Stormwater Management Design Manual

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1 Introduction

1.1 Authority

The stormwater management provisions of the Stafford County Code[1] were adopted to establish requirements for management, control, and reduction of stormwater runoff and pollutants from developed properties in the County prior to, during, and after their construction. The Stafford County Stormwater Management Design Manual contains guidance for designers in order to assist them in meeting those requirements. It serves as a supplement to State and Federal design manuals that govern stormwater management design including the following:

- Virginia Stormwater Management Handbook, prepared by the Virginia Department of Environmental Quality (DEQ), as amended.
- Virginia Stormwater BMP Clearinghouse website (BMP Clearinghouse), prepared by the Virginia Water Resources Research Center and the Virginia Department of Environmental Quality, as amended.
- Virginia Erosion and Sediment Control Handbook (VESCH), prepared by the Virginia Department of Conservation and Recreation dated 1992, as amended.
- Virginia Department of Transportation (VDOT) Drainage Manual, prepared by the Hydraulics Section of the Virginia Department of Transportation dated 2002, as amended.

Collectively, these are referred to in this manual as the Design Manuals.[2] These manuals should be used by designers to ensure that standard, acceptable design practices are employed in developing their stormwater management designs. This manual provides further guidance where local conditions and requirements differ from the State and Federal manuals. The manual is structured to provide guidance throughout the development

[1] Chapter 11, Erosion and Sediment Control and Chapter 21.5, Stormwater Management, Stafford County Code

[2] Should information among these documents conflict or differ, the stricter on this list takes precedence.

process, from the development of a stormwater management concept, through a stormwater management design, and to post-construction (as-built) requirements.

1.2 Applicable Programs and Regulations

Beginning with passage of an Erosion and Sediment Control Ordinance in 1982, Stafford County has a long history of supporting environmental protection by addressing stormwater pollution resulting from land disturbing activities and construction activities. In addition to erosion and sediment control, the County began requiring that post-development stormwater runoff be addressed in 1994, as a result of the Chesapeake Bay Preservation Act.

Modifications to the federal Clean Water Act in 1987 resulted in the Environmental Protection Agency and associated State agencies initiating a phased implementation regulating stormwater discharges from construction activities independent of Stafford County's efforts. These regulations require that permit coverage be obtained and that construction site operators develop and implement Stormwater Pollution Prevention Plans (SWPPP) compliant with the permit. In Virginia, this permit coverage is obtained under the General Permit for the Discharge of Stormwater from Construction Activities (General Permit) issued by the Department of Environmental Quality.

In 2011, Virginia passed modified stormwater regulations combining local regulatory control and oversight of stormwater management with General Permit compliance. Under these regulations, a SWPPP is defined to include the following:

1. An Erosion and Sediment Control Plan **approved by Stafford County** under Chapter 11 of the County Code of Ordinances;

2. A Stormwater Management Plan **approved by Stafford County** under Chapter 21.5 of the County Code of Ordinances and described in detail in this manual; and,

3. A Pollution Prevention Plan **approved by Stafford County** designed to address additional stormwater pollutants associated with construction activities other than sediment such as paint, oils and other chemicals. Pollution Prevention Plan guidance and development are discussed in Chapter 7 of this manual.

Although the plans described above represent a majority of the requirements necessary to comply with the General Permit, their implementation alone without a thorough review of additional General Permit requirements cannot guarantee compliance with the General Permit. As required by State

regulation, Stafford County inspectors will also be looking for compliance with additional General Permit requirements not covered in this manual. These additional requirements include items like addressing Total Maximum Daily Loads (TMDLs), conducting self-inspections, and other language specific to the General Permit in place at the time of coverage.

The designer is responsible for knowing the details of all applicable ordinances and regulations before submitting a stormwater management concept or design plan. The developer is responsible for securing applicable Federal and State permits and should keep the County informed as to their status. The County will not issue permits without proof of compliance with Federal and State permitting requirements. The following is a list of Local, State, and Federal programs and regulations related to stormwater management and erosion and sediment control that may be applicable to land development projects in the County. This list is not intended to be all-inclusive and other programs and regulations may be applicable to a particular development site in the County, depending upon its specific location and unique environmental features.

- Virginia Stormwater Management Act and Regulations administered by the Virginia Department of Environmental Quality.
- Virginia Erosion & Sediment Control Act and Regulations administered by the Virginia Department of Environmental Quality.
- Chesapeake Bay Preservation Act and Regulations administered by the Virginia Department of Environmental Quality.
- Virginia Stormwater Management Program (VSMP) administered by the Virginia Department of Environmental Quality.
- Virginia Dam Safety Act and Dam Safety Impounding Structure Regulations administered by the Virginia Department of Conservation and Recreation.
- Section 404 of the Clean Water Act administered by the United States Army Corps of Engineers (USACE) and the United States Environmental Protection Agency.
- Virginia Water Protection Permits administered by the Virginia Department of Environmental Quality.
- National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA).
- Chapter 11, Erosion and Sediment Control, Stafford County Code administered by Stafford County Virginia.
- Chapter 21.5, Stormwater Management, Stafford County Code administered by Stafford County, Virginia.

- Chapter 22, Subdivisions, Stafford County Code administered by Stafford County, Virginia.
- Chapter 28, Zoning, Stafford County Code administered by Stafford County, Virginia.

1.3 Stormwater System Design Basics

Stormwater systems in the County are comprised of two parts:

1) **Drainage systems** to convey storm and other surface flows through the land development project; and,
2) **Stormwater management (SWM) facilities** to minimize the adverse impact of increased stormwater runoff on downstream properties.

The ultimate objective of drainage systems and stormwater management facilities is to convey, control and reduce/treat stormwater from a developed site. This ensures that the site itself and the downstream areas are not adversely affected by increased runoff caused by the development, and reduces the amount of pollutants leaving the site.

Traditionally, stormwater drainage systems have consisted of natural streams, swales, engineered open conveyance channels, storm sewers, and road culverts, while stormwater management facilities consisted of detention ponds, infiltration facilities, bioretention facilities, etc.

SWM facilities primarily detain runoff which allows pollutants to settle out before being released, promoting pollutant load reductions. SWM facilities may also reduce runoff volumes from development sites, thus replicating pre-development hydrologic conditions, as well as protect downstream receiving channels from erosion. On-site linear implementation of small scale SWM facilities, coupled with larger scale SWM facilities designed to detain and release runoff volume from the 1-year, 24-hr storm, over the entire 24-hour period of the event, may further abate erosion potential caused by the increase in runoff volume.

A recent, more non-traditional practice for stormwater management is the use of Environmental Site Design (ESD) techniques prior to any land disturbing activities. ESD utilizes non-structural and natural design approaches, and incorporates these practices into new development and redevelopment projects. The fundamental tenant of ESD is to limit impacts on watersheds by conserving natural areas, reducing impervious areas, and integrating stormwater treatment into the landscape. ESD promotes better site planning to mimic natural hydrologic runoff characteristics and minimizes the impact of land development on water resources. Chapter 4 of this manual introduces ESD's role in the design process. Chapter 6 of the

Virginia Stormwater Management Handbook should also be used as guidance when selecting and implementing ESD practices.

1.4 Stormwater Management Design Review and Approval

Stafford County is responsible for ensuring that stormwater management facilities constructed in the County comply with regulatory requirements. Therefore, the County will review stormwater management plans at every stage of development. Stages at which review and approval is required are concept design, final design, individual lot grading, and post-construction as-built.

Applicants must demonstrate compliance with requirements in their plan submissions. It is significant to note that compliance with technical design requirements alone is not sufficient for approval. Compliance must be *demonstrated* during the review process. Failure to do so shall be cause for rejection of the plan.[3] Plans submitted for County review should be comprehensive, organized and presented so that compliance is evident to someone familiar with requirements but unfamiliar with the project, project site, or surroundings.

Some common barriers to effective plan presentations are:

- The use of values in supporting computations not evident in drawings. These often include drainage areas, land uses, time-of-concentration flow path segments, and treatment volume;
- The inclusion of computer output that is not summarized, cross-referenced, or indexed to indicate its relevance in the design;
- The depiction of information unrelated to stormwater management design which detracts from or obscures stormwater management information;
- Reliance upon information contained in other plans to support the presented concept or design, which are not adequately referenced or shown;
- Failure to obtain and present information required to support elements of design, e.g., geotechnical recommendations for design and construction of a pond embankment;
- Depiction of drainage divides that are incomplete, do not honor the underlying topography, or do not show the underlying topography;

[3] Stafford County Code § 21.5-3

- Reliance upon off-site facilities without demonstrating their adequacy to meet the code requirement.
- Refer to Chapter 5 for County specific Stormwater Management Concept Plan minimum requirements and Chapter 6 for County specific Stormwater Management Design Plan minimum requirements.

1.5 Conditions of Stormwater Management Design Plan Approval[4]

Once approved, a Stormwater Management Design Plan carries the following conditions:

- The provisions of the approved plan must be adhered to during and after construction.
- No changes to the approved plan may be made without review and approval by the ***ADMINISTRATOR***[5]. Examples of allowable changes are:
- Use of a higher class pipe than proposed.
- Minor changes in horizontal and/or vertical alignment that have no impact on the Hydraulic Grade Line.
- Recordation of a final plat for a section of a multi-section subdivision (or initiation of construction in a section) ***does not vest the approval of the design plan for the remainder of the subdivision***. If the design plan expires, the applicant must file for re-approval.
- The effects of approval of any plan shall not transfer to any other plan. Enforcement or non-enforcement of any specific requirement during review and approval of any plan shall not constitute a precedent to be relied upon during preparation of any other plan.

1.5.1 Grandfathering

Section 21.5-10 of the Stafford County Code allows certain land disturbing activities to address post-development stormwater management, by utilizing alternative State technical criteria found at 9VAC25-870-94. In order to be considered for the allowance, a land disturbing activity must meet all criteria identified at 9VAC25-870-48.

[4] Stafford County Code § 21.5-4(e)

[5] Administrator is defined as the VSMP authority including the County Administrator or his/her designee(s) responsible for administering the VSMP on behalf of the county.

Stafford County is developing a list of land disturbance activities that potentially meet these criteria. Contact the Stafford County Department of Planning and Zoning for additional information pertaining to this allowance.

Chapter
2

2 Stormwater Drainage System Design

2.1 Introduction

This chapter discusses stormwater drainage design in Stafford County. Stormwater drainage is the collection and conveyance of storm and other surface water flows through a land development project in a manner to prevent flooding of structures associated with properties and erosion of channels. Stormwater drainage systems include stormwater conveyance channels (both natural and manmade), storm sewers, and culverts. Drainage systems do not include facilities for storage, treatment, or disposal of stormwater runoff. Design of those systems is discussed in Chapter 3 of this manual.

2.2 General Requirements

Stormwater drainage systems are to be designed and constructed to conform to Virginia Department of Transportation (VDOT) design standards as provided for in the latest edition of the VDOT Drainage Manual and VDOT Road and Bridge Standards, except as noted in this chapter.

The method(s) of drainage (i.e., constructed channels, storm sewer system, etc.) proposed for residential development sites must be in accordance with an approved Stormwater Management Concept Plan detailed in Chapter 5 of this manual.

All drainage systems must be designed and sized based on ultimate development. Ultimate development is defined as proposed development, existing zoning, or comprehensive plan land use, whichever is more restrictive, within the contributory watershed. Drainage systems must be designed to convey both onsite and offsite surface waters. In addition, overland relief, via an adequate and safe overflow path for the 100-year flow must be provided should the drainage system become inoperable due to blockage.

Easements must be provided for stormwater drainage systems in accordance with requirements in this manual.

2.3 Hydrologic Computations

There are a variety of hydrologic computation methods available to the designer. It is the designer's responsibility to know the limitations of each method, as well as select the method that is most appropriate for a particular design or analysis. Designers shall use Chapter 11 of the Virginia Stormwater Management Handbook for guidance on acceptable hydrologic methods and computations.

2.4 Runoff Computations

Five methods for calculating runoff are available. Selection of the appropriate method[6] is based upon drainage area size and output information required. Table 1 lists acceptable calculation methods for drainage areas of different sizes and differing output requirements.

Table 1. Hydrologic Computation Methods

Appropriate Hydrologic Computation Methods						
Output Requirements	Drainage Area	Rational Method	Modified Rational Method	Graphical Peak Discharge Method	Tabular Method	Unit Hydrograph Method
Peak Discharge Only	Up to 200 acres	X		X	X	X
	Up to 2,000 acres			X	X	X
	Up to 20 square miles				X	X
Peak Discharge and Total Runoff Volume	Up to 200 acres		X	X	X	X
	Up to 20 square miles				X	X
Runoff Hydrograph	Up to 20 square miles				X	X

When hydrologic methods require intensity-duration-frequency (IDF) information, the curves in Figure 1 and accompanying Table 2 are to be used for sites in Stafford County.

[6] The rainfall data used with the selected appropriate method shall be according to the latest NOAA or VDOT Hydraulic Design Advisory.

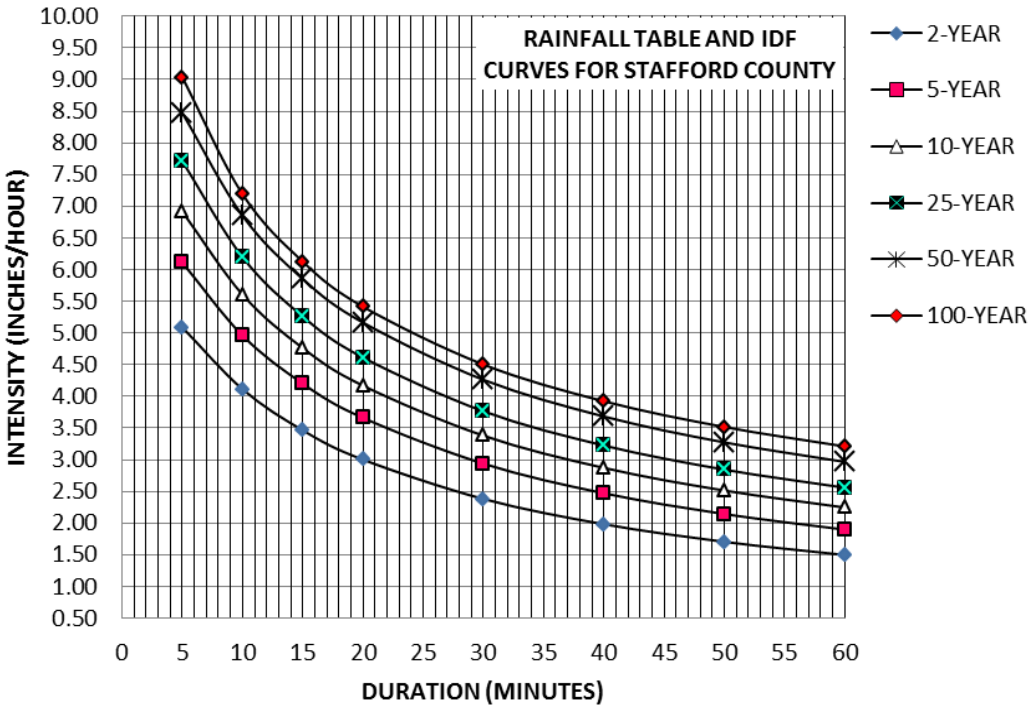


Figure 1. Stafford County IDF Curves

Table 2. Stafford County Rainfall Table

DURATION (minutes)	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR
5	5.09	6.11	6.91	7.71	8.47	9.03
10	4.11	4.96	5.60	6.19	6.85	7.19
15	3.46	4.20	4.76	5.26	5.85	6.13
20	3.00	3.66	4.17	4.61	5.16	5.41
30	2.38	2.94	3.38	3.76	4.26	4.50
40	1.98	2.47	2.87	3.22	3.68	3.92
50	1.70	2.14	2.51	2.84	3.27	3.52
60	1.50	1.90	2.25	2.56	2.97	3.21
Based on data provided by the Virginia Department of Transportation. From HYDRO 35.						

When designing a storm sewer network for multiple drainage basins, the designer may compute and tabulate flows using the Rational Method. This methodology is acceptable provided that flows to all entrance structures with a drainage area greater than 200 acres are computed using other acceptable hydrologic methods, and the time of concentration is computed using the SCS method.

2.5 Stormwater Conveyance Channels

Stormwater conveyance channels must be designed to convey the peak discharge from a ten-year storm with a minimum freeboard of 1.5 times the flow depth or one foot, whichever is greater. In addition, man-made channels should convey the ten-year peak discharge within the channel banks and the 2-year peak discharge at a non-erosive velocity. Channel linings must be selected using procedures in the VDOT Drainage Manual and the latest edition of the Virginia Erosion and Sediment Control Handbook (VESCH). The Virginia Stormwater Management Handbook and Virginia Stormwater BMP Clearinghouse website (BMP Clearinghouse) should be used for design guidance when selecting appropriate channel geometric properties (bank and longitudinal slope, shape, etc.). Low flow sections are recommended in the design of channels with large cross sections.

2.6 Storm Sewers and Culverts

2.6.1 Overland flow and blockage requirements

An adequate and safe overland flow path for the 100-year storm event must be calculated and shown on plan view in case of storm sewer blockages. For storm sewers, use 100 percent inlet blockage (non-operative inlet) to model overland relief. For culverts, use the following blockage parameters.

Culvert Inlet Diameter	Blockage
< 24 inches	100 %
24-48 inches	50 %
> 48 inches	25%

Detailed cross sections and water surface profile computations must be provided where flooding of structures could be possible.

In channels used by anadromous fish, the outlet end of the culvert pipe should always be slightly submerged. If multiple pipes are to be installed, the invert of one pipe should be at least six (6) inches below the others, at least on the inlet end, that all the other pipes and the outlet end of that pipe should be slightly submerged.

2.6.2 Storm Sewer and Culvert Pipe Materials

Storm sewers and culverts shall use reinforced concrete pipe (RCP). However High Density Polyethylene (HDPE) or Polyvinyl Chloride (PVC) pipes can be used for storm drainage in (a) Driveway Culverts, (b) Commercial Projects, and (c) Segments of residential projects within the VDOT right of way, with the following specifications:

- **RCP**
  - RCP shall meet the three-edge bearing strength test requirements for ASTM C76 Class III RCP or better.
  - Non-residential projects shall be in accordance with VDOT standards.
- **HDPE and PVC Pipes**
  - The maximum allowable diameter is forty-eight (48) inches. However, in locations within the state right-of-way and where approved by VDOT, maximum culvert size may be sixty (60) inches.
  - The maximum depth of trench, when measured from final grade, shall be ten (10) feet, and the minimum cover shall be eighteen (18) inches.
  - HDPE pipe shall conform to ASTM F2306/F2306M-05 "Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications". PVC Pipe shall meet the requirements of ASTM F949, "Standard Specification for Polyvinyl Chloride Corrugated Sewer Pipe with Smooth Interior and Fittings."
  - Joints for HDPE and PVC shall conform to ASTM D3212, "Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals". Gasket shall meet or exceed the requirements of ASTM F477-07, "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe."
  - Installation of HDPE and PVC pipe and fittings shall be in accordance with the more stringent of the following two: (a) ASTM D2321, "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications". This section of ASTM includes foundation, embedment and backfill material requirements, trench

excavation, installation, joints, inspection, handling and storage of pipe material. (b) The current VDOT standards.

- In residential installations, bond release and acceptance shall require visual inspection[7]. County may choose to require mandrel testing during visual inspection. Pipe shall be replaced where deflection exceeds 7.5% of the initial inside diameter. Pipe in non-residential settings shall require visual inspections to ensure proper installations with requirements similar to residential installations.
- A residential project with more than ninety (90) percent of the total storm sewer located in the state right-of-way, when measured in length, may use HDPE or PVC pipe outside the state right-of way with prior approval from Administrator. The requirements for bond release of HDPE or PVC storm sewer, when used in a subdivision outside the state right of way, shall be consistent with the bond release of storm sewers in segments of the subdivision within the state right of way.
- HDPE and PVC pipes will be the materials of preference in sites of proven acidity or alkalinity with potential adverse effects on concrete pipe.

2.7 Grading Plans

Two distinct types of Grading Plans are recognized, reviewed, and approved by the County. The first plan type is appropriate at the beginning of development or may constitute the complete anticipated development. This plan is classified as an Early (Overlot) Grading plan, and generally describes the clearing and grading of more than one lot. The plan type is appropriate at the end of horizontal development to prepare the site for vertical development. This plan is referred to as an Individual Residential Lot Grading Plan and consists of details and information pertaining to the final grading of a single lot.

[7] The term "visual inspection" in regards to HDPE pipe installation requirements entails internal video inspection of the storm sewers provided to the County. This data shall be acquired using appropriate video inspection equipment and must be provided to the County on a DVD or electronically for review with the submittal of as-built plans.

2.7.1 Early (Overlot) Grading Plans

Stafford County allows developers to obtain an early grading permit provided they meet the following requirements:

- All plans (both residential and commercial) must meet all E&S and final SWM design requirements.
- For residential applications, Early Grading Plans should be submitted after the approval of the Preliminary Subdivision Plan and should be submitted concurrently with the Subdivision Construction Plan.
- For commercial applications, if a property is zoned, an Early Grading Plan can be submitted to the County at any time. If a property is not zoned, the Early Grading Plan may be submitted after rezoning is approved.

2.7.2 Individual Residential Lot Grading Plans

For Individual Residential Lot Grading Plans, Plan preparers shall include, at a minimum, the following information:

- The proposed lowest opening for each structure should be identified and its elevation shown. Common lowest openings include doorway and window sills, the top of an area way, or a floor drain with a daylight outlet.
- The proposed location, elevation, and depth of flow of the 100-year flood at the control point. Common control points include the channel bottom across from the lowest opening, the point where water first overflows the road, the crest of the sump at a yard inlet, or the crest of an emergency spillway for a nearby SWM facility.
- If the location of the control point is off-site, indicate its location with an appropriate notation and show its elevation and depth of flow.
- The proposed location of erosion and sediment controls.
- When SWM facilities are proposed for construction on individual lots, a complete design and construction plan for the facility shall be prepared as required in Chapters 5 and 6 of this manual.
- All discharge lines and outfall locations/elevations for roof drains, foundation drains, and sump pumps shall be designed and shown on the grading plan.
- Sump pumps shall discharge into a publicly maintained drainage system if available or an established continuously flowing natural watercourse to safely convey surface and groundwater in such a

manner as to prevent detrimental erosion, ponding, or nuisance of any kind.

- Discharge lines shall not encroach on adjoining properties until an easement has been recorded.
- A note that elevation verification is required prior to framing inspections for the structure.

2.7.2.1 Residential Lot Drainage

1) A lot grading plan must be approved by the County prior to issuance of a building permit. Drainage for single family lots must be designed to function with the drainage system plan for the entire development site. When possible, grading plans for single lots should be incorporated in the construction or site plan for the project.
2) Lots must be graded to provide positive drainage away from the house. A minimum drop of six (6) vertical inches must be provided within ten (10) horizontal feet measured at a right angle to the wall of the house.
3) A minimum two (2) percent grade shall be established for sheet flow of grassed areas within the limits of clearing.
4) Natural streams and improved channels must not be erosive. Where possible, open, unimproved streams on lots smaller than one acre must be avoided.
5) Lots shall be graded to divert runoff to a ditch or swale along lot lines. Large volumes of runoff in swales between houses should be avoided. Drainage systems shall be designed so that runoff passing between houses originates on those two lots rather than bringing large volumes of runoff from several lots together before passing it between two houses.
6) In general, runoff exceeding three (3) cfs for the ten-year storm event that flows through lots must be piped when average lot size is less than 30,000 square feet. The Administrator may approve an open channel system in order to preserve a natural drainage way or when it can be shown that use of an open channel will not interfere with the use of the property.
7) Residential lots less than 30,000 square feet in size must be graded so that surface runoff does not cross more than three lots before it is collected in an underground storm sewer system or engineered stormwater conveyance channel which provides the required freeboard. Where lot layout does not permit the design of an appropriate channel and easement, an underground storm sewer must be provided.
8) Yard inlets for storm sewer systems must be designed for the ten-year storm event. Any area subject to water ponding must be within a storm drainage easement. The ten-year water surface around the yard inlets

must be shown in plan view and be accompanied by supporting computations.

9) Lot grading, siting and elevations of residential structures must be such that no flooding of structures will result from ponding or overflow of pipe systems during the one hundred-year storm. Proposed lowest floor elevations and wall penetrations must be no less than one foot above the 100-year flood elevation.

Stafford County's Lot Grading Plan submittal checklist[8] is located in the Appendix 3 of this manual. Designers shall use this checklist to ensure all County requirements are met prior to the submittal of a Lot Grading Plan.

2.7.2.2 Elevation Verification

Verification of final elevations is required to ensure the completed construction will meet those provisions of Stafford County Code intended to prevent flooding of structures during storms. This must be done after grading is complete, but before any vertical construction (framing) begins on the house. Topography of adjacent properties depicted on grading plans must match what exists at the time of current field conditions.

Documentation may consist of a copy of the approved lot grading plan with As-Built elevations and 100-year water elevation "boxed in." These must show:

- The As-Built elevation of the lowest opening
- The As-Built elevation of the control point
- The permit number, clearly shown
- The professional seal and signature of the certifying consultant

Plan preparers must submit the Stafford County Department of Public Works Elevation Verification Form (Appendix 4) when preparing these plans, and ensure all information required is provided.

[8] The lot grading plan submittal checklist is available at the Stafford County Department of Planning and Zoning Website.

Chapter
3

3 Stormwater Management Facility Design

3.1 Introduction

This chapter discusses stormwater management facility (SWM) design in the County. Stormwater management is defined as the collection, conveyance, storage, treatment, and disposal of stormwater runoff in a manner to prevent accelerated channel erosion, increased flood damage, and degradation of water quality.

Acceptable design and planning methodologies that should be used when addressing stormwater management requirements in Stafford County include the following: On-site SWM facilities; Low-Impact Development (LID) Site Planning; and Environmental Site Design (ESD). Facilities and practices must be designed and constructed to conform to the applicable Design Manuals and specifications, as well as the other guidance documents listed in Chapter 1 of this manual, except as noted in this chapter.

Design specifications for post construction proprietary and non-proprietary BMPs[9] credited for use in Stafford County are available at the BMP Clearinghouse. All specifications are available on the BMP Clearinghouse to allow designers and developers easier access to the specifications as well as any updates. The BMP Clearinghouse also provides a forum for the evaluation, management, and approval of manufactured treatment devices (MTDs). Designers shall consult the BMP Clearinghouse for SWM facility specification updates, and to evaluate if additional practices have been credited[10] for use in Virginia, and consequently Stafford County.

[9] For the purposes of this manual, SWM Facility will be used synonymously with BMP where most applicable.

[10] Stafford County will, at a minimum, defer to the BMP Clearinghouse in regards to BMP accreditation. The County reserves the right to limit the use of any BMP in accordance with the provisions of Paragraph C the Code of Virginia Section 62.1-44.15:33.

3.2 Stormwater Management Facilities

In general, all land development must provide for stormwater management on site. Exceptions to this include cases in which stormwater management requirements are met by an existing or proposed off-site facility. In any case, methods of stormwater management proposed for the site must be in accordance with an approved Stormwater Management Concept Plan.

Conventional SWM facilities must be designed and constructed to conform to the requirements set forth in the Virginia Stormwater Management Handbook, 2nd Edition, dated 2013, as amended, as well as the design specifications located at the BMP Clearinghouse. Conventional SWM facilities shall be platted on separate tracts intended for that purpose. Furthermore, easements must be provided for all SWM facilities in accordance with requirements in Chapter 10 and Appendix 11 of this manual.

For SWM ponds that initially serve as temporary sediment basins during construction, Stafford County requires designers to follow the construction sequencing and requirements set forth in specifications located at the BMP Clearinghouse, as well as the Virginia Erosion and Sediment Control Handbook. For all SWM facilities requiring a riser structure, all riser structures must be concrete unless a substitute material has been specifically approved by the Program Administrator.

Designers shall note that the use of underground water quality or detention structures and/or proprietary Manufactured Treatment Devices (MTDs) that have the potential for expensive long term maintenance costs, as determined by the Program Administrator, shall be prohibited in residential subdivisions.

3.3 Water Quantity

3.3.1 Introduction

Site development activity increases the overall runoff volume of a site. The increase in runoff volume has an adverse effect on downstream receiving channels in smaller scale storms, and overbanks and floodplains in larger intensity storm events. Chapter 10 of the Virginia Stormwater Management Handbook provides guidance for sizing SWM facilities based on water quality and water quantity requirements. Chapter 11 of the Virginia Stormwater Management Handbook presents the hydrologic methods to support the design requirements. Receiving channel protection, overbank flood protection, and extreme flood protection should all be addressed with both

the Stormwater Management Concept Plan and the Stormwater Management Design Plan.

3.3.2 Receiving Stream Channel Protection

SWM facilities designed to capture, then release concentrated stormwater runoff into a stormwater conveyance system shall meet one of the two acceptable flood protection design criteria presented in Section 9VAC25-870-66 of the Virginia Code, titled Water Quantity. All natural conveyance system design requirements must also meet the provisions set forth in Section 9VAC25-870-66 of the Virginia Code. Design guidance for receiving channel protection can be found in Section 10.1.3 and Chapter 11 of the Virginia Stormwater Management Handbook, as well as Technical Bulletin No. 1 titled "Stream Channel Erosion Control" on the VA DEQ Website.

3.3.3 Frequent Overbank Flood Protection

In a bankfull storm event where water spills out of the channel and into the overbank areas of a floodplain, an over-bank flood control design storm should be used for design purposes. This storm is the same as what is used to design open channels, culverts, bridges, and storm drainage systems. Refer to Section 10.1.4 and Chapter 11 of the Virginia Stormwater Management Handbook for overbank flood protection guidance.

3.3.4 Extreme Flood Protection

In instances where a storm event activates the 100-year floodplain, measures should be taken to reduce the risk to life and property and protect the physical integrity of stormwater BMPs and downstream infrastructure. Refer to Section 10.1.5 and Chapter 11 of the Virginia Stormwater Management Handbook for extreme flood protection guidance.

3.4 Water Quality

The BMP Clearinghouse provides pollutant removal efficiencies for all approved proprietary and non-proprietary BMPs credited for use in Stafford County. The published pollutant removal efficiencies shall be used to determine the appropriate BMP(s) that need to be implemented on-site in order to meet each site's specific water quality requirements. Furthermore, to receive full credit for the published pollutant removal efficiencies, proposed BMPs shall meet all design and construction requirements set forth in their

corresponding design specifications[11] at the BMP Clearinghouse. All proposed BMPs must be located in a manner to target runoff from impervious, disturbed, or turfed areas of the proposed development project, including runoff from road surfaces.

3.5 BMP Selection and Application

3.5.1 Introduction

Advancements in BMP designs and implementation have increased significantly in response to construction related stormwater runoff control. The need for site-specific BMPs has increased the overall array of practices available. Regulatory restrictions, pollutant removal capability, land use, feasibility, etc., are some of the primary factors that influence each site's BMP selection. The evaluation of site features, coupled with the correct selection of BMP(s), is imperative in ensuring that designers and developers comply with the stormwater management requirements laid forth in the local and State regulations.

3.5.2 BMP Selection Tables

Chapter 8 of the Virginia Stormwater Management Handbook provides BMP selection tables that should be used as design guidance when selecting appropriate BMPs based on site layout and development characteristics. Selection tables are provided where BMP groups have been analyzed against opportunities and constraints proposed by the following site features:

- Land Use
- Physical Feasibility
- Winter and Cold Weather Stormwater Control Operational Criteria
- Critical Water/Watershed Resources
- Stormwater Management Capability
- BMP Pollutant Removal Efficiencies
- Community and Environmental Factors
- Location-Specific Restrictions and Setbacks
- Contributing Drainage Area Served

[11] For all SWM facility designs, the most current BMP Clearinghouse Specification must be used.

Designers should use these selection tables when preparing the SWM Concept Plan, and subsequently the SWM Design Plan.

3.5.3 Post Construction BMP Design & Construction Standards and Specifications

This manual provides general guidance on the practices and facilities that are available for site stormwater design and compliance in Stafford County. As stated throughout this manual, the full array of specific SWM facilities credited for use in the County are available at the BMP Clearinghouse. Practices listed on the website have a corresponding public domain BMP that presents criteria available for designers to use when addressing the topics related to the following:

1. **Practice Description:** Describes the practice and explains its purpose and how it functions.
2. **Performance:** Identifies how well the practice addresses various objectives of SWM (e.g., Runoff Reduction, Total Phosphorous and Nitrogen Removal, Total Suspended Solids (TSS) Removal, Channel Protection, and Flood Mitigation).
3. **Design Table:** Identifies the sizing criteria for the practice needed to accommodate the full Treatment Volume (T_v) and geotechnical or other testing that must be done to provide information needed to correctly design the facility.
4. **Typical Graphical Details:** Provides visual guidance regarding how to correctly design and build the particular practice.
5. **Physical Feasibility and Design Applications:** Identifies site considerations and physical constraints that determine where a practice may be applied or that may restrict the use of a practice.
6. **Design Criteria:** Identifies the specific standards and specifications that govern the correct design of specific devices, including dimensions, components, orientation, etc.
7. **Regional and Climate Design Adaptations:** Identifies considerations and adaptations needed to address particular kinds of regional characteristics or climate variations.
8. **Construction Sequence and Inspection:** Identifies factors important to the proper construction and long-term viability of the particular practice.
9. **Maintenance:** Describes how to maintain the long-term performance of the practice through regular maintenance activities.

10. **Community and Environmental Considerations:** Addresses issues such as physical safety, potential vectors, aesthetics, etc.
11. **References:** Provides a list of resources from which the criteria and information in the design specification were taken.

The criteria presented for each specification is fundamentally essential for designers to use when developing sound and approvable design plans in the County. Many of the plan and design components required by the SWM Concept Plan and SWM Design Plan can be found within the criteria listed for each BMP specification provided at the BMP Clearinghouse.

3.6 Geotechnical Study Requirements

The need for a geotechnical study consisting of a field investigation, laboratory testing, and a geotechnical engineering analysis with recommendations will be determined on a case-by-case basis, by the Administrator, depending upon the complexity of the proposed facility design and the extent to which its proper design and performance may be affected by the geotechnical properties of the site. At a minimum, geotechnical studies are required for the following SWM facilities:

- Wet Ponds
- Extended Detention (ED) Dry Ponds
- Infiltration Facilities
- Underground Detention Storage Facilities
- Bioretention Facilities

Results of the geotechnical study are to be documented in a geotechnical report prepared by a licensed geotechnical engineer. This report shall be submitted with the Stormwater Management Design Plan. The geotechnical recommendations must be identified on the design plan.

Information to be included in the geotechnical report will vary depending upon the facility type. The designer should consult both the Virginia Stormwater Management Handbook (and its associated references) and the project geotechnical engineer for more specific guidance on pertinent geotechnical information needs by SWM facility type. At a minimum the following information should be provided in the report:

- Identification and description of the proposed facility
- Site map showing locations of soil borings and test pits
- Soil logs containing unified soil classification system (USCS) by depth
- Depth to seasonal water table and bedrock

- Degree of mottling and chroma of mottles
- Presence of porous or fractured bedrock, mica schist, and iron pyrite
- Other soil properties as deemed appropriate by the geotechnical engineer
- Geotechnical engineer's recommendations

For infiltration practices, the geotechnical report must indicate appropriate subsoil infiltration.[12] At least two feet of depth is required from the bottom of the infiltration facility to the seasonal water table and bedrock to allow the facility to operate as designed.

3.7 SWM Facility Safety Design Considerations

3.7.1 Introduction

SWM facilities designed and constructed in Stafford County must fulfill all safety requirements set forth in the Design Manuals referenced in Chapter 1 of this manual. Furthermore, each proposed SWM facility must incorporate the safety features presented in their respective BMP Clearinghouse Standard, and shall be designed in accordance to the standard specifications.

3.7.2 Wet Pond Safety Considerations Specific to Stafford County

Wet ponds designed in the County must conform to the safety guidelines referenced above, as well as the following:

- All SWM facilities designed with a permanent pool must have permanent fencing (wooden or metal) around the entire facility at a height no less than four (4) feet, and no greater than eight (8) ft.
- Fencing must have a gate sized to allow vehicular access.
- Safety/aquatic benches for ponds and forebays must conform to the specifications outlined at the BMP Clearinghouse.
- Signage depicting the hazards of the facility shall be posted in a clearly visible area and contain the contact information of the party/parties responsible for maintaining the facility. A facility safety signage template is available from the Department of Public Works.
- A handrail is required for all pipe ends into and out of the pond greater than thirty-six (36) inches in height.

[12] Appropriate subsoil infiltration rates for Non-Proprietary Level 1 and Level 2 BMP Designs are available at the BMP Clearinghouse.

3.8 Requests for Exception

Exceptions to the minimum stormwater management requirements of the Stafford County Code may be granted by the Administrator, upon receipt in writing from the applicant or property owner. Such exception requests are best made in conjunction with the Stormwater Management Concept Plan since they must be accompanied by descriptions, drawings, calculations, and other information necessary to evaluate the request, all of which are to be included in the Stormwater Management Concept Plan.

The request for exception(s) must be made in writing (separately from the Stormwater Management Concept Plan submission) and must be signed by the applicant or property owner.

The Administrator may grant exceptions to the technical requirements of the stormwater management provisions of Section 21.5-11 of the Stafford County Code, provided that:

- The exception is the minimum necessary to afford relief;
- Reasonable and appropriate conditions are imposed so that the intent of the Act, the Regulations, and the stormwater management provision of the Stafford Code itself is preserved;
- Granting the exception will not confer any special privileges that are denied in other similar circumstances;
- Exception requests are not based upon conditions or circumstances that are self-imposed or self-created;
- Economic hardship alone is not sufficient reason to grant an exception from the requirements of the Stafford County Code.

The Administrator shall not grant an exception to the requirement that the land-disturbing activity obtain required VSMP, and other state permits. Also, the Administrator will not approve the use of a BMP not found on the BMP Clearinghouse, or any other control measure duly approved by the DEQ Director.

The Administrator shall not grant exceptions to requirements for phosphorous reductions unless offsite options available through 9VAC25-870-69 have been considered and found not available.

A record of all exceptions granted shall be maintained by the Administrator in accordance with 9VAC25-870-126.

Requests for exception must:

- Specify the specific provision(s) of Stafford County Code from which relief is being sought.

- Describe the project condition (other than economic) that makes compliance with the provision(s) impossible or impracticable.
- Stipulate which one or more of the condition(s) necessary to grant the waiver is true for the exception being requested.
- Demonstrate with descriptions, drawings, calculations, and other information that the condition(s) necessary to grant the waiver exists in fact.

Copies of any approved requests for exception which apply or which are being sought must be included in the Stormwater Management Concept Plan submission.

Chapter
4

4 Runoff Reduction and Design

4.1 Introduction

The Virginia Runoff Reduction Method (VRRM) was created as a regulatory compliance tool in regards to stormwater management for new development and redevelopment. The methodology was developed over a several year joint effort between the Center for Watershed Protection (CWP), the Chesapeake Stormwater Network (CSN), and the Virginia Department of Environmental Quality (DEQ). The VRRM has been instrumental in revamping the Virginia Stormwater Management Program (VSMP) codes, the creation of the Virginia Stormwater BMP Clearinghouse (BMP Clearinghouse), and the redesign of the Virginia Stormwater Management Handbook, all of which are referenced throughout this manual. The implementation of the Runoff Reduction Method is governed by the use its corresponding spreadsheet(s) and the specifications located at the BMP Clearinghouse.

Several years of BMP performance data was compiled to develop the VRRM and its associated tools. The data acquired was used to develop a framework that can be used by both designers and Stafford County plan reviewers to verify compliance with stormwater regulations in the State of Virginia. The end product of the VRRM is a system that incorporates site design, stormwater management planning, and BMP selection that provides designers with the most effective stormwater approach for a given site.

4.2 The Runoff Reduction Method and Compliance Process

4.2.1 Introduction

BMP success traditionally has been measured solely on the pollutant removal capability of each implemented practice. Advanced research has shown that BMP's actually have a variably positive effect on volumetric runoff, some with higher capabilities than previously thought. Runoff reduction provided by BMPs yield pollutant load reductions, replicate pre-development

hydrologic conditions thus protecting downstream channels, and in some cases can even reduce overbank flooding.

Another traditional tenant of stormwater management design is the focus on impervious cover as the primary indicator of a development site's water quality impacts. The VRRM extrapolates site analysis beyond percent imperviousness, to include forested land cover, disturbed soils, and managed turf. The inclusions of expanded land use analysis provide extra incentive for designers and site planners to protect or restore forest cover and reduce impervious areas and disturbed soils on development sites.

Stafford County designers shall use the VRRM to: (1) Attain the tributary strategy goals set forth for phosphorous and nitrogen reduction; (2) Reduce site runoff volume, and consequently reduce downstream channel erosion and sediment transport; (3) Promote planning techniques to limit certain land covers while promoting reforestation and forest conservation; and (4) Promote innovative site design practices that attain these goals.

4.2.2 Runoff Reduction Compliance

The VRRM employs a three-step procedure to determine site compliance. The steps correspond to the inputs required for the Runoff Reduction spreadsheet(s) available at Virginia's DEQ website. Stafford County engineers and designers shall use the steps listed in the subsequent section for all site planning, conceptual design and final design. Furthermore, the inclusion of the completed Runoff Reduction spreadsheet shall be required with the submittal of the Stormwater Management Concept Plan and Stormwater Management Design Plan referenced in Chapters 5 and 6 of this manual, respectively.

4.2.2.1 Runoff Reduction Method Stepwise Compliance Procedure

- **Step 1: Apply Site Design Practices to Minimize Impervious Cover, Grading and Loss of Forest Cover.** Step 1 focuses on Environmental Site Design (ESD) practices during the early phases of the site layout. Designers should minimize impervious cover and mass grading, and maximize retention of forest cover, natural areas and undisturbed soils. Chapter 6 of the Virginia Stormwater Management Handbook should be used for ESD guidance. All components of this step shall be clearly identified and summarized in the Concept Plan and Stormwater Management Design Plan.
- **Step 2: Apply Runoff Reduction Practices.** Designers shall iteratively experiment with the combinations of credited runoff reduction practices located at the BMP Clearinghouse. For individual

site drainage areas, designers should use runoff reduction practices in series in order to maximize runoff reduction.

- **Step 3: Compute Pollutant Removal (PR) by Selected BMPs**. Designers shall use the Runoff Reduction spreadsheet to gauge whether a site's phosphorous load reduction has been achieved by the combined application of selected ESD and runoff reduction practices selected in steps 1 and 2, respectively. If the phosphorous load limit has not been reached, designers should select additional credited BMPs to meet the remaining load requirements.

The flowchart in Figure 2 represents the iterative Runoff Reduction compliance process.

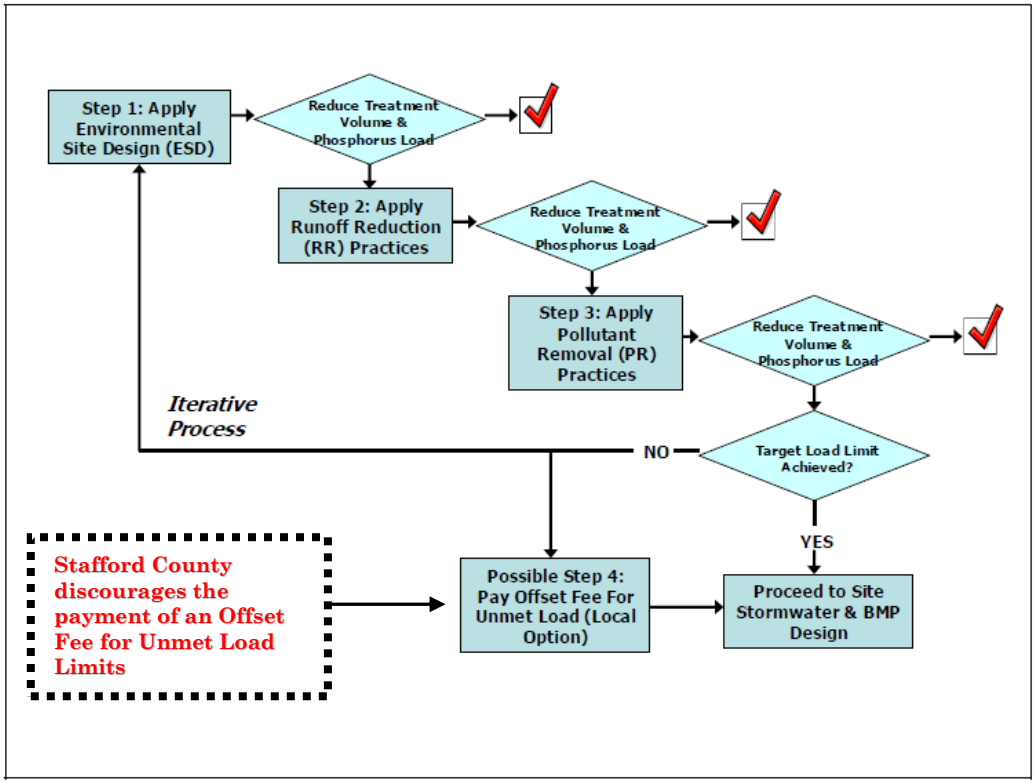


Figure 2. The Virginia Runoff Reduction Method step-wise compliance procedure. ***Source: Technical Memorandum: The Runoff Reduction Method: Center for Watershed Protection, 2008.***

4.3 Runoff Coefficients (Rv)

As stated earlier in the chapter, the increase in site imperviousness within a development or redevelopment sites' drainage area(s) has traditionally dictated the stormwater runoff characteristics, stormwater impacts, and water quality of a given site. Managed turf and disturbed soils traditionally

have been neglected in site runoff analysis, but research has shown both covers have a negative impact on site runoff characteristics and water quality components. The grading, construction and compaction of disturbed soils has been found to increase runoff volume from a site, whereas managed turf can contribute to elevated nutrient loads. Because these characteristics were never accounted for, it can be stated that pollutant loads and runoff volumes have been historically underestimated.

To account for further stratification in land use designations, runoff coefficients were derived and assigned to the following site covers:

- Forested Areas
- Disturbed Soils/Managed Turf
- Impervious Cover

Figure 3 compares Runoff Coefficients (Rv) for different soil conditions. Designers shall utilize these site cover runoff relationships when implementing ESD practices, in order to minimize areas with high runoff coefficients.

Site Cover Runoff Coefficients (Rv)	
Soil Condition	Runoff Coefficient
Forest Cover	0.02 to 0.05*
Disturbed Soils/Managed Turf	0.15 to 0.25*
Impervious Cover	0.95
*Range dependent on original Hydrologic Soil Group (HSG)	
Forest A: 0.02 B: 0.03 C: 0.04 D: 0.05	
Disturbed Soils A: 0.15 B: 0.20 C: 0.22 D: 0.25	

Figure 3. Site Cover Runoff Coefficients (Rv)

Source: Technical Memorandum: The Runoff Reduction Method: Center for Watershed Protection, 2008.

Designers shall present both graphically and in tabular format the (Rv) coefficients for all existing and proposed land cover conditions displayed on the Stormwater Management Concept Plan and Stormwater Management Design Plan.

4.4 Treatment Volume (Tv)

The Runoff Reduction Technical Memorandum establishes Treatment Volume (Tv) as being "the common currency for site compliance". This distinction in terms of site design should not be understated. Treatment Volume is the central component of the VRRM, and ultimately the single most important factor driving site development, redevelopment, and design. The designer's fundamental goal should be applying site design, structural, and non-structural practices referenced throughout this manual, in order to reduce the treatment volume on-site by reducing the overall volume of runoff leaving the site.

The Runoff Reduction spreadsheet uses the equation given in Figure 4 to determine a site's Stormwater Treatment Volume. The runoff coefficients provided in Section 4.3 of this manual are used in the equation for their corresponding variables.

Determining the Stormwater Treatment Volume

$$Tv = \frac{P * (Rv_I * \%I + Rv_T * \%T + Rv_F * \%F) * SA}{12}$$

Where

Tv = Runoff reduction volume in acre feet
P = Depth of rainfall for "water quality" event
Rv_I = runoff coefficient for impervious cover[1]
Rv_T = runoff coefficient for turf cover or disturbed soils[1]
Rv_F = runoff coefficient for forest cover[1]
% I = percent of site in impervious cover (fraction)
%T = percent of site in turf cover (fraction)
%F = percent of site in forest cover (fraction)
SA = total site area, in acres

[1] Rv values from **Figure 3.**

Figure 4. Stormwater Treatment Volume (Tv) equation and variables.

Source: Technical Memorandum: The Runoff Reduction Method: Center for Watershed Protection, 2008.

Designers shall present both graphically and in tabular format, the (Tv) calculated for all site development and redevelopment projects displayed on the Stormwater Management Concept Plan and Stormwater Management Design Plan.

4.5 Runoff Reduction Design Resources

Designers and engineers should use this chapter as a supplemental guidance document for development and redevelopment projects, and their associated plans in Stafford County. The VRRM and its associated components are ingrained throughout the Virginia Stormwater Management Handbook, BMP Clearinghouse, and State stormwater codes. It should be noted that the VRRM compliance spreadsheets are **NOT** BMP design tools. When a BMP is selected in a spreadsheet, it is assumed that the designer will locate and design the BMP according to the design criteria provided in the BMP Clearinghouse Design Specifications. Designers and engineers should utilize the following resources to ensure comprehensive synergy between the VRRM tenants, and the policy, planning, and design requirements and procedures in Stafford County:

- **Chapter 12 of the Virginia Stormwater Management Handbook**. Includes guidance on:
  - VRRM Compliance Spreadsheet Basics
  - Using the VRRM Spreadsheet
  - Using VRRM Compliance Spreadsheet for development on prior developed land (redevelopment)
  - VRRM Compliance Spreadsheet Documentation
  - Associated References
  - Tables
  - Equations

- **Virginia Department of Environmental Quality Website – Stormwater Management Guidance Tab**. Includes the following:
  - VRRM Development Spreadsheet (most current version)
  - VRRM Redevelopment Spreadsheet (most current version)
  - Step-wise spreadsheet instructions and documentation
  - The Center for Watershed Protection (CWP) Technical Memorandum on Development of the VRRM

- **The Virginia Stormwater BMP Clearinghouse**. Includes the following:
  - BMP Pollutant removal efficiencies and Runoff Reduction percentages for all Stafford County approved BMPs
  - Specifications and design procedures for Level 1 BMP designs that provide lower RR and pollutant removal efficiency, and Level 2 BMP designs which provide higher RR and pollutant removal efficiency.

Chapter
5

5 Stormwater Management Concept Plans

5.1 Introduction

Chapter 21.5-6 of the Stafford County Code requires all preliminary plans of subdivision to include a Stormwater Management Concept Plan generally describing how stormwater runoff through and from a development will be addressed. The purpose of a Stormwater Management Concept Plan is to assess the hydrologic and hydraulic conditions of the site prior to any development, and to describe in a general way, the stormwater management practices and features needed to meet applicable requirements while minimizing the downstream impacts of the proposed development. A Stormwater Management Concept Plan is a complete and distinct plan intended to depict only the elements of a workable stormwater management concept for the proposed development.

The Stormwater Management Concept Plan is the basis for preparing a Stormwater Management Design Plan. Chapter 21.5-6 of the Stafford County Code requires that a Stormwater Management Concept Plan *must* be approved prior to the submission of a Stormwater Management Design Plan (as part of a construction plan) for an entire subdivision development plan, or portions thereof. **A copy of the approved Stormwater Management Concept Plan *does not* have to be submitted with a Site Plan, but *must* be submitted with the Subdivision Construction Plan**. A revised Stormwater Management Concept Plan may be required if changes to a development proposal (i.e., a Preliminary Subdivision Plan) are made and deemed by the Administrator to not be in substantial conformance with the approved Stormwater Management Concept Plan.

Concept plans for preliminary plans of subdivision should be prepared in accordance with this chapter and submitted to the Department of Planning and Zoning as a component of the Subdivision Preliminary Plan. Application and review fees will apply.

5.2 Stormwater Concept Plan Requirements

5.2.1 Introduction

A completed design is not required in the Stormwater Management Concept Plan. However, sufficient analyses must be performed to show the plan is workable. The Stormwater Management Concept Plan gives the developer, as well as County review authority, a "first look" at the stormwater management system(s) for the proposed development. The amount of analyses required will vary depending on the size and complexity of the site and the development.

Designers should adhere to the following steps when developing the Stormwater Management Concept Plan:

1.) Use Environmental Site Design (ESD) approaches, as applicable, to develop the site layout.

2.) Calculate preliminary estimates of the unified stormwater sizing criteria requirements for water quality, channel protection, overbank flooding protection and extreme flood protection based on the concept plan site layout.

3.) Determine the site design stormwater credits to be accounted for in the design of structural stormwater controls handling the water quality volume.

4.) Perform screening and preliminary selection of appropriate structural and non-structural stormwater controls, and identify potential siting locations.

5.2.2 Stormwater Management Concept Plan Components

At a minimum, the Stormwater Management Concept Plan shall contain the following elements:

- Summary/Cover Sheet;
    - A sheet index is required for all plan sets greater than two (2) sheets.
- Project Narrative;
- Illustrative drawings (existing and proposed conditions, concept design drawings and details, conceptual E&S controls);
- Preliminary calculations, supporting documents and studies; and,

- List of required permits and identification of preliminary waiver requests.

This chapter elaborates on the minimum information required for all preliminary subdivision Stormwater Management Concept Plans. Designers should reference Chapter 6 of the Virginia Stormwater Management Handbook for further guidance in preparing a Stormwater Concept Plan.

5.2.2.1 Summary/Cover Sheet

The summary section of the Stormwater Management Concept Plan is a one-sheet synopsis that contains essential project information to be included in the plan set. At a minimum, the following information shall be included on the summary sheet:

- A vicinity map including north-orienting arrow;
- Applicant name, legal address, and contact information;
- Graphic scale;
- Common address and legal description of the site;
- A sheet index;
- A summary table of all drainage outfalls and their contributing drainage areas, as well as the percentages of forest, disturbed soil, managed turf, and impervious cover proposed
- A summary table of all soil types found on the project site with all the information for each type as shown in Appendix 7 of this manual;
- Identification of the FEMA FIRM Panel Number(s) for the entire site;
- A statement as to whether any waiver requests apply or are being sought for the project and the nature of any such requests;
- A list of all other State and Federal permits expected to be required for the project; and,
- Schematic on which hydrologic and hydraulic analyses are based.

5.2.2.2 Narrative

This section of the Stormwater Management Concept Plan consists of a narrative used to describe and relate the other components of the plan to each other. The narrative, not the drawings, is the centerpiece of the plan. It should address the features shown in the illustrative drawings provided and give County reviewers a sense of the proposed project and potential impacts. The narrative must include the following, at a minimum:

- A description of existing land use and drainage patterns at the site, including natural drainage and any existing constructed drainage and/or stormwater management systems.
- A description of the existing site impervious areas and existing site runoff coefficients.
- A description of natural and manmade features at the site including wetlands, karst topography, watercourses, floodplains, and development (roads, buildings, and other structures).
- The number and a general description of conveyances at each point where shallow concentrated flow or channel flow crosses the project limits. Show these points in the illustrative drawing section of the plan.
- A description of existing hydraulic conditions of the conveyances downstream of each point identified above.
- A description of the proposed development and, in general, its impact upon the existing drainage as described above.
- A description of the impacts upon wetlands presented by the proposed project. Illustrate these impacts, as appropriate, in the illustrative drawing section of the plan.
- A description of potential stormwater impacts affecting storm water quality, peak flow, and groundwater recharge.
- A description of critical on-site and off-site resources that could potentially be impacted by stormwater runoff (i.e., RPA, steep slopes, etc.).
- A description of the impacts upon one hundred-year floodplain areas presented by the proposed project. These impacts should be presented in the illustrative drawing portion of the plan.
- A description of the on-site drainage and stormwater management practices proposed for the control of water quantity and quality. Source controls, ESD, runoff volume control practices, and stormwater treatment practices are all examples of practices requiring detailed descriptions. Locations of these practices should be shown in the illustrative drawing section of the plan.
- Initial design data and computations for all proposed stormwater control practices, in order to indicate that the proposed siting is likely to work (e.g., large enough area, great enough infiltration rate, etc.).
- A description of the total treatment volume required on site, the proposed calculated runoff reduction percentage, and the proposed calculated phosphorous reduction. Include a statement detailing if compliance was met based on an initial site analysis through the

VRRM. See Chapter 4 of this manual, and Chapter 12 of the Virginia Stormwater Management Handbook for guidance regarding Runoff Reduction compliance.

- If off-site facilities will be relied upon to provide all or part of the required control, provide a description of the facilities and demonstrate on the plan how they will meet the requirements. Provide a drawing in the illustrative section of the plan that shows the location of the off-site facility relative to the site and the conveyance features which transport runoff from the site to the facility. Provide data and computations to indicate the adequacy of these conveyance features to transport runoff from the site to the facility.
- A description of conveyances downstream of each outfall including an initial determination as to whether the conveyance will be adequate. Support this assessment in the calculations section of the plan.
- A discussion of any local, state, or federal permits necessary for the proposed development.
- For multi-phase projects, a preliminary schedule of facility construction indicating how stormwater management and drainage requirements will be met as each phase of construction is completed.
- A copy of any request for exception to stormwater management requirements being sought pursuant to Section 21.5-11 of the Stafford County Code. See the Section 3.8 of this manual for guidance regarding requests for exception.

5.2.2.3 Illustrative Drawings

Existing Conditions

This section of the Stormwater Management Concept Plan consists of one or more drawing(s) used to illustrate conditions at the site at the start of the project. Designers shall provide one or more drawing(s) of the site at a clearly legible scale (all text being at least 0.1 inch in height), that includes the following, as a minimum:

- The property lines of the proposed site. If the property lines do not describe the project limits, show the project limits. Indicate in the narrative the authority required to work outside the property limits.
- Boundaries of each soil type on the site. The scale of the soils map shall be the same as that used in the site plan or construction plan. Label each area with soil name, hydrologic soil group, and whether or not the soil is hydric. All soil types shown in the table of the summary section of the plan should be shown. (Soil borings may be required

where infiltration facilities are proposed. If so, show boring locations, as well.)

- The boundaries of existing predominant vegetation, such as the tree-line or heavy brush.
- Boundaries of natural feature protection and conservation areas such as wetlands, lakes, ponds, riparian stream buffers, and Chesapeake Bay Preservation Areas (CBPAs) located on the site.
- Boundaries of the one hundred-year floodplain as shown on the most current FEMA Flood Insurance Rate Maps (FIRMs) for Stafford County.
- Drawings extracted from the most current FEMA Flood Insurance Rate Maps for Stafford County with the project limits shown and with a reference to the map panel numbers.
- A statement as to whether a Floodplain Study may be required. Note: If grading is anticipated within the 100-year floodplain, or if construction is proposed which may significantly affect the location of the 100-year water surface elevation, a study will be required. (Reference Stafford County Zoning Ordinance 28-57 for additional information.)
- Site topography with contours at least every two feet in elevation. Contours must be clearly labeled. Electronic versions of the topography are generally available for sites in Stafford County from the Department of Information Technology, GIS division.
- All points where shallow concentrated flow or channel flow crosses the project limits. Number or letter these for cross-reference.
- Drainage areas to each point described above. Drainage area boundaries must indicate flow direction and must respect the underlying contours upon which they are drawn. Refer to each area using the number or letter (e.g., DA-1 for drainage area, or SB-1 for sub-basin) given to its point of analysis. Label the size of each area in acres. If the drainage areas delineated extend beyond the project boundaries, these off-site areas, and the underlying topography, must be shown.
- The location of existing roads, roadway easements, buildings, parking areas and impervious surfaces.
- The location of any existing utilities and easements (e.g., water supply wells, septic systems, water, sewer, gas and electric lines).
- **DO NOT SHOW ANY PROPOSED DEVELOPMENT** on drawings depicting existing conditions.

Proposed Conditions

This section of the Stormwater Management Concept Plan consists of one or more drawing(s) used to illustrate proposed conditions at the site after the project is completed. As with the Existing Conditions sheet requirements, all features of the drawing(s) shall be drawn at a legible scale with all text being at least 0.1 inch in height. That includes the following, as a minimum:

- The property lines of the proposed site as shown on drawings for existing conditions.
- The proposed limits of clearing and grading.
- The boundaries predominant vegetation, such as the tree-line or heavy brush.
- The boundaries of each soil type on the site as shown on drawings for existing conditions.
- Boundaries of wetlands and Chesapeake Bay Preservation Areas (CBPAs) found on the site, as shown on the drawings for existing conditions. Show changes in boundaries caused by proposed development using different, more prominent line weight, type, or shading.
- Site topography as shown on drawings for existing conditions. Show proposed changes to existing contours using a different, more prominent line weight and style. Proposed changes should honor natural drainage divides to the maximum extent practicable. Contours must be clearly labeled.
- All points where shallow concentrated flow or channel flow crosses the project limits. Label these with a number or letter for cross-reference. To honor natural drainage divides, these points should be the same as those for existing conditions to the maximum extent practicable.
- Drainage areas to each point described above. Drainage area boundaries must indicate flow direction and must respect the underlying contours upon which they are drawn. Refer to each area using the number or letter (e.g., DA-1 for drainage area, or SB-1 for sub-basin) given to its point of analysis. Label the size of each area in acres. If the drainage areas delineated extend beyond the project boundaries, these off-site areas, and the underlying topography, must be shown.
- Delineation of the location of the one hundred-year floodplain limits overlaid on a drawing of the site development.
- If private water or sewer systems are proposed, the location of proposed water supply wells and septic filter fields when infiltration facilities are proposed.

- Preliminary estimates of unified stormwater sizing criteria requirements.
- Identification and calculation of stormwater site design credits.
- Preliminary selection, location, layout, and size of proposed structural stormwater controls.
- Locations of pollution control sources.

5.3 Preliminary Computations

This section of the Stormwater Management Concept Plan consists of data and computations which support the drainage and stormwater management elements proposed. Computations showing a completed design are not required; however, those computations shown must be complete and in accordance with accepted engineering practices presented in the Design Manuals listed in Chapter 1. Designers must include a preliminary output of the Runoff Reduction Spreadsheet on the computation plan sheet(s). All spreadsheet inputs and outputs must match the data included on the narrative sheets and all corresponding plan view sheets.

For any ponds shown in the drawings, computations must show the anticipated performance (storage, discharges, etc.) requirements of the facility.

Chapter
6

6 Stormwater Management Design Plans

6.1 Introduction

A Stormwater Management Design Plan is a set of drawings and supporting documents provided in conjunction with the construction plan or final site plan. It comprises all of the information and specifications for the systems and structures to be used to convey and control stormwater runoff. It is complete, separate, and distinct from other elements of the construction plan and is intended only to depict a workable stormwater management design.

This chapter presents an overview of submission requirements for technical review and approval of Stormwater Management Design Plans. The Stormwater Management Design Manuals and other guidance documents listed in Chapter 1 of this manual should be consulted for details of these requirements. Designers must provide all information needed to support the stormwater management design. Design, calculation, and plan review checklists are provided in Appendix 8-A of the Virginia Stormwater Management Handbook. These checklists should be used for stormwater management design in Stafford County to ensure all necessary information is included on plan sets.

6.2 Stormwater Management Design Plan Requirements

6.2.1 Introduction

All Stormwater Management Design Plans must include, at a minimum, the information described in this section. Information must be shown clearly and unambiguously. Scale, line weight, line type, typeface size, shading, information crowding, and other such factors should be considered when preparing sheets. Information which is unclear, ambiguous, or overcrowded may be rejected as though it were not presented in the plan. Stormwater

Management Design Plan requirements are outlined in Chapter 6 of the Virginia Stormwater Management Handbook. The guidelines provided in the Handbook, along with the information provided in this chapter, should be used during the Stormwater Management Design Plan production and development.

6.3 Stormwater Management Design Plan Components

At a minimum, the Stormwater Management Design Plan shall contain the following elements:

- A copy of the approved Stormwater Management Concept Plan for the project (*Note: This pertains only to a Subdivision Construction Plan, not a Site Plan*);
- A Summary/Cover Sheet (including Project Description);
    - A sheet index is required on the Cover Sheet for all plan sets greater than two sheets.
- An overall site development plan;
- Drainage area map(s);
- Plan View(s) of proposed drainage and stormwater management;
- Profile and cross sectional view(s) of proposed drainage and stormwater management, with computations;
- Construction details for non-standard drainage structures and SWM facilities;
- An Erosion and Sediment (E&S) Control Plan complete with a Pollution Prevention (P2) Narrative;
- Operation and Maintenance (O&M) plans for all SWM facilities;
- Any applicable recommendations from the geotechnical study report;
- Evidence of Acquisition of Applicable Local and Non-local Permits; and,
- Refined and complete calculations

6.3.1 Summary Sheet

A summary sheet shall be provided and shall include, at a minimum, the following information:

- General information including the project title, location, owner, legal address, contact information, assessor's map and parcel number of the subject site, name of the plan preparer, date of drawing, legend, vicinity map, graphic scale and north arrow.
- A narrative description of the project and proposed design indicating how site drainage, storm water quality, and storm water quantity requirements are addressed in the stormwater management design. Highlight areas where the SWM Design Plan differs from the approved SWM Concept Plan.
- A tabulation of all land cover areas (impervious cover, managed turf, forest cover) in the contributing drainage area, and treatment volume requirements calculated using the Runoff Reduction Method (VRRM) spreadsheet. The spreadsheet must be provided to the County with the submission of the SWM Design Plans.
- A description of any areas of the SWM Design Plan which depart from the proposal shown in the approved SWM Concept plan.

6.3.2 Overall Development Plan

The overall development plan should be provided at a scale that contains the project extents on a single sheet. The property line of the development project must be included on the plan. If property lines do not accurately reflect the limits of the project, provide a line indicating those limits and documentation of authority to develop. Include a project schedule that includes a sequence of construction. If the sequence of construction is included in the E&S control narrative, reference it in this section of the plan.

6.3.3 Drainage Area Map

The Stormwater Management Design Plan must include a map showing onsite and offsite drainage areas at a scale of 1 inch equals 200 feet or larger. A smaller scale may be used when a large offsite area is involved. At a minimum, the following items are required:

- **Property Line of Development Project**. If for any reason, property lines do not accurately reflect the limits of the project, a line indicating those limits and documentation of authority to develop shall be provided. The property boundary shall depict the parcels, or portions thereof, of abutting land and roadways within one hundred (100) feet of the property boundary.
- **Existing Contours**. Show the existing contours of the site at one- or two-foot intervals. Contours must be clearly labeled.

- **Proposed Contours**. Show changes to the existing contours using different line weight and style. Contours must be clearly labeled.
- **Stormwater Outfalls**. Indicate the points along the property line or project limits where concentrated stormwater runoff leaves the site.
- **Land Uses**. Delineate existing and proposed land uses. Indicate the size of each area delineated in acres.
- **Soils**. Show the boundaries and soil mapping units of different soil types.
- **Site Cover Runoff Coefficients (Rv).** Indicate the site cover Runoff Coefficients used for each drainage area basin or sub-basin. Use the Rv coefficient data provided in Chapter 4 of this manual.
- **Treatment Volume (Tv)**. Indicate the treatment volume (in acre feet) calculated for each drainage area basin or sub-basin.
- **Drainage Areas**. Delineate the drainage areas to the stormwater outfalls as indicated above. Indicate the size of each drainage area in acres. Label drainage areas for cross-referencing computations.
- **Existing and Proposed Drainage**. Show stormwater outfalls and drainage areas for both existing and proposed conditions.
- **Drainage to Structures**. Delineate the drainage areas to all existing and proposed drainage structures and SWM facilities.
- **Structure Labels**. Provide structure numbers and labels for drainage system and stormwater management facility structures for cross-referencing computations.
- **Times of Concentration (Tc)**. Show time of concentration flow paths for both existing and proposed drainage areas. Identify sheet flow, shallow concentrated flow, and channel flow segments for each flow path to support the calculations.
- **North Arrow**. Provide an arrow indicating north and a graphic scale for each plan view included. If more than one plan view is shown on a single sheet of the plan set, include a north arrow and graphic scale for each.

6.3.4 Plan View Requirements

Designers should use the plan review checklists for all facilities listed in Appendix 8-A of the Virginia Stormwater Management Handbook. Stormwater management facilities must be illustrated in plan view showing, at a minimum, the following information pertaining to:

6.3.4.1 General Requirements

- The property line the of development project
- Name of adjacent property owner(s) and tax map parcel number(s)
- Existing and proposed contours at one- or two-foot contour intervals
- Floodplains, as shown on the most recent FEMA map
- The extent of wetlands
- Perennial and intermittent streams and other surface water features
- Proposed buffers and conservation easements
- Soils information with hydrologic soil groups identified
- Resource Protection Areas (RPA), environmentally sensitive areas and associated buffer and easements

6.3.4.2 Stormwater Conveyance Systems

- Structure numbers
- Existing and proposed storm drainage and access easements. Cite the deed book and page references
- Drainage pipes showing diameter, material, and flow direction arrows
- Proposed roads showing high and low points and throat elevations of inlets
- Grading and spot elevations at outflows, headwalls, and over storm sewer systems
- Path of overland relief
- House/building locations where critical to assess adequacy of drainage
- The one hundred-year headwater pool at proposed culverts and storm drainage structures, except driveway culverts
- The location of existing and proposed utilities
- Spot elevations showing the limits of the 100-year flood elevations resulting from blocked conditions
- Location(s) of required easement(s)

6.3.4.3 Wet Ponds

- Show the limits of clearing and grading, noting that they should be identified and protected by acceptable signage, silt fence, snow fence, or other comparable barrier.
- Show the topography, layout, and dimensions of basin features such as the permanent pool, sediment forebay, embankment, basin side slopes, basin bottom, etc.
- Show the location, topography, and dimensions of all emergency spillways and outlet channels of the design.
- Provide the outlet protection and outfall channel details.
- Indicate the location of soil borings made to support soils studies, as well as geotechnical recommendations and earthwork specifications.
- Show all locations of pre-treatment practices and conveyance system outfalls into the basin.
- Show dry and wet weather flow paths in extended detention basins and stormwater wetlands designed to eliminate short circuiting.
- Indicate the top of bank and basin bottom elevations.
- Show the location of all safety features (signage, fencing, handrails etc.).
- Indicate the elevations of the permanent pool, the treatment volume and the maximum design water surface elevations for all appropriate design storms and safety storms.
- Show sufficient maintenance access to all of the following, if applicable: Forebay, safety and aquatic benches, riser structure, embankment, emergency spillway, basin shoreline, drawdown device, principal spillway outlet, stilling basin, toe drains, and any sediment accumulation areas. Access roads must conform to the standards listed in the wet ponds design checklist, located in Chapter 8 of the Virginia Stormwater Management Handbook.
- Address and show the location of all facility safety measures presented in Section 3.7.2 of this manual.
- Show the location of required easements.

6.3.4.4 Extended Detention (ED) Ponds

- Show the limits of clearing and grading, noting that they should be identified and protected by acceptable signage, silt fence, snow fence, or other comparable barrier.
- Show the topography, layout, and dimensions of basin features such as the permanent pool, sediment forebay, embankment, basin side slopes, basin bottom, etc.
- Show the location, topography, and dimensions of all emergency spillways and outlet channels of the design.
- Show all locations of pre-treatment practices and conveyance system outfalls into the basin.
- Provide the outlet protection and outfall channel details.
- Indicate the location of soil borings made to support soils studies, as well as geotechnical recommendations and earthwork specifications.
- Delineate the normal pool, one-, two-, ten-, and one hundred-year pools in detention and retention basins. Also delineate the Water Quality elevation.
- Show the location of all safety features (signage, fencing, handrails etc.).
- For Extended Detention pond benches, show the location and designation of safety bench vs. aquatic bench. Designers must conform to the bench characteristics listed in the ED ponds design checklist, located in Chapter 8 of the Virginia Stormwater Management Handbook, as well as the Virginia BMP Clearinghouse Stormwater Design Specification for ED Ponds.
- Show the location of any micropools.
- Indicate the top of bank and basin bottom elevations.
- Show the location of dry and wet weather flow paths in extended detention basins and stormwater wetlands designed to eliminate short circuiting.
- Indicate the elevations of the permanent pool, the treatment volume and the maximum design water surface elevations for all appropriate design storms and safety storms.
- Show sufficient maintenance access to all of the following, if applicable: Forebay, safety and aquatic benches, riser structure, embankment, emergency spillway, basin shoreline, drawdown device, principal spillway outlet, stilling basin, toe drains, and any sediment

accumulation areas. Access roads must conform to the standards listed in the wet ponds design checklist, located in Chapter 8 of the Virginia Stormwater Management Handbook.

- Show the location of required easements.

6.3.4.5 Bioretention and Biofilter Facilities

- Provide the location, topography, and dimensions of the facility including the impoundment, layout, embankment(s), underdrains, and primary outlet structure elements. Topography shall be at no greater than 1-foot intervals; (6-inch contours are preferred), or provide a fully descriptive set of spot elevations.
- Show the limits of clearing and grading.
- Show the treatment volume and maximum water surface elevations for all appropriate design storms and safety storms.
- Show the location and topography of any emergency spillways, conveyance systems outfalls (inlets) into the facility, and outlet channel protection designed in accordance with the Virginia Erosion and Sediment Control Handbook.
- Indicate the location of soil borings made to support soils studies and geotechnical recommendations.
- Provide the location and type of plantings.
- Show the location of observation wells (if applicable).
- Show sufficient maintenance access to all components of the Bioretention facility.
- Show the location of required easements.

6.3.5 Profile and Section View Requirements

Designers should use the plan review checklists for all facilities listed in Appendix 8-A of the Virginia Stormwater Management Handbook. Stormwater management facilities must be illustrated in profile and section views showing, at a minimum, the following information pertaining to:

6.3.5.1 Stormwater Conveyance Systems

- Structure numbers
- Size, type, class, length, inverts and slope of pipes and/or structure

- Existing ground and proposed grade at channel centerline and both left and right banks
- Ten-year velocity and discharge, friction slope
- Ten- and one hundred-year water surface elevations at entrances and outfalls
- Outfall protection detail
- Utility crossings and inverts
- Typical cross section(s) for stormwater conveyance channels and storm drain outfalls
- Scale for all profile(s) shall be at a ratio of 1":10' (e.g., 1":10', 1":50', 1":100') horizontal, and 1":5' (e.g., 1":5', 1":10', 1":15') vertical.
- The horizontal scale must match the plan view scale
- Bottom width, height, existing ground side slope and type of stabilization
- Ten-year water surface elevation
- Ten-year hydraulic grade line

6.3.5.2 Stormwater Management Facilities

- Principal spillway profile and associated details
- Existing ground and proposed grade
- Indicate embankment type (homogenous vs. zoned)
- Dam side slopes
- Top width and length
- Core and cut-off trench
- Dam construction materials
- Bottom width, side slopes, depth
- Riser Structure (detail required) including materials, structure and orifice dimensions
- Trash rack (detail as required for construction)
- Anti-vortex (detail as required for construction)
- Structure footing detail
- Barrel including materials, bedding detail, location of phreatic line (for retention ponds), seepage control elements

- Outfall protection with section detail as required for construction showing rip-rap size, bottom width, side slope, filter cloth, etc.
- Top of dam elevations (including constructed height and settled height), crest of emergency spillway, crest of riser structure, and inverts of orifices and weirs
- Water quality, one-, two-, ten-, and one hundred-year pool elevations
- Show the elevations of the permanent pool, treatment volume and maximum design water surface elevations for all appropriate design storms and safety storms
- Barrel with inlet and outlet invert, size and slope
- Scale for profile(s) shall be at a ratio of 1":10' (i.e. 1":30', 1":40') , and 1"=5' for horizontal and vertical, respectively
- The horizontal scale must match the plan view scale

6.3.5.3 Bioretention and Biofilter Facilities

- Elevation of excavation bottom
- Elevations of all backfill materials including mulch layer
- Elevations of treatment volume and maximum design water surface elevations for all appropriate design storms and safety storms
- Underdrain pipe size, type, and perforation pattern
- Maximum ponding depth
- Show the facility rim elevations: Show both the constructed height and the settled height (allowing 10% for settlement)
- Weir and orifice invert elevations
- Weir length and width, and orifice diameter
- Observation/cleanout pipe
- Inlet details (curb cut, or other)

6.3.6 Construction Details

In addition to the information required in the plan and profile views, the following information must be provided:

- Design detail when not using standard structure.
- Geotechnical report prepared by a licensed geotechnical engineer including soil boring locations and logs

- Site preparation notes
- Sequence of construction (Use the BMP Clearinghouse Standards and Specifications for SWM facility installation and construction notes guidance)
- Dam construction notes
- Concrete construction notes
- Material and compaction specifications
- Rip-rap and slope protection notes
- Site stabilization notes
- Schedule of required inspections

6.3.7 Erosion and Sediment Control Plan

The Stormwater Management Design Plan must include a complete Erosion and Sediment Control Plan, in accordance with the requirements set forth in Chapter 6 of the Virginia Erosion and Sediment Control Handbook and Chapter 11 of the Stafford County Code. Information required elsewhere (soils information, for example) need not be duplicated in the Erosion and Sediment Control portion of the Stormwater Management Design Plan.

Erosion and sediment (E&S) control measures must be included on the plans with sufficient detail, in order to facilitate review of the design by Stafford County Plan reviewers. Sufficient detail is also required to ensure proper construction of all E&S measures. A narrative describing the sequencing/phasing of the construction and temporary stabilization measures must be included with the plans. A Pollution Prevention (P2) Control Narrative must also be included on the E&S Plan sheet. Plan preparers should utilize Chapter 7 of this manual, as well as Appendix 5 for guidance in determining the required P2 measure, components, and narrative language.

If temporary E&S Control facilities are to be converted into permanent SWM facilities, the plan preparer must include a description regarding how and when the conversion will be accomplished.

6.4 Maintenance Plans for Stormwater Management Facilities

Long term maintenance plans must be provided for all stormwater management facilities. These plans must be included in the Stormwater Management Design Plan. Sample maintenance plans can be found in Chapter 9, Appendix 9-C of the VA SWM Handbook. The sample plans

should serve as a starting point in preparing maintenance plans for the stormwater management facility types credited for use in Stafford County.

The following Operation and Maintenance elements shall be included in the Stormwater Management Design Plan, at a minimum:

- A BMP Maintenance Agreement(s) executed with the Stafford County
    - A sample copy of this agreement can be found in Appendix 8 of this manual.
- Detailed inspection and maintenance checklists, identifying requirements/tasks
- Inspection and maintenance schedules
- List of all parties legally and financially responsible for maintenance (name, address, and telephone number)
- As-Built plans of completed structures - (As-Built plan requirements are outlined in Chapter 8 of this manual)

As-Built plan preparers should view the maintenance plan as an "owner and operator manual" for the stormwater management design. Therefore, it should contain physical and functional descriptions of stormwater management features so the owner can identify the elements, appreciate their importance, and understand how they are intended to work.

6.5 Calculations

The calculation sheet(s) of the Stormwater Management Design Plan consists of data and computations that support the drainage and stormwater management elements of the design. Computations showing a completed design in accordance with accepted engineering practices given in the design manuals listed in Chapter 1 are required.

Computations must be provided which support all the hydrologic and hydraulic elements of the design. At a minimum, the following is required:

- A completed Virginia Runoff Reduction Method Spreadsheet for the development or redevelopment site.
- Hydrologic and hydraulic computations for storm drains.
- Hydraulic grade line computations for storm drain systems.
- Hydrologic, hydraulic, and water quality computations for stormwater management facilities.
- Design computations as required by design guidelines being followed, *e.g.,* buoyancy computations for riser structures, emergency spillway and conveyance channel computations, outfall analyses, etc.

6.5.1 Wet Pond and Extended Detention (ED) Pond Computations

For each pond shown in the drawings, computations must show the performance (storage, discharges, etc.) required of the facility. Computations must be provided to verify elevation-discharge-storage tables for stormwater management facilities.

Chapter
7

7 Pollution Prevention Plans

7.1 Introduction

As described in Section 1.2 of this manual, a Pollution Prevention Plan (P2 Plan) is one part a complete Stormwater Pollution Prevention Plan (SWPPP). A SWPPP is necessary for any construction project required[13] to obtain coverage under the Virginia Stormwater Management Program (VSMP) Construction General Permit[14] (State General Permit). P2 Plans are developed and implemented to address potential construction site pollutants not addressed through the Erosion and Sediment Control Plan ***during construction***.

Construction projects generate large amounts of construction-related waste and pollutants, which, if not properly managed, can pollute downstream waterbodies (i.e., rivers, streams, etc.) through stormwater runoff. It is imperative that construction site operators identify probable construction activities that could pollute stormwater and downstream waterbodies, and design, implement and maintain a P2 Plan containing Best Management Practices (BMPs[15]) that minimize and/or prevent the negative impacts cause by construction activities. P2 BMPs include strategies, procedures, training, and structural and non-structural facilities that typically revolve around good housekeeping measures.

Chapter 7 should be used by the Plan Preparer as guidance on the development and implementation of P2 Plans, as required by Stafford County. In addition to the requirements set forth in this Chapter, the construction site operator(s) are responsible for identifying and implementing any additional requirements presented in the State General Permit.

[13] Reference 9VAC25-870-10 for guidance and definition of "Large Construction Activities" and "Small Construction Activities"
[14] Reference 9VAC25-880-70 for permit requirements.
[15] Best Management Practices referenced throughout this Chapter relate to Pollution Prevent BMPs (i.e. Good Housekeeping BMPs). BMPs referenced throughout the rest of this manual are SWM facilities designed to address post-construction stormwater runoff.

7.2 P2 Plan Requirements

A P2 Plan should be designed to minimize stormwater pollution from identified construction activities, as well as control the discharge of pollutants from identified non-stormwater discharges. Section 21.5-7 (Pollution Prevention Plan; Contents of Plans) of the Stafford County Ordinance requires P2 Plans to be developed, implemented, and maintained up-to-date, as well as address any additional requirements identified in the State General Permit. Along with identifying the "pollutant generating activities", the P2 Plan must also identify the pollutants associated with each activity, and where all pollutant generating activities are expected to occur.

In developing a P2 Plan, plan preparers must select, design, implement and provide maintenance requirements for BMPs identified to control and minimize pollutant generating activities from reaching stormwater runoff. In regards to developing P2 Plans designers/plan preparers shall recognize that "minimize" means the reduction or elimination of pollutant discharge to the extent achievable, using stormwater controls technologically available and economically practicable.

A P2 Plan shall be submitted as a component of the Stormwater Management Design Plan (SWM Design Plan) and/or Early (Overlot) Grading Plan, where applicable, for residential or commercial development. A P2 Plan shall be submitted as a component of the individual lot grading plan where applicable for a single lot residence.

Stafford will review the P2 Plan for 'completeness of submission' only. Plan preparers should refer to the Stafford County P2 Plan Review Checklist (Appendix 5) when preparing the P2 Plan to ensure all information included on the checklist is also included on the plan. The County will not make a determination as to the overall effectiveness of the Plan, nor its compliance with the State General Permit. Like construction activity itself, the P2 Plan is dynamic. A dated copy of the plan submitted to the County must be kept as part of the SWPPP and made available to County Inspectors upon their request. The plan must be modified and updated in accordance with the State General Permit and Section 7.8 of this manual.

7.3 Contents of a P2 Plan

P2 Plans must include the information described in this section and be clear and unambiguous. A complete P2 Plan must include, at a minimum, the following information:

- A Summary Sheet;
- Identification and Description of Pollutant Generating Activities; and,

- P2 Planning Measures and BMP Selection

7.3.1 Summary Sheet

The Summary Sheet is a one-page synopsis that identifies the construction activity, its location, and key site personnel. At a minimum, the Summary Sheet shall include the following items:

- The name of the project;
- The project's street address, if known;
- The project's tax parcel number;
- The owner(s) name and contact information;
- The name, title, and contact information of the Qualified Personnel[16];
- When applicable, written authorization of any Duly Authorized Representative[17], including the following:
  - The name, title and signature of signee providing the authorization;
  - The date of signature; and,
  - The name, title, and contact information of the Duly Authorized Representative.
- The P2 Plan's preparer name and contact information; and,
- The preparation date of the P2 Plan.

7.3.2 Identification and Description of Pollutant Generating Activities

To effectively address a construction site's impact on stormwater pollution, as well as protect downstream waterbodies, the State General Permit requires that P2 Plans must identify all construction activities on site that have the potential to cause pollutant discharges and ultimately affect downstream waterbodies. For the purpose of inclusion in the P2 Plan, and as referenced in the State General Permit, these activities shall be deemed as "pollutant

[16] "Qualified Personnel" is defined by the State General Permit as a person identified by the owner who is capable of conducting site inspections for all plans incorporated under the SWPPP (E&SC Plan, SWM Design Plan, and PPP). As such, the identified Qualified Personnel will in all likelihood also be the person responsible for insuring the implementation and maintenance of PPP BMPs.

[17] A "Duly Authorized Representative" which is defined by the State General Permit as an appointee that acts as the owner/site operator's representative on-site. A Duly Authorized Representative is authorized to make changes and modifications to the SWPPP, including the PPP. To be considered a Duly Authorized Representative, written authorization must be given to the person(s) or the person(s) position and must be included in the SWPPP.

generating activities." The P2 Plan preparer must address these potential pollutant generating activities that may reasonably be expected to affect the quality of stormwater discharges from the construction activity, including any support activity. For each Pollutant Generating Activity, the plan preparer must include:

The State General Permit requires that the P2 Plan identify and addresses potential pollutant generating activities that may reasonably be expected to affect the quality of stormwater discharges from the construction activity, including any support activity. The P2 Plan must:

- Identify the potential pollutant generating activities, and the pollutant that is expected to be exposed to stormwater (See Section 7.3.2.1);
- Describe the location where the potential pollutant generating activities will occur, or if identified on the site plan, reference the site plan (See Section 7.3.2.2);
- Identify all non-stormwater discharges, as identified in the State General Permit, that are or will be commingled with stormwater discharges from the construction activity, including any applicable support activity (See Section 7.3.2.3);

7.3.2.1 Identifying Pollutant Generating Activities

Land disturbance as part of site preparation is the primary pollutant generating activity found on construction sites. Land disturbing activities loosen large amounts of sediment across construction sites, which then is picked up by stormwater and carried into storm drainage systems and downstream waterbodies. The impact of land disturbing activities in regards to stormwater pollution shall be addressed through the development and implementation of a County-approved Erosion and Sediment Control Plan, as required by Stafford County Ordinance, Chapter 11. As such, land disturbing activities are not required to be addressed as part of a P2 Plan.

Other construction activities besides land disturbance contribute to stormwater pollution and shall be addressed through the P2 Plan. Nutrients, heavy metals, organic compounds, pesticides, oil and grease, bacteria, viruses, trash, debris, and toxic chemicals are pollutants that can be washed away by stormwater runoff and ultimately discharged into receiving streams and waterbodies. In developing the P2 Plan, plan preparers should utilize Table 3 below as a plan development aide. Table 3 contains a list of common pollutant generating activities on a construction site, as well as the accompanying pollutants associated with each activity. Plan preparers should note that Table 3 is not a comprehensive list of all site pollutant generating activities, and it is the responsibility of the plan preparer to

identify all probable pollutant generating activities and associated pollutants for each specific project.

Table 3: Common Pollutant Generating Activities and Associated Pollutants[2]

Pollutant Generating Activities	Associated Pollutants								
	Sediment	Nutrients	Heavy Metals	pH (Acids & Bases)	Pesticides & Herbicides	Oil & Grease	Bacteria & Viruses	Trash, Debris & Solids	Toxic Chemicals
Solid waste (trash and debris)								●	●
Demolition and debris disposal	●							●	
Drilling and blasting operations	●			●				●	
Sanitary/septic waste		●		●			●		●
Hazardous waste			●	●	●	●			●
Material delivery and storage	●	●	●	●	●	●		●	●
Material use during building process		●	●	●	●	●		●	●
Contaminated spills		●	●	●	●	●			●
Vehicle/equipment fueling and maintenance						●			●
Vehicle/equipment use and storage						●			●
Concrete washout and waste			●	●				●	
Structure construction/painting/cleaning		●		●				●	●
Paving and grinding operations	●							●	
Landscaping operations	●	●						●	
Dewatering operations	●	●					●		

[2]EPA-R33-06-004. May 2007. "Developing Your Stormwater Pollution Prevention Plan."

7.3.2.2 Narrative Description of the Pollutant Generating Activity

The State General Permit requires that P2 Plans must include descriptions of each pollutant generating activity. The description must identify the pollutants associated with the each activity as well as the location(s) where the pollutant generating activity may occur during the construction project. Plan preparers should reference specific project plan sheets if the pollutant generating activities are identified in such sheets.

7.3.2.3 Identification of Non-Stormwater Discharges

Certain pollutant generating activities create waste streams and discharges which, if disposed of via the storm drain system, would be considered non-stormwater discharges. As part of the P2 Plan, all potential non-stormwater discharges must be identified. The State General Permit categorizes non-stormwater discharges into the following three groups:

1. Prohibited Discharges

Discharges from certain pollutant generating activities are prohibited from entry into storm drainage systems, streams, rivers or other waterbodies. Plan preparers must account for this requirement in the P2 Plan by the proper selection and implementation of BMPs. Prohibited discharges are:

- Wash water from the clean-up of concrete equipment and mixers;
- Wash water from the clean-up of stucco, paint, form release oils, curing compounds, and other construction materials;
- Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;
- Sanitary wastewater and sewage;
- Soaps or solvents used in vehicle and equipment washing; and,
- Hazardous materials and wastes.

The discharge of these prohibited materials is a violation of the Stafford County Ordinance, as well as the State General Permit.

2. Allowable Discharges if Settled or Filtered Prior to Discharge

Discharges from certain pollutant generating activities are allowed to be discharged into the storm drainage systems provided pollutants are allowed to settle or filter out prior to disposal into the storm drain system. Plan preparers must account for this requirement in the P2 Plan by the proper selection and implementation of BMPs. Allowable discharges that are required to settle or must be filtered prior to discharge are:

- Rinse water that is used to wash vehicles or equipment provided that soaps, solvents, or detergents were not used;
- Water used to control dust;
- Water used for routine external washing of buildings provided that soaps, detergents or detergents were not used;

- Water used to wash pavement provided any toxic or hazardous spills or leaks have been removed and where soaps, solvents or detergents have not been used in the wash; and,
- Water discharged as a result of the dewatering of trenches and excavations.

3. Allowable Discharges, if Identified

Discharges from certain pollutant generating activities are deemed to not significantly pollute downstream waterbodies, and are allowed to be discharged into the storm drainage system. These discharges can be released via storm drainage systems provided they are released in a manner that prevents them from becoming polluted. Plan preparers must identify the following discharges in the P2 Plan prior to their discharge:

- Fire hydrant flushings;
- Potable water sources, including uncontaminated waterline flushings;
- Uncontaminated air conditioning or compressor condensate;
- Uncontaminated groundwater or spring water;
- Foundation or footing drains where flows are not contaminated with process materials such as solvents; and,
- Landscape irrigations.

It is the responsibility of the Plan Preparer to identify all potential non-stormwater discharges in the P2 Plan, and subsequently determine if any restrictions have been placed on the discharge into the storm drain system. The P2 Plan must be updated in accordance with Section 7.8 of this Chapter if any additional non-stormwater discharges are identified once construction begins. Table 4 illustrates an acceptable format that can be used by plan preparers to identify non-stormwater discharges.

Table 4. Example P2 Plan table format identifying pollutant generating activities and non-stormwater discharges during construction.

Pollutant Generating Activity	Pollutant	Description of Non-Stormwater Discharge	Location
Vehicle/equipment fueling	Fuel and other hydrocarbons	Discharge of fuel could result from leaking storage tanks, the overfill of fuel tanks and improper fueling procedures.	Dedicated fueling area illustrated on Design Sheet # - General Site Plan
Waste water from washout of concrete from equipment and mixers	Concrete wastewater	Discharge of concrete wastewater could be discharged from the rinsing of concrete mixer chutes and other equipment.	Dedicated concrete washout area illustrated on Design Sheet # - General Site Plan
Waste water from clean-up of paint brushes, containers and other equipment	Paint, contaminated water	Discharge of paint and contaminated water could result from failure to utilize proper BMPs.	Variable locations
Routine external building wash down	Solids, Sediment	The building will be washed down with a power washer once the exposed earth has been stabilized.	Around entire building upon completion
Trash and debris accumulation	Trash and debris	Trash and debris may be found anywhere on site. Trash and debris is the result of staff not providing good housekeeping.	Site-wide
Landscape irrigation	Sediment and nutrients	Landscape irrigation will be utilized to insure sod survival after it is placed down.	Areas of turf illustrated on Design Sheet # - Landscape Plan

7.3.3 P2 Planning and BMP Selection

The State General Permit requires that a P2 Plan must include a description of the selected P2 BMPs implemented during the construction project. Plan preparers shall reference specific project plans sheets if the BMP(s) are identified in such sheets. Furthermore, all proposed BMPs should include a

description stating how they will address the following items, when applicable:

- Prevent and respond to leaks, spills and other releases;
- Prevent spills and leaks of fuels and chemicals from vehicle fueling and maintenance activities;
- Prevent soaps, solvents, detergents, and wash water discharges from construction materials, including the clean-up of stucco, paint, form release oils, and curing compounds;
- Minimize of pollutant discharges from vehicle and equipment washing, wheel wash water, and other types of washing;
- Contain concrete wash water into leak-proof containers or leak-proof settling basins;
- Prevent fuel, oil, other petroleum products, hazardous or toxic wastes, and sanitary waste discharges; and,
- Prevent and minimize any other discharges from potential pollutant-generating activities not addressed above.

Plan preparers must select BMPs specifically designed to minimize or prevent the discharge of each identified pollutant generating activity. Unlike most other design plans, P2 Plans often employ good housekeeping procedures that may not require engineered designs. However, if an engineered design is necessary, one must be included as part of the BMP, and meet all acceptable design standards and specifications. At a minimum, plan preparers must include the following for each proposed BMP:

- The name of the BMP(s) selected;
- The pollutant generating activity that the BMP will address (it is possible that there will be more than one BMP selected to address an individual pollutant generating activity);
- A description of the BMP that includes its implementation and maintenance requirements;
- If necessary, the design standards and specifications; and;
- The person(s) responsible for ensuring proper implementation, maintenance and upkeep of the specific BMP (reference can be made to the Qualified Personnel when that person is the responsible person).

7.3.3.1 BMP Selection

When selecting BMPs that prevent or minimize the potential impact of a pollutant generating activity, plan preparers should consider the following

types of questions as guidance in choosing the most optimal good housekeeping measure:

- What part of the pollutant generating activity generates the pollutants?
- What types of pollutants are generated and how are they generated?
- Are any potential non-stormwater discharges associated with this activity? If so, what are the requirements for their discharge?
- What BMPs best control these pollutants?
- Are specific designs required to ensure that these BMPs are constructed and maintained properly?
- What are the maintenance requirements are for the BMPs selected?

7.3.3.2 Commonly Used P2 BMPs

The following section identifies some on the most commonly employed BMPs designed to minimize and/or prohibit the impact of specific pollutant generating activities. Plan preparers can use the information provided to develop the requisite sections of the P2 Plan, and, if applicable, include the following BMP specific information regarding:

(BMP 1) - Building, Pavement and Vehicle Wash Down

Required Note: Wash water from Building, Pavement and Vehicle wash down must not contain soaps, detergents, solvents or hazardous waste and any pollutants must be filtered or allowed to settle out prior to discharge.

If applicable, Plan Preparers can:

- Designate vehicle and equipment wash down areas on-site that are away from drainage facilities and watercourses.
- Minimize the volume of water used during dust control and wash down activities.
- Provide signage in wash down areas prohibiting the use of soaps, solvents or detergents.
- Implement construction entrance wash down areas, to ensure sediment laden water is carried away from the entrance to an approved settling area. For further guidance refer to Standard and Specifications (STD & SPEC 3.02) of the Virginia Erosion and Sediment Control Handbook (VESCH), current edition.
- Employ a sediment control practice such as a sediment trap or basin, to allow for pollutant settling, as well as complete all maintenance requirements as described in the Standards and Specifications identified

in the VESCH. Refer to the VESCH for assistance selecting an appropriate dewatering device.

(BMP 2) - Concrete washout

Required Note: Concrete washout is prohibited from discharge into the storm drainage system.

If applicable, Plan Preparers can:

- Designate concrete truck washout areas. Concrete truck washout areas should be clearly identified and located on-site in areas that are conveniently located away from drainage facilities and watercourses.
- Provide signage directing concrete haulers to the identified wash down areas.
- Direct concrete wash water that must be directed into leak-proof containers or leak-proof settling basins, designed so that overflows will not occur due to inadequate sizing or precipitation. Design specifications must be included with the BMPs if leak-proof containers will be constructed on-site.
- Note that if a Concrete washout is needed, Design Standards and Specifications for the washout area (i.e., chute washout box, vinyl washout container, metal washout container, etc.) ***must be included as part of the BMP***. For additional information, utilize the EPA Stormwater Best Management Practice Concrete Washout detail located at http://www.epa.gov/npdes/pubs/concretewashout.pdf.
- Direct that concrete waste water should be allowed to evaporate and let the concrete harden. If evaporation of the waste water is not possible, contract with a service companies to provide dewatering services. Liquid concrete wastes must be removed and not discharged into the storm drainage system or downstream waterbodies.
- Direct that hardened concrete wastes should be removed and disposed of in dumpster or recycled.

(BMP 3) - Dewatering Activities

Required Note: Water being discharged as a result of dewatering activities must be filtered or allowed to settle out prior to discharge.

If applicable, Plan Preparers can:

- Select proper dewatering structure(s) from the list of approved structure standards and specifications. The structures may vary depending on site-specific features such as soils, topography, anticipated discharge

quantities, and discharge location. Dewatering may involve the use of BMPs in sequence.

- Pump sediment laden water through properly selected, installed, and maintained controls.
- Direct dewatering activities to be conducted away from drainage facilities and watercourses.
- Direct that used dewatering bags must be properly disposed of, as well as sediment must be removed from the dewatering BMPs.
- Instruct that if sediment control practices, such as sediment traps or basins are proposed, all maintenance requirements described in their respective standards and specifications must be completed.
- Use a velocity dissipation device when discharging utility flushing water to non-paved to minimize scour potential at the discharge point.
- Use the VESCH Standards and Specification (STD & SPEC 3.26) for further guidance regarding dewatering activity standards and specifications.

(BMP 4) - Dust Control Activities

Required Note: Runoff from Dust Control Activities must be filtered or allowed to settle out prior to discharge.

If applicable, Plan Preparers can:

- Use Standard and Specifications (STD & SPEC 3.39) in the Virginia Erosion and Sediment Control Handbook for guidance regarding Dust Control Activities.
- Instruct that the volume of water used for dust control should be minimized to prevent runoff.
- Instruct that dust suppression should not be conducted when wet weather is expected.

(BMP 5) - Equipment/Vehicle Fueling

If applicable, Plan Preparers can:

- Direct equipment/vehicle fueling to be performed at an off-site facility, particularly for vehicles and equipment that regularly enter and leave the construction site (e.g., trucks and vans). For grading and excavating equipment, this may not possible or desirable.
- Create an on-site fueling area that is clean and dry and equipped with a spill kit.

- Direct that, if possible, vehicle fueling should be conducted in a covered area.
- Direct that if a covered vehicle fueling area is not possible, vehicle fueling should be conducted on a level grade. A berm, dike, or temporary diversion structure should be constructed around the area to prevent stormwater run-on and runoff from leaving the fueling area.
- Instruct that spills on pavement should be cleaned with absorbent, and any contaminated soil should be cleaned and waste disposed of properly.
- Direct that fuel tanks should be placed in a bermed temporary containment facility.
- State that fuel nozzles should be equipped with an automatic shut-off to control drips.
- Instruct that fueling operations should not be unattended.
- Instruct that fuel tanks should not be topped off.
- Fuel tanks should be secured during non-working hours.

(BMP 6) - Equipment/Vehicle Maintenance

If applicable, Plan Preparers can:

- Direct that on-site vehicles and equipment should be inspected daily for leaks, equipment damage, and other service problems.
- Instruct that vehicles and equipment should be repaired immediately, or removed from the project site. Direct that drip pans or absorbent materials are to be placed under parked vehicles and equipment spills on pavement should be cleaned with absorbent.
- Direct that vehicle/equipment preventative or routine maintenance be performed at an off-site facility, particularly for vehicles and equipment that regularly enter and leave the construction site (e.g., trucks, vans). For grading and excavating equipment this may not possible.
- Direct that significant maintenance on vehicles and equipment should be conducted off-site.
- Create an on-site maintenance area that is clean and dry and equipped with a spill kit.
- Instruct that if a covered vehicle maintenance area is not possible, vehicle fueling and maintenance activities should be conducted on a level grade. A berm, dike, or temporary diversion structure should be constructed around the area to prevent stormwater run-on and runoff from leaving the fueling area.

- For maintenance involving fluids, instruct that drip pans or absorbent pads must be placed under vehicles unless the work is being done in a dedicated maintenance area that is constructed over an impermeable surface.
- Direct that used materials (e.g., used oil filters and batteries) be placed in a temporary containment facility, and regular pickups should be scheduled to dispose of these materials.

(BMP 7) - General Site Planning

If applicable, Plan Preparers can:

- Locate pollutant generating activities, such as material storage, dumpsters, portable toilets, fueling operations and equipment maintenance areas, away from drainage facilities and watercourses to minimize the potential for polluting stormwater runoff and preventing accidental release.
- Identify/mark the locations of designated BMPs via signage or other applicable method to notify employees and subcontractors of the proper locations that certain activities are to occur.
- Designate a foreman or supervisor to oversee and enforce specific BMPs and conduct policing of the site daily.
- Ensure that adequate cleanup and containment materials are available onsite.

(BMP 8) - Hazardous Wastes

If applicable, Plan Preparers can:

- Instruct the minimization of hazardous waste generation on the job-site.
- Develop and implement employee and subcontractor education for hazardous and toxic waste handling, storage, disposal, and cleanup.
- Direct the collection, storage, and disposal of hazardous wastes using practices that prevent contact with stormwater.
- Designate hazardous waste-collection areas on-site and ensure that hazardous waste collection containers are conveniently located.
- Instruct that all hazardous and toxic material wastes be placed in secondary containment and handled in compliance with all local, state and federal requirements.

- Direct that marks should clearly be made on all hazardous waste containers labeling which materials are acceptable for the container.
- State that potentially hazardous waste materials should not accumulate.

(BMP 9) - Material Handling and Storage

If applicable, Plan Preparers can:

- Instruct that paint and other chemicals should be mixed indoors or in a containment area.
- Direct that all excess paint be collected. Paint cans, brushes, rags, absorbent materials, and rags, when thoroughly dry, should also be disposed of with other construction debris.
- State that soaps and detergents should only be used as recommended, and their use should be limited on the site.
- Designate that new and used petroleum products for vehicles and equipment should be stored in covered areas with berms or dikes in place to contain any spills.

(BMP 10) - Paving and Grinding Operations

If applicable, Plan Preparers can:

- Instruct the removal and disposal of grindings and wastes as work progresses. Note that the grindings and wastes should be placed away from drainage facilities and watercourses and covered with plastic until they are removed from the site. State that these wastes should be removed from the site immediately.
- State that equipment should be cleaned offsite whenever possible. Note that when paving equipment is kept onsite, paving equipment should be placed on bermed plastic sheeting to capture drips or leaks.
- Direct that wastes such as asphalt pieces, Portland cement concrete grindings and other paving and grinding operation wastes be swept, vacuumed and collected to prevent entry into storm drains and / or waterbodies.
- Direct that seal coat, tack coat, slurry seal, or fog seal should not be applied if rain is predicted during the application or curing period.
- State that during application of seal coats, tack coats, slurry seals, or fog seals, drainage inlets and manhole covers should be covered with filter fabrics. Instruct that these materials should not be applied in the rain.

- Instruct that streets should be swept when practical and washing should be minimized. Direct that if washing is necessary, inlets and receiving waters should be protected during operations in order to prevent grinding and saw cutting operation water residue from entering drainage ways.

(BMP 11) - Pesticide, Herbicide, and Fertilizer Application

If applicable, Plan Preparers can:

- Instruct that soil should be prepared for planting in accordance to soil analysis, Nutrient Management Plan direction, or in accordance with manufacturer's recommendations.
- Ensure that persons applying pesticides and herbicides are certified in accordance with 2VAC5-685.
- State that materials shouldn't be handled any more than necessary.
- Indicate that pesticides, herbicides, and fertilizers be stored in a dry, covered area.
- Direct that equipment and absorbent materials be available in storage areas to contain and clean up any spills that occur.
- State that pesticide, herbicide, and fertilizer application should not be applied when precipitation is in the weather forecast.
- Direct that pesticides, herbicides, or fertilizers should not be over sprayed onto impervious surfaces.
- Instruct inspection of newly landscaped areas for landscaping trash and debris.
- Instruct inspection of irrigated areas on the construction site for excessive watering. Direct the watering schedule and times should be adjusted, and sprinklers should be turned off when they are no longer necessary to maintain vegetation.

(BMP 12) - Sanitary and Septic Wastes

Required Note: Sanitary wastes are prohibited from discharge into the storm drainage system.

If applicable, Plan Preparers should:

- Ensure that any temporary facility plumbed to the sanitary sewer is properly connected to prevent illicit discharges.

- Ensure that sanitary/septic facilities are maintained in good working order, and that wastes are transported offsite by a licensed service.
- Provide secondary containment pans under portable toilets, where possible.
- Provide tie-downs or stake downs for portable toilets in areas of high winds or heavy vandalism.

(BMP 13) - Trash and Debris and Solid Waste

If applicable, Plan Preparers can:

- Instruct that waste materials should not be allowed to accumulate on the ground.
- Direct that litter and debris should be collected from the construction site daily.
- Designate trash and bulk waste-collection areas on-site, and ensure that the waste collection areas are conveniently located. Indicate that these facility locations should be clearly identified or marked.
- Prohibit littering by workers and visitors.
- State that debris and trash be kept under cover, either in a closed dumpster or other enclosed trash container that limits contact with rain and runoff, and prevents light materials from blowing out.
- Ensure trash and debris is disposed of properly (i.e., construction debris landfill or sanitary landfill).

(BMP 14) - Washout/Clean-Up Measures

Required Note: Contaminated wash water is prohibited from discharge into the storm drainage system.

If applicable, Plan Preparers can:

- Direct that adequate containment be provided for the amount of wash water that will be used.
- Instruct that prefabricated washout containers be rented or bought. Alternatively, it can be directed that washout areas can be constructed either by digging a pit and lining it with plastic sheeting, or creating an aboveground structure from straw bales or sandbags with a plastic liner.
- Direct that wash water should be allowed to evaporate or be disposed of into the sanitary sewer in accordance with local regulations.

Examples of P2 Plan BMP descriptions and presentation layouts can be found in Appendix 6 of this manual.

7.4 Staff Awareness

In addition to implementation, maintenance, and upkeep of P2 BMPs, Plan preparers must describe procedures that provide construction personnel with P2 awareness for all applicable wastes (including wash water), disposal practices, and applicable disposal locations of such wastes. In order to address P2 awareness with onsite construction staff, the following notes must be included in the SWM Design Plan, located on the Erosion and Sediment Control Plan Sheet or General Notes and Details Plan Sheet:

P2 Plan Notes:

- Discharges from the following pollutant generating activities are prohibited from entry into the storm drainage system and streams, river or other waterbody:
  - Waters and wastes from rinsing or cleaning of concrete equipment or mixers;
  - Wash water containing soap, detergents or solvents;
  - Wastes and waters from such clean-up from pollutant generating activities such as painting or the application of stucco or plaster;
  - Sanitary sewage; and,
  - Hazardous Wastes.
- Spills and accidental releases must be contained and cleaned up immediately.
- All trash and debris must be disposed of properly.
- The discharge from all dewatering activities must be settled or filtered prior to entry into the storm drainage system or waterbody.
- Questions regarding Pollution, or to report a spill or accidental release, contact the Qualified Personnel responsible for Spill Prevention, Response and Reporting, as identified in Section 7.5 of this manual.

7.5 Spill Prevention, Response and Reporting

P2 Plans must include a BMP or series of BMPs that address prevention and control of spills and accidental releases so that materials do not enter into the storm drainage system and the impact downstream waterbodies. The P2 Plan must detail strategies and methods designed to prevent or minimize

pollutant discharges from chemical spills and leaks, as well as implement corresponding prevention and response procedures. Spill prevention BMPs may rely on the implementation of other plans such as Spill Prevention, Control and Countermeasure (SPCC) plans which are required under the Oil Pollution Act (33 U.S.C. 40). If such a plan is relied upon, the plan preparer must provide the name and date of the referenced plan, as well as keep the referenced plan on-site for review if requested by a Program Administrator. If any other plan is referenced, the contents of such plan become enforceable under the County Ordinance.

In addition to referencing other plans, BMPs implemented as part of SPCC Plan procedures must incorporate all requirements regarding hazardous materials and wastes. It is the responsibility of the plan preparer to identify and incorporate all additional requirements.

Plan preparers should implement BMPs ensuring that in the instance of spills or accidental releases, the following entities are notified:

- The proper on-site employee, such as the Qualified Personnel. This contact should be notified as soon as the spill or accidental release occurs;
- Stafford County must be notified if the spill or accidental release reaches any storm drainage system or a waterbody. Releases or spills that require emergency response shall be reported to 911. On-site spills and releases that do not require emergency response shall be recorded in the P2 Plan and reported to the site inspector;
- The State of Virginia, if the spill or accidental release meets the conditions found in the State General Permit Section III.G.; and,
- Emergency Services by dialing 911.

7.6 Referenced Plans

In order to minimize a duplicative effort, P2 Plans are allowed to reference other plans that are designed to minimize pollutant impacts from specific pollutant generating activities. Examples of common referenced plans include the following:

- Approved Erosion and Sediment Control Plans detailing dewatering activities;
- SPCC Plans detailing spill prevention and response;
- Nutrient Management Plans detailing fertilizer application rates; and
- Plans containing secondary containment designs that are necessary to meet State Fire Codes.

If plan preparers reference any other plan within the P2 Plan, the plan name and effective date of the other plan must be referenced. All plans referenced in the P2 Plan shall become enforceable under the P2 Plan. As such, all referenced plans must be retained on-site, must be the most current version, and should be available to the Program Administrator at their request.

7.7 Inspections

Inspections are required in order to ensure that P2 Plans are implemented and updated in such a manner as to minimize downstream impacts from pollutant generating activities. Inspections must ensure that BMPs identified in the plan are being properly and effectively implemented. Inspections are also required to identify and account for any additional pollutant generating activities.

7.7.1 P2 Plan Inspections

Qualified Personnel must conduct site inspections in the manner and schedule identified in the State General Permit. Unless special conditions apply (i.e., discharges to exceptional waters or impaired waters for which Total Maximum Daily Load (TMDL) wasteload allocation has been established and approved), these inspections must follow the following protocol:

- Inspections must be completed at least every five (5) business days; or,
- Inspections must be completed at least once every ten (10) business days, and no later than 48 hours following a measurable storm event producing 0.25 inches of rain or great over a 24 hour period.[18].

The Qualified Personnel is responsible for maintaining a written report or log containing inspection dates, times, and comments concerning verbal communications relating to the project throughout the entire course of construction. Record of inspections must be maintained and made available for review by the Program Administrator at their request. Inspection records may be included as part of an overall SWPPP log, or other tracking mechanism; however, the P2 Plan must clearly identify both the name of the document and the location within the document where the information is located. At a minimum each inspection must include all required items identified in the State General Permit.

[18] In the event that a measurable storm event occurs when there are more than 48 hours between business days, the inspection shall be conducted no later than the next business day.

7.7.2 County Inspections

The County will conduct routine inspections pertaining to the P2 Plan. At a minimum, the County will inspect construction activities requiring P2 Plans for the follow:

- The presence of an updated and maintained P2 Plan;
- Evidence of prohibited discharges;
- Pollutant generating activities not included in the P2 Plan;
- Proper operation and maintenance of BMPs;

Record of required inspections; and,

Implementation of any corrective actions necessary as identified though inspection and required by the State General Permit.

7.8 P2 Plan Maintenance and Updates

The P2 Plan must be updated no later than seven (7) days following any modification to its implementation. A log of all modifications must be maintained and include:

- The date of modification(s);
- A description of the modification(s);
- Documentation that BMPs were modified as a result of inspection or other information;
- If the modification(s) are the result of a prohibited discharge:
    - The date of the prohibited discharge;
    - The discharge volume relates;
    - The actions taken to minimize the impact of the release;
    - The measures taken to prevent its reoccurrence;
- The signature and date of the Duly Authorized Representative

Chapter
8

8 Construction Inspections and As-Built Plans

8.1 Inspections

Construction inspections are required to ensure that stormwater management facilities and stormwater drainage systems are constructed in accordance with the approved design plan. It is critical that these inspections be scheduled to allow for inspection of subsurface components that will be impossible to visually inspect after backfilling. The developer is responsible for maintaining a written report or log containing dates, times of inspections, and comments concerning verbal communications relating to the project throughout the course of construction.

8.2 Pre-Construction Conference

A pre-construction conference is required prior to any land disturbance on a new project in the County. Required attendees for the conference consist of County Inspection Staff, an agent of the Stafford County Department of Public Works, the developer/applicant/owner, the contractor, the design engineer(s), and the soils engineer.

A line of communication should be established between the County and all parties involved, and from this, a pre-construction meeting shall be scheduled. The meeting attendees must be prepared to provide all required materials, as well as ask and/or answer all questions related to the following:

- Pertinent permit and code requirements (review permit package, posting of permits);
- Review and discuss the requirements of the Stormwater Pollution Prevention Plan (Accessibility for Review by the Public);
- Review and discussion of the installation, inspection and final approval of the approved designed Storm Sewer/SWM Infrastructure (Pipe Type, County Inspection, Video Inspection, Geo-Technical Inspection, As-Built Plans, Certifications);

- Phasing of the land disturbance and the installation of required Erosion and Sediment controls prior to any land disturbing activity;
- Critical site areas are to be identified and discussed as to the need for special attention and/or extra controls added during construction activities.
- Maintenance requirements for all proposed Erosion and Sediment Controls, such as:
    - Seeding requirements and deadlines,
    - The process of making changes to the approved design plans,
    - Maintenance responsibility,
    - Inspection and enforcement procedures,
    - Requesting controls in addition to those not shown on the approved design plans,
    - Final grading and permanent stabilization,
    - Removal of the Erosion control devices.
- Review and discussion of the Pollution Prevention (P2) Plan requirements, including the following:
    - The various types of Pollutant Generating Construction Activities,
    - Implementing and maintaining various methods of preventing/minimizing pollution to downstream water bodies,
    - Identifying the responsible construction operator and reviewing the responsibilities included in the record keeping,
    - Requirements for modification of the P2 Plan, as shown in Section 7.8 of this manual.

8.3 Construction Inspections

Construction inspections shall be performed by qualified personnel during the construction of all SWM facilities and stormwater drainage systems. Documentation shall be provided to ensure these facilities are constructed in accordance with the approved design plans and specifications.

The owner and contractor are responsible for ensuring that all required inspections are performed by qualified personnel during construction and for obtaining the required professional certifications upon the completion of construction.

8.4 County Inspections

County Inspections must be scheduled in order to allow inspectors to perform visual inspections on all subsurface components prior to backfilling. The contractor shall notify the County Department of Public Works Environmental Inspections Division at least twenty-four (24) hours in advance of starting work on the following items as they shall be visually inspected prior to placement/backfilling.

It should be noted that periodic spot inspections will be performed by Stafford County Inspection staff during the construction process, as well as a final inspection at project completion.

At a minimum, the County will inspect the features listed for the following facilities:

8.4.1 Stormwater Conveyance Channels

- The type of channel (e.g., grassed, concrete etc.)
- Location of the channel
- Size and geometry (e.g., trapezoidal, rectangular, etc.)
- Alignment and elevations
- Installation of proper E&S controls

8.4.2 Storm Sewer

8.4.2.1 Trench

- Location per plan
- Widths
- Elevations per plan

8.4.2.2 Bedding

- Size
- Thickness (depth)
- Material

8.4.2.3 Pipes

- Material Type (RCP/CMP/HDPE/PVC)
- Class
- Size
- Location, Alignment and Elevation
- Joint Material
- Proper compaction of backfill material
- Outlet protection

8.4.2.4 Storm Sewer Structures

- Type
- Location and elevation
- Bedding Material (type and amount)
- Joints sealed (grouted)
- Invert channel installed
- Proper compaction of backfill
- Installation of proper E&S controls

8.4.2.5 Wet Ponds / Extended Detention Dry Ponds

- Type (Extended Detention or Wet Pond)
- Dam/Berm location and elevation
- Emergency Spillway location, material, and elevation
- Riser Structure size, material, and elevation
- Principle spillway pipe size, material, and elevations
- Aquatic/Safety bench slopes
- Adequate outfall protection
- Inflow locations

8.4.2.6 Other SWM facilities

- SWM facility type

- Location and layout of the facility
- Materials
- Size of the facility (dimensions and elevations)
- Plantings
- Maintenance Access

8.4.2.7 Monitoring of the Geo-Technician to Ensure Proper Testing and Inspections

- Copies of the daily inspection log
- Copies of the test reports
- Copies of pictures showing the various construction phases/items being installed and inspected

8.5 Geotechnical Inspections

Geotechnical inspections shall be performed under the direction of a licensed geotechnical engineer during the construction of stormwater management facilities and stormwater drainage systems. Compliance with the requirements of the approved design plans and specifications entails the following items:

- Completion of excavations
- Construction of embankments
- Installation of concrete cradles
- Installation of bedding
- Installation of underlayment fabric
- Installation of each layer of backfill

Further geotechnical specifications are listed in the subsequent sections.

8.5.1 Wet Pond / Extended Detention Dry Ponds Geotechnical Requirements

No fill may be placed in a core (cutoff, key) trench until the geotechnical engineer has inspected the trench and approved the location, shape and depth of the trench. Trenches shall normally be installed under the centerline of the dam. The exception is where the trench is to be placed under the upstream toe of the dam and tied in with a clay lining. Variations from the approved design plan shall be discussed with the Administrator

before any variation is implemented and may require submission of a revised design plan.

The geotechnical engineer shall inspect all fill placed in the core trench and in the dam. The geotechnical engineer shall ensure that no objectionable materials are placed in the trench or in the dam. In zoned dams, the geotechnical engineer shall ensure that the gradation of adjacent zones is in accordance with criteria set forth in most recent edition of *Design of Small Dams*[19]. The geotechnical engineer shall ensure that fill materials under the barrel and the riser are compacted in accordance with the design plan.

The geotechnical engineer shall ensure use of proper compaction methods for all materials placed in the trench and in the dam.

The geotechnical engineer will also inspect special features such as toe and blanket drain. Sand and gravel used in drains shall be encapsulated in filter fabric; such encapsulation and the type of fabric will be verified by the geotechnical engineer. The VDOT number or size and gradation of drainage materials and compaction by a vibratory compactor will also be verified.

8.5.2 Geotechnical Inspection Reports

8.5.2.1 Wet Pond / Extended Detention Dry Ponds

After completion of the required inspections and associated tests and analyses, a report shall be prepared by a licensed geotechnical engineer for all retention basins. A report shall be prepared for all extended detention basins with greater than five feet dam height. A written report is not required for small structures; however, the inspections shall still be performed in accordance with this chapter. If the report indicates that changes to design are needed, it shall be submitted for review at such time along with a revised design plan. Otherwise, the report shall be submitted with the As-Built plans. Each report shall include:

- Core trench depths and types of materials encountered. The description shall include the classification under the Universal Soil Classification System (USCS) in addition to a geologic description.
- Description of fill materials used, including USCS classes and presence of mica schist. The report shall verify that no objectionable materials (including organic OH and OL soil materials, topsoil, organic matter, stones larger than six inches, frozen soil) were placed in the dam or in the core trench. The report shall verify that fill material under the pond barrel and the riser was compacted to at

[19] Design of Small Dams is a Water Resources technical publication developed by the United States Department of the Interior, Bureau of Reclamation.

least 95%. The report shall verify the compaction of the remainder of the fill, including percentage of compaction and methods used to obtain the compaction.

- The report shall include details of special features such as toe/blanket drains, filter materials, etc.

8.5.2.2 Other SWM facilities

If geotechnical inspections were required based on the soils investigation, an appropriate geotechnical inspection report shall be prepared and submitted by a licensed geotechnical engineer.

8.5.3 County Inspections

The contractor must notify the Administrator at least 24 hours in advance of starting work on each of the following:

8.5.3.1 Stormwater Conveyance Channels

- Completion of excavation
- Construction of check dams (vegetated swales)
- Final stabilization

8.5.3.2 Storm Sewers and Culverts

- At beginning of excavation
- During pipe laying and backfill
- Placement of concrete structures
- Prior to finalization; structure must be cleaned

8.5.3.3 Wet Ponds / Extended Detention Dry Ponds

- Core trench fully excavated and no fill in place
- Core trench backfill
- Bedding and installation of barrel
- Installation of toe drains, etc.
- Pouring of concrete for riser base

- Construction of embankment
- Final stabilization

8.5.3.4 Underground Detention Systems

- Installation and backfill of pipe
- Placement of concrete
- Prior to finalization

8.5.3.5 Bioretention, Biofilter, and Infiltration Facilities

- Completion of excavation
- Construction of embankment (infiltration basin)
- Placement of concrete
- Installation of filter fabric
- Placement of each layer of backfill
- Installation of final cover and plantings
- Final stabilization

8.5.3.6 Porous Pavement Facilities

- Completion of sub-grade section
- Placement of aggregate base course
- Placement of the aggregate filter course
- Placement of porous asphalt concrete surface course to ensure laying temperatures and compaction

Periodic inspections of the stormwater management system throughout construction will be conducted by County staff at the discretion of the Administrator. However, the developer shall be responsible for performing the required inspections in accordance with Sections 8.3 through 8.5 of this manual, and providing professional certification of the construction in accordance with Section 8.7.

8.6 As-Built Requirements

An As-Built plan is required for all stormwater management structures (drainage systems, stormwater management facilities, filters, and infiltration facilities). As-Built plans must be submitted to the County within sixty (60) days after completion of the structure, and/or prior to security reductions. As-Built plans must be approved by the Administrator prior to the release of the security.

As-Built plans must provide at a minimum all of the information required in the Virginia Stormwater Management Handbook and Appendix 9 of this manual. As-Built plans shall include a copy of the approved construction plans with the as-built elevations and dimensions boxed in. Design elevations and dimensions must not be changed, unless approved by the Administrator. For significant deviations from approved plans, formal plan revisions may be required.

If a structure is built differently from the Stormwater Management Design Plan (see acceptable construction requirements on checklist), the Administrator must be contacted to determine whether the variation is acceptable, or modifications to the structure will be required. The designer must provide complete hydrologic and hydraulic computations utilizing the as-built data to verify that the structure functions as intended.

8.6.1 Storm Sewer and Stormwater Management As-Built Plan Submission Requirements

The following items address the minimum requirements for As-Built Plan submission review and approval:

- Two (2) copies of the original approved design plans with the As-Built information boxed in adjacent to the design information.
- Inclusion of the location, length, size, percent grade, elevations, and type of pipe(s), as well as the elevations and locations for the storm sewer structures. These need to be included on both the plan and profiles sheets.
- A long term maintenance plan included with As-Built information, for all BMPs.
- Tables, charts, and photos are preferred with the submission, and are beneficial during the review process.
- A geotechnical inspection summary letter from a licensed geotechnical engineer that summarizes inspections performed, and verifies that the storm sewer or stormwater management infrastructure was

constructed in accordance with the requirements of the approved design plans and specifications.

- A signed and dated certification statement located on the As-Built Plan's Cover Sheet, by a professional licensed in Virginia to perform such work. See Section 8.7 of this manual for a valid certification statement.

Once the As-Built Plan has been reviewed and approved, a CD containing PDF formats of every sheet solely pertaining to the storm sewer/stormwater management infrastructure is required for future reference purposes.

8.6.2 As-Built Data Requirements

The As-Built Plan submission requires professional certification of the construction in accordance with Section 8.7 of this manual. At a minimum, the following data regarding all SWM facilities and drainage system outfall(s) should be included in tabular format on the plan (A sample format can be found in Appendix 9, Section 11.9.8 of this manual):

8.6.2.1 General Information

- The watershed terminus to which the outfall drains
- The Hydrologic Unit Code (HUC) of said watershed
- The reach ID
    - Name(s) of any impaired waters
- The latitude and longitude
- Location
    - Street Address
    - Tax Parcel Number
- The drainage area (in acres)

8.6.2.2 SWM Specific Information

- SWM facility type
- Area treated by the SWM facility (in acres)
    - Total
    - Pervious (excluding forest)
    - Impervious

  - Forested
- Presence of a current maintenance agreement
- Land record number where the maintenance agreement has been recorded, if applicable

8.6.2.3 Outfall Specific Information

- Outfall type (e.g., manmade, natural channel etc.)
- Outfall outlet type (pipe with end-section, wing-wall etc.)
- Outfall material (RCP, CMP etc.)
- Shape
- Diameter

8.7 Certification

Each As-Built plan must provide a certification statement by a professional licensed in Virginia to perform such work. The required certification statement is as follows:

> I (submitting professional's name) certify that, to the best of my knowledge, this As-Built plan represents the actual condition of the structure(s) and conforms to the approved design plan except as shown and that all aspects of the structure(s) were constructed in accordance with the approved design plans and the Stormwater Management Design Manuals.

The County may accept separate certifications for various aspects of the project provided that the certifications, when combined, cover all As-Built information and site construction.

Chapter
9

9 Maintenance

9.1 Introduction

Stormwater management facilities are critical components of Stafford County's stormwater management infrastructure. All stormwater management facilities must be properly maintained in order to perform as expected. This chapter will assist plan preparers in documenting the operation, inspection, and maintenance requirements for stormwater management systems, in terms property owners and/or owner's representatives can understand and carry out.

9.2 Maintenance Program

Stafford County's maintenance program consists of inspections driven by both County responsibilities and Property owner(s) responsibilities.

9.2.1 Maintenance Inspections (County Responsibilities)

Stafford County will perform maintenance inspections of a SWM facility in accordance with local and state regulations, and in accordance with the Stafford County Stormwater Inspection and Maintenance Program. The County shall notify the property owner(s) and/or owner's representative, in writing, of an impending maintenance inspection. Once the maintenance inspection is completed, the County shall notify, in writing, the results of the maintenance inspection to the property owner(s) and/or owners representative.

If maintenance is required for a SWM facility, the owner(s) and/or owner's representative shall complete the required maintenance within a specified time period set by the County. If the responsible party fails to perform the required maintenance, the County shall have the authority to perform the maintenance, and recover costs associated with the maintenance.

9.2.2 Maintenance Inspections (Property Owner's Responsibilities)

If not specified per Section 9.3 of this manual (Maintenance Agreements), the property owner's representative shall perform inspections of a SWM facility within twenty-four (24) hours after each rainfall of one (1) inch or more. The property owner(s) and/or representative shall keep written records of maintenance inspections, as well as any maintenance performed, and said records must be accessible to the County upon request. The property owner(s) and/or owner's representative must provide, to the County, a right of ingress/egress to the stormwater management facility to ensure proper inspection and maintenance is being performed.

9.3 Maintenance Agreements

All SWM facilities shall be entered into a maintenance agreement between the property owner(s) and the Board Supervisors. The maintenance agreement shall be executed and recorded with the Clerk of Circuit Court prior to the Stormwater Management Design Plan approval. Responsibility for the operation and maintenance of the stormwater management facility and stormwater drainage system, unless assumed by the County, shall remain with the property owner(s) and/or owner(s) representative. All maintenance activities shall be in accordance with the standard maintenance practices for stormwater facilities outlined in Chapter 9 of the Virginia Stormwater Management Handbook. Refer to the Stafford County Stormwater Ordinance, Section 21.5-12, for further guidance on long term maintenance requirements in the County.

A copy of a sample maintenance agreement can be found in Appendix 8 of this manual.

9.4 Maintenance Plans

A long term maintenance plan must be prepared for all SWM facilities in accordance with all local and state requirements. The plan must describe the facility, and list all components of the facility that require inspection and maintenance. The maintenance plan should be described in a manner that is understood by the owner(s) and/or owner's representative.

The maintenance plan must be prepared in conjunction with the SWM Design Plan. A copy of the plan must be attached to the maintenance agreement. The maintenance plan shall be prepared in accordance with Chapter 9 of the Virginia Stormwater Management Handbook.

The maintenance plan must specify an inspection schedule in accordance with the Operation and Maintenance (O&M) inspection checklists that

provided in the Appendix 9-C of the Virginia Stormwater Management Handbook. If applicable, the maintenance plan must specify that any modifications to the structure and related components must be approved by the Administrator before such a task is undertaken.

9.5 SWM Facility Maintenance

SWM facilities shall require legal information and instruments to ensure that they are properly maintained. These may include easements, maintenance agreements, and homeowners' association (HOA) covenants depending on the type of development. A long term maintenance agreement between the landowner and the Board Supervisors must be executed and recorded with the Clerk of Circuit Court prior to approval of the Stormwater Management Design Plan. For SWM facilities located on individual residential building lots, an additional legal document(s) is usually necessary to fully define the HOA's and homeowner's maintenance responsibilities and obligations. For example, the homeowner may be responsible for maintenance of an SWM facility that captures runoff from the rooftop and driveway with HOA's role limited to oversight and enforcement of the maintenance plan. The particular arrangements between the HOA and lot owner shall be defined in the homeowners' association covenants. For SWM facilities that are designed to capture runoff from the road (a common area) and other off-lot runoff, the HOA may be solely responsible for all maintenance and upkeep of the facility. This type of arrangement also needs to be clearly defined through legal documents. The developer's attorney will typically prepare HOA covenants. The County may request review of covenants to ensure that adequate arrangements are in place to ensure long-term performance and maintenance of SWM facilities.

Where SWM designs are incorporated on individual lots and homeowners will be primarily responsible for their maintenance, the maintenance plan must incorporate a means to ensure that homeowners:

- Are made aware of their responsibilities for maintaining the SWM facility, including the requirement that modification of the facility not be made without the permission of the County,
- Are provided materials adequately explaining the purpose, design, inspection, and maintenance aspects of the facility located on their lot,
- Perform or provide for required inspection and maintenance of their SWM facility,
- Are directed on where to procure sample maintenance plans/guidance for SWM facilities (Chapter 9 of the Virginia Stormwater Management Handbook

Chapter
10

10 Easements

10.1 Stormwater Drainage Systems

Within all land development projects, stormwater drainage easements must be provided for all improved stormwater drainage systems (except roof leader connectors twelve (12) inches in diameter or less). Storm drainage easements must be provided for existing or improved swales and channels receiving runoff from more than two lots.

Stormwater drainage easements must be extended to upstream property lines to permit future development to have reasonable access for connections to on-site drainage ways or drainage systems.

Stormwater drainage easements must be shown on the record plat and on the Stormwater Management Design Plan. New storm drainage easements shown on lot grading plans must be properly recorded prior to building permit issuance.

Adequate access easements must be provided to any storm drainage easement. Adequate access easements must accommodate all vehicles that are necessary for the maintenance and/or repair of storm drainage and SWM structures. Width, slope, and surface (compacted soil, gravel, paving, etc.) should be considered and addressed when determining an adequate access easement. Furthermore, accesses shall not cross landscape islands.

10.2 Easement Width Requirements

Appendix 10 of this manual provides guidance regarding Easement Width Requirements for both Open Systems and Storm Sewer Systems. Designers should utilize the subsequent sections of this Chapter, coupled with Appendix 10, when determining easement requirements for SWM facilities.

10.2.1 Open Systems

Open system easements must be in accordance with the requirements set forth in Table 4. The top width for open channels shall be of a width that conveys the 10-year discharge, plus the width required to accommodate one (1) foot of freeboard.

Table 4: Easement widths for Open Systems

Top Width of Channel (ft)	Minimum Easement Width (ft)
Less than 2	15
2 – 5	20
5 -10	25
Greater than 10	15 ft greater than top width of channel

A minimum of ten (10) feet of the above easement must be on one side of the channel.

10.2.2 Storm Sewers

Storm sewer easements must be in accordance with the requirements set forth in Table 5.

Table 5: Easement widths for Storm Sewers

Diameter of Pipe (in)	Minimum Easement Width (ft)
15 - 18	15
21 -33	20
36 - 48	25
54 - 72	30

All storm sewer pipes must be located in the middle one-third of the easement.

Beginning at ten (10) feet in depth, an additional five (5) feet of easement must be required for each five (5) foot increment of additional depth.

For dual pipes each less than or equal to sixty (60) inches in diameter, the easement width must be increased by five (5) feet. For dual pipes each greater than sixty (60) inches in diameter, the easement width must be increased by ten (10) feet.

Storm drainage easement for inlets shall encompass 10-year ponding elevation.

10.2.3 Stormwater Management Facilities

Storm drainage easements must be provided for all stormwater management facilities located within any land development project.

Storm drainage easements must be shown on the record plat and on the Stormwater Management Design Plan.

Easements for conventional retention, detention and infiltration basins must encompass pond area, embankment and outlet structures. The easement must be located a minimum of twenty-five (25) feet horizontal distance outside of the one hundred-year pool area.

Easements for bioretention facilities must encompass pond area and outlet structures.

Easements for underground storage facilities are required. The Administrator must determine easement size for pipes larger than seventy-two (72) inches and for underground storage chambers.

A minimum 12-foot-wide access road with a maximum grade of 15% and accompanying access easement should be provided to allow vehicular access to both the outlet structure area and at least one side of the basin. The road's surface material should be selected to support the anticipated frequency of use and the anticipated vehicular load without excessive erosion or damage.[20] Refer to Appendix 11 for further guidance.

10.2.4 Access Easements

Access to stormwater management facilities and best management practices from public routes must be provided. These must be within access easements with minimum width of ten (10) feet. See Appendix 11 for further guidance.

[20] As a minimum, 4 inches of aggregate 21A shall be used.

Chapter
11

11 Appendices

11.1 Appendix 1 – Glossary of Terms

INTRODUCTION

The following glossary contains terms and definitions referenced in the Stafford County Stormwater Management Design Manual. For purposes of this document, the glossary has been limited to include only select terms used to clearly define the Stafford county Design process. Comprehensive glossaries are provided in the Virginia Department of Environmental Quality's Stormwater Management Handbook, the Virginia Stormwater Management Act and Regulations (9VAC25-870-10), Stafford County's Stormwater Management Ordinance and the Virginia Stormwater BMP Clearinghouse.

Key:

Terms shown in italics (e.g., ***Adequate channel***) are Virginia legal or regulatory definitions.

DEFINITIONS OF TERMS AND ACRONYMS

	A
Administrator	The VSMP authority including the County Administrator or his designee(s) responsible for administering the VSMP on behalf of the County
Applicant (in the context of stormwater management)	Any person submitting an application for a permit or requesting issuance of a permit under Virginia Code [§10.1-603.1 et seq.]
	B
Best management practice or **BMP**	Schedules of activities, prohibitions of practices, including both structural or nonstructural practices, maintenance procedures, and other management practices to prevent or reduce the pollution of surface waters and groundwater systems from the impacts of land-disturbing activities. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. (also see Stormwater control measure and Stormwater treatment practice.)
	C
Certification	The process whereby the [State Water Control] Board, on behalf of the Commonwealth, issues a certificate to persons who have completed Board-approved training programs and met any additional eligibility requirements of 9VAC25-850-50 related to the specified classifications (9VAC25-850-40) within the areas of ESC or SWM, or in other ways demonstrated adequate knowledge and experience in accordance with the eligibility requirements of 9VAC25-850-50 in the specified classifications within the areas of ESC or SWM.

Clean Water Act or CWA	The federal Clean Water Act (33 U.S.C. §1251 et seq.), formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500, as amended by Public Law 95-217, Public Law 95-576, Public Law 96-483, and Public Law 97-117, or any subsequent revisions thereto.
Comprehensive stormwater management plan	A plan, which may be integrated with other land use plans or regulations, that specifies how the water quality components, quantity components, or both of stormwater are to be managed on the basis of an entire watershed of portion thereof. The plan may also provide for the remediation of erosion, flooding, and water quality and quantity problems caused by prior development.
	D
DEQ	The Virginia Department of Environmental Quality.
Director	The Director of the Department of Environmental Quality or his designee.
Developer	A person who undertakes land disturbance activities or the refurbishment of existing properties.
Development (in the context of stormwater management)	Land disturbance and the resulting landform associated with the construction of residential, commercial, industrial, institutional, recreation, transportation, or utility facilities, or structures, or the clearing of land for nonagricultural or non-silvicultural purposes.
	E
Environmental Site Design or **ESD**	Using small-scale stormwater management practices, non-structural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development.
Erosion and Sediment Control Plan[or **E&S Control Plan** or **ESC Plan**]	A document containing material for the conservation of soil and water resources of a unit or group of units of land. It may include appropriate maps, an appropriate soil and water plan inventory and management information with the needed interpretations, and a record of decisions contributing to conservation treatment. The plan shall contain all major conservation decisions to ensure that the entire unit or units of land will be so treated to achieve the conservation objective.
Exception	A waiver or one or more stipulated provisions of the applicable regulations, as granted by the regulatory authority, allowing the applicant to proceed with the regulated activity without having to fully comply with the applicable requirements.
	G
General permit	The "General Permit for Discharges of Stormwater from Construction Activities" found at 9VAC25-880-70 authorizing a category of discharges under the CWA and the Act within Virginia.

	L
Land disturbance or ***land-disturbing activity*** (in the context of stormwater)	A manmade change to the land surface that potentially changes its runoff characteristics including clearing, grading, or excavation except that the term shall not include those exemptions specified in Virginia Code §10.1-603.8.
	M
Maintenance agreement	A legally recorded document that acts as a deed restriction, and which provides for long-term maintenance of stormwater management practices.
Manufactured treatment device or **MTD**	A fabricated BMP used to remove pollutants from stormwater runoff. MTD designs may involve proprietary components or processes. MTDs may not be installed in Virginia for the treatment of stormwater runoff quality control credit unless they are approved by the Director in accordance with Section 1 of [9VAC25-870 et seq.] and the VTAP process, and are listed for permitted use on the [Virginia Stormwater BMP Clearinghouse] website. (also see Proprietary treatment device)
Municipal separate storm sewer system or **MS4**	All separate storm sewers that are defined as "large" or "medium" or "small" municipal separate storm sewer systems or designated under 9VAC25-870-380 A 1.
	N
National Pollutant Discharge Elimination System or ***NPDES***	The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements under §§307, 402, 318, and 405 of the CWA. The term includes an approved program.
New development	The construction of new impervious surface and activities defined as development on a tract or tracts of land where no impervious surface or development previously existed.
Non-proprietary BMP	Any stormwater BMP used to remediate stormwater that was developed in the public domain; is not patented, and for which design specifications are publicly available; and installation of which is not limited by licensing or royal considerations.
Overland flow	Water that travels over the ground surface to a point of concentration where turbulent flow occurs; also called surface runoff.
Overland Relief	Drainage and grading design, assuming that all storm inlets are non-functional, which provides a flow path for stormwater such that no structure will be flooded.

	P
Permit or **VSMP authority permit**	An approval to conduct a land-disturbing activity issued by the VSMP authority for the initiation of a land-disturbing activity after evidence of state VSMP general permit coverage has been provided where applicable.
Permittee	The person to which the state permit or VSMP authority permit is issued, including any owner or operator whose construction site is covered under a state construction general permit.
Plan approving authority (in the context of stormwater management)	The [State Water Control] Board, the program authority, or a department of a program authority responsible for determining the adequacy of a submitted stormwater management plan, a conservation plan or other document(s) submitted for land disturbing activities on a unit or units of land and for approving plans, stipulating the methods of compliance with regulatory requirements.
Plan reviewer	Anyone who is responsible for determining the accuracy of ESC plans and supporting documents or SWM plans and supporting documents for approval by a VESCP authority or a VSMP authority as may be applicable in the areas of ESC or SWM.
***Pollutant removal* (PR)**	The reduction by a SWM facility of one or more pollutants including, but not limited to, phosphorus, sediment, or nitrogen in stormwater. Data collected on pollutant removal, efficiency is utilized to establish the pollutant removal credit for TP, TSS, or TN, or other pollutants.
Pollutant removal credit	The percent reduction in the load or EMC of a pollutant as runoff flows into and out of a BMP or MTD, also referred to as the pollutant removal efficiency.
Post-construction stormwater management	A term used to distinguish stormwater practices used during site construction (otherwise known as "construction stormwater management" or "erosion and sediment control") from those that are used to achieve permanent control of stormwater runoff once construction is complete. "Construction stormwater management" is minimum measure #4 in the Phase II MS4 permit program, and "post-construction stormwater management" is minimum measure.

	Q
Qualified Personnel	A person knowledgeable in the principles and practices of erosion and sediment and stormwater management controls who possesses the skills to assess conditions at the construction site for the operator that could impact stormwater quality and quantity and to assess the effectiveness of any sediment and erosion control measures or stormwater management facilities selected to control the quality and quantity of stormwater discharges from the construction activity. For VSMP authorities this requires the use of a person who holds a certificate of competency from the board in the area of project inspection for ESC and project inspection for SWM or combined administrator for ESC and combined administrator for SWM as defined in 9VAC25-850-10 or a combination of ESC and SWM qualifications from these two areas.
	R
Redevelopment	Any reconstruction, alteration, improvement or replacement of existing development.
Regulations	The Virginia Stormwater Management Program (VSMP) Permit Regulations, 9VAC25-870-10 et seq., as amended.
Retrofit	The introduction of a new or improved stormwater control measure where it either never existed or where the existing stormwater control measure did not operate adequately to meet the stormwater management requirements of the site.
Runoff coefficient	The fraction of total rainfall that will appear at a conveyance as runoff.
Virginia Runoff Reduction Method (VRRM)	The total annual runoff volume reduced through canopy interception, soil infiltration, evaporation, transpiration, rainfall harvesting, engineered infiltration, or extended filtration, also the spreadsheet calculation method used to compute, determine and demonstrate compliance with the water quality requirements in the Virginia Stormwater Management Regulations (9VAC25-870 et seq.)
	S
State application or ***application***	The standard form or forms, including any additions, revisions, or modifications to the forms, approved by the administrator and the [State Water Control] Board for applying for a state permit.

State permit	An approval to conduct a land-disturbing activity issued by the [State Water Control] Board in the form of a state stormwater individual permit or coverage issued under a state general permit, or an approval issued by the Board for stormwater discharges from the MS4. Under these state permits, the Commonwealth imposes and enforces requirements pursuant to the federal Clean Water Act and regulations, the [Stormwater Management] Act and the [Virginia Stormwater Management] Regulations. State permit does not include any state permit that has not been the subject of final Board action, such as a draft state permit or a proposed state permit.
Stormwater management	(1) The recognition of adverse drainage resulting from altered runoff and the solutions resulting from the cooperative efforts of public agencies and the private sector to mitigate, abate, or reverse those adverse results; (2) the control, regulation, or treatment of stormwater runoff, especially relating to the effects of land.
Stormwater management facility	A control measure that controls stormwater runoff and changes the characteristics of that runoff including, but not limited to, the quantity and quality, the period of release or the velocity of flow.
Stormwater concept plan	A preliminary plan set demonstrating the stormwater management system(s) for the proposed development.
Stormwater design plan	A detailed plan set outlining the stormwater management system(s) for the proposed development, including all computations and specifications. The stormwater design plan is submitted in conjunction with the construction plan or final site plan.
SWM	Stormwater management.
SWM Act	The Virginia Stormwater Management Act, Virginia Code Article 2.3 (§ 62.1-44.15:24et seq.) of Chapter 3.1 of Title 62.1.
	T
Total removal or **TR**	The pollutant mass load reduction, which is the product of both runoff volume reduction (RR) and pollutant concentration reduction (PR).
Treatment Volume or T_V	The volume of rainfall or stormwater runoff that is required by the Virginia Stormwater Management Regulations (9VAC25-870-65 Virginia Runoff Reduction Method) to be treated by one or more BMPs. In Virginia, this amount is based on a rainfall depth of 1-inch (generally, the 90th percentile rainstorm).
	V
VDOT	The Virginia Department of Transportation.

Virginia Erosion and Sediment Control Program or ***VESCP***	A program approved by the [State Water Control] Board that has been established by a VESCP authority for the effective control of soil erosion, sediment deposition, and nonagricultural runoff associated with a land-disturbing activity to prevent the unreasonable degradation of properties, stream channels, waters, and other natural resources, and shall include such items where applicable, as local ordinances, rules, permit requirements, annual standards and specifications, policies and guidelines, technical materials, and requirements for plan review, inspection, enforcement where authorized in the ESC Act and its attendant [ESC and ESC Certification] regulations, and evaluation consistent with the requirements of the ESC Act and its attendant [ESC and ESC Certification] regulations.
Virginia Erosion and Sediment Control Program authority or ***VESCP authority***	An authority approved by the [State Water Control] Board to operate a Virginia Erosion and Sediment Control Program. An authority may include a state entity, including the Department; a federal entity; a district, county, city, or town; or for linear projects subject to annual standards and specifications, electric, natural gas, and telephone utility companies, interstate or intrastate natural gas pipeline companies, railroad companies, or authorities created pursuant to Virginia Code §15.2-5102.
VESCH	The Virginia Erosion and Sediment Control Handbook, latest edition.
Virginia Pollutant Discharge Elimination System (VPDES) permit or ***VPDES permit***	A document issued by the State Water control Board pursuant to the State Water Control Law authorizing, under prescribed conditions, the potential or actual discharge of pollutants from a point source to surface waters and the use or disposal of sewage sludge.
Virginia Stormwater BMP Clearinghouse website	A website that contains detailed design standards and specifications for control measures that may be used in Virginia to comply with requirements of the Virginia Stormwater Management Act, and associated regulations, and that is jointly created by the department and the Virginia Resource Research Center, subject to advice from a permanent stakeholder advisory committee.
Virginia Stormwater Management Handbook	A collection of pertinent information that provides general guidance for compliance with the [Virginia Stormwater Management] Act and associated regulations and is developed by the department with advice from a stakeholder advisory committee

Virginia Stormwater Management authority or ***VSMP authority***	An authority approved by the [State Water Control] Board after September 13, 2011, to operate a Virginia Stormwater Management Program or, until such approval is given the Department. An authority may include a locality; state entity, including the Department; federal entity; or for linear projects subject to annual standards and specifications in accordance with Virginia Code subsection B of §62.1-44.15:31, electric, natural gas and telephone utility companies, interstate and intrastate natural gas pipeline companies, railroad companies, or authorities created pursuant to Virginia Code §15.2-5102. Prior to approval, the Board must find that the ordinances adopted by the locality's VSMP authority are consistent with the Act and the [Virginia Stormwater Management Regulations] including the General Permit for Discharges of Stormwater from Construction Activities [Part XIV 99VAC25-880-1 et seq.) of the [Virginia Stormwater Management Regulations].
VSMP application or ***application***	The standard form or forms, including any additions, revisions or modifications to the forms, approved by the administrator and the [State Water Control] Board for applying for a VSMP permit.
	Z
Zoning or **zoning ordinance**	An ordinance based on the police power of government to protect the public health, safety, and general welfare of the population. It may regulate the type of use and intensity of development of land and structures to the extent necessary for a public purpose. Requirements may vary among various geographically defined areas called zones. Regulations generally cover such items as height and bulk of buildings, density of dwelling units, off-street parking, control of signs, and use of land for residential, commercial, industrial, institutional or agricultural purposes. A zoning ordinance is one of the major methods of implementation of a local comprehensive plan.

11.2 Appendix 2 – Stormwater Management Ordinance Download Locations

Plan preparers, developers, and engineers can locate the Stafford County Stormwater Management Ordinance, in its entirety, at the County's website. Furthermore, the ordinance can also be found at the Municipal Code Corporation's (Municode) website by following the hyperlink below:

Stafford County SWM Ordinance Municode hyperlink

https://library.municode.com/index.aspx?clientId=11500

11.3 Appendix 3 – Residential Lot Grading Plan Submittal Checklist

All Residential Lot Grading Plans submittals to Stafford County must meet the following requirements:

1. Submit the required number of copies of materials per DPW (typically 3 prints - plus a .PDF file for plans larger than 11" x 17").
2. Draw plans to scale. Plans shall be readable as a drawing and electronic file.
3. List the subdivision name, section, lot #, street name, and TM identification.
4. Plans shall be signed and sealed by P.E. or L.S.
5. List separate building permit application numbers for retaining walls 2' or more in height.
6. List boundary information and lot area.
7. Access easements to the lot must be recorded and the recordation information must be shown on the plan.
8. Existing and proposed contours (min 2 foot contours) for areas within the limits of grading shall be field surveyed. Areas outside the limits of grading may use County GIS topographic information. In situations where any portion of the lot is in a floodplain, all elevations and contour information shall be on the FEMA approved datum for the FIRM. This shall be noted.
9. List F.F. GAR and B.F. elevations.
10. Show spot elevations at the R.O.W. and driveway slope within R.O.W.
11. Demonstrate positive drainage away from house (min. 6" in 10 ft., 5%).
12. Demonstrate Minimum 2% slope on grass and paved areas.
13. Show w/o location with a spot elevation, if applicable. (The elevation difference between the BF and natural grade immediately outside the w/o shall be a minimum of 8" (0.67'). (The elevation difference between the BF and a concrete surface immediately outside the w/o shall be a minimum of 4" (0.33').
14. List the applicable FIRM(s) with date.
15. List and plot the 100-year WSEL and 100-year overland relief flow path at inlets and culverts.
16. Demonstrate that a minimum of one (1) foot freeboard is provided between any non-floodplain 100-year WSEL and the lowest floor or opening.
17. Provide the following note in situations where the lowest floor elevation is within two (2) feet of the 100-yr WSEL: "Prior to

beginning framing of the structure, the applicant shall provide verification by a professional engineer or land surveyor that the lowest floor is one (1) foot above the 100-yr WSEL." The elevation verification shall be submitted to the Environmental Division of Public of Public Works during construction.

18. Design driveway culverts or list the plan on which the approved design may be found.
19. Demonstrate that VDOT driveway entrance requirements are accomplished
20. Show adjacent parcels with TM and departing lot lines.
21. Show existing and proposed water lines, meters, and services as well as sewer, sewer lateral; or well and drainfields.
22. Show existing and proposed easements.
23. List the area of disturbance and other information required for record keeping.
24. Show the limits of disturbance.
25. List the RLD name, certificate and expiration date.
26. Provide E&SC measures per the VESCH and County requirements.
27. List how SWM is provided; reference an approved plan by name and A/P number.
28. In situations where SWM must be provided a SWM Maintenance Agreement (MA) is required. This MA shall be recorded prior to plan approval.
29. Grading on steep slopes shall conform to the requirements of the Section 28-39(f) "Special provisions applicable to the disturbance or creation of a steep slope" of the Zoning Ordinance.
30. Streets must be stoned or paved prior to grading plan approval.
31. Provide "Standard Notes" as required by the County.

11.4 Appendix 4 – Department of Public Works Elevation Verification Form

ELEVATION VERIFICATION FORM

A/P NUMBER: _____
PROJECT NAME: _____
TAX MAP IDENTIFICATION: _____
DESCRIPTION/NOTES: (OPTIONAL) _____

The lowest opening (floor, top of areaway or lower edge of basement window) shall be situated at a minimum of one (1) foot freeboard above the 100-year water surface elevation (WSEL) as shown on the lot grading plan for a single family detached dwelling, town house or multifamily structure. The 100-year WSEL for normal operation and 100-year WSEL for overland relief shall be considered; freeboard shall be computed based on the highest 100-year WSEL.

Prior to beginning framing of the structure and subsequent to final grading for drainage, the applicant shall conduct a field survey of the structure and contributing adjacent drainage structure (ditch, inlet, overland relief point etc.) From the information obtained in the field survey, the professional shall provide verification that the lowest opening is no less than one (1) foot above the 100-year WSEL.

Plan Information: _____ 100-year WSEL _____ Lowest Opening

Field Survey: _____ 100-year WSEL _____ Lowest Opening

I, _____ a licensed (professional engineer) (land surveyor) have conducted a field survey of the above listed structure and site. I certify that the lowest opening of the above listed structure is a minimum of one (1) foot above the 100-year WSEL.

_____
(Professional Seal with signature and date)

Notes:

1. In the case of "Shells", the elevation verification provided for the "Shell" will apply to all units within the "Shell".

An As-Built plan with boxed-in elevations shall be submitted prior to issuance of an Occupancy Permit.

11.5 Appendix 5 – Stafford County P2 Plan Review Checklist

Stafford County will review P2 Plans for completeness. To be considered complete, a P2 Plan must include the following information:

1. A Summary Sheet that contains the following information:

- Project Name;
- Street address;
- Tax parcel number;
- The owner(s) name and contact information;
- The name, title, and contact information of the Qualified Personnel;
- Written authorization for any applicable Duly Authorized Representative that includes the following:
  - The name, title and signature of signee providing the authorization;
  - The date of signature; and,
  - The name, title, and contact information of the Duly Authorized Representative.
- The P2 Plan's preparer name and contact information; and,
- The P2 Plan preparation date.

2. Identification and description of expected Pollutant Generating Activities

The P2 Plan must:

- Identify any expected Pollutant Generating Activities and the pollutant that is expected to be exposed to stormwater;
- Provide a narrative description of each identified Pollutant Generating Activity The expected location where the potential Pollutant Generating Activities will occur;
- Identify any expected non-stormwater discharges;

3. P2 Planning Measures and BMPs

The P2 Plan shall include information regarding selected P2 BMPs that includes the following:

- The name of the BMP(s);
- The Pollutant Generating Activity addressed by the BMP;

- A narrative description of the BMP that includes any necessary implementation and maintenance requirements and schedules;
- Any necessary BMP design standards and specifications; and
- The person(s) responsible for ensuring proper implementation, maintenance and upkeep of the BMP (reference can be made to the Qualified Personnel when that person is the responsible person).

4. Staff Awareness

- *The P2 Plan must detail a staff awareness plan.*
- *The following notes must be included on the Erosion and Sediment Control Plan Sheet or on the General Notes and Details Plan Sheet:*

1. *Discharges from the following pollutant generating activities are prohibited from entry into the storm drainage system and streams, river or other waterbody:*
   - Waters and wastes from rinsing or cleaning of concrete equipment or mixers;
   - Wash water containing soap, detergents or solvents;
   - Wastes and waters from such clean-up from pollutant generating activities such as painting or the application of stucco or plaster;
   - Sanitary sewage; and,
   - Hazardous Wastes.

2. *Spills and accidental releases must be contained and cleaned up immediately.*
3. *All trash and debris must be disposed of properly.*
4. *The discharge from all dewatering activities must be settled or filtered prior to entry into the storm drainage system or waterbody.*
5. *Questions regarding P2, or to report a spill or accidental release, contact the Qualified Personnel regarding Spill Prevention, Response and Reporting, as identified in Section 7.6 of P2 Plan.*

5. Spill Prevention and Reporting

The P2 Plan must address Spill Prevention and Reporting

6. Referenced Plans

The P2 Plan must reference any other plans, such as the approved erosion and sediment control plan, referenced as part of the P2 Plan including:

- The Plan Name; and,
- The Date of Completion.

11.6 Appendix 6 – Pollution Prevention (P2) Plan Best Management Practice (BMP) Examples

11.6.1 Introduction

The State General Permit requires that a P2 Plan include a description of practices and procedures (i.e., BMPs) that will be implemented during the construction project for each pollutant generating activity. Included in this Appendix are examples that illustrate how BMPs should be organized and described in the P2 Plan. The BMPs and explanatory text presented are intended to be hypothetical. The BMPs required in each sites specific P2 Plan must be created on a case-by-case basis that addresses the unique conditions and issues presented at a given construction site. Relying on the wording in the hypothetical examples is discouraged and will not necessarily result in compliance with the requirements of the P2 Plan and Virginia Stormwater Management Program (VSMP) Construction General Permit (State General Permit).

Within this Appendix examples are provided for the following activities:

- Training and outreach (Figures 1 and 2).
- Prevention of the discharge of spills and accidental releases (Figures 3 and 4).
- Concrete washout (Figure 5).
- Dewatering (Figure 6).
- Equipment/vehicle fueling and maintenance (Figures 7 and 8).

11.6.2 P2 BMP Examples

Pollution Prevention Plan Activity	Stormwater training and outreach
Pollutant Generating Activity	General construction activities
Pollutants	All identified pollutants
Type of Discharge	All identified types
BMP Name	General stormwater and BMP awareness training for staff and subcontractors
Responsible Person(s)	I.B. Trainer, Site Superintendent
BMP Description	
Mr. Trainer will conduct informal training for all staff, including subcontractors, on the site. The training will be conducted primarily via tailgate sessions and will focus on avoiding damage to stormwater BMPs and preventing illicit discharges. The tailgate sessions will be conducted biweekly and will address the following topics: Erosion Control BMPs, Sediment Control BMPs, Non-Stormwater BMPs, Waste Management and Materials Storage BMPs, and Emergency Procedures specific to the construction site. The dates, times and number of staff attending each session will be included as part of the Pollution Prevention Plan Update and Modification Log.	
Installation Schedule	The first training session will be upon installation of the initial erosion and sediment controls.
Maintenance Schedule	Training sessions will continue bi-weekly on Monday mornings.
Design Standards	N/A

Figure 1: Example BMP Detailing Informal Bi-Weekly Training for All Staff

Pollution Prevention Plan Activity	Stormwater training and outreach
Pollutant Generating Activity	General construction activities
Pollutants	All identified pollutants
Type of Discharge	All identified types
BMP Name	Specific stormwater and BMP awareness training for staff and subcontractors:
Responsible Person(s)	I.B. Trainer, Site Superintendent
BMP Description	
Mr. Trainer will provide formal training to all staff and subcontractors with specific stormwater responsibilities, such as installing and maintaining BMPs. The formal training will cover all design and construction specifications for installing the BMPs and proper procedures for maintaining each BMP. Formal training will occur before any BMPs are installed on the site. The dates, times and number of staff attending each session will be included as part of the Pollution Prevention Plan Update and Modification Log.	
Installation Schedule	The training sessions will be provided to the specific staff upon installation of the applicable BMP.
Maintenance Schedule	Training sessions will continue as determined necessary as a result of inspection findings.
Design Standards	N/A

Figure 2: Example BMP Detailing Formal Training for Staff with Specific Pollution Prevention Responsibilities

Pollution Prevention Plan Activity	Spill prevention and control procedures
Pollutant Generating Activity	Spills and accidental releases from on-site equipment/vehicles
Pollutants	Fuels, oils, hydraulic fluid, and hazardous wastes
Type of Discharge	Contaminated discharges
BMP Name	Equipment and Vehicle Spill Prevention and Control
Responsible Person(s)	U.R. Inspector, Qualified Personnel; Equipment and Vehicle Operators
BMP Description	
Routine maintenance on equipment and vehicles will be maintained off-site. Vehicles leaking fluids will not be allowed to remain on-site. Drip pans will be placed under any piece of equipment that begins leaking fluid such as from a broken hydraulic line and emergency repair will be conducted on-site.	
Installation Schedule	Equipment and vehicle spill prevention and control will initiate with the first piece of equipment being delivered to the site.
Maintenance Schedule	This BMP will remain in place for the length of the project.
Design Standards	N/A

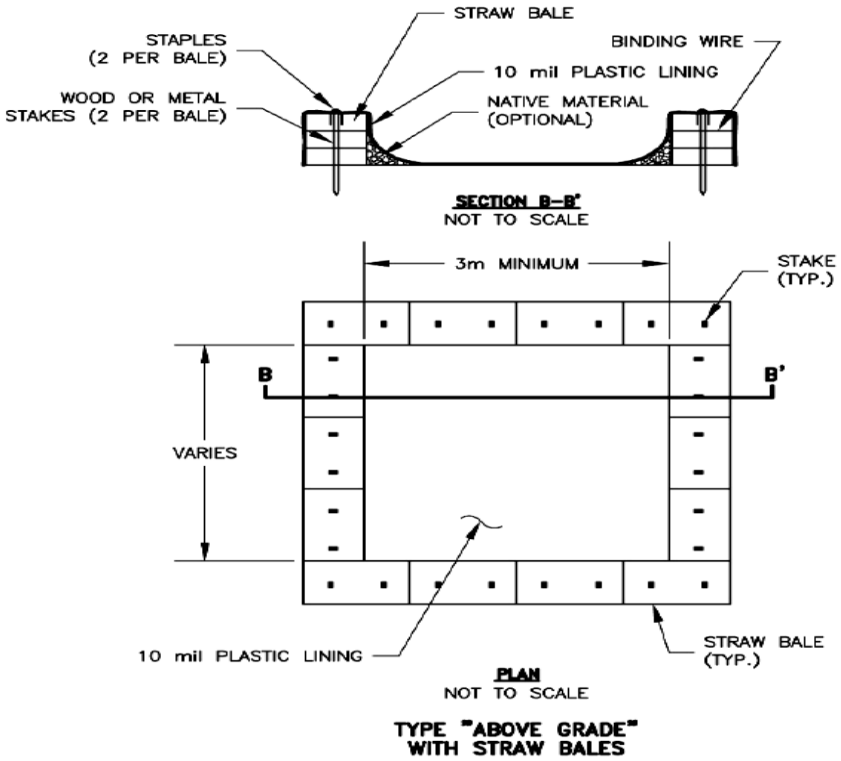
Figure 3: Example BMP Detailing Routine Maintenance and Emergency Repairs to Leaking Equipment and Vehicles

Pollution Prevention Plan Activity	Spill prevention and control procedures
Pollutant Generating Activity	Spills and accidental releases from on-site equipment
Pollutants	Fuels, oils, hydraulic fluid, and hazardous wastes
Type of Discharge	Contaminated discharges
BMP Name	Spill Kits and Drip Pans
Responsible Person(s)	U.R. Inspector and Equipment Operators
BMP Description	
Spill kits and drip plans will be located in the construction trailers for use by equipment operators in containing and clean-up of spills and accidental releases. Equipment operators will be given specific instruction as part of formal training. Upon their use, U.R. Inspector will be contacted for proper disposal of wastes. Mr. U.R. Inspector will ensure that spill kits are properly restocked and that collected wastes and contaminated materials are properly disposed of.	
Installation Schedule	The spill kits will be placed in the construction trailer upon its delivery to the construction site. Training provided prior to equipment operation on-site.
Maintenance Schedule	Contaminated absorbent materials and other spill kit contents will be replaced upon their use.
Design Standards	N/A

Figure 4: Example BMP Detailing the Use of Spill Kits and Drip Pans

Pollution Prevention Plan Activity	Concrete washout
Pollutant Generating Activity	Concrete pouring and washout
Pollutants	Heavy metals, pH, and trash, debris, and solids
Type of Discharge	Prohibited discharge
BMP Name	Concrete Washout Area(s)
Responsible Person(s)	U.R. Inspector, Qualified Personnel; concrete truck operators
BMP Description	
A designated temporary, above-grade concrete washout area will be constructed on the northeast portion of the site, as detailed on the site map. The temporary concrete washout area will be constructed as shown below, with a recommended minimum length and minimum width of 10 feet, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations. The washout area will be lined with plastic sheeting at least 10 mils thick and free of any holes or tears. Signs will be posted marking the location of the washout area to ensure that concrete equipment operators use the proper facility. Concrete pours will not be conducted during or before an anticipated storm event. Concrete mixer trucks and chutes will be washed in the designated area or concrete wastes will be properly disposed of off-site. When the temporary washout area is no longer needed for the construction project, the hardened concrete and materials used to construct the area will be removed and disposed of according to the maintenance section below, and the area will be stabilized. Concrete truck operators will be given specific instruction as part of formal training.	
Installation Schedule	The washout area will be constructed before concrete pours occur at the site.

Maintenance Schedule	The washout areas will be inspected daily to ensure that all concrete washing is being discharged into the washout area, no leaks or tears are present, and to identify when concrete wastes need to be removed. The washout areas will be cleaned out once the area is filled to 75 percent of the holding capacity. Once the area's holding capacity has been reached, the concrete wastes will be allowed to harden; the concrete will be broken up, removed, and taken to landfill for disposal. The plastic sheeting will be replaced if tears occur during removal of concrete wastes from the washout area.
Design Standards	



1. Temporary concrete washout type Above Grade will be constructed as shown above, with a recommended minimum length and minimum width of 10 feet.
2. The washout will be a minimum of 50 feet from storm drain inlets.
3. Plastic lining will be free of holes, tears, or other defects that compromise the impermeability of the material.

Figure 5: Example BMP Detailing Concrete Washout Procedures

Pollution Prevention Plan Activity	Dewatering
Pollutant Generating Activity	Excavation dewatering
Pollutants	Sediment, nutrients, and bacteria & viruses
Type of Discharge	Contaminated discharges
BMP Name	Dewatering
Responsible Person(s)	U.R. Inspector, Qualified Personnel
BMP Description	
Because construction for this site is being conducted during the dry season, dewatering activities are not expected to occur at the project site. If dewatering does occur, the Pollution Prevention Plan will be revised to address the need for appropriate BMPs.	
Installation Schedule	N/A
Maintenance Schedule	N/A
Design Standards	N/A

Figure 6: Example BMP Detailing Dewatering Activities

Pollution Prevention Plan Activity	Equipment and vehicle and fueling
Pollutant Generating Activity	Fueling
Pollutants	Oil and grease and toxic chemicals
Type of Discharge	Prohibited discharges
BMP Name	Equipment and Vehicle Fueling
Responsible Person(s)	U.R. Inspector, Qualified Personnel; Vehicle and Equipment Operators
BMP Description	
Several types of equipment and vehicles will be used on-site throughout the project, including graders, scrapers, excavators, loaders, paving equipment, rollers, trucks and trailers, backhoes, and forklifts. All major equipment/vehicle fueling will be performed off-site. A small, 20-gallon pickup bed fuel tank will be kept on-site in the combined staging area. When vehicle fueling must occur on-site, the fueling activity will occur in the staging area.	
Installation Schedule	BMPs implemented for equipment and vehicle fueling activities will begin at the start of the project.
Maintenance Schedule	This BMP will remain in place for the length of the project. Inspect equipment/vehicle fuel tank weekly and after storm events. Keep ample supply of spill-cleanup materials on-site and immediately clean up spills and dispose of materials properly.
Design Standards	N/A

Figure 7: Example BMP Detailing Equipment and Vehicle Fueling

Pollution Prevention Plan Activity	Equipment and vehicle maintenance
Pollutant Generating Activity	Maintenance
Pollutants	Fuels, oils, hydraulic fluid, and hazardous wastes
Type of Discharge	Prohibited discharges
BMP Name	Equipment and Vehicle Maintenance
Responsible Person(s)	U.R. Inspector, Qualified Personnel; Equipment and Vehicle Operators
BMP Description	
Several types of equipment and vehicles will be used on-site throughout the project, including graders, scrapers, excavators, loaders, paving equipment, rollers, trucks and trailers, backhoes, and forklifts. All major equipment/vehicle maintenance will be performed off-site. Only minor equipment maintenance will occur on-site. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets in accordance with Part 3.1. Absorbent, spill-cleanup materials and spill kits will be available at the combined staging and materials storage area. Drip pans will be placed under all equipment receiving maintenance and vehicles and equipment parked overnight.	
Installation Schedule	BMPs implemented for equipment and vehicle maintenance activities will begin at the start of the project.
Maintenance Schedule	This BMP will remain in place for the length of the project. Inspect equipment/vehicle storage areas and weekly and after storm events. Vehicles and equipment will be inspected on each day of use. Leaks will be repaired immediately, or the problem vehicle(s) or equipment will be removed from the project site. Keep ample supply of spill-cleanup materials on-site and immediately clean up spills and dispose of materials properly.
Design Standards	N/A

Figure 8: Example BMP Detailing Equipment and Vehicle Maintenance Activities

11.7 Appendix 7 – Selected Soils Data

							SUBSOIL				
MAP	HYDRIC	K FACTOR		HYDROLOGIC	DEPTH TO		PERME-	SOIL	SHRINK-	FLOOD-	P=PIEDMONT
SYMBOL		TOPSOIL	SUBSOIL	SOIL GROUP	ROCK	WATER	ABILITY	NAME	SWELL	PLAIN	CP=COASTA
					(FEET)		(IN./HR.)				PLAIN
Ad	N	0.32*	0.32*	alluvial land, sandy and gravelly, terraces and floodplains						?	
Ae	Y	0.32*	0.32*	alluvial land, wet, subject to frequent flooding						Y	
Af	N	0.20	0.24	C	5+	2.5-3.5	0.63-2.0	Altavista	M		
Al	N	0.24	0.20	B	6+	5+	0.63-2.0	Appling	M		P
An, Ap	N	0.20	0.2	B	6+	5+	0.63-2.0	Appling	M		P
As	N	0.24	0.24	B	2.0-4.0	2+	2.0-6.3	Ashlar	L		P
At	N			C	5+	1.5-2.5	0.06-0.02	Altee	L		P
Au	N*1	0.15	0.24	C	5+	1.0-1.5	0.63-2.0	Augusta	H		
Av	N	0.37	0.17	B	5+	6+	0.32-2.0	Aura	L		CP
Aw	Aura-Galestown-Sassafras complex										
	N	0.37	0.17	B	5+	6+	0.32-2.0	Aura	L		CP
	N	0.28	0.28	A	5+	5+	6.3+	Galestown	L		CP
	N	0.28	0.43	B	5+	5+	0.63-2.0	Sassafras	L		CP
Ba	I*2	0.20	0.24	B	5+	1.0-1.5	0.63-2.0	Bertie	M		CP
					at 4+ft.		2.0-6.3				
Bb	Y	0.20	0.37	C	5+	0.0-1.0	2.0-6.3	Bibb	L	Y	CP
Bd	Y	0.37	0.37	D	5+	0.0-1.0	<0.2	Bladen	H		CP
Bm, Bo	I*2	0.28	0.37	C	5+	1.5-2.5	<0.2	Bourne	M		CP
					at 4+ ft.		0.2-2.0				
Bn	N	0.28	0.28	C	5+	1.5-2.5	<0.20	Bourne	M		CP
					at 4+ ft.		0.2-0.63				
Br	N	0.28	0.28	C	2.5	2.5+	2.0-6.3	Bremo	L		P
Ca, Cc	N	0.43	0.32	C	5+	5+	0.2-0.63	Caroline	M		CP
Cd	Caroline-Sassafras complex										
	N	0.43	0.32	C	5+	5+	0.2-0.63	Caroline	M		CP
	N	0.28	0.43	B	5+	5+	0.63-2.0	Sassafras	L		CP
Ce	Y	0.24	0.24	C	5+	1.0-1.5	2.0-6.3	Cartecay	L		
Cf, Ch	N	0.28	0.28	B	5+	5+	0.63-2.0	Cecil	M		P
Cg	N	0.15	0.28	B	5+	5+	0.63-2.0	Cecil	M		P
Cl	N*3	0.28	0.28	C	5+	1.0-1.5	<0.63	Colfax	M 1-2'		P
Cm	N*3	0.28	0.28	C	5+	1.5-2.0	0.63-2.0	Colfax	L		P
					at 4+ ft.		2.0-6.3				
Cn	N	0.24	0.24	B	5+	4+	0.63-2.0	Congaree	L	Y	
Cr	N	0.32	0.32	C	5+	2.5-5	<0.20	Craven	M		CP
Cu, Cv	N	0.37	0.24	C	5+	5+	0.63-2.0	Cullen	M		P
Cw		0.32*	cut and fill land								
Do	N	0.37	0.28	C	5+	2.5-3.5	0.2-0.63	Dogue	M		P
					at 4+ft.		0.63-2.0				
Eb	Y	0.49	0.24	D	5+	0.0-1.0	<0.20	Elbert	M 1-3'		P
El, Em	N	0.32	0.28	C	5+	5+	0.63-2.0	Elioak	M 1-4'		P
Fa	N	0.43	0.43	B	5+	5+	0.63-2.00	Fairfax	M 1-4'		P
Fd	Y	0.28	0.43	D	5+	0.0-1.5	0.63-2.0	Fallsington	M 1-3'		CP
Fs	Y	0.32*	fresh water swamp								
Gs		Galestown-Sassafras complex									
	N	0.28		A	5+	5+	6.3+	Galestown	L		CP
	N	0.28	0.43	B	5+	5+	0.63-2.0	Sassafras	L		CP
Iu	I*2	0.17	0.28	C	5+	2.5-3.5	0.63-2.0	Iuka	L	Y	CP

							SUBSOIL				
MAP	HYDRIC	K FACTOR		HYDROLOGIC	DEPTH TO		PERME-	SOIL	SHRINK-	FLOOD-	
SYMBOL		TOPSOIL	SUBSOIL	SOIL GROUP	ROCK	WATER	ABILITY	NAME	SWELL	PLAIN	
					(FEET)		(IN./HR.)				
Ke	N	0.32	0.24	B	5+	5+	0.63-2.0	Kempsville	L		CP
					at 4+ ft.		2.0-6.3				
Kf	N	0.28		B	5+	5+	0.63-2.0	Kempsville	L		CP
					at 4+ ft.		2.0-6.3				
Lg	I	0.43	0.28	C	5+	1.0-2.0	0.20-0.63	Lignum	M		P
MA	N	0.43	0.28	B	5+	5+	2.0-6.3	Manor	L		
Md	N	0.32	0.28	B	5+	5+	0.63-2.0	Marr	L		CP
					at 3+ ft.		2.0-6.3				
Me	I	0.37	0.28	B	5+	3.0-5.0	0.63-2.0	Meadowville	M		P
					at 4+ ft.		2.0-6.3				
Mk	N	0.24	0.32	C	5+	5+	<0.63	Mecklenburg	H		P
Ml	N	0.28	0.32	C	5+	5+	<0.63	Mecklenburg	H		P
Na, Nc	N	0.37	0.28	C	5+	5+	0.63-2.0	Nason	M		P
Or	I	0.49	0.28	D	4.0-6.0	1.0-3.0	<0.63	Orange	H		P
Po	Y	0.37		D	5+	1.0 - 1.5	<0.63	Pooler	H		CP
Ro	Y	0.37	0.24	D	5+	0 - 1	<0.63	Roanoke	H		
Sa		0.32*	sand and gravel pits								
Sc		0.32*	sandy and clayey land								
Sf	N	0.28	0.43	B	5+	5+	0.63-2.0	Sassafras	L		CP
					at 3+ ft.		2.0-6.3				
Sn	I	0.28	0.28	B	5+	4+	2.0-6.3	State	M		P
St		0.32*		D	stony land						
Su	I	0.43	0.32	D	5+	3.0-5.0	<0.20	Susquehanna	H		CP
Te	I	0.28	0.32	C	5+	1.2-2.5	0.63-2.0	Tetotum	M		CP
Tm	Y	0.32*		D	tidal marsh						
Tu	N	0.32	0.24	C	5+	5+	0.63-2.0	Turbeville	M		
Wa	N*4	0.28	0.28	D	5+	1.0-1.5	<0.63	Wahee	H		
Wg	N	0.32	0.24	D	1.5-3.0	1.5+	0.63-2.0	Watt	L		P
	Watt is formed in Quantico slate, the slate becomes very acidic when exposed to air and water										
Wh	Y	0.24	0.32	C	5+	0 - 1	0.20-0.63	Wehadkee	L	Y	P
					at 4+ ft.		2.0-6.3				
Wl	N	0.49	0.43	B	5+	5+	2.0-6.3	Westphalia	L		CP
Wm	N	0.20	0.24	B	5+	5+	0.63-2.0	Wickham	M		
					at 3.5+ ft.		>6.3				
Wn	N	0.20	0.24	B	5+	5+	2.0-6.3	Wickham	M		
					at 2.5+ ft.		>6.3				
Wo	N	0.28		C	5+	1.5-2.5	0.63-2.0	Woodstown	L		CP
Wr	Y	0.37	0.28	D	5+	0.0-1.0	<0.63	Worsham	H		P
Zl	N	0.37	0.28	C	4.0-6.0	6+	0.2-0.63	Zion	H		P

From "Soil Survey – Stafford and King George Counties Virginia (issued February 1974)
N = no, Y= yes I = hydric inclusions in mapping unit
*0.32 data not available in the published report so 0.32 has been designated by the State.
*1 - *4 report descriptions show 6/1 or 6/2 mottles within 18"

11.8 Appendix 8 – Sample Maintenance Agreement

MAINTENANCE AGREEMENT
for
STORMWATER MANAGEMENT SYSTEM

This agreement is entered into this_____ day of _____,
_____, by and between _____, hereinafter referred to as the "Landowner" and the Board of Supervisors of Stafford County, Virginia, hereinafter referred to as "County"

WITNESSETH:

WHEREAS, the landowner has submitted a development plan for a project known as ____ _____, which includes, among other features, a system that regulates peak rates of discharge and/or quality of runoff water (the term "*system*" includes any and all components designed to regulate flow, provide storage for runoff water, remove pollutants from runoff water and increase infiltration of runoff water into the soil); and

WHEREAS, the Landowner will install the system in order to comply with one or more of the following laws, regulations and codes:

Virginia Code

Title 62.1, Ch. 3.1, Art. 2.3	Stormwater Management Act
Title 62.1, Ch. 3.1, Art. 2.5	Chesapeake Bay Preservation Act
Title 62.1, Ch. 3.1, Art. 2.4	Erosion and Sediment Control Law

Virginia Administrative Code

9VAC25-870 et seq.	Virginia Stormwater Management Program (VSMP) Regulation
9VAC25-830 et seq.	Chesapeake Bay Preservation Area Designation and Management Regulations
9VAC25-840 et seq.	Erosion and Sediment Control Regulations

Stafford County Code

Chapter 21.5	Stormwater Management
Sec. 28-62	Chesapeake Bay Preservation Area Overlay District
Chapter 11	Erosion and Sediment Control; and

WHEREAS, this system includes _____
_____
_____

WHEREAS, it is in the best interests of both parties and the general public to ensure proper maintenance of the system; and

WHEREAS, a maintenance plan (Attachment _____) for the system has been submitted by the Landowner and approved by the County in conjunction with this Agreement; and

Tax Mao/Parcel(s) Number _____

WHEREAS, both parties desire to ensure sufficient maintenance to maintain the integrity and the proper functioning of the system;

NOW, THEREFORE, for and in consideration of the mutual covenants stated below, the parties agree as follows:

1. The County shall:

A. Release construction security after as-built plans and other appropriate certifications, showing adequate completion of the system, have been submitted and approved by the County and after an inspection report prepared by County staff recommends approval of the system. The certification shall be made by a Professional Engineer (or a qualified Class B surveyor or certified Landscape Architect) and shall certify that the as-built plan represents the actual condition of the structure(s) and shows that all aspects of the structure(s) conform substantially with the approved design plans and the Stafford County Stormwater Management Design Manual. Where the as-built condition varies significantly from the approved design, appropriately revised calculations shall also be provided by the professional certifying the system.

B. Perform maintenance inspections and provide copies of the maintenance inspection reports to the Landowner. These inspections will be performed at reasonable times (between 8 A.M. and 4:30 P.M., Monday through Friday) and with the Landowner or agent(s) of the Landowner, if available. Periodic inspections may be conducted after storms producing high rates of runoff. Whenever possible, the County shall notify the Landowner prior to entering the property.

2. The Landowner shall:

A. Construct the system in accordance with approved designs. Provide as-built data and drawings, soil/geotechnical reports, and other certifications requested by the County in order to document compliance with the approved designs and the requirements set forth in Stafford County's Stormwater Management Design Manual.

B. Provide maintenance, which keeps the system in good working order acceptable to the County. Such maintenance shall be provided in perpetuity unless and until both parties formally enter into a revised agreement. Maintenance inspections will be performed within twenty-four (24) hours after each rainfall of one (1) inch or more.

C. Provide a right of ingress and egress for the County and agents of the County for maintenance inspections and, if deemed by the County to be needed and not adequately done by the Landowner within a reasonable time after due notice, maintenance and repair of the system. Thirty (30) days shall normally be regarded as a reasonable time. The Landowner will reimburse the County for maintenance and repair costs within ten (10) working days after receiving a request for reimbursement. It is expressly understood and agreed that the County is under no obligation to maintain or repair said system, and in no event shall this Agreement be construed to impose any such obligation on the County.

However, if the County performs or otherwise provides maintenance and/or repair, the Landowner will hold harmless and indemnify the County with regard to damage to or destruction of personal or real property.

D. Keep written records of inspections and repairs and provide access to those records to the County upon request.

E. Record this Agreement in the land records of Stafford County along with a copy of the approved maintenance plan. The Landowner also stipulates, by this Agreement, that final plats for any and on which this system and/or a portion of this system is situated will include a reference to this Agreement and to its location (deed book designation, page number, etc.) in the land records of Stafford County.

F. Agree that the terms of this Agreement shall be binding upon the heirs, successors and assigns of the Landowner and that any subsequent owner of the property shall be responsible for the maintenance of the system and shall hold the County harmless from any loss, damage, injury, cost or other claim resulting from the operation of the subject system.

G. Agree that for any systems to be maintained by a property owner's association, deed restrictions and covenants will include membership in a property owner's association responsible for providing maintenance of the system.

WITNESS THE FOLLOWING SIGNATURES:

DEVELOPER/OWNER:

OWNER'S NAME: _____

EXECUTIVE OFFICER'S NAME (PRINTED): _____

ADDRESS: _____

TITLE: _____

SIGNATURE OF OWNER: _____

COMMONWEALTH OF VIRGINIA
COUNTY OF STAFFORD, to wit:

If Corporation or Company:

The foregoing Agreement was acknowledged by me this _____ day of _____, 20____, by _____, who is the _____ of the [Corporation] [Company] and authorized to bind the [Corporation] [Company].

My commission expires: _____

_____
Notary Public

Or, if individual:

The foregoing Agreement was acknowledged by me this _____ day of _____, 20____, by _____, the owner.

My commission expires: _____

_____
Notary Public

BOARD OF SUPERVISORS OF STAFFORD COUNTY, VIRGINIA

By: _____
Jeffrey A, Harvey
Director of Planning and Zoning

COMMONWEALTH OF VIRGINIA
COUNTY OF STAFFORD, to-wit:

The foregoing Agreement was acknowledged before me this _____ day of

_____ By Jeffrey A. Harvey, Director of Planning and Zoning on

Behalf of the Board of Supervisors of Stafford County, Virginia.

My commission expires: _____

_____
Notary Public

11.9 Appendix 9 – As-Built Plan Checklist

11.9.1 Stormwater Conveyance Channels

A. Minimum Information

____ 1. Invert elevations and top of bank elevations, side slopes at cross section locations

____ 2. Type and class of materials

____ 3. Size and depth of rip-rap, and specify that it has been underlain by filter fabric

____ 4. Type and condition of vegetation

____ 5. Location of channel

____ 6. Certification Statement

B. Acceptable Construction

____ 1. Geometry of channel must be consistent with design plan

____ 2. Capacity of channel must be no less than design plan capacity

____ 3. Materials must be consistent with design plan

____ 4. All channels shall be located correctly

____ 5. All E&S Controls must be properly installed

11.9.2 Storm Sewers and Culverts

A. Minimum Information

____ 1. Diameter and type/class of all pipes

____ 2. Invert elevations of pipe at all entrances, outfalls, and structures

____ 3. Slope of pipe

____ 4. Pipe lengths

____ 5. Location of all pipe and structures

____ 6. Type of structures, including throat width

____ 7. Elevation of structure top

____ 8. Types of material

____ 9. Length, width and depth of all riprap and other outlet protection

____ 10. Ground elevations over pipe where depth of cover might exceed allowable maximum cover depths

____ 11. Certification Statement

B. Acceptable Construction

____ 1. Pipe diameter and elevations must be correct
____ 2. Structure dimensions and elevations must be correct
____ 3. All pipes and structures shall be located correctly
____ 4. Proper bedding and backfill of pipes and structures
____ 5. Materials must be consistent with design plan
____ 6. Outlet protection shall be adequate

11.9.3 Wet Ponds / Extended Detention Ponds

A. Minimum Information

____ 1. Indicate type of Pond (Extended Detention or Wet Pond)
____ 2. Profile of top of dam. Elevations at each end, intervals not to exceed 50 feet and where low points are evident
____ 3. Cross section of emergency spillway at control section
____ 4. Profile along centerline of emergency spillway
____ 5. Width and shape of emergency spillway entrance channel, control section (all four corners) and exit channel, size and depth of rip-rap, and specify that rip-rap has been underlain by filter fabric
____ 6. Elevation of principal spillway crest, inlet and outlet
____ 7. Cross section of dam through principal spillway
____ 8. Riser diameter/dimensions and riser base size
____ 9. Type of materials used
____ 10. Barrel diameter, length and slope
____ 11. Outfall protection including size and depth of rip-rap and specify that it has been underlain by filter fabric
____ 12. Location, size and number of anti-seep collars
____ 13. Type and dimensions of anti-vortex and trash rack device
____ 14. Shape and elevations of all orifices and weirs
____ 15. Length, width and depth of ponds and contours of pond bottom
____ 16. Core trench depth and types of materials
____ 17. Size of stone, type of filter fabric, and tubing of toe drain/blanket drain
____ 18. Location, dimensions and materials of any liners
____ 19. Geotechnical Inspections Report

____ 20. As-Built topography and computation of all designed storage volumes

____ 21. Aquatic and/or Safety Bench Side slopes

____ 22. Locations of all safety measures

____ 23. Certification Statement

B. Acceptable Construction

____ 1. Pipe diameter, length, material and elevations must be correct

____ 2. Area of orifices correct

____ 3. Trash rack, anti-vortex device, number of anti-seep collars are correct

____ 4. Emergency spillway may be 1-2% steeper, but no flatter or narrower than design. Located and aligned as shown on approved plans

____ 5. Embankment top elevation must be no less than design elevation plus allowance for settlement

____ 6. Riser size correct

____ 7. Top width of dam and pond side slopes must meet design

____ 8. Must have proper relation in elevation between principal spillway crest, emergency spillway crest and top of dam

____ 9. Outlet protection as per design plan

____ 10. Pond storage volume at the water quality pool, 1-year, 2-year and at the 10-year storm design elevations must be equal to or greater than volume on approved design plans

11.9.4 Bioretention and Biofilter Facilities

A. Minimum Information

____ 1. Plan and profile views of facility drawn to scale

____ 2. Elevation of principal spillway crest, inlet and outlet

____ 3. Profile view of principal spillway with all dimensions shown

____ 4. Type of materials used

____ 5. Shape and elevations of all orifices and weirs

____ 6. Elevation at top of all layers of materials used and materials used for any liners

____ 7. For bioretention facilities, geotechnical report indicating infiltration rates

____ 8. Number, type, and location of plantings

____ 9. Undisturbed subsoil measured infiltration rate (for bioretention facilities)

____ 10. Photographs documenting construction and showing: the site before beginning construction; the excavation's undisturbed walls and bottom before any backfill; placement of each material layer showing the final top surface of each layer; placement of the underdrain system; and, outlet works.

____ 12. Maintenance access

____ 13. Certification Statement

B. Acceptable Construction

____ 1. Material types and top elevations correct
____ 2. Area of orifices correct
____ 3. Appropriate underdrain design
____ 4. Must have proper relation in elevation between principal spillway crest, emergency spillway crest and top of dam
____ 5. Outlet protection as per design plan
____ 6. Pond storage volume at the water quality pool, 1-year, 2-year and at the 10-year storm design elevations must be equal to or greater than volume on approved design plans

11.9.5 Underground Detention Systems

A. Minimum Information

____ 1. Size of all pipes
____ 2. Elevation and slope of all pipes
____ 3. Elevation and size of all orifices
____ 4. Elevation and thickness of weir walls
____ 5. Location and elevation of manholes
____ 6. Types of material
____ 7. Location of structure
____ 8. Geotechnical Inspections Report
____ 9. Certification Statement

B. Acceptable Construction

____ 1. Pipe diameter, elevation and materials must be correct

____ 2. Proper bedding and backfill of pipe and structures

____ 3. Dimensions and elevations of structures must be correct

____ 4. Location of structure correct

11.9.6 Infiltration Trenches

A. Minimum Information

____ 1. Type of materials

____ 2. Location of trench

____ 3. Dimensions and elevations

____ 4. Location and invert elevation of monitoring well

____ 5. Elevation of bedrock and groundwater

____ 6. Geotechnical Inspections Report

____ 7. Certification Statement

B. Acceptable Construction

____ 1. Pipe diameters and elevations must be correct

____ 2. Infiltration material as per design plans

____ 3. Dimensions and elevations of trench must be correct

____ 4. Monitoring well must be correct

____ 5. Bottom of trench a minimum of four feet above bedrock or seasonal water table

____ 6. Soil permeability acceptable

11.9.7 Other Types of Facilities

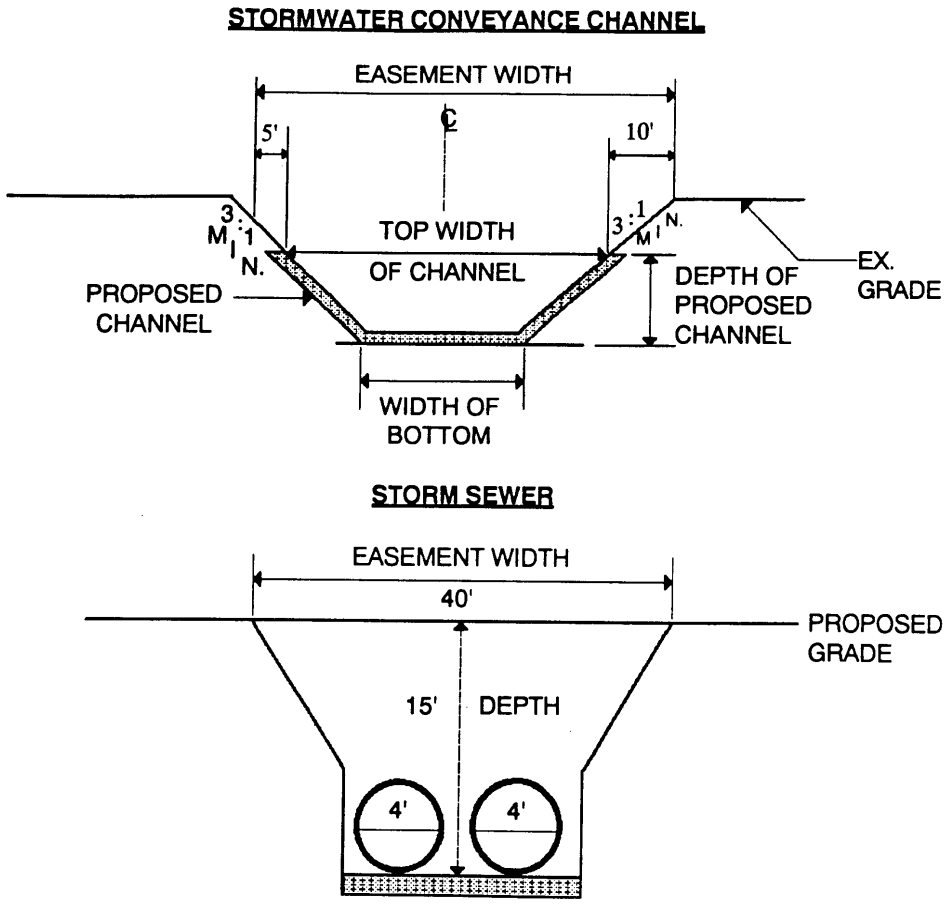
As-Built plans shall provide necessary information to demonstrate that the facility as it is built conforms to all specifications and requirements of the approved design plan.

11.9.8 SWM & Outfall As-Built Data Summary Table

SWM & Outfall As-Built Data Summary Table												
Facility ID	Facility Type (SWM / Outfall)	Latitude	Longitude	Hydrologic Unit Code (HUC)	Receiving Waters	Area Treated by Facility (Acres)				Public / Private	Maintenance Agreement (Y / N)	Maint. Agreement Recorded At:
						Impervious	Pervious (Exluding Forest)	Forest	Total			

General Information:	
Owner Name:	
Owner Address:	
Owner Phone Number:	
Project Address:	
Project Tax Parcel #:	

11.10 Appendix 10 – Easement Width



EXAMPLE: 4' DUAL PIPES AT 15' DEPTH

EASEMENT = 25' + 10' + 5' = 40'

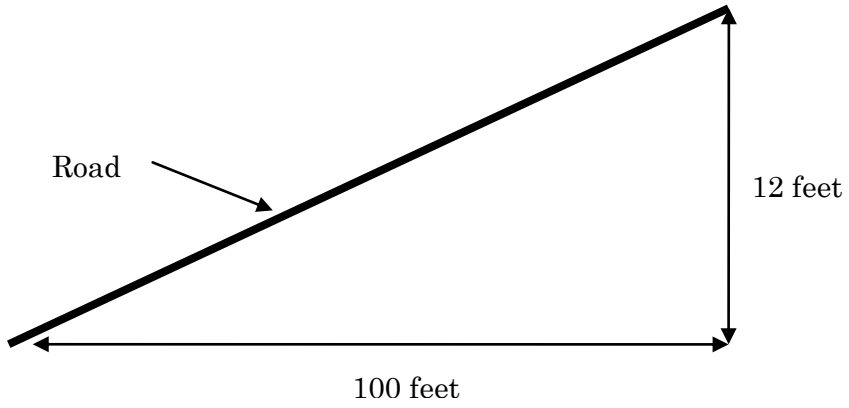
Adapted from Prince George's County, MD Stormwater Management Design Manual

11.11 Appendix 11 – Stormwater Management Facility Access Requirements

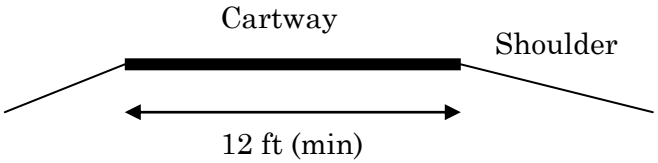
Access to a public route must be provided for stormwater management facilities.

11.11.1 Layout Requirements

Maximum (steepest) grade for access roads is 12% as illustrated below.

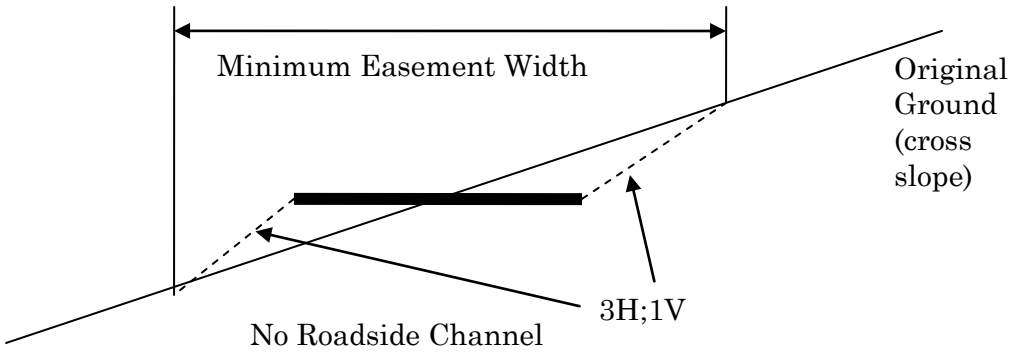


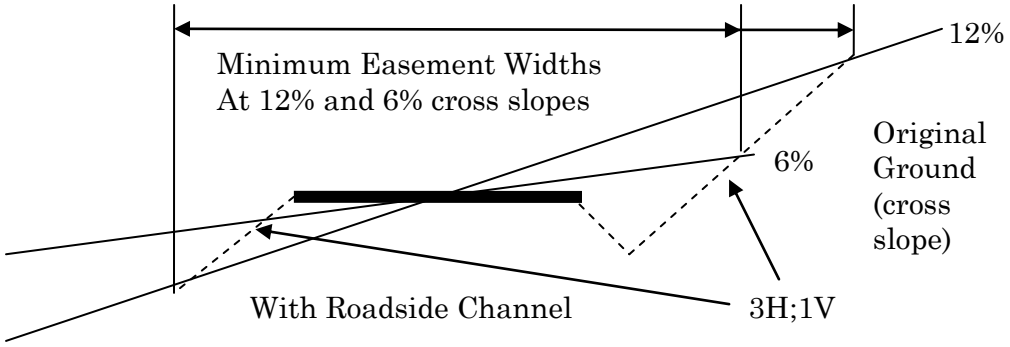
Minimum cartway width is 12 feet with any shoulders extending beyond the cartway as illustrated below.



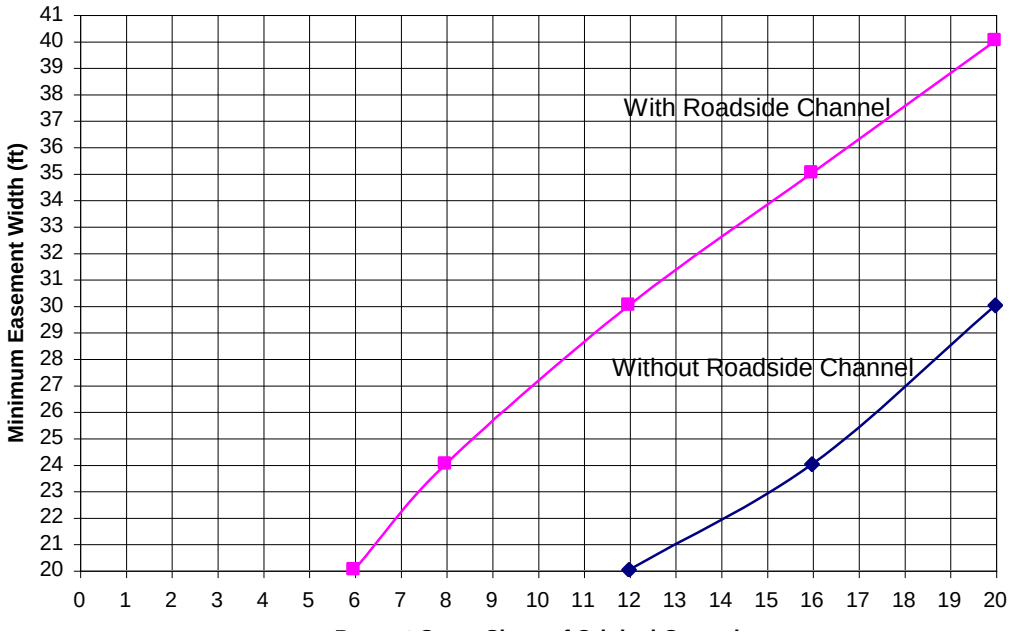
11.11.2 Easement Requirements

Minimum easement width is 20 feet if no road channel is needed and if the road is not crossing a slope steeper than 12%. Easements must include the full width of land needed to construct the road with the resulting slopes on each side no steeper than one foot of rise or fall in 3 horizontal feet. See the following illustrations.





As illustrated, the minimum easement width is a function of the cross slope of the original ground on which the road is built. Use the following chart to determine minimum easement widths for stormwater management access roads.



11.12 Appendix 12 – Stormwater Management Facilities within Chesapeake Bay Resource Protection Areas (CRPA)

The following is an excerpt from Section 28-62, Chesapeake Bay Preservation Overlay District of the Stafford County Zoning Ordinance (28-62(f)(1)(e)), as it relates to stormwater management facilities. Please refer to Section 28-62 of the Zoning Ordinance for a complete coverage of requirements related to CRPAs.

For reference the section of Zoning Ordinance 28-62(f)(1)(e) is provided below:

Land development in critical resource protection areas may be allowed only when permitted by the administrator and if it is:

> A flood control or stormwater management facility satisfying the conditions set forth in subdivision 1 of this subsection.
>
> 1. Flood control or stormwater management facilities that drain or treat water from multiple development projects or from a significant portion of the watershed may be allowed in the CRPA provided that:
>
> a. The local government has conclusively established that the proposed location of the facility is the optimum location;
>
> b. The size of the facility is the minimum necessary to provide necessary flood control, stormwater treatment both;
>
> c. The facility must be identified in U.S. Army Corps of Engineers permit number 97-1212-45 or be consistent with a stormwater management program that has been approved by the Chesapeake Bay local assistance board as a phase one modification;
>
> d. All applicable permits for construction in state or federal waters must be obtained from the appropriate state and federal agencies such as the U.S. Army Corps of Engineers, the Virginia Marine Resources Commission, and the Virginia Department of Environmental Quality;
>
> e. Approval must be received from the local government prior to construction; and
>
> f. Routine maintenance is allowed to be performed on such facilities to assure that they continue to function as designed.

2. It is not the intent of this subsection to allow a best management practice that collects and treats runoff from only an individual lot or some portion of the lot to be located in the CRPA.

3. Stormwater management facilities that do not meet all of the above criteria shall not be allowed in the CRPA unless a variance has been granted in accordance with the requirements of subsection 28-62(l) of the Stafford County Zoning Ordinance.

Note: Outfalls for storm sewers are considered water dependent and are allowed within the CRPA. However, conveyance structures (i.e., pipes and channels) are not considered water dependent. To the extent feasible, such features should be located outside of the CRPA. Under certain circumstances, such as in locations with steep slopes and/or erodible soils, it may be preferable to protect the CRPA and have the outfall structure located at the toe of the slope. These situations will be reviewed on an individual basis at the stormwater concept plan phase.