New Jersey Stormwater Best Management Practices Manual

February 2004

A P P E N D I X C

Sample Municipal Stormwater Management Plan

This is a sample of a municipal stormwater management plan. It was prepared to assist municipalities in developing the municipal stormwater management plans required by the new Stormwater Phase II Permitting Regulations and the Stormwater Management Rules. The plan has all of the required elements outlined in the Stormwater Management Rules at N.J.A.C. 7:8-4.2. The plan also includes additional recommended elements to enable municipalities to better manage the impact of stormwater on the receiving waters of the state from new and existing development. *Throughout the document, italicized text is provided to assist municipalities in the preparation of their own plan.*

Please note that portions of this plan are fictional and intended only as a model to assist municipalities in the development of the stormwater management plan. It is anticipated that municipalities will provide more detail and information than what is presented in this plan.

Note: Figures can be viewed in color in the PDF version of this appendix available at http://www.state.nj.us/dep/watershedmgt/bmpmanualfeb2004.htm

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Introduction

Every plan should include an introduction to identify why the plan is being prepared and a summary of the contents of the plan. Here is sample language.

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for the ABC Township ("the Township") to address stormwater-related impacts. The creation of this plan is required by N.J.A.C. 7:14A-25 Municipal Stormwater Regulations. This plan contains all of the required elements described in N.J.A.C. 7:8 Stormwater Management Rules. The plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new major development, defined as projects that disturb one or more acre of land. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow in receiving water bodies. The plan describes long-term operation and maintenance measures for existing and future stormwater facilities.

A "build-out" analysis has been included in this plan based upon existing zoning and land available for development. The plan also addresses the review and update of existing ordinances, the Township Master Plan, and other planning documents to allow for project designs that include low impact development techniques. The final component of this plan is a mitigation strategy for when a variance or exemption of the design and performance standards is sought. As part of the mitigation section of the stormwater plan, specific stormwater management measures are identified to lessen the impact of existing development.

Goals

Although each municipal plan may have different or more specific goals, listed below are the minimum set of goals that should be included in all municipal stormwater management plans.

The goals of this MSWMP are to:

- reduce flood damage, including damage to life and property;
- minimize, to the extent practical, any increase in stormwater runoff from any new development;
- reduce soil erosion from any development or construction project;
- assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
- maintain groundwater recharge;
- prevent, to the greatest extent feasible, an increase in nonpoint pollution;
- maintain the integrity of stream channels for their biological functions, as well as for drainage;
- minimize pollutants 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, industrial, and other uses of water; and
- protect public safety through the proper design and operation of stormwater basins.

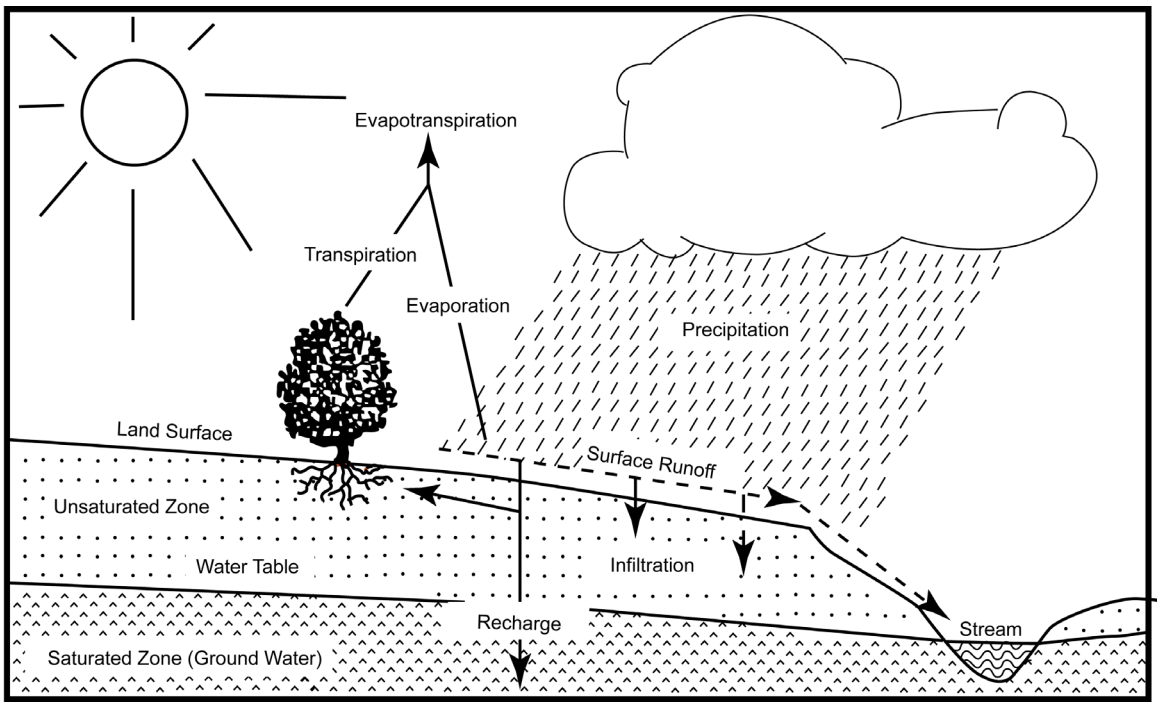
To achieve these goals, this plan outlines specific stormwater design and performance standards for new development. Additionally, the plan proposes stormwater management controls to address impacts from existing development. Preventative and corrective maintenance strategies are included in the plan to ensure long-term effectiveness of stormwater management facilities. The plan also outlines safety standards for stormwater infrastructure to be implemented to protect public safety.

Stormwater Discussion

Some of the readers of the plan may have limited knowledge of stormwater related issues. A brief description of the hydrologic cycle and how development affects the cycle may be useful to the reader. Sample language is provided below.

Land development can dramatically alter the hydrologic cycle (See Figure C-1) of a site and, ultimately, an entire watershed. Prior to development, native vegetation can either directly intercept precipitation or draw that portion that has infiltrated into the ground and return it to the atmosphere through evapotranspiration. Development can remove this beneficial vegetation and replace it with lawn or impervious cover, reducing the site's evapotranspiration and infiltration rates. Clearing and grading a site can remove depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration ability, resulting in increased volumes and rates of stormwater runoff from the site. Impervious areas that are connected to each other through gutters, channels, and storm sewers can transport runoff more quickly than natural areas. This shortening of the transport or travel time quickens the rainfall-runoff response of the drainage area, causing flow in downstream waterways to peak faster and higher than natural conditions. These increases can create new and aggravate existing downstream flooding and erosion problems and increase the quantity of sediment in the channel. Filtration of runoff and removal of pollutants by surface and channel vegetation is eliminated by storm sewers that discharge runoff directly into a stream. Increases in impervious area can also decrease opportunities for infiltration which, in turn, reduces stream base flow and groundwater recharge. Reduced base flows and increased peak flows produce greater fluctuations between normal and storm flow rates, which can increase channel erosion. Reduced base flows can also negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on base flows. Finally, erosion and sedimentation can destroy habitat from which some species cannot adapt.

Figure C-1: Groundwater Recharge in the Hydrologic Cycle



Source: New Jersey Geological Survey Report GSR-32.

In addition to increases in runoff peaks, volumes, and loss of groundwater recharge, land development often results in the accumulation of pollutants on the land surface that runoff can mobilize and transport to streams. New impervious surfaces and cleared areas created by development can accumulate a variety of pollutants from the atmosphere, fertilizers, animal wastes, and leakage and wear from vehicles. Pollutants can include metals, suspended solids, hydrocarbons, pathogens, and nutrients.

In addition to increased pollutant loading, land development can adversely affect water quality and stream biota in more subtle ways. For example, stormwater falling on impervious surfaces or stored in detention or retention basins can become heated and raise the temperature of the downstream waterway, adversely affecting cold water fish species such as trout. Development can remove trees along stream banks that normally provide shading, stabilization, and leaf litter that falls into streams and becomes food for the aquatic community.

Background

The plan should include background information on the municipality to help the reader understand its characteristics – size in square miles, population, population changes, waterways, and health of these waterways. For example, is the municipality a rural community rapidly becoming developed or is it an older established community where land use is fairly stable? Is the health of the waterways in the municipality impaired? Are there flooding concerns in the municipality? Also, maps should be included to help the reader visualize the municipality and its physical features.

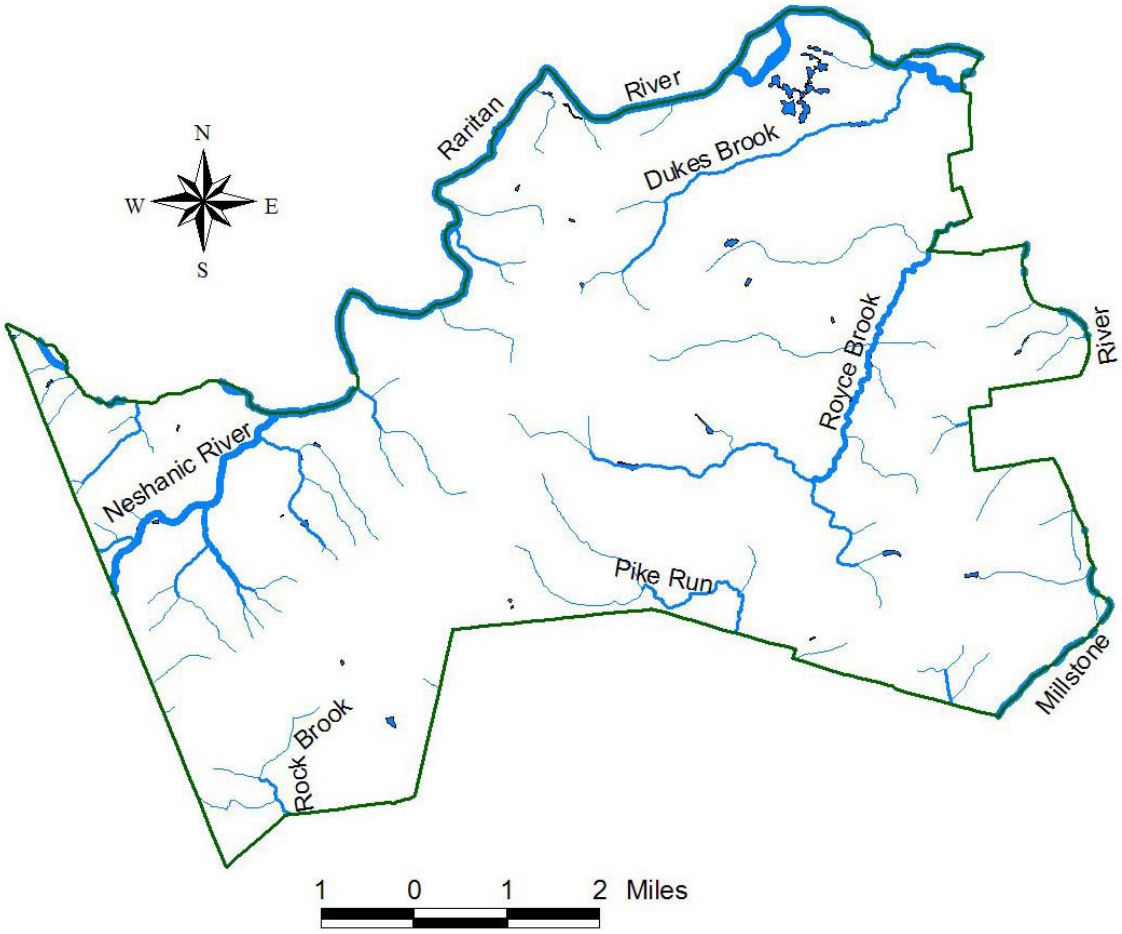
A township was selected for this sample plan so that the mapping and municipal characteristics can be presented along with information as to where to obtain these data. Due to the sample nature of this plan, this section does not present a comprehensive background of the municipality and its stormwater-related issues.

The Township encompasses 55 square mile area in Somerset County, New Jersey. In recent years, the Township has been under significant development pressure. The population of the Township has increased from 19,061 in 1980, to 28,808 in 1990, to 36,634 in 2000. This population increase has resulted in considerable demand for new development; changes in the landscape have most likely increased stormwater runoff volumes and pollutant loads to the waterways of the municipality. Figure C-2 illustrates the waterways in the Township. Figure C-3 depicts the Township boundary on the USGS quadrangle maps.

Each municipality should have population statistics. This information is available from the New Jersey Department of Labor at www.wnjpin.net/OneStopCareerCenter/LaborMarketInformation/lmi25/index.html. Mapping required for a municipal plan is fairly simple, but requires Geographic Information System (GIS) software. Mapping information is available at http://www.nj.gov/dep/gis/lists.html as well as a link to a free version of GIS software, ArcExplorer. Many local watershed associations and environmental commissions have GIS and can help create maps for an MSWMP. Rutgers University Center for Remote Sensing and Spatial Analysis can also assist in preparing these maps. Detailed direction on how to create these maps is provided at http://rwqp.rutgers.edu/univ/nj/.

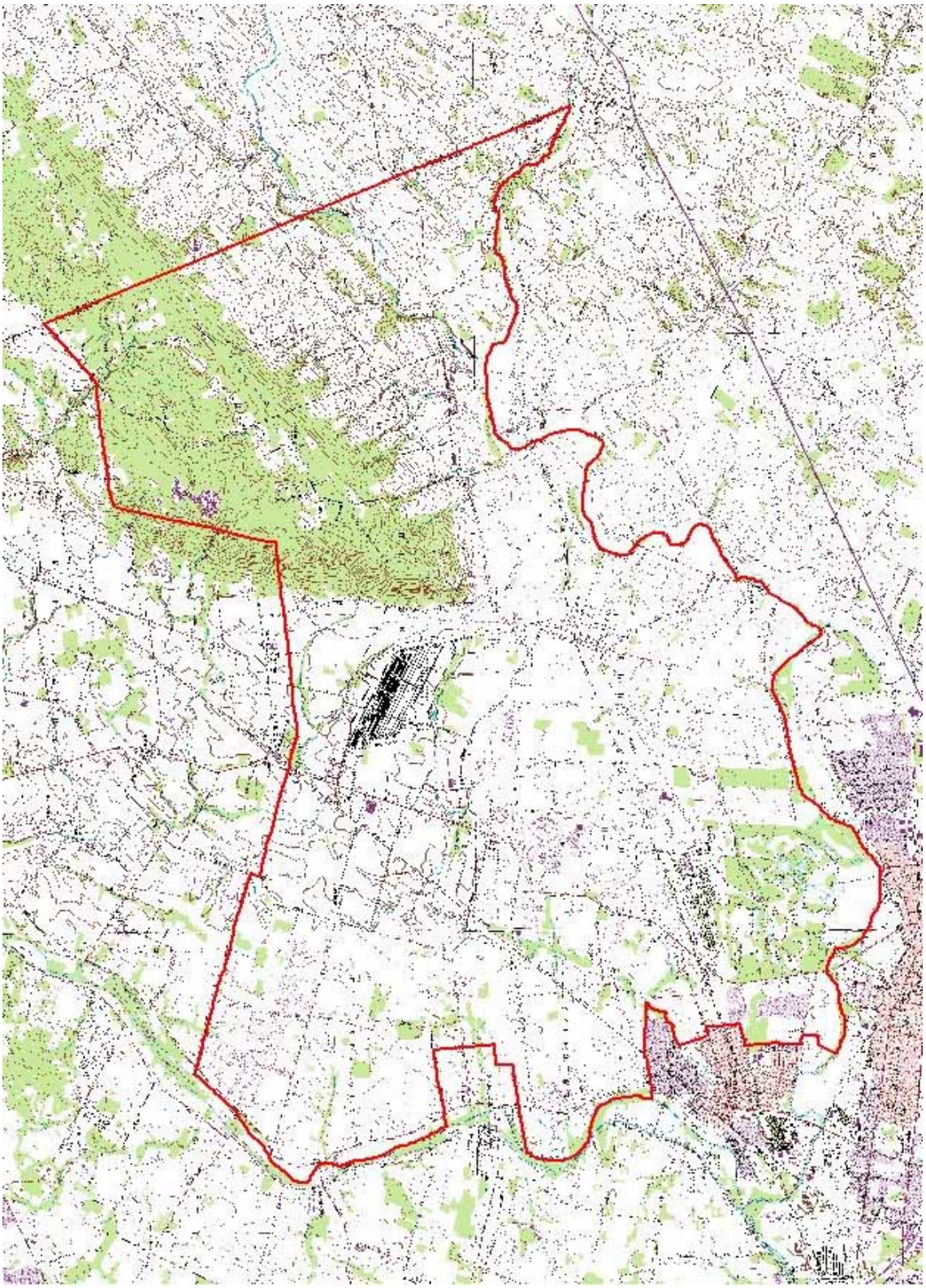
The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are over 800 AMNET sites throughout the state of New Jersey. These sites are sampled for benthic macroinvertebrates by NJDEP on a five-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired based on the AMNET data. The data is used to generate a New Jersey Impairment Score (NJIS), which is based on a number of biometrics related to benthic macroinvertebrate community dynamics. The two major rivers that border the Township to the north and east, the Raritan River and the Millstone River,

Figure C-2: Township and Its Waterways



This figure can be viewed in color in the PDF version of this appendix available at http://www.state.nj.us/dep/watershedmgt/bmpmanualfeb2004.htm

Figure C-3: Township Boundary on USGS Quadrangles



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respectively, are both moderately impaired. The five tributaries that flow through the Township to these major rivers are also moderately impaired based on AMNET data. In addition to the AMNET data, the NJDEP and other regulatory agencies collect water quality chemical data on the streams in the state. These data show that the instream total phosphorus concentrations and fecal coliform concentrations of the Raritan River and Millstone River frequently exceed the state's criteria. This means that these rivers are impaired waterways and the NJDEP is required to develop a Total Maximum Daily Load (TMDL) for these pollutants for each waterway.

A TMDL is the amount of a pollutant that can be accepted by a waterbody without causing an exceedance of water quality standards or interfering with the ability to use a waterbody for one or more of its designated uses. The allowable load is allocated to the various sources of the pollutant, such as stormwater and wastewater discharges, which require an NJPDES permit to discharge, and nonpoint source, which includes stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan is developed to identify how the various sources will be reduced to the designated allocations. Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems, and other BMPs.

The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)) (Integrated List) is required by the federal Clean Water Act to be prepared biennially and is a valuable source of water quality information. This combined report presents the extent to which New Jersey waters are attaining water quality standards, and identifies waters that are impaired. Sublist 5 of the Integrated List constitutes the list of waters impaired or threatened by pollutants, for which one or more TMDLs are needed.

The integrated list is available from the NJDEP website at www.nj.gov/dep/wmm/sgwqt/wat/index.html. Specific data on biological monitoring (AMNET data) is available from the NJDEP web site at www.state.nj.us/dep/wmm/bfbm. Additional data can be found on the United States Geological Survey (USGS) site at www.water.usgs.gov.

In addition to water quality problems, the Township has exhibited severe water quantity problems including flooding, stream bank erosion, and diminished base flow in its streams. Many of the culverts associated with road crossings in the Township are undersized. During severe storm events, these undersized culverts do not have adequate capacity, thereby causing a backwater effect and flooding upstream.

The municipality should list specific areas that are affected by stormwater quantity problems and the extent. For example, if in a storm event in 2001, considered equivalent to a 20-year design storm, specific areas reached particular elevations, that should be included.

These culverts were designed for much different hydrologic conditions (i.e., less impervious area) than presently exist in the Township. As the imperviousness increased in the Township, the peak and volumes of stream flows also increased. The increased amount of water resulted in stream bank erosion, which resulted in unstable areas at roadway/bridge crossings, and degraded stream habitats. The high imperviousness of the Township has significantly decreased groundwater recharge, decreasing base flows in streams during dry weather periods. Lower base flows can have a negative impact on instream habitat during the summer months. A map of the groundwater recharge areas are shown in Figure C-4. Wellhead protection areas, also required as part of the MSWMP, are shown in Figure C-5.

The Township may want to adopt specific ordinances to protect wellhead protection areas to minimize the infiltration of pollutants into aquifers.

Figure C-4: Groundwater Recharge Areas in the Township

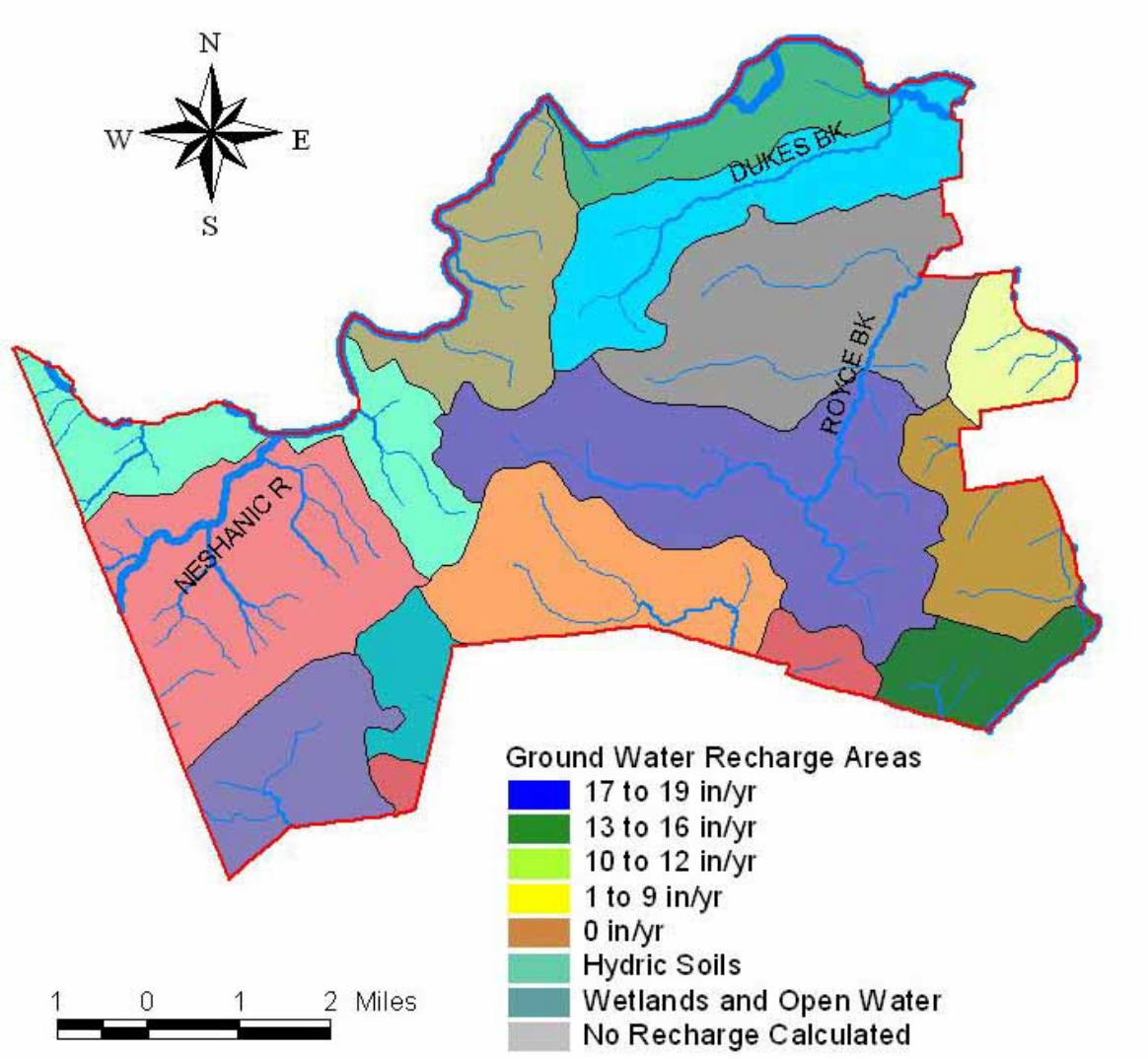

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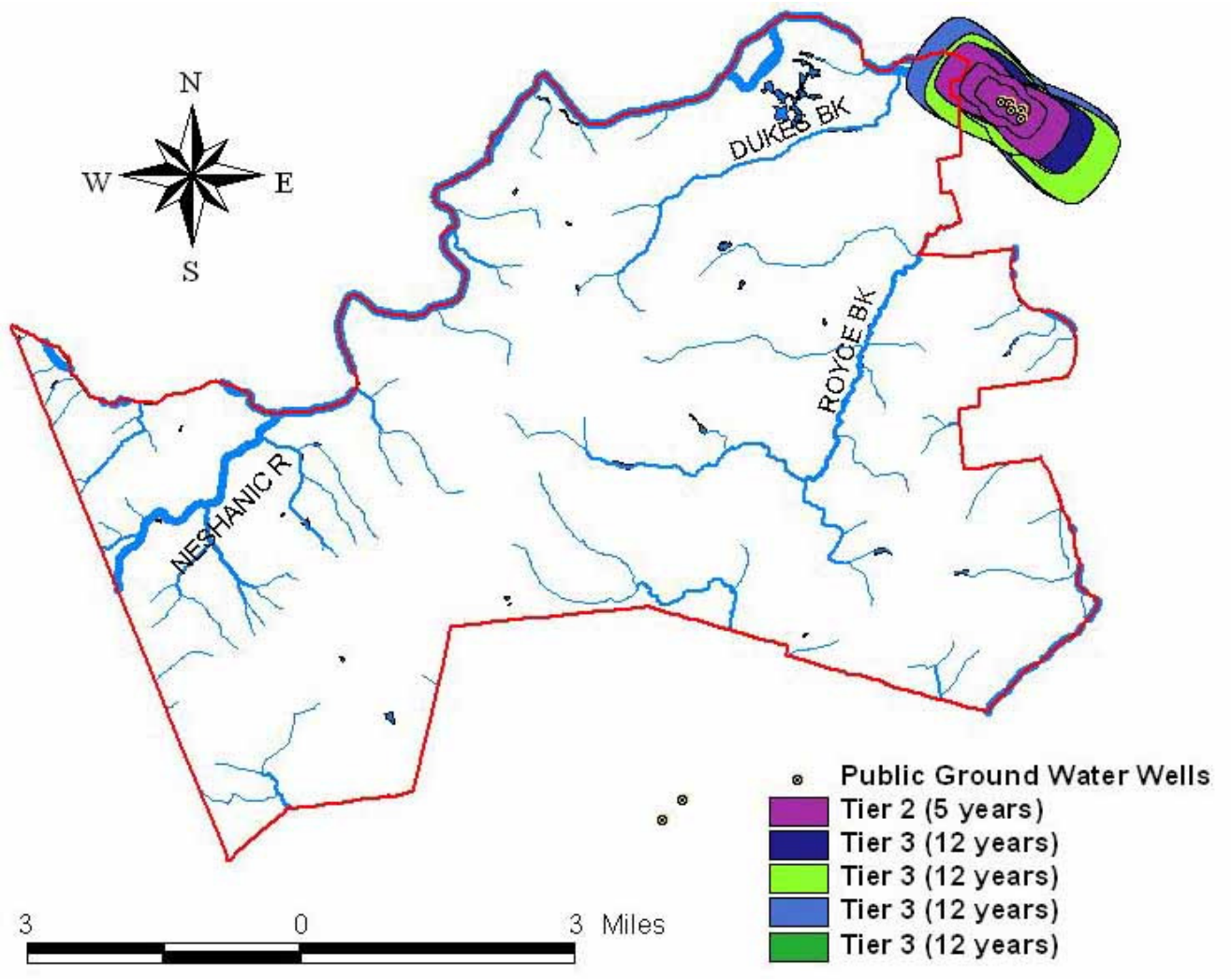
Figure C-5: Wellhead Protection Areas in the Township



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Design and Performance Standards

Municipal stormwater management plans must describe how the plan incorporates the design and performance standards in N.J.A.C. 7:8-5 or alternative design and performance standards that were adopted as a part of a regional stormwater management plan or water quality management plan. The design and performance standards should be incorporated into the municipality's stormwater management ordinance to be consistent with this requirement. A sample ordinance is provided in Appendix D: Model Stormwater Control Ordinance for Municipalities *to assist in the incorporation of these design and performance standards into municipal plans. This section should clearly state that the municipality will adopt ordinances consistent with the design and performance standards at N.J.A.C. 7:8-5, ordinances to address maintenance consistent with N.J.A.C. 7:8-5.8, and ordinances to address safety consistent with N.J.A.C. 7:8-6. It should also indicate steps the municipality will take to ensure compliance with these standards.*

The Township will adopt the design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies. The design and performance standards include the language for maintenance of stormwater management measures consistent with the stormwater management rules at N.J.A.C. 7:8-5.8 Maintenance Requirements, and language for safety standards consistent with N.J.A.C. 7:8-6 Safety Standards for Stormwater Management Basins. The ordinances will be submitted to the county for review and approval within [24 months of the effective date of the Stormwater Management Rules.]

During construction, Township inspectors will observe the construction of the project to ensure that the stormwater management measures are constructed and function as designed.

The simplest method to address the need to incorporate design and performance standards is to adopt the language in the Stormwater Management Rules and model ordinance. However, the municipality may adjust these standards. For example, certain municipalities have designated entities required to assume maintenance responsibility. In some cases, the municipality may choose to assume this responsibility. The municipality may choose to revise land use and zoning ordinances to prescribe how nonstructural stormwater management measures must be addressed. Additional discussion on the relationship of nonstructural stormwater management measures and ordinances are provided in Chapter 2: Low Impact Development Techniques, Chapter 3: Regional and Municipal Stormwater Management Plans, and Appendix B: Municipal Regulations Checklist.

Plan Consistency

The MSWMP must be coordinated with the appropriate Soil Conservation District and any other stormwater management plan, such as an adopted regional stormwater management plan. A short paragraph as given below is sufficient to comply with this requirement unless there is a TMDL for any of the waterways within the municipality. If a TMDL is in place and requires reductions in nonpoint sources within the municipalities, the TMDL requirements should be incorporated into this municipal stormwater management plan. For example, if a TMDL completed for fecal coliform identified the need for a goose management plan to control the impact from the resident geese at a local park, the goose management plan should be incorporated into this municipal stormwater management plan. Another example is that a TMDL may have identified over-fertilization of residential lawns as a source of nutrients to the impaired waterway and recommended development of a no-phosphorus ordinance for a particular section of the Township unless soil testing indicates a lack of sufficient phosphorus in the soil. This ordinance should be incorporated into this municipal stormwater management plan.

The Township is not within a Regional Stormwater Management Planning Area and no TMDLs have been developed for waters within the Township; therefore this plan does not need to be consistent with any regional stormwater management plans (RSWMPs) nor any TMDLs. If any RSWMPs or TMDLs are developed in the future, this Municipal Stormwater Management Plan will be updated to be consistent.

The Municipal Stormwater Management Plan is consistent with the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21. The municipality will utilize the most current update of the RSIS in the

stormwater management review of residential areas. This Municipal Stormwater Management Plan will be updated to be consistent with any future updates to the RSIS.

The Township's Stormwater Management Ordinance requires all new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards. During construction, Township inspectors will observe on-site soil erosion and sediment control measures and report any inconsistencies to the local Soil Conservation District.

Nonstructural Stormwater Management Strategies

In addition to the design and performance standards for nonstructural strategies discussed above, the municipal stormwater management plan must be evaluated to determine how the municipal plan and ordinances should be amended to implement the principles of nonstructural stormwater management. Municipalities are required to evaluate the municipal master plan, and land use and zoning ordinances to determine what adjustments need to be made to allow the implementation of nonstructural stormwater management techniques, also called low impact development techniques, which are presented in Chapter 2: Low Impact Development Techniques. Additional discussion on the relationship of nonstructural stormwater management measures and ordinances is provided in Chapter 3: Regional and Municipal Stormwater Management Plans.

To address this requirement, municipal ordinances and plans must be reviewed to determine where changes can be made to incorporate nonstructural stormwater management strategies. Appendix B: Municipal Regulations Checklist has been provided to assist municipalities.

An example of the changes identified in ordinances is given below. (Note: This is not an exhaustive list of every ordinance that should be evaluated, but presents some examples.) Since many municipal codes are similar in much of the state, the recommendations provided here may prove useful in modifying individual municipal codes. When submitting the plan and ordinances to the county for review and a copy to the Department, all revised ordinances, master plans, and maps must be attached, along with an adoption schedule.

The Township has reviewed the master plan and ordinances, and has provided a list of the sections in the Township land use and zoning ordinances that are to be modified to incorporate nonstructural stormwater management strategies. These are the ordinances identified for revision. Once the ordinance texts are completed, they will be submitted to the county review agency for review and approval within [24 months of the effective date of the Stormwater Management Rules]. A copy will be sent to the Department of Environmental Protection at the time of submission.

Chapter 77 of the Township Code, entitled Development Regulations, was reviewed with regard to incorporating nonstructural stormwater management strategies. Several changes were made to Article VI of this Chapter, entitled "Design and Performance Standards" to incorporate these strategies.

Section 77-39: Buffers requires buffer areas along all lot and street lines separating residential uses from arterial and collector streets, separating a nonresidential use from either a residential use or residential zoning district line, and along all street lines where loading and storage areas can be seen from the street. The landscape requirements for these buffer areas in the existing section do not recommend the use of native vegetation. The language of this section was amended to require the use of native vegetation, which requires less fertilization and watering than non-native species. Additionally, language was included to allow buffer areas to be used for stormwater management by disconnecting impervious surfaces and treating runoff from these impervious surfaces. This section currently requires the preservation of natural wood tracts and limits land disturbance for new construction.

Section 77-41: Cluster Development provides for a cluster development option to preserve land for public and agricultural purposes, to prevent development on environmentally sensitive areas, and to aid in reducing the cost of providing streets, utilities and services in residential developments. This cluster

option is an excellent tool for reducing impervious roads and driveways. The option allows for smaller lots with smaller front and side yard setbacks than traditional development options. It also minimizes the disturbance of large tracts of land, which is a key nonstructural stormwater management strategy. The cluster option is being amended to require that [*insert percentage here*] of the total tract be preserved as common open space for residential area. The cluster option does require that 25 percent of the green or common area be landscaped with trees and/or shrubs. This language was amended to promote the use of native vegetation, which requires less fertilization and watering than non-native ornamental plants. Although the cluster option requires public concrete sidewalks to be installed along all streets, the option requires paths in open space to be mulched or stone to decrease the impervious area.

Section 77-43: Curbs and Gutters requires that concrete curb and gutter, concrete curb, or Belgian block curb be installed along every street within and fronting on a development. This section was amended to allow for curb cuts or flush curbs with curb stops to allow vegetated swales to be used for stormwater conveyance and to allow the disconnection of impervious areas.

Section 77-44: Drainage, Watercourses and Flood Hazard Areas requires that all streets be provided with inlets and pipes where the same are necessary for proper drainage. This section was amended to encourage the used of natural vegetated swales in lieu of inlets and pipes.

Section 77-45: Driveways and Accessways describes the procedure for construction of any new driveway or accessway to any street. This section was amended to allow the use of pervious paving materials to minimize stormwater runoff and promote groundwater recharge.

Section 77-60: Natural Features requires that natural features, such as trees, brooks, swamps, hilltops, and views, be preserved whenever possible, and that care be taken to preserve selected trees to enhance soil stability and landscaped treatment of the area. This section was amended to expand trees to forested areas, to ensure that leaf litter and other beneficial aspects of the forest are maintained in addition to the trees.

Section 77-62: Nonconforming Uses, Structures or Lots requires a variance for existing single family homes proposing additions that exceed the maximum percent impervious. The homeowner must mitigate the impact of the additional impervious surfaces unless the stormwater management plan for the development provided for these increases in impervious surfaces. This mitigation effort must address water quality, flooding, and groundwater recharge as described in Chapter 135. A detailed description of how to develop a mitigation plan is present in the Township Code.

Section 77-63: Off-site and Off-tract Improvements describes essential off-site and off-tract improvements. Language was added to this section to require that any off-site and off-tract stormwater management and drainage improvements must conform to the "Design and Performance Standards" described in this plan and provided in Chapter 135 of the Township Code.

Section 77-64: Off-street Parking and Loading details off-street parking and loading requirements. All parking lots with more than 10 spaces and all loading areas are required to have concrete or Belgian block curbing around the perimeter of the parking and loading areas. This section also requires that concrete or Belgian block curbing be installed around all landscaped areas within the parking lot or loading areas. This section was amended to allow for flush curb with curb stop, or curbing with curb cuts to encourage developers to allow for the discharge of impervious areas into landscaped areas for stormwater management. Also, language was added to allow for use of natural vegetated swales for the

water quality design storm, with overflow for larger storm events into storm sewers. This section also provides guidance on minimum parking space requirements. These requirements are based on the number of dwelling units and/or gross floor area. The section allows a developer to demonstrate that fewer spaces would be required, provided area is set aside for additional spaces if necessary. This section was amended to allow pervious paving to be used in areas to provide overflow parking, vertical parking structures, smaller parking stalls, and shared parking.

Sections 77-66: Performance Standards provide pollution source control. It prohibits materials or wastes to be deposited upon a lot in such form or manner that they can be transferred off the lot, directly or indirectly, by natural forces such as precipitation, evaporation or wind. It also requires that all materials and wastes that might create a pollutant or a hazard be enclosed in appropriate containers.

Section 77-73: Shade Trees requires a minimum of three shade trees per lot to be planted in the front yard. In addition to Section 77-73, the Township has a Tree Preservation Ordinance (Sections 77-160 to 77-165) that restricts and otherwise controls the removal of mature trees throughout the Township. This ordinance recognizes that the preservation of mature trees and forested areas is a key strategy in the management of environmental resources, particularly watershed management, air quality, and ambient heating and cooling. These sections set out a "critical footprint area" that extends 20 feet beyond the driveway and building footprint where clearing of trees cannot occur. This complies with minimizing land disturbance, which is a nonstructural stormwater management strategy. These sections were amended to require the identification of forested areas, and that [*insert percentage here*] of forested areas be protected from disturbance.

Section 77-74: Sidewalks describe sidewalk requirements for the Township. Although sidewalks are not required along all streets, the Township can require them in areas where the probable volume of pedestrian traffic, the development's location in relation to other populated areas and high vehicular traffic, pedestrian access to bus stops, schools, parks, and other public places, and the general type of improvement intended indicate the advisability of providing a pedestrianway. Sidewalks are to be a minimum of four feet wide and constructed of concrete. Language was added to this section to require developers to design sidewalks to discharge stormwater to neighboring lawns where feasible to disconnect these impervious surfaces, or use permeable paving materials where appropriate.

Section 77-77: Soil Erosion and Sediment Control addresses soil erosion and sediment control by referencing Chapter 128, the Township's Soil Erosion and Sediment Control Ordinance. This ordinance requires developers to comply with the New Jersey Soil Erosion and Sediment Control Standards and outlines some general design principles, including: whenever possible, retain and protect natural vegetation; minimize and retain water runoff to facilitate groundwater recharge; and, install diversions, sediment basins, and similar required structures prior to any on-site grading or disturbance.

Section 77-79 Stormwater Runoff addresses stormwater runoff by referencing Chapter 135, the Township's Surface Water Management Ordinance, which was updated to include all requirements outlined in N.J.A.C. 7:8-5. These changes were presented earlier in this document.

Section 77-82: Streets describes the requirements for streets in the Township. The Township has several street classifications, ranging from "Arterial," which has a minimum right-of-way of 80 feet, to "Secondary Local," which has a minimum right-of-way of 50 feet. Street paving widths are a function of the number of units served, whether a street is curbed, whether on-street parking is permitted, whether the interior streets serve lots of two acres or larger, and whether on-site topographical constraints allow design flexibility. Depending on these factors, paving width for secondary local streets has a range from 20 to 32 feet. This section was amended to encourage developers to limit on-street parking to allow for narrower paved widths. This section also required that cul-de-sacs have a minimum radius of 50 feet. Language was added to this section to reduce the minimum radius of cul-de-sac designs. Cul-de-sacs with landscaped islands have a minimum radius of [*insert radius here*], cul-de-sacs with flush curbs have a minimum radius of [*insert radius here*], with a [*insert width here*] reinforced shoulder to accommodate larger equipment and emergency vehicles.

Several changes were made to Article VII of the Township Code entitled "Zoning Districts and Standards." The Township has 11 types of residential districts. Each district has a maximum percent impervious surface allocation, ranging from 5 percent for the MZ District, which has a minimum lot size of five acres for detached single-family homes, to 40 percent for the AM and RCA Districts, which have a minimum lot size of 7,000 square feet for cluster single-family homes. The Township has 12 types of non-residential districts. Each of these districts has a maximum percent impervious surface allocation, ranging from 30 percent for the HOO District to 60 percent for the I-1 District. Although each zone has a maximum allowable percent impervious surface, the Township Code was amended to remind developers that satisfying the percent impervious requirements does not relieve them of responsibility for complying with the Design and Performance Standards for Stormwater Management Measures contained in Chapter 135 – Surface Water Runoff. The Township is evaluating the maximum allowable impervious cover for each zone to determine whether a reduction in impervious cover is appropriate. The Township is also evaluating a maximum percent of disturbance for each zone, for those areas identified as natural features in Section 77-60. Also, if a developer is given a variance to exceed the maximum allowable percent imperviousness, the developer must mitigate the impact of the additional impervious surfaces. This mitigation effort must address water quality, flooding, and groundwater recharge as described in Chapter 135. A detailed description of how to develop a mitigation plan is included in this Municipal Stormwater Management Plan.

Land Use/Build-Out Analysis

If a municipality can document that it has a combined total of less than one square mile of vacant or agricultural lands, the municipality is not required to complete the following build-out analysis. Otherwise, a build-out analysis must be conducted assuming full development under existing zoning for each HUC14 drainage area in the municipality. To satisfy the minimum requirements, the result of the build-out analysis is acreage of impervious surfaces by HUC14 and associated nonpoint loadings attributed to the build-out of the municipality. Although not required by the regulations, a quantitative analysis of the impact of build-out can be calculated, including population and number of school-age children, housing units and housing density, traffic, tax revenues, demands on schools, water supply, sewage, electrical production, and police force. Additional information on the build-out is provided in Chapter 3.

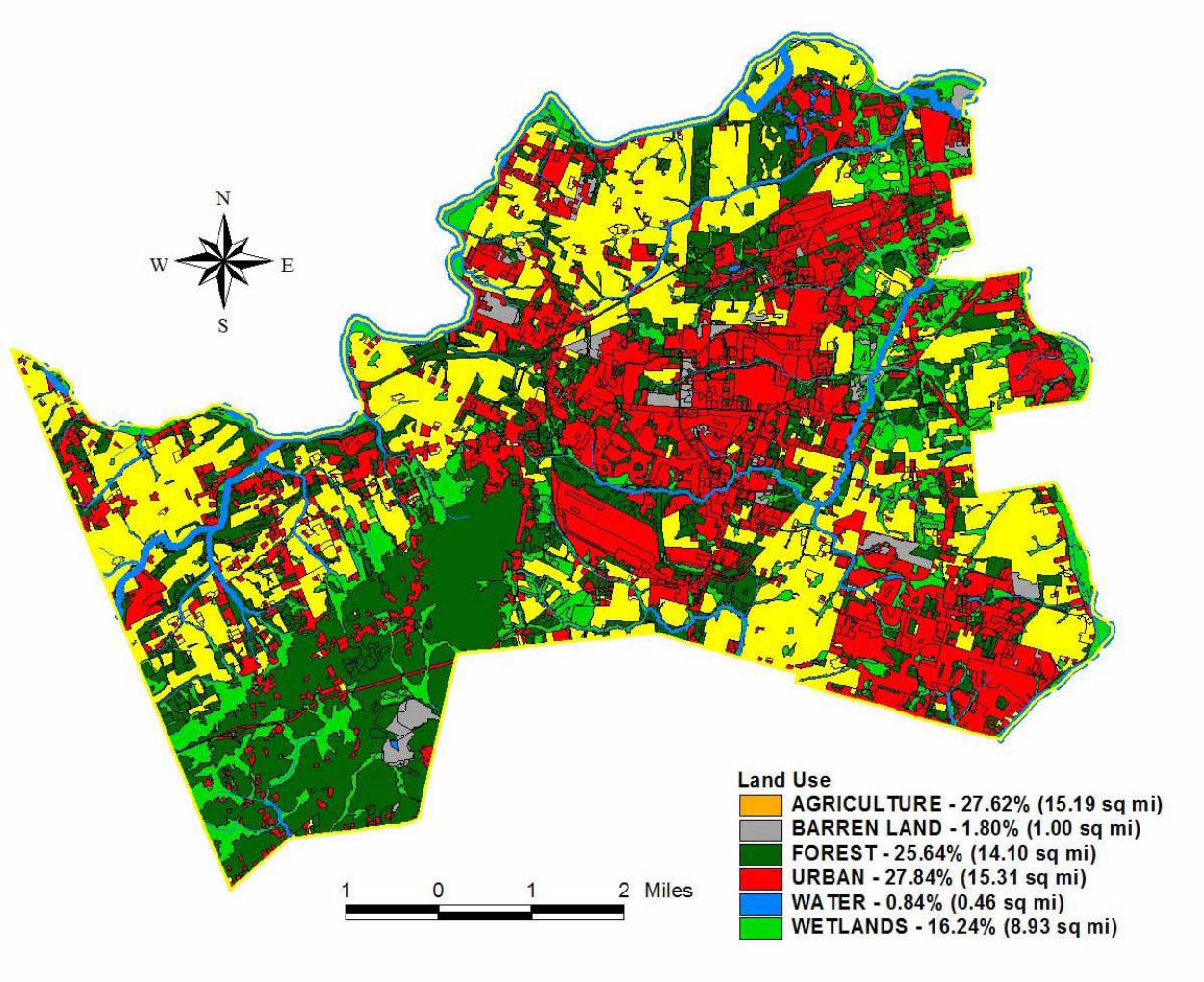
There are four steps to preparing a build-out analysis that satisfies the requirements for the municipal stormwater management plan:

1. *Determine the total land area within each of the HUC14s of the municipality.*
2. *Determine the area of constrained lands within each HUC14 of the municipality.*
3. *Determine the land available for development by simply subtracting the constrained lands from the total land area for each HUC14. In essence, the land available for development is the agricultural, forest and/or barren lands available within each HUC14. Existing residential, commercial, and industrial areas are also eligible for redevelopment and should be considered as land available for development.*
4. *For each HUC14, complete a build-out analysis by using the municipal zoning map and applicable ordinances to determine the acreage of new development. Once the build-out acreage of each land use is determined for each HUC14, nonpoint source loadings can be determined for the build-out scenario. Shown below are examples of build-out analyses for two HUC14s located in the municipality.*

A detailed land use analysis for the Township was conducted. Figure C-6 illustrates the existing land use in the Township based on 1995/97 GIS information from NJDEP. Figure C-7 illustrates the HUC14s within the Township. The Township zoning map is shown in Figure C-8. Figure C-9 illustrates the constrained lands within the Township. *(Note: For this sample plan, every constrained land was not mapped.)* The build-out calculations for impervious cover are shown in Table C-1. As expected when developing agricultural and forest lands, the build-out of these two HUC14s will result in a significant increase in impervious surfaces.

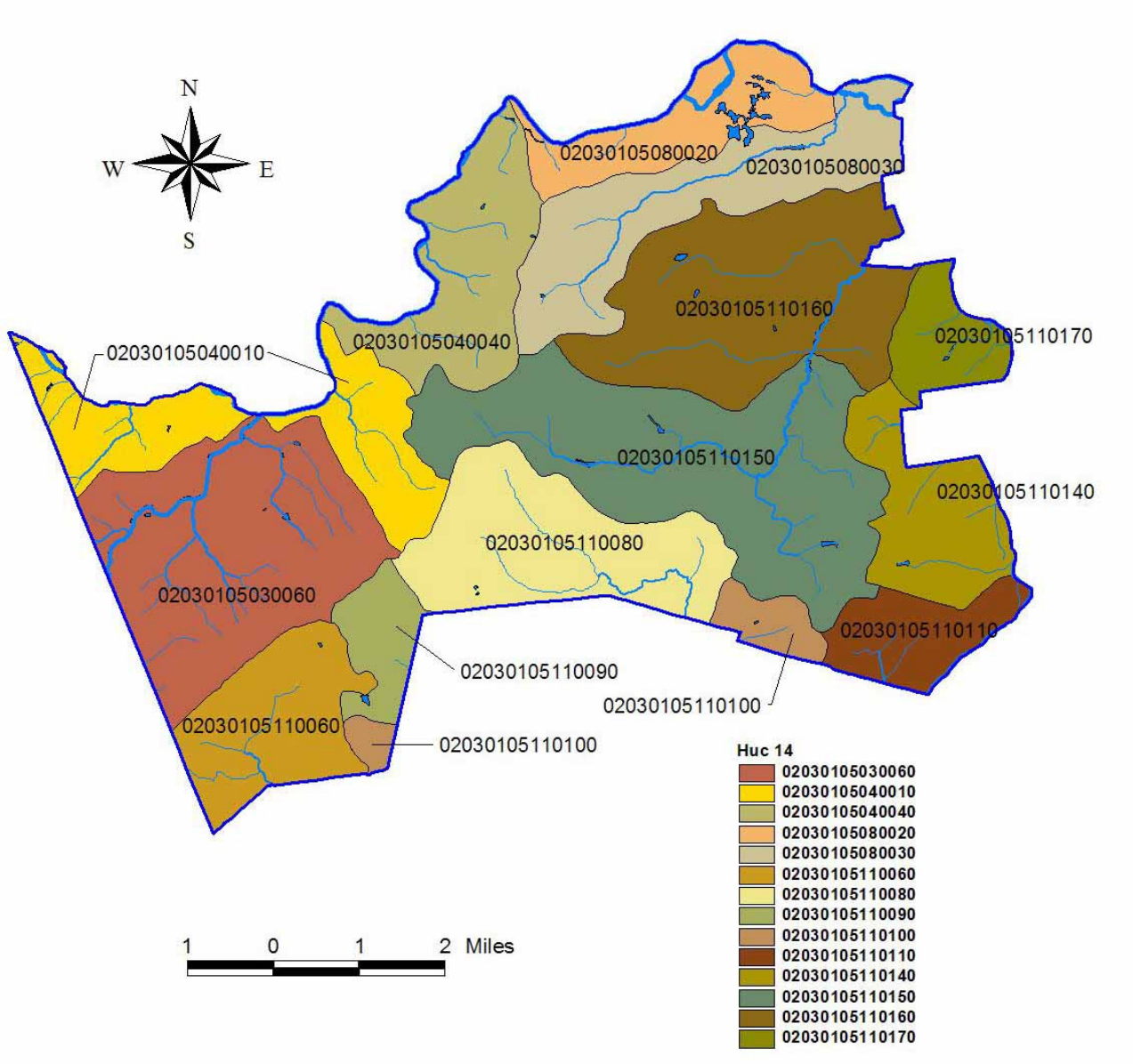
Table C-2 presents the pollutant loading coefficients by land cover. The pollutant loads at full build-out are presented in Table C-3.

Figure C-6: Township's Existing Land Use



This figure can be viewed in color in the PDF version of this appendix available at http://www.state.nj.us/dep/watershedmgt/bmpmanualfeb2004.htm

Figure C-7: Hydrologic Units (HUC14s) Within the Township

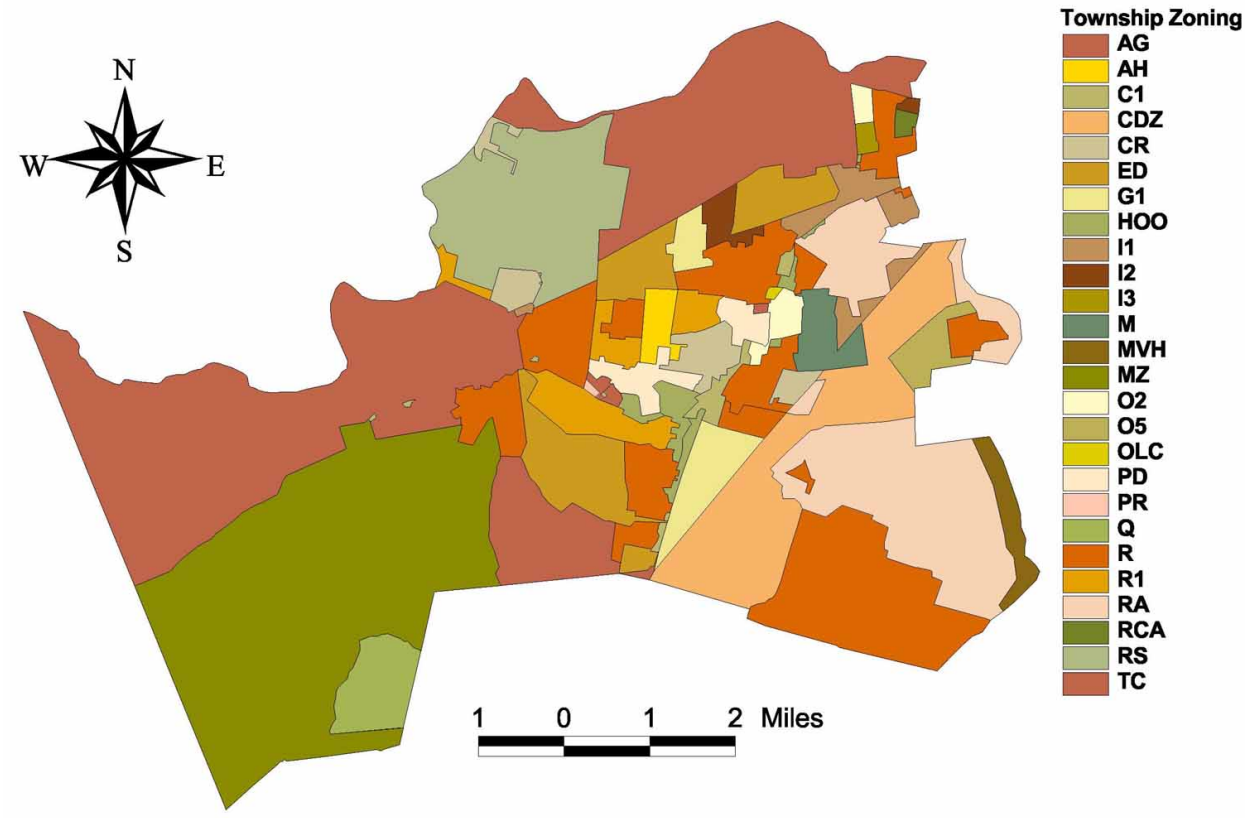


This figure can be viewed in color in the PDF version of this appendix available at http://www.state.nj.us/dep/watershedmgt/bmpmanualfeb2004.htm

It is important to note that, although the pollutant loads for agricultural lands are higher than those for low density residential for the parameters in Table C-2, converting agricultural lands to residential typically results in an increase in pollutant loads for metals and petroleum hydrocarbons. It is recommended that each municipality calculate build-out pollutant loads for each. Also, total suspended solids loads due to stormwater runoff may decrease due to the conversion of agricultural lands to low density residential, but the percentage of impervious surfaces increases dramatically. If, due to the increase of impervious surfaces, increases in stormwater runoff flows are not managed properly, these high flows will increase streambank erosion, thereby increasing sediment loads to the receiving waters.

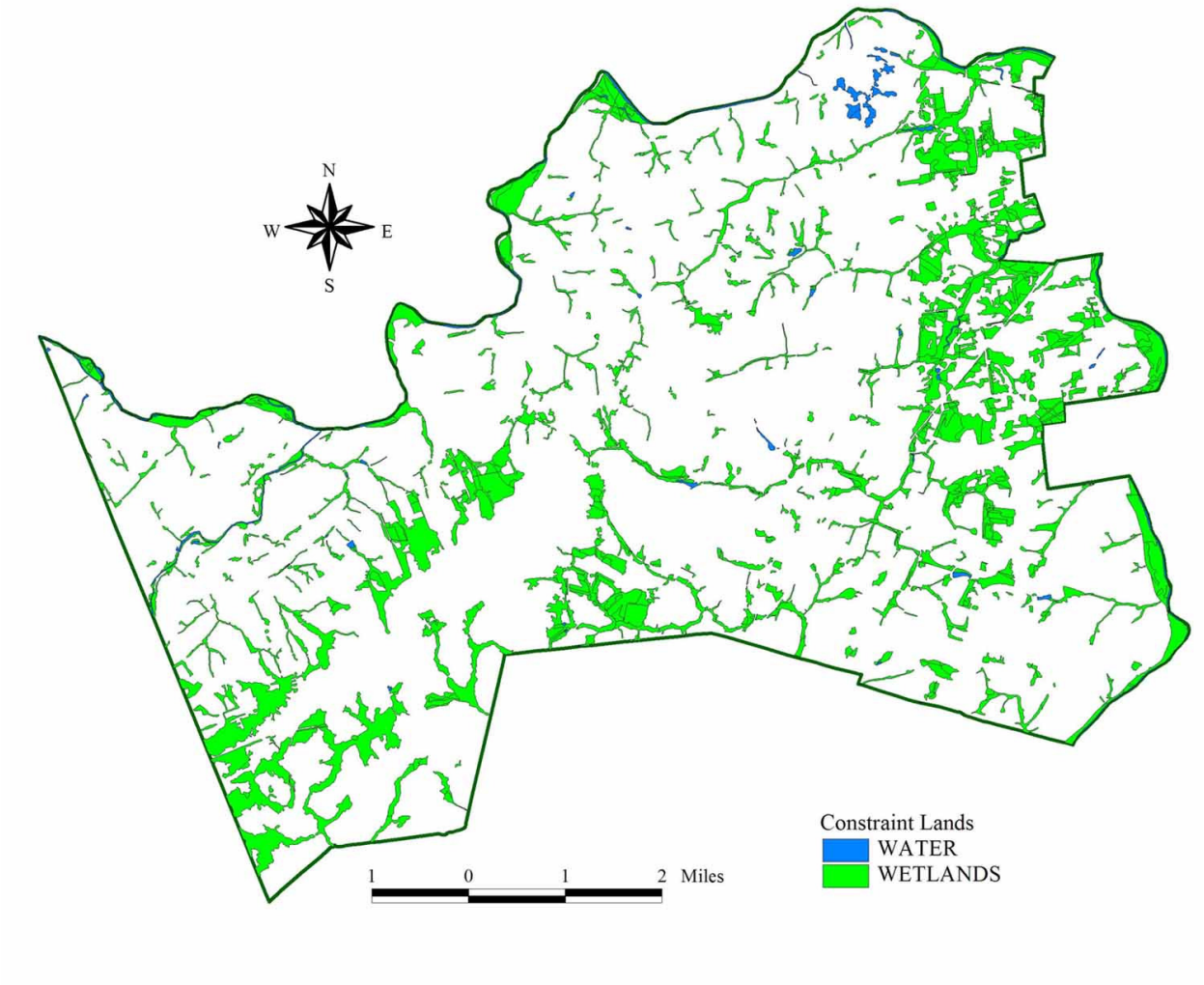
There are a number of resources available for assistance with preparing the build-out analysis, including the Association of New Jersey Environmental Commissions (ANJEC), the Stony Brook-Millstone Watershed Association, Rutgers University's Center for Remote Sensing and Spatial Analysis, the Nonpoint Education of Municipal Officials (NEMO), and USEPA (Green Communities: How to do a Build-Out Analysis at www.epa.gov/greenkit/build-out.htm). The mapping and querying ability of GIS software such as ESRI's ArcView is essential for preparing a build-out analysis in a cost-effective manner.

Figure C-8: Zoning Districts Within the Township



This figure can be viewed in color in the PDF version of this appendix available at http://www.state.nj.us/dep/watershedmgt/bmpmanualfeb2004.htm

Figure C-9: Wetlands and Water Land Uses Within the Township – Constrained Land



This figure can be viewed in color in the PDF version of this appendix available at http://www.state.nj.us/dep/watershedmgt/bmpmanualfeb2004.htm

Table C-1: Sample Build-Out Calculations for Two HUC14s

HUC14 and Zone	Total Area (acres)	Existing Impervious (%)	Existing Impervious (acres)	Wetlands/ Water Area (acres)	Developable Area (acres)	Allowable Impervious (%)	Build-Out Impervious (acres)
02030105110060							
Mountain (MZ)	2,009.84	1.08%	21.68	485.84	1,524.00	5%	76.20
Quarry (Q)	765.52	0.02%	0.18	32.46	733.06	5%	36.65
TOTALS	2,775.36	0.8%	21.86	518.30	2,257.06	5%	112.85
020301050040010							
Agriculture (AG)	2,206.32	2.94%	64.92	327.38	1,878.94	5%	93.95
Neighborhood Shopping Center District (C1)	402.70	1.85%	7.47	7.05	395.65	65%	257.17
Mountain (MZ)	663.23	2.88%	19.12	134.88	528.35	5%	26.42
TOTALS	3,272.25	2.8%	91.51	469.31	2,802.94	13%	377.54

Note: The Mountain, Quarry, and Agricultural Zoning District allow for rural residential development on five acre lots with a maximum percent impervious of 5 percent.

Table C-2: Pollutant Loads by Land Cover

Land Cover	Total Phosphorus Load (lbs/acre/year)	Total Nitrogen Load (lbs/acre/year)	Total Suspended Solids Load (lbs/acre/yr)
High, Medium Density Residential	1.4	15	140
Low Density, Rural Residential	0.6	5	100
Commercial	2.1	22	200
Industrial	1.5	16	200
Urban, Mixed Urban, Other Urban	1.0	10	120
Agricultural	1.3	10	300
Forest, Water, Wetlands	0.1	3	40
Barrenland/Transitional Area	0.5	5	60

Source: NJDEP Stormwater BMP Manual 2004.

Table C-3: Nonpoint Source Loads at Build-Out for Two Example HUC14s

HUC14 and Zone	Build-Out Zoning	Developable Area (acres)	TP (lbs/acre/yr)	TP (lbs/yr)	TN (lbs/acre/yr)	TN (lbs/yr)	TSS (lbs/acre/yr)	TSS (lbs/yr)
02030105110060								
Mountain (MZ)	Rural Residential	1,524	0.60	963	5	7,685	100	153,267
Quarry (Q)	Rural Residential	733	0.60	443	5	3,666	100	73,313
TOTALS		2,257		1,406		11,351		226,580
020301050040010								
Agriculture (AG)	Rural Residential	1,879	0.60	1,160	5	9,589	100	190,491
Neighborhood Shopping Center District (C1)	Commercial	396	2.10	832	22	8,727	200	79,429
Mountain (MZ)	Rural Residential	528	0.60	331	5	2,699	100	53,600
TOTALS		2,803		2,323		21,015		323,520

Mitigation Plans

A mitigation plan is required to grant a variance or exemption from the design and performance standards of a municipal stormwater management plan. The mitigation requirements should offer a hierarchy of options that clearly offset the effect on groundwater recharge, stormwater quantity control, and/or stormwater quality control that was created by granting the variance or exemption. The following fictional example is one of the means a municipality can select for a mitigation plan.

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

Mitigation Project Criteria

1. The mitigation project must be implemented in the same drainage area as the proposed development. The project must provide additional groundwater recharge benefits, or protection from stormwater runoff quality and quantity from previously developed property that does not currently meet the design and performance standards outlined in the Municipal Stormwater Management Plan. The developer must ensure the long-term maintenance of the project, including the maintenance requirements under Chapters 8 and 9 of the NJDEP Stormwater BMP Manual.

a. The applicant can select one of the following projects listed to compensate for the deficit from the performance standards resulting from the proposed project. More detailed information on the projects can be obtained from the Township Engineer. Listed below are specific projects that can be used to address the mitigation requirement.

Groundwater Recharge

- Retrofit the L.B. Middle School site and detention basin to provide an additional 300,000 cf of average annual groundwater recharge.
- Replace the existing deteriorated 20,000 sf overflow impervious parking lot at Children's Memorial Soccer Complex with permeable paving to provide 150,000 cf of additional average annual groundwater recharge.

Water Quality

- Retrofit the existing stormwater management facility at Matisse Elementary School to provide the removal of 80 percent of total suspended solids from the parking lot runoff.
- Retrofit the existing parking area at the West Side Municipal Complex to provide the removal of 80 percent of total suspended solids. Due to site constraints, the retrofit BMP must be installed underground and cannot reduce the existing number of parking spaces.

Water Quantity

- Install stormwater management measures in the open space in the Woodlot Development to reduce the peak flow from the upstream development on the receiving stream by 20 cfs, 35 cfs, and 100 cfs for the 2, 10, and 100-year storms respectively.

2. If a suitable site cannot be located in the same drainage area as the proposed development, as discussed in Option 1, the mitigation project may provide mitigation that is not equivalent to the impacts for which the variance or exemption is sought, but that addresses the same issue. For example, if a variance is given because the 80 percent TSS requirement is not met, the selected project may address water quality impacts due to a fecal impairment. Listed below are specific projects that can be used to address the mitigation option.

Water Quality

- Re-establish a vegetative buffer (minimum 50 foot wide) along 1,500 linear feet of the shoreline at Sunshine Pond as a goose control measure and to filter stormwater runoff from the high goose traffic areas.
- Provide goose management measures, including public education at Central Park.

Options 1 and 2 would be available only if the MSWMP includes a list of environmental enhancement projects that provide groundwater recharge, control flooding, or control nonpoint source pollution. These are fictitious projects for the purposes of providing examples for this plan. Although only a brief description of each project is presented here, it is important for the municipality to have sufficient information on each project, including size of the project, permit requirements, land ownership, and estimated project costs (i.e., permitting fees, engineering costs, construction costs, and maintenance costs).

The municipality may allow a developer to provide funding or partial funding to the municipality for an environmental enhancement project that has been identified in a Municipal Stormwater Management Plan, or towards the development of a Regional Stormwater Management Plan. The funding must be equal to or greater than the cost to implement the mitigation outlined above, including costs associated with purchasing the property or easement for mitigation, and the cost associated with the long-term maintenance requirements of the mitigation measure.