Date: June 10, 2019

To: Urban Stormwater Work Group

From: Tom Schueler and David Wood
Bay Stormwater Coordinators
Chesapeake Stormwater Network

Re: Proposed Strategy for Crediting Bioretention, Swale and Ditch Retrofits

Action Requested: Provide feedback on memo by July 1. Agree to implement revised strategy on credit development this summer. Consider nominating yourself or a colleague to serve on the small advisory group.

This memo presents a strategy to develop a retrofit credit for enhancements to existing bioretention areas, swales and ditches to boost their ability to remove nutrients and other pollutants from urban stormwater runoff. The memo begins with some background on recent research on the potential increments of pollutant reduction that might be achieved by these enhancements.

The memo also outlines a suggested time line for a technical review process to develop potential credits. Lastly, the memo outlines a second phase to credit other types of roadside ditch management practices, such as ditch elimination, adjustment and stabilization within the next year.

Background

The Chesapeake Bay Program has produced several iterations of pollutant removal credits for this group of urban BMPs over the past 15 years, in response to new monitoring data and the continued evolution in practice design. The original removal rates for bioretention and swales, were established by Baldwin et al (2003) and Simpson and Weammert (2009) and were subsequently revisited by two expert panels that updated the pollutant removal credits to account for the new stormwater design criteria adopted by the Bay states (NSSPS EPR, 2013) and the installation of stormwater retrofits (SR EPR, 2013).

These expert panels calibrated their recommendations to the prevailing state criteria for sizing and designing bioretention, swales and filtering practices (for a typical example, see VA DCR, 2010).

A STAC workshop held in 2016 suggested that significant opportunities exist to "re-plumb" or retrofit the existing ditch network of the Bay watershed to both reduce high flows and pollutant loads (Schneider and Boomer, 2016). A year later, an expert group formed by the USWG recommended detailed procedures for crediting six different types of roadside ditch management practices (CB RDMT, 2017). While the USWG supported of the crediting proposals at the time, they noted that more technical support

information was needed so that states and local governments could properly implement them in the future.

Subsequent monitoring studies, research reviews and engineering analyses sponsored by NFWF, EPA and CBT have filled these implementation support gaps. Some of the key studies included research by Davis and others (2014-18), Hirschman (2016), Hirschman et al (2017), HWE (2018 a-e), Imhoff and others (2018) and others. A recent research review explored the runoff reduction and pollutant removal rates for ten different LID practices studied over the past decade (Hirschman et al 2018) which provides a stronger foundation for defining removal rates for innovative design enhancements.

Proposed Technical Approach

The proposed approach is to condense the recent technical support information into simple, constructible and verifiable retrofit criteria that prescribe how to install design enhancements within existing stormwater BMPs. The criteria would be accompanied by specific protocols to calculate the higher removal these retrofits achieve.

The proposed enhancement techniques include:

- Biochar amendments
- Water treatment residual amendments
- Iron amendments
- Soil or sand amendments
- Internal water storage devices
- Enhanced conservation landscaping
- Media replacement
- Wood chip bioreactors
- Other techniques, as identified by the experts

The likely retrofit applications for these enhancement techniques might include:

- Media amendments within existing bioretention areas (post-2010)
- Upgrades of legacy bioretention areas (pre-2010)
- New treatment in existing roadside ditches
- Media amendments within existing grass swales
- Other applications, as defined by the experts

Note: At this time, these design enhancements are not being considered as an acceptable BMP for new land development, since they are not currently included in the state stormwater design manuals that prescribe the specific practices that acceptable for use by the appropriate state-wide stormwater agency. It is anticipated that Bay states may elect to incorporate these specifications for enhancement techniques when they update their stormwater manuals in the future.

The preferred method for calculating the pollutant removal credit should be consistent with prior expert panels. It should:

- Be generally adapted from the existing runoff adjustor curves
- Establish a pre-retrofit baseline removal rates for older stormwater practices and ditches
- Discount the baseline rate to account for older (and less effective) stormwater treatment design standards, where appropriate.
- Define how the incremental improvement in removal rates is calculated for each enhancement technique (or combination of techniques) employed at an individual retrofit site
- Include other methods or qualifying conditions, as defined by the advisory group.

Recommended Process and Timeline

Under the CBP BMP Review Protocol (WQGIT, 2016), sector workgroups can establish small teams to provide further detail and interpretation on expert panel reports that were previously approved by the CBP partnership (see also Schueler, 2016). While the recommendations of these small groups still need approval by the USWG and the CBP modeling team, they do not require the full partnership approval process that comes with a formal expert BMP review panel. The small group process has the added benefit that it provides local governments more options to apply existing and approved urban BMPs.

Five steps are recommended to guide the small group process:

Step 1: Coordinate with Key Parties. (Summer, 2019). CSN will coordinate with the experts that helped develop the key reports that potentially support a new crediting approach (e.g., Davis, Imhoff, Hirschman, Lindow and others). In addition, CSN will consult with state stormwater agencies and the CBPO modeling team. CSN will also check in with the agricultural work group on progress being made by the expert panel on treatment in farm ditches (which may be completed this summer).

Step 2: Compile Draft Credit Synthesis Report. (Summer, 2019). CSN will then produce a condensed summary of the enhancement technique literature described in the background section. The report will answer the following questions for each of the proposed enhancement techniques:

1. Does the enhancement technique produce a measurable and reliable improvement in the baseline nitrogen and/or phosphorus removal rate for the practice?

2. If so, can the incremental benefit of the enhancement technique be expressed in the context of the existing runoff adjustor curves that are currently used to define the baseline?

3. Do specific engineering criteria exist on how to properly design, construct, maintain and verify the enhancement technique?

4. Are the materials needed for the enhancement technique clearly specified and commercially available?

5. Is the enhancement technique feasible over the range of soil, groundwater and terrain conditions encountered across the Bay watershed?

If the answer to all five questions is affirmative, the report will recommend a crediting protocol for the enhancement technique and reference the appropriate technical specifications needed to properly implement it.

Some enhancement techniques may not be quite ready for implementation, as they may need more testing, product specifications or demonstration studies to provide "proof of concept" for the enhancement technique. This is likely to be true for both biochar and water treatment residuals. In these cases, the report will identify what further investments are needed to pilot these techniques.

Step 3: Form a Small USWG Group to Review Report. (Fall, 2019). A small group of stormwater stakeholders will be assembled to review the draft credit synthesis report. The group will feature individual state, local and private sector experts with extensive experience in stormwater retrofit implementation. Nominations for the small group will be solicited by the Urban Stormwater Work Group until September 1, 2019. Several meetings will be convened throughout the Fall to allow the group to conduct their review and make their findings.

*Step 4: Present Findings to USWG and Solicit External Comment***.** (Late fall, 2019). The small group would then present its findings to the USWG, and members would have an opportunity to provide additional feedback.

Step 5: Seek Approval as an Existing Retrofit BMP (early 2020). The draft report will then be revised and final approval will be sought from the USWG to adopt its crediting recommendations.

Review of other Roadside Ditch Management Practice in 2020.

The CB RDMT (2017) recommended that sediment reduction credits be developed for other ditch management practices, including ditch elimination, adjustment (length/slope) and stabilization methods. Some preliminary work on developing credits has been done recently by Siepp et al (2019), and it is proposed that a second small group be convened in early 2020 to work on them.

References:

Baldwin, A., T. Simpson and S. Weammert. 2003. Reports of urban BMP efficiencies. Prepared for EPA Chesapeake Bay Program. Urban Stormwater Workgroup. University of Maryland, College Park

Chesapeake Bay Roadside Ditch Management Team (CB RDMT). 2017. Options for Crediting Pollutant Reduction from Roadside Ditch Management (RDM) Practices in the Chesapeake Bay Watershed. Technical Memo to Urban Stormwater and Agricultural Work Groups. Chesapeake Bay Program. Annapolis, MD

Chesapeake Stormwater Network. 2016b. Visual indicators for inspecting and verifying grass channels, filter strips and sheet flow to buffers. Webcast powerpoint. Chesapeake Bay Stormwater Training Partnership. October, 2016.

Allan Davis Bioretention References and PED webcast

Hirschman, D. 2016. Technical memos: PED Recommendations and Technical Support. To Chesapeake Stormwater Network and USWG. Hirschman Water and Environment.

Hirschman, D., Brian Seipp and T. Schueler. 2017. Performance enhancing devices for stormwater best management practices. Final Technical Report. Chesapeake Stormwater Network and Center for Watershed Protection.

Hirschman, D., G. Hoffmann, J. Hathaway, K. Lindow and M. Aguilar. 2018. Runoff reduction revisited: Final report to DC Department of Energy and Environment. Washington, D.C.

Hirschman Water and Environment, LLC. (HWE). 2018a. Performance enhancing devices for stormwater BMPs: Internal water storage. Report prepared for Chesapeake Bay Trust.

HWE, 2018b. Performance enhancing devices for stormwater BMPs: Iron amendments. Report prepared for Chesapeake Bay Trust.

HWE, 2018c. Performance enhancing devices for stormwater BMPs: Water treatment residuals. Report prepared for Chesapeake Bay Trust.

HWE, 2018d. Performance enhancing devices for stormwater BMPs: Biochar. Report prepared for Chesapeake Bay Trust.

HWE, 2018e. Performance enhancing devices for stormwater BMPs: Enhanced vegetation. Report prepared for Chesapeake Bay Trust.

Imhoff Biochar references

New State Stormwater Performance Standards Expert Panel Report (NSSPS EPR). 2013. Recommendations of the Expert Panel to Define Removal Rates for State Stormwater Performance Standards. Approved by the CBP WQGIT. March 2013

Schneider, R. and K. Boomer. 2016. Re-plumbing the Chesapeake Watershed: Improving roadside ditch management to meet TMDL water quality goals. STAC Publication No. 16-001. Edgewater, MD.

Schueler, T. 2016. Process for handling urban BMP decision requests. Approved by Urban Stormwater Workgroup. February, 2016. Chesapeake Bay Program Office.

Siepp, B. et al 2019

Simpson, T. and S. Weammert. 2009. Developing nitrogen, phosphorus and sediment efficiencies for tributary strategy practices. BMP Assessment Final Report. University of Maryland Mid-Atlantic Water Program. College Park, MD.

Stormwater Retrofit Expert Panel Report (SR EPR). 2013. Recommendations of the Expert Panel to Define Removal Rates for Individual Stormwater Retrofit Practices. Approved by the CBP WQGIT. March, 2013.

Virginia Department of Conservation Resources (VA DCR). 2010. Virginia Stormwater Design Specifications. Version 1.7.

#3 Grass Channels
#4 Soil Amendments
#9 Bioretention
#10 Dry Swales
#11 Wet Swale

Water Quality Goal Implementation Team (WQGIT). 2015. Revised protocol for the development, review and approval of loading and effectiveness estimates for nutrient and sediment controls in the Chesapeake Bay Watershed Model. US EPA Chesapeake Bay Program. Annapolis, MD.