

Princeton Borough

1.0 Introduction

This Municipal Stormwater Management Plan for the Borough of Princeton describes the policies and measures that the Borough will implement to address stormwater-related impacts of land development and redevelopment projects. This Plan has been developed in response to the post-construction stormwater management requirements for new development and redevelopment contained in the Borough's Tier A Municipal Stormwater General Permit (Permit No. NJ0141852) issued by the New Jersey Department of Environmental Protection (NJDEP) and described in N.J.A.C. 7:14A - Municipal Stormwater Regulations.

The Princeton Borough Municipal Stormwater Management Plan has been prepared in accordance with the NJDEP *Tier A Stormwater Guidance Document* dated April 2004 and contains all of the required elements of a Municipal Stormwater Management Plan contained in N.J.A.C. 7:8 Stormwater Management Rules. The Plan addresses the groundwater recharge, stormwater quality, and stormwater quantity impacts of land development and redevelopment projects by identifying stormwater management design and performance standards for new major land developments, defined as projects that disturb one or more acre of land. These standards are intended to minimize the adverse impacts of stormwater runoff from such projects on water quality and quantity and prevent a loss of groundwater recharge. The Plan also describes operation and maintenance requirements for the stormwater management facilities that are created to achieve these standards in order to insure their long-term performance.

It is important to note that this Plan contains those Municipal Stormwater Management Plan components that must be completed within twelve months of the April 1, 2005 effective date of the Borough's Tier A Municipal Stormwater General Permit. As such, this Plan will require modification in the future to incorporate the adopted municipal Stormwater Control Ordinance and Mitigation Plan that must be completed within twelve months of the Plan's original adoption date.

1.1 Stormwater Impacts of Land Development and Redevelopment

According to the United States Environmental Protection Agency (USEPA), stormwater runoff is a major component of nonpoint source (NPS) pollution, the largest remaining source of pollutants in our nation's waters. The USEPA has also documented how the quality of our surface and ground waters is directly related to the overall health of our environment. Similarly, the NJDEP estimates that up to 60 percent of

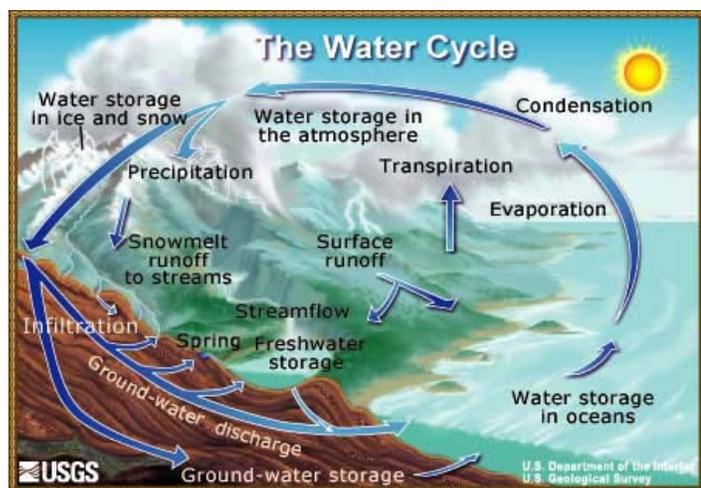


Illustration by John M. Evans, Colorado District, USGS

existing water pollution problems are attributable to NPS pollution and, in particular, the pollutants in stormwater runoff. However, since these pollutants originate from numerous, diffuse sources and are conveyed by runoff from an entire drainage area or watershed, they can be difficult to identify, regulate, and treat.

In natural environments that are undisturbed by land development, precipitation that reaches the ground surface can follow a number of routes. If the surface is covered with vegetation, the majority of the precipitation is either intercepted by the surface vegetation or infiltrates into the soil. Intercepted precipitation can evaporate back into the atmosphere along with the precipitation that collects in depressions on the ground surface. Infiltrated precipitation can either be drawn up by the root systems of the surface vegetation and transpired back into the atmosphere or can move downward to the groundwater, thereby recharging this important resource. A smaller portion of the precipitation typically runs off the ground surface to downstream creeks, streams, and rivers. This process, known as the hydrologic or water cycle and illustrated in the above figure, generally functions in equilibrium, but is susceptible to changes in the cycle's various processes, most notably changes in the ground surface upon which the precipitation falls.

Since land development by its very nature alters the ground surface, it can dramatically impact the natural hydrologic cycle and cause severe stormwater impacts if it is not carefully planned, designed, constructed, and maintained. Land development typically replaces natural vegetation with lawns and impervious surfaces, thereby reducing the site's natural evaporation, transpiration and infiltration rates. Construction activities can compact the soil, further reducing its ability to infiltrate. These reductions increase the amount of stormwater runoff that flows across the ground surface and decrease the amount that recharges into the groundwater. Land development also typically connects the runoff from impervious surface directly to a constructed drainage system of gutters, channels, and storm sewers. These systems transport runoff more quickly than natural surfaces and conveyance systems. This, in turn, shortens the area's rainfall-runoff response time, causing flow in downstream waterways to peak faster and at greater rates than natural conditions. This combination of increased runoff volumes and greater runoff rates can create new and aggravate existing downstream flooding and erosion problems and increase the quantity of sediment both transported by and deposited in the waterway's channel. Filtration of runoff and removal of pollutants by natural surface and channel vegetation is also eliminated through the use of constructed drainage systems.

Coupled with increased surface flows, reduced base flows due to decreases in groundwater recharge can produce greater fluctuations between normal and storm flow rates in streams and rivers, which can further increase channel erosion. Reduced base flows can also negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on this source of water. Finally, erosion and sedimentation can destroy habitat from which some species cannot adapt.

In addition to surface runoff increases and the loss of groundwater, land development often results in the accumulation of pollutants on the land surface that can be mobilized by runoff and

transport to streams. New impervious surfaces and cleared areas created by development can accumulate a variety of pollutants from numerous sources, including the atmosphere, fertilizers, animal wastes, and leakage and wear from vehicles. These pollutants can include metals, suspended solids, hydrocarbons, pathogens, and nutrients which can adversely impact water quality and a wide range of important stream biota.

Land development can also 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.

Finally, the pollution of surface waters and the depletion of groundwater caused by land development can impact both the quantity and quality of the drinking water supplies that are necessary to sustain existing populations and industries as well the recreational use of streams, rivers, and lakes.

1.2 NJDEP Municipal Stormwater Regulation Program

In response to the adverse impacts of nonpoint source pollution, including those caused by uncontrolled land development, the United States Congress amended the 1972 Clean Water Act in 1987 to require management and control of these pollutant sources. As a result of this amendment, the USEPA expanded the National Pollutant Discharge Elimination System (NPDES) to include regulations for stormwater discharges. This included the issuance of a series of regulations culminating in the Phase II Storm Water Regulations in December 1999. Among other requirements, these regulations directed municipalities with separate storm sewer systems to develop programs to control the post-construction runoff from land development and redevelopment projects.

In response to these Phase II Regulations, the State of New Jersey, which administers the federal NPDES program through the State's own New Jersey Pollutant Discharge Elimination System (NJPDES), initiated the New Jersey Municipal Stormwater Regulation Program (NJAC 7:14A) in March 2004. This program, which is administered by the NJDEP, addresses pollutants entering the State's waters from stormwater systems operated by local, county, state, interstate, and federal government agencies. These systems are collectively referred to as Municipal Separate Storm Sewer Systems (MS4s). Under the Municipal Stormwater Regulation Program, stormwater discharges from MS4s are regulated through one of four general NJPDES Permits. These are the Tier A and Tier B Municipal Stormwater General Permits, the Public Complex Stormwater General Permit, and the Highway Agency Stormwater General Permit. Each General Permit includes a number of Statewide Basic Requirements (SBRs) that must be met by those authorized through the Permit to discharge stormwater from their MS4. Each SBR includes minimum performance standards, measurable goals, and implementation schedules. All New Jersey municipalities have been classified as either Tier A or Tier B municipalities

depending upon such factors as total population and population density as determined in the 2000 United States Census.

Princeton Borough has been designated by the NJDEP as a Tier A municipality. As such, the discharge of stormwater from the Borough's storm sewer systems has been authorized under NJPDES Stormwater Tier A General Permit No. NJ0141852. A key component of the Post-Construction Stormwater Management SBR is the requirement that Princeton Borough develop and adopt both a Municipal Stormwater Management Plan and implementing Stormwater Control Ordinance that addresses the impacts of major land developments on the quality and quantity of those storm sewer system discharges. This Plan represents Princeton Borough's compliance with this General Permit SBR.

1.3 NJDEP Stormwater Management Rules

Concurrently with the initiation of the Municipal Stormwater Regulation Program, the State of New Jersey also enacted major revisions to the New Jersey Stormwater Management Rules (NJAC 7:8). These revisions were the first major update to the State's Stormwater Management Rules since their original promulgation in 1983 and represented a fundamental change in the management of stormwater runoff in New Jersey. In addition, associated revisions were also enacted to portions of several related State regulations that involve stormwater management, including the Residential Site Improvement Standards (NJAC 5:21), the Freshwater Wetland Protection Act Rules (NJAC 7:7A), the Flood Hazard Area Control Act Rules (NJAC 7:13), the Watershed Management Rules (NJAC 7:15), and the New Jersey Dam Safety Standards (NJAC 7:20).

The new Stormwater Management Rules provide both a framework and incentives for managing runoff and resolving NPS impairment caused by land development. The Rules also establish a hierarchy for implementation of stormwater management measures at major land development projects, with initial reliance on nonstructural stormwater management measures (also known as low impact development techniques) to manage stormwater runoff before using more traditional structural measures. The Rules also establish runoff control performance standards for soil erosion and sediment control, groundwater recharge, water quality, and water quantity; establish Special Area Protection measures for pristine and exceptional value waters; provide regulatory consistency between local and State regulatory agencies; and provide maintenance and safety standards for stormwater management measures.

In Subchapter 4, the new Stormwater Management Rules specify the required goals and contents of a Municipal Stormwater Management Plan as well as the schedule for its adoption as part of a municipality's Master Plan. According to the Stormwater Management Rules and the Borough's Tier A Stormwater General Permit, a first version of this Plan must be adopted within twelve months of the Borough's April 1, 2004 effective date of General Permit authorization. In addition, the Stormwater Management Rules also contain the minimum technical and performance standards to be included in the implementing Stormwater Control Ordinance that is also required by the Borough's Tier A Stormwater General Permit. According to both the Rules

and the Borough's General Permit, both the Stormwater Control Ordinance and the final version of the Plan must be adopted within twelve months of the Plan's original adoption date.

The goals of the Borough's Municipal Stormwater Management Plan are presented below.

2.0 Princeton Borough Municipal Stormwater Management Plan Goals

As required by the New Jersey Stormwater Management Rules at NJAC 7:8-4.2-c-1, the Princeton Borough Municipal Stormwater Management Plan has been developed to achieve the following stormwater management planning goals:

1. Reduce flood damage, including damage to life and property.
2. Minimize, to the extent practical, any increase in stormwater runoff from any new development.
3. Reduce soil erosion from any development or construction project.
4. Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures.
5. Maintain groundwater recharge.
6. Prevent, to the greatest extent feasible, an increase in NPS pollution.
7. Maintain the integrity of stream channels for their biological functions, as well as for drainage.
8. Minimize pollutants in stormwater runoff from new and existing development in order 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.
9. Protect public safety through the proper design and operation of stormwater management basins.

In addition, the Princeton Borough Land Use Code requires the following:

- Proposed development shall provide for proper surface water drainage so that the removal of surface waters will not adversely affect the neighboring properties or the public drainage system and will, so far as practicable, conserve the water resources of the area and avoid flooding, erosion, and detrimental depositing of silt, gravel, or stone.

Finally, the Princeton Regional Planning Board's stormwater control policy states:

1. Control both stormwater quality and quantity in the Borough where feasible.
2. Detention basins should be designed utilizing techniques that minimize disturbance and the size of the basin such as diversion of flow, compensation, and alternative quality measures.

To achieve all of the above goals, the Princeton Borough Municipal Stormwater Management Plan outlines specific stormwater design and performance standards for major land development

and redevelopment projects. 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 protect public safety.

3.0 Borough Description

The Borough of Princeton covers an area of 1.85 square miles in central New Jersey. It is located in northern Mercer County and is surrounded by the 16.25 square mile Township of Princeton. While the two municipalities are completely separate political entities, a close governmental relationship exists between them. In addition to the Princeton Regional Board, which oversees both municipalities, and a joint Environmental Commission, Princeton Borough and Township jointly provide community recreational facilities including a large pool complex, tennis and paddle tennis courts, athletic playing fields and various parks and playgrounds. According to the 2000 U.S. Census, the population of Princeton Borough was 14,203. The Borough boundary is identified on the USGS Map - Figure C1.

Princeton Borough is an attractive college town that balances commercial and residential development with open space preservation. The community is served by a lively downtown which is the center of business, cultural, and educational activities. The Borough is home to Princeton University, the Princeton Theological Seminary, and Westminster Choir College. Surrounding the town center are architecturally diverse, residential neighborhoods on tree-lined streets. Based upon an analysis of existing land use data, the Borough is essentially fully developed.

While there are no interstate highways within the Borough, U.S. Highway Route 206 and State Highway Route 27 cross the Borough. In addition to Routes 206 and 27, which are maintained by the New Jersey Department of Transportation (NJDOT), portions of Mercer County Routes 583, 604, and 629 are located within the Borough. These highways and County roadways and their associated stormwater conveyance systems are covered under NJPDES Highway Agency Stormwater General Permits issued to the NJDOT and Mercer County, respectively. As such, stormwater runoff from these systems is not covered under this Plan and the systems are not the responsibility of Princeton Borough to operate and maintain. All roadways in Princeton Borough are shown on Figure C2.

As part of the New Jersey State Planning Commission's Cross Acceptance process of the proposed State Development and Redevelopment Plan, Princeton Borough would be in Planning Area 2. In addition, the Borough is included along with a portion of Princeton Township as a Designated Regional Center. These proposals, however, are subject to final approval by the Commission.

Presently, the majority of Princeton Borough is zoned for residential use. Minimum residential lot sizes range from 3,000 square feet in the R4 Zone to 20,000 square feet in the R1 Zone. The remaining portions of the Borough include Business, Educational, and Hospital Districts. Copies

of the Borough's official Zoning Map are available from the Princeton Regional Planning Board and the Princeton Borough Engineer's Office.

It should be noted that Princeton Borough presently regulates the quantity of stormwater runoff from land developments through the Surface Water Drainage requirements in its Land Use Code.

3.1 Environmental and Water Resources

3.1.1 Environmental Resources

Open Space - Based on data obtained from the Princeton Regional Planning Board, 188 acres or approximately 16% of Princeton Borough are preserved as public or private open space. This includes golf courses, state, county, and Borough-owned land, and private land that is restricted.

Contaminated Sites – According to the NJDEP, there are presently 14 sites with on-site sources of contamination in Princeton Borough. These sites were identified from the NJDEP's *Known Contaminated Sites in New Jersey* report last updated in 2001. The *Known Contaminated Sites in New Jersey* report is a municipal listing of sites where contamination of soil and/or ground water is confirmed at levels greater than the applicable cleanup criteria or standards. According to the NJDEP, remedial activities at these sites are either required or underway. It is important that the precise location, contaminants, case status, and required remedial activities at these sites be determined before specific stormwater management measures are proposed for any land development projects in their vicinity since they may impact measure selection, design, and maintenance.

Wellhead Protection Areas - There are no existing Public Community Water Supply (PCWS) wells located within Princeton Borough. In addition, none of the Wellhead Protection Areas (WHPAs) for the nine PCWS wells located within Princeton Township extend into the Borough. As described below, a WHPA is a calculated area around a production well that defines the portion of an aquifer that contributes water to a well over a specified time interval. Figure C3 has been prepared to demonstrate the absence of WHPAs within the Borough.

A WHPA is divided into three sequential tiers based on the Time of Travel (TOT) to a production well. TOT is the time it takes for a given particle of groundwater to flow to a pumping well. It is directly related to the distance the groundwater must travel to arrive at the well once well pumping starts. For a given TOT, the distance will vary from well to well depending on the rate of pumping and aquifer characteristics. WHPA Tier 1 is derived from a 2-Year TOT and is based on findings that bacteria have polluted wells and viruses have survived in groundwater for up to 270 days. WHPA Tier 2, derived from a 5-year TOT, is based on the lag time of a pollution plume caused by adsorption/desorption, the variable rate of pollutant travel, and the acceleration of groundwater once it comes close to a pumping well. WHPA Tier 3 is derived from a 12-year TOT, and is established to provide sufficient time so that monitoring and cleanup of a potential pollution source or release can be completed before contamination reaches

a pumping well. All three WHPA Tiers are defined using line boundaries and polygon areas generated with the ARC/INFO Geographic Information System.

Groundwater Recharge - A map of the various annual groundwater recharge rates in Princeton Borough are depicted in Figure C4. As can be seen in the Figure, the majority of the Borough is not considered to achieve any significant groundwater recharge within its borders. This is due primarily to the highly developed character of the Borough and the disturbed soil profiles that are found in much of the Borough. The annual recharge rates shown in Figure C5 were obtained from the New Jersey Geological Survey (NJGS) and are based on *New Jersey Geological Survey Report GSR-32 – A Method for Evaluating Ground-Water-Recharge Areas in New Jersey*. These rates are presented as guidance for identifying both general groundwater recharge rates and areas for potential recharge measures and are not intended for design purposes.

Geology - According to the Soil Survey of Mercer County prepared by the USDA Natural Resources Conservation Service and the New Jersey Agricultural Experiment Station, the soils in Princeton Borough belong to the Quakertown-Chalfont-Doylestown association, which are found in the Northern Piedmont. Soils of the Quakertown-Chalfont-Doylestown association are moderately deep to deep, well drained to poorly drained, nearly level to moderately steep soils that have a silty subsoil over mainly sandstone and argillite but with areas of red shale and siltstone.

Steep Slopes - Based upon an analysis of topographic mapping of the Borough, steep slopes exist at scattered locations throughout Princeton Borough. Steep slopes are generally considered in two categories. Slopes in excess of 25% present serious limitations for development, often requiring extensive and costly engineering and construction efforts. Development on slopes in excess of 15% can degrade the environment if not properly managed. The locations of such slope areas are shown on Figure C5. Typically, the effects of steep slopes must be carefully considered in the selection of appropriate stormwater management measures for land developments.

3.1.2 Water Resources

Wetlands - Based the NJDEP Wetlands Inventory for Mercer County, there are approximately 1.7 acres of freshwater wetlands within Princeton Borough. The locations of these wetlands are shown on Figure C6.

Waterways – A plan of the waterways in Princeton Borough as delineated by the U.S. Geological Survey (USGS) is shown on Figure C7. In addition, streams are delineated by the USDA Natural Resources Conservation Service (NRCS) in the Soil Survey of Mercer County. None of the waterways within the Borough are classified as Category One (C1) waters by the New Jersey Surface Water Quality Standards.

Watersheds – According to the NJDEP and USGS, portions of three major watersheds are located within Princeton Borough. The Hydrologic Unit Code 14 (HUC14) of each of these watersheds is shown on Figure C7. These HUC14 watersheds are listed in the Table below.

HUC14 Watersheds in Princeton Borough

| HUC14 | Waterway | Description |
|----------------|-----------------|---|
| 02030105090060 | Stony Brook | From Route 206 to Provinceline Road |
| 02030105090070 | Stony Brook | From Harrison Street to Route 206 |
| 02030105110020 | Millstone River | From Heathcote Brook to Harrison Street |

In addition, the Delaware and Raritan Canal passes near Princeton Borough and Review Zone B of the Delaware and Raritan Canal Commission includes the Borough. As such, the Delaware and Raritan Canal Commission (DRCC) must review all stormwater measures proposed for land development projects located within the Borough. Figure C8 identifies the DRCC Regulatory Review Zones within and adjacent to the Borough.

Current Waterway Health – The NJDEP has established the 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 only major waterway in Princeton Borough is Harry’s Brook. Currently, no AMNET data is collected for this watercourse. However, the Harry’s Brook is tributary to Carnegie Lake and the Millstone River. Therefore, any TMDLs identified for the Lake and Millstone River downstream may impact the Borough. In addition to the AMNET data, the NJDEP and other regulatory agencies collect water quality chemical data on streams in the state. These data show that Carnegie Lake is not currently attaining the water quality standard for mercury. This means that the lake is impaired and the NJDEP is required to develop a Total Maximum Daily Load (TMDL) for this pollutant.

A TMDL is the amount of a pollutant that can be assimilated by a waterbody without causing its water quality standards to be exceeded or one or more of its designated uses to be interfered with. The TMDL is allocated, along with a margin of safety, to the various sources of the pollutant, including point sources such as wastewater discharges and nonpoint sources, which include runoff from agricultural, commercial, industrial, and residential areas. 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 stormwater control ordinances, reforestation of stream corridors, retrofitting of existing stormwater systems, and other structural and nonstructural stormwater management measures.

The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)) (Integrated List) is a valuable source of water quality information. The Integrated List must be prepared biennially by NJDEP as required under the federal Clean Water Act. This combined report presents the extent to which New Jersey waters are attaining water quality standards and identifies waters that are impaired. NJDEP must prepare TMDLs for all waters on Sublist 5 of the Integrated List, which constitutes the list of waters impaired or threatened by pollutants in the State of New Jersey. The Integrated List identifies Carnegie Lake on Sublist 5 for mercury. The water quality standard for mercury is not attained based on data collected by the NJDEP Clean Lakes and the NJDEP Fish Tissue Monitoring. As such, Carnegie Lake will require a TMDL for this pollutant. Insufficient data was available to determine whether attainment of the phosphorus standard was achieved in the lake.

3.2 Current Waterway Flooding and Erosion

Due to the small amount of open waterways within Princeton Borough, current flooding and erosion problems are limited. According to the Princeton Borough Flood Insurance Study, flooding has occurred in the past along the Harry's Brook in the eastern portion of the Borough. In addition, storm sewer flooding and drainage problems presently occur at scattered locations in the Borough, most notably at the intersection of Witherspoon and Spring Streets.

4.0 Design and Performance Standards

In accordance with the requirements of the New Jersey Stormwater Management Rules (NJAC 7:8), major land developments within Princeton Borough will be required to meet specific stormwater design and performance standards. These standards will be applied to these developments through the forthcoming Stormwater Control Ordinance that will be developed and adopted by the Borough following the adoption of this Municipal Stormwater Management Plan. Summaries of these design and performance standards are presented below.

It is important to note that any major residential land development proposed subject to review and approval by Princeton Borough will also be reviewed in accordance with the stormwater management requirements of the New Jersey Residential Site Improvement Standards (NJAC 5:21). These standards may be supplemented where permitted by additional stormwater design and performance standards developed by the Borough.

4.1 General Design and Performance Standards

In accordance with the requirements of Subchapter 5 of the Stormwater Management Rules, stormwater management measures for major land developments in Princeton Borough will be designed to meet the following design and performance standards. Complete details of each standard can be found in Subchapter 5 of the New Jersey Stormwater Management Rules.

- **Soil Erosion and Sediment Control** – All major developments shall meet the requirements of the *Soil Erosion and Sediment Control Standards for New Jersey*. The

Mercer County Soil Conservation District is responsible for conducting all design and construction reviews to insure compliance with these standards within Princeton Borough.

- **Groundwater Recharge** – Unless otherwise exempted by the Stormwater Management Rules, all major developments must either maintain 100% of the development site’s pre-developed annual groundwater recharge under post-developed site conditions or infiltrate the runoff increase between pre- to post-developed site conditions for a 2-Year, 24-hour III storm. Compliance with this standard must consider certain designated redevelopment areas and any WHPAs and known contaminated sites within the Borough.
- **Stormwater Quality** – All major developments must reduce the total suspended solids (TSS) load in the development site’s post-construction runoff by a minimum of 80%. In addition, the post-construction nutrient load from the site must be reduced by the maximum extent feasible. Additional stormwater quality requirements are described below for land developments that drain to a Category One watercourse or its mapped tributaries.
- **Stormwater Quantity** – All major developments must demonstrate compliance with one of three alternative stormwater quantity requirements for the 2, 10, and 100-Year storm events. These alternatives are: 1) preservation of existing development site runoff volumes and rates, 2) preservation of existing downstream peak runoff rates under full watershed development, or 3) reduction in existing site peak runoff rates by 50%, 25%, and 20%, respectively.
- **Nonstructural Stormwater Management** - Compliance with the groundwater recharge and stormwater quality and quantity standards described above must be achieved through the use of nonstructural stormwater management measures to the maximum extent feasible. If the standards cannot be met through the exclusive use of nonstructural measures, then structural stormwater management measure shall be utilized to complete compliance.
- **Special Water Resource Protection Areas** – All major developments must maintain a 300-foot buffer measured from the top of bank of all Category One watercourses, as designated by the NJDEP, and their tributaries, as mapped by the USGS and the Soil Survey of Mercer County. At the present time, there are no NJDEP designated Category One watercourses within Princeton Borough. As such, this requirement will apply to any waterway within the Borough designated as a Category One watercourse by the NJDEP in the future.
- **Threatened and Endangered Species Searches** – All major developments subject to review by NJDEP’s Land Use Regulation Program must conduct a Threatened and Endangered Species search using the Natural Heritage Database.

4.2 Exemption and Waiver Criteria

In addition to the design and performance standards described above, the New Jersey Stormwater Management Rules contain both exemption and waiver criteria for each standard. These criteria are presented in Subchapter 5 of the Stormwater Management Rules. Princeton Borough will utilize these criteria in the development of its Stormwater Control Ordinance. In addition, the Borough will develop a Mitigation Plan in accordance with Subchapter 4 of the Stormwater Management Rules in order to grant necessary waivers from the design and performance standards on a case-by-case basis. Development of this Mitigation Plan will be done concurrently with the development of the Borough's Stormwater Control Ordinance.

Finally, in accordance with Section 2.5 of Subchapter 2 of the Stormwater Management Rules, Princeton Borough has the ability to petition the NJDEP for an exemption from any of the design and performance standards presented in Subchapter 5 of the Rules provided that such exemption will not result in an increase in flood damage, water pollution, threats to biological integrity, or constitute a threat to public safety. The Borough may utilize this petition process if necessary during the development of its Stormwater Control Ordinance.

4.3 Maintenance Requirements

In order to ensure the proper functioning and operation of all structural and nonstructural stormwater management measures, Princeton Borough will require that maintenance plans be developed for all such measures incorporated into the design of major land developments. All maintenance plans shall meet the requirements specified in Section 5.8 of Subchapter 5 of the Stormwater Management Rules. The Borough will also utilize the maintenance plan recommendations and references contained in the NJDEP Stormwater Best Management Practices Manual. Final maintenance plan requirements will be included in the Borough's Stormwater Control Ordinance and also be applied to any stormwater management measure included in a major development activity by the Borough.

According to the maintenance plan requirements contained in the Stormwater Management Rules, all stormwater management measure maintenance plans must contain:

- Specific preventative and corrective maintenance tasks and schedules.
- Cost estimates including the estimated costs of sediment, debris, and trash removal.
- The name, address, and telephone number of those responsible for maintenance.

In addition, the maintenance plan must guarantee that preventative and corrective maintenance will be performed to maintain the function of the stormwater management measure, including (where appropriate) structural repairs and replacements; sediment, debris, and trash removal; restoration of eroded areas; snow and ice removal; fence repair and replacement; restoration of vegetation; and repair and replacement of non-vegetated linings.

4.4 Safety Standards

In order to protect the safety of maintenance and inspection personnel and the general public, Princeton Borough will develop safety standards for the proper design and operation of new structural stormwater management measures utilized at major land developments. These standards will be included in the Borough's Stormwater Control Ordinance and also be applied to any structural stormwater management measure included in a major development activity by the Borough. At a minimum, these safety standards will be based upon the safety standards for stormwater management basins contained in Subchapter 6 of the Stormwater Management Rules. The Borough may adopt additional and/or more stringent standards as necessary in order to provide an appropriate level of safety at such stormwater management measures.

5.0 Stormwater Management Measures

In order to meet the design and performance standards for major land developments described in Subchapter 5 of the Stormwater Management Rules, Princeton Borough will allow the utilization of a range of nonstructural and structural stormwater management measures. In general, the design, construction, and maintenance of these measures, which are also known as Best Management Practices or BMPs, will be based upon the guidance provided by the current version of the NJDEP *Stormwater Best Management Practices Manual*. In particular, the guidance provided Chapter Two of the Manual will be used for nonstructural stormwater management measures and the guidance provided in Chapter Nine of the Manual will be used for structural stormwater management measures.

As a result, the NJDEP *Stormwater Best Management Practices Manual* is incorporated by reference into the Princeton Borough Municipal Stormwater Management Plan.

6.0 Mitigation Plan

As noted above in **4.2 – Exemption and Waiver Criteria**, Princeton Borough will utilize the waiver criteria contained in Subchapter 5 of the Stormwater Management Rules to develop a Mitigation Plan in order to grant necessary waivers from the design and performance standards at major land developments on a case-by-case basis. Development of this Mitigation Plan will be done concurrently with the development of the Borough's Stormwater Control Ordinance and will be based upon the Mitigation Plan requirements contained in Subchapter 4 of the Stormwater Management Rules.

7.0 Build-Out and Pollutant Load Analysis

In accordance with the Municipal Stormwater Management Plan requirements in Subchapter 4 of the Stormwater Management Rules, Princeton Borough is not required to a Build-Out and Pollutant Load Analysis. This is because an analysis of the Borough indicates that there is less than one square mile of developable land remaining in the Borough.

8.0 Master Plan Evaluation

In accordance with the Municipal Stormwater Management Plan requirements in Subchapter 4 of the Stormwater Management Rules, Princeton Borough is not required to evaluate the extent to which its Master Plan, official map, land use ordinances, and construction standards implement the nonstructural stormwater management strategies described in Subchapter 5 of the Rules. This is because an analysis indicates that there is less than one square mile of developable land remaining in the Borough. Nevertheless, the Borough may wish to perform such an analysis in the future as part of a required Master Plan review. If performed, appropriate revisions to the Princeton Borough Municipal Stormwater Management Plan will be made to incorporate its results and recommendations.

9.0 Recommended Stormwater Control Ordinance

A copy of a recommended Stormwater Control Ordinance has been provided at the end of this appendix. This recommended ordinance is based upon the model ordinance contained in the NJDEP Stormwater Best Management Practices Manual. This model ordinance will serve as the basis for the final Stormwater Control Ordinance to be developed and adopted by the Borough. Such adoption will occur within twelve months of the original adoption of this Plan.

10.0 Achievement of NJDEP Stormwater Management Planning Goals

In accordance with the Municipal Stormwater Management Plan requirements in Subchapter 4 of the Stormwater Management Rules, the Princeton Borough Municipal Stormwater Management Plan must demonstrate achievement of the general goals for stormwater management planning specified in Subchapter 2 of the Rules. These goals were previously discussed above in **2.0 - Princeton Borough Municipal Stormwater Management Plan Goals**. The following has been prepared to demonstrate how the Plan achieves these goals.

- **GOAL: Reduce flood damage, including damage to life and property** – By requiring all major land developments to meet the stormwater quantity design and performance standards in Subchapter 5 of the Stormwater Management Rules, the Princeton Borough Municipal Stormwater Management Plan will reduce flood damage. In addition, the Plan will require mitigation measures for major developments that cannot strictly comply with the stormwater quantity design and performance standards in the Borough's Stormwater Control Ordinance or the Residential Site Improvement Standards. Retrofits to existing stormwater collection systems and stormwater quantity management measures mandated by the Mitigation Plan will also reduce existing flood damage.
- **GOAL: Minimize, to the extent practical, any increase in stormwater runoff from any new development** – By requiring the use of nonstructural stormwater management measures, the Princeton Borough Municipal Stormwater Management Plan will minimize the increase in stormwater runoff from new major land developments. Additionally,

requiring compliance with the stormwater quantity standards described above will further decrease the potential for stormwater runoff increases from new land developments.

- **GOAL: Reduce soil erosion from any development or construction project** – The Princeton Borough Municipal Stormwater Management Plan requires that the *Soil Erosion and Sediment Control Standards in New Jersey* be followed for all major development projects. In addition, the Borough also presently requires compliance with these standards for all projects that disturb at least 5,000 square feet of land.
- **GOAL: Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures** – By requiring all major land developments to meet the stormwater quantity design and performance standards in Subchapter 5 of the Stormwater Management Rules either directly or through appropriate mitigation measures, the Princeton Borough Municipal Stormwater Management Plan will help assure the adequacy of existing and proposed culverts, bridges, and other in-stream structures.
- **GOAL: Maintain groundwater recharge** – By requiring all major land developments to meet the groundwater recharge design and performance standards in Subchapter 5 of the Stormwater Management Rules either directly or through appropriate mitigation measures analyses, the Princeton Borough Municipal Stormwater Management Plan will help maintain groundwater recharge in the Borough.
- **GOAL: Prevent, to the greatest extent feasible, an increase in NPS pollution** – By requiring all major land developments to meet the stormwater quality design and performance standards in Subchapter 5 of the Stormwater Management Rules either directly or through appropriate mitigation measures analyses, the Princeton Borough Municipal Stormwater Management Plan will help prevent an increase in NPS pollution in the Borough. These results will be enhanced through the maximum practical use of nonstructural stormwater management measures at such developments.
- **GOAL: Maintain the integrity of stream channels for their biological functions, as well as for drainage** – By requiring all major land developments to meet the groundwater recharge and stormwater quality and quantity design and performance standards in Subchapter 5 of the Stormwater Management Rules either directly or through appropriate mitigation measures analyses, the Princeton Borough Municipal Stormwater Management Plan will help maintain the biological integrity of stream channels in the Borough. These results will be enhanced through the maximum practical use of nonstructural stormwater management measures at such developments.
- **GOAL: Minimize pollutants in stormwater runoff from new and existing development in order 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** - By requiring all major

land developments to meet the groundwater recharge and stormwater quality and quantity design and performance standards in Subchapter 5 of the Stormwater Management Rules either directly or through appropriate mitigation measures analyses, the Princeton Borough Municipal Stormwater Management Plan will help achieve these multiple goals in waterways in the Borough. These results will be enhanced through the maximum practical use of nonstructural stormwater management measures at such developments.

- **GOAL: Protect public safety through the proper design and operation of stormwater management basins** – By requiring the design of structural stormwater management facilities at major land developments to comply with the safety standards in Subchapter 6 of the Stormwater Management Rules, the Princeton Borough Municipal Stormwater Management Plan will protect the safety of inspection and maintenance personnel and members of the general public.

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