

Memorandum

Date: July 31, 2020

To: S. Douglas Hokuf, Jr., P.E.
Chief of Site Management
New Castle County

From: Greg Hoffmann, P.E.
Center for Watershed Protection, Inc.

Re: Review of Proposed New Castle County
Drainage Code



3290 NORTH RIDGE RD, SUITE 290
ELLCOTT CITY, MD 21043

The Center for Watershed Protection, Inc., (the Center) has assessed the stormwater regulations for six different communities, with the intent of comparing each community's rules to those proposed by New Castle County. The six communities included:

- Anne Arundel County, Maryland – selected for its similarity in population and land area to New Castle County, as well as its proximity in a neighboring state.
- Prince George's County, Maryland – selected as second view of regulations in Maryland.
- Henrico County, Virginia – selected as a suburban county in a neighboring state.
- Chester County, Pennsylvania – selected for its similarity in population and land area to New Castle County, as well as its proximity in a neighboring state.
- Washington, DC – selected because it is known to have high stormwater standards
- King County, WA – selected because it is known to have high stormwater standards

A brief summary of each community's stormwater regulations is provided below.

New Castle County, Delaware (494 square miles; population 555,133)

In New Castle County a project must reduce the Resource Protection Event Volume (RPv), the 1-year storm event, to the pre-development runoff rate. However, the required treatment of runoff from the RPv event is capped at a maximum of 1" of runoff. The Conveyance event (Cv), which is the 10-year storm event, and the Flooding Event Volume (Fv), which is the 100- year storm event, must be managed so that the downstream post-developed water surface elevation does not increase more than 0.05 feet.

The following county and state codes and manuals apply:

- Title 7 Natural Resources & Environmental Control Delaware Administrative Code 5101 Sediment and Stormwater Regulations, February 2019 (DSSR)
- New Castle County Code, with proposed revisions, April 2020 (NCCC)

Anne Arundel County, Maryland (588 square miles; population 579,000)

Stormwater management must be provided through Environmental Site Design (ESD) practices to the Maximum Extent Practicable (MEP) to capture the runoff from the regulatory rainfall event, which ranges from 1 inch to 2.6 inches depending on the soil type and proposed imperviousness of a development. ESD practices are small-scale stormwater management practices and non-structural techniques that mimic natural hydrologic runoff characteristics and minimize the impact of land development. Once opportunities for ESD practices have been exhausted, then structural BMPs may be implemented to meet the remainder of the required capture volume. Runoff from the 10-year storm event must be detained to the pre-development rate, and the runoff from the 100-year storm

event must also be detained to the pre-development rate if the development is in the 100-year floodplain. The county requires compliance with the state manual for the general stormwater management provisions.

The following county and state codes and manuals apply:

- Anne Arundel County Stormwater Management Practices and Procedures Manual (AACM)
- Anne Arundel County Code (AACC)
- 2000 Maryland Stormwater Design Manual (MDSM)
- Maryland Department of The Environment General Permit for Stormwater Associated with Construction Activity General NPDES Permit Number MDRC State Discharge Permit Number 14GP (14GP)

Prince George's County, Maryland (499 square miles; population 863,420)

Stormwater management must be provided through Environmental Site Design (ESD) practices to the Maximum Extent Practicable (MEP) to capture the runoff from the regulatory rainfall event, which ranges from 1 inch to 2.6 inches depending on the soil type and proposed imperviousness of a development. ESD practices are small-scale stormwater management practices and non-structural techniques that mimic natural hydrologic runoff characteristics and minimize the impact of land development. Once opportunities for ESD practices have been exhausted, then structural BMPs may be implemented to meet the remainder of the required capture volume. Runoff from the 10-year storm event must be detained to the pre-development rate, and the runoff from the 100-year storm event must also be detained to the pre-development rate if the development is in the 100-year floodplain.

Prince George's County also requires compliance with the state manual for the general stormwater management provisions, so their requirements are generally the same as Anne Arundel County's.

The following county and state codes and manuals apply:

- Prince George's County Stormwater Management Design Manual (PGCM)
- Prince George's County Code (PGCC)
- 2000 Maryland Stormwater Design Manual (MDSM)
- Maryland Department of The Environment General Permit for Stormwater Associated with Construction Activity General NPDES Permit Number MDRC State Discharge Permit Number 14GP (14GP)

Henrico County, Virginia (245 square miles; population 331,000)

There are two different types of land disturbing activities that must meet stormwater management provisions in Henrico County: Chesapeake Bay Preservation Act (CPBA) land disturbing activity which is located in the Chesapeake Bay Preservation Area and Virginia Stormwater Management Program (VSMP) land disturbing activity. A development must be designed to meet the stormwater quality criteria where the total phosphorous load cannot exceed 0.41 pounds per acre per year, and control the runoff for the 1-year and 10-year storm events to match the pre-development rate. For developments in the 50-year floodplain, the 50-year storm event must be detained such that the 50-year peak flow does not exceed the pre-developed peak flow rate for the 10-year storm event.

The following county and state codes and manuals apply:

- Henrico County Environmental Compliance Manual (HCM)
- Henrico County Code (HCC)
- Virginia Stormwater BMP Clearinghouse (VSBC)
- General VPDES Permit for Discharges of Stormwater from Construction Activities (VGCP)

Chester County, Pennsylvania (759 square miles; population 525,000)

Chester County does not have a county-wide ordinance. Instead, they have a model ordinance for the county that each municipality must adopt (or a more stringent ordinance). The minimum requirement in the model ordinance for stormwater management is to treat the difference in runoff between pre- and post-development condition for the 2-year storm for water quality, reduce the post-development runoff of the 2-year storm event to the pre-development runoff for the 1 year storm event, reduce the post-development

runoff of the 5-year storm event to the pre-development runoff for the 2 year storm event, reduce the post-development runoff of the 10-year storm event to the pre-development runoff for the 2 year storm event, and detain runoff from the 25, 50 and 100 year storm events to the pre-development rate for each storm.

The following county and state codes and manuals apply:

- County-wide Act 167 Stormwater Management Model Ordinance (CMO)
- Pennsylvania Stormwater Best Management Practices Manual (PASM)
- PAG-02 Authorization to Discharge Under the National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges of Stormwater Associated with Construction Activities (PAG-02)

Washington, DC (68 square miles; population 705,749)

In Washington, DC, a development must be designed to retain the Stormwater Retention volume (SWR_v), which is equal to the runoff from a 1.2” rainfall event. Runoff from the 2-year storm must be detained to the pre-development rate, and runoff from the 15-year storm must be detained to the pre-project rate. The pre-development condition is the land condition prior to any construction, i.e meadows and pre-project condition is the current condition of the site as it exists prior to the proposed improvements.

The following codes and manuals apply:

- District of Columbia Stormwater Management Guidebook (DCSG)
- National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities (as modified) (GCP)

King County, Washington (2,307 square miles; population 2,252,782)

King County has nine Core Requirements for stormwater management, including #3: Flow Control, and #8: Water Quality. For flow control, runoff from the 2- and 10-year storm events must be detained to match the existing peak runoff rates for each storm event. For water quality, if the water quality treatment practice is downstream of a detention facility, the 2-year storm event must be treated. If the water quality treatment practice precedes a detention facility (or if detention is not required), 91% of the total runoff volume must be treated.

The following county and state codes and manuals apply:

- King County, Washington Surface Water Design Manual (KCM)
- King County Code (KCC)
- Construction Stormwater General Permit NPDES (WGCP)

In reviewing the regulations of these six communities, the Center focused on seven different topics to compare to the New Castle County proposed regulations:

1. Redevelopment treatment standard.
2. Consideration of extended detention as equivalent to runoff reduction.
3. Designer P.E. sign off on as-built plans.
4. Enforcement of Total Maximum Daily Loads (TMDLs) on new development projects.
5. Bacteria removal values for Best Management Practices (BMPs).
6. Minimum disturbed area/lot size to which regulations apply.
7. Off-site compliance options.

Section 1: Redevelopment:

Table 1 summarizes the runoff treatment standards for redevelopment in each community.

Table 1 - Redevelopment Treatment Standards			
Community	Definition of Redevelopment	Redevelopment Treatment Standard	Water Quality Storm/Volume
New Castle County, Delaware	Redevelopment "... means a construction, alteration or improvement, including but not limited to the demolition or building of structures, filling, grading, paving, or excavating, where existing land use is residential, commercial, industrial, or institutional." (DSSR Sec. 2)	Treat 50% of the pre-developed impervious coverage for the RPv. Treatment emphasis on paved surfaces for greater water quality benefits. (NCCC Sec. 12.05.006.B.1)	1" x 50% = 0.5" (DSSR Sec. 5.2.3)
Anne Arundel County, Maryland	Redevelopment is "any construction, alteration, or improvement performed on sites where the existing land use is commercial, industrial, institutional, or multifamily residential and existing site impervious area exceeds 40%" (MDSM Sec. 5.5.1)	50% of existing impervious area must be removed or treated with ESD practices to the MEP within the limit of disturbance (LOD). (AACC § 16-4-202 (b)(1))	1" x 50% = 0.5"
Prince George's County, Maryland	Redevelopment is "any construction, alteration, or improvement performed on sites where the existing land use is commercial, industrial, institutional, or multifamily residential and existing site impervious area exceeds 40%" (PGCC Sec. 32-171.55)	100% of existing impervious area must be removed or treated with ESD practices to the MEP within the LOD. (PGCC Sec. 32-175(d))	1" x 100% = 1"
Henrico County, Virginia	Redevelopment is "prior developed lands" which are "land that has been previously utilized for residential, commercial, industrial, institutional, recreation, transportation or utility facilities or structures and that will have the impervious areas associated with those uses altered during a land-disturbing activity." (HCM Sec. 2.1)	The total phosphorous (TP) load must be reduced for all land-disturbing activities. Different disturbances require varying levels of reduction of TP load, but not more than the new development standard. (HCM Sec 9.3.2)	TP reduction varies but is based on 1" storm.
Chester County, Pennsylvania	Redevelopment is "any Regulated Activity that may affect stormwater runoff that involves demolition, removal, reconstruction, or replacement of existing Impervious Surface(s)" (CMO Sec. 202)	Runoff volume to be treated is the difference between the predevelopment and the post-development conditions. Runoff must be treated by infiltration first then treated by other techniques and practices. (CMO 305.E)	2-year, 24-hour design storm is 3.16" (CMO Sec. 305.A)
Washington, DC	Existing building renovations are defined as Major Substantial Improvement Projects. Otherwise there is no distinction between development and redevelopment projects.	Runoff from a 0.8" rain event must be retained on site. (DCSG Sec.2.3)	0.8"
King County, Washington	Redevelopment is a "project that proposes to add, replace, or modify impervious surfaces for purposes other than a residential subdivision or maintenance on a site that is already substantially developed in a manner consistent with its current zoning or with a legal non-conforming use, or has an existing impervious surface coverage of 35% or more." (KCM Ch. 1)	Projects with 5,000 square feet or more of new and replaced pollution generating impervious surface must meet Core Requirement 8 (water quality). (KCC Sec. 9.04.050.A.8)	Downstream of detention: 2-year 24-hour storm. 1.4" – 3.5" Preceding detention: 91% of the total runoff volume. (KCM Sec. 6.2.1)

Redevelopment Findings and Recommendations:

All the communities except for Washington DC have a specific definition for redevelopment that generally includes any type of modification, alteration or replacement of impervious surfaces onsite. Three of the communities (both Maryland counties and King County) associate redevelopment with a minimum existing onsite impervious coverage. New Castle County's definition is most similar to Henrico and Chester Counties. Although Washington DC does not differentiate between new and redevelopment, they do have different requirements for Major Substantial Improvements (significant building renovations) and Major Land Disturbing Activities.

In order of stringency relative to the standard development rules, Washington, DC is first, with no differentiation in rules between development and redevelopment, as well as stormwater requirements for building renovations that do not even disturb the land. Prince George's County and King County come next, with Prince George's County requiring 100% of the pre-existing impervious surface be treated and King County requiring 100% of all new and replaced "pollutant-generating surfaces" be treated. New Castle County and Anne Arundel County both require a minimum of 50% pre-existing impervious development be treated. Chester County has perhaps the lowest redevelopment standard, as only the difference in runoff volume between pre- and post-development conditions must be treated. Henrico County is difficult to quantify as it has a phosphorus-based standard.

Among the communities analyzed, there seems to be a clear split between urban and suburban areas with regard to stringency of redevelopment standards. The more urban communities (Washington, DC, Prince George's County, and King County) have very little difference between their development and redevelopment standards, whereas the more suburban communities (New Castle County, Anne Arundel County, Chester County, and Henrico County) make more significant reductions in their redevelopment requirements – likely in an attempt to incentivize redevelopment over new development. Given the suburban nature of much of New Castle County, the 50% treatment requirement proposed is reasonable, and in line with what several other communities require.

Section 2: Extended Detention:

Table 2 summarizes the runoff communities’ consideration of extended detention as equivalent to runoff reduction. This distinction was not always clear in the various county ordinances, manuals and state manuals, especially since not all of the counties use runoff reduction as their water quality standard. To gain a fuller picture of how each community views extended detention we expanded the analysis to include both total runoff volume reduction, runoff flow rate reduction and pollutant removal efficiency of total nitrogen, phosphorous, and suspended solids for various extended detention BMPs.

Table 2 - Extended Detention (ED)			
Community	Runoff Volume Reduction	Runoff Flow Rate Reduction	BMP Pollutant Removal Efficiency
New Castle County, Delaware	Dry and Wet ED facilities credit 100% runoff reduction for the RPv (1-year) storm event, 1% for the Cv (10-year) storm event and 0% of the Fv (100-year) when 48- hours of ED is provided (DSSR Sec.11.10 and 11.13)	Silent	20% TN (Dry ED) 20% TP (Dry ED) 60% TSS (Dry ED) (State Code Sec. 11.10.11.2 of 5101) 30% TN (Wet ED) 55% TP (Wet ED) 60% TSS (Wet ED) (DSSR Sec. 11.13.1.2)
Anne Arundel County, Maryland	Micropool ED, Wet ED Pond, ED Wetland are not considered ESD practices, but they can be used as structural practices to meet the target treatment volume once ESD practices have been used to the MEP. (MDSM Sec. 5)	Micropool ED, Wet ED Pond, ED Wetland can be used to meet the 1-year, 24-hour extended detention requirement and the 10-year peak flow reduction requirement (MDSM Sec. 4.3)	40% TP (Micropool ED pond, wet ED pond, ED shallow wetlands) 80% TSS (Micropool ED pond, wet ED pond, ED shallow wetlands) (State Manual Sec. 2.7.1) Less than 40% TP (Dry ED) Less than 80% TSS (Dry ED) (MDSM Sec. 2.7.2)
Prince George's County, Maryland	Micropool ED, Wet ED Pond, ED Wetland are not considered ESD practices, but they can be used as structural practices to meet the target treatment volume once ESD practices have been used to the MEP. (MDSM Sec. 5)	Micropool ED, Wet ED Pond, ED Wetland can be used to meet the 1-year, 24-hour extended detention requirement and the 10-year peak flow reduction requirement (MDSM Sec. 4.3)	40% TP (Micropool ED pond, wet ED pond, ED shallow wetlands) 80% TSS (Micropool ED pond, wet ED pond, ED shallow wetlands) (State Manual Sec. 2.7.1) Less than 40% TP (Dry ED) Less than 80% TSS (Dry ED) (MDSM Sec. 2.7.2)
Henrico County, Virginia	Level 2** ED ponds can achieve 15% of the Annual Runoff Reduction (VSBC No. 15 Sec. 2)	Level 1* and Level 2 ED Ponds can be used to meet the 1-year, 24-hour storm channel protection storage volume and control up to the 50-year 24-hour storm peak discharge rate. (HCM Sec 9.1)	10% TN (Level 1 ED Pond) 15% TP (Level 1 ED Pond) 24% TN (Level 2 ED Pond) 31% TP (Level 2 ED Pond) (VSBC No. 15 Sec. 2)
Chester County, Pennsylvania	ED practices have low volume reductions functions (PASM Sec 6.6.1 through 6.6.3)	ED basins can have High peak rate control functions (PASM Sec 6.6.3)	30% TN (ED Shallow Wetlands) 85% TP (ED Shallow Wetlands) 85% TSS (ED Shallow Wetlands) (Sec. 6.6.1) 30% TN (Wet ED) 60% TP (Wet ED) 70% TSS (Wet ED) (Sec. 6.6.1) 20% TN (Dry ED) 40% TP (Dry ED) 60% TSS (Dry ED) (PASM Sec 6.6.3)

Table 2 - Extended Detention (ED)

Community	Runoff Volume Reduction	Runoff Flow Rate Reduction	BMP Pollutant Removal Efficiency
Washington, DC	Not Permitted (DCSG Table 4-1)	Micropool ED, Wet ED Pond, ED Shallow Wetland can be used to meet the 2-year and 15-year peak flow reduction requirements (DCSG Table 4-1)	80% TSS (Micropool ED pond, wet ED pond, ED shallow wetlands) (DCSG Sec 2.3)
King County, Washington	Stormwater rules are based on treatment rather than runoff reduction (KCM Sec. 1.1.4)	Extended Detention is not referenced	Extended Detention is not referenced
*Level 1 ponds are the baseline ED Ponds **Level 2 ponds are enhanced for more volume and pollutant load reduction for ED Ponds			

Extended Detention Findings and Recommendations:

New Castle County and Henrico County are the only counties that assign runoff volume reduction values to extended detention BMPs, but Henrico County’s runoff reduction credit for extended detention is much lower. Both Maryland counties have a 1-year storm extended detention requirement, but this requirement has mostly been superseded by the ESD to the MEP rules, for which extended detention does not qualify. This effectively results in a policy that requires other BMPs to be used before extended detention can be considered. Chester County does not assign runoff volume reduction but categorizes extended detention BMPs as having low volume reduction functions. Washington, DC does not allow extended detention facilities to reduce the required runoff volume.

New Castle County, Chester County, and Henrico County all note pollutant removal values for extended detention BMPs, whereas the Maryland counties and Washington, DC note only whether or not extended detention BMPs exceed a minimum standard. New Castle County pollutant removal values fall generally in line with Chester County and Henrico County for TN, TP, and TSS (Chester County only).

As can be seen from this analysis, it is unusual to credit extended detention toward runoff reduction. While there may be some water quality benefits to extended detention, there is very little runoff reduction that actually occurs. The Center’s Runoff Reduction Method Technical Memorandum published in 2008 suggested a runoff reduction value of 0% - 15% for extended detention ponds (as Henrico County has adopted). This low value seems to be a more appropriate runoff reduction credit for extended detention. The Maryland counties’ approach, in which ESD BMPs must be used to the MEP prior to consideration of extended detention is also an approach worth considering.

Section 3: Post Construction As-builts:

Table 3 summarizes the post-construction as-built requirements for each community, with particular focus on whom is required to sign off on the as-built submittal.

Table 3 - Post Construction As-Built Requirements		
Community	Is certification by the Designer who prepared the construction plans?	Post Construction As-Built Submittals Requirements
New Castle County, Delaware	Yes	Written documentation from the Design Engineer verifying that the constructed site is in accordance with their design and functions accordingly is required. An as-built survey is required for all conveyance systems discharging to a stormwater facility. (NCCC Sec. 12.05.007.E and 12.05.007.G)
Anne Arundel County, Maryland	No. The as-built can be signed by any "design professional", including a professional engineer, land surveyor or landscape architect. (AACC § 16-4-302)	The as-built plan and as-built certification prepared by a "design professional" must include drawings comparing what was constructed to the "approved stormwater management plan". (AACC § 16-4-302)
Prince George's County, Maryland	No. PGCC Sec. 32-191(d) allows a professional land surveyor to prepare the as-built plan, but Sec. PGCC 32-192 permits only a professional engineer to prepare the as-built plan.	An as-built plan certification that all stormwater management facilities are on the plans and measures comply with the specifications and have been constructed to meet the approved final stormwater management plan must be provided. (PGCC Sec. 32-191(d), Sec. 32-192(a) and Sec. 32-192(b)).
Henrico County, Virginia	No. The stormwater management facility construction record drawing may be signed by a professional engineer or land surveyor. (HCC Sec. 10-47(b))	A construction record drawing must be submitted which includes as-built details, inverts, lengths, depths, material types and sizes and the location of all stormwater facilities. The drawing must also include a statement certifying that the construction of the Stormwater Management Facilities were constructed in accordance with the approved plans. (HCM Sec. 9.6)
Chester County, Pennsylvania	No. Any qualified "Licensed Professional" which, based on the definition in Sec. 202 of the Model Ordinance is either a Professional Engineer, Landscape Architect, Land Surveyor or Professional Geologist. (CMO Sec 502.A)	An As-Built Plan is required for developments disturbing (1) or more acres. It must include grading, location, elevations, dimensions and as-built conditions for all BMPs, conveyance, all other stormwater facilities/related improvements, typical details for stormwater structures and facilities and impervious surfaces included in the approved plan. (CMO Sec 502)
Washington, DC	No. A registered professional engineer (PE) must certify the as-built. (DCSG Sec. 5.3.3)	As-built plans with the as-built certification form signed must be submitted. They must include all BMPs, land covers and stormwater conveyances as constructed and all changes to the plan must be approved. The as-built certification form certifies that all stormwater management facilities and improvements have been built in accordance with the approved plans and any deviations will still function and comply with stormwater management plan. (DCSG Sec. 5.2.3.29(b) and Sec. 5.3.3)
King County, Washington	No. The final corrected plan must be signed by any P.E. in civil engineering (KCM Sec 2.4.2)	A final corrected plan is required, including revisions made to the original plans during construction. (KSM Sec 2.4.2)

Post Construction Findings and Recommendations:

New Castle County is the only community that requires the Design Engineer to verify that the constructed site is in accordance with his or her design and functions accordingly. All the other communities permit other design professionals or engineers to certify the as-built plan and associated documents. A certification that a development was constructed and that stormwater facilities are

functioning according to the plans is an appropriate requirement, but requiring the original designer to provide this certification may be overly burdensome. There are many projects in which, for a variety of reasons, the original designer is not involved in the construction phase. If New Castle County chooses to remove the Design Engineer requirement from the as-built requirements, it may be appropriate to reference the language in Section 6.5.6 of the DSSR which provides criteria that must be met, including approval of “post construction verification documents” to receive Notice of Completion.

While there appears to be little precedent for requiring the Design Engineer to certify as-built plans, there is some precedent for this in the field of architecture. The Delaware State Code (Title 24, Professions and Occupations, Chapter 3. Architecture) does not specifically require that the architect who designed a building be responsible for construction inspection, but it does require that an architect or engineer “furnish construction contract administration services”, and it also requires the designing architect to notify building officials if he or she will not be the one providing the construction contract administration services.

Section 4: TMDL Enforcement:

Table 4 summarizes additional requirements that apply in each community if a development is located in a watershed with a TMDL assigned to it. In several cases, little information was available in the codes and ordinances on this topic.

Table 4 - TMDL Enforcement on New Development	
Community	County Code/Manual or State Manual
New Castle County, Delaware	If a development is within an area that is subject to a Water Quality Improvement Plan which includes a TMDL, the design must comply with all TMDL requirements (NCCC Sec. 12.05.006.B) The DURMM worksheet shows TMDL requirements and compliance with same.
Anne Arundel County, Maryland	Silent
Prince George's County, Maryland	The controls for new and redevelopment are generally under the control of the County's Stormwater Managements Ordinance and meeting the water quality requirement is deemed to be complying with any TMDLs. (PGCM Sec 1.11 and Sec 5.2.7.2)
Henrico County, Virginia	For VSMP land disturbing activities, the Stormwater Pollution Prevention Plan (SWPPP) must include the approved TMDLs with WLAs assigned to construction activities. Inspections will be conducted at least once every three months to monitor compliance with the TMDL requirements of the erosion control plans. The County Manual and the General Construction Permit have the same requirements. (HCM Sec. 11.3 and 11.5 and VGCP Part II B.5)
Chester County, Pennsylvania	The municipalities can require additional measures on Regulated Activities that discharge to an approved TMDL (CMO Sec. 301.P) The plan requires a note with the "Name, date, and target pollutant(s) for any approved Total Maximum Daily Load (TMDL)" if discharging to a water way with an approved TMDL (CMO Sec. 402.B.8.f.iii)
Washington, DC	Silent
King County, Washington	A SWPPP must be submitted that shows compliance with TMDL requirements. (KCM Sec. D.2.5.2.1)

TMDL Enforcement Findings and Recommendations:

New Castle County uses the DURMM worksheet which will calculate the annual pollutant load generated by a development for TN, TP and TSS as well as the pollutant load reduction requirement for the applicable TMDL and the pollutant removal rate for each proposed BMP. No other community in this analysis calculates the reductions required when the new development discharges into a waterway or watershed with a TMDL. All of the other communities except King County either rely on the NPDES General Construction Permit to comply with TMDL enforcement or assume that their stormwater ordinance and manual requirements are sufficient to meet TMDL requirements. While New Castle County is unique, the approach is sound. Since the DURMM model is available to calculate pollutant loads and removal capabilities, it would be inappropriate to ignore the model for developments in TMDL watersheds. All communities should be requiring that developments meet TMDL load reduction requirements, and it is better to calculate the actual loads rather than simply assuming that the existing regulations are sufficient.

Section 5: Bacteria Removal:

Table 5 summarizes bacterial removal requirements and BMP removal rates for each community.

Table 5 - Bacteria Removal		
Community	Bacteria Removal Requirement	Bacteria Removal Rates For BMPS
New Castle County, Delaware	Silent	Silent
Anne Arundel County, Maryland	Watersheds that drain to shellfish harvesting or public beaches require BMPs that are designed to maximize bacteria removal. (MDSM Sec. 4.1)	No specific values are assigned to removal of bacteria. MDSM Table 4.1 includes guidance on bacterial removal for BMP Groups for Shellfish/Beach
Prince George's County, Maryland	Watersheds that drain to shellfish harvesting or public beaches require BMPs that are designed to maximize bacteria removal. (MDSM Sec. 4.1)	No specific values are assigned to removal of bacteria MDSM Table 4.1 includes guidance on bacterial removal for BMP Groups for Shellfish/Beach
Henrico County, Virginia	Although there are 6 TMDLs for bacteria in the County no WLAs have been assigned and therefore there is no bacteria removal requirement. (HCM Sec. 11.4)	Silent
Chester County, Pennsylvania	Silent	Silent
Washington, DC	Bacteria removal targets are provided for rainwater harvesting to ensure safe use of the water.	Several treatment system options for harvested rainwater are identified, each with expected bacteria removal rates.
King County, Washington	Bacteria removal is required for developments that drain within a quarter mile to a water deemed to have a bacteria problem. (KCM Sec. 1.2.2.3)	No specific values are assigned for removal of bacteria however sand filters or stormwater wetlands are required. (KCM Sec. 1.2.2.3)

Bacteria Removal Findings and Recommendations

New Castle County, Henrico County, Chester County, and Washington, DC do not have any bacteria removal/reduction requirements and therefore do not have removal rates assigned to any BMPs. Both Maryland counties and King County do not assign bacterial removal rates to their BMPS however they do require certain BMPs when discharging to a shellfish harvesting area and/or beach or waters with bacteria problems.

If New Castle County wishes to incorporate bacteria removal requirements for watersheds with bacteria TMDLs, the document Fecal Indicator Bacteria Management by the Chesapeake Stormwater Network <https://chesapeakestormwater.net/2018/10/fecal-indicator-bacteria-management/> is a useful resource, as it includes recommended removal rates for various BMPs. However, the document also notes several difficulties with managing bacteria as a typical stormwater pollutant; many bacteria problems are due to unknown untreated wastewater discharges, and while typical BMPs have some ability to reduce bacteria, they are generally not efficient enough to meet water quality standards.

Section 6: Minimum Area Requirements:

Table 6 identifies the minimum area requirements for which stormwater regulations apply in each community.

Table 6 – Minimum Area Requirements in Stormwater Management Regulations				
Community	Minimum Disturbance Area (SF)	Minimum Impervious Area (SF)	Are both required to be met for SMR to Apply?	Exemptions
New Castle County, Delaware	5,000 (DSSR Sec. 1.4.2)	None	N/A	Non-residential redevelopment projects between 5,000 SF and 1 acre may be eligible “Standard Plan Approval”, which is less stringent. (DSSR Sec. 3.7) Agricultural land management, commercial forest harvesting, projects regulated by state or federal law, and permitted biosolids and residual uses. (DSSR Sec. 1.4)
Anne Arundel County, Maryland	5,000 (AACC § 16-4-101.(C))	None	N/A	Agricultural land management, additions and modifications to single-family dwellings that are not substantial improvements and do not disturb more than 5,000 SF, and projects regulated by state law. (AACC § 16-4-101.(C))
Prince George's County, Maryland	5,000 (PGCC Sec. 32-174)	None	N/A	Agricultural land management, additions and modifications to single-family dwellings that do not disturb more than 5,000 SF and do not exceed maximum allowable lot coverage, and projects regulated by state law (PGCC Sec. 32-174)
Henrico County, Virginia	CBPA: 2,500 VSMP: 43,560 (HCC Sec. 10-28)	None	N/A	Mining, agricultural practices, livestock operations, projects regulated by state or federal law, discharges to the sanitary sewer, routine maintenance including paving of existing roads, and emergencies. (HCC Sec. 10-28)
Chester County, Pennsylvania	5,000 (CMO Sec. 106.B.1)	1,000 (CMO Sec. 106.B.1)	Yes	Emergencies, maintenance of existing stormwater management systems, existing landscaping, gardening, agricultural activities, forest management, maintenance of existing paved surfaces, roadway shoulder improvements, replacement of residential dwellings in same footprint, replacement, repair and maintenance of residential impervious surfaces in exact footprint. (CMO Sec. 106.B.1)
Washington, DC	5,000 (DCSG App. Y)	2,500 (DCSG App. Y)	Yes	BMP installation, athletic playing fields, permeable athletic tracks, permeable playground surfaces, utility trenches, affordable single- and two-family dwellings under 5,000 SF of disturbance on a single lot, trails, and small structures at parks. (DCSG Sec. 2.12)
King County, Washington	7,000 (KCM Sec. 1.1.1)	2,000	No	King County does not have any exemptions, however if single family homes and agricultural projects are classified as "Simplified Drainage Review", the full drainage review requirements are replaced with simplified requirements that can be prepared by a non-engineer. KCM Sec. C.2.1.1

Minimum Area Requirements Findings and Recommendations:

New Castle County's minimum disturbance area requirement is the same as most of the other communities in this analysis. However, non-residential redevelopment projects that disturb less than 1 acre may be eligible to use a "Standard Plan" if they meet one of the following conditions:

- a. Project site location is within an area previously managed for stormwater quantity and quality under an approved Sediment and Stormwater Plan, AND the post construction condition meets the original stormwater design criteria, OR
- b. Comparison of the existing parcel curve number (CN), based upon the Department's 2017 aerial photography to the proposed CN for the parcel after non-residential construction results in less than one whole number change in the CN, OR
- c. No new impervious area is proposed as a result of construction.

King County has a slightly higher disturbance minimum, but includes an impervious area qualifier, and Henrico County's disturbance minimum varies based on location. Chester County and Washington, DC include an impervious cover minimum in conjunction with their disturbance minimum. The Center does not recommend changing New Castle County's 5,000-square foot disturbed area minimum. However, the use of "Standard Plan" 3.7.13 for non-residential redevelopment projects effectively eliminates the proposed redevelopment requirements described in Section 1 for a significant group of projects. Elimination of standard plan compliance for non-residential redevelopment projects is recommended. Standard plans for single family homes may still be appropriate and would be in line with other communities' exemptions. Additionally, the County may want to consider including an impervious area minimum like Chester County and Washington, DC have in order to eliminate projects like park redevelopments that have very little stormwater impact.

Section 7: Off-Site Compliance

Table 7 summarizes the off-site compliance options for developments in each of the communities.

Table 7 - Off-Site Compliance					
Community	Is Off-Site Compliance allowed?	When is it allowed?	Where can compliance be achieved?	Can you pay a fee-in-lieu?	Options for Off-Site Compliance in addition to fee-in-lieu
New Castle County, Delaware	Yes	It must be demonstrated that requirements for the RPv, Cv or Fv storm cannot be achieved on-site. (DSSR Sec. 13.1.2 of 5101)	Same 10-digit HUC or adjacent 10-digit HUC within the same eight digit HUC (DSSR Sec. 13.1.3 of 5101)	Yes	Stormwater Management Trading (RPv only) Stormwater Management Banking (RPv only) (DSSR Secs. 13.3 and 13.4 of 5101)
Anne Arundel County, Maryland	Yes	It must be demonstrated that redevelopment projects and projects in the "Intensely Developed Area" Zone cannot meet water quality requirements. (AACC § 16-4-202(b) and MDSM Appx. D-4)	Same sub-watershed	Yes	Construct or retrofit of off-site BMP, reforest existing impervious property or riparian areas. (AACC § 16-4-202(b) and MDSM Appx. D-4)
Prince George's County, Maryland	Yes	If the Qp and Qf requirements are waived or reduced on a project. (PGCM Sec. 3.1.2 B), Or, it must be demonstrated that redevelopment projects and projects in the "Intensely Developed Area" Zone cannot meet water quality requirements. ((PGCM Sec. 5.2.7.1 and MDSM Appx. D-4)	Same sub-watershed	Yes	Construct or retrofit of off-site BMP, reforest existing impervious property or riparian areas. (PGCM Sec. 5.2.7.1 and MDSM Appx. D-4)
Henrico County, Virginia	Yes	Pollutant load reduction cannot be met onsite, the project is less than 5 acres, or the post-construction TP reduction requirement is less than 10 lbs/year and 75% of the TP reduction requirement is achieved on site. (HCM Sec. 9.3.3.C.3)	Same HUC or located in a HUC upstream from the project (HCM Sec. 9.3.3.C.3)	No	Stormwater management facility on property owned by the same operator and the facility must be constructed prior to on-site land disturbance. (HCM Sec. 9.3.3.C.3).
Chester County, Pennsylvania	No	n/a	n/a	n/a	n/a

Table 7 - Off-Site Compliance

Community	Is Off-Site Compliance allowed?	When is it allowed?	Where can compliance be achieved?	Can you pay a fee-in-lieu?	Options for Off-Site Compliance in addition to fee-in-lieu
Washington, DC	Yes	No restrictions, as long as at least 50% of the runoff reduction requirement is achieved on site. Exceptions allow more than 50% of requirement to be obtained off site in some cases. (DCSG Sec. 6.2)	The location of the development determines what sewershed the offsite credits may be used from. (DCSG Sec. 6.3)	Yes	Purchase stormwater retention credits (SRCs) which are produced by other projects that exceed their runoff reduction requirement (DCSG Sec. 6.1)
King County, Washington	Not generally.	When it is determined that the post-development runoff will cause downstream flooding or erosion, the problems may be addressed off-site rather than strictly on-site. (KCM Sec. 1.2.2.1.e and Sec. 3.3.5)	Downstream of the proposed development. (KCM Sec. 3.3.5)	No	Improve existing conveyance system, create additional water storage, or elevate buildings and roadways. (KCM Sec. 3.3.5)

Off-Site Compliance Findings and Recommendations:

Just like New Castle County, the Maryland counties and Henrico County permit off-site compliance only if it is demonstrated that on-site compliance cannot be achieved. In Washington, DC it is not necessary to demonstrate that on-site compliance cannot be achieved before utilizing off-site options. The Center does not recommend changes to New Castle’s approach, although if it is desired to encourage more off-site compliance, the rule requiring demonstration of infeasibility on site may be eliminated.

It appears that while several of the other communities analyzed allow off site compliance, Washington, DC is the only community with a robust program. Washington, DC has expended considerable effort to set up the infrastructure to create a market for stormwater retention credits. This makes it possible for almost any development project to choose off-site compliance rather than on-site.] For the other communities that allow off-site compliance, it seems that the developer must submit plans for a specific off-site project to off-set the on-site requirements. This makes off-site compliance more of a case-by-case assessment in these communities.

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