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Maryland League of Conservation Voters
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January 5, 2009

Mr. Brian Clevenger
Water Management Administration
Maryland Department of the Environment
1800 Washington Blvd.
Baltimore, Maryland 21

Re: Comments on MD Stormwater Management Act Draft Regulations and Design Manual Changes

Dear Mr. Clevenger:

We are pleased to present the written comments of the Maryland Stormwater Consortium on the proposed regulations and Maryland Stormwater Design Manual changes to establish environmental site design (ESD) pursuant to the Maryland Stormwater Management Act of 2007 (the Act). The Consortium, a coalition of environmental organizations committed to improving stormwater management in Maryland, finds that the proposed COMAR regulations and manual revisions are positive and commends the Department of the Environment (MDE) on their efforts to make this progress.

In particular, we support the provisions relating to the requirement that ESD be invoked early in the site concept plan phase; the use of the three phases of concept plan, site development plan, and final stormwater plan; and the use of the flow charts to show the design process for both development and redevelopment.

In our view, however, several significant changes should be made to these regulations in order to bring them into conformity with the letter and the spirit of the Stormwater Act of 2007, and to achieve the promise of substantial positive impact on stormwater pollution in Maryland's rivers and streams. The changes and additions we recommend herein are intended to build upon the foundation which MDE has proposed and we urge that our recommendations be received in that vein. Our comments and recommendations address issues raised during the public hearing on December 8. We have also included in our comments several recommended COMAR language and manual text revisions.

1. Minimum Stormwater Treatment Volumes are Inadequate

Maryland’s stormwater regulations must establish adequate minimum stormwater volume standards for new development and redevelopment, and must fully implement the Stormwater Management Act’s groundwater recharge requirement. Md. Environ. Article Code Ann., § 4-203(b)(8)(vi) (2008). All development and redevelopment projects subject to stormwater regulations under the Act must determine the stormwater volumes to be reduced on-site. For Environmental Site Design to be effective, numeric volume standards that determine the quantity of stormwater to be reduced are critical to the entire design process.

Additionally, we believe that the definition of “Runoff Reduction” is crucial, because it provides the allowable set of hydrologic functions and performance objectives, along with the percentage of volume reduction that ESD practices and whole sites must attain. Each is discussed below.

A. MDE’s proposed new development minimum volume and ESD Sizing methodology are not adequate.

The ESD Sizing Criteria in Chapter Five should be revised to require on-site reduction of the full Channel Protection Volume (CPv). The Act requires developers to demonstrate that they have implemented ESD to the Maximum Extent Practicable (MEP). Md. Environ. Article Code Ann. § 4-203(b)(5)(ii)3.A. (2008). ESD is defined in the statute as:

“Using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources.” Md. Environ. Article Code Ann. § 402.1(b) (2008).

In order to fully mimic “natural hydrologic runoff characteristics,” and ensure that ESD is implemented to the MEP, MDE must establish a numeric stormwater retention or reduction volume for new development that preserves and/or recreates the original pre-development hydrologic runoff characteristics of the site. As noted below, without an adequate numeric runoff reduction volume to be required of developers, site designers will fall back to the pre-Stormwater Management Act approach of using standard structural practices. This scenario will not protect streams or groundwater supplies nor is it consistent and compliant with the Act.

MDE obviously recognizes that a required minimum volume of water must be established for on-site retention via ESD measures, and has attempted to address this crucial need. Unfortunately the minimum volume MDE has proposed for on-site retention via ESD practices is far below the level that would mimic pre-development hydrology and also far below the level that is practicable.

We support the intent of the draft regulations – to treat the full CPv with ESD, but MDE has proposed that the CPv be merely a target to be addressed, not a requirement that sets the minimum on-site reduction that must be achieved. The proposed Chapter 5 ESD sizing criteria actually only requires the one-inch Water Quality Volume (WQv) as the floor for sizing ESD

measures. The required volume must be the actual reduction of the full CPv, as opposed to just a “target” for on-site retention of stormwater via ESD techniques.

Existing ESD subdivisions, such as Pembroke in Frederick County, have demonstrated that much larger volumes of stormwater, far beyond MDE’s proposed minimum of 1”, can be fully reduced on-site. Pembroke’s designers used the 2-year storm (3 inches of rainfall) as the design storm and achieved downstream protection for large flood events.

MDE must require the full CPv, ranging from 99% of 2.4” to 2.8” depending on the County, to be reduced (retained on-site) via use of ESD measures.

To achieve this fundamentally important change, MDE should revise Draft Chapter 5, page 5.18, Section 5.2.3. Addressing Stormwater Management Requirements Using ESD as follows:

- Change the subheading of “Treatment” to the term “Runoff Reduction” (see below)
- Change the text to read as follows:

ESD practices shall be used to reduce the Channel Protection Volume (CPv) on all new developments where stormwater management is required.

Delete the text immediately below this statement, beginning with the phrase, “ESD practices shall be used to the MEP to address CPv...”

B. MDE needs to establish an operational definition of “runoff reduction”.

Chapter 5 breaks important new ground in defining the need for runoff reduction as the primary means of defining what constitutes an ESD practice, and the extent to which MEP compliance is assessed at the site. However, Chapter 5 does not go beyond a specific list of practices, which studies show can differ in runoff reduction by as much as 50 to 75%, depending on their design, soil type and sizing. In addition to listing and providing specifications for individual ESD practices, MDE must adequately define the objectives and numeric standards that entire sites as a whole must attain.

The proposed COMAR Section 0.02 Definitions would be greatly improved if it provided an operational and numeric definition of “runoff reduction”, that is easily understood by both the design consultant and the local plan reviewer. A clear definition of “runoff reduction” is also needed in Chapter 1 to provide a numerical benchmark to define the quality of MEP achieved by ESD practices. This approach is technically documented by CSN (2008) and is recommended by the National Research Council (2008).

We recommend the following operational definition of “runoff reduction”:

“Runoff reduction is defined as the total annual runoff volume reduced by an ESD practice through canopy interception, soil infiltration, evaporation, rainfall harvesting, engineered infiltration, evapo-transpiration or extended filtration that delays the delivery of stormwater from small sites to the stream system by six hours or more. The rate of

runoff reduction is expressed as a numerical percentage, as based on current available science.”

C. MDE’s proposed treatment requirements for redevelopment are insufficient.

The proposed standard for treatment in redevelopment settings remains inadequate. While the 50% reduction in impervious coverage and/or treatment of 50% of site imperviousness represents an improvement over the existing redevelopment treatment requirement (20%), it would represent a missed opportunity to make a truly meaningful improvement in stormwater management in areas which currently have little to no stormwater management.

There is ample support for significantly increased stormwater management standards in recent reports discussing Chesapeake Bay restoration needs; both the US EPA Office of Inspector General and the National Research Council have recently published analyses and recommendations for increasingly stringent stormwater requirements. Many jurisdictions around the country have successfully, and with no ill effects, adopted more stringent stormwater treatment requirements in highly urbanized areas. Indeed, even in Maryland, Montgomery County strives for the full CPv treatment for redevelopment projects, but accepts some waivers and sets a *minimum* treatment requirement of the WQv (roughly 1 inch). Philadelphia, PA to our immediate north, requires treatment of the WQv for both new development and redevelopment. Seattle, WA; Portland, OR; Minneapolis, MN; Austin, TX; Charlotte-Mecklenburg, NC; and Knox County, TN all have elevated stormwater management standards that require at least the treatment of 1 inch or management of the full WQv, despite the fact that parts of these jurisdictions are densely developed, that some are experiencing much redevelopment, and that others are challenged by more rainfall than we experience in Maryland.

We firmly believe that MDE must require a minimum stormwater treatment requirement of the WQv (i.e., manage for the 90th percentile of average annual runoff volume) for redevelopment projects, even for highly urbanized sites. This treatment performance standard is reasonable and economically achievable, it is straightforward and eminently understandable, and it allows site designers and engineers to utilize what site designs, practices, or systems work best, instead of merely requiring impervious surface reduction by a certain percentage. Urbanized areas can and should be required to meet these higher - but still achievable - standards, or we may never see the kinds of significant water quality improvements in waterways that course through urbanized areas of Maryland, that most experts agree are crucial to obtaining Chesapeake Bay water quality advances.

We also steadfastly reject the notion that strengthening stormwater treatment requirements for redevelopment projects will inherently “kill Smart Growth efforts” in Maryland. Nowhere to our knowledge has this claim been credibly demonstrated, yet it unfortunately is circulated and held as truth by many who would rather not impose higher standards for stormwater or change “business-as-usual”. A 1-inch treatment requirement for redevelopment would still be a lower treatment standard than what we propose for so called “green-field,” *new development*, so it does not intrinsically place redevelopment at a competitive disadvantage when compared to green-field development projects. This position was recently articulated in a letter to MDE Secretary

Wilson by several state, regional, and national environmental organizations that focus efforts on Smart Growth.

In addition, in October 2008, the Chesapeake Bay Foundation, Audubon Naturalist Society, and the Anacostia Watershed Society sponsored an assessment of relative costs associated with meeting both the WQv and the CPv on three actual urban sites within Maryland jurisdictions with hypothetical and real redevelopment projects. What the exercise revealed was that the use of ESD in many urban settings can be a cost-effective way to meet redevelopment stormwater treatment requirements, and that the attainment of the 1" standard is not infeasible. While we are not asserting that the entire WQv of 1 inch can always be achieved through ESD alone, this minimum standard, in combination with the step-wise process included in the draft Manual, can maximize the use of ESD in redevelopment.

Where physical site constraints make on-site treatment of 1 inch simply unachievable, the kinds of "alternative management" options included in the draft manual, including off-site treatment BMPs, stream restoration or retrofits elsewhere within the same watershed, or perhaps increases in land use intensity (housing or employment) on-site, to achieve smart growth objectives, are possible alternatives. We believe this standard represents a fair, though stringent, requirement that can be met and that will advance important Chesapeake Bay-related water quality goals for Maryland's urbanized watersheds.

Of further concern is the definition of "redevelopment", which contains a size threshold of 5000 square feet. This is too high to meaningfully include enough redevelopment activity in highly-urbanized areas, and will eliminate opportunities to improve stormwater management. A recent review of redevelopment projects in Baltimore City in 2005 found that of the 476 projects that required grading permits, 418, or 88%, were exempted from stormwater treatment requirements because the projects were not greater than the 5000 square foot threshold. The Cities of Portland, OR and Austin, TX use a threshold of 500 ft², while Washington DC applies its runoff reduction requirements to 250 ft². We recommend reducing the current threshold to 2500 square feet to capture more redevelopment projects and, of crucial importance in the Chesapeake Bay watershed, to increase opportunities to add stormwater management where none currently exist, especially in urban areas.

D. The numeric groundwater recharge requirement in the Act has been omitted.

The groundwater recharge and groundwater portion of the ESD Sizing Criteria in COMAR and the Manual must reflect the statutory language that requires all stormwater management plans to "maintain 100% of the average annual predevelopment groundwater recharge volume" for a given site. Md. Environ. Article Code Ann. § 4-203(b)(8)(vi) (2008). This specific recharge volume for each site must be demonstrated by the developer using hydrologic and hydraulic calculations based upon data indicating pre-development groundwater recharge levels provided by MDE. New Jersey uses a "Groundwater Recharge Spreadsheet" to enable place-based calculations of recharge levels based on mass balance calculations from precipitation and runoff data. Similar data tables must be developed for Maryland in order to establish adequate groundwater recharge volumes that will comply with the Act and protocols for natural or enhanced infiltration wherever necessary.

The language of Standard No. 3 on page 1.13 of the Manual is noncompliant with the Act, which requires not merely mimicking of pre-development groundwater recharge volumes, but maintenance of such volumes. We propose the following revision to Standard 3:

“Annual groundwater recharge rates and volumes shall be maintained through full use of non-structural and structural infiltration practices. Developers must demonstrate through hydraulic and hydrologic calculations and other site-specific data that the average annual pre-development groundwater recharge volume will be maintained.”

All additional sections in the proposed revised Manual that implement this standard and that otherwise pertain to groundwater recharge and infiltration volume requirements should be revised to fully reflect and comply with the Act’s specific groundwater recharge volume requirement. For example:

- Section 2.0, page 2.1. Table 2.1: “Recharge Volume Description.”
- Section 2.2, page 2.5 Recharge Volume Requirements (Rev)
- All Design Examples throughout the Manual that include Recharge calculations need to be revised.
- All Stormwater practice information in the Manual Chapters 3, 4, and 5, that rests upon assumptions related to the Recharge requirements, needs to be revised to fully require and to implement the statute’s groundwater recharge requirement.

2. **“Maximum Extent Practicable” must be Strengthened**

The definition of maximum extent practicable (MEP) proposed within the COMAR text is a good start, but we believe the General Assembly provided further guidance regarding application of “MEP” by including language that standard BMPs may be used at a development site only when “absolutely necessary.” Md. Environ. Article Code Ann. § 4-203(b)(5)(ii)3.B. (2008). To fully capture this legislative intent, we recommend modifying the proposed definition of “MEP” and several additional text changes in COMAR and the Manual.

“(22) Maximum extent practicable (MEP) means, for the purposes of this chapter, designing stormwater management systems so that all opportunities for using ESD planning techniques and treatment practices are exhausted and that the developer demonstrates to the approving authority that it is absolutely necessary to use standard best management practices on a development site.”

We also firmly believe that it is crucial that there is consistent use of the definition of MEP throughout COMAR and the Manual text. It is both misleading and inaccurate to substitute the words “explore” or “evaluate” when the intent is to “exhaust” the use of ESD. Such substitution does not reflect the Act or the definition of MEP. Therefore, we recommend the following changes to COMAR text.

26.17.02.01 .01 **Purpose and Scope**

A. In the last line, insert “ABSOLUTELY” between “when” and “necessary”

26.17.02.01 .04 Stormwater Management Ordinances

B. (1) Insert: “d. REQUIRES THE IMPLEMENTATION OF ENVIRONMENTAL SITE DESIGN TO THE MAXIMUM EXTENT PRACTICABLE.”

26.17.02.06 .06 Minimum Control Requirements

(2) At the end of the last sentence in this numbered paragraph which begins with “The MEP standard is met”, insert, after the word “necessary” the following: “BY THE APPROVING AUTHORITY.”

26.17.02.09 .09 Stormwater Management Plans

(e) Insert after “design”: “AND WHICH DEMONSTRATES THAT ESD WAS USED IN THE FINAL DESIGN TO THE MEP;”

Such language is important in order to comply with the law itself, which uses the term “practicable,” not practical. “Practicable” is a term of art used in environmental policy and regulation to describe that which is *at all feasible*, not merely that which is most convenient, or that which is less costly than some other means. Weak language leaves unclear the rationale that may be accepted for failure to maximize ESD. For example, could a developer suggest ESD practices were “explored” but because they cost a bit more, s/he decided against implementation? Could the designer/engineer contend s/he used practices that were “proven” or “customarily used?” In addition, we believe it is imperative that site developers be required to *demonstrate* or describe how they have achieved ESD to the MEP within each review phase. For example, the developer could include computations of runoff reduction, or could include a narrative description of which ESD practices were considered and how each were ruled out or incorporated.

Additionally, in the Manual, we believe the following changes would buttress the application of the definition of MEP.

Section 5.1.1 Introduction

After the full paragraph and in the fourth bullet, strike “explored” and insert “EXHAUSTED;” and insert after “surfaces” the words “AND THAT STANDARD BEST MANAGEMENT PRACTICES HAVE BEEN USED ONLY WHERE ABSOLUTELY NECESSARY.”

Furthermore, we believe that process flow charts in the Manual should also be revised. Figures 5.1 and 5.21 in Chapter 5 depict the design processes for new development and redevelopment, respectively, and Section 5.1.3 text states that these design process shall be used as “an enforceable mechanism during review of the plan.” However, there is an inconsistency between the text description of the development phases and the figures. To remedy this

inconsistency, we believe that information should be added to guide the design practitioner/developer with respect to full achievement of ESD to MEP and full achievement of the integration of erosion and sediment control (ESC).

Figure 5.1 should be amended as follows to address the inconsistency:

1. The concept phase box should include an entry indicating that erosion and sediment control design issues have been addressed.
2. There should be a diamond between “submit concept plan” and “site development plan” which inquires as to whether all ESD options were used and whether ESC issues have been addressed. If the answer to either of the questions is “no” then an arrow should show that the proposed concept plan had been returned to the applicant to address these two issues.

These same amendments should be made to Figure 5.21.

3. **Supplemental Design Guidance for ESD and Other Tools are Needed to Ensure Meaningful Local Implementation**

A. MDE must allow flexibility in using the most up-to-date design standards.

While the technical standards for ESD practices contained in Chapter 5 are a good start, these design specifications are continuously evolving, and many technical elements of the new Chapter are missing and/or will soon be out of date. A few examples where expanded or more detailed design specifications are needed include:

- The proposed bioretention media mix has been shown to result in increased phosphorus discharge according to recent research;
- Standards are lacking for practices such as soil compost amendments, and much more detail is needed for non-structural practices such as filter strips, grass channel and rooftop disconnection, and reforestation than is currently provided in the Chapter 5;
- Changes are needed to traditional structural BMP specifications to ensure they are only used as a practice of last resort, along with updated design;
- More specific detail on proper practice installation, construction sequence and maintenance is needed to promote greater performance and longevity and prevent premature practice failure; and
- Special design modifications need to be provided for karst and coastal plain terrain which is present in much of the state (e.g., CSN 2008b and CSN 2008c).

The key point is that a flexible update process is needed to enable MDE and local jurisdictions to enhance their current design standards to continuously improve the performance, installation, and maintenance of both ESD and non-ESD practices. The Chesapeake Stormwater Network (CSN), in collaboration with dozens of researchers, engineers and plan reviewers, has engaged in a process to continuously update design standards for the following practices, with current editions of each design specification readily accessible on the CSN website (www.chesapeakestormwater.net):

Rooftop Disconnection Filter Strips Grass Channels Soil Compost Amendments Green Roofs	Rain Tanks and Cisterns Permeable Pavers Infiltration Bioretention Urban Bioretention	Dry Swales Filtering Practices Constructed Wetlands ED Ponds Wet Ponds
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These peer-reviewed design specifications are being adapted by the Commonwealth of Virginia, and are under consideration by the District of Columbia, West Virginia and other States, and provide an excellent resource for local government

We firmly believe that the following COMAR modification would provide clear flexibility to utilize the best new ESD design technical standards as they are developed.

Section 0.01- 1B Documents Incorporated

(1) Insert after “Supplement 1” the following “OR MOST RECENT EDITION OF BAY-WIDE STORMWATER DESIGN SPECIFICATIONS OR SUBSEQUENT MDE SUPPLEMENTS OR LOCAL EQUIVALENTS ARE”

This minor change to the existing language takes the pressure off of MDE to be the sole arbiter of design requirements for ESD practices in the coming years, and grants flexibility to early local adopters to go well beyond the minimums in Chapter 5.

B. Implementation Tools are Needed for Local Governments.

The transition to the new ESD stormwater paradigm will be temporarily difficult for the stormwater design and plan review community, and will require considerable investments by MDE, local governments, and NGO technical service providers to develop on-site compliance tools, training and certification, and maintenance reduction techniques to improve real world implementation. The Consortium believes the following should be priorities for early action.

i. Compliance Tool (Spreadsheet)

The biggest missing link in the proposed regulatory package is that it does not outline a specific methodology for showing numeric compliance at a development site (e.g. the Virginia runoff reduction compliance spreadsheet (CSN, 2008). This is significant since there is no transparent way for design consultants and local plan reviewers to agree on what constitutes ESD compliance to the MEP at real world sites. A small technical workgroup could quickly come to consensus on how to adapt the Virginia spreadsheet to meet Maryland conditions. This need has been expressed by both the design community and local government plan review staff

ii. Training and Certification

An intensive training program is needed to get the several thousand local designers, plan reviewers, and other decision-makers up-to-speed on the new techniques and compliance methods. The responsibility for this training can be shared among MDE and myriad stakeholders. In fact, the CSN and the Center for Watershed Protection (CWP) recently developed a proposal to create a statewide stormwater training alliance involving all major stakeholders in the training process.

4 Additional Sediment and Erosion Control Protections are Needed

Section 5.1.3.2, "Erosion and Sediment Control Plans," requires that sediment and erosion control plans contain four elements. We believe each can be strengthened.

Preservation (p.5.12)

After the sentence ending with "be identified" insert: "A MAXIMUM UPPER LIMIT FOR UPSTREAM DRAINAGE AREAS TO INDIVIDUAL SEDIMENT BASINS OR TRAPS AND A PROHIBITION ON DIRECT DISCHARGES TO STREAMS SHALL BE ESTABLISHED."

Phasing and Sequences of Construction During Each State of Development (p. 5.12)

At the end of the first paragraph, insert: "FOR EACH SEQUENCE OF CONSTRUCTION, SOIL STABILIZATION SHALL BE COMPLETED WITHIN 24 - 72 HOURS AFTER SOIL HAS BEEN EXPOSED."

Stabilization Strategies (p. 5.13)

In the first paragraph, third sentence, strike "Where this cannot be accommodated;"
Replace "14 days" with "24 hours."

In the second paragraph, strike the first two sentences. Insert: "NO MORE THAN SIX ACRES AT A TIME ARE TO BE CLEARED, GRADED, OR OTHERWISE DISTURBED."

In the third paragraph beginning with "Natural vegetation", insert a new third sentence to read: "STOCKPILES OF EARTH SHALL BE COVERED OR STABILIZED WITHIN 24 HOURS OF ESTABLISHMENT OR USE."

5. Clarify the Three-Step Planning Process

First, within the initial Concept Plan review step, there appears to only be a requirement for the review of submitted plans and feedback from the local authority, but no provision for outright rejection of what may be truly inadequate plans that do not maximize ESD approaches and practices. We believe that applicants must understand the repercussions of inadequate utilization

of ESD to the MEP and that a local reviewing agency must have the authority to require a full overhaul of insufficient plans.

Second, nowhere in the three-step design and planning process are there public notice or review opportunities. While the sediment and erosion control plan element has (based on the Construction General Permit recently released) a provision for notifying interested stakeholders via posting of Notices of Intent on the MDE website, there are no similar notification or allowances for public input into other phases of the project design and review outlined in the regulations or manual. Public review and opportunity for comment must be included in each stage of the design and planning process outlined within the Manual if we wish to ensure an open and inclusive process.

6. Grandfathering Must be Adequately Addressed

At the public hearing, several stakeholders requested inclusion of a “grandfather clause” for development projects that should not be covered by the new regulations or manual. While no specific recommendations were proposed, we believe that the statute sets forth sufficient guidance. By detailing requirements for ESD to the MEP and the coordination of stormwater and ESC planning, we believe the General Assembly clearly intended these activities to begin immediately upon completion of the required regulatory and design modifications.

We believe that when MDE receives final approval of the proposed COMAR and Manual changes, any project-level ESC plan application submitted to the approving authority and not yet approved, will be required to adhere fully to the Act and the regulations. Nonconforming plans should be returned to the applicant by the approving authority.

Such a procedure would be clear enough for the regulated community. The Act was passed in April 2007 and work on the regulations and Manual changes commenced shortly thereafter; the proposed changes were published in October, 2008. We recommend that the following be added to the proposed COMAR regulations:

26.17.02.01 Purpose and Scope

“C. Once finalized, these regulations and any amendments apply to all qualifying new development and redevelopment projects that do not have an approved erosion and sediment control plan at the time such regulations take effect.”

7. Protections for Trout Streams and Wetlands Must be Expanded

Recent research has demonstrated that direct stormwater discharges can have a deleterious impact on sensitive receiving waters such as trout streams and wetlands at extremely low levels of land development (Stranko et al, 2008, Wright et al 2007, Cappiella et al 2006, and Schueler et al, in press). Consequently, a greater level of protection is needed to safeguard these important ecosystems from the impacts of land development. The section in Chapter 5 on Special

Watersheds mentions these ecosystems but needs to be expanded to provide comprehensive, numeric stormwater protection measures, beyond the basic minimum requirements for other receiving waters. In each of the following sections, we recommend the following changes.

3a: Stormwater Discharges to Trout Streams

Add the following to Section 5.6.6:

- Maximize the infiltration capacity of each practice in order to minimize the thermal impacts associated with runoff from impervious surfaces. All practices should be designed to cause no increase in downstream temperature;
- Explicitly prohibit the use of ponds for runoff treatment in trout watersheds; and
- Ensure all zero-order and other streams have a high quality riparian forest buffer

Add the following to *3b Stormwater Discharge to Wetlands*

- Define a series of sensitive MD wetland types that merit special protection (e.g., bogs, fens and others, see Wright et al, 2007);
- Explicitly prohibit the use of natural wetlands for stormwater treatment of any kind; and
- Require modeling and monitoring analyses to confirm no changes in post development hydro-period in sensitive wetlands, which is operationally defined as no more than six inches of additional water level fluctuation for a one-inch storm.

8. MDE Should Examine Alternatives to the Hydrologic Soil Group System

The use of Hydrologic Soil Group system (“HSG”) to derive infiltration rates and curve numbers is problematic, and we urge MDE to examine alternatives. While the HSG and related curve number methods are convenient for site designers and regulators as a substitute for actual field measurements, a growing body of evidence from stormwater engineers, soil scientists, and others suggests that there are several significant flaws associated with this method. These flaws raise doubts about the ability of HSG and related curve numbers to adequately represent actual in-the-field infiltration capacity of soils and associated vegetation and bedrock.

MDE must reconsider its heavy reliance on the NRCS HSG methodology, in favor of an ESD sizing criteria methodology that both surveys site-specific soil, water, bedrock, and vegetation conditions, and that requires developers to demonstrate via a spreadsheet or other simple method that the full Runoff Reduction Volume has been reduced on-site. MDE’s regulations and Manual should also specify enforceable methods to protect intact vegetation and soils from destruction and compaction.

Overall, our organizations commend the work that has clearly gone into modifying MD’s stormwater regulations and Design Manual to reflect the Stormwater Management Act of 2007. While we believe these proposed changes represent a good step in the right direction, we firmly believe that Maryland will miss the statutory intent, as well as the real-world opportunity presented by more aggressive modification of the proposed regulations and manual. Recent modeling results suggest that we are collectively much further behind in Chesapeake Bay

restoration than previously believed and urban/suburban stormwater impacts are a primary culprit in this lack of progress. Indeed, stormwater represents the only sector moving in a negative direction in terms of tangible nutrient and sediment pollution reduction to our rivers and streams. It is through this lens that we reviewed the proposed regulations and developed our comprehensive comments for necessary changes. Without more stringent stormwater management regulations, Maryland will certainly fail to make meaningful progress toward cleaning up our rivers, streams, and the Chesapeake Bay.

Sincerely,

Jenn Aiosa
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Attachment 1: References Cited

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Attachment 2: Questions and Concerns about use of the Hydrologic Soil Group (HSG) method.

Further discussion of the flaws in the HSG-based method

Vegetation coverage on a given site, its density, coverage and maturity are critical to the quantitative stormwater reduction capacity of the site. Yet, the current HSG method, based on the “extreme storm” (saturated antecedent conditions) is based upon bare soils. This method is then supplemented via curve numbers that make broad assumptions about various land covers that don’t fully reflect on-the-ground conditions.

The basis for “pre-development hydrology” indicated in the Stormwater Management Act of 2007 is “woods in good condition.” Yet MDE’s proposed ESD sizing criteria methodology does not adequately reflect the complex hydrologic functions of such woods. Healthy woodland soils in good condition actually can infiltrate much higher quantities than commonly assumed.¹ Root density is one factor – large vertical tree roots in a healthy forest can exceed 4000 per acre.² The factors that matter most for water infiltration are:

- 1) Whether the soil has intact organic layers
- 2) Whether the soil has intact, preserved, mature vegetation, and
- 3) Whether the soil has been protected from compaction.

Interestingly, though clay soils certainly behave differently than loamy soils in terms of their permeability and water retention characteristics, clay content is not as strong a predictor of whole-catchment hydrology and runoff reduction capacity, as whether the native soils and vegetation have been preserved or destroyed. Both the Sisters Creek and Pembroke studies cited above are located in the Maryland Piedmont, a high-clay region, and both studies documented high levels of runoff reduction.

HSG factors and Curve Numbers have been found to be Inaccurate.

A recent field survey of soils in Ocean County, New Jersey indicates that measured infiltration rates for disturbed soils with high bulk densities were significantly lower than expected, while the measured infiltration rates of undisturbed wooded and pastured soil were higher than expected.³ In a separate study, a group of Pennsylvania researchers found that of 37 of the original watersheds used in the NRCS TR-55 and HSG papers, in 25 of the watersheds, the NRCS models were either over- or under-predicting the actual historical watershed runoff rates

¹ Ocean County NJ Soil Conservation District (March 2001). *Impact of Soil Disturbance During Construction on Bulk Density and Infiltration in Ocean County, New Jersey.*

² Carmean, Willard. (1957). The Structure of Forest Soils. The Ohio Journal of Science 57(3): 165. Carmean cited the work of Gaiser, R.N. and J.R. Campbell (1951) The concentration of roots in the white oak forests of southeastern Ohio. Central States Forest Expt. Sta. Tech. Paper 120. and (1952). Root channels and roots in forest soils. Soil Sci. Soc. Amer. Proc. 16:62-65.

³ Ocean County Soil Conservation District, Schnabel Engineering Associates, Inc. and USDA Natural Resources Conservation Service (2001) Impact of Soil Disturbance During Construction on Bulk Density and Infiltration in Ocean County, New Jersey. at <http://www.ocscd.org/soil.pdf>

by more than 30 percent.⁴ The extreme storm event basis for the NRCS/HSG method has also been questioned recently as inappropriate for non-extreme event modeling in humid regions.⁵

Soils can be amended to retain and infiltrate higher-than-expected quantities of water.

Another reason to question the appropriateness of using the NRCS HSG database and curve number model is that developers and land management and landscaping contractors can do much to alter the standard curve number through revegetation and reforestation methods as well as through compost and various other soil amendments and land management techniques. For instance, something as simple as whether or not a forest bordering a row of houses and backyards is protected legally from incursions, and whether or not it is subjected to homeowners' clearing of brush and leaf-blowing operations, can affect the soil condition, organic content and permeability. As noted by a land management consultant in Georgia, "Soil amendments like compost could be used to improve the hydrology and move from one soil group to another."⁶

Destruction and Compaction of Native Soils can create long-term permeability losses.

University of Maryland Soil Scientist Gary Felton has noted studies from the technical literature indicating that once native soils developed for residential subdivisions have been compacted below 2 inches, infiltration rates remain depressed after 12 years of turf growth – essentially, "moderate to deep compaction is forever." By far the best "cure" for soil compaction is prevention.

The statute requires replication of pre-development hydrology, and MDE must reflect the science that indicates that woods in good condition reduce runoff volumes by more than 99%. At least one published scientific field study using the observed mass balance methodology documented that 99% of annual precipitation is captured on-site by woods in good condition. Also, a well-documented ESD site in Maryland has shown that even very large storms are controlled by well-designed ESD subdivisions. One study of the hydrology of "woods in good condition" was performed by Leopold, Wolman and Miller of then-fully-forested Sisters Creek subwatershed of Cabin John Creek. They reported:

".... In 1961, during which there was 37.6 inches of precipitation, there were 11 events during which runoff occurred in the rill, and this runoff totaled about 0.21 inch, or less than 0.6% of the precipitation. "

Thus, a mature forest in heavy clay soils in Montgomery County has been documented as providing nearly 100% capture of annual precipitation.

Reasons why the HSG method is less than desirable for use in ESD include:

⁴ Fennessey et al. (2002) Accuracy and Precision of NRCS Models for Small Watersheds. Paper No. 00007 of the Journal of the American Water Resources Association, abstract at

<http://www3.interscience.wiley.com/journal/119029251/abstract?CRETRY=1&SRETRY=0>

See also: Fennessey (2001) The NRCS Curve Number: A New Look at an Old Tool. Proceedings of the 2001 Pennsylvania Stormwater Management Symposium. <http://www.opp.psu.edu/environment/stormwater/CN-paper.pdf>

⁵ Fennessey op cit. (2001).

⁶ King, W. (2003) *Innovative Uses of Engineered Soils and Functional Landscapes in Stormwater Management and Land Planning*. Proceedings of the 2003 Georgia Water Resources Conference, University of Georgia.

- The soils on which the HSG method is based were tested as bare soils, whereas ESD by its very nature usually involves vegetated practices both non-structural and structural.⁷ It's crucial that the role of vegetation be fully and accurately rolled into whatever ESD sizing criteria methodology that MDE uses.
- Field surveys have suggested that the HSG infiltration rates are inaccurate.
- HSG infiltration rates and associated curve numbers are subject to change by site practices both positive and negative.

The most accurate way to apply Environmental Site Design to a given site in order to maximize its stormwater retention capacity is to conduct appropriate field tests of soil permeability; site field surveys of vegetation health and diversity; soil and rock strata and groundwater characteristics; and other site-specific factors. MDE needs to require field testing of soils and mapping of natural features as part of site characterization, and also needs to re-examine the accuracy and appropriateness of the HSG and related curve number methodology, and alternative proposed methodologies, based on available technical research. Further information on this topic is provided in the Appendix to these comments.

The “triple whammy” that conventional non-ESD development practices do to native soils: clearing of vegetation, stripping of the organic layer, and compaction – profoundly affects infiltration rates and capacities. Another study, also noted by Felton, found that turf grass established over an original (intact) soil profile infiltrated 2 to 4 times as much water as sites with “standard” construction practices.⁸

MDE should reconsider the HSG method, and consider requiring site-specific field surveys and tests. A growing body of evidence suggests that the HSG database and curve numbers which are of questionable relevance to “woods in good condition.” The site-specific field surveys should include: hydrologic mass balance field tests⁹; measurements of soil permeability; natural drainageways; soil and bedrock strata; vegetative conditions, planned soil and vegetative restoration measures; and the preservation of these features through a detailed ESD site plan and map.

MDE should also revise Chapter 5 to require field testing of soil permeability and field mapping and preservation of natural drainageways and intact vegetation and other key natural features. Instead of requiring the use of the HSG-based Curve Number methodology, require a more accurate methodology that either is based on alternative curve numbers that more accurately reflect the critical runoff source and absorption areas before and after development,¹⁰ or on other

⁷ Natural Resources Conservation Service, National Engineering Handbook, Part 630 Hydrology. Chapter 7, Hydrologic Soil Groups, p. 7-1. <http://directives.sc.egov.usda.gov/17757.wba>

⁸ Felton, G. Research Review of Nitrogen Losses From Turfgrass. (undated) at: <http://www.mawaterquality.org/themes/realm/backyardstothebay/1FeltonTurfNitrogenLitSur.pdf>

⁹ Livingston, Eric. (undated). “Lessons Learned about Successfully Using Infiltration Practices.” page 88. “Infiltration rates should be determined by mass balance field tests if possible. They provide the most realistic, accurate estimate of the percolation rate.” www.epa.gov/ORD/WebPubs/nctuwl/Livingston2.pdf

¹⁰ Fennessey and Hawkins, (2001), proposed a new conceptual curve number model that more intricately reflects the wide differences in hydrologic behavior and runoff characteristics within a small site or catchment. Fennessey’s

field-data-based methodologies. Whatever the suggested or required methodology, the site designers should be required to incorporate this quantified field data and proposed ESD site map into their runoff reduction calculations.

Exclusions and discouragement of clay soils from the use of ESD practices should be removed from the draft manual. The current draft excludes or discourages clay soils from use in permeable pavements, rooftop disconnection, and other practices. The Stormwater Management Act requires that developers mimic the hydrology of woods in good condition, and even high-clay soils in such conditions have high water retention and infiltration capacities via many ESD practices. MDE should remove the clay soils exclusions and discouragements in the permeable pavement, rooftop disconnection, landscape infiltration, dry wells, and all other Chapter 5 sections and practices where they appear. Replace these with requirements for site-specific soil permeability testing and soil and vegetation preservation requirements for all sites, as recommended above, regardless of actual or presumed soil type; and allow and encourage the use of first, non-structural, and secondly, structural ESD practices in all soils.

proposed conceptual model derived significantly lower curve numbers for upland areas' pre-developed conditions, compared with the conventional HSG model results. Fennessey, A.J. and Hawkins, R.H. (2001) *The NRCS Curve Number: A New Look at an Old Tool*. Proceedings of the 2001 Pennsylvania Stormwater Management Symposium. <http://www.opp.psu.edu/environment/stormwater/CN-paper.pdf>