MUNICIPAL STORMWATER MANAGEMENT PLAN
MASTER PLAN ELEMENT

BOROUGH OF NATIONAL PARK
GLOUCESTER COUNTY, NEW JERSEY

Resolution No. 2005-09 adopted by
Land Use Board of the Borough of National Park
May 17, 2005

Prepared for:

BOROUGH OF NATIONAL PARK
LAND USE BOARD

Prepared by:

T&M ASSOCIATES

1256 North Church Street
Moorestown, New Jersey 08057-1129
(856) 722-6700

MARCH 2005

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ADOPTING RESOLUTION

1.0 INTRODUCTION

As required by the Municipal Stormwater Regulations (N.J.A.C. 7:14A-25), the Borough of National Park has developed a Municipal Stormwater Management Plan (Plan) to address the impacts resulting from stormwater related issues associated with future development and land use changes. The Plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts through the incorporation of stormwater design and performance standards for new development and redevelopment projects that disturb one (1) or more acres of land or increase impervious surface by one-quarter acre or more. This Stormwater Master Plan Element shall be incorporated into the *Master Plan for the Borough of National Park*.

The State's stormwater regulations are intended to minimize negative or adverse impacts of development such as degraded water quality, increased runoff, and reduced groundwater recharge. In accordance with Statewide Basic Requirements established by New Jersey, the Plan provides long-term operation and maintenance measures for existing and proposed stormwater management facilities. A mitigation plan is inclusive of this Stormwater Management Plan Element to enable the Borough to grant variances or exemptions from proposed design and performance standards set forth in this document.

1.1 GOALS & OBJECTIVES

National Park has established the following goals:

Goal A: ***Reduce flood damage, including damage to life and property.***

Goal B: ***Minimize, to the extent practicable, any increase in stormwater runoff from a new development.***

Goal C: ***Reduce soil erosion from development, redevelopment, or construction projects.***

Goal D: ***Ensure the adequacy of existing and proposed culverts, bridges, and other in-stream structures.***

Goal E: ***Maintain groundwater recharge and base flow of streams during periods of drought.***

Goal F: ***Prevent, to the greatest extent feasible, an increase in non-point source pollution.***

Goal G: ***Maintain the integrity of stream channels for their biological function, as well as for drainage.***

Goal H: ***Minimize pollutants and the amount of total suspended solids in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, commercial, industrial, and other uses of water.***

Goal I: ***Protect public safety through the proper design and operation of stormwater basins and Best Management Practices.***

In addition to the State mandated requirements described above, the Borough has the following additional goals:

Goal J: ***Limit disturbance of environmentally sensitive lands such as steep slopes, floodplains and wetlands.***

Goal K: ***Protect groundwater and surface water quality to safeguard its use for drinking water, recreation, and natural habitat for animals.***

Goal L: ***Protect important wildlife habitat, streams, waterways, wetlands and other unique or irreplaceable land types.***

Goal M: ***Preserve important visual amenities, placing special emphasis on preservation of river views, wetland marshes, woodland, vistas, and other scenic resources.***

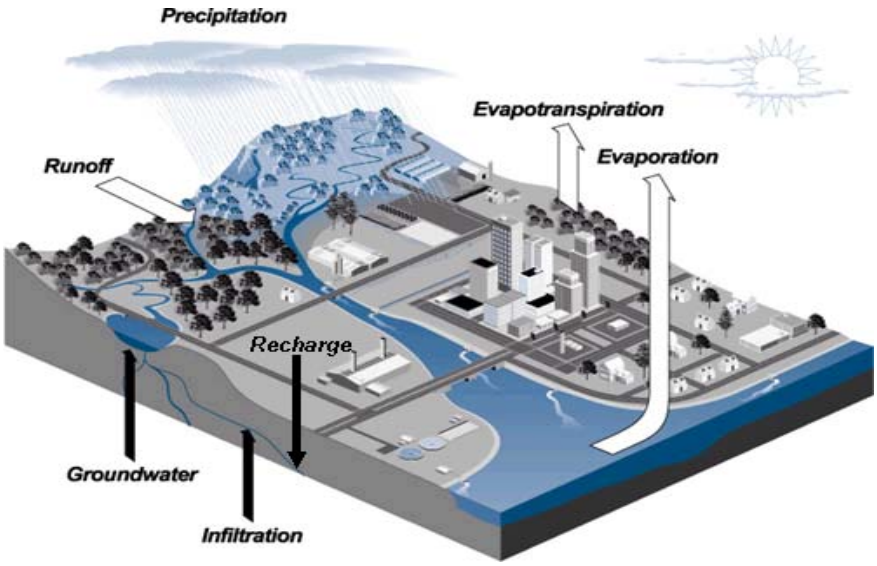
Goal N: ***Review site plans to minimize environmental disruption and to encourage development of landscapes and streetscapes consistent with these goals.***

2.0 STORMWATER DISCUSSION

2.1 HYDROLOGIC CYCLE

The hydrologic cycle or water cycle is the continuous circulation of water between the ocean, atmosphere, and the land. The driving force of this natural cycle is the sun. Water, stored in oceans, depressions, streams, rivers, waterbodies, vegetation and soil evaporates due to solar energy. Water vapor condenses in the atmosphere to form clouds and fog. After water condenses, it precipitates, usually in the form of rain or snow, onto land surfaces and waterbodies.

The Hydrologic Cycle



Definitions:
Runoff – water that travels over the ground surface to a channel
Groundwater flow – movement of water through the subsurface
Infiltration – penetration of water through the ground surface
Recharge – water that reaches saturated zone

Source: Kern River Connections
http://www.creativille.org/kernriver/watershed.htm

Precipitation falling on land surfaces is often intercepted and utilized by vegetation. Plants and trees transpire water vapor back into the atmosphere, as well as aid in the infiltration of water into the soil. The vaporization of water through transpiration and evaporation is called evapo-transpiration. Infiltrated water percolates through the soil as groundwater, while water that flows overland is called surface water. Water flows across or below the surface to reach major water bodies and aquifers and eventually flows to the Earth's seas and oceans. This constant process of evapo-transpiration, condensation, precipitation, and infiltration comprises the hydrologic cycle.

2.2 IMPACTS OF DEVELOPMENT AND STORMWATER

As towns and cities develop, the landscape is altered. Both residential and non-residential developments have a significant impact on the hydrologic cycle. Localized impacts to the hydrologic cycle will ultimately impact the hydrologic cycle of the entire watershed encompassing the developed site.

Prior to development, natural vegetation often intercepts precipitation directly or absorbs infiltrated runoff into their roots. Development often replaces natural vegetation with grass lawns or impervious cover, such as pavement or structures, thereby reducing the amount of evapo-transpiration and infiltration. Regrading and clearing of lots disturbs the natural topography of rises and depressions that can naturally capture rainwater and allow for infiltration and evaporation. Construction activities often compact soil, thereby decreasing its permeability or ability to infiltrate stormwater. Development activities also generally increase the volume of stormwater runoff from a given site.

Connected impervious surfaces and storm sewers (such as roof gutters emptying into a paved parking lot that drains into a storm sewer) allow the runoff to be transported downstream more rapidly than natural areas. This shortens travel time and increases the rainfall-runoff response of the drainage area, causing downstream waterways to peak higher and quicker than natural areas, a situation that can cause or exacerbate downstream flooding, and sedimentation in stream channels. Furthermore, connected impervious surfaces do not allow contaminants to be

filtered, or for infiltration and ground water recharge to occur prior to reaching the receiving waters. Increased volume combined with reduced base flows results in a greater fluctuation between normal and storm flow rate causing greater channel erosion. Additionally, reduced base flows, flow rate fluctuation, and soil erosion can significantly affect the downstream hydrology, and impact the ecological integrity of the watershed.

Connected Impervious Surfaces

Rainwater is intercepted by roofing and collected into gutters. The water then discharges the downspout onto a paved driveway and flows to the gutter and storm drain inlets. Alternatively, the collected water is piped underground directly to the storm sewer. Photograph source: Titan Gutters

Water quantity impacts, combined with land development, often adversely impact stormwater quality. Impervious surfaces collect contaminants from the atmosphere, animal wastes, fertilizers and pesticides, as well as contaminants from motor vehicles. Contaminants such as hydrocarbons, metals, suspended solids, pathogens, and organic and nitrogen-containing compounds, collect and concentrate on impervious surfaces. During a storm event, these contaminants are conveyed directly into the stormwater system. In addition to chemical and biological contamination, thermal pollution can occur from water collected or stored on

impervious surfaces or in stormwater impoundments, which has been heated by the sun. Large impervious areas can result in “heat islands” where the surface temperatures are up to 10 degrees warmer than the surrounding areas. Thermal pollution can affect aquatic habitats, adversely impacting cold-water fish. Removal of trees and vegetation from stream banks also contributes to thermal pollution as no protection from the sun’s rays are provided.

Proper stormwater management will help mitigate the negative impact of land development, redevelopment, or construction within the Borough. The implementation of Best Management Practices (BMPs) approved by the State should help to reduce stormwater quantity, increase groundwater recharge, and improve water quality within the Borough.

3.0 BACKGROUND

The Borough of National Park covers approximately one (1) square mile and is located in Gloucester County, New Jersey. The Borough is bounded by the Delaware River to the north, and is bordered by West Deptford Township on the south, east, and west.

In 2002, the Borough updated its master plan. A study of the existing conditions and trends within National Park was performed as part of the 2002 update and includes goals, objectives, policies, and recommendations for the future development of National Park.

This Municipal Stormwater Management Plan was prepared for incorporation into the Borough's Master Plan. It is intended to expand the Master Plan's existing research, background information, goals, objectives, and recommendations.

3.1 DEMOGRAPHICS

Table 1 presents population changes from 1960 to 2000, and compares the demographics of National Park to Gloucester County and the State of New Jersey. Based upon the 2000 census, the population of National Park is estimated at 3,205, Gloucester County is estimated at 254,673, and New Jersey is estimated at 8,414,350.

From 1990 to 2000, the population of National Park remained relatively constant, Gloucester County's population increased 10.7 percent (%), and New Jersey's population increased 8.6%. National Park has essentially reached full build-out, which has kept the borough's population steady.

Table 1: Historical Population Growth 1960 – 2000

Year	*National Park Borough*		*Gloucester County*		*New Jersey*	
	Total Population	*Average Annual Growth Rate Over the Prior Period*	*Total Population*	*Average Annual Growth Rate Over the Prior Period*	*Total Population*	*Average Annual Growth Rate Over the Prior Period*
1960	3,380	N/A	134,840	N/A	6,066,782	2.6%
1970	3,730	10.4%	172,681	28.1%	7,168,164	18.3%
1980	3,552	-4.8%	199,917	15.8%	7,364,823	2.7%
1990	3,413	-3.9%	230,082	15.1%	7,730,188	5.0%
2000	3,205	-6.1%	254,673	10.7%	8,414,350	8.6%

Sources: U.S. Census – www.census.gov

U.S.G.S Quadrangle Map

3.2 LAND USE CHARACTERISTICS

National Park covers 656 acres or approximately one square mile. Approximately 256 acres or 39 percent (%) is undeveloped. Of the approximately 400 acres that are developed, 61% is in residential use while another 19% is used for rights-of-way. Thus, only 20% of the Borough's land area is currently used for public, industrial, and commercial purposes. The Land Use Map on page 3-6 clearly shows developed and undeveloped areas of the Borough.

3.3 WATERWAYS

There are three (3) significant waterways that traverse or border National Park. They are the Delaware River to the north and west, Woodbury Creek to the south and southwest, and Hessian Run to the southeast (see attached Waterways Map on page 3-7).

The U.S. Geological Survey has identified two subwatersheds (sub-drainage areas) within the Borough that have a 14 digit identifier or Hydrologic Unit Code (HUC-14) They include HUC-14 02040202120110 (i.e. 110) and HUC-14 02040202120120 (i.e. 120). HUC-14 120 is a subwatershed of Woodbury Creek and comprises most of the town (see attached Hydrologic Unit Code (HUC-14) - Subwatersheds Map).

The map indicates that most of the Borough's stormwater runoff is conveyed to Woodbury Creek and its Tidal marsh complex, which covers a significant portion of the Borough. Implementation of the Borough's stormwater management program is critical in maintaining and improving the water quality of the Creek. Stormwater management strategies and Best Management Practices are provided in the Borough's Stormwater Pollution Prevention Plan presently on file at Borough Hall.

3.4 WATER QUALITY

The Ambient Biomonitoring Network (AMNET) was established by the New Jersey Department of Environmental Protection (NJDEP) to monitor and document the health of New Jersey's waterways. This statewide network of over 800 stations employs sampling and taxonomic analysis of in-stream macroinvertebrate communities to assess the ecological

condition at each site. These bioassessments utilize several community "biometrics", such as pollution tolerances of individual taxa; the product of this multi-metric analysis assigns one of three biological "impairment" levels rating a given site as non-impaired, moderately impaired or severely impaired (http://www.state.nj.us/dep).

Table 2: Water Quality Scores 2001

Station	*Waterbody*	*NJ Impairment Score*	*Rating*
AN0667	Woodbury Creek	9	Moderately Impaired

Non-impaired – 24-30
Moderately Impaired – 9-21
Severely Impaired – 0-6

These water quality data are used by NJDEP to develop Total Daily Maximum Load (TMDL). TMDL is the quantity of a pollutant that can enter a waterbody without exceeding water quality standards or interfering with the ability to use the waterbody for its designated usage. Point and non-point pollution, surface water withdrawals and natural background levels are included in the determination of a TMDL, as required by Section 303(d) of the Clean Water Act. Point source pollution includes, but is not limited to, NJPDES permitted discharges, while non-point source pollution can include stormwater runoff from agricultural lands or impervious surfaces. TMDLs determine the allowable load from each source, with a factor of safety for the pollutant entering the water body. TMDLs can be used to prevent further deterioration of a water body, or to improve the current water quality. Currently there are no established stormwater TMDLs in National Park.

Land Use Map

Waterways Map

Hydrologic Unit Code (HUC 14) Map

3.5 WATER QUANTITY

Stormwater also often causes water quantity issues. There are several flood prone areas in National Park Borough including, but not limited to, the following:

- Areas along the Delaware River waterfront
- Areas along the Woodbury Creek (wetlands and tributaries)

The Borough manages flooding problems on an as needed basis.

3.6 GROUNDWATER RECHARGE

Recharge is the process by which groundwater is replenished. A recharge area is where water from precipitation is transmitted downward to an aquifer. An aquifer may be either a consolidated (bedrock) unit or an unconsolidated (alluvium, glacial material) unit. Most areas, unless composed of solid rock or covered by development, allow a certain percentage of total precipitation to reach the water table. However, in some areas more precipitation will infiltrate than in others. Areas that transmit the most precipitation are often referred to as "high" or "critical" recharge areas. Water infiltration depends on vegetation cover, slope, soil composition, depth to the water table, the presence or absence of confining beds and other factors. Natural vegetation cover, flat topography, permeable soils, a deep water table and the absence of confining beds promote recharge.

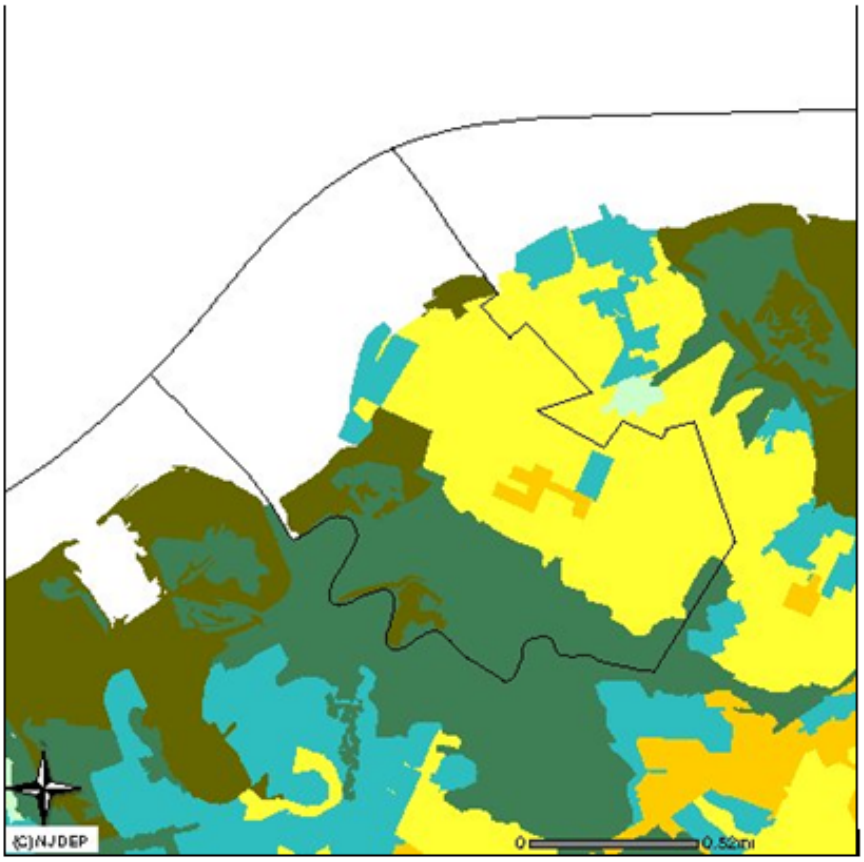
National Park Borough is underlain by the Potomac-Raritan-Magothy (PRM) aquifer system and the Merchantville-Woodbury confining unit. The PRM aquifer is replenished primarily by recharge from the Delaware River induced by pumping of water supply wells and to a much less extent by stormwater infiltration. The Surficial Geology Map, provided at the end of Section 3, shows the location of the aquifer within the Borough's boundary.

Impervious surface is increased as vacant sites are developed. Impervious surface is the portion of a site covered with structures and paving, which prevents the underlying soil from

absorbing stormwater. As impervious surfaces increase, groundwater recharge areas and rates decrease. Additional stormwater runoff alters the floodplain and has adverse impacts on the stream and river ecosystems. As shown on the groundwater recharge map (page 3-10), approximately 60 percent of the Borough is in the 8 to 10 inches per year range, while most of the remaining land is considered wetlands. Protection of groundwater recharge areas is vital in maintaining water quality and quantity.

The supplemental flow to streams in the groundwater discharge areas is the single most important factor maintaining the stream flow during periods of annual low flow (hot, dry summer and early fall months) and during periods of drought. During these times, base flow of the stream is maintained via discharging groundwater. The maintenance of quantity of flow, the water quality, and the survival of the aquatic and wetlands communities are directly dependent upon this groundwater discharge. National Park is working to preserve and protect the quality of groundwater as outlined in the goals discussed previously.

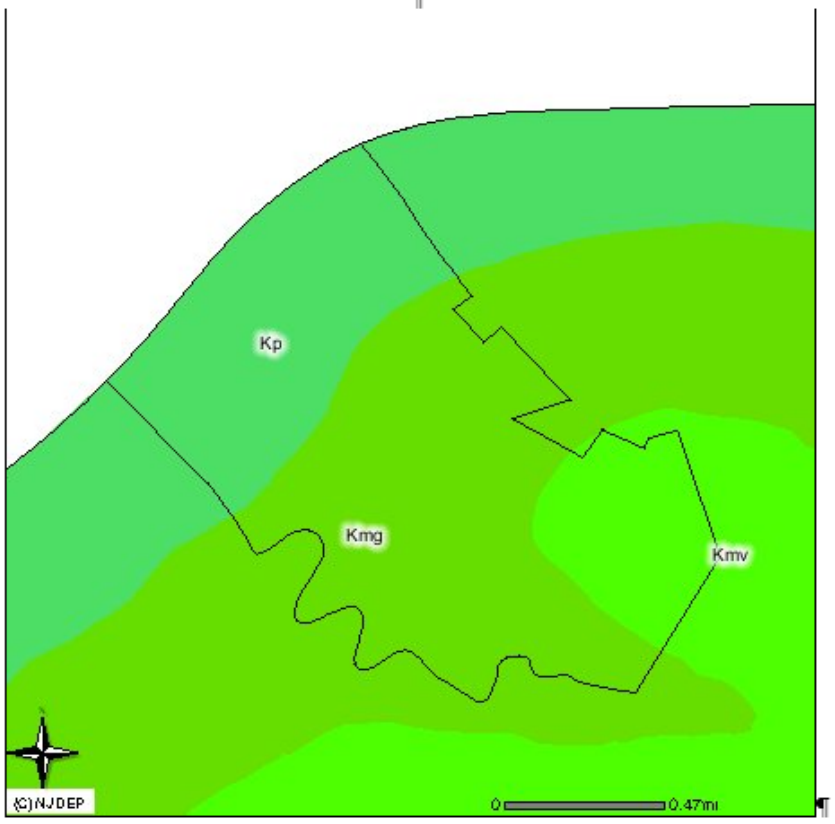
Groundwater Recharge
Borough of National Park



Well-head Protection Areas

Wetlands and Floodprone Areas

Surficial Geology
Borough of National Park



Outcrop Areas

Kp – Potomac Formation
Kmg – Magothy Formation
Kmv – Merchantville Formation

4.0 DESIGN AND PERFORMANCE STANDARDS

The Borough should adopt applicable design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 to reduce the negative impact of stormwater runoff on water quality and quantity, and loss of groundwater recharge. Section 6.0 of this plan, entitled "Stormwater Management Strategies", indicates actions appropriate for various types of development in National Park. Ultimately, design and performance standards should be created to contain the necessary language to maintain stormwater management measures consistent with applicable stormwater management rules at N.J.A.C. 7:8-5.8 - Maintenance Requirements. This includes language for safety standards consistent with N.J.A.C. 7:8-6 - Safety Standards for Stormwater Management Basins. The ordinances must be submitted to the County for review and approval within 12 months of the adoption of this plan.

A number of structural and nonstructural strategies require water to be retained for long periods of time and, if improperly maintained, may encourage mosquito breeding. New development and redevelopment activities should be coordinated with the Gloucester County Mosquito Extermination Commission so that the facilities can be properly maintained.

Proper construction and maintenance are critical to the successful performance of a stormwater management system. During construction, Borough inspectors will observe the construction of the project to ensure that the stormwater management measures are constructed and will function as designed.

The Borough is also preparing a Stormwater Pollution Prevention Plan (SPPP) that establishes a maintenance schedule for all existing stormwater related maintenance requirements. The Borough will also initiate a local education program to educate property owners on the control of household waste, fertilizers, solids, floatable controls, pesticides and other methods to reduce stormwater contaminants that may adversely affect the Borough's waterways. For new development and redevelopment projects meeting the stormwater management threshold, the

Borough will require an operation and maintenance plan in accordance with the DEP BMP manual. Copies of each maintenance plan will be filed with the Borough. Borough personnel will perform inspections during the first two years of operation or after significant storms to ensure that the system is functioning properly. After this, annual checks will be done to identify maintenance needs. As part of these inspections, blockages must be cleared from inlets and outlets. Unhealthy vegetation may need to be tended or replaced. The design of stormwater management practices for water quality improvement is based primarily on removal of sediment. Therefore, at some point, accumulated material must be removed. Borough ordinances should indicate that the inspection of systems is permissible on private property, provided the necessary easements are in place, upon giving reasonable notice. Ordinances should also indicate a time frame for maintenance procedures to occur upon receiving notice from the Borough that maintenance is required.

5.0 PLAN CONSISTENCY

5.1 REGIONAL STORMWATER MANAGEMENT PLANS

Currently, there are no adopted Regional Stormwater Management Plans (Regional Plans) developed for waters "within" the Borough. This plan will be updated to be consistent with any Regional Plans or Total Maximum Daily Loads (TMDLs) that are established in the future. The Borough plans to take part in the development of any Regional Plans that affect waterbodies within or adjacent to the municipality.

5.2 TOTAL MAXIMUM DAILY LOADS

There is an ongoing study on Woodbury Creek to: a) determine sources of fecal coliform and phosphorus; b) develop a model to assess water quality impacts from erosion, stormwater, and non-point source contaminants; and c) develop TMDLs for Woodbury Creek to reduce impairments. There are no stormwater TMDLs currently developed for the Borough. This plan will be updated to comply with TMDLs issued in the future. Refer to Section 3.4 for a discussion of TMDLs and water quality.

5.3 RESIDENTIAL SITE IMPROVEMENT STANDARDS (RSIS)

This Municipal Stormwater Management Plan is consistent with regulations established under the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21, and will be updated to remain consistent with any future updates of RSIS. Additionally, the Borough will use the latest version of the RSIS during its reviews of residential developments for stormwater management.

5.4 SOIL CONSERVATION

The Borough's requires that all new development and redevelopment site plans and subdivisions, including renovations, comply with the Soil Erosion and Sediment Control Standards of New Jersey. In cooperation with the Gloucester County Soil Conservation District, inspectors retained by the Borough will observe on-site soil erosion and sediment control measures as part of construction site inspections.

6.0 STORMWATER MANAGEMENT STRATEGIES

6.1 MASTER PLAN & ORDINANCE REVIEW

The Borough will review its master plan and land use/zoning ordinances for consistency with the new stormwater regulations. The review will concentrate on areas pertaining to buffers, curbs and gutters, off-site and off-tract improvements, off-street parking and loading, performance standards, sidewalks, streets, groundwater protection and drainage, and stream corridors.

Revisions to sections of Borough ordinances will allow the incorporation of the non-structural strategies. Drafts of the updated ordinances will be submitted to the County for review and approval within 12 months of plan adoption. A copy will be sent concurrently to the New Jersey Department of Environmental Protection.

6.2 NONSTRUCTURAL STRATEGIES

This Plan recommends the practical use of the following nonstructural strategies for all major developments in accordance with Subchapter 5 of the NJDEP BMP manual:

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.
2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.
3. Maximize the protection of natural drainage features and vegetation.
4. Minimize the decrease in the pre-construction “time of concentration.”
5. Minimize land disturbance, including clearing and grading.
6. Minimize soil compaction.
7. Provide vegetated open-channel conveyance systems that discharge into and through stable vegetated areas.
8. Provide preventative source controls. In addition, Subchapter 5 further requires an

applicant seeking approval for a major development[1] to specifically identify how these nonstructural strategies have been incorporated into the development's design. Finally, for each of those nonstructural strategies that could not be incorporated into the development's design due to engineering, environmental, or safety reasons, the applicant must provide a basis for this contention.

Recommended Measures

Recommendations in the BMP manual may be implemented through the use of:

Vegetated Filter Strips

Vegetated filter strips are engineered stormwater conveyance systems that treat small drainage areas. Generally, a vegetated filter strip consists of a level spreader and planted vegetation. The level spreader ensures uniform flow over the vegetation that filters out contaminants, and promotes infiltration of the stormwater.

Vegetated filter strips are best utilized adjacent to a buffer strip, watercourse or drainage swale since the discharge will be in the form of sheet flow, making it difficult to convey the stormwater downstream in a normal conveyance system (swale or pipe).

Stream Corridor Buffer Strips

Buffer strips are undisturbed areas between development and the receiving waters. There are two management objectives associated with stream and valley corridor buffer strips:

- To provide buffer protection along a stream and valley corridor to protect existing ecological form and functions; and
- To minimize the impact of development on the stream itself (filter

[1] Major Development – means any 'development' that provides for ultimately disturbing one or more acres of land or increasing impervious surface by one-quarter acre or more. Disturbance for the purpose of this rule is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation. Projects undertaken by any government agency which otherwise meet the definition of 'major development' but which do not require approval under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq., are also considered "major development".

contaminants, provide shade and bank stability, reduce the velocity of overland flow).

Buffers only provide limited benefits in terms of stormwater management; however, they are an integral part of a system of best management practices.

The Stabilization of Banks, Shoreline and Slopes

The root systems of trees, shrubs and plants effectively bind soils to resist erosion. Increasing the amount of required plant material for new and redeveloped residential and non-residential sites should be encouraged throughout the Borough. Planting schemes should be designed by a certified landscape architect to combine plant species that have complementary rooting characteristics to provide long-term stability.

Pond Configuration

Several homes in National Park have created ponds for aesthetic purposes. Some of these ponds are shallow and suffer from eutrophic conditions. This leads to large amount of weed and algae growth that depletes the amount of dissolved oxygen in the water. Through proper design, increases in water temperature during summer months can be minimized.

The configuration of a pond will affect its temperature. The width of the pond should be minimized to prevent the occurrence of large open areas of water that cannot be shaded by vegetation. The pond should provide one area at least 4 to 6 feet deep to keep pond waters cool and to maintain an area sustaining a fish population. The positioning of deciduous and coniferous trees along the edges of a pond, channel or wetland can assist in mitigating undesirable increases in water temperature and contribute to the maintenance of dissolved oxygen levels by inhibiting the growth of algae.

Deterrence of Geese and Deer

Maintaining or planting dense woody vegetation around the perimeter of a pond

or wetland is the most effective means of deterring geese from taking over and contaminating local lakes and ponds. Minimizing the amount of land that is mowed will limit the preferred habitat for geese. Also the planting of deer-tolerant vegetation adjacent to waterbodies is a means of deterring deer by minimizing food sources. If however, these actions are not sufficient, the Borough should investigate other means of deterrence.

Fertilizers

The use of fertilizers to create the "perfect lawn" is an increasingly common problem in many residential areas. Fertilizer run-off increases the level of nutrients in water bodies and can accelerate eutrophication[2] in the lakes and rivers and continue on to the coastal areas. The excessive use of fertilizers causes nitrate contamination of groundwater and may lead to levels in drinking water that are above recommended safety levels. Good fertilizer maintenance practices help in reducing the amount of nitrates in the soil and thereby lower its content in the water. Initially, the Borough should work with the NJDEP to educate homeowners of the impacts of the overuse of fertilizers. This discussion should include other techniques to create a "green lawn" without over-fertilizing. Almost as important as the use of fertilizer is the combination of over-fertilizing and over-watering lawns. In many cases this leads to nutrient rich runoff, which ultimately migrates to a nearby stream, lake or other water body. If fertilizer is applied correctly, the natural characteristics of the underlying soils will absorb or filter out the nutrients in the fertilizer.

Minimizing Lawns

Reducing the amount of manicured lawn area and increasing the amount of woods and native vegetation provides several benefits. Native vegetation requires less fertilizer, filters out more contaminants, and it promotes groundwater recharge.

[2] Eutrophication – The normally slow aging process by which a lake evolves into a bog or marsh and ultimately assumes a completely terrestrial state and disappears.

Unpaved Roads and Driveways

While there are no unpaved public roads in the Borough, there are a few privately maintained unpaved roads or driveways. There is a need to manage the runoff from these roadways. Poorly maintained roads and driveways may contribute to water quality problems, and erosion from unpaved roads may increase non-point source pollution. This Plan recommends utilizing Best Management Practices (BMPs) to properly manage existing unpaved roads.

6.3 STRUCTURAL STORMWATER MANAGEMENT

In Chapter 9 of its *Stormwater Management Best Management Practices* (BMP) manual, the Department of Environmental Protection identifies several structural stormwater management options. The Borough recommends the following structural devices in accordance with the Borough's Design and Performance Standards – Policy Implementation Table included in this Plan. Structural methods should be used only after all non-structural strategies are deemed impracticable or unsafe. Specifically, the Borough encourages the use of structural stormwater management systems in a manner that maximizes the preservation of community character:

Bioretention Systems

A bioretention system consists of a soil bed planted with native vegetation located above an underdrained sand layer. It can be configured as either a bioretention basin or a bioretention swale. Stormwater runoff entering the bioretention system is filtered first through the vegetation and then the sand/soil mixture before being conveyed downstream by the underdrain system. Runoff storage depths above the planting bed surface are typically shallow. The adopted Total Suspended Solids (TSS) removal rate for bioretention systems is 90 %.

Constructed Stormwater Wetlands

Constructed stormwater wetlands are wetland systems designed to maximize the removal of contaminants from stormwater runoff through settling and both uptake and

filtering by vegetation. Constructed stormwater wetlands temporarily store runoff in relatively shallow pools that support conditions suitable for the growth of wetland plants. The adopted removal rate for constructed stormwater wetlands is 90%.

Dry Wells

A dry well is a subsurface storage facility that receives and temporarily stores stormwater runoff from roofs of structures. Discharge of this stored runoff from a dry well occurs through infiltration into the surrounding soils. A dry well may be either a structural chamber and/or an excavated pit filled with aggregate. Due to the relatively low level of expected contaminants in roof runoff, a dry well cannot be used to directly comply with the suspended solids and nutrient removal requirements contained in the NJDEP Stormwater Management Rules at N.J.A.C. 7:8. However, due to its storage capacity, a dry well may be used to reduce the total amount of stormwater runoff that a roof would ordinarily discharge to downstream stormwater management facilities. Care should be taken with the location and size of drywells due to potential adverse impacts on basements and foundations.

Extended Detention Basins

An extended detention basin is a facility constructed through filling and/or excavation that provides temporary storage of stormwater runoff. It has an outlet structure that detains and attenuates runoff inflows and promotes the settlement of contaminants. An extended detention basin is normally designed as a multistage facility that provides runoff storage and attenuation for both stormwater quality and quantity management. The adopted TSS removal rate for extended detention basins is 40 to 60 %, depending on the duration of detention time provided in the basin.

Infiltration Basins

An infiltration basin is a facility constructed within highly permeable soils that provides temporary storage of stormwater runoff. An infiltration basin does not normally have a structural outlet to discharge runoff from the stormwater quality design storm, but may require an emergency overflow for extraordinary storm events. Instead, outflow

from an infiltration basin is through the surrounding soil. An infiltration basin may also be combined with an extended detention basin to provide additional runoff storage for both stormwater quality and quantity management. The adopted TSS removal rate for infiltration basins is 80 %.

Manufactured Treatment Devices

A manufactured treatment device is a pre-fabricated stormwater treatment structure utilizing settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, and/or other appropriate technology to remove contaminants from stormwater runoff. The TSS removal rate for manufactured treatment devices is based on the NJDEP certification of the pollutant removal rates on a case-by-case basis. Other contaminants, such as nutrients, metals, hydrocarbons, and bacteria can be included in the verification/certification process if the data supports their removal efficiencies.

Pervious Paving Systems

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. This reduction is achieved primarily through the infiltration of a greater portion of the rain falling on the area than would occur with conventional paving. This increased infiltration occurs either through the paving material itself or through void spaces between individual paving blocks known as pavers. Pervious paving systems are divided into three general types. Each type depends primarily upon the nature of the pervious paving surface course and the presence or absence of a runoff storage bed beneath the surface course. Porous paving and permeable pavers with storage bed systems treat the “stormwater quality” design storm runoff through storage and infiltration. Therefore, these systems have adopted TSS removal rates similar to infiltration structures. Care must be taken in the use of pervious systems to avoid subgrade instability and frost related deterioration. Pervious paving systems also require significant maintenance to maintain their designed porosity.

Sand Filters

A sand filter consists of a forebay and underdrained sand bed. It can be

configured as either a surface or subsurface facility. Runoff entering the sand filter is conveyed first through the forebay, which removes trash, debris, and coarse sediment, and then through the sand bed to an outlet pipe. Sand filters use solids settling, filtering, and adsorption processes to reduce pollutant concentrations in stormwater. The adopted TSS removal rate for sand filters is 80 %.

Vegetative Filters

A vegetative filter is an area designed to remove suspended solids and other contaminants from stormwater runoff flowing through a length of vegetation called a vegetated filter strip. The vegetation in a filter strip can range from turf and native grasses to herbaceous and woody vegetation, all of which can either be planted or indigenous. It is important to note that all runoff to a vegetated filter strip must both enter and flow through the strip as sheet flow. Failure to do so can severely reduce and even eliminate the filter strip's pollutant removal capabilities. The total suspended solid (TSS) removal rate for vegetative filters will depend upon the vegetated cover in the filter strip.

Wet Ponds

A wet pond is a stormwater facility constructed through filling and/or excavation that provides both permanent and temporary storage of stormwater runoff. It has an outlet structure that creates a permanent pool and detains and attenuates runoff inflows and promotes the settlement of contaminants. A wet pond, also known as a retention basin, can also be designed as a multi-stage facility that also provides extended detention for enhanced "stormwater quality" design storm treatment and runoff storage and attenuation for stormwater quantity management. The adopted TSS removal rate for wet ponds is 50 to 90 % depending on the permanent pool storage volume in the pond and the length of retention time provided by the pond.

Each of these structures has advantages and disadvantages to manage stormwater Table 3 Design and Performance Standards – Policy Implementation Table indicates the appropriateness of these structural stormwater management structures in National Park.

7.0 LAND USE/BUILD-OUT ANALYSIS

National Park covers 656 acres or approximately one square mile. An estimated 60 percent of the Borough is presently developed. The State requires a land use/build-out analysis for municipalities that have more than one square mile of vacant or developable land. Considering the Borough has less than one square mile of vacant or developable land, a land use/build-out analysis is not required for this Stormwater Management Pla

Zoning Map

8.0 MITIGATION PLAN

This mitigation plan is provided for proposed development that is granted a variance or exemption from stormwater management design and performance standards.

8.1 MITIGATION PROJECT CRITERIA

The developer must propose a mitigation project located in the same drainage basin as the proposed development. The mitigation project must provide additional groundwater recharge benefits, or protection from stormwater runoff quantity or quality from previously developed property that does not currently meet the design and performance standards outlined in this plan. The developer must ensure the long-term maintenance of the project including all maintenance required in Chapters 8 and 9 of the NJDEP Stormwater BMP Manual.

Projects must be proposed on an equivalent basis. Developers must propose a mitigation project that is equivalent to the type requested in the variance. This means a "stormwater quality" variance can only be mitigated by a "stormwater quality" mitigation project.

It is the developer's responsibility to provide a detailed study of any proposed mitigation project, and must provide the Borough with a proposed mitigation plan for review and approval.

9.0 RECOMMENDATIONS

The *National Park Borough Master Plan*, last updated in 2002, should be updated to incorporate the following recommendations.

Recommendation A: Review and update the existing elements of the Master Plan to implement the principals of non-structural and structural stormwater management strategies to reduce stormwater quantity, improve stormwater quality, and to maintain or increase groundwater recharge.

The Master Plan should be updated to comply with the recently adopted New Jersey Department of Environmental Protection (NJDEP) Stormwater Management Regulations and the NJDEP *Best Management Practices for the Control of Non-Point Source Pollution from Stormwater Manual*.

The Residential Site Improvement Standards (RSIS) require all residential developments with more than 1 acre of impervious coverage or ¼ acre of additional impervious coverage to comply with the NJDEP Stormwater Regulations. However, non-residential developments are currently exempt from the Stormwater Regulations. The Borough should consider implementing regulations to require major development not regulated by the RSIS, such as non-residential development and building permit applications not regulated by site plan and/or subdivision, to comply with portions of the stormwater rules and regulations. These regulations should seek to achieve a balance between minimizing impact on stormwater quality, stormwater quantity and ground water recharge, while protecting private property rights.

Recommendation B: To improve stormwater management, water quantity and groundwater recharge, consider reducing permitted impervious coverage such as buildings

and parking lots throughout the Borough.

The Borough should closely evaluate site plans for impervious surfaces such as oversized parking lots. Parking lots generate large volumes of stormwater. The Borough should evaluate the existing parking requirement and design standards to prevent over-development of parking lots and to encourage the separation ("disconnection") of impervious areas with landscaping areas to collect stormwater and encourage groundwater recharge.

An evaluation of vacant sites throughout the Borough should be performed to determine which sites have impervious coverage which are no longer in use and are not functional. They include areas such as abandoned parking lots and tennis courts. Additional impervious coverage contributes to additional stormwater runoff. The Borough should investigate methods to remove abandoned impervious coverage and to replace it with vegetation to receive stormwater runoff.

Recommendation C: Explore and consider establishing a Stream Corridor Buffer Ordinance.

The NJDEP Stormwater Regulations requires any development with more than 1 acre of disturbance or ¼ acre of impervious coverage to provide a 300-foot Buffer along a Category-1 stream.

Recommendation D: Work with residents, property owners and businesses to encourage the installation of vegetation along stream corridors and within existing stormwater detention facilities.

Landscaping with native vegetation along stream corridors and within detention basins improves the quality of stormwater.

Recommendation E: Seek to limit encroachments into existing conservation easements.

Properties throughout the Borough may have existing conservation easements. National Park should consider establishing a Conservation Easement Ordinance prohibiting the removal of trees and ground cover within a conservation easement. The Conservation Easement Ordinance would also prohibit the construction of any structures, walls, or fences within the easement.

Recommendation F: Educate residents on the impacts of the overuse of fertilizers and good fertilizer maintenance practices.

As stated in Section 6.2, the overuse of fertilizers has a significant detrimental impact on surface water bodies and groundwater. The Borough should work with the NJDEP to educate residents on these impacts and encourage residents to use techniques to create a "green lawn" without over- fertilizing and/or to convert lawn areas to other kinds of vegetation that do not require fertilization and other chemical treatments. Many lawn services also "overspray" fertilizer onto roadways and adjacent properties. The Borough should investigate methods to minimize the application of fertilizers beyond property lines.

Recommendation G: Educate residents on techniques to deter geese, deer, and other wildlife.

Geese population can take over and contaminate local water bodies. The planting of vegetation around the perimeter of a waterbody is an effective means of deterring geese.

Recommendation H: Consider implementing restrictions that limit the allowable disturbance of existing vegetated areas and removal of vegetation and woodlands.

The Ordinance may include regulations prohibiting clear-cutting, removal of trees on or adjacent to environmentally sensitive areas and/or the protection of specimen trees that are more

stringent than State requirements or federal requirements.

Recommendation I: Seek to ensure the proper inspection, monitoring, and maintenance of all stormwater management facilities and develop strategies for all existing and future maintenance and improvements.

Stormwater facilities require regular maintenance to ensure effective and reliable performance. Failure to perform the necessary maintenance can lead to diminished performance, deterioration and failure. In addition, a range of health and safety problems, including mosquito breeding and the potential for drowning, can result from improperly maintained facilities. To minimize these risks, the Borough should implement a procedure for regular inspection, monitoring, and maintenance of Borough owned stormwater facilities.

Additionally, there are a number of privately maintained stormwater facilities within the Borough. The Borough should work with the various property owners, residents and business owners to identify maintenance and/or improvements needs and develop strategies for regular inspection and maintenance of these facilities.

The Borough should also encourage the use of low impact design methods and non-structural strategies, which require less maintenance.

Recommendation J: Work with the County Mosquito Commission to monitor existing and proposed BMP's.

Many of the recommended non-structural and structural strategies are designed to retain water for a period of time to promote groundwater recharge. These conditions could be favorable to mosquito breeding habitats. To date there is no data relating mosquito breeding and best management practices. The Borough should coordinate new development and redevelopment project using non-structural and structural strategies with the County Mosquito Commission so that these facilities can be periodically monitored, inspected and maintained.

Developers and the Borough should also solicit input from the County Mosquito Commission early in the design process for new facilities to obtain additional guidance and recommendations.

Recommendation K: Encourage existing storm drains to be replaced with bicycle safe grates and NJDEP approved inlet heads to prevent floatable and solid debris from entering the storm water conveyance system.

Typical roadway debris, such as bottles and cans, can easily enter stormwater conveyance systems through typical inlet openings. This debris is then transported downstream into the receiving water bodies. By replacing existing storm drain inlets with new inlet grates and inlet heads, which have a maximum opening size of 2-inches by 4-inches, the amount of debris entering the stream can be reduced, improving water quality.

Recommendation L: To reduce erosion and sedimentation in streams; encourage residents and property owners to minimize the amount of regrading.

During construction large amounts of disturbance can cause soil erosion. This can result in accumulation and/or sedimentation in streams and elevated amounts of Total Suspended Solids which can impact the existing vegetation and wildlife.

Recommendation M: Seek to limit erosion and exposure of acid producing soils, especially along stream corridors and floodplain areas.

As reported in the Technical Manual for Stream Encroachment (NJDEP, revised 1988), iron sulfide minerals (pyrite or marcasite) exposed to oxygen from air or surface waters will oxidize and produce sulfuric acid. Geologic deposits which contain such minerals are called "acid producing deposits". The sulfuric acid increases the solubility of metals, which could reach concentrations that endanger aquatic flora and fauna or impact the potable water supply. The following geologic formations in National Park Borough have the potential to contain substantial acid-producing deposits:

- Magothy Formation
- Merchantville Formation

The Borough should ensure that the New Jersey Standards for Soil Erosion and Sediment Control are followed for projects proposing to disturb deposits within these geologic formations.

10.0 BIBLIOGRAPHY

Kern River Connections. The Hydrologic Cycle.
http://www.creativille.org/kernriver/watershed.htm

Linsley, Ray K., Franzini, Joseph B., Freyber, David L, and George Tchobanoglous. *Water Resources Engineering.* 4th ed. New York, New York: Irwin McGraw-Hill, 1992.

National Park Borough. Master Plan. 2002.

New Jersey Administrative Code N.J.A.C. 7:14A-25: NJPDES Stormwater Rules. Jan. 5, 2004.

New Jersey Administrative Code, N.J.A.C. 7:8, Stormwater Management Rules, Feb. 2, 2004.

New Jersey Department of Environmental Protection, Division of Watershed Management *New Jersey Stormwater Best Management Practices Manual* April 2004.

New Jersey Department of Environmental Protection, Division of Watershed Management. *Tier A Municipal Guidance Document: NJPDES General Permit No. NJ0148938*. April 2004.

New Jersey Department of Environmental Protection. Division of Watershed Management. Total Maximum Daily Loads. http://www.state.nj.us/dep/watershedmgt/tmdl.htm. Sept. 1, 2004.

New Jersey Department of Environmental Protection. Division of Watershed Management. http://www.state.nj.us/dep/watershedmgt/index.htm. Dec. 15, 2004.

New Jersey Department of Environmental Protection. List of Category One Streams, Lakes and Reservoirs. http://www.nj.gov/dep/cleanwater/c1_waters_list.pdf.

New Jersey Department of Environmental Protection. Stormwater and Nonpoint Source Pollution, <www.njstormwater.org> August 30, 2004.

New Jersey Department of Environmental Protection. Sub-list 1-5, New Jersey's 2004 Integrated List of Water Bodies <http://www.state.nj.us/dep/wmm/bfbm/>, June 22, 2004.

New Jersey Department of Environmental Protection. *The Ambient Biomonitoring Network Watershed Management Area 12, 13, 14, 15, and 16, Atlantic Region*. March 2001. http://www.state.nj.us/dep/wmm/bfbm/.

United States Census Bureau. 1990 Summary Tape File (STF 1), 1990.

United States Census Bureau. Profile of General Demographic Characteristics: 1990, 1990.

United States Census Bureau. Profile of General Demographic Characteristics: 2000, 2000.