Stormwater Best Management Practice

Post-Construction Plan Review

Minimum Measure: Post Construction Stormwater Management in New Development and Redevelopment
Subcategory: Municipal Program Elements

Description

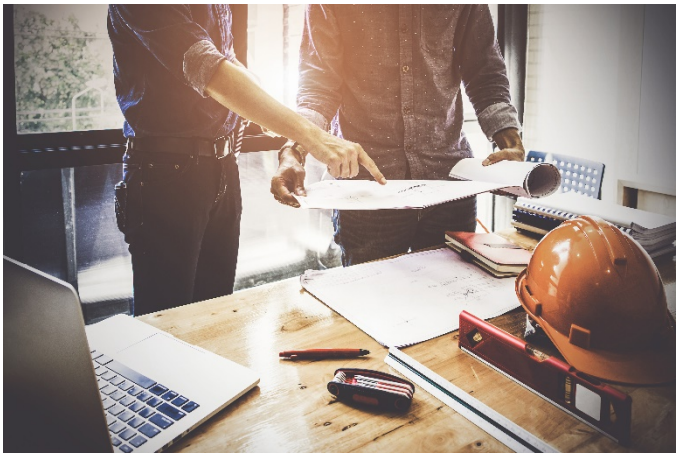
Municipal separate storm sewer system (MS4) permittees should develop and implement strategies that combine structural and/or non-structural practices appropriate for the community, develop ordinances or other regulatory mechanisms to address post-construction stormwater discharges from new and redevelopment projects, and ensure adequate long-term operation and maintenance of stormwater controls. To do this, municipalities implement a thorough review process to ensure development plans minimize water quality impacts from the site after construction is complete.

Development can alter landscapes by increasing impervious surfaces—such as roofs, driveways and parking lots—and changing drainage patterns. This increases the volume and rate of stormwater discharges, which degrades receiving waters and increases flooding. Stormwater from developed impervious areas can also contain a variety of pollutants that are detrimental to water quality, such as sediments, nutrients, deicing materials, heavy metals, pathogenic bacteria and petroleum hydrocarbons.

Considering water quality impacts early in the design process can provide long-term water quality benefits. For example, a project that uses biofiltration and reduces impervious surfaces should decrease a site's stormwater discharges. New development projects on undeveloped land offer many opportunities to reduce a site's stormwater discharges. Redevelopment projects, which replace an existing development and are typically in more urban areas, can have less land area available for stormwater controls; however, these projects can implement smaller-scale stormwater controls to treat and reduce a site's stormwater discharge volumes.

Development Plan Review Process

Each municipality has its own process to review and approve development plans. However, the following elements have helped ensure that municipalities address water quality early in the development plan review process:



Engineers reviewing plans.

1. Education and training on green infrastructure and post-construction stormwater controls
2. Pre-submittal meetings with developers/engineers
3. Review of conceptual and design plans

Education and Training on Green Infrastructure and Post-Construction Stormwater Controls

A critical aspect in reviewing post-construction plans is training plan review staff. Staff should be familiar with stormwater standards, site design techniques, construction issues and a wide variety of stormwater management practices to ensure projects meet all applicable requirements and effectively control stormwater discharges.

In addition, municipalities should educate developers and engineers on the post-construction requirements and options available to meet those requirements—such as how to use green infrastructure practices, as well as how to choose effective post-construction stormwater controls that integrate with/complement development projects and provide desired outcomes for stormwater management. For example, the Philadelphia Water Department (2018) developed a *Green Stormwater Infrastructure Planning & Design Manual* to educate

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engineers and developers on innovative approaches to land development and stormwater management. Numerous other online repositories of information are also available, such as:

- EPA's low impact development site
- EPA's green infrastructure site
- The International Stormwater BMP Database

Pre-Submittal Meetings with Developers/Engineers

Early interaction with developers and engineers is important to address stormwater management at the beginning stages of project planning. Pre-submittal meetings are a good opportunity to discuss post-construction requirements and issues, including green infrastructure, locations of sensitive areas and other issues critical to stormwater. These meetings enable the municipality to encourage more natural practices that reduce the volume, velocity and pollutant load of stormwater discharges.

Review of Conceptual and Final Design Plans

At any development site, the design engineer should prepare a conceptual plan that identifies basic site information, locations of proposed development features, and preliminary locations and sizing of stormwater controls based on calculations of the site's stormwater discharges. After an MS4 permittee reviews and approves a conceptual plan, the design engineer should prepare a final plan that provides more detailed design information for stormwater controls and much more detailed information on hydrologic conditions and site features. The design engineer should address post-construction stormwater discharges in both the conceptual and final design plan stages. Municipal staff should ensure that, to the extent practical, conceptual plans include preservation of natural areas, minimization of impervious surfaces and promotion of green infrastructure. This will ensure that design engineers consider appropriate approaches as early in the design process as possible and integrate them into final designs.

Elements to Look for in an Effective Development Plan

Pre- and Post-Development Hydrologic Analysis

The Phase II Rule includes guidance that selected stormwater controls should "attempt to maintain pre-development runoff conditions." A hydrologic analysis or drainage report that considers both pre- and post-development stormwater discharges usually addresses the following storm sizes:

- The 1-year or 2-year storm, also known as the "water quality storm," to protect natural channels from erosion.
- The 10-year or 25-year storm to size storm drainage infrastructure.
- The 100-year storm to address flooding.

The North Central Texas Council of Governments has developed an "integrated Stormwater Management" or iSWM program for construction and development. Chapter 5 of the *iSWM Criteria Manual* has checklists of information that municipal staff should consider when reviewing conceptual plans and final design plans (North Central Texas Council of Governments, 2014).

Identification of Green Infrastructure Opportunities to Reduce Stormwater Volume and Peak Flow Rate

Project designer engineers should attempt to mimic a site's natural hydrology after development by following better site design principles, including on-site retention; minimizing the project's impervious footprint; conserving natural areas; and minimizing directly connected impervious areas. These types of practices encourage infiltration and reduce the volume of stormwater discharges from the site.

Practices include:

- Using permeable pavers or green parking.
- Constructing right-sized residential streets and following innovative street design and patterns.
- Eliminating curbs and gutters.
- Installing green roofs.
- Using bioretention (rain gardens).

- Incorporating infiltration basins or infiltration trenches into the design.

Identification of Pollutants of Concern

Municipal staff should ensure that project design engineers identify the expected pollutants of concern at the site after development so that they select the most appropriate stormwater controls to address those pollutants. The design engineers can determine the pollutants of concern by considering the site's post-development land use and specific water quality concerns associated with any downstream waterbodies, such as total maximum daily load programs. Sediments, nutrients, oxygen-demanding substances, bacteria, and oil and grease are among the most common pollutants found in stormwater discharges after site development. For general land use relationships, Appendix J of the *County of San Diego BMP Design Manual* contains information about the pollutants that sites are most likely to generate by land use type after development. In all cases, design engineers should determine local water quality concerns associated with downstream waterbodies.

Identification of Pollution Prevention Measures

MS4 permittees should review projects to ensure that the initial design includes measures that minimize and control pollutant sources. Pollution prevention measures are usually the most cost-effective methods for controlling stormwater pollution and can include:

- Providing storm drain stenciling and signage.
- Designing outdoor material storage areas to minimize exposure to stormwater.
- Designing trash storage areas to minimize exposure to stormwater.
- Using efficient irrigation systems and landscape design.
- Designing vehicle and equipment wash areas to minimize discharges to the storm drain.
- Designing fueling areas to prevent spills and exposure to stormwater.

Identification of Post-Construction Stormwater Controls

Design engineers should select and design the structural and non-structural stormwater controls to control the pollutant(s) of concern and size the structural stormwater controls to control the discharges from a storm size specific to the area. Structural treatment controls can fall into a few categories that generally include but are not limited to:

- Filtering practices
- Infiltration practices
- Wet ponds or wetlands
- Micro practices

Design engineers should select stormwater controls based on their effectiveness in reducing the identified pollutants of concern at the project. For example, filtering practices (especially those with multiple types of filter media) can be highly effective at removing total suspended solids (TSS), bacteria, metals, nitrogen and phosphorus. Infiltration practices are also highly effective at removing TSS, bacteria and phosphorus and reducing the total volume of stormwater discharges. However, if an infiltration practice does not contain a permanent pool of water or a zone of regular saturation, it may not be effective at removing nitrogen (NHDES, 2011). Wet ponds and wetlands are effective stormwater controls for removing TSS, bacteria, phosphorus and nitrogen.

The International Stormwater BMP Database contains detailed information about pollutant removal rates for common types of stormwater controls and can help design engineers determine the effectiveness of potential treatment practices for pollutants of concern.

Provide Protocols for Long-Term Operation and Maintenance of Stormwater Controls

The *Stormwater Management Manual for Western Washington: Volume IV—Source Control BMPs* provides good examples of both structural and non-structural stormwater controls for pollutant-specific sources.

Stormwater controls are not effective without proper maintenance. Therefore, the municipality-approved plan should address who will be responsible for ongoing maintenance of stormwater controls. The MS4 permittee, property owner, or an association or special district can conduct maintenance. They should record a maintenance agreement with the property that contains

the proof of maintenance. This maintenance agreement should contain the following information:

- A description of routine maintenance requirements
- Schedules for maintenance
- Inspection requirements
- Provisions for the municipality to access stormwater controls
- Penalties for failure to maintain stormwater controls
- A provision to legally record the maintenance agreement

The municipality will need to periodically assess the maintenance of stormwater controls.

Additional Information

Additional information on related practices and the Phase II MS4 program can be found at EPA's National Menu of Best Management Practices (BMPs) for Stormwater website

References

New Hampshire Department of Environmental Services (NHDES). (2011). *Pollutant removal efficiencies for best management practices for use in pollutant loading analysis.*

North Central Texas Council of Governments. (2014). *iSWM criteria manual for site development and construction*.

Philadelphia Water Department. (2018). *Green stormwater infrastructure planning & design manual.*

Disclaimer

This fact sheet is intended to be used for informational purposes only. These examples and references are not intended to be comprehensive and do not preclude the use of other technically sound practices. State or local requirements may apply.