

## Michigan Municipal Separate Storm Sewer System (MS4) Permit Post-Construction Storm Water Control for New Developments and Redevelopment Projects

Part 1.A.4.b.4., pages 15-17, of the Municipal Separate Storm Sewer System (MS4) Watershed General Permit and Part I.A.8., pages 10-12, of the MS4 Jurisdictional General Permit require that the permittee develop, implement, and enforce a program to address post-construction storm water runoff from all new and redevelopment projects that disturb one acre or more. Projects that disturb less than one acre are subject to the requirements if they are part of a larger common plan of development or sale that would disturb one acre or more. The permittee shall have the authority to implement and enforce its post-construction storm water runoff control program through an ordinance or other regulatory mechanism.

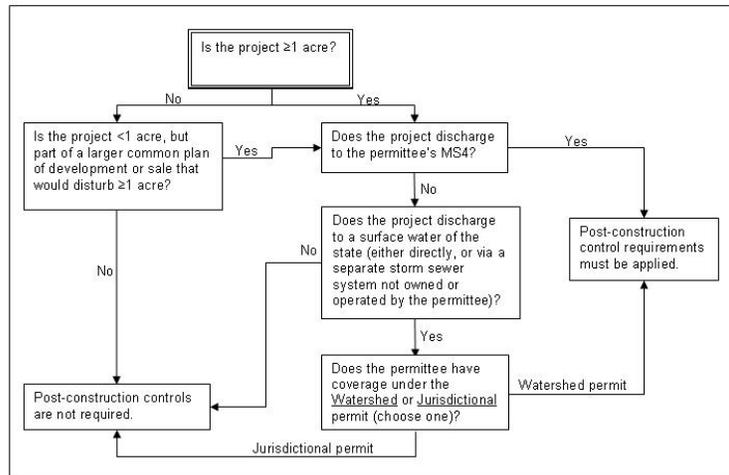
**Post-Construction Storm Water runoff** means the storm water that would flow from a project site to an MS4 or surface water of the state following (not during) development or redevelopment.

For the MS4 Watershed General Permit, the post-construction storm water runoff control program shall be implemented across the permittee's jurisdiction in the regulated area (watershed and urbanized area). The program is applicable to all development and redevelopment projects that disturb one acre or more (i.e., both permittee projects and non-permittee projects) and discharge to a surface water of the state, either directly or via a separate storm sewer system.

For the MS4 Jurisdictional General Permit, the post-construction storm water runoff control program shall be implemented for development and redevelopment projects that disturb one acre or more and discharge to the permittee-owned or permittee-operated MS4 within the urbanized area. This requirement is applicable to both permittee and non-permittee projects that discharge to the permittee's MS4.

For additional details on the geographic extent of the post-construction program requirements in the MS4 Watershed and Jurisdictional General Permits, refer to the separate compliance assistance document entitled *Scope of the Storm Water Pollution Prevention Initiative and Storm Water Management Plan*.

**Post-Construction Control (PCC) Requirements Decision Flow Chart**



The post-construction storm water runoff control program shall include all of the following components:

- A minimum water quality treatment volume standard
- Channel protection criteria
- Site plan requirements
- Operation and maintenance (O&M) requirements
- Enforcement mechanisms
- Recordkeeping procedures

The minimum water quality treatment volume standard, channel protection criteria, site plan requirements, and O&M requirements are mandatory components of the permittee's program that shall be applied to project developers (even when the permittee is the developer), by the permittee. Enforcement mechanisms and recordkeeping procedures also are mandatory

**Project Developer** means the person or entity responsible for writing and implementing site plans (e.g., development company, individual lot landowner, municipality).

components of the permittee's program, but they represent the methods that the permittee will use to implement and track its program. The minimum water quality treatment volume standard, channel protection criteria, O&M requirements, site plan requirements, and enforcement mechanisms shall be incorporated into the permittee's ordinance or regulatory mechanism. The permittee may incorporate all components into a single ordinance or regulatory mechanism or a combination of ordinances and regulatory mechanisms, provided all permit requirements are covered. Further, a permittee may choose to address the recordkeeping requirements with supplemental procedures to the ordinance or regulatory mechanism. If the permittee is placing any portion of the recordkeeping responsibility on the project developer, however, the permittee's ordinances or regulatory mechanisms must incorporate recordkeeping requirements.

Permittees are required to track and maintain records of their post-construction control program. An effective recordkeeping program will ensure that sufficient information is maintained to document the implementation and compliance with the permittee's post-construction storm water control program. Permittees shall have copies of their storm water control ordinances, regulatory mechanisms, and/or procedures. Further, permittees shall maintain records for all development and redevelopment projects that are required to comply with the permittee's post-construction storm water control requirements. These records shall document: 1) developer site plans; 2) O&M plans or agreements; and 3) all enforcement actions taken. Permittees are required to maintain these records and make them available to the Department of Natural Resources and Environment (Department) upon request.

The Storm Water Pollution Prevention Initiative (SWPPI) (MS4 Watershed General Permit) and the Storm Water Management Program (SWMP) (MS4 Jurisdictional General Permit) shall describe the permittee's post-construction storm water runoff control program. The following sections describe the post-construction storm water runoff control program requirements in more detail. Unless otherwise noted, the requirements described apply to both the MS4 Watershed and MS4 Jurisdictional General Permits.

*Minimum Treatment Volume and Channel Protection Requirements*

**Minimum Treatment Volume Standard**

Part I.A.4.b.4.a., page 16, of the MS4 Watershed General Permit and Part I.A.8.a., page 11, of the MS4 Jurisdictional General Permit specifies a minimum treatment volume that the permittee shall apply to address water quality impacts of storm water runoff. The treatment volumes specified are based on capturing and treating the volume of storm water that is the first to run off in a storm and expected to contain the majority of pollutants. This volume of runoff is often referred to as the “first flush.” Sizing best management practices (BMPs) to meet the permit conditions will ensure acceptable storm water treatment that minimizes water quality impacts.

The Minimum Treatment Volumes specified in the permit are:

- 1) One inch of runoff generated from the entire site (see below Calculate One Inch of Runoff from the Entire Site). *Note: For the MS4 Watershed General Permit only, an additional option of using 1/2 inch of runoff from the entire site can be used if the permittee demonstrates technical support for it in the Watershed Management Plan (WMP).*
- 2) The calculated site runoff from the 90 percent annual non-exceedance storm for the region or locality according to one of the following (see below Calculate Runoff Generated by 90 Percent Annual Non-Exceedance Storm):
  - a. The statewide analysis by region for the 90 Percent Annual Non-Exceedance Storms summarized in a memorandum dated March 24, 2006, and available on the Internet at [www.michigan.gov/degstormwater](http://www.michigan.gov/degstormwater) under the “Municipal Program/MS4 Compliance Assistance” link.
  - b. The analysis of at least ten years of local published rain gauge data following the method in the memo “90 Percent Annual Non-Exceedance Storms” cited above.

Calculate One Inch of Runoff from the Entire Site

This is the simplest and most conservative approach. Research has shown that nearly all the pollutants washed off in the “first flush” of runoff from impervious surfaces are contained in the first inch of runoff. To calculate, determine the area of land contributing storm runoff (A) in square feet and multiply by 1/12 feet:

$$A \text{ ft}^2 \times 1/12 \text{ ft} = \text{Minimum Treatment Volume in cubic feet}$$

Calculate Runoff Generated By 90 Percent Annual Non-exceedance Storm

This method is a more rigorous analysis of the runoff generated from different land types for 90% of all the storms that generate runoff. It is a more accurate representation of the runoff from the site and usually results in a smaller treatment volume than using one inch of runoff from the entire site.

The 90% storms for ten regions of the state are found in the memo mentioned above, and range from 0.77 inch to 1.0 inch. An acceptable substitute for the statewide regional analysis would be an analysis of a minimum of ten years of local published rain gauge data (using the method in the memo mentioned above); however, this approach is subject to approval by the Department.

The rainfall for the area where the site is located can be used in a number of computer programs or formulas that calculate runoff by land type. Many appropriate methods are described in Chapter 9 of the Low Impact Development Manual for Michigan and available at: [www.semco.org/LowImpactDevelopment.aspx](http://www.semco.org/LowImpactDevelopment.aspx). The Small Storm Hydrology Method is described on page 366 of the *Low Impact Development Manual for Michigan* and is a relatively simple method that may be applied at most sites.

Total Suspended Solids (TSS) Calculations

The permit requires that the methods selected to treat the volume of water calculated above shall be designed on a site-specific basis to achieve either a minimum of 80 percent removal of TSS, as compared with uncontrolled runoff, or a discharge concentration of TSS that does not exceed 80 mg/l. Where site conditions do not generate TSS concentrations greater than 80 mg/l, water quality treatment of the runoff is not required.

This permit requirement is based on TSS as a surrogate for other pollutants normally found in storm water runoff. Control of TSS to meet this permit requirement is expected to achieve control of other pollutants to an acceptable level that protects water quality. Determination of runoff quality and application of additional controls for other pollutants may be necessary to meet MS4 permit requirements where Total Maximum Daily Loads (TMDL) have been developed.

The chart below was compiled by the Rouge River Wet Weather Demonstration Project with Michigan data and provides the event mean, maximum, and minimum concentration of suspended solids in storm water runoff for several land uses. The data shows that wherever the maximum event concentration was reported it was substantially higher than 80 mg/l. Without site-specific documentation that the suspended solids concentration will not exceed 80 mg/l, treatment (BMPs) must be applied to remove 80% of suspended solids from all sites under permit.

Land Use Category	Percent Imperviousness	TSS		
		Mean (mg/l)	Min (mg/l)	Max (mg/l)
Forest/Rural Open	2	51		
Urban Open	11	51		
Agricultural/Pasture	2	145		
Low-Density Residential	19	70	2	367
Medium-Density Residential	38	70	2	367
High-Density Residential	51	97	2	380
Commercial	56	77	5	280
Industrial	76	149	5	271
Highways	53	141	130	406

Taken from "Rouge River Wet Weather Demonstration Project, Selection of Stormwater Pollutant Loading Factors", RPO-MOD-TM34.00, October 1994, Table 3-13

The intent is not for permittees to monitor sites to determine compliance with this permit requirement. Instead, the expected reduction of suspended solids by BMPs is obtained from the literature. The National Pollutant Removal Performance Database, Version 3 contains the expected percent reduction of suspended solids by many common BMPs. It is available at:

[www.cwp.org/Resource\\_Library/Center\\_Docs/SW/bmpwriteup\\_092007\\_v3.pdf](http://www.cwp.org/Resource_Library/Center_Docs/SW/bmpwriteup_092007_v3.pdf).

The International Stormwater BMP Database reports BMP performance by effluent concentration and is available at:

<http://www.bmpdatabase.org/Docs/Performance%20Summary%20June%202008.pdf>

Many BMPs are sufficient individually to achieve the required removal of TSS. Compliance can also be achieved through the use of a system of BMPs each achieving less than the required removal of TSS but, when properly applied as a system, achieve the required removal for the site.

To achieve the required removal performance, BMPs must be designed and installed properly. Accepted design guidance can be found in the *Low Impact Development Manual for Michigan* available at:

<http://library.semcoq.org/InmagicGenie/DocumentFolder/LIDManualWeb.pdf>.

or the *Guidebook of BMPs for Michigan Watersheds* available at:

[http://www.michigan.gov/deg/0,1607,7-135-3313\\_3682\\_3714-118554--,00.html](http://www.michigan.gov/deg/0,1607,7-135-3313_3682_3714-118554--,00.html)

Design guidance and efficiency information for proprietary devices are generally obtained from the manufacturer.

Sites are in compliance with this permit requirement if the minimum treatment volume from the site is treated by properly designed BMPs that achieve either 80% removal of TSS, or discharge 80 mg/l or less of TSS according to accepted literature. It is also important to note that new development will often be in compliance with this permit requirement if the volume control specified in the channel protection requirement of this permit is achieved.

Compliance may be shown through calculation or through direct measurement. Calculations or measurements must show reductions to the calculated TSS concentration in uncontrolled runoff using the data provided here or another acceptable literature source.

#### **Channel Protection Criteria**

Part I.A.4.b.4.b., page 16, of the Watershed General Permit and Part I.A.8., page 12, of the MS4 Jurisdictional General Permit specifies channel protection criteria that require maintaining the post-development site runoff volume and peak flow rate at or below existing levels for all storms up to the 2-year, 24-hour event. One of the biggest threats to stream water quality is excess sediment and channel

instability caused by the increased rate and volume of storm water runoff resulting from development. Stream forms and dimensions are determined by the geology and rainfall of the contributing watershed. When development occurs, the land cover is often changed in a way that alters the response of that land to rainfall. Rainfall that infiltrated into the ground or was evaporated off the leaves and branches of plants or was soaked up by the roots of plants now runs off directly to a stream. The outcome is that the surface runoff from the watershed increases in both amount and rate and channel erosion results as the stream adapts to the new flow.

**Existing Levels** means the runoff flow volume and rate for the last land use prior to the planned new development or redevelopment.

Compliance with this permit requirement is determined by calculating the existing and post-development runoff volume and rate for the 2-year and smaller storm events. The permit specifies using the method described in the Department publication *Computing Flood Discharges for Small Ungaged Watersheds*, dated July 2003 (updated June 2008) and available at the Department website, [www.michigan.gov/degstormwater](http://www.michigan.gov/degstormwater) (under the “Municipal Program/MS4 Compliance Assistance” link, then the “Guidance for Calculating Runoff Volume and Peak Flow Rate” link). If the post-development volume or rate exceeds the existing volume or rate then appropriate controls or design changes shall be implemented to make the post-development condition equal to or less than the existing levels for all storms up to the 2-year, 24-hour event.

An acceptable source of rainfall data for calculating runoff volume and peak flow rate is the *Rainfall Frequency Atlas of the Midwest*, Huff & Angel, NOAA Midwest Climate Center and Illinois State Water Survey, 1992 available at [www.sws.uiuc.edu/pubdoc/B/ISWSB-71.pdf](http://www.sws.uiuc.edu/pubdoc/B/ISWSB-71.pdf). Permittees wishing to use other rainfall data sources and/or runoff models shall request approval from the Department.

#### Runoff Volume

Determining the runoff volume of a site is done by a calculation. The calculation method identified in the permit is the Natural Resources Conservation Service (NRCS) Curve Number (CN) method and is described in *Computing Flood Discharges for Small Ungaged Watersheds* stated above. A CN represents the runoff potential of a site based on cover and soils. The lower the CN the less runoff, the higher the CN the more runoff. Using the CN, runoff is calculated using the following formula;

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S}$$

Where;

$Q$  = runoff (in.)

$P$  = rainfall (in.)

$I_a$  = initial abstraction (in.) =  $0.2S$

$S$  = potential maximum retention after runoff begins (in.)

$S$  is defined by the following formula;

$$S = \frac{1000}{CN} - 10$$

So the volume of runoff can be calculated using only the precipitation, CN and area of the site.

$$Q_v = Q \times 1/12 \times A$$

Where  $A$  is the area of the site in square feet.

The runoff must be calculated for the impervious area of the site and the pervious area of the site and then added together. The calculations can be organized in a spreadsheet or table:

Cover Type	Soil Type	Area (sf)	Area (ac)	CN (from TR-55)	S	Q Runoff * (in)	Runoff Volume (ft <sup>3</sup> )
					$\frac{1000}{CN} - 10$	$\frac{(P - I_a)^2}{(P - I_a) + S}$	$Q \times 1/12 \times A$
Woods/Meadow	A	0		30	23.3	<b>0.25073734</b>	<b>0</b>
Open Space (Lawn)	A	0		39	15.6	<b>0.03862675</b>	<b>0</b>
Woods	B	0		55	8.2	<b>0.06036959</b>	<b>0</b>
Meadow	B	0		58	7.2	<b>0.10407505</b>	<b>0</b>
Open Space (Lawn)	B	0		61	6.4	<b>0.15911822</b>	<b>0</b>
Woods	C	0		70	4.3	<b>0.394707</b>	<b>0</b>
Meadow	C	0		71	4.1	<b>0.42786165</b>	<b>0</b>
Open Space (Lawn)	C	0		74	3.5	<b>0.53657244</b>	<b>0</b>
Woods	D	0		77	3.0	<b>0.6601594</b>	<b>0</b>
Meadow	D	<b>1476684</b>	33.90	78	2.8	<b>0.70492355</b>	<b>86745.777</b> <b>5</b>
Open Space (Lawn)	D	0		80	2.5	<b>0.80020595</b>	<b>0</b>
Impervious	N/A	0		98	0.20	<b>2.141543</b>	<b>0</b>
Other:		0					<b>0</b>
<b>TOTAL:</b>	<b>N/A</b>		<b>33.9</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>86,746</b>

\* In this example the rainfall (P), used to calculate Q Runoff, was equal to 2.37 inches. The quantity used for P (and consequently, the calculation for Q) will vary regionally.

Set up the table and enter the area of the site for each applicable cover type and soil combination, and for the amount of impervious area. The columns for S, Runoff, and Runoff Volume are calculations based on the formulas at the top of each column and explained in the description above. Use the table to add up the volume of runoff for each applicable CN and show the total volume of runoff from the site in the bottom right hand corner. The example above is for pre-development conditions where the site was entirely undeveloped. Prepare separate tables for the existing site and the post-development site and compare the total volume of runoff for both conditions.

If the post-development volume of runoff is equal to or less than the volume of runoff from the existing site then the runoff volume permit condition is met.

If the volume of runoff from post-development is greater than the volume of runoff from the existing site then the excess runoff volume must be removed to meet the runoff volume control condition of the permit. Example mechanisms to remove excess runoff volume include, but are not limited to, infiltration BMPs, capture and reuse, enhancing the site with vegetation or soil amendments to reduce runoff and design changes such as reducing the amount of imperviousness.

Peak Runoff Rate

The peak runoff rate is a function of runoff volume and time of concentration (Tc). Tc is the time it takes a drop of water to move from the hydraulically most distance point in the watershed to a downstream point in the watershed. In the case of the MS4 permit requirements the watershed is the development site. In general, if the runoff volume is controlled as described previously (in Runoff Volume above) and the Tc of the existing site is maintained or increased for the developed condition, then the peak runoff rate will also be controlled. As sites increase in size, however, the movement of water through them becomes more complex. Sites that propose change to more than ten acres or have one acre or greater impervious area or have more than 50% impervious cover for the site should not assume that if volume and Tc are controlled that peak runoff rate will be controlled.

If the Tc of the existing site is not maintained or if the site size criteria described above is exceeded, then the rate of runoff for the existing site must be determined and compared to the rate of runoff for post-development. Calculating the rate of runoff requires the use of a hydrologic model. The recommended model for most sites under the MS4 permit is TR-55 available from NRCS at [http://www.wsi.nrcs.usda.gov/products/W2Q/H&H/Tools\\_Models/WinTR-55.html](http://www.wsi.nrcs.usda.gov/products/W2Q/H&H/Tools_Models/WinTR-55.html).

This model can be used to calculate both volume and rate. TR-55 uses the CN method described above to calculate volume of runoff and the unit hydrograph method to calculate peak rate. Although TR-55 is a relatively simple model to run, some training in hydrology is recommended. Other more complex models such as HEC-HMS available from the US Army Corps of Engineers, Storm Water Management Model (SWMM) available from EPA and the Source Loading and Management Model (SLAMM) may be needed to evaluate larger and more complex sites and require more hydrology experience to set up.

As with runoff volume, the model will be run once for the existing site condition and again for the post-development site condition.

More detailed descriptions of methods to determine both runoff volume and rate can be found in Chapter 9 of the *Low Impact Development Manual for Michigan* available at: <http://www.semcoq.org/LowImpactDevelopment.aspx>

A specific, detailed discussion of the Unit Hydrograph method for calculating peak rate and the CN method for calculating volume is explained in the document *Computing Flood Discharges for Small Ungaged Watersheds* available on the Department's Web site at: [www.michigan.gov/deqstormwater](http://www.michigan.gov/deqstormwater).

Channel protection criteria shall not be required for the following waterbodies:

- The Great Lakes or connecting channels of the Great Lakes
- The Rouge River downstream of the Turning Basin
- The Saginaw River
- Mona Lake and Muskegon Lake in Muskegon County
- Lake Macatawa and Spring Lake in Ottawa County

**Other Options for Minimum Treatment Volume Standard and Channel Protection Criteria**

The MS4 Watershed General Permit and the MS4 Jurisdictional General Permit both offered a number of options for meeting the minimum water quality treatment volume standard and channel protection criteria. Permit applicants were required to identify in the application the option(s) they intended to use to meet the minimum water quality treatment volume standard and channel protection criteria.

Any combination of existing regulatory mechanism or procedure, approved alternative approach, elective option, or adoption of an ordinance or regulatory mechanism in accordance with the requirements listed in Part I.A.4.B.4.a and b, page 16, of the MS4 Watershed General Permit or Part I.A.8.a and b, pages 11-12, of the MS4 Jurisdictional General Permit was considered by the Department during the application review process. The accepted approach was identified in each permittee’s certificate of coverage (COC). Permittees shall follow the specifications and dates identified in the COC for establishing and implementing the minimum water quality treatment volume standard and channel protection criteria.

The list of options for meeting the minimum water quality treatment volume standard and channel protection criteria that were considered during the permit application process are described in the table below.

<b>Minimum Water Quality Treatment Volume Standard and Channel Protection Criteria Options</b> (Note: Refer to the permittee’s COC for permittee-specific options)
The permittee identified in its application a schedule to develop and place in effect an ordinance or other regulatory mechanism that incorporates the <i>minimum treatment volume standard</i> and the <i>channel protection criteria</i> listed in Part I.A.4.B.4.a and b of the MS4 Watershed General Permit <u>or</u> Part I.A.8.a and b of the MS4 Jurisdictional General Permit. This option is discussed in detail in the <i>Minimum Treatment Volume and Channel Protection Requirements</i> section of this document.
The permittee identified in its application for coverage under this general permit its applicable local ordinance or regulatory mechanisms that implement a standard for storm water treatment and criteria for channel protection that existed before the permittee submitted its application.
The permittee identified in its application for coverage under this general permit the applicable local procedures that implement a standard for storm water treatment and criteria for channel protection that existed before submittal of its application, and these local procedures will be converted into an ordinance or other regulatory mechanism by the date specified in the permittee’s COC for SWPPI (MS4 Watershed General Permit) or SWMP Plan (MS4 Jurisdictional General Permit) submittal.

The permittee submits with the SWPPI (MS4 Watershed General Permit) an alternative approach, such as design criteria based on low-impact development (LID), that provides at least the same level of water quality treatment and channel protection as listed in Part I.A.4.B.4.a and b of the MS4 Watershed General Permit or the permittee submits with the SWMP Plan (MS4 Jurisdictional General Permit) an alternative approach based on LID that provides an equivalent or greater level of water quality treatment and channel protection as listed in Part I.A.8.a and b of the MS4 Jurisdictional General Permit. The range of alternatives suitable for MS4 watershed permittees is intended to be greater than those for MS4 jurisdictional permittees (limited to LID-based alternatives) due to the potential for collaborative efforts amongst MS4 watershed permittees. For example, a watershed group might consider regional controls as a means for fulfilling the minimum water quality treatment volume and channel protection criteria, or a permittee may be able to demonstrate that site conditions preclude the need for meeting the requirements listed in Part I.A.4.B.4.a and b of the MS4 Watershed General Permit. Alternative submittals are subject to approval by the Department. For additional details on alternative submittals, please refer to the separate compliance assistance document entitled *Storm Water Pollution Prevention Initiative and Storm Water Management Plan—Alternative Approaches*.

MS4 Watershed General Permit Only—Elective Option: The permittee identified in the application for coverage under this general permit that it will develop an ordinance or other regulatory mechanism to meet the following outcomes:

- A methodology and standard for treating water quality based on watershed priorities identified in the WMP;
- Criteria for channel protection based on scientifically accepted morphological concepts; or
- The requirements of Part I.A.4.b.4.c.

The permittee shall submit its standards and criteria proposed under the elective option as a request for permit modification by the date specified in the COC to the Chief of the Permits Section, Water Resources Division, Michigan Department of Natural Resources and Environment, P.O. Box 30273, Lansing, Michigan 48909-7773.

*Additional resource materials for the topics of minimum treatment volume standard and channel protection criteria are described in Appendix A.*

#### *Developer Site Plan Requirement*

##### Site Plans

Part 1.A.4.b.4, page 15, of the MS4 Watershed General Permit and Part I.A.8, page 10, of the MS4 Jurisdictional General Permit state that the permittee's post-construction storm water runoff control program shall include a requirement that the developer prepare and implement site plans for each project subject to the post-construction storm water runoff control requirements of the MS4 permit identified by the permittee's COC (MS4 watershed or MS4 jurisdictional). In general, site plan review allows the permittee to require and evaluate a suite of project construction and design details, including storm water management practices, during the project planning stage.

"A site plan is a plan, drawn to scale, showing the layout of proposed uses and structures. Site plans include lot lines, streets, building sites, existing structures, reserved open space, utilities, and any other required information." (Ardizzone, K. A. and M.A. Wyckoff, 2003)

Review and approval of the site plan according to the permittee's established standards provides the permittee with a foundation for ensuring that the finished project will sufficiently meet post-construction storm water runoff control requirements. Construction inspections, evaluation of as-built plans, and as-built inspections should be used to confirm that completed projects meet requirements.

In order to ensure that site plans are reviewed consistently and adequately incorporate permit requirements, the permittee should have a checklist or specific criteria to be used by plan reviewers. The checklist and/or criteria should include all the standard conditions of the permittee's post-construction storm water runoff control program—from installation through O&M. At a minimum, the checklist and/or criteria should prompt the permittee to assess whether:

It is critical that site plan review checklists be tailored to the permittee's program. An example site plan design checklist for LID is available in Chapter 5 of the *Low Impact Development Manual for Michigan* (SEMCOG, 2008).

- MS4 and waterbodies are accurately represented;
- Adequate BMPs are shown on the plans;
- Standard conditions are followed;
- Appropriate requirements are specified to ensure long-term O&M; and
- BMP placement would obstruct adequate O&M.

Although projects proposed for both private properties and municipal properties are subject to the site plan requirement, the review process may vary. For example, the review process for private properties may be delineated in an ordinance, whereas the review process for a permittee's own projects may be via an internal policy. As long as the processes equivalently ensure that permit requirements are met, this is acceptable.

#### **Tracking the Developer Site Plan Requirement**

To document the developer site plan process, permittees shall maintain records of the site plans and information that demonstrates the site plan process was used to implement the post-construction storm water control permit requirements such as, copies of the reviewer's completed checklist and/or the review criteria used during the review process, copies of correspondence between the permittee and the developer, a copy of the final approved design, and any other relevant information.

Further, since the purpose of the site plan requirement is to ensure that proposed and completed projects comply with the permittee's post-construction storm water control requirements, it is important for permittees to have a construction and as-built inspection program. A construction and as-built inspection program will help to ensure that projects are constructed and completed in accordance with approved site plans. It is recommended that inspection records or logs be maintained by the permittee and document the site conditions, proper construction of BMPs in accordance with approved plans, and any non-compliance issues or violations observed at the time of the inspection. The enforcement actions taken to resolve the violations shall be documented.

In addition, permittees should consider maintaining records of employee trainings to document that the appropriate municipal staff, contract staff, or engineers are appropriately trained to implement the site plan process and ensure long-term O&M of BMPs.

### *O&M Requirements*

Part I.A.4.b.4.c., page 17, of the MS4 Watershed General Permit and Part I.A.b.8.c., page 12, of the MS4 Jurisdictional General Permit state that the permittee's post-construction control program shall include a plan for maintaining maximum design performance through long-term O&M of all structural and vegetative BMPs installed as a part of the program. Further, permittees are required to track and enforce a program, through an ordinance or other regulatory mechanism, to ensure long-term O&M plans for the water quality treatment and channel protection controls the permittee requires.

#### Ordinance or Other Regulatory Mechanism Authority

The permittee shall develop a program to ensure long-term O&M as part of an ordinance or other regulatory mechanism. The ordinance or other regulatory mechanism shall require the submittal of an O&M plan to identify responsibilities for the O&M of all post-construction structural and vegetative BMPs, including BMPs owned or operated by the permittee

Permittees shall include a tracking and enforcement requirement in an ordinance or other regulatory mechanism to ensure maximum design performance is maintained for the life of the BMP. Permittees should decide whether permittee staff and/or the BMP owner/operator will perform the necessary O&M. The permittee shall have authority to address inadequate BMP performance if necessary, which may include the ability to access BMPs. For example, a storm water easement may be necessary to establish a legal contract to access and maintain a BMP.

#### O&M Plan Review

The permittee shall review the O&M plan, which may be submitted as part of the site plan process, to ensure maximum design performance is maintained for the life of the BMP and the permittee's standards for water quality treatment and channel protection controls are met. Factors to consider when reviewing an O&M plan may include:

- Operating instructions for the outlet component;
- Vegetation maintenance schedule;
- Responsible party designation;
- Inspection checklists;
- Maintenance checklists; and
- Tracking requirements.

Permittees shall maintain records documenting O&M plans, and information that demonstrates the O&M plan review process, such as copies of the reviewer's checklist and/or the review criteria used during the review process, copies of correspondence between the permittee and the developer, a copy of the final approved plan, and any other relevant information. Permittees may use other agencies or contract staff to review and approve O&M plans. It is important for permittees to review O&M plans approved by other agencies and contract staff to ensure consistency.

#### Construction Inspection

Proper BMP installation is critical to optimizing the effectiveness of post-construction BMPs. Performance bonds can be used to provide a financial incentive for proper BMP construction. Following construction, the permittee should complete an inspection or require a self-certification process to ensure the BMP was constructed in accordance with the approved final site plan.

Implement O&M Plan

Routine inspections are critical to ensure BMPs are performing as designed and the permittee's requirements for water quality treatment and channel protection are being met. BMPs should be inspected in accordance with the approved O&M plan. This includes BMPs owned/operated by the permittee. Based on the results of the inspection, short-term (routine or more frequent), long-term (non-routine or less frequent), and major (rare) actions may be necessary to ensure proper maintenance. Also, emergency maintenance may be necessary to address unexpected problems.

<b>Storm Water BMP O&amp;M Frequency Guidelines</b>	
Short-term (more frequent)	<u>Routine</u> Visual assessment, litter and debris removal, vegetation management
Long-term (less frequent)	<u>Non-routine</u> Clean out trash and solids, structural repairs, partial rehabilitation
Rare	<u>Major</u> Rehabilitation or rebuild

Tracking O&M

Permittees shall track the BMP O&M plans. A good tracking system would include documentation of the O&M plans along with the locations, conditions, and ages of BMPs and could be developed through the use of geographical information systems, databases, spreadsheets, or lists.

It is recommended that permittees also track inspection findings by permittee staff and the BMP owner/operator to ensure proper O&M occurs for the life of the BMP. Depending on the requirements of the permittee's ordinance or other regulatory mechanism for ensuring O&M plans, the BMP owner/operator could be required to 1) submit documentation identifying inspection dates and details as well as maintenance performed or 2) maintain inspection and maintenance information and make this information available to permittee staff during an inspection.

An example of a maintenance agreement is available in Appendix G of the *Low Impact Development Manual for Michigan* (SEMCOG, 2008).

*Enforcement*

Part 1.A.4.b.4, pages 15-17, of the MS4 Watershed General Permit  
 Part 1.A.8, pages 10-12, of the MS4 Jurisdictional General Permit

**Program Enforcement through an Ordinance and/or Regulatory Mechanism**  
Ordinance/Regulatory Mechanism Applicability

The permittee is required to implement and enforce its post-construction storm water runoff control program through an ordinance or other regulatory mechanism. Examples of non-ordinance regulatory mechanisms include local permit programs and internal policies or procedures.

A number of factors may influence the appropriateness of an ordinance or other regulatory mechanism including whether the permittee has the MS4 Watershed General Permit or the MS4 Jurisdictional General Permit and whether the permittee has ordinance authority. A combination of an ordinance and other regulatory mechanism may also be appropriate. As long as the post-construction storm water runoff control requirements are fully addressed, the requirements may be distributed throughout a combination of several ordinances and/or regulatory mechanisms. In addition, if standards and criteria are contained in a separate specification manual, it is acceptable to adopt the manual by reference in the ordinance or regulatory mechanism.

For the MS4 Watershed General Permit, in most cases, cities, villages, and townships will have an ordinance for regulating discharges from private development or redevelopment to a separate storm sewer system or directly to surface waters of the state. Cities, villages, and townships may choose to have an internal policy or procedure as the regulatory mechanism for their own municipal projects. County entities that do not have ordinance authority, but have the authority to regulate discharges to their own MS4s, such as road commissions, drain commissioners, and county administrations (e.g., for county facilities such as parks or administration buildings) may use a regulatory mechanism such as a local permit program. County entities also may use an internal written policy for their own projects (e.g., road constructing). Public institutions such as school systems or universities may use a written internal policy because their authority is limited to the institution’s own development or redevelopment projects.

For the MS4 Jurisdictional General Permit, an ordinance is appropriate for cities and villages regulating discharges from private development or redevelopment to their own MS4. The ordinance may cover development or redevelopment of the city or village’s own properties, or these properties could be addressed through an internal policy or procedure. Townships with more complex MS4s that receive discharges from non-municipal properties (e.g., a township that owns or operates roads) should use an ordinance to address discharges from development or redevelopment of those private properties. Townships addressing development or redevelopment of their own properties, as well as townships with an MS4 that is limited to buildings and parking lots and do not receive storm water runoff from private properties, may use an internal policy or procedure. County entities and public institutions such as school systems or universities may use the same mechanisms described above for the MS4 Watershed General Permit.

Likely scenarios for applicability of ordinance and other regulatory mechanisms, by permittee type, are provided in the following table.

**Likely Scenarios for Applicability of Ordinance and Other Regulatory Mechanisms**

Permittee Type		Ordinance	Other Regulatory Mechanism	
			Local Permit Program	Internal Written Policy
City		◆		◆
Village		◆		◆
Township	Watershed General Permit	◆		◆
	Jurisdictional General Permit w/private discharges to its MS4	◆		◆
	Jurisdictional General Permit w/o private discharges to its MS4			◆
County Road Commission			Both	
County Drain Commissioner			Both	
County Administration			Both	
Public Institution				◆

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Ordinance/Regulatory Mechanism Contents

The ordinance or regulatory mechanism shall include provisions for water quality treatment volume, channel protection, developer site plan requirements, and O&M requirements. In addition, the ordinance or regulatory mechanism shall include a means for resolving noncompliance.

- *Treatment Volume Standard and Channel Protection Criteria*—The ordinance or regulatory mechanism shall incorporate the permittee’s water quality treatment volume standard and channel protection criteria. If the aforementioned standard and criteria are contained in a separate specification manual, it is acceptable to adopt the manual by reference in the ordinance or regulatory mechanism. Please see the *Minimum Treatment Volume and Channel Protection Requirements* section of this document for details that may be inserted into ordinance or regulatory mechanism language.
- *Developer Site Plan Requirement*—The permittee’s ordinance or regulatory mechanism shall include a provision that the developer prepare and implement site plans for each project subject to the post-construction storm water runoff control requirements of the MS4 permit and the permittee’s COC. Some entities, such as county drain commissioners or road commissions, may have a slightly different, but equivalent site plan requirement that occurs through a local permitting process. A similar scenario may apply for permittee-initiated projects, which may be addressed through an internal policy or procedure.
- *O&M Requirements*—The ordinance or regulatory mechanism shall require the BMP owner or operator to provide a plan for long-term O&M of structural and vegetative BMPs installed as a requirement of the post-construction storm water runoff control program. The O&M plan shall ensure proper maintenance to maintain maximum design performance of the BMPs for the life of the BMP. Permittees may require a maintenance agreement or other binding contract to identify responsibilities for maintenance and the course of action as a result of inadequately maintained BMPs.
- *Resolving Noncompliance*—The permittee shall have measures for resolving noncompliance when a project developer or BMP owner/operator is not achieving requirements of the post-construction storm water runoff control program. The ability to impose these enforcement measures shall be supported by the permittee’s ordinance or regulatory mechanism. Enforcement measures include, but are not limited to, right of entry for inspections, notices of violation, mandatory abatement, authorization of the permittee to conduct BMP maintenance and re-coup costs from the developer or BMP owner/operator when BMPs are not properly inspected and/or maintained, ability to issue civil penalties, and ability to issue monetary fines proportionate to the violation.

Example ordinances are provided in Appendix B.

Adopting Another Entity’s Standards by Reference

A number of permittees have adopted, or proposed to adopt, another entity’s post-construction storm water runoff control standards for minimum water quality treatment and channel protection. Whether the permittee has elected to defer to the post-construction storm water runoff control requirements of another entity or has simply duplicated that entity’s requirements within the permittee’s own ordinance or regulatory mechanism, the permittee shall still have in place an ordinance or regulatory mechanism to ensure that the post-construction storm water runoff controls are enforced according to MS4 permit requirements.

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Ordinance/Regulatory Mechanism Amendments

Once the ordinance or regulatory mechanism is established according to the COC specifications, it may be amended if the modifications do not reduce the level of channel protection or water quality treatment that were provided prior to the amendment. The aforementioned modifications are not required to be submitted to the Department.

**Tracking Enforcement**

As required by the permit, a permittee's post-construction program is required to have an enforcement mechanism for resolving issues of non-compliance (e.g., failure to construct a BMP in accordance with the approved site plan or a home owner's association failing to implement their O&M plan). Permittees are also required to have a recordkeeping procedure for documenting the enforcement of the permittee's post-construction storm water control program. When developing this recordkeeping procedure, permittees shall make sure that detailed information about the enforcement action is adequately documented. Therefore, enforcement records should document the dates of the violations, how the violation was identified (during construction inspections, O&M inspections, referral, complaint, etc.), what actions the permittee took to address the violation (stop work orders, violation notices, civil and criminal penalties, etc.), and date that the violations were resolved.

**Timing of Program Implementation**

Permittees that have had coverage under previous MS4 permits already should have a post-construction storm water runoff control program in place as required by the previous permit; however, the current permit requires the program to include a treatment volume standard and channel protection criteria. The permittee's post-construction storm water runoff control program, including the treatment volume standard and the channel protection criteria, shall be developed, implemented, and enforceable no later than the due date indicated in the permittee's COC for an ordinance or other regulatory mechanism.

Please note that the MS4 permits allow options for achieving the treatment volume standard and the channel protection criteria ordinance or regulatory mechanism. The permittee's COC reflects a due date appropriate to the option associated with the permittee. A discussion of each option is provided in the *Minimum Treatment Volume and Channel Protection Requirements* section of this document.

Some permittees identified in the permit application an existing local ordinance or regulatory mechanism that implements a standard for storm water treatment and criteria for channel protection. If such is identified in the permittee's COC, the permittee shall continue to implement and enforce the standard for storm water treatment and criteria for channel protection through the identified ordinance or regulatory mechanism. It may be necessary, however, for the permittee to make additional program updates to meet all of the post-construction general requirements related to O&M, enforcement mechanisms, recordkeeping, and site plans.

*References*

Ardizone, Katherine A. and Mark A. Wyckoff, FAICP. *FILLING the GAPS: Environmental Protection Options for Local Governments*, Michigan Department of Environmental Quality Coastal Management Program with financial assistance from the National Oceanic and Atmospheric Administration, authorized by the Coastal Zone Management Act of 1972. June 2003.

Managing Stormwater in Your Community. A Guide for Building an Effective Post-Construction Program. Center for Watershed Protection. EPA Publication No.: 833-R-08-001. July 2008

*Minnesota Stormwater Manual*, 2006. Minnesota Pollution Control Agency, St. Paul, MN.

SEMCOG, the Southeast Michigan Council of Governments. *Low Impact Development Manual for Michigan: A Design Guide for Implementors and Reviewers*. 2008.

U.S. EPA. *MS4 Program Evaluation Guidance*. U.S. Environmental Protection Agency, Office of Wastewater Management. January 2007

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Revised April 12, 2010

## Appendix A

### Resource List

**90-Percent Annual Non-Exceedance Storms Memorandum**, March 24, 2006, Michigan Department of Environmental Quality (now Department of Natural Resources and Environment). [www.michigan.gov/degstormwater](http://www.michigan.gov/degstormwater), under the “Municipal Program/MS4 Compliance Assistance” link.

*This memorandum provides a statewide analysis, by region, for the 90 percent annual non-exceedance storms.*

**Computing Flood Discharges for Small Ungaged Watersheds**, July 2003 (updated June 2008), Michigan Department of Environmental Quality (now Department of Natural Resources and Environment). [www.michigan.gov/degstormwater](http://www.michigan.gov/degstormwater), under the “Municipal Program/MS4 Compliance Assistance” link, then the “Guidance for Calculating Runoff Volume and Peak Flow Rate” link.

*This report presents a method for computing flood discharges using unit hydrograph (UH) and Curve Number (CN) techniques. It contains the permit-specified methods for estimating pre- and post-development runoff volume and peak flow rate.*

**Guidebook of BMPs for Michigan Watersheds**, Michigan Department of Environmental Quality (now Department of Natural Resources and Environment). [www.michigan.gov/deqnps](http://www.michigan.gov/deqnps), under the “Technical Assistance” heading, click on the “BMP Design, Pollutants Controlled Calculation Assistance, and other Technical Manuals” link.

*This document contains design guidance for a suite of BMPs appropriate for Michigan. Site-level and watershed-level BMPs are included.*

**International Stormwater Best Management Practice (BMP) Database**, several sponsors, including the U.S. Environmental Protection Agency <http://www.bmpdatabase.org/>.

*The purpose of the site is to provide scientifically sound information to improve the design, selection, and performance of BMPs. Includes technical documents, software and a database developed over the past decade.*

**Low Impact Development Manual for Michigan: A Design Guide for Implementors and Reviewers**, Southeast Michigan Council of Governments. [www.semcoq.org/LowImpactDevelopment.aspx](http://www.semcoq.org/LowImpactDevelopment.aspx)

*This manual provides communities, agencies, builders, developers, and the public with guidance on how to apply LID to new, existing, and redevelopment sites. The manual provides information on integrating LID from the community level down to the site level. It outlines technical details of BMPs and provides a larger scope of managing storm water through policy decision, including ordinances, master plans, and watershed plans. Example ordinances, worksheets, and checklists are provided.*

**Post Construction Controls for Water Quality and Channel Protection**, Microsoft PowerPoint presentation, Michigan Department of Environmental Quality (now Department of Natural Resources and Environment) [www.michigan.gov/degstormwater](http://www.michigan.gov/degstormwater), under the “Municipal Program/MS4 Compliance Assistance” link.

*This Microsoft PowerPoint presentation (viewed with its associated notes) provides educational information helpful in understanding the water quality treatment volume standard and channel protection criteria requirements of the MS4 permits. Definitions and/or explanations are provided for such topics as stream channel stability, stream dimension, stream discharge, first flush, peak flow, and the impact of land development on hydrology. Descriptions and explanations also are provided for the calculations related to the water quality treatment volume standard and channel protection criteria requirements.*

**Rainfall Frequency Atlas of the Midwest**, Huff & Angel, NOAA Midwest Climate Center and Illinois State Water Survey, 1992  
[www.sws.uiuc.edu/pubdoc/B/ISWSB-71.pdf](http://www.sws.uiuc.edu/pubdoc/B/ISWSB-71.pdf).

*This is an acceptable source of rainfall data for calculating runoff volume and peak flow rate.*

**The National Pollutant Removal Performance Database, Version 3**, September 2007, Center for Watershed Protection.  
[www.cwp.org/Resource\\_Library/Center\\_Docs/SW/bmpwriteup\\_092007\\_v3.pdf](http://www.cwp.org/Resource_Library/Center_Docs/SW/bmpwriteup_092007_v3.pdf)

*The National Pollutant Removal Performance Database contains the expected percent reduction of TSS for many common BMPs. Version 2 of the database consisted of 139 individual BMP performance studies published through 2000. Version 3 updated the database with an additional 27 studies published through 2006.*

**TR-55**, U.S. Department of Agriculture, Natural Resources Conservation Service.  
[http://www.wsi.nrcs.usda.gov/products/W2Q/H&H/Tools\\_Models/WinTR-55.html](http://www.wsi.nrcs.usda.gov/products/W2Q/H&H/Tools_Models/WinTR-55.html)

*This hydrologic model can be used to calculate both runoff volume and rate. TR-55 uses the CN method to calculate volume of runoff and the UH method to calculate peak rate. Although TR-55 is a relatively simple model to run, some training in hydrology is recommended.*

## **Appendix B**

### *Example Ordinances*

#### Discussion

No single ordinance is perfect for each and every MS4 permittee. Nor is a single ordinance expected to wholly describe a permittee's post-construction storm water runoff control program. Enforceable requirements may be included in multiple ordinances or regulatory mechanisms. In addition, some program elements are procedural and may be better addressed in supplemental procedures to an ordinance or regulatory mechanism. Taking the aforementioned into consideration, two example post-construction storm water ordinances are provided on the following pages.

#### **Example 1**

This example ordinance is designed for a permittee following the default permit requirements for minimum treatment volume and channel protection (Parts I.A.8.a and b, of the MS4 Jurisdictional General Permit and Parts I.A.4.b.4.a and b, of the MS4 Watershed General Permit).

With the exception of a site plan requirement, the example ordinance includes the mandatory enforceable post-construction storm water elements of the MS4 permits. To assist permittees with evaluating how the example ordinance may be applicable to their own circumstances, shaded boxes have been added to provide additional comments and information. In addition, the shaded boxes note areas or topics that should have associated supporting documents, such as procedures or technical reference manuals. The shaded boxes are not intended to cover all elements appropriate to the post-construction storm water runoff control program. Such elements are described in the document preceding Appendices A and B.

Please be advised that the following comments do not constitute legal advice or a review of the legal validity of the example ordinance.

Ordinance

**ORDINANCE NO. 00-000**

An Ordinance to establish standards for the discharge of storm water in the City of XX.

**THE CITY OF XX ORDAINS.**

SECTION 1. PURPOSE

The provisions set forth in this ordinance have been set forth in order to assist in compliance with the Federal Phase 2 National Pollutant Discharge Elimination System (NPDES) storm water regulations, which are and will be administered by the State of Michigan. This administration is authorized by Michigan Public Act 451 of 1994, as amended, Part 31. The City of XX is subject to the requirements of this Act, and has been issued a jurisdictional general permit for discharges from

This ordinance references the MS4 Jurisdictional General Permit. Permittees with the MS4 Watershed General Permit should substitute "watershed" for "jurisdictional" here.

its Municipal Separate Storm Sewer System (MS4). Provisions of this ordinance are set forth to establish requirements for the management of storm water from new development and redevelopment throughout the City of XX to ensure consistency with state and federal regulations and administrative rules.

SECTION 2. APPLICABILITY

The requirements of this Ordinance shall apply to all new and redeveloped sites with projects that disturb one (1) acre or more, including projects less than one (1) acre that are part of a larger common plan of development or sale that would disturb one (1) acre or more. These requirements shall apply to all public and private sites within the City of XX, regardless of whether the storm water

The example ordinance references its applicability to all public sites within the municipality. A permittee may apply the post-construction storm water control requirements to its own properties via an internal procedure, if desired.

outlet(s) from the site discharge to a designated county drain, city storm sewer system, waters of the state, or any other type of conveyance. These requirements shall also apply to sites under the

By including discharges to designated county drains, the city storm sewer system, and waters of the state, the example ordinance is more restrictive than the MS4 Jurisdictional General Permit, which only regulates post-construction storm water discharges to the permittee's MS4. For a permittee with the MS4 Watershed General Permit, the ordinance or regulatory mechanism would need to regulate discharges to surface waters of the state (either from direct conveyance or via a separate storm sewer system) within the permittee's jurisdiction in the regulated area (watershed and urbanized area).

control of public agencies such as schools, federal and state governmental facilities, and other entities that might not otherwise be subject to site plan procedures and requirements set forth in other sections of the City's codified ordinances.

The MS4 permits mandate that the permittee's post-construction storm water runoff control program include a requirement for the project developer to write and implement site plans that incorporate the MS4 permits' post-construction control requirements. This requirement may be included in a single storm water ordinance or in other ordinances or regulatory mechanisms established by the permittee. The example ordinance makes reference to site plan requirements in other sections of the City's codified ordinance but there is not enough information to know if the site plan requirement for all development and redevelopment scenarios regulated by the MS4 permits is covered. When using a combination of ordinances or regulatory mechanisms for the site plan requirement the permittee must ensure that the combination covers all development and redevelopment scenarios regulated by the MS4 permits.

### SECTION 3. STANDARDS

All sites subject to the provisions of this ordinance shall be reviewed by the City Engineer, or other individual designated by the City of XX, for the following items:

- A. Minimum treatment volume standard. The minimum treatment volume standard shall be one inch of rainfall from the entire site. Treatment methods shall be designed on a site-specific basis to achieve either a minimum of 80 percent removal of total suspended solids (TSS) as compared with uncontrolled runoff or the limitation of discharge concentrations of TSS to no more than 80 milligrams per liter. A minimum treatment volume standard is not required where site conditions are such that TSS concentrations in storm water discharges will not exceed 80 milligrams per liter.

The example ordinance repeats the minimum treatment volume standard from Part I.A.4.b.4.a of the MS4 Watershed General Permit and Part I.A.8.a of the MS4 Jurisdictional General Permit. This is appropriate for an ordinance; however, the ordinance should have supporting documents, such as procedures or a technical reference manual, that explain how to ensure the minimum treatment volume standard is met. Information on this topic is presented preceding Appendices A and B.

B. Channel protection criteria. The channel protection criteria shall be established to maintain post-development site runoff volume and peak flow rate at or below existing levels for all storms up to the 2-year, 24-hour event. "Existing levels" shall mean the runoff volume and peak flow rate of the last land use prior to the planned new development or redevelopment. Evaluation of this standard shall be made by the applicant and reviewed by the City Engineer.

The example ordinance repeats the channel protection criteria from Part I.A.4.b.4.b of the MS4 Watershed General Permit and Part I.A.8.b of the MS4 Jurisdictional General Permit. This is appropriate for an ordinance; however, the ordinance should have supporting documents, such as procedures or a technical reference manual, that explain how to ensure the channel protection criteria are met. Information on this topic is presented preceding Appendices A and B.

C. Establishment of long-term operation and maintenance program. All structural and vegetative Best Management Practices (BMPs) installed to meet the requirements of this ordinance shall include a plan for maintaining maximum design performance through long-term operation and maintenance as a part of the application submittal. Where appropriate

The example ordinance references an application submittal through which O&M plans shall be submitted. Because all permittee's have locally-specific processes, the timing and venue for the O&M plan requirement will be permittee-specific. The key is that each permittee's ordinances or regulatory mechanisms (possibly supported by supplemental procedures) adequately identifies the O&M requirement and submittal process.

and necessary, the City of XX may require an easement for ongoing access to the facility, may require the facility itself to become a part of the public storm sewer system, or other requirements may be imposed as deemed necessary on a case-by-case basis. The City of XX shall retain all remedies available to it through other sections of the Code of the City of XX to address failure of the property owner to maintain all required BMPs, such as vegetated swales, sedimentation structures, and the like, as a public nuisance, blight, or other appropriate enforcement mechanism. Costs required for compliance shall be billed as a lien against the property as appropriate.

The MS4 permits require that the permittee require a plan of the project developer for maintaining maximum design performance through long-term O&M of post-construction storm water controls. To ensure that this long-term requirement is met, the permittee shall conduct tracking and recordkeeping. If the permittee chooses to pass any portion of the tracking/recordkeeping responsibility to the project developer, these tracking/recordkeeping requirements shall be identified in the permittee's ordinance or regulatory mechanism.

#### SECTION 4. VIOLATIONS AND PENALTY

- A. A violation of any of the provisions of this Ordinance shall be deemed a municipal civil infraction and subject to the payment of a civil fine determined in accordance with the following schedule:
- (1) First violation within a two-year period: \$100;
  - (2) Second violation within a two-year period: \$250; and
  - (3) Third or subsequent violation within a two-year period: \$500.
- B. The two-year period referenced in Subsection A shall be determined as of the date of the first violation. For illustrative purposes only: if the first violation occurs on July 1, 1999, the two-year period shall be from July 1, 1999, to June 30, 2001.
- C. Each day that a violation exists, occurs or continues constitutes a separate offense and shall be subject to the penalties or sanctions provided herein as a separate offense.
- D. Whoever violates this chapter shall also be subject to such additional sanctions, remedies, and judicial orders as are authorized and provided for under Michigan law.

The permittee shall have measures for resolving noncompliance when a project developer or BMP owner/operator is not achieving requirements of the post-construction storm water runoff control program. The ability to impose these enforcement measures shall be supported by the permittee's ordinances or regulatory mechanisms. Enforcement measures include, but are not limited to, right of entry for inspections, notices of violation, mandatory abatement, authorization of the permittee to conduct BMP maintenance and re-coup costs from the developer or BMP owner/operator when BMPs are not properly inspected and/or maintained, ability to issue civil penalties, and ability to issue monetary fines proportionate to the violation.

#### SECTION 5. SEVERABILITY

The various parts, portions, sections and clauses of this Ordinance are hereby declared to be severable. If any part, sentence, paragraph, section, phrase or clause is adjudged unconstitutional or invalid by a court of competent jurisdiction, the remainder of the Ordinance shall not be affected thereby.

## **SECTION 4. EFFECTIVE DATE.**

This Ordinance shall become effective 20 days after its passage and publication.

### **Example 2 Model Low Impact Development (LID) Storm Water Ordinance From the *Low Impact Development Manual for Michigan***

Appendix H of the *Low Impact Development Manual for Michigan* (SEMCOG, 2008) contains a model LID storm water ordinance. The LID Manual, with model ordinance, is available at [www.semco.org/LowImpactDevelopment.aspx](http://www.semco.org/LowImpactDevelopment.aspx). Permittees seeking a LID approach may wish to use this model as a foundation for developing their own post-construction storm water control ordinances or regulatory mechanisms.

**It is important to note that the model LID ordinance differs from the MS4 Jurisdictional General Permit and Watershed General Permit requirements in a number of areas and is not a “cookbook” or “plug and play” approach to meeting post-construction storm water control permit requirements. The model LID ordinance would require modifications to meet minimum MS4 permit requirements for an ordinance or other regulatory mechanism and the use of a number of parts of the model ordinance would require an alternative submittal to the Department for review and approval.**

The paragraphs and table below list areas of the model LID ordinance that may need modification in order to meet MS4 permit requirements for minimum water quality treatment volume and channel protection criteria. Due to the complexity of the model LID ordinance, the list is not all-inclusive. Permittees wishing to use the model LID ordinance must evaluate local conditions along with the model ordinance and the specifications in the permittee’s COC and MS4 permit to ensure that MS4 post-construction storm water control permit requirements for an ordinance or regulatory mechanism are sufficiently met.

Please be advised that the following comments do not constitute legal advice or a review of the legal validity of the example ordinance.

General Note #1: The process of reviewing and approving storm water plans stated in this ordinance may differ from a permittee’s existing process. Permittees should review and compare their existing submittal requirements to this ordinance and adopt the process most appropriate for the permittee in meeting permit requirements.

General Note #2: The channel protection and flooding standards presented in the LID Manual are based on maintaining the presettlement hydrologic response of the site. The MS4 Jurisdictional General Permit and Watershed General Permit require that, at a minimum, the current hydrologic response be maintained. Maintaining the presettlement condition is the most assured way to provide channel protection, but it is more restrictive than what the MS4 permits require (which is to maintain existing levels for the last land use prior to the planned new development or redevelopment). For permittees that wish to only meet the minimum permit requirements for channel protection criteria, the model ordinance language still may be used by substituting “existing” conditions for “presettlement” conditions.

**Comparison of the Model LID Storm Water Ordinance from the *Low Impact Development Manual for Michigan* to MS4 Permit Requirements for Post-Construction Storm Water Control**

Model Ordinance Section/Subsection Headings and Excerpted Ordinance Language	Department of Natural Resources and Environment Notes
Section 4.03 Standards for Storm Water Management Plan Approval	
Throughout Section 4.03	<i>Note:</i> The channel protection and flooding standards presented in the LID Manual are based on maintaining the presettlement hydrologic response of the site. The MS4 permits require that, at a minimum, the current hydrologic response be maintained. Maintaining the presettlement condition is the most assured way to provide channel protection, but it is more restrictive than what the MS4 permits require (which is to maintain existing levels for the last land use prior to the planned new development or redevelopment). For permittees that wish to only meet the minimum permit requirements for channel protection criteria, the model ordinance language still may be used by substituting “existing” conditions for “presettlement” conditions.
A. On-Site Storm Water Management	<p data-bbox="370 810 776 1024">4b. <i>Retaining this volume meets water quality criteria described in Number 6 below.</i></p> <p data-bbox="370 1024 776 1360">4c. <i>Those granted a waiver shall detain the runoff from storm events up to the one-year, 24-hour event and release over 24 hours.</i></p> <p data-bbox="370 1360 776 1696">5. <i>The following peak rate/flood control criteria shall be met. The peak discharge rate from all storms up to the 100-year, 24-hour event shall not be greater than presettlement discharge rates. Where the runoff volume is not increased from the presettlement condition, the peak rate corresponding to the same storms is considered controlled.</i></p>
B. Storm Water Credits for Onsite Stormwater Management	<i>Note:</i> Credits described in Section 4.03 B are not required to achieve design or performance criteria but may be helpful to communities to encourage the protection or enhancement of portions of a site for the purpose of reducing the amount of storm runoff generated from the land.
C. Waiver from Volume Control Criteria for On-	<i>Note:</i> The waiver criteria are based solely on the ability

<p>Site Storm Water Management</p>	<p>to infiltrate storm water. As the model ordinance is written, if the infiltration capacity is limited to the level of the waiver criteria, no volume reduction will be required and extended detention will be required instead as described in Part A, 4c. There is no recommendation to infiltrate up to the extent possible, store and reuse or evapotranspire through the use of proper vegetation and bioretention. Although some sites will have difficulty providing the entire volume reduction required in the MS4 permits, volume reduction could be maximized to the extent possible for the site and extended detention could be applied to the remaining volume increase from the development. Extended detention does not meet the channel protection requirements for volume reduction in the permits and would have to be considered as an alternative approach.</p> <p>Additional recommended criteria for waivers include:</p> <ol style="list-style-type: none"> <li>1. Whatever infiltration is available onsite is maximized.</li> <li>2. Capture and reuse is evaluated and considered impractical.</li> <li>3. Evaluate volume reduction through the use of self contained, underdrained bioretention or similar practice that captures storm runoff in soil or stone media for removal by plant uptake and evaporation.</li> </ol> <p>If a permittee chooses to structure their ordinance to meet the minimum permit requirements that maintain the predevelopment volume instead of the presettlement volume, the need for waivers is greatly reduced.</p>
<p>Section 4.07 Off-Site Storm Water Management</p>	
<p>Throughout Section 4.07</p>	<p><i>Note:</i> If the volume control criteria from the permit cannot be met on the site it will most often be healthier for the river channel to apply the volume control requirements from the MS4 permits to a small watershed level than to request a waiver and provide a reduced level of control at the site level. This approach is more consistent with the channel protection permit requirement than the use of extended detention. Such an approach would need to be submitted as an alternative in the SWPPI or SWMP.</p>