What's in This Chapter

Section 2.1 provides a brief overview of Minimum Measure #5 – Controlling Runoff from New Development and Redevelopment ("Post-Construction Stormwater").

Section 2.2 outlines how the post-construction standards intersect with other state and federal permits and programs.

Section 2.3 details a general compliance procedure for municipal separate storm sewer systems (MS4s) and other local stormwater programs to administer the post-construction standards.

Section 2.4 references national guidance materials that may assist local programs with the development and implementation of their programs.

2.1. Overview of West Virginia's MS4 General Permit – Minimum Measure #5

This section provides a brief overview of the (A) Watershed Protection and (B) Site and Neighborhood Design Elements of Minimum Measure #5 (Controlling Runoff from New Development and Redevelopment). Readers are encouraged to consult the MS4 General Permit and associated fact sheet to obtain more detailed information and specific standards.

A. Watershed Protection Elements

Part II, Section C.b.5.a.i of the MS4 General Permit outlines the Watershed Protection Elements of Minimum Measure #5. This section requires the MS4 or permittee to incorporate six Watershed Protection Elements into local development codes, policies, and ordinances, as well as comprehensive and master plans for land use, transportation, and neighborhoods. The six elements include:

1. Minimize impervious surfaces
2. Preserve, protect, create and restore ecologically sensitive areas
3. Prevent or reduce thermal impacts to streams
4. Avoid or prevent hydromodification of streams and other waterbodies
5. Protect trees and other vegetation
6. Protect native soils

Additional information and resources to review and update development codes and ordinances are provided in Better Site Design: A Handbook for Changing Development Rules in Your Community (CWP, 1998). The handbook can be downloaded at http://www.cwp.org > Publications & Goods > Free Downloads > Better Site Design Publications.

Each of the six Watershed Protection elements is described briefly below. More information is provided in the MS4 General Permit and associated fact sheet.

1. Minimize Impervious Surfaces

The impervious footprint of a development project is dictated, in part, by the development codes of the local jurisdiction. These include subdivision regulations, zoning regulations, parking and street standards and drainage requirements. Often, these codes require or allow excessive impervious cover through wide residential streets, large commercial parking lots, and large cul-de-sacs, among other practices. Essentially, the codes act as *de facto* stormwater regulations, even though they were not created for that purpose. This watershed protection element encourages updating and making changes to development codes in order to reduce the amount of impervious cover created during the development process (**Figure 2.1**). Examples include reduced road width standards (at least in certain districts), parking lot maximum standards (or requiring pervious surfaces above a certain threshold), and reducing the use and required radius of culs-de-sac.

Figure 2.1. Pervious pavers used for overflow parking
(Source: National Nonpoint Education for Municipal Officials Network)

2. Preserve, protect, create and restore ecologically sensitive areas

During the development process, ecologically sensitive areas that provide water quality benefits and serve critical watershed functions should be protected. These include headwater and perennial streams, wetlands, 100-year floodplains, and steep slopes. These areas should be identified as part of a natural resources inventory prior to conducting a development layout or design. Regional approaches, such as watershed/green infrastructure plans or area-wide plans (**Figure 2.2**), are recommended because they identify regionally-significant and interconnected ecologically sensitive areas, and then use site-level plans to implement the findings through incentives, regulations, and policies (e.g., stream buffer standards).

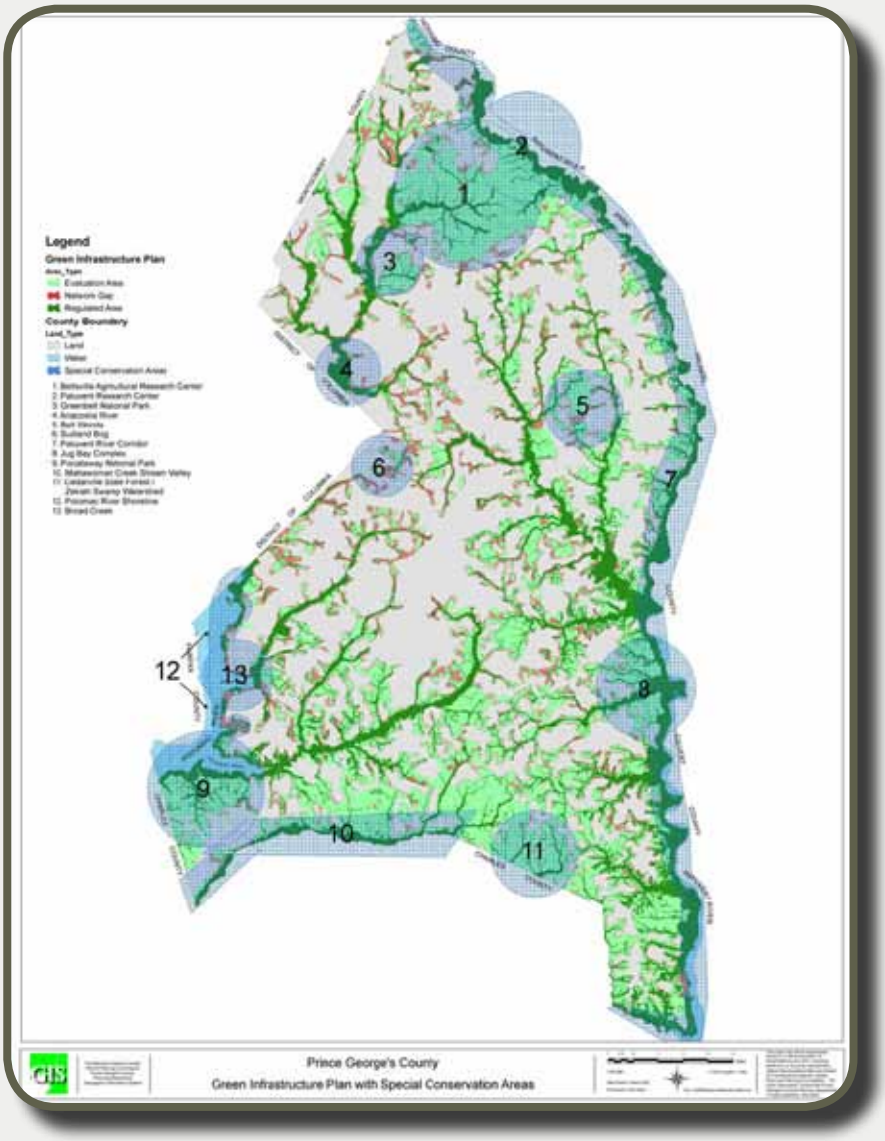


Figure 2.2 Green infrastructure plans identify significant resources and ecologically sensitive areas for protection in advance of site development (Source: Prince George's County Planning Department)

3. Prevent or reduce thermal impacts to streams

Preventing or reducing thermal impacts to streams is important to protect temperature sensitive aquatic species. West Virginia is fortunate to have over 1,000 streams that contain segments supporting trout populations. These streams provide a valuable recreational fishery contributing over $180 million to the state's economy every year. Just a few degrees of temperature alteration during critical times can be detrimental to trout survival.

Stream warming can occur from a lack of vegetated stream buffers and increased temperature of stormwater runoff discharges from impervious surfaces and stormwater ponds. During the summer months, stormwater that flows over impervious surfaces (such as parking lots or driveways) or that is detained within stormwater ponds is warmed before it flows to receiving streams. Practices that should be used to reduce thermal impacts from stormwater include disconnecting or directing runoff from impervious surfaces to pervious areas, especially to stormwater practices that have a subsurface component, such as bioretention with a relatively deep (e.g., three feet) soil media layer (**Figure 2.3**). Additionally, requiring vegetated stream buffers provides tree canopy to shade and cool the stream.

Figure 2.3 Parking lot runoff directed into a bioretention facility reduces thermal impacts (Source: National Nonpoint Education for Municipal Officials Network)

4. Avoid or prevent hydromodification of streams and other waterbodies

Modification of stream and waterbody hydrology should be avoided or prevented during development (**Figure 2.4**). Piping, filling or burying of streams alters the natural stream processes and disrupts the physical habitat. Site designs should seek to "avoid and minimize" these impacts through careful design and properly-conceived mitigation that accounts for stream hydrologic and hydraulic processes.

Figure 2.4. Streams provide water quality benefits such as nutrient processing and groundwater recharge and should be protected from development impacts (Source: Center for Watershed Protection)

5. Protect trees and other vegetation

During development, mass clearing and grading removes trees and vegetation. Trees and other vegetation provide important benefits that include stabilizing soil and preventing erosion, enhancing the function of stormwater management practices, reducing construction and maintenance costs, and improving aesthetics. The loss of trees and other vegetation can be minimized through local regulations or standards that:

- Limit clearing of native vegetation
- Require forest conservation
- Require forested stream buffers (**Figure 2.5**)
- Promote development that conserves open space (this open space or green space can often be used for stormwater management as well)
- Include provisions for physically protecting trees during construction
- Provide stormwater credits for tree conservation and planting
- Require tree planting in landscaped areas or as part of reforestation incentives or regulatory approach

To obtain additional resources on forest friendly development, visit the Watershed Forestry Resource Guide website http://www.forestsforwatersheds.org/

Figure 2.5. Preservation of forested stream buffers during development (Source: Center for Watershed Protection)

6. Protect native soils and topsoil

During the development process, native soils should be protected to the extent possible. Wholesale topsoil stripping and compaction of soils should be prevented, especially soils that may be most conducive for stormwater absorption and infiltration. This practice helps reduce stormwater runoff, as undisturbed native soils have higher infiltration rates than soils that are cleared and compacted during development. Erosion and sediment control ordinances can be modified to reduce clearing and grading of forests and native vegetation. Also, phased site clearing should be encouraged to reduce mass clearing and grading and minimize exposed soils. In addition, site fingerprinting should be encouraged; this means limiting disturbance to the minimum area necessary for the construction of the buildings, roadways and a safety setback, while preserving other areas as green space (**Figure 2.6**).

Figure 2.6. During construction of this subdivision, clearing was limited to the minimum area necessary, protecting native soils
(Source: National Nonpoint Education for Municipal Officials Network)

B. Site and Neighborhood Design Elements

Part II, Section C.b.5.a.ii of the MS4 General Permit outlines the Site and Neighborhood Design Elements of Minimum Measure #5.

The general objectives of this section are stated as follows:

"The permittee shall develop a program to protect water resources by requiring all new and redevelopment projects to control stormwater discharge rates, volumes, velocities, durations and temperatures. These standards shall apply at a minimum to all new development and redevelopment disturbing one acre or greater, including projects less than one acre that are part of a larger common plan of development or sale."

The specific performance standard of this section contains the primary design goal for post-construction stormwater designs and practices:

"Site design standards for all new and redevelopment that require, in combination or alone, management measures that keep and manage on site the first one inch of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation. Runoff volume reduction can be achieved by canopy interception, soil amendments, evaporation, rainfall harvesting, engineered infiltration, extended filtration and/or evapotranspiration and any combination of the aforementioned practices."

Runoff Reduction Practices Can Meet The One-Inch Performance Standard

The types of practices that achieve the one-inch reduction are known as "runoff reduction practices." Chapter 4 provides detailed specifications for a range of runoff reduction practices that achieve this particular level of runoff reduction and associated pollutant removal. The volume of water that must be treated by these practices is known as the design "Target Treatment Volume," and equates to one-inch of rainfall multiplied by the runoff coefficient for the site. Chapter 3 explains the design methodology for calculating the Target Treatment Volume and using selected runoff reduction practices to manage this volume.

The Site and Neighborhood Design section of the MS4 General Permit also addresses the following elements of a local stormwater program:

- Special treatment for "stormwater hotspots," which are sites or facilities with an increased potential for pollutant loadings, such as vehicle maintenance facilities (**Figure 2.7**).
- Incentive standards to reduce the volume of water that must be managed (the Target Treatment Volume) by using certain development or redevelopment strategies. There are five incentive standards: (1) redevelopment, (2) Brownfield redevelopment, (3) high density development, (4) vertical density, and (5) mixed use and transit-oriented development. Each incentive can reduce the one-inch reduction standard by 0.2 inches, up to a maximum of 0.75 inches.
- Off-site compliance options for projects where it is documented that the full runoff reduction requirement for a site cannot be met. There are two off-site options: (1) off-site mitigation projects, and (2) payment in lieu of constructing on-site practices.
- The requirement to incorporate runoff reduction practices into public street and parking lot modification or reconstruction projects.
- Standards for an MS4's plan review, approval, and enforcement program.
- A requirement for maintenance agreements and plans for all approved stormwater management practices.
- Standards for MS4s to inspect, inventory, track, and report on stormwater management practices.

Figure 2.7. Public works yards are one type of stormwater hotspot due to the high number of potential polluting materials stored outside (Source: Center for Watershed Protection)

Section 2.3 provides additional guidance on several of these programmatic elements and a general procedure for an MS4 or local stormwater program to verify compliance with the MS4 General Permit.

Chapter 2. West Virginia Stormwater Regulatory Framework

Section 2.2. Other State and Federal Programs That Influence Local Stormwater Programs

The MS4 General Permit does not function in isolation. There are several other state and/or federal regulatory programs (or "regulatory drivers") that will influence how stormwater is managed by an MS4 or other local program. While the MS4 is not responsible for administering or enforcing state or federal permits, it may be placed in the role of integrating or coordinating state and federal permits with local stormwater ordinances and standards for certain new development and redevelopment projects. For instance, the MS4 may need to coordinate approval of the stormwater plan with other approvals for activities in streams and/or wetlands, underground injection, or dam safety (to name just a few).

Table 2.1 outlines some of the more prominent state and federal regulatory drivers that may intersect with local stormwater programs. While the table is not exhaustive in this regard, it does highlight the degree of coordination that may be necessary in certain instances. The table provides a brief description of each program along with its link to local stormwater programs and the main contact agency.

Table 2.1. Other Regulatory Drivers That Influence Local Stormwater Programs in West Virginia

Regulatory Driver	Description & Link With Local Stormwater Program
State and Federal Programs	
Construction Stormwater General Permit	Applies to all sites with disturbance of one acre or greater to regulate sediment discharges into waters of the state. Projects disturbing at least one but less than three acres are required to submit a Notice of Intent (NOI) application. Projects disturbing three acres or greater must submit a Site Registration Application Form. The permit is reissued on a periodic basis (e.g., every five years). This permit program is accompanied by the West Virginia Erosion and Sediment Control Best Management Practice Manual (2006). Part II, Section C.b.4 of the MS4 General Permit also addresses discharges from construction sites. Link With Stormwater Program: This permit provides an opportunity for local programs to coordinate construction and post-construction stormwater in plan review, inspection, and maintenance. Contact: West Virginia Department of Environmental Protection (WVDEP), Division of Water and Waste Management http://www.dep.wv.gov/WWE/Programs/stormwater/csw/Pages/home.aspx
Multi-Sector Stormwater General Permit (Industrial Activities)	In order to minimize the impact of stormwater discharges from industrial facilities, the National Pollutant Discharge Elimination System (NPDES) program includes an industrial stormwater permitting component. Operators of industrial facilities included in one of the 20 categories of stormwater discharges associated with industrial activity that discharge or have the potential to discharge stormwater to an MS4 or directly to waters of the state require authorization under a NPDES industrial stormwater permit. Link With Stormwater Program: This permit provides an opportunity for local programs to coordinate stormwater review for industrial operations. Part II, Section C.b.6 of the MS4 General Permit also addresses Pollution Prevention & Good Housekeeping for Municipal Operations, including industrial activities. Contact: WVDEP, Division of Water and Waste Management http://www.dep.wv.gov/WWE/Programs/stormwater/multisector/Pages/home.aspx

Table 2.1. Other Regulatory Drivers That Influence Local Stormwater Programs in West Virginia

Regulatory Driver	Description & Link With Local Stormwater Program
Other NPDES Permits -- Non-Stormwater General Permits & Individual Permits	A variety of industrial and wastewater operations are covered through both general and individual permits that authorize the discharge of wastewater to waters of the state. Potential examples include car washes that have a discharge to state waters, water treatment facilities, discharges from highway or municipal maintenance facilities, and other discharging facilities (see link below for list of permitted activities). Link With Stormwater Program: It may be necessary for local programs to coordinate review for certain types of facilities or sites that must obtain both local and state permits. Contact: WVDEP, Division of Water and Waste Management http://www.dep.wv.gov/WWE/permit/general/Pages/default.aspx
Underground Injection Permits	WVDEP regulates non-mining Class V injection wells. In certain and very specific circumstances, stormwater best management practices (BMPs) may be subject to Underground Injection Control (UIC) permits, particularly infiltration practices that have a subsurface fluid distribution system (e.g., underdrain that does not discharge to the surface or the storm drain system) or that are deeper than their widest dimension. However, most standard stormwater BMPs are not considered to be Class V wells. Link With Stormwater Program: The local program will likely have to coordinate potential UIC permit coverage of a small number of qualifying practices with WVDEP or, more importantly, guide the design of those practices to avoid being considered a Class V well. Contact: WVDEP, Division of Water and Waste Management http://www.dep.wv.gov/WWE/permit/uic/Pages/default.aspx

Table 2.1. Other Regulatory Drivers That Influence Local Stormwater Programs in West Virginia

Regulatory Driver	Description & Link With Local Stormwater Program
Floodplain Permits	To date (2011), 55 counties and 214 communities in West Virginia have voluntarily adopted and are enforcing local floodplain management ordinances in concert with the National Floodplain Insurance Program. Local ordinances can include a flood map that designates floodplain areas, and establishes a permitting system to regulate new development in the floodplain. Link With Stormwater Program: If at all possible, stormwater practices should not be located within a floodplain. The local program will have to coordinate reviews for any practices that are authorized to be located in the floodplain. Also, preservation, protection, and/or restoration of floodplains and riparian corridors are specifically mentioned as a Watershed Protection element in the MS4 General Permit (Part II, Section C.b.5.a.i). Contact: West Virginia Division of Homeland Security and Emergency Management http://www.dhsem.wv.gov/mitigation/floodplain/Pages/default.aspx
Stream Activity Applications	Public Land Corporation applications are for the protection of water quality and aquatic life and are required when working or placing equipment in the stream. West Virginia Division of Natural Resources (WVDNR) fisheries biologists review applications to ensure high quality streams are protected and that activities, such as installation of culverts and re-channelizing streams, do not have detrimental effects on habitat. Link With Stormwater Program: The MS4 General Permit directs MS4s to "seek to avoid or prevent hydromodification of streams and other water bodies caused by development, including roads, highways, and bridges" [Part II, Section C.b.5.a.i(4)]. Contact: WVDNR, Office of Land & Streams http://www.wvdnr.gov/REM/PLC.shtm

Table 2.1. Other Regulatory Drivers That Influence Local Stormwater Programs in West Virginia

Regulatory Driver	Description & Link With Local Stormwater Program
Clean Water Act Section 404 Permit and 401 Certification	The physical alteration of water bodies in West Virginia, including wetlands and streams, is regulated by federal and state statutes under Section 401 (Certification) and Section 404 (Permits) of the Federal Clean Water Act. The U.S. Army Corps of Engineers regulates the discharge of dredged and/or fill material in waters of the U.S. Section 401 of the Clean Water Act requires that any applicant for a Section 404 permit also obtain a Water Quality Certification from the state. The purpose of the certification is to confirm that the discharge of fill materials will be in compliance with the state's applicable Water Quality Standards. Link With Stormwater Program: See above for "Stream Activity Applications." The effort on behalf of the MS4 to "avoid or prevent hydromodification of streams and other water bodies" overlaps with the intent of the Section 404 permit to "avoid and minimize" impacts. Contact: U.S. Army Corps of Engineers, WVDEP, WVDNR
Section 438 of the Energy Independence and Security Act (EISA)	Section 438 of EISA states that "the sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow." In 2009, the U.S. Environmental Protection Agency (EPA) issued technical guidance for implementing this provision of EISA. Link With Stormwater Program: The local program should be aware of the EISA requirements and guidance for federal facilities that may be constructed or redeveloped within the community. The local program may not have authority to review federal projects, but these projects often seek to coordinate with any local requirements. In addition, federal facilities can often discharge into the MS4; therefore the MS4 should be aware of this discharge and have the ability to address adverse impacts to their system. Contact: U.S. Environmental Protection Agency http://www.epa.gov/owow/NPS/lid/section438/

Table 2.1. Other Regulatory Drivers That Influence Local Stormwater Programs in West Virginia

Regulatory Driver	Description & Link With Local Stormwater Program
Combined Sewer System Long-Term Control Plan	This program requires communities with combined sewer systems to develop a plan to eliminate combined sewer overflows (CSOs) to ultimately comply with water quality standards. Link With Stormwater Program: Some communities have both an MS4 and a combined sewer system, and management practices should be coordinated. For instance, practices that limit the volume of stormwater discharges can also help reduce the incidence of overflows. In addition, stormwater treatment practices, such as street sweeping and catch basin cleaning, can reduce floatables and sediment and thus reduce overflows. Contact: WVDEP, Division of Water and Waste Management http://www.dep.wv.gov/wwe/permit/individual/pages/default.aspx#mdwastewater
Total Maximum Daily Load (TMDL)	TMDLs provide a system to develop studies and plans for stream segments that do not meet water quality standards. The Chesapeake Bay TMDL and the Watershed Implementation Plan (WIP) applies to the portion of the state that drains to the Potomac or James Rivers and subsequently the Chesapeake Bay. Other TMDLs apply across the state based on Hydrologic Groups. Link With Stormwater Program: There is a growing trend to link TMDL requirements with MS4 permits. There is still uncertainty about this link, but it may take the form of implementing stormwater retrofits on existing developed land, using BMPs that address a pollutant of concern, or developing pollutant load limits for new development and redevelopment. Contact: WVDEP, Division of Water and Waste Management, Watershed Management http://www.dep.wv.gov/WWE/watershed/TMDL/Pages/default.aspx

Table 2.1. Other Regulatory Drivers That Influence Local Stormwater Programs in West Virginia

Regulatory Driver	Description & Link With Local Stormwater Program
Dam Safety Program	Construction, modification, or removal of a dam under state jurisdiction requires a Certificate of Approval. Safety standards set by West Virginia's Dam Safety Rule (Rule) must be met before issuance of a certificate. Annual renewal of certificates helps to ensure that dams are maintained in a safe condition. In general, the Rule applies to dams that equal or exceed 25 feet in height and 15 acre-feet of storage capacity, or six feet in height and 50 acre-feet of storage capacity. Link With Stormwater Program: It is possible that large stormwater ponds and basins may trigger a dam safety certificate, and coordinated review would be necessary. Contact: WVDEP, Division of Water and Waste Management, Environmental Enforcement http://www.dep.wv.gov/WWE/ee/ds/Pages/default.aspx

Chapter 2. West Virginia Stormwater Regulatory Framework

Section 2.3. General Compliance Procedure For New Development & Redevelopment Projects

As noted above, Part II, Section C.b.5.ii of the MS4 General Permit establishes general standards for plan review, approval, and enforcement for Minimum Measure #5 -- Controlling Runoff from New Development and Redevelopment (see **Table 2.2**).

The successful implementation of this program requires coordinated efforts by the both the MS4/local stormwater program and the owner or applicant for new development and redevelopment projects. The program elements include preparation, submittal, review, and approval of stormwater plans as well as construction, inspection, and maintenance of post-construction stormwater BMPs.

Figure 2.8 illustrates a general flowchart by which both the MS4 and the project owner/applicant can verify compliance with the provisions in the MS4 General Permit. The left side of the figure refers to activities or actions undertaken by the MS4/local program, and the right side refers to activities and actions by the project owner/applicant.

It is important to note that the flowchart in **Figure 2.8** is a typical depiction of this process. An individual local program may have other plan review and inspection procedures and policies that take precedence, and that achieve similar outcomes. Local governments can adapt or modify individual components of the process in the figure to develop a local stormwater program and compliance procedures.

Table 2.2. West Virginia MS4 General Permit Language for Plan Review, Approval, and Enforcement [Part II, Section C.b.5.a.ii.B]

Plan Review, Approval and Enforcement. To ensure that all new development and redevelopment projects conform to the standards stipulated in Part II, Section C.b.5.ii, the permittee shall develop project review, approval and enforcement procedures. The review, approval and enforcement procedures shall apply at a minimum to all new development and redevelopment disturbing greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, and shall include:

(1) Requirements to submit for review and approval a pre-application concept plan that describes how the performance standards will be met. A pre-application meeting attended by a project land owner or developer, the project design engineer, and municipal planning staff to discuss conceptual designs may also meet this requirement.

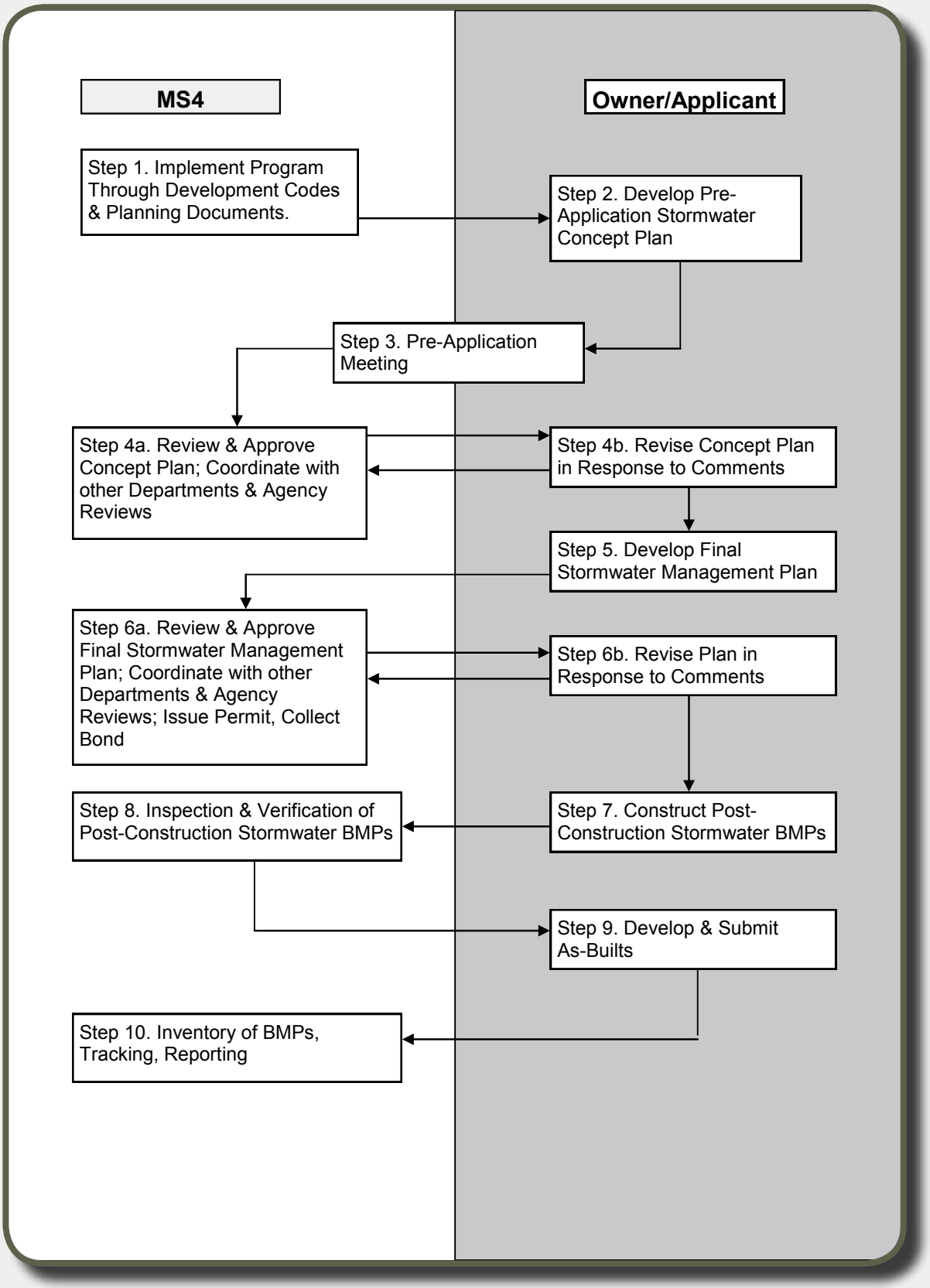
(2) Development of procedures for the site plan review and approval process(es) that include inter-departmental consultations, as needed, and a required re-approval process when changes to an approved plan are desired.

(3) A requirement for submittal of "as-built" certifications within 90 days of completion of a project.

(4) A post-construction verification process to ensure that stormwater standards are being met, that includes enforceable procedures for bringing noncompliant projects into compliance.

(5) A description of a program to educate both internal staff and external project proponents of the requirements of Part II, Section C.b.5 of this permit.

Figure 2.8. Typical Compliance Pathway for the Minimum Control Measure # 5 -- Controlling Runoff from New Development and Redevelopment



The remainder of this section describes each step in **Figure 2.8** in more detail.

Step 1: Implement Program Through Development Codes & Planning Documents

Who Does This Step?

- The MS4 or local stormwater program

When Does This Step Occur?

- At initial program development prior to plans being submitted

Description:

Minimum Measure #5 contains provisions for Watershed Protection and Site and Neighborhood Design (see Section 2.1). These provisions must be translated into local codes, policies, and planning documents so that they become design standards for new development and redevelopment projects. The Watershed Protection provisions are likely to be incorporated into local zoning and/or subdivision codes because they relate to site design, reduction of impervious cover and protection of sensitive areas, trees and vegetation, and soils. The Site and Neighborhood Design provisions can be incorporated into the local zoning and/or subdivision codes or into a stand-alone stormwater or environmental code. This step is a prerequisite to having a functioning stormwater program that follows the stipulations of the MS4 General Permit.

Step 2: Develop Pre-Application Stormwater Concept Plan

Who Does This Step?

- The owner/applicant/design engineer for a new development or redevelopment project that disturbs one-acre or greater (including projects of less than one acre that are part of a common plan of development or sale that will disturb, in total, one acre or more).

When Does This Step Occur?

- Very early in the site planning process, before infrastructure and lot configurations are locked down.

Description:

The MS4 General Permit provides for the "review and approval of a pre-application concept plan that describes how the performance standards will be met." The Concept Plan provides the opportunity for the applicant to put basic stormwater design ideas and practices on paper before expending time and resources preparing more complex engineered plans and computations. This step can help both the local stormwater program and the developer avoid problems that could occur if the plan is submitted later in the process. The Concept Plan should include:

- Graphical Elements showing site design features in accordance with the Watershed Protection provisions (as reflected in local development codes as part of **Step 1** above). This may include alternative conceptual site designs or other graphical tools. The graphical element should also show the general type, location, and size or proposed stormwater BMPs that will be used to meet the Site and Neighborhood Design performance standard to manage to first one-inch of rainfall. Stormwater BMPs can be shown as bubbles or "blobs" on the plan, although some effort should be made to demonstrate that they are sized adequately to capture the design volume.
- Narrative & Computation Elements that describe:
  (a) Site design incentives from Part II, Section C.b.5.ii.A.3 of the MS4 General Permit that are proposed to reduce the Target Treatment Volume (e.g., redevelopment, Brownfield redevelopment, high density, vertical density, mixed use and transit oriented development).

(b) Conceptual or preliminary computations that show the Target Treatment Volume (after site design incentives are taken) and the stormwater BMP types and sizing necessary to control it. The best way to do this is using the Design Compliance Spreadsheet described in **Chapter 3 of the Manual**. A project-specific version of the spreadsheet should be included in the submittal package.

(c) Other narrative elements that will assist the plan review in understanding how the concept plan complies with the provisions of the MS4 General Permit, as reflected in local development codes.

Step 3: Pre-Application Meeting

Who Does This Step?

- Both the MS4/local stormwater program AND the owner/applicant along with the project design engineer.

When Does This Step Occur?

- Soon after the owner/applicant prepares the Concept Plan outlined in **Step 2**. However, it may be advantageous for the parties to meet in the office or in the field prior to completion of the Concept Plan if site design and stormwater discussions would aid the applicant in preparing the Concept Plan.

Description:

The intent of this meeting is to discuss site compliance issues and allow for constructive interaction between the parties. It is hoped that this meeting will result in a higher quality submittal and a faster compliance schedule. The meeting is particularly relevant to discuss site design issues that can reduce the Target Treatment Volume, application of site design incentives, and the most applicable stormwater BMPs for the site.

Step 4a: Review & Approve Concept Plan; Coordinate with Other Departments & Agency Reviews

Who Does This Step?

- MS4/local stormwater program

When Does This Step Occur?

- Within the specified time for review of the Concept Plan after accepting the submittal as complete.

Description:

The approval of the Concept Plan means that there is enough information to confirm that the Final Stormwater Management Plan (see **Step 5**) is very likely to achieve compliance. To do this, the plan reviewer will need to review the graphical elements and ensure that they are consistent with the project-specific Design Compliance Spreadsheet, computations, and other narrative elements.

The Concept Plan is the Time to Coordinate Internal & External Reviews

There are several other important coordination steps that should be done at this point:

- Coordinate the review with other internal reviews, such road and drainage plans, subdivision plats, water and sewer, floodplains, erosion control and grading, and groundwater/wellhead protection. This is a chance to vet and resolve possible internal conflicts that may limit or omit the use of certain practices (including site design practices, such as narrow streets, alternative site layouts, parking materials, etc.).
- Coordinate the review with external reviews, especially for plans that are subject to state or federal reviews, such as wetland and stream permits, other discharge permits, requirements for federal projects (e.g., ERISA), dam safety permits, and other required permits for the site (see **Table 2.1**).

Step 4b: Revise Concept Plan in Response to Comments

Who Does This Step?

- Owner/applicant and design engineer

When Does This Step Occur?

- After receiving comments, if any, from the plan reviewer.

Description:

The design engineer revises the Concept Plan components in response to reviewer comments. The objective at this point is to ensure that there is enough information to ensure a complete and compliant Final Stormwater Management Plan. Engineering details and final computations are not expected at the concept plan stage.

Step 5: Develop Final Stormwater Management Plan

Who Does This Step?

- Owner/applicant and design engineer

When Does This Step Occur?

- After approval of Concept Plan.

Description:

Using the approved Concept Plan as a framework, the Final Stormwater Management Plan is developed. A typical plan submittal package includes the items listed in **Table 2.3**. It should be noted that the final stormwater management plan is often coordinated or combined with other final plans, such as grading and drainage, erosion control, utilities, and road plans. The actual content for final plans is dictated by the local program requirements; the items in **Table 2.3** are guidelines.

Table 2.3. Recommended Computation Submittal Package (derived from Claytor, 2006)

Graphical
• Vicinity map • Plan view showing BMP locations, sizing, post-development drainage areas, and layout with storm sewer and other utilities • For each BMP: necessary cross-sections and profiles with elevations of critical components to ensure that BMP can be properly constructed • Graphical portrayal of coordination with erosion and sediment control measures (e.g., will any be converted to permanent BMPs at the completion of construction) • Typical details and notes • As relevant to the stormwater design, soil survey, geology, slope, land cover, and other maps
Narrative & Computations
• Cover: Project title, client, nature of computations • Copy or summary of Design Compliance Spreadsheet for the project • able of proposed BMPs with Target Treatment Volume for drainage area (one-inch capture), volume provided, and sizing • Watershed delineation for pre- and post-development conditions with travel times (times of concentration), land use, and soils • Narrative of stormwater management system • Summary of hydrology and hydraulics • Table of drainage areas, curve numbers (CNs), time of concentration, and peak discharges (pre- and post-construction) that summarizes the performance of proposed stormwater measures. • Detailed hydraulic calculations (hydraulic calculations of outlet orifice, weirs, spillways, etc.) • Hydrologic analyses (e.g., area CN calculation spreadsheets, practice sizing equations, model run outputs) • Other calculations (e.g., inflow channel sizing, outfall channel, downstream analyses, dam breach assessments, filter diaphragm sizing, groundwater mounding analyses, structural calculations) • Site photographs, as applicable • List of permit requirements and how project is in compliance (including permits needed for construction stormwater, streams and wetlands, floodplains, stream buffers, wellhead protection, dam safety and other relevant permits) • Supporting data (as applicable) • Soil test pits and/or borings; results of infiltration tests • Pollutant monitoring data • Groundwater elevation data • Habitat evaluations • Tree surveys • Threatened and endangered species • Receiving water classification (e.g., 303(d) listing, cold-water fishery)

Supporting Documents

- Maintenance agreement
- Maintenance plan for each BMP (or type of BMP)
- Submittal fees (as applicable to the local program)
- Engineer's certification statement
- Documentation of other permits (e.g., wetlands, floodplain)
- Performance bond (as applicable to the local program)

Steps 6a: Review and Approve Final Stormwater Management Plan; Coordinate with Other Departments & Agency Reviews; Issue Permit; Collect Bond

Who Does This Step?

- MS4/local stormwater program.

When Does This Step Occur?

- Within the specified time for review of the Final Stormwater Management Plan after accepting the submittal as complete.

Description:

This is a detailed review to verify compliance with the standards in MS4 General Permit and the local ordinance. The reviewer should verify that the information submitted in the Design Compliance Spreadsheet matches up with information shown on the plan. The plan reviewer can at this point develop specific comments that need to be addressed in order for the plan to receive approval (see Step 6b below). Final approval requires coordination with other internal and external reviews for the project. Some programs specify that a performance bond be posted as a condition of final approval.

Step 6b: Revise Final Plan in Response to Comments

Who Does This Step?

- Owner/applicant and design engineer

When Does This Step Occur?

- After receiving comments from the plan reviewer.

Description:

The design engineer responds to comments from the reviewer. This is an iterative step with Step 6a.

Step 7: Construct Post-Construction Stormwater BMPs

Who Does This Step?

- Owner/applicant and site contractor

When Does This Step Occur?

- After receiving final approval of the Stormwater Management Plan, posting performance bond (if required by the local program), receiving all necessary permits and approvals, and following the proper construction/BMP installation sequence as specified on the plan.

Description:

Depending on the BMP, a very specific construction sequence should be followed. In particular, BMPs that have a filter media, rely on infiltration into the underlying soil, and/or that are vulnerable to construction sediments should only be installed once the contributing drainage areas reach a specified level of stabilization. The Final Stormwater Management Plan should be coordinated with the grading and drainage and erosion and sediment control plans to ensure that the installation of permanent stormwater BMPs follows the proper sequence. It is often helpful for the design engineer to have a role in ensuring that post-construction BMPs are built according to the plan.

Step 8: Inspection & Verification of Post-Construction Stormwater BMPs

Who Does This Step?

- MS4/local stormwater program.

When Does This Step Occur?

- Post-construction BMPs should be inspected at critical stages during installation, and a final inspection should be conducted to verify that the BMP is installed in accordance with the plan and/or any approved field changes.

Description:

Many BMPs do not perform as intended due to improper installation and construction issues. **Figure 2.9** illustrates several common construction and installation pitfalls, using bioretention as an example. Inspection frequency depends on the type of practice. Practices with multiple materials and layers, subgrade construction, and multiple-step construction sequences usually require more interim inspections. One of the most important roles for inspectors during BMP installation is to ensure that drainage areas are adequately stabilized in order to install post-construction BMPs. For instance, premature installation of bioretention soil media is one of the major causes of failure of these practices. _

For more information on inspection and verification and post-construction BMPs during initial installation, see Chapter 8 in *Managing Stormwater In Your Community* (CWP, 2008). See **Section 2.4** at the end of this chapter for links to download this manual.

Appendix A of this Manual contains checklists for various BMPs that can be used as a tool for the inspection process.

Figure 2.9. Common issues with installation of post-construction BMPs, using bioretention as an example (Source: Center for Watershed Protection).

Bioretention swale, installed too early during active construction, has become clogged with sediment.

Bioretention area does not drain because of improper soil media, soils compacted during installation, and/or filter fabric under media

Curb inlets to bioretention swale have eroded because of improper sizing of stone.

High plant mortality has occurred because improper species were substituted during construction.

Site runoff by-passes bioretention swale because of small elevation changes during construction.

Some site runoff by-passes bioretention because of inadequate slope of filter strip.

Step 9: Develop & Submit As-Builts

Who Does This Step?

- Owner/applicant, site contractor and/or design engineer.

When Does This Step Occur?

- Once the final sign-off occurs from the inspector. The MS4 General Permit requires that "as-built certifications" be submitted "within 90 days of completion of a project."

Description:

Once BMP installation is complete, as verified by the inspector, the applicant's design consultant prepares an as-built plan for each stormwater BMP based on actual site conditions. This plan can take the form of a "red-lining" approved design plan to note any discrepancies. The design professional also certifies that the constructed BMP meets or exceeds plan specifications. It is important for the as-built plan to confirm:

- Placement of BMPs within easements
- Proper sizing, dimensions, and materials
- Elevations of inlets, outlets, risers, embankments, etc.
- Vegetation per the planting plan or any approved substitutions
- Location of permanent access easements for maintenance

Step 10: Inventory of BMPs, Tracking, Reporting

Who Does This Step?

- MS4/local stormwater program.

When Does This Step Occur?

- Ongoing, as part of a BMP maintenance, tracking, and reporting program.

Description:

The proper installation of a post-construction BMP is only the beginning of its life-cycle. Long-term maintenance and operation are needed to ensure continued performance and functioning. In this regard, the MS4 General Permit contains provisions for maintenance agreements, inventory, inspections, and tracking of BMPs, and annual reporting. **Table 2.4** outlines the MS4 General Permit sections for each of these topics. The MS4 General Permit should be consulted for the full details concerning these program elements.

Table 2.4. Outline of MS4 General Permit Sections Pertaining to Long-Term Tracking, Inspection, and Reporting for Post-Construction BMPs

Topic	MS4 General Permit Section (Part II)	Brief Description[1]
Maintenance Agreements	Section C.b.5.ii(C)	Specifies that owners/operators submit maintenance agreement and maintenance plan, along with proper documentation including transfer of maintenance responsibility. Authorizes MS4 to conduct inspections and performance of corrective actions if necessary.
Inventory and Tracking of Management Practices	Section C.b.5.ii(D)	Requires MS4 to establish an inventory and tracking system (e.g., with GIS) that begins at plan review and extends through long-term maintenance. Specifies minimum content for tracking system. Tracking includes "source control management practices" as well as structural or non-structural "treatment control practices."
Stormwater BMP Inspections	Section C.b.5.ii(E)	Requires MS4 to establish a long-term maintenance inspection and enforcement program, including an inspection calendar (all BMPs inspected at least once during permit cycle), content of inspection reports, and an enforcement and response plan.
Reporting	Section C.b.5.ii(F)	An outline of the basic information to be included in the MS4's Annual Report.

[1] *Consult the full text of the MS4 General Permit and associated fact sheet for all of the details concerning these provisions.*

2.4. National Guidance for Building Effective Post-Construction Stormwater Programs

The steps in **Figure 2.8** are adapted to specific language in the MS4 General Permit. However, many of the steps are also key components for establishing a successful stormwater management program. National guidance on building an effective post-construction stormwater program, supported by the U.S. EPA, is available from the Center for Watershed Protection. The guidance is accompanied by several downloadable tools to assist MS4s and other localities in developing their stormwater management programs. All of the steps and topics addressed in **Figure 2.8** are included in the guide and associated tools. The guide, *Managing Stormwater in Your Community: A Guide for Building an Effective Post-Construction Program* (Hirschman and Kosco, 2008), can be found at:

http://cwp.org/postconstruction/ or
http://www.dep.wv.gov/WWE/Programs/stormwater/MS4/guidance/Pages/default.aspx

Table 2.5 cross-references the specific steps in Figure 2.8 with the chapters and tools in *Managing Stormwater in Your Community* that are relevant to that step.

Table 2.5. Link Between Compliance Steps and Resources in Hirschman and Kosco (2008)

Compliance Procedure Step From Figure 2.8	**Relevant Chapter in Hirschman and Kosco (2008)**[1]	**Relevant Tool from Hirschman and Kosco (2008)**
Step 1. Implement Program Through Development Codes & Planning Documents	Chapter 2: Post-Construction Program Development – Assessing Your Program Chapter 3: Land Use Planning as the First BMP: Linking Stormwater to Land Use Chapter 4: Developing a Stormwater Management Approach and Criteria Chapter 5: Developing A Post-Construction Stormwater Ordinance	Tool 1: Post-Construction Stormwater Program Self-Assessment Tool 2: Program and Budget Planning Tool Tool 3: Post-Construction Model Ordinance[2] Tool 4: Codes and Ordinance Worksheet
Steps 2 through 6: • Develop Pre-Application Stormwater Concept Plan • Pre-Application Meeting • Review & Approve Concept Plan • Develop Final Stormwater Management Plan • Review & Approval Final Stormwater Management Plan	Chapter 7: The Stormwater Plan Review Process	Tool 6: Checklists Tool 7: Performance Bond Tool Tool 8: BMP Evaluation Tool (for proprietary devices)

Compliance Procedure Step From Figure 2.8	Relevant Chapter in Hirschman and Kosco (2008) [1]	Relevant Tool from Hirschman and Kosco (2008)
Steps 7 through 9: • Construct Post-Construction BMPs • Inspect & Verify Post-Construction BMPs • Develop & Submit As-Builts	Chapter 8: Inspection of Permanent Stormwater BMPs During Construction	Tool 6: Checklists Tool 7: Performance Bond Tool
Step 10. Inventory of BMPs, Tracking, Reporting	Chapter 9: Developing a Maintenance Program Chapter 10: Tracking, Monitoring, and Evaluation	Tool 6: Checklists

[1] *Hirschman, D. and Kosco, J. 2008.* ***Managing Stormwater in Your Community: A Guide for Building An Effective Post-Construction Program.*** *EPA Publication No: 833-R-08-001. http://cwp.org/postconstruction/*

[2] *The Post-Construction Model Ordinance tool from Hirschman and Kosco (2008) is a general, national model ordinance. There are useful components in the model ordinance for West Virginia localities. However, West Virginia MS4s (and other local governments wishing to develop a local stormwater program) should incorporate elements from the MS4 General Permit to ensure compliance with the specific MS4 General Permit requirements.*

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