

Chapter 4: Post Construction Water Quality Best Management Practices

4.1 Introduction to Storm Water Quality

Under the regulations governing the NPDES Storm Water Phase II program, Montgomery County is required to develop and implement a post-construction storm water quality program. The County's storm water quality program has been developed with input from stakeholders' groups and after investigating other storm water quality programs. This chapter provides design criteria and information for storm water quality best management practices, or BMPs, to be included in storm water quality plans.

Runoff water quality in urban areas can be extremely detrimental to local fish and wildlife habitat. Paved surfaces and standing water bodies constructed for storm water management control can elevate the temperature of water entering streams. Chemicals in standing water and ponds are oxidized, resulting in depressed levels of dissolved oxygen. Increased runoff volumes and rates create scour and deposition damage to in-stream habitat. Activities in urbanized areas, such as vehicular traffic, deposit pollutants such as heavy metals and oil and grease on paved surfaces where they easily wash off into the streams. Storm water quality best management practices, both structural and non-structural, can reduce the amount of pollutants in storm water.

BMPs noted in this chapter refer to the post-construction BMPs listed in Chapter 4 of this manual, installed after the site has been stabilized. Installing certain BMPs, such as bioretention areas and sand filters, prior to stabilization can cause failure of the measure due to clogging from sediment. However, with a strict construction sequence, detention ponds and other BMPs can be installed initially during construction and used as sediment control measures. In those instances, the construction sequence must require that the pond be cleaned out with pertinent elevations and storage and treatment capacities reestablished as noted in the approved storm water management plan. The final as-built certification must verify that final elevations and volumes are established as outlined in the approved Storm Water Quality plans.

Various BMPs will have different rates of effectiveness. For most BMPs, the goal is to discharge clear storm water with no visible pollutants and no known sources of man-made pollution (such as toxic substances, chemicals or fertilizers). The objective is to establish a baseline for pollution removal goals to evaluate the storm water treatment BMPs, especially manufactured BMP systems, oil/water separators, or other methods of treating storm water runoff.

There is a three-step approach to achieving higher water quality. The first step is large-scale prevention of pollution from entering or even contacting any storm water runoff. The second step is removal of the visible components of storm water runoff pollution, such as coarse sediment, oil and grease, bulk materials, and floating debris. The third step is the treatment and removal of the less obvious pollutants in storm water runoff, such as fine sediment, nutrients, and heavy metals from automotive emissions.

Montgomery County requires that the "first flush" volume must be detained and treated in some manner. The first flush represents the early stages of a storm event, which usually delivers a large amount of accumulated pollutants and sediments that have been deposited since the last

storm event. In actuality, it is not possible to predict the manner in which rainfall will come. The first flush may be a steady drizzle that slowly dissolves oil, grease or other automotive combustion byproducts from the streets, or it may be a heavy downpour that really does flush all sediments and accumulated particulates down the storm drain.

The first flush volume is defined as one-half inch of direct runoff over the entire contributing drainage area with a minimum value of 4500 cubic feet. First flush volume is released over a minimum time period of 24 hours. As a frame of reference, first flush volumes are widely required throughout the United States and generally depend on the types of local rainfall patterns.

4.2 Storm Water Quality Control Requirements

The County has adopted the following requirements pertaining to storm water quality permits:

- 1) The control of storm water runoff quality County-wide is based on the management of total suspended solids (TSS). This requirement is being adopted as the basis of the County's storm water quality management program for all areas of the County. The target TSS removal rate is 80%. A listing of post-construction control BMPs is provided in Chapter 4 that either fully meet the 80% TSS reduction goal or that partially meet the goal. It should also be noted that control of sediment is required for construction site runoff County-wide.
- 2) All new development and significant redevelopment affecting one acre or more of land must obtain a storm water quality permit.
- 3) All new hot spot type developments, such as car washes, car maintenance facilities, restaurants and other land uses characterized as priority locations (hotspots), must obtain a storm water quality permit, regardless of disturbance size.
- 4) New residential developments that limit the imperviousness of the entire development to 15% or less are not required to implement any additional structural storm water quality BMPs. However, developers choosing this option must develop permanent restrictive covenants for the development and must record the restrictive covenant with the Register of Deeds. Copies of the recorded restrictive covenants must be submitted to the Montgomery County Building and Codes Department with the storm water quality plan. Residential developments meeting these criteria must also use vegetated channels and ditches to convey runoff instead of pipes or hardened channels.

4.3 Storm Water Quality Permits

New development and redevelopment within Montgomery County may require a storm water quality permit as well as a grading permit. The storm water quality permit shall be in conformance with the provisions of the Storm Water Resolution and is required prior to the

commencement of any development activities. The storm water quality permit is issued separately from the grading permit but the storm water quality permit application should be submitted at the same time as the grading permit application, except in where exempted. Additional permits may be required by state or federal agencies and copies of any necessary permit applications for these agencies shall be submitted to the Montgomery County Storm Water Program for record keeping.

Except for exempted activities, a building permit cannot be issued until a storm water quality plan has been approved by the Montgomery County Storm Water Program, and the Storm Water Coordinator has issued a storm water quality permit. When non-exempt new development or redevelopment activities do not require a building permit, a storm water quality permit may still be required. The Storm Water Coordinator retains the authority to remove storm water quality permit exemptions should development be found in violation of the exemption criteria.

In addition, none of the following documents shall be issued or granted under the application zoning or other laws unless and until a storm water quality plan has been approved by the Street Montgomery County Storm Water Program as applicable:

1. Final approval for a proposed subdivision by the Regional Planning Commission.
2. Final approval for a proposed PUD by the Regional Planning Commission.
3. Building permit(s) issued by the Building and Codes Department.
4. Grading, drainage and erosion control plan by the Montgomery County Storm Water Program.

Any of the above shall be applied for and submitted at the same time as the storm water quality permit application. “Conditional final approval” does not constitute “final approval” under this section.

Storm water quality permits are required for all hot spot (pollution priority sites). Hot spot land uses are defined in the Storm Water Management Ordinance as the following land uses:

- Restaurants
- Car maintenance facilities
- Gas stations
- Car washes
- Lawn care companies
- Commercial nurseries
- Dry cleaning companies
- New or used car sales, and
- Other land uses where the potential for storm water pollution is high, as determined by the Building Commissioner or his Qualified Designee.

New developments requiring a storm water quality permit must first submit a storm water quality plan to the Montgomery County Building and Codes Department, prepared by a competent professional, as appropriate under state law. Storm water quality plans may require a project team, including engineering, soils, vegetation, and water quality professionals. Methods used shall be consistent with the procedures in this manual unless otherwise approved by the Building Commissioner.

4.4 Storm Water Permit Exemptions

Exemption for Agricultural Practices: No storm water quality permit shall be required for accepted agricultural land management practices such as plowing; cultivation; construction of agricultural structures; nursery operations such as the removal of or transplanting of cultivated sod and trees; tree cuttings at or above existing ground level; and logging operations leaving the stump, ground cover, and root mat intact. However, agricultural practices shall adhere to agricultural best management practices to prevent storm water pollution to the extent practicable and feasible.

Exemption for Residential Additions, Modifications and Accessory Structures: No storm water quality permit shall be required for construction of accessory structures related to single family residential, duplex dwellings or their accessory buildings authorized by a valid building permit, unless said construction results in increased runoff flow, sedimentation deposition, and/or debris deposition onto adjacent properties.

4.5 Storm Water Quality Plans

Storm water quality plans must include or address the following, at a minimum, to be considered complete:

- 1) A breakdown of the anticipated pervious/impervious acreage (in percentages) for the fully developed site. The impervious acreage must include driveways (paved or graveled), new roads (including roads to be upgraded), roofs, walkways, patios, decks and out buildings.
- 2) A description of how the proposed storm water management system(s) will be designed, constructed, maintained and operated to:
 - a. Enhance the quality of runoff through the application of best management practices (BMPs) to maximize the infiltration on site by minimizing impervious surfaces, minimizing conveyance through hardened, impervious channels and conduits, and distributing flow through vegetative buffers and/or wetlands;
 - b. Extend the time of concentration of storm water runoff to the maximum practical level;

- c. Preserve and protect natural drainage way(s) (piping or channeling natural drainage ways and water courses is prohibited);
 - d. Respect the practical limits of public and private storm drainage facilities and protect other properties from unreasonable adverse effects resulting from development.
- 3) A vicinity map and USGS topographic map excerpt identifying the drainage area(s). Drainage areas must be identified for the site and for downstream structures.

4.6 Water Quality Volume Calculations

Storm water quality BMPs must be designed to treat the water quality volume (WQv). The goal of the water quality treatment volume is to capture the majority of pollutants in urban runoff. Approved BMPs listed in Chapter 4 are based upon meeting an 80 percent total suspended solids reduction from typical urban runoff for the 85th percentile storm event, meaning that they are designed to capture and treat approximately 85 percent of the annual storm water runoff volume. The calculation for determining the WQv is provided below:

Water Quality Volume (WQv)

$$(P)(Rv)(A)/12$$

Where:

P = 85% rainfall event, 1.1 inches

Rv = runoff coefficient

A = site area, acres and

Rv = 0.05 + 0.009(I)

Where:

I = site imperviousness in percent

Note that the water quality volume is directly proportional to the imperviousness of a site. While this manual does not address better site design practices that can be employed to reduce the overall imperviousness, the following site design principles should be incorporated into new development planning and design.

Residential Streets and Parking Lots:

- 1) Design streets for the minimum possible pavement width.
- 2) Reduce the total residential street length by examining alternative street layouts.
- 3) Use vegetated open channels where possible instead of hardened channels or pipes.
- 4) Incorporate landscaped areas into cul-de-sacs and direct runoff into these areas.

- 5) Integrate filter strips and bioretention areas into required landscape areas and use these to treat parking lot runoff where possible.

Lot Development:

- 6) Protect natural areas.
- 7) Connect open spaces instead of fragmenting them.
- 8) Locate sidewalks on only one side of a street instead of two.
- 9) Direct rooftop runoff into pervious areas instead of onto sidewalks, driveways or streets.

Conservation of Natural Areas:

- 10) Create a variable width stream buffer system beyond the requirements of the County's water quality buffer requirements. Incorporate sensitive features, such as floodplains, wetlands and sinkholes.
- 11) Limit clearing in natural areas.
- 12) Discharge sheet flow into natural areas.

4.7 Structural Best Management Practices

In BMPs, pollutant removal is achieved through a number of mechanisms. Understanding pollution removal mechanisms is important when developing a BMP design to meet a pollutant reduction goal. Some pollutants are water soluble, while others adhere to solids. Therefore, one BMP may employ several different pollutant reduction mechanisms to effectively treat urban storm water runoff. Pollutant reduction mechanisms include the following:

- 1) **Infiltration** – Storm water seeps into porous soils. The soils act as a filtering mechanism, removing pollutants as runoff infiltrates.
- 2) **Deposition** – Sediments and other solids settle out as runoff is detained/retained in a BMP. Some pollutants adhere to solids. However, these solids accumulate and must be periodically removed.
- 3) **Microbes** – Microbial action within the soil works to break pollutants down into useable forms.
- 4) **Filtration** – Vegetation acts as a filtering system to remove solids and pollutants that adsorb to solids.

- 5) **Plant Take-up** – Plants within a BMP are key in nutrient reduction, such as nitrogen and phosphorus. However, plants must be harvested and removed to actually remove the pollutants from the BMP.

4.8 Selection Criteria

When developing the BMP plan, consider the land use, imperviousness of the contributing watershed, maintenance needs and general acceptance of the BMP. Each BMP description in the subsequent sections outlines such determining factors to aid in the plan development.

While most BMPs have a pollutant removal capable of meeting or exceeding the 80% TSS reduction goal, several do not. Some BMPs must be “chained” or used in conjunction with other BMPs together as BMPs to meet the overall reduction goal of 80% TSS treatment goals. For example, filter strips alone do not meet the overall reduction goal. However, filter strips combined with an infiltration trench will effectively meet the required goals.

Some structural BMPs are not pre-approved for use in the County but can potentially meet the County’s storm water quality goals. Additional supporting information will be needed to support the pollutant reduction ability as well as the maintenance requirements, and will be reviewed on a site-by-site basis.

4.9 Innovative BMPs

Unapproved BMPs must be professionally certified. ASTM standard methods must be followed when verifying performance of new measures. New BMPs must meet the 80% TSS removal rate based upon the target water quality volume treatment requirements, and must have a low to medium maintenance requirement to be considered by the County. Testing to establish the TSS removal rate must be conducted by an independent testing facility, not the BMP manufacturer.

4.10 Operation and Maintenance Agreement

Maintenance, ownership and legal liability for installed storm water control structures and BMPs will remain the responsibility of the landowner (original developer, builder, etc.), unless and until the landowner transfers ownership to another party (i.e.: a homeowners association or individual landowner). Transfer of ownership will also transfer maintenance responsibility and legal liability for the structure. This transfer must include the submission of an approved, signed Storm Water Maintenance Agreement to the Montgomery County Building and Codes Department. A copy of the approved Montgomery County Storm Water Maintenance Agreement can be found on the Montgomery County Storm Water Website.

4.11 Storm Water Quality BMPs and Mosquito Control

Some storm water quality BMPs either provide permanent sources of water or hold storm water over an extended period of time, and can therefore contribute to mosquito problems through providing a breeding habitat. However, if the BMPs are properly designed, installed, and maintained, mosquito problems can be minimized. The following controls should be considered when determining the appropriate BMP for each development:

- 1) BMPs with open ponding water (such as storm water ponds) may need aeration or some other means of water movement through artificial means. Mosquitoes breed in stagnant water, but moving water or surface disturbances discourage mosquito breeding.
- 2) Mosquito breeding cycles cannot be completed in fewer than 72 hours. Therefore, BMPs should discharge storm water rapidly. Completely draining a BMP in fewer than 72 hours can minimize mosquito problems by breaking the breeding cycle.
- 3) Good maintenance and monitoring of water-holding BMPs is essential. For instance, discharge orifices should be monitored for debris or sediment clogging *weekly* in the summer months when mosquito breeding peaks
- 4) Since loose riprap may hold small pockets of water over a long period and provide mosquito breeding habitats, consider concrete grouting around riprap to prevent pooling, while maintaining the benefits of the riprap energy dissipation.
- 5) Consider introducing *Gambusia affinis* (mosquitofish) into storm water ponds. They feed on immature mosquitoes.
- 6) Only use mosquito larvicides to control mosquitoes as a last resort.

For more information about BMPs and mosquito control options consult the following source: Metzger, Marco M. "Managing Mosquitoes in Stormwater Treatment Devices." University of California at Davis—Division of Agriculture and Natural Resources, <http://anrcatalog.ucdavis.edu/pdf/8125.pdf>. Publication 8125, 2003.