pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Clean Water

Managed Release Concept

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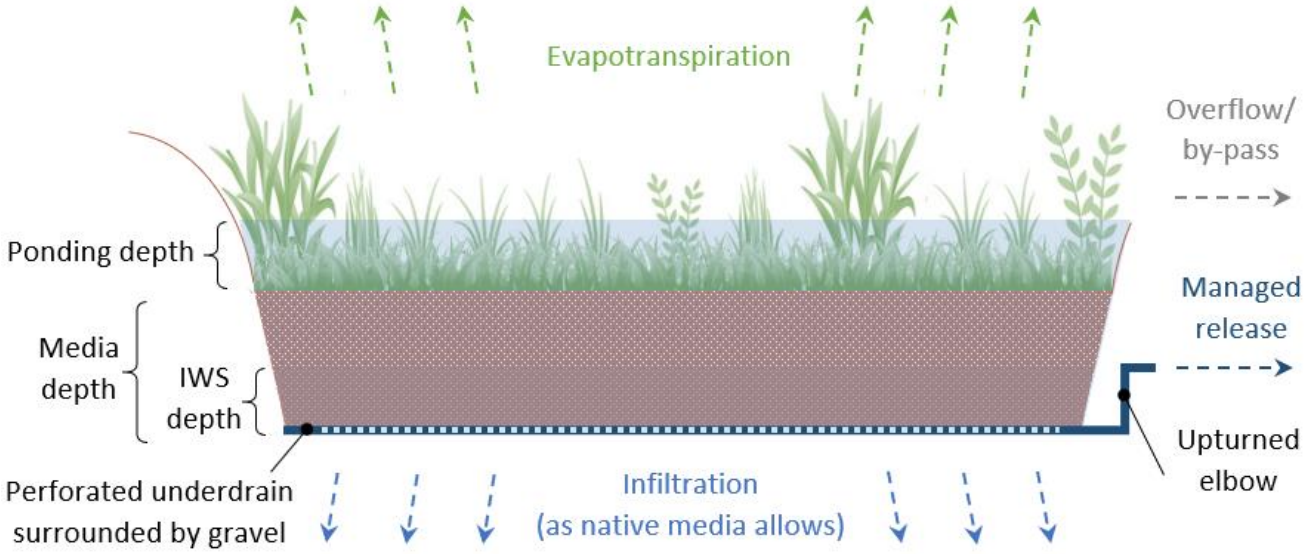
Version 1.2

Description

Managed Release Concept (MRC) is a post-construction stormwater management (PCSM) strategy that comprises the collection, management, and filtration of captured runoff from the contributing drainage area through a best management practice (BMP) that is preferably vegetated and includes release of a portion of the captured runoff through an underdrain within the BMP. If the MRC BMP is not vegetated, then pretreatment is required to meet water quality requirements. MRC is intended to be used for project areas or subareas where infiltration is considered infeasible to meet regulatory requirements under § 102.8(g)(2). Figure 1 illustrates the components of a typical MRC BMP.

Figure 1: Managed Release Concept with Internal Water Storage (IWS) and Upturned Elbow for a Vegetated BMP



MRC requires that runoff from the 1.2-inch/2-hour storm[1] is temporarily impounded for use by vegetation, is filtered through a soil media or another acceptable pre-treatment device, is infiltrated through on-site undisturbed soils to the highest degree feasible, and is released through an underdrain or control structure at a rate similar to the lateral unsaturated flow movement to the receiving waters from undeveloped areas. Flow out of the MRC during the 1.2-inch/2-hour storm event must be limited to the managed release rate (i.e., flow through the underdrain only).

Runoff above the 1.2-inch/2-hour storm and up to the 2-year/24-hour storm is managed back to the 1-year/24-hour peak rate in one or more BMPs to protect and improve geomorphologic processes downstream of earth disturbances. An internal water storage is included in the design for further water quality and evapotranspiration (ET) benefits. When the MRC is designed according to the design standards within, it may be used to satisfy 25 Pa. Code § 102.8(g)(2) requirements for the management of all events up to and including the 2-year/24-hour storm.

[1] 1.2 inches of rainfall is equivalent to 1.0 inches of runoff from impervious surfaces using the NRCS curve number method. The 2-hour distribution is a common practice used to develop a short duration rainfall pattern for analysis.

In accordance with 25 Pa. Code § 102.8(e), the person preparing the PCSM Plan shall be trained and experienced in PCSM design methods and techniques applicable to the size and scope of the project being designed. Due to the complexity of the design of an MRC BMP and the associated analyses, the Department of Environmental Protection (DEP) requires that a licensed professional engineer perform the design and analyses identified in this document.

Applicability

MRC may be authorized as a PCSM BMP where certain criteria are met, as follows:

1. A professional engineer, licensed in the Commonwealth of Pennsylvania, must perform the analyses, calculations, and evaluations associated with MRC BMPs.

2. The applicant has completed a thorough pre-development site characterization and assessment of soil and geology of the project site (not just the proposed location of the BMP), and the applicant's licensed professional engineer has determined that it is not feasible to manage the required volume through infiltration and ET alone due to soil and/or geologic conditions or other environmental constraints on the project site. DEP intends for the use of MRC to be limited to sites where infiltration is extremely limited (i.e., very slow infiltration rate), not feasible (i.e., groundwater and/or regularly occurring seasonally high-water tables within one foot of the bottom of the BMP's soil media), or undesirable (e.g., sinkhole-prone areas or contaminated soils).

3. The installation and implementation of structural and non-structural BMPs on the project site, to the extent practicable, is not sufficient to manage the required volume.

4. BMPs providing infiltration and ET are maximized on the overall project site to the extent practicable.

5. The licensed professional engineer has investigated downstream conditions and identifies in the PCSM Plan that the off-site discharge flow path to the confluence with the receiving surface water will not experience accelerated erosion or damage.

Where all of these criteria are met, and assuming use of MRC does not conflict with local ordinances or the provisions of an approved Act 167 plan, DEP or a delegated conservation district (CCD) may authorize the use of MRC for BMPs proposed on a project site.

The use of MRC does not preclude the applicant from minimizing any increase in stormwater runoff volume to the extent practicable, per 25 Pa. Code § 102.8(b)(3), and, when applicable, does not alleviate the requirement to demonstrate that non-discharge alternatives do not exist for the project, per 25 Pa. Code § 102.8(h)(1). Infiltration must be maximized on a project site before MRC can be applied.

MRC can be utilized with various types of BMPs. The licensed professional engineer would need to determine suitability and may adapt various elements to achieve the project goals. MRC can be used for both new construction and retrofit projects. Other uses of MRC may be proposed by the licensed professional engineer for DEP review and approval. Meeting the MRC requirements can involve a combination of analysis at the point of interest. MRC may be applied by using one or a combination of BMPs to satisfy § 102.8(g)(2) requirements. MRC BMPs can be combined with other volume reducing BMPs, except that MRC cannot be used to manage stormwater that could reasonably be infiltrated elsewhere.

DEP Review

When CCDs receive a Notice of Intent (NOI) for PAG-02 General Permit coverage that includes a PCSM Plan with MRC BMP(s), CCDs will forward the PCSM Plan to the appropriate DEP regional office for technical review when one or more of the following conditions exist, unless otherwise waived by DEP:

1. The total drainage area to any individual MRC BMP exceeds 3 acres or the total impervious area to any individual

MRC BMP exceeds 1.5 acres.

2. The applicant proposes an overall increase in impervious area (including gravel, stone, etc.) that exceeds 10 acres.

3. The MRC BMP will be designed to discharge to waters classified as impaired due to siltation/sediment or flow alterations, regardless of whether the water is under an approved Total Maximum Daily Load (TMDL).

Eligibility for PAG-02 coverage will not be affected by DEP's technical review. DEP may also delegate the technical review to CCDs that have PCSM delegation.

In addition, if deviations from the design standards set forth in this document are proposed, the submission of an individual permit application is necessary, unless waived by DEP.

If none of these conditions apply, the delegated CD may complete the review of the MRC BMP and PCSM Plan.

Completing Module 2 and DEP's PCSM Spreadsheet

An applicant proposing the use of an MRC BMP should include a complete MRC Design Summary sheet with the NOI or Application and with PCSM Module 2. One MRC Design Summary sheet should be completed and submitted for each BMP that will utilize MRC. The MRC Design Summary sheet is available through DEP's website as a PDF and Word document.

In addition, MRC BMPs must be documented in DEP's PCSM Spreadsheet (i.e., Quality Worksheet at a minimum). Identify any BMP that is designed to achieve MRC standards in the Structural BMP Volume Credits Table of the Volume Worksheet, which will automatically transfer the BMP to the Quality Worksheet. Enter the proposed volume of stormwater that will be routed to the MRC BMP, not exceeding the volume associated with the 2-year/24-hour storm event, in the Structural BMP Volume Credits Table. The outflow from the MRC BMP will be considered managed with respect to volume and water quality.

MRC Design Standards

Implementation of the following design standards will satisfy the requirements in 25 Pa. Code §§ 102.8(g)(2) and 102.8(g)(3) for managing the net change in runoff volume, rate and water quality for the stormwater managed by MRC BMPs. MRC BMPs and these standards constitute an approved alternative BMP and design standard under Pa. Code § 102.11(b). Deviations from the MRC Design Standards may be proposed by the licensed professional engineer through an individual permit application.

When similar non-regulated impervious areas (existing impervious area not included in the proposed earth disturbance) drain to an MRC BMP, the volume managed can be increased to offset volume from adjacent earth disturbance not captured by the MRC that drains to the same surface water in close proximity to the MRC (only if infiltration is not feasible in the adjacent drainage area being routed to the MRC BMP). In these instances, the MRC design should be adjusted to account for equivalent capture, release rate, and peak flow attenuation from the combined areas.

1. **Runoff Capture** – The runoff from the 1.2-inch/2-hour storm from the contributing watershed that the MRC is intended to treat should be captured and managed by the MRC BMP, without overflow. The runoff is filtered through vegetated media or treated and filtered to the extent practicable through the on-site undisturbed soils or other acceptable treatment systems, and released through the underdrain as indicated in MRC Standard 2. The MRC BMP may be designed for offsetting when contributing non-regulated earth disturbance (either impervious area or compacted pervious areas) is present in the contributing drainage area. Uncompacted pervious surfaces outside the disturbed area should be bypassed to the maximum extent practical.

   NOTE 1 – Runoff from existing similar impervious and compacted pervious areas can be used to offset undetained areas. The runoff volume for the 1.2 inch/2-hour storm from the two areas must be equivalent (See Figure 2). In addition, the pollutant contribution as determined through land use of the two areas

should be similar.

NOTE 2 – A composite Curve Number is not adequate for the modeling of the 1.2 inch/2-hour storm due to the large error associated with averaging of initial abstractions for storms less than or equal to the 2-year/24-hour storm event. Curve numbers must be separate for this analysis.

2. **Release Rate for the 1.2-inch/2-hour Storm** – The stormwater release rate from the MRC BMP for the 1.2-inch/2-hour storm should not exceed 0.01 cubic feet per second (cfs) from the equivalent impervious area. To obtain the equivalent impervious area being managed by a MRC BMP, determine the total volume of runoff generated during the 1.2-inch/2-hour event from all pervious and impervious areas contributing to the MRC and divide by 0.0833 feet. This release rate is rounded to the nearest hundredth of a cfs (e.g., 1.576 ac. is 0.01576 cfs, rounded to 0.02 cfs). Routing is necessary to demonstrate compliance with the standard for release rate.

3. **Internal Water Storage (IWS)** – A volume for IWS should be provided that is at least one foot deep below the lowest structural outlet (i.e., the outlet for the underdrain) in the MRC BMP to encourage ET, infiltration and denitrification. To encourage ET, the overall soil media depth of a facility including the IWS can be no deeper than four (4) feet, and up to 50% of the IWS void volume can be included (only for vegetated MRC BMPs) as available storage during hydrologic routings to demonstrate compliance with the standards for the release rate (No. 2 above) and peak flow attenuation (No. 4 below). For soil media, a void space of 30% can be used to describe the soil volume storage and recovery. If a void space of 30% is to be used, the void space in the soil media in the IWS should be modeled at 15% (0.5 x 0.3 void space = 0.15 or 15%). If an alternate void space is used for soil media, specific data demonstrating the void space should be submitted. For non-vegetated MRC designs, the IWS must be above the underdrain, but below the outlet, to promote a change of the stormwater stored during rain events.

   Use of Liners and Infiltration – The MRC BMP should <u>not</u> have an impervious liner installed unless environmental or geological conditions necessitate use of a liner, or if an existing structure would be damaged as a result of not lining the facility. Although MRC BMPs are for areas with infiltration limitations, whatever infiltration that can be achieved is encouraged. Measured saturated hydraulic conductivity rates are encouraged to be used in design and modeling.

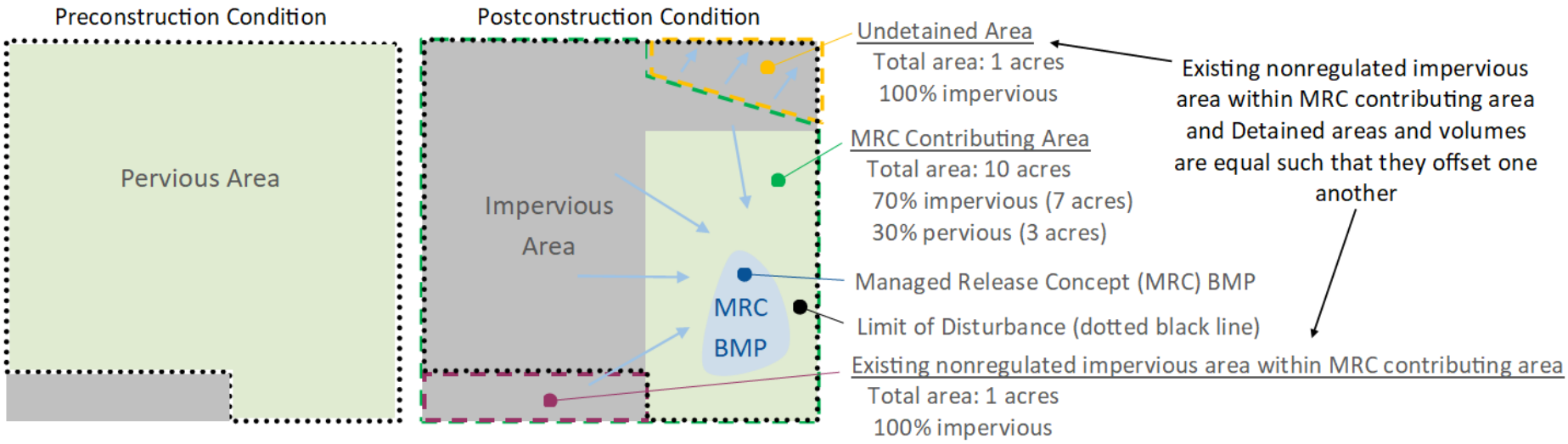
   NOTE 3 – The presence of a project site in an area of known karst conditions does not, in itself, serve as evidence of the applicability of MRC to a project site or to the use of a liner to avoid infiltration. DEP and delegated CCDs reserve the right to request a detailed subsurface investigation where considered warranted to evaluate the likelihood of sinkhole formation as a result of post-construction stormwater management.

4. **Geomorphologic Peak Flow Management for the 2-year/24-hour Event** – The peak flow from the post-construction 2-year/24-hour storm should be managed back to the pre-construction 1-year/24-hour storm peak flow, unless an approved and current Act 167 Plan or another requirement (such as limited capacity of a downstream channel) is more restrictive. In general, this rate is determined at the project point of interest. In the event the MRC drainage area is part of a larger overall site with non-MRC BMPs, only the MRC drainage peak flows should be managed back to the 1-year/24-hour level and overflows can be combined with flows from the non-MRC BMPs.

   In situations where the pre-construction drainage area to the MRC BMP varies significantly compared to the post-construction drainage area, the post-construction drainage area boundary to the MRC BMP (using existing land uses) can be used to calculate the target pre-construction 1-year/24-hour rate, as long as all areas in question are in close proximity to the MRC BMP and drain to the same surface water. In cases where the BMP is managing additional volume to offset adjacent areas that could not be captured in the MRC BMP, the targeted pre-construction 1-year/24-hour release rate should be calculated based on the combined flow rates from the BMP drainage area and adjacent area.

   NOTE 4 – This standard is used to ensure that MRC does not contribute to channel-eroding flows in receiving surface waters.

Figure 2: Offsetting and Equivalent Impervious Area Calculation Example



Calculation of Equivalent Impervious Area due to pervious surface within MRC contributing area:

$$\frac{\text{Total Volume of 1.2-in/2-hr Storm Inflow (cubic feet)}}{\text{0.0833 feet * 43560 square feet/acre}} = \text{Equivalent Impervious Area} \quad \frac{\text{26499 cubic feet}}{\text{0.0833 feet * 43560 square feet/acre}} = 7.3 \text{ acres}$$

NOTE 5 – This release rate (0.01 cfs / equivalent impervious acre) is approximately the expected rate of interflow (lateral movement of stormwater to a stream) after a 2-year/24-hour storm event for a Pennsylvania non-karst watershed based on the NRCS curvilinear unit hydrograph. Releasing at this rate will produce a condition where baseflow contributions will be similar to that of an undeveloped area during and after storm events. As the level of outflow would be similar to what would be expected during and after the storm, it would not be expected to impact the storm event's effects on flooding and erosion. This rate should also be used for karst watersheds unless it can be demonstrated that interflow on a particular project site differs from this standard (such a demonstration would be considered an alternative to the MRC Design Standard).

Flows Greater Than 2-Year/24-Hour Storm – The recommended design for MRC BMPs is to bypass storm events larger than the 2-year/24-hour storm to a rate control BMP; however, DEP understands that site and cost limitations may not allow for this bypass. When it is demonstrated by the licensed professional engineer that larger storm events cannot reasonably be bypassed, the MRC BMP surface component should be designed to manage the post-construction 10-, 50- and 100-year/24-hour storm event peak flows to their corresponding pre-construction rates and the MRC BMP should have an increased (i.e., more frequent) inspection and maintenance schedule that includes inspection and repair after extreme events (10-, 50- and 100-year/24-hour storm events).

5. **Stormwater BMP Manual** – Follow the design considerations for BMPs as presented in the *Pennsylvania Stormwater Best Management Practices Manual* (Stormwater BMP Manual) (363-0300-002), as revised. MRC may be incorporated into the design of any BMP by a licensed professional engineer.

6. **MRC BMP Selection** – Standard MRC BMPs include the following system types:

   a. **Vegetated MRC** – Vegetation must be provided for 75% of the surface of the MRC BMP. Native vegetation should be selected by the licensed professional engineer in consultation with a professional that is knowledgeable in native plant ecology. Vegetation should be selected based on the plants' ability to grow within the anticipated conditions considering the depth and duration of stormwater stored in the MRC BMP.

   b. **Non-vegetated MRC: Porous Pavement** – Porous pavements with a storage bed require a vacuum street sweeping maintenance regime adequate for the drainage area characteristics; the vacuum street sweeping equipment must provide adequate suction capacity to remove particles on the pavement's surface to provide a sufficient water quality demonstration and to maintain flow pathways.

   c. **Non-vegetated MRC: Underground Storage Chambers** –Underground storage chambers must be accessible for maintenance, and for this reason underground storage is not recommended to be rock beds. The water quality demonstration is then made through the Quality Worksheet on the DEP Spreadsheet. DEP highly recommends that designers consider adequate pretreatment as necessary for system longevity.

7. **Pre-Development Site Characterization and Assessment of Soil and Geology** – Adequate and appropriate soils and geologic testing and evaluation must be performed to demonstrate the infiltration capacity of the entire project site to the satisfaction of DEP. At a minimum, one infiltration test for every 40,000 square feet of disturbed acreage should be performed with a minimum of four tests, equally distributed across a site. The infiltration tests must be done in the most accommodating soil horizon for infiltration as demonstrated by a deep hole test within 100 feet of the infiltration test. All other sections of Appendix C Protocol 1, Site Evaluation and Soil Infiltration Testing and Appendix C Protocol 2, Infiltration Systems Guidelines per the Stormwater BMP Manual (as revised) should be followed to clearly demonstrate the infiltration capability of on-site undisturbed soils at applicable elevations and for a variety of locations. Soil probes and infiltration test locations should be identified on the PCSM Plan drawing(s). The use of soil borings as a substitute for test pits can be used as a planning tool but will not generally be accepted for final design of infiltration MRC BMPs.

   NOTE 6 – The above recommended number of infiltration tests per disturbed area is to be based upon the disturbed area that is not considered a restoration activity or road maintenance activity. For example, a large sewer main installation project disturbs 30 acres in total, with 29 acres of disturbance for the sewer line installation (that will be covered by a restoration plan) and 1 acre of disturbance for a pumping station that requires a PCSM plan. The recommended number of infiltration tests would be based on the 1 acre, not 30 acres.

   NOTE 7 – The minimum number of tests can be reduced, if it can be demonstrated that the subsurface conditions are uniform; however, this is considered a deviation from MRC Design Standards, requiring an individual permit.

   NOTE 8 – Infiltration tests resulting in saturated hydraulic conductivities (as identified in the field) of less than or equal to 0.2 inch per hour (prior to application of a safety factor) classify as extremely limited. This is a saturated hydraulic conductivity representative of the lower part of the range of HSG C soils and HSG D soils.

NOTE 9 – Research has shown that limited infiltration rates (i.e., less than or equal to 0.2 inch per hour) over time with an IWS can result in measurable losses from a BMP. Therefore, a designer can use results from the infiltration testing to describe infiltration losses for unlined MRC BMPs or utilize an infiltration rate of 0. Testing for infiltration rates should be performed as per Protocol 1 of Appendix C of the Stormwater BMP Manual (as revised). The recommendation in Protocol 2 of Appendix C that "soils underlying infiltration devices should have infiltration rates between 0.1 and 10 inches per hour" does not apply to MRC BMPs.

8. **Separation Distance** – At least one foot of separation distance should be maintained between groundwater or the seasonally high-water table and the bottom footprint of the MRC BMP's soil media; however, a two-foot separation is preferred. There is no minimum separation required between bedrock or hardpan and the MRC BMP's soil media.

9. **Ponding Depth and Drawdown time** – The maximum ponding time (i.e., the time after the end of the storm event for stored surface water to lower to soil surface) should not exceed 72 hours for any storm event. In general, a maximum ponding depth (i.e., storage depth above BMP surface) of preferably one foot with a maximum of two feet at the peak of the 2-year/24-hour storm event should not be exceeded for the design of surface BMPs. In accordance with MRC Design Standard 4, the MRC could incorporate a multi-stage detention facility with the upper portions of the facility providing flow attenuation for storm events greater than a 2-year/24-hour storm, to meet 25 Pa. Code § 102.8(g)(3). An engineered overflow structure or reinforced spillway / berm should be installed to provide safe conveyance for storm events greater than a 2-year/24-hour storm. Ponding depth for storms larger than the 2-year/24-hour storm should not exceed four feet, and drawdown to the MRC BMP surface should not exceed 72 hours for all design storms. For underground storage chambers and porous pavement MRC systems, drawdown to the IWS storage level should not exceed 7 days.

10. **Soil Media** – The selection of soil media should be done by considering anticipated pollutants to be treated and the vegetation that will be used. On-site soils should be evaluated for desired characteristics and infiltration capabilities as listed below. The depth of the soil media above the invert elevation of the underdrain pipe should be a minimum of 2 feet (24 inches) to provide pollutant removal. If on-site undisturbed soils are unsuitable for the purpose of providing IWS, an additional one to two feet of suitable soil media should be provided below the underdrain.

    Soil Media Drainage – The designer will need to exercise caution when selecting a soil media, as there is a delicate balance between infiltration rate and residence time. To maximize water quality treatment, the residence time within the soil media used in MRC BMPs should be selected to be close to the parameters established for infiltration into native soils. **The designer will need to select a soil media that provide the proper infiltration rate and ponding time to achieve water quality for the anticipated life cycle of the BMP**.

    See Figures 3 – 6 for a demonstration of how the separation distances (Design Standard #8) relate to the soil media.

11. **Underdrain Design** – The licensed professional engineer can refer to PennDOT Publication 408 Section 610 for specifications of underdrains. However, underdrains should have a minimum flow rate of 10 gallons (1.34 cubic feet) per minute per linear foot of pipe not considering the flow control orifice or upturned elbow. For non-vegetated MRC BMPs, the underdrain should be located at the bottom of the IWS to promote movement of water from previous storms. There may need to be multiple underdrains, or longer underdrains, to provide adequate design capacity for drainage. Section 6.4.7 (Constructed Filter) of the Stormwater BMP Manual (as revised) has recommended design standards for lateral spacing of multiple underdrains.

Figure 3: Managed Release Concept Where In-Situ Soils <u>are</u> Suitable in Relation to Groundwater/Seasonal High Water Table

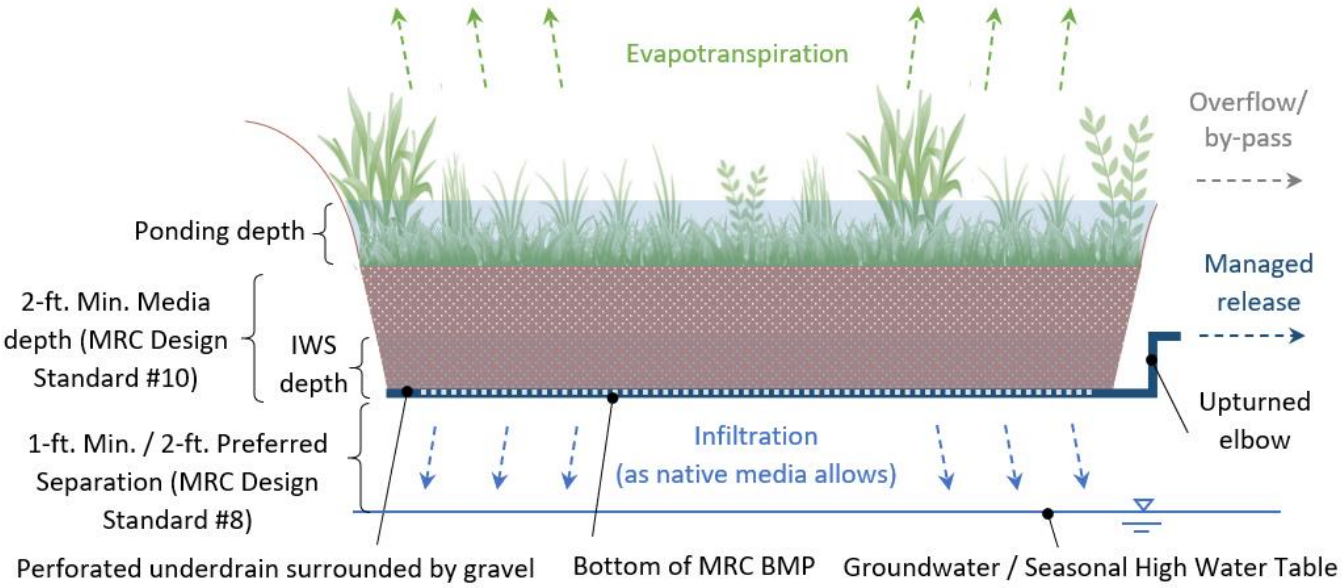


Figure 4: Managed Release Concept Where In-Situ Soils <u>are not</u> Suitable in Relation to a Groundwater/Seasonal High Water Table

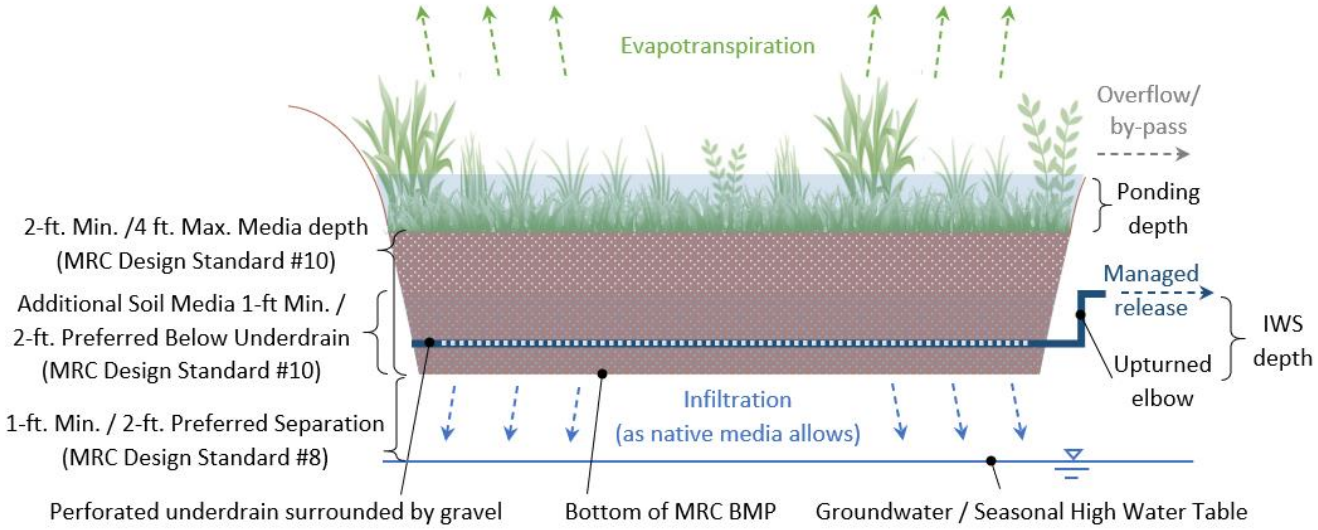


Figure 5: Managed Release Concept Where In-Situ Soils <u>are</u> Suitable in Relation to Bedrock/Hardpan

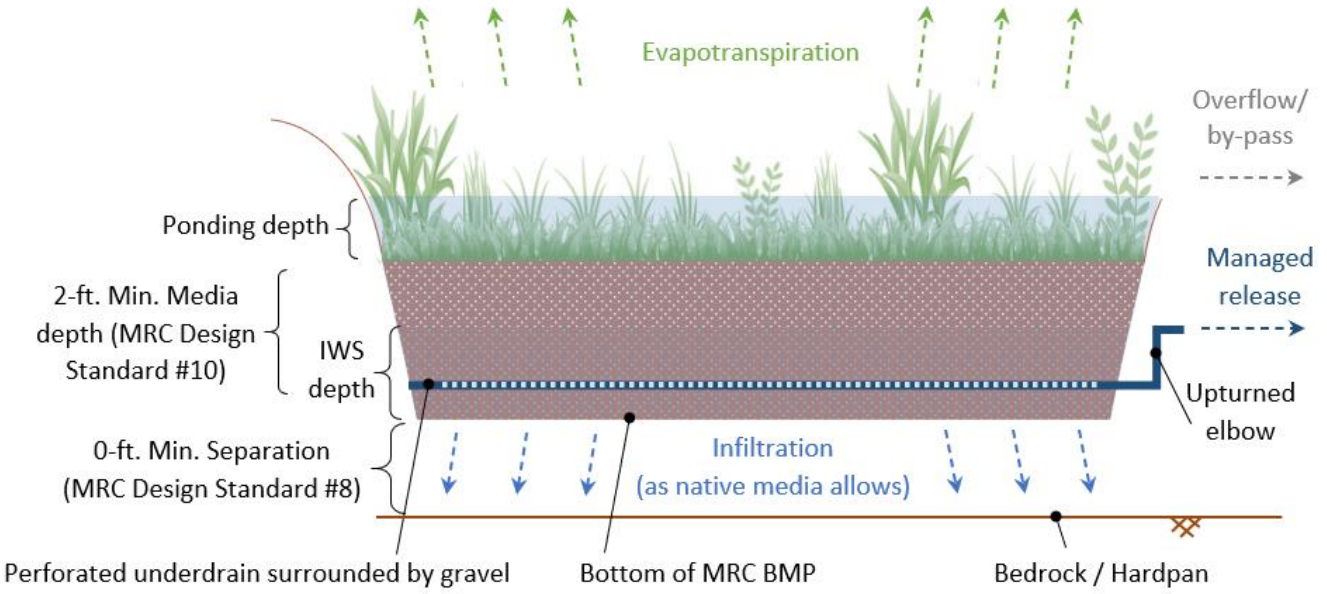
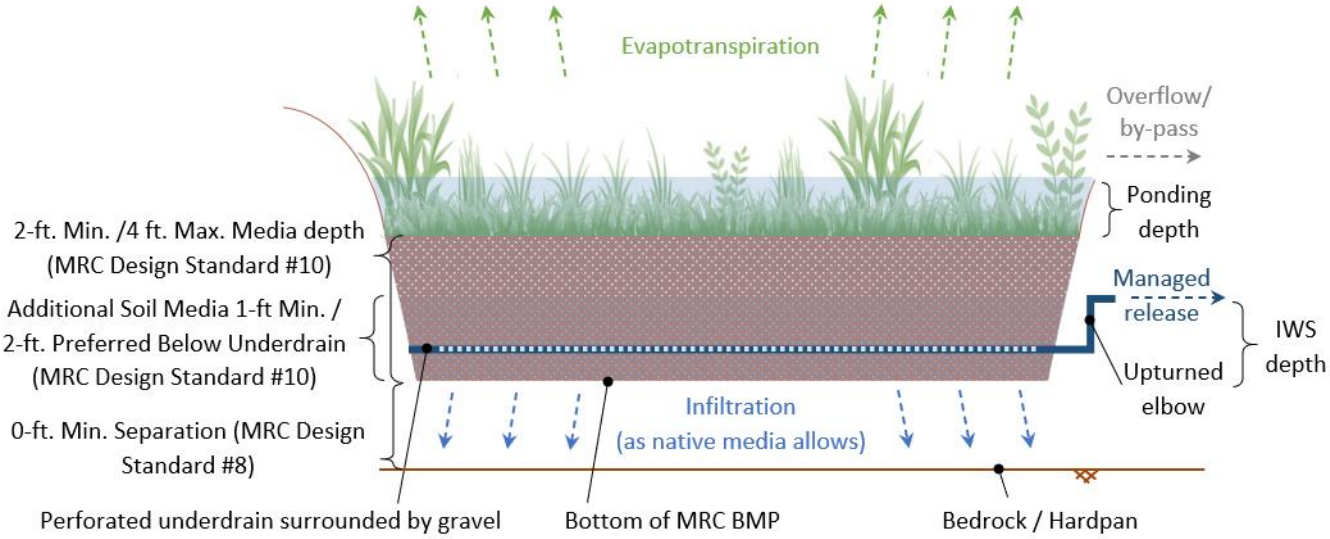


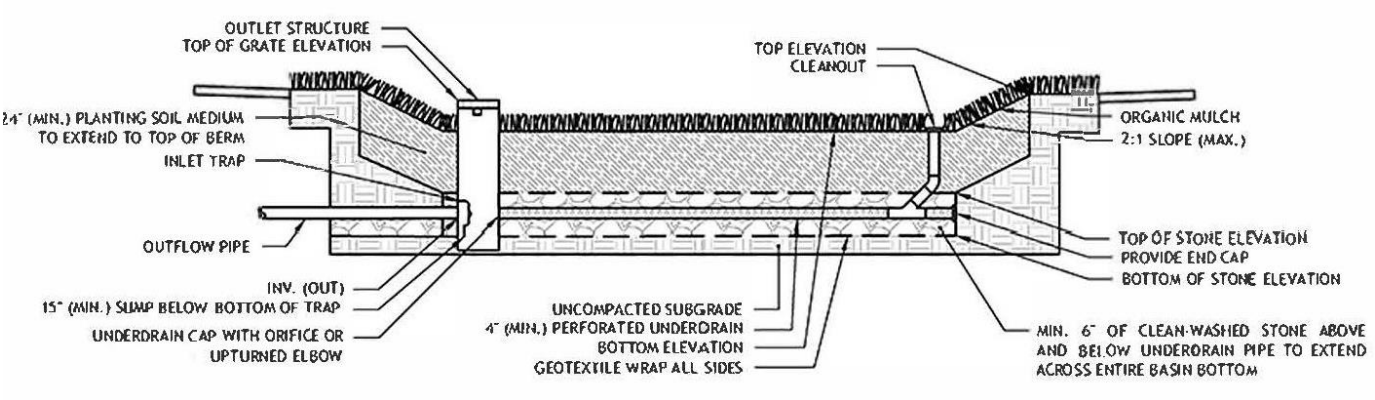
Figure 6: Managed Release Concept Where In-Situ Soils <u>are not</u> Suitable in Relation to Bedrock/Hardpan



IWS Outflow with Capped / Orifice Underdrain – It is highly recommended that an upturned elbow or an elevated weir be designed at the outlet of the underdrain (see Figure 1). The upturned elbow or elevated weir will create a zone within the soil media, referred to as the IWS. Research has shown that IWS can reduce runoff volume and improve water quality treatment. The upturned elbow or elevated weir can also help if site conditions present daylighting issues for the underdrain's discharge elevation. Underdrains should be capped within an outlet structure when used to allow access for maintenance. The cap should be drilled to provide an appropriately sized orifice. Figure 7 below provides an example of an underdrain detail. Note that all cleanouts and angles within the underdrain should not exceed 45 degrees. For lined, non-vegetated MRCs the underdrain leading to the upturned elbow should be located at the bottom of the

IWS.

Figure 7: Example Underdrain Detail (courtesy of Philadelphia Water Department's *Stormwater Management Guidance Design Manual*)



Underdrain Aggregate Envelope – A 6-inch stone envelope of AASHTO #57 should be placed around the underdrain. A geotextile (or pea gravel diaphragm) is needed around the aggregate envelope. Note that the stone should not be placed throughout the bottom of the BMP, but just in the envelope of the underdrain.

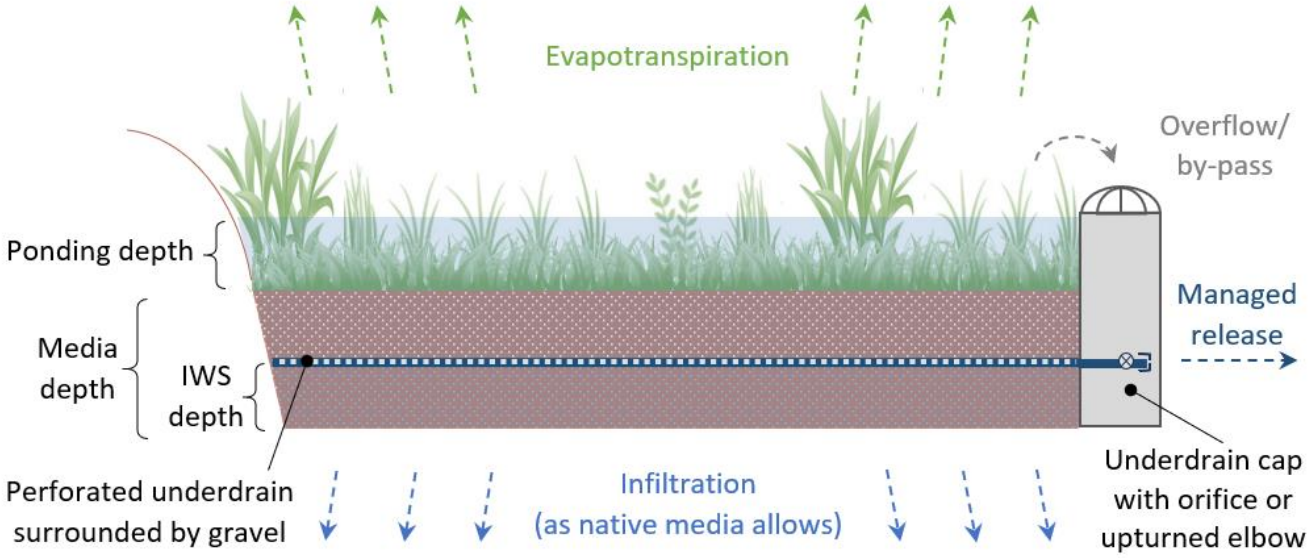
Cleanout for Underdrain – The underdrain(s) should be equipped with a clean-out for maintenance. The design of any clean-out should ensure that surface water does not enter the underdrain system through the top of the cleanout. Consideration must be given for cleaning and inspecting underdrains and access to the upturned elbow or elevated weir.

Orifices – An appropriately sized orifice is necessary on the outlet of the underdrain to control flow to the required release rate (see Figure 8). The orifice should be clean, smooth and sanded so that no burs or irregularities are present. The orifice should be on a plate or cap of sufficient thickness, and the edges of the orifice should be ground so that flow through the orifice is smooth. Orifices should be vertical. The orifice plate and other connections should be water-tight and accessible for maintenance. Control valves cannot be substituted for an orifice.

12. **Discharge Flow Path** – The MRC BMP should be directed to a suitably vegetated flow path, which can safely convey the releases without erosion or loss of stability. The discharge should be dispersed through the use of a level spreader. A licensed professional engineer can provide an analysis, with calculations, which identifies that a level spreader is not necessary, or that discharge to a channel will not cause increased erosion.

13. **Antidegradation Requirements** – Where the stormwater from the project site discharges to a special protection surface water, an MRC BMP can be used to satisfy the Antidegradation Best Available Combination of Technologies (ABACT) regulatory requirements from Chapters 93 and 102 (assuming that non-discharge alternatives do not exist).

Figure 8: Managed Release Concept with Capped / Orifice Underdrain with Maintenance Access for a Vegetated BMP



Construction Sequence

A licensed professional engineer should provide appropriate construction sequencing for the MRC BMP. Guidance should be based on the Stormwater BMP Manual to the greatest degree possible. Construction sequencing should be project-specific, but at a minimum should include the following:

1. Install the MRC BMP during final phases of site construction to prevent sedimentation and/or damage from construction activity. After installation, prevent sediment-laden water from entering the facility.

2. Install and maintain proper E&S BMPs during construction.

3. The MRC BMP bottom should be un-compacted, free from rocks and debris. Do NOT compact the subgrade.

4. Install outlet control structures, reinforced spillway, pipe bedding, underdrain piping with aggregate envelope, cleanouts, etc.

5. Place soil media gently. Do not compact soil media or the basin bottom. The placement of soil media should be done from outside the BMP footprint to avoid compaction by construction equipment. Equipment should never drive over placed soil media without construction matting.

6. Seed and stabilize disturbed area. Vegetate with native plantings.

7. Maintain inlet protection and other E&S controls until the site is fully stabilized.

Operation and Maintenance Schedule

A licensed professional engineer should provide an appropriate long-term operation and maintenance schedule for the MRC BMP. Guidance should be based on the Stormwater BMP Manual to the greatest degree possible. The long-term operation and maintenance schedule should be project-specific. At a minimum, the long-term operation and maintenance schedule must meet 25 Pa. Code § 102.8(f)(10) and include the following:

1. Upgradient catch basins and inlets should be inspected and cleaned annually, or more often if historical

maintenance records suggest a more frequent cleaning.

2. The vegetation (for the MRC BMP and contributing drainage area) should be maintained in good condition, and any bare spots revegetated.

3. Care should be taken to avoid excessive compaction by mowers. Mow only as appropriate for vegetative species.

4. Inspect at least two times per year after runoff events greater than 0.8 inch and make sure that runoff drains down within the design parameters (a licensed professional engineer should clearly identify what these parameters are).

5. At least two times per year, or more if historical maintenance indicate it is necessary, inspect for accumulation of sediment, damage to outlet control structures, erosion, signs of water contamination/spills, and instability. Leaf litter needs to be removed annually.

6. As needed, remove accumulated sediment as required to maintain infiltration through the MRCs soil media and to maintain water quality functionality. Restore original cross section. Properly dispose of sediment.

7. If porous pavement is included in the design, vacuum at least twice per year. Vacuum should have sufficient suction power and be designed for use with porous pavements.

8. All MRC BMP components should be maintained as indicated in the Stormwater BMP Manual.

As noted above, if the MRC BMP will manage peak flows in excess of the 2-year/24-hour storm event, an increased inspection and maintenance frequency will typically be necessary.

Version History

Date	Version	Revision Reason
8/25/2020	1.2	Renamed the "Completing the NOI/Application and Worksheets Where an MRC BMP Is Proposed" section to "Completing Module 2 and DEP PCSM Spreadsheet," and revised the section for PCSM Module 2 and the DEP PCSM Spreadsheet. Updated MRC Design Summary sheet, MRC FAQ and MRC Design Examples. Provided Figures 3 – 6 for clarity on MRC Design Standards 8 & 10. Removed section on Water Quality as the information has been incorporated in other sections.
5/15/2019	1.1	Updated MRC Design Summary sheet; developed a separate document for Frequently Asked Questions and MRC Design Examples; changed trigger for technical review by DEP to a total drainage area of 3 acres (1.5 acres of impervious); modified runoff capture requirement to the 1.2-inch/2-hour storm event; clarified offsetting allowances for impervious areas; revised release rate to 0.01 cfs for equivalent impervious area at the 1.2-inch/2-hour storm event; and provided clarifications throughout.
12/13/2018	1.0	Original