COMMONWEALTH OF VIRGINIA

Department of Environmental Quality

Subject: Guidance Memo No. 22-2012 - **Stormwater Management and Erosion & Sediment Control Design Guide**

To: Regional Directors, Central Office, Office of Stormwater Management

From: Melanie D. Davenport, Director, Division of Water Permitting

Date: July 1, 2022

Copies: James Golden, Jeff Steers

Summary:

This guidance document has been developed to assist the public and the development community in determining the policies and procedures, which apply to land development in the Commonwealth of Virginia where the Department of Environmental Quality (DEQ or Department) serves as the Virginia Stormwater Management Program (VSMP) authority and/or the Virginia Erosion and Sediment Control Program (VESCP) authority. It contains information primarily concerned with the design guidelines for Erosion & Sediment Control Plans and Stormwater Management Plans.

Electronic Copy:

Once effective, an electronic copy of this guidance will be available on:

- The Virginia Regulatory Town Hall under the Department of Environmental Quality (http://www.townhall.virginia.gov/L/gdocs.cfm?agencynumber=440).
- The Department's website at www.deq.virginia.gov.

Contact Information:

Please contact Melanie D. Davenport, Director, Division of Water Permitting, at Melanie.Davenport@deq.virginia.gov or 804-698-4038, with any questions regarding the application of this guidance.

Certification:

As required by Subsection B of § 2.2-4002.1 of the APA, the agency certifies that this guidance document conforms to the definition of a guidance document in § 2.2-4101 of the Code of Virginia.

Disclaimer:

This document is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate or prohibit any particular action not otherwise required or prohibited by law or regulation. If alternative proposals are made, such proposals will be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.

Effective Date:_____ **Initials:**_____

TABLE OF CONTENTS

END OF TABLE OF CONTENTS

CHAPTER 1.000
INTRODUCTION

1.100 GENERAL

This document has been developed to assist the public and the development community in determining the policies and procedures, which apply to land development in the Commonwealth of Virginia where the Department of Environmental Quality (DEQ or Department) serves as the Virginia Stormwater Management Program (VSMP) authority and/or the Virginia Erosion and Sediment Control Program (VESCP) authority. It contains information primarily concerned with the design and construction guidelines for improvements related to Erosion & Sediment Control (ESC) Plans and Stormwater Management (SWM) Plans.

A majority of the information contained herein is a compilation of existing requirements already in place. This guidance document will serve as a central reference for these items. Please refer to the Reference Material contained in Section 1.300 herein for a more in-depth discussion.

Except as expressly stated otherwise in this guidance document, each Erosion & Sediment Control Plan and Stormwater Management Plan for land development is subject to the version of this guidance document in effect at the time of initial plan acceptance.

1.200 DISCLAIMER OF LIABILITY

Approval of plans by DEQ pursuant to the VSMP Regulation, ESC Regulations, and this document, is not intended and shall not be deemed as a guarantee or warranty for any individual, landowner, or developer that any improvements will be designed, planned, constructed, or operated in any particular manner or be free from defects. Such approval shall create no duty or result in any liability on the part of DEQ or its employees for any claim, demand, suit, or damages alleged to have resulted from the development, construction, existence, or operation of improvements constructed pursuant to such approved plans. Further, no such approval shall operate as or be deemed as an exception to any provision of the VSMP Regulation, ESC Regulations, or this document, unless such exception has been specifically granted in writing by DEQ. In the event that any aspect of any such approved plan fails to comply with any provision of the VSMP Regulation, ESC Regulations, or this document, in effect at the time of such approval, such provision of the VSMP Regulation, ESC Regulations, or this document, shall take precedence over the approved plans.

1.300 REFERENCE MATERIAL

To properly use this document, the design professional should have certain reference materials readily available. A listing of the materials referenced throughout this document is as follows:

Virginia Erosion and Sediment Control Regulations, 9VAC25-840

Virginia Erosion and Sediment Control Handbook (1992)

Virginia Stormwater Management Program (VSMP) Regulation, 9VAC25-870

Virginia Stormwater BMP Clearinghouse Website

DEQ Guidance Memo No. 16-2001 (Virginia Runoff Reduction Method, Version 3.0)

DEQ Guidance Memo No. 21-2007 (Local Water Quality Protections for Nonpoint Source Nutrient Credit Use for Regulated Land Disturbing Activities)

Chapter 7 (Hydrologic Soil Groups), Part 630 (Hydrology), NRCS National Engineering Handbook

Chapter 9 (Hydrologic Soil-Cover Complexes), Part 630 (Hydrology), NRCS National Engineering Handbook

Chapter 15 (Time of Concentration), Part 630 (Hydrology), NRCS National Engineering Handbook

NRCS Soil Survey Manual (1993)

NRCS Technical Release 55, Urban Hydrology for Small Watersheds (1986)

Owner of Operator Online Form for Inventory of Injection Wells (EPA Form 7520-16)

END OF CHAPTER

CHAPTER 2.000
EROSION AND SEDIMENT CONTROL

2.100 PURPOSE / OBJECTIVE

The purpose of this chapter is to convey the minimum acceptable erosion and sediment control design and construction guidelines for the effective control of soil erosion, sediment deposition, and non-agricultural runoff to prevent the unreasonable degradation of properties, stream channels, waters, and other natural resources.

2.200 INTERPRETATION

These erosion and sediment control design and construction guidelines are designed to supplement the provisions of existing Federal and State laws and regulations. Nothing contained herein shall be deemed to waive or modify other requirements of existing laws or regulations. The Virginia Erosion and Sediment Control Program (VESCP) authority (i.e., the Department of Environmental Quality or the local government) is the designated entity charged with the administration of the design and construction guidelines contained herein. The VESCP authority may allow for variations to given guidelines in accordance with the Erosion and Sediment Control (ESC) Regulations, 9VAC25-840-50.

2.300 DESIGN AND CONSTRUCTION GUIDELINES

Except where specifically supplemented herein, each Erosion & Sediment Control Plan is subject to the minimum standards contained in the ESC Regulations, 9VAC25-840-40, and the standards and specifications contained in the Virginia Erosion and Sediment Control Handbook in effect at the time of initial plan acceptance.

2.301 SOIL STOCK PILES

A. All soil stock piles, including topsoil stock piles located onsite or offsite, should be stabilized or protected with sediment trapping measures. See Minimum Standard #2, 9VAC25-840-40 2.

B. Temporary soil stabilization should be applied within seven (7) days to all soil stock piles that will remain dormant for longer than 14 days. See Minimum Standard #1, 9VAC25-840-40 1.

C. Permanent soil stabilization should be applied to all soil stock piles that will remain dormant for longer than one (1) year. See Minimum Standard #1, 9VAC25-840-40 1.

D. Soil stock pile side slopes should not exceed 2:1. See Standard and Specification 3.30 (Topsoiling).

2.302 TEMPORARY SEDIMENT TRAP

A. Temporary sediment traps should be designed and constructed based upon the total drainage area to be served by the sediment trap. The total drainage area to be served by a temporary sediment trap should be less than three (3) acres. See Minimum Standard #6, 9VAC25-840-40 6.

B. The minimum storage capacity of a temporary sediment trap should be 134 cubic yards per acre of total drainage area, half of which should be in the form of a permanent pool or wet storage to provide a stable settling medium. The remaining half should be in the form of a drawdown or dry storage to provide extended settling time during less frequent, larger storm events. See Minimum Standard #6, 9VAC25-840-40 6, and Standard and Specification 3.13.

C. A temporary sediment trap should be used no longer than 18 months. See Standard and Specification 3.13.

D. Runoff coefficients or curve numbers used in runoff computations should correspond to a bare earth condition. See Section 5.303 herein.

2.303 TEMPORARY SEDIMENT BASIN

A. Temporary sediment basins should be designed and constructed based upon the total drainage area to be served by the sediment basin. The maximum total drainage area to be served by a temporary sediment basin should be 100 acres. See Minimum Standard #6, 9VAC25-840-40 6, and Standard and Specification 3.14.

B. The minimum storage capacity of a temporary sediment trap should be 134 cubic yards per acre of total drainage area, half of which should be in the form of a permanent pool or wet storage to provide a stable settling medium. The remaining half should be in the form of a drawdown or dry storage to provide extended settling time during less frequent, larger storm events. See Minimum Standard #6, 9VAC25-840-40 6, and Standard and Specification 3.14.

C. A temporary sediment basin should be used no longer than 18 months unless designed as a permanent impoundment. See Standard and Specification 3.14.

D. Concentrated stormwater flow from a temporary sediment basin should be released into an adequate stormwater conveyance system.

1. Adequacy of all stormwater conveyance systems should be verified in the following manner:

a. Demonstrate that the total drainage area at the point of discharge within the stormwater conveyance system is at least 100 times greater than the drainage area served by the temporary sediment basin in question; **OR**

b. Manmade stormwater conveyance systems should be analyzed by the use of the 2-year 24-hour storm event to demonstrate that stormwater flow will be contained within the system and to demonstrate that stormwater flow will not cause erosion of the system; **OR**

c. Restored stormwater conveyance systems should be analyzed to demonstrate that stormwater flow, in combination with other stormwater runoff, is consistent with the design parameters of the restored stormwater conveyance system; **OR**

d. Natural stormwater conveyance systems should be analyzed by the use of the 2-year 24-hour storm event to demonstrate that stormwater flow will be contained within the system and to demonstrate that stormwater flow will not cause erosion of the system.

2. If an existing manmade stormwater conveyance system is not adequate, the applicant should:

    a. Improve the manmade stormwater conveyance system to a condition where the 2-year 24-hour storm event is contained within the system and does not cause erosion of the system; **OR**

    b. Develop a temporary sediment basin design that will not cause the pre-development peak runoff rate from a 2-year 24-hour storm event to increase; **OR**

    c. Provide a combination of manmade stormwater conveyance system improvement, stormwater detention, or other measures which is satisfactory to the VESCP authority.

3. If an existing restored stormwater conveyance system is not adequate, the applicant should develop a temporary sediment basin design to ensure that stormwater flow, in combination with other stormwater runoff, is consistent with the design parameters of the restored stormwater conveyance system.

4. If an existing natural stormwater conveyance system is not adequate, the applicant should:

    a. Improve the natural stormwater conveyance system to a condition where the 2-year 24-hour storm event is contained within the system and does not cause erosion of the system; **OR**

    b. Develop a temporary sediment basin design that will not cause the pre-development peak runoff rate from a 2-year 24-hour storm event to increase; **OR**

c. Provide a combination of natural stormwater conveyance system improvement, stormwater detention, or other measures which is satisfactory to the VESCP authority.

E. The structural integrity of a temporary sediment basin should be analyzed by the use of the 25-year 24-hour storm event. See Standard and Specification 3.14.

F. Runoff coefficients or curve numbers used in runoff computations should correspond to a bare earth condition. See Minimum Standard #6, 9VAC25-840-40 6, and Section 5.303 herein.

2.304 OUTLET PROTECTION

A. Adequate outlet protection should be installed and stabilized before newly constructed stormwater conveyance channels or pipes are made operational. See Minimum Standard #11, 9VAC25-840-40 11.

B. Structurally lined aprons at the outlets of pipes and paved channels should be designed and constructed at a zero percent (0%) grade for a distance related to the outlet flow rate and the tailwater depth. See Standard and Specification 3.18 (Outlet Protection) and Plates 3.18-1 through 4.

C. The design of structurally lined aprons applies to the immediate area below the pipe or paved channel outlet and does not apply to linings of channels or streams. See Standard and Specification 3.17 (Stormwater Conveyance Channel).

D. Pipe or paved channel outlets at the top of cut slopes or on slopes steeper than 10% should not be protected using solely a structurally lined apron. See Standard and Specification 3.18 (Outlet Protection).

2.305 SURFACE ROUGHENING

A. Slopes with grades greater than or equal to 3:1 should be surface roughened, either by stair-step grading, grooving, furrowing, or tracking if they are to be stabilized with vegetation. See Standard and Specification 3.29 (Surface Roughening) and Plates 32.9-1 through 4.

B. Slopes or areas with grades less than 3:1 should be surface roughened to a depth of at least two (2) to four (4) inches prior to applying temporary or permanent seeding. See Standard and Specification 3.29 (Surface Roughening).

2.306 TOPSOILING

A. Topsoil should be used where the existing soil presents the following problems:

1. The texture, pH, or nutrient balance of the existing soil cannot be modified to provide an adequate growth medium;

2. The existing soil material is too shallow to provide an adequate root zone and to supply necessary moisture and nutrients for plant growth; or

3. The existing soil contains substances potentially toxic to plant growth.

B. After areas to be topsoiled have been brought to grade, and immediately prior to dumping and spreading the topsoil, the subgrade (subsoil) should be loosened by discing or scarifying to a depth of at least two (2) inches to ensure boding of the topsoil and subsoil. See Standard and Specification 3.30 (Topsoiling).

C. Topsoil should be uniformly distributed to a minimum compacted depth of at least two (2) inches on slopes with grades greater than or equal to 3:1. See Standard and Specification 3.30 (Topsoiling)

D. Topsoil should be uniformly distributed to a minimum compacted depth of at least four (4) inches on slopes or areas with grades less than 3:1. See Standard and Specification 3.30 (Topsoiling)

E. Topsoil should be compacted enough to ensure good contact with the underlying subsoil and to obtain a level seedbed for the establishment of permanent or temporary seeding. Undue compaction is to be avoided as it increases runoff velocity and volume, and deters seed germination.

2.307 PERMANENT AND TEMPORARY SOIL STABILIZATION

A. Permanent or temporary soil stabilization should be applied within seven (7) days to all denuded areas at final grade. See Minimum Standard #1, 9VAC25-840-40 1.

B. Temporary soil stabilization should be applied within seven (7) days to all denuded areas that may not be at final grade but will remain dormant for longer than 14 days. However, permanent soil stabilization should be applied to all areas that will remain dormant for longer than one (1) year. See Minimum Standard #1, 9VAC25-840-40 1.

C. A permanent vegetative cover should be established on all denuded areas not otherwise permanent stabilized. See Minimum Standard #3, 9VAC25-840-40 3, and Standard and Specification 3.32 (Permanent Seeding).

D. Permanent or temporary soil stabilization should be applied to all earthen structures such as dams, dikes, and diversions <u>immediately after installation</u>. See Minimum Standard #5, 9VAC25-840-40 5.

E. Cut or fill slopes that are found to be eroding excessively within one (1) year of permanent soil stabilization should be provided with additional slope stabilizing measures until the problem is corrected. See Minimum Standard #7, 9VAC25-840-40 7.

2.308 TREE PRESERVATION AND PROTECTION

A. Stands of trees and individual trees selected for preservation should be accurately located on the Erosion & Sediment Control Plan and designated as "TREE(S) TO BE SAVED" or equivalent. See Standard and Specification 3.38 (Tree Preservation & Protection).

B. The limits of clearing should be located outside the drip line of any tree to be preserved and, in no case, closer than five (5) feet to the trunk of any tree whose dripline is less than five (5) feet. See Standard and Specification 3.38 (Tree Preservation & Protection) and Plate 3.38-1.

C. Prior to the commencement of construction, stands of trees and individual trees to be preserved should be marked at a height visible to equipment operators. See Standard and Specification 3.38 (Tree Preservation & Protection).

D. Trees being removed should not be felled, pushed, or pulled into any tree being preserved. See Standard and Specification 3.38 (Tree Preservation & Protection).

E. Equipment operators should not clean any part of their equipment by slamming it against the trunk of any tree to be preserved. See Standard and Specification 3.38 (Tree Preservation & Protection).

END OF CHAPTER

CHAPTER 3.000
STORMWATER MANAGEMENT – WATER QUANTITY

3.100 PURPOSE / OBJECTIVE

The purpose of this chapter is to convey the minimum acceptable post-development water quantity design and construction guidelines to ensure the general health, safety, and welfare of the citizens of the Commonwealth as well as protect the quality and quantity of state waters from the potential harm of unmanaged stormwater.

3.200 INTERPRETATION

These post-development water quantity design and construction guidelines are designed to supplement the provisions of existing Federal and State laws and regulations. Nothing contained herein shall be deemed to waive or modify other requirements of existing laws or regulations. Except as expressly stated otherwise in this document, the Department of Environmental Quality (DEQ or Department) is the designated entity charged with the administration of the post-development water quantity design and construction guidelines contained herein. DEQ may allow for exceptions to given guidelines in accordance with the Virginia Stormwater Management Program (VSMP) Regulation, 9VAC25-870-57 and 9VAC25-870-122.

3.300 DESIGN AND CONSTRUCTION GUIDELINES

Except where specifically supplemented herein, each Stormwater Management (SWM) Plan is subject to the administrative and technical criteria contained in the VSMP Regulation, 9VAC25-870-40 et seq., and the best management practice (BMP) design specifications found on the Virginia Stormwater BMP Clearinghouse Website in effect at the time of initial plan acceptance.

3.301 DESIGN STORMS AND HYDROLOGIC METHODS

A. The prescribed design storms are the 1-year, 1.5-year (Safe Harbor), 2-year, 10-year, and 100-year 24-hour storms using the site specific rainfall precipitation frequency data recommended by the U.S. National Oceanic and Atmospheric Administration (NOAA) Atlas 14. See 9VAC25-870-72 A.

B. All water quantity design computations shall be based on the existing watershed characteristics and the ultimate development condition of the proposed land-disturbing activity. See 9VAC25-870-72 B.

C. The Natural Resources Conservation Service (NRCS) synthetic 24-hour rainfall distribution models, including but not limited to, NRCS Technical Release 55 and NRCS Technical Release 20, should be used to perform the water quantity design computations herein. Hydrologic and hydraulic methods developed by the U.S. Army Corps of Engineers may also be used. See 9VAC25-870-72 C.

D. For drainage areas of 200 acres or less, the Rational Method may be used for storm sewer, culvert, and stormwater conveyance channel (i.e., open channel) sizing. See 9VAC25-870-72 D.

E. All pervious lands should be assumed to be in good hydrologic condition, regardless of conditions existing at the time of pre-development runoff computation. See 9VAC25-870-66 E.

F. Pre- and post-development site conditions and hydrology should be verified by site inspections, topographic surveys, available soil mapping/studies, and calculations consistent with good engineering practices. See 9VAC25-870-66 F.

3.302 CHANNEL PROTECTION

Channel protection requirements are outlined in 9VAC25-870-66 B of the VSMP Regulation. Concentrated stormwater runoff from a land-disturbing activity should be discharged into a stormwater conveyance system in a manner that meets the channel protection design criteria at each point of discharge.

3.302.1 DISCHARGES TO MANMADE STORMWATER CONVEYANCE SYSTEMS

"Manmade stormwater conveyance system" means a pipe, ditch, vegetated swale, or other stormwater conveyance system constructed by man (except for restored stormwater conveyance systems).

"Point of discharge" means a location at which concentrated stormwater runoff is released.

A. When concentrated stormwater runoff is discharged into a manmade stormwater conveyance system:

1. The manmade stormwater conveyance system should convey the post-development peak flow rate from the 2-year 24-hour storm event without causing erosion of the system AND the system should be analyzed from the point of discharge until it reaches the limits of analysis (see Section 3.302.1.B herein).

   If the point of discharge is at or below the limits of analysis (see Section 3.302.1.B herein), then no additional downstream stormwater conveyance system analysis is required.

   If a natural stormwater conveyance system is encountered before the limits of analysis is reached, the stormwater peak discharge should satisfy the requirements for discharges to natural stormwater conveyance systems (see Section 3.302.3 herein); **OR**

2. The stormwater peak discharge should satisfy the requirements for discharges to natural stormwater conveyance systems (see Section 3.302.3 herein). If these requirements are met or exceeded, then no downstream stormwater conveyance system analysis is required.

B. Limits of Analysis. The limits of analysis is the point at which either:

1. The site's contributing drainage area is less than or equal to 1.0% of the total watershed area; **OR**

2. The site's un-attenuated post-developed peak flow rate from the 1-year 24-hour storm is less than or equal to 1.0% of the existing peak flow rate from the 1-year 24-hour storm.

C. Channel Protection Computations.

1. Manmade stormwater conveyance systems should be analyzed to determine whether the post-development stormwater velocity exceeds the permissible (non-erosive) velocity for each portion of the system. Post-development stormwater velocities should be computed based on existing slopes, materials, linings, and soil types as applicable.

2. Open stormwater conveyance channels.

    a. For the first 150 feet, field surveyed cross-sections should be analyzed every 50 feet and wherever there is a substantial change in channel geometry, roughness coefficient, or slope. Non-uniform channels may require analysis of additional cross-sections, particularly at constrictions or changes in stormwater flow characteristics.

    b. After the first 150 feet, to the downstream limits of analysis, a narrative based on visual inspection should be provided. Field surveyed cross-sections should be analyzed at constrictions and areas with flatter (<1%) slopes. Additional cross-section analyses may be requested by DEQ.

3. Permissible (non-erosive) velocities.

    a. Reinforced Concrete Pipe (RCP). Post-development stormwater velocities should be less than or equal to 10 feet per second (ft/sec).

    b. Open stormwater conveyance channels. Post-development stormwater velocities should be less than or equal to the following:

Channel Slope	Channel Lining	Velocity (ft/sec)*
0% - 5%	Bermudagrass	6
0% - 5%	Reed canarygrass Tall fescue Kentucky bluegrass	5
0% - 5%	Grass-legume mixture	4
0% - 5%	Red fescue Redtop Sericea lespedeza Annual lespedeza Small grains Temporary vegetation	2.5
5% - 10%	Bermudagrass	5
5% - 10%	Reed canarygrass Tall fescue Kentucky bluegrass	4
5% - 10%	Grass-legume mixture	3
Greater than 10%	Bermudagrass	4
Greater than 10%	Reed canarygrass Tall fescue Kentucky bluegrass	3
Any	Earth, sandy silt	2
Any	Earth, silt clay	3.5
Any	Earth, clay	6
Any	Rock, sedimentary	10
Any	Rock, sandstone	8
Any	Rock, shale	3.5
Any	Rock, igneous or metamorphic	20

(Source: Virginia Erosion & Sediment Control Handbook, Table 5-14)

*For highly erodible soils (i.e., soils with an erodibility factor [K factor] greater than 0.35), permissible velocities should be decreased by 25%. See Appendix 6C of 1992 Virginia Erosion & Sediment Control Handbook for reported K factors.

3.302.2 DISCHARGES TO RESTORED STORMWATER CONVEYANCE SYSTEMS

"Restored stormwater conveyance system" means a stormwater conveyance system that has been designed and constructed using natural channel design concepts to ensure the restored and stabilized stream conveys its bankfull storm event within its banks and allows larger flows to access its floodplain. Restored stormwater conveyance systems include the main channel and the flood-prone area adjacent to the main channel.

"Flood-prone area" means the component of a natural or restored stormwater conveyance system that is outside the main channel. They may include, but are not limited to, the floodplain, floodway, flood fringe, wetlands, riparian buffers, or other areas adjacent to the main channel.

"Point of discharge" means a location at which concentrated stormwater runoff is released.

A. When concentrated stormwater runoff is discharged into a restored stormwater conveyance system:

    1. Stormwater runoff, in combination with other offsite stormwater runoff, should be consistent with the design parameters of the restored stormwater conveyance system that is functioning in accordance with the design objectives AND the system should be analyzed from the point of discharge until it reaches the limits of analysis (see Section 3.302.2.B herein);

       If the point of discharge is at or below the limits of analysis (see Section 3.302.1.B herein), then no additional downstream stormwater conveyance system analysis is required; **OR**

    2. The stormwater peak discharge should satisfy the requirements for discharges to natural stormwater conveyance systems (see Section 3.302.3 herein). If these requirements are met or exceeded, then no downstream stormwater conveyance system analysis is required.

B. Limits of Analysis. The limits of analysis is the point at which either:

    1. The site's contributing drainage area is less than or equal to 1.0% of the total watershed area; **OR**

    2. The site's un-attenuated post-developed peak flow rate from the 1-year 24-hour storm is less than or equal to 1.0% of the existing peak flow rate from the 1-year 24-hour storm.

3.302.3 DISCHARGES TO NATURAL STORMWATER CONVEYANCE SYSTEMS

"Natural stormwater conveyance system" means the main channel of a natural stream and the flood-prone area adjacent to the main channel. This includes any natural or perennial or intermittent streams, unimproved ephemeral channels, wetlands, or swales. A manmade lake or reservoir not created for the purpose of managing post-development stormwater should be considered a natural stormwater conveyance system.

"Flood-prone area" means the component of a natural or restored stormwater conveyance system that is outside the main channel. They may include, but are not limited to, the floodplain, floodway, flood fringe, wetlands, riparian buffers, or other areas adjacent to the main channel.

"Point of discharge" means a location at which concentrated stormwater runoff is released.

A. When concentrated stormwater runoff is discharged into a natural stormwater conveyance system, the following equation should be used to compute the allowable peak flow rate for the 1-year 24-hour storm:

$$Q_{developed} \leq IF \times \frac{(Q_{pre-developed} \times RV_{pre-developed})}{RV_{developed}}$$

where:

$Q_{developed}$ = the allowable peak flow rate of runoff from the developed site

$RV_{developed}$ = the un-attenuated volume of runoff from the site in the developed condition

$Q_{pre\text{-}developed}$ = the peak flow rate of runoff from the site in the pre-developed condition

$RV_{pre\text{-}developed}$ = the volume of the runoff from the site in the pre-developed condition

IF = Improvement Factor
= 0.8 for sites with total land disturbance > 1 acre
= 0.9 for sites with total land disturbance ≤ 1 acre

B. Under no circumstances should $Q_{developed}$ be greater than $Q_{pre\text{-}developed}$. See 9VAC25-870.66 B 3.

C. Under no circumstances should $Q_{developed}$ be required to be less than:

$$Q_{forest} \times \frac{RV_{forest}}{RV_{developed}}$$

where:

$RV_{developed}$ = the un-attenuated volume of runoff from the site in the developed condition

Q_{forest} = the peak flow rate of runoff from the site in good forested condition

RV_{forest} = the volume of runoff from the site in the good forested good condition

D. The allowable peak flow rate for the 1-year 24-hour storm should be based on the area of the site that drains to the point of discharge (i.e., outfall) in the pre-development condition.

3.302.4 DETERMINATION OF FLOOD-PRONE AREA

A. The limits of a natural stormwater conveyance system's flood-prone area should be determined by mapping the water surface elevation associated with the pre-development 1-year 24-hour storm event. Computations supporting the natural system's 1-year 24-hour water surface elevation should be provided with the plan.

B. DEQ may consider discharges to other areas adjacent to main channel (e.g., mapped Federal Emergency Management Agency (FEMA) floodplain, FEMA floodway, FEMA floodway fringe, wetlands, riparian buffers, Resource Protection Areas) on a case-by-case basis.

3.302.5 CHANNEL PROTECTION ANALYSIS POINTS

Each point of discharge (i.e., outfall) from the site should be analyzed independently. Where applicable, the allowable peak flow rate should be based on the area of the site that drains to the point of discharge in the pre-development condition.

3.303 FLOOD PROTECTION

Flood protection requirements are outlined in 9VAC25-870-66 C of the VSMP Regulation. Concentrated stormwater runoff from a land-disturbing activity should be discharged into a stormwater conveyance system in a manner that meets the flood protection design criteria at each point of discharge. The applicable flood protection criteria depends on whether or not pre-development localized flooding exists downstream from the site.

3.303.1 NO PRE-DEVELOPMENT LOCALIZED FLOODING

"Localized flooding" means smaller scale flooding that may occur outside a stormwater conveyance system. This may include high water, ponding, or standing water from stormwater runoff, which is likely to cause property damage or unsafe conditions.

"Point of discharge" means a location at which concentrated stormwater runoff is released.

A. When concentrated stormwater runoff is discharged to a stormwater conveyance system that does not experience pre-development localized flooding (within the limits of analysis) during the 10-year 24-hour storm, the stormwater conveyance system should confine the post-development peak flow rate from the 10-year 24-hour storm within the system AND the system should be analyzed from the point of discharge until it reaches the limits of analysis (see Section 3.303.1.C herein).

   If the point of discharge is at or below the limits of analysis (see Section 3.303.1.C herein), then no additional downstream stormwater conveyance system analysis is required.

B. Stormwater detention or downstream stormwater conveyance system improvements may be used to meet this criteria.

C. Limits of Analysis. The limit of analysis is the point at which either:

1. The site's contributing drainage area is less than or equal to 1.0% of the total watershed area; **OR**

2. The site's un-attenuated post-developed peak flow rate from the 10-year 24-hour storm is less than or equal to 1.0% of the existing peak flow rate from the 10-year 24-hour storm; **OR**

3. The stormwater conveyance system enters a mapped FEMA floodplain.

D. Flood Protection Computations.

1. Open stormwater conveyance channels.

a. For the first 150 feet, field surveyed cross-sections should be analyzed every 50 feet and wherever there is a substantial change in channel geometry, roughness coefficient, or slope. Non-uniform channels may require analysis of additional cross-sections, particularly at constrictions or changes in flow characteristics.

b. After the first 150 feet, to the downstream limit of analysis, a narrative based on visual inspection should be provided. Field surveyed cross-section should be analyzed at constrictions and areas with flatter (<1%) slopes.

2. Storm Sewers. Storm sewer systems should be analyzed to determine if the potential for surcharge of the system exists, and hydraulic grade line (HGL) computations should be provided.

3. Culverts. Culverts should be analyzed to determine the controlling headwater using VDOT Design Form LD-269 or through a stormwater routing computation using U.S. Department of Transportation HY-8, or similar.

3.303.2 PRE-DEVELOPMENT LOCALIZED FLOODING

"Localized flooding" means smaller scale flooding that may occur outside a stormwater conveyance system. This may include high water, ponding, or standing water from stormwater runoff, which is likely to cause property damage or unsafe conditions.

"Point of discharge" means a location at which concentrated stormwater runoff is released.

A. When concentrated stormwater runoff is discharged to a stormwater conveyance system that experiences pre-development localized flooding (within the limits of analysis) during the 10-year 24-hour storm either:

1. The stormwater conveyance system should confine the post-development peak flow rate from the 10-year 24-hour storm within the stormwater conveyance system to avoid (i.e., eliminate) the localized flooding AND the system should be analyzed from the point of discharge until it reaches the limits of analysis (see

Section 3.303.2.B herein). Stormwater detention or downstream stormwater conveyance system improvements may be used to meet this criteria.

If the point of discharge is at or below the limits of analysis (see Section 3.303.2.B herein), then no additional downstream stormwater conveyance system analysis is required; **OR**

2. The post-development peak flow rate for the 10-year 24-hour storm should be less than the pre-development peak flow rate from the 10-year 24-hour storm at the point of discharge. If these requirements are met or exceeded, then no downstream stormwater conveyance system analysis is required.

B. Limits of Analysis. The limit of analysis is the point at which either:

1. The site's contributing drainage area is less than or equal to 1.0% of the total watershed area; **OR**

2. The site's un-attenuated post-developed peak flow rate from the 10-year 24-hour storm is less than or equal to 1.0% of the existing peak flow rate from the 10-year 24-hour storm; **OR**

3. The stormwater conveyance system enters a mapped FEMA floodplain.

C. Flood Protection Computations.

1. Open stormwater conveyance channels.

    a. For the first 150 feet, field surveyed cross-sections should be analyzed every 50 feet and wherever there is a substantial change in channel geometry, roughness coefficient, or slope. Non-uniform channels may require analysis of additional cross-sections, particularly at constrictions or changes in flow characteristics.

    b. After the first 150 feet, to the downstream limit of analysis, a narrative based on visual inspection should be provided. Field surveyed cross-section should be analyzed at constrictions and areas with flatter (<1%) slopes.

2. Storm Sewers. Storm sewer systems should be analyzed to determine if the potential for surcharge of the system exists. Hydraulic grade line (HGL) computations should be provided.

3. Culverts. Culverts should be analyzed to determine the controlling headwater using VDOT Design Form LD-269 or through a stormwater routing computation using U.S. Department of Transportation HY-8, or similar.

3.303.4 DETERMINATION OF PRE-DEVELOPMENT LOCALIZED FLOODING

"Localized flooding" means smaller scale flooding that may occur outside a stormwater conveyance system. This may include high water, ponding, or standing water from stormwater runoff, which is likely to cause property damage or unsafe conditions.

A. Stormwater conveyance systems should be analyzed using *existing conditions* to determine if pre-development localized flooding exists during the 10-year 24-hour storm.

B. Open stormwater conveyance channels. If the 10-year 24-hour pre-development water surface elevation is determined to be higher than the bank of the channel, then an existing localized flooding condition is present.

C. Storm sewers. If the 10-year 24-hour pre-development HGL is not confined with the storm sewer system, then an existing localized flooding condition is present.

D. Culverts. If the 10-year 24-hour pre-development headwater or tailwater elevation is determined to be higher than the bank of the channel, then an existing localized flooding condition is present.

3.303.4 FLOOD PROTECTION ANALYSIS POINTS

Each point of discharge (i.e., outfall) from the site should be analyzed independently. Where applicable, the allowable peak flow rate should be based on the area of the site that drains to the point of discharge in the pre-development condition.

3.304 SAFE HARBOR (VA. Code § 62.1-44.15:28 A 10)

If all three criteria (A, B and C) identified below are met or exceeded, no additional water quantity control or downstream stormwater conveyance system analysis is required at the point of discharge.

A. Detain the water quality volume and release it over 48 hours.

    1. "Water quality volume" means the volume equal to the first half inch of runoff multiplied by the impervious surface of the land development project. See Va. Code § 62.1-44.15:24.

    2. Drawdown time (i.e., time to empty) should be greater than or equal to 48 hours.

B. Detain and release over a 24-hour period the expected runoff resulting from the post-development 1-year 24-hour storm.

    1. Stormwater management facility or best management practice outflow routing should be greater than or equal to 24 hours.

C. Reduce the peak flow rate resulting from the 1.5-year, 2-year, and 10-year 24-hour storms to a level less than or equal to the peak flow rate from the site assuming it was in

good forested condition, achieved through multiplication of the forested peak flow rate by a reduction factor that is equal to the runoff volume from the site when it was in good forested condition divided by the runoff volume from the site in its proposed condition.

1. The 1.5-year 24-hour rainfall should be computed using linear interpolation with the 1- and 2-year 24-hour rainfall data from NOAA Atlas 14.

2. Curve numbers for the purposes of performing runoff computations should be as follows:

Land Cover	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Woods, good condition	30	55	70	77

3. The allowable peak flow rate should be computed using the following equation:

$$Q_{developed} \leq Q_{forest} \times \frac{RV_{forest}}{RV_{developed}}$$

where:

$Q_{developed}$ = the allowable peak flow rate of runoff from the developed site

$RV_{developed}$ = the un-attenuated volume of runoff from the site in the developed condition

Q_{forest} = the peak flow rate of runoff from the site in good forested condition

RV_{forest} = the volume of runoff from the site in the good forested good condition

3.305 SHEET FLOW

A. Increased volumes of sheet flow resulting from pervious or disconnected impervious areas, or from physical spreading of concentrated flow through level spreaders, should be identified and evaluated for potential impacts on down-gradient properties or resources. See 9VAC25-870-66 D.

B. Increased volumes of sheet flow that will cause or contribute to erosion, sedimentation, or flooding of down-gradient properties or resources should be diverted to a stormwater management facility or a stormwater conveyance system that conveys the runoff without causing down-gradient erosion, sedimentation, or flooding. See 9VAC25-870-66 D.

3.305.1 DISCHARGES OF SHEET FLOW FROM PERVIOUS OR DISCONNECTED IMPERVIOUS AREAS

A. In the case where pre- and post-development stormwater runoff occur as sheet flow **AND** the runoff volume and velocity will not increase from pre-development to post-development, the plans, narrative, computations, and existing and proposed grades should demonstrate no increase in the 10-year 24-hour storm post-development runoff volume and velocity as compared to the pre-development volume and velocity.

B. In the case where pre- and post-development stormwater runoff occur as sheet flow **AND** the runoff volume will increase from pre-development to post-development:

1. The 10-year 24-hour post-development sheet flow velocity should be less than or equal to the following:

Land Slope	Land Cover	Velocity (ft/sec)*
0% - 5%	Bermudagrass	6
0% - 5%	Reed canarygrass Tall fescue Kentucky bluegrass	5
0% - 5%	Grass-legume mixture	4
0% - 5%	Red fescue Redtop Sericea lespedeza Annual lespedeza Small grains Temporary vegetation	2.5
5% - 10%	Bermudagrass	5
5% - 10%	Reed canarygrass Tall fescue Kentucky bluegrass	4
5% - 10%	Grass-legume mixture	3
Greater than 10%	Bermudagrass	4
Greater than 10%	Reed canarygrass Tall fescue Kentucky bluegrass	3
Any	Earth, sandy silt	2
Any	Earth, silt clay	3.5
Any	Earth, clay	6
Any	Rock, sedimentary	10
Any	Rock, sandstone	8
Any	Rock, shale	3.5
Any	Rock, igneous or metamorphic	20

(Source: Virginia Erosion & Sediment Control Handbook, Table 5-14)

*For highly erodible soils (i.e., soils with an erodibility factor [K factor] greater than 0.35), permissible velocities should be decreased by 25%. See Appendix 6C of 1992 Virginia Erosion & Sediment Control Handbook for reported K factors.

2. The 10-year 24-hour post-development sheet flow depth should be less than or equal to 0.1 feet for the entire length of the flow path to the down-gradient stormwater conveyance system.

3. The length of sheet flow should be less than or equal to the following, (NRCS National Engineering Handbook, Equation 15-9):

$$L_{SF} = \frac{100\sqrt{S}}{n}$$

where:

L_{SF} = maximum length of sheet flow (ft)

S = land slope (ft/ft)

n = Manning's roughness coefficient (see table below)

Land Cover	**Manning's *n***
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils: Residue cover ≤ 20% Residue cover > 20%	 0.06 0.17
Grass: Short-grass prairie Dense grasses* Bermudagrass	 0.15 0.24 0.41
Range (natural)	0.13
Woods:** Light underbrush Dense underbrush	 0.40 0.80

(Source: NRCS National Engineering Handbook, Table 15-1)

* Includes weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

** When selecting *n*, consider cover to a height of about 0.1 feet, as this is the only part of the plant cover that will obstruct sheet flow.

4. Documentation/computations should be provided demonstrating that increased volumes of sheet flow:

a. Will not adversely impact any down-gradient property (i.e., cause erosion and/or cause or worsen localized flooding).

b. Will not adversely impact any down-gradient environmental features.

c. Will be conveyed within any down-gradient manmade stormwater conveyance system without causing erosion of the system for the 2-year 24-hour storm **AND** will be confined within any down-gradient manmade stormwater conveyance system without causing or worsening localized flooding for the 10-year 24-hour storm.

d. Will meet the design parameters of any down-gradient restored stormwater conveyance system.

e. Will be conveyed within any down-gradient natural stormwater conveyance system without causing erosion of the system for the 1-year 24-hour storm **AND** will be confined within any down-gradient manmade stormwater conveyance system without causing or worsening localized flooding for the 10-year 24-hour storm.

5. Remediation of any active erosion, sedimentation, or flooding in the sheet flow path should be specified on the plans.

3.305.2 DISCHARGES OF SHEET FLOW FROM LEVEL SPREADERS

A. Piped or channelized stormwater runoff converted to sheet flow prior to discharge should comply with 9VAC25-870-66 B (see Section 3.302 herein) and 9VAC25-870-66 C (see Section 3.303 herein) or "Safe Harbor" (see Section 3.304 herein).

B. The 10-year 24-hour post-development sheet flow velocity should be less than or equal to the following to ensure that re-concentration does not prematurely occur:

Land Slope	Land Cover	Velocity (ft/sec)*
0% - 5%	Bermudagrass	4
0% - 5%	Reed canarygrass Tall fescue Kentucky bluegrass	3.3
0% - 5%	Grass-legume mixture	2.7
0% - 5%	Red fescue Redtop Sericea lespedeza Annual lespedeza Small grains Temporary vegetation	1.7
5% - 10%	Bermudagrass	3.3

Land Slope	Land Cover	Velocity (ft/sec)*
5% - 10%	Reed canarygrass Tall fescue Kentucky bluegrass	2.7
5% - 10%	Grass-legume mixture	2
Greater than 10%	Bermudagrass	2.7
Greater than 10%	Reed canarygrass Tall fescue Kentucky bluegrass	2
Any	Earth, sandy silt	1.3
Any	Earth, silt clay	2.3
Any	Earth, clay	4
Any	Rock, sedimentary	10
Any	Rock, sandstone	8
Any	Rock, shale	3.5
Any	Rock, igneous or metamorphic	20
Any	Mulch	1

(Source: Virginia Erosion & Sediment Control Handbook, Table 5-14)

*For highly erodible soils (i.e., soils with an erodibility factor [K factor] greater than 0.35), permissible velocities should be decreased by 25%. See Appendix 6C of 1992 Virginia Erosion & Sediment Control Handbook for reported K factors.

C. The 10-year 24-hour post-development sheet flow depth should be less than or equal to 0.1 feet for the entire length of the flow path to the down-gradient stormwater conveyance system.

D. The length of sheet flow path to the down-gradient stormwater conveyance system should be less than or equal to the following (NRCS National Engineering Handbook, Equation 15-9):

$$L_{SF} = \frac{100\sqrt{S}}{n}$$

where:

L_{SF} = maximum length of sheet flow (ft)

S = slope (ft/ft)

n = Manning's roughness coefficient (see table below)

Land Cover	Manning's *n*
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011

Land Cover	Manning's *n*
Fallow (no residue)	0.05
Cultivated soils: Residue cover ≤ 20% Residue cover > 20%	 0.06 0.17
Grass: Short-grass prairie Dense grasses* Bermudagrass	 0.15 0.24 0.41
Range (natural)	0.13
Woods:** Light underbrush Dense underbrush	 0.40 0.80

(Source: NRCS National Engineering Handbook, Table 15-1)

* Includes weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

** When selecting *n*, consider cover to a height of about 0.1 feet, as this is the only part of the plant cover that will obstruct sheet flow.

E. Documentation/computations should be provided demonstrating that discharges of sheet flow from level spreaders:

   1. Will not adversely impact any down-gradient property (i.e., cause erosion and/or cause or worsen localized flooding).

   2. Will not adversely impact any down-gradient environmental features.

F. Remediation of any active erosion, sedimentation, or flooding in the sheet flow path should be specified on the plans.

G. The area of sheet flow should be located outside the limits of clearing and grading and be protected by erosion and sediment controls, or the area should undergo soil restoration via full implementation of DEQ Stormwater Design Specification No. 4 (Soil Compost Amendment) immediately prior to establishing permanent stabilization.

H. Level spreader lengths should be computed using the following equation (minimum level spreader length should be no less than 10 feet; maximum level spreader length should be no more than 200 feet):

$$L_{LS} = \frac{Q}{C_W \times H^{3/2}}$$

where:

L_{LS} = Length of level spreader (ft)

Q = 10-year 24-hour post-development peak flow rate (cfs)

C_W = Weir Coefficient (assume 3.3 for rectangular weir)

H = Depth of water immediately upslope of level spreader (assume 0.1 ft)

I. 10-year 24-hour post-development sheet flow velocities down-gradient of level spreader should be computed using the following equation (Manning's equation):

$$V = \frac{1.486}{n} \times R^{2/3} \times S^{1/2}$$

where:

V = Velocity (fps)

n = Manning's roughness coefficient (see Section 3.305.2.D herein)

R = Hydraulic radius (ft) = A / P

S = Land slope (ft/ft)

and:

A = Flow area (ft^2) = L_{LS} x 0.1 ft

P = Wetted perimeter (ft) = L_{LS} + 0.1 ft + 0.1 ft

J. Detailed level spreader designs should be provided on the plans (to include construction details, dimensions, materials, layout, and site-specific details to ensure the level spreader ties into adjacent slopes and stormwater runoff does not short circuit and flow around the level spreader).

K. Level spreaders should be oriented parallel to down-gradient contours.

L. Level spreaders (top or lip elevation) should be no higher than 3 to 4 inches above the down-gradient land surface. A smooth transition between the level spreader and down-gradient land surface should be provided.

M. Level spreaders should be constructed of concrete or other non-erodible material (e.g., rock).

N. A maintenance plan should be provided on the plans.

3.306 STORMWATER DISCHARGES TO KARST FEATURES

"Karst area" means any land area predominantly underlain at the surface or shallow subsurface by limestone, dolomite, or other soluble bedrock regardless of any obvious surface karst features.

“Karst features” means sinkholes, sinking and losing streams, caves, large flow springs, and other such landscape features found in karst areas.

"Stormwater management facility" means a control measure that controls stormwater runoff and changes the characteristics of that runoff including the quantity and quality, the period of release or the velocity of flow.

A. When a land-disturbing activity discharges stormwater runoff to karst features, the channel protection (see Section 3.302.3) and flood protection (see Section 3.303.2) requirements herein should be applied independently to each karst feature. See 9VAC25-870-85 C.

B. When performing water quantity design computations, the pre-development peak flow rates should be adjusted using the following *Karst Loss Modification Values*:

% of Drainage Area in Karst	2-year Storm	10-year Storm	100-year Storm
100	0.33	0.43	0.50
90	0.35	0.46	0.56
80	0.38	0.51	0.62
70	0.47	0.58	0.68
60	0.55	0.66	0.74
50	0.64	0.73	0.80
40	0.73	0.80	0.85
30	0.82	0.86	0.89
20	0.91	0.92	0.93
10	1.00	0.98	0.97
0	1.00	1.00	1.00

(Source: Laughland, J. 2007. “Adjusting Hydrology Models and Using Karstic Features.” Stormwater Management in Karst Terrain. Facility Design Group. County Engineer. Jefferson County, WV.)

C. When a land-disturbing activity discharges stormwater runoff to a karst feature, the design professional should screen for the existence of known natural heritage resources located in the karst feature. Screening should be performed in consultation with the Department of Conservation and Recreation’s Natural Heritage Program (https://www.dcr.virginia.gov/natural-heritage/nhserviceform/).

D. Construction of stormwater management facilities in karst areas should only occur after a study of the geology and hydrology to determine the presence or absence of karst features that may be impacted by stormwater runoff or stormwater management facility placement. See 9VAC25-870-85 B.

E. Construction of a stormwater management facility in a karst feature should only occur after the completion of a geotechnical investigation that identifies any necessary

modifications to the facility to ensure its structural integrity and to maintain its water quality and/or water quantity efficiencies. See 9VAC25-870-85 C.

F. The use of centralized stormwater management facilities with large drainage areas is discouraged.

G. Stormwater management facilities should disperse flows over the broadest area possible to avoid ponding, concentration, or soil saturation.

H. Stormwater management facilities requiring deep excavations or pools of standing water should be avoided.

I. The following stormwater management facilities or best management practices are preferred for use in karst areas:

- Rooftop (impervious surface) disconnection (DEQ Stormwater Design Specification No. 1)
- Sheet flow to vegetated filter strip / conserved open space (DEQ Stormwater Design Specification No. 2)
- Vegetated roof (DEQ Stormwater Design Specification No. 5)
- Rainwater harvesting (DEQ Stormwater Design Specification No. 6)
- Bioretention (DEQ Stormwater Design Specification No. 9)
- Dry swales (DEQ Stormwater Design Specification No. 10)
- Filtering practices (DEQ Stormwater Design Specification No. 12)

J. The following stormwater management facilities or best management practices are discouraged and not recommended for use in karst areas:

- Infiltration practices (DEQ Stormwater Design Specification No. 8)
- Construction wetlands (DEQ Stormwater Design Specification No. 13)
- Wet ponds (DEQ Stormwater Design Specification No. 14)
- Extended detention ponds (DEQ Stormwater Design Specification No. 15)

K. Copies of all Underground Injection Control (UIC) Class V Well inventory forms (EPA Form 7520-16) for discharges of stormwater runoff to improved sinkholes should be included in the Stormwater Pollution Prevention Plan (SWPPP) for the land disturbing activity. See 9VAC25-870-85 C.

3.307 DRAINAGE EASEMENTS

Storm drainage easements should be obtained and recorded among the local land records to encompass any proposed offsite manmade stormwater conveyance systems (including their outfall structures, such as outlet protection or level spreaders), and any proposed offsite sheet flow paths to an existing stormwater conveyance system. The does not apply to improvements or sheet flow paths located solely within a public right-of-way.

A. Open stormwater conveyance channels should be encompassed with a drainage easement whose minimum width is 16 feet or provides containment of the 10-year water surface elevation, whichever is greater.

B. Culverts should be encompassed with a drainage easement whose minimum width is 16 feet or provides containment of the 10-year water surface elevation, whichever is greater.

C. Storm sewer pipes should be aligned in the center of the drainage easement. Drainage easement widths should be greater than or equal to the following:

Pipe Diameter	Easement Width (ft)
Up to 18 inches	10
21 to 33 inches	15
36 to 48 inches	20
54 to 72 inches	24

D. Offsite discharges of sheet flow from a level spreader, with the exception of those discharges meeting the requirements of Safe Harbor (Section 3.304) herein, should be encompassed with a drainage easement. The minimum width of the easement should be the length of the level spreader plus 5 feet on each side. The minimum length of the easement should be the distance of the sheet flow path to the down-gradient stormwater conveyance system.

END OF CHAPTER

CHAPTER 4.000
STORMWATER MANAGEMENT – WATER QUALITY

4.100 PURPOSE / OBJECTIVE

The purpose of this chapter is to convey minimum acceptable post-development water quality design and construction guidelines to ensure the general health, safety, and welfare of the citizens of the Commonwealth as well as protect the quality and quantity of state waters from the potential harm of unmanaged stormwater.

4.200 INTERPRETATION

These post-development water quality design and construction guidelines are designed to supplement the provisions of existing Federal and State laws and regulations. Nothing contained herein shall be deemed to waive or modify other requirements of existing laws or regulations. Except as expressly stated otherwise in this document, the Department of Environmental Quality (DEQ or Department) is the designated entity charged with the administration of the post-development water quality design and construction guidelines contained herein. DEQ may allow for exceptions to given guidelines in accordance with the Virginia Stormwater Management Program (VSMP) Regulation, 9VAC25-870-57 and 9VAC25-870-122.

4.300 DESIGN AND CONSTRUCTION GUIDELINES

Except where specifically supplemented herein, each Stormwater Management Plan is subject to the administrative and water quality design criteria contained in the VSMP Regulation, 9VAC25-870-40 et seq., and the DEQ stormwater design specifications found on the Virginia Stormwater BMP Clearinghouse Website in effect at the time of initial plan acceptance.

4.301 NEW DEVELOPMENT

A. The total phosphorus load of new land-disturbing activities should not exceed 0.41 pounds per acre per year. See 9VAC25-870-63 A 1.

B. Compliance should be determined by using the Virginia Runoff Reduction Method. See 9VAC25-870-65 A, DEQ Guidance Memo No. 16-2001, and Section 4.400 herein.

C. When a land-disturbing activity drains to more than one 6th order (12-digit) hydrologic unit code, the total phosphorus load requirement in this section should be applied independently within each HUC. See 9VAC25-870-65 F.

D. The total phosphorus load design criteria is subject to change. DEQ is currently reviewing the existing water quality design criteria consistent with 9VAC25-870-63 C.

4.302 DEVELOPMENT PROJECTS ON PRIOR DEVELOPED LANDS

"Linear development project" means a land-disturbing activity that is linear in nature such as, but not limited to, (i) the construction of electric and telephone utility lines, and natural gas pipelines; (ii) construction of tracks, rights-of-way, bridges, communication facilities and other

related structures of a railroad company; (iii) highway construction projects; (iv) construction of stormwater channels and stream restoration activities; and (v) water and sewer lines. Private subdivision roads or streets shall not be considered linear development projects.

"Prior developed lands" means 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.

A. For land-disturbing activities disturbing greater than or equal to one (1) acre that result in no net increase in impervious cover from the pre-development condition, the total phosphorus load should be reduced at least 20% below the pre-development total phosphorus load. See 9VAC25-870-63 A 2 a.

B. For land-disturbing activities disturbing less than one (1) acre that result in no net increase in impervious cover from the pre-development condition, the total phosphorus load should be reduced at least 10% below the pre-development total phosphorus load. See 9VAC25-870-63 A 2 b.

C. For land-disturbing activities that result in a net increase in impervious cover over the pre-development condition, the design criteria for new land-disturbing activities (0.41 pounds per acre per year) should be applied to the increased impervious area. Depending upon the total area of land disturbance, the criteria of A or B above, shall be applied to the remainder of the land-disturbing activity. See 9VAC25-870-63 A 2 c.

D. In lieu of subsection C above, the total phosphorus load of a linear development project should be reduced 20% below the pre-development total phosphorus load. See 9VAC25-870-63 A 2 d.

E. In no instance should the total phosphorus load be required to be reduced below 0.41 pounds per acre per year. See 9VAC25-870-63 A 2 e.

F. Compliance should be determined by using the Virginia Runoff Reduction Method. See 9VAC25-870-65 A, DEQ Guidance Memo No. 16-2001, and Section 4.400 herein.

G. When a land-disturbing activity discharges stormwater runoff to more than one 6th order (12-digit) hydrologic unit code, the total phosphorus load reduction requirements in this section should be applied independently within each HUC. See 9VAC25-870-65 F.

H. The total phosphorus load design criteria is subject to change. DEQ is currently reviewing the existing water quality design criteria consistent with 9VAC25-870-63 C.

4.303 BROWNFIELD DEVELOPMENT

A. In lieu of Sections 4.301 or 4.302 herein, the post-development total phosphorus load should be reduced at least 20% via the implementation of stormwater management facilities or best management practices.

B. In no instance should the total phosphorus load be required to be reduced below 0.41 pounds per acre per year. See 9VAC25-870-63 A 2 e.

C. Compliance should be determined by using the Virginia Runoff Reduction Method. See 9VAC25-870-65 A and DEQ Guidance Memo No. 16-2001, and Section 4.400 herein.

D. When a land-disturbing activity discharges stormwater runoff to more than one 6th order (12-digit) hydrologic unit code, the total phosphorus load reduction requirement in this section shall be applied independently within each HUC. See 9VAC25-870-65 F.

4.304 RECLAIMED COAL MINE DEVELOPMENT

A. In lieu of Sections 4.301 or 4.302 herein, the post-development total phosphorus load should be reduced at least 20% via the implementation of stormwater management facilities or best management practices.

B. In no instance should the total phosphorus load be required to be reduced below 0.41 pounds per acre per year. See 9VAC25-870-63 A 2 e.

C. Compliance should be determined by using the Virginia Runoff Reduction Method. See 9VAC25-870-65 A, DEQ Guidance Memo No. 16-2001, and Section 4.400 herein.

D. When a land-disturbing activity discharges stormwater runoff to more than one 6th order (12-digit) hydrologic unit code, the total phosphorus load reduction requirement in this section shall be applied independently within each HUC. See 9VAC25-870-65 F.

4.305 STORMWATER DISCHRAGES TO KARST FEATURES

"Karst area" means any land area predominantly underlain at the surface or shallow subsurface by limestone, dolomite, or other soluble bedrock regardless of any obvious surface karst features.

“Karst features" means sinkholes, sinking and losing streams, caves, large flow springs, and other such landscape features found in karst areas.

"Stormwater management facility" means a control measure that controls stormwater runoff and changes the characteristics of that runoff including the quantity and quality, the period of release or the velocity of flow.

A. When a land-disturbing activity discharges stormwater runoff to karst features, the total phosphorus load reduction requirements in Sections 4.301 or 4.302, as applicable, should be applied independently to each karst feature. See 9VAC25-870-85 C.

B. When a land-disturbing activity discharges stormwater runoff to a karst feature, the design professional should screen for the existence of known natural heritage resources located in the karst feature. Screening should be performed in consultation with the Department of Conservation and Recreation’s Natural Heritage Program (https://www.dcr.virginia.gov/natural-heritage/nhserviceform/).

C. Construction of stormwater management facilities in karst areas should only occur after a study of the geology and hydrology to determine the presence or absence of karst features that may be impacted by stormwater runoff or stormwater management facility placement. See 9VAC25-870-85 B.

D. Construction of a stormwater management facility in a karst feature should only occur after the completion of a geotechnical investigation that identifies any necessary modifications to the facility to ensure its structural integrity and to maintain its water quality and/or water quantity efficiencies. See 9VAC25-870-85 C.

E. The use of centralized stormwater management facilities with large drainage areas is discouraged.

F. Stormwater management facilities should disperse flows over the broadest area possible to avoid ponding, concentration, or soil saturation.

G. Stormwater management facilities requiring deep excavations or pools of standing water should be avoided.

H. The following stormwater management facilities or best management practices are preferred for use in karst areas:

- Rooftop (impervious surface) disconnection (DEQ Stormwater Design Specification No. 1)
- Sheet flow to vegetated filter strip / conserved open space (DEQ Stormwater Design Specification No. 2)
- Vegetated roof (DEQ Stormwater Design Specification No. 5)
- Rainwater harvesting (DEQ Stormwater Design Specification No. 6)
- Bioretention (DEQ Stormwater Design Specification No. 9)
- Dry swales (DEQ Stormwater Design Specification No. 10)
- Filtering practices (DEQ Stormwater Design Specification No. 12)

I. The following stormwater management facilities or best management practices are discouraged and not recommended for use in karst areas:

- Infiltration practices (DEQ Stormwater Design Specification No. 8)
- Construction wetlands (DEQ Stormwater Design Specification No. 13)
- Wet ponds (DEQ Stormwater Design Specification No. 14)
- Extended detention ponds (DEQ Stormwater Design Specification No. 15)

J. Copies of all Underground Injection Control (UIC) Class V Well inventory forms (EPA Form 7520-16) for discharges of stormwater runoff to improved sinkholes should be included in the Stormwater Pollution Prevention Plan (SWPPP) for the land disturbing activity. See 9VAC25-870-85 C.

4.400 VIRGINIA RUNOFF REDUCTION METHOD

The Virginia Runoff Reduction Method (VRRM) was developed in order to promote better stormwater management design and uses an iterative four-step process for evaluating compliance with the water quality design criteria requirements. Design professionals should make full use of the VRRM four-step process, as described below, when developing stormwater management plans.

4.401 STEP 1: APPLY ENVIRONMENTAL SITE DESIGN PRACTICES

A. Design professionals should implement environmental site design (ESD) practices during the initial phases of site layout to the maximum extent practicable. This includes minimizing soil disturbance and maximizing the retention of forest cover and undisturbed soils, especially those soils most conducive to landscape-scale infiltration.

B. ESD practices that should be implemented to the maximum extent practicable include, but are not limited to:

- Site design to minimize soil disturbance;
- Soil restoration / soil compost amendment (DEQ Stormwater Design Specification No. 4);
- Site design to maximize the retention of forest cover; and,
- Site reforestation.

4.402 STEP 2: APPLY RUNOFF REDUCTION PRACTICES

A. Design professionals should implement runoff reduction (RR) practices during site layout to the maximum extent practicable.

B. RR practices that should be implemented to the maximum extent practicable include, but are not limited to:

- Rooftop (impervious surface) disconnection (DEQ Stormwater Design Specification No. 1);
- Sheet flow to vegetated filter strip / conserved open space (DEQ Stormwater Design Specification No. 2);
- Grass channels (DEQ Stormwater Design Specification No. 3);

- Vegetated roof (DEQ Stormwater Design Specification No. 5);
- Permeable pavement (DEQ Stormwater Design Specification No. 7);
- Infiltration practices (DEQ Stormwater Design Specification No. 8);
- Bioretention (DEQ Stormwater Design Specification No. 9);
- Dry swales (DEQ Stormwater Design Specification No. 10); and,
- Extended detention ponds / Level 2 (DEQ Stormwater Design Specification No. 15).

4.403 STEP 3: APPLY POLLUTANT REMOVAL PRACTICES

A. Design professionals should implement pollutant removal (PR) practices during site layout to the maximum extent practicable.

B. PR practices that should be implemented to the maximum extent practicable include, but are not limited to:

- Wet swales (DEQ Stormwater Design Specification No. 11);
- Filtering practices (DEQ Stormwater Design Specification No. 12);
- Constructed wetlands (DEQ Stormwater Design Specification No. 13);
- Wet ponds (DEQ Stormwater Design Specification No. 14);
- Extended detention ponds / Level 1 (DEQ Stormwater Design Specification No. 15); and
- Proprietary best management practices / manufactured treatment devices.

4.404 STEP 4: OFFSITE COMPLIANCE OPTIONS

A. Design professionals should investigate the use of offsite compliance options if the required total phosphorus load cannot be achieved onsite through the implementation of ESD, RR, and PR practices.

B. The use of offsite compliance options should comply with the VSMP Regulation, 9VAC25-870-69, and DEQ Guidance Memo No. 21-2007.

END OF CHAPTER

CHAPTER 5.000
GOOD ENGINEERING DESIGN PRACTICES

5.100 PURPOSE / OBJECTIVE

The purpose of this chapter is to convey good engineering design practices to ensure that acceptable Stormwater Management and/or Erosion & Sediment Control Plans are submitted to the Department of Environmental Quality (DEQ or Department) at the time of initial plan submission.

5.200 PRE- VS. POST-DEVELOPMENT DRAINAGE AREAS / DIVIDES

A. Post-development drainage areas and drainage divides should replicate, as nearly as practicable, the pre-development drainage areas and drainage divides. See Va. Code § 62.1-44.15:28 A 10.

B. Post-development drainage areas should deviate from the pre-development condition by no more than plus or minus 10%.

5.300 RUNOFF CURVE NUMBER SELECTION

Except where specifically supplemented herein, runoff curve number (CN) selection should be performed consistent with Chapter 9, Part 630, of the Natural Resources Conservation Service (NRCS) National Engineering Handbook.

5.301 PRE-DEVELOPMENT CURVE NUMBER SELECTION

A. All impervious and water surfaces should be assigned a CN of 98. See Chapter 9, Part 630, NRCS National Engineering Handbook.

B. All artificial turf with no runoff reduction potential should be assigned a CN of 98.

C. All pervious lands should be assumed to be in good hydrologic condition, regardless of conditions existing at the time of pre-development runoff computation. See 9VAC25-870-66 E.

D. The hydrologic soil group (HSG) used for pre-development CN selection should be based on the soil conditions existing at the time of pre-development runoff computation. For previously disturbed soils (e.g., native soil profiles that have been mixed or removed or fill material from other areas has been previously introduced), the design professional should:

   1. Adjust the native HSG by at least one factor (i.e., HSG A $\rightarrow$ HSG B; HSG B $\rightarrow$ HSG C; HSG C $\rightarrow$ HSG D) when selecting the pre-development CN; or

   2. Perform an onsite investigation to determine the appropriate pre-development HSG consistent with Appendix A, NRCS Technical Release 55 (1986); or

3. Perform an onsite investigation to determine the appropriate pre-development HSG consistent with Chapter 7, Part 630, NRCS National Engineering Handbook. Guidelines for determining HSG from field saturated hydrologic conductivity observations can be found in the NRCS Soil Survey Manual (1993).

5.302 POST-DEVELOPMENT CURVE NUMBER SELECTION

A. All impervious and water surfaces should be assigned a CN of 98. See Chapter 9, Part 630, NRCS National Engineering Handbook.

B. All artificial turf with no runoff reduction potential should be assigned a CN of 98.

C. All pervious lands should be assumed to be in good hydrologic condition.

D. The hydrologic soil group (HSG) used for post-development CN selection should be based on the ultimate development condition of the subject land-disturbing activity. See 9VAC25-870-72 A. For disturbed soils (e.g., pre-development soil profiles that will be mixed or removed or fill material from other areas will be introduced), the design professional should:

1. Adjust the pre-development HSG by at least one factor (i.e., HSG A $\rightarrow$ HSG B; HSG B $\rightarrow$ HSG C; HSG C $\rightarrow$ HSG D) when selecting the post-development CN. See Section 5.302 D herein; or

2. Use the pre-development HSG and specify the full implementation of DEQ Stormwater Design Specification No. 4 (Soil Compost Amendment) immediately prior to establishing permanent stabilization; or

3. Specify an appropriate post-development HSG during plan preparation and subsequently perform an onsite investigation prior to project closeout to determine the actual post-development HSG consistent with Appendix A, NRCS Technical Release 55 (1986). A revised plan with associated computations should be submitted to DEQ if it is determined that the field verified HSG does not correspond to the HSG originally specified; or

4. Specify an appropriate post-development HSG during plan preparation and subsequently perform an onsite investigation prior to project closeout to determine the actual post-development HSG consistent with Chapter 7, Part 630, NRCS National Engineering Handbook. Guidelines for determining HSG from field saturated hydrologic conductivity observations can be found in the NRCS Soil Survey Manual (1993). A revised plan with associated computations should be submitted to DEQ if it is determined that the field verified HSG does not correspond to the HSG originally specified

E. Unadjusted and adjusted post-development CNs for the specified land cover categories within the Virginia Runoff Reduction Method should be as follows:

Land Cover	HSG A	HSG B	HSG C	HSG D
Forest Cover	30	55	70	77
Forest Cover (adjusted)	55	70	77	77
Open Space	30	58	71	78
Open Space (adjusted)	58	71	78	78
Managed Turf	39	61	74	80
Managed Turf (adjusted)	61	74	80	80
Impervious Cover	98	98	98	98

5.303 BARE EARTH CURVE NUMBER SELECTION

Bare earth CNs for the purposes of performing runoff computations for erosion and sediment controls (temporary sediment traps, temporary sediment basins, etc.) should be as follows:

Land Cover	HSG A	HSG B	HSG C	HSG D
Bare Earth	77	86	91	94

5.400 UNCONNECTED IMPERVIOUS AREAS

When stormwater runoff from an impervious area occurs as sheet flow over a pervious area prior to entering the stormwater conveyance system, the impervious area is considered unconnected. The runoff curve numbers published in Chapter 9, Part 630, of the NRCS National Engineering Handbook (and NRCS Technical Release 55), however, were developed assuming that all impervious areas were directly connected to the stormwater conveyance system. To determine the runoff CN when all or part of the impervious area is not directly connected to the stormwater conveyance system, the design professional should use one of the CN adjustment methods detailed below.

5.401 CURVE NUMBER ADJUSTMENT BY VRRM

A. Post-development runoff CN adjustment should be performed consistent with Section 7.1 (Runoff Volume and CN Tab) of the Virginia Runoff Reduction Method, Version 3.0. See DEQ Guidance Memo No. 16-2001.

B. When using this method, all runoff reduction (RR) practices should be designed and sized according to the minimum requirements of the DEQ Stormwater Design Specifications.

5.402 CURVE NUMBER ADJUSTMENT BY NRCS METHOD

A. The following equation should be used to compute the composite runoff curve number (CN_c) when all or part of the impervious area is not directly connected to the stormwater

conveyance system **AND** the total impervious area is less than 30% of the total drainage area:

$$CN_c = CN_p + \left(\frac{P_{imp}}{100}\right)(98 - CN_p)(1 - 0.5R)$$

where:

CN_c = composite runoff curve number

CN_p = pervious runoff curve number

P_{imp} = percent imperviousness

R = ratio of unconnected impervious area to total impervious area

B. The following equation should be used to compute the composite runoff curve number (CN_c) when all or part of the impervious area (including the solar panels) is not directly connected to the stormwater conveyance system **AND** the total impervious area is greater than or equal to 30% of the total drainage area:

$$CN_c = CN_p + \left(\frac{P_{imp}}{100}\right)(98 - CN_p)$$

where:

CN_c = composite runoff curve number

CN_p = pervious runoff curve number

P_{imp} = percent imperviousness

5.500 SOLAR PANEL ARRAYS

On March 29, 2022, DEQ issued a technical memorandum stating that starting immediately, DEQ is implementing a stronger post-development stormwater management policy for solar projects that are subject to VSMP requirements. Specifically, the memo states that ground mounted solar panels shall be considered unconnected impervious cover as defined in Chapter 9, Part 630 of the NRCS National Engineering Handbook.

A subsequent memorandum, dated April 14, 2022, recognized that for those solar projects in advanced stages of design or implementation a number of fiscal, contractual and other obligations need to be considered in the implementation timing of the March 29, 2022 memo. Specifically, the April memorandum states:

"Therefore, any solar project that does not obtain an interconnection approval by a regional transmission organization or electric utility by December 31, 2024 must comply with the requirements detailed in the Department's March 29, 2022, memorandum, which will be further clarified in an agency guidance document. Any owner or operator with a previously DEQ-

approved solar project that does not obtain an interconnection approval by a regional transmission organization or electric utility on or before December 31, 2024, may submit a revised stormwater management plan to DEQ for a fast-tracked (expedited) review to verify compliance with this section. No additional plan review fee(s) will be assessed by DEQ for solar projects falling within this category."

To provide further guidance, "Interconnection Approval" can be demonstrated by the issuance of the System Impact Study as defined in PJM Manual 14a: New Services Request Process, Section 4.3 or equivalent study that results from PJM Reform Process. "Interconnection Approval" can also be demonstrated by the issuance of a Small Generator Interconnection Agreement for projects that go through the state interconnection process.

Additionally, if an owner or operator desires certainty as to whether the stronger post-development stormwater requirements will apply to a particular project, "Interconnection Approval" may also be demonstrated by PJM approval of a new service request on or before April 14, 2022. In all cases, an owner or operator should indicate on the plan Cover Sheet which demonstration is being selected and provide a copy of appropriate documentation of acceptance of this new service request by the applicable entity of the Cover Sheet.

Finally, in accordance with the April 14, 2022 memorandum, any owner or operator with a previously DEQ-approved solar project that does not obtain an interconnection approval, as further demonstrated by the above, may submit a revised stormwater management plan to DEQ for a fast-tracked (expedited) review to verify compliance with Chapter 9, Part 630 of the NRCS National Engineering Handbook. No additional plan review fee(s) will be assessed by DEQ for solar projects falling within this category.

A. Unless directly connected to the stormwater conveyance system, the horizontal projected area of all solar panels should be considered unconnected impervious area when performing runoff computations for erosion and sediment controls (temporary sediment traps, temporary sediment basins, etc.). As shown in the picture below, this represents the worst case scenario for erosion and sediment control design and implementation (i.e., drainage areas consisting of unconnected impervious cover constructed over newly-graded, compacted bare earth conditions). See Section 5.400 herein.

(Source: Appalachian Power, Leatherwood Solar)

B. Unless directly connected to the stormwater conveyance system, the horizontal projected area of all solar panels should be considered unconnected impervious area when performing post-development water quantity and water quality design computations. See Section 5.400 herein.

C. The following equation should be used to determine a solar panel's horizontal projected area (HPA) when performing erosion and sediment control, water quantity, and water quality design computations:

$$HPA = L \times W \times \cos\theta$$

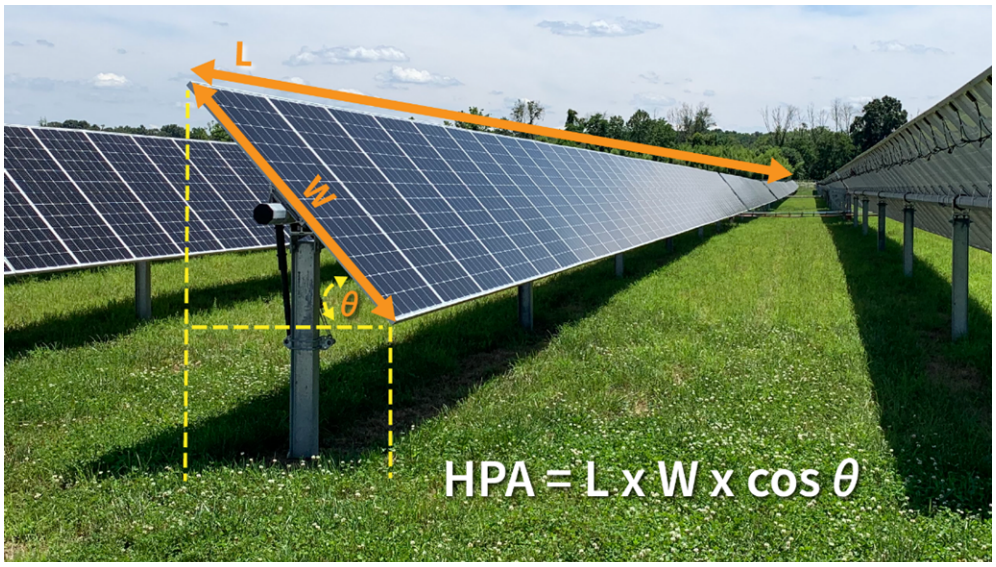
where:

HPA = Horizontal projected area (square-feet)

L = Solar panel length (feet)

W = Solar panel width (feet)

θ = Solar panel minimum operating angle from horizontal (degrees) for normal operations without a rain sensor, or the maximum angle from horizontal (degrees) when a rain sensor is deployed in accordance with Section 5.500 D herein



D. Should a project owner elect to implement rain-sensing technology such that the solar panels rotate to a completely vertical position during storm events, the horizontal projected area may be assumed to be zero. If the rain sensing technology results in a less than vertical position, the equation in Section 5.500 C herein should be used to reflect that as the operating angle. In either instance, the acreage of the solar panel support posts, columns, beams, etc. that are not underneath a solar panel's horizontal projected area (HPA) should be considered impervious area when performing erosion and sediment control, water quantity, and water quality design computations.

   The rain sensor should be programmed to rotate the solar panels to their "rain position" after cumulative rainfall exceeds 0.25 inches in one hour until the rainfall rate drops to less than 0.1 inches per hour. Documentation as to the design standards for the selected rain-sensing technology should be provided on the Cover Sheet of the plan.

5.600 ACID FORMING SOILS (ACID SULFATE SOILS)

(Adapted from: https://landrehab.org/home/programs/acid-sulfate-soils-management/)

Acid sulfate soils form when sulfide-bearing materials are excavated from below the land surface and are exposed to the atmosphere. The sulfides oxidize to produce sulfuric acid, iron oxides/hydroxides, and sulfate precipitates. The resulting soil is typically highly acidic (pH less than 3.0), and is often associated with acidic, metal-laden stormwater runoff.

In land-disturbing activities (e.g. clearing, grading, or excavating), the exposure of sulfidic materials can present a number of technical, environmental, and social problems, such as:

- Acids degrade metal and concrete building materials;
- Weathering of fill material and precipitation of sulfates compromise structural stability;

- Highly acidic soils cannot support temporary or permanent vegetation resulting in increased erosion and acidic stormwater runoff;
- Highly acidic and metal-laden stormwater runoff impairs surface water quality and aquatic life; and,
- Visible pollution and adverse conditions for aquatic life limit recreational use of impacted surface waters.

(Source: http://landrehab.org)

Acid sulfate soils occur at several sites in different geologic and geomorphic settings across the Commonwealth of Virginia, including:

- Coastal Plain: Tertiary marine sediments and the Tabb formation;
- Piedmont: Phyllite and slate of the Quantico Formation;
- Blue Ridge: Alum phyllite;
- Valley and Ridge: Devonian black shale including the Marcellus, Millboro, and Chattanooga shale and Needmore Formation; and,

- Appalachian Plateau: Coal seams and shale including the Wise, Kanawha, Norton, New River, Lee and Pocahontas Formations.

A. The design professional should screen for the relative risk of encountering acid sulfate soils within the proposed limits of clearing and grading. Screening should be performed in consultation with Virginia Tech, College of Agriculture and Life Science, School of Plant and Environmental Sciences (http://landrehab.org) or another qualified professional with experience in acid sulfate soil recognition and remediation.

   The following map may be used to screen for the potential risk of encountering acid sulfate soils in near-surface excavations:

   https://www.deq.virginia.gov/home/showpublisheddocument/15599/

   Please keep in mind the following:

   - This map is based on small-scale (state-wide) geologic mapping and therefore provides only a rough guideline for site-specific planning;

   - This map is based on surficial geology, therefore significant geologic changes may occur with depth (i.e. an area mapped as "no-risk" or "low-risk" may have problematic sulfide-bearing formations occurring within an excavation depth beneath the surficial geologic formation), and a "high-risk" geologic unit which has undergone significant geologic weathering may no longer be acid forming through the depth of weathering; and

   - This map is based on the Digital Representation of the 1993 Geologic Map of Virginia, and is best interpreted with an understanding of local geology and landforms for the given area.

B. If the relative risk of encountering acid sulfate soils within the proposed limits of clearing and grading is moderate- to high-risk, the design professional or another qualified professional with experience in acid sulfate soil recognition and remediation should perform a site investigation, which includes the collection of soil and drainage samples.

C. Laboratory analyses including pH, Potential Peroxide Acidity test, and other relevant characterization tests should be completed on the soil and drainage samples.

D. Based upon the site-specific conditions and the laboratory results, the design professional or another qualified professional with experience in acid sulfate soil recognition and remediation should develop a site soil reclamation prescription. This prescription should be incorporated into the land-disturbing activity's Erosion & Sediment Control Plan and geotechnical investigation/report.

END OF CHAPTER

CHAPTER 6.000
ADMINISTRATIVE PROCEDURES

6.100 PURPOSE / OBJECTIVE

The purpose of this chapter is to convey minimum acceptable criteria to allow for a systematic approach to Stormwater Management and/or Erosion & Sediment Control Plan review and to ensure that complete plans are submitted to the Department of Environmental Quality (DEQ or Department) at the time of initial plan submission.

6.200 SUBMISSION OF COMPLETE PLANS

A. Complete plans and computations ready for construction should be submitted to DEQ. Advance or preliminary copies of incomplete plans or incomplete computations will not be accepted by the Department.

B. Normal State work hours are 8:15 am to 5:00 pm. Plans received on or after 5:00 pm will be marked as received the next business day (Monday through Friday, excluding State holidays).

6.300 SUBMISSION OF DIGITAL DATA

If produced electronically, an electronic copy in PDF format of the required submission materials (e.g., plans, computations, reports, studies, etc.) is preferred.

6.400 GENERAL STANDARDS

A. Cover sheet. The design professional should use the digital Cover Sheet provided by the Department for all plan submissions. The Cover Sheet in DWG format can be found at the following location:

https://www.deq.virginia.gov/home/showpublisheddocument/15588/

B. Revision block. A revision block should be provided on the Cover Sheet of the plans. The Cover Sheet revision block should contain a summary of all revisions made to the plans. All other plan sheets should contain a revision block detailing the revisions applicable to each plan sheet.

C. Approval block. An approval block per the following should be provided on the Cover Sheet of the plans.

APPROVAL BLOCK
DEQ PLAN # _____
_____ Dept. of Environmental Quality
_____ Date

D. Seal and signature. Unless otherwise exempt under Va. Code § 54.1-401, the seal, signature, and date of the design professional should be provided on each sheet of the plans. The seal, signature, and date of the design professional should also be provided on the cover page of all other required submission materials (e.g., computations, reports, studies, etc.).

6.500 PLAN SUBMISSION CHECKLIST

The following Plan Submission Checklist should be completed in its entirety and included on the Cover Sheet of all plans submitted to the Department. DEQ will consider your submission incomplete if you do not provide an answer (or indicate "NA" or "not applicable") for all fields on the checklist.

PLAN SUBMISSION CHECKLIST

A. APPLICATION TYPE

☐ Initial Submission

☐ Resubmission DEQ Plan #:_____

☐ Modification with Acreage Increase DEQ Plan #:_____

☐ Modification without Acreage Increase DEQ Plan #:_____

B. DESIGN PROFESSIONAL

Design Firm:_____

Contact Name:_____

Mailing Address:_____

City:_____ State:_____ Zip:_____

Telephone No.:_____

Email Address:_____

C. PROJECT DEVELOPER

Project Developer:_____

Contact Name:_____

Mailing Address:_____

City:_____ State:_____ Zip:_____

Telephone No.:_____

Email Address:_____

D. PROPERTY OWNER [repeat as necessary for all property owners]

Property Owner:_____

Contact Name:_____

Mailing Address:_____

City:_____ State:_____ Zip:_____

Telephone No.:_____

Email Address:_____

E. PROJECT INFORMATION

Project Name (as it appears on the plans):_____

Address (911 address if available):_____

City:_____ State:_____ Zip:_____

County (if not located within a City):_____

Tax Map No. (or GPIN):_____

[repeat as necessary for all Tax Map Nos. or GPINs]

Latitude (6 digits, decimal degrees format):_____

Longitude (6 digits, decimal degrees format):_____

Total Land Area of Development (1/100th of an acre):_____

Estimated Area to be Disturbed (1/100th of an acre):_____

Project Status: ☐ Federal ☐ State ☐ Public ☐ Private

Part of a Larger Common Plan of Development? ☐ Yes ☐ No

Offsite Improvements Proposed? ☐ Yes ☐ No

F. OFFSITE SUPPORT ACTIVITY INFORMATION

Offsite Support Activity Name:_____

Address (911 address if available):_____

City:_____ State:_____ Zip:_____

County (if not located within a City):_____

Tax Map No. (or GPIN):_____

[repeat as necessary for all Tax Map Nos. or GPINs]

Latitude (6 digits, decimal degrees format):_____

Longitude (6 digits, decimal degrees format):_____

Estimated Offsite Area to be Disturbed (1/100th of an acre):_____

G. PLAN INFORMATION [provide the plan sheet number where information is located]

General Plan Information	Plan Sheet No.
1. Vicinity map	
2. North arrow	
3. Plan legend	
4. Plan scale	
5. Plan sheet index	

Pre-development Site Information	Plan Sheet No.
6. Narrative of pre-development site conditions	
7. Existing property boundaries (inc. lease boundaries)	
8. Existing topography (existing contours)	
9. Existing streams, ponds, ditches, wetlands & other water bodies	
10. Existing karst features	
11. Existing 100-year FEMA floodplain	
12. Resource Protection Areas	
13. Existing Improvements (inc. buildings, roads, parking & utilities)	
14. Existing vegetative areas (inc. forest cover, open space & turf)	
15. Existing land cover / use tabulation	Sec. H, checklist
16. Existing easements (inc. Deed Book/Page ref. or Instrument #)	
17. Pre-development drainage areas (inc. acreage, divides and flow paths)	

Post-development Site Information	Plan Sheet No.
18. Narrative of post-development site conditions	
19. Proposed property boundaries (inc. lease boundaries)	
20. Proposed limits of land disturbance (limits of clearing & grading)	
21. Proposed grading (proposed contours inc. stormwater practices)	
22. Proposed 100-year FEMA floodplain	
23. Proposed improvements (inc. buildings, roads, parking & utilities)	
24. Proposed vegetative areas (inc. forest cover, open space & turf)	
25. Proposed land cover /use tabulation	Sec. H, checklist
26. Proposed easements	
27. Post-development drainage areas (inc. acreage, divides and flow paths)	

Erosion & Sediment Control Information	Plan Sheet No.
28. Narrative of proposed erosion & sediment controls	
29. Minimum standards (9VAC25-840-40)	
30. Critical erosion areas (see VESCH, Chapter 6)	
31. Proposed erosion & sediment controls (see VESCH, Chapter 3)	
32. Erosion & sediment control detail drawings	
33. Hydrologic & hydraulic computations (inc. runoff characteristics)	
34. Inspection, operation & maintenance requirements	

Post-development Water Quantity & Water Quality Control Information	Plan Sheet No.
35. Narrative of proposed stormwater management facilities / practices	
36. Proposed stormwater management facilities / practices	Sec. L, checklist
37. Hydrologic & hydraulic computations (inc. runoff characteristics)	
38. Long-term inspection, operation & maintenance requirements	

Soils & Geotechnical Information	Plan Sheet No.
39. Soils map (inc. NRCS soil types)	
40. Soils tabulation	Sec. I, checklist
41. Geotechnical investigation / report (inc. acid forming soils, karst, impoundments & site preparation)	

Other Supporting Information	Plan Sheet No.
42. Boundary survey (see 18VAC10-20-370)	
43. Physical improvement survey (see 18VAC10-20-380)	
44. Topographic survey (see 18VAC10-20-382)	

H. LAND COVER TABULATION [acreages reported to 1/100th of an acre]

Existing Land Cover / Use	Acres
1. Impervious Cover	
Impervious Cover (percentage of total land area of development)	%
2. Managed Turf	
3. Open Space	
4. Forest Cover	
5. Prime Farmland (per NRCS Farmland Classification)	

Proposed Land Cover / Use (per "Site" tab of VRRM spreadsheet)	Acres
1. Impervious Cover	
Impervious Cover (percentage of total land area of development)	%
2. Managed Turf	
3. Open Space	
4. Forest Cover	

I. SOILS TABULATION [acreages reported to 1/100th of an acre]

Map Unit Symbol	Map Unit Name	HSG	K factor	Erodibility	Acres in LOD	% of LOD

"HSG" means Hydrologic Soil Group. See Appendix 6C of 1992 Virginia Erosion & Sediment Control Handbook for groupings.

K factor indicates the susceptibility of soil to the forces of erosion. See Appendix 6C of 1992 Virginia Erosion & Sediment Control Handbook for reported values.

Erodibility (Low, Moderate or High). See Appendix 6A of 1992 Virginia Erosion & Sediment Control Handbook for groupings based on K factor.

"LOD" means Limits of Land Disturbance (limits of clearing & grading).

J. EROSION & SEDIMENT CONTROL

ESC Plan Variance Request? ☐ Yes ☐ No

If "yes", please provide justification for the variance request:_____

_____

_____

_____

_____

K. STORMWATER MANAGEMENT

Applicable Design Criteria: ☐ Part II B ☐ Part II C (Grandfathering)

☐ Part II C (Time Limits on Applicability)

☐ "Safe Harbor" (Va. Code § 62.1-44.15:28.A.10)

Offsite Compliance Option(s)? ☐ Yes ☐ No

If "yes", please describe the offsite compliance option(s) (see 9VAC25-870-69):

Discharge to a karst feature(s)? ☐ Yes ☐ No

If "yes", please describe the karst feature(s):

If "yes", please describe any known natural heritage resources in the karst feature(s):

SWM Plan Exception Request? ☐ Yes ☐ No

If "yes", please provide justification for the exception request:

L. STORMWATER MANAGEMENT FACILITIES / PRACTICES [latitude and longitude reported to 6 digits, decimal degrees format; acreages reported to 1/100th of an acre]

Facility No.	Facility Type	Lat.	Long.	Rec. Water	Tot. Acres Treated	Imp. Acres Treated	Plan Sheet No.

M. OWNER / DEVELOPER CERTIFICATION

I hereby certify that coverage under the General VPDES Permit for Discharges of Stormwater from Construction Activities will be obtained, if required, prior to commencing land-disturbing activities.

I hereby certify that all wetlands permits required by law will be obtained, if required, prior to commencing land disturbing activities.

I hereby certify that permission to construct any offsite improvements, if proposed, will be obtained prior to commencing land disturbing activities.

I hereby certify that all offsite nonpoint source nutrient credits will be obtained, if proposed, prior to commencing land disturbing activities.

I hereby certify that construction record drawings (as-built drawings) for all permanent stormwater management facilities/practices will be prepared and submitted to DEQ prior to project closeout. The construction record drawings will be appropriately sealed and by a professional registered in the Commonwealth of Virginia, certifying that the stormwater management facilities/practices have been constructed in accordance with the approved plan(s).

I hereby certify that a long-term maintenance agreement(s) for all permanent stormwater management facilities/practices and other techniques specified to manage the quality and quantity of runoff will be submitted to DEQ, if required, prior to project closeout. The long-term maintenance agreement(s) will be recorded in the local land records prior to termination of coverage under the General VPDES Permit for Discharges of Stormwater from Construction Activities.

Owner / Developer Name:_____

Owner / Developer Title:_____

Signature: _____

Date:_____

N. DESIGN PROFESSIONAL CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I hereby certify that the plans and hydrologic & hydraulic computations herein are in compliance with the Stormwater Management Act and attendant regulations, the Erosion and Sediment Control Law and attendant regulations, and applicable DEQ guidance.

Design Professional Name:_____

License No.:_____

Signature:_____

Date:_____

O. DUAL COMBINED ADMINISTRATOR (DCA) CERTIFICATION [include this section/certification if requesting a streamlined plan review in accordance with DEQ Guidance Memo No. 22-2011, otherwise delete]

I hereby certify that I have reviewed the plans and hydrologic & hydraulic computations herein for compliance with the Stormwater Management Act and attendant regulations, the Erosion and Sediment Control Law and attendant regulations, and applicable DEQ guidance, and recommend the plans and computations for DEQ approval.

DCA Name:_____

DCA Certification No.:_____

Signature:_____

Date:_____

END OF CHAPTER

CHAPTER 7.000
CONSTRUCTION RECORD DRAWINGS

7.100 PURPOSE / OBJECTIVE

The purpose of this chapter is to convey minimum acceptable criteria to allow for a systematic approach to Construction Record Drawing (as-built drawing) review and to ensure that complete construction record drawings are submitted to the Department of Environmental Quality (DEQ or Department) prior to project closeout.

7.200 SUBMISSION OF COMPLETE CONSTRUCTION RECORD DRAWINGS

A. Construction record drawings (as-built drawings) for all permanent stormwater management features should be prepared and submitted to DEQ prior to project closeout (e.g., prior to terminating coverage under General VPDES Permit for Discharges of Stormwater from Construction Activities). See 9VAC25-870-55 D.

B. Normal State work hours are 8:15 am to 5:00 pm. Construction record drawings received on or after 5:00 pm will be marked as received the next business day (Monday through Friday excluding State holidays).

7.300 SUBMISSION OF DIGITAL DATA

If produced electronically, an electronic copy in PDF format of the construction record drawings is preferred.

7.400 GENERAL STANDARDS

A. Dimensions and elevations. Construction record drawings should show actual (i.e., field) dimensions and elevations alongside the design (i.e., plan) dimensions and elevations. The actual information should be shown [boxed in] for comparison to the design information.

B. Storm sewers and culverts. Construction record drawings should show the following information at a minimum: pipe materials identified based on visual inspection, sizes, lengths, invert-in and invert-out elevations, and percent grade of pipe as computed.

C. Storm sewer and culvert outlet protection. Construction record drawings should show the following information at a minimum: apron materials (e.g., riprap, concrete) identified based on visual inspection, lengths, widths, invert elevations, and percent grade of apron as computed.

D. Level spreaders. Construction record drawings should show the following information at a minimum: weir materials identified based on visual inspection, lengths, weir elevations and percent grade of weir as computed.

E. Stormwater conveyance channels. Construction record drawings should show the following information at a minimum: top of channel elevations, invert elevations, and percent grade of channel as computed.

F. Stormwater management facilities and best management practices. Construction record drawings should show the following information at a minimum: dimensions and elevations of top of embankments, toe of embankments, principal spillways (including weirs, orifices, and outlet pipes), emergency spillways, and low flow channels (or drainage way to the principal spillway structure). Capacities should be shown topographically and volumetrically with sufficient spot elevations to compute the capacities for as-built verification.

G. Certification statement. A certification statement per the following should be provided on the Cover Sheet of the construction record drawings.

STORMWATER MANAGEMENT FACILITIES CERTIFICATION

DEQ PLAN # _____

Pursuant to 9VAC25-870-55, I hereby certify that to the best of my knowledge and belief, the stormwater management facilities shown on these construction record drawings have been constructed in accordance with the approved plans and specifications.

_____ _____

Name Signature

_____ _____

Virginia License No. Date

"Certify" means to state or declare a professional opinion based on sufficient and appropriate onsite inspections, material tests, as-built survey data, and information provided by other professionals and the contractor, conducted during or after inspection.

H. Seal and signature. Unless otherwise exempt under Va. Code § 54.1-401, the seal, signature, and date of the design professional should be provided on each sheet of the plans. The seal, signature, and date of the design professional should also be provided on the cover page of all other required submission materials (e.g., computations, reports, studies, etc.).

END OF CHAPTER