ROBERT G. CASSILLY
Harford County Executive

ROBERT S. McCORD
Director of Administration

JOSEPH J. SIEMEK, P.E.
Director of Public Works

DEPARTMENT OF PUBLIC WORKS
BUREAU OF STORMWATER MANAGEMENT

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FROM: Division of Environment and Sustainability ~ Bureau of Stormwater Management

TO: Harford County Engineering, Developer and Consultant Community

SUBJECT: Stormwater Management Compliance Guidance - **Frequently Asked Questions**

The MDE is currently working on proposed changes to §4-201 and §4-203, annotated Code of Maryland Title 26 Department of the Environment Subtitle 17 Water Management and Chapter 02 Stormwater Management. Until these changes are enacted, the following Harford County guidance items are to be implemented:

1. Can Enhanced filters provide ESDv?

Enhanced Filters may be utilized in combination with properly designed Environmental Site Design (ESD) facilities to provide water quality volume (WQv) and recharge volume (Rev). Enhanced Filters cannot be utilized to provide channel protection volume (CPv). The Environmental Site Design volume (ESDv) is comprised of both WQv and CPv. Enhanced Filters do not meet the full intent of the CPv component of ESDv. Enhanced Filter practices have high flowrates and the drain down time is significantly shorter than the 24–36-hour requirement for CPv. To achieve CPv a facility must meet the intent of the slow-release rate. Enhanced Filters cannot be used as a standalone practice to meet the full ESDv requirement.

a. MDE approved technology enhanced filters, such as Filtera's, do not provide CPv because of the high flow rate and are for WQv only.
b. Enhanced filters designed directly below Micro-Bioretention or Bioswale, etc (as shown in the MDE Stormwater Design Manual) are purely for Recharge Volume (Rev) ONLY. Harford County does not credit additional WQv or CPv associated with this enhanced filter configuration. The runoff enters the enhanced filter only after slowly passing through the properly designed Micro-Bioretention media where the ESDv credit is obtained. Only additional Rev credit is obtained in the enhanced filter below the treatment facility.

2. Is 4-foot Groundwater Separation required for all ESD infiltration facilities?

Yes. Facilities designed as Infiltration Practices require a 4-foot separation from the bottom of the facility to the seasonally high ground water table. Infiltration practices include the natural ground as part of the filtering mechanism (media). Infiltration practices introduce a large amount of water into the ground. When a large amount of water is introduced this way, inadequate separation may allow the ground water to mound up and encroach into the facility eliminating the filtering mechanism and the facility will stop working. All *Infiltration* practices must have the 4-foot minimum separation from the seasonally high groundwater.

The determination of the seasonally high groundwater needs to be clearly documented by a qualified professional. To avoid re-design issues at the Final design, the determination of seasonally high groundwater must be submitted as part of the Site design phase.

For facilities designed as Filtering Practices where the filtering mechanism (media) is placed at the surface; includes an aggregate reservoir provided below the media; and also includes an underdrain piping system, the groundwater mounding is most likely to be drained off through the underdrain system. In this case the filtering mechanism is not impacted, and the facility will continue to function as designed. Therefore, the inclusion of the underdrain could be a case where the ground water separation is *not completely necessary for the operation of the facility and ground water may approach closer to the bottom of the facility while still meeting the treatment design intent of the facility*. Therefore, on a case-by-case basis Harford County may allow a Waiver of the reduction of the 4-foot groundwater separation. The County will require a formal written Waiver request. Groundwater shall never be allowed to be above the invert of the underdrain thereby continuously draining the water table. The designer must select the most appropriate facility type when groundwater is present. County approval of the Waiver request is not guaranteed and depends on the actual separation of groundwater and the bottom of the facility. Impermeable liners for filtering practices are not preferred by the County to keep ground water separate.

3. How do I determine Recharge volume compliance?

If a project meets the Target ESDv volume requirement, then it is allowable to state that the Rev requirements have also been achieved for the project. Designers may calculate the Rev provided by individual facilities utilizing the contributing drainage area and the corresponding Composite Soil Specific Recharge Factor. The Rev provided by each facility may be summed for a total project Rev. However, if a facility has an impermeable liner such as a concrete box or Clay/PVC liner, then the facility will not provide Rev and cannot be credited toward a projects Rev.

a. Regardless of the presence of an underdrain, an individual facility can be considered to meet Rev only if it meets the Target ESDv and does not have an impermeable liner.
b. Designers may calculate Rev below underdrains to determine Rev for each facility, however this is not necessary.
c. Submerged Gravel Wetlands are ESD facilities with media; Rev can be credited for these facilities only if they meet the Target ESDv for the drainage area to the facility. No enhanced filter can be used with SGWs.

4. How do I determine the remaining ESDv, and can I capture it in water quality practices?

The Target ESDv for the project (Limit of Disturbance) must be provided by Chapter 5 practices unless all Chapter 5 practice options have been exhausted. The County retains the authority to determine if all Chapter 5 practices for a project have been exhausted. The project must treat a minimum of 1-inch of runoff volume (Pe = 1 inch) in ESD practices before standard Chapter 3 facilities may be utilized to provide/store the remaining ESDv requirement. Computations must be provided to show how the selected Chapter 3 practices will store/treat the remaining ESDv.

5. What is Harford County's understanding of the requirement that certain ESD facilities shall store 75% of the ESDv?

Chapter 3 of the MDE Manual states that for Stormwater Filtering Systems the entire treatment system shall temporarily hold at least 75% of the WQv prior to filtration (above the surface). This concept should therefore be applied to Chapter 5 ESD Micro-Scale facilities where the MDE Stormwater Design Manual references that a facility shall store 75% of the ESDv, which will also include Micro-Bioretention's, Bioswales and Submerged

Gravel Wetlands. The media section of ESD facilities is considered the filtering mechanism and therefore 75% of the Target volume must be stored ***above the media***. Harford County does not allow for storage calculations to include the porosity of the media and aggregate layers. The 75% surface storage requirement provides a 25% credit for storage within the filtering media. The ESDv credit of any facility is limited to the runoff generated by the 1-yr 24-hr storm NOAA Type C distribution (Pe = 2.69") from the facilities contributing area. Refer to the NRCS Maryland National Engineering Field Handbook Part 650 Change Notice No. 6 (July 11, 2016).

Therefore:

a. Only the actual Surface Storage Volume Provided at the design ponding depth may be divided by 75% to obtain the total Facility ESDv provided. (Total ESDv = Surface Storage Volume / 75%).
b. The total ESDv provided can only be up to a maximum of the 1-yr ESD target volume for the facility's contributing area (Pe = 2.69").

6. How is "ESDv provided" determined for a Submerged Gravel Wetland?

Submerged Gravel Wetland facilities must provide a minimum of 75% storage of the Target ESDv above the surface (ponding storage to the ponding depth, which does not include the dry 4" below the surface). See item #5 regarding the 75% Surface Storage volume. The volume within the submerged gravel wetland layers is considered "Dead Storage" and cannot be counted toward the storage provided. ESDv storage requirement is based on the surface storage provided as stated in item #5 above (maximum ponding depth = 2').

a. ESDv provided = Surface Storage Volume / 75% (up to the maximum Target ESDv of the contributing area to the SGW facility for 1-yr 24hr storm (Pe = 2.69")
b. Submerged Gravel Wetlands should not be designed in A/B soils. Generally, Submerged gravel wetlands should not be designed with liners for use in A/B soils. A different facility that is more appropriate to the site's soil should be considered to promote localized groundwater recharge.

7. How is "ESDv provided" determined for a Landscape Infiltration?

Do not confuse "Filtering Practices" and "Infiltration Practices." Filtering practices vs. Infiltration practices are basically the same except for the location of the storage reservoir and filtering mechanism. Landscape Infiltration facilities (M-3) are "Infiltration Practices" that utilize the natural/native soil as the filtering mechanism. The storage reservoir is considered temporary ponding and includes the sand and aggregate media layers above the natural/native soils. The ESDv provided is the temporary ponding volume plus the porosity (n=0.40) volume of the sand and aggregate media layers that are above the natural/native soils.

a. ESDv provided = Surface Storage Volume + 0.40 x (volume in the sand and aggregate media layers)

8. How is "ESDv provided" determined for a Bio-Swale?

Bio-Swale facilities must provide 75% storage above the filtering media (surface storage). See item #5 regarding 75% Surface Storage volume. Increasing the media depth from 2' to 4' will not generate additional ESDv provided since the ESDv storage requirement is based only on the surface storage provided as stated in item #5 above. Harford County does not accept the use of MDE Equation 5.2 to determine the ESDv provided for Grass Swales. Use Equation 5.3 for grass swales.

a. Check dams may be used to provide increased surface storage volume up to 1-foot. However, check dams' main function is for velocity control. If a Bio-swale includes check dams, then the geometric volume behind each check dam is calculated to determine the surface storage volume in each segment.

b. Bioswale with Check Dams →ESDv = Total Surface Storage Volume provided behind the check dams (above the surface/media) / 75% (up to the maximum Target ESDv of the contributing area for 1-yr 24hr storm {Pe = 2.69'}).
c. If a Bio-swale does not have check dams, then the surface storage would be based on the ***calculated*** flow depth (1-year storm event) multiplied by the average swale width and multiplied by the swale length. The flow criteria restrictions provided in MDE Chapter 5 (M-8 Swales) must be achieved to be able to obtain the ESDv credit (i.e., 4" max ESDv flow depth, 1 ft./sec ESDv flow velocity). Note: Manning's n = 0.15 is achieved when the grass depth is equal to the flow depth. Reminder: having a 4" depth of grass does not create a 4" flow depth.
d. Bioswale without Check Dams→ESDv = (calculated flow depth x average swale width x swale length) / 75% (up to a maximum Target ESDv of the contributing area for 1-yr 24hr storm) {Pe = 2.69'}).
e. Note: a control structure at the end of the swale with an elevated weir can be utilized to create ponding depth for a bioswale, since the ponding is temporary with the flow passing through the media and the underdrain connected to the control structure.

9. How is "ESDv provided" determined for a Grass Swale?

ESDv provided by Grass Swales is calculated based on the length of the swale times the average cross-sectional width times the depth of the flow produced by the 1-yr 24-hr (ESDv {Pe = 2.69'}) storm. The flow depth is based on manning's equation for the peak 1-yr storm event (SCS Method: WinTR55) flow produced by the contributing area, limited to a maximum flow depth of 4-inches. Harford County does not accept the use of MDE Equation 5.3 to determine the ESDv provided for Grass Swales.

a. Provided ESDv = Average cross-section width x calculated flow depth x swale length (up to the maximum Target ESDv of the contributing area for 1-yr 24hr storm {Pe = 2.69'})).
b. ESDv flow depth and velocity calculations must be provided using Manning's equation with n=0.15
c. The flow criteria in MDE Chapter 5 must be achieved to obtain the ESDv credit (i.e., 4" max ESDv flow depth, 1 ft./sec. ESDv flow velocity). Note: Manning's n = 0.15 is achieved when the grass depth is equal to the flow depth. Reminder: having a 4" depth of grass does not create a 4" flow depth.

10. Can hydraulic routing be used for ESD facilities?

Yes, current hydraulic modeling software can be used to determine WSE and flow rates out of ESD facilities. Runoff based on SCS Method, NOAA Atlas 14 precipitation values with Type C rainfall distribution (Refer to the NRCS Maryland National Engineering Field Handbook Part 650 Change Notice No. 6 July 11, 2016).

If hydrograph routing is to be conducted for ESD facilities, then the following techniques must be utilized for Harford County acceptance:

a. For a filtering facility, it is acceptable to only use surface storage and surface outlet control devices in the routing model. Even if an ESD facility includes an underdrain beneath filter media, the underdrain cannot be used as a direct and/or indirect discharge stage in the routing model.
b. For infiltration facilities (no underdrains), it is acceptable to use surface storage, surface outlet control devices and apply an infiltration flow using an infiltration rate (Rawls) across the surface area (or area of the bottom of the media, when applicable), in the routing model. Note: if the surface area is not flat, then the determination of the infiltration flow value needs to be presented in a detailed calculation. Reminder: for flat facilities, the infiltration component does not start until the entire surface area is ponding. The model needs to be set with a starting ponding depth for the infiltration.

11. Can the Reduced Runoff Curve Number Method be used?

The Runoff reduction methodology was intended to incentivize developers to utilize ESD facilities. The use of the runoff reduction method should be considered on a case-by-case basis to determine if it is applicable to the site's configuration. Use of the method is intended for smaller storm events such as the 1-yr and 2-year events for the drainage areas to the ESD facilities. This method could also be used for the 10-year event based on the MDE guidelines but is not recommended by Harford County; the County will require a formal written Waiver request.

The reduction method should not be used for 100-year storm event. The 100-year design is to ensure safe passage of extreme events. Utilizing the runoff reduction method to reduce the CN value for 100-year event assumes each ESD facility is functioning at 100% design. This may not be realistic as ESD facilities will most likely be inundated during extreme storm events allowing runoff to short circuit the peak flow. Additionally, long term maintenance inadequacies may reduce the effectiveness of each ESD facility. As a result, utilizing runoff reduction method for 100-year events may allow for the under sizing of ponds resulting in freeboard requirements not being achieved for safe passage of extreme events.

Hydraulic routing is a preferable method and is an acceptable method to determine peak discharge flows. Hydraulic routing allows for specific hydrograph analysis that accounts for each facility's storage vs. control stages.

12. What is the maximum credit and size ESD facility designed for?

The state mandates that WQv, Rev, and CPv are to be provided for projects that require SWM. As a result, Harford County allows ESDv credit for the entire 1-year 24-hour storm event up to a Pe = 2.69" of runoff. In addition to the state mandate, Harford County requires Flood Protection of the 10-year 24-hour storm event.

Harford County only allows ESDv provided credit up to the 1-year 24-hour storm event (Pe = 2.69"), however ESD facilities may be oversized to account for the County's 10-year flood protection requirement. Oversizing ESD facilities (that do not have to be off-line) for 10-year management is not recommended and is not a normal course of practice. The preferred design will use ESD practices for the 1-year storm event with excess volume bypassing or spilling into a traditional Chapter 3 facility for 10-year quantity management. The County understands that this traditional method may not be appropriate for specific lots and therefore will allow the use of ESD facilities to be oversized for 10-year quantity. However, there is a practical limit to enlarging ESD facilities where the ESD begins to become a Chapter 3 facility and therefore the County will evaluate the appropriateness of oversized ESD facilities on a case-by-case basis. If ESD facilities are used for 10-year quantity management, the designer should evaluate the following:

a. Perform hydraulic routing of the ESD facility to determine 10-yr WSE and peak discharge rates.
b. Evaluate embankment classification. Based on the embankment classification the engineer must meet all required criteria.
c. Maximum WSE must not be more than 2-feet above the facility surface. Planting plans must be provided that demonstrate the plantings will survive the designed water depths.
d. Sizing for 10-year management should be based on hydraulic routing.

13. What is the minimum freeboard for ESD and Quantity Management Facilities?

ESD facilities that are designed offline, have a drainage area of less than 0.50 acres, and are not intended to provide quantity management (Qp) shall provide a minimum freeboard of 6-inches above the 10-yr WSE. For all MDE Chapter 5 facilities with drainage areas greater than 0.50 acres and Chapter 3 facilities that are not classified as MDE Code 378 facilities must be designed in accordance with the requirements of the sub-code

378 criteria in the front end of MDE Manual Chapter 3 Section 3.1.1 Pond Feasibility Criteria. The table below shows the minimum requirements for different example embankments, it is the Engineer's responsibility to evaluate all embankments, meet all regulated requirements, and provide all necessary design measures to ensure the safety and stability of the design. All MDE Code 378 embankments must be approved by Harford Soil Conservation District. The designer must submit the MDE Embankment Flow Chart for each facility to demonstrate the design requirement category.

Table 14.1 - Common Embankment Requirements

	ESD (<0.50 acres)*	Chapter 3 Pond	Excavated Ponds	Special Embankment	Code 378 (Class a)
Concrete Cradle / ASTM C-361	No	Yes	Yes	Yes	Yes
Cutoff Trench / Impervious Core	No	Engineer's Judgement	Engineer's Judgement	Engineer's Judgement	Yes
Seepage Control	No gravel under spillway pipe	No gravel under spillway pipe	No gravel under spillway pipe	Yes	Yes
Design Conveyance	10-yr	10-yr	100-yr	100-yr	100-yr
Freeboard above 10-yr WSE	6-inches minimum	12-inches minimum	See 100-yr	See 100-yr	See 100-yr
Freeboard above 100-yr WSE	No	No	2' without ES or 1' with ES	2' without ES or 1' with ES	2' without ES or 1' with ES
Dam Breach Analysis	No**	No**	No**	Yes	Yes

*ESD facilities with drainage areas greater than 0.50 acres shall follow the Chp. 3 Pond criteria.

**The designer must consider the downstream reach conditions and provide a basis for not providing a dam breach analysis (i.e., no structures downstream, downgrade conveyance, small storage volume, etc.) Should Harford County not agree with the screening level assessment, a dam breach analysis will be required.

14. Use of "Site Area" or "Limit of Disturbance" to determine ESDv requirements.

The area used for calculating existing percent impervious (%I) corresponds to either the project's property boundary for a residential lot less than 1 acre or the Limit of Disturbance (LOD) for all other projects. For Redevelopment classifications, only the impervious area within the LOD is used to determine the Target ESDv. Refer to the Harford County ESDv Requirement guideline for detailed discussion on how to determine a projects ESDv requirements.

15. Does Harford County allow Forest Conservation Area ESDv Credit?

No, Harford County does not allow Forest Conservation Area ESDv Credit. Appendix E.1 – Formerly Chapter 5 prior to 2009 was not required and was intended to incentivize developers to use better site design methods. The credits in this chapter no longer apply. The only applicable technique related to Forest conservation is in the 2009 Chapter 5 N-3 Sheet flow to Conservation Areas. Using the entire property as the Site area and then subtracting out the conservation area for the ESDv requirement calculation is not acceptable.

16. What rainfall data does Harford County use for design?

The 24-hour design rainfall amounts for various frequencies for Harford County has been developed by NOAA Atlas 14. These values are based upon rainfall data developed by the National Oceanic and Atmospheric Administration Atlas 14 (NOAA 14). Revised rainfall distribution tables have been developed for three different regions of Maryland. These rainfall data and rainfall distributions have replaced data from Weather Bureau Technical Paper 40 (TP-40) and the standard NRCS rainfall distributions Type II, listed in the EFH on page 2-13. The old values shall no longer be used for design purposes.

The 24-hour design rainfall in the table below shall be used with the NOAA C distribution table.

Harford County 24-hour rainfall duration values							
Storm	**1-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**
Unit	**in.**	**In.**	**In.**	**In.**	**In.**	**In.**	**In.**
Rainfall	**2.69**	**3.26**	**4.19**	**5.00**	**6.25**	**7.34**	**8.58**

17. Does Harford County have Guidelines and/or Requirements for Large Building Projects?

The state mandates that WQv, Rev, and CPv are to be provided for projects that require SWM. The preparation of the Concept Stormwater Management will establish the Target treatment requirements based on the Limit of Disturbance and proposed impervious area. Chapter 5 facilities, appropriately spread out within the site, must be considered, and utilized for all the proposed development beyond the footprint of the large building (< 250,000 sf or about 5.75 ac).

Since the entire roof area will create a series of drainage areas that will exceed design limits of most Chapter 5 facilities, it is understood that the use of small-scale practices may be difficult or physically impossible to fully implement treatment for the roof areas. For Large Building Projects, the architectural plans for the roof area drainage and discharge piping locations are critical to the design and must be provided as part of the Concept Stormwater Management Plan submission.

The initial evaluation process for the treatment of the roof area needs to consider the use of Chapter 5 Submerged Gravel Wetlands (SGW) for treatment (HSG C and HSG D soils), since these facilities are allowed to have larger contributing drainage areas. The use of the SGW facilities will be in addition to the other Chapter 5 facilities that will be throughout the site. The SGW facilities are not “regional” facilities, nor are they intended to be used to meet Qp or Qf requirements.

Only after the evaluation and implementation of Chapter 5 practices has been exhausted and documented, Harford County will consider allowing a Stormwater Management Qualitative Control Waiver per § 214-28 C and D and submitted per § 214-28 G.

If Harford County determines that a Waiver can be approved, the Waiver will require the use of Chapter 3 F-6 Bioretention facilities to provide the treatment of the roof areas. As a condition for approving a qualitative control waiver, the following design items must be provided:

a) The F-6 facilities are to treat roof drainage areas only.
b) The maximum drainage area, including the F-6 facility, shall be less than five (5) acres.
c) The F-6 facilities are not to be designed to meet Cpv, Qp, or Qf.
d) The F-6 facility is to be off-line. A flow splitter device will be provided to divert the roof runoff for the water quality storm event to the facility, with the by-passing flow piped to the project's quantity control facility.
e) The F-6 facility will be provided with an overflow designed for a 10-year storm and underdrain pipe system to an outfall location. The overflow must also be able to safely pass a 100-year storm.
f) Since the facility is only treating roof drainage, a sediment forebay pretreatment basin will not be required, except that flow entering the facility will have suitable erosion protection to spread the flow into the facility.
g) The Target ESDv shall be based on the drainage area to the facility.
h) Surface ponding limited to a 12" maximum.
i) A drop of at least 6" above the ponding elevation shall be provided at all inlets of the facility.
j) The minimum "surface storage" below the overflow device shall be 75% of the Target ESDv.
k) The ESDv provided (surface storage) shall not exceed the Maximum ESDv based on a Pe = 2.69".
l) The typical bioretention filter bed will include the following:
    i. Surface treatment: The 3" mulch layer should be 1-1/2" mulch layer with 1-1/2" light color stone layer on top to prevent mulch migration, per latest MDE landscape guidance.
    ii. Filter bed: Media 2.5' to 4.0' deep (per Appendix B.3. Table B.3.2 Materials Specifications for Bioretention)
    iii. Perforated underdrain (6" dia. min.) located in a gravel layer with 4" bedding and 2" pipe cover.
    iv. Permeable filter fabric shall be placed between the gravel layer and the filter bed.
    v.
m) The F-6 facilities shall meet the same set-back requirements as micro-bioretention facilities.
n) A landscaping plan shall be provided per the Maryland Stormwater Design Manual, except, no trees are allowed within the facility.
o) The facility shall not be used for sediment control. The practice should not be constructed until the contributing drainage area is permanently stabilized. If this is not possible, the runoff from disturbed areas shall be diverted away and no sediment control practices shall be used near the proposed location. If site work requires that these facilities be constructed earlier in the sequence, then the E&S plans should consider other protections (e.g., covering the facilities with an impermeable liner.) Permanent stabilization shall be established over the contributing drainage area before runoff can be accepted into the facility.
p) Construction and material specifications shall be in accordance with Appendix B-4 of the 2000 Maryland Stormwater Design Manual Volumes I & II, as amended unless specified above.