

Functional Categories of Structural Stormwater BMPs

This section introduces the following major categories and types of structural stormwater BMPs that are recommended for use in Connecticut, based on their primary function:

- Pretreatment BMPs
- Infiltration BMPs
- Filtering BMPs
- Stormwater Pond BMPs
- Stormwater Wetland BMPs
- Water Quality Conveyance BMPs
- Stormwater Reuse BMPs
- Proprietary BMPs
- Other BMPs and BMP Accessories

Selection, design, construction, and maintenance considerations for structural stormwater BMPs are addressed in later sections of this Manual.

Pretreatment BMPs

Pretreatment BMPs remove coarse sediment and debris (e.g., trash, leaves, floatables) upstream of another structural stormwater BMP, while consolidating maintenance to a specific location. Properly designed Pretreatment BMPs help preserve pollutant removal efficiency, extend service life and reduce maintenance costs of the main stormwater BMP. All pretreatment practices require regular maintenance to function properly.

Pretreatment BMPs can be designed as an integral component of another BMP, such as a sediment forebay within another practice, or as a separate structure preceding the main stormwater BMP, such as an upstream structure or proprietary device. Pretreatment BMPs can also be configured as on-line or off-line. On-line systems are designed to treat the applicable Water Quality Volume or Water Quality Flow and safely convey larger flows through the system. Off-line systems are designed to treat a specified discharge rate or volume, such as the Water Quality Volume or Water Quality Flow, and bypass larger flows. Pretreatment BMPs addressed in this Manual include:

- Sediment Forebay
- Pretreatment Vegetated Filter Strip
- Pretreatment Swale
- Flow-through Devices
 - Deep Sump Hooded Catch Basin
 - Oil Grit Separator
 - Proprietary Pretreatment Device

Pretreatment BMPs are only suitable as pretreatment for other stormwater BMPs and cannot be used alone to meet the retention or treatment performance criteria, except for proprietary pretreatment devices. When designed to achieve the minimum required pollutant load reductions described in [Chapter 4 - Stormwater Management Standards and Performance Criteria](#), proprietary devices can be used for stormwater treatment.

Infiltration BMPs

Infiltration BMPs reduce stormwater runoff volumes and pollutant loads, and help to recharge groundwater, by capturing, temporarily storing, and infiltrating stormwater in permeable soils below the bottom of the BMP. Pollutant removal occurs through physical filtering, adsorption of pollutants onto soil particles, and subsequent biological and chemical conversion in the soil. Infiltration practices must be carefully designed and maintained to prevent clogging and system failure. Infiltration BMPs addressed in this Manual include:

- Infiltration Trench
- Underground Infiltration System
- Infiltration Basin
- Dry Well
- Infiltrating Catch Basin
- Permeable Pavement

Unlike the Filtering BMPs described in the next category, the Infiltration BMPs in this category are not designed with underdrains (unless located in Hydrologic Soil Group C or D soils) and therefore are not considered “filtering” practices. Infiltration BMPs can be used to meet the retention and treatment performance criteria and can also be designed for stormwater quantity control.

Filtering BMPs

Filtering BMPs treat stormwater runoff by capturing, temporarily storing, and filtering stormwater through sand, soil, organic material, or other porous media. As the water flows through the filter media, sediment particles and attached pollutants, as well as some soluble pollutants, are removed through physical straining and adsorption. The filtered water is then collected via an underdrain and discharged back to the drainage system or to a receiving waterbody. Pretreatment is generally required to remove debris and floatables and to prolong the service life of the filter media.

Filtering BMPs are generally less cost-effective than Infiltration BMPs and therefore are typically used where site characteristics limit the use of Infiltration BMPs, such as in areas with low permeability soils, where minimum setback distances cannot be met, or where infiltration of stormwater may contaminate groundwater. Each of these filtering practices can be designed as infiltration systems (i.e., exfiltration into the underlying soils) using a raised underdrain and when used in areas with sufficiently permeable soils. Filtering BMPs addressed in this Manual include:

- Bioretention
- Sand Filter
- Tree Filter

Unless specifically designed for infiltration, Filtering BMPs do not provide significant retention or runoff volume reduction and therefore may not fully meet the retention performance criterion.

Filtering BMPs are suitable for providing treatment in combination with other BMPs or in situations where the retention performance criterion cannot be fully achieved.

Stormwater Pond BMPs

Stormwater ponds maintain either a permanent pool of water or a combination of a permanent pool and extended detention. The permanent pool of water in these systems enhances pollutant removal through mechanisms such as sedimentation, biological uptake, microbial breakdown, gas exchange, volatilization, and decomposition. This category of stormwater ponds does not include traditional dry detention basins or dry flood control basins, which do not provide significant water quality treatment functions. Stormwater Pond BMPs addressed in this Manual include:

- Wet Pond
- Micropool Extended Detention Pond
- Wet Extended Detention Pond
- Multiple Pond System

Stormwater ponds do not provide sufficient retention or runoff volume reduction through infiltration or other processes and therefore cannot be used to meet the Standard 1 retention performance criterion of this Manual. Stormwater ponds are suitable for treatment and stormwater quantity control.

Stormwater Wetland BMPs

Stormwater wetlands are constructed wetland systems designed to treat polluted stormwater runoff by several mechanisms, including sedimentation, adsorption, biological uptake, photodegradation, and microbial breakdown. Stormwater wetlands typically include sediment forebays, shallow and deep pool areas, meandering flow paths, and vegetative measures to enhance pollutant removal. Stormwater wetlands are engineered specifically for pollutant removal and flood control purposes. They typically do not have the full range of ecological functions of natural wetlands or wetlands constructed for compensatory storage or wetland mitigation. Stormwater Wetland BMPs addressed in this Manual include:

- Subsurface Gravel Wetland
- Shallow Wetland
- Extended Detention Shallow Wetland
- Pond/Wetland System

Stormwater wetlands do not provide sufficient retention or runoff volume reduction through infiltration or other processes and therefore cannot be used to meet the Standard 1 retention performance criterion of this Manual. Stormwater wetlands are suitable for treatment and stormwater quantity control.

Water Quality Conveyance BMPs

Water Quality Conveyance BMPs include several types of water quality swales. Water quality swales reduce the velocity of, and temporarily store, stormwater runoff and promote infiltration. Pollutant removal mechanisms in water quality swales are similar to constructed wetlands and include sedimentation, adsorption, biological uptake, and microbial breakdown. These practices differ from conventional grass channels and ditches that are designed for conveyance only, as they provide higher levels of pollutant removal. Water Quality Conveyance BMPs addressed in this Manual include:

- Dry Water Quality Swale
- Wet Water Quality Swale

Given their reliance on infiltration, dry water quality swales can be used for stormwater retention, while wet water quality swales are generally more suitable for treatment.

Stormwater Reuse BMPs

Stormwater Reuse BMPs, also commonly called “stormwater or rainwater harvesting and use” are designed to collect, store, potentially treat, and later use the water to meet various demands such as landscape irrigation. Less common uses include drinking, washing, cooling, and flushing. Stormwater Reuse BMPs addressed in this Manual include:

- Rain Barrel
- Cistern

Stormwater Reuse BMPs reduce the volume of runoff from a site and therefore can be used for meeting the retention performance criterion. Small-scale Stormwater Reuse BMPs (i.e., rain barrels) alone may be insufficient to retain the runoff volume required to fully meet the retention performance criterion.

Proprietary BMPs

Proprietary stormwater BMPs are manufactured systems that use proprietary settling, filtration, absorption/adsorption, vortex principles, vegetation, and other processes to remove pollutants from stormwater runoff. The most common types of proprietary

BMPs include hydrodynamic separators, filtration systems, wet vaults, and catch basin inserts. Underground storage and infiltration systems are not considered proprietary BMPs since treatment typically occurs in the soil below the structure, not in the structure itself. Proprietary BMPs may be used for pretreatment (in conjunction with other BMPs) or as stand-alone treatment; however, proprietary BMPs alone cannot be used to meet the stormwater retention performance criterion since they generally do not reduce runoff volumes. [Chapter 11 - Proprietary Stormwater BMPs](#) of this Manual addresses criteria for evaluating the use of proprietary BMPs when proposed as stand-alone treatment, including existing systems and emerging/innovative systems and new technologies.

Other BMPs and BMP Accessories

This Manual includes other common structural practices that are used as part of an overall stormwater management system:

- Green Roof
- Dry Extended Detention Basin
- Underground Detention (no infiltration)
- Inlet and Outlet Controls

Green roofs can be used for on-site retention, thereby reducing runoff volumes and peak runoff rates, but are generally not used for stormwater treatment because they capture rainwater that falls directly on the roof surface before it encounters pollutant sources or nearby sources of pollution may perpetually deposit pollutants on all surfaces. Dry extended detention basins and underground detention systems are designed to provide peak runoff attenuation through surface and subsurface storage, respectively, but do not provide sufficient levels of pollutant removal or infiltration to meet stormwater treatment or retention goals. Inlet and outlet controls measures manage runoff into and out of structural stormwater BMPs.