

1 INTRODUCTION

The Wreck Pond Brook Watershed Regional Stormwater Management Plan (WPB RSWMP) was developed to address stormwater quantity and quality concerns within the watershed. The Plan was prepared in accordance with Subchapter 3 (Regional Stormwater Management Planning) of the New Jersey Department of Environmental Protection (NJDEP) Stormwater Management regulations (NJAC 7:8). The regional stormwater planning process is designed to address stormwater issues that are best managed on a regional, not a state or local basis.

The Plan provides a detailed description of existing watershed conditions including the results of several monitoring efforts and field investigations, modeling studies, identification of problems and proposed solutions. Book 1 of the RSWMP and provides data on the characterization of the watershed and environmental concerns. Book 2 provides the Management Plan, including analysis of the potential impacts of future development on the watershed.

Book 1 provides a Characterization Report including overall watershed characteristics, details and results of the various monitoring programs conducted as part of these studies, and results to date of the modeling efforts undertaken.

Wreck Pond Brook extends from its headwaters in Wall Township near Allaire Airport east-southeast to Wreck Pond. Wreck Pond is located on the boundary between the Boroughs of Spring Lake and Sea Girt in Monmouth County, New Jersey. Wreck Pond is approximately 73 acres in size and a portion of it is tidally influenced. The eastern end of the Pond contains an outfall structure that exchanges water with the Atlantic Ocean. Figure 1 shows the location of the watershed. Figure 2 provides an aerial photograph.

The Wreck Pond Brook watershed was identified as a watershed of concern by the NJDEP. Outflow from Wreck Pond to the Ocean during storm events has been identified as the cause of swimming beach closings in Spring Lake and Sea Girt. The Monmouth County Health Department (MCHD) regularly monitors bacteria levels at Ocean swimming beaches. Using those data, MCHD found that bacteria levels exceeded the Ocean bathing beach standards at Ocean beaches in the vicinity of the outfall following storm events. In 2002, the Health Department instituted a 24-hour swimming ban that would be implemented whenever rainfall exceeds 0.1 inch or when a plume from the outfall was visible and a 48-hour ban when rainfall exceeds 2.8 inches in 24 hours. This ban applies to the recreational bathing waters at the Brown and York Avenue beaches in Spring Lake and The Terrace and Beacon beaches in Sea Girt. Due to this provisional ban, the outfall from Wreck Pond has been the presumed source of most of the swimming bans at the New Jersey Ocean beaches over the last several years.

**Figure 1: Wreck Pond Brook Watershed
Watershed Location Map**

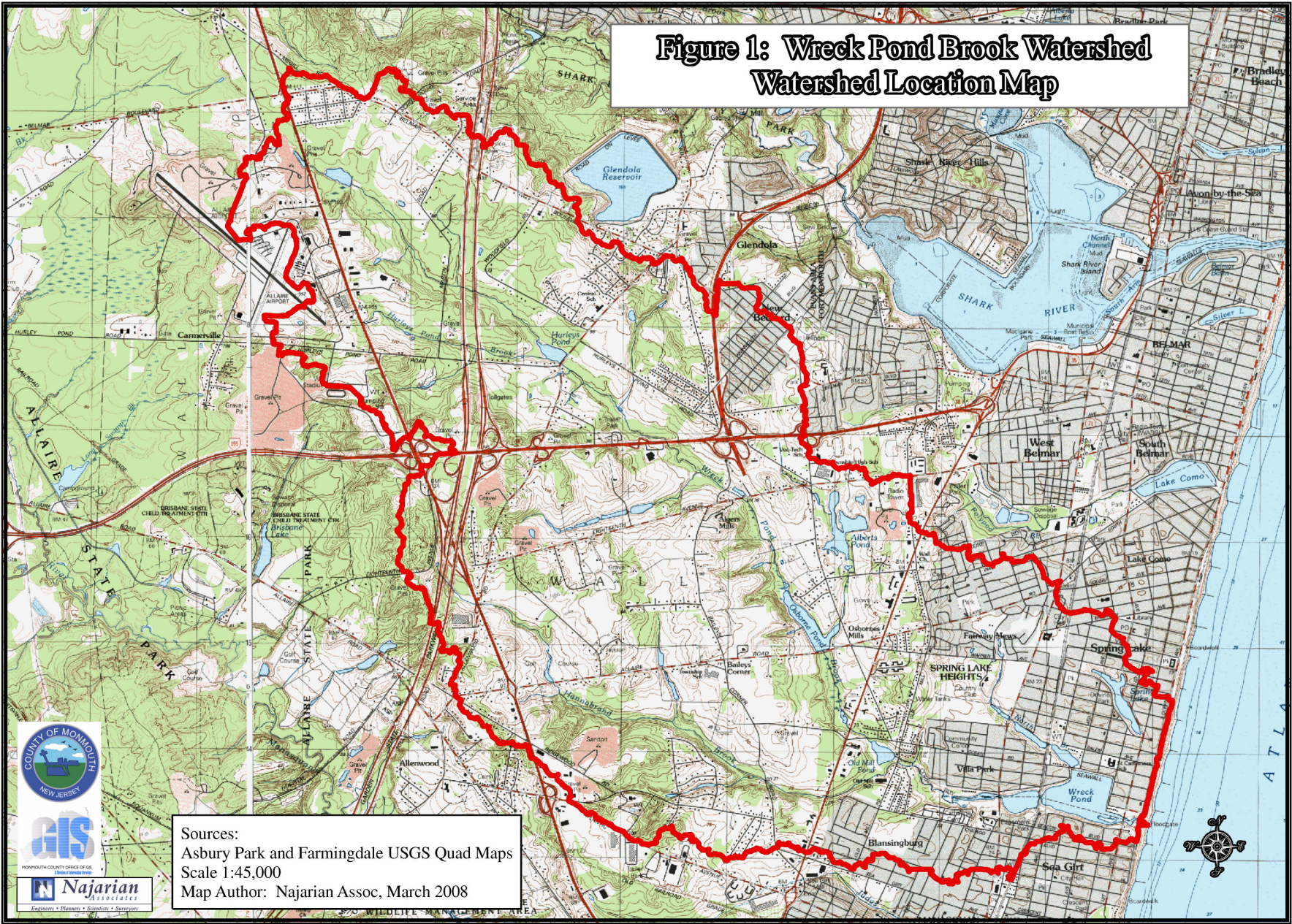
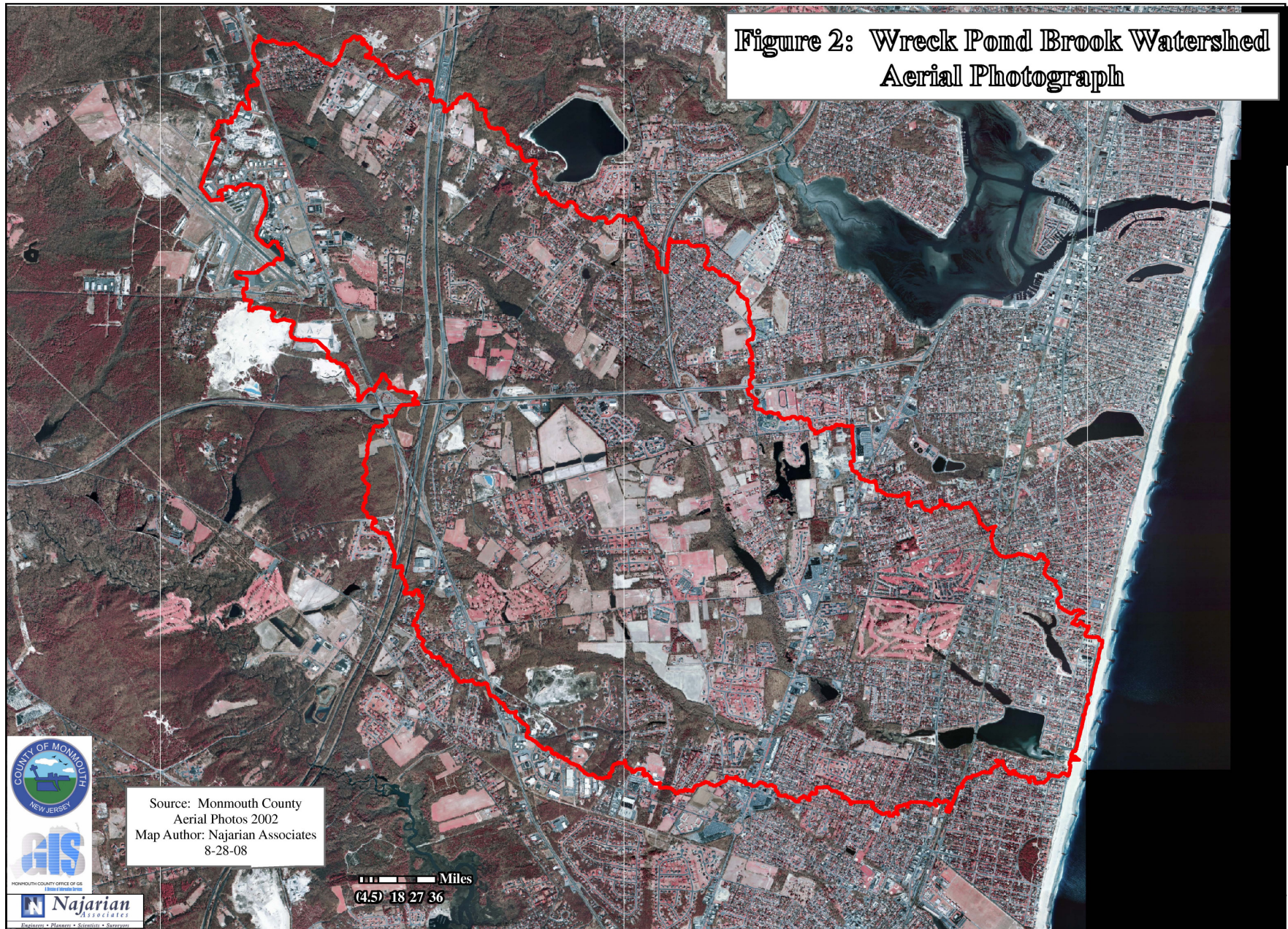


Figure 2: Wreck Pond Brook Watershed
Aerial Photograph



In addition, the overall water quality of waters in the watershed, including Wreck Pond is of concern. Algal blooms, nutrient loads, and sedimentation are noted issues. Further, flooding has been noted in many parts of the watershed. The storm of October 2005 caused significant flooding, particularly in the lower portions of the watershed.

Book 1 provides information on the stormwater related concerns identified in Wreck Pond and the overall watershed. Portions of the Introductory Sections of Book 1 are repeated or summarized herein.

1.1 Purpose and Goal

This Wreck Pond Brook RSWMP is designed to meet the requirements for a Regional Stormwater Management Plan in accordance with NJDEP regulations at NJAC 7:8-3. According to that regulation “A Regional Stormwater Management Plan shall address stormwater-related water quality, ground water recharge and/or water quantity impacts of new and existing land uses in a Regional Stormwater Management Planning Area.”

The overall goal of this management plan is to outline measures that may be adopted to improve the water quality of the ponds and streams within the watershed, to reduce watershed loadings of pollutants associated with current and future land uses, to reduce flooding, and to eliminate or greatly reduce beach closings from the discharge from Wreck Pond to the Atlantic Ocean. The Plan is to develop workable solutions that can be implemented by the municipalities and standards that may be employed in review of new projects. The Plan also will be reviewed and updated as needed to ensure it continues to be responsive to changing watershed conditions.

As discussed in Book 1, the Wreck Pond Brook Regional Stormwater Management Plan Committee selected Monmouth County Planning Board as the lead agency for development of the Regional Stormwater Management Plan (RSWMP). In addition, a Technical Advisory Committee (TAC) was developed to provide technical studies and other technical support for development of the Plan. The RSWMP Committee has been meeting regularly, with over sixty members including those on the TAC, municipal officials and staff, as well as other interested parties, including local residents.

Agencies, institutions and firms represented on the TAC or the Stormwater Committee include Monmouth County Office of GIS, Monmouth County Engineering, NJDEP, Division of Watershed Management, NJ Department of Agriculture, Rutgers Cooperative Extension, Freehold Soil Conservation District, Monmouth University, Najarian Associates, US Fish and Wildlife Service, Monmouth County Health Department, NJDEP Marine Water Monitoring, and the Municipalities.

At the start of this process, the NJDEP and Monmouth County Planning Board staff had identified the following issues of concern

- Erosion in the watershed.

- Sediment loads and deposition at Wreck Pond and other watershed ponds.
- Bacteria, nitrate and phosphorus loads discharged to Wreck Pond.
- Swimming bans at beaches near the Ocean outfall from Wreck Pond.
- Stream base flow to maintain/improve dilution factors.
- Stream peak flow and the connection to stream bank erosion and sediment transport.
- Stream passing flow and potential as a future surface water supply.
- Existing impoundments as stormwater management, scenic and recreation features.
- Municipal stormwater management planning efforts.

The initial planning process expanded the scope to include flooding, algal blooms and sediment in other watershed ponds. The need for improvements in flood control was further highlighted by the storms of October 2005.

During development of the plan, additional issues related to stormwater in the watershed were identified by the County, NJDEP, other agencies, municipalities, and local residents. For example, Wreck Pond has reportedly become very shallow with mucky sediments and other signs of water quality impairment while tidal fluctuation is reportedly reduced. The impounded portion of Black Creek is noted to be very shallow and mucky and subject to algal blooms.

The streams within the watershed also are of concern for water quality and flow issues. Both major tributaries to the Pond have been found by NJDEP to be in non-attainment status for certain designated uses, including Aquatic Life and/or Recreation Uses.

1.2 Scope

The project scope is to provide a Regional Stormwater Management Plan that characterizes the watershed, identifies stormwater related problems, proposes solutions to those problems, conforms to regulatory requirements and provides guidance to regional and local decision makers and stakeholders. The Plan includes overall watershed characterization, stream assessments, agricultural land analysis, water quality data collection and analysis, watershed land use review, build-out land use analysis, hydrologic and hydraulic modeling, watershed water quality modeling and a bacteria source tracking study. The results of these studies have been synthesized to focus areas of concern and to develop management measures and restoration options within the watershed.

NJDEP provided ongoing guidance in the Plan development process. The Plan includes several elements undertaken by the County and the study partners. These elements are discussed in detail within Book 1 of the Plan. Primary responsibilities of TAC Study Partners are summarized as follows:

- Monmouth County Planning Board: Overall study coordination, identification of areas of concern, proposed mitigation measures
- Monmouth County staff, in particular the GIS Office, assessed the preliminary data and support with the County GIS system. The GIS data was then used to develop GIS thematic layers unique to the Wreck Pond Brook Watershed. The GIS data were used by the other partners in preparing their studies and to identify management and restoration options for the watershed.
- Monmouth County Staff: Collection of weekly water quality data
- NJ Department of Agriculture, State Soil Conservation Committee: Measured stream flow and analyzed stream and watershed runoff characteristics in order to develop stream flow models and comprehensive watershed runoff models. These models were designed to assess the hydrologic condition of the watershed and assist in the development of management recommendations for land and water resources.
- Freehold Soil Conservation District: Conducted stream assessments along the streams and tributaries within the watershed.
- Monmouth University: Microbial Source Tracking Study: Employed the Multiple Antibiotic Resistance technique to attempt to identify the sources of bacteria in samples taken from Wreck Pond and other watershed waters along with collection of water quality data.
- Rutgers Cooperative Extension: Surveyed agricultural and recreational lands within the watershed for pollutant generation sources. Conducted water quality and soils monitoring, analyzed current management techniques and proposed management recommendations.
- Najarian Associates: The County contracted with Najarian Associates (NA) to coordinate the plan document, including detailed analysis of the County water quality data, development of the watershed characterization portion of the Plan and writing of the report based on technical studies, field investigations and data from the County and other study partners. The watershed characterization included the synthesis and mapping of GIS data from the MC Office of GIS and NJDEP as well as other watershed information. NA also participated in watershed modeling and conducted surveying of stream sections.

Other agencies that assisted or provided data include Monmouth County Health Department who collects weekly beach bacteria data and the Southern Monmouth Regional Sewerage Authority who provided laboratory services for bacteria analyses for County Monitoring Data.

The study partners, other members of the TAC, and the RSWMP Committee used the data and results of the detailed watershed studies, monitoring, field studies, and modeling analyses to develop the Management Plan, including the stormwater specific mitigation projects, design and performance standards and the implementation strategy.

1.3 Introduction to Book Two

Book One of this document presents the Watershed characterization including results of the various technical studies that were undertaken.

The main body of Book 2 is synthesis of the data and other information from Book 1 to develop a comprehensive Stormwater Management Plan. This includes analysis of impacts of land development on stormwater flows and water quality. In addition, the study results were done to provide a detailed analysis of identified stormwater-related concerns within the watershed. The management plan presents BMP projects currently funded and underway in the watershed as well as future proposed projects. Measures that could be undertaken by the municipalities and other agencies are also identified. The Implementation Plan includes creation of a Wreck Pond Watershed Commission to continue the process, with input from the municipalities, the County, NJDEP and local residents.

2 WATERSHED CHARACTERIZATION

Book 1 provides data to characterize the watershed including soils, geology, topography, hydrology, ecology, wetlands and land use. Book 1 also provides discussion of the major technical studies done for this Plan including collection of data on stream characteristics and flow, water quality, assessment of agricultural and recreational lands, stream assessment, microbial source tracking, and watershed hydrologic and water quality modeling. Analysis of available water quality data also is provided.

The Wreck Pond Brook watershed includes about 8,174 acres (± 12.74 sq. miles) in southern Monmouth County New Jersey. As shown on Figure 2, municipalities within the watershed are the Township of Wall, and the Boroughs of Sea Girt, Spring Lake Heights and Spring Lake. Wreck Pond Brook flows from its western boundary near Allaire Airport to the east-southeast, discharging into Wreck Pond on the border of Spring Lake and Sea Girt. The Pond exchanges flow with the Atlantic Ocean through an outflow structure. Figure 3 shows the major watershed features.

Hannabrand Brook is the major tributary to Wreck Pond Brook, and is located in the southern portion of the watershed, joining Wreck Pond Brook just below Old Mill Road. Black Creek, also known as the North Branch of Wreck Pond Brook, is located in the northeastern part of the watershed. The lower portion of Black Creek is ponded. This stream discharges directly into Wreck Pond via a structure at Ocean Road. Numerous ponds are found within the watershed. A wetland corridor is present along most of the streams. Figure 3 provides the hydrologic features of the watershed. Further detail is provided in Book 1.

The watershed was divided into sub-watersheds for the hydrologic modeling and for water quality data collection by Monmouth County. The County established a monitoring location within each subwatershed. Table 1 summarizes these locations. Figure 3 shows the subwatershed areas and monitoring locations.

The watershed characterization is based primarily on existing data. Much of the data was provided by the MC Office of GIS office as data layers from the GIS mapping. Additional data was taken from the NJDEP GIS data layers. Other available local data was used including NJDEP, USGS, Freehold Soils, EPA, County and other reports.

As part of the characterization, several watershed technical studies were undertaken as discussed in Section 2.1. These technical studies provided needed background information on existing condition of the watershed and the potential pollution sources. The studies included collection of water quality monitoring data on the streams and in Wreck Pond. The water quality studies confirmed that the water quality of Wreck Pond is degraded and that loadings of sediment, nutrients and bacteria are of particular concern. Other water bodies, including Black Creek, are very shallow, with mucky bottoms and noticeable algal blooms.

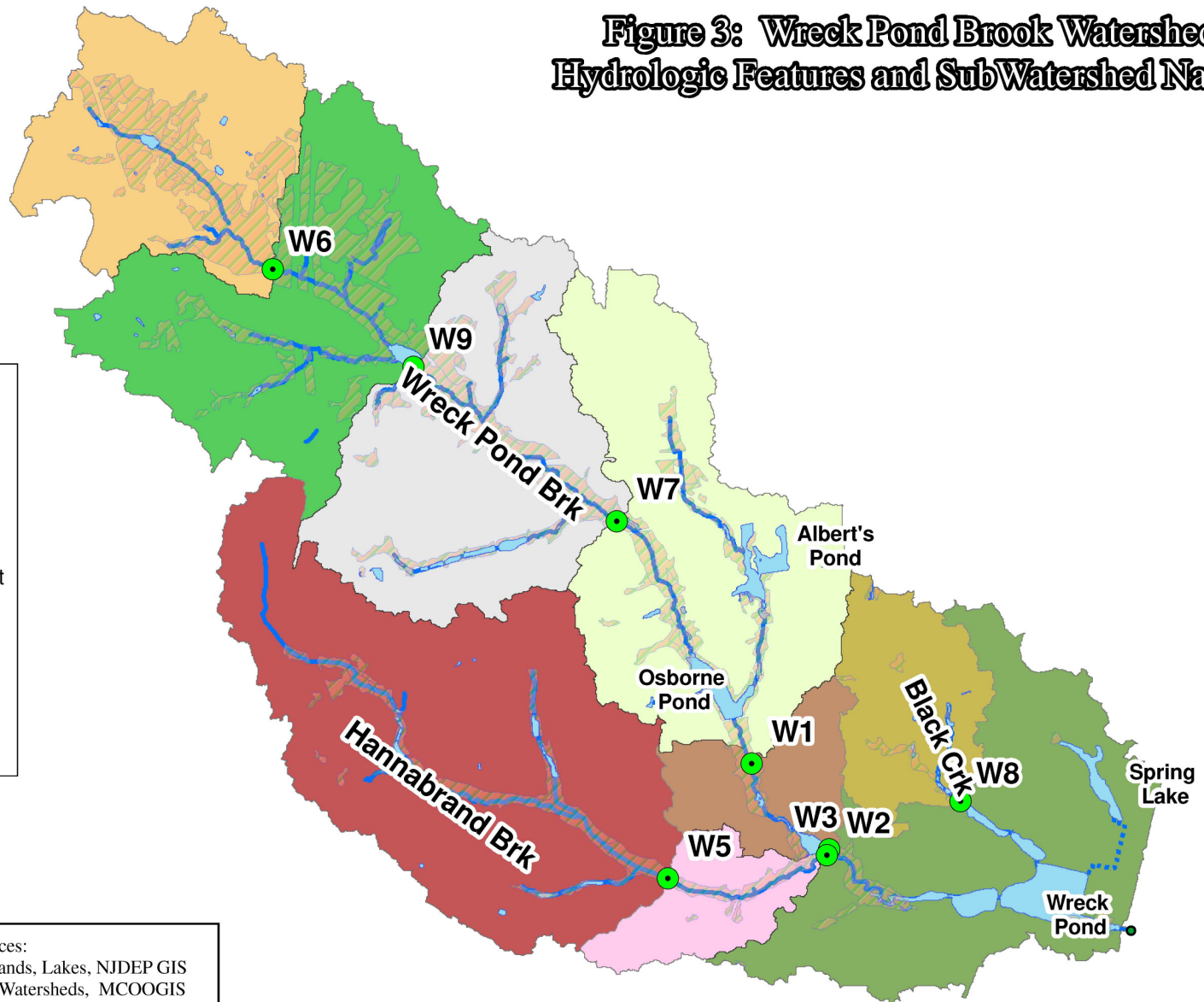
Table 1: County Gage and Sampling Stations		
Station #	Subwatershed	Location
Wreck Pond Brook		
W6	Martins Road	Just west of Garden State Parkway, upstream side of Martins Road culvert
W9	Hurley's Pond Dam	Downstream Side of Allenwood Road Culvert, Near Intersection of Hurley Pond Road and Allenwood Road
W7	Glendola Road	Downstream Side of Glendola Road Culvert, Adjacent to Taylor Pond
W1	Waterford Glen	Wreck Pond Brook, Stream Location Behind Waterford Glen Assisted Living Facility, Off of Route 35
W3	Old Mill Dam Culvert	Wreck Pond Brook, Downstream Side of Old Mill Road Culvert, Across Street of Old Mill Restaurant
Hannabrand Brook		
W5	Bailey's Corner Road	Hannabrand Brook, Downstream Side of Bailey's Corner Road Culvert, Just South of Pump Station
W2	Hannabrand Brook Culvert	Hannabrand Brook, Upstream Side of Old Mill Road Culvert, Adjacent to Old Mill Restaurant
Black Creek		
W8	Spring Lake Golf Club	North Branch of Wreck Pond Brook, Downstream Side of Route 71 Culvert, Southeast of Golf Course

Wetlands are generally located in a corridor along the tributary streams. A few endangered or threatened species are noted in the vicinity of Wreck Pond. According to NJDEP GIS data from early 2008, the Least Tern nests in the dunes along the beach adjacent to the eastern portion of Wreck Pond. Reportedly, the Piping Plover also nests in the dunes adjacent to the outlet. A state-listed plant is reported along the southern Wreck Pond shoreline and the northern Pine Snake is reported in the northwest part of the watershed. Otherwise, the woodlands and wetlands are generally categorized as Rank 2, which is "Priority Concern" on the NJDEP GIS data through early 2008. This indicates that no endangered species or habitat for such species have been found in, or in the vicinity of, these habitats. Thus, the streams and wetlands in the watershed would generally receive buffers of 50 feet in accordance with State regulations.

**Figure 3: Wreck Pond Brook Watershed
Hydrologic Features and SubWatershed Names**

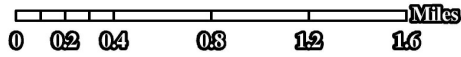
Legend

- Lakes
- Wetlands
- SubWatershed**
- Bailey's Corner Rd
- Glendola Rd
- Hanabrand Brk Culvert
- Hurley's Pond Dam
- Martin's Road
- Old Mill Dam
- Black Creek
- Waterford Glen
- Wreck Pond Direct



Sources:
Wetlands, Lakes, NJDEP GIS
Sub-Watersheds, MCOOGIS

Map Author Najarian Associates
3/26/2008



The Wreck Pond Brook watershed includes some environmentally sensitive lands, primarily the ponds, streams and associated wetlands. The watershed does not include significant steep slope areas and there are only very limited areas with endangered species. No waters in the watershed are Category 1 waters.

Land use within the watershed includes about 35% residential, 27% woods, and 10% commercial and industrial uses based on 2006 data.

2.1 Technical Studies

The Wreck Pond Brook watershed has been the subject of a variety of detailed technical studies. These studies included monitoring of water depth data and water quality data. The depth data was converted to flow using rating curves developed for the streams. Watershed streams were assessed by Freehold Soils Conservation District and stream segments of concern were identified. Rutgers Cooperative Extension (RCE) studied agricultural and recreational lands and found minimal potential impacts to water quality from these lands. RCE proposed modification to certain current land management practices to further reduce these minimal potential impacts. Monmouth University conducted bacteria source tracking and found a variety of sources for bacteria found in Wreck Pond and other watershed locations.

A hydrologic watershed model was developed by New Jersey Department of Agriculture and a watershed model was developed by Najarian Associates. The models investigated flow issues and pollutant loadings. Several water quality monitoring programs were conducted, including the County weekly sampling and the sampling done for the Borough of Spring Lake's Wreck Pond Environmental Study. In addition, Monmouth University and Rutgers Cooperative Extension collected water quality data as part of their studies. Further, MCHD continues to conduct summer bacteria monitoring at the beaches and NJDEP is conducting bacteria studies. The results of these studies were used to evaluate possible pollutant sources, as discussed in Section 10 of Book 1. Those results are summarized here.

2.2 Overall Evaluation of Pollutant Sources

The results of the technical studies were synthesized in Book 1, including analysis of water quality data and modeling results. These analyses were used to evaluate pollutant sources as described in the following sections.

2.2.1 Watershed Sources

The watershed contains a number of sources that may contribute to the loading of bacteria, nutrients and other pollutants. However, there are no known point source discharges in the watershed and there are no known septic systems within the

watershed as the area is entirely sewer. It is possible that unknown historic septic systems are present. In addition, inter-connection of sanitary sewer and stormwater piping systems may transport sewage to watershed streams and ponds. Also, leaking sewer pipe systems may be a source of bacteria and other pollutants within the watershed. The municipalities have been surveying their piping systems and have not reported any major leaks or inter-connections. Further piping analysis will continue.

The primary non-point source of stormwater pollution is runoff from the land surfaces within the watershed. The various land uses generate water pollutants. Given the mixed land uses within each sub-watershed, the pollution budget monitoring and the watershed model loading analysis could not be used to directly determine the relative contribution of each land use. However, the mix of agricultural, suburban, commercial and industrial lands are contributing to the overall pollutant loads. In particular, some developed areas of the watershed do not have any stormwater management facilities due primarily to the age of the development.

2.2.2 Pond Processes

The ponds in the upper watershed appear to act as retention structures that slow the flow of water and allow some settling of sediment and associated pollutants, based on the NJDA modeling results and stream monitoring of storms. Under certain conditions, the sediments in these ponds may become re-suspended in high flows and be transported downstream.

The sediments and organic matter in the bottom of the upstream ponds and of Wreck Pond were found to contain bacteria and nutrients. Under certain environmental conditions, these pollutants may be released from the sediments back into the water column. The studies conducted thus far have not quantified these processes.

2.2.3 Water Fowl and Wildlife

Wreck Pond, Black Creek and the watershed ponds are home to a variety of water fowl including mute swans, geese and ducks. Water fowl produce fecal matter that adds bacteria directly to the ponds and is deposited along the shorelines. Other wildlife, including deer, may produce fecal matter that is carried to the waterways and may streams by over-grazing vegetation to increase erosion.

2.2.4 Natural Conditions

The low pH in the western portions of the streams may well be due to the naturally acidic soils found in the Pineland-type woodlands and soils.

Streams may also produce sediment from natural erosion processes, particularly during larger storms. Bacteria may be associated with soils and other watershed sediments.

2.2.5 Pollutant Source Summary

For the Wreck Pond watershed, the mixed land uses are a major source of all pollutants of interest. The results of the watershed modeling, agricultural survey, stream assessments, and bacteria source tracking did not identify one source of highest importance. For each pollutant group, identified sources are noted below.

Nutrients: Developed land uses, agricultural lands, fertilizer application

Bacteria: Developed land use, manure management in farmlands, water fowl, possible leaking infrastructure, wildlife, pets, release from Pond sediments

Sediment: Developed lands, agricultural land, un-vegetated uplands, construction sites, stream erosion, re-suspension of pond sediments