐ Partial sun ☐ Shade ☐ Unknown

C2. Nearby water source? ☐ Y ☐ N ☐ Unknown

C3. Other constraints: ☐ Overhead wires ☐ Underground Utilities ☐ Pavement ☐ Buildings
☐ Other (please describe): ___________________

D. NOTES

E. INITIAL RECOMMENDATION

☐ Good candidate for natural regeneration
☐ May be reforested with minimal site preparation
☐ May be reforested with extensive site preparation
☐ Poor reforestation or regeneration site

PART III. SKETCH

WATERSHED:	**SUBWATERSHED:**	**UNIQUE SITE ID:**
DATE: ___/___/_____	**ASSESSED BY:**	**CAMERA ID:**
MAP GRID	**RAIN IN LAST 24 HOURS** ☐ Y ☐ N	**PIC #**

A. LOCATION

A1. Street names or neighborhood surveyed:

____

A2. Adjacent land use: ☐ Residential ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

A3. Corresponding HSI or NSA field sheet? If so, circle HSI or NSA and record its Unique Site ID here _____________

B. STREET CONDITIONS

B1. Road Type: ☐ Arterial ☐ Collector ☐ Local ☐ Alley ☐ Other: __________

B2. Condition of Pavement: ☐ New ☐ Good ☐ Cracked ☐ Broken

B3. Is on-street parking permitted ☐ Y ☐ N If yes, approximate number of cars per block: ________

B4. Are large cul-de-sacs present? ☐ Y ☐ N

B5. Is trash present in curb and gutter? If so, use the index to the right to record amount.	Index Rating for Accumulation in Gutters				
	Clean				Filthy
Sediment	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Organic Material	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Litter	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

C. STORM DRAIN INLETS AND CATCH BASINS

C1. Type of storm drain conveyance: ☐ open ☐ enclosed ☐ mixed

C2. Percentage of inlets with catch basin storage: _________ ☐ N/A

Sample 1-2 catch basins per NSA/HSI	**C3.** Catch basin #1	**C4.** Catch basin #2
Latitude	___° ______' ______"	___° ______' ______"
Longitude	___° ______' ______"	___° ______' ______"
LMK #		
Picture #		
Current Condition	☐ Wet ☐ Dry	☐ Wet ☐ Dry
Condition of Inlet	☐Clear ☐Obstructed	☐Clear ☐Obstructed
Litter Accumulation	☐Y ☐ N	☐Y ☐ N
Organics Accumulation	☐Y ☐ N	☐Y ☐ N
Sediment Accumulation	☐Y ☐ N	☐Y ☐ N
Sediment Depth (in feet)	__________ ft.	__________ ft.
Water Depth	__________ ft.	__________ ft.
Evidence of oil and grease	☐Y ☐ N	☐Y ☐ N
Sulfur smell	☐Y ☐ N	☐Y ☐ N
Accessible to vacuum truck	☐Y ☐ N	☐Y ☐ N

D. NON-RESIDENTIAL PARKING LOT (>2 acres)

D1. Approximate size: _________ acres

D2. Lot Utilization: ☐ Full ☐ About half full ☐ Empty

D3. Overall condition of Pavement: ☐ Smooth (no cracks) ☐ Medium (few cracks) ☐ Rough (many cracks) ☐ Very Rough (numerous cracks and depressions)

D4. Is lot served by a storm water treatment practice? ☐ Y ☐ N If yes, describe: ______________________

D5. On-site retrofit potential: ☐ Excellent ☐ Good ☐ Poor

E. MUNICIPAL POLLUTANT REDUCTION STRATEGIES

E1. Degree of pollutant accumulation in the system: ☐ High ☐ Medium ☐ Low ☐ None

E2. Rate the feasibility of the following pollution prevention strategies:

Street Sweeping:	☐ High	☐ Moderate	☐ Low
Storm Drain Stenciling:	☐ High	☐ Moderate	☐ Low
Catch Basin Clean-outs:	☐ High	☐ Moderate	☐ Low
Parking Lot Retrofit Potential:	☐ High	☐ Moderate	☐ Low

CATCH BASIN SKETCHES

#1	**#2**

Notes:

APPENDIX C

Description of Proposed Best Management Practices

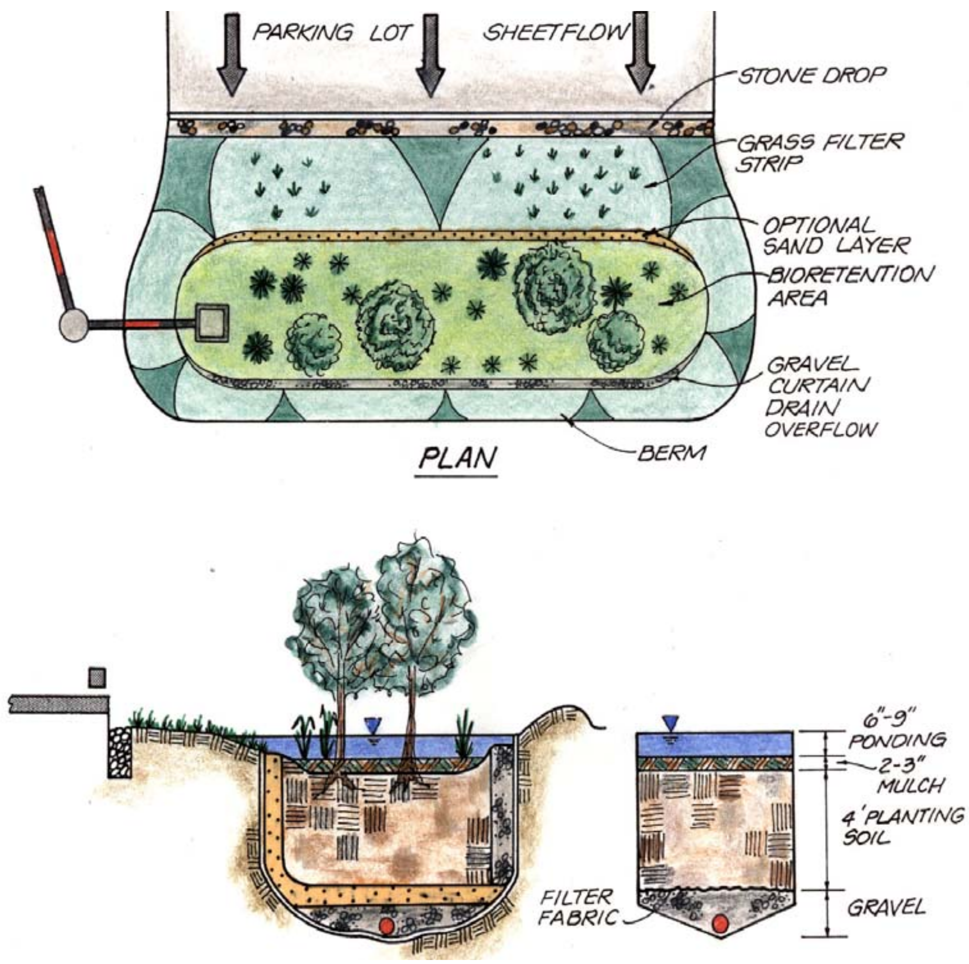
DESCRIPTION OF PROPOSED BEST MANAGEMENT PRACTICES

The best management practices proposed for implementation at sites in the West Neck Bay watershed include bioretention systems, micro-bio inlets, dry swales, grass channels, and oil/grit separators. A detailed description of each is included below.

1. Bioretention System

The bioretention system (also referred to as a "rain garden" or a "biofilter") is a stormwater management practice to manage and treat stormwater runoff using a conditioned soil bed and planting materials to filter runoff stored within a shallow depression. The method combines physical filtering and adsorption with bio-geochemical processes to remove pollutants. The system consists of an inflow component, a pretreatment element, an overflow structure, a shallow ponding area (less than 6" deep), a surface organic layer of mulch, a planting soil bed, plant materials, and an underdrain system to convey treated runoff to a downstream facility (see Figure C-1).

Figure C-1: Schematic of a Bioretention System (Claytor & Schueler, 1996)



Bioretention facility surface areas are typically sized at a ratio of 5% of the impervious area draining to the facility to capture, manage, and treat runoff from the 1.2-inch precipitation event (Claytor & Schueler, 1996). Pretreatment for bioretention consists of a grass channel or grass filter strip, a gravel diaphragm / stone drop, and a mulch layer. In addition, there are several physical geometry recommendations that should be considered in the layout and design of bioretention facilities. Suggested design guidance is included in Table C-1.

Bioretention facilities are cost-effective measures designed to help meet many of the management objectives of watershed protection. Because these practices are proportional to the percentage of impervious area, the cost is relatively constant with drainage area. Unlike retention ponds and constructed stormwater wetlands, whose cost decreases with increasing drainage area, bioretention does not benefit from economies of scale. Typical capital construction costs are in the range of approximately $7 to $8 per cubic foot of storage. Annual maintenance cost is approximately 5 to 7% of capital construction costs or in the range of $900 to $1,000 per impervious acre treated.

Table C-1. Design Guidance for a Bioretention System

Design Guidance	
Minimum width	10 feet
Minimum length	15 feet
Length to width ratio	2:1
Maximum ponding depth	6 inches
Planting soil depth	4 feet
Underdrain system	6" pipe in 8" gravel bed
Plant spacing	trees* at 10-foot centers; shrubs* at 5-foot centers; herbaceous materials* at 1- to 2-foot centers

*See the Native Plant Guide (Table H.5) in the New York State Stormwater Management Design Manual for particular native plant species that work well in bioretention systems.

Inspections are an integral part of system maintenance. During the six months immediately after construction, bioretention facilities should be inspected at least twice or more following precipitation events of at least 0.5 inch to ensure that the system is functioning properly. Thereafter, inspections should be conducted on an annual basis and after storm events of greater than or equal to the water quality storm event. Minor soil erosion gullies should be repaired when they occur. Pruning or replacement of woody vegetation should occur when dead or dying vegetation is observed. Separation of herbaceous vegetation root stock should occur when over-crowding is observed, or approximately once every 3 years. The mulch layer should also be replenished (to the original design depth) every other year as directed by inspection reports. The previous mulch layer would be removed, and properly disposed of, or roto-tilled into the soil surface. If at least 50% vegetation coverage is not established after two years, a reinforcement planting should be performed. If the surface of the bioretention system becomes clogged to the point that standing water is observed on the surface 48 hours after precipitation events, the surface should be roto-tilled or cultivated to breakup any hard-packed sediment, and then revegetated.

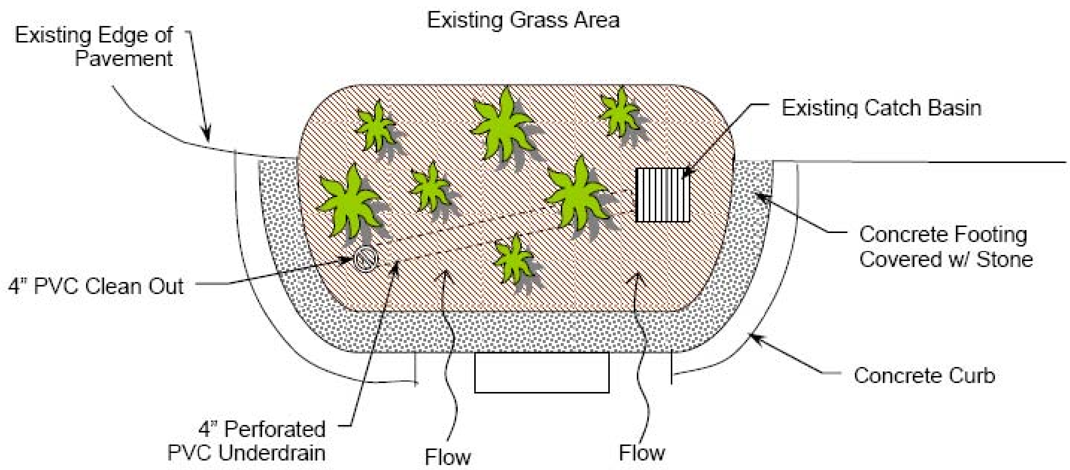
2. Micro-Bio Inlet

Micro-bio inlets are small-scale versions of bioretention systems (Figure C-2). They are recommended at locations where a full-size bioretention system will not fit. Existing roadside catch basins can be used as the overflow structure, and the filter media and plantings can be installed around it, forming an island. Curbing with inlet cuts and traffic bollards are required to prevent damage from vehicles while still allowing stormwater to enter. A curtain of stone or gravel should be used to provide pretreatment of the stormwater prior to the filter portion of this BMP.

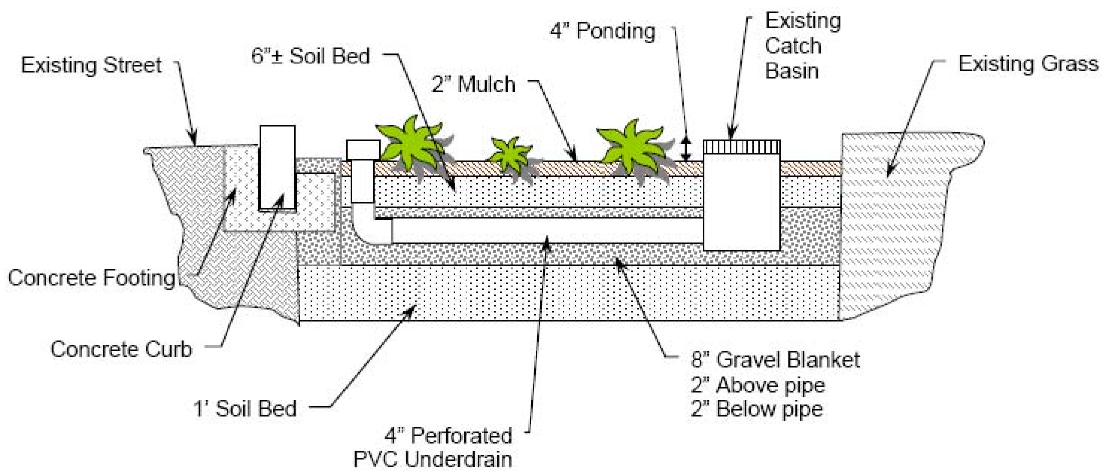
Costs for Micro-bio inlets are higher than bioretention systems since additional traffic control and pavement restoration are needed. Typical capital construction costs are in the range of approximately $10 to $12 per cubic foot of storage. Annual maintenance cost is approximately 5 to 7% of capital construction costs.

Maintenance requirements are similar to bioretention systems. Inspections are an integral part of system maintenance. During the six months immediately after construction, micro-bio inlets should be inspected at least twice, or more, following precipitation events of at least 0.5 inch to ensure that the system is functioning properly. Thereafter, inspections should be conducted on an annual basis and after storm events of greater than or equal to the water quality storm event. Minor soil erosion gullies should be repaired when they occur. Pruning or replacement of woody vegetation should occur when dead or dying vegetation is observed. Separation of herbaceous vegetation root stock should occur when over-crowding is observed, or approximately once every 3 years. The mulch layer should also be replenished (to the original design depth) every other year as directed by inspection reports. The previous mulch layer would be removed, and properly disposed of, or roto-tilled into the soil surface. If at least 50% vegetation coverage is not established after two years, a reinforcement planting should be performed. If the surface of the bioretention system becomes clogged to the point that standing water is observed on the surface 48 hours after precipitation events, the surface should be roto-tilled or cultivated to breakup any hard-packed sediment, and then revegetated.

Figure C-2: Schematic of a Micro-Bio Inlet



Micro-Bio Inlet Schematic Plan

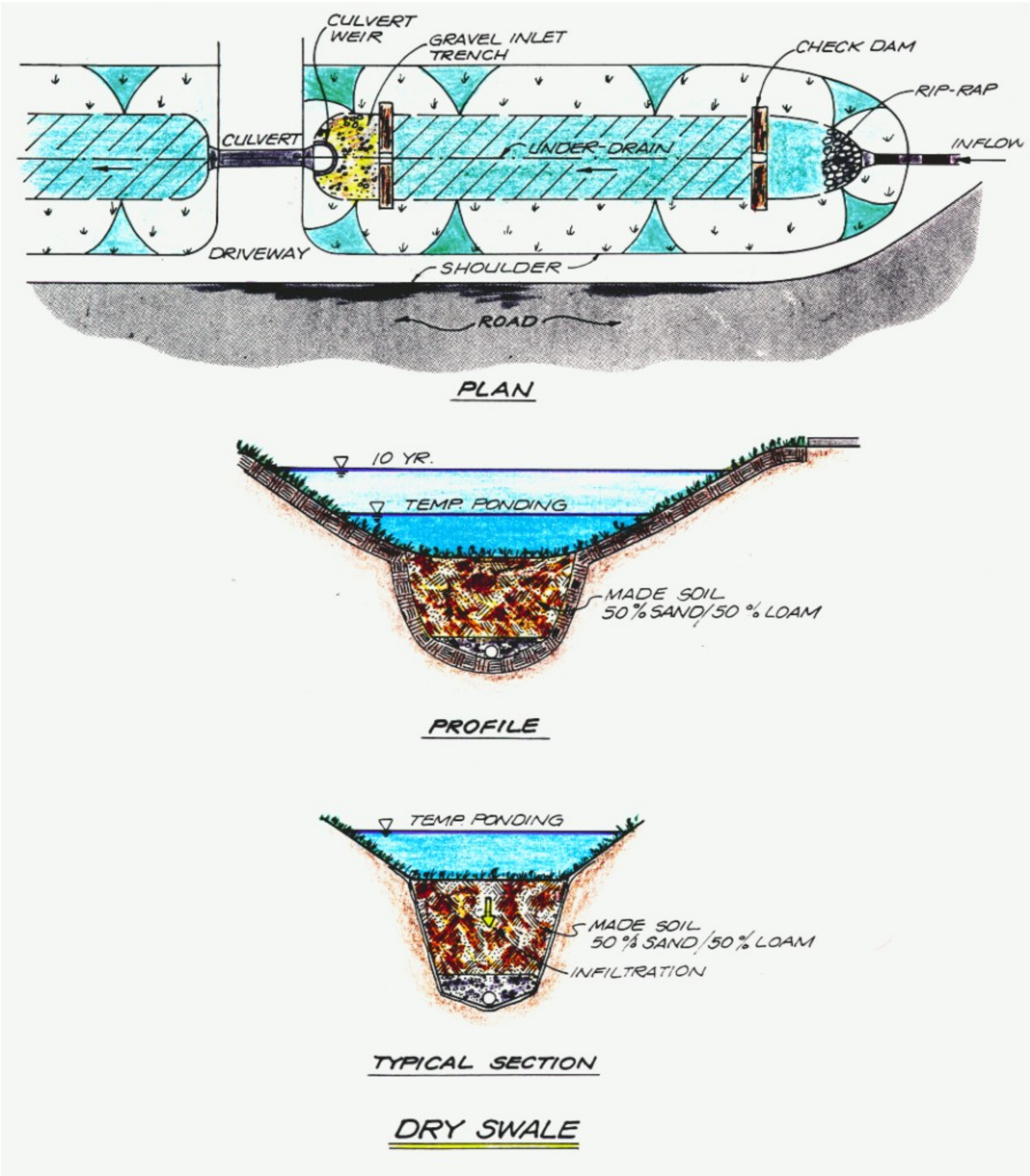


Micro-Bio Inlet Schematic Profile

3. Dry Swale

Dry swales are concave, vegetated conveyance systems that can improve water quality through infiltration and filtering. When designed properly, they can be used to retain and treat stormwater runoff. Dry swales are appropriate in areas where standing water is not desirable such as residential, commercial, industrial areas and highway medians. In dry swales, a prepared soil bed is designed to filter the runoff for water quality (Figure C-3). Runoff is then collected in an underdrain system and discharged to the downstream drainage system. The design objective for dry swales is to drain down within twenty-four hours of a storm event, which is similar to a bioretention system; except that the pollutant uptake is likely to be more limited, since only a grass cover crop is available for nutrient uptake.

Figure C-3: Schematic of a Dry Swale (Claytor & Schueler, 1996)



The general design of dry swales takes into consideration the following design criteria (Table C-2):

Table C-2: Design Criteria for Dry Swales (Claytor and Schueler, 1996)

Design Criteria	
Bottom Width	2 feet minimum, 8 feet maximum, widths up to 16 feet are allowable if a dividing berm or structure is used
Side Slopes	2:1 maximum, 3:1 or flatter preferred
Longitudinal Slope	1.0% to 2.0% without check dams
Flow Depth and Capacity	Surface storage of water quality volume with a maximum depth of 18 inches for water quality treatment (12 inches average depth). Adequate capacity for 10 year storm with 6 inches of freeboard
Flow Velocity	4.0 fps to 5.0 fps for 2 year storm
Length	Length necessary to drain (dry swale) runoff for 24 hours

A designed swale, such as a dry swale with prepared soil and underdrain piping, has an estimated cost of $4.25 per cubic foot (SWRPC, 1991). Relative to other filtering system options, these costs are considered to be moderate to low. Most recent cost estimates have approximated $19 per linear feet for dry swales. The annual maintenance cost can range from 5 to 7% of the construction cost (SWRPC, 1991).

The life of dry swales is directly proportional to the maintenance frequency. The maintenance objective for this practice includes keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover. The following activities are recommended on an annual basis or as needed:

- Mowing and litter and debris removal
- Stabilization of eroded side slopes and bottom
- Nutrient and pesticide use management
- Dethatching swale bottom and removal of thatching
- Discing or aeration of swale bottom

Every five years, scraping of the channel bottom and removal of sediment to restore original cross section and infiltration rate, and seeding or sodding to restore ground cover are recommended.

Dry swales should be inspected on an annual basis and just after storms of greater than or equal to the water quality storm event. Both the structural and vegetative components should be inspected and repaired. When sediment accumulates to a depth of approximately 3 inches, it should be removed, and the swale should be reconfigured to its original dimensions. The grass in the dry swale should be mowed at least 4 times during the growing season. If the surface of the dry swale becomes clogged to the point that standing water is observed in the surface 48 hours after precipitation events, the bottom should be roto-tilled or cultivated to break up any hard-packed sediment, and then reseeded. Trash and debris should be removed and properly disposed.

4. Grass Channel

Grass drainage channels (also commonly referred to as swales) are proposed for conveyance and pretreatment use (Figure C-4). Grassed drainage channels accent the natural landscape, break up impervious areas, and are appropriate alternatives to curb and gutter systems. They are best suited to treat runoff from lower density areas and roadways. They are often used in combination with other stormwater management practices as a part of the runoff conveyance system to provide pre-treatment. They are designed for water quality treatment and provide limited infiltration to groundwater.

The design criteria for grass channels are similar to dry swales (see Table C-3). However, the costs to construct grass channels are much lower because the prepared soil and underdrain system are not part of the design. Grass channels have an estimated cost of $0.50 per cubic foot (based on cost per square foot, and assuming 6 inches of storage in the filter) (SWRPC, 1991). The annual maintenance cost can range from 5 to 7 % of the construction cost (SWRPC, 1991).

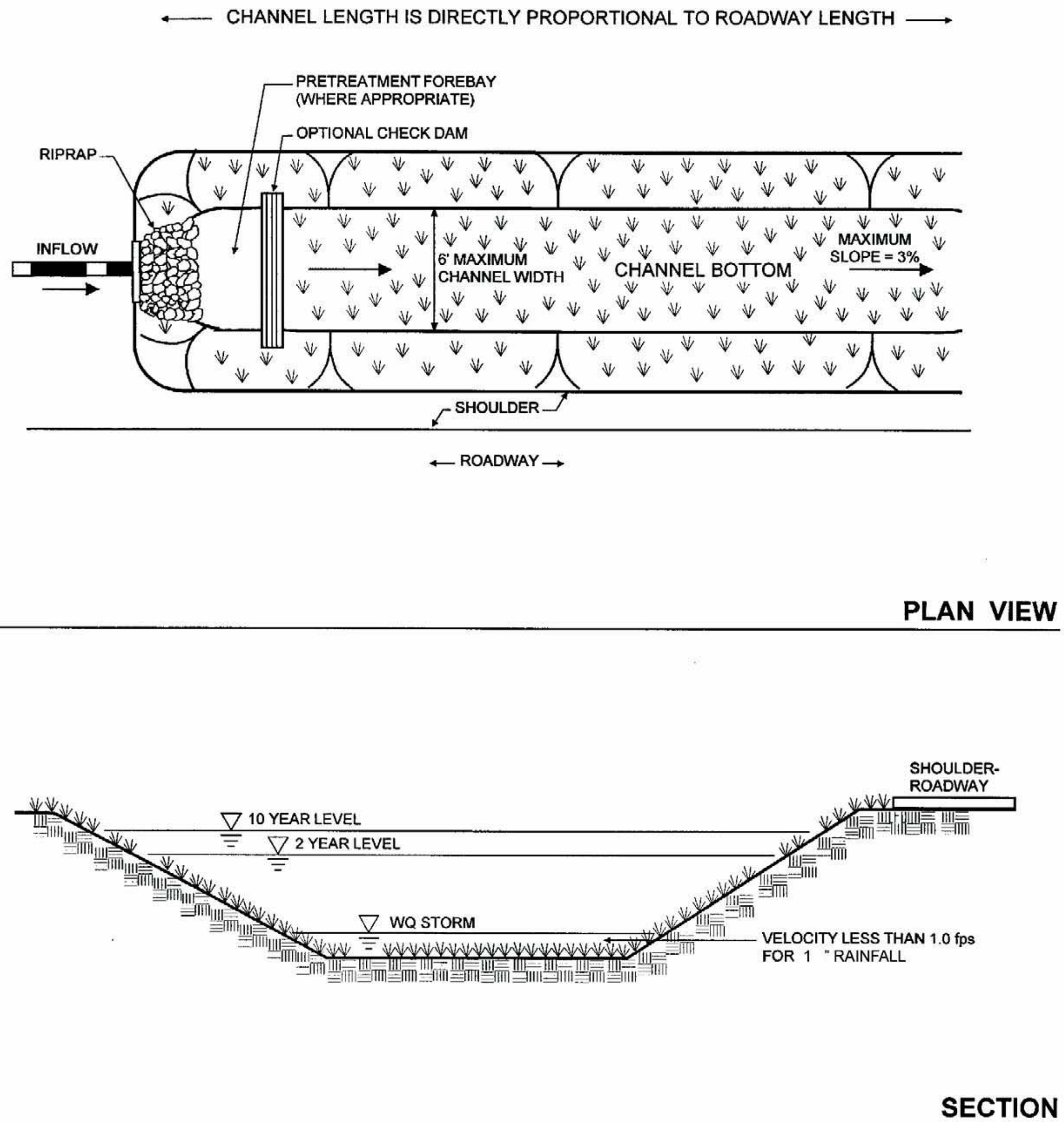
Similar to dry swales, the lifetime of grass channels is directly proportional to the maintenance frequency. The maintenance objective for this practice includes preserving or retaining the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover. The following activities are recommended on an annual basis or as needed:

- Mowing and litter and debris removal
- Stabilization of eroded side slopes and bottom
- Nutrient and pesticide use management
- Dethatching swale bottom and removal of thatching
- Discing or aeration of swale bottom

Table C-3: Design Criteria for Grass Channels (Claytor and Schueler, 1996)

Design Criteria	
Bottom Width	2 feet minimum, 6 feet maximum, widths up to 12 feet are allowable if a dividing berm or structure is used
Side Slopes	3:1 or flatter
Longitudinal Slope	1.0% minimum, 4.0% maximum
Flow Depth and Capacity	4 inch for water quality treatment
Flow Velocity	1.0 fps for water quality treatment, 4.0 to 5.0 fps for 2 year storm, 7.0 fps for 10-year storm
Length	Length necessary for 10-minute residence time

Figure C-4: Schematic of a Grassed Channel (Vermont Agency of Natural Resources, 2002)



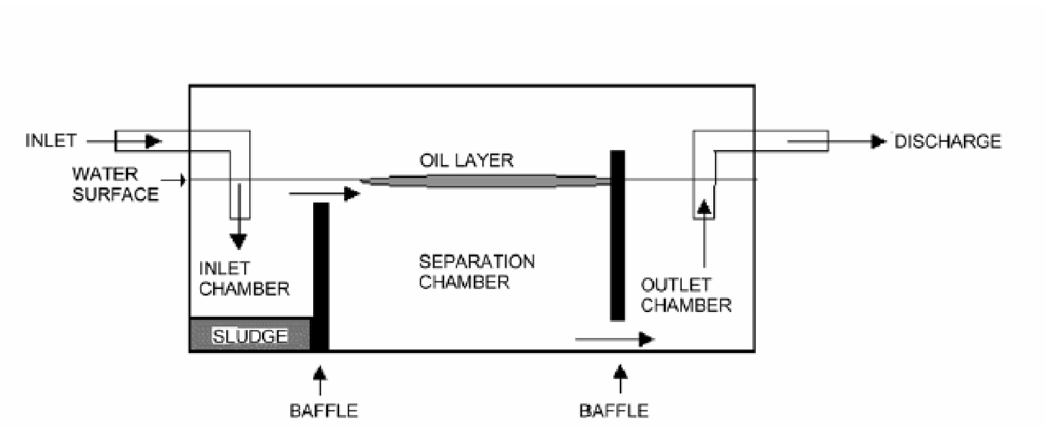
Grass channels should be inspected on an annual basis and just after storms of greater than or equal to the water quality storm event. Both the structural and vegetative components should be inspected and repaired. When sediment accumulates to a depth of approximately 3 inches, it should be removed, and the swale should be reconfigured to its original dimensions. The grass in the channel should be mowed at least 4 times during the growing season. If the surface of the grass channel becomes clogged to the point that standing water is observed on the surface 48 hours after precipitation events, the bottom should be roto-tilled or cultivated to break up any hard-packed sediment, and then reseeded. Trash and debris should be removed and properly disposed of.

5. Oil/Grit Separator

Oil/grit separators are pollution prevention devices that remove oil and sediment from stormwater runoff and store them for safe and easy removal. They operate by employing various physical or chemical separation methods, including gravity separation, filters, coagulation/flocculation, and flotation. Typically, these devices contain a series of chambers which serve to first trap floatables, and then employ gravity settling of sediment. Oil and grease float to the top of a permanent pool of water, and ultimately get trapped in the second (separation) chamber. It is recommended that this practice is a bypass structure. Storms that exceed the design capacity are bypassed by the structure, minimizing the potential for resuspension of previously settled materials. Figure C-5 below is an illustration of an oil/grit separator.

The estimated capital costs for these technologies vary and depend on the design capacity. Smaller units that are sized under 200 cubic feet will cost just under $10,000, while larger units sized over 1,500 cubic feet can cost up to $80,000.

Figure C-5: Schematic of an Oil/Grit Separator



Maintenance burdens for these units are heavy and represent one of the larger drawbacks to their application. Another limitation of these practices is their reported inability to remove bacteria and nutrients. Because of this limitation, the devices are only specified where no other BMP is feasible. Regular inspection, ranging from monthly to quarterly, is required with routine removal of sand and oil. Further unplanned pump-outs are required in the event of a large contaminant spill. Removal and disposal of sand and oil generally costs approximately $400 per cleanout.

Cleanout is required once the stored volume reaches 15% of the device’s capacity, or immediately in the event of a spill. Maintenance intervals vary depending on the application, but are recommended quarterly for the first year. Oils and sediments can be removed via accessible pipes and inspection ports.

APPENDIX D

Selected BMP Sites

D-1	Subwatershed WN-1
D-2	Subwatershed WN-3

APPENDIX D-1

Subwatershed WN-1

Peconic Bay Estuary Stormwater Retrofit Reconnaissance Inventory

1. Site Number: WN-1

2. Location (Address and/or Parcel ID) Community Dr. & Hilo Dr.

3. Description (preliminary assessment of most likely retrofit-quality, quantity, or both): Water runs down both hills before entering salt marsh at the intersection. There is no existing drainage structure.

4. Unique elements of retrofit (e.g., method of conveyance or stormwater diversion):

Dry swale along one side of roadway. Pavement is in bad condition, will need to repave, during which cross slope of pavement can be directed to the dry swale. Bioretention at intersection with a private easement.

5. Date of Preliminary Survey: 9/13/05

6. Property Ownership (public or private): Public in R.O.W of road, otherwise private

7. Drainage Area: 15 acres

8. Approximate imperviousness (%): 18%

9. Adjacent Land Use (Possible conflicts): Private property easement required.

10. Conflicts with Existing Utilities: None

11. Construction and Maintenance Access: Good

12. Wetlands Present? ☑ Yes ☐ No

If yes, describe: Salt Marsh nearby

13. Retrofit Volume Computations: 90% Rule: WQV = [(P) (Rv) (A)] / 12

Rv = 0.05+0.009(I)

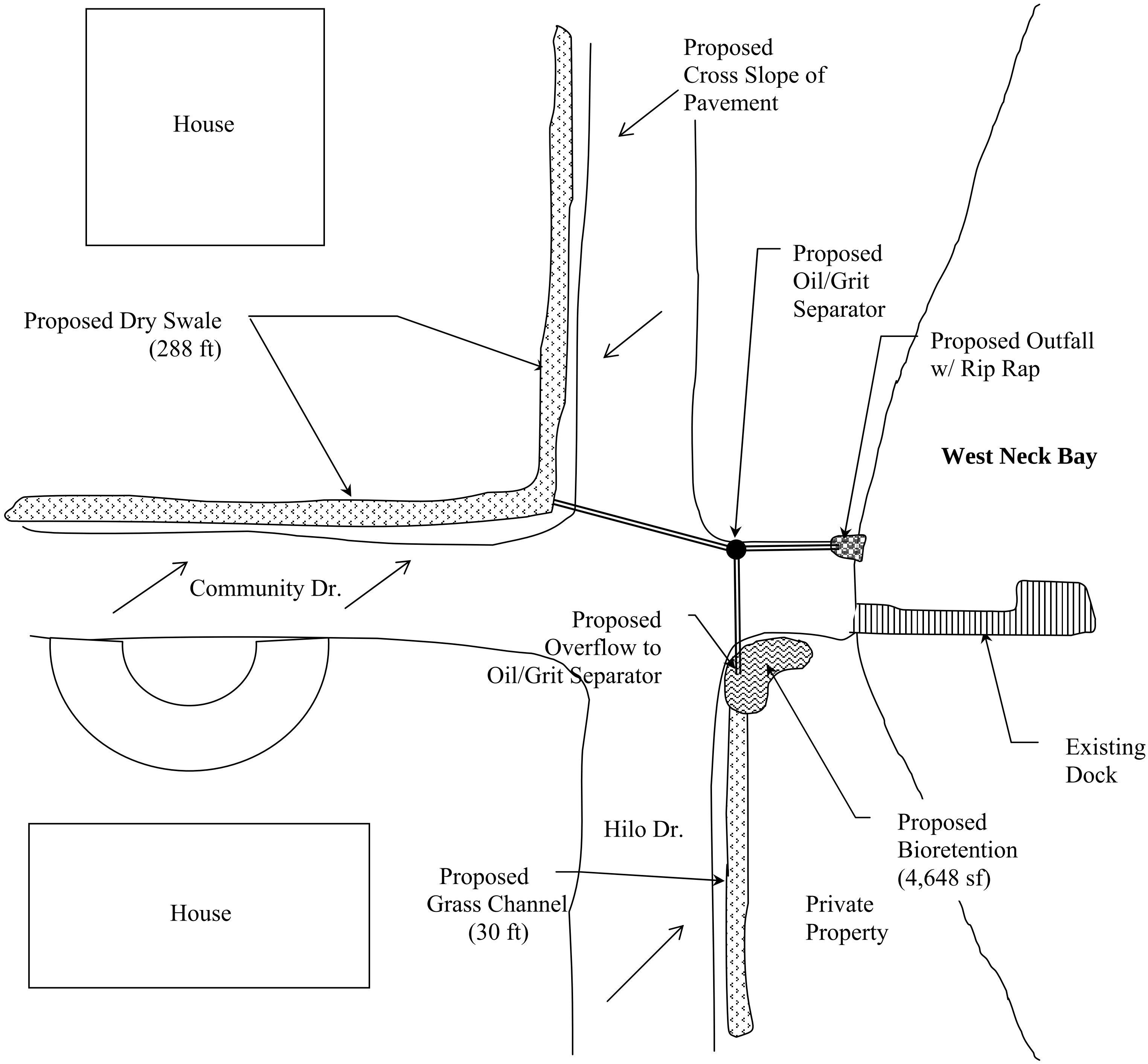
WQV = [(**P**) (0.05+0.009(**I**)) (**A**)] / 12

WQV = [(**1.2”**) (0.05+0.009(**18**)) (**15**)]/ 12

WQV = 0.32_acre-ft ≅ 13,852 cf

14. Photo # WN1-1 – WN1-5

15. Additional Notes and/or Sketch Information:



16. Site Candidate for Further Investigation: ☑ Yes ☐ No

Legend

Proposed BMP Drainage Areas

Bioretention

Dry Swale

Grass Channels

WN-1 Site Location

Drywells

* Source: Aerial Photo, NYS Office of Cyber Security & Critical Infrastructure Coordination, Spring 2004

N

Feet

250

Horsley Witten Group
phone: 508-833-6600
www.horsleywitten.com

Best Management Practices (BMP) Sites
West Neck Bay Watershed
Shelter Island

7/19/06 EC
J:\4094 Peconic Bay Estuary\GIS\WN-1.mxd

Figure D-1

West Neck Bay

WN-1 Hilo Drive (West 1)

WN-1 Hilo Drive (East)

WN-1 Hilo Drive (West 2)

WN-1 Hilo Drive (North) & Community Drive

WN-1 Hilo Drive (South)

APPENDIX D-2

Subwatershed WN-3

Peconic Bay Estuary Stormwater Retrofit Reconnaissance Inventory

1. Site Number: WN-3

2. Location (Address and/or Parcel ID) Terry Dr.

3. Description (preliminary assessment of most likely retrofit-quality, quantity, or both):
Retrofit for water quality treatment of roadway runoff prior to being infiltrated underground.

4. Unique elements of retrofit (e.g., method of conveyance or stormwater diversion):

Use the existing infrastructure and low point to treat the runoff with a proposed micro-bio inlet with a stone curtain around existing infiltrating catch basin.

5. Date of Preliminary Survey: 9/13/05

6. Property Ownership (public or private): Private/Public in Right of Way

7. Drainage Area: 9.1 acres

8. Approximate imperviousness (%): 20%

9. Adjacent Land Use (Possible conflicts): None

10. Conflicts with Existing Utilities: None

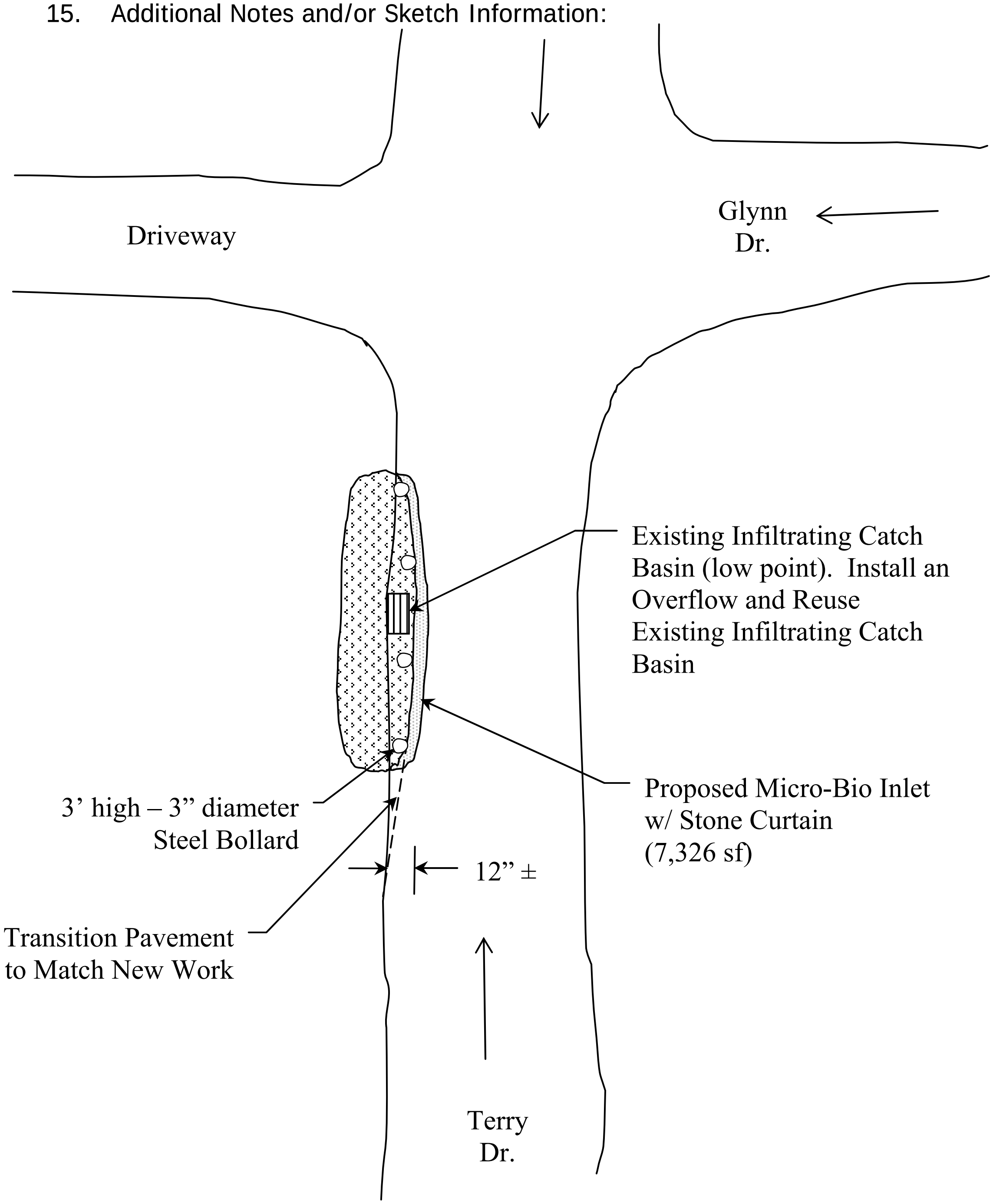
11. Construction and Maintenance Access:
Excellent

12. Wetlands Present? ☐ Yes ☑ No
If yes, describe:

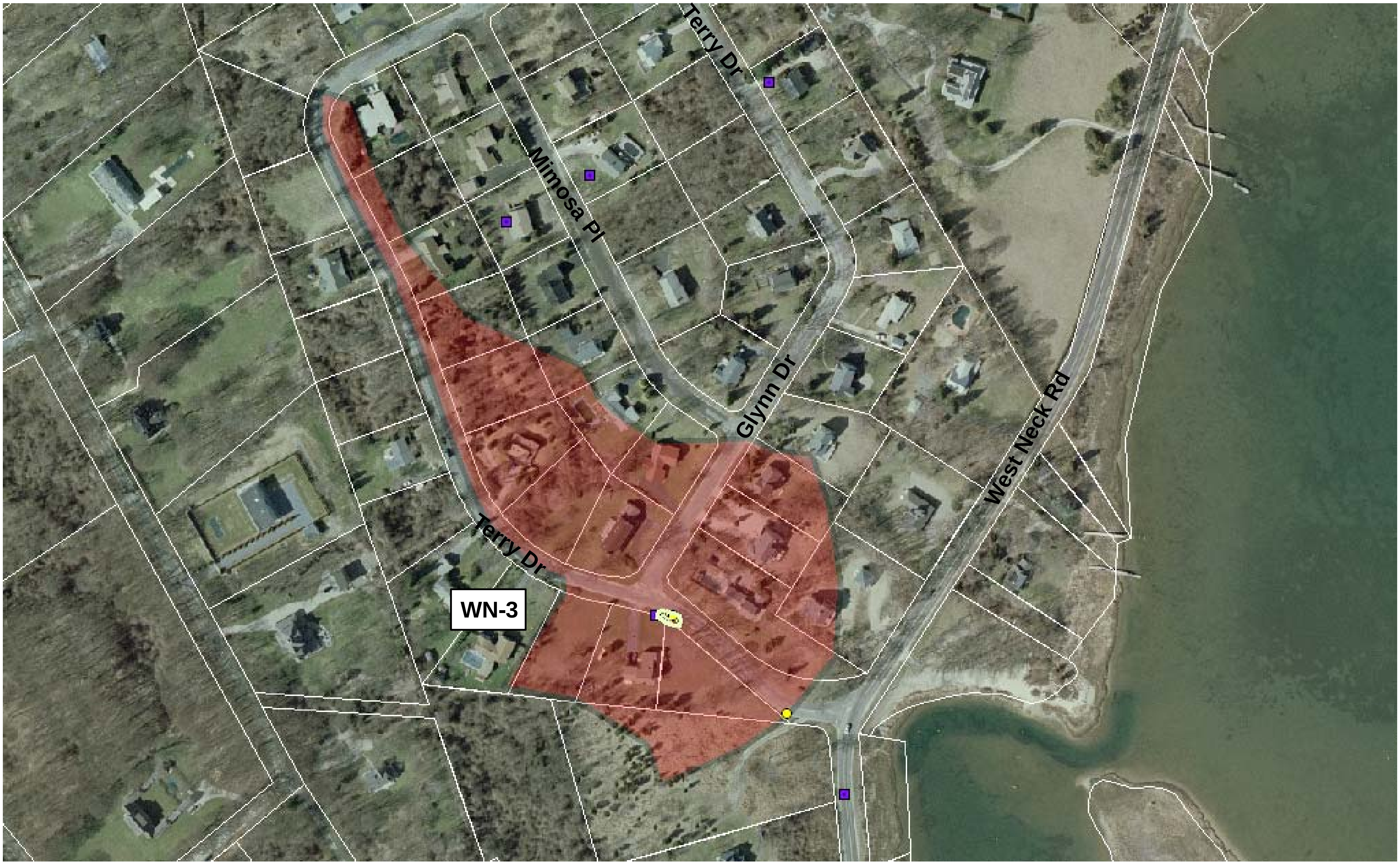
13. Retrofit Volume Computations: 90% Rule: WQV = [(P) (Rv) (A)] / 12
Rv = 0.05+0.009(I)
WQV = [(**P**) (0.05+0.009(**I**)) (**A**)] / 12
WQV = [(**1.2"**) (0.05+0.009(**20**)) (**9.1**)]/ 12
WQV = 0.21_acre-ft ≅ 9,117 cf

14. Photo # WN3-SSD

15. Additional Notes and/or Sketch Information:



16. Site Candidate for Further Investigation: ☑ Yes ☐ No



Legend

Proposed BMP Drainage Areas

Micro-bio Inlet

Drywells

Infiltration catch basin

WN-3 Site Location

* Source: Aerial Photo, NYS Office of Cyber Security & Critical Infrastructure Coordination, Spring 2004

N

Feet

250

Horsley Witten Group
phone: 508-833-6600
www.horsleywitten.com

Best Management Practices (BMP) Sites
West Neck Bay Watershed
Shelter Island

6/27/06 EC
J:\4094 Peconic Bay Estuary\GIS\WN-3.mxd

Figure D-2

West Neck Bay

WN-3 (Terry Drive)

APPENDIX E

Unified Subwatershed and Site Reconnaissance

WATERSHED: WEST NECK BAY	**SUBWATERSHED:** WN-3	**UNIQUE SITE ID:** WN-3
DATE: _09_/_13_/_05_	**ASSESSED BY:** T.W & N.P	**CAMERA ID:** Canon
MAP GRID	**RAIN IN LAST 24 HOURS** ☐ Y ☑ N	**PIC #** WN3-SSD

A. LOCATION

A1. Street names or neighborhood surveyed: ____________________

A2. Adjacent land use: ☑ Residential ☐ Commercial ☐ Industrial ☐ Institutional ☐ Municipal ☐ Transport-Related

A3. Corresponding HSI or NSA field sheet? If so, circle HSI or NSA and record its Unique Site ID here ____________

B. STREET CONDITIONS

B1. Road Type: ☐ Arterial ☐ Collector ☑ Local ☐ Alley ☐ Other: _________

B2. Condition of Pavement: ☐ New ☑ Good ☐ Cracked ☐ Broken

B3. Is on-street parking permitted ☑ Y ☐ N If yes, approximate number of cars per block: ________

B4. Are large cul-de-sacs present? ☐ Y ☑N

B5. Is trash present in curb and gutter? If so, use the index to the right to record amount.

	Index Rating for Accumulation in Gutters				
	Clean				Filthy
Sediment	☐ 1	☐ 2	☑ 3	☐ 4	☐ 5
Organic Material	☐ 1	☐ 2	☑ 3	☐ 4	☐ 5
Litter	☐ 1	☑ 2	☐ 3	☐ 4	☐ 5

C. STORM DRAIN INLETS AND CATCH BASINS

C1. Type of storm drain conveyance: ☑ open ☐ enclosed ☐ mixed

C2. Percentage of inlets with catch basin storage: ________ ☐ N/A

Sample 1-2 catch basins per NSA/HSI	**C3.** Catch basin #1	**C4.** Catch basin #2
Latitude	___°_____'_____"	___°_____'_____"
Longitude	___°_____'_____"	___°_____'_____"
LMK #		
Picture #		
Current Condition	☐ Wet ☑ Dry	☐ Wet ☐ Dry
Condition of Inlet	☑Clear ☐Obstructed	☐Clear ☐Obstructed
Litter Accumulation	☑ Y ☐ N	☐Y ☐ N
Organics Accumulation	☑ Y ☐ N	☐Y ☐ N
Sediment Accumulation	☑ Y ☐ N	☐Y ☐ N
Sediment Depth (in feet)	__________ ft.	__________ ft.
Water Depth	__________ ft.	__________ ft.
Evidence of oil and grease	☐Y ☑ N	☐Y ☐ N
Sulfur smell	☐Y ☑ N	☐Y ☐ N
Accessible to vacuum truck	☑ Y ☐ N	☐Y ☐ N

D. NON-RESIDENTIAL PARKING LOT (>2 acres)

D1. Approximate size: _________ acres

D2. Lot Utilization: ☐ Full ☐ About half full ☐ Empty

D3. Overall condition of Pavement: ☐ Smooth (no cracks) ☐ Medium (few cracks) ☐ Rough (many cracks) ☐ Very Rough (numerous cracks and depressions)

D4. Is lot served by a storm water treatment practice? ☐ Y ☐ N If yes, describe: ____________________

D5. On-site retrofit potential: ☐ Excellent ☐ Good ☐ Poor

E. Municipal Pollutant Reduction Strategies

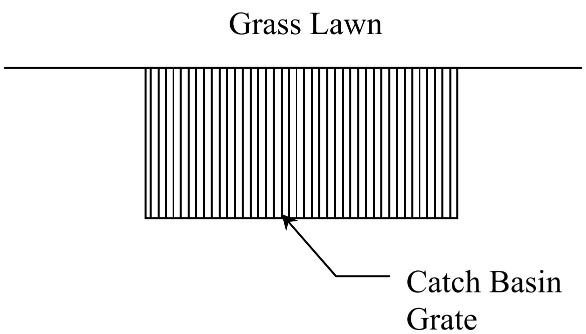
E1. Degree of pollutant accumulation in the system: ☐ High ☑ Medium ☐ Low ☐ None

E2. Rate the feasibility of the following pollution prevention strategies:

Street Sweeping:	☑ High	☐ Moderate	☐ Low
Storm Drain Stenciling:	☐ High	☐ Moderate	☑ Low
Catch Basin Clean-outs:	☑ High	☐ Moderate	☐ Low
Parking Lot Retrofit Potential:	☐ High	☐ Moderate	☐ Low

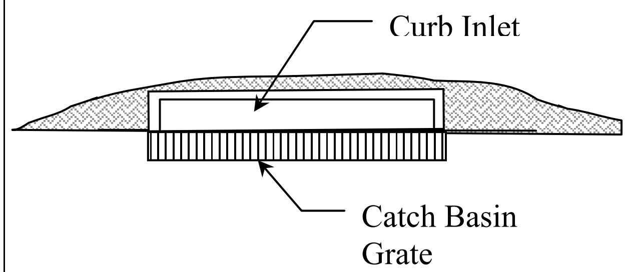
Catch Basin Sketches

#1



Plan View

#2



Profile View

Notes:

WATERSHED: West Neck Bay	**SUBWATERSHED:** WN-5	**UNIQUE SITE ID:** WN-5	
DATE: _9_/_13_/_05__	**ASSESSED BY:** T.W & N.P	**CAMERA ID:** CANON	**PIC#:** WN5-1 – WN5-3

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: ______ Neighborhood Area (acres) ______

If unknown, address (or streets) surveyed: _Westmoreland Dr.._______

Homeowners Association? ☐ Y ☐ N ☒ Unknown If yes, name and contact information: ______

Residential (*circle average single family lot size):*

☐ Single Family Attached (Duplexes, Row Homes) <⅛ ⅛ ¼ ⅓ ⅓ acre ☐ Multifamily (Apts, Townhomes, Condos)

☒ Single Family Detached <¼ ¼ ½ 1 >1 acre ☐ Mobile Home Park

Estimated Age of Neighborhood: 30+ years	Percent of Homes with Garages: _100 % With Basements _100 %					**INDEX***
Sewer Service? ☐ Y ☒ N						○ ✓
Index of Infill, Redevelopment, and Remodeling ☒ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%						○
Record percent observed for each of the following indicators, depending on applicability and/or site complexity		**Percentage**			**Comments/Notes**	
B. YARD AND LAWN CONDITIONS	PICTURE (WN5-#)	1	2	3		
B1. % of lot with impervious cover		10	50	20		
B2. % of lot with grass cover		60	20	70		○ ✓
B3. % of lot with landscaping (e.g., mulched bed areas)		10	10	5		◇ ✓
B4. % of lot with bare soil		0	0	0		○
**Note: B1 through B4 must total 100%*		20	20	5		
B5. % of lot with forest canopy		20	20	10		◇ ✓
B6. Evidence of permanent irrigation or "non-target" irrigation		N	N	N		○
B7. Proportion of *total neighborhood* turf lawns with following management status:		High: _20 %_				○
		Med: _80 %_				
		Low: ____				
B8. Outdoor swimming pools? ☒Y ☐N ☐ Can't Tell Estimated # ____						○ ✓
B9. Junk or trash in yards? ☐ Y ☒ N ☐ Can't Tell						○
C. DRIVEWAYS, SIDEWALKS, AND CURBS						
C1. % of driveways that are impervious ☐ N/A 100 %						
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up						○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐						
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation						○
What is the distance between the sidewalk and street? _____ ft.						◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A						○
C4. Is curb and gutter present? ☐ Y ☒ N If yes, check all that apply:						
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment						○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy						◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

D. ROOFTOPS			
D1. Downspouts are directly connected to storm drains or sanitary sewer	NO		◇ ○
D2. Downspouts are directed to impervious surface	50 %		
D3. Downspouts discharge to pervious area	50%		
D4. Downspouts discharge to a cistern, rain barrel, etc.	NO		
**Note: C1 through C4 should total 100%*			
D5. Lawn area present downgradient of leader for rain garden? ☒ Y ☐ N			◇ ✓

E. COMMON AREAS NONE	
E1. Storm drain inlets? ☐ Y ☐ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty	◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: ________________	○
E2. Storm water pond? ☐ Y ☐ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre	◇
E3. Open Space? ☐ Y ☐ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N	○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N	

F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS	
Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply*) ☒ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☐ Sediment ☐ Other __________________	○

Recommended Actions

Specific Action

- ☒ Onsite retrofit potential?
- ☒ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ___________________________

Describe Recommended Actions:

- Public education on lawn and landscape practices
- Rain gardens for roof runoff

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☒ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☒ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

NOTES:

WATERSHED: West Neck Bay	**SUBWATERSHED:** WN-1	**UNIQUE SITE ID:** WN-1	
DATE: _9_/_13_/_05__	**ASSESSED BY:** T.W & N.P	**CAMERA ID:** CANON	**PIC#:** WN1-1 – WN1-3

A. NEIGHBORHOOD CHARACTERIZATION

Neighborhood/Subdivision Name: ______________ Neighborhood Area (acres) _______

If unknown, address (or streets) surveyed: _Hillside Dr., Community Dr., & Hilo Dr.______

Homeowners Association? ☐ Y ☐ N ☒ Unknown If yes, name and contact information: ______________

Residential *(circle average single family lot size):*

☐ Single Family Attached (Duplexes, Row Homes) <⅛ ⅛ ¼ ⅓ ⅓ acre ☐ Multifamily (Apts, Townhomes, Condos)

☒ Single Family Detached <¼ ¼ ½ 1 >1 acre ☐ Mobile Home Park

		INDEX*
Estimated Age of Neighborhood: 30+ years	Percent of Homes with Garages: _100 % With Basements _100 %	
Sewer Service? ☐ Y ☒ N		✓○
Index of Infill, Redevelopment, and Remodeling ☒ No Evidence ☐ <5% of units ☐ 5-10% ☐ >10%		○

Record percent observed for each of the following indicators, depending on applicability and/or site complexity		**Percentage**			**Comments/Notes**	
B. YARD AND LAWN CONDITIONS	PICTURE (WN1-#)	1	2	3		
B1. % of lot with impervious cover		25	25	25		
B2. % of lot with grass cover		30	40	50		✓○
B3. % of lot with landscaping (e.g., mulched bed areas)		5	5	10		✓◇
B4. % of lot with bare soil		0	0	0		○
**Note: B1 through B4 must total 100%*		40	30	15		
B5. % of lot with forest canopy		15	40	25		✓◇
B6. Evidence of permanent irrigation or "non-target" irrigation		N	N	N		○
B7. Proportion of *total neighborhood* turf lawns with following management status:		High: ____				○
		Med: _80 %_				
		Low: _20 %_				
B8. Outdoor swimming pools? ☒Y ☐N ☐ Can't Tell Estimated # ____						✓○
B9. Junk or trash in yards? ☐ Y ☒ N ☐ Can't Tell						○

C. DRIVEWAYS, SIDEWALKS, AND CURBS

			INDEX*
C1. % of driveways that are impervious ☐ N/A 100 %			
C2. Driveway Condition ☒ Clean ☐ Stained ☐ Dirty ☐ Breaking up			○
C3. Are sidewalks present? ☐ Y ☒ N If yes, are they on one side of street ☐ or along both sides ☐			
☐ Spotless ☐ Covered with lawn clippings/leaves ☐ Receiving 'non-target' irrigation			○
What is the distance between the sidewalk and street? _____ ft.			◇
Is pet waste present in this area? ☐ Y ☐ N ☐ N/A			○
C4. Is curb and gutter present? ☐ Y ☒ N If yes, check all that apply:			
☐ Clean and Dry ☐ Flowing or standing water ☐ Long-term car parking ☐ Sediment			○
☐ Organic matter, leaves, lawn clippings ☐ Trash, litter, or debris ☐ Overhead tree canopy			◇

* INDEX: ○ denotes potential pollution source; ◇ denotes a neighborhood restoration opportunity

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E. COMMON AREAS NONE			
E1. Storm drain inlets? ☐ Y ☐ N If yes, are they stenciled? ☐ Y ☐ N Condition: ☐ Clean ☐ Dirty			◇
Catch basins inspected? ☐ Y ☐ N If yes, include Unique Site ID from SSD sheet: ________________			○
E2. Storm water pond? ☐ Y ☐ N Is it a ☐ wet pond or ☐ dry pond? Is it overgrown? ☐ Y ☐ N What is the estimated pond area? ☐ <1 acre ☐ about 1 acre ☐ > 1 acre			◇
E3. Open Space? ☐ Y ☐ N If yes, is pet waste present? ☐ Y ☐ N dumping? ☐ Y ☐ N			○
Buffers/floodplain present: ☐ Y ☐ N If yes, is encroachment evident? ☐ Y ☐ N			
F. INITIAL NEIGHBORHOOD ASSESSMENT AND RECOMMENDATIONS			
Based on field observations, this neighborhood has significant indicators for the following: (*check all that apply*) ☒ Nutrients ☐ Oil and Grease ☐ Trash/Litter ☐ Bacteria ☒ Sediment ☐ Other __________________			○

Recommended Actions

Specific Action

- ☒ Onsite retrofit potential?
- ☒ Better lawn/landscaping practice?
- ☐ Better management of common space?
- ☐ Pond retrofit?
- ☐ Multi-family Parking Lot Retrofit?
- ☐ Other action(s) ___________________________

Describe Recommended Actions:

Initial Assessment

NSA Pollution Severity Index

- ☐ Severe (More than 10 circles checked)
- ☐ High (5 to 10 circles checked)
- ☒ Moderate (Fewer than 5 circles checked)
- ☐ None (No circles checked)

Neighborhood Restoration Opportunity Index

- ☐ High (More than 5 diamonds checked)
- ☒ Moderate (3-5 diamonds checked)
- ☐ Low (Fewer than 3 diamonds checked)

NOTES:

West Neck Bay


NSA WN-1 (1)


NSA WN-5 (1)


NSA WN-1 (2)


NSA WN-5 (2)


NSA WN-1 (3


NSA WN-5 (3)

NSA WN-3 (Terry Drive)