Water Quality Protection Charge Credit Procedures Manual

Prepared for

Montgomery County Department of Environmental Protection

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DEPARTMENT OF ENVIRONMENTAL PROTECTION
MONTGOMERY COUNTY • MARYLAND

Change Log

Date	Version	Change	Author / Editor

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Appendices

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SECTION 1

Introduction

The purpose of this credit manual is to provide Montgomery County residents, land and business owners with information regarding how to obtain a credit for their Water Quality Protection Charge (WQPC).

1.1 Overview

Background
The Water Quality Protection Charge (WQPC) is a part of Montgomery County property tax bills. The WQPC raises funds to improve the water quality of our streams and reduce the impacts of stormwater runoff. Stormwater is rain that runs off hard surfaces and carries pollution to our streams. It is one of the biggest water quality problems in Montgomery County. When left unmanaged, stormwater flows through storm drains to nearby creeks and streams at high speeds and in large volumes. This polluted, unhealthy water damages property, erodes creek banks, harms wildlife, and eventually ends up in the Chesapeake Bay.

Restoration projects funded by the WQPC reverse and prevent the impact of stormwater. They also create jobs and boost the local economy.

What is the Water Quality Protection Charge?
The Water Quality Protection Charge (WQPC) can be found on Montgomery County property tax bills. All property owners in Montgomery County pay the WQPC, including businesses, Home Owner Associations, and non-profit organizations.

The WQPC is calculated based on the potential for a property to contribute to stormwater runoff. Typically, a larger, more developed property produces more runoff, and therefore, receives a higher charge. The WQPC is based on the amount of impervious area on a property. Impervious surfaces, like sidewalks and driveways, block water from infiltrating the ground. They cause increased runoff, overload the drainage system, and transport pollutants and nutrients to bodies of water.

What is the Credit Program?
Property owners can receive a credit off their annual Water Quality Protection Charge by maintaining stormwater management practices on their property. Stormwater management practices capture and treat runoff so that the water does not flow directly into storm drains or streams. They remove pollutants, protect public health and prevent flooding, stream damage and erosion.

For more information about the WQPC or the Credit program, please refer to the County Department of Environment's website at the following location:

https://www.montgomerycountymd.gov/DEP/water/wqpc.html

1.2 Organization

The remainder of this WQPC Credit Procedures Manual is organized into the following sections:

Section 2: Single-Family Residential Credits
Section 3: Non-Residential/Multi-Family Credits

1.3 Definitions

This section provides definitions for key terms in this WQPC User's Guide.

Environmental Site Design (ESD): As defined by the Maryland Department of Environment Stormwater Design Manual, Environmental Site Design, or ESD, is a comprehensive design strategy for maintaining predevelopment runoff characteristics and protecting natural resources and relies on integrating site design, natural hydrology, and smaller controls to capture and treat runoff.

Environmental Site Design Volume (ESDv): The Environmental Site Design Volume (ESDv) is based on the ESD Rainfall Target, P_E, which ranges from 1-inch to 2.6-inches and is multiplied by the volumetric runoff coefficient (Rv) and the site area. Refer to the Stormwater Design Manual for more details.

Impervious Area: Hard surfaces like sidewalks, driveways and roofs that block water from infiltrating the ground and generate stormwater "runoff" or flow onto another area.

Maryland Department of Environment Stormwater Design Manual: Herein referred to as the "Stormwater Design Manual", this refers to Maryland's official guide for stormwater management principals, methods, and practices in Maryland. It is available for download or viewing at MDE's website. The Stormwater Design Manual was originally published in October 2000 and was most recently updated in May 2009.

Multi-Family Residential (MFR) Property: A multifamily residential property (also known as a condo) is any housing unit that is subject to the condominium regime established under the Maryland Condominium Act. Multiple residences share a common entrance and they can be arranged above, below or next to one another in the same building.

Non-Residential (NR) Property: Commercial properties such as office buildings, hotels, retail establishments or industrial properties such as factories and warehouses. Also includes properties owned by homeowner associations, not-for-profit entities such as religious institutions, healthcare facilities, other developed properties devoted to non-governmental charitable and institutional uses, and any government-owned properties subject to the WQPC.

Single Family Residential (SFR) Property: A detached home or townhome. A detached home is a free-standing residence that does not share a wall with another property. A townhome, also known as a rowhouse or attached house, is a semi-detached property that shares at least one wall with another property.

Volumetric Runoff Coefficient (Rv): Defined by the Stormwater Design Manual as the value that is applied to a given rainfall volume to yield a corresponding runoff volume based on the percent impervious cover in a drainage area. The Rv value is calculated using the following: Rv = 0.05 +

0.009(I); where I = percent impervious cover. Refer to the Stormwater Design Manual for more details.

Water Quality Protection Charge (WQPC): The Water Quality Protection Charge (WQPC) is Montgomery County's stormwater charge, and is a part of Montgomery County property tax bills. The WQPC raises funds to improve the water quality of our streams and reduce the impacts of stormwater runoff.

Water Quality Volume (WQv): The Water Quality Volume (WQv) is defined by the Maryland Department of Environment Stormwater Design Manual as the storage needed to capture and treat the runoff from 90% of the average annual stormwater runoff volume equal to 1-inch multiplied by the volumetric runoff coefficient (Rv) and the site area. Refer to the Stormwater Design Manual for more details

Single Family Residential WQPC Credits

2.1 Overview

Credits of up to 60% off the Water Quality Protection Charge (WQPC) are available to property owners who maintain stormwater management practices on their property. The credit is provided to property owners who own and maintain on-site stormwater management practices and is based on the volume of water captured as defined by the (MDE) Stormwater Design Manual and as described in the section below.

Only properties with stormwater management practices are eligible for a credit. Those practices must be maintained by the property owner and in accordance with the maintenance requirements of the Montgomery County Department of Environmental Protection.

2.2 SFR Stormwater Practices

In general, stormwater practices located on SFR properties are smaller and defined substantially in the MDE Stormwater Design Manual, Volume I, Chapter 5 "Environmental Site Design". The following are definitions for stormwater management system facility types as defined by MDE and recognized by the Montgomery County WQPC SFR Credit Application.

2.2.1 Swales

Swales are vegetated landscaped channels that provide drainage, water quality treatment, and lower peak flow rates of stormwater runoff. Swales can be surfaced with grass (grass swales), plants (bioswales) or may be designed to have ponding (wet swales). Swales provide pollutant removal through vegetative filtering, settling of sediment, biological uptake by plants, and/or infiltration into the underlying soil media.

- *MDE Stormwater Design Manual Reference: Page 5.108, ESD Practice M-8*

2.2.2 Roof Leader Disconnection to Pervious Areas

Roof leader disconnection involves directing flow from roof downspouts onto vegetated areas where it can soak into or filter over the ground. This "disconnects" the rooftop from the storm drain system and reduces both runoff volume and pollutants delivered to waterways and water bodies. Disconnected downspouts should be discharged to pervious areas (lawns, landscaping, or undisturbed forests) with slopes less than 5% and to undisturbed or uncompacted soils that will allow stormwater to infiltrate.

- *MDE Stormwater Design Manual Reference: Page 5.57, ESD Practice N-1*

2.2.3 Non-Roof Area Disconnection to Pervious Areas

Non-rooftop disconnection involves directing flow from impervious surfaces onto vegetated areas where it can soak into or filter over the ground. Non-rooftop disconnection is commonly applied to smaller or narrower impervious areas like driveways, sidewalks and patios, and small parking lots. Note: driveways typically drain to the street and do not typically qualify for this practice. Disconnections should be discharged to pervious areas with slopes less than 5% and to undisturbed or uncompacted soils that will allow stormwater to infiltrate.

- *MDE Stormwater Design Manual Reference:*
  Page 5.61, ESD Practice N-2

2.2.4 Dry Well

A dry well is an excavated pit or structural chamber filled with gravel or stone that provides temporary storage of stormwater runoff, typically from rooftops. Rooftop runoff is directed to these storage areas and infiltrates into the surrounding soils prior to the next storm event. Pretreatment of water is recommended to filter sediment, leaves, and other debris that might clog the dry well. The drainage area to a dry well should not exceed 1,000 square feet and should be not be located in silt or clay soils. Dry wells constructed prior to ESD regulations (pre-2011) are not an accepted stormwater management practice.

- *MDE Stormwater Design Manual Reference: Page 5.91, ESD Practice M-5*

2.2.5 Green Roofs

Green roofs are alternative surfaces that replace conventional construction materials and include a protective covering of planting soil and vegetation. Also known as vegetated roofs, roof gardens, or eco-roofs, these may be used in place of traditional flat or pitched roofs to reduce impervious cover and more closely mimic natural hydrology. The more common "extensive" green roof is a lightweight system where the soil layer (growing medium) is between two and six inches thick and limits plants to low-growing, herbaceous varieties. "Intensive" green roofs have thicker soil layers (eight inches or greater) and are capable of supporting more diverse plants including trees and shrubs. A more robust structural loading capacity is needed to support the additional weight of green roofs.

- *MDE Stormwater Design Manual Reference: Page 5.91, ESD Practice M-5*

2.2.6 Conservation Landscaping

Conservation landscaping includes removing impervious surfaces, mowed turf, and/or invasive species and replacing with 6-9" of uncompacted soil, native plant species, and 1-2" of ponding depth (a depression above the soil that allows water to pond temporarily before infiltration). Conservation landscaping also helps with stormwater management because native plants don't need as much fertilizer or pesticide to thrive. This means that when it rains, fewer chemicals are channeled into the nearby waterways, which leads to healthier and cleaner streams and rivers.

- *MDE Stormwater Design Manual Reference: Page 5.91, ESD Practice M-5*

2.2.7 Micro-bioretention and Rain Gardens

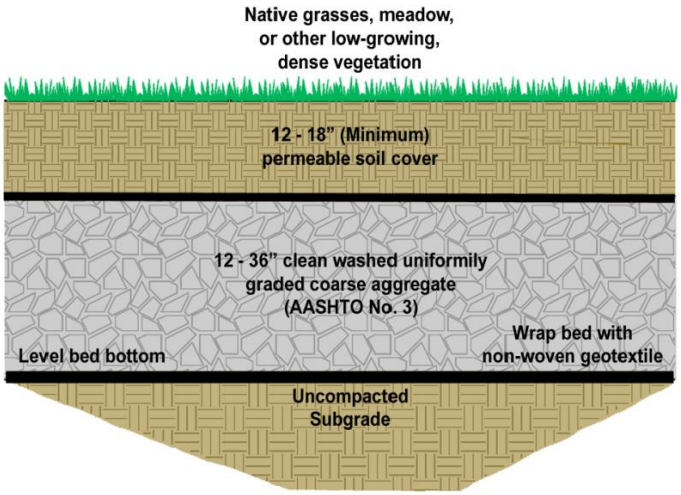
Micro-bioretention practices capture and treat runoff from small impervious areas by passing it through a filter bed mixture of sand, soil, and organic matter. Filtered stormwater is either returned to the site through an underdrain or partially infiltrated into the soil. Micro-bioretention practices are versatile and may be adapted for use anywhere there is landscaping. Micro-bioretention should be downhill and set back at least 10' from structures to protect the structures, unless an impermeable liner is provided. They should comprise of a 2-4' filter media later underlain by a gravel drainage layer. A perforated underdrain pipe is recommended in all applications and is required in poorly draining soils such as silts and clays.

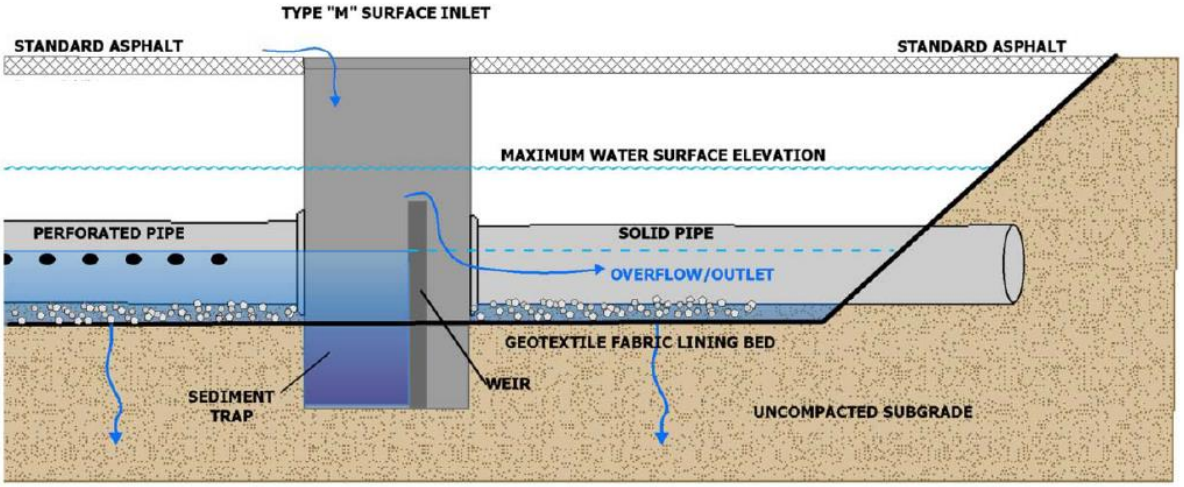
Rain gardens are similar practices, except are typically smaller and do not have underdrainage (typically buried perforated pipe). Rain gardens always depend on the underlying soil for proper drainage. Also, rain gardens are built with native soils mixed with compost or a special soil mix, while bioretention has a special soil mixed with sand, as well as gravel beneath, for the system to hold more water. The rain garden soil and mulch layer should be 12" minimum. An overflow conveyance system should be included to pass larger storms. Rain gardens are restricted for smaller drainage areas, 2,000 square feet or less.

- *MDE Stormwater Design Manual Reference:*
  - *Micro-bioretention Page 5.96, ESD Practice M-6*
  - *Rain Garden (MDE Manual Page 5.104, ESD Practice M-7*

2.2.8 Micro-infiltration

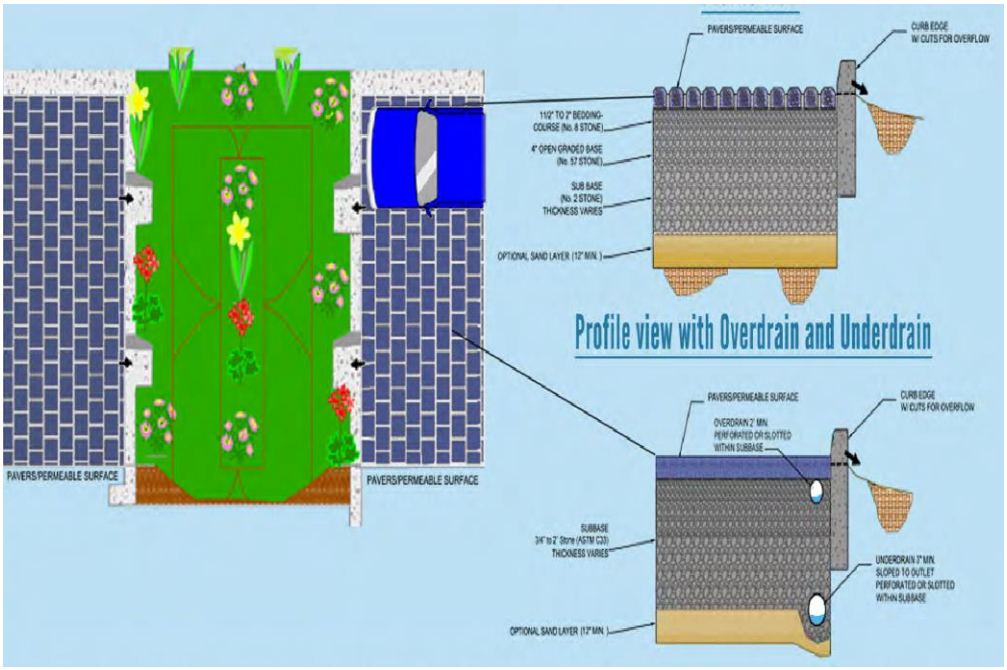
Micro-infiltration is comprised of stone gravel or prefabricated plastic structure layers called "infiltration beds" underlaying various site surfaces such as driveways, sidewalks, patios, or turf. Separation with filter fabric or permeable sand layers is needed to keep the infiltration bed clean.
Micro-infiltration must be installed over permeable, sandy soils, and the bottom of the infiltration bed must be level and uncompacted. An underdrain or overflow may be necessary to handle large rain events.





2.2.9 Pervious Pavement

Pervious pavements are alternatives that may be used to reduce imperviousness. While there are many different materials commercially available, permeable pavements may be divided into three basic types: porous bituminous asphalt, pervious concrete, and permeable interlocking concrete pavements. Permeable pavements typically consist of a pervious surface course and open graded stone base/subbase or sand drainage system, with a minimum open graded stone depth of 12". Stormwater drains through the pavement, is captured in the stone layer, and infiltrates into the surrounding soils. Porous pavements are best suited over sandy, permeable soils, and may require an underdrain or overflow for large rain events.



- *MDE Stormwater Design Manual Reference: Page 5.46, ESD Practice A-2*

2.2.10 Rainwater Harvesting: Rain Barrels and Cisterns

Rainwater harvesting practices intercept and store rainfall for future use. Stored water may be used for outdoor landscaping irrigation, car washing, or non-potable water supply. The capture and re-use of rainwater promotes conservation, as well as reduces runoff volumes and the discharge of pollutants downstream. These practices should be drained after each storm to make room to store rainfall runoff from the next storm.

Rain barrels are small stormwater containers, typically prefabricated, less than 100 gallons, and in the shape of a barrel. They are typically used to provide temporary storage of stormwater from roof leaders. These systems are generally designed for outdoor use.

Cisterns are large storage tanks typically used in capturing rainwater for non-potable water supply, providing a year-round source. The complexity of the sizing, installation, and accessories of this type of application make it more realistic for commercial operations. Separate plumbing, pressure tanks, pumps, and backflow preventers are necessary for indoor applications.

- *MDE Stormwater Design Manual Reference: Page 5.71, ESD Practice M-1*

2.2.11 Sheet Flow to Conservation Area

Conservation areas or easements are typically set up when land is developed and may or may not be owned by individual residents themselves. Stormwater runoff is effectively treated when flow from developed land is directed to adjacent conservation areas which are essentially natural, undisturbed areas water can soak into or filter over the ground. Landscaping should consist of uncompacted soils with native, non-turf landscaping or vegetation. This practice can only be used for stormwater that is sheet flowing (not concentrated or channelized) from an impervious area less than 100 feet in length. The conservation area should have a slope less than 5%, a minimum width of 50 feet, and should be approximately ½ acre or larger in total size.

2.3 SFR Credit Application and Calculator

The SFR credit application is available on the County's WQPC website and prepopulates initial application information including parcel area, impervious area, year the permit for the primary structure was approved, and WQPC information. Applicants must complete their contact information and whether they are the owner or owner's agent completing the application.

The primary form on the application "Stormwater Management System Information", referred to herein as the "SFR Credit Calculator". In this section applicants must input the size and/or number of stormwater management systems on their property. Based on this information, the SFR Credit Calculator computes a volume of water treated by the practice based on assumptions typical for each practice within the County, and within the context of a typical single family residence structure and how it is typically drained to stormwater facilities. ***Explanation of how volume captured by each practice is computed is provided in Appendix A.***

In general, practices which are larger and/or hold more volume such as bioretention are given more credit, while smaller and less intensive practices such as rainwater harvesting are given less credit.

Once completed, the SFR Credit Calculator accumulates the volume treated by all practices on the site and prorates the WQPC credit up to 60%. Credit is prorated according to Equation 2.1 based on how much volume is provided ("Volume Captured") versus how much is required at the property per the MDE Maryland Stormwater Design Manual ("Environmental Site Design Volume", ESDv):

Eqn. 2.1

$$SFR\ WQPC\ Percent\ Credit = \frac{Total\ Volume\ Captured}{Environmental\ Site\ Design\ Volume,\ ESDv} \times 60\%$$

The credit and WQPC charge (after credit) is computed according to Equations 2.2 and 2.3:

Eqn. 2.2

$$WQPC\ Credit = Percent\ Credit \times WQPC\ Charge\ on\ Bill\ (before\ credit)$$

Eqn. 2.3

$$WQPC\ Charge\ (after\ credit) = WQPC\ Charge\ on\ Bill\ (before\ credit) - WQPC\ Credit$$

SECTION 3

Nonresidential/Multifamily Residential WQPC Credits

3.1 Overview

The Non-Residential/Multi-Family (NR/MFR) Water Quality Protection Charge (WQPC) Credit is calculated for a single parcel (referred to herein as "the site") and is based on the sum of the volume of stormwater treatment provided by each stormwater management system practice at the site. Stormwater management system practices are generally based on Maryland Department of the Environment (MDE) recognized practices in the Maryland Stormwater Design Manual (MDE, revised 2010). After the volume of stormwater treatment provided ("Treatment Volume") is assessed for each stormwater management system at the site, the total Treatment Volume is used to calculate the total site WQPC Credit as described in this section.

WQPC Credits of up to 60% are available to NR/MFR property owners who own and maintain approved stormwater management practices on the site. For property owners that treat stormwater drainage from offsite in addition to all of the onsite required volume, WQPC credits of up to 100% are available. The list of approved NR/MFR WQPC practices which are eligible to receive credit is provided in Table B-2 of Appendix B.

Only properties with approved stormwater management practices are eligible for a credit. Those practices must be maintained by the property owner and in accordance with the maintenance requirements of the Montgomery County Department of Environmental Protection.

3.2 NR/MFR Credit Application and Calculator

The NR/MFR Credit application is available on the County's WQPC website and prepopulates initial application information including parcel area, impervious area, and WQPC information. Applicants must provide their contact information and whether they are the owner or owner's agent completing the application. The applicant may also provide site specific soils data according to the Soil Conservation Services (SCS) Hydrologic Soil Group, if available. If no site-specific soil data is available, Type C soils are assumed, since that is the predominant soil type in Montgomery County.

If stormwater drainage from offsite is also treated by one of the onsite stormwater management systems, the "Offsite Data" section can be completed for credit up to 100% off the WQPC. ***Explanation of how the Offsite Data and additional WQPC Credit is calculated is provided in Appendix B.***

The primary form on the application is Section 3, called the "Stormwater Management System Information", and referred to herein as the "NR/MFR Credit Calculator". At a minimum, the following information is required to be entered in the NR/MFR Credit Calculator for each stormwater management system entry:

- Facility Type: To be selected from a prepopulated list of approved practices which generally correspond to practices approved by MDE according to the Maryland Stormwater Design Manual. See Table B-2 provided in Appendix B for a complete list of approved practices.
- Year Permitted: The year that the stormwater management system was permitted, to be selected from the following eras: Pre-1985, 1985-2003, 2003-2010, or Post-2010.
- DEP Maintained: The applicant must certify whether the stormwater management system is maintained by the County DEP or by the property owner. Only stormwater management systems maintained by the property owner exclusively are eligible for WQPC Credit.
- Onsite Drainage Area: The total contributing drainage area which drains to the stormwater management system, to be entered in units of square feet.
- Onsite Impervious Drainage Area: The portion of total contributing drainage area which is considered to be impervious, to be entered in units of square feet.

Applicants have two options for obtaining WQPC Credit:

1. Applicant Input Design Volume ("Provided WQv"): Applicant can directly input the design volume into the NR/MFR Credit Calculator if design plans or other design data are available. This volume will typically be provided in the design plans as Water Quality Volume (WQv) (if project pre-dates Environmental Site Design (ESD) site requirements), or Environmental Site Design Volume (ESDv), and should be entered in units of cubic feet. The applicant may also have an agent evaluate the design treatment volume if documentation from the original design is not available. Note that the County DEP will check design documentation for all applications with input design treatment volume.
2. Assumed Volume ("Assumed Provided WQv"): If no design data are available for the stormwater management system's treatment volume, the NR/MFR Credit Calculator will automatically calculate an Assumed Treatment Volume based on the practice's design era and contributing drainage area. The assumed volume calculator cannot calculate and account for offsite credit. Offsite credit must be calculated using the Applicant Input Design Volume method and engineering calculations must be submitted to support the offsite treatment. ***Explanation of how the Assumed Treatment Volume is calculated is provided in Appendix B***.

Once completed, the NR/MFR Credit Calculator accumulates the volume treated by all practices on the site and prorates the WQPC Credit up to a maximum of 60% for practices that treat the full Environmental Site Design volume (ESDv), as defined in Chapter 5 of the MDE Maryland Stormwater Design Manual. For sites with stormwater management systems which pre-date the ESD era systems and treat up to the full Water Quality Volume (WQv) as defined in Chapter 2 of the MDE Maryland Stormwater Design Manual, a maximum WQPC Credit of up to 45% is available. Credit is prorated according to Equations 3.1 and 3.2, based on how much total volume is provided ("Provided WQv") versus how much is required at the property per the MDE Maryland Stormwater Design Manual (either "Water Quality Volume", WQv; or "Environmental Site Design Volume", ESDv):

For treatment up to the first 1-inch (up to 45% WQPC Credit):

Eqn. 3.1

$$\text{NR/MFR WQPC \% Credit} = \frac{\text{Provided WQv}}{\text{Required WQv}} \times 45\%$$

For treatment over 1-inch (up to 60% WQPC Credit):

Eqn. 3.2

$$\text{NR/MFR WQPC \% Credit} = \left[\frac{\text{Provided WQv}}{\text{Required WQv}} \times 45\%\right] + \left[\frac{\text{Provided (ESDv} - \text{WQv)}}{\text{Required (ESDv} - \text{WQv)}} \times 15\%\right]$$

After the WQPC Percent Credit is calculated, the credit and WQPC charge (after credit) is then computed according to Equations 3.3 and 3.4:

Eqn. 3.3

$$\textit{WQPC Credit} = \textit{Percent Credit} \times \textit{WQPC Charge on Bill (before credit)}$$

Eqn. 3.4

$$\textit{WQPC Charge (after credit)} = \textit{WQPC Charge on Bill (before credit)} - \textit{WQPC Credit}$$

3.3 NR/MFR Credit Calculation Examples

The following examples are provided to further illustrate the NR/MFR WQPC Credit program.

3.3.1 Example 1 – Design Data Available - NR/MFR Pre-ESD Era

EXAMPLE 1 – NR/MFR PRE-ESD ERA, DESIGN DATA AVAILABLE

➢ **Site Information:**

- Single wet pond extended detention SWM system (P-3) to treat all onsite impervious and some pervious area, built in 2005
- Design Plans available
- Site-specific soils data, split between "HSG-B" and "HSG-C" soils
- **WQPC = $2,968.49** for 80,794 SF of impervious

From County WQPC:

Surface	Area (square feet)
Building Area	29,773
Driveway/Parking	51,021
Other Impervious	0
Total Impervious	**80,794**
Total Lot Area	**121,096**
% Impervious	**66.72%**

% Impervious
% I = 66.72%

Site Runoff Coefficient
Rv = 0.05 + 0.009 x % I
Rv = 0.65

Note: WQPC Property Image used to illustrate example only and does not reflect actual site treatment conditions.

➢ **SWM System Information:**

- ✓ **Facility Type**: Wet Pond Extended Detention (P-3)
- ✓ Built in the 2003-2010 era
- ✓ Property Owner maintained
- ✓ **Total Drainage Area:** 106,349 square feet
- ✓ **Impervious Drainage Area:** 80,794 square feet
- ✓ No Offsite Area Treated
- ✓ **Provided WQv for P = 1-inch:**
  - WQv = 5,765 cubic feet from design plans
  - Applicant input

➢ **Calculate Required WQv:**

1. Rainfall Depth, P = 1 inch
2. Site Runoff Coefficient, Rv = 0.65 (rounded)
3. Required WQv per Stormwater Design Manual:

$$WQv = \frac{P \times Rv\ x\ Area}{12\ inch/ft} = \frac{(1\ inch) x\ 0.65\ x\ 121{,}096\ sq-ft}{12\ inch/ft} =$$

$$= 6{,}564\ cubic\ ft$$

➢ **Calculate WQPC % Credit (for treatment up to the first 1-inch):**

$$\text{WQPC \% Credit} = \frac{Provided\ WQv}{Required\ WQv} \times 45\% = \frac{5{,}765\ cu-ft}{6{,}564\ cu-ft} \times 45\% = \mathbf{39.52\%}$$

➢ **Calculate WQPC Credit:**

$$\text{Onsite WQPC Credit} = Percent\ Credit \times Onsite\ WQPC = 39.52\% \times \$2{,}968.49 = \mathbf{\$1{,}173.15}$$

➢ **Calculate WQPC:**

$$\text{WQPC (after credit)} = Onsite\ WQPC - WQPC\ Credit = \$2{,}968.49 - \$1{,}173.15 = \mathbf{\$1{,}795.35}$$

3.3.2 No Design Data - NR/MFR Pre-ESD Era

EXAMPLE 2 – NR/MFR PRE-ESD ERA, NO DESIGN DATA

➢ **Site Information:**

- Single Bioretention SWM system to treat all onsite impervious/pervious area, built in 2000
- No design documentation available
- No soils data
- **WQPC = $2,968.49** for 80,794 SF of impervious

From County WQPC:

Surface	Area (square feet)
Building Area	29,773
Driveway/Parking	51,021
Other Impervious	0
Total Impervious	**80,794**
Total Lot Area	**121,096**
% Impervious	**66.72%**

% Impervious
% I = 66.72%

Site Runoff Coefficient
Rv = 0.05 + 0.009 x % I
Rv = 0.65

Note: WQPC Property Image used to illustrate example only and does not reflect actual site treatment conditions.

➢ **SWM System Information:**

- ✓ **Facility Type:** Bioretention (F-6)
- ✓ Built in the 1985-2003 era
- ✓ Property Owner maintained
- ✓ **Total Drainage Area:** 121,096 SF
- ✓ **Impervious Drainage Area:** 80,794 SF
- ✓ No Offsite Area Treated
- ✓ **No Design WQv available**
  - Auto-calculate WQv in Calculator

➢ **Required WQv calculated in (Ex. 1)**

- 6,564 cubic feet

➢ **Design Treatment Volume (Assumed Provided WQv):**

1. Treatment Fraction, By Era = 0.50 (*from Table B-2*)
2. Treatment Depth for Full Credit, By Era = 1.0 inch (*from Table B-2*)
3. Treatment Depth Credit, P = 1.0 inch x (0.50) = 0.50 inch
4. Provided WQv calculated per Stormwater Design Manual:

$$WQv = \frac{P \times Rv \times Area}{12\ inch/ft} = \frac{(0.50\ inch) \times 0.65 \times 121{,}096\ SF}{12\ inch/ft} =$$

$$= 3{,}282\ cubic\ ft$$

➢ **Calculate WQPC % Credit (for treatment up to the first 1-inch):**

$$\text{WQPC \% Credit} = \frac{Provided\ WQv}{Required\ WQv} \times 45\% = \frac{3{,}282\ cu-ft}{6{,}564\ cu-ft} \times 45\% = \mathbf{22.50\%}$$

➢ **Calculate WQPC Credit:**

$$\text{Onsite WQPC Credit} = Percent\ Credit \times Onsite\ WQPC = 22.50\% \times \$2{,}968.49 = \mathbf{\$667.91}$$

➢ **Calculate WQPC:**

$$\text{WQPC (after credit)} = Onsite\ WQPC - WQPC\ Credit = \$2{,}968.49 - \$667.91 = \mathbf{\$2{,}300.58}$$

3.3.3 No Available Treatment Volume - ESD era Practice

EXAMPLE 3 – NR/MFR ESD ERA, NO DESIGN DATA

➢ **Site Information:**
- Submerged Gravel Wetland SWM system to treat all onsite area, built in 2011
- No design documentation available, no soils data
- **WQPC = $2,968.49** for 80,794 SF of impervious

From County WQPC:

Surface	Area (square feet)
Building Area	29,773
Driveway/Parking	51,021
Other Impervious	0
Total Impervious	**80,794**
Total Lot Area	**121,096**
% Impervious	**66.72%**

% Impervious
% I = 66.72%

Site Runoff Coefficient
Rv = 0.05 + 0.009 x % I
Rv = 0.65

Note: WQPC Property Image used to illustrate example only and does not reflect actual site treatment conditions.

➢ **SWM System Information:**
- ✓ **Facility Type**: Submerged Gravel Wetland (M-2)
- ✓ Built in the Post-2010 era
- ✓ Property Owner maintained
- ✓ **Total Drainage Area:** 121,096 square feet
- ✓ **Impervious Drainage Area:** 80,794 square feet
- ✓ No Offsite Area Treated
- ✓ **No Design WQv/ESDv available**
  - Auto-calculate WQv and ESDv in Calculator

➢ **Required WQv calculated in (Ex. 1)**
- 6,564 cubic feet

➢ **Calculate Required ESDv (Assumed Provided ESDv):**
1. Site ESD Rainfall Target, P_E = 2.0 inch
2. ESDv calculated per MDE Stormwater Design Manual:

$$ESDv = \frac{P_E \times Rv \times Area}{12\ inch/ft} = \frac{(2.00\ inch) \times 0.65 \times 121{,}096\ sq-ft}{12\ inch/ft} = 13{,}128\ cubic\ ft$$

➢ **Design Treatment Volume (Assumed Provided WQv):**
1. Treatment Fraction, By Era = 1.0 (*from Table B-2*); Treatment Depth for Full Credit, P_E = 2.0 inch
2. Treatment Depth Credit, P_E = 2.0 inch x (1.0) = 2.0 inch
3. Provided ESDv Calculated per MDE Stormwater Design Manual:

$$ESDv = \frac{P_E \times Rv \times Area}{12\ inch/ft} = \frac{(2.0\ inch) \times 0.65 \times 121{,}096\ sq-ft}{12\ inch/ft} = 13{,}128\ cubic\ ft$$

➢ **Calculate WQPC % Credit (for treatment over 1-inch):**

$$\text{WQPC \% Credit} = \frac{Provided\ WQv\ (6{,}564\ cf)}{Required\ WQv\ (6{,}564\ cf)} \times 45\% + \frac{Provided\ (ESDv-WQv)\ (13{,}128\ cf - 6{,}564\ cf)}{Required\ (ESDv-WQv)\ (13{,}128\ cf - 6{,}564\ cf)} \times 15\% = \mathbf{60.00\%}$$

➢ **Calculate WQPC Credit:**

$$\text{Onsite WQPC Credit} = Percent\ Credit \times Onsite\ WQPC = 60.00\% \times \$2{,}968.49 = \mathbf{\$1{,}781.09}$$

➢ **Calculate WQPC:**

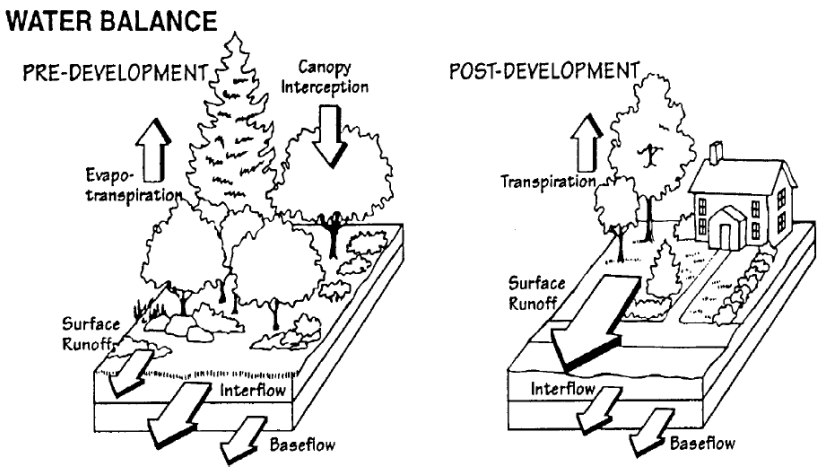
$$\text{WQPC (after credit)} = Onsite\ WQPC - WQPC\ Credit = \$2{,}968.49 - \$1{,}781.09 = \mathbf{\$1{,}187.40}$$

Appendix A: Basis for Single Family Residential Credit Calculation

A.1 Background

Stormwater practices located on SFR properties are smaller and defined substantially in the MDE Stormwater Design Manual, Volume I, Chapter 5 "Environmental Site Design" (ESD). According to the manual, the target for ESD implementation is "woods in good condition" or better, representing a predevelopment condition. Woods in good condition holds and treats stormwater much better than typical residential land by storing, soaking in, filtering, evaporating, and consuming water. This is demonstrated by the Water Balance Figure below from Page 1.3 of the MDE Manual.

Figure 1.1 Water Balance at a Developed and Undeveloped Site
(Source: Schueler, 1987)



Surface runoff is minimal in an undeveloped site, but dominates the water balance at a highly impervious site.

ESD stormwater practices and approved facilities mimic how woods in good condition keeps and treats stormwater. Acceptable ESD practices are defined in the body of this Manual; however, applicants can also download and refer to the MDE Stormwater Design Manual.

A.2 Environmental Site Design Volume (ESDv) Requirement

The primary requirement under ESD stormwater facilities is to provide the equivalent volume of water that "woods in good condition" at that site would provide. Contingent on the ESD practice, this volume can be based on the equivalent storage, infiltration, or evapotranspiration of the stormwater.

1. The **ESDv Formula** is located on page 5.18 of the MDE Manual and is calculated by the following equation:

$$\text{ESDv (Required)} = \frac{\text{Design Rainfall (Pe) x Runoff Coefficient (Rv) x Area (A)}}{12}$$

2. **Area** is equal to the residence's Parcel Area. This entire area must mimic "woods in good condition" land in terms of stormwater to fully satisfy ESD requirements.

3. **Design or Target Rainfall, Pe**, is the inches of rain required to be captured. Pe is variable dependent on how impervious the parcel is and what type of soils are on the parcel. The more impervious the parcel is, the more that ESD stormwater facilities must provide capture volume to compensate. The better the soils are (the more porous and better at soaking in rain) the more stormwater that must be captured to mimic woods in good condition. Type A and B soils are best and tend to be sandy and coarse in texture. Type C and D soils are finer, such as clays and silts. **For the SFR application, Type C soils are assumed, since that is the predominant soils type in Montgomery County.**

   Table 5.3 below from Page 5.22 of the MDE manual is used to determine the Design Pe for Type C soils, dependent on the percent imperviousness (%I). An example of how to use this table for a 25% impervious site is displayed, resulting in a Pe requirement of 1.2".

Table 5.3 Runoff Curve Number Reductions used for Environmental Site Design (continued)

Hydrologic Soil Group C										
%I	RCN*	P_E = 1"	1.2"	1.4"	1.6"	1.8"	2.0"	2.2"	2.4"	2.6"
0%	74									
5%	75									
10%	76									
15%	78									
20%	79	**70**								
25%	80	72	**70**	**70**						
30%	81	73	72	71						
35%	82	74	73	72	**70**					
40%	84	77	75	73	71					
45%	85	78	76	74	71					
50%	86	78	76	74	71					
55%	86	78	76	74	71	**70**				
60%	88	80	78	76	73	71				
65%	90	82	80	77	75	72				
70%	91	82	80	78	75	72				
75%	92	83	81	79	75	72				
80%	93	84	82	79	76	72				
85%	94	85	82	79	76	72				
90%	95	86	83	80	77	73	**70**			
95%	97	88	85	82	79	75	71			
100%	98	89	86	83	80	76	72	**70**		

4. **Runoff Coefficient, Rv**, is a dimensionless coefficient in the ESDv Formula that represents the percent of rainfall that will be converted to stormwater runoff. This is also a function of % Impervious because impervious surfaces do not let rain soak into the ground.

   The formula for calculating Rv is provided below. The maximum Rv for a 100% impervious site is 0.95 since even impervious surfaces have a small amount of surface storage for evaporation, and may even have cracks or joints in the surface. The runoff coefficient in this example is 0.257:

$$\mathbf{Rv = 0.05 + 0.009\ (\%I) = 0.05 + 0.009\ (25\%) = 0.275}$$

5. Revisiting the ESDv equation above, the **ESDv Required** is divided by 12 to convert Pe from inches to feet, resulting in an ESDv in units of cubic feet which is reported in the SFR Credit Calculator.

A.3 Volume Captured Calculations for Approved Practices

ESD practices accepted in the SFR Credit Application are listed in the SFR Credit Calculator under "Stormwater Management System Information". The SFR Credit Calculator tab of the SFR application requires the applicant to input the size, and in some cases the quantity, of Stormwater Management Systems on the property. These inputs are used to compute the Volume Captured. A summary of the equations used to compute Volume Captured is provided in the sections below with important assumptions depending on the practice.

A.3.1 Swales

Credit for swales is based on the assumption that most houses are placed at the high point of the parcel, with the half of the residence's impervious area sloped to the front of the parcel and the other half sloped to the rear of the parcel. A swale located either across the front or rear of the property would accordingly treat one half of the property's impervious area. Therefore the volume captured by a swale is assumed to be the following, where the runoff coefficient is 0.95 for 100% impervious area:

- **Volume Captured = 50% of Lot's Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12**

Note, the County will check the linear feet of swale to ensure the volume provided by the swale is practical given the amount of volume provided as calculated by this equation.

A.3.2 Roof Leader Disconnection to Pervious Areas

Disconnection practices rely on the porosity and infiltration of the soils on the property to treat stormwater. To determine the volume captured, the SFR Credit Calculator requests the square feet of pervious areas (such as lawns and landscaped areas) receiving flow from disconnected roof leaders, as well as the number of roof leaders disconnected. Important assumptions regarding this practice include:

i. 100 square feet of pervious area is assumed able to hold approximately 2 cubic feet of volume, capped at the pervious area on the parcel.

ii. The SFR Credit Calculator checks whether the volume received by the pervious area can hold the volume it receives from the roof leaders, otherwise the volume is capped at the volume of the pervious area.

iii. The SFR Calculator checks the volume received by the roof leaders (assuming the house's roof is drained by approximately 4 leaders) to ensure it does not exceed 500 square feet, which is the maximum amount allowed to this practice per the MDE Stormwater Design Manual.

iv. Overall, the practice volume is discounted by 50% to account for compacted soils and/or insufficient groundcover in pervious areas, or insufficient flow path lengths prior to the

disconnected flow potentially re-entering an impervious area and ultimately in the storm drain system, etc.

The logic for computing the volume captured by this practice therefore is:

- **If** 2 ft^3 per 100 ft^2 of pervious area < Roof Leader Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 50% Discount x 2 ft^3 per ft^2 pervious area disconnected to, capped at parcel's pervious area.
- **If** 2 ft^3 per 100 ft^2 of pervious area > Roof Leader Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 50% Discount x Roof Leader Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, capped at 500 ft^2 roof impervious area.

A.3.3 Non-Roof Area Disconnection to Pervious Areas

The assumptions used to compute Volume Captured by this practice are identical to the previous practice (Roof Area Disconnection to Pervious Areas), except that since the impervious areas tributary to this practice are non-roof areas (such as driveways, parking, decks, sidewalks, etc.), assumption (iii) from A.3.2 above must be revised to the following:

iii. The SFR Calculator checks the volume received by a maximum of 2 non-roof areas (assuming the non-roof areas are evenly split between front and back of parcel, where the pervious disconnection areas are assumed to be) to ensure it does not exceed 1,000 square feet, which is the maximum amount allowed to this practice per the MDE Stormwater Design Manual.

The logic for computing the volume captured by this practice therefore is:

- **If** 2 ft^3 per 100 ft^2 of pervious area < Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 50% Discount x 2 ft^3 per ft^2 pervious area disconnected to, capped at parcel's pervious area.
- **If** 2 ft^3 per 100 ft^2 of pervious area > Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 50% Discount x Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, capped at 1,000 ft^2 non-roof impervious area.

A.3.4 Dry Well

Dry wells have been permitted to be constructed as stormwater management practices in Montgomery County since 2003, even though the practice was not included in the MDE Stormwater Design Manual until ESD was introduced and ESD-type dry wells began to be constructed in approximately 2011. Therefore, Volume Captured credit is based on the era in which it was permitted as itemized below. The SFR Credit Calculator caps tributary impervious area to each dry well at the residence's roof area or 1,000 square feet, which is the maximum to the practice according to the MDE Stormwater Design Manual.

- **If Dry Well(s) permitted prior to 2003**, the practice was not permitted or approved for water quality treatment in the County, therefore **Volume Treated = 0.**
- **If Dry Well(s) permitted between 2003 and 2010**, the practice was permitted/approved for 1" water quality volume credit (pre-ESD volume requirement) and therefore:

  Volume Captured = # Dry Wells x 1,000 ft^2 or Roof Area x 1" Pe x Runoff Coefficient (0.95) / 12

- **If Dry Well(s) permitted between 2011 or after**, the practice was permitted/approved for ESD treatment therefore:

  Volume Captured = # Dry Wells x 1,000 ft^2 or Roof Area x 2.2" Pe x Runoff Coefficient (0.95) / 12

A.3.5 Green Roofs

Green roof design as it relates to storage volume is widely varied based on the structural capacity of the roof, drainage configuration, roof slope (if any), types of media, and thicknesses of the media. The average depth of an extensive green roof, the most common green roof type, is approximately 4" and contains approximately 25% voids, which equates to approximately 1" of storage in the media. The SFR Calculator therefore computes volume captured as:

- 1" storage x 1 square foot area / 12 = 0.083 ft^3 volume x 7.48 gallons per ft^3 = 0.62 gallons
- Rounding down to account for media compaction, system fouling and variability:

  Volume Captured = 0.5 gallons per ft^2 green roof

Note, this is also the basis for calculating volume for the County's Rainscapes Rewards program.

A.3.6 Conservation Landscaping

Conservation landscaping receives flow from the residence's impervious areas and stores stormwater within depressed areas around plantings. Since this practice is not drained, ponding depth is typically minimal therefore 2" ponding is assumed. The SFR Calculator therefore computes volume captured as:

- 2" ponding x 1 square foot area / 12 = 0.166 ft^3 volume x 7.48 gallons per ft^3 = 1.24 gallons
- 9" planting soil with 33% voids is assumed, or 9" x 33% x 7.48 gallons per ft^3 / 12 = 1.85 gallons
- Rounding to the nearest whole number, 1.24 gallons + 1.85 gallons = 3 gallons
- **Volume Captured = 3 gallons per ft^2 conservation landscaping**

Note, this is also the basis for calculating volume for the County's Rainscapes Rewards program.

A.3.7 Rain Gardens, Micro-bioretention, and Micro-infiltration

These three practices are designed similarly in that the volume captured varies based on the amount of surface ponding and media depth that is placed. 6" is the most common ponding depth for these practices, which represents a balance of capturing volume while avoiding excessive standing water. While media depth varies between these 2 practices, rain garden depths are between 1' minimum and 3' maximum while micro-bioretention is typically always at the equivalent of a 3' depth (including drainage layer). Micro-infiltration designs vary widely but are also assumed to capture the equivalent of a 3' media depth (including drainage layer).The SFR Calculator therefore computes volume captured as:

- 6" ponding x 1 square foot area / 12 = 0.5 ft^3 volume x 7.48 gallons per ft^3 = 3.74 gallons
- 1' media x 65% of ponding area (assumed) x 33% voids (assumed) x 1 square foot area / 12 = 1.60 gallons

- **Volume Captured (1' media Rain Garden) = 3.74 + 1.60 = 5 gallons per ft^2 (rounded)**
- **Volume Captured (2' media Rain Garden) = 3.74 + (2 x 1.60) = 7 gallons per ft^2 (rounded)**
- **Volume Captured (3' media Rain Garden, Micro-bioretention, or Micro-infiltration) = 3.74 + (3 x 1.60) = 9 gallons per ft^2 (rounded)**

Note, this is also the basis for calculating volume for the County's Rainscapes Rewards program.

A.3.8 Pervious Pavement

Pervious pavement does not contain surface storage, and the pervious pavement matrix itself is designed not to hold water to prevent damaging the pavement and standing water. Therefore, volume captured by pervious pavement is limited to the underlying stone layer(s) which typically consists of a leveling or base course immediately beneath the pavement, and possibly a coarser stone reservoir or subbase course beneath that. Typically the combination of the stone courses is approximately 12" for pervious pavement designs, therefore the SFR Credit Calculator computes volume captured as:

- 1' stone course x 40% voids (assumed) x 1 square foot area x 7.48 gallons per ft^3 = 2.99 gallons
- **Volume Captured = 3 gallons per ft^2 pervious pavement**

A.3.9 Rainwater Harvesting: Rain Barrels and Cisterns

Stormwater captured by rainwater harvesting practices are not treated, rather, they are reused onsite for a variety of purposes at a highly variable rate. While the volume of the harvesting devices are fixed and easy to measure and count, the SFR Credit Calculator assumes approximately 40% of the volume is regularly used or "turned over" due to inefficiency in using the volume after rain events, or alternatively assuming the other 60% overflows, becoming stormwater runoff or otherwise not being captured. Therefore, the SFR Credit Calculator computes volume captured as:

- **Volume Captured = Volume of Rainwater Harvesting Device x 40% reuse efficiency**

A.3.10 Sheet Flow to Conservation Area

This practice is similar to the disconnection practices except that conservation areas are typically much larger and are often part of the subdivision process in a development.

To determine the volume captured, the SFR Credit Calculator requests the square feet of conservation area receiving flow. Important assumptions regarding this practice include:

i. 100 square feet of conservation area is assumed able to hold approximately 6 cubic feet of volume, capped at the pervious area on the parcel.

ii. The SFR Calculator assumes the entire non-roof impervious on the parcel drains to the conservation area.

iii. Roof impervious is not eligible for credit due to its proximity to turf areas and that it is unlikely to exist as "sheet" flow (not concentrated or channelized). The roof disconnection credit should be used instead.

iv. The SFR Credit Calculator checks whether the volume received by the conservation area can hold the volume it receives from the roof leaders, otherwise the volume is capped at the volume of the conservation area.

The logic for computing the volume captured by this practice therefore is:

- **If** 6 ft^3 per 100 ft^2 of conservation area < Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = 6 ft^3 per ft^2 conservation area disconnected to.
- **If** 6 ft^3 per 100 ft^2 of conservation area > Non-Roof Leader Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, **then Volume Captured** = Non-Roof Impervious Area x 2.2" Pe x Runoff Coefficient (0.95) / 12, capped at the parcel's total non-roof impervious area.

Appendix B: Basis for Non-Residential/Multi-Family Residential Credit Calculation

B.1 Credit Calculation for Treatment of Onsite Areas

The maximum WQPC Credit for providing stormwater treatment of all onsite area is 60% and is based on providing the full Environmental Site Design volume (ESDv) treatment as defined in Chapter 5 of the MDE Stormwater Design Manual. The 60% maximum WQPC credit is based on the fact that approximately 60% of the County's Municipal Separate Storm Sewer System (MS4) permit impervious area is located within private property parcels in the county.

Calculation of the required ESDv requires site impervious/pervious data in addition to hydrologic soil group data specific to the site. If no site-specific soils data are available, Hydrologic Soil Group "C" (i.e. HSG C) will be used to evaluate the ESDv required for full treatment.

For sites that provide less than the full ESDv treatment requirement onsite, WQPC credit is based on the fraction of Water Quality Volume (WQv) treatment (as defined in Chapter 2 of the MDE Stormwater Design Manual) provided by each practice and is prorated according to the County average ESDv treatment depth of 2.2-inches (based on typical Hydrologic Soil Group "C" soils within the County) and Table 5.3 of the MDE MS4 guidelines, "Accounting for Stormwater Wasteload Allocations and Impervious Area Treated" (MDE, 2014). Table 3-2 below correlates the ESDv treatment depth with an impervious acre credit per acre of impervious watershed area (also referred to as "impervious area factor") as shown below. For a treatment depth of 2.2-inches (i.e. the typical ESDv depth for the County), the corresponding impervious area factor is 1.3 impervious acres per acre of watershed impervious area and the corresponding WQPC Credit is 45% (i.e. 60% divided by 1.3, rounded from 46% to 45% for simplicity). A WQPC Credit of 45% therefore applies to practices which treat the full WQv treatment depth of 1-inch, with treatment depths below 1-inch and above 1-inch (but less than the ESDv) prorated as indicated below in Figure B-1.

Table B-1. Impervious Acre Credit for Treatment Above and Below 1-inch of Rainfall
Based on Table 3 of the MDE MS4 guidelines, "Accounting for Stormwater Wasteload Allocations and Impervious Area Treated (2014)"

Impervious Acre Credit for Treatment Above and Below 1 Inch of Rainfall (Source: Table 3: Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated Guidance for NPDES Stormwater Permits, MDE, August 2014).	
Rainfall Depth Treated with ESD (inches), From Table 5.3 in MD Stormwater Manual	Impervious Acre Credit per Acre of Watershed Impervious Area
0.5	0.5
0.75	0.75
1.0	1
1.4	1.1
1.8	1.2
2.2	1.3
2.6	1.4

In summary, the WQPC Credit associated with treatment of the full WQv (based on 1" of treatment depth) is prorated based on linear interpolation according to the values provided in Figure B-3 below.

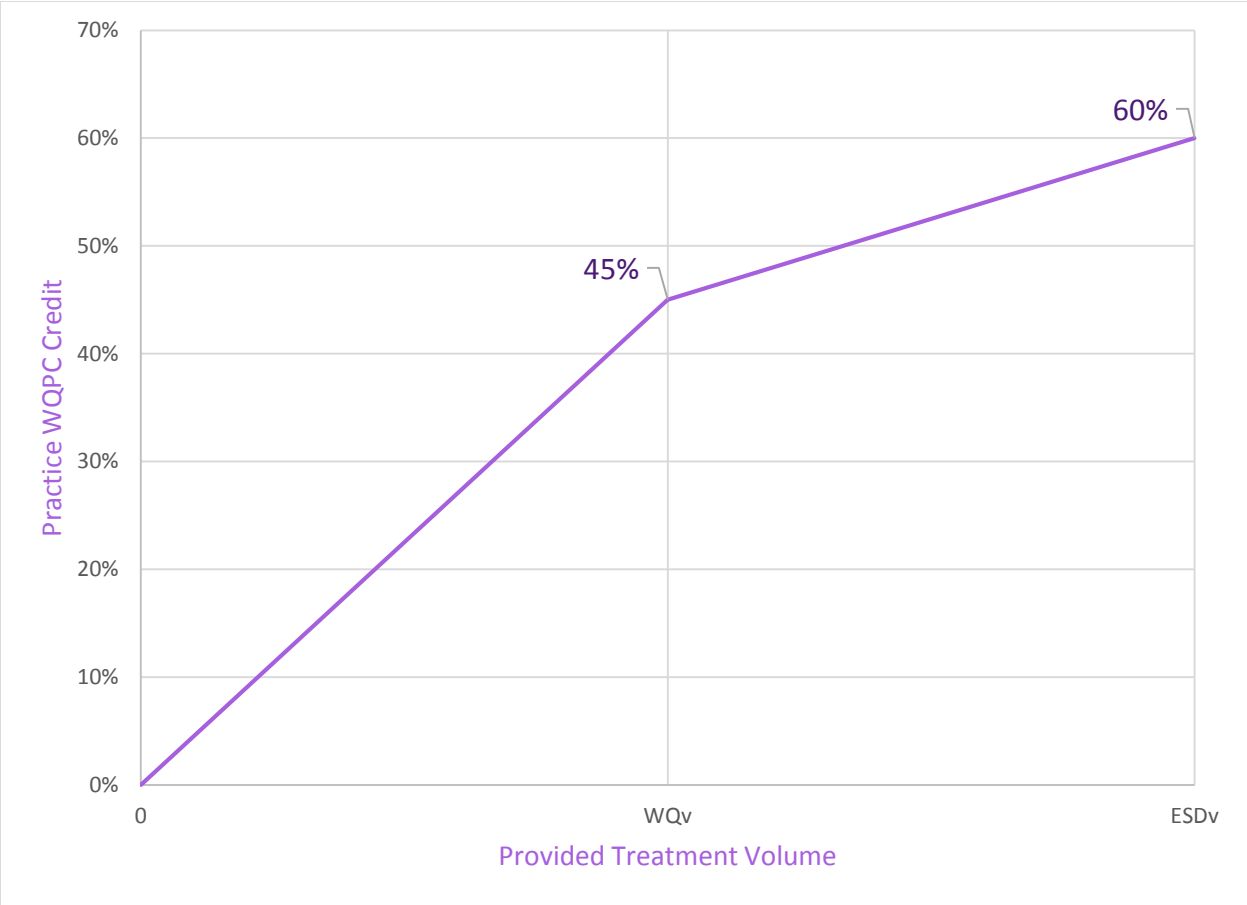


Figure B-1. WQPC Credit Based on Provided Onsite Treatment Volume

B.2 Treatment Volume Calculations

Stormwater treatment practices eligible for credit are generally based on Maryland Department of the Environment (MDE) recognized practices in the Maryland Stormwater Design Manual (MDE, revised 2010). The treatment volume can be determined using one of the following methods:

1. Applicant Input Design Volume ("Provided WQv", to be entered by the applicant)

- or -

2. Assumed Volume ("Assumed Provided WQv", to be evaluated by the WQPC calculator)

These two methods are described in more detail in this section.

B.2.1 Design Volume

If design information is available, the Design Volume can be entered by the applicant into the calculator. The Design Volume may also be referred to on the record plans or drawings as the Water Quality Volume (WQv) provided, or Environmental Site Design Volume (ESDv) provided. The Design Volume should be entered in units of cubic feet.

Treatment Volume calculations for each practice should be completed in accordance with the MDE Stormwater Design Manual using the Unified Stormwater Sizing Criteria referenced in Chapters 2 and 5. For convenience, a summary of these calculations is also provided below.

ESD Sizing Requirements:

P_E = Rainfall Target from Table 5.3 used to determine ESD goals and size practices

Q_E = Runoff depth in inches that must be treated using ESD practices
= P_E x R_v; R_v = the dimensionless volumetric runoff coefficient
= 0.05 + 0.009(I) where I is percent impervious cover

ESD_v = Runoff volume (in cubic feet or acre-feet) used in the design of specific ESD practices

$$= \frac{(P_E)(R_v)(A)}{12}$$ where A is the drainage area (in square feet or acres)

$$WQ_v = \frac{(1.0)\ (R_v)(A)}{12}$$ Eastern Rainfall Zone P = 1.0 inches of rainfall

where:
WQ_v = water quality volume (in acre-feet)
R_v = 0.05 + 0.009(I) where I is percent impervious cover
A = area in acres*

Figure B-2. ESDv and WQv Sizing Requirements
Excerpts from the Maryland Stormwater Design Manual (MDE, 2010)

B.2.2 Assumed Volume

If design information is not available, the Assumed Volume will be evaluated in the NR/MFR calculator based on design era as determined by the Year Permit was Approved for each practice. The volume is calculated using an assumed fraction of required treatment according to what was typical in that design era as shown below in Table 3-1. This assumed fraction of required volume is applied to the typical design standard (provided in treatment depth in inches) as per Year Permit was Approved for each practice as follows:

- Pre-1985: Stormwater management regulations came into effect after this era, and typically no stormwater management was provided prior to 1985; therefore no Assumed Volume will be calculated for practices permitted in this era;
- 1985-2003: Practices permitted in this era included flood control requirements, and the typical design standard is ½-inch of water quality treatment with varying design criteria depending on the practice;

- 2003-2010: The current MDE Stormwater Design Manual (MDE, 2002) was implemented in this era and the typical design standard is treatment of 1-inch of water quality treatment according to water quality volume (WQv) requirements; and
- Post-2010: Chapter 5 of the MDE Stormwater Design Manual took effect in 2010 and the design standard is based on treatment of the required Environmental Design Volume (ESDv), which varies from 1-2.6 inches and is evaluated using hydrologic soil group classification and site imperviousness.

The Assumed Volume is evaluated by multiplying the Treatment Fraction for the selected practice, by the Treatment Depth Required for the era, in order to determine the assumed Treatment Depth. The assumed treatment depth is then applied to the Water Quality Volume (WQv) equation as defined by the MDE Maryland Stormwater Design Manual and summarized below.

$$\text{Assumed Volume (cubic feet)} = \frac{\text{Treatment Fraction} \times \text{Treatment Depth Required (inch)} \times \text{Site Runoff Coefficient, Rv} \times \text{Drainage Area to Practice (square feet)}}{\text{12 inch/foot}}$$

See Table B-2 below for assumed Treatment Fractions and Treatment Depths by era.

Table B-2. Assumed Treatment Fractions

Based on Design Era, for valid treatment practices within each design era only

NR-MFR WQPC Credit Application Assumed Treatment Volume Table					
Water Quality Treatment Practice Category	**Facility**	**Assumed Volume Fraction Provided of the 1" WQv Requirement or ESDv (based on Era, and if practice was valid in that Era)**			
		Pre-1985 (No water quality requirements - assume no treatment provided)	**Installed from 1985-2003** (Fraction of 1" WQv Requirement Provided)	**Installed 2003 - 2010** (Fraction of 1" WQv Requirement Provided)	**Installed 2011 or after** (Fraction of ESDv Provided. ESDv requirement varies between 1" to 2.6")
Proprietary Structural Practices (Non-ESD)	Aquafilter	0	0.5	1	0.5
	Bayfilter	0	0.5	1	0.5
	Stormfilter	0	0.5	1	0.5
Structural Practices (Non-ESD)	Bioretention (F-6)	0	0.5	1	1
	Bioswale	0	0.5	1	1
	Dry Swale (O-1)	0	0.5	1	1
	Infiltration Trench (I-1)	0	0.5	1	1
	Infiltration Basin (I-2)	0	0.5	1	1
	Peat Sandfilter	0	0.5	1	1
	Separator Sandfilter	0	0.5	1	1
	Surface Sandfilter (F-1)	0	0.5	1	1
	Underground Sandfilter (F-2)	0	0.5	1	1
	Wet Pond (P-2)	0	0.5	1	1
	Wetland	0	0.5	1	1
	Wet Pond Extended Detention (P-3)	0	0.5	1	1
	Wetland Extended Detention (W-2)	0	0.5	1	1
	Dry Pond with Sand Filter Base	0	0.5	1	0
	Tree Box	0	0.5	1	1
ESD Practices Constructed Prior to ESD Standards	Permeable Pavement	0	0	1	0
	Green Roof	0	0	1	0
	Dry Well	0	0	1	0
ESD Practices	Rain Garden (M-7)	0	0	0	1
	Permeable Pavement (A-2)	0	0	0	1
	Rainbarrel (M-1)	0	0	0	1
	Cistern (M-1)	0	0	0	1
	Micro - Bioretention (M-6)	0	0	0	1
	Submerged Gravel Wetlands (M-2)	0	0	0	1
	Landscape Infiltration (M-3)	0	0	0	1
	Micro - Infiltration	0	0	0	1
	Swales (M-8)	0	0	0	1
	Green Roof (A-1)	0	0	0	1
	Reinforced Turf (A-3)	0	0	0	1
	Disconnection (N-1 or N-2)	0	0	0	1
	Sheet Flow (N-3)	0	0	0	1
	Dry well (M-5)	0	0	0	1

Stormwater Pretreatment and Quantity Practices not Providing Water Quality Treatment Volume	
Type	*Name*
Proprietary	Aquaswirl
	Baysaver
	Baysaver Flowsplitter
	Contech CDS System
	Flow Splitter
	Flow Splitter Underground
	Oil/Grit Separators
	Stormcepter
	Stormchamber
	Infiltrator/Stormtech
	Snout
	V2B1
	Vortechnics
	Vortsentry
Generic	Dry Pond
	Dry Pond Extended Detention
	Underground Storage

B.3 Treatment of Offsite Areas

For stormwater management systems that provide full treatment of the Environmental Site Design Volume (ESDv) as defined by Chapter 5 of the MDE Maryland Stormwater Design Manual and also treat additional stormwater runoff from offsite, a WQPC Credit up to a maximum of 100% may be obtained for the practice. To be eligible for the additional offsite credit, the maximum onsite NR/MFR WQPC Credit of 60% must already be achieved and is calculated as described in Section 3 of the Manual and B-1 and B-2 of this Appendix.

In Section 2 of the NR/MFR WQPC Credit Application, the applicant can select "Yes" in the Offsite Treatment Information dialogue box and the following additional site information will be required:

- Total Offsite Impervious Area: The portion of contributing offsite drainage area which is considered to be impervious, to be entered in units of square feet. This area does not include onsite impervious area.
- Total Offsite Drainage Area: The total contributing offsite drainage area which drains to the stormwater management system, to be entered in units of square feet. This area does not include onsite contributing drainage area.

The applicant may also provide site specific soils data according to the Soil Conservation Services (SCS) Hydrologic Soil Group, if available. If no site-specific soil data is available, Type C soils are assumed for all offsite areas, since that is the predominant soils type in Montgomery County. The data in Section 2 is used to calculate the offsite required Environmental Site Design Volume (ESDv) as defined by Chapter 5 of the MDE Maryland Stormwater Design Manual.

In Section 3, the applicant may select "Yes" in the "Offsite Area Treated?" dialogue box for individual stormwater management systems which treat additional offsite areas. The applicant must provide an input design Treatment Volume for all facilities that treat offsite area, and this Treatment Volume should include both onsite and offsite areas in units of cubic feet. Additional design plans or other design data is required in order to be eligible for the additional offsite credit, and design treatment volume will be verified by the County DEP. The "Incremental Offsite Treatment Volume" will be back-calculated for each practice from the onsite required ESDv, and a total offsite treatment volume will be calculated for applications with multiple stormwater management systems providing offsite treatment. The Total Incremental Offsite Volume will be used to calculate the additional offsite WQPC Percent Credit.

The Offsite WQPC will be calculated based on the total offsite impervious area treated and the County DEP's WQPC formula:

$$\text{Offsite WQPC} = \left[\frac{\text{Offsite Impervious Area}}{\text{Equivalent Residential Unit, ERU}} \times \text{Rate}\right]$$

The Equivalent Residential Unit (ERU) is equal to 2,406 square feet, and represents the median amount of impervious space on residential properties in the County. The Rate is set by the County Council each year.

The Offsite Percent Credit is calculated by prorating according to Equation B.1 based on how much offsite treatment volume is provided ("Total Incremental Offsite Volume") versus how much is required for the offsite drainage area per the MDE Maryland Stormwater Design Manual (offsite ESDv), up to a maximum of 40%:

Eqn. B.1 $$Offsite\ WQPC\ Percent\ Credit = \frac{Total\ Incremental\ Offsite\ Volume}{Offsite\ Environmental\ Site\ Design\ Volume,\ ESDv} \times 40\%$$

The Offsite WQPC Credit and Total WQPC Credit is computed according to Equations B.2 and B.3:

Eqn. B.2 $$Offsite\ WQPC\ Credit = Offsite\ WQPC\ Percent\ Credit \times Offsite\ WQPC$$

Eqn. B.3 $$Total\ WQPC\ Credit = Onsite\ WQPC\ Credit + Offsite\ WQPC\ Credit$$

The WQPC Charge is computed according to Equation B.4:

Eqn. B.4 $$WQPC\ Charge\ (after\ credit) = WQPC\ Charge\ on\ Bill\ (before\ credit) - Total\ WQPC\ Credit$$