



Department of Public Works
Operations Division

NORFOLK STORMWATER DESIGN AND CONSTRUCTION MANUAL

FINAL

JULY 2014

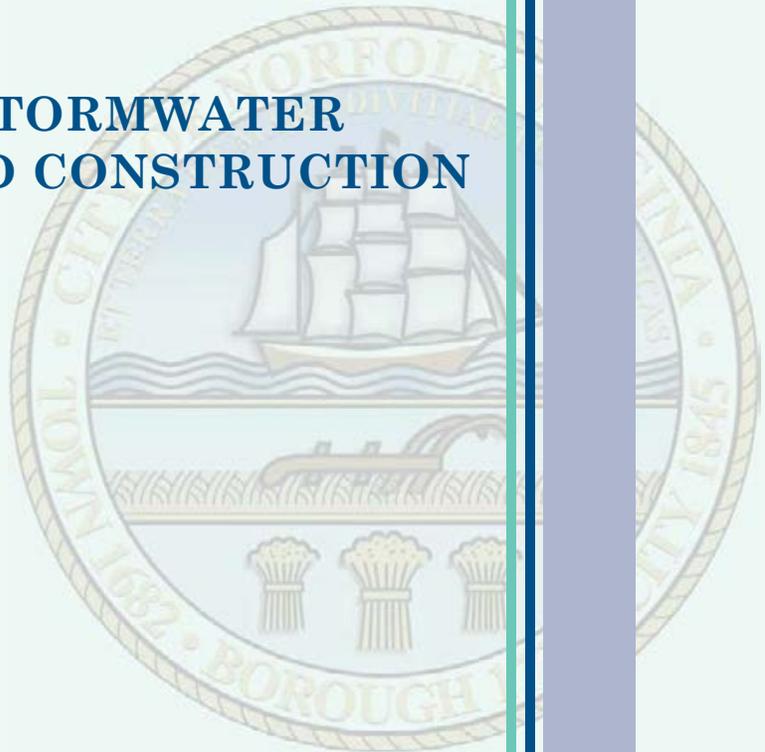


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CHAPTER 1.0 INTRODUCTION AND PURPOSE

This design and construction manual is intended for use by any person, agency or organization involved in the development, design or construction of projects which will impact storm water runoff. Possible users of this manual include homeowners, builders, developers, design professionals, redevelopment authorities, and City staff.

1.1 Purpose

Compliance with this document is required to ensure the general health, safety, and welfare of the citizens of the City of Norfolk (City) and protect the quality of state waters from the potential harm of unmanaged stormwater runoff, including protection from a land disturbing activity causing unreasonable degradation of properties, water quality, stream channels and other natural resources, and, in accordance with *Code of Virginia*, § 62.1-44.15:27, to establish procedures whereby stormwater requirements related to water quality and quantity shall be administered and enforced. Stormwater runoff is flow overland from precipitation that accumulates in and flows through natural or man-made conveyance systems during rainfall events or from snowmelt.

Development and redevelopment projects shall be conducted in accordance with the requirements of this manual and subsequent amendment made thereto. This manual will be amended to reflect changes in the *Code of Virginia* or Virginia Administrative Code affecting local implementation of the Virginia Stormwater Management Program. Any subsequent amendments to this design manual will be reviewed and approved by the Virginia Department of Environmental Quality prior to incorporation herein.

Upon the adoption of an amended manual, previous versions of the design manual will be null and void and development and redevelopment projects will be required to be conducted in accordance with the amended design and construction manual from its effective date unless another date is specified within the amendment.

The effective date of this design and construction manual is **July 1, 2014**.

1.2 Definitions

Notwithstanding other definitions to the contrary in the Norfolk City Code or Zoning Ordinance, as used in this design and construction manual, the following terms have the following definitions:

"*Administrator*" means the Director of the Department of City Planning or his designated agent.

"*Applicant*" means any person submitting an application for a permit or requesting issuance of a permit under this chapter.

"*Agreement in lieu of a stormwater management plan*" means a contract between the VSMP authority and the owner or permittee that specifies methods that shall be implemented to comply with the requirements of a VSMP for the construction of a single-family residence; such contract may be executed by the VSMP authority in lieu of a stormwater management plan.

"Best management practice" or *"BMP"* means schedules of activities, prohibitions of practices, including both structural and 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.

"Chesapeake Bay Preservation Act land-disturbing activity" means a land-disturbing activity including clearing, grading or excavation that results in a land disturbance equal or greater than 2,500 square feet and less than one acre in all areas of jurisdictions designated as subject to the regulations adopted pursuant to the Chesapeake Bay Preservation Act, *Code of Virginia*, § 62.1-44.15:67, et seq.

"Common plan of development or sale" means a contiguous area where separate and distinct construction activities may be taking place at different times on different schedules.

"Conservation management area or CMA" means an area designated by Department of Public Works – Operations Division to be conserved for the purpose of improved environmental quality. Vegetation in CMAs will be managed towards this goal and is not subject to ordinances for management of turf, landscaping or trees. CMAs may include, but are not limited to: tidal or non-tidal wetlands; forested or grass buffers around wetlands, streams, ditches, or stormwater ponds; managed meadows; and upland forest groves.

"Construction record drawing" means a design, working drawing or as built drawing submitted as the final record of documentation for a land disturbing activity.

"Control measure" means any best management practice or other method used to prevent or reduce the discharge of pollutants to surface waters.

"Clean Water Act" or *"CWA"* means the federal Clean Water Act (33 USC §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.

"Department" or *"DEQ"* means the Department of Environmental Quality.

"Development" means 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 non-agricultural or non-silvicultural purposes.

"General permit" means the VSMP GENERAL PERMIT FOR DISCHARGES OF STORMWATER FROM CONSTRUCTION ACTIVITIES found at 9 VAC 25-880-70 authorizing a category of discharges under the CWA and the Act within a geographical area of the Commonwealth of Virginia.

"Land disturbance" or *"land-disturbing activity"* means a manmade change to the land surface that potentially changes its runoff characteristics including any clearing, grading, or excavation except that the term shall not include those exemptions specified in Section 2.1 of this Design Manual.

“*Land disturbing activity permit*” means an approval to conduct a land-disturbing activity issued by the Administrator for the initiation of a land-disturbing activity, and which may only be issued after evidence of general permit coverage has been provided by the Department, where applicable.

“*Layout*” means a conceptual drawing sufficient to provide for the specified stormwater management facilities required at the time of approval.

“*Minor modification*” means an amendment to an existing permit before its expiration not requiring extensive review and evaluation including, but not limited to, changes in EPA promulgated test protocols, increasing monitoring frequency requirements, changes in sampling locations, and changes to compliance dates within the overall compliance schedules. A minor permit modification or amendment does not substantially alter permit conditions, substantially increase or decrease the amount of surface water impacts, increase the size of the operation, or reduce the capacity of the facility to protect human health or the environment.

“*New Development*” means development where the predevelopment land cover condition is forested or mowed at a frequency of less than four times per year.

“*Operator*” means the owner or operator of any facility or activity subject to regulation under this Ordinance.

“*Permit*” or “*VSMP Authority Permit*” means a land disturbing activity permit.

“*Permittee*” means the person to whom the Permit is issued.

“*Person*” means any individual, corporation, partnership, association, state, municipality, commission, or political subdivision of a state, governmental body, including federal, state, or local entity as applicable, any interstate body or any other legal entity.

“*Postdevelopment*” means conditions that reasonably may be expected or anticipated to exist after completion of the land development activity on a specific site.

“*Predevelopment*” means the conditions that exist at the time that plans for the land development of a tract of land are submitted to the VSMP authority. Where phased development or plan approval occurs (preliminary grading, demolition of existing structures, roads and utilities, etc.), the existing conditions at the time prior to the first item being submitted shall establish predevelopment conditions.

“*Redevelopment*” means the process of developing land that is or has been previously developed.

“*Regulations*” means the Virginia Stormwater Management Program (VSMP) Permit Regulations, 9 VAC 25-870-10, *et. seq.*, as amended.

“*Single family*” means a detached building containing only one dwelling unit surrounded by yards. Manufactured homes, mobile homes, travel trailers, housing mounted on self-propelled or drawn vehicles, tents, or other forms of temporary housing or portable housing are not included in this definition.

"*Site*" means the land or water area where any facility or activity is physically located or conducted, a parcel of land being developed, or a designated area of a parcel in which the land development project is located. Areas channelward of mean low water in tidal Virginia shall not be considered part of a site.

"*State*" means the Commonwealth of Virginia.

"*State Board*" means the Virginia State Water Control Board.

"*State permit*" means an approval to conduct a land-disturbing activity issued by the State Board in the form of a state stormwater individual permit or coverage issued under a state general permit or an approval issued by the State Board for stormwater discharges from an MS4. Under these state permits, the Commonwealth imposes and enforces requirements pursuant to the federal Clean Water Act and regulations, the Virginia Stormwater Management Act and the Regulations. "State Water Control Law" means Chapter 3.1 (§62.1-44.2 et seq.) of Title 62.1 of the Code of Virginia.

"*State waters*" means all water, on the surface and under the ground, wholly or partially within or bordering the Commonwealth or within its jurisdiction, including wetlands.

"*Stormwater*" means precipitation that is discharged across the land surface or through conveyances to one or more waterways and that may include stormwater runoff, snow melt runoff, and surface runoff and drainage.

"*Stormwater management plan*" means a document(s) containing material for describing methods for complying with the requirements of Chapter 5 of this Design Manual.

"*Stormwater Pollution Prevention Plan*" or "*SWPPP*" means a document that is prepared in accordance with good engineering practices and that identifies potential sources of pollutants that may reasonably be expected to affect the quality of stormwater discharges from the construction site, and otherwise meets the requirements of this Ordinance. In addition the document shall identify and require the implementation of control measures, and shall include, but not be limited to the inclusion of, or the incorporation by reference of, an approved erosion and sediment control plan, an approved stormwater management plan, and a pollution prevention plan.

"*Subdivision*" means the same as defined in Chapter 42.5 – Subdivision Ordinance of the Norfolk City Code.

"*Total maximum daily load*" or "*TMDL*" means the sum of the individual wasteload allocations for point sources, load allocations for nonpoint sources, natural background loading and a margin of safety. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure. The TMDL process provides for point versus nonpoint source trade-offs.

"*Virginia Stormwater Management Act*" or "*Act*" means Article 2.3 (§62.1-44.15:24 et seq.) of Chapter 3.1 of Title 62.1 of the Code of Virginia.

"*Virginia Stormwater BMP Clearinghouse website*" means a website that contains detailed design standards and specifications for control measures that may be used in Virginia to comply with the requirements of the Virginia Stormwater Management Act and associated regulations.

“*Virginia Stormwater Management Program*” or “*VSMP*” means a program approved by the VSWCB after September 13, 2011, that has been established by a locality to manage the quality and quantity of runoff resulting from land-disturbing activities and shall include such items 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 this article, and evaluation consistent with the requirements of this article and associated regulations.

"*Virginia Stormwater Management Program authority*" or "*VSMP authority*" means an authority approved by the 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 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 § 15.2-5102.

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CHAPTER 2.0 STORMWATER MANAGEMENT PLAN PREPARATION

2.1 Stormwater Plan Review Process Overview

To protect the quality and quantity of state water from the potential harm of unmanaged stormwater runoff resulting from land-disturbing activities, the City requires all development and redevelopment which go through site plan review, as required in the Chapter 26, *Site Plan Review*, of the Zoning Ordinance of the City of Norfolk, and to comply with the applicable storm water technical criteria for regulated land-disturbing activities as determined in Section 2.3.1, below.

2.2 Exemptions

The following activities are exempt from City of Norfolk stormwater management technical criteria but may be subject to regulation under the City of Norfolk Municipal Separate Storm Sewer System permit where discharges from these activities enter the City storm sewer system:

1. Routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original construction of the project. The paving of an existing road with a compacted or impervious surface and reestablishment of existing associated ditches and shoulders shall be deemed routine maintenance if performed in accordance with this subsection;¹
2. Single-family residences separately built and disturbing less than 2,500 square feet and not part of a larger common plan of development or sale, including additions or modifications to existing single-family detached residential structures;²
3. Land disturbing activities that disturb less than 2,500 square feet of land area except for land disturbing activities that are part of a larger common plan of development or sale that is 2,500 square feet or greater of disturbance;
4. Discharges to a sanitary sewer or combined sewer system;³
5. Conducting land-disturbing activities in response to a public emergency where the related work requires immediate authorization to avoid imminent endangerment to human health or the environment. In such situations, the VSMP authority shall be advised of the disturbance within seven days of commencing the land-disturbing activity and compliance with the administrative requirements of Section 2.3 is required within 30 days of commencing the land-disturbing activity.
6. Activities under a State or federal reclamation program to return an abandoned property to an agricultural or open land use;
7. Clearing of lands specifically for agricultural purposes and the management, tilling, planting or harvesting of agricultural, horticultural, or forest crops, livestock feedlot operations, or as additionally set forth by the Board in regulations, including engineering operations as follows: construction of terraces, terrace outlets, check dams, desilting basins, dikes, ponds, ditches, strip cropping, lister furrowing, contour cultivating, contour furrowing, land drainage, and land irrigation; however, this exception shall not apply to harvesting of forest crops unless the area on which harvesting occurs is reforested artificially or naturally in accordance with the provisions of Chapter 11 (§ 10.1 – 1100 et seq.) or is converted to bona fide agricultural or improved pasture use as described in subsection B of §10.1-1163;

8. Permitted surface or deep mining operations and projects, or oil and gas operations and projects conducted under the provisions of Title 45:1;

¹ Routine maintenance does not include the wholesale replacement of an existing improvement.

² Single family residence construction usually results in more than 2,500 square feet of land disturbance and generally requires a land disturbance permit.

³ Discharges to the sanitary sewer system must be in accordance with either Chapter 39.1 or Chapter 39.2 of the Code of the City of Norfolk.

2.3 Determining Which Stormwater Technical Criteria Apply to a Project

Regulated land disturbance activities must either comply with the technical criteria contained in Part II B or Part II C of the Virginia Stormwater Management Regulations based on whether the site qualifies as either a grandfathered site or a site having received initial coverage under the General permit prior to July 1, 2014. The applicant must determine which stormwater technical criteria apply to their site, and, if proposing to develop or redevelop a site based on grandfathering provisions or based on the date of initial General permit coverage, submit proof of the applicability of grandfathering or General permit coverage to the City at the time of site plan submission.

2.3.1 Single Family Home Construction

Single family home construction permit requirements are driven by the amount of land disturbance, whether the construction is part of a larger development or not and whether or not the home site is located in a Resource Protection Area (RPA) or Resource Management Area (RMA). The following tables describe the permitting required for single family home construction depending upon whether the construction is stand alone or part of a larger development (subdivision).

Single family home construction sites must provide appropriate drainage to avoid creating a nuisance to neighboring properties. On-site drainage must be conveyed from the property to the City's right of way or to an existing drainage system capable of conveying the anticipated volume of storm water runoff, or the lot must provide a public drainage easement to convey storm water runoff to the City right of way or an existing storm water conveyance system (10 foot minimum along a property line to the City right of way or public storm water conveyance system).

Table 2.1: Stand-Alone Single Family Home Permitting

Single family construction,	Erosion and Sediment Control Approval Required?	Stormwater Management Plan Approval or Executed Agreement in Lieu of a Stormwater Management Plan Required?	Construction General Permit Required?
2,500 square feet ≤ disturbance ≤ 43,559 square feet	Yes (agreement in lieu)	No	No
Disturbance ≥ 1 acre	Yes	Yes	Yes (Permit by Rule for up to 5 acres of disturbance)

Table 2.2: Single Family Home Permitting Within a Common Plan of Development greater than 1 acre.

Single Family Construction, PART of Larger Development Plan	Erosion and Sediment Control Approval Required?	Stormwater Management Plan Approval or Executed Agreement in Lieu of a Stormwater Management Plan Required?	Construction General Permit Required?
2,500 square feet ≤ disturbance ≤ 43,559 square feet	Yes (agreement in lieu)	Yes (Plan from larger development may qualify)	Yes (Permit by Rule)
Disturbance ≥ 1 acre	Yes	Yes (Plan from larger development may qualify)	Yes (Permit by Rule for up to 5 acres of disturbance)

An agreement in lieu of a stormwater plan may be used for those single family home sites within larger common plans of development where the stormwater management plan for the larger development does not account fully for the pollutant loading or runoff from the single family home site. An agreement in lieu of a stormwater management plan may also be used to satisfy stormwater quality requirements from standalone single family home construction instead of a full stormwater management plan as described in Section 2.4.1.

2.3.2 Fill Permit Required

Before any filling is done by any person in any area in the City which could affect the direction, rate or volume of surface flow from one property onto another or onto a public right of way, a fill plan shall be filed with the Director of Public Works, or his designee. This fill plan can be incorporated into site plans for a site and must contain, at a minimum, the following items:

1. A survey drawn to scale, certified as complete and accurate by a professional engineer, landscape architect or a certified land surveyor, which clearly delineates:
 - a. The existing topography of the area proposed to be filled or graded shown by contour lines;

- b. The location, elevation, extent, and type of proposed fill or grading shown by contour lines and total fill and disturbed area calculations; and,
 - c. The location of natural drainage areas which would or could be obstructed by the fill.
2. Appropriate erosion and sedimentation control procedures as required by Chapter 15 of the City Code.
3. A description of the purpose and necessity of the filling or grading.
4. Any additional information or data the Director of Public Works or his designee requests to complete their review of the fill plan.

Filling of portions of property which do not affect the direction, rate or volume of surface flow from one property onto or into another shall not require a fill permit at the discretion of the Director of Public Works or his designee. The issuance of a fill permit does not convey property rights in either real or personal property, or exclusive privileges, nor does it authorize injury to private property or invasion of personal property rights, nor infringement of any other federal, state or local law or regulation.

2.3.3 Chesapeake Bay Land Disturbing Activities

After July 1, 2014, commercial, industrial, institutional and multi-family projects disturbing between 2,500 square feet and 43,559 square feet, which are not part of a larger common plan of development or sale, do not require coverage under a general permit and are not required to prepare a stormwater pollution prevention plan. These sites still require coverage under a land disturbing permit issued by the City of Norfolk and are also subject to the stormwater management technical criteria and stormwater management plan criteria of Chapter 42.1 of the Code of the City of Norfolk and this Design Manual.

The original or subsequent owners of commercial, industrial or institutional lots within larger common plans of development may utilize the stormwater management plan approved for the common plan of development to satisfy the requirement for the preparation of a stormwater management plan for their individual lot or parcel provided the development is conducted in conformance with the previously approved stormwater management plan and the water quality and quantity control features designed and installed to treat runoff from the lot are installed and functioning in accordance with their approved design.

All development equaling or exceeding one acre (43,560 square feet) of land disturbance must obtain coverage under the general permit and provide proof of general permit coverage to the City of Norfolk prior to the issuance of a land disturbance permit.

2.3.4 Grandfathering

Any project meeting the grandfathering criteria is not subject to the technical criteria of Part II B of the Virginia Stormwater Management Regulations (9 VAC 25-870-62 through 9 VAC 25-870-92), but is subject to the technical criteria of Part II C of the Virginia Stormwater Management Regulations (9 VAC 25-870-93 through 9 VAC 25-870-98) for those areas that were included in the approval. Nothing in this section precludes an owner from constructing their project to a more stringent standard at their discretion.

The following projects are considered vested (grandfathered) to the stormwater regulations as outlined above:

1. Until June 30, 2019, any land-disturbing activity for which a currently valid proffered or conditional zoning plan, preliminary or final subdivision plat, preliminary or final site plan or

zoning with a plan of development, or any document determined by the City as being equivalent thereto, was approved by the City's site plan review process prior to July 1, 2012 and that provides a layout as defined herein and will comply with the Part II C technical criteria of the Virginia Stormwater Management Regulations, and has not been subsequently modified or amended in a manner resulting in an increase in the amount of phosphorus leaving each point of discharge, and such that there is no increase in the volume or rate of runoff, and has not received coverage under the VSMP Construction General Permit prior to July 1, 2014 and has not commenced land disturbing activities prior to July 1, 2014.

2. Local, state, and federal projects for which there has been an obligation of funding, in whole or in part, prior to July 1, 2012, or for which the Commonwealth has approved a stormwater management plan prior to July 1, 2012, shall be considered grandfathered and shall not be subject to the technical requirements of Part II B of the Virginia Stormwater Management Regulations, but shall be subject to the technical requirements of Part II C of the Virginia Stormwater Management Regulations for those areas that were included in the approval provided such project has not received coverage under the VSMP Construction General Permit prior to July 1, 2014 and has not commenced land disturbing activities prior to July 1, 2014.
3. Notwithstanding anything to the contrary, in cases where governmental bonding or public debt financing has been issued for a project prior to July 1, 2012, such project shall be subject to the technical criteria of Part II C in perpetuity.
4. For those sites that are authorized to design utilizing Part II C of the Virginia Stormwater Management Regulations, the default watershed impervious value (**I watershed**) to be used for performance based water quality calculations is 16%.

2.3.5 On-Going Land Disturbing Activities and Sites that Continue General Permit Coverage

Land-disturbing activities without current site plan approval and which do not qualify for grandfathering in accordance with Section 2.3.4 that obtain general permit coverage prior to July 1, 2014 but do not commence land disturbing activities prior to July 1, 2014 may be designed to Part II C of the Virginia Stormwater Management Regulations provided they:

1. Maintain permit coverage continuously (submit for coverage under the 2014 General permit prior to June 30, 2014) for the 2014-2019 General permit;
2. Submit to the City for review a stormwater management plan and erosion and sediment control plan within 60 days of receipt of coverage under the 2014 General permit, and;
3. Receive plan approval from the City within 120 calendar days from initial submittal.

Land disturbing activities that commence lawful land disturbance prior to July 1, 2014 shall be conducted in accordance with the technical criteria of Part II C of the Virginia Stormwater Management Regulations (9 VAC 25-870-93 through 9 VAC 25-870-98) until June 30, 2024. After such time, portions of the project not under construction shall become subject to any new technical criteria adopted by the City of Norfolk.

The grandfathering clause applies specifically to land-disturbing activities and does not apply to regional or watershed storm water management plans or storm water master plans. Regional and watershed storm

water management plans and storm water master plans will need to be reviewed and modified in order to ensure compliance with Part II B of the Virginia Stormwater Management Regulations.

2.3.6 New Development and Redevelopment Projects Lacking a General Permit and Grandfathering

For non-grandfathered new development and redevelopment sites, and for sites that have not obtained a Virginia Stormwater Management Program General Permit for Construction Activities prior to June 30, 2014, the stormwater management plan shall apply the technical criteria contained in Part II B of the Virginia Stormwater Management Regulations (9 VAC 25-870-62 through 9 VAC 25-870-92).

2.4 Development of the Stormwater Management Plan

As a part of the site plan review process, a stormwater management plan must be developed and submitted to the City of Norfolk for review for all land disturbance exceeding 2,500 square feet. The Department of City Planning is responsible for site plan review and for distributing site plans to additional departments for review. The Department of Public Works Operations Division reviews stormwater management for water quantity and quality calculations and stormwater management facility design. Where stormwater runoff is comingled with other sources of surface or subsurface water runoff from a site, the stormwater management plan must consider the combined flow in its totality regardless of source. Stormwater management plans are not considered submitted for review until any required plan review fees are paid to the City of Norfolk by the applicant.

2.4.1 Stormwater Management Plan Contents

The required elements of the stormwater management plan are the same, regardless of whether the stormwater runoff must meet the technical criteria of either Part II B or Part II C of the Virginia Stormwater Management Regulations. For a stormwater management plan to be considered complete, it must contain the following elements:

1. Information on the type of and location of stormwater discharges, information on the features to which stormwater is being discharged including surface waters if present, and predevelopment and post-development drainage areas;
2. Contact information including the name, address, and telephone number of the owner and the tax reference number and parcel number of the property or properties affected;
3. A narrative that includes a description of current site conditions and final site conditions;
4. A general description of the proposed stormwater management facilities and the mechanism through which the facilities will be operated and maintained after construction is complete;
5. Information on *each* of the proposed on-site stormwater management facilities, including:
 - a. the type of facility;
 - b. its location, including geographic coordinates;
 - c. the square feet and acreage treated;

- d. the surface waters into which each facility will discharge. For interconnected stormwater management features, the ultimate receiving water for each series of interconnected features should be reported; and,
 - e. documentation and calculations verifying compliance with the applicable water quality and quantity requirements.
6. Hydrologic and hydraulic computations, runoff characteristics including site specific determination of the depth to seasonal high groundwater and infiltration rate;
7. A map or maps of the site that depict the topography of the site and that include:
 - a. All contributing drainage areas;
 - b. Existing streams, ponds, culverts, ditches, wetlands, other water bodies, Chesapeake Bay Preservation Area features and any associated buffers, and floodplains;
 - c. Soil types, geologic formations if karst features are present in the area, forest cover, and other vegetative areas;
 - d. Current land use including existing structures, roads, and locations of known utilities and easements;
 - e. Sufficient information on adjoining parcels to assess the impacts of stormwater from the site on these parcels;
 - f. The limits of clearing and grading, and the proposed drainage patterns on the site;
 - g. Proposed buildings, roads, parking areas, utilities, and stormwater management facilities; and
 - h. Proposed land use with tabulation of the percentage of surface area to be adapted to various uses, including but not limited to planned locations of utilities, roads, and easements;
8. If an operator intends to meet the water quality requirements established by either Part II B or Part II C of the Virginia Stormwater Management Regulations through the use of off-site compliance options, where applicable, then a letter of availability from the off-site provider must be included; and

2.4.2 Certification Requirements for Plan Preparation

Elements of the stormwater management plans that include activities regulated under Chapter 4 (§[54.1-400](#) et seq.) of Title 54.1 of the Code of Virginia shall be appropriately sealed and signed by a professional registered in the Commonwealth of Virginia pursuant to Article 1 (§ [54.1-400](#) et seq.) of Chapter 4 of Title 54.1 of the Code of Virginia.

2.4.3 Maintenance Plan Requirements

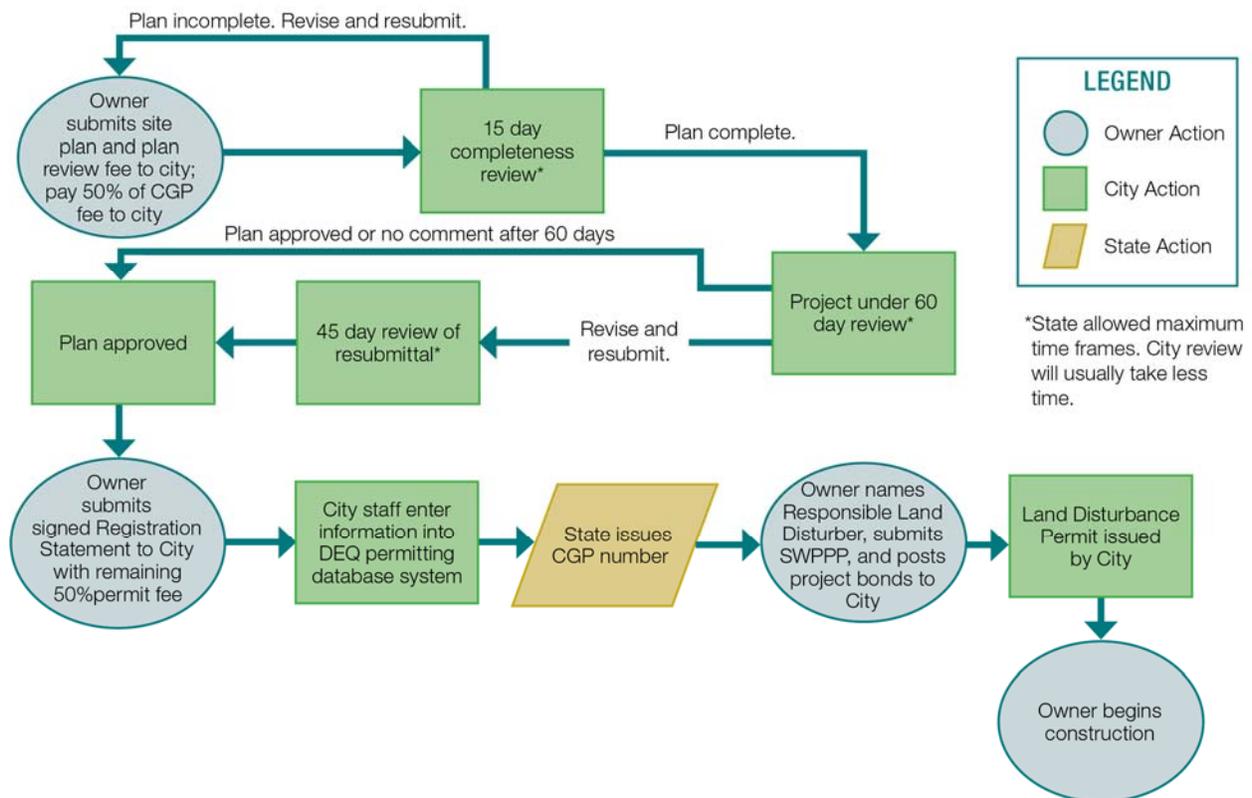
Prior to land disturbance permit issuance, the applicant must prepare and submit for formal review and approval a BMP Maintenance Manual as described in 7.2.1 and an executed Declaration of Covenants for the proposed permanent stormwater management facilities on the project site.

CHAPTER 3.0 STORMWATER MANAGEMENT AND EROSION AND SEDIMENT CONTROL PLAN REVIEW PROCESS

3.1 Stormwater Approval Process

Stormwater runoff is regulated by federal, state and local laws and regulations. The purpose of these regulations is to limit the amount of pollutants that are discharged into the waterways around the City of Norfolk with stormwater. A key aspect of the program for reducing pollution in stormwater runoff is the treatment of stormwater runoff both during and after construction within urban areas like Norfolk. Runoff from construction activities and from the completed projects is controlled through design practices contained in the project plans. These plans are reviewed by the Department of City Planning – Bureau of Environmental Services for erosion and sediment control compliance and by the Department of Public Works, Operations Division for stormwater quality and runoff reduction compliance. Figure 3.1 depicts the stormwater plan review and approval process.

Figure 3.1: Stormwater Plan Approval Process



The City of Norfolk will enter project information into the state developed e-Permitting system on behalf of the owner / applicant and will notify the Commonwealth via the e-Permitting system when the stormwater plan and erosion and sediment control plans are approved.

3.2 Stormwater Management Plan Completeness Review

Upon receipt of a stormwater management plan and one half of the fee specified based on project disturbed area in Appendix 7 of this Design Standards Manual, the plan will be reviewed for completeness.

Incomplete fee payments are deemed non-payments. The applicant will be notified within fifteen (15) days of receipt as to whether the plan is complete and if incomplete, what items are required to be submitted for the plan to be considered complete.

3.3 Stormwater Management and Erosion and Sediment Control Plan Technical Review

Upon receipt of a complete stormwater management plan, the plan will be reviewed for compliance with the technical criteria of Part II B or Part II C of the Regulations, Chapter 42.1 of the code of the City of Norfolk and this design manual. The erosion and sediment control plan will be reviewed for compliance with the Virginia Erosion and Sediment Control Law and Regulations and Chapter 15.1 of the code of the City of Norfolk by the Department of City Planning – Bureau of Environmental Services.

3.4 Stormwater Management and Erosion and Sediment Control Plan Approval or Disapproval

The results of the technical review will be communicated to the applicant and the plan will be deemed approved or not approved. For plans where the applicant was notified that the plan was complete within 15 days from submittal, the City will have up to sixty (60) additional days to perform the stormwater management plan technical review. For plans reviewed by the City where no written notification of plan completeness was provided to the applicant, the City will perform the technical review within sixty (60) days of the date of initial stormwater management plan submittal to the City. For plans deemed not approved, the applicant must revise and resubmit the stormwater management plan and/or erosion and sediment control plan for technical review to the Department of City Planning – Bureau of Environmental Services. Revised plans will be reviewed and approval or disapproval with written comments will be provided to the applicant within forty-five (45) days of resubmittal.

3.5 Plan Modification

The approved stormwater management plan or erosion and sediment control plan may only be modified by the applicant after the submittal of the proposed modification to the Department of City Planning and the proposed stormwater management plan modification reviewed by the Department of Public Works, Operations Division staff and the proposed erosion and sediment control plan modifications reviewed by the Department of City Planning – Bureau of Environmental Services.

CHAPTER 4.0 EROSION AND SEDIMENT CONTROL PLAN REQUIREMENTS

All projects having land disturbance of 2,500 square feet or more, excluding single family residences disturbing between 2,500 square feet and one acre, are required to submit and obtain approval of an erosion and sediment control plan prior to land disturbance. This requirement is more stringent than the state law of 10,000 square feet for land disturbance. Single family residences are handled by having the owner/developer sign an agreement in lieu of an erosion and sediment control plan.

4.1 Standard Erosion and Sediment Control Plan

All erosion and sediment control plans must comply with Title 62.1, Chapter 3.1, Article 2.4 of the Code of Virginia, including the applicable regulations. Generally, all erosion and sediment control plans must include a map or maps depicting proposed structural and non-structural measures and associated details, City of Norfolk Standard Erosion and Sediment Control Notes, an erosion and sediment control narrative, temporary and permanent vegetative stabilization specifications, calculation of the total site area and proposed amount of land disturbance, Virginia Stormwater Management Program General Permit for Stormwater Discharges from Construction Activities note (if required), and preconstruction conference note.

The plans are reviewed by a Virginia certified erosion and sediment control plan reviewer who utilizes the Virginia Department of Environmental Quality plan review checklist and the plan is either approved or disapproved within 60 days of plan submittal. For plans disapproved, the reason(s) for plan disapproval are communicated to the applicant in writing. Prior to the issuance of a land disturbance permit, the owner or applicant must name a Responsible Land Disturber (RLD) who will assume the responsibility of site compliance with the Erosion and Sediment Control ordinance.

4.2 Agreement In-Lieu of a Plan

For land disturbance of greater than 2,500 square feet but less than one acre on a single-family residential lot, the land disturber may choose to file an agreement in lieu of an erosion and sediment control plan with the Department of City Planning. Prior to the execution of the agreement in lieu of a plan, the owner or applicant must name a Responsible Land Disturber (RLD) who will assume the responsibility of site compliance with the Erosion and Sediment Control ordinance. The agreement in lieu of an erosion and sediment control plan form can be found in Appendix 6 of this stormwater design and construction manual.

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CHAPTER 5.0 STORMWATER QUALITY AND QUANTITY TECHNICAL CRITERIA

5.1 General Criteria Applicable to Water Quality and Quantity Compliance

The following items apply to regulated land disturbing activities within the City of Norfolk regardless of whether the technical criteria of Part II B or Part II C of the Regulations apply to a particular land disturbance project.

Stormwater harvesting is encouraged for the purposes of landscape irrigation systems, fire protection systems, flushing water closets and urinals, and other water handling systems to the extent such systems are consistent with federal, state, and Norfolk Health Department regulations. The preservation of open space, maintenance or creation of natural buffers and other low impact design practices are encouraged as a means to both reduce the volume of stormwater runoff and improve runoff quality. Infiltration practices are generally discouraged in the City of Norfolk due to the presence of a high ground water table and poor soils. Any stormwater management facilities designed to detain, retain or treat stormwater runoff proposed to be constructed in City rights of way are subject to the review and approval of the Director of Public Works or their designee.

Under certain circumstances, and subject to certain conditions, offsite compliance options may be utilized to meet the water quality requirements of these regulations in accordance with 9 VAC 25-870-69 and 9 VAC 25-870-99. Even if offsite water quality compliance options are used, all site water quantity requirements must be satisfied on the project site. Where nutrient credits are proposed to meet the required pollutant reduction in whole or in part, the applicant must submit proof of credit availability from an approved nutrient bank to the City with the stormwater management plan and shall submit proof of purchase of nutrient credits to the City prior to land disturbance permit issuance.

5.2 Technical Criteria of Part II B of the Virginia Stormwater Management Regulations

In order to protect the quality of state waters and to control the discharge of stormwater pollutants from regulated activities, the following minimum design criteria and statewide standards for stormwater management shall be applied to the site.

5.2.1 New Development

The total phosphorus load of new development projects shall not exceed 0.41 pounds per acre per year, as calculated pursuant to 9 VAC 25-870-65.

5.2.2 Redevelopment

For land-disturbing activities disturbing greater than or equal to one acre that result in no net increase in impervious cover from the predevelopment condition, the total phosphorus load shall be reduced at least 20% below the predevelopment total phosphorus load.

For regulated land-disturbing activities disturbing greater than 2,500 square feet and less than one acre that result in no net increase in impervious cover from the predevelopment condition, the total phosphorus load shall be reduced at least 10% below the predevelopment total phosphorus load.

For land-disturbing activities that result in a net increase in impervious cover over the predevelopment condition, the design criteria for new development shall be applied to the increased impervious area. Depending on the area of disturbance, either a 10% reduction, for disturbance of up to one acre, or a 20% reduction, for disturbance equal to one acre or greater, in the predevelopment total phosphorous load must be achieved on the remainder of the site.

For redevelopment projects, under no case will the total phosphorus load be required to be reduced to below the applicable standard for new development.

5.2.3 Linear Redevelopment Projects

The total phosphorus load discharged from any linear development project occurring on prior developed lands shall be reduced 20% below the predevelopment total phosphorus load.

The total phosphorus load shall not be required to be reduced to below the applicable standard for new development.

5.2.4 Water Quality Compliance

Projects subject to the requirements of Part II B of the Regulations shall meet the water quality standards found at 9 VAC 25-870-65.

5.2.5 Design Storms and Hydraulic Methods

The prescribed design storms are the one-year, two-year, and 10-year 24-hour storms using the site-specific rainfall precipitation frequency data recommended by the U.S. National Oceanic and Atmospheric Administration (NOAA) Atlas 14. Partial duration time series shall be used for the precipitation data.

The following steps should be used for calculating storm water runoff.

1. Use the Norfolk Master Storm Drain Plan sheets or other appropriate mapping with elevation information to delineate drainage basin boundaries for the site. Outline the drainage area contributing storm water runoff to the site and include off-site drainage areas that contribute runoff discharge through the project site.
2. Measure drainage area and project site area in acres. Measure impervious area of project site for existing and proposed conditions. Impervious area shall include pavement, buildings, roofs and any other surface which does not allow infiltration of water into the soil. Concrete, asphalt, and gravel surfaces are considered impervious.
3. Based on size of drainage area contributing runoff to the site, use Table 5.2 to choose the runoff calculation method.
4. Calculate storm water runoff for design of the storm drain system.

All hydrologic analyses shall be based on the existing watershed characteristics and how the ultimate development condition of the subject project will be addressed.

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) synthetic 24-hour rainfall distribution and models, including, but not limited to TR-55 and TR-20; hydrologic and hydraulic methods developed by the U.S. Army Corps of Engineers; or other standard hydrologic and hydraulic methods, shall be used to conduct hydraulic analysis for projects subject to Part II B of the Regulations.

5.2.6 Use of BMPs from the Virginia BMP Clearinghouse Required

The BMPs listed on the Virginia Stormwater BMP Clearinghouse Website are approved for use as necessary to effectively reduce the phosphorus load and runoff volume in accordance with the Virginia Runoff Reduction Method.

Other approved BMPs found on the Virginia Stormwater BMP Clearinghouse Website at <http://www.vwrrc.vt.edu/swc> may also be utilized. Design specifications and the pollutant removal efficiencies for all approved BMPs are found on the Virginia Stormwater BMP Clearinghouse.

Where a BMP listed on the Virginia BMP Clearinghouse contains Coastal Plain design considerations, these considerations shall be employed during the design of the BMP within the City of Norfolk.

5.3 Technical Criteria of Part II C of the Virginia Stormwater Management Regulations

Sites that qualify as grandfathered sites under the Regulations may meet water quality and quantity compliance requirements by using Part II C of the Regulations until June 30, 2019. Sites that had begun construction or that had obtained general permit coverage prior to June 30, 2014 may meet water quality and quantity compliance requirements by using Part II C of the Regulations until June 30, 2024, provided they comply with the submittal timeframes contained in Section 2.3.5.

5.3.1 New Development

The default impervious cover to be used for determining water quality compliance under Part II C of the Regulations in the City of Norfolk is the greater of the actual impervious area of the site at the time the development plan is filed or 16%. No water quality measures are required if the post construction site impervious area will be less than or equal to the amount of impervious area on site at the time the site plan is filed. Where post construction impervious area will exceed the site impervious area as of the date the site plan is filed, the owner is responsible with removing this additional pollutant load in stormwater runoff from the increased impervious area. In no case shall the developer be required to reduce the loading from the site below 0.45 pounds of phosphorous per acre per year.

5.3.2 Redevelopment

Redevelopment projects within the City of Norfolk are required to reduce their pollutant discharge by at least 10% from the existing pollutant discharge. This reduction can be accomplished through structural and non-structural BMPs or through the use of offsite nutrient compliance options.

5.3.3 Linear Development Projects

Linear development projects shall control post development stormwater runoff in accordance with a site-specific stormwater management plan or a comprehensive watershed stormwater management plan developed in accordance with the Virginia Stormwater Management Program Regulations.

5.3.4 Water Quality Compliance

Water quality compliance shall be determined based on the methodology and requirements of Section 5.3.5.

5.3.5 Stormwater Pollutant Removal Calculations

Most projects which go through site plan review are required to have stormwater Best Management Practices (BMP) to achieve post-construction water quality compliance. BMPs are methods of improving the quality of storm water runoff from developed land. The following steps should be used for selection and design of a BMP. Some BMPs may also be used for quantity control of storm water runoff as described in Section 5.4.1.

1. Determine which calculation procedure to use:

Use the Guidance Calculation Procedure worksheets found in Appendix 1E to compute the pollutant removal requirement for the site. Worksheet A is for new development and Worksheet B is for redevelopment. New development is defined as siting new impervious surfaces on existing *pervious* surfaces. Redevelopment is defined as siting new impervious surfaces over existing *impervious* surfaces. If you are not sure how to classify your project, contact the Department of Public Works, Operations Division.

2. New Development: - Guidance Calculation (Procedure Worksheet A)

- a. Calculate % impervious area of proposed site, I_{site} , based on the entire area of the site, A.
- b. Compare to % impervious area of entire watershed. $I_{watershed} = 16$ for Norfolk.
- c. If $I_{site} \leq I_{watershed}$, the required pollutant removal efficiency is zero and no BMP is required.
- d. If $I_{site} > I_{watershed}$, calculate predevelopment and post development loadings. Constants and formulas are provided in the worksheet.
- e. Calculate pollutant removal efficiency requirement.

BMP Selection:

- a. If $I_{site} \leq I_{watershed}$, then no BMP is required. Otherwise, the required pollutant removal efficiency is as calculated in the Worksheet.
 - b. From Table 5.1, identify the BMP that will achieve the required pollutant removal efficiency as calculated.
3. Redevelopment – Guidance Calculation Procedure Worksheet B:
 - a. Calculate % impervious area for predevelopment and for postdevelopment conditions
 - b. Calculate predevelopment and postdevelopment loading using constants and formulas providing in the worksheet.
 - c. Calculate pollutant removal efficiency requirement.

- d. Select BMP types from Table 5.1 that will provide the required pollutant removal efficiency.
 - e. If no BMP type can provide the required efficiency, the site plan must be revised to satisfy the requirement. The Division of Environmental Storm Water Management may require a higher removal efficiency without reducing the size of the proposed impervious area.
4. Subdivisions Creating New Buildable Lots:
- a. Determine the maximum buildable zoning, wetlands or dune/beach, and buffer area requirements. Determine the area of proposed off-site impervious surfaces such as streets and parking.
 - b. Calculate the pollutant removal efficiency requirements for the proposed parcel(s) and off-site improvements assuming full coverage of maximum building area with impervious surfaces. See the steps outlined above for **New Development** or **Redevelopment**.
 - c. Identify from Table 5.1 the type of BMP necessary to meet the pollutant removal requirement that is also consistent with maximum building area, soils conditions, depth to groundwater, and other appropriate site limitations of the proposed subdivision.
 - d. Identify with a note on the plat the maximum buildable area of each parcel and the type of BMP needed to meet the removal requirement. The detail needed for the note will be determined by type of BMP. At a minimum, the note will include type of BMP (e.g. infiltration practices, detention/ retention) and the location (Public vs. private property, inside or outside buffer area). It is the option of the developer to identify a building area less than the maximum in order to reduce the pollutant removal requirement, as long as minimum buildable area, parking, circulation and road width requirements are met.
5. Required Site Data:
- a. Identify environmental site features such as wetlands, CBPA buffer zone and coastal primary sand dunes and obtain preliminary approval from the Department of City Planning, Bureau of Environmental Services for location and size of proposed impervious surfaces (e.g. buildings and parking areas). Preliminary approval is required for structural BMP's located in the CBPA buffer zone.
 - b. Conduct a minimum of one, ten-foot piezometer test to determine seasonal high groundwater table.
 - c. Obtain a minimum of one soil sample, taken two feet above the groundwater table or at the bottom of the proposed BMP Structure to determine classification, permeability coefficient, infiltration rate, and plastic and liquid limits. For infiltration facilities, modified grass swales, and bioretention basins and swales, more soil samples are required to include the above soil information. Additionally, for bioretention or infiltration practices, the site specific permeability must be calculated at the proposed location of each measure.

5.3.6 Best Management Practices

Table 5.1: Acceptable Best Management Practices to meet the requirements of Part II C of the Regulations

Type of BMP*	Average Total Phosphorus Removal Efficiency	Percent Impervious Cover
Vegetated Filter Strip	10%	16% - 21%
Grassed Swale	15%	
Constructed Wetlands	20%	22% - 37%
Extended Detention (2 x WQ Vol)	35%	
Retention Basin I (3 x WQ Vol)	40%	
Bioretention Basin	40%	38% - 66%
Bioretention Filter	50%	
Extended Detention-Enhanced	50%	
Retention Basin II (4 x WQ Vol)	50%	
Infiltration (1 x WQ Vol)	50%	67% - 100%
Sand Filter	65%	
Infiltration (2 x WQ Vol)	65%	
Retention Basin III (4 x WQ Vol with aquatic bench)	65%	

*Innovative or alternate BMPs not included in this table may be allowed at the discretion of the Administrator or the Department. Innovative or alternate BMPs not included in this table that target appropriate nonpoint source pollution other than phosphorous may be allowed at the discretion of the local program administrator or the department.

1. **BMP Design:**

Design the BMP using the guidelines found in the latest edition of the Virginia Stormwater Management Handbook. These BMP design guidelines correspond to the types shown in Table 5.1. Some BMPs, such as retention and detention basins, may also be used for storm water quantity control. Other types of BMPs may be accepted by the City if supporting data can demonstrate an acceptable pollutant removal efficiency.

2. **Maintenance Agreement:**

A maintenance agreement is required from the property owner by the City and is included in Appendix 5. Easement requirements for maintenance access to BMPs are discussed in Section 5.4.1.

3. **Design for Multi-Use Facilities:**

Construction of BMPs which result in a pond, lake, or wetlands can provide additional benefits beyond the design intent of pollutant reduction. Although not specifically required by existing criteria and

regulations, design of BMPs for multi-use benefits is encouraged. The designer should consult the Division of Environmental Storm Water Management concerning additional features which could be incorporated into the BMP design. Typical additional benefits which can be designed into BMPs include:

- Wetlands Mitigation
- Public Use and Education
- Wildlife Habitat Creation
- Improved Site Aesthetics
- Water Supply Protection

A more detailed discussion of how these additional benefits could be incorporated into the BMP design and a technique for introducing alternative BMP technologies are included in the Norfolk Storm Water Management Plan.

5.3.7 Stream Channel Erosion and Flooding Prevention

Erosion to streams and ditches shall be prevented by designing to the requirements of 9 VAC 25-870-97 of the Regulations. Flooding shall be prevented by designing to the requirements of 9 VAC 25-870-98 of the Regulations.

5.3.8 Design Storms and Hydraulic Methods

Determination of flooding and channel erosion impacts to receiving streams due to land disturbing activities shall be measured at each point of discharge from the land disturbance and such determination shall include any runoff from the balance of the watershed that also contributes to that point of discharge.

The specified design storms shall be defined as either a 24-hour storm using the rainfall distribution recommended by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) when using NRCS methods or as the storm of critical duration that produces the greatest required storage volume at the site when using a design method such as the Modified Rational Method.

For purposes of computing runoff, all pervious lands in the site shall be assumed prior to development to be in good condition (if the lands are pastures, lawns, or parks), with good cover (if the lands are woods), or with conservation treatment (if the lands are cultivated); regardless of conditions existing at the time of computation. Pre-development and post-development runoff rates shall be verified by calculations that are consistent with good engineering practices.

Outflows from a stormwater management facility or stormwater conveyance system shall be discharged to an adequate channel.

The storm drain system shall be designed for the 10-year frequency storm and it shall be checked to meet the following requirement:

The postdevelopment peak runoff discharge rate from the 10-year frequency storm shall not exceed the respective predevelopment discharge rates for the 10-year frequency storm.

The method for calculating the peak runoff discharge rate shall be as shown in Table 5.2.

If the proposed storm water drainage system does not limit the postdevelopment peak runoff discharge rate to equal the predevelopment rate for the 10-year frequency storm, the system design shall be modified to meet this requirement. The peak runoff discharge rate shall be defined as the maximum runoff rate leaving the site and discharging into a natural or man-made receiving channel, pipe, or storm drain system at each point of discharge.

If the City determines that the site is not required to limit its postdevelopment peak discharge rate to the predevelopment peak discharge rate for the 10-year storm, the site shall meet the requirements for discharging to an adequate channel as described in Virginia Erosion and Sediment Control Minimum Standard #19, *Virginia Erosion and Sediment Control Regulations (9 VAC 25-840-40)*. *The Virginia Erosion and Sediment Control Handbook*, 1992, Chapter 4 describes how to apply the requirements for an adequate receiving channel.

The following steps should be used for calculating storm water runoff from a project:

1. Use the Norfolk Master Storm Drain Plan sheets or other appropriate mapping with elevation information to delineate drainage basin boundaries for the site. Outline the drainage area contributing storm water runoff to the site and include off-site drainage areas that contribute runoff discharge through the project site.
2. Measure drainage area and project site area in acres. Measure impervious area of project site for existing and proposed conditions. Impervious area shall include pavement, buildings, roofs and any other surface which does not allow infiltration of water into the soil. Concrete, asphalt, and gravel surfaces are considered impervious.
3. Utilize the 10-year, 24 hour storm for hydraulic design.
4. Based on size of drainage area contributing runoff to the site, use Table 5.2 to choose the runoff calculation method.
5. Calculate storm water runoff for design of the storm drain system.

Table 5.2: Runoff Calculation Methods

Approved Procedure	Total Drainage Area
<ul style="list-style-type: none"> • Rational Method • Modified Rational Method (peak discharge only) 	≤ 20 Acres
<ul style="list-style-type: none"> • SCS Graphical Peak Discharge Method (peak discharge only) • SCS Tabular Method (runoff hydrograph) 	> 20 Acres

Table 5.3: Design Storms

System Component	Minimum Design Storm Frequency
<ul style="list-style-type: none"> • On-Site Storm Drain System • Local Street System • Minor Storm Drain System • Collector Street System • Major Trunk Line • Regional Storm Water Facility • Pump Station 	10-year

Definitions of System Components
<ul style="list-style-type: none"> • <i>On-Site Storm Drain System</i> – Privately owned storm drain system that includes pipes, inlets, ditches, culverts and retention or detention basins. It usually connects to a City-owned minor storm drain system or major trunk line system. The owner shall provide drainage for a minimum design storm. A greater design storm may be used to lessen the risk of flooding. • <i>Local Street System</i> - Runoff from a local street will be conveyed by a minor storm drain system and in some cases by a major trunk line system. Spacing of curb drop inlets and diameter of connecting pipes will determine the amount of storm water runoff that can be conveyed off of the street. • <i>Minor Storm Drain System</i> – Total drainage area to this City-owned system is less than 20 acres. A minor system usually conveys the storm water runoff from local streets. • <i>Collector Street System</i> – Runoff from a collector street is usually conveyed by a major trunk line system. A collector street is usually used as an emergency route and should have lower flooding risk than a secondary road. • <i>Major Trunk Line System</i> – Total drainage area to this system is 20 acres or more. The system is usually characterized by a combination of two or more minor systems into a major trunk line which is City-owned. A major trunk line will be more likely to flood when undersized due to the combination of peak flows from contributing minor storm drain systems. • <i>Regional Storm Water Facility</i> – Usually a retention pond or lake that drains an area of 10 acres or more. Design requires calculation of the total volume of runoff for the design year storm. A regional storm water facility shall allow a 100-year design storm to pass without flooding surrounding structures. • <i>Pump Stations</i> – Pump stations are usually located at underpasses of collector or arterial streets used as primary routes. Pump stations may also be located in other areas to provide flood control. The pump station and underpass storm drain system, if present, should be designed for peak discharge rate.

5.4 City of Norfolk Design Criteria

This section provides the specific criteria and approved methods for design of storm water drainage systems in the City of Norfolk. The user should contact the Department of Public Works, Operations Division to obtain any revisions to the criteria made subsequent to issuance of this manual.

The latest versions of the City of Norfolk standard notes and details must be incorporated into the design and included on all stormwater management and erosion and sediment control plans submitted for review. In addition to the requirements specified in the Virginia Stormwater Management Handbook and the Virginia Stormwater BMP Clearinghouse, the following requirements must be complied with when designing stormwater management systems for new development and redevelopment projects in the City of Norfolk, regardless of the procedure being utilized to meet water quality and quantity compliance.

5.4.1 Storm Drain System

The criteria and steps for designing a storm drain system are listed below. The components of a storm drain system consist of inlet structures, pipe laterals and trunk lines, manholes, junction chambers, culverts, channels, and detention/retention basins. The Virginia Stormwater Management Handbook and Virginia Department of Transportation (VDOT) Drainage Manual provide guidelines for designing inlets, piping, culverts, open channels, detention basins, and for computing the hydraulic grade line.

Inlet Design:

If pavement gutters are present, the amount of flow in the gutter must be calculated to check the spread of water on the pavement. Maximum spread shall be the lesser of 7 feet or one-half of the vehicle travel way in each direction for rainfall intensity of 3.5 inches per hour. Inlets along the gutter shall be spaced and sized to limit the spread to the maximum width.

Pipe System Design:

Pipe laterals and trunk lines usually consist of two or more pipes in a series connected by one or more drop inlets. This step should follow the location, spacing and design of all drop inlets. Figure 5.1 shows the design criteria for pipe systems.

Since a tail water elevation of 1.7 (NAVD 88) corresponds to an annual high tide and is frequently exceeded, it should be considered as the minimum design reference elevation for storm drain system tail water calculations.

Hydraulic Grade Line (HGL):

This is the final step in design of a pipe system. The hydraulic grade line is calculated to determine, for the design year storm, the elevation the water will rise in inlets, manholes, or junctions. The hydraulic grade line elevation shall not exceed the curb flow line grade at the inlet opening or manhole rim elevation.

Culvert Design:

A culvert conveys surface water across or from a street or road right-of-way. A culvert must be designed to support the embankment and road for traffic conveyance. Where a culvert is constructed in the 100-year flood plain, it shall allow the 100-year flood to pass over the culvert without raising the water surface elevation more than one foot over existing conditions. The minimum culvert diameter shall be

12 inches for a length of 50 feet or less. For lengths over 50 feet, the minimum diameter shall be 15 inches. The minimum diameter for a culvert under a driveway entrance is 12 inches.

The headwater elevation for the design discharge shall not exceed an elevation which is 18 inches below the edge of shoulder of the road. The following upstream controls may also limit the headwater elevation:

- upstream property damage
- headwater depth/culvert diameter or depth = 1.0 to 1.5
- low point in the road grade that is not at the culvert location
- ditch or ground elevations that will permit flow to divert around culvert
- elevations established to delineate floodplain zoning

The outlet velocity shall be computed for the design discharge and erosion control shall be provided in accordance with VDOT criteria contained in the VDOT Drainage Manual.

At culvert sites where a heavy volume of debris is expected, debris control structures shall be provided. For culverts without endwalls or headwalls, the potential for failure due to buoyancy forces shall be checked.

If the outfall channel consists of material which could experience erosion, the following criteria shall apply:

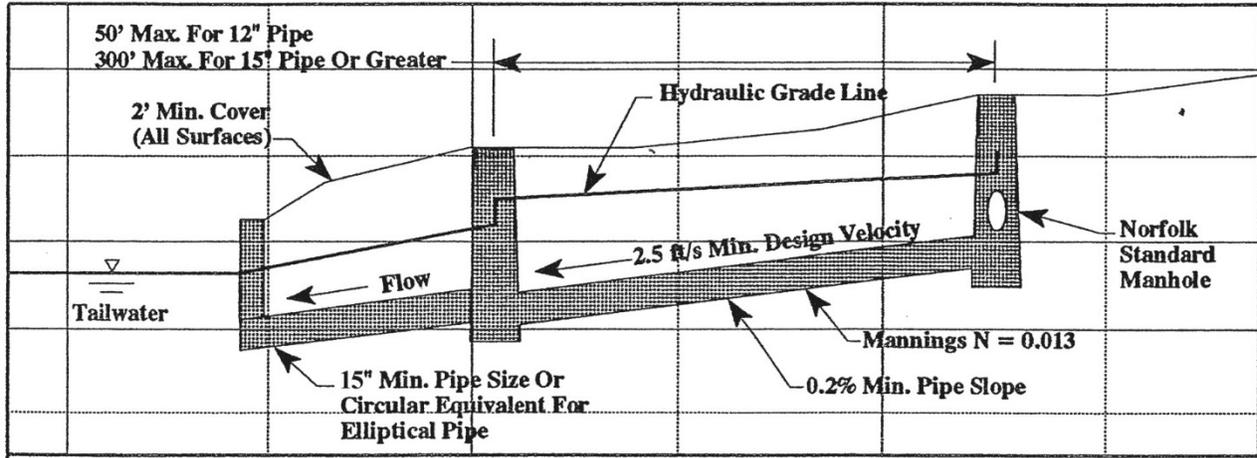
- The outlet velocity shall be computed for the design discharge.
- Erosion Control Treatment - Type A & B shall be in accordance with the VDOT Standard EC-1.
- Special Design Energy Dissipaters - shall consist of heavy rip rap or other structures designed to provide protection for the specific site conditions.

Table 5.3: Required Energy Dissipation Devices for Various Discharge Rates

Outlet Velocity (fps)	Culvert End Treatment	
	End Section	Endwall, or Headwall with Curtain Walls
0 - 6	None	None
6 - 10	EC-1 Type A	None
10 - 14	EC-1 Type A	EC-1 Type A
14 - 19	EC-1 Type B	EC-1 Type B
19+	Special Design	Special Design

SOURCE: VDOT DRAINAGE MANUAL

Figure 5.1: Pipe System Design



Design Criteria:

1. Storm drain design shall be in accordance with Chapter 4 of the VDOT Drainage Manual. Where design criteria conflict, Norfolk criteria in this manual shall take precedence.
2. Storm drain systems shall be designed to convey peak storm water flows based on the design storm required in
3. Table 5.3.
4. Maximum hydraulic grade line elevation for the design year storm shall not exceed curb flowline grade at inlet opening or manhole rim elevation.
5. Maximum spread shall be 7 ft. or one-half of the vehicle travelway in each direction for rainfall intensity of 3.5 in/hr.
6. Tailwater elevation, the initial outfall hydraulic grade, shall be the highest of:
 - elevation corresponding to 80% of outfall pipe diameter; or
 - elevation 1.7 (NAVD 88 with 92 adjustment, City of Norfolk 2000)
 For systems that outfall to Lake Whitehurst use a tailwater elevation of 5.5 (NAVD 88 92 adjustment).
7. Outfall erosion protection shall be in accordance with VDOT standards.
8. Proposed storm drain systems which convey public water through private properties shall have a drainage easement. Easement widths are calculated by methods described in Section 5.4.1 and shown on Figure 5.2.

Pipe Materials:

1. Storm drain pipes shall be reinforced concrete pipe.
2. Storm drain pipes in right-of-way and subject to vehicular traffic shall be VDOT Class III.
3. Other types of pipe materials may be considered by the City in non-traffic areas.

Construction Standards:

1. Inlet structures, conduit, outfall structures, manholes and drainage components required to construct a system shall be in accordance with VDOT Road and Bridge Standards, Volumes I and II, latest edition.
2. When specified by the Department of Public Works, the storm drain system shall be constructed in accordance with Norfolk standards.

Open Channel Design:

Roadside ditches, median ditches and man- made channels that convey storm water runoff are classified as open channels.

Roadside and median ditches shall have an adequate capacity to convey a design year storm applicable to the type of roadway. A 2-year frequency storm shall be used in the design of the roadside or median ditch lining for erosion control.

Man-made drainage channels other than roadside ditches shall convey a minimum 10- year design storm. The channel lining shall also be designed for the 10-year frequency storm. The City may require a higher design storm frequency for man-made channels depending upon location, flood risk, future needs and environmental considerations.

In accordance with the policy of the Department of Public Works, Operations Division, natural channels shall not be modified or disturbed if possible. If a natural channel or floodplain encroachment is unavoidable, then a detailed environmental, regulatory, hydraulic and legal evaluation of such action shall be made.

There are several reasons why a ditch or channel should not be filled in and piped and they are listed below:

- The ditch may contain tidal wetlands and/or be a water of the United States or a state water and may require permits from natural resource agencies for impacts to the ditch.
- Pollutants in the storm water runoff are treated by filtration through the grass, infiltration through the soil, and some settling of sediments.
- More runoff can be stored in a ditch than in a pipe system and this helps to prevent flooding of properties.
- Flow velocities are decreased by the vegetated lining in a ditch and this helps prevent erosion downstream.
- Natural habitat for wildlife is provided by the vegetated banks of ditches.

Some existing ditches may have erosion, sedimentation, and stagnant water problems that can be fixed by maintenance and repairs. If ditch health or safety problems cannot be solved by maintenance or repair, the Department of Public Works, Operations Division will determine if the ditch should be piped.

Storm Water Detention:

BMP facilities such as retention or detention basins that are designed to improve storm water runoff quality may also be used to control the quantity of runoff. The BMP shall be designed to treat the required water quality volume and, for quantity control, it shall be sized for 10-year storm. A retention or detention basin shall also be checked so that a 100-year design storm can pass without flooding surrounding structures.

Maintenance:

The storm water system designer must address the considerations for maintenance of the system during the design phase of the project. These factors can be categorized as follows:

- Location
- Easements
- Landscaping

Location:

The location of storm water piping, manholes, BMPs and related structures shall be designed to take into account natural topography and runoff patterns. In no case will storm water be allowed to be redirected to another drainage area. Natural drainage courses shall be utilized wherever possible to convey treated runoff from the site. The designer should make an effort to maximize overland flow and vegetative filters as they improve the performance of the BMP.

Easements:

Proposed drainage systems which convey public storm water through private properties shall have drainage easements to provide access to the system. Subject to a minimum width of fifteen (15) feet, easement widths for pipes and closed culverts are calculated by:

$$W = 2d + D + 2 \text{ (rounded to nearest 5')}$$

Where: d = Depth to invert

D = Diameter of pipe or total width of closed culvert

W = Easement width in feet

Minimum easement widths for open ditches or culverts shall be calculated by:

$$W = Tw + 12$$

Where: Tw = Top width of ditch or culvert

W = Easement width in feet

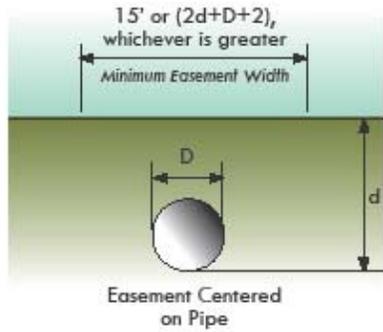
For culverts crossing roadway projects, the minimum easement shall be extended to 25 feet beyond the end of the culvert or wing wall structure.

BMPs which collect public storm water and are located on private properties shall have easements. A minimum 25-foot access easement from a paved, public street to the BMP shall be provided. In addition, a minimum 15-foot flat clear maintenance easement located-around the perimeter of the BMP shall be provided. Access from public or private streets shall be provided to allow maintenance of privately owned BMPs. See Figure 5.2 for easement dimensions.

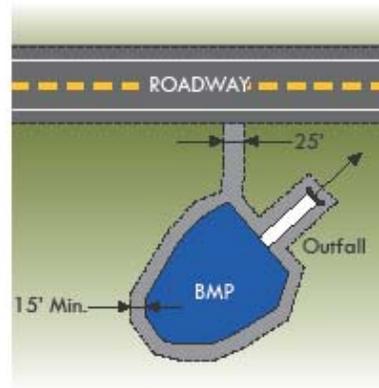
Landscaping:

Landscaping in maintenance access zones shall be limited to grass and small caliper shrubs.

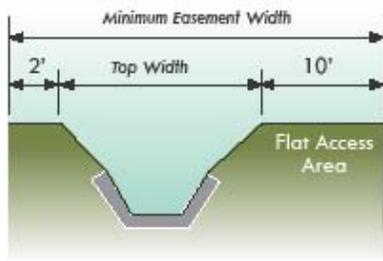
Figure 5.2: Easement Width Calculation



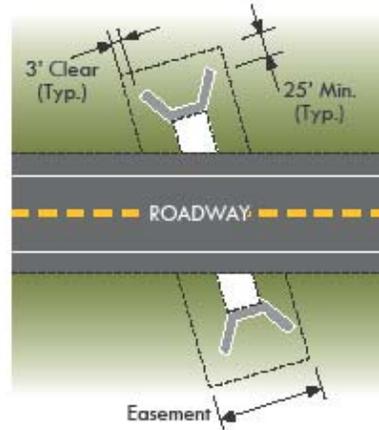
PIPE OR CULVERT



BMP



OPEN CHANNEL



ROADWAY CULVERT

5.4.2 Coastal Plain Design Criteria

In addition to City of Norfolk specified design criteria, all BMPs proposed for use in the City of Norfolk shall incorporate all of the Coastal Plain design criteria specified in the Virginia BMP Clearinghouse. In addition, designers should consider the information contained in Section 1 of the Hampton Roads Planning District Commission Report *Land and Water Quality in Hampton Roads, Phase II, November 2013* contained in Appendix 3.

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CHAPTER 6.0 REQUIREMENTS FOR WATER QUALITY RETROFITS TO EXISTING SITES

Projects developed specifically to improve the quality of runoff leaving an existing developed site or from upstream developed areas and not designed to treat stormwater runoff from new land development or redevelopment will follow guidance developed by the Virginia Department of Environmental Quality for assessing MS4 compliance with the Chesapeake Bay Total Maximum Daily Load. In addition to BMPs listed on the Virginia Stormwater BMP Clearinghouse and techniques approved by the Chesapeake Bay Program, water quality retrofits may include, but are not limited to:

- Expansion or enhancement of existing storm water BMPs;
- Shoreline and buffer management;
- Stream restoration; and,
- Improvements to the storm water conveyance ditches, and wetland restoration.

While the DEQ guidance allows for flexibility in project design, projects are encouraged to meet the design standards of the Virginia Stormwater BMP Clearinghouse Manual to the extent practicable. Greater effort should be made to meet standards required by the City of Norfolk Design and Specification Manual and Section 1 of the Hampton Roads Planning District Commission Report *Land and Water Quality in Hampton Roads, Phase II, November 2013*. Construction of stormwater quality retrofit projects are not subject to the technical requirements of Part II B or Part II C of the regulations pertaining to post construction water quality; however, water quantity requirements must be maintained at the existing value. Projects exceeding 2,500 square feet must demonstrate compliance with erosion and sediment control Minimum Standard 19. Construction of water quality retrofits remain subject to all other regulations regarding land disturbing activities in the City of Norfolk.

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CHAPTER 7.0 LAND DISTURBANCE REQUIREMENTS

7.1 Required Bonds

All development subject to the City's site plan review process per Chapter 26 of the Zoning Ordinance is required to provide a performance bond for the stormwater infrastructure. Bonds shall be provided in the form of a surety bond, letter of credit, or escrow account, and will be collected by the Department of Public Works, Right-of-Way Division prior to the issuance of a land disturbing permit.

7.1.1 Bond Amount Calculation

The contractor is to provide an itemized cost estimate for all components of the stormwater infrastructure based on the City's approved stormwater bond estimate form. The bond estimate will be reviewed and approved by the Storm Water Engineer or his designee.

7.1.2 Inspection

Sites will be inspected by the Department of Public Works, Operations. Deficiency punch lists will be prepared, and sent back to the contractor for review and action. This process will continue until there are no longer any punch list items needing action. When the final site inspection and final cost estimates for the bonds are approved, and all re-inspections have resulted in no further punch list items, the bond can be released, a certificate of occupancy (CO) will be issued, and the site will enter the defect surety process.

7.1.3 Special Performance Security Bond

In most cases, a developer may request to use a Special Performance Surety Process to allow for incomplete items (final layer of asphalt, residential sidewalks, street trees and buffer plant materials [delayed due to inappropriate planting season, drought, etc.]) when releasing the bond. This process follows the performance bond process above, where cost estimates for incomplete items are reviewed and resubmitted for approval by the Storm Water Engineer or his designee. Once the surety bond has been accepted, the incomplete items should be completed within the first year of the two year Defect Bond period, with the remaining year of the defect period covering these items for faulty workmanship and materials.

7.1.4 Bond Release Procedures

Bonds will be released by the Department of Public Works, Right-Of-Way upon completion of a final inspection of the storm water infrastructure performed by the Storm Water Engineer or his designee, and submittal and final approval of construction record drawings and any other construction certifications to ensure that stormwater infrastructure installation was performed in accordance with the approved site plan by the Storm Water Engineer or his designee. For all stormwater infrastructure within the right-of-way, a copy of the CCTV must be submitted for review by the Storm Water Engineer or his designee prior to release of bond.

7.1.5 Defect Security Bond Process

Once a CO has been issued, a defect surety bond is to be submitted for review and approval by the Storm Water Engineer or his designee. The defect bond lasts for two years. At least 90 days prior to the expiration of the defect bond, the site will be inspected by the Department of Public Works, Operations.

Deficiency punch lists will also be prepared, and sent back to the contractor for review and action. When the final site inspection has been completed with no further punch list items, and all of the Special Performance Surety Bond items have been completed, the defect bond is released / allowed to expire and all surety institutions are notified by the Department of Public Works, Right-of-Way Division.

Note: If part of the site within contributing drainage area served by the system does not have permanent stabilization for E&S control and/or storm water infrastructure is not 100% installed and functional, then the full bond will not be released and the project may be subject to partial bond release up to 1 year.

7.2 BMP Maintenance Agreement

The appropriate BMP maintenance agreement must be executed by the applicant and the City of Norfolk prior to site plan approval for all proposed permanent stormwater management features. The appropriate BMP maintenance agreement templates contained in Appendix 5 shall be utilized by all applicants.

7.2.1 Maintenance Manual Required

The maintenance agreement must also include a site specific BMP maintenance manual specifying the frequency and scope of BMP inspections for each permanent BMP and detailing a schedule of maintenance for each of the proposed BMPs.

At a minimum, the manual shall contain the design plans depicting the size and location of drainage and maintenance easements, the sizing calculations for the BMPs, an inspection checklist for each BMP, any information on maintenance items or frequencies from the manufacturer of any BMP component and typical corrective action(s) for each inspection item on the checklist. Much of this information can be found on the Virginia BMP Clearinghouse website or from the manufacturer of a proprietary BMP.

7.2.2 Recordation

Executed BMP maintenance agreements are recorded by the Department of Public Works, Operations Division with the Clerk's Office of the Circuit Court of the City of Norfolk. The applicant is required to pay all recordation fees for BMP maintenance agreements.

7.2.3 Transfer

A BMP owner must notify the City when they transfer any of their ownership rights or responsibilities for the facility to another party. The owner shall supply the Department of Public Works, Operations Division with a copy of the document of transfer, executed by both parties and a copy the maintenance agreement acknowledged by both parties. Upon the City's receipt of the document to transfer, the conveying owner of the property will be released from all liability arising under the Declaration of Covenants subsequent to the date of conveyance.

7.3 Proof of Construction General Permit Coverage

All land disturbing activities that equal or exceed one acre (43,560 square feet), and land disturbing activities exceeding 2,500 square feet that are part of a larger common plan of development or sale, shall receive coverage under the general permit (VAR10).

7.3.1 Presentation of Coverage Letter

The Owner or Operator of a land disturbing activity subject to coverage under the general permit shall provide the Department of City Planning – Bureau of Environmental Services with a copy of the general

permit coverage verification upon receipt by the Owner or Operator. Proof of coverage for regulated land disturbing activities is required to be presented prior to the issuance of a City of Norfolk land disturbance or fill permit.

For projects required to obtain coverage under the general permit, prior to land disturbance permit issuance, the applicant shall submit a complete stormwater pollution prevention plan containing all of the required elements found at 9 VAC 25-880-70 Part II to the Department of City Planning – Bureau of Environmental Services for review and initial approval.

7.3.2 Responsible Land Disturber Required

Prior to the issuance of the land disturbance permit or fill permit, a Responsible Land Disturber or individual holding a certificate of Erosion and Sediment Control Inspection must be named in accordance with Section 15-8 of the Code of the City of Norfolk.

7.3.3 Issuance of Land Disturbance Permit

Upon the applicant paying the required fee and providing proof of site plan approval where required, proof of stormwater management plan approval, proof of erosion and sediment control plan approval or, for single family residences, an executed agreement in lieu of an erosion and sediment control plan and, where required, an agreement in lieu of a stormwater management plan, the designation of a Responsible Land Disturber (RLD), a copy of proof of coverage under the VSMP Construction General permit if applicable, completed land disturbance permit application, proof of the purchase of non-point nutrient offsets if applicable and upon review and approval of the project SWPPP by the Department of City Planning – Bureau of Environmental Services, a land disturbance permit shall be issued.

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CHAPTER 8.0 CONSTRUCTION PHASE INSPECTIONS AND MAINTENANCE

8.1 Pre-Construction Conference

After issuance of the land disturbing permit and after the establishment of initial erosion and sediment control measures, the identified Responsible Land Disturber must schedule a pre-construction conference with the Department of City Planning – Bureau of Environmental Services. Staff from the Department of Public Works, Operations Division will attend the pre-construction conference where there are permanent stormwater management facilities proposed or where public stormwater infrastructure will be installed including where proposed connections between private and public stormwater conveyance systems will be made.

The pre-construction conference is held at the project site and a review of the approved erosion and sediment control and stormwater management plans is conducted with the owner, contractor and/or Responsible Land Disturber. In addition, the project stormwater pollution prevention plan (SWPPP) (if applicable) is again reviewed for compliance

8.2 Construction General Permit Stormwater Pollution Prevention Plan Review

Each land disturbing activity receiving general permit coverage from the Commonwealth is required to develop, implement, maintain and update a project specific stormwater pollution prevention plan (SWPPP) for the land disturbing activity. The SWPPP shall contain the elements listed in 9 VAC 25-870-54 of the Regulations and the requirements of the general permit found at 9 VAC 25-880-70.

For projects required to obtain coverage under the general permit, prior to land disturbance permit issuance, the applicant shall submit a complete stormwater pollution prevention plan containing all of the required elements found at 9 VAC 25-880-70 Part II to the Department of City Planning – Bureau of Environmental Services for review and initial approval.

During project construction, City staff shall periodically review the project stormwater pollution prevention plan. Failure to have a complete SWPPP on site during construction or failure to implement the SWPPP or approved stormwater management or erosion and sediment control plans may result in the issuance of a “STOP WORK” order for the site until the SWPPP is deemed complete by the Department of City Planning - Bureau of Environmental Services during project construction.

8.2.1 Modification to a Stormwater Pollution Prevention Plan

The project SWPPP must be amended when, at the discretion of the City of Norfolk, there is a change in design, construction, operation or maintenance that has significant effect on discharge of pollutants not addressed by existing SWPPP.

8.2.2 Maintenance of the SWPPP by the Operator

The SWPPP must be maintained by the operator at a central location onsite. If an onsite location is unavailable, a notice of the SWPPP’s location must be posted at a location visible from the public right of

way near the main entrance at the construction site listing the location of the SWPPP and the name and contact number for the operator.

8.3 Pollution Prevention Plan Required

Each land disturbing activity requiring coverage under the general permit shall develop, implement and maintain a plan for implementing pollution prevention measures during construction activities.

8.3.1 Pollution Prevention Plan Contents

The pollution prevention plan shall detail the design, installation, implementation, and maintenance of effective pollution prevention measures to minimize the discharge of pollutants. At a minimum, the pollution prevention plan must:

1. Describe measures and practices implemented to minimize discharge of pollutants from equipment and vehicle washing, wheel wash water and other wash waters. Wash waters must be treated prior to discharge;
2. Describe measures and practices implemented to minimize exposure of all materials on site to precipitation and stormwater;
3. Describe measures and practices implemented to minimize discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures;
4. Describe the measures and practices implemented to prohibit wastewater from washout of concrete, unless managed by appropriate control;
5. Describe the measures and practices implemented to prohibit wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds, and other construction materials;
6. Describe the measures and practices implemented to prohibit discharges of fuels, oils or other pollutants used in vehicle/equipment operation/ maintenance;
7. Describe the measures and practices implemented to prohibit discharges of soaps or solvents used in vehicle/equipment washing;

Discharges from dewatering activities are prohibited unless managed by appropriate controls. Dewatering controls shall be selected based on the pollutants contained in the dewatering discharge. Pollutants expected in dewatering discharges (including sediment) should be described in the pollution prevention plan and appropriate controls for each identified pollutant described.

8.3.2 Pollution Prevention Plan Review

Staff from the Department of City Planning – Bureau of Environmental Services will review the site pollution prevention plan during the SWPPP review, at the preconstruction meeting and then periodically during construction activities.

8.3.3 Modification and Update to Pollution Prevention Plan

Where staff determines the pollution prevention plan is inadequate to either minimize or prohibit the discharge of pollution with stormwater runoff in accordance with Section 8.2.1, the plan shall be amended

and additional measures or practices added to the site and their installation, inspection and maintenance described in the pollution prevention plan.

8.4 Land Disturbance and Construction General Permit Inspections

Staff from the Department of City Planning – Bureau of Environmental Services and the Department of Public Works, Operations Division conduct periodic inspections of active construction projects to determine site compliance with the Regulations and Code of the City of Norfolk. Inspections will review site compliance with erosion and sediment control plan and stormwater management plan, implementation and updating of the pollution prevention plan and development and implementation of additional control measures to address an approved total maximum daily load (TMDL) implementation plan.

8.5 Corrective Action Policy

Failure to comply with the land disturbance permit; approved erosion and sediment control, stormwater management, stormwater pollution prevention or pollution prevention plans; or, the general permit may result in an unauthorized discharge and a violation of local, state and federal laws and regulations.

If the City determines that an unauthorized discharge has occurred from a construction activity, it must be contained so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of onsite or offsite soil.

Any observed violations of approved plans or issued permits excluding the need for performing routine maintenance to existing silt fence, existing inlet protection, and an existing construction entrance will be considered a violation against the site. Unauthorized discharges from failed erosion and sediment control measures or stormwater pollution prevention measures are violations of the Code of the City of Norfolk.

If violations are noted during the duration of construction then a summons may be issued in accordance with Chapter 15-11 of the Code of the City of Norfolk - Erosion and Sediment Control Ordinance which is a class one misdemeanor punishable by not more than 12 months in prison and / or a \$2,500 per day fine. Each day of non-compliance shall constitute a separate offence. Discharges that occur in an egregious manner may result in the issuance of an immediate notice of violation, stop work order or summons.

If unauthorized discharges from construction activity occur other than those in violation of Chapter 15 of the Code of the City of Norfolk including but not limited to the discharge of oil, petroleum or lubricants from vehicle fueling or maintenance, paint waste and wash out water, concrete washout rinse water or concrete residue, etc., the responsible party will be in violation of Chapter 41.1-4 of the Code of the City of Norfolk - Pollution of the Storm Water System which is a class one misdemeanor, punishable by a \$2,500/day fine.

In addition to these remedies, the City of Norfolk reserves the right to utilize all authorities granted under 9 VAC 25-870-116 of the Regulations, §62.1-44.15:37 and §62.1-44.15:49 of the Code of Virginia and the Norfolk City Code.

Additionally, the responsible party will be required to clean the spill or discharge. If the responsible party fails to mitigate the discharge, the City of Norfolk will abate the spill/discharge and charge the responsible party for any clean-up costs associated with the release.

8.6 Permanent Stormwater Management Facility Construction Inspections

The Department of Public Works, Operations Division shall be contacted at least two working days prior to the intended inspection date for scheduling the inspection of the construction of permanent stormwater management facilities that receive, treat or convey public water or the tie-in point from a private conveyance and/or treatment system and the public stormwater system. The frequency of construction phase stormwater infrastructure inspections will be established at the pre-construction conference and the specific structures and items requiring City inspection will be provided to the contractor by the City.

8.7 Construction Record Drawings and Record Certifications

Two (2) hard copies and one (1) electronic copy of construction record drawings for permanent stormwater management facilities shall be submitted to the Department of Public Works, Operations Division in accordance with 9 VAC 25-870-108 and 9 VAC 25-870-112. The construction record drawing shall be appropriately sealed and signed by a professional registered in the Commonwealth of Virginia, and contain a certification statement attesting that the stormwater management facilities have been constructed in accordance with the approved stormwater management plan. The certification shall also contain a table of actual volumes at the completion of construction for all stormwater practices using retention or detention as a treatment mechanism.

For wet ponds, the survey shall include both topography of the area within the pond maintenance area as well as the bathymetry of the completed pond.

For infiltration and bioretention facilities, the as-built survey shall include a post-construction infiltration test calculating the rate of infiltration in inches per hour (in/hr) within the feature soil media and immediately below the bottom of the feature in the substrate.

For manufactured BMPs, submit manufacturer supplied activation letters certifying that the BMP was installed and activated per manufacturer standards and specifications.

8.8 Submittal of Proof of Construction General Permit Notice of Termination

Prior to the release of the stormwater performance bond for a project with general permit coverage, the permit holder must submit a copy of the completed Notice of Termination form submitted to the Department of City Planning – Bureau of Environmental Services.

CHAPTER 9.0 POST CONSTRUCTION STORMWATER MANAGEMENT FACILITY INSPECTION AND MAINTENANCE

9.1 Inspection Frequency

All non-proprietary permanent stormwater management facilities, including conservation management areas, except those on a single family lot serving that lot alone, shall be inspected at least once every five years by the Department of Public Works, Operations Division. An owner of a single family lot with a stormwater management facility on the lot shall ensure that the facility continues to function in accordance with its original design and shall comply with the conditions recorded on the plat and contained in the declaration of covenants on file with the City.

Owners of proprietary BMPs, including underground detention/infiltration structures and pervious pavement/pavers/asphalt, shall submit maintenance certifications to the Department of Public Works, Operations Division at the frequency specified by the manufacturer but not less than once every five years.

9.2 Certification of Inspection Reports

Inspection reports required to be submitted by proprietary BMP owners in Section 9.1 shall be signed by either an individual holding a valid stormwater management inspector certification from the Virginia Department of Environmental Quality, by a Virginia licensed professional engineer, architect, land surveyor or landscape architect or by a person who works under the direction and oversight of the licensed professional engineer, architect, landscape architect, or land surveyor provided the inspection report is signed and sealed by the licensed professional overseeing the inspector.

9.3 Stormwater Management Facility Corrective Action Plans

Deficiencies identified through the performance of an inspection shall be corrected by the owner of the facility to restore its design and function to that which meets or exceeds the design contained in the approved facility certified record drawing in accordance with the recorded declaration of covenants and Chapter 41.1-5 of the Code of the City of Norfolk, Virginia. In the event that the Director of Public Works determines that emergency maintenance to a stormwater management facility is needed to protect the health, safety and general welfare of the citizens of the City of Norfolk, it will be undertaken by the Department of Public Works, Operations Division in accordance with the provisions of the BMP Maintenance Agreement.

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CHAPTER 10.0 EXCEPTIONS FROM THE STORMWATER MANAGEMENT REQUIREMENTS

10.1 Procedure for Requesting an Exception

Exception requests to the requirements of the stormwater management requirements shall be submitted in writing as part of the stormwater management plan during the plan review process.

10.2 Exception Request Evaluation

An exception may be granted provided that:

- a. the exception is the minimum necessary to afford relief,
- b. reasonable and appropriate conditions shall be imposed as necessary upon any exception granted so that the intent of the Act and the Regulations are preserved,
- c. granting the exception will not confer any special privileges that are denied in other similar circumstances, and
- d. 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 stormwater management requirements.

Under no circumstance shall an exception to the requirement that the regulated land-disturbing activity obtain required state permits, nor shall an exception be granted to approve the use of a BMP not found on the Virginia Stormwater BMP Clearinghouse Website.

Exceptions to requirements for phosphorus reductions shall not be allowed unless offsite options available through 9 VAC 25-870-69 have been considered and found not available.

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CHAPTER 11.0 HEARINGS AND APPEALS

11.1 Hearings

Any permit applicant or permittee aggrieved by any action associated with this manual by a City representative without a formal hearing, or by inaction of the City representative, may request in writing a formal hearing by the VSMP Authority Hearing Board. The VSMP Authority Hearing Board will be made up of members of the City of Norfolk Planning and Public Works Departments consisting of the Environmental Services Bureau Manager (Chair), Storm Water Senior Construction Project Manager, Storm Water Civil Engineer III, and Zoning Administrator or their designees. A verbatim record of the hearing will be recorded by the City and maintained in the project file by the Department of City Planning – Bureau of Environmental Services.

A written petition requesting a hearing must be filed with the Department of City Planning – Bureau of Environmental Services Bureau Manager within 30-days of the action. Failure to submit a written petition within the timeframe specified by this section shall constitute unconditional acceptance of the action of the City.

The petition submitted by the aggrieved party and the testimony of witnesses, including City staff members, will be presented at the next scheduled VSMP Authority Hearing Board. Board hearings will be scheduled within 30-business days from receipt of a petition. Follow-up investigations will be conducted, where necessary, by the Department of City Planning – Bureau of Environmental Services Bureau Manager. The Hearing Board will offer a majority rule decision on the matter and provide the decision in writing to the aggrieved party. This written decision will be retained as part of the record. The applicant or Department impacted may appeal the decision of the VSMP Authority Board.

11.2 Appeal of Decision

Any permit applicant or permittee, or person subject to the requirement of this manual, including City staff, aggrieved by any decision of the VSMP Authority Hearing Board process may appeal the decision in writing to the Director of Public Works or his designee.

The Director will schedule a hearing within 15-business days after receiving the formal petition for appeal. The review will be based upon a review of the record from the formal hearing and argument of the parties to the appeal. The decision made by the Director or his designee shall be provided in writing to the party filing the appeal.

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CHAPTER 12.0 APPENDICES

Appendix 1: Engineering Calculations

- 1A – Appendix 11-A VSWMH HCS Soil Group by Soil Series
- 1B – Appendix 11-B VSWMH - Rainfall Depths in Virginia
- 1C – Appendix 11-C VSWMH – Rainfall-Runoff Curves for Selected CN
- 1D – Virginia Runoff Reduction Method Worksheets
- 1E – Norfolk Guidance Calculation Procedure Worksheets

Appendix 2: Norfolk Standard Notes and Details

- 2A – Norfolk Standard Engineering Details
- 2B – Norfolk Standard Notes

Appendix 3: Section 1 from the Hampton Roads Planning District Commission Report *Land and Water Quality in Hampton Roads, Phase II, November 2013*

Appendix 4: Approved Stormwater Management Practices

- 4A – Norfolk Modifications to the Approved Virginia BMP Clearinghouse Practices
- 4B – Encased Falling Head Infiltration Testing Procedure for use in the City of Norfolk

Appendix 5: BMP Maintenance Standards

- 5A – Standard Declaration of Covenants
- 5B – Subdivision Declaration of Covenants
- 5C – Pollutant Reduction Declaration of Covenants
- 5D – BMP Inspection Agreement
- 5E – Appendix 9-C VSWMH Sample BMP Inspection Checklists

Appendix 6: Norfolk Sample Forms

- 6A – Land Disturbance Permit Application
- 6B – Agreement in Lieu of a Plan
- 6C – Stormwater Pre-Construction Checklist

Appendix 7: Stormwater Program Fees (As set forth annually by the Norfolk City Council)

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- 1E – Norfolk Guidance Calculation Procedure Worksheets

1A – Appendix 11-A VSWMH HCS Soil Group by Soil Series

Appendix 11-A

HYDROLOGIC SOIL GROUPS OF VIRGINIA SOILS

The Virginia state office of the USDA-Natural Resource Conservation Service has provided the following guidance pertaining to accessing Hydrologic Soil Group information from the *National Engineering Handbook* and NRCS web resources:

NEH630, Chapter 7 Hydrologic Soils Group Update

What's new? Chapter 7 contains the official definitions of the four hydrologic soils groups that, along with land use, management practices and hydrologic conditions, determine a soil's associated runoff curve number. Chapter 7 was revised in January 2009 and May 2007. HSGs are now listed by soil map unit. **A single national [or state list] list will not be maintained and is obsolete.**

Where is the official HSG information? HSG information can be found by consulting the Soils section of the VA NRCS web site. www.va.nrcs.usda.gov/technical/Soils/index.html. You can access the soils data through the eFOTG, the State Soil Geographic Database (STATSGO), the Soil Data Mart, or the Web Soil Survey.

What about Table 2.1 in the Engineering Field Handbook? Table 2.1 is a list of HSGs by soil series and is now obsolete.

What about the EFH-2 Runoff and Peak Discharge software and the HSG database (Soils.HG)? The software has an HSG database for Virginia, available on the engineering web site www.va.nrcs.usda.gov/technical/hydrology.html. The HSG database is "officially" obsolete. However, we will review the list once per year to ensure it is current. The HSG database is current for 2008. A notification will go out once it is updated for 2009. However, the most up-to-date soils information is located on the Web Soil Survey.

Additional information for obtaining and using digital soil information
(Contact your friendly area Soil Resource Specialist for further information.)

Web Soil Survey <http://websoilsurvey.nrcs.usda.gov/app/>



Using Soil Data Viewer with ArcMap 9.2: Once a digitized soil data layer is available, the user can use soil data viewer and toolkit to create soil-based thematic map. A step-by-step guide for using soil data viewer and toolkit is available on the web (from the main soils page, <http://www.va.nrcs.usda.gov/technical/Soils/index.html>, on the left; and on the training page <http://www.va.nrcs.usda.gov/intranet/training.html>).

In light of this NRCS guidance, designers are advised to obtain soil HSG information from directly from the NRCS soils web site, in order to have the most accurate, reliable and up-to-date information.

Table 11-A.1 below is an update of a similar table provided in Appendix A of Chapter 4 of the 1999 Virginia Stormwater Management Handbook, for which this is an update. **Table 11-A.1** contains the majority of soils found in Virginia, along with their corresponding Hydrologic Soil Group designations. Soil names that appear in *italics* were listed in the 1999 Handbook but are no longer included in Virginia soils as identified by the NRCS. However, we have included them here in order for designers and regulators to be able to reference the information that may have been used in earlier stormwater management plans and BMP designs. However, **designers should note that all stormwater BMP/SCM designs that require specific soil conditions to be present should be based on an actual analysis of soils at the site.**

Table 11-A.1. Hydrologic Soil Groups in Virginia

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Abell	B	Ackwater	D	Acredale (SIL)	D
Aden (SIL)	C	Airmont (FLV-L)	C	Alaga	A
Alanthus (SIL)	B	Albano (SIL)	D	Albermarle (FSL)	B
Alderflats (SIL)	D	Allegheny	B	Alluvial Land (FSL)	B
Alluvial Land (FSL)	B/D	Alluvial Land, Sandy and Gravelly (S)	C/D	Alluvial Land, Wet (SL)	C/D
Alonzville	B	Altavista	C	Alticrest	B
Appling	B	Appomattox	B	Aqualfs (SIL)	D
Aquents (CN-SIL)	B	Aquic Udifluvents (FSL)	B	Aquults (FSL)	D
Aquults (L)	C/D	Arapahoe	B/D	Arcola	C
Argent (SIL)	D	Ashburn (SIL)	C	Ashe	B
Ashlar	B	Assateague	A	Atkins	D
Atlee	C	Augusta	C	Aura	B
Austinville (SICL)	B	Axis (VFSL)	D	Aycock (SIL)	B
Ayersville (PGR-L)	B	Backbay (MPT)	D	Badin (SIL)	B
Baile (L)	D	Bailegap	B	Balsam (CB-L)	B
Bama (SL)	B	Bayboro	D	Banister	C
Barkers Crossroads (L)	D	Batteau (L)	C	Beaches (S)	D
Beckham (CL)	B	Beech Grove	C	Beech Grove (SIL)	D
Belhaven (MUCK)	D	Beltsville	C	Belvoir	C
Benthole (GR-SIL)	B	Bentley (LS)	C	Berks (CN-SIL)	C
Berks (CNV-SIL)	D	Bermudian (SIL)	B	Bertie (FSL)	C
Bertie (VFSL)	B	Bethera (SIL)	D	Bethesda (GR-SIL)	C
Bibb	D	Biltmore (FSL)	A	Birdsboro (L)	B
Birdsboro (SIL)	C	Bladen	D	Blairton (SIL)	C
Bland (SICL)	C	Bleakhill	C	Blocktown (GR-SIL)	C/D

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Bloodyhorse (GR-L)	B	Bluemount (GR-SIL)	C	Bohicket	D
Bojac	B	Bolling	C	Bolton (L)	B
Bonneau (LS)	A	Bookwood (SIL)	B	Botetourt	C
Bourne	C	Bowmansville (SIL)	B/D	Braddock	B
<i>Bradley</i>	C	Brandywine	A	<i>Brecknock</i>	B
Bremo	C	Brentsville	C	Brevard (GR-FSL)	B
Brickhaven (FSL)	C	Brinklow (SIL)	D	Broadway (SIL)	B
Brockroad (SIL)	C	Brownwood	B	Brumbaugh	B
Brushy	B	Buchanan	C	Buckhall	B
<i>Bucks</i>	B	Buckton	B	Buffstat (CN-SIL)	B
Buffstat (SIL)	C	Bugley	C/D	Buncombe	A
Burketown (FSL)	C	Burrowsville	C	Burton (L)	B
Buzzrock (L)	B	Calverton (SIL)	C	Calvin	C
Camocca (FS)	A/D	Caneyville (SIL)	C	Carbo	C
Carbonton (FSL)	C	Cardiff	B	Cardova (GR-L)	C
Caroline	C	<i>Carrvale</i>	D	Cartecay	C
Cataska	D	Catharpin (SIL)	C	Catlett (GR-SIL)	C/D
Catoctin	C	Catpoint	A	Caverns (SL)	B
Cecil	B	Cedarcreek	C	Chagrin	B
Chandler (L)	B	Chantilly (L)	D	Chapanoke (SIL)	C
Chastain	D	Chatuge	D	Chavies (FSL)	B
Chenneby	C	Chesapeake (SL)	B	Chester	B
Chestnut (GR-FSL)	C	Chestnut (SL)	B	Chewacla	C
Chickahominy	D	Chilhowie	C	Chincoteague (SIL)	D
Chipley (FS)	C	Chiswell	D	Christian	C
Cid	C	Claiborne (SIL)	B	Clapham (SIL)	C
Clearbrook (CN-SIL)	D	Clifffield (CBV-FSL)	B	Clifford (L)	C
<i>Clifton</i>	C	Clingman (MK-PEAT)	D	Clover	B

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Cloverlick (GR-SIL)	B	Clubcaf (SIL)	D	Clymer	B
<i>Coastal Beach</i>	<i>D</i>	Codorus	C	Colescreek (FSL)	C
Colfax	C	Colleen	C	Colvard (FSL)	B
Combs	B	Comus	B	Conetoe	A
Congaree	B	<i>Coosaw</i>	<i>B</i>	Corolla (S)	D
Corydon (SICL)	D	Cotaco	C	Cottonbend	B
Coursey	C	Cowee	B	Coxville (L)	D
Craigsville (CB-SL)	B	Craven	C	Creedmoor	C
<i>Croton</i>	<i>D</i>	Cullasaja	B	Cullen	C
Culleoka (GR-SIL)	B	Culpeper	C	Daleville	D
Dan River (L)	B	Dandridge (CN-SICL)	D	Danripple	C
<i>Davidson</i>	<i>B</i>	Dawhoo (FSL)	D	<i>Decatur</i>	<i>B</i>
Dekalb	C	Delanco	C	Delila (SL)	D
Dellwood (CB-SL)	A	Deloss (FSL)	B/D	Derroc (CBV-L)	B
Devotion (SL)	B	Diana Mills (PCB-L)	C	<i>Dillard</i>	<i>C</i>
Dogue	C	Dorovan	D	Dothan (LS)	B
Downer (LS)	A	Dragston (FSL)	C	Drall	B
Drapermill (GR-L)	B	Drypond	D	Duckston (FS)	A/D
Duffield (SIL)	B	Dulles (SIL)	D	Dumfries (SL)	B
Dumps Variant	?	Dunbar (FSL)	D	Dunning (SIL)	D
Duplin (FSL)	C	Durham	B	Dyke	B
Dystrochrepts (LS)	B/D	Easthamlet (SL)	D	Ebbing (L)	C
Edgehill (GRV-FSL)	C	Edgehill (GRV-SL)	B	Edgemont	B
Edneytown	B	Edneyville	B	Edom	C
Elbert	D	Elioak	C	<i>Eliock</i>	<i>C</i>
Elkton (SIL)	C/D	Elliber (GRV-SIL)	A	Elsinboro	B
Emporia (FSL)	C	Endcav	C	Enon	C
Enott	C	Ernest	C	Escatawba	B

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Eubanks	B	Eulonia (FSL)	C	Eunola	C
Evansham (SICL)	D	Evard	B	<i>Evergreen</i>	B
Exum (SIL)	C	Exway (CL)	B	Faceville	B
Fairfax (L)	B	Fairpoint (CN-SIL)	C	Fairview	B
Fallsington	B/D	Fauquier	C	Faywood	C
Featherstone (MK-SIL)	D	Feedstone (SIL)	B	Fisherman (FS)	D
Fiveblock (CNV-SL)	C	Flairmont (FLV-L)	C	Flatwoods (SIL)	C
Fletcher (L)	C	Flume (L)	C	Fluvanna	C
Fluvaquents (L/SL/VFSL)	B/D	Fluvaquents (SIL/SICL/FSL)	D	Forestdale	D
Fork (FSL)	C	Frankstown (CN-SIL)	B	Frederick	B
French (L)	C	Fresh Water Swamp (MK-SL)	B/D	Fripp (S)	A
Gaila (SL)	B	Gainesboro	C	Galestown (LFS)	A
Galtsmill (FSL)	B	Georgeville	B	Germanna (SIL)	B
Gertie (SIL)	D	Gilpin	C	Gladehill	B
Glenelg	B	Glenville (L)	C	<i>Glenwood</i>	B
Golbintown (MPM)	B	Goldsboro	B	Goldston	C
Goldvein (GRV-SIL)	C	Goresville	B	Gravelly Alluvial Land (GR-L)	B/D
Greenlee (CBV-L)	B	Griffinsburg (GRV-SL)	C	Grigsby	B
Grimsley	B	Grist Mill (SL)	D	Gritney	B
Groseclose	C	Grover	B	Guernsey (SIL)	C
Gunstock	C	Gunston (SIL)	D	Guyan (SIL)	C
<i>Gwinett Variant</i>	B	Hagerstown (SIL)	C	Halewood (FSL)	C
Halifax	C	Haplaquepts (L)	A/D	Hapludults (FSL)	B/D
Happyland (GR-L)	D	Hartleton (CN-L)	B	Hatboro	D
Hattontown (SIL)	D	Hawksbill	B	Hayesville	B

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Hayesville (Stony)	C	Haymarket (SIL)	D	Hayter	B
<i>Haywood</i>	<i>B</i>	Hazel	C	<i>Hazel Channery</i>	<i>C</i>
Hazleton	B	Helena	C	Herndon	B
Hibler (SIL)	B	Hickoryknob (MPM)	C	Highsplint (CN-SIL)	B
Hiwassee	B	Hoadly (L)	C	Hobucken (L)	D
<i>Hogeland</i>	<i>C</i>	Holly (L)	D	Hollywood (CL)	D
Honga (PEAT)	D	Huntington	B	<i>Hyattsville</i>	<i>B</i>
Hyde (SIL)	B/D	Hydraquents (MK)	D	Ingledove (L)	B
Iotla (SL)	B	Iredell	C/D	Irongate	B
Itmann	C	Iuka (FSL)	C	Izagora	C
Izagora	C	Jackland (SIL)	D	Jedburg (L)	C
Jefferson	B	Johns	C	Johnston	D
Junaluska (CN-L)	B	Kalmia	B	Kaymine (CNV-SIL)	C
Keener (L)	B	Kelly (SIL)	D	Kempsville (LFS)	B
Kenansville	A	<i>Kenansville Variant</i>	C	Keyport (SIL)	C
Kingstowne (SCL)	D	Kinkora (SIL)	D	Kinston	B/D
<i>Klej</i>	<i>B</i>	Klinesville (CN-SIL)	C/D	Konnarock (CN-SIL)	<i>C</i>
Lackstown (FSL)	C	Laidig	C	Lakehurst (S)	A
Lakeland	A	Lakin (LS)	A	Lanexa	D
<i>Lansdale</i>	<i>B</i>	LaRoque (L)	B	Lawnes	D
Leaf (SIL)	D	Leaksville (SIL)	D	Leck Kill (SIL)	B
Leedsville (CB-SIL)	B	Leetonia (GR-LS)	C	Legore (L)	B
Lehew	C	Lenoir	D	Leon (S)	B/D
Levy	D	Lew	B	<i>Lewisberry</i>	<i>B</i>
Library (SIL)	D	Lignum	C	Lily	B
Lindside (SIL)	C	Littlejoe	B	Litz	C
Lloyd	C	Lobdell	B	Local Alluvial Land (L)	B
Lodi	B	Louisa	B	Louisburg	B

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Lowell (SIL)	C	Luckettes (SIL)	B	Lucy (LS)	A
<i>Lugnum</i>	C	Lumbee	B/D	Lunt	C
Lynchburg	C	Macove	B	Madison	B
Madsheep	C	Maggodee (FSL)	B	Magotha (FSL)	D
Manassas (SIL)	B	Mandy (CN-SIL)	C	Manor	B
<i>Mantachie</i>	C	Manteo	C/D	Marbie (SIL)	C
Marbleyard (CBL-SL)	C	Margo (L)	B	Marlboro (FSL)	B
Marr (VFSL)	B	Marrowbone (FSL)	C	Marumsco (L)	C
Masada	C	Massanetta	B	Massanutten	B
Matapeake (SIL)	B	Matewan (FL-FSL)	B	Matneflat (GR-SL)	B
Mattan	D	Mattapex	C	Maurertown	D
Mayodan	B	McCamy (FSL)	B	McClung (SL)	B
McGary (SIL)	C	<i>McQueen</i>	C	Meadows (GR-L)	D
Meadowville	B	Mecklenburg	C	Meggett (SL)	D
Melfa (MPT)	D	Melvin (SIL)	D	Middleburg	B
Milldraper (L)	B	Millrock	A	Mine Run (LS)	B
Minnieville	C	Mirerock	D	Mixed Alluvial Land	D
"Mixed Alluvium M1" (SIL)	B/D	"Mixed Aluvium Mm" (SIL)	B	Molena (LS)	A
Monacan (SIL)	C	Mongle (L)	C	Mongle (SIL)	D
Monongahela	C	Montalto	C	Montonia (CN-SIL)	B
<i>Montessor</i>	B	Montross (SIL)	C	Moomaw	C
<i>Morrisonville</i>	B	Morven (SIL)	B	Mount Lucas (L)	C
Mt Rogers (GR-L)	B	<i>Mt Weather</i>	B	Muckalee (L)	D
Munden	B	Murrill	B	Myatt	D
<i>Myatt Variant</i>	D	Myersville	B	Nahunta (SIL)	C
Nanford (SIL)	C	Nansemond (LS)	C	Nason (GR-L/GR-SIL)	B
Nason (L/SIL/SICL)	C	Nathalie	B	Nawney	D

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Neabsco (L)	C	Nestoria	C/D	Nevarc	C
Newark (SIL)	C	Newbern (SIL)	C	Newflat (SIL)	D
Newhan (FS)	A	Newmarc (SIL)	C	Nicelytown (SIL)	C
Nicholson (SIL)	C	Nimmo	D	Nixa	C
Nolichucky	B	Nolin (SIL)	B	Nomberville	B
Nopan (L)	D	Norfolk	B	Oak Level (L)	C
Oakhill	B	Oaklet (SIL)	C	Oatlands	B
Occoquan	B	Ochlockonee (SIL)	B	Ochraquults (FSL)	B/D
Ochrepts (CN-SIL)	D	Ochrepts (SIL)	B/D	Ocilla (LS)	B
Ogles (CBV-L)	B	Okeetee (SL)	D	Opequon (SICL)	C
Orange	D	Orangeburg	B	Orenda (L)	B
Oriskany	B	Orrville (L)	C	Osier (LFS)	A/D
Othello (SIL)	C/D	Ott (SIL)	B	Pacolet	B
Pactolus	A	Paddyknob (CNV-L)	C	Paddyknob (GR-L)	A
Pagebrook	D	Pamlico	D	Pamunkey (FSL/L)	B
Pamunkey (GR-SL)	A	Panorama (SIL)	B	Parker	B
Partlow	D	Pasquotank (SIL)	B/D	Peaks	C
Peawick	D	Penhook	B	Penn	C
Philo	B	Philomont (GR-SL)	B	Pigeonroost	B
Pignut (SIL)	C	Pineola (L)	B	Pineville (CN-L)	B
Pineywoods (SIL)	D	Pinkston	B	Pinoka (GR-FSL)	B
Pisgah (SIL)	C	Pits (S/GRX-S)	A	Pocaty (MUCK)	D
<i>Pocomoke</i>	<i>B/D</i>	Poindexter	B	Polawana	A/D
Pooler (L)	D	Pope (FSL)	B	Poplimento	C
Porters	B	Portsmouth	B/D	Pouncey (FSL)	D
Poynor (GRV-SIL)	B	Psammets (FS)	A	Pungo	D
Purcellville (SICL)	B	Purdy	D	Quantico (L)	B
Rabun (SIL)	B	Rains	B/D	Ramsey	D

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Rapidan (L)	B	Rappahannock (MUCK)	D	<i>Raritan</i>	C
Rasalo (SL)	C	Rayne	B	<i>Readington</i>	C
Reaville (SIL)	C	Redbrush (L)	C	Remlick	A
Rhodhiss (SL)	B	Rigley (SL)	B	Rion	B
Riverview	B	Rixeyville (FSL)	C	Roanoke	D
Rock Outcrop (BR)	D	Rohrersville	D	Ross (L)	B
Rough	D	Rowland (SIL)	C	Rubble Land (BYX-BY)	A
Rumford	B	Rushtown	A	<i>Ruston</i>	B
<i>Safell</i>	B	Sandy and Clayey Land (GR-SL)	B/D	Sassafras	B
Saunook (L)	B	Sauratown (GR-L)	B	Savannah	C
Scales (PEAT)	D	Scattersville	C	Schaffemaker (LS)	A
Seabrook	C	<i>Sedgefield</i>	C	Sekil (SL)	B
Seneca	B	Sequoia	C	Sewell	C
Shelocta	B	Shenval	B	Sherando	B
Sheva (FSL)	C	Shottower	B	Siloam (FSL)	D
Siloam (MPM)	C	Sindion	B	Sketerville (SIL)	C
Slabtown (SIL)	B	Slagle	C	<i>Slickens</i>	B
Sloping Sandy Land (FS)	A	<i>Snickersville</i>	B	Sowego (L)	B
Speedwell	B	Spessard (LS)	A	<i>Spivey</i>	B
Spotsylvania (FSL)	C	Spriggs	C	Springwood (SIL)	B
<i>Stanton</i>	D	Starr	C	State	B
Steep Sandy Land (FS)	A	Steinsburg (FSL)	B	Stonecoal (CNX-SL)	C
Stoneville	B	Stony Local Alluvial Land (L)	D	Stott Knob	B
Straightstone (L)	B	Strawfield (CL)	B	<i>Stuart</i>	C
Stumptown (FLV-L)	B	Suches	B	<i>Sudley (L)</i>	B

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Suffolk	B	Sugarhol (SIL)	B	Sulfaquents (MK-SICL)	D
Sumerduck (L)	C	Susquehanna (L)	D	<i>Swamp</i>	<i>D</i>
Swampoodle (L)	C	Sweetapple (FSL)	B	Swimley	C
Sycoline (SIL)	D	Sylco	C	Sylvatus	D
Talladega (SIL)	C	<i>Tallapoosa</i>	C	Tankerville (L)	C
Tarboro	A	Tarrus (SIL)	B	Tate (L)	B
Tatum	B	Tetotum	C	Thunder (CB-L)	B
Thurmont	B	Tidal Marsh (MUCK)	B/D	“Tidal Marsh, High” (ML-SL)	D
“Tidal Marsh, Low” (MK-SICL)	D	Timberville	B	Tioga (FSL)	B
Toast (SL)	B	Toccoa	B	Toddstav (SIL)	D
Tomotley	B/D	Toms (SIL)	C	Torhunta (L)	C
<i>Totier</i>	C	Toxaway (SIL)	B/D	Trappist (SIL)	C
<i>Trego</i>	<i>B</i>	Trenholm (SL)	D	Trimont (L)	B
Tuckahoe (L)	B	Tuckasegee (CB-L)	B	Ti,b;omg	B
Tirbevo;;e	C	Tisqiotee	B	Tugart)SIL)	D
Typic Udorthents (GRV-SL)	A/D	Uchee	A	Udalfs	D
Udifluvents	B/D	Udipsamments	A/D	Udorthents (FSL)	B
Udorthents (L)	D	Udults (SL)	B/D or C/D	Unaka (L)	B
Unicoi (GRV-SL)	C	Unison	B	Urban Land (MAT)	D
Vance	C	Varina	C	Vaucluse (SL)	C
Vertrees	B	Virgilina (GR-SIL)	C	Wadesboro (CL)	B
Wahee	D	Wallen	B	Walnut (MPM)	B
Wando (LFS)	A	Warminster (CL)	C	Warne (FSL)	D
Watahala	B	Watauga	B	Wateree	B

Soil Name	Hydro Group	Soil Name	Hydro Group	Soil Name	Hydro Group
Watt	D	Waxpool (SIL)	D	Weaver (SIL)	C
<i>Weaverton</i>	C	Webbtown (CN-SIL)	C	Wedowee	B
Weeksville (SIL)	B/D	Wehadkee	D	Weikert	C/D
Westfield (L)	B	Westmoreland (SIL)	B	Weston (FSL)	D
Westphalia (LVFS)	B	Weverton	B	Wharton (SIL)	C
Wheaton (L)	D	Wheeling	B	<i>White Stone</i>	D
Whiteford (SIL)	B	Wickham (FSL)	B	Wilkes	C
Wingina (L)	B	Winnsboro (SL)	C	Wintergreen	B
Winton (FSL)	C	Wolfgap	B	Wolftrap (FSL)	D
Woodington (FSL)	B/D	Woodstown	C	Woolwine	B
Worsham	D	Wrightsboro (FSL)	C	Wurno	C
Wyrick	B	Yadkin	B	Yellowbottom (L)	C
Yemassee (FSL)	C	Yeopim (SIL)	B	Yogaville	B/D
York (SIL)	C	Zepp	B	Zion	C
Zoar	C				

Source: Compiled from the USDA-NRCS Online Soil Survey Data for Virginia, July, 2009

1B – Appendix 11-B VSWMH - Rainfall Depths in Virginia

Appendix 11-B

24-HOUR RAINFALL DEPTH DATA FOR VIRGINIA

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Table 11-B.1 provides the 24-hour rainfall depths for Virginia counties and major cities. For counties having more than one rainfall zone, consult the appropriate map figures following the table for the approximate boundaries of the various zones.

Table 11-B.1. NRCS Implementation of NOAA's ATLAS 14 Rainfall Data for Virginia

County	Storm Return Frequency (Years)						
	1	2	5	10	25	50	100
Accomack	2.67	3.25	4.23	5.07	6.36	7.48	8.75
Albermarle (Zone 1)	3.42	4.14	5.27	6.21	7.59	8.77	10.10
Albermarle (Zone 2)	3.00	3.63	4.63	5.48	6.72	7.79	8.96
Alleghany	2.39	2.88	3.60	4.20	5.05	5.77	6.53
Amelia	2.73	3.30	4.22	5.00	6.15	7.13	8.20
Amherst	2.80	3.39	4.32	5.09	6.22	7.17	8.21
Appomattox	2.82	3.42	4.37	5.17	6.36	7.37	8.49
Arlington	2.69	3.15	4.05	4.84	6.06	7.14	8.37
August (Zone 1)	2.48	3.00	3.78	4.43	5.38	6.17	7.02
Augusta (Zone 2)	2.98	3.61	4.59	5.40	6.58	7.58	8.67
Bath	2.49	3.00	3.76	4.38	5.27	6.01	6.80
Bedford (Zone 1)	3.10	3.76	4.80	5.66	6.92	8.01	9.20
Bedford (Zone 2)	2.76	3.35	4.27	5.04	6.17	7.13	8.18
Bland	2.16	2.58	3.13	3.58	4.19	4.68	5.19
Botetourt	2.60	3.15	4.00	4.70	5.71	6.57	7.50
Brunswick	2.78	3.37	4.33	5.13	6.29	7.27	8.33
Buchanan	2.18	2.60	3.17	3.65	4.34	4.91	5.51
Buckingham	2.78	3.37	4.31	5.09	6.26	7.26	8.36
Campbell	2.75	3.33	4.25	5.03	6.18	7.17	8.25
Caroline	2.68	3.25	4.19	5.00	6.24	7.33	8.56
Carroll (Zone 1)	2.29	2.76	3.48	4.05	4.85	5.50	6.18
Carroll (Zone 2)	2.62	3.17	4.02	4.71	5.68	6.48	7.33
Carroll (Zone 3)	2.95	3.57	4.55	5.35	6.50	7.46	8.50
Carroll (Zone 4)	3.36	4.97	5.20	6.13	7.49	8.65	9.92
Charles City	2.82	3.42	4.41	5.25	6.49	7.57	8.76
Charlotte	2.71	3.28	4.20	4.97	6.10	7.08	8.14
Chesapeake (city)	3.03	3.69	4.76	5.67	7.01	8.17	9.44
Chesterfield	2.77	3.35	4.29	5.09	6.27	7.28	8.39
Clarke	2.41	2.90	3.64	4.25	5.16	5.92	6.75
Craig	2.40	2.89	3.64	4.25	5.12	5.86	6.65
Culpeper	2.70	3.27	4.19	4.99	6.19	7.24	8.42
Cumberland	2.71	3.28	4.19	4.96	6.09	7.07	8.14
Dickenson	2.21	2.63	3.22	3.72	4.44	5.04	5.69
Dinwiddie	2.80	3.39	4.35	5.15	6.32	7.30	8.38
Essex	2.67	3.25	4.20	5.03	6.29	7.40	8.64
Fairfax	2.57	3.11	4.00	4.78	5.98	7.05	8.25

County	Storm Return Frequency (Years)						
	1	2	5	10	25	50	100
Fauquier	2.59	3.13	3.99	4.74	5.88	6.88	7.99
Floyd (Zone 1)	2.55	3.09	3.93	4.62	5.64	6.49	7.40
Floyd (Zone 2)	2.86	3.47	4.42	5.21	6.37	7.34	8.41
Floyd (Zone 3)	3.38	4.11	5.24	6.19	7.59	8.78	10.09
Floyd (Zone 4)	3.81	4.63	5.92	7.00	8.59	9.97	11.49
Fluvanna	2.68	3.25	4.15	4.91	6.03	7.00	8.05
Franklin	2.83	3.43	4.37	5.16	6.32	7.31	8.39
Frederick	2.36	2.83	3.53	4.11	4.96	5.68	6.46
Giles (Zone 1)	2.11	2.53	3.14	3.63	4.34	4.92	5.53
Giles (Zone 2)	2.34	2.81	3.51	4.08	4.90	5.57	6.31
Gloucester	2.87	3.49	4.52	5.41	6.73	7.89	9.19
Goochland	2.71	3.28	4.19	4.97	6.12	7.11	8.19
Grayson (Zone 1)	3.24	3.89	4.83	5.59	6.68	7.59	8.57
Grayson (Zone 2)	2.46	2.95	3.66	4.22	5.00	5.64	6.29
Grayson (Zone 3)	2.59	3.13	3.94	4.59	5.50	6.24	7.02
Greene (Zone 1)	3.38	4.09	5.19	6.11	7.47	8.63	9.92
Greene (Zone 2)	3.05	3.69	4.70	5.54	6.79	7.85	9.03
Greensville	2.74	3.32	4.28	5.08	6.25	7.23	8.31
Halifax	2.70	3.26	4.15	4.89	5.96	6.86	7.84
Hampton (city)	2.93	3.57	4.62	5.53	6.87	8.04	9.33
Hanover	2.71	3.28	4.21	5.01	6.21	7.26	8.42
Henrico	2.75	3.33	4.27	5.06	6.26	7.28	8.42
Henry	2.89	3.50	4.47	5.29	6.49	7.51	8.63
Highland	2.44	2.93	3.61	4.18	5.01	5.69	6.42
Isle of Wight	2.95	3.59	4.64	5.53	6.84	7.96	9.20
James City	2.90	3.53	4.56	5.45	6.75	7.89	9.15
King and Queen	2.72	3.31	4.28	5.11	6.38	7.49	8.73
King George	2.62	3.19	4.12	4.94	6.19	7.28	8.52
King William	2.70	3.28	4.23	5.05	6.30	7.38	8.59
Lancaster	2.74	3.33	4.33	5.19	6.49	7.63	8.91
Lee	2.56	3.05	3.71	4.26	5.03	5.68	6.38
Loudoun	2.53	3.05	3.89	4.61	5.70	6.64	7.70
Louisa	2.73	3.31	4.23	5.01	6.18	7.18	8.28
Lunenburg	2.72	3.29	4.21	4.99	6.12	7.09	8.15
Lynchburg (city)	2.75	3.33	4.26	5.03	6.17	7.14	8.20
Madison (Zone 1)	3.36	4.07	5.18	6.10	7.46	8.62	9.91
Madison (Zone 2)	2.87	3.48	4.44	5.25	6.45	7.48	8.61
Mathews	2.83	3.45	4.47	5.36	6.70	7.87	9.17
Mecklenburg	2.68	3.25	4.14	4.87	5.94	6.84	7.82
Middlesex	2.77	3.37	4.37	5.24	6.54	7.68	8.96
Montgomery (Zone 1)	2.00	2.42	3.06	3.58	4.34	4.97	5.64

County	Storm Return Frequency (Years)						
	1	2	5	10	25	50	100
Montgomery (Zone 2)	2.28	2.76	3.50	4.11	4.99	5.73	6.52
Montgomery (Zone 3)	2.60	3.15	4.01	4.72	5.75	6.61	7.55
Nelson	2.99	3.62	4.62	5.45	6.66	7.70	8.83
New Kent	2.78	3.37	4.35	5.19	6.45	7.53	8.75
Newport News (city)	2.94	3.58	4.63	5.53	6.86	8.01	9.28
Norfolk (city)	2.94	3.57	4.62	5.50	6.82	7.95	9.20
Northampton	2.74	3.33	4.33	5.19	6.48	7.61	8.88
Northumberland	2.69	3.27	4.25	5.10	6.39	7.51	8.78
Nottoway	2.73	3.31	4.23	5.00	6.15	7.12	8.19
Orange	2.76	3.34	4.27	5.07	6.27	7.30	8.46
Page (Zone 1)	2.44	2.94	3.71	4.35	5.28	6.07	6.93
Page (Zone 2)	3.06	3.70	4.69	5.52	6.73	7.77	8.90
Patrick (Zone 1)	3.79	4.61	5.89	6.97	8.57	9.94	11.46
Patrick (Zone 3)	3.06	3.71	4.73	5.59	6.85	7.93	9.10
Petersburg (city)	2.80	3.40	4.35	5.16	6.35	7.36	8.46
Pittsylvania	2.78	3.37	4.29	5.07	6.20	7.17	8.23
Poquoson (city)	2.93	3.56	4.61	5.42	6.87	8.05	9.35
Portsmouth (city)	2.96	3.61	4.66	5.55	6.87	8.01	9.27
Powhatan	2.71	3.28	4.20	4.97	6.12	7.11	8.19
Prince Edward	2.74	3.32	4.24	5.02	6.18	7.16	8.25
Prince George	2.81	3.41	4.39	5.21	6.42	7.45	8.58
Prince William	2.51	3.04	3.91	4.67	5.84	6.86	8.03
Pulaski	2.03	2.46	3.10	3.63	4.39	5.02	5.69
Rappahannock	2.74	3.31	4.22	4.98	6.12	7.10	8.18
Richmond (city)	2.76	3.34	4.28	5.08	6.27	7.29	8.42
Richmond	2.70	3.29	4.26	5.11	6.40	7.52	8.80
Roanoke (Zone 1)	2.37	2.87	3.64	4.27	5.19	5.96	6.78
Roanoke (Zone 2)	2.62	3.17	4.03	4.74	5.77	6.64	7.58
Rockbridge (Zone 1)	2.54	3.07	3.90	4.58	5.57	6.39	7.29
Rickbridge (Zone 2)	2.94	3.56	4.53	5.33	6.48	7.46	8.51
Rockingham (Zone 1)	2.27	2.73	3.43	4.03	4.91	5.66	6.49
Rockingham (Zone 2)	3.06	3.69	4.68	5.50	6.69	7.72	8.84
Russell	2.20	2.62	3.17	3.62	4.27	4.80	5.36
Scott (Zone 1)	2.39	2.84	3.43	3.91	4.59	5.15	5.75
Scott (Zone 2)	2.25	2.67	3.18	3.59	4.14	4.58	5.02
Shenandoah	2.31	2.78	3.48	4.07	4.94	5.69	6.50
Smyth	2.34	2.78	3.35	3.81	4.44	4.95	5.47
Southampton	2.87	3.49	4.50	5.35	6.60	7.66	8.83
Spotsylvania	2.66	3.22	4.14	4.93	6.13	7.19	8.37
Stafford	2.58	3.11	4.00	4.79	5.99	7.05	8.25
Suffolk (city)	2.99	3.64	4.70	5.59	6.91	8.04	9.28

County	Storm Return Frequency (Years)						
	1	2	5	10	25	50	100
Surry	2.90	3.52	4.55	5.42	6.70	7.80	9.02
Sussex	2.85	3.46	4.45	5.29	6.50	7.52	8.03
Tazewell	2.16	2.56	3.09	3.52	4.12	4.61	5.11
Virginia Beach (city)	3.01	3.67	4.74	5.65	6.99	8.15	9.42
Warren (Zone 1)	2.48	2.99	3.78	4.43	5.38	6.19	7.08
Warren (Zone 2)	2.84	3.43	4.35	5.11	6.25	7.23	8.31
Washington	2.21	2.62	3.13	3.54	4.10	4.54	4.99
Westmoreland	2.66	3.24	4.20	5.04	6.31	7.42	8.68
Wise	2.29	2.73	3.33	3.85	4.59	5.21	5.87
Wythe	2.13	2.55	3.13	3.60	4.24	4.75	5.27
York	2.93	3.56	4.61	5.51	6.84	8.00	9.28

Source: USDA-NRCS State Office, Richmond, VA

1C– Appendix 11-C VSWMH – Rainfall-Runoff Curves for Selected CN

Appendix 11-C

RAINFALL-RUNOFF TABLES FOR SELECTED RUNOFF CURVE NUMBERS

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The USDA-Natural Resources Conservation Service's *National Engineering Handbook*, Part 630, Hydrology, chapter 10, publishes figure 10–2 (**Figure 11-C.1** below) for estimating direct runoff from rainfall for selected runoff curve numbers. Many users find it more convenient to work with the tables that follow in this appendix, which were published by the NRCS in 1960 and revised in 1976. The tables show runoff amounts from rainfall quantities up to 40 inches and for runoff curve numbers 50 to 98, inclusive. In most cases the tables give more exact solutions than can be interpolated from the graph in **Figure 11-C.1**. The runoff value was determined using the equation:

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S}$$

Where: Q = Depth of runoff (inches)

P = Depth of rainfall (inches)

S = Maximum potential retention (inches)

Figure 10–2 ES-1001 graphical solution of the equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

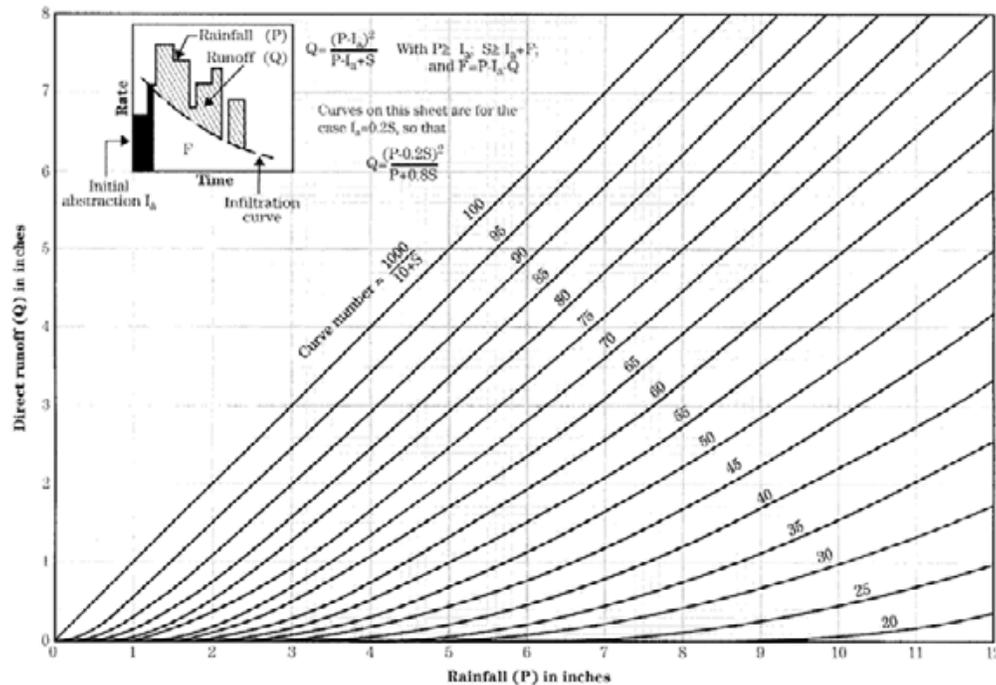


Figure 11-C.1. NRCS Graphical Solution to Determine Runoff Depth from Rainfall Depth

Table 11-C.1. NRCS Rainfall-Runoff Table for CN = 50

Curve
50

Runoff for inches of rainfall—Curve no. 50

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1										
2	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.05	0.06	0.07
3	0.09	0.11	0.13	0.15	0.17	0.20	0.22	0.25	0.27	0.30
4	0.33	0.36	0.40	0.43	0.46	0.50	0.54	0.57	0.61	0.65
5	0.69	0.73	0.78	0.82	0.86	0.91	0.95	1.00	1.05	1.09
6	1.14	1.19	1.24	1.29	1.34	1.40	1.45	1.50	1.56	1.61
7	1.67	1.72	1.78	1.84	1.89	1.95	2.01	2.07	2.13	2.19
8	2.25	2.31	2.37	2.43	2.50	2.56	2.62	2.69	2.75	2.82
9	2.88	2.95	3.01	3.08	3.15	3.21	3.28	3.35	3.42	3.49
10	3.56	3.62	3.69	3.76	3.83	3.91	3.98	4.05	4.12	4.19
11	4.26	4.34	4.41	4.48	4.55	4.63	4.70	4.78	4.85	4.93
12	5.00	5.08	5.15	5.23	5.30	5.38	5.45	5.53	5.61	5.68
13	5.76	5.84	5.92	5.99	6.07	6.15	6.23	6.31	6.39	6.47
14	6.55	6.62	6.70	6.78	6.86	6.94	7.02	7.11	7.19	7.27
15	7.35	7.43	7.51	7.59	7.67	7.76	7.84	7.92	8.00	8.08
16	8.17	8.25	8.33	8.42	8.50	8.58	8.67	8.75	8.83	8.92
17	9.00	9.08	9.17	9.25	9.34	9.42	9.51	9.59	9.68	9.76
18	9.85	9.93	10.02	10.10	10.19	10.27	10.36	10.45	10.53	10.62
19	10.70	10.79	10.88	10.96	11.05	11.14	11.22	11.31	11.40	11.48
20	11.57	11.66	11.75	11.83	11.92	12.01	12.10	12.18	12.27	12.36
21	12.45	12.54	12.62	12.71	12.80	12.89	12.98	13.07	13.16	13.24
22	13.33	13.42	13.51	13.60	13.69	13.78	13.87	13.96	14.05	14.14
23	14.23	14.32	14.41	14.49	14.58	14.67	14.76	14.85	14.94	15.03
24	15.13	15.22	15.31	15.40	15.49	15.58	15.67	15.76	15.85	15.94
25	16.03	16.12	16.21	16.30	16.39	16.49	16.58	16.67	16.76	16.85
26	16.94	17.03	17.12	17.22	17.31	17.40	17.49	17.58	17.67	17.77
27	17.86	17.95	18.04	18.13	18.22	18.32	18.41	18.50	18.59	18.69
28	18.78	18.87	18.96	19.05	19.15	19.24	19.33	19.42	19.52	19.61
29	19.70	19.80	19.89	19.98	20.07	20.17	20.26	20.35	20.45	20.54
30	20.63	20.72	20.82	20.91	21.00	21.10	21.19	21.28	21.38	21.47
31	21.56	21.66	21.75	21.84	21.94	22.03	22.13	22.22	22.31	22.41
32	22.50	22.59	22.69	22.78	22.88	22.97	23.06	23.16	23.25	23.34
33	23.44	23.53	23.63	23.72	23.82	23.91	24.00	24.10	24.19	24.29
34	24.38	24.48	24.57	24.66	24.76	24.85	24.95	25.04	25.14	25.23
35	25.33	25.42	25.51	25.61	25.70	25.80	25.89	25.99	26.08	26.18
36	26.27	26.37	26.46	26.56	26.65	26.75	26.84	26.94	27.03	27.13
37	27.22	27.32	27.41	27.51	27.60	27.70	27.79	27.89	27.98	28.08
38	28.17	28.27	28.36	28.46	28.56	28.65	28.75	28.84	28.94	29.03
39	29.13	29.22	29.32	29.41	29.51	29.61	29.70	29.80	29.89	29.99
40	30.08	30.18	30.27	30.37	30.47	30.56	30.66	30.75	30.85	30.94

Example: 4.50 inches rainfall = 0.50 inches runoff

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^4}{P + 0.8S}$

Table 11-C.2. NRCS Rainfall-Runoff Table for CN = 51

Curve
51

Runoff for inches of rainfall—Curve no. 51

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1										
2	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.06	0.07	0.09
3	0.11	0.13	0.15	0.17	0.20	0.22	0.25	0.28	0.31	0.34
4	0.37	0.40	0.44	0.47	0.51	0.55	0.58	0.62	0.66	0.70
5	0.75	0.79	0.83	0.88	0.92	0.97	1.02	1.07	1.11	1.16
6	1.21	1.27	1.32	1.37	1.42	1.48	1.53	1.59	1.64	1.70
7	1.76	1.81	1.87	1.93	1.99	2.05	2.11	2.17	2.23	2.29
8	2.35	2.42	2.48	2.54	2.61	2.67	2.74	2.80	2.87	2.94
9	3.00	3.07	3.14	3.20	3.27	3.34	3.41	3.48	3.55	3.62
10	3.69	3.76	3.83	3.90	3.97	4.05	4.12	4.19	4.26	4.34
11	4.41	4.48	4.56	4.63	4.71	4.78	4.86	4.93	5.01	5.08
12	5.16	5.24	5.31	5.39	5.47	5.54	5.62	5.70	5.78	5.85
13	5.93	6.01	6.09	6.17	6.25	6.33	6.41	6.49	6.57	6.65
14	6.73	6.81	6.89	6.97	7.05	7.13	7.21	7.29	7.37	7.46
15	7.54	7.62	7.70	7.79	7.87	7.95	8.03	8.12	8.20	8.28
16	8.37	8.45	8.53	8.62	8.70	8.79	8.87	8.95	9.04	9.12
17	9.21	9.29	9.38	9.46	9.55	9.63	9.72	9.81	9.89	9.98
18	10.06	10.15	10.24	10.32	10.41	10.49	10.58	10.67	10.75	10.84
19	10.93	11.02	11.10	11.19	11.28	11.36	11.45	11.54	11.63	11.72
20	11.80	11.89	11.98	12.07	12.16	12.24	12.33	12.42	12.51	12.60
21	12.69	12.78	12.86	12.95	13.04	13.13	13.22	13.31	13.40	13.49
22	13.58	13.67	13.76	13.85	13.94	14.03	14.12	14.21	14.30	14.39
23	14.48	14.57	14.66	14.75	14.84	14.93	15.02	15.11	15.20	15.29
24	15.38	15.47	15.56	15.66	15.75	15.84	15.93	16.02	16.11	16.20
25	16.29	16.38	16.48	16.57	16.66	16.75	16.84	16.93	17.03	17.12
26	17.21	17.30	17.39	17.49	17.58	17.67	17.76	17.85	17.95	18.04
27	18.13	18.22	18.32	18.41	18.50	18.59	18.69	18.78	18.87	18.96
28	19.06	19.15	19.24	19.33	19.43	19.52	19.61	19.71	19.80	19.89
29	19.99	20.08	20.17	20.26	20.36	20.45	20.54	20.64	20.73	20.82
30	20.92	21.01	21.11	21.20	21.29	21.39	21.48	21.57	21.67	21.76
31	21.86	21.95	22.04	22.14	22.23	22.32	22.42	22.51	22.61	22.70
32	22.79	22.89	22.98	23.08	23.17	23.27	23.36	23.45	23.55	23.64
33	23.74	23.83	23.93	24.02	24.12	24.21	24.30	24.40	24.49	24.59
34	24.68	24.78	24.87	24.97	25.06	25.16	25.25	25.35	25.44	25.54
35	25.63	25.73	25.82	25.92	26.01	26.11	26.20	26.30	26.39	26.49
36	26.58	26.68	26.77	26.87	26.96	27.06	27.15	27.25	27.34	27.44
37	27.53	27.63	27.73	27.82	27.92	28.01	28.11	28.20	28.30	28.39
38	28.49	28.58	28.68	28.78	28.87	28.97	29.06	29.16	29.25	29.35
39	29.45	29.54	29.64	29.73	29.83	29.93	30.02	30.12	30.21	30.31
40	30.40	30.50	30.60	30.69	30.79	30.88	30.98	31.08	31.17	31.27

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.3. NRCS Rainfall-Runoff Table for CN = 52



Runoff for inches of rainfall—Curve no. 52

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1										
2	0.00	0.01	0.01	0.02	0.03	0.04	0.06	0.07	0.09	0.11
3	0.13	0.15	0.17	0.20	0.22	0.25	0.28	0.31	0.34	0.37
4	0.41	0.44	0.48	0.52	0.55	0.59	0.63	0.67	0.72	0.76
5	0.80	0.85	0.89	0.94	0.99	1.04	1.09	1.14	1.19	1.24
6	1.29	1.34	1.40	1.45	1.50	1.56	1.62	1.67	1.73	1.79
7	1.85	1.91	1.97	2.03	2.09	2.15	2.21	2.27	2.33	2.40
8	2.46	2.53	2.59	2.66	2.72	2.79	2.85	2.92	2.99	3.06
9	3.12	3.19	3.26	3.33	3.40	3.47	3.54	3.61	3.68	3.75
10	3.82	3.90	3.97	4.04	4.11	4.19	4.26	4.33	4.41	4.48
11	4.56	4.63	4.71	4.78	4.86	4.94	5.01	5.09	5.16	5.24
12	5.32	5.40	5.47	5.55	5.63	5.71	5.79	5.87	5.94	6.02
13	6.10	6.18	6.26	6.34	6.42	6.50	6.58	6.66	6.75	6.83
14	6.91	6.99	7.07	7.15	7.23	7.32	7.40	7.48	7.56	7.65
15	7.73	7.81	7.90	7.98	8.06	8.15	8.23	8.31	8.40	8.48
16	8.57	8.65	8.74	8.82	8.91	8.99	9.08	9.16	9.25	9.33
17	9.42	9.50	9.59	9.68	9.76	9.85	9.93	10.02	10.11	10.19
18	10.28	10.37	10.45	10.54	10.63	10.72	10.80	10.89	10.98	11.07
19	11.15	11.24	11.33	11.42	11.50	11.59	11.68	11.77	11.86	11.95
20	12.04	12.12	12.21	12.30	12.39	12.48	12.57	12.66	12.75	12.84
21	12.93	13.01	13.10	13.19	13.28	13.37	13.46	13.55	13.64	13.73
22	13.82	13.91	14.00	14.09	14.18	14.27	14.37	14.46	14.55	14.64
23	14.73	14.82	14.91	15.00	15.09	15.18	15.27	15.36	15.46	15.55
24	15.64	15.73	15.82	15.91	16.00	16.10	16.19	16.28	16.37	16.46
25	16.55	16.65	16.74	16.83	16.92	17.01	17.11	17.20	17.29	17.38
26	17.48	17.57	17.66	17.75	17.85	17.94	18.03	18.12	18.22	18.31
27	18.40	18.49	18.59	18.68	18.77	18.87	18.96	19.05	19.15	19.24
28	19.33	19.42	19.52	19.61	19.70	19.80	19.89	19.98	20.08	20.17
29	20.27	20.36	20.45	20.55	20.64	20.73	20.83	20.92	21.02	21.11
30	21.20	21.30	21.39	21.48	21.58	21.67	21.77	21.86	21.96	22.05
31	22.14	22.24	22.33	22.43	22.52	22.61	22.71	22.80	22.90	22.99
32	23.09	23.18	23.28	23.37	23.47	23.56	23.65	23.75	23.84	23.94
33	24.03	24.13	24.22	24.32	24.41	24.51	24.60	24.70	24.79	24.89
34	24.98	25.08	25.17	25.27	25.36	25.46	25.55	25.65	25.74	25.84
35	25.93	26.03	26.12	26.22	26.32	26.41	26.51	26.60	26.70	26.79
36	26.89	26.98	27.08	27.17	27.27	27.37	27.46	27.56	27.65	27.75
37	27.84	27.94	28.03	28.13	28.23	28.32	28.42	28.51	28.61	28.71
38	28.80	28.90	28.99	29.09	29.18	29.28	29.38	29.47	29.57	29.66
39	29.76	29.86	29.95	30.05	30.14	30.24	30.34	30.43	30.53	30.63
40	30.72	30.82	30.91	31.01	31.11	31.20	31.30	31.40	31.49	31.59

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.4. NRCS Rainfall-Runoff Table for CN = 53

Curve
53

Runoff for inches of rainfall—Curve no. 53

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1										
2	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.13
3	0.15	0.17	0.20	0.22	0.25	0.28	0.31	0.34	0.38	0.41
4	0.45	0.48	0.52	0.56	0.60	0.64	0.68	0.73	0.77	0.81
5	0.86	0.91	0.95	1.00	1.05	1.10	1.15	1.20	1.26	1.31
6	1.36	1.42	1.47	1.53	1.59	1.64	1.70	1.76	1.82	1.88
7	1.94	2.00	2.06	2.12	2.18	2.25	2.31	2.37	2.44	2.50
8	2.57	2.63	2.70	2.77	2.83	2.90	2.97	3.04	3.11	3.17
9	3.24	3.31	3.38	3.45	3.53	3.60	3.67	3.74	3.81	3.89
10	3.96	4.03	4.10	4.18	4.25	4.33	4.40	4.48	4.55	4.63
11	4.70	4.78	4.86	4.93	5.01	5.09	5.16	5.24	5.32	5.40
12	5.48	5.55	5.63	5.71	5.79	5.87	5.95	6.03	6.11	6.19
13	6.27	6.35	6.43	6.51	6.59	6.68	6.76	6.84	6.92	7.00
14	7.09	7.17	7.25	7.33	7.42	7.50	7.58	7.67	7.75	7.83
15	7.92	8.00	8.08	8.17	8.25	8.34	8.42	8.51	8.59	8.68
16	8.76	8.85	8.93	9.02	9.10	9.19	9.28	9.36	9.45	9.53
17	9.62	9.71	9.79	9.88	9.97	10.05	10.14	10.23	10.32	10.40
18	10.49	10.58	10.67	10.75	10.84	10.93	11.02	11.11	11.19	11.28
19	11.37	11.46	11.55	11.64	11.73	11.81	11.90	11.99	12.08	12.17
20	12.26	12.35	12.44	12.53	12.62	12.71	12.80	12.89	12.98	13.07
21	13.16	13.25	13.34	13.43	13.52	13.61	13.70	13.79	13.88	13.97
22	14.06	14.15	14.24	14.33	14.42	14.51	14.61	14.70	14.79	14.88
23	14.97	15.06	15.15	15.24	15.34	15.43	15.52	15.61	15.70	15.79
24	15.89	15.98	16.07	16.16	16.25	16.35	16.44	16.53	16.62	16.71
25	16.81	16.90	16.99	17.08	17.18	17.27	17.36	17.45	17.55	17.64
26	17.73	17.83	17.92	18.01	18.10	18.20	18.29	18.38	18.48	18.57
27	18.66	18.76	18.85	18.94	19.04	19.13	19.22	19.32	19.41	19.50
28	19.60	19.69	19.79	19.88	19.97	20.07	20.16	20.25	20.35	20.44
29	20.54	20.63	20.72	20.82	20.91	21.01	21.10	21.19	21.29	21.38
30	21.48	21.57	21.67	21.76	21.85	21.95	22.04	22.14	22.23	22.33
31	22.42	22.52	22.61	22.71	22.80	22.89	22.99	23.08	23.18	23.27
32	23.37	23.46	23.56	23.65	23.75	23.84	23.94	24.03	24.13	24.22
33	24.32	24.41	24.51	24.60	24.70	24.79	24.89	24.98	25.08	25.18
34	25.27	25.37	25.46	25.56	25.65	25.75	25.84	25.94	26.03	26.13
35	26.22	26.32	26.42	26.51	26.61	26.70	26.80	26.89	26.99	27.09
36	27.18	27.28	27.37	27.47	27.56	27.66	27.76	27.85	27.95	28.04
37	28.14	28.24	28.33	28.43	28.52	28.62	28.72	28.81	28.91	29.00
38	29.10	29.20	29.29	29.39	29.49	29.58	29.68	29.77	29.87	29.97
39	30.06	30.16	30.26	30.35	30.45	30.54	30.64	30.74	30.83	30.93
40	31.03	31.12	31.22	31.32	31.41	31.51	31.61	31.70	31.80	31.90

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.5. NRCS Rainfall-Runoff Table for CN = 54



Runoff for inches of rainfall—Curve no. 54

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1										
2	0.01	0.02	0.03	0.04	0.05	0.07	0.09	0.10	0.12	0.15
3	0.17	0.20	0.22	0.25	0.28	0.31	0.35	0.38	0.41	0.45
4	0.49	0.53	0.57	0.61	0.65	0.69	0.73	0.78	0.83	0.87
5	0.92	0.97	1.02	1.07	1.12	1.17	1.22	1.28	1.33	1.38
6	1.44	1.50	1.55	1.61	1.67	1.73	1.79	1.85	1.91	1.97
7	2.03	2.09	2.16	2.22	2.28	2.35	2.41	2.48	2.54	2.61
8	2.68	2.74	2.81	2.88	2.95	3.02	3.08	3.15	3.22	3.29
9	3.37	3.44	3.51	3.58	3.65	3.73	3.80	3.87	3.94	4.02
10	4.09	4.17	4.24	4.32	4.39	4.47	4.54	4.62	4.70	4.77
11	4.85	4.93	5.01	5.08	5.16	5.24	5.32	5.40	5.48	5.55
12	5.63	5.71	5.79	5.87	5.95	6.03	6.11	6.20	6.28	6.36
13	6.44	6.52	6.60	6.68	6.77	6.85	6.93	7.01	7.10	7.18
14	7.26	7.35	7.43	7.51	7.60	7.68	7.77	7.85	7.93	8.02
15	8.10	8.19	8.27	8.36	8.44	8.53	8.61	8.70	8.79	8.87
16	8.96	9.04	9.13	9.22	9.30	9.39	9.48	9.56	9.65	9.74
17	9.82	9.91	10.00	10.09	10.17	10.26	10.35	10.44	10.52	10.61
18	10.70	10.79	10.88	10.97	11.05	11.14	11.23	11.32	11.41	11.50
19	11.59	11.68	11.77	11.86	11.94	12.03	12.12	12.21	12.30	12.39
20	12.48	12.57	12.66	12.75	12.84	12.93	13.02	13.11	13.20	13.30
21	13.39	13.48	13.57	13.66	13.75	13.84	13.93	14.02	14.11	14.20
22	14.30	14.39	14.48	14.57	14.66	14.75	14.84	14.94	15.03	15.12
23	15.21	15.30	15.39	15.49	15.58	15.67	15.76	15.85	15.95	16.04
24	16.13	16.22	16.32	16.41	16.50	16.59	16.69	16.78	16.87	16.96
25	17.06	17.15	17.24	17.34	17.43	17.52	17.62	17.71	17.80	17.89
26	17.99	18.08	18.17	18.27	18.36	18.45	18.55	18.64	18.74	18.83
27	18.92	19.02	19.11	19.20	19.30	19.39	19.49	19.58	19.67	19.77
28	19.86	19.96	20.05	20.14	20.24	20.33	20.43	20.52	20.61	20.71
29	20.80	20.90	20.99	21.09	21.18	21.27	21.37	21.46	21.56	21.65
30	21.75	21.84	21.94	22.03	22.13	22.22	22.32	22.41	22.51	22.60
31	22.70	22.79	22.89	22.98	23.08	23.17	23.27	23.36	23.46	23.55
32	23.65	23.74	23.84	23.93	24.03	24.12	24.22	24.31	24.41	24.50
33	24.60	24.69	24.79	24.89	24.98	25.08	25.17	25.27	25.36	25.46
34	25.55	25.65	25.75	25.84	25.94	26.03	26.13	26.22	26.32	26.42
35	26.51	26.61	26.70	26.80	26.90	26.99	27.09	27.18	27.28	27.38
36	27.47	27.57	27.66	27.76	27.86	27.95	28.05	28.14	28.24	28.34
37	28.43	28.53	28.63	28.72	28.82	28.91	29.01	29.11	29.20	29.30
38	29.40	29.49	29.59	29.68	29.78	29.88	29.97	30.07	30.17	30.26
39	30.36	30.46	30.55	30.65	30.75	30.84	30.94	31.04	31.13	31.23
40	31.33	31.42	31.52	31.62	31.71	31.81	31.91	32.00	32.10	32.20

Note: Runoff value determined by equation $Q = \frac{(P - 0.28)^2}{P + 0.88}$

Table 11-C.6. NRCS Rainfall-Runoff Table for CN = 55



Runoff for inches of rainfall—Curve no. 55

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
2	0.02	0.02	0.04	0.05	0.07	0.08	0.10	0.12	0.15	0.17
3	0.19	0.22	0.25	0.28	0.31	0.35	0.38	0.42	0.45	0.49
4	0.53	0.57	0.61	0.65	0.70	0.74	0.79	0.83	0.88	0.93
5	0.98	1.03	1.08	1.13	1.19	1.24	1.29	1.35	1.40	1.46
6	1.52	1.58	1.63	1.69	1.75	1.81	1.87	1.94	2.00	2.06
7	2.12	2.19	2.25	2.32	2.38	2.45	2.51	2.58	2.65	2.72
8	2.78	2.85	2.92	2.99	3.06	3.13	3.20	3.27	3.34	3.42
9	3.49	3.56	3.63	3.71	3.78	3.85	3.93	4.00	4.08	4.15
10	4.23	4.30	4.38	4.46	4.53	4.61	4.69	4.76	4.84	4.92
11	5.00	5.08	5.15	5.23	5.31	5.39	5.47	5.55	5.63	5.71
12	5.79	5.87	5.95	6.03	6.12	6.20	6.28	6.36	6.44	6.53
13	6.61	6.69	6.77	6.86	6.94	7.02	7.11	7.19	7.27	7.36
14	7.44	7.53	7.61	7.69	7.78	7.86	7.95	8.03	8.12	8.20
15	8.29	8.38	8.46	8.55	8.63	8.72	8.81	8.89	8.98	9.07
16	9.15	9.24	9.33	9.41	9.50	9.59	9.68	9.76	9.85	9.94
17	10.03	10.11	10.20	10.29	10.38	10.47	10.56	10.64	10.73	10.82
18	10.91	11.00	11.09	11.18	11.27	11.36	11.45	11.53	11.62	11.71
19	11.80	11.89	11.98	12.07	12.16	12.25	12.34	12.43	12.52	12.61
20	12.70	12.80	12.89	12.98	13.07	13.16	13.25	13.34	13.43	13.52
21	13.61	13.70	13.80	13.89	13.98	14.07	14.16	14.25	14.34	14.44
22	14.53	14.62	14.71	14.80	14.90	14.99	15.08	15.17	15.26	15.36
23	15.45	15.54	15.63	15.73	15.82	15.91	16.00	16.10	16.19	16.28
24	16.37	16.47	16.56	16.65	16.75	16.84	16.93	17.03	17.12	17.21
25	17.31	17.40	17.49	17.59	17.68	17.77	17.87	17.96	18.05	18.15
26	18.24	18.33	18.43	18.52	18.62	18.71	18.80	18.90	18.99	19.08
27	19.18	19.27	19.37	19.46	19.56	19.65	19.74	19.84	19.93	20.03
28	20.12	20.22	20.31	20.40	20.50	20.59	20.69	20.78	20.88	20.97
29	21.07	21.16	21.26	21.35	21.45	21.54	21.64	21.73	21.83	21.92
30	22.02	22.11	22.21	22.30	22.40	22.49	22.59	22.68	22.78	22.87
31	22.97	23.06	23.16	23.25	23.35	23.44	23.54	23.63	23.73	23.82
32	23.92	24.02	24.11	24.21	24.30	24.40	24.49	24.59	24.68	24.78
33	24.88	24.97	25.07	25.16	25.26	25.35	25.45	25.55	25.64	25.74
34	25.83	25.93	26.03	26.12	26.22	26.31	26.41	26.51	26.60	26.70
35	26.79	26.89	26.99	27.08	27.18	27.28	27.37	27.47	27.56	27.66
36	27.76	27.85	27.95	28.05	28.14	28.24	28.33	28.43	28.53	28.62
37	28.72	28.82	28.91	29.01	29.11	29.20	29.30	29.40	29.49	29.59
38	29.69	29.78	29.88	29.98	30.07	30.17	30.27	30.36	30.46	30.56
39	30.65	30.75	30.85	30.94	31.04	31.14	31.23	31.33	31.43	31.52
40	31.62	31.72	31.82	31.91	32.01	32.11	32.20	32.30	32.40	32.49

Note: Runoff value determined by equation $Q = \frac{(P - 0.25)^2}{P + 0.8S}$

Table 11-C.7. NRCS Rainfall-Runoff Table for CN = 56

Curve
56

Runoff for inches of rainfall—Curve no. 56

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
2	0.02	0.03	0.05	0.06	0.08	0.10	0.12	0.14	0.17	0.19
3	0.22	0.25	0.28	0.31	0.34	0.38	0.42	0.45	0.49	0.53
4	0.57	0.62	0.66	0.70	0.75	0.79	0.84	0.89	0.94	0.99
5	1.04	1.09	1.15	1.20	1.25	1.31	1.36	1.42	1.48	1.54
6	1.60	1.66	1.72	1.78	1.84	1.90	1.96	2.02	2.09	2.15
7	2.22	2.28	2.35	2.41	2.48	2.55	2.62	2.68	2.75	2.82
8	2.89	2.96	3.03	3.10	3.17	3.25	3.32	3.39	3.46	3.54
9	3.61	3.68	3.76	3.83	3.91	3.98	4.06	4.13	4.21	4.28
10	4.36	4.44	4.51	4.59	4.67	4.75	4.83	4.90	4.98	5.06
11	5.14	5.22	5.30	5.38	5.46	5.54	5.62	5.70	5.78	5.86
12	5.95	6.03	6.11	6.19	6.27	6.36	6.44	6.52	6.60	6.69
13	6.77	6.85	6.94	7.02	7.11	7.19	7.27	7.36	7.44	7.53
14	7.61	7.70	7.78	7.87	7.95	8.04	8.13	8.21	8.30	8.38
15	8.47	8.56	8.64	8.73	8.82	8.90	8.99	9.08	9.16	9.25
16	9.34	9.43	9.52	9.60	9.69	9.78	9.87	9.96	10.04	10.13
17	10.22	10.31	10.40	10.49	10.58	10.67	10.75	10.84	10.93	11.02
18	11.11	11.20	11.29	11.38	11.47	11.56	11.65	11.74	11.83	11.92
19	12.01	12.10	12.19	12.28	12.37	12.46	12.55	12.65	12.74	12.83
20	12.92	13.01	13.10	13.19	13.28	13.37	13.47	13.56	13.65	13.74
21	13.83	13.92	14.02	14.11	14.20	14.29	14.38	14.48	14.57	14.66
22	14.75	14.84	14.94	15.03	15.12	15.21	15.31	15.40	15.49	15.58
23	15.68	15.77	15.86	15.96	16.05	16.14	16.24	16.33	16.42	16.51
24	16.61	16.70	16.79	16.89	16.98	17.07	17.17	17.26	17.36	17.45
25	17.54	17.64	17.73	17.82	17.92	18.01	18.11	18.20	18.29	18.39
26	18.48	18.58	18.67	18.76	18.86	18.95	19.05	19.14	19.24	19.33
27	19.42	19.52	19.61	19.71	19.80	19.90	19.99	20.09	20.18	20.28
28	20.37	20.46	20.56	20.65	20.75	20.84	20.94	21.03	21.13	21.22
29	21.32	21.41	21.51	21.60	21.70	21.79	21.89	21.98	22.08	22.18
30	22.27	22.37	22.46	22.56	22.65	22.75	22.84	22.94	23.03	23.13
31	23.22	23.32	23.42	23.51	23.61	23.70	23.80	23.89	23.99	24.09
32	24.18	24.28	24.37	24.47	24.56	24.66	24.76	24.85	24.95	25.04
33	25.14	25.24	25.33	25.43	25.52	25.62	25.72	25.81	25.91	26.01
34	26.10	26.20	26.29	26.39	26.49	26.58	26.68	26.78	26.87	26.97
35	27.06	27.16	27.26	27.35	27.45	27.55	27.64	27.74	27.84	27.93
36	28.03	28.13	28.22	28.32	28.42	28.51	28.61	28.71	28.80	28.90
37	29.00	29.09	29.19	29.29	29.38	29.48	29.58	29.67	29.77	29.87
38	29.96	30.06	30.16	30.25	30.35	30.45	30.54	30.64	30.74	30.84
39	30.93	31.03	31.13	31.22	31.32	31.42	31.51	31.61	31.71	31.81
40	31.90	32.00	32.10	32.19	32.29	32.39	32.49	32.58	32.68	32.78

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.8. NRCS Rainfall-Runoff Table for CN = 57

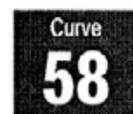
Curve
57

Runoff for inches of rainfall—Curve no. 57

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
2	0.03	0.04	0.06	0.08	0.09	0.12	0.14	0.16	0.19	0.22
3	0.25	0.28	0.31	0.34	0.38	0.42	0.45	0.49	0.53	0.58
4	0.62	0.66	0.71	0.75	0.80	0.85	0.90	0.95	1.00	1.05
5	1.11	1.16	1.21	1.27	1.33	1.38	1.44	1.50	1.56	1.62
6	1.68	1.74	1.80	1.86	1.93	1.99	2.05	2.12	2.18	2.25
7	2.31	2.38	2.45	2.52	2.58	2.65	2.72	2.79	2.86	2.93
8	3.00	3.07	3.15	3.22	3.29	3.36	3.44	3.51	3.59	3.66
9	3.73	3.81	3.88	3.96	4.04	4.11	4.19	4.27	4.34	4.42
10	4.50	4.58	4.65	4.73	4.81	4.89	4.97	5.05	5.13	5.21
11	5.29	5.37	5.45	5.53	5.61	5.69	5.78	5.86	5.94	6.02
12	6.10	6.19	6.27	6.35	6.44	6.52	6.60	6.69	6.77	6.85
13	6.94	7.02	7.11	7.19	7.28	7.36	7.45	7.53	7.62	7.70
14	7.79	7.88	7.96	8.05	8.13	8.22	8.31	8.39	8.48	8.57
15	8.66	8.74	8.83	8.92	9.00	9.09	9.18	9.27	9.36	9.44
16	9.53	9.62	9.71	9.80	9.89	9.98	10.06	10.15	10.24	10.33
17	10.42	10.51	10.60	10.69	10.78	10.87	10.96	11.05	11.14	11.23
18	11.32	11.41	11.50	11.59	11.68	11.77	11.86	11.95	12.04	12.13
19	12.22	12.31	12.41	12.50	12.59	12.68	12.77	12.86	12.95	13.04
20	13.14	13.23	13.32	13.41	13.50	13.59	13.69	13.78	13.87	13.96
21	14.06	14.15	14.24	14.33	14.42	14.52	14.61	14.70	14.79	14.89
22	14.98	15.07	15.17	15.26	15.35	15.44	15.54	15.63	15.72	15.82
23	15.91	16.00	16.10	16.19	16.28	16.38	16.47	16.56	16.66	16.75
24	16.85	16.94	17.03	17.13	17.22	17.31	17.41	17.50	17.60	17.69
25	17.78	17.88	17.97	18.07	18.16	18.25	18.35	18.44	18.54	18.63
26	18.73	18.82	18.92	19.01	19.10	19.20	19.29	19.39	19.48	19.58
27	19.67	19.77	19.86	19.96	20.05	20.15	20.24	20.34	20.43	20.53
28	20.62	20.72	20.81	20.91	21.00	21.10	21.19	21.29	21.38	21.48
29	21.57	21.67	21.77	21.86	21.96	22.05	22.15	22.24	22.34	22.43
30	22.53	22.63	22.72	22.82	22.91	23.01	23.10	23.20	23.30	23.39
31	23.49	23.58	23.68	23.77	23.87	23.97	24.06	24.16	24.25	24.35
32	24.45	24.54	24.64	24.74	24.83	24.93	25.02	25.12	25.22	25.31
33	25.41	25.50	25.60	25.70	25.79	25.89	25.99	26.08	26.18	26.28
34	26.37	26.47	26.57	26.66	26.76	26.85	26.95	27.05	27.14	27.24
35	27.34	27.43	27.53	27.63	27.72	27.82	27.92	28.01	28.11	28.21
36	28.30	28.40	28.50	28.59	28.69	28.79	28.89	28.98	29.08	29.18
37	29.27	29.37	29.47	29.56	29.66	29.76	29.85	29.95	30.05	30.15
38	30.24	30.34	30.44	30.53	30.63	30.73	30.83	30.92	31.02	31.12
39	31.21	31.31	31.41	31.51	31.60	31.70	31.80	31.90	31.99	32.09
40	32.19	32.28	32.38	32.48	32.58	32.67	32.77	32.87	32.97	33.06

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.9. NRCS Rainfall-Runoff Table for CN = 58



Runoff for inches of rainfall—Curve no. 58

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03
2	0.04	0.05	0.07	0.09	0.11	0.13	0.16	0.18	0.21	0.24
3	0.27	0.31	0.34	0.38	0.41	0.45	0.49	0.53	0.58	0.62
4	0.67	0.71	0.76	0.81	0.86	0.91	0.96	1.01	1.06	1.11
5	1.17	1.22	1.28	1.34	1.40	1.45	1.51	1.57	1.63	1.70
6	1.76	1.82	1.88	1.95	2.01	2.08	2.14	2.21	2.27	2.34
7	2.41	2.48	2.55	2.62	2.69	2.76	2.83	2.90	2.97	3.04
8	3.11	3.19	3.26	3.33	3.41	3.48	3.55	3.63	3.70	3.78
9	3.86	3.93	4.01	4.09	4.16	4.24	4.32	4.40	4.47	4.55
10	4.63	4.71	4.79	4.87	4.95	5.03	5.11	5.19	5.27	5.35
11	5.43	5.52	5.60	5.68	5.76	5.84	5.93	6.01	6.09	6.17
12	6.26	6.34	6.43	6.51	6.59	6.68	6.76	6.85	6.93	7.02
13	7.10	7.19	7.27	7.36	7.44	7.53	7.62	7.70	7.79	7.87
14	7.96	8.05	8.13	8.22	8.31	8.40	8.48	8.57	8.66	8.75
15	8.83	8.92	9.01	9.10	9.19	9.27	9.36	9.45	9.54	9.63
16	9.72	9.81	9.90	9.98	10.07	10.16	10.25	10.34	10.43	10.52
17	10.61	10.70	10.79	10.88	10.97	11.06	11.15	11.24	11.33	11.42
18	11.52	11.61	11.70	11.79	11.88	11.97	12.06	12.15	12.24	12.33
19	12.43	12.52	12.61	12.70	12.79	12.88	12.98	13.07	13.16	13.25
20	13.34	13.44	13.53	13.62	13.71	13.81	13.90	13.99	14.08	14.18
21	14.27	14.36	14.45	14.55	14.64	14.73	14.83	14.92	15.01	15.10
22	15.20	15.29	15.38	15.48	15.57	15.66	15.76	15.85	15.95	16.04
23	16.13	16.23	16.32	16.41	16.51	16.60	16.70	16.79	16.88	16.98
24	17.07	17.17	17.26	17.35	17.45	17.54	17.64	17.73	17.83	17.92
25	18.01	18.11	18.20	18.30	18.39	18.49	18.58	18.68	18.77	18.87
26	18.96	19.06	19.15	19.25	19.34	19.44	19.53	19.63	19.72	19.82
27	19.91	20.01	20.10	20.20	20.29	20.39	20.48	20.58	20.67	20.77
28	20.86	20.96	21.05	21.15	21.25	21.34	21.44	21.53	21.63	21.72
29	21.82	21.91	22.01	22.11	22.20	22.30	22.39	22.49	22.58	22.68
30	22.78	22.87	22.97	23.06	23.16	23.26	23.35	23.45	23.54	23.64
31	23.74	23.83	23.93	24.03	24.12	24.22	24.31	24.41	24.51	24.60
32	24.70	24.80	24.89	24.99	25.08	25.18	25.28	25.37	25.47	25.57
33	25.66	25.76	25.86	25.95	26.05	26.15	26.24	26.34	26.44	26.53
34	26.63	26.73	26.82	26.92	27.02	27.11	27.21	27.31	27.40	27.50
35	27.60	27.69	27.79	27.89	27.98	28.08	28.18	28.28	28.37	28.47
36	28.57	28.66	28.76	28.86	28.95	29.05	29.15	29.25	29.34	29.44
37	29.54	29.63	29.73	29.83	29.93	30.02	30.12	30.22	30.31	30.41
38	30.51	30.61	30.70	30.80	30.90	31.00	31.09	31.19	31.29	31.38
39	31.48	31.58	31.68	31.77	31.87	31.97	32.07	32.16	32.26	32.36
40	32.46	32.55	32.65	32.75	32.85	32.94	33.04	33.14	33.24	33.33

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.10. NRCS Rainfall-Runoff Table for CN = 59



Runoff for inches of rainfall—Curve no. 59

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03
2	0.05	0.07	0.08	0.11	0.13	0.15	0.18	0.21	0.24	0.27
3	0.30	0.34	0.37	0.41	0.45	0.49	0.53	0.58	0.62	0.67
4	0.71	0.76	0.81	0.86	0.91	0.96	1.01	1.07	1.12	1.18
5	1.23	1.29	1.35	1.41	1.47	1.53	1.59	1.65	1.71	1.77
6	1.84	1.90	1.97	2.03	2.10	2.17	2.23	2.30	2.37	2.44
7	2.51	2.58	2.65	2.72	2.79	2.86	2.93	3.00	3.08	3.15
8	3.22	3.30	3.37	3.45	3.52	3.60	3.67	3.75	3.82	3.90
9	3.98	4.05	4.13	4.21	4.29	4.37	4.45	4.53	4.60	4.68
10	4.76	4.84	4.92	5.01	5.09	5.17	5.25	5.33	5.41	5.49
11	5.58	5.66	5.74	5.82	5.91	5.99	6.07	6.16	6.24	6.33
12	6.41	6.50	6.58	6.66	6.75	6.83	6.92	7.01	7.09	7.18
13	7.26	7.35	7.43	7.52	7.61	7.69	7.78	7.87	7.95	8.04
14	8.13	8.22	8.30	8.39	8.48	8.57	8.66	8.74	8.83	8.92
15	9.01	9.10	9.19	9.28	9.36	9.45	9.54	9.63	9.72	9.81
16	9.90	9.99	10.08	10.17	10.26	10.35	10.44	10.53	10.62	10.71
17	10.80	10.89	10.98	11.07	11.16	11.25	11.35	11.44	11.53	11.62
18	11.71	11.80	11.89	11.98	12.08	12.17	12.26	12.35	12.44	12.53
19	12.63	12.72	12.81	12.90	13.00	13.09	13.18	13.27	13.36	13.46
20	13.55	13.64	13.74	13.83	13.92	14.01	14.11	14.20	14.29	14.39
21	14.48	14.57	14.67	14.76	14.85	14.95	15.04	15.13	15.23	15.32
22	15.41	15.51	15.60	15.69	15.79	15.88	15.98	16.07	16.16	16.26
23	16.35	16.45	16.54	16.63	16.73	16.82	16.92	17.01	17.11	17.20
24	17.29	17.39	17.48	17.58	17.67	17.77	17.86	17.96	18.05	18.15
25	18.24	18.34	18.43	18.53	18.62	18.72	18.81	18.91	19.00	19.10
26	19.19	19.29	19.38	19.48	19.57	19.67	19.76	19.86	19.95	20.05
27	20.14	20.24	20.33	20.43	20.53	20.62	20.72	20.81	20.91	21.00
28	21.10	21.20	21.29	21.39	21.48	21.58	21.67	21.77	21.87	21.96
29	22.06	22.15	22.25	22.35	22.44	22.54	22.63	22.73	22.83	22.92
30	23.02	23.11	23.21	23.31	23.40	23.50	23.60	23.69	23.79	23.88
31	23.98	24.08	24.17	24.27	24.37	24.46	24.56	24.66	24.75	24.85
32	24.95	25.04	25.14	25.24	25.33	25.43	25.53	25.62	25.72	25.82
33	25.91	26.01	26.11	26.20	26.30	26.40	26.49	26.59	26.69	26.78
34	26.88	26.98	27.07	27.17	27.27	27.37	27.46	27.56	27.66	27.75
35	27.85	27.95	28.05	28.14	28.24	28.34	28.43	28.53	28.63	28.73
36	28.82	28.92	29.02	29.11	29.21	29.31	29.41	29.50	29.60	29.70
37	29.79	29.89	29.99	30.09	30.18	30.28	30.38	30.48	30.57	30.67
38	30.77	30.87	30.96	31.06	31.16	31.26	31.35	31.45	31.55	31.65
39	31.74	31.84	31.94	32.04	32.13	32.23	32.33	32.43	32.52	32.62
40	32.72	32.82	32.92	33.01	33.11	33.21	33.31	33.40	33.50	33.60

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.11. NRCS Rainfall-Runoff Table for CN = 60



Runoff for inches of rainfall—Curve no. 60

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.04
2	0.06	0.08	0.10	0.12	0.15	0.17	0.20	0.23	0.26	0.30
3	0.33	0.37	0.41	0.45	0.49	0.53	0.57	0.62	0.67	0.71
4	0.76	0.81	0.86	0.91	0.97	1.02	1.07	1.13	1.19	1.24
5	1.30	1.36	1.42	1.48	1.54	1.60	1.66	1.73	1.79	1.86
6	1.92	1.99	2.05	2.12	2.19	2.25	2.32	2.39	2.46	2.53
7	2.60	2.67	2.74	2.82	2.89	2.96	3.04	3.11	3.18	3.26
8	3.33	3.41	3.48	3.56	3.63	3.71	3.79	3.87	3.94	4.02
9	4.10	4.18	4.26	4.34	4.42	4.49	4.57	4.65	4.74	4.82
10	4.90	4.98	5.06	5.14	5.22	5.31	5.39	5.47	5.55	5.64
11	5.72	5.80	5.89	5.97	6.05	6.14	6.22	6.31	6.39	6.48
12	6.56	6.65	6.73	6.82	6.90	6.99	7.08	7.16	7.25	7.34
13	7.42	7.51	7.60	7.68	7.77	7.86	7.95	8.03	8.12	8.21
14	8.30	8.38	8.47	8.56	8.65	8.74	8.83	8.92	9.01	9.09
15	9.18	9.27	9.36	9.45	9.54	9.63	9.72	9.81	9.90	9.99
16	10.08	10.17	10.26	10.35	10.44	10.53	10.62	10.71	10.81	10.90
17	10.99	11.08	11.17	11.26	11.35	11.44	11.54	11.63	11.72	11.81
18	11.90	11.99	12.09	12.18	12.27	12.36	12.45	12.55	12.64	12.73
19	12.82	12.92	13.01	13.10	13.19	13.29	13.38	13.47	13.57	13.66
20	13.75	13.85	13.94	14.03	14.12	14.22	14.31	14.40	14.50	14.59
21	14.69	14.78	14.87	14.97	15.06	15.15	15.25	15.34	15.44	15.53
22	15.62	15.72	15.81	15.91	16.00	16.09	16.19	16.28	16.38	16.47
23	16.57	16.66	16.76	16.85	16.94	17.04	17.13	17.23	17.32	17.42
24	17.51	17.61	17.70	17.80	17.89	17.99	18.08	18.18	18.27	18.37
25	18.46	18.56	18.65	18.75	18.84	18.94	19.03	19.13	19.22	19.32
26	19.42	19.51	19.61	19.70	19.80	19.89	19.99	20.08	20.18	20.28
27	20.37	20.47	20.56	20.66	20.76	20.85	20.95	21.04	21.14	21.23
28	21.33	21.43	21.52	21.62	21.71	21.81	21.91	22.00	22.10	22.20
29	22.29	22.39	22.48	22.58	22.68	22.77	22.87	22.97	23.06	23.16
30	23.26	23.35	23.45	23.54	23.64	23.74	23.83	23.93	24.03	24.12
31	24.22	24.32	24.41	24.51	24.61	24.70	24.80	24.90	24.99	25.09
32	25.19	25.28	25.38	25.48	25.57	25.67	25.77	25.87	25.96	26.06
33	26.16	26.25	26.35	26.45	26.54	26.64	26.74	26.84	26.93	27.03
34	27.13	27.22	27.32	27.42	27.52	27.61	27.71	27.81	27.90	28.00
35	28.10	28.20	28.29	28.39	28.49	28.59	28.68	28.78	28.88	28.97
36	29.07	29.17	29.27	29.36	29.46	29.56	29.66	29.75	29.85	29.95
37	30.05	30.14	30.24	30.34	30.44	30.53	30.63	30.73	30.83	30.92
38	31.02	31.12	31.22	31.32	31.41	31.51	31.61	31.71	31.80	31.90
39	32.00	32.10	32.19	32.29	32.39	32.49	32.59	32.68	32.78	32.88
40	32.98	33.08	33.17	33.27	33.37	33.47	33.56	33.66	33.76	33.86

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.12. NRCS Rainfall-Runoff Table for CN = 61

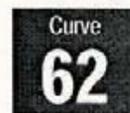
Curve
61

Runoff for inches of rainfall—Curve no. 61

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.06
2	0.07	0.09	0.12	0.14	0.17	0.20	0.23	0.26	0.29	0.33
3	0.37	0.40	0.44	0.49	0.53	0.57	0.62	0.67	0.71	0.76
4	0.81	0.86	0.92	0.97	1.02	1.08	1.14	1.19	1.25	1.31
5	1.37	1.43	1.49	1.55	1.62	1.68	1.74	1.81	1.87	1.94
6	2.01	2.07	2.14	2.21	2.28	2.35	2.42	2.49	2.56	2.63
7	2.70	2.78	2.85	2.92	3.00	3.07	3.14	3.22	3.29	3.37
8	3.45	3.52	3.60	3.68	3.75	3.83	3.91	3.99	4.07	4.15
9	4.23	4.31	4.38	4.47	4.55	4.63	4.71	4.79	4.87	4.95
10	5.03	5.12	5.20	5.28	5.36	5.45	5.53	5.61	5.70	5.78
11	5.87	5.95	6.04	6.12	6.20	6.29	6.38	6.46	6.55	6.63
12	6.72	6.80	6.89	6.98	7.06	7.15	7.24	7.32	7.41	7.50
13	7.59	7.67	7.76	7.85	7.94	8.03	8.11	8.20	8.29	8.38
14	8.47	8.56	8.65	8.74	8.82	8.91	9.00	9.09	9.18	9.27
15	9.36	9.45	9.54	9.63	9.72	9.81	9.90	9.99	10.08	10.18
16	10.27	10.36	10.45	10.54	10.63	10.72	10.81	10.90	11.00	11.09
17	11.18	11.27	11.36	11.45	11.55	11.64	11.73	11.82	11.91	12.01
18	12.10	12.19	12.28	12.38	12.47	12.56	12.65	12.75	12.84	12.93
19	13.03	13.12	13.21	13.30	13.40	13.49	13.58	13.68	13.77	13.86
20	13.96	14.05	14.15	14.24	14.33	14.43	14.52	14.61	14.71	14.80
21	14.90	14.99	15.08	15.18	15.27	15.37	15.46	15.55	15.65	15.74
22	15.84	15.93	16.03	16.12	16.22	16.31	16.41	16.50	16.59	16.69
23	16.78	16.88	16.97	17.07	17.16	17.26	17.35	17.45	17.54	17.64
24	17.73	17.83	17.93	18.02	18.12	18.21	18.31	18.40	18.50	18.59
25	18.69	18.78	18.88	18.97	19.07	19.17	19.26	19.36	19.45	19.55
26	19.64	19.74	19.84	19.93	20.03	20.12	20.22	20.32	20.41	20.51
27	20.60	20.70	20.80	20.89	20.99	21.08	21.18	21.28	21.37	21.47
28	21.57	21.66	21.76	21.85	21.95	22.05	22.14	22.24	22.34	22.43
29	22.53	22.63	22.72	22.82	22.92	23.01	23.11	23.20	23.30	23.40
30	23.49	23.59	23.69	23.79	23.88	23.98	24.08	24.17	24.27	24.37
31	24.46	24.56	24.66	24.75	24.85	24.95	25.04	25.14	25.24	25.34
32	25.43	25.53	25.63	25.72	25.82	25.92	26.01	26.11	26.21	26.31
33	26.40	26.50	26.60	26.70	26.79	26.89	26.99	27.08	27.18	27.28
34	27.38	27.47	27.57	27.67	27.77	27.86	27.96	28.06	28.16	28.25
35	28.35	28.45	28.54	28.64	28.74	28.84	28.93	29.03	29.13	29.23
36	29.33	29.42	29.52	29.62	29.72	29.81	29.91	30.01	30.11	30.20
37	30.30	30.40	30.50	30.59	30.69	30.79	30.89	30.99	31.08	31.18
38	31.28	31.38	31.47	31.57	31.67	31.77	31.87	31.96	32.06	32.16
39	32.26	32.36	32.45	32.55	32.65	32.75	32.85	32.94	33.04	33.14
40	33.24	33.34	33.43	33.53	33.63	33.73	33.83	33.92	34.02	34.12

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.13. NRCS Rainfall-Runoff Table for CN = 62



Runoff for inches of rainfall—Curve no. 62

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.05	0.07
2	0.09	0.11	0.13	0.16	0.19	0.22	0.25	0.29	0.32	0.36
3	0.40	0.44	0.48	0.52	0.57	0.62	0.66	0.71	0.76	0.81
4	0.86	0.92	0.97	1.03	1.08	1.14	1.20	1.26	1.32	1.38
5	1.44	1.50	1.56	1.63	1.69	1.76	1.82	1.89	1.95	2.02
6	2.09	2.16	2.23	2.30	2.37	2.44	2.51	2.58	2.65	2.73
7	2.80	2.87	2.95	3.02	3.10	3.17	3.25	3.33	3.40	3.48
8	3.56	3.63	3.71	3.79	3.87	3.95	4.03	4.11	4.19	4.27
9	4.35	4.43	4.51	4.59	4.67	4.75	4.83	4.92	5.00	5.08
10	5.17	5.25	5.33	5.42	5.50	5.58	5.67	5.75	5.84	5.92
11	6.01	6.09	6.18	6.26	6.35	6.43	6.52	6.61	6.69	6.78
12	6.87	6.95	7.04	7.13	7.22	7.30	7.39	7.48	7.57	7.65
13	7.74	7.83	7.92	8.01	8.10	8.19	8.27	8.36	8.45	8.54
14	8.63	8.72	8.81	8.90	8.99	9.08	9.17	9.26	9.35	9.44
15	9.53	9.62	9.71	9.80	9.89	9.99	10.08	10.17	10.26	10.35
16	10.44	10.53	10.62	10.72	10.81	10.90	10.99	11.08	11.18	11.27
17	11.36	11.45	11.54	11.64	11.73	11.82	11.91	12.01	12.10	12.19
18	12.28	12.38	12.47	12.56	12.66	12.75	12.84	12.94	13.03	13.12
19	13.22	13.31	13.40	13.50	13.59	13.68	13.78	13.87	13.97	14.06
20	14.15	14.25	14.34	14.43	14.53	14.62	14.72	14.81	14.91	15.00
21	15.09	15.19	15.28	15.38	15.47	15.57	15.66	15.76	15.85	15.95
22	16.04	16.14	16.23	16.33	16.42	16.52	16.61	16.71	16.80	16.90
23	16.99	17.09	17.18	17.28	17.37	17.47	17.56	17.66	17.75	17.85
24	17.94	18.04	18.14	18.23	18.33	18.42	18.52	18.61	18.71	18.80
25	18.90	19.00	19.09	19.19	19.28	19.38	19.48	19.57	19.67	19.76
26	19.86	19.96	20.05	20.15	20.24	20.34	20.44	20.53	20.63	20.73
27	20.82	20.92	21.01	21.11	21.21	21.30	21.40	21.50	21.59	21.69
28	21.79	21.88	21.98	22.08	22.17	22.27	22.37	22.46	22.56	22.66
29	22.75	22.85	22.95	23.04	23.14	23.24	23.33	23.43	23.53	23.62
30	23.72	23.82	23.91	24.01	24.11	24.21	24.30	24.40	24.50	24.59
31	24.69	24.79	24.88	24.98	25.08	25.18	25.27	25.37	25.47	25.57
32	25.66	25.76	25.86	25.95	26.05	26.15	26.25	26.34	26.44	26.54
33	26.64	26.73	26.83	26.93	27.03	27.12	27.22	27.32	27.41	27.51
34	27.61	27.71	27.80	27.90	28.00	28.10	28.20	28.29	28.39	28.49
35	28.59	28.68	28.78	28.88	28.98	29.07	29.17	29.27	29.37	29.46
36	29.56	29.66	29.76	29.86	29.95	30.05	30.15	30.25	30.35	30.44
37	30.54	30.64	30.74	30.83	30.93	31.03	31.13	31.23	31.32	31.42
38	31.52	31.62	31.72	31.81	31.91	32.01	32.11	32.21	32.30	32.40
39	32.50	32.60	32.70	32.79	32.89	32.99	33.09	33.19	33.28	33.38
40	33.48	33.58	33.68	33.78	33.87	33.97	34.07	34.17	34.27	34.36

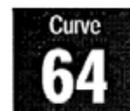
Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.14. NRCS Rainfall-Runoff Table for CN = 63

Curve 63											
Runoff for inches of rainfall—Curve no. 63											
Inches	Tenths										
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
0											
1	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	0.06	0.08	
2	0.10	0.13	0.15	0.18	0.21	0.24	0.28	0.31	0.35	0.39	
3	0.43	0.48	0.52	0.57	0.61	0.66	0.71	0.76	0.81	0.86	
4	0.92	0.97	1.03	1.09	1.14	1.20	1.26	1.32	1.38	1.45	
5	1.51	1.57	1.64	1.70	1.77	1.84	1.90	1.97	2.04	2.11	
6	2.18	2.25	2.32	2.39	2.46	2.53	2.61	2.68	2.75	2.83	
7	2.90	2.98	3.05	3.13	3.20	3.28	3.36	3.44	3.51	3.59	
8	3.67	3.75	3.83	3.91	3.99	4.07	4.15	4.23	4.31	4.39	
9	4.47	4.55	4.64	4.72	4.80	4.88	4.97	5.05	5.13	5.22	
10	5.30	5.38	5.47	5.55	5.64	5.72	5.81	5.89	5.98	6.07	
11	6.15	6.24	6.32	6.41	6.50	6.58	6.67	6.76	6.84	6.93	
12	7.02	7.11	7.20	7.28	7.37	7.46	7.55	7.64	7.73	7.81	
13	7.90	7.99	8.08	8.17	8.26	8.35	8.44	8.53	8.62	8.71	
14	8.80	8.89	8.98	9.07	9.16	9.25	9.34	9.43	9.52	9.61	
15	9.71	9.80	9.89	9.98	10.07	10.16	10.25	10.35	10.44	10.53	
16	10.62	10.71	10.80	10.90	10.99	11.08	11.17	11.27	11.36	11.45	
17	11.54	11.64	11.73	11.82	11.92	12.01	12.10	12.19	12.29	12.38	
18	12.47	12.57	12.66	12.75	12.85	12.94	13.04	13.13	13.22	13.32	
19	13.41	13.50	13.60	13.69	13.79	13.88	13.97	14.07	14.16	14.26	
20	14.35	14.45	14.54	14.63	14.73	14.82	14.92	15.01	15.11	15.20	
21	15.30	15.39	15.49	15.58	15.68	15.77	15.87	15.96	16.06	16.15	
22	16.25	16.34	16.44	16.53	16.63	16.72	16.82	16.91	17.01	17.10	
23	17.20	17.30	17.39	17.49	17.58	17.68	17.77	17.87	17.97	18.06	
24	18.16	18.25	18.35	18.44	18.54	18.64	18.73	18.83	18.92	19.02	
25	19.12	19.21	19.31	19.40	19.50	19.60	19.69	19.79	19.89	19.98	
26	20.08	20.17	20.27	20.37	20.46	20.56	20.66	20.75	20.85	20.95	
27	21.04	21.14	21.24	21.33	21.43	21.53	21.62	21.72	21.82	21.91	
28	22.01	22.11	22.20	22.30	22.40	22.49	22.59	22.69	22.78	22.88	
29	22.98	23.08	23.17	23.27	23.37	23.46	23.56	23.66	23.75	23.85	
30	23.95	24.05	24.14	24.24	24.34	24.44	24.53	24.63	24.73	24.82	
31	24.92	25.02	25.12	25.21	25.31	25.41	25.51	25.60	25.70	25.80	
32	25.89	25.99	26.09	26.19	26.28	26.38	26.48	26.58	26.67	26.77	
33	26.87	26.97	27.07	27.16	27.26	27.36	27.46	27.55	27.65	27.75	
34	27.85	27.94	28.04	28.14	28.24	28.34	28.43	28.53	28.63	28.73	
35	28.82	28.92	29.02	29.12	29.22	29.31	29.41	29.51	29.61	29.70	
36	29.80	29.90	30.00	30.10	30.19	30.29	30.39	30.49	30.59	30.68	
37	30.78	30.88	30.98	31.08	31.17	31.27	31.37	31.47	31.57	31.66	
38	31.76	31.86	31.96	32.06	32.16	32.25	32.35	32.45	32.55	32.65	
39	32.74	32.84	32.94	33.04	33.14	33.24	33.33	33.43	33.53	33.63	
40	33.73	33.83	33.92	34.02	34.12	34.22	34.32	34.42	34.51	34.61	

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.15. NRCS Rainfall-Runoff Table for CN = 64



Runoff for inches of rainfall—Curve no. 64

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.01	0.01	0.02	0.04	0.05	0.07	0.09
2	0.12	0.14	0.17	0.20	0.24	0.27	0.31	0.35	0.39	0.43
3	0.47	0.51	0.56	0.61	0.66	0.71	0.76	0.81	0.86	0.92
4	0.97	1.03	1.09	1.15	1.21	1.27	1.33	1.39	1.45	1.52
5	1.58	1.65	1.71	1.78	1.85	1.92	1.98	2.05	2.12	2.19
6	2.27	2.34	2.41	2.48	2.55	2.63	2.70	2.78	2.85	2.93
7	3.00	3.08	3.16	3.23	3.31	3.39	3.47	3.55	3.62	3.70
8	3.78	3.86	3.94	4.02	4.11	4.19	4.27	4.35	4.43	4.51
9	4.60	4.68	4.76	4.85	4.93	5.01	5.10	5.18	5.27	5.35
10	5.43	5.52	5.61	5.69	5.78	5.86	5.95	6.03	6.12	6.21
11	6.29	6.38	6.47	6.56	6.64	6.73	6.82	6.91	6.99	7.08
12	7.17	7.26	7.35	7.44	7.53	7.61	7.70	7.79	7.88	7.97
13	8.06	8.15	8.24	8.33	8.42	8.51	8.60	8.69	8.78	8.87
14	8.96	9.05	9.15	9.24	9.33	9.42	9.51	9.60	9.69	9.78
15	9.88	9.97	10.06	10.15	10.24	10.34	10.43	10.52	10.61	10.70
16	10.80	10.89	10.98	11.07	11.17	11.26	11.35	11.45	11.54	11.63
17	11.73	11.82	11.91	12.01	12.10	12.19	12.29	12.38	12.47	12.57
18	12.66	12.75	12.85	12.94	13.04	13.13	13.22	13.32	13.41	13.51
19	13.60	13.69	13.79	13.88	13.98	14.07	14.17	14.26	14.36	14.45
20	14.55	14.64	14.73	14.83	14.92	15.02	15.11	15.21	15.30	15.40
21	15.49	15.59	15.69	15.78	15.88	15.97	16.07	16.16	16.26	16.35
22	16.45	16.54	16.64	16.73	16.83	16.93	17.02	17.12	17.21	17.31
23	17.40	17.50	17.60	17.69	17.79	17.88	17.98	18.08	18.17	18.27
24	18.36	18.46	18.56	18.65	18.75	18.85	18.94	19.04	19.13	19.23
25	19.33	19.42	19.52	19.62	19.71	19.81	19.91	20.00	20.10	20.20
26	20.29	20.39	20.48	20.58	20.68	20.77	20.87	20.97	21.07	21.16
27	21.26	21.36	21.45	21.55	21.65	21.74	21.84	21.94	22.03	22.13
28	22.23	22.32	22.42	22.52	22.62	22.71	22.81	22.91	23.00	23.10
29	23.20	23.30	23.39	23.49	23.59	23.69	23.78	23.88	23.98	24.07
30	24.17	24.27	24.37	24.46	24.56	24.66	24.76	24.85	24.95	25.05
31	25.15	25.24	25.34	25.44	25.54	25.63	25.73	25.83	25.93	26.02
32	26.12	26.22	26.32	26.41	26.51	26.61	26.71	26.81	26.90	27.00
33	27.10	27.20	27.29	27.39	27.49	27.59	27.69	27.78	27.88	27.98
34	28.08	28.17	28.27	28.37	28.47	28.57	28.66	28.76	28.86	28.96
35	29.06	29.15	29.25	29.35	29.45	29.55	29.64	29.74	29.84	29.94
36	30.04	30.13	30.23	30.33	30.43	30.53	30.62	30.72	30.82	30.92
37	31.02	31.12	31.21	31.31	31.41	31.51	31.61	31.70	31.80	31.90
38	32.00	32.10	32.20	32.29	32.39	32.49	32.59	32.69	32.79	32.88
39	32.98	33.08	33.18	33.28	33.38	33.47	33.57	33.67	33.77	33.87
40	33.97	34.06	34.16	34.26	34.36	34.46	34.56	34.65	34.75	34.85

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.16. NRCS Rainfall-Runoff Table for CN = 65

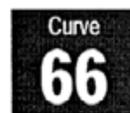
Curve
65

Runoff for inches of rainfall—Curve no. 65

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.00	0.01	0.02	0.03	0.05	0.06	0.09	0.11
2	0.14	0.16	0.19	0.23	0.26	0.30	0.34	0.38	0.42	0.46
3	0.51	0.55	0.60	0.65	0.70	0.75	0.81	0.86	0.92	0.97
4	1.03	1.09	1.15	1.21	1.27	1.33	1.39	1.46	1.52	1.59
5	1.65	1.72	1.79	1.86	1.93	2.00	2.07	2.14	2.21	2.28
6	2.35	2.43	2.50	2.57	2.65	2.72	2.80	2.87	2.95	3.03
7	3.10	3.18	3.26	3.34	3.42	3.50	3.58	3.66	3.74	3.82
8	3.90	3.98	4.06	4.14	4.22	4.30	4.39	4.47	4.55	4.64
9	4.72	4.80	4.89	4.97	5.06	5.14	5.23	5.31	5.40	5.48
10	5.57	5.65	5.74	5.83	5.91	6.00	6.09	6.17	6.26	6.35
11	6.44	6.52	6.61	6.70	6.79	6.88	6.96	7.05	7.14	7.23
12	7.32	7.41	7.50	7.59	7.68	7.77	7.86	7.95	8.04	8.13
13	8.22	8.31	8.40	8.49	8.58	8.67	8.76	8.85	8.94	9.03
14	9.13	9.22	9.31	9.40	9.49	9.58	9.68	9.77	9.86	9.95
15	10.04	10.14	10.23	10.32	10.41	10.51	10.60	10.69	10.78	10.88
16	10.97	11.06	11.16	11.25	11.34	11.44	11.53	11.62	11.72	11.81
17	11.90	12.00	12.09	12.18	12.28	12.37	12.47	12.56	12.65	12.75
18	12.84	12.94	13.03	13.12	13.22	13.31	13.41	13.50	13.60	13.69
19	13.79	13.88	13.98	14.07	14.17	14.26	14.35	14.45	14.54	14.64
20	14.73	14.83	14.93	15.02	15.12	15.21	15.31	15.40	15.50	15.59
21	15.69	15.78	15.88	15.97	16.07	16.17	16.26	16.36	16.45	16.55
22	16.64	16.74	16.84	16.93	17.03	17.12	17.22	17.32	17.41	17.51
23	17.60	17.70	17.80	17.89	17.99	18.09	18.18	18.28	18.37	18.47
24	18.57	18.66	18.76	18.86	18.95	19.05	19.15	19.24	19.34	19.44
25	19.53	19.63	19.73	19.82	19.92	20.02	20.11	20.21	20.31	20.40
26	20.50	20.60	20.69	20.79	20.89	20.98	21.08	21.18	21.27	21.37
27	21.47	21.57	21.66	21.76	21.86	21.95	22.05	22.15	22.25	22.34
28	22.44	22.54	22.63	22.73	22.83	22.93	23.02	23.12	23.22	23.32
29	23.41	23.51	23.61	23.71	23.80	23.90	24.00	24.10	24.19	24.29
30	24.39	24.49	24.58	24.68	24.78	24.88	24.97	25.07	25.17	25.27
31	25.36	25.46	25.56	25.66	25.75	25.85	25.95	26.05	26.15	26.24
32	26.34	26.44	26.54	26.63	26.73	26.83	26.93	27.03	27.12	27.22
33	27.32	27.42	27.52	27.61	27.71	27.81	27.91	28.01	28.10	28.20
34	28.30	28.40	28.50	28.59	28.69	28.79	28.89	28.99	29.08	29.18
35	29.28	29.38	29.48	29.57	29.67	29.77	29.87	29.97	30.07	30.16
36	30.26	30.36	30.46	30.56	30.66	30.75	30.85	30.95	31.05	31.15
37	31.24	31.34	31.44	31.54	31.64	31.74	31.83	31.93	32.03	32.13
38	32.23	32.33	32.42	32.52	32.62	32.72	32.82	32.92	33.02	33.11
39	33.21	33.31	33.41	33.51	33.61	33.70	33.80	33.90	34.00	34.10
40	34.20	34.30	34.39	34.49	34.59	34.69	34.79	34.89	34.99	35.08

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.17. NRCS Rainfall-Runoff Table for CN = 66



Runoff for inches of rainfall—Curve no. 66

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.01	0.01	0.02	0.04	0.06	0.08	0.10	0.13
2	0.15	0.18	0.22	0.25	0.29	0.33	0.37	0.41	0.45	0.50
3	0.55	0.59	0.64	0.69	0.75	0.80	0.86	0.91	0.97	1.03
4	1.09	1.15	1.21	1.27	1.33	1.40	1.46	1.53	1.59	1.66
5	1.73	1.80	1.87	1.94	2.01	2.08	2.15	2.22	2.29	2.37
6	2.44	2.52	2.59	2.67	2.74	2.82	2.89	2.97	3.05	3.13
7	3.21	3.28	3.36	3.44	3.52	3.60	3.68	3.76	3.85	3.93
8	4.01	4.09	4.17	4.26	4.34	4.42	4.51	4.59	4.67	4.76
9	4.84	4.93	5.01	5.10	5.18	5.27	5.35	5.44	5.53	5.61
10	5.70	5.79	5.87	5.96	6.05	6.13	6.22	6.31	6.40	6.49
11	6.57	6.66	6.75	6.84	6.93	7.02	7.11	7.20	7.29	7.38
12	7.47	7.56	7.65	7.74	7.83	7.92	8.01	8.10	8.19	8.28
13	8.37	8.46	8.55	8.64	8.73	8.83	8.92	9.01	9.10	9.19
14	9.28	9.38	9.47	9.56	9.65	9.74	9.84	9.93	10.02	10.11
15	10.21	10.30	10.39	10.49	10.58	10.67	10.76	10.86	10.95	11.04
16	11.14	11.23	11.33	11.42	11.51	11.61	11.70	11.79	11.89	11.98
17	12.08	12.17	12.26	12.36	12.45	12.55	12.64	12.74	12.83	12.92
18	13.02	13.11	13.21	13.30	13.40	13.49	13.59	13.68	13.78	13.87
19	13.97	14.06	14.16	14.25	14.35	14.44	14.54	14.63	14.73	14.82
20	14.92	15.02	15.11	15.21	15.30	15.40	15.49	15.59	15.68	15.78
21	15.88	15.97	16.07	16.16	16.26	16.36	16.45	16.55	16.64	16.74
22	16.84	16.93	17.03	17.12	17.22	17.32	17.41	17.51	17.61	17.70
23	17.80	17.89	17.99	18.09	18.18	18.28	18.38	18.47	18.57	18.67
24	18.76	18.86	18.96	19.05	19.15	19.25	19.34	19.44	19.54	19.63
25	19.73	19.83	19.92	20.02	20.12	20.22	20.31	20.41	20.51	20.60
26	20.70	20.80	20.89	20.99	21.09	21.19	21.28	21.38	21.48	21.58
27	21.67	21.77	21.87	21.96	22.06	22.16	22.26	22.35	22.45	22.55
28	22.65	22.74	22.84	22.94	23.04	23.13	23.23	23.33	23.43	23.52
29	23.62	23.72	23.82	23.91	24.01	24.11	24.21	24.30	24.40	24.50
30	24.60	24.70	24.79	24.89	24.99	25.09	25.18	25.28	25.38	25.48
31	25.58	25.67	25.77	25.87	25.97	26.06	26.16	26.26	26.36	26.46
32	26.55	26.65	26.75	26.85	26.95	27.04	27.14	27.24	27.34	27.44
33	27.53	27.63	27.73	27.83	27.93	28.03	28.12	28.22	28.32	28.42
34	28.52	28.61	28.71	28.81	28.91	29.01	29.10	29.20	29.30	29.40
35	29.50	29.60	29.69	29.79	29.89	29.99	30.09	30.19	30.28	30.38
36	30.48	30.58	30.68	30.78	30.87	30.97	31.07	31.17	31.27	31.37
37	31.47	31.56	31.66	31.76	31.86	31.96	32.06	32.15	32.25	32.35
38	32.45	32.55	32.65	32.75	32.84	32.94	33.04	33.14	33.24	33.34
39	33.44	33.53	33.63	33.73	33.83	33.93	34.03	34.13	34.22	34.32
40	34.42	34.52	34.62	34.72	34.82	34.91	35.01	35.11	35.21	35.31

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^3}{P + 0.8S}$

Table 11-C.18. NRCS Rainfall-Runoff Table for CN = 67

Curve
67

Runoff for inches of rainfall—Curve no. 67

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.00	0.01	0.02	0.03	0.05	0.07	0.09	0.12	0.14
2	0.17	0.21	0.24	0.28	0.32	0.36	0.40	0.44	0.49	0.54
3	0.59	0.64	0.69	0.74	0.80	0.85	0.91	0.97	1.03	1.09
4	1.15	1.21	1.27	1.34	1.40	1.47	1.53	1.60	1.67	1.74
5	1.80	1.87	1.95	2.02	2.09	2.16	2.23	2.31	2.38	2.46
6	2.53	2.61	2.68	2.76	2.84	2.92	2.99	3.07	3.15	3.23
7	3.31	3.39	3.47	3.55	3.63	3.71	3.79	3.88	3.96	4.04
8	4.12	4.21	4.29	4.37	4.46	4.54	4.63	4.71	4.80	4.88
9	4.97	5.05	5.14	5.22	5.31	5.40	5.48	5.57	5.66	5.75
10	5.83	5.92	6.01	6.10	6.18	6.27	6.36	6.45	6.54	6.63
11	6.72	6.81	6.90	6.98	7.07	7.16	7.25	7.34	7.43	7.52
12	7.61	7.71	7.80	7.89	7.98	8.07	8.16	8.25	8.34	8.43
13	8.53	8.62	8.71	8.80	8.89	8.98	9.08	9.17	9.26	9.35
14	9.45	9.54	9.63	9.72	9.82	9.91	10.00	10.09	10.19	10.28
15	10.37	10.47	10.56	10.65	10.75	10.84	10.94	11.03	11.12	11.22
16	11.31	11.40	11.50	11.59	11.69	11.78	11.87	11.97	12.06	12.16
17	12.25	12.35	12.44	12.54	12.63	12.73	12.82	12.91	13.01	13.10
18	13.20	13.29	13.39	13.48	13.58	13.67	13.77	13.87	13.96	14.06
19	14.15	14.25	14.34	14.44	14.53	14.63	14.72	14.82	14.92	15.01
20	15.11	15.20	15.30	15.39	15.49	15.59	15.68	15.78	15.87	15.97
21	16.07	16.16	16.26	16.36	16.45	16.55	16.64	16.74	16.84	16.93
22	17.03	17.13	17.22	17.32	17.42	17.51	17.61	17.70	17.80	17.90
23	17.99	18.09	18.19	18.28	18.38	18.48	18.58	18.67	18.77	18.87
24	18.96	19.06	19.16	19.25	19.35	19.45	19.54	19.64	19.74	19.84
25	19.93	20.03	20.13	20.22	20.32	20.42	20.52	20.61	20.71	20.81
26	20.90	21.00	21.10	21.20	21.29	21.39	21.49	21.59	21.68	21.78
27	21.88	21.98	22.07	22.17	22.27	22.37	22.46	22.56	22.66	22.76
28	22.85	22.95	23.05	23.15	23.24	23.34	23.44	23.54	23.64	23.73
29	23.83	23.93	24.03	24.12	24.22	24.32	24.42	24.52	24.61	24.71
30	24.81	24.91	25.01	25.10	25.20	25.30	25.40	25.49	25.59	25.69
31	25.79	25.89	25.98	26.08	26.18	26.28	26.38	26.48	26.57	26.67
32	26.77	26.87	26.97	27.06	27.16	27.26	27.36	27.46	27.55	27.65
33	27.75	27.85	27.95	28.05	28.14	28.24	28.34	28.44	28.54	28.64
34	28.73	28.83	28.93	29.03	29.13	29.23	29.32	29.42	29.52	29.62
35	29.72	29.82	29.91	30.01	30.11	30.21	30.31	30.41	30.51	30.60
36	30.70	30.80	30.90	31.00	31.10	31.19	31.29	31.39	31.49	31.59
37	31.69	31.79	31.88	31.98	32.08	32.18	32.28	32.38	32.48	32.57
38	32.67	32.77	32.87	32.97	33.07	33.17	33.27	33.36	33.46	33.56
39	33.66	33.76	33.86	33.96	34.05	34.15	34.25	34.35	34.45	34.55
40	34.65	34.75	34.84	34.94	35.04	35.14	35.24	35.34	35.44	35.54

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.19. NRCS Rainfall-Runoff Table for CN = 68



Runoff for inches of rainfall—Curve no. 68

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.01	0.01	0.03	0.04	0.06	0.08	0.11	0.13	0.16
2	0.20	0.23	0.27	0.31	0.35	0.39	0.43	0.48	0.53	0.58
3	0.63	0.68	0.73	0.79	0.85	0.90	0.96	1.02	1.08	1.14
4	1.21	1.27	1.34	1.40	1.47	1.53	1.60	1.67	1.74	1.81
5	1.88	1.95	2.03	2.10	2.17	2.25	2.32	2.40	2.47	2.55
6	2.62	2.70	2.78	2.86	2.93	3.01	3.09	3.17	3.25	3.33
7	3.41	3.49	3.58	3.66	3.74	3.82	3.90	3.99	4.07	4.15
8	4.24	4.32	4.41	4.49	4.58	4.66	4.75	4.83	4.92	5.00
9	5.09	5.18	5.26	5.35	5.44	5.53	5.61	5.70	5.79	5.88
10	5.97	6.05	6.14	6.23	6.32	6.41	6.50	6.59	6.68	6.77
11	6.86	6.95	7.04	7.13	7.22	7.31	7.40	7.49	7.58	7.67
12	7.76	7.85	7.94	8.04	8.13	8.22	8.31	8.40	8.49	8.59
13	8.68	8.77	8.86	8.95	9.05	9.14	9.23	9.33	9.42	9.51
14	9.60	9.70	9.79	9.88	9.98	10.07	10.16	10.26	10.35	10.44
15	10.54	10.63	10.73	10.82	10.91	11.01	11.10	11.20	11.29	11.38
16	11.48	11.57	11.67	11.76	11.86	11.95	12.04	12.14	12.23	12.33
17	12.42	12.52	12.61	12.71	12.80	12.90	12.99	13.09	13.18	13.28
18	13.38	13.47	13.57	13.66	13.76	13.85	13.95	14.04	14.14	14.23
19	14.33	14.43	14.52	14.62	14.71	14.81	14.91	15.00	15.10	15.19
20	15.29	15.39	15.48	15.58	15.67	15.77	15.87	15.96	16.06	16.16
21	16.25	16.35	16.45	16.54	16.64	16.73	16.83	16.93	17.02	17.12
22	17.22	17.31	17.41	17.51	17.60	17.70	17.80	17.89	17.99	18.09
23	18.19	18.28	18.38	18.48	18.57	18.67	18.77	18.86	18.96	19.06
24	19.16	19.25	19.35	19.45	19.54	19.64	19.74	19.84	19.93	20.03
25	20.13	20.23	20.32	20.42	20.52	20.61	20.71	20.81	20.91	21.00
26	21.10	21.20	21.30	21.39	21.49	21.59	21.69	21.79	21.88	21.98
27	22.08	22.18	22.27	22.37	22.47	22.57	22.66	22.76	22.86	22.96
28	23.06	23.15	23.25	23.35	23.45	23.54	23.64	23.74	23.84	23.94
29	24.03	24.13	24.23	24.33	24.43	24.52	24.62	24.72	24.82	24.92
30	25.01	25.11	25.21	25.31	25.41	25.50	25.60	25.70	25.80	25.90
31	26.00	26.09	26.19	26.29	26.39	26.49	26.58	26.68	26.78	26.88
32	26.98	27.08	27.17	27.27	27.37	27.47	27.57	27.67	27.76	27.86
33	27.96	28.06	28.16	28.26	28.35	28.45	28.55	28.65	28.75	28.85
34	28.95	29.04	29.14	29.24	29.34	29.44	29.54	29.63	29.73	29.83
35	29.93	30.03	30.13	30.23	30.32	30.42	30.52	30.62	30.72	30.82
36	30.92	31.01	31.11	31.21	31.31	31.41	31.51	31.61	31.70	31.80
37	31.90	32.00	32.10	32.20	32.30	32.40	32.49	32.59	32.69	32.79
38	32.89	32.99	33.09	33.19	33.28	33.38	33.48	33.58	33.68	33.78
39	33.88	33.98	34.07	34.17	34.27	34.37	34.47	34.57	34.67	34.77
40	34.86	34.96	35.06	35.16	35.26	35.36	35.46	35.56	35.66	35.75

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.20. NRCS Rainfall-Runoff Table for CN = 69

Curve 69										
Runoff for inches of rainfall—Curve no. 69										
Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.01	0.02	0.03	0.05	0.07	0.09	0.12	0.15	0.18
2	0.22	0.25	0.29	0.33	0.38	0.42	0.47	0.52	0.57	0.62
3	0.67	0.72	0.78	0.84	0.90	0.95	1.02	1.08	1.14	1.20
4	1.27	1.33	1.40	1.47	1.53	1.60	1.67	1.74	1.81	1.89
5	1.96	2.03	2.11	2.18	2.25	2.33	2.41	2.48	2.56	2.64
6	2.71	2.79	2.87	2.95	3.03	3.11	3.19	3.27	3.35	3.43
7	3.52	3.60	3.68	3.76	3.85	3.93	4.01	4.10	4.18	4.27
8	4.35	4.44	4.52	4.61	4.69	4.78	4.87	4.95	5.04	5.13
9	5.21	5.30	5.39	5.48	5.56	5.65	5.74	5.83	5.92	6.01
10	6.10	6.18	6.27	6.36	6.45	6.54	6.63	6.72	6.81	6.90
11	6.99	7.08	7.17	7.27	7.36	7.45	7.54	7.63	7.72	7.81
12	7.90	8.00	8.09	8.18	8.27	8.36	8.46	8.55	8.64	8.73
13	8.83	8.92	9.01	9.11	9.20	9.29	9.38	9.48	9.57	9.66
14	9.76	9.85	9.95	10.04	10.13	10.23	10.32	10.41	10.51	10.60
15	10.70	10.79	10.88	10.98	11.07	11.17	11.26	11.36	11.45	11.55
16	11.64	11.74	11.83	11.93	12.02	12.12	12.21	12.31	12.40	12.50
17	12.59	12.69	12.78	12.88	12.97	13.07	13.16	13.26	13.35	13.45
18	13.55	13.64	13.74	13.83	13.93	14.02	14.12	14.22	14.31	14.41
19	14.50	14.60	14.70	14.79	14.89	14.99	15.08	15.18	15.27	15.37
20	15.47	15.56	15.66	15.76	15.85	15.95	16.05	16.14	16.24	16.34
21	16.43	16.53	16.63	16.72	16.82	16.92	17.01	17.11	17.21	17.30
22	17.40	17.50	17.59	17.69	17.79	17.88	17.98	18.08	18.18	18.27
23	18.37	18.47	18.56	18.66	18.76	18.86	18.95	19.05	19.15	19.25
24	19.34	19.44	19.54	19.63	19.73	19.83	19.93	20.02	20.12	20.22
25	20.32	20.41	20.51	20.61	20.71	20.80	20.90	21.00	21.10	21.20
26	21.29	21.39	21.49	21.59	21.68	21.78	21.88	21.98	22.08	22.17
27	22.27	22.37	22.47	22.56	22.66	22.76	22.86	22.96	23.05	23.15
28	23.25	23.35	23.45	23.54	23.64	23.74	23.84	23.94	24.03	24.13
29	24.23	24.33	24.43	24.52	24.62	24.72	24.82	24.92	25.02	25.11
30	25.21	25.31	25.41	25.51	25.61	25.70	25.80	25.90	26.00	26.10
31	26.19	26.29	26.39	26.49	26.59	26.69	26.78	26.88	26.98	27.08
32	27.18	27.28	27.38	27.47	27.57	27.67	27.77	27.87	27.97	28.06
33	28.16	28.26	28.36	28.46	28.56	28.66	28.75	28.85	28.95	29.05
34	29.15	29.25	29.35	29.44	29.54	29.64	29.74	29.84	29.94	30.04
35	30.13	30.23	30.33	30.43	30.53	30.63	30.73	30.83	30.92	31.02
36	31.12	31.22	31.32	31.42	31.52	31.61	31.71	31.81	31.91	32.01
37	32.11	32.21	32.31	32.41	32.50	32.60	32.70	32.80	32.90	33.00
38	33.10	33.20	33.29	33.39	33.49	33.59	33.69	33.79	33.89	33.99
39	34.09	34.18	34.28	34.38	34.48	34.58	34.68	34.78	34.88	34.98
40	35.07	35.17	35.27	35.37	35.47	35.57	35.67	35.77	35.87	35.97

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.21. NRCS Rainfall-Runoff Table for CN = 70

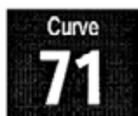


Runoff for inches of rainfall—Curve no. 70

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0										
1	0.00	0.01	0.03	0.04	0.06	0.08	0.11	0.14	0.17	0.20
2	0.24	0.28	0.32	0.36	0.41	0.46	0.50	0.56	0.61	0.66
3	0.72	0.77	0.83	0.89	0.95	1.01	1.07	1.14	1.20	1.27
4	1.33	1.40	1.47	1.54	1.61	1.68	1.75	1.82	1.89	1.96
5	2.04	2.11	2.19	2.26	2.34	2.42	2.49	2.57	2.65	2.73
6	2.81	2.89	2.97	3.05	3.13	3.21	3.29	3.37	3.46	3.54
7	3.62	3.70	3.79	3.87	3.96	4.04	4.13	4.21	4.30	4.38
8	4.47	4.55	4.64	4.73	4.81	4.90	4.99	5.07	5.16	5.25
9	5.34	5.43	5.52	5.60	5.69	5.78	5.87	5.96	6.05	6.14
10	6.23	6.32	6.41	6.50	6.59	6.68	6.77	6.86	6.95	7.04
11	7.13	7.23	7.32	7.41	7.50	7.59	7.68	7.78	7.87	7.96
12	8.05	8.14	8.24	8.33	8.42	8.51	8.61	8.70	8.79	8.89
13	8.98	9.07	9.17	9.26	9.35	9.45	9.54	9.63	9.73	9.82
14	9.92	10.01	10.10	10.20	10.29	10.39	10.48	10.57	10.67	10.76
15	10.86	10.95	11.05	11.14	11.24	11.33	11.43	11.52	11.62	11.71
16	11.81	11.90	12.00	12.09	12.19	12.28	12.38	12.47	12.57	12.67
17	12.76	12.86	12.95	13.05	13.14	13.24	13.34	13.43	13.53	13.62
18	13.72	13.82	13.91	14.01	14.10	14.20	14.30	14.39	14.49	14.58
19	14.68	14.78	14.87	14.97	15.07	15.16	15.26	15.36	15.45	15.55
20	15.65	15.74	15.84	15.94	16.03	16.13	16.23	16.32	16.42	16.52
21	16.61	16.71	16.81	16.90	17.00	17.10	17.20	17.29	17.39	17.49
22	17.58	17.68	17.78	17.88	17.97	18.07	18.17	18.27	18.36	18.46
23	18.56	18.65	18.75	18.85	18.95	19.04	19.14	19.24	19.34	19.43
24	19.53	19.63	19.73	19.82	19.92	20.02	20.12	20.22	20.31	20.41
25	20.51	20.61	20.70	20.80	20.90	21.00	21.10	21.19	21.29	21.39
26	21.49	21.58	21.68	21.78	21.88	21.98	22.07	22.17	22.27	22.37
27	22.47	22.56	22.66	22.76	22.86	22.96	23.05	23.15	23.25	23.35
28	23.45	23.55	23.64	23.74	23.84	23.94	24.04	24.13	24.23	24.33
29	24.43	24.53	24.63	24.72	24.82	24.92	25.02	25.12	25.22	25.31
30	25.41	25.51	25.61	25.71	25.81	25.90	26.00	26.10	26.20	26.30
31	26.40	26.49	26.59	26.69	26.79	26.89	26.99	27.09	27.18	27.28
32	27.38	27.48	27.58	27.68	27.78	27.87	27.97	28.07	28.17	28.27
33	28.37	28.47	28.56	28.66	28.76	28.86	28.96	29.06	29.16	29.25
34	29.35	29.45	29.55	29.65	29.75	29.85	29.95	30.04	30.14	30.24
35	30.34	30.44	30.54	30.64	30.74	30.83	30.93	31.03	31.13	31.23
36	31.33	31.43	31.53	31.63	31.72	31.82	31.92	32.02	32.12	32.22
37	32.32	32.42	32.51	32.61	32.71	32.81	32.91	33.01	33.11	33.21
38	33.31	33.41	33.50	33.60	33.70	33.80	33.90	34.00	34.10	34.20
39	34.30	34.39	34.49	34.59	34.69	34.79	34.89	34.99	35.09	35.19
40	35.29	35.38	35.48	35.58	35.68	35.78	35.88	35.98	36.08	36.18

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.22. NRCS Rainfall-Runoff Table for CN = 71



Runoff for inches of rainfall—Curve no. 71

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0								0.00	0.00	0.00
1	0.01	0.02	0.03	0.05	0.07	0.10	0.13	0.16	0.19	0.23
2	0.27	0.31	0.35	0.40	0.44	0.49	0.54	0.60	0.65	0.70
3	0.76	0.82	0.88	0.94	1.00	1.07	1.13	1.19	1.26	1.33
4	1.40	1.46	1.53	1.60	1.68	1.75	1.82	1.89	1.97	2.04
5	2.12	2.19	2.27	2.35	2.43	2.50	2.58	2.66	2.74	2.82
6	2.90	2.98	3.06	3.14	3.23	3.31	3.39	3.47	3.56	3.64
7	3.73	3.81	3.89	3.98	4.06	4.15	4.24	4.32	4.41	4.50
8	4.58	4.67	4.76	4.84	4.93	5.02	5.11	5.20	5.28	5.37
9	5.46	5.55	5.64	5.73	5.82	5.91	6.00	6.09	6.18	6.27
10	6.36	6.45	6.54	6.63	6.72	6.81	6.90	7.00	7.09	7.18
11	7.27	7.36	7.45	7.55	7.64	7.73	7.82	7.92	8.01	8.10
12	8.19	8.29	8.38	8.47	8.57	8.66	8.75	8.85	8.94	9.03
13	9.13	9.22	9.32	9.41	9.50	9.60	9.69	9.79	9.88	9.97
14	10.07	10.16	10.26	10.35	10.45	10.54	10.64	10.73	10.83	10.92
15	11.02	11.11	11.21	11.30	11.40	11.49	11.59	11.68	11.78	11.87
16	11.97	12.06	12.16	12.25	12.35	12.45	12.54	12.64	12.73	12.83
17	12.93	13.02	13.12	13.21	13.31	13.41	13.50	13.60	13.69	13.79
18	13.89	13.98	14.08	14.18	14.27	14.37	14.47	14.56	14.66	14.76
19	14.85	14.95	15.05	15.14	15.24	15.34	15.43	15.53	15.63	15.72
20	15.82	15.92	16.01	16.11	16.21	16.30	16.40	16.50	16.60	16.69
21	16.79	16.89	16.98	17.08	17.18	17.28	17.37	17.47	17.57	17.67
22	17.76	17.86	17.96	18.06	18.15	18.25	18.35	18.45	18.54	18.64
23	18.74	18.84	18.93	19.03	19.13	19.23	19.32	19.42	19.52	19.62
24	19.71	19.81	19.91	20.01	20.11	20.20	20.30	20.40	20.50	20.60
25	20.69	20.79	20.89	20.99	21.08	21.18	21.28	21.38	21.48	21.57
26	21.67	21.77	21.87	21.97	22.07	22.16	22.26	22.36	22.46	22.56
27	22.65	22.75	22.85	22.95	23.05	23.15	23.24	23.34	23.44	23.54
28	23.64	23.73	23.83	23.93	24.03	24.13	24.23	24.32	24.42	24.52
29	24.62	24.72	24.82	24.92	25.01	25.11	25.21	25.31	25.41	25.51
30	25.60	25.70	25.80	25.90	26.00	26.10	26.20	26.29	26.39	26.49
31	26.59	26.69	26.79	26.89	26.98	27.08	27.18	27.28	27.38	27.48
32	27.58	27.67	27.77	27.87	27.97	28.07	28.17	28.27	28.37	28.46
33	28.56	28.66	28.76	28.86	28.96	29.06	29.16	29.25	29.35	29.45
34	29.55	29.65	29.75	29.85	29.95	30.04	30.14	30.24	30.34	30.44
35	30.54	30.64	30.74	30.84	30.93	31.03	31.13	31.23	31.33	31.43
36	31.53	31.63	31.73	31.82	31.92	32.02	32.12	32.22	32.32	32.42
37	32.52	32.62	32.72	32.81	32.91	33.01	33.11	33.21	33.31	33.41
38	33.51	33.61	33.71	33.80	33.90	34.00	34.10	34.20	34.30	34.40
39	34.50	34.60	34.70	34.80	34.89	34.99	35.09	35.19	35.29	35.39
40	35.49	35.59	35.69	35.79	35.89	35.98	36.08	36.18	36.28	36.38

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.23. NRCS Rainfall-Runoff Table for CN = 72

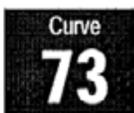


Runoff for inches of rainfall—Curve no. 72

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0									0.00	0.00
1	0.01	0.02	0.04	0.06	0.09	0.11	0.14	0.18	0.21	0.25
2	0.29	0.34	0.38	0.43	0.48	0.53	0.58	0.64	0.69	0.75
3	0.81	0.87	0.93	0.99	1.06	1.12	1.19	1.25	1.32	1.39
4	1.46	1.53	1.60	1.67	1.75	1.82	1.89	1.97	2.04	2.12
5	2.20	2.27	2.35	2.43	2.51	2.59	2.67	2.75	2.83	2.91
6	2.99	3.07	3.16	3.24	3.32	3.41	3.49	3.57	3.66	3.74
7	3.83	3.91	4.00	4.09	4.17	4.26	4.34	4.43	4.52	4.61
8	4.69	4.78	4.87	4.96	5.05	5.14	5.22	5.31	5.40	5.49
9	5.58	5.67	5.76	5.85	5.94	6.03	6.12	6.21	6.30	6.39
10	6.49	6.58	6.67	6.76	6.85	6.94	7.04	7.13	7.22	7.31
11	7.40	7.50	7.59	7.68	7.77	7.87	7.96	8.05	8.15	8.24
12	8.33	8.43	8.52	8.61	8.71	8.80	8.90	8.99	9.08	9.18
13	9.27	9.37	9.46	9.55	9.65	9.74	9.84	9.93	10.03	10.12
14	10.22	10.31	10.41	10.50	10.60	10.69	10.79	10.88	10.98	11.07
15	11.17	11.26	11.36	11.45	11.55	11.65	11.74	11.84	11.93	12.03
16	12.12	12.22	12.32	12.41	12.51	12.60	12.70	12.80	12.89	12.99
17	13.08	13.18	13.28	13.37	13.47	13.57	13.66	13.76	13.86	13.95
18	14.05	14.15	14.24	14.34	14.44	14.53	14.63	14.73	14.82	14.92
19	15.02	15.11	15.21	15.31	15.40	15.50	15.60	15.70	15.79	15.89
20	15.99	16.08	16.18	16.28	16.38	16.47	16.57	16.67	16.76	16.86
21	16.96	17.06	17.15	17.25	17.35	17.45	17.54	17.64	17.74	17.84
22	17.93	18.03	18.13	18.23	18.33	18.42	18.52	18.62	18.72	18.81
23	18.91	19.01	19.11	19.20	19.30	19.40	19.50	19.60	19.69	19.79
24	19.89	19.99	20.09	20.18	20.28	20.38	20.48	20.58	20.67	20.77
25	20.87	20.97	21.07	21.16	21.26	21.36	21.46	21.56	21.66	21.75
26	21.85	21.95	22.05	22.15	22.24	22.34	22.44	22.54	22.64	22.74
27	22.83	22.93	23.03	23.13	23.23	23.33	23.42	23.52	23.62	23.72
28	23.82	23.92	24.02	24.11	24.21	24.31	24.41	24.51	24.61	24.70
29	24.80	24.90	25.00	25.10	25.20	25.30	25.39	25.49	25.59	25.69
30	25.79	25.89	25.99	26.08	26.18	26.28	26.38	26.48	26.58	26.68
31	26.78	26.87	26.97	27.07	27.17	27.27	27.37	27.47	27.57	27.66
32	27.76	27.86	27.96	28.06	28.16	28.26	28.36	28.45	28.55	28.65
33	28.75	28.85	28.95	29.05	29.15	29.25	29.34	29.44	29.54	29.64
34	29.74	29.84	29.94	30.04	30.14	30.23	30.33	30.43	30.53	30.63
35	30.73	30.83	30.93	31.03	31.12	31.22	31.32	31.42	31.52	31.62
36	31.72	31.82	31.92	32.02	32.11	32.21	32.31	32.41	32.51	32.61
37	32.71	32.81	32.91	33.01	33.11	33.20	33.30	33.40	33.50	33.60
38	33.70	33.80	33.90	34.00	34.10	34.20	34.29	34.39	34.49	34.59
39	34.69	34.79	34.89	34.99	35.09	35.19	35.29	35.39	35.48	35.58
40	35.68	35.78	35.88	35.98	36.08	36.18	36.28	36.38	36.48	36.58

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.24. NRCS Rainfall-Runoff Table for CN = 73



Runoff for inches of rainfall—Curve no. 73

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
1	0.02	0.03	0.05	0.07	0.10	0.13	0.16	0.20	0.24	0.28
2	0.32	0.37	0.41	0.46	0.51	0.57	0.62	0.68	0.74	0.80
3	0.86	0.92	0.98	1.05	1.11	1.18	1.25	1.32	1.39	1.46
4	1.53	1.60	1.67	1.75	1.82	1.90	1.97	2.05	2.12	2.20
5	2.28	2.36	2.44	2.52	2.60	2.68	2.76	2.84	2.92	3.01
6	3.09	3.17	3.25	3.34	3.42	3.51	3.59	3.68	3.76	3.85
7	3.93	4.02	4.11	4.19	4.28	4.37	4.46	4.54	4.63	4.72
8	4.81	4.90	4.99	5.08	5.17	5.25	5.34	5.43	5.52	5.61
9	5.70	5.80	5.89	5.98	6.07	6.16	6.25	6.34	6.43	6.52
10	6.62	6.71	6.80	6.89	6.98	7.08	7.17	7.26	7.35	7.45
11	7.54	7.63	7.73	7.82	7.91	8.01	8.10	8.19	8.29	8.38
12	8.48	8.57	8.66	8.76	8.85	8.95	9.04	9.13	9.23	9.32
13	9.42	9.51	9.61	9.70	9.80	9.89	9.99	10.08	10.18	10.27
14	10.37	10.46	10.56	10.65	10.75	10.84	10.94	11.04	11.13	11.23
15	11.32	11.42	11.51	11.61	11.71	11.80	11.90	11.99	12.09	12.19
16	12.28	12.38	12.47	12.57	12.67	12.76	12.86	12.96	13.05	13.15
17	13.25	13.34	13.44	13.54	13.63	13.73	13.83	13.92	14.02	14.12
18	14.21	14.31	14.41	14.50	14.60	14.70	14.79	14.89	14.99	15.09
19	15.18	15.28	15.38	15.48	15.57	15.67	15.77	15.86	15.96	16.06
20	16.16	16.25	16.35	16.45	16.55	16.64	16.74	16.84	16.94	17.03
21	17.13	17.23	17.33	17.42	17.52	17.62	17.72	17.82	17.91	18.01
22	18.11	18.21	18.30	18.40	18.50	18.60	18.70	18.79	18.89	18.99
23	19.09	19.19	19.28	19.38	19.48	19.58	19.68	19.77	19.87	19.97
24	20.07	20.17	20.26	20.36	20.46	20.56	20.66	20.75	20.85	20.95
25	21.05	21.15	21.25	21.34	21.44	21.54	21.64	21.74	21.84	21.93
26	22.03	22.13	22.23	22.33	22.43	22.52	22.62	22.72	22.82	22.92
27	23.02	23.12	23.21	23.31	23.41	23.51	23.61	23.71	23.81	23.90
28	24.00	24.10	24.20	24.30	24.40	24.50	24.59	24.69	24.79	24.89
29	24.99	25.09	25.19	25.28	25.38	25.48	25.58	25.68	25.78	25.88
30	25.98	26.07	26.17	26.27	26.37	26.47	26.57	26.67	26.77	26.86
31	26.96	27.06	27.16	27.26	27.36	27.46	27.56	27.65	27.75	27.85
32	27.95	28.05	28.15	28.25	28.35	28.45	28.54	28.64	28.74	28.84
33	28.94	29.04	29.14	29.24	29.34	29.44	29.53	29.63	29.73	29.83
34	29.93	30.03	30.13	30.23	30.33	30.43	30.52	30.62	30.72	30.82
35	30.92	31.02	31.12	31.22	31.32	31.42	31.52	31.61	31.71	31.81
36	31.91	32.01	32.11	32.21	32.31	32.41	32.51	32.61	32.70	32.80
37	32.90	33.00	33.10	33.20	33.30	33.40	33.50	33.60	33.70	33.80
38	33.89	33.99	34.09	34.19	34.29	34.39	34.49	34.59	34.69	34.79
39	34.89	34.99	35.08	35.18	35.28	35.38	35.48	35.58	35.68	35.78
40	35.88	35.98	36.08	36.18	36.28	36.38	36.47	36.57	36.67	36.77

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.25. NRCS Rainfall-Runoff Table for CN = 74



Runoff for inches of rainfall—Curve no. 74

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
1	0.02	0.04	0.06	0.09	0.12	0.15	0.18	0.22	0.26	0.30
2	0.35	0.40	0.45	0.50	0.55	0.61	0.67	0.72	0.78	0.85
3	0.91	0.97	1.04	1.11	1.17	1.24	1.31	1.38	1.45	1.52
4	1.60	1.67	1.75	1.82	1.90	1.97	2.05	2.13	2.21	2.29
5	2.37	2.45	2.53	2.61	2.69	2.77	2.85	2.94	3.02	3.10
6	3.19	3.27	3.36	3.44	3.53	3.61	3.70	3.78	3.87	3.96
7	4.04	4.13	4.22	4.31	4.39	4.48	4.57	4.66	4.75	4.84
8	4.93	5.02	5.11	5.20	5.29	5.38	5.47	5.56	5.65	5.74
9	5.83	5.92	6.01	6.11	6.20	6.29	6.38	6.47	6.57	6.66
10	6.75	6.84	6.94	7.03	7.12	7.21	7.31	7.40	7.49	7.59
11	7.68	7.77	7.87	7.96	8.06	8.15	8.24	8.34	8.43	8.53
12	8.62	8.71	8.81	8.90	9.00	9.09	9.19	9.28	9.38	9.47
13	9.57	9.66	9.76	9.85	9.95	10.04	10.14	10.23	10.33	10.43
14	10.52	10.62	10.71	10.81	10.90	11.00	11.10	11.19	11.29	11.38
15	11.48	11.58	11.67	11.77	11.86	11.96	12.06	12.15	12.25	12.35
16	12.44	12.54	12.64	12.73	12.83	12.93	13.02	13.12	13.22	13.31
17	13.41	13.51	13.60	13.70	13.80	13.89	13.99	14.09	14.19	14.28
18	14.38	14.48	14.57	14.67	14.77	14.87	14.96	15.06	15.16	15.26
19	15.35	15.45	15.55	15.65	15.74	15.84	15.94	16.04	16.13	16.23
20	16.33	16.43	16.52	16.62	16.72	16.82	16.91	17.01	17.11	17.21
21	17.31	17.40	17.50	17.60	17.70	17.79	17.89	17.99	18.09	18.19
22	18.28	18.38	18.48	18.58	18.68	18.77	18.87	18.97	19.07	19.17
23	19.27	19.36	19.46	19.56	19.66	19.76	19.85	19.95	20.05	20.15
24	20.25	20.35	20.44	20.54	20.64	20.74	20.84	20.94	21.03	21.13
25	21.23	21.33	21.43	21.53	21.62	21.72	21.82	21.92	22.02	22.12
26	22.22	22.31	22.41	22.51	22.61	22.71	22.81	22.91	23.00	23.10
27	23.20	23.30	23.40	23.50	23.60	23.69	23.79	23.89	23.99	24.09
28	24.19	24.29	24.39	24.48	24.58	24.68	24.78	24.88	24.98	25.08
29	25.18	25.27	25.37	25.47	25.57	25.67	25.77	25.87	25.97	26.06
30	26.16	26.26	26.36	26.46	26.56	26.66	26.76	26.86	26.95	27.05
31	27.15	27.25	27.35	27.45	27.55	27.65	27.75	27.85	27.94	28.04
32	28.14	28.24	28.34	28.44	28.54	28.64	28.74	28.83	28.93	29.03
33	29.13	29.23	29.33	29.43	29.53	29.63	29.73	29.83	29.92	30.02
34	30.12	30.22	30.32	30.42	30.52	30.62	30.72	30.82	30.92	31.01
35	31.11	31.21	31.31	31.41	31.51	31.61	31.71	31.81	31.91	32.01
36	32.11	32.20	32.30	32.40	32.50	32.60	32.70	32.80	32.90	33.00
37	33.10	33.20	33.30	33.40	33.49	33.59	33.69	33.79	33.89	33.99
38	34.09	34.19	34.29	34.39	34.49	34.59	34.69	34.78	34.88	34.98
39	35.08	35.18	35.28	35.38	35.48	35.58	35.68	35.78	35.88	35.98
40	36.08	36.18	36.27	36.37	36.47	36.57	36.67	36.77	36.87	36.97

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.26. NRCS Rainfall-Runoff Table for CN = 75



Runoff for inches of rainfall—Curve no. 75

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
1	0.03	0.05	0.07	0.10	0.13	0.17	0.20	0.24	0.29	0.33
2	0.38	0.43	0.48	0.54	0.59	0.65	0.71	0.77	0.83	0.90
3	0.96	1.03	1.10	1.16	1.23	1.30	1.37	1.45	1.52	1.59
4	1.67	1.74	1.82	1.90	1.97	2.05	2.13	2.21	2.29	2.37
5	2.45	2.53	2.61	2.70	2.78	2.86	2.95	3.03	3.11	3.20
6	3.28	3.37	3.46	3.54	3.63	3.71	3.80	3.89	3.98	4.06
7	4.15	4.24	4.33	4.42	4.51	4.59	4.68	4.77	4.86	4.95
8	5.04	5.13	5.22	5.32	5.41	5.50	5.59	5.68	5.77	5.86
9	5.95	6.05	6.14	6.23	6.32	6.42	6.51	6.60	6.69	6.79
10	6.88	6.97	7.07	7.16	7.25	7.35	7.44	7.53	7.63	7.72
11	7.82	7.91	8.00	8.10	8.19	8.29	8.38	8.48	8.57	8.67
12	8.76	8.86	8.95	9.05	9.14	9.24	9.33	9.43	9.52	9.62
13	9.71	9.81	9.90	10.00	10.09	10.19	10.29	10.38	10.48	10.57
14	10.67	10.77	10.86	10.96	11.05	11.15	11.25	11.34	11.44	11.54
15	11.63	11.73	11.82	11.92	12.02	12.11	12.21	12.31	12.40	12.50
16	12.60	12.69	12.79	12.89	12.99	13.08	13.18	13.28	13.37	13.47
17	13.57	13.67	13.76	13.86	13.96	14.05	14.15	14.25	14.35	14.44
18	14.54	14.64	14.74	14.83	14.93	15.03	15.13	15.22	15.32	15.42
19	15.52	15.61	15.71	15.81	15.91	16.00	16.10	16.20	16.30	16.40
20	16.49	16.59	16.69	16.79	16.88	16.98	17.08	17.18	17.28	17.37
21	17.47	17.57	17.67	17.77	17.86	17.96	18.06	18.16	18.26	18.36
22	18.45	18.55	18.65	18.75	18.85	18.94	19.04	19.14	19.24	19.34
23	19.44	19.53	19.63	19.73	19.83	19.93	20.03	20.12	20.22	20.32
24	20.42	20.52	20.62	20.72	20.81	20.91	21.01	21.11	21.21	21.31
25	21.40	21.50	21.60	21.70	21.80	21.90	22.00	22.09	22.19	22.29
26	22.39	22.49	22.59	22.69	22.79	22.88	22.98	23.08	23.18	23.28
27	23.38	23.48	23.58	23.67	23.77	23.87	23.97	24.07	24.17	24.27
28	24.37	24.46	24.56	24.66	24.76	24.86	24.96	25.06	25.16	25.26
29	25.35	25.45	25.55	25.65	25.75	25.85	25.95	26.05	26.15	26.24
30	26.34	26.44	26.54	26.64	26.74	26.84	26.94	27.04	27.14	27.23
31	27.33	27.43	27.53	27.63	27.73	27.83	27.93	28.03	28.13	28.22
32	28.32	28.42	28.52	28.62	28.72	28.82	28.92	29.02	29.12	29.22
33	29.31	29.41	29.51	29.61	29.71	29.81	29.91	30.01	30.11	30.21
34	30.31	30.41	30.50	30.60	30.70	30.80	30.90	31.00	31.10	31.20
35	31.30	31.40	31.50	31.60	31.70	31.79	31.89	31.99	32.09	32.19
36	32.29	32.39	32.49	32.59	32.69	32.79	32.89	32.99	33.08	33.18
37	33.28	33.38	33.48	33.58	33.68	33.78	33.88	33.98	34.08	34.18
38	34.28	34.38	34.48	34.57	34.67	34.77	34.87	34.97	35.07	35.17
39	35.27	35.37	35.47	35.57	35.67	35.77	35.87	35.97	36.07	36.16
40	36.26	36.36	36.46	36.56	36.66	36.76	36.86	36.96	37.06	37.16

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.27. NRCS Rainfall-Runoff Table for CN = 76



Runoff for inches of rainfall—Curve no. 76

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
1	0.04	0.06	0.09	0.12	0.15	0.19	0.23	0.27	0.32	0.36
2	0.41	0.47	0.52	0.58	0.63	0.69	0.76	0.82	0.88	0.95
3	1.01	1.08	1.15	1.22	1.29	1.36	1.44	1.51	1.59	1.66
4	1.74	1.81	1.89	1.97	2.05	2.13	2.21	2.29	2.37	2.45
5	2.53	2.62	2.70	2.78	2.87	2.95	3.04	3.12	3.21	3.29
6	3.38	3.47	3.55	3.64	3.73	3.81	3.90	3.99	4.08	4.17
7	4.26	4.35	4.43	4.52	4.61	4.70	4.79	4.88	4.97	5.07
8	5.16	5.25	5.34	5.43	5.52	5.61	5.71	5.80	5.89	5.98
9	6.07	6.17	6.26	6.35	6.45	6.54	6.63	6.72	6.82	6.91
10	7.01	7.10	7.19	7.29	7.38	7.47	7.57	7.66	7.76	7.85
11	7.95	8.04	8.14	8.23	8.32	8.42	8.51	8.61	8.70	8.80
12	8.90	8.99	9.09	9.18	9.28	9.37	9.47	9.56	9.66	9.76
13	9.85	9.95	10.04	10.14	10.23	10.33	10.43	10.52	10.62	10.72
14	10.81	10.91	11.00	11.10	11.20	11.29	11.39	11.49	11.58	11.68
15	11.78	11.87	11.97	12.07	12.16	12.26	12.36	12.46	12.55	12.65
16	12.75	12.84	12.94	13.04	13.14	13.23	13.33	13.43	13.52	13.62
17	13.72	13.82	13.91	14.01	14.11	14.21	14.30	14.40	14.50	14.60
18	14.69	14.79	14.89	14.99	15.09	15.18	15.28	15.38	15.48	15.57
19	15.67	15.77	15.87	15.97	16.06	16.16	16.26	16.36	16.46	16.55
20	16.65	16.75	16.85	16.95	17.04	17.14	17.24	17.34	17.44	17.53
21	17.63	17.73	17.83	17.93	18.03	18.12	18.22	18.32	18.42	18.52
22	18.62	18.71	18.81	18.91	19.01	19.11	19.21	19.30	19.40	19.50
23	19.60	19.70	19.80	19.89	19.99	20.09	20.19	20.29	20.39	20.49
24	20.58	20.68	20.78	20.88	20.98	21.08	21.18	21.27	21.37	21.47
25	21.57	21.67	21.77	21.87	21.97	22.06	22.16	22.26	22.36	22.46
26	22.56	22.66	22.76	22.85	22.95	23.05	23.15	23.25	23.35	23.45
27	23.55	23.65	23.74	23.84	23.94	24.04	24.14	24.24	24.34	24.44
28	24.54	24.63	24.73	24.83	24.93	25.03	25.13	25.23	25.33	25.43
29	25.52	25.62	25.72	25.82	25.92	26.02	26.12	26.22	26.32	26.42
30	26.51	26.61	26.71	26.81	26.91	27.01	27.11	27.21	27.31	27.41
31	27.51	27.60	27.70	27.80	27.90	28.00	28.10	28.20	28.30	28.40
32	28.50	28.60	28.70	28.79	28.89	28.99	29.09	29.19	29.29	29.39
33	29.49	29.59	29.69	29.79	29.89	29.99	30.08	30.18	30.28	30.38
34	30.48	30.58	30.68	30.78	30.88	30.98	31.08	31.18	31.28	31.37
35	31.47	31.57	31.67	31.77	31.87	31.97	32.07	32.17	32.27	32.37
36	32.47	32.57	32.67	32.77	32.86	32.96	33.06	33.16	33.26	33.36
37	33.46	33.56	33.66	33.76	33.86	33.96	34.06	34.16	34.26	34.35
38	34.45	34.55	34.65	34.75	34.85	34.95	35.05	35.15	35.25	35.35
39	35.45	35.55	35.65	35.75	35.85	35.95	36.05	36.14	36.24	36.34
40	36.44	36.54	36.64	36.74	36.84	36.94	37.04	37.14	37.24	37.34

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.28. NRCS Rainfall-Runoff Table for CN = 77



Runoff for inches of rainfall—Curve no. 77

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03
1	0.05	0.07	0.10	0.13	0.17	0.21	0.25	0.30	0.34	0.39
2	0.45	0.50	0.56	0.62	0.68	0.74	0.80	0.87	0.93	1.00
3	1.07	1.14	1.21	1.28	1.36	1.43	1.50	1.58	1.66	1.73
4	1.81	1.89	1.97	2.05	2.13	2.21	2.29	2.37	2.46	2.54
5	2.62	2.71	2.79	2.87	2.96	3.04	3.13	3.22	3.30	3.39
6	3.48	3.56	3.65	3.74	3.83	3.92	4.01	4.10	4.18	4.27
7	4.36	4.45	4.54	4.63	4.73	4.82	4.91	5.00	5.09	5.18
8	5.27	5.36	5.46	5.55	5.64	5.73	5.83	5.92	6.01	6.10
9	6.20	6.29	6.38	6.48	6.57	6.66	6.76	6.85	6.95	7.04
10	7.13	7.23	7.32	7.42	7.51	7.61	7.70	7.79	7.89	7.98
11	8.08	8.17	8.27	8.36	8.46	8.56	8.65	8.75	8.84	8.94
12	9.03	9.13	9.22	9.32	9.42	9.51	9.61	9.70	9.80	9.90
13	9.99	10.09	10.19	10.28	10.38	10.47	10.57	10.67	10.76	10.86
14	10.96	11.05	11.15	11.25	11.34	11.44	11.54	11.64	11.73	11.83
15	11.93	12.02	12.12	12.22	12.31	12.41	12.51	12.61	12.70	12.80
16	12.90	13.00	13.09	13.19	13.29	13.39	13.48	13.58	13.68	13.78
17	13.87	13.97	14.07	14.17	14.26	14.36	14.46	14.56	14.65	14.75
18	14.85	14.95	15.05	15.14	15.24	15.34	15.44	15.54	15.63	15.73
19	15.83	15.93	16.03	16.12	16.22	16.32	16.42	16.52	16.61	16.71
20	16.81	16.91	17.01	17.11	17.20	17.30	17.40	17.50	17.60	17.70
21	17.79	17.89	17.99	18.09	18.19	18.29	18.38	18.48	18.58	18.68
22	18.78	18.88	18.98	19.07	19.17	19.27	19.37	19.47	19.57	19.67
23	19.76	19.86	19.96	20.06	20.16	20.26	20.36	20.45	20.55	20.65
24	20.75	20.85	20.95	21.05	21.15	21.24	21.34	21.44	21.54	21.64
25	21.74	21.84	21.94	22.03	22.13	22.23	22.33	22.43	22.53	22.63
26	22.73	22.83	22.92	23.02	23.12	23.22	23.32	23.42	23.52	23.62
27	23.72	23.82	23.91	24.01	24.11	24.21	24.31	24.41	24.51	24.61
28	24.71	24.81	24.90	25.00	25.10	25.20	25.30	25.40	25.50	25.60
29	25.70	25.80	25.89	25.99	26.09	26.19	26.29	26.39	26.49	26.59
30	26.69	26.79	26.89	26.99	27.08	27.18	27.28	27.38	27.48	27.58
31	27.68	27.78	27.88	27.98	28.08	28.18	28.28	28.37	28.47	28.57
32	28.67	28.77	28.87	28.97	29.07	29.17	29.27	29.37	29.47	29.57
33	29.66	29.76	29.86	29.96	30.06	30.16	30.26	30.36	30.46	30.56
34	30.66	30.76	30.86	30.96	31.05	31.15	31.25	31.35	31.45	31.55
35	31.65	31.75	31.85	31.95	32.05	32.15	32.25	32.35	32.45	32.55
36	32.64	32.74	32.84	32.94	33.04	33.14	33.24	33.34	33.44	33.54
37	33.64	33.74	33.84	33.94	34.04	34.14	34.24	34.33	34.43	34.53
38	34.63	34.73	34.83	34.93	35.03	35.13	35.23	35.33	35.43	35.53
39	35.63	35.73	35.83	35.93	36.03	36.13	36.22	36.32	36.42	36.52
40	36.62	36.72	36.82	36.92	37.02	37.12	37.22	37.32	37.42	37.52

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.29. NRCS Rainfall-Runoff Table for CN = 78



Runoff for inches of rainfall—Curve no. 78

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04
1	0.06	0.09	0.12	0.15	0.19	0.23	0.28	0.33	0.38	0.43
2	0.48	0.54	0.60	0.66	0.72	0.79	0.85	0.92	0.99	1.06
3	1.13	1.20	1.27	1.35	1.42	1.50	1.57	1.65	1.73	1.81
4	1.89	1.97	2.05	2.13	2.21	2.29	2.38	2.46	2.54	2.63
5	2.71	2.80	2.88	2.97	3.05	3.14	3.23	3.32	3.40	3.49
6	3.58	3.67	3.76	3.85	3.93	4.02	4.11	4.20	4.29	4.38
7	4.48	4.57	4.66	4.75	4.84	4.93	5.02	5.11	5.21	5.30
8	5.39	5.48	5.58	5.67	5.76	5.86	5.95	6.04	6.14	6.23
9	6.32	6.42	6.51	6.60	6.70	6.79	6.89	6.98	7.08	7.17
10	7.26	7.36	7.45	7.55	7.64	7.74	7.83	7.93	8.03	8.12
11	8.22	8.31	8.41	8.50	8.60	8.69	8.79	8.89	8.98	9.08
12	9.17	9.27	9.37	9.46	9.56	9.65	9.75	9.85	9.94	10.04
13	10.14	10.23	10.33	10.43	10.52	10.62	10.72	10.81	10.91	11.01
14	11.11	11.20	11.30	11.40	11.49	11.59	11.69	11.79	11.88	11.98
15	12.08	12.17	12.27	12.37	12.47	12.56	12.66	12.76	12.86	12.95
16	13.05	13.15	13.25	13.34	13.44	13.54	13.64	13.74	13.83	13.93
17	14.03	14.13	14.22	14.32	14.42	14.52	14.62	14.71	14.81	14.91
18	15.01	15.11	15.20	15.30	15.40	15.50	15.60	15.70	15.79	15.89
19	15.99	16.09	16.19	16.28	16.38	16.48	16.58	16.68	16.78	16.87
20	16.97	17.07	17.17	17.27	17.37	17.47	17.56	17.66	17.76	17.86
21	17.96	18.06	18.16	18.25	18.35	18.45	18.55	18.65	18.75	18.85
22	18.94	19.04	19.14	19.24	19.34	19.44	19.54	19.63	19.73	19.83
23	19.93	20.03	20.13	20.23	20.33	20.42	20.52	20.62	20.72	20.82
24	20.92	21.02	21.12	21.22	21.31	21.41	21.51	21.61	21.71	21.81
25	21.91	22.01	22.11	22.20	22.30	22.40	22.50	22.60	22.70	22.80
26	22.90	23.00	23.10	23.19	23.29	23.39	23.49	23.59	23.69	23.79
27	23.89	23.99	24.09	24.19	24.28	24.38	24.48	24.58	24.68	24.78
28	24.88	24.98	25.08	25.18	25.28	25.37	25.47	25.57	25.67	25.77
29	25.87	25.97	26.07	26.17	26.27	26.37	26.47	26.56	26.66	26.76
30	26.86	26.96	27.06	27.16	27.26	27.36	27.46	27.56	27.66	27.76
31	27.86	27.95	28.05	28.15	28.25	28.35	28.45	28.55	28.65	28.75
32	28.85	28.95	29.05	29.15	29.25	29.34	29.44	29.54	29.64	29.74
33	29.84	29.94	30.04	30.14	30.24	30.34	30.44	30.54	30.64	30.74
34	30.84	30.93	31.03	31.13	31.23	31.33	31.43	31.53	31.63	31.73
35	31.83	31.93	32.03	32.13	32.23	32.33	32.43	32.53	32.62	32.72
36	32.82	32.92	33.02	33.12	33.22	33.32	33.42	33.52	33.62	33.72
37	33.82	33.92	34.02	34.12	34.22	34.32	34.42	34.52	34.61	34.71
38	34.81	34.91	35.01	35.11	35.21	35.31	35.41	35.51	35.61	35.71
39	35.81	35.91	36.01	36.11	36.21	36.31	36.41	36.51	36.61	36.70
40	36.80	36.90	37.00	37.10	37.20	37.30	37.40	37.50	37.60	37.70

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.30. NRCS Rainfall-Runoff Table for CN = 79



Runoff for inches of rainfall—Curve no. 79

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04
1	0.07	0.10	0.13	0.17	0.21	0.26	0.31	0.36	0.41	0.46
2	0.52	0.58	0.64	0.71	0.77	0.84	0.90	0.97	1.04	1.12
3	1.19	1.26	1.34	1.41	1.49	1.57	1.64	1.72	1.80	1.88
4	1.96	2.04	2.13	2.21	2.29	2.38	2.46	2.54	2.63	2.71
5	2.80	2.89	2.97	3.06	3.15	3.24	3.32	3.41	3.50	3.59
6	3.68	3.77	3.86	3.95	4.04	4.13	4.22	4.31	4.40	4.49
7	4.58	4.67	4.77	4.86	4.95	5.04	5.14	5.23	5.32	5.41
8	5.51	5.60	5.69	5.79	5.88	5.97	6.07	6.16	6.26	6.35
9	6.44	6.54	6.63	6.73	6.82	6.92	7.01	7.11	7.20	7.30
10	7.39	7.49	7.58	7.68	7.77	7.87	7.96	8.06	8.16	8.25
11	8.35	8.44	8.54	8.63	8.73	8.83	8.92	9.02	9.12	9.21
12	9.31	9.41	9.50	9.60	9.70	9.79	9.89	9.99	10.08	10.18
13	10.28	10.37	10.47	10.57	10.66	10.76	10.86	10.96	11.05	11.15
14	11.25	11.34	11.44	11.54	11.64	11.73	11.83	11.93	12.03	12.12
15	12.22	12.32	12.42	12.51	12.61	12.71	12.81	12.90	13.00	13.10
16	13.20	13.30	13.39	13.49	13.59	13.69	13.79	13.88	13.98	14.08
17	14.18	14.28	14.37	14.47	14.57	14.67	14.77	14.86	14.96	15.06
18	15.16	15.26	15.36	15.45	15.55	15.65	15.75	15.85	15.95	16.04
19	16.14	16.24	16.34	16.44	16.54	16.64	16.73	16.83	16.93	17.03
20	17.13	17.23	17.32	17.42	17.52	17.62	17.72	17.82	17.92	18.02
21	18.11	18.21	18.31	18.41	18.51	18.61	18.71	18.80	18.90	19.00
22	19.10	19.20	19.30	19.40	19.50	19.60	19.69	19.79	19.89	19.99
23	20.09	20.19	20.29	20.39	20.49	20.58	20.68	20.78	20.88	20.98
24	21.08	21.18	21.28	21.38	21.47	21.57	21.67	21.77	21.87	21.97
25	22.07	22.17	22.27	22.37	22.47	22.56	22.66	22.76	22.86	22.96
26	23.06	23.16	23.26	23.36	23.46	23.56	23.65	23.75	23.85	23.95
27	24.05	24.15	24.25	24.35	24.45	24.55	24.65	24.75	24.84	24.94
28	25.04	25.14	25.24	25.34	25.44	25.54	25.64	25.74	25.84	25.94
29	26.04	26.13	26.23	26.33	26.43	26.53	26.63	26.73	26.83	26.93
30	27.03	27.13	27.23	27.33	27.43	27.52	27.62	27.72	27.82	27.92
31	28.02	28.12	28.22	28.32	28.42	28.52	28.62	28.72	28.82	28.92
32	29.02	29.11	29.21	29.31	29.41	29.51	29.61	29.71	29.81	29.91
33	30.01	30.11	30.21	30.31	30.41	30.51	30.61	30.71	30.80	30.90
34	31.00	31.10	31.20	31.30	31.40	31.50	31.60	31.70	31.80	31.90
35	32.00	32.10	32.20	32.30	32.40	32.50	32.60	32.70	32.79	32.89
36	32.99	33.09	33.19	33.29	33.39	33.49	33.59	33.69	33.79	33.89
37	33.99	34.09	34.19	34.29	34.39	34.49	34.59	34.69	34.79	34.88
38	34.98	35.08	35.18	35.28	35.38	35.48	35.58	35.68	35.78	35.88
39	35.98	36.08	36.18	36.28	36.38	36.48	36.58	36.68	36.78	36.88
40	36.98	37.08	37.18	37.27	37.37	37.47	37.57	37.67	37.77	37.87

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.31. NRCS Rainfall-Runoff Table for CN = 80



Runoff for inches of rainfall—Curve no. 80

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.06
1	0.08	0.12	0.15	0.19	0.24	0.29	0.34	0.39	0.44	0.50
2	0.56	0.62	0.69	0.75	0.82	0.89	0.96	1.03	1.10	1.18
3	1.25	1.33	1.40	1.48	1.56	1.64	1.72	1.80	1.88	1.96
4	2.04	2.12	2.21	2.29	2.38	2.46	2.55	2.63	2.72	2.81
5	2.89	2.98	3.07	3.16	3.24	3.33	3.42	3.51	3.60	3.69
6	3.78	3.87	3.96	4.05	4.14	4.24	4.33	4.42	4.51	4.60
7	4.69	4.79	4.88	4.97	5.06	5.16	5.25	5.34	5.44	5.53
8	5.63	5.72	5.81	5.91	6.00	6.10	6.19	6.28	6.38	6.47
9	6.57	6.66	6.76	6.85	6.95	7.04	7.14	7.23	7.33	7.43
10	7.52	7.62	7.71	7.81	7.90	8.00	8.10	8.19	8.29	8.38
11	8.48	8.58	8.67	8.77	8.87	8.96	9.06	9.16	9.25	9.35
12	9.45	9.54	9.64	9.74	9.83	9.93	10.03	10.13	10.22	10.32
13	10.42	10.51	10.61	10.71	10.81	10.90	11.00	11.10	11.20	11.29
14	11.39	11.49	11.59	11.68	11.78	11.88	11.98	12.07	12.17	12.27
15	12.37	12.47	12.56	12.66	12.76	12.86	12.96	13.05	13.15	13.25
16	13.35	13.45	13.54	13.64	13.74	13.84	13.94	14.03	14.13	14.23
17	14.33	14.43	14.53	14.62	14.72	14.82	14.92	15.02	15.12	15.21
18	15.31	15.41	15.51	15.61	15.71	15.80	15.90	16.00	16.10	16.20
19	16.30	16.40	16.49	16.59	16.69	16.79	16.89	16.99	17.09	17.19
20	17.28	17.38	17.48	17.58	17.68	17.78	17.88	17.98	18.07	18.17
21	18.27	18.37	18.47	18.57	18.67	18.77	18.86	18.96	19.06	19.16
22	19.26	19.36	19.46	19.56	19.66	19.76	19.85	19.95	20.05	20.15
23	20.25	20.35	20.45	20.55	20.65	20.75	20.84	20.94	21.04	21.14
24	21.24	21.34	21.44	21.54	21.64	21.74	21.83	21.93	22.03	22.13
25	22.23	22.33	22.43	22.53	22.63	22.73	22.83	22.93	23.02	23.12
26	23.22	23.32	23.42	23.52	23.62	23.72	23.82	23.92	24.02	24.12
27	24.22	24.31	24.41	24.51	24.61	24.71	24.81	24.91	25.01	25.11
28	25.21	25.31	25.41	25.51	25.61	25.70	25.80	25.90	26.00	26.10
29	26.20	26.30	26.40	26.50	26.60	26.70	26.80	26.90	27.00	27.10
30	27.20	27.29	27.39	27.49	27.59	27.69	27.79	27.89	27.99	28.09
31	28.19	28.29	28.39	28.49	28.59	28.69	28.79	28.89	28.98	29.08
32	29.18	29.28	29.38	29.48	29.58	29.68	29.78	29.88	29.98	30.08
33	30.18	30.28	30.38	30.48	30.58	30.68	30.78	30.88	30.97	31.07
34	31.17	31.27	31.37	31.47	31.57	31.67	31.77	31.87	31.97	32.07
35	32.17	32.27	32.37	32.47	32.57	32.67	32.77	32.87	32.97	33.06
36	33.16	33.26	33.36	33.46	33.56	33.66	33.76	33.86	33.96	34.06
37	34.16	34.26	34.36	34.46	34.56	34.66	34.76	34.86	34.96	35.06
38	35.16	35.26	35.36	35.46	35.55	35.65	35.75	35.85	35.95	36.05
39	36.15	36.25	36.35	36.45	36.55	36.65	36.75	36.85	36.95	37.05
40	37.15	37.25	37.35	37.45	37.55	37.65	37.75	37.85	37.95	38.05

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.32. NRCS Rainfall-Runoff Table for CN = 81

Curve
81

Runoff for inches of rainfall—Curve no. 81

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.07
1	0.10	0.13	0.17	0.22	0.27	0.32	0.37	0.42	0.48	0.54
2	0.61	0.67	0.74	0.80	0.87	0.94	1.02	1.09	1.16	1.24
3	1.32	1.39	1.47	1.55	1.63	1.71	1.79	1.87	1.96	2.04
4	2.12	2.21	2.29	2.38	2.47	2.55	2.64	2.73	2.81	2.90
5	2.99	3.08	3.17	3.26	3.34	3.43	3.52	3.62	3.71	3.80
6	3.89	3.98	4.07	4.16	4.25	4.35	4.44	4.53	4.62	4.72
7	4.81	4.90	5.00	5.09	5.18	5.28	5.37	5.46	5.56	5.65
8	5.75	5.84	5.94	6.03	6.13	6.22	6.31	6.41	6.51	6.60
9	6.70	6.79	6.89	6.98	7.08	7.17	7.27	7.37	7.46	7.56
10	7.65	7.75	7.85	7.94	8.04	8.13	8.23	8.33	8.42	8.52
11	8.62	8.71	8.81	8.91	9.00	9.10	9.20	9.30	9.39	9.49
12	9.59	9.68	9.78	9.88	9.98	10.07	10.17	10.27	10.37	10.46
13	10.56	10.66	10.76	10.85	10.95	11.05	11.15	11.24	11.34	11.44
14	11.54	11.63	11.73	11.83	11.93	12.03	12.12	12.22	12.32	12.42
15	12.52	12.61	12.71	12.81	12.91	13.01	13.11	13.20	13.30	13.40
16	13.50	13.60	13.69	13.79	13.89	13.99	14.09	14.19	14.29	14.38
17	14.48	14.58	14.68	14.78	14.88	14.97	15.07	15.17	15.27	15.37
18	15.47	15.57	15.66	15.76	15.86	15.96	16.06	16.16	16.26	16.36
19	16.45	16.55	16.65	16.75	16.85	16.95	17.05	17.15	17.24	17.34
20	17.44	17.54	17.64	17.74	17.84	17.94	18.04	18.13	18.23	18.33
21	18.43	18.53	18.63	18.73	18.83	18.93	19.03	19.12	19.22	19.32
22	19.42	19.52	19.62	19.72	19.82	19.92	20.02	20.11	20.21	20.31
23	20.41	20.51	20.61	20.71	20.81	20.91	21.01	21.11	21.21	21.30
24	21.40	21.50	21.60	21.70	21.80	21.90	22.00	22.10	22.20	22.30
25	22.40	22.50	22.59	22.69	22.79	22.89	22.99	23.09	23.19	23.29
26	23.39	23.49	23.59	23.69	23.79	23.88	23.98	24.08	24.18	24.28
27	24.38	24.48	24.58	24.68	24.78	24.88	24.98	25.08	25.18	25.28
28	25.38	25.47	25.57	25.67	25.77	25.87	25.97	26.07	26.17	26.27
29	26.37	26.47	26.57	26.67	26.77	26.87	26.97	27.07	27.16	27.26
30	27.36	27.46	27.56	27.66	27.76	27.86	27.96	28.06	28.16	28.26
31	28.36	28.46	28.56	28.66	28.76	28.86	28.96	29.06	29.15	29.25
32	29.35	29.45	29.55	29.65	29.75	29.85	29.95	30.05	30.15	30.25
33	30.35	30.45	30.55	30.65	30.75	30.85	30.95	31.05	31.15	31.25
34	31.34	31.44	31.54	31.64	31.74	31.84	31.94	32.04	32.14	32.24
35	32.34	32.44	32.54	32.64	32.74	32.84	32.94	33.04	33.14	33.24
36	33.34	33.44	33.54	33.64	33.74	33.83	33.93	34.03	34.13	34.23
37	34.33	34.43	34.53	34.63	34.73	34.83	34.93	35.03	35.13	35.23
38	35.33	35.43	35.53	35.63	35.73	35.83	35.93	36.03	36.13	36.23
39	36.33	36.43	36.53	36.62	36.72	36.82	36.92	37.02	37.12	37.22
40	37.32	37.42	37.52	37.62	37.72	37.82	37.92	38.02	38.12	38.22

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.33. NRCS Rainfall-Runoff Table for CN = 82



Runoff for inches of rainfall—Curve no. 82

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.08
1	0.11	0.15	0.20	0.24	0.29	0.34	0.40	0.46	0.52	0.58
2	0.65	0.71	0.78	0.85	0.92	1.00	1.07	1.15	1.22	1.30
3	1.38	1.46	1.54	1.62	1.70	1.78	1.86	1.95	2.03	2.12
4	2.20	2.29	2.37	2.46	2.55	2.63	2.72	2.81	2.90	2.99
5	3.08	3.17	3.26	3.35	3.44	3.53	3.62	3.71	3.80	3.89
6	3.98	4.08	4.17	4.26	4.35	4.45	4.54	4.63	4.73	4.82
7	4.91	5.01	5.10	5.19	5.29	5.38	5.48	5.57	5.67	5.76
8	5.86	5.95	6.05	6.14	6.24	6.33	6.43	6.52	6.62	6.71
9	6.81	6.91	7.00	7.10	7.19	7.29	7.39	7.48	7.58	7.68
10	7.77	7.87	7.96	8.06	8.16	8.25	8.35	8.45	8.55	8.64
11	8.74	8.84	8.93	9.03	9.13	9.23	9.32	9.42	9.52	9.61
12	9.71	9.81	9.91	10.00	10.10	10.20	10.30	10.39	10.49	10.59
13	10.69	10.79	10.88	10.98	11.08	11.18	11.28	11.37	11.47	11.57
14	11.67	11.77	11.86	11.96	12.06	12.16	12.26	12.35	12.45	12.55
15	12.65	12.75	12.85	12.94	13.04	13.14	13.24	13.34	13.44	13.53
16	13.63	13.73	13.83	13.93	14.03	14.13	14.22	14.32	14.42	14.52
17	14.62	14.72	14.82	14.91	15.01	15.11	15.21	15.31	15.41	15.51
18	15.60	15.70	15.80	15.90	16.00	16.10	16.20	16.30	16.40	16.49
19	16.59	16.69	16.79	16.89	16.99	17.09	17.19	17.29	17.38	17.48
20	17.58	17.68	17.78	17.88	17.98	18.08	18.18	18.28	18.37	18.47
21	18.57	18.67	18.77	18.87	18.97	19.07	19.17	19.27	19.37	19.46
22	19.56	19.66	19.76	19.86	19.96	20.06	20.16	20.26	20.36	20.46
23	20.56	20.65	20.75	20.85	20.95	21.05	21.15	21.25	21.35	21.45
24	21.55	21.65	21.75	21.85	21.95	22.04	22.14	22.24	22.34	22.44
25	22.54	22.64	22.74	22.84	22.94	23.04	23.14	23.24	23.34	23.43
26	23.53	23.63	23.73	23.83	23.93	24.03	24.13	24.23	24.33	24.43
27	24.53	24.63	24.73	24.83	24.93	25.03	25.12	25.22	25.32	25.42
28	25.52	25.62	25.72	25.82	25.92	26.02	26.12	26.22	26.32	26.42
29	26.52	26.62	26.72	26.82	26.92	27.01	27.11	27.21	27.31	27.41
30	27.51	27.61	27.71	27.81	27.91	28.01	28.11	28.21	28.31	28.41
31	28.51	28.61	28.71	28.81	28.91	29.01	29.11	29.20	29.30	29.40
32	29.50	29.60	29.70	29.80	29.90	30.00	30.10	30.20	30.30	30.40
33	30.50	30.60	30.70	30.80	30.90	31.00	31.10	31.20	31.30	31.40
34	31.50	31.59	31.69	31.79	31.89	31.99	32.09	32.19	32.29	32.39
35	32.49	32.59	32.69	32.79	32.89	32.99	33.09	33.19	33.29	33.39
36	33.49	33.59	33.69	33.79	33.89	33.99	34.09	34.19	34.29	34.39
37	34.48	34.58	34.68	34.78	34.88	34.98	35.08	35.18	35.28	35.38
38	35.48	35.58	35.68	35.78	35.88	35.98	36.08	36.18	36.28	36.38
39	36.48	36.58	36.68	36.78	36.88	36.98	37.08	37.18	37.28	37.38
40	37.48	37.58	37.68	37.78	37.87	37.97	38.07	38.17	38.27	38.37

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.34. NRCS Rainfall-Runoff Table for CN = 83

Curve
83

Runoff for inches of rainfall—Curve no. 83

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.06	0.09
1	0.13	0.17	0.22	0.27	0.32	0.38	0.44	0.50	0.56	0.63
2	0.69	0.76	0.83	0.91	0.98	1.06	1.13	1.21	1.29	1.37
3	1.45	1.53	1.61	1.69	1.77	1.86	1.94	2.03	2.11	2.20
4	2.29	2.37	2.46	2.55	2.64	2.72	2.81	2.90	2.99	3.08
5	3.17	3.26	3.35	3.45	3.54	3.63	3.72	3.81	3.90	4.00
6	4.09	4.18	4.28	4.37	4.46	4.56	4.65	4.74	4.84	4.93
7	5.03	5.12	5.22	5.31	5.40	5.50	5.59	5.69	5.79	5.88
8	5.98	6.07	6.17	6.26	6.36	6.45	6.55	6.65	6.74	6.84
9	6.93	7.03	7.13	7.22	7.32	7.42	7.51	7.61	7.71	7.80
10	7.90	8.00	8.09	8.19	8.29	8.39	8.48	8.58	8.68	8.78
11	8.87	8.97	9.07	9.16	9.26	9.36	9.46	9.56	9.65	9.75
12	9.85	9.95	10.04	10.14	10.24	10.34	10.44	10.53	10.63	10.73
13	10.83	10.93	11.02	11.12	11.22	11.32	11.42	11.51	11.61	11.71
14	11.81	11.91	12.01	12.10	12.20	12.30	12.40	12.50	12.60	12.69
15	12.79	12.89	12.99	13.09	13.19	13.29	13.38	13.48	13.58	13.68
16	13.78	13.88	13.98	14.07	14.17	14.27	14.37	14.47	14.57	14.67
17	14.77	14.86	14.96	15.06	15.16	15.26	15.36	15.46	15.56	15.66
18	15.75	15.85	15.95	16.05	16.15	16.25	16.35	16.45	16.55	16.64
19	16.74	16.84	16.94	17.04	17.14	17.24	17.34	17.44	17.54	17.64
20	17.73	17.83	17.93	18.03	18.13	18.23	18.33	18.43	18.53	18.63
21	18.73	18.82	18.92	19.02	19.12	19.22	19.32	19.42	19.52	19.62
22	19.72	19.82	19.92	20.02	20.11	20.21	20.31	20.41	20.51	20.61
23	20.71	20.81	20.91	21.01	21.11	21.21	21.31	21.41	21.51	21.60
24	21.70	21.80	21.90	22.00	22.10	22.20	22.30	22.40	22.50	22.60
25	22.70	22.80	22.90	23.00	23.10	23.19	23.29	23.39	23.49	23.59
26	23.69	23.79	23.89	23.99	24.09	24.19	24.29	24.39	24.49	24.59
27	24.69	24.79	24.89	24.99	25.08	25.18	25.28	25.38	25.48	25.58
28	25.68	25.78	25.88	25.98	26.08	26.18	26.28	26.38	26.48	26.58
29	26.68	26.78	26.88	26.98	27.08	27.17	27.27	27.37	27.47	27.57
30	27.67	27.77	27.87	27.97	28.07	28.17	28.27	28.37	28.47	28.57
31	28.67	28.77	28.87	28.97	29.07	29.17	29.27	29.37	29.47	29.57
32	29.66	29.76	29.86	29.96	30.06	30.16	30.26	30.36	30.46	30.56
33	30.66	30.76	30.86	30.96	31.06	31.16	31.26	31.36	31.46	31.56
34	31.66	31.76	31.86	31.96	32.06	32.16	32.26	32.36	32.46	32.56
35	32.65	32.75	32.85	32.95	33.05	33.15	33.25	33.35	33.45	33.55
36	33.65	33.75	33.85	33.95	34.05	34.15	34.25	34.35	34.45	34.55
37	34.65	34.75	34.85	34.95	35.05	35.15	35.25	35.35	35.45	35.55
38	35.65	35.75	35.85	35.95	36.04	36.14	36.24	36.34	36.44	36.54
39	36.64	36.74	36.84	36.94	37.04	37.14	37.24	37.34	37.44	37.54
40	37.64	37.74	37.84	37.94	38.04	38.14	38.24	38.34	38.44	38.54

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.35. NRCS Rainfall-Runoff Table for CN = 84



Runoff for inches of rainfall—Curve no. 84

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.05	0.08	0.11
1	0.15	0.20	0.25	0.30	0.36	0.42	0.48	0.54	0.61	0.68
2	0.75	0.82	0.89	0.97	1.04	1.12	1.20	1.28	1.36	1.44
3	1.52	1.60	1.68	1.77	1.85	1.94	2.03	2.11	2.20	2.29
4	2.37	2.46	2.55	2.64	2.73	2.82	2.91	3.00	3.09	3.18
5	3.27	3.37	3.46	3.55	3.64	3.73	3.83	3.92	4.01	4.11
6	4.20	4.29	4.39	4.48	4.58	4.67	4.76	4.86	4.95	5.05
7	5.14	5.24	5.33	5.43	5.52	5.62	5.72	5.81	5.91	6.00
8	6.10	6.20	6.29	6.39	6.48	6.58	6.68	6.77	6.87	6.97
9	7.06	7.16	7.26	7.35	7.45	7.55	7.64	7.74	7.84	7.94
10	8.03	8.13	8.23	8.33	8.42	8.52	8.62	8.72	8.81	8.91
11	9.01	9.11	9.20	9.30	9.40	9.50	9.60	9.69	9.79	9.89
12	9.99	10.09	10.18	10.28	10.38	10.48	10.58	10.67	10.77	10.87
13	10.97	11.07	11.17	11.26	11.36	11.46	11.56	11.66	11.76	11.85
14	11.95	12.05	12.15	12.25	12.35	12.45	12.54	12.64	12.74	12.84
15	12.94	13.04	13.14	13.23	13.33	13.43	13.53	13.63	13.73	13.83
16	13.93	14.02	14.12	14.22	14.32	14.42	14.52	14.62	14.72	14.82
17	14.91	15.01	15.11	15.21	15.31	15.41	15.51	15.61	15.71	15.81
18	15.90	16.00	16.10	16.20	16.30	16.40	16.50	16.60	16.70	16.80
19	16.90	17.00	17.09	17.19	17.29	17.39	17.49	17.59	17.69	17.79
20	17.89	17.99	18.09	18.19	18.28	18.38	18.48	18.58	18.68	18.78
21	18.88	18.98	19.08	19.18	19.28	19.38	19.48	19.58	19.67	19.77
22	19.87	19.97	20.07	20.17	20.27	20.37	20.47	20.57	20.67	20.77
23	20.87	20.97	21.07	21.17	21.26	21.36	21.46	21.56	21.66	21.76
24	21.86	21.96	22.06	22.16	22.26	22.36	22.46	22.56	22.66	22.76
25	22.86	22.96	23.06	23.15	23.25	23.35	23.45	23.55	23.65	23.75
26	23.85	23.95	24.05	24.15	24.25	24.35	24.45	24.55	24.65	24.75
27	24.85	24.95	25.05	25.15	25.24	25.34	25.44	25.54	25.64	25.74
28	25.84	25.94	26.04	26.14	26.24	26.34	26.44	26.54	26.64	26.74
29	26.84	26.94	27.04	27.14	27.24	27.34	27.44	27.54	27.64	27.73
30	27.83	27.93	28.03	28.13	28.23	28.33	28.43	28.53	28.63	28.73
31	28.83	28.93	29.03	29.13	29.23	29.33	29.43	29.53	29.63	29.73
32	29.83	29.93	30.03	30.13	30.23	30.33	30.43	30.53	30.63	30.72
33	30.82	30.92	31.02	31.12	31.22	31.32	31.42	31.52	31.62	31.72
34	31.82	31.92	32.02	32.12	32.22	32.32	32.42	32.52	32.62	32.72
35	32.82	32.92	33.02	33.12	33.22	33.32	33.42	33.52	33.62	33.72
36	33.82	33.92	34.02	34.12	34.22	34.31	34.41	34.51	34.61	34.71
37	34.81	34.91	35.01	35.11	35.21	35.31	35.41	35.51	35.61	35.71
38	35.81	35.91	36.01	36.11	36.21	36.31	36.41	36.51	36.61	36.71
39	36.81	36.91	37.01	37.11	37.21	37.31	37.41	37.51	37.61	37.71
40	37.81	37.91	38.01	38.11	38.21	38.31	38.41	38.51	38.61	38.71

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.36. NRCS Rainfall-Runoff Table for CN = 85

Curve 85											
Runoff for inches of rainfall—Curve no. 85											
Inches	Tenths										
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
0	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.06	0.09	0.13	
1	0.17	0.22	0.28	0.33	0.39	0.45	0.52	0.58	0.65	0.72	
2	0.80	0.87	0.95	1.02	1.10	1.18	1.26	1.34	1.42	1.51	
3	1.59	1.68	1.76	1.85	1.93	2.02	2.11	2.19	2.28	2.37	
4	2.46	2.55	2.64	2.73	2.82	2.91	3.00	3.10	3.19	3.28	
5	3.37	3.46	3.56	3.65	3.74	3.84	3.93	4.02	4.12	4.21	
6	4.31	4.40	4.50	4.59	4.68	4.78	4.87	4.97	5.07	5.16	
7	5.26	5.35	5.45	5.54	5.64	5.74	5.83	5.93	6.02	6.12	
8	6.22	6.31	6.41	6.51	6.60	6.70	6.80	6.89	6.99	7.09	
9	7.19	7.28	7.38	7.48	7.57	7.67	7.77	7.87	7.96	8.06	
10	8.16	8.26	8.35	8.45	8.55	8.65	8.75	8.84	8.94	9.04	
11	9.14	9.24	9.33	9.43	9.53	9.63	9.73	9.82	9.92	10.02	
12	10.12	10.22	10.32	10.41	10.51	10.61	10.71	10.81	10.91	11.00	
13	11.10	11.20	11.30	11.40	11.50	11.60	11.69	11.79	11.89	11.99	
14	12.09	12.19	12.29	12.39	12.48	12.58	12.68	12.78	12.88	12.98	
15	13.08	13.18	13.27	13.37	13.47	13.57	13.67	13.77	13.87	13.97	
16	14.07	14.16	14.26	14.36	14.46	14.56	14.66	14.76	14.86	14.96	
17	15.06	15.16	15.25	15.35	15.45	15.55	15.65	15.75	15.85	15.95	
18	16.05	16.15	16.25	16.35	16.44	16.54	16.64	16.74	16.84	16.94	
19	17.04	17.14	17.24	17.34	17.44	17.54	17.64	17.73	17.83	17.93	
20	18.03	18.13	18.23	18.33	18.43	18.53	18.63	18.73	18.83	18.93	
21	19.03	19.13	19.23	19.32	19.42	19.52	19.62	19.72	19.82	19.92	
22	20.02	20.12	20.22	20.32	20.42	20.52	20.62	20.72	20.82	20.92	
23	21.01	21.11	21.21	21.31	21.41	21.51	21.61	21.71	21.81	21.91	
24	22.01	22.11	22.21	22.31	22.41	22.51	22.61	22.71	22.81	22.91	
25	23.01	23.10	23.20	23.30	23.40	23.50	23.60	23.70	23.80	23.90	
26	24.00	24.10	24.20	24.30	24.40	24.50	24.60	24.70	24.80	24.90	
27	25.00	25.10	25.20	25.30	25.40	25.50	25.59	25.69	25.79	25.89	
28	25.99	26.09	26.19	26.29	26.39	26.49	26.59	26.69	26.79	26.89	
29	26.99	27.09	27.19	27.29	27.39	27.49	27.59	27.69	27.79	27.89	
30	27.99	28.09	28.19	28.29	28.39	28.49	28.58	28.68	28.78	28.88	
31	28.98	29.08	29.18	29.28	29.38	29.48	29.58	29.68	29.78	29.88	
32	29.98	30.08	30.18	30.28	30.38	30.48	30.58	30.68	30.78	30.88	
33	30.98	31.08	31.18	31.28	31.38	31.48	31.58	31.68	31.78	31.88	
34	31.98	32.08	32.17	32.27	32.37	32.47	32.57	32.67	32.77	32.87	
35	32.97	33.07	33.17	33.27	33.37	33.47	33.57	33.67	33.77	33.87	
36	33.97	34.07	34.17	34.27	34.37	34.47	34.57	34.67	34.77	34.87	
37	34.97	35.07	35.17	35.27	35.37	35.47	35.57	35.67	35.77	35.87	
38	35.97	36.07	36.17	36.27	36.37	36.47	36.57	36.67	36.77	36.86	
39	36.96	37.06	37.16	37.26	37.36	37.46	37.56	37.66	37.76	37.86	
40	37.96	38.06	38.16	38.26	38.36	38.46	38.56	38.66	38.76	38.86	

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.37. NRCS Rainfall-Runoff Table for CN = 86

Curve
86

Runoff for inches of rainfall—Curve no. 86

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.07	0.11	0.15
1	0.20	0.25	0.31	0.36	0.43	0.49	0.56	0.63	0.70	0.77
2	0.85	0.92	1.00	1.08	1.16	1.24	1.32	1.41	1.49	1.58
3	1.66	1.75	1.83	1.92	2.01	2.10	2.19	2.27	2.36	2.45
4	2.54	2.64	2.73	2.82	2.91	3.00	3.09	3.19	3.28	3.37
5	3.47	3.56	3.65	3.75	3.84	3.93	4.03	4.12	4.22	4.31
6	4.41	4.50	4.60	4.69	4.79	4.88	4.98	5.08	5.17	5.27
7	5.36	5.46	5.56	5.65	5.75	5.85	5.94	6.04	6.14	6.23
8	6.33	6.43	6.52	6.62	6.72	6.82	6.91	7.01	7.11	7.20
9	7.30	7.40	7.50	7.59	7.69	7.79	7.89	7.99	8.08	8.18
10	8.28	8.38	8.47	8.57	8.67	8.77	8.87	8.97	9.06	9.16
11	9.26	9.36	9.46	9.55	9.65	9.75	9.85	9.95	10.05	10.15
12	10.24	10.34	10.44	10.54	10.64	10.74	10.84	10.93	11.03	11.13
13	11.23	11.33	11.43	11.53	11.62	11.72	11.82	11.92	12.02	12.12
14	12.22	12.32	12.42	12.51	12.61	12.71	12.81	12.91	13.01	13.11
15	13.21	13.31	13.40	13.50	13.60	13.70	13.80	13.90	14.00	14.10
16	14.20	14.30	14.40	14.49	14.59	14.69	14.79	14.89	14.99	15.09
17	15.19	15.29	15.39	15.49	15.59	15.69	15.78	15.88	15.98	16.08
18	16.18	16.28	16.38	16.48	16.58	16.68	16.78	16.88	16.98	17.08
19	17.17	17.27	17.37	17.47	17.57	17.67	17.77	17.87	17.97	18.07
20	18.17	18.27	18.37	18.47	18.57	18.67	18.77	18.86	18.96	19.06
21	19.16	19.26	19.36	19.46	19.56	19.66	19.76	19.86	19.96	20.06
22	20.16	20.26	20.36	20.46	20.56	20.66	20.76	20.85	20.95	21.05
23	21.15	21.25	21.35	21.45	21.55	21.65	21.75	21.85	21.95	22.05
24	22.15	22.25	22.35	22.45	22.55	22.65	22.75	22.85	22.95	23.05
25	23.15	23.24	23.34	23.44	23.54	23.64	23.74	23.84	23.94	24.04
26	24.14	24.24	24.34	24.44	24.54	24.64	24.74	24.84	24.94	25.04
27	25.14	25.24	25.34	25.44	25.54	25.64	25.74	25.84	25.94	26.03
28	26.13	26.23	26.33	26.43	26.53	26.63	26.73	26.83	26.93	27.03
29	27.13	27.23	27.33	27.43	27.53	27.63	27.73	27.83	27.93	28.03
30	28.13	28.23	28.33	28.43	28.53	28.63	28.73	28.83	28.93	29.03
31	29.13	29.23	29.33	29.43	29.53	29.62	29.72	29.82	29.92	30.02
32	30.12	30.22	30.32	30.42	30.52	30.62	30.72	30.82	30.92	31.02
33	31.12	31.22	31.32	31.42	31.52	31.62	31.72	31.82	31.92	32.02
34	32.12	32.22	32.32	32.42	32.52	32.62	32.72	32.82	32.92	33.02
35	33.12	33.22	33.32	33.42	33.52	33.62	33.72	33.82	33.92	34.02
36	34.12	34.22	34.31	34.41	34.51	34.61	34.71	34.81	34.91	35.01
37	35.11	35.21	35.31	35.41	35.51	35.61	35.71	35.81	35.91	36.01
38	36.11	36.21	36.31	36.41	36.51	36.61	36.71	36.81	36.91	37.01
39	37.11	37.21	37.31	37.41	37.51	37.61	37.71	37.81	37.91	38.01
40	38.11	38.21	38.31	38.41	38.51	38.61	38.71	38.81	38.91	39.01

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.38. NRCS Rainfall-Runoff Table for CN = 87

Curve
87

Runoff for inches of rainfall—Curve no. 87

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.01	0.02	0.05	0.09	0.13	0.17
1	0.22	0.28	0.34	0.40	0.47	0.54	0.61	0.68	0.75	0.83
2	0.91	0.99	1.07	1.15	1.23	1.31	1.40	1.48	1.57	1.65
3	1.74	1.83	1.92	2.01	2.10	2.19	2.28	2.37	2.46	2.55
4	2.64	2.73	2.82	2.92	3.01	3.10	3.20	3.29	3.38	3.48
5	3.57	3.66	3.76	3.85	3.95	4.04	4.14	4.23	4.33	4.43
6	4.52	4.62	4.71	4.81	4.90	5.00	5.10	5.19	5.29	5.39
7	5.48	5.58	5.68	5.77	5.87	5.97	6.06	6.16	6.26	6.36
8	6.45	6.55	6.65	6.75	6.84	6.94	7.04	7.14	7.23	7.33
9	7.43	7.53	7.63	7.72	7.82	7.92	8.02	8.12	8.21	8.31
10	8.41	8.51	8.61	8.71	8.80	8.90	9.00	9.10	9.20	9.30
11	9.39	9.49	9.59	9.69	9.79	9.89	9.99	10.08	10.18	10.28
12	10.38	10.48	10.58	10.68	10.78	10.87	10.97	11.07	11.17	11.27
13	11.37	11.47	11.57	11.67	11.76	11.86	11.96	12.06	12.16	12.26
14	12.36	12.46	12.56	12.66	12.75	12.85	12.95	13.05	13.15	13.25
15	13.35	13.45	13.55	13.65	13.75	13.85	13.94	14.04	14.14	14.24
16	14.34	14.44	14.54	14.64	14.74	14.84	14.94	15.04	15.14	15.23
17	15.33	15.43	15.53	15.63	15.73	15.83	15.93	16.03	16.13	16.23
18	16.33	16.43	16.53	16.63	16.73	16.82	16.92	17.02	17.12	17.22
19	17.32	17.42	17.52	17.62	17.72	17.82	17.92	18.02	18.12	18.22
20	18.32	18.42	18.52	18.62	18.71	18.81	18.91	19.01	19.11	19.21
21	19.31	19.41	19.51	19.61	19.71	19.81	19.91	20.01	20.11	20.21
22	20.31	20.41	20.51	20.61	20.71	20.81	20.91	21.00	21.10	21.20
23	21.30	21.40	21.50	21.60	21.70	21.80	21.90	22.00	22.10	22.20
24	22.30	22.40	22.50	22.60	22.70	22.80	22.90	23.00	23.10	23.20
25	23.30	23.40	23.50	23.60	23.70	23.80	23.89	23.99	24.09	24.19
26	24.29	24.39	24.49	24.59	24.69	24.79	24.89	24.99	25.09	25.19
27	25.29	25.39	25.49	25.59	25.69	25.79	25.89	25.99	26.09	26.19
28	26.29	26.39	26.49	26.59	26.69	26.79	26.89	26.99	27.09	27.19
29	27.29	27.39	27.49	27.58	27.68	27.78	27.88	27.98	28.08	28.18
30	28.28	28.38	28.48	28.58	28.68	28.78	28.88	28.98	29.08	29.18
31	29.28	29.38	29.48	29.58	29.68	29.78	29.88	29.98	30.08	30.18
32	30.28	30.38	30.48	30.58	30.68	30.78	30.88	30.98	31.08	31.18
33	31.28	31.38	31.48	31.58	31.68	31.78	31.88	31.98	32.08	32.18
34	32.28	32.37	32.47	32.57	32.67	32.77	32.87	32.97	33.07	33.17
35	33.27	33.37	33.47	33.57	33.67	33.77	33.87	33.97	34.07	34.17
36	34.27	34.37	34.47	34.57	34.67	34.77	34.87	34.97	35.07	35.17
37	35.27	35.37	35.47	35.57	35.67	35.77	35.87	35.97	36.07	36.17
38	36.27	36.37	36.47	36.57	36.67	36.77	36.87	36.97	37.07	37.17
39	37.27	37.37	37.47	37.57	37.67	37.77	37.87	37.97	38.07	38.17
40	38.27	38.37	38.47	38.57	38.67	38.77	38.87	38.96	39.06	39.16

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.39. NRCS Rainfall-Runoff Table for CN = 88



Runoff for inches of rainfall—Curve no. 88

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.01	0.03	0.06	0.10	0.15	0.20
1	0.25	0.31	0.38	0.44	0.51	0.58	0.66	0.73	0.81	0.89
2	0.97	1.05	1.13	1.21	1.30	1.38	1.47	1.56	1.64	1.73
3	1.82	1.91	2.00	2.09	2.18	2.27	2.36	2.45	2.55	2.64
4	2.73	2.82	2.92	3.01	3.11	3.20	3.29	3.39	3.48	3.58
5	3.67	3.77	3.86	3.96	4.05	4.15	4.24	4.34	4.44	4.53
6	4.63	4.73	4.82	4.92	5.02	5.11	5.21	5.31	5.40	5.50
7	5.60	5.69	5.79	5.89	5.99	6.08	6.18	6.28	6.38	6.47
8	6.57	6.67	6.77	6.87	6.96	7.06	7.16	7.26	7.36	7.45
9	7.55	7.65	7.75	7.85	7.94	8.04	8.14	8.24	8.34	8.44
10	8.53	8.63	8.73	8.83	8.93	9.03	9.13	9.22	9.32	9.42
11	9.52	9.62	9.72	9.82	9.92	10.01	10.11	10.21	10.31	10.41
12	10.51	10.61	10.71	10.81	10.91	11.00	11.10	11.20	11.30	11.40
13	11.50	11.60	11.70	11.80	11.90	11.99	12.09	12.19	12.29	12.39
14	12.49	12.59	12.69	12.79	12.89	12.99	13.09	13.19	13.28	13.38
15	13.48	13.58	13.68	13.78	13.88	13.98	14.08	14.18	14.28	14.38
16	14.48	14.58	14.67	14.77	14.87	14.97	15.07	15.17	15.27	15.37
17	15.47	15.57	15.67	15.77	15.87	15.97	16.07	16.17	16.27	16.37
18	16.46	16.56	16.66	16.76	16.86	16.96	17.06	17.16	17.26	17.36
19	17.46	17.56	17.66	17.76	17.86	17.96	18.06	18.16	18.26	18.36
20	18.46	18.56	18.65	18.75	18.85	18.95	19.05	19.15	19.25	19.35
21	19.45	19.55	19.65	19.75	19.85	19.95	20.05	20.15	20.25	20.35
22	20.45	20.55	20.65	20.75	20.85	20.95	21.05	21.15	21.25	21.35
23	21.44	21.54	21.64	21.74	21.84	21.94	22.04	22.14	22.24	22.34
24	22.44	22.54	22.64	22.74	22.84	22.94	23.04	23.14	23.24	23.34
25	23.44	23.54	23.64	23.74	23.84	23.94	24.04	24.14	24.24	24.34
26	24.44	24.54	24.64	24.74	24.84	24.94	25.03	25.13	25.23	25.33
27	25.43	25.53	25.63	25.73	25.83	25.93	26.03	26.13	26.23	26.33
28	26.43	26.53	26.63	26.73	26.83	26.93	27.03	27.13	27.23	27.33
29	27.43	27.53	27.63	27.73	27.83	27.93	28.03	28.13	28.23	28.33
30	28.43	28.53	28.63	28.73	28.83	28.93	29.03	29.13	29.23	29.33
31	29.43	29.53	29.63	29.73	29.82	29.92	30.02	30.12	30.22	30.32
32	30.42	30.52	30.62	30.72	30.82	30.92	31.02	31.12	31.22	31.32
33	31.42	31.52	31.62	31.72	31.82	31.92	32.02	32.12	32.22	32.32
34	32.42	32.52	32.62	32.72	32.82	32.92	33.02	33.12	33.22	33.32
35	33.42	33.52	33.62	33.72	33.82	33.92	34.02	34.12	34.22	34.32
36	34.42	34.52	34.62	34.72	34.82	34.92	35.02	35.12	35.22	35.32
37	35.42	35.52	35.62	35.72	35.82	35.92	36.02	36.12	36.22	36.32
38	36.42	36.52	36.62	36.71	36.81	36.91	37.01	37.11	37.21	37.31
39	37.41	37.51	37.61	37.71	37.81	37.91	38.01	38.11	38.21	38.31
40	38.41	38.51	38.61	38.71	38.81	38.91	39.01	39.11	39.21	39.31

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.40. NRCS Rainfall-Runoff Table for CN = 89

Curve
89

Runoff for inches of rainfall—Curve no. 89

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.00	0.02	0.04	0.08	0.12	0.17	0.22
1	0.28	0.35	0.41	0.48	0.55	0.63	0.71	0.78	0.86	0.94
2	1.03	1.11	1.19	1.28	1.37	1.45	1.54	1.63	1.72	1.81
3	1.90	1.99	2.08	2.17	2.26	2.35	2.45	2.54	2.63	2.73
4	2.82	2.91	3.01	3.10	3.20	3.29	3.39	3.48	3.58	3.67
5	3.77	3.86	3.96	4.06	4.15	4.25	4.35	4.44	4.54	4.64
6	4.73	4.83	4.93	5.02	5.12	5.22	5.31	5.41	5.51	5.61
7	5.70	5.80	5.90	6.00	6.10	6.19	6.29	6.39	6.49	6.58
8	6.68	6.78	6.88	6.98	7.08	7.17	7.27	7.37	7.47	7.57
9	7.67	7.76	7.86	7.96	8.06	8.16	8.26	8.36	8.45	8.55
10	8.65	8.75	8.85	8.95	9.05	9.15	9.24	9.34	9.44	9.54
11	9.64	9.74	9.84	9.94	10.04	10.14	10.23	10.33	10.43	10.53
12	10.63	10.73	10.83	10.93	11.03	11.13	11.23	11.32	11.42	11.52
13	11.62	11.72	11.82	11.92	12.02	12.12	12.22	12.32	12.42	12.52
14	12.61	12.71	12.81	12.91	13.01	13.11	13.21	13.31	13.41	13.51
15	13.61	13.71	13.81	13.91	14.01	14.11	14.20	14.30	14.40	14.50
16	14.60	14.70	14.80	14.90	15.00	15.10	15.20	15.30	15.40	15.50
17	15.60	15.70	15.80	15.90	16.00	16.10	16.19	16.29	16.39	16.49
18	16.59	16.69	16.79	16.89	16.99	17.09	17.19	17.29	17.39	17.49
19	17.59	17.69	17.79	17.89	17.99	18.09	18.19	18.29	18.39	18.49
20	18.59	18.68	18.78	18.88	18.98	19.08	19.18	19.28	19.38	19.48
21	19.58	19.68	19.78	19.88	19.98	20.08	20.18	20.28	20.38	20.48
22	20.58	20.68	20.78	20.88	20.98	21.08	21.18	21.28	21.38	21.48
23	21.58	21.68	21.78	21.88	21.98	22.07	22.17	22.27	22.37	22.47
24	22.57	22.67	22.77	22.87	22.97	23.07	23.17	23.27	23.37	23.47
25	23.57	23.67	23.77	23.87	23.97	24.07	24.17	24.27	24.37	24.47
26	24.57	24.67	24.77	24.87	24.97	25.07	25.17	25.27	25.37	25.47
27	25.57	25.67	25.77	25.87	25.97	26.07	26.17	26.27	26.37	26.47
28	26.57	26.66	26.76	26.86	26.96	27.06	27.16	27.26	27.36	27.46
29	27.56	27.66	27.76	27.86	27.96	28.06	28.16	28.26	28.36	28.46
30	28.56	28.66	28.76	28.86	28.96	29.06	29.16	29.26	29.36	29.46
31	29.56	29.66	29.76	29.86	29.96	30.06	30.16	30.26	30.36	30.46
32	30.56	30.66	30.76	30.86	30.96	31.06	31.16	31.26	31.36	31.46
33	31.56	31.66	31.76	31.86	31.96	32.06	32.16	32.26	32.36	32.46
34	32.56	32.66	32.76	32.86	32.96	33.06	33.16	33.26	33.35	33.45
35	33.55	33.65	33.75	33.85	33.95	34.05	34.15	34.25	34.35	34.45
36	34.55	34.65	34.75	34.85	34.95	35.05	35.15	35.25	35.35	35.45
37	35.55	35.65	35.75	35.85	35.95	36.05	36.15	36.25	36.35	36.45
38	36.55	36.65	36.75	36.85	36.95	37.05	37.15	37.25	37.35	37.45
39	37.55	37.65	37.75	37.85	37.95	38.05	38.15	38.25	38.35	38.45
40	38.55	38.65	38.75	38.85	38.95	39.05	39.15	39.25	39.35	39.45

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^3}{P + 0.8S}$

Table 11-C.41. NRCS Rainfall-Runoff Table for CN = 90



Runoff for inches of rainfall—Curve no. 90

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.01	0.02	0.06	0.10	0.14	0.20	0.26
1	0.32	0.39	0.46	0.53	0.61	0.68	0.76	0.84	0.93	1.01
2	1.09	1.18	1.27	1.35	1.44	1.53	1.62	1.71	1.80	1.89
3	1.98	2.08	2.17	2.26	2.36	2.45	2.54	2.64	2.73	2.83
4	2.92	3.02	3.11	3.21	3.30	3.40	3.49	3.59	3.68	3.78
5	3.88	3.97	4.07	4.17	4.26	4.36	4.46	4.56	4.65	4.75
6	4.85	4.94	5.04	5.14	5.24	5.33	5.43	5.53	5.63	5.73
7	5.82	5.92	6.02	6.12	6.22	6.31	6.41	6.51	6.61	6.71
8	6.81	6.91	7.00	7.10	7.20	7.30	7.40	7.50	7.60	7.69
9	7.79	7.89	7.99	8.09	8.19	8.29	8.39	8.48	8.58	8.68
10	8.78	8.88	8.98	9.08	9.18	9.28	9.38	9.47	9.57	9.67
11	9.77	9.87	9.97	10.07	10.17	10.27	10.37	10.47	10.57	10.66
12	10.76	10.86	10.96	11.06	11.16	11.26	11.36	11.46	11.56	11.66
13	11.76	11.86	11.96	12.05	12.15	12.25	12.35	12.45	12.55	12.65
14	12.75	12.85	12.95	13.05	13.15	13.25	13.35	13.45	13.55	13.65
15	13.75	13.85	13.94	14.04	14.14	14.24	14.34	14.44	14.54	14.64
16	14.74	14.84	14.94	15.04	15.14	15.24	15.34	15.44	15.54	15.64
17	15.74	15.84	15.94	16.04	16.14	16.24	16.33	16.43	16.53	16.63
18	16.73	16.83	16.93	17.03	17.13	17.23	17.33	17.43	17.53	17.63
19	17.73	17.83	17.93	18.03	18.13	18.23	18.33	18.43	18.53	18.63
20	18.73	18.83	18.93	19.03	19.13	19.23	19.33	19.43	19.52	19.62
21	19.72	19.82	19.92	20.02	20.12	20.22	20.32	20.42	20.52	20.62
22	20.72	20.82	20.92	21.02	21.12	21.22	21.32	21.42	21.52	21.62
23	21.72	21.82	21.92	22.02	22.12	22.22	22.32	22.42	22.52	22.62
24	22.72	22.82	22.92	23.02	23.12	23.22	23.32	23.42	23.52	23.62
25	23.72	23.82	23.92	24.02	24.11	24.21	24.31	24.41	24.51	24.61
26	24.71	24.81	24.91	25.01	25.11	25.21	25.31	25.41	25.51	25.61
27	25.71	25.81	25.91	26.01	26.11	26.21	26.31	26.41	26.51	26.61
28	26.71	26.81	26.91	27.01	27.11	27.21	27.31	27.41	27.51	27.61
29	27.71	27.81	27.91	28.01	28.11	28.21	28.31	28.41	28.51	28.61
30	28.71	28.81	28.91	29.01	29.11	29.21	29.31	29.41	29.51	29.61
31	29.71	29.81	29.91	30.01	30.11	30.21	30.31	30.41	30.51	30.61
32	30.71	30.81	30.91	31.01	31.11	31.20	31.30	31.40	31.50	31.60
33	31.70	31.80	31.90	32.00	32.10	32.20	32.30	32.40	32.50	32.60
34	32.70	32.80	32.90	33.00	33.10	33.20	33.30	33.40	33.50	33.60
35	33.70	33.80	33.90	34.00	34.10	34.20	34.30	34.40	34.50	34.60
36	34.70	34.80	34.90	35.00	35.10	35.20	35.30	35.40	35.50	35.60
37	35.70	35.80	35.90	36.00	36.10	36.20	36.30	36.40	36.50	36.60
38	36.70	36.80	36.90	37.00	37.10	37.20	37.30	37.40	37.50	37.60
39	37.70	37.80	37.90	38.00	38.10	38.20	38.30	38.40	38.50	38.60
40	38.70	38.80	38.90	39.00	39.10	39.20	39.30	39.40	39.50	39.60

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.42. NRCS Rainfall-Runoff Table for CN = 91

Curve
91

Runoff for inches of rainfall—Curve no. 91

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.01	0.03	0.07	0.12	0.17	0.23	0.29
1	0.36	0.43	0.50	0.58	0.66	0.74	0.82	0.91	0.99	1.08
2	1.16	1.25	1.34	1.43	1.52	1.61	1.70	1.79	1.89	1.98
3	2.07	2.16	2.26	2.35	2.45	2.54	2.64	2.73	2.83	2.92
4	3.02	3.11	3.21	3.31	3.40	3.50	3.59	3.69	3.79	3.89
5	3.98	4.08	4.18	4.27	4.37	4.47	4.57	4.66	4.76	4.86
6	4.96	5.06	5.15	5.25	5.35	5.45	5.55	5.64	5.74	5.84
7	5.94	6.04	6.14	6.23	6.33	6.43	6.53	6.63	6.73	6.83
8	6.92	7.02	7.12	7.22	7.32	7.42	7.52	7.62	7.72	7.81
9	7.91	8.01	8.11	8.21	8.31	8.41	8.51	8.61	8.71	8.80
10	8.90	9.00	9.10	9.20	9.30	9.40	9.50	9.60	9.70	9.80
11	9.90	10.00	10.09	10.19	10.29	10.39	10.49	10.59	10.69	10.79
12	10.89	10.99	11.09	11.19	11.29	11.39	11.49	11.59	11.69	11.78
13	11.88	11.98	12.08	12.18	12.28	12.38	12.48	12.58	12.68	12.78
14	12.88	12.98	13.08	13.18	13.28	13.38	13.48	13.58	13.68	13.78
15	13.88	13.97	14.07	14.17	14.27	14.37	14.47	14.57	14.67	14.77
16	14.87	14.97	15.07	15.17	15.27	15.37	15.47	15.57	15.67	15.77
17	15.87	15.97	16.07	16.17	16.27	16.37	16.47	16.57	16.67	16.77
18	16.87	16.96	17.06	17.16	17.26	17.36	17.46	17.56	17.66	17.76
19	17.86	17.96	18.06	18.16	18.26	18.36	18.46	18.56	18.66	18.76
20	18.86	18.96	19.06	19.16	19.26	19.36	19.46	19.56	19.66	19.76
21	19.86	19.96	20.06	20.16	20.26	20.36	20.46	20.56	20.66	20.76
22	20.86	20.96	21.06	21.16	21.26	21.36	21.46	21.55	21.65	21.75
23	21.85	21.95	22.05	22.15	22.25	22.35	22.45	22.55	22.65	22.75
24	22.85	22.95	23.05	23.15	23.25	23.35	23.45	23.55	23.65	23.75
25	23.85	23.95	24.05	24.15	24.25	24.35	24.45	24.55	24.65	24.75
26	24.85	24.95	25.05	25.15	25.25	25.35	25.45	25.55	25.65	25.75
27	25.85	25.95	26.05	26.15	26.25	26.35	26.45	26.55	26.65	26.75
28	26.85	26.95	27.05	27.15	27.25	27.35	27.45	27.55	27.65	27.75
29	27.85	27.95	28.05	28.15	28.25	28.35	28.45	28.55	28.65	28.75
30	28.84	28.94	29.04	29.14	29.24	29.34	29.44	29.54	29.64	29.74
31	29.84	29.94	30.04	30.14	30.24	30.34	30.44	30.54	30.64	30.74
32	30.84	30.94	31.04	31.14	31.24	31.34	31.44	31.54	31.64	31.74
33	31.84	31.94	32.04	32.14	32.24	32.34	32.44	32.54	32.64	32.74
34	32.84	32.94	33.04	33.14	33.24	33.34	33.44	33.54	33.64	33.74
35	33.84	33.94	34.04	34.14	34.24	34.34	34.44	34.54	34.64	34.74
36	34.84	34.94	35.04	35.14	35.24	35.34	35.44	35.54	35.64	35.74
37	35.84	35.94	36.04	36.14	36.24	36.34	36.44	36.54	36.64	36.74
38	36.84	36.94	37.04	37.14	37.24	37.34	37.44	37.54	37.64	37.74
39	37.84	37.94	38.04	38.14	38.24	38.34	38.44	38.54	38.64	38.74
40	38.84	38.94	39.04	39.14	39.24	39.34	39.44	39.54	39.64	39.74

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.43. NRCS Rainfall-Runoff Table for CN = 92

Curve
92

Runoff for inches of rainfall—Curve no. 92

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.02	0.05	0.09	0.14	0.20	0.26	0.33
1	0.40	0.48	0.56	0.64	0.72	0.80	0.89	0.97	1.06	1.15
2	1.24	1.33	1.42	1.51	1.60	1.69	1.79	1.88	1.97	2.07
3	2.16	2.26	2.35	2.45	2.54	2.64	2.73	2.83	2.92	3.02
4	3.12	3.21	3.31	3.41	3.50	3.60	3.70	3.80	3.89	3.99
5	4.09	4.19	4.28	4.38	4.48	4.58	4.68	4.77	4.87	4.97
6	5.07	5.17	5.27	5.36	5.46	5.56	5.66	5.76	5.86	5.96
7	6.05	6.15	6.25	6.35	6.45	6.55	6.65	6.75	6.85	6.94
8	7.04	7.14	7.24	7.34	7.44	7.54	7.64	7.74	7.84	7.93
9	8.03	8.13	8.23	8.33	8.43	8.53	8.63	8.73	8.83	8.93
10	9.03	9.13	9.23	9.32	9.42	9.52	9.62	9.72	9.82	9.92
11	10.02	10.12	10.22	10.32	10.42	10.52	10.62	10.72	10.82	10.92
12	11.02	11.12	11.21	11.31	11.41	11.51	11.61	11.71	11.81	11.91
13	12.01	12.11	12.21	12.31	12.41	12.51	12.61	12.71	12.81	12.91
14	13.01	13.11	13.21	13.31	13.41	13.51	13.61	13.71	13.80	13.90
15	14.00	14.10	14.20	14.30	14.40	14.50	14.60	14.70	14.80	14.90
16	15.00	15.10	15.20	15.30	15.40	15.50	15.60	15.70	15.80	15.90
17	16.00	16.10	16.20	16.30	16.40	16.50	16.60	16.70	16.80	16.90
18	17.00	17.10	17.20	17.30	17.40	17.50	17.60	17.70	17.79	17.89
19	17.99	18.09	18.19	18.29	18.39	18.49	18.59	18.69	18.79	18.89
20	18.99	19.09	19.19	19.29	19.39	19.49	19.59	19.69	19.79	19.89
21	19.99	20.09	20.19	20.29	20.39	20.49	20.59	20.69	20.79	20.89
22	20.99	21.09	21.19	21.29	21.39	21.49	21.59	21.69	21.79	21.89
23	21.99	22.09	22.19	22.29	22.39	22.49	22.59	22.69	22.79	22.89
24	22.99	23.09	23.19	23.29	23.39	23.49	23.59	23.69	23.79	23.89
25	23.99	24.09	24.19	24.29	24.39	24.48	24.58	24.68	24.78	24.88
26	24.98	25.08	25.18	25.28	25.38	25.48	25.58	25.68	25.78	25.88
27	25.98	26.08	26.18	26.28	26.38	26.48	26.58	26.68	26.78	26.88
28	26.98	27.08	27.18	27.28	27.38	27.48	27.58	27.68	27.78	27.88
29	27.98	28.08	28.18	28.28	28.38	28.48	28.58	28.68	28.78	28.88
30	28.98	29.08	29.18	29.28	29.38	29.48	29.58	29.68	29.78	29.88
31	29.98	30.08	30.18	30.28	30.38	30.48	30.58	30.68	30.78	30.88
32	30.98	31.08	31.18	31.28	31.38	31.48	31.58	31.68	31.78	31.88
33	31.98	32.08	32.18	32.28	32.38	32.48	32.58	32.68	32.78	32.88
34	32.98	33.08	33.18	33.28	33.38	33.48	33.58	33.68	33.78	33.88
35	33.98	34.08	34.18	34.28	34.38	34.48	34.58	34.68	34.78	34.88
36	34.98	35.08	35.18	35.28	35.38	35.48	35.58	35.68	35.78	35.88
37	35.98	36.08	36.18	36.28	36.38	36.48	36.58	36.68	36.78	36.88
38	36.98	37.08	37.18	37.28	37.38	37.48	37.58	37.68	37.78	37.88
39	37.98	38.08	38.17	38.27	38.37	38.47	38.57	38.67	38.77	38.87
40	38.97	39.07	39.17	39.27	39.37	39.47	39.57	39.67	39.77	39.87

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.44. NRCS Rainfall-Runoff Table for CN = 93

Curve
93

Runoff for inches of rainfall—Curve no. 93

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.00	0.02	0.06	0.11	0.17	0.23	0.30	0.37
1	0.45	0.53	0.61	0.69	0.78	0.87	0.95	1.04	1.13	1.22
2	1.31	1.41	1.50	1.59	1.69	1.78	1.87	1.97	2.06	2.16
3	2.25	2.35	2.45	2.54	2.64	2.73	2.83	2.93	3.03	3.12
4	3.22	3.32	3.41	3.51	3.61	3.71	3.81	3.90	4.00	4.10
5	4.20	4.30	4.39	4.49	4.59	4.69	4.79	4.89	4.98	5.08
6	5.18	5.28	5.38	5.48	5.58	5.68	5.78	5.87	5.97	6.07
7	6.17	6.27	6.37	6.47	6.57	6.67	6.77	6.86	6.96	7.06
8	7.16	7.26	7.36	7.46	7.56	7.66	7.76	7.86	7.96	8.06
9	8.16	8.25	8.35	8.45	8.55	8.65	8.75	8.85	8.95	9.05
10	9.16	9.25	9.35	9.45	9.55	9.65	9.75	9.85	9.95	10.05
11	10.15	10.24	10.34	10.44	10.54	10.64	10.74	10.84	10.94	11.04
12	11.14	11.24	11.34	11.44	11.54	11.64	11.74	11.84	11.94	12.04
13	12.14	12.24	12.34	12.44	12.54	12.64	12.74	12.84	12.94	13.04
14	13.14	13.23	13.33	13.43	13.53	13.63	13.73	13.83	13.93	14.03
15	14.13	14.23	14.33	14.43	14.53	14.63	14.73	14.83	14.93	15.03
16	15.13	15.23	15.33	15.43	15.53	15.63	15.73	15.83	15.93	16.03
17	16.13	16.23	16.33	16.43	16.53	16.63	16.73	16.83	16.93	17.03
18	17.13	17.23	17.33	17.43	17.53	17.63	17.73	17.83	17.93	18.03
19	18.13	18.23	18.33	18.42	18.52	18.62	18.72	18.82	18.92	19.02
20	19.12	19.22	19.32	19.42	19.52	19.62	19.72	19.82	19.92	20.02
21	20.12	20.22	20.32	20.42	20.52	20.62	20.72	20.82	20.92	21.02
22	21.12	21.22	21.32	21.42	21.52	21.62	21.72	21.82	21.92	22.02
23	22.12	22.22	22.32	22.42	22.52	22.62	22.72	22.82	22.92	23.02
24	23.12	23.22	23.32	23.42	23.52	23.62	23.72	23.82	23.92	24.02
25	24.12	24.22	24.32	24.42	24.52	24.62	24.72	24.82	24.92	25.02
26	25.12	25.22	25.32	25.42	25.52	25.62	25.72	25.82	25.92	26.02
27	26.12	26.22	26.32	26.42	26.52	26.62	26.72	26.82	26.92	27.02
28	27.12	27.22	27.32	27.42	27.52	27.62	27.72	27.82	27.92	28.02
29	28.12	28.22	28.32	28.42	28.52	28.62	28.72	28.82	28.92	29.01
30	29.11	29.21	29.31	29.41	29.51	29.61	29.71	29.81	29.91	30.01
31	30.11	30.21	30.31	30.41	30.51	30.61	30.71	30.81	30.91	31.01
32	31.11	31.21	31.31	31.41	31.51	31.61	31.71	31.81	31.91	32.01
33	32.11	32.21	32.31	32.41	32.51	32.61	32.71	32.81	32.91	33.01
34	33.11	33.21	33.31	33.41	33.51	33.61	33.71	33.81	33.91	34.01
35	34.11	34.21	34.31	34.41	34.51	34.61	34.71	34.81	34.91	35.01
36	35.11	35.21	35.31	35.41	35.51	35.61	35.71	35.81	35.91	36.01
37	36.11	36.21	36.31	36.41	36.51	36.61	36.71	36.81	36.91	37.01
38	37.11	37.21	37.31	37.41	37.51	37.61	37.71	37.81	37.91	38.01
39	38.11	38.21	38.31	38.41	38.51	38.61	38.71	38.81	38.91	39.01
40	39.11	39.21	39.31	39.41	39.51	39.61	39.71	39.81	39.91	40.01

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.45. NRCS Rainfall-Runoff Table for CN = 94

Curve
94

Runoff for inches of rainfall—Curve no. 94

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.01	0.04	0.08	0.14	0.20	0.27	0.35	0.42
1	0.50	0.59	0.67	0.76	0.85	0.94	1.03	1.12	1.21	1.30
2	1.40	1.49	1.58	1.68	1.77	1.87	1.97	2.06	2.16	2.25
3	2.35	2.45	2.54	2.64	2.74	2.84	2.93	3.03	3.13	3.23
4	3.32	3.42	3.52	3.62	3.72	3.82	3.91	4.01	4.11	4.21
5	4.31	4.41	4.51	4.60	4.70	4.80	4.90	5.00	5.10	5.20
6	5.30	5.40	5.50	5.59	5.69	5.79	5.89	5.99	6.09	6.19
7	6.29	6.39	6.49	6.59	6.69	6.79	6.88	6.98	7.08	7.18
8	7.28	7.38	7.48	7.58	7.68	7.78	7.88	7.98	8.08	8.18
9	8.28	8.38	8.48	8.58	8.68	8.78	8.87	8.97	9.07	9.17
10	9.27	9.37	9.47	9.57	9.67	9.77	9.87	9.97	10.07	10.17
11	10.27	10.37	10.47	10.57	10.67	10.77	10.87	10.97	11.07	11.17
12	11.27	11.37	11.47	11.57	11.67	11.77	11.87	11.97	12.06	12.16
13	12.26	12.36	12.46	12.56	12.66	12.76	12.86	12.96	13.06	13.16
14	13.26	13.36	13.46	13.56	13.66	13.76	13.86	13.96	14.06	14.16
15	14.26	14.36	14.46	14.56	14.66	14.76	14.86	14.96	15.06	15.16
16	15.26	15.36	15.46	15.56	15.66	15.76	15.86	15.96	16.06	16.16
17	16.26	16.36	16.46	16.56	16.66	16.76	16.86	16.96	17.06	17.16
18	17.26	17.36	17.46	17.56	17.66	17.76	17.86	17.96	18.06	18.16
19	18.26	18.36	18.46	18.55	18.65	18.75	18.85	18.95	19.05	19.15
20	19.25	19.35	19.45	19.55	19.65	19.75	19.85	19.95	20.05	20.15
21	20.25	20.35	20.45	20.55	20.65	20.75	20.85	20.95	21.05	21.15
22	21.25	21.35	21.45	21.55	21.65	21.75	21.85	21.95	22.05	22.15
23	22.25	22.35	22.45	22.55	22.65	22.75	22.85	22.95	23.05	23.15
24	23.25	23.35	23.45	23.55	23.65	23.75	23.85	23.95	24.05	24.15
25	24.25	24.35	24.45	24.55	24.65	24.75	24.85	24.95	25.05	25.15
26	25.25	25.35	25.45	25.55	25.65	25.75	25.85	25.95	26.05	26.15
27	26.25	26.35	26.45	26.55	26.65	26.75	26.85	26.95	27.05	27.15
28	27.25	27.35	27.45	27.55	27.65	27.75	27.85	27.95	28.05	28.15
29	28.25	28.35	28.45	28.55	28.65	28.75	28.85	28.95	29.05	29.15
30	29.25	29.35	29.45	29.55	29.65	29.75	29.85	29.95	30.05	30.15
31	30.25	30.35	30.45	30.55	30.65	30.75	30.85	30.95	31.05	31.15
32	31.25	31.35	31.45	31.55	31.65	31.75	31.85	31.95	32.05	32.15
33	32.25	32.35	32.45	32.55	32.65	32.75	32.85	32.95	33.05	33.15
34	33.25	33.35	33.45	33.55	33.65	33.75	33.85	33.95	34.05	34.15
35	34.25	34.35	34.45	34.55	34.65	34.75	34.85	34.95	35.05	35.15
36	35.25	35.35	35.45	35.55	35.65	35.75	35.85	35.95	36.05	36.15
37	36.25	36.35	36.45	36.55	36.65	36.75	36.85	36.95	37.05	37.14
38	37.24	37.34	37.44	37.54	37.64	37.74	37.84	37.94	38.04	38.14
39	38.24	38.34	38.44	38.54	38.64	38.74	38.84	38.94	39.04	39.14
40	39.24	39.34	39.44	39.54	39.64	39.74	39.84	39.94	40.04	40.14

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.46. NRCS Rainfall-Runoff Table for CN = 95

Curve
95

Runoff for inches of rainfall—Curve no. 95

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.01	0.05	0.11	0.17	0.24	0.32	0.40	0.48
1	0.56	0.65	0.74	0.83	0.92	1.01	1.11	1.20	1.29	1.39
2	1.48	1.58	1.67	1.77	1.87	1.96	2.06	2.16	2.25	2.35
3	2.45	2.55	2.65	2.74	2.84	2.94	3.04	3.14	3.23	3.33
4	3.43	3.53	3.63	3.73	3.83	3.93	4.02	4.12	4.22	4.32
5	4.42	4.52	4.62	4.72	4.82	4.92	5.01	5.11	5.21	5.31
6	5.41	5.51	5.61	5.71	5.81	5.91	6.01	6.11	6.21	6.31
7	6.41	6.51	6.61	6.70	6.80	6.90	7.00	7.10	7.20	7.30
8	7.40	7.50	7.60	7.70	7.80	7.90	8.00	8.10	8.20	8.30
9	8.40	8.50	8.60	8.70	8.80	8.90	9.00	9.10	9.20	9.30
10	9.40	9.50	9.59	9.69	9.79	9.89	9.99	10.09	10.19	10.29
11	10.39	10.49	10.59	10.69	10.79	10.89	10.99	11.09	11.19	11.29
12	11.39	11.49	11.59	11.69	11.79	11.89	11.99	12.09	12.19	12.29
13	12.39	12.49	12.59	12.69	12.79	12.89	12.99	13.09	13.19	13.29
14	13.39	13.49	13.59	13.69	13.79	13.89	13.99	14.09	14.19	14.29
15	14.39	14.49	14.59	14.69	14.79	14.89	14.99	15.09	15.19	15.29
16	15.39	15.49	15.59	15.69	15.79	15.89	15.99	16.08	16.18	16.28
17	16.38	16.48	16.58	16.68	16.78	16.88	16.98	17.08	17.18	17.28
18	17.38	17.48	17.58	17.68	17.78	17.88	17.98	18.08	18.18	18.28
19	18.38	18.48	18.58	18.68	18.78	18.88	18.98	19.08	19.18	19.28
20	19.38	19.48	19.58	19.68	19.78	19.88	19.98	20.08	20.18	20.28
21	20.38	20.48	20.58	20.68	20.78	20.88	20.98	21.08	21.18	21.28
22	21.38	21.48	21.58	21.68	21.78	21.88	21.98	22.08	22.18	22.28
23	22.38	22.48	22.58	22.68	22.78	22.88	22.98	23.08	23.18	23.28
24	23.38	23.48	23.58	23.68	23.78	23.88	23.98	24.08	24.18	24.28
25	24.38	24.48	24.58	24.68	24.78	24.88	24.98	25.08	25.18	25.28
26	25.38	25.48	25.58	25.68	25.78	25.88	25.98	26.08	26.18	26.28
27	26.38	26.48	26.58	26.68	26.78	26.88	26.98	27.08	27.18	27.28
28	27.38	27.48	27.58	27.68	27.78	27.88	27.98	28.08	28.18	28.28
29	28.38	28.48	28.58	28.68	28.78	28.88	28.98	29.08	29.18	29.28
30	29.38	29.48	29.58	29.68	29.78	29.88	29.98	30.08	30.18	30.28
31	30.38	30.48	30.58	30.68	30.78	30.88	30.98	31.08	31.18	31.28
32	31.38	31.48	31.58	31.68	31.78	31.88	31.98	32.08	32.18	32.28
33	32.38	32.48	32.58	32.68	32.78	32.88	32.98	33.08	33.18	33.28
34	33.38	33.48	33.58	33.68	33.78	33.88	33.98	34.08	34.18	34.28
35	34.38	34.48	34.58	34.68	34.78	34.88	34.98	35.08	35.18	35.28
36	35.38	35.48	35.58	35.68	35.78	35.88	35.98	36.08	36.18	36.28
37	36.38	36.48	36.58	36.68	36.78	36.88	36.98	37.08	37.18	37.28
38	37.38	37.48	37.58	37.68	37.78	37.88	37.98	38.08	38.18	38.28
39	38.38	38.48	38.58	38.68	38.78	38.88	38.98	39.08	39.18	39.28
40	39.38	39.48	39.58	39.68	39.78	39.88	39.98	40.08	40.18	40.28

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.47. NRCS Rainfall-Runoff Table for CN = 96



Runoff for inches of rainfall—Curve no. 96

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.03	0.07	0.14	0.21	0.29	0.37	0.45	0.54
1	0.63	0.72	0.81	0.91	1.00	1.09	1.19	1.29	1.38	1.48
2	1.57	1.67	1.77	1.87	1.96	2.06	2.16	2.26	2.36	2.45
3	2.55	2.65	2.75	2.85	2.95	3.04	3.14	3.24	3.34	3.44
4	3.54	3.64	3.74	3.84	3.94	4.04	4.13	4.23	4.33	4.43
5	4.53	4.63	4.73	4.83	4.93	5.03	5.13	5.23	5.33	5.43
6	5.53	5.63	5.73	5.83	5.93	6.03	6.12	6.22	6.32	6.42
7	6.52	6.62	6.72	6.82	6.92	7.02	7.12	7.22	7.32	7.42
8	7.52	7.62	7.72	7.82	7.92	8.02	8.12	8.22	8.32	8.42
9	8.52	8.62	8.72	8.82	8.92	9.02	9.12	9.22	9.32	9.42
10	9.52	9.62	9.72	9.82	9.92	10.02	10.12	10.22	10.32	10.42
11	10.51	10.61	10.71	10.81	10.91	11.01	11.11	11.21	11.31	11.41
12	11.51	11.61	11.71	11.81	11.91	12.01	12.11	12.21	12.31	12.41
13	12.51	12.61	12.71	12.81	12.91	13.01	13.11	13.21	13.31	13.41
14	13.51	13.61	13.71	13.81	13.91	14.01	14.11	14.21	14.31	14.41
15	14.51	14.61	14.71	14.81	14.91	15.01	15.11	15.21	15.31	15.41
16	15.51	15.61	15.71	15.81	15.91	16.01	16.11	16.21	16.31	16.41
17	16.51	16.61	16.71	16.81	16.91	17.01	17.11	17.21	17.31	17.41
18	17.51	17.61	17.71	17.81	17.91	18.01	18.11	18.21	18.31	18.41
19	18.51	18.61	18.71	18.81	18.91	19.01	19.11	19.21	19.31	19.41
20	19.51	19.61	19.71	19.81	19.91	20.01	20.11	20.21	20.31	20.41
21	20.51	20.61	20.71	20.81	20.91	21.01	21.11	21.21	21.31	21.41
22	21.51	21.61	21.71	21.81	21.91	22.01	22.11	22.21	22.31	22.41
23	22.51	22.61	22.71	22.81	22.91	23.01	23.11	23.21	23.31	23.41
24	23.51	23.61	23.71	23.81	23.91	24.01	24.11	24.21	24.31	24.41
25	24.51	24.61	24.71	24.81	24.91	25.01	25.11	25.21	25.31	25.41
26	25.51	25.61	25.71	25.81	25.91	26.01	26.11	26.21	26.31	26.41
27	26.51	26.61	26.71	26.81	26.91	27.01	27.11	27.21	27.31	27.41
28	27.51	27.61	27.71	27.81	27.91	28.01	28.11	28.21	28.31	28.41
29	28.51	28.61	28.71	28.81	28.91	29.01	29.11	29.21	29.31	29.41
30	29.51	29.61	29.71	29.81	29.91	30.01	30.11	30.21	30.31	30.41
31	30.51	30.61	30.71	30.81	30.91	31.01	31.11	31.21	31.31	31.40
32	31.50	31.60	31.70	31.80	31.90	32.00	32.10	32.20	32.30	32.40
33	32.50	32.60	32.70	32.80	32.90	33.00	33.10	33.20	33.30	33.40
34	33.50	33.60	33.70	33.80	33.90	34.00	34.10	34.20	34.30	34.40
35	34.50	34.60	34.70	34.80	34.90	35.00	35.10	35.20	35.30	35.40
36	35.50	35.60	35.70	35.80	35.90	36.00	36.10	36.20	36.30	36.40
37	36.50	36.60	36.70	36.80	36.90	37.00	37.10	37.20	37.30	37.40
38	37.50	37.60	37.70	37.80	37.90	38.00	38.10	38.20	38.30	38.40
39	38.50	38.60	38.70	38.80	38.90	39.00	39.10	39.20	39.30	39.40
40	39.50	39.60	39.70	39.80	39.90	40.00	40.10	40.20	40.30	40.40

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.48. NRCS Rainfall-Runoff Table for CN = 97

Curve
97

Runoff for inches of rainfall—Curve no. 97

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.00	0.04	0.10	0.18	0.26	0.34	0.43	0.52	0.61
1	0.71	0.80	0.90	0.99	1.09	1.18	1.28	1.38	1.48	1.57
2	1.67	1.77	1.87	1.97	2.07	2.16	2.26	2.36	2.46	2.56
3	2.66	2.76	2.86	2.96	3.06	3.15	3.25	3.35	3.45	3.55
4	3.65	3.75	3.85	3.95	4.05	4.15	4.25	4.35	4.45	4.55
5	4.65	4.75	4.85	4.95	5.05	5.15	5.25	5.35	5.44	5.54
6	5.64	5.74	5.84	5.94	6.04	6.14	6.24	6.34	6.44	6.54
7	6.64	6.74	6.84	6.94	7.04	7.14	7.24	7.34	7.44	7.54
8	7.64	7.74	7.84	7.94	8.04	8.14	8.24	8.34	8.44	8.54
9	8.64	8.74	8.84	8.94	9.04	9.14	9.24	9.34	9.44	9.54
10	9.64	9.74	9.84	9.94	10.04	10.14	10.24	10.34	10.44	10.54
11	10.64	10.74	10.84	10.94	11.04	11.14	11.24	11.34	11.44	11.54
12	11.64	11.74	11.84	11.94	12.04	12.14	12.24	12.34	12.44	12.54
13	12.64	12.74	12.84	12.94	13.04	13.14	13.24	13.34	13.44	13.54
14	13.64	13.74	13.84	13.94	14.04	14.14	14.24	14.34	14.44	14.54
15	14.64	14.74	14.84	14.94	15.04	15.14	15.24	15.34	15.44	15.54
16	15.64	15.74	15.84	15.93	16.03	16.13	16.23	16.33	16.43	16.53
17	16.63	16.73	16.83	16.93	17.03	17.13	17.23	17.33	17.43	17.53
18	17.63	17.73	17.83	17.93	18.03	18.13	18.23	18.33	18.43	18.53
19	18.63	18.73	18.83	18.93	19.03	19.13	19.23	19.33	19.43	19.53
20	19.63	19.73	19.83	19.93	20.03	20.13	20.23	20.33	20.43	20.53
21	20.63	20.73	20.83	20.93	21.03	21.13	21.23	21.33	21.43	21.53
22	21.63	21.73	21.83	21.93	22.03	22.13	22.23	22.33	22.43	22.53
23	22.63	22.73	22.83	22.93	23.03	23.13	23.23	23.33	23.43	23.53
24	23.63	23.73	23.83	23.93	24.03	24.13	24.23	24.33	24.43	24.53
25	24.63	24.73	24.83	24.93	25.03	25.13	25.23	25.33	25.43	25.53
26	25.63	25.73	25.83	25.93	26.03	26.13	26.23	26.33	26.43	26.53
27	26.63	26.73	26.83	26.93	27.03	27.13	27.23	27.33	27.43	27.53
28	27.63	27.73	27.83	27.93	28.03	28.13	28.23	28.33	28.43	28.53
29	28.63	28.73	28.83	28.93	29.03	29.13	29.23	29.33	29.43	29.53
30	29.63	29.73	29.83	29.93	30.03	30.13	30.23	30.33	30.43	30.53
31	30.63	30.73	30.83	30.93	31.03	31.13	31.23	31.33	31.43	31.53
32	31.63	31.73	31.83	31.93	32.03	32.13	32.23	32.33	32.43	32.53
33	32.63	32.73	32.83	32.93	33.03	33.13	33.23	33.33	33.43	33.53
34	33.63	33.73	33.83	33.93	34.03	34.13	34.23	34.33	34.43	34.53
35	34.63	34.73	34.83	34.93	35.03	35.13	35.23	35.33	35.43	35.53
36	35.63	35.73	35.83	35.93	36.03	36.13	36.23	36.33	36.43	36.53
37	36.63	36.73	36.83	36.93	37.03	37.13	37.23	37.33	37.43	37.53
38	37.63	37.73	37.83	37.93	38.03	38.13	38.23	38.33	38.43	38.53
39	38.63	38.73	38.83	38.93	39.03	39.13	39.23	39.33	39.43	39.53
40	39.63	39.73	39.83	39.93	40.03	40.13	40.23	40.33	40.43	40.53

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

Table 11-C.49. NRCS Rainfall-Runoff Table for CN = 98



Runoff for inches of rainfall—Curve no. 98

Inches	Tenths									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.01	0.07	0.15	0.23	0.32	0.41	0.50	0.60	0.69
1	0.79	0.89	0.99	1.08	1.18	1.28	1.38	1.48	1.58	1.68
2	1.77	1.87	1.97	2.07	2.17	2.27	2.37	2.47	2.57	2.67
3	2.77	2.87	2.97	3.07	3.17	3.27	3.37	3.47	3.57	3.67
4	3.77	3.86	3.96	4.06	4.16	4.26	4.36	4.46	4.56	4.66
5	4.76	4.86	4.96	5.06	5.16	5.26	5.36	5.46	5.56	5.66
6	5.76	5.86	5.96	6.06	6.16	6.26	6.36	6.46	6.56	6.66
7	6.76	6.86	6.96	7.06	7.16	7.26	7.36	7.46	7.56	7.66
8	7.76	7.86	7.96	8.06	8.16	8.26	8.36	8.46	8.56	8.66
9	8.76	8.86	8.96	9.06	9.16	9.26	9.36	9.46	9.56	9.66
10	9.76	9.86	9.96	10.06	10.16	10.26	10.36	10.46	10.56	10.66
11	10.76	10.86	10.96	11.06	11.16	11.26	11.36	11.46	11.56	11.66
12	11.76	11.86	11.96	12.06	12.16	12.26	12.36	12.46	12.56	12.66
13	12.76	12.86	12.96	13.06	13.16	13.26	13.36	13.46	13.56	13.66
14	13.76	13.86	13.96	14.06	14.16	14.26	14.36	14.46	14.56	14.66
15	14.76	14.86	14.96	15.06	15.16	15.26	15.36	15.46	15.56	15.66
16	15.76	15.86	15.96	16.06	16.16	16.26	16.36	16.46	16.56	16.66
17	16.76	16.86	16.96	17.06	17.16	17.26	17.36	17.46	17.56	17.66
18	17.76	17.86	17.96	18.06	18.16	18.26	18.36	18.46	18.56	18.66
19	18.76	18.86	18.96	19.06	19.16	19.26	19.36	19.46	19.56	19.66
20	19.76	19.86	19.96	20.06	20.16	20.26	20.36	20.46	20.56	20.66
21	20.76	20.86	20.96	21.06	21.16	21.26	21.36	21.46	21.56	21.66
22	21.76	21.86	21.96	22.06	22.16	22.26	22.36	22.46	22.56	22.66
23	22.76	22.86	22.96	23.06	23.16	23.26	23.36	23.46	23.56	23.66
24	23.76	23.86	23.96	24.06	24.16	24.26	24.36	24.46	24.56	24.66
25	24.76	24.86	24.96	25.06	25.16	25.26	25.36	25.46	25.56	25.66
26	25.76	25.86	25.96	26.06	26.16	26.26	26.36	26.46	26.56	26.66
27	26.76	26.86	26.96	27.06	27.16	27.26	27.36	27.46	27.56	27.66
28	27.76	27.86	27.96	28.06	28.16	28.26	28.36	28.46	28.56	28.66
29	28.76	28.86	28.96	29.06	29.16	29.26	29.36	29.46	29.56	29.66
30	29.76	29.86	29.96	30.06	30.16	30.26	30.36	30.46	30.56	30.66
31	30.76	30.86	30.96	31.06	31.16	31.26	31.36	31.46	31.56	31.66
32	31.76	31.86	31.96	32.06	32.16	32.26	32.36	32.46	32.56	32.66
33	32.76	32.86	32.96	33.06	33.16	33.26	33.36	33.46	33.56	33.66
34	33.76	33.86	33.96	34.06	34.16	34.26	34.36	34.46	34.56	34.66
35	34.76	34.86	34.96	35.06	35.16	35.26	35.36	35.46	35.56	35.66
36	35.76	35.86	35.96	36.06	36.16	36.26	36.36	36.46	36.56	36.66
37	36.76	36.86	36.96	37.06	37.16	37.26	37.36	37.46	37.56	37.66
38	37.76	37.86	37.96	38.06	38.16	38.26	38.36	38.46	38.56	38.66
39	38.76	38.86	38.96	39.06	39.16	39.26	39.36	39.46	39.56	39.66
40	39.76	39.86	39.96	40.06	40.16	40.26	40.36	40.46	40.56	40.66

Note: Runoff value determined by equation $Q = \frac{(P - 0.2S)^2}{P + 0.8S}$

1D – Virginia Runoff Reduction Method Worksheets

Virginia Runoff Reduction Method ReDevelopment Worksheet v2.7 Revised April 2013								
Site Data								
Project Name:								
Date:								
	data input cells							
	calculation cells							
	constant values							
Post-ReDevelopment Project & Land Cover Information				Total Disturbed Acreage	0.00			
Constants								
Annual Rainfall (inches)	43							
Target Rainfall Event (inches)	1.00							
Phosphorus EMC (mg/L)	0.26			Nitrogen EMC (mg/L)	1.86			
Target Phosphorus Target Load (lb/acre/yr)	0.41							
Pj	0.90							
Pre-ReDevelopment Land Cover (acres)								
	A soils	B Soils	C Soils	D Soils	Totals			
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.00	0.00			
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	0.00	0.00			
Impervious Cover (acres)	0.00	0.00	0.00	0.00	0.00			
				Total	0.00			
Post-ReDevelopment Land Cover (acres)								
	A soils	B Soils	C Soils	D Soils	Totals			
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land	0.00	0.00	0.00	0.00	0.00			
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.00	0.00	0.00	0.00	0.00			
Impervious Cover (acres)	0.00	0.00	0.00	0.00	0.00			
				Total	0.00			
Area Check	Okay	Okay	Okay	Okay				
Rv Coefficients								
	A soils	B Soils	C Soils	D Soils				
Forest/Open Space	0.02	0.03	0.04	0.05				
Managed Turf	0.15	0.20	0.22	0.25				
Impervious Cover	0.95	0.95	0.95	0.95				
Land Cover Summary								
	Listed	Adjusted¹	Land Cover Summary Post-ReDevelopment		Land Cover Summary Post-ReDevelopment New Impervious			
Forest/Open Space Cover (acres)	0.00	0.00	Forest/Open Space Cover (acres)	0.00				
Composite Rv(forest)	0.00	0.00	Composite Rv(forest)	0.00				
% Forest	0%	0%	% Forest	0%				
Managed Turf Cover (acres)	0.00	0.00	Managed Turf Cover (acres)	0.00				
Composite Rv(turf)	0.00	0.00	Composite Rv(turf)	0.00				
% Managed Turf	0%	0%	% Managed Turf	0%				
Impervious Cover (acres)	0.00	0.00	ReDev. Impervious Cover (acres)	0.00	New Impervious Cover (acres)	0.00		
Rv(impervious)	0.95	0.95	Rv(impervious)	0.95	Rv(impervious)	0.95		
% Impervious	0%	0%	% Impervious	0%	% Impervious	Check Area		
Total Site Area (acres)	0.00	0.00	Total ReDev. Site Area (acres)	0.00	Total New Dev. Site Area (acres)	0.00		
Site Rv	0.00	0.00	ReDev. Site Rv	0.00	New Dev. Site Rv	0.95		
Pre-Development Treatment Volume (acre-ft)	0.0000	0.0000	Post-ReDevelopment Treatment Volume (acre-ft)	0.0000	Post-Development Treatment Volume (acre-ft)	0.0000		
Pre-Development Treatment Volume (cubic feet)	0	0	Post-ReDevelopment Treatment Volume (cubic feet)	0	Post-Development Treatment Volume (cubic feet)	0		
Pre-Development Load (TP) (lb/yr)	0.00	0.00	Post-ReDevelopment Load (TP) (lb/yr)	0.00	Post-Development Load (TP) (lb/yr)	0.00		
¹ Adjusted Land Cover Summary reflects the pre redevelopment land cover minus the pervious land cover (forest/open space or managed turf) acreage proposed for new impervious cover. The adjusted total acreage is consistent with the Post Redevelopment acreage (minus the acreage of new impervious cover). The load reduction requirement for the new impervious cover to meet the new development load limit is computed in Column I .			Maximum % Reduction Required Below Pre-ReDevelopment Load	10%				
			TP Load Reduction Required for Redeveloped Area (lb/yr)	#DIV/0!	TP Load Reduction Required for New Impervious Area (lb/yr)	0.00		
			Total Load Reduction Required (lb/yr)	#DIV/0!				
Pre-Development Load (TN) (lb/yr)	0.00		Post-Development Load (TN) (lb/yr)	0.00				

Drainage Area A

Drainage Area A Land Cover (acres)						
A Soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv	
0.00	0.00	0.00	0.00	0.00	0.00	
0.00	0.00	0.00	0.00	0.00	0.00	
0.00	0.00	0.00	0.00	0.00	0.00	
Total				0.00		
Post Development Treatment Volume (cf)						0

Apply Runoff Reduction Practices to Reduce Treatment Volume & Post-Development Load in Drainage Area A

Credit	Unit	Description of Credit	Credit	Area (acres)	Volume from Upstream RR Practices (cf)	Runoff Reduction (cf)	Remaining Runoff Volume (cf)	Phosphorus Efficiency (%)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed	Nitrogen Efficiency (%)	Nitrogen Load from Upstream RR Practices (lbs)	Untreated Nitrogen Load to Practice (lbs.)	Nitrogen Removed By Practice (lbs.)	Remaining Nitrogen Load (lbs.)	
1. Vegetated Roof																			
1.a. Vegetated Roof #1 (Spec #5)	acres of green roof	45% runoff volume reduction	0.45	0.00	0	0	0	0	0	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
1.b. Vegetated Roof #2 (Spec #5)	acres of green roof	60% runoff volume reduction	0.60	0.00	0	0	0	0	0	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
2. Rooftop Disconnection																			
2.a. Simple Disconnection to AB Soils (Spec #1)	impervious acres disconnected	50% runoff volume reduction for treated area	0.50	0.00	0	0	0	0	0	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
2.b. Simple Disconnection to CD Soils (Spec #1)	impervious acres disconnected	25% runoff volume reduction for treated area	0.25	0.00	0	0	0	0	0	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
2.c. To Soil Amended Filter Path as per specifications (existing C/D soils) (Spec #4)	impervious acres disconnected	50% runoff volume reduction for treated area	0.50	0.00	0	0	0	0	0	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
2.d. To Dry Well or French Drain #1 (Microinfiltration #1) (Spec #8)	impervious acres disconnected	50% runoff volume reduction for treated area	0.50	0.00	0	0	0	25	0.00	0.00	0.00	0.00		15	0.00	0.00	0.00	0.00	
2.e. To Dry Well or French Drain #2 (Microinfiltration #2) (Spec #8)	impervious acres disconnected	90% runoff volume reduction for treated area	0.90	0.00	0	0	0	25	0.00	0.00	0.00	0.00		15	0.00	0.00	0.00	0.00	
2.f. To Rain Garden #1 (Micro-Bioretenion #1) (Spec #9)	impervious acres disconnected	40% of volume captured based on tank size and design spreadsheet (See Spec #6)	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00		40	0.00	0.00	0.00	0.00	
2.g. To Rain Garden #2 (Micro-Bioretenion #2) (Spec #9)	impervious acres disconnected	80% runoff volume reduction for treated area	0.80	0.00	0	0	0	50	0.00	0.00	0.00	0.00		60	0.00	0.00	0.00	0.00	
2.h. To Rainwater Harvesting (Spec #6)	impervious acres captured		0.00	0.00	0	0	0	0	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
2.i. To Stormwater Planters (Urban Bioretention) (Spec #9, Appendix A)	impervious acres disconnected	40% runoff volume reduction for treated area	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00		40	0.00	0.00	0.00	0.00	
3. Permeable Pavement																			
3.a. Permeable Pavement #1 (Spec #7)	acres of permeable pavement + acres of "external" (upgradient) impervious pavement	45% runoff volume reduction	0.45	0.00	0	0	0	25	0.00	0.00	0.00	0.00		25	0.00	0.00	0.00	0.00	
3.b. Permeable Pavement #2 (Spec #7)	acres of permeable pavement	75% runoff volume reduction	0.75	0.00	0	0	0	25	0.00	0.00	0.00	0.00		25	0.00	0.00	0.00	0.00	
4. Grass Channel																			
4.a. Grass Channel A/B Soils (Spec #3)	impervious acres draining to grass channels	20% runoff volume reduction	0.20	0.00	0	0	0	15	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00	
	turf acres draining to grass channels	20% runoff volume reduction	0.20	0.00	0	0	0	15	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00	
4.b. Grass Channel C/D Soils (Spec #3)	impervious acres draining to grass channels	10% runoff volume reduction	0.10	0.00	0	0	0	15	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00	
	turf acres draining to grass channels	10% runoff volume reduction	0.10	0.00	0	0	0	15	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00	
4.c. Grass Channel Compost Amended Soils as per specs (see Spec #4)	impervious acres draining to grass channels	30% runoff volume reduction	0.20	0.00	0	0	0	15	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00	
	turf acres draining to grass channels	30% runoff volume reduction	0.20	0.00	0	0	0	15	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00	
5. Dry Swale																			
5.a. Dry Swale #1 (Spec #10)	impervious acres draining to dry swale	40% runoff volume reduction	0.40	0.00	0	0	0	20	0.00	0.00	0.00	0.00		25	0.00	0.00	0.00	0.00	
	turf acres draining to dry swale	40% runoff volume reduction	0.40	0.00	0	0	0	20	0.00	0.00	0.00	0.00		25	0.00	0.00	0.00	0.00	
5.b. Dry Swale #2 (Spec #10)	impervious acres draining to dry swale	60% runoff volume reduction	0.60	0.00	0	0	0	40	0.00	0.00	0.00	0.00		35	0.00	0.00	0.00	0.00	
	turf acres draining to dry swale	60% runoff volume reduction	0.60	0.00	0	0	0	40	0.00	0.00	0.00	0.00		35	0.00	0.00	0.00	0.00	
6. Bioretention																			
6.a. Bioretention #1 or Urban Bioretention (Spec #9)	impervious acres draining to bioretention	40% runoff volume reduction	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00		40	0.00	0.00	0.00	0.00	
	turf acres draining to bioretention	40% runoff volume reduction	0.40	0.00	0	0	0	25	0.00	0.00	0.00	0.00		40	0.00	0.00	0.00	0.00	
6.b. Bioretention #2 (Spec #9)	impervious acres draining to bioretention	80% runoff volume reduction	0.80	0.00	0	0	0	50	0.00	0.00	0.00	0.00		60	0.00	0.00	0.00	0.00	
	turf acres draining to bioretention	80% runoff volume reduction	0.80	0.00	0	0	0	50	0.00	0.00	0.00	0.00		60	0.00	0.00	0.00	0.00	
7. Infiltration																			
7.a. Infiltration #1 (Spec #8)	impervious acres draining to infiltration	50% runoff volume reduction	0.50	0.00	0	0	0	25	0.00	0.00	0.00	0.00		15	0.00	0.00	0.00	0.00	
	turf acres draining to infiltration	50% runoff volume reduction	0.50	0.00	0	0	0	25	0.00	0.00	0.00	0.00		15	0.00	0.00	0.00	0.00	
7.b. Infiltration #2 (Spec #8)	impervious acres draining to infiltration	90% runoff volume reduction	0.90	0.00	0	0	0	25	0.00	0.00	0.00	0.00		15	0.00	0.00	0.00	0.00	
	turf acres draining to infiltration	90% runoff volume reduction	0.90	0.00	0	0	0	25	0.00	0.00	0.00	0.00		15	0.00	0.00	0.00	0.00	
8. Extended Detention Pond																			
8.a. ED #1 (Spec #15)	impervious acres draining to ED	0% runoff volume reduction	0.00	0.00	0	0	0	15	0.00	0.00	0.00	0.00		10	0.00	0.00	0.00	0.00	
	turf acres draining to ED	0% runoff volume reduction	0.00	0.00	0	0	0	15	0.00	0.00	0.00	0.00		10	0.00	0.00	0.00	0.00	
8.b. ED #2 (Spec #15)	impervious acres draining to ED	15% runoff volume reduction	0.15	0.00	0	0	0	15	0.00	0.00	0.00	0.00		10	0.00	0.00	0.00	0.00	
	turf acres draining to ED	15% runoff volume reduction	0.15	0.00	0	0	0	15	0.00	0.00	0.00	0.00		10	0.00	0.00	0.00	0.00	
9. Sheetflow to Filter/Open Space																			
9.a. Sheetflow to Conservation Area with A/B Soils (Spec #2)	impervious acres draining to conserved open space	75% runoff volume reduction for treated area	0.75	0.00	0	0	0	0	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
	turf acres draining to conserved open space	75% runoff volume reduction for treated area	0.75	0.00	0	0	0	0	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
9.b. Sheetflow to Conservation Area with C/D Soils (Spec #2)	impervious acres draining to conserved open space	50% runoff volume reduction for treated area	0.50	0.00	0	0	0	0	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
	turf acres draining to conserved open space	50% runoff volume reduction for treated area	0.50	0.00	0	0	0	0	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
9.c. Sheetflow to Vegetated Filter Strip in A Soils or Compost Amended B/C/D Soils (Spec #2 & #4)	impervious acres draining to conserved open space	50% runoff volume reduction for treated area	0.50	0.00	0	0	0	0	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
	turf acres draining to conserved open space	50% runoff volume reduction for treated area	0.50	0.00	0	0	0	0	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00	
TOTAL IMPERVIOUS COVER TREATED (ac)				0.00															
TOTAL TURF AREA TREATED (ac)				0.00															
AREA CHECK OK																			
TOTAL PHOSPHOROUS REMOVAL REQUIRED ON SITE (lb/yr)				#DIV/0!															
TOTAL RUNOFF REDUCTION IN D.A. A (cf)				0															
PHOSPHORUS REMOVAL FROM RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)				0.00															
SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS														TOTAL RUNOFF REDUCTION IN D.A. A (cf)					0
														NITROGEN REMOVAL FROM RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)					0.00

Apply Practices that Remove Pollutants but Do Not Reduce Runoff Volume

Practice	Unit	Description of Credit	Credit	Area (excluding areas treated by upstream practices)	Runoff from Upstream RR Practices (cf)	Runoff Reduction (cf)	Remaining Runoff Volume (cf)	Phosphorus Efficiency (%)	Phosphorus Load from Upstream RR Practices (lbs)	Untreated Phosphorus Load to Practice (lbs.)	Phosphorus Removed By Practice (lbs.)	Remaining Phosphorus Load (lbs.)	Downstream Treatment to be Employed	Nitrogen Efficiency (%)	Nitrogen Load from Upstream RR Practices (lbs)	Untreated Nitrogen Load to Practice (lbs.)	Nitrogen Removed By Practice (lbs.)	Remaining Nitrogen Load (lbs.)
10. Wet Swale (Coastal Plain)																		
10.a. Wet Swale #1 (Spec #11)	impervious acres draining to wet swale		0.00	0.00	0.00	0	0	20	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
	turf acres draining to wet swale		0.00	0.00	0.00	0	0	20	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
10.b. Wet Swale #2 (Spec #11)	impervious acres draining to wet swale		0.00	0.00	0.00	0	0	40	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
	turf acres draining to wet swale		0.00	0.00	0.00	0	0	40	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
11. Filtering Practices																		
11.a. Filtering Practice #1 (Spec #12)	impervious acres draining to filter		0.00	0.00	0.00	0	0	60	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
	turf acres draining to filter		0.00	0.00	0.00	0	0	60	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
11.b. Filtering Practice #2 (Spec #12)	impervious acres draining to filter		0.00	0.00	0.00	0	0	65	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
	turf acres draining to filter		0.00	0.00	0.00	0	0	65	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
12. Constructed Wetland																		
2.a. Constructed Wetland #1 (Spec #13)	impervious acres draining to wetland		0.00	0.00	0.00	0	0	50	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
	turf acres draining to wetland		0.00	0.00	0.00	0	0	50	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
2.b. Constructed Wetland #2 (Spec #13)	impervious acres draining to wetland		0.00	0.00	0.00	0	0	75	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
	turf acres draining to wetland		0.00	0.00	0.00	0	0	75	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
13. Wet Ponds																		
13.a. Wet Pond #1 (Spec #14)	impervious acres draining to wet pond		0.00	0.00	0.00	0	0	50	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
	turf acres draining to wet pond		0.00	0.00	0.00	0	0	50	0.00	0.00	0.00	0.00		20	0.00	0.00	0.00	0.00
13.b. Wet Pond #1 (Coastal Plain) (Spec #14)	impervious acres draining to wet pond		0.00	0.00	0.00	0	0	45	0.00									

		1-year storm	2-year storm	10-year storm		
Target Rainfall Event (in)		2.70	3.35	5.15		
Drainage Area A						
Drainage Area (acres)		0.00				
Runoff Reduction Volume (cf)		0				
Drainage Area B						
Drainage Area (acres)		0.00				
Runoff Reduction Volume (cf)		0				
Drainage Area C						
Drainage Area (acres)		0.00				
Runoff Reduction Volume (cf)		0				
Drainage Area D						
Drainage Area (acres)		0.00				
Runoff Reduction Volume (cf)		0				
Drainage Area E						
Drainage Area (acres)		0.00				
Runoff Reduction Volume (cf)		0				
Based on the use of Runoff Reduction practices in the selected drainage areas, the spreadsheet calculates an adjusted $RV_{Developed}$ and adjusted Curve Number.						
Drainage Area A		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.00	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	0.00	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					0	1000.00
		1-year storm	2-year storm	10-year storm		
$RV_{Developed}$ (in) with no Runoff Reduction		0.00	0.00	0.00		
$RV_{Developed}$ (in) with Runoff Reduction		0.00	0.00	0.00		
Adjusted CN		#N/A	#N/A	#N/A		
Drainage Area B						
		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.00	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	0.00	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					0	1000.00
		1-year storm	2-year storm	10-year storm		
$RV_{Developed}$ (in) with no Runoff Reduction		0.00	0.00	0.00		
$RV_{Developed}$ (in) with Runoff Reduction		0.00	0.00	0.00		
Adjusted CN		#N/A	#N/A	#N/A		
Drainage Area C						
		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.00	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	0.00	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					0	1000.00
		1-year storm	2-year storm	10-year storm		
$RV_{Developed}$ (in) with no Runoff Reduction		0.00	0.00	0.00		
$RV_{Developed}$ (in) with Runoff Reduction		0.00	0.00	0.00		
Adjusted CN		#N/A	#N/A	#N/A		
Drainage Area D						
		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.00	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	0.00	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					0	1000.00
		1-year storm	2-year storm	10-year storm		
$RV_{Developed}$ (in) with no Runoff Reduction		0.00	0.00	0.00		
$RV_{Developed}$ (in) with Runoff Reduction		0.00	0.00	0.00		
Adjusted CN		#N/A	#N/A	#N/A		
Drainage Area E						
		A soils	B Soils	C Soils	D Soils	
Forest/Open Space -- undisturbed, protected forest/open space or reforested land	Area (acres)	0.00	0.00	0.00	0.00	
	CN	30	55	70	77	
Managed Turf -- disturbed, graded for yards or other turf to be mowed/managed	Area (acres)	0.00	0.00	0.00	0.00	
	CN	39	61	74	80	
Impervious Cover	Area (acres)	0.00	0.00	0.00	0.00	
	CN	98	98	98	98	
					Weighted CN	S
					0	1000.00
		1-year storm	2-year storm	10-year storm		
$RV_{Developed}$ (in) with no Runoff Reduction		0.00	0.00	0.00		
$RV_{Developed}$ (in) with Runoff Reduction		0.00	0.00	0.00		
Adjusted CN		#N/A	#N/A	#N/A		

Virginia Runoff Reduction Method ReDevelopment Worksheet v2.7 Revised April 2013

Site Data Summary

Total Rainfall = 43 inches

Site Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Turf (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Impervious (acres)	0.00	0.00	0.00	0.00	0.00	0.00
					0.00	0.00

Site Rv	#DIV/0!
Post Development Treatment Volume (ft ³)	0
Post Development TP Load (lb/yr)	0.00
Post Development TN Load (lb/yr)	0.00
Total TP Load Reduction Required (lb/yr)	#DIV/0!

Total Runoff Volume Reduction (ft ³)	0
Total TP Load Reduction Achieved (lb/yr)	0
Total TN Load Reduction Achieved (lb/yr)	0.00
Adjusted Post Development TP Load (lb/yr)	0.00
Remaining Phosphorous Load Reduction (Lb/yr) Required	0.00

Drainage Area Summary

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	Total
Forest (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Turf (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Impervious (acres)	0.00	0.00	0.00	0.00	0.00	0.00
						0.00

Drainage Area Compliance Summary

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	Total
TP Load Red. (lb/yr)	0.00	0.00	0.00	0.00	0.00	0.00
TN Load Red. (lb/yr)	0.00	0.00	0.00	0.00	0.00	0.00

Channel and Flood Protection

	Weighted CN	1-year storm Adjusted CN	2-year storm Adjusted CN	10-year storm Adjusted CN
Target Rainfall Event (in)		2.70	3.35	5.15
D.A. A CN	0	#N/A	#N/A	#N/A
D.A. B CN	0	#N/A	#N/A	#N/A
D.A. C CN	0	#N/A	#N/A	#N/A
D.A. D CN	0	#N/A	#N/A	#N/A
D.A. E CN	0	#N/A	#N/A	#N/A

Site Results						
	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	AREA CHECK
IMPERVIOUS COVER	0.00	0.00	0.00	0.00	0.00	OK.
IMPERVIOUS COVER TREATED	0.00	0.00	0.00	0.00	0.00	OK.
TURF AREA	0.00	0.00	0.00	0.00	0.00	OK.
TURF AREA TREATED	0.00	0.00	0.00	0.00	0.00	OK.
AREA CHECK	OK.	OK.	OK.	OK.	OK.	
Phosphorous						
TOTAL PHOSPHOROUS LOAD REDUCTION REQUIRED (LB/YEAR)	#DIV/0!					
RUNOFF REDUCTION (cf)	0					
PHOSPHOROUS LOAD REDUCTION ACHIEVED (LB/YR)	0.00					
ADJUSTED POST-DEVELOPMENT PHOSPHOROUS LOAD (TP) (lb/yr)	0.00					
REMAINING PHOSPHOROUS LOAD REDUCTION (LB/YR) NEEDED	#DIV/0!					
Nitrogen (for information purposes)						
RUNOFF REDUCTION (cf)	0					
NITROGEN LOAD REDUCTION ACHIEVED (LB/YR)	0.00					
ADJUSTED POST-DEVELOPMENT NITROGEN LOAD (TP) (lb/yr)	0.00					

1E – Norfolk Guidance Calculation Procedure Worksheets

WORKSHEET A
GUIDANCE CALCULATION PROCEDURE – NEW DEVELOPMENT

1. Compile site-specific data and determine site imperviousness (I_{site}).

		POST-DEVELOPMENT
A^*		= _____ acres
I_a^{**}	structures	= _____ acres
	parking lot	= _____ acres
	roadway	= _____ acres
	other	= _____ acres
		= _____ acres
		= _____ acres
	total I_a	= _____ acres
$I_{site} = (\text{total } I_a / A) \times 100$		= _____ (percent expressed in whole numbers)

* Although the area subject to regulations may be only the area actually in a CBPA, some localities may require all of the site to comply with criteria.

** I_a represents the actual amount of impervious area.

2. Determine the average land cover conditions ($I_{watershed}$).

Use $I_{watershed} = I_{VA} = 16$ because $F_{average} = 0.45$ lbs/ac/yr for Virginia's Chesapeake Bay Watershed.
 Use $C_{pre} = 0.26$ mg/l.

3. Determine need to continue.

$$\begin{aligned} I_{site} &= \frac{\quad}{\quad} \% \text{ (from Step 1)} \\ I_{watershed} &= \frac{\quad}{16} \% \text{ (from Step 2)} \end{aligned}$$

If $I_{site} \leq I_{watershed}$ STOP and submit analysis to this point.

If $I_{site} > I_{watershed}$ CONTINUE.

4. Set constants.

P_j	= unitless rainfall correction factor = 0.9 for all of Tidewater Virginia	P	= annual rainfall depth in inches = 40 inches for Northern Virginia area = 43 inches for Richmond Metropolitan area = 45 inches for Hampton Roads area
C	= flow weighted mean concentration of total phosphorus = 0.26 mg /l for all I_{site}		

12 and 2.72 are used in the equation as unit conversion factors.

5. Calculate the pre-development load (L_{pre}).

$$\begin{aligned} L_{pre} &= P \times P_j \times [0.05 + (0.009 \times I_{watershed})] \times C_{pre} \times A \times 2.72 / 12 \\ &= \underline{\quad} \times 0.9 \times [0.05 + (0.009 \times \underline{\quad})] \times 0.26 \times \underline{\quad} \times 2.72 / 12 \\ &= \underline{\quad} \text{ pounds per year} \end{aligned}$$

6. Calculate the post-development load (L_{post}).

$$\begin{aligned}L_{\text{post}} &= P \times P_j \times [0.05 + (0.009 \times I_{\text{site}})] \times C \times A \times 2.72 / 12 \\ &= \underline{\hspace{2cm}} \times 0.9 \times [0.05 + (0.009 \times \underline{\hspace{2cm}})] \times 0.26 \times \underline{\hspace{2cm}} \times 2.72 / 12 \\ &= \underline{\hspace{2cm}} \text{ pounds per year}\end{aligned}$$

7. Calculate the pollutant removal requirement (RR)

$$\begin{aligned}\text{RR} &= L_{\text{post}} - L_{\text{pre}} \\ &= \underline{\hspace{2cm}} - \underline{\hspace{2cm}} \\ &= \underline{\hspace{2cm}} \text{ pounds per year}\end{aligned}$$

To determine the overall BMP efficiency required (%RR) when selecting BMP options:

$$\begin{aligned}\%RR &= \text{RR} / L_{\text{post}} \times 100 \\ &= (\underline{\hspace{1cm}} / \underline{\hspace{1cm}}) \times 100 \\ &= \underline{\hspace{1cm}} \%\end{aligned}$$

WORKSHEET B
GUIDANCE CALCULATION PROCEDURE – REDEVELOPMENT

1. Compile site-specific data

	PRE-DEVELOPMENT	POST-DEVELOPMENT
A*	= _____ acres	= _____ acres
I _a :		
structures	= _____ acres	= _____ acres
parking lot	= _____ acres	= _____ acres
roadway	= _____ acres	= _____ acres
other	= _____ acres	= _____ acres
	= _____ acres	= _____ acres
	= _____ acres	= _____ acres
total I _a	= _____ acres	= _____ acres
I = (total I _a / A) x 100	= _____ percent expressed in whole numbers	= _____ percent expressed in whole numbers
R _v = 0.05 = (0.009 x I)	= _____ unitless	= _____ unitless
C: I ≥ 20 = 1.08 mg / l		
I < 20 = 0.26 mg / l	= _____ mg/l	= _____ mg/l

* Although the area subject to regulations may be only the area actually in a CBPA, some localities may require all of the site to comply with criteria.

2. Set constants.

<p>P_j = unitless rainfall correction factor = 0.9 for all of Tidewater Virginia</p>	<p>P = annual rainfall depth in inches = 40 inches for Northern Virginia area = 43 inches for Richmond Metropolitan area = 45 inches for Hampton Roads area</p>
--	---

12 and 2.72 are used in the equation as unit conversion factors.

3. Calculate the pre-development load (L_{pre}).

$$L_{pre} = P \times P_j \times R_{v(pre)} \times C_{pre} \times A \times 2.72 / 12$$

$$= \underline{\hspace{2cm}} \times 0.9 \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times 2.72 / 12$$

$$= \underline{\hspace{2cm}} \text{ pounds per year}$$

4. Calculate the post-development load (L_{post}).

$$L_{post} = P \times P_j \times R_{v(post)} \times C_{post} \times A \times 2.72 / 12$$

$$= \underline{\hspace{2cm}} \times 0.9 \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times 2.72 / 12$$

$$= \underline{\hspace{2cm}} \text{ pounds per year}$$

5. Calculate the pollutant removal requirement (RR).

$RR = L_{post} - (0.9 \times L_{pre})$ $= \underline{\hspace{2cm}} - (0.9 \times \underline{\hspace{2cm}})$ $= \underline{\hspace{2cm}} \text{ pounds per year}$	$\%RR = (RR / L_{post}) \times 100$ $= (\underline{\hspace{2cm}} / \underline{\hspace{2cm}}) \times 100$ $= \underline{\hspace{2cm}} \%$
--	--

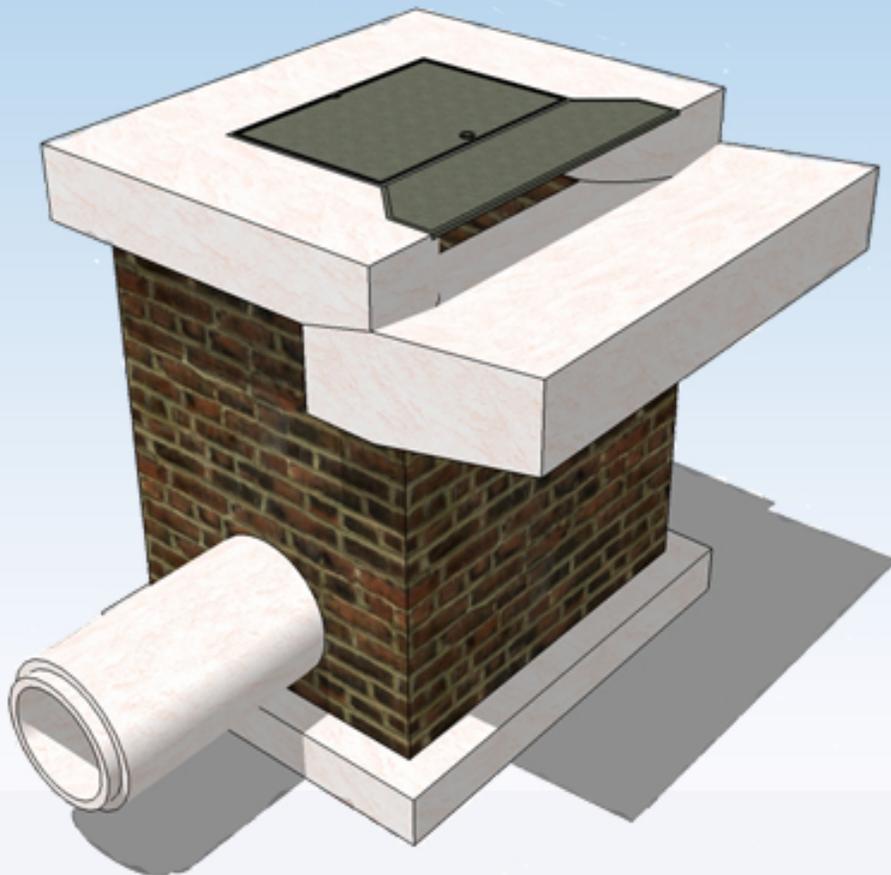
Appendix 2: Norfolk Standard Notes and Details

2A – Norfolk Standard Engineering Details

2B – Norfolk Standard Notes

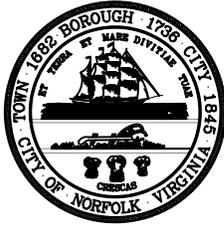
2A – Norfolk Standard Engineering Details

NCDS2013.7



NORFOLK CITY DESIGN STANDARDS

<http://www.norfolk.gov/index.aspx?NID=819>



DESIGN STANDARDS INDEX

City of Norfolk Department of Public Works

Designation	Description
HS-101	STANDARD CURB INLET
HS-102	STANDARD DOUBLE CURB INLET
HS-103	STANDARD GRATE INLET
HS-104	STANDARD MANHOLE
HS-105	STANDARD MANHOLE COVER
HS-106	FABRIC JOINT WRAP
HS-107	STANDARD ROADSIDE GROUNDWATER UNDERDRAIN
HS-201	STANDARD 6" PARKWAY CURB
HS-202	STANDARD 6" CURB AND GUTTER
HS-203	METHOD OF SETTING GRANITE CURB
HS-204	STANDARD ROLL-TYPE CURB AND GUTTER
HS-205	STANDARD VALLEY GUTTER
HS-206	STANDARD SIDEWALK DETAIL
HS-207	STANDARD RESIDENTIAL DRIVEWAY APRON
HS-208	ADA VARIATION OF DRIVEWAY APRON
HS-209	STANDARD RESIDENTIAL DRIVEWAY W/O CURB AND GUTTER
HS-210	COMMERCIAL BRICK DRIVEWAY
HS-211	STANDARD DOWNTOWN BRICK SIDEWALK
HS-212	MODIFIED 7" CURB AND GUTTER
HS-301	STANDARD PAVEMENT REPLACEMENT - ASPHALT OVER STONE
HS-302	STANDARD PAVEMENT REPLACEMENT - ASPHALT OVER CONCRETE
HS-303	STANDARD PAVEMENT REPLACEMENT CONCRETE
HS-304	CONCRETE PAVEMENT DOWELING DETAIL
HS-601	STANDARD GRASS PLANTING DETAIL
HS-602	STANDARD TREE PROTECTION DETAIL
HS-603	RECYCLED RUBBER WHEEL STOP
HS-604	STANDARD CITY CONSTRUCTION SIGN - SMALL
HS-605	CONSTRUCTION SIGN INSTALLATION - SMALL
HS-606	STANDARD CITY CONSTRUCTION SIGN - LARGE
HS-607	CONSTRUCTION SIGN INSTALLATION - LARGE

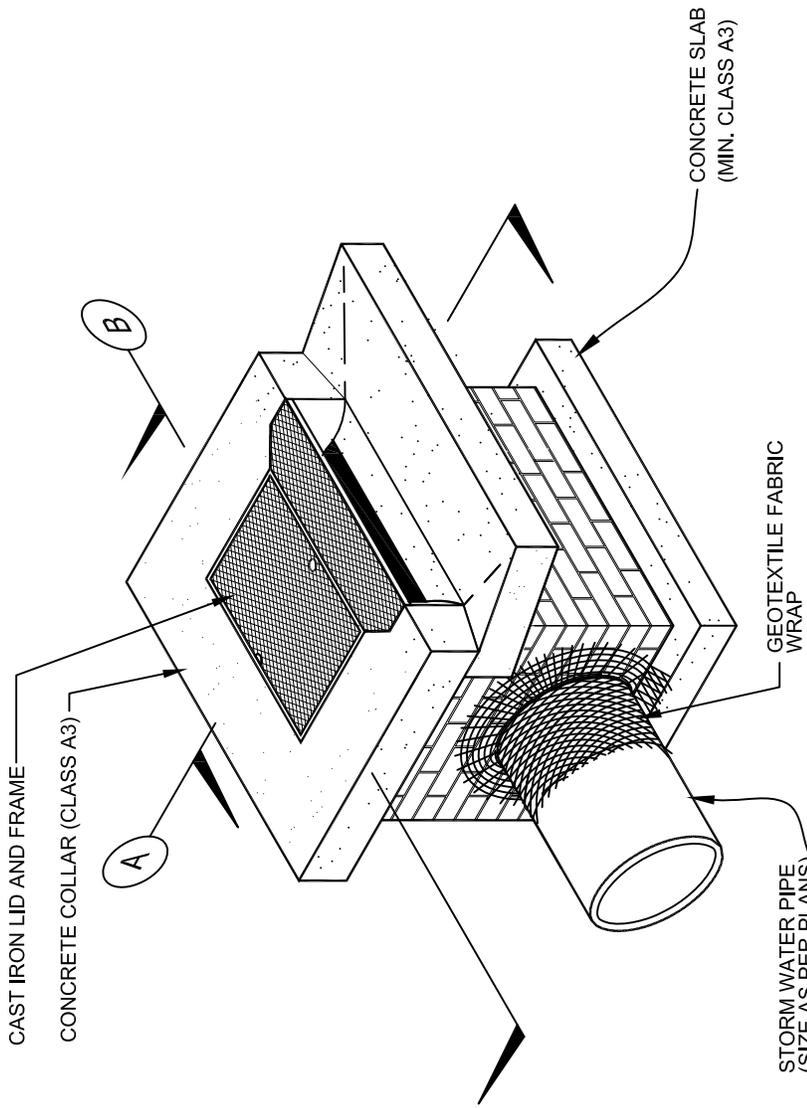
DESIGN STANDARDS README FILE

City of Norfolk, Department of Public Works

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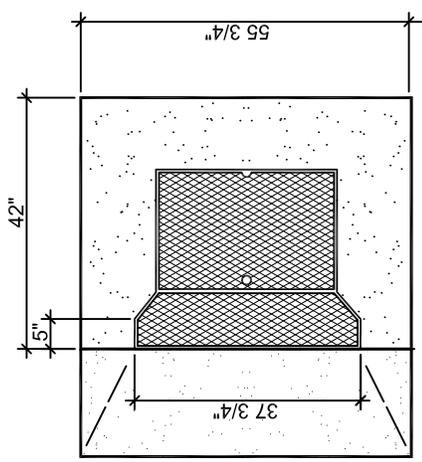
This compilation of the Norfolk City Design Standards is subject to improvements and updates. A current copy is on file and maintained by the Engineering Bureau of the Department of Public Works. If you are not certain whether or not this copy is current, you may access the Public Works web site at <http://www.norfolk.gov/index.aspx?nid=819>. You may also contact Robert Clark or Tammy Halstead at 664-4602 between 8:30 a.m. and 5:00 p.m., Monday through Friday.

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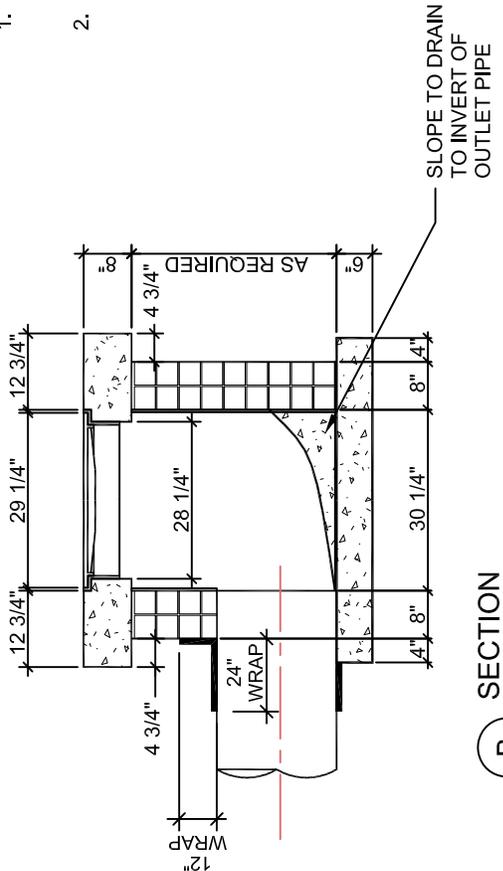


NOTES:

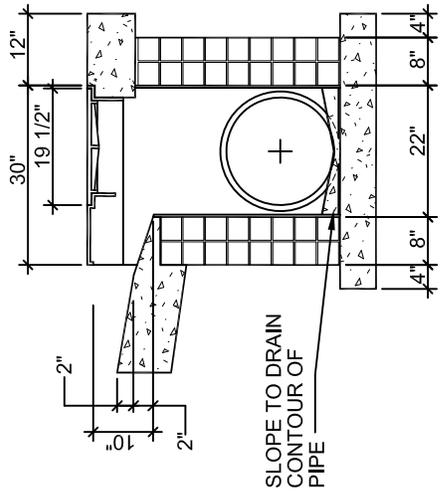
1. MORTAR PARGE BRICK INSIDE AND OUT (TYPE 6N).
2. INVERT SHAPING SHALL BE IN ACCORDANCE WITH VDOT STANDARD B-1.



PLAN



SECTION B



SECTION A

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD CURB INLET

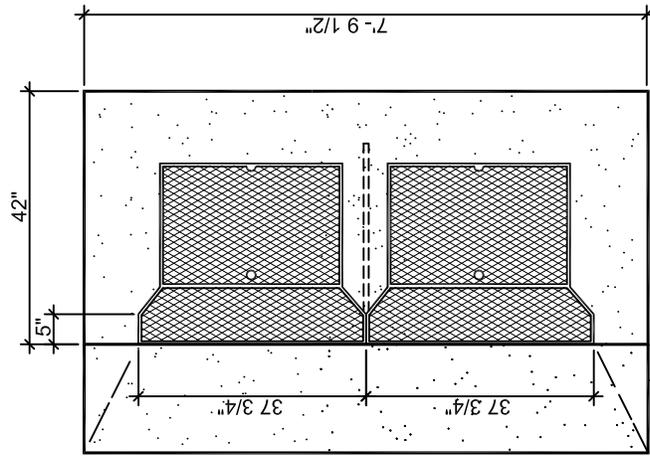
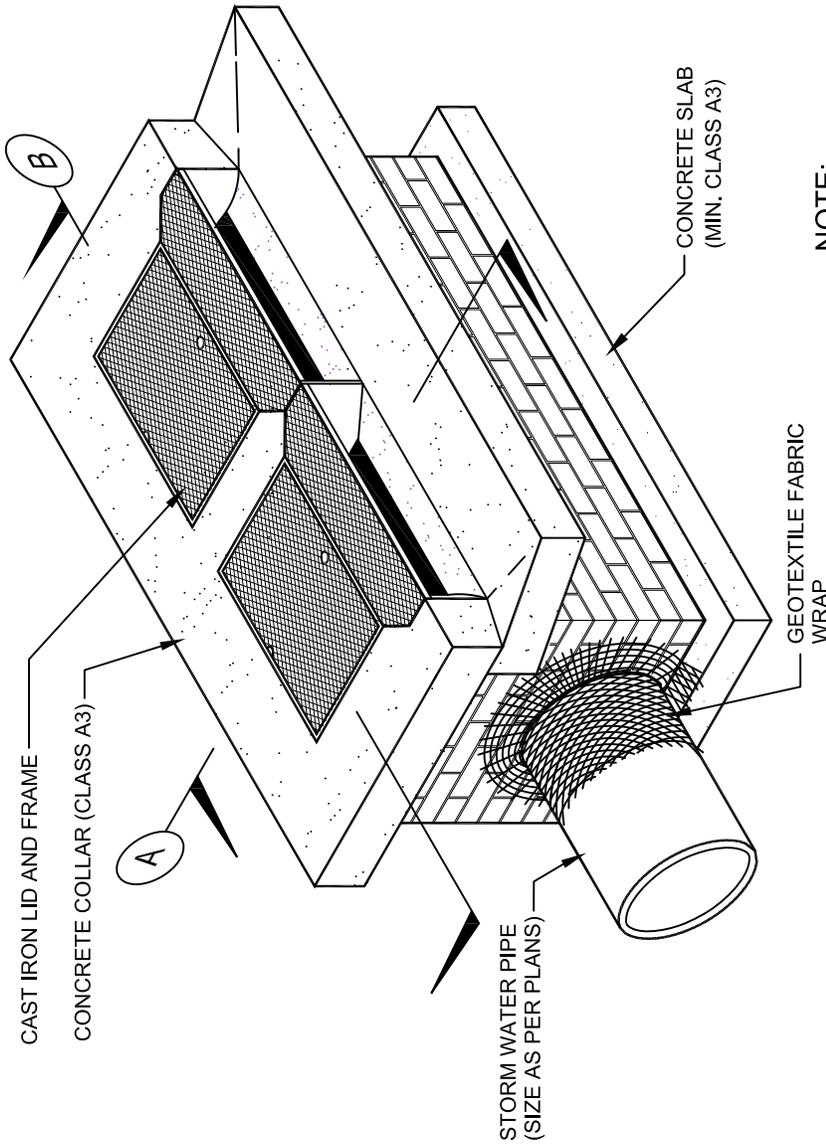
DESIGNATION

HS-101

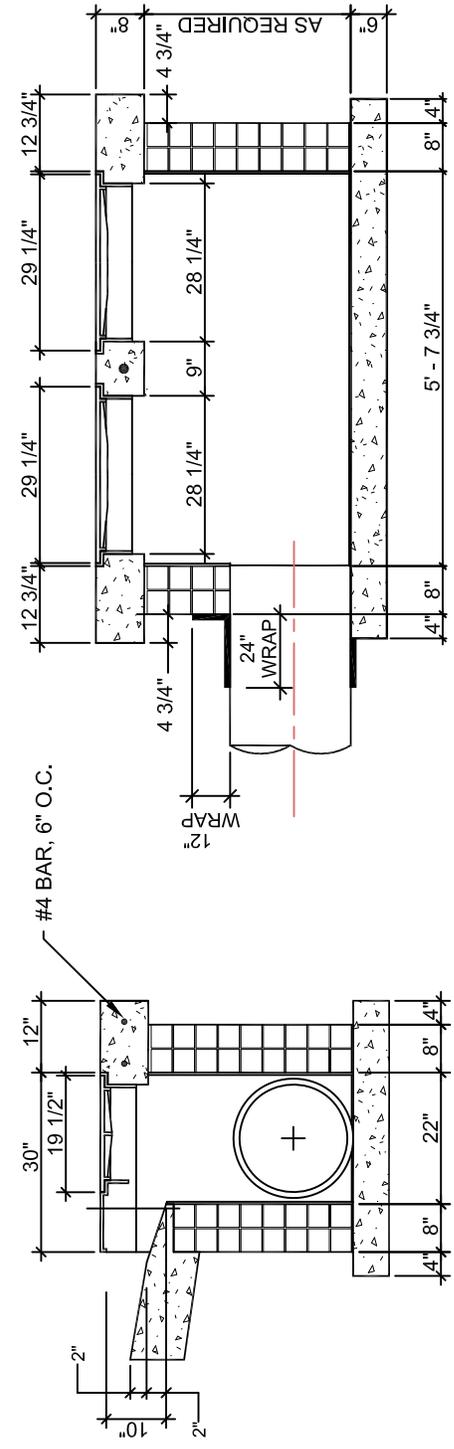
SCALE
NOT TO SCALE

EDITION
NCDS2013.7

REVISED
JAN. 2004



PLAN

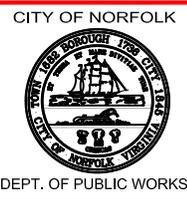


SECTION B

SECTION A

NOTE:

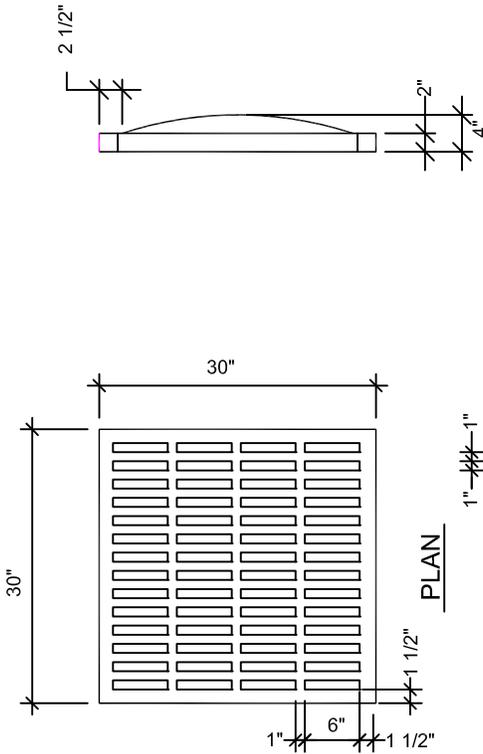
1. MORTAR PARGE BRICK INSIDE AND OUT (TYPE 6N).
2. INVERT OF STRUCTURE TO BE SHAPED IN ACCORDANCE WITH VDOT STANDARD IS-1.



DESCRIPTION		DESIGNATION
STANDARD DOUBLE CURB INLET		HS-102
SCALE	EDITION	REVISED
NOT TO SCALE	NCDS2013.7	DECEMBER 2007

NOTES:

1. MORTAR PARGE BRICK INSIDE AND OUT (TYPE 6N).
2. WRAP CONNECTION BETWEEN PIPE AND STRUCTURE WITH GEOTEXTILE FABRIC.
3. INVERT OF STRUCTURE TO BE SHAPED IN ACCORDANCE WITH VDOT STANDARD IS-1.
4. CONCRETE COVER AND GRATE ARE TO BE FURNISHED AS A SINGLE UNIT.
5. GRATE BARS ARE TO PARALLEL TO DITCH FLOW.

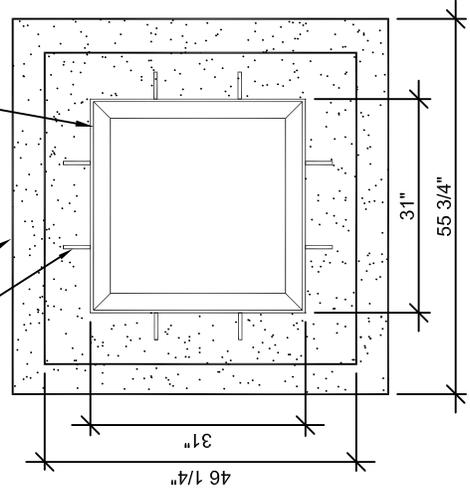


ELEVATION

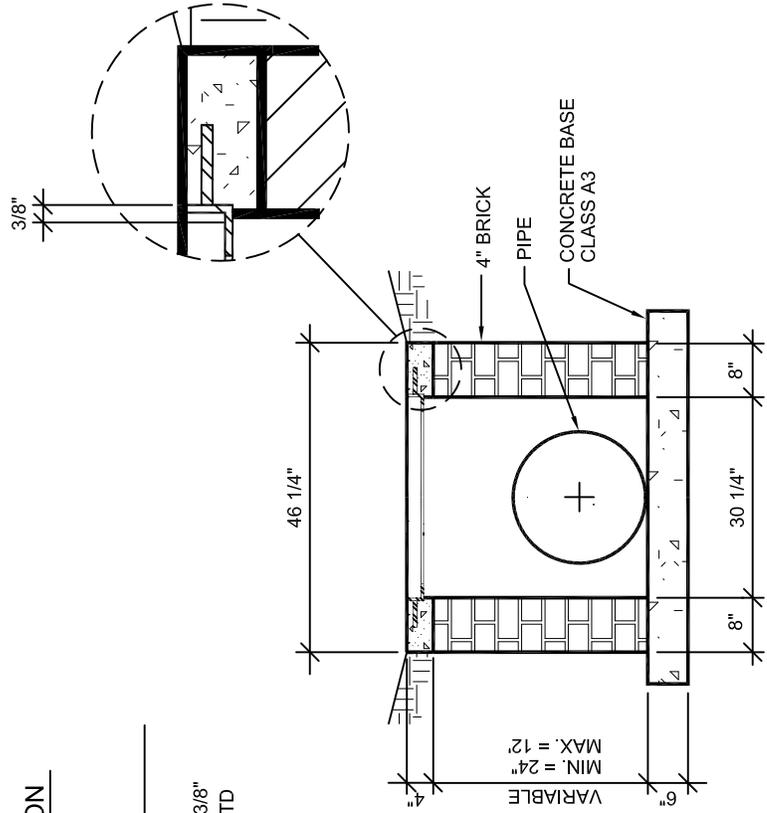
SECTION

CAST IRON GRATE

CONCRETE BASE (CLASS A3)
 1/2" DIA. x 4" BOLT (TYP.)
 L2-1/2"x2-1/2"x3/8" FRAME FOR STD GRATE.



PLAN



SECTION

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD GRATE INLET

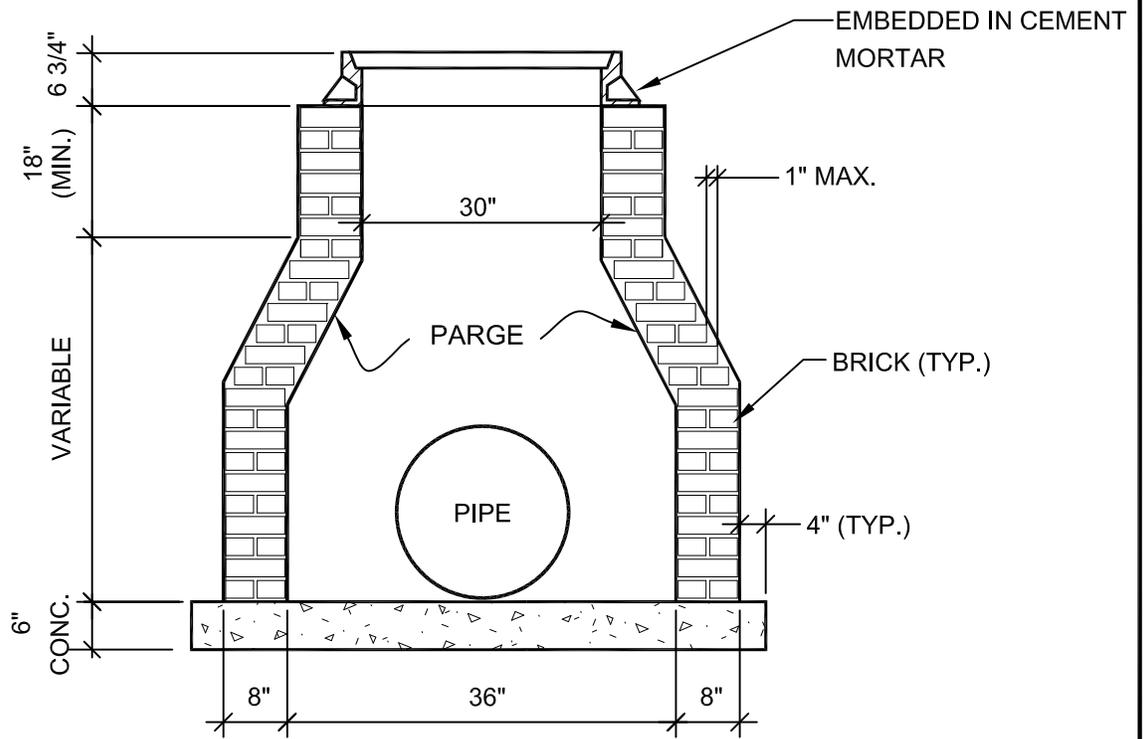
DESIGNATION

HS-103

SCALE
 NOT TO SCALE

EDITION
 NCDS2013.7

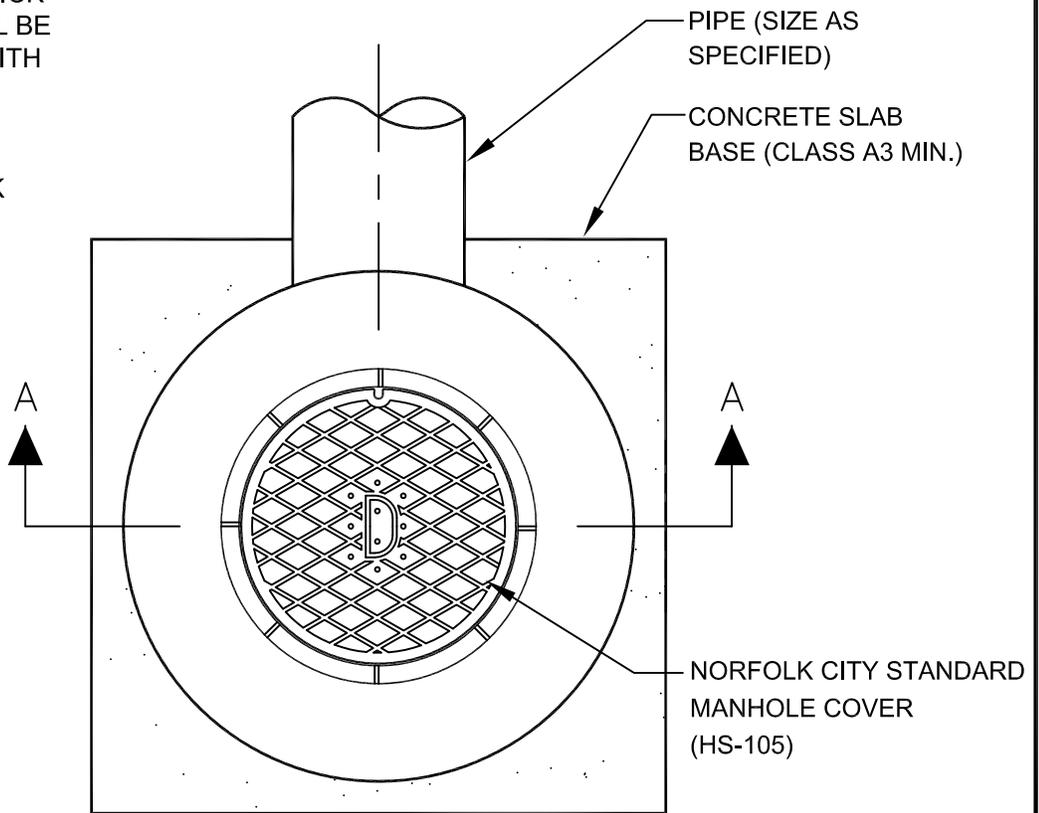
REVISED
 JAN. 2004



SECTION A - A

NOTE

HARD, SOUND, COMMON BRICK OR CONCRETE BRICK SHALL BE LAID IN CEMENT MORTAR WITH SHOVED JOINTS NOT TO EXCEED 3/8" THICK. INTERIOR FACE SHALL BE PLASTERED WITH 1/2" THICK CEMENT MORTAR (MIN.).



PLAN

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD MANHOLE

DESIGNATION

HS-104

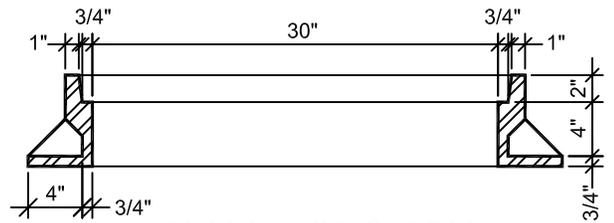
SCALE
NOT TO SCALE

EDITION
NCDS2013.7

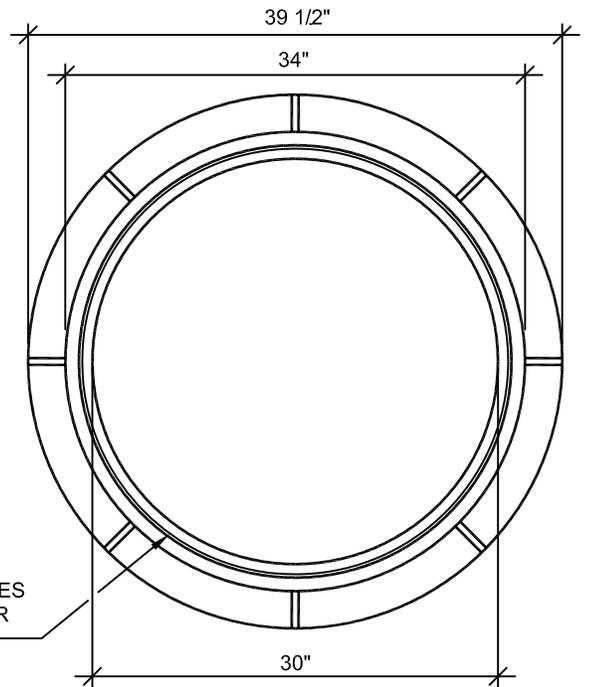
REVISED
JAN. 2004

NOTE

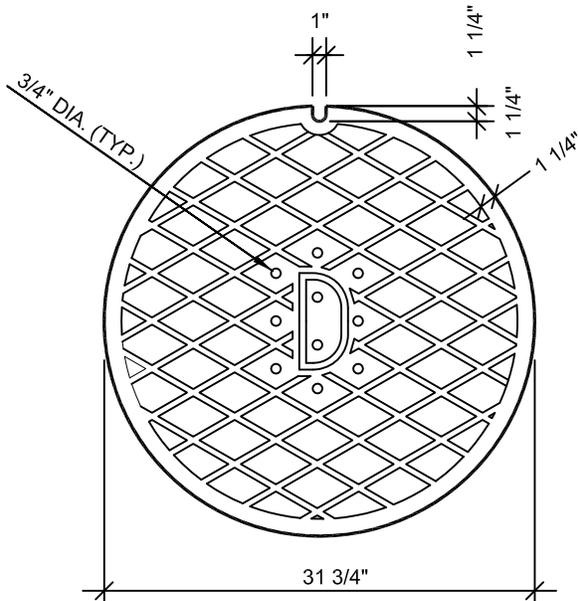
LARGE LETTER IN CENTER OF COVER MAY BE S, W, OR D, AS SPECIFIED IN ORDER. IRON SHALL BE 35,000 P.S.I. A.S.T.M. SPECS. A-48-60 WEIGHT SHALL BE PAINTED ON FRAME AND TOP.



FRAME SECTION



FRAME

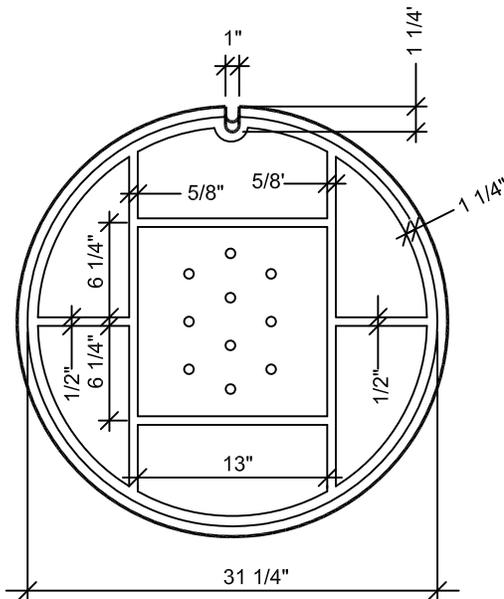


FRONT

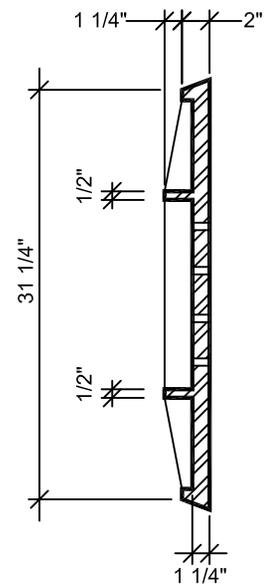
BOTH SURFACES MACHINED FOR PERFECT FIT

WEIGHT

FRAME 250 LBS.
COVER 290 LBS.
TOTAL 540 LBS.



BACK



SECTION

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD MANHOLE COVER

DESIGNATION

HS-105

SCALE

NOT TO SCALE

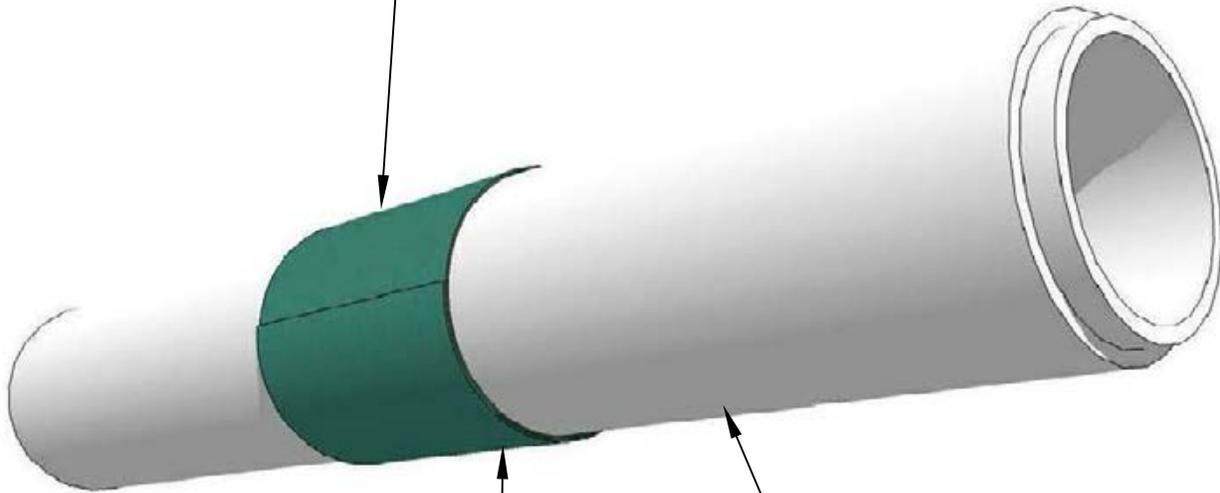
EDITION

NCDS2013.7

REVISED

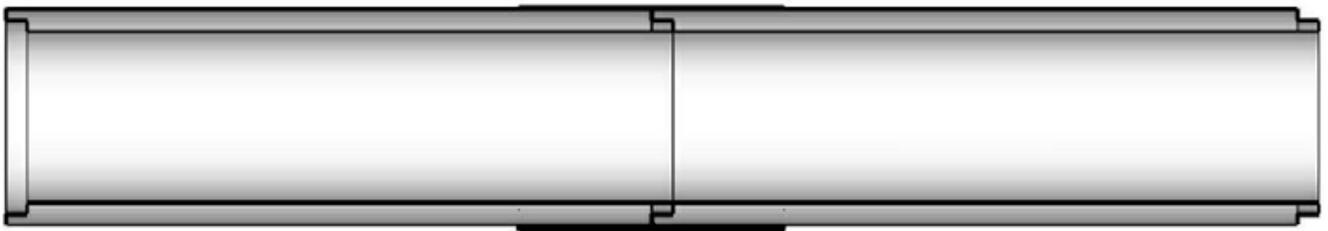
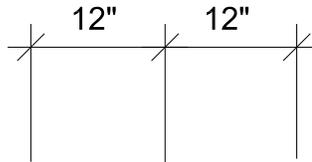
JAN. 2004

FILTER FABRIC SHALL BE CENTERED ON PIPE JOINT 12" MINIMUM EITHER SIDE OF JOINT



18" RCP

FILTER FABRIC SHALL WRAP AROUND OUTER DIAMETER OF RCP 1 1/2 TIMES MINIMUM.



FILTER FABRIC WRAP

RCP JOINT

SECTION

NOTE

FILTER FABRIC SHALL BE NONWOVEN GEOTEXTILE CONSTRUCTION FABRIC (ACF ENVIRONMENTAL #35)

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

FABRIC JOINT WRAP

DESIGNATION

HS-106

SCALE

NOT TO SCALE

EDITION

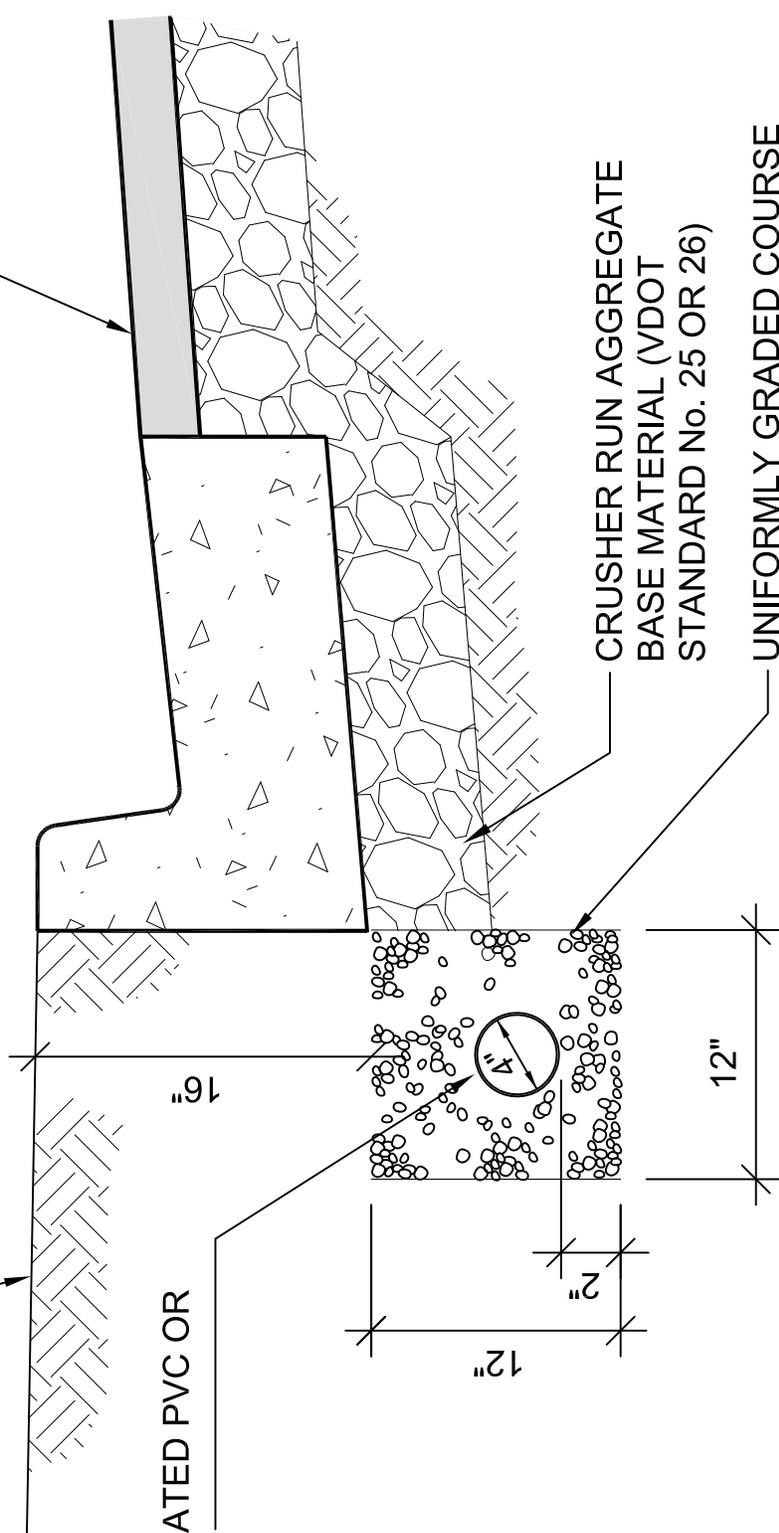
NCDS2013.7

REVISED

MARCH 2013

COMPACT BACKFILL IN 6" LIFTS TO 90% OF MAX. DENSITY

PAVEMENT



PERFORATED PVC OR PE PIPE.

CRUSHER RUN AGGREGATE BASE MATERIAL (VDOT STANDARD No. 25 OR 26)

UNIFORMLY GRADED COURSE AGGREGATE (VA SIZE No. 8)
WRAP STONE BED IN GEOTEXTILE DRAINAGE FABRIC (ASTM D4751, ASTM 4491, VTM-52).

NOTE

CONNECT PERFORATED OUTLET PIPE TO NEAREST STORMWATER MANHOLE OR CURB INLET

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD ROADSIDE GROUNDWATER UNDERDRAIN

DESIGNATION

HS-107

SCALE

NOT TO SCALE

EDITION

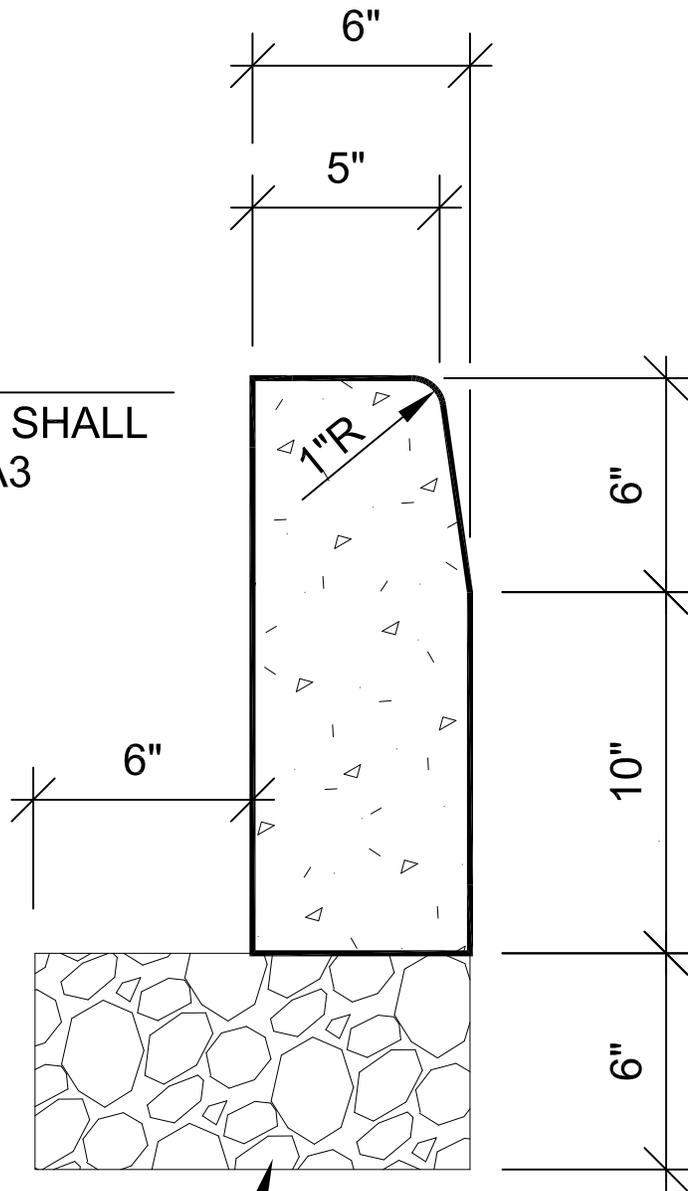
NCDS2013.7

REVISED

JAN. 2004

NOTE:

CONCRETE SHALL
BE CLASS A3



STONE (ROC)

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD 6" PARKWAY CURB

DESIGNATION

HS-201

SCALE

NOT TO SCALE

EDITION

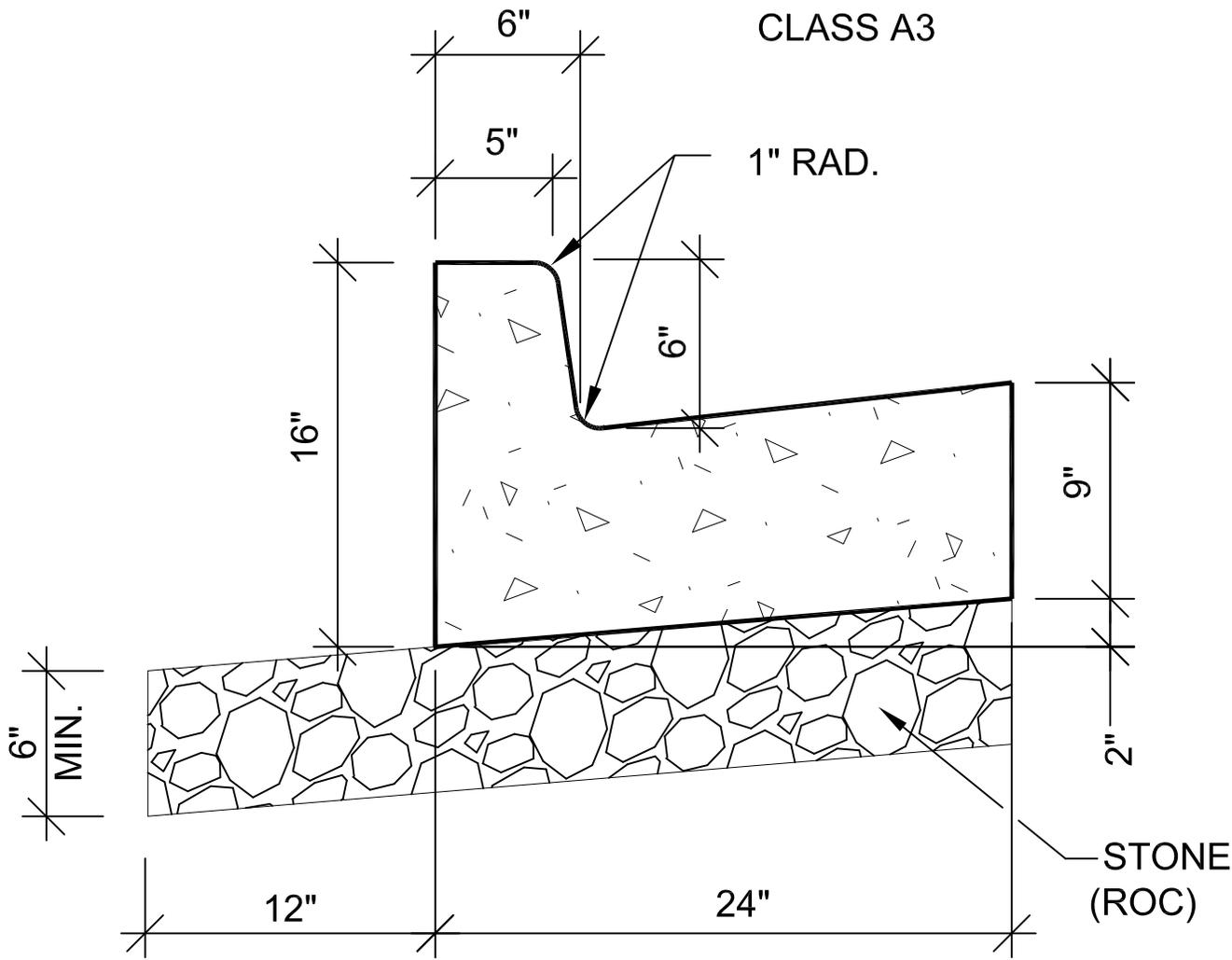
NCDS2013.7

REVISED

JULY 2013



MAT'L CONCRETE
CLASS A3



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD 6" CURB AND GUTTER

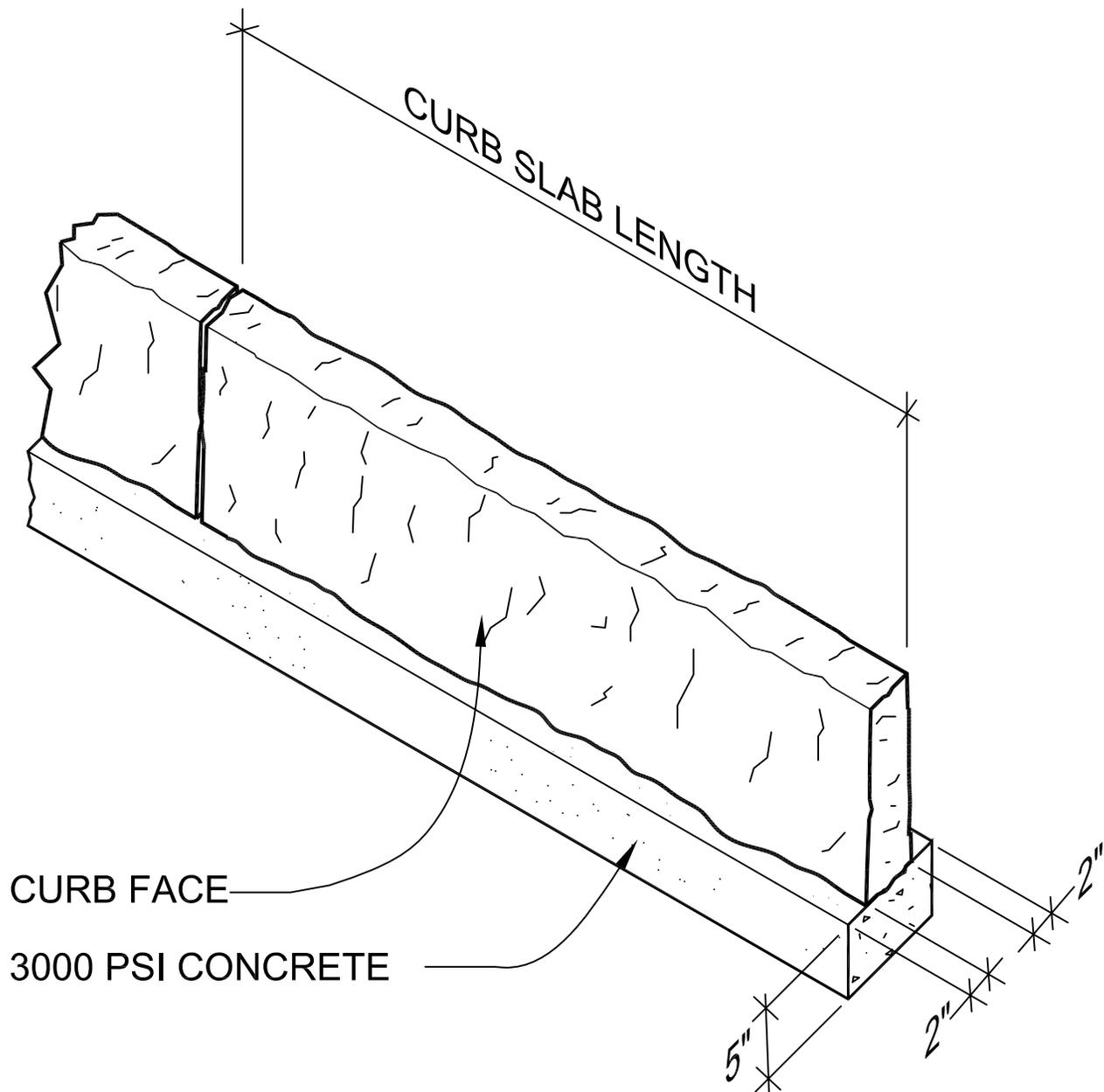
DESIGNATION

HS-202

SCALE
NOT TO SCALE

EDITION
NCDS2013.7

REVISED
JULY 2013



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

METHOD OF SETTING GRANITE CURB

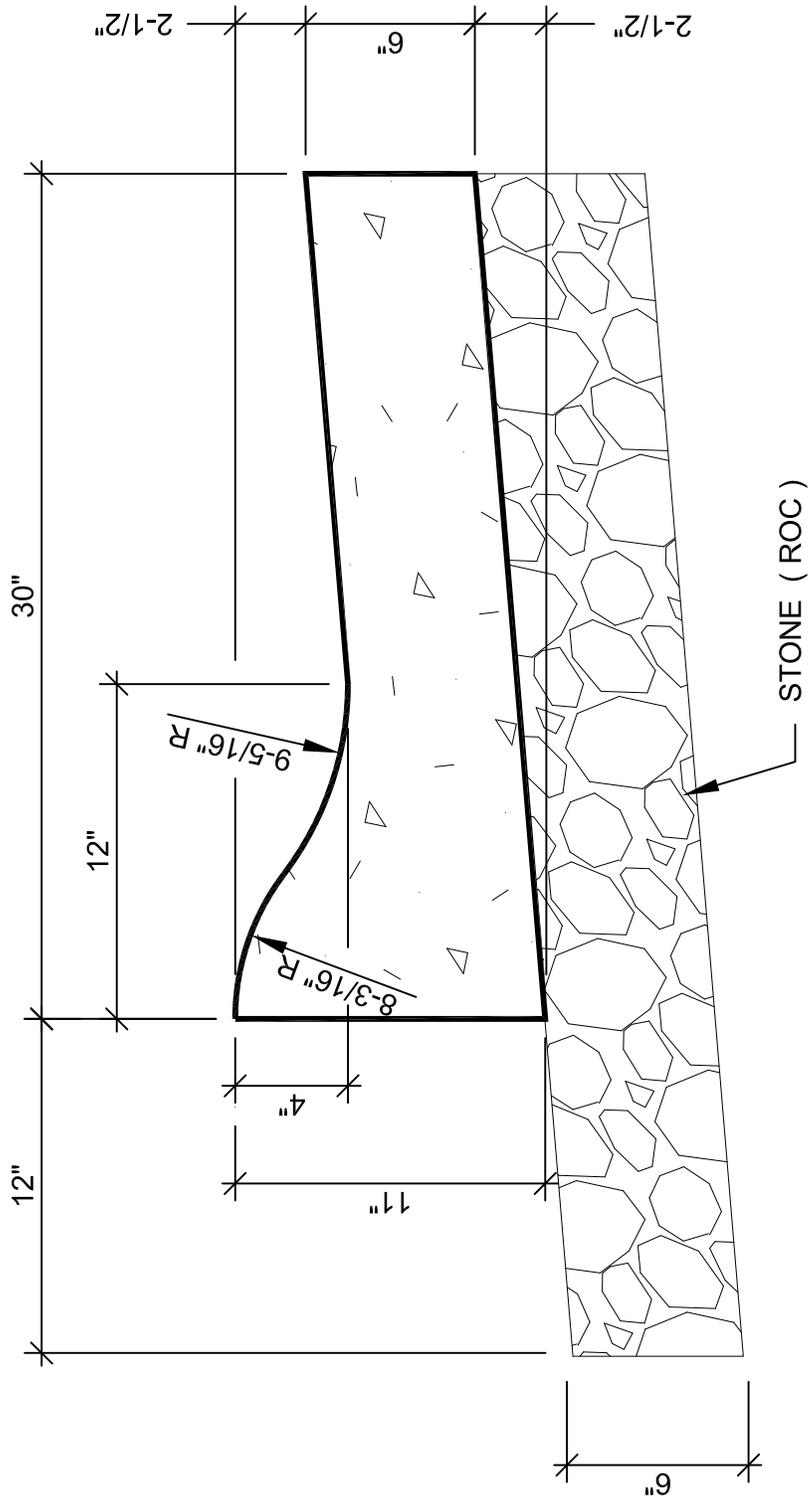
SCALE
NOT TO SCALE

EDITION
NCDS2013.7

REVISED
JAN. 2004

DESIGNATION

HS-203



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD ROLL-TYPE CURB AND GUTTER

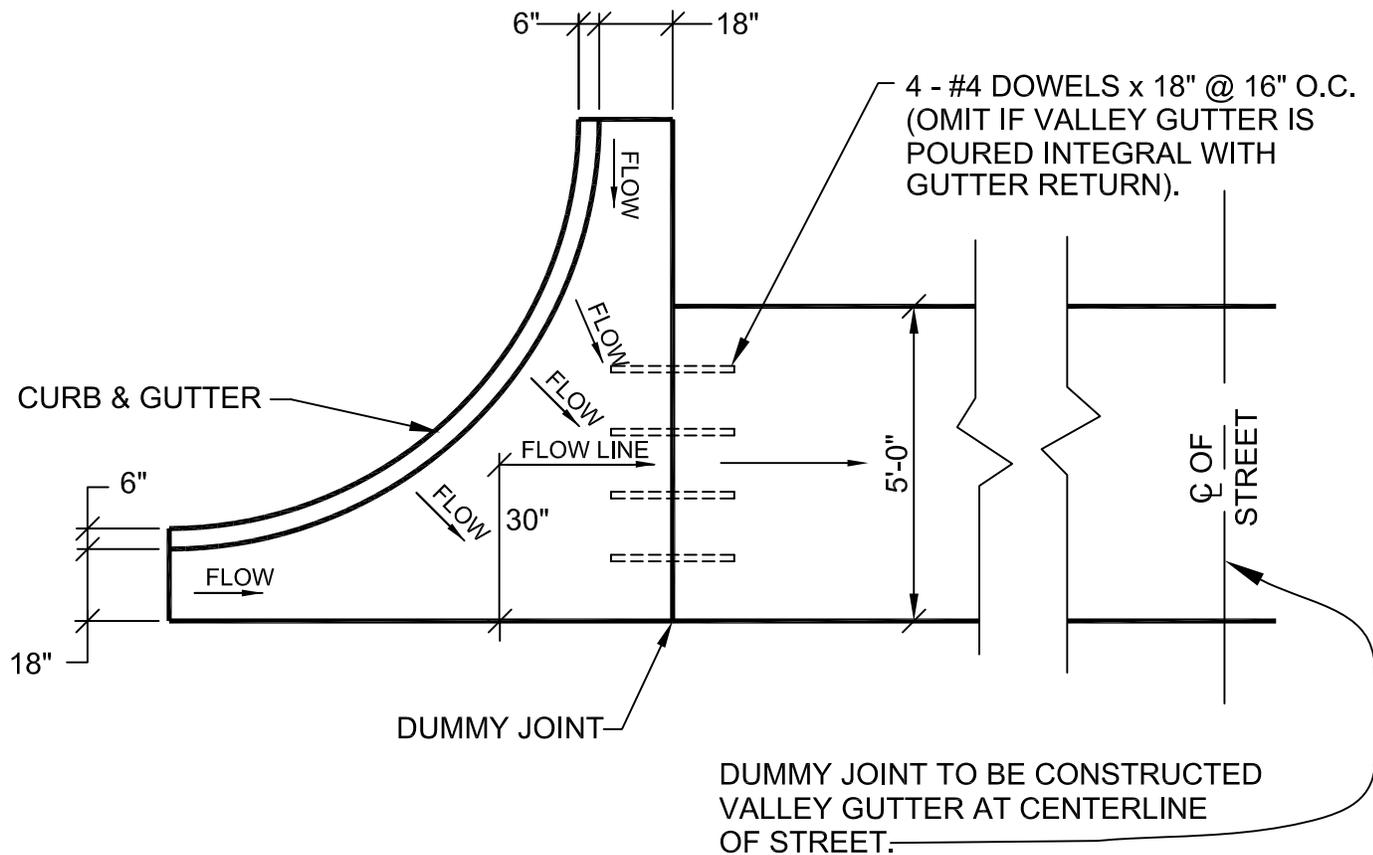
DESIGNATION

HS-204

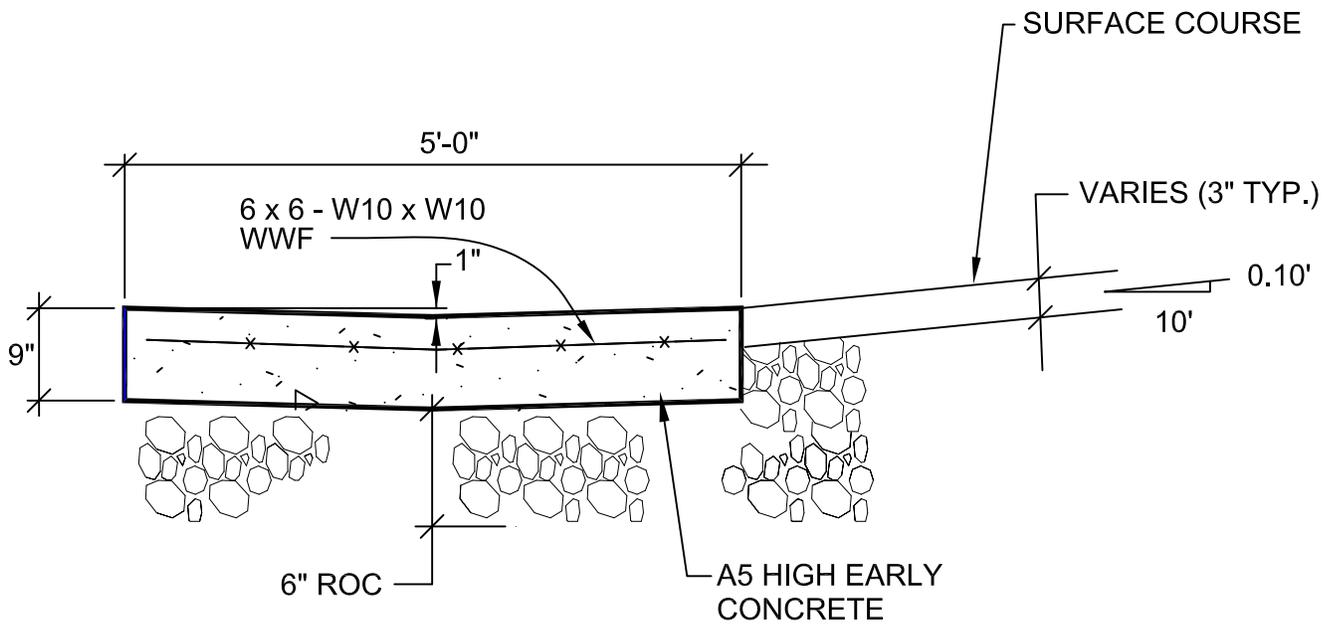
SCALE
NOT TO SCALE

EDITION
NCDS2013.7

REVISED
JAN. 2004



PLAN VIEW



SECTION AT Q

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD VALLEY GUTTER

DESIGNATION

HS-205

SCALE

NOT TO SCALE

EDITION

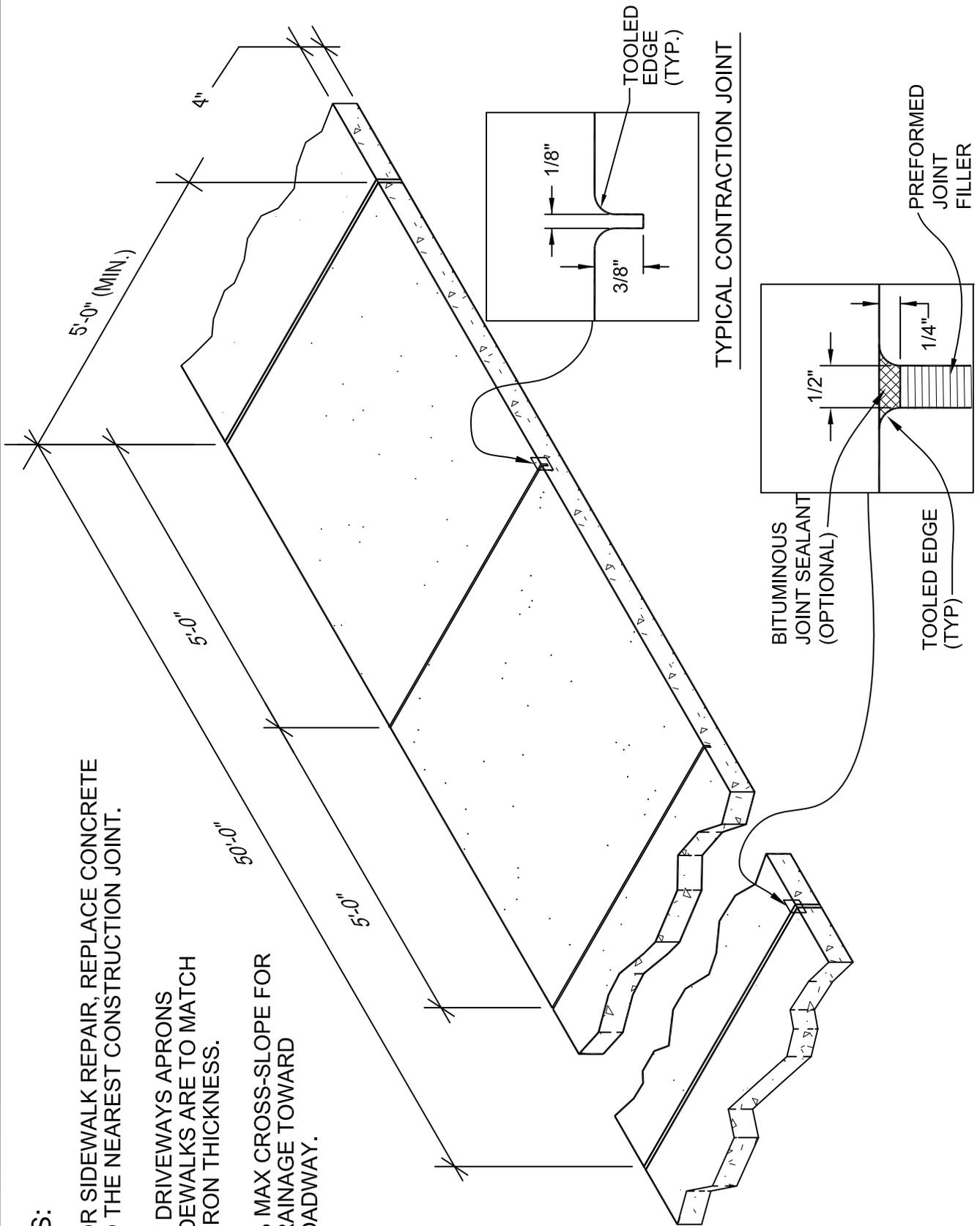
NCDS2013.7

REVISED

JAN. 2004

NOTES:

1. FOR SIDEWALK REPAIR, REPLACE CONCRETE TO THE NEAREST CONSTRUCTION JOINT.
2. AT DRIVEWAYS APRONS SIDEWALKS ARE TO MATCH APRON THICKNESS.
3. 2% MAX CROSS-SLOPE FOR DRAINAGE TOWARD ROADWAY.



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD SIDEWALK DETAIL

DESIGNATION

HS-206

SCALE

NOT TO SCALE

EDITION

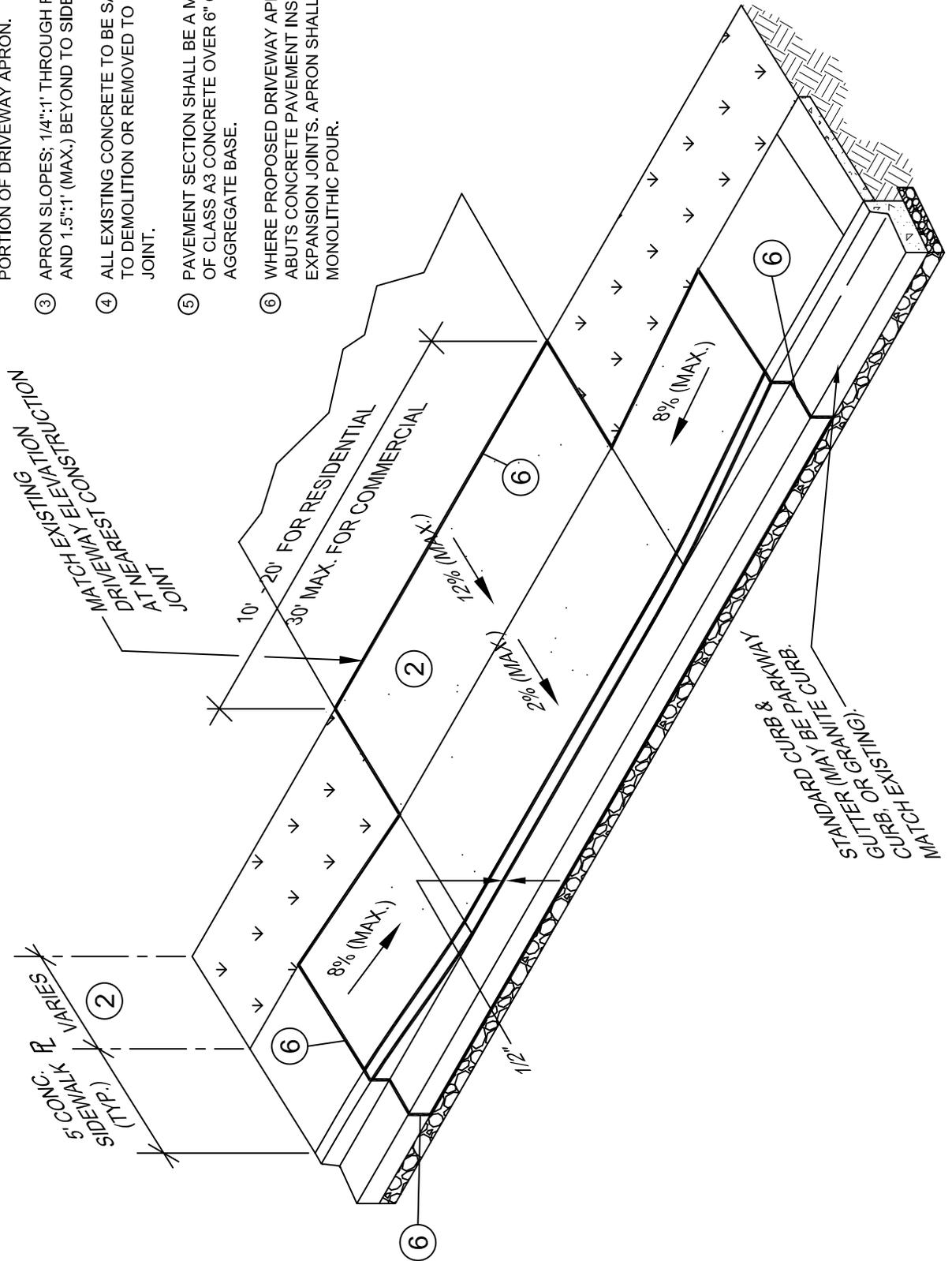
NCDS2013.7

REVISED

JAN. 2004

NOTES

- ① APRONS SHALL BE CONSTRUCTED AT LEAST 3 FT. FROM ALL UTILITY POLES, FIRE HYDRANTS, TELEPHONE PEDESTALS, ETC.
- ② PERMISSION FROM PROPERTY OWNER SHALL BE ACQUIRED BEFORE CONSTRUCTING THIS PORTION OF DRIVEWAY APRON.
- ③ APRON SLOPES: 1/4":1" THROUGH FIRST 3' (MIN.) AND 1.5":1" (MAX.) BEYOND TO SIDEWALK.
- ④ ALL EXISTING CONCRETE TO BE SAW-CUT PRIOR TO DEMOLITION OR REMOVED TO NEAREST JOINT.
- ⑤ PAVEMENT SECTION SHALL BE A MINIMUM OF 7" OF CLASS A3 CONCRETE OVER 6" OF AGGREGATE BASE.
- ⑥ WHERE PROPOSED DRIVEWAY APRON ABUTS CONCRETE PAVEMENT INSTALL 1/2" EXPANSION JOINTS. APRON SHALL BE A MONOLITHIC POUR.



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

ADA VARIATION OF DRIVEWAY APRON

DESIGNATION

HS-208

SCALE

NOT TO SCALE

EDITION

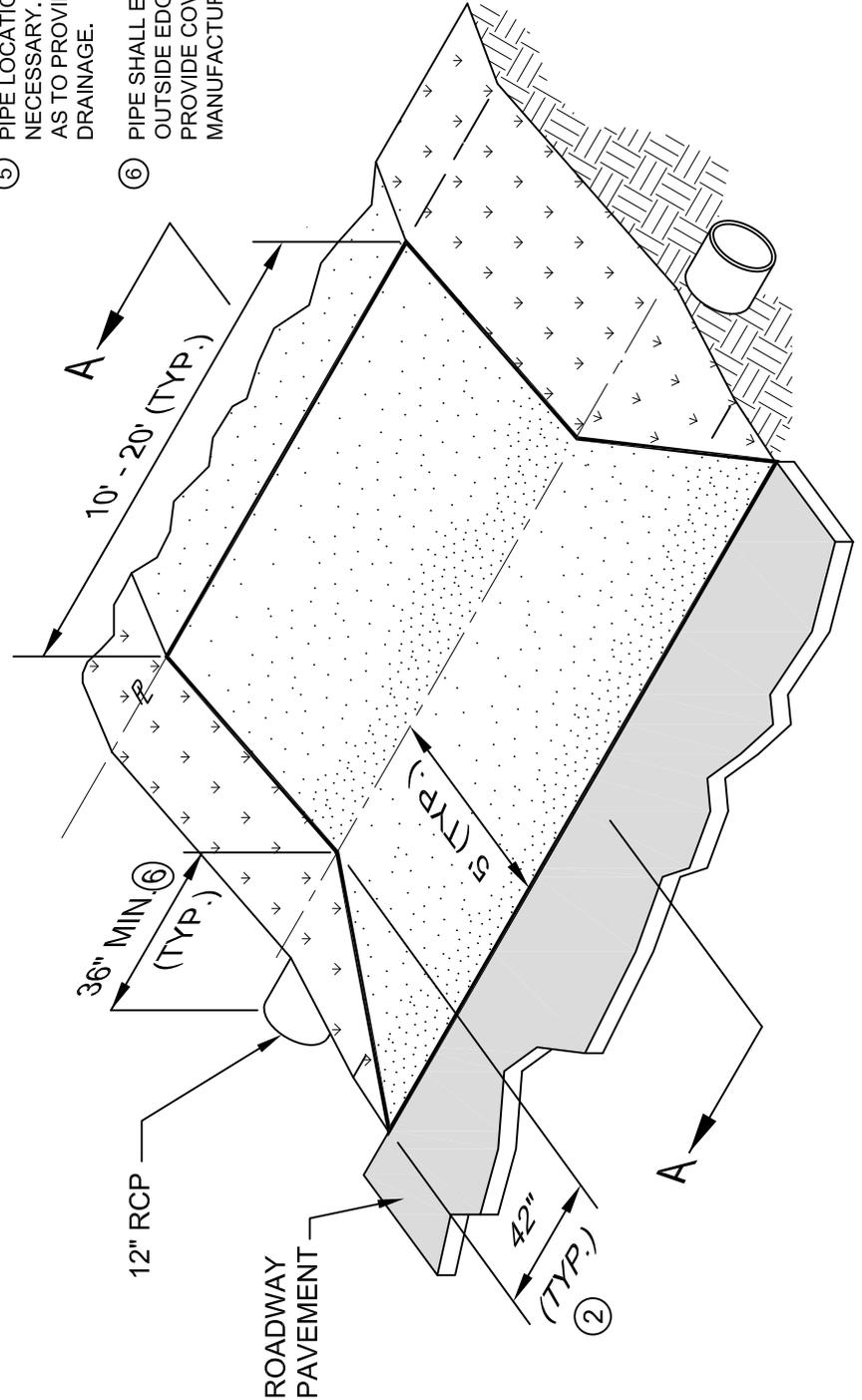
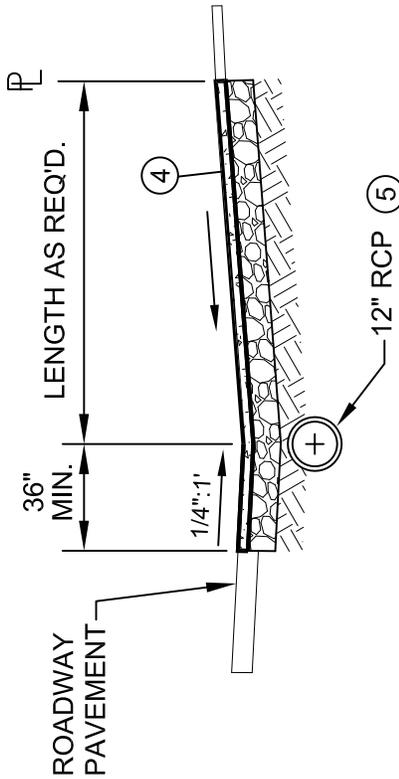
NCDS2013.7

REVISED

DECEMBER 2007

NOTES

- ① APRONS SHALL BE CONSTRUCTED AT LEAST 3 FT. FROM ALL UTILITY POLES, FIRE HYDRANTS, TELEPHONE PEDESTALS, ETC.
- ② APRON FLARES OR ANY OTHER PART OF THE DRIVEWAY APRON SHALL NOT ENCRoACH ONTO THE ADJACENT PROPERTY.
- ③ APRON SLOPES:
RECOMMENDED: 1/2": 1'
NOT TO EXCEED: 1-1/4": 1'
NOT TO EXCEED: 1/4": 1' ACROSS PEDESTRIAN CROSSING (WHERE APPLICABLE)
- ④ RESIDENTIAL DRIVEWAY APRONS SHALL BE 2" BITUMINOUS CONCRETE SURFACE MIX OVER 8" COMPACTED AGGREGATE BASE OR 6" OF CLASS A3 CONCRETE, MONOLITHICALLY POURED.
- ⑤ PIPE LOCATION MAY VARY WITHIN THE R.O.W. AS NECESSARY. THE PIPE SHALL BE INSTALLED SO AS TO PROVIDE AND MAINTAIN POSITIVE DRAINAGE.
- ⑥ PIPE SHALL EXTEND 3' (MIN.) BEYOND FARTHEST OUTSIDE EDGE OF ENTRANCE AT CROSSING. PROVIDE COVER AS SPECIFIED BY MANUFACTURER.



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD RESIDENTIAL DRIVEWAY APRON
WITHOUT CURB AND GUTTER

DESIGNATION

HS-209

SCALE

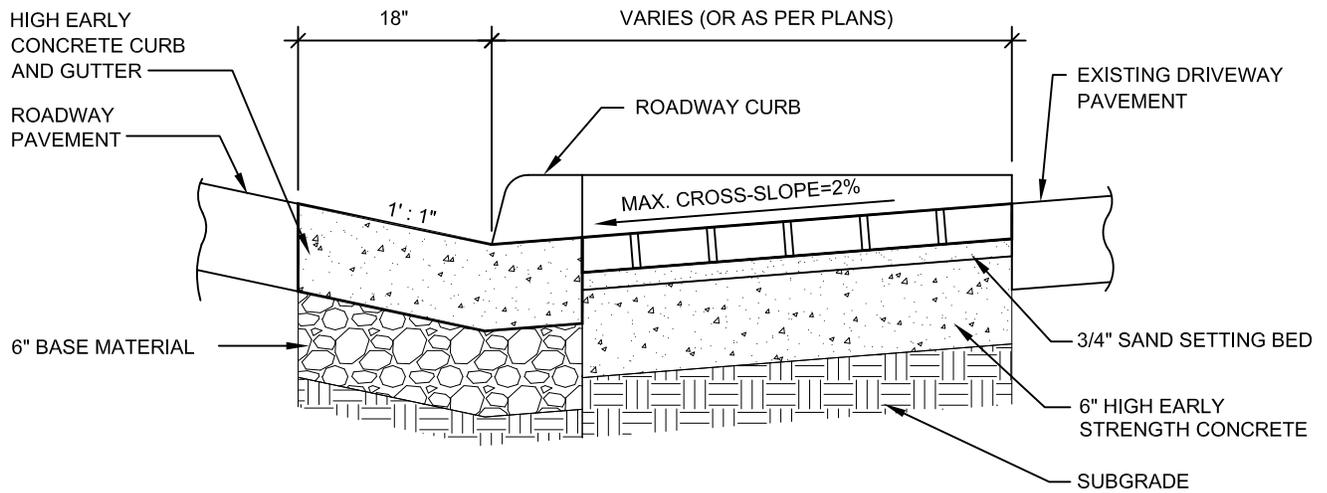
NOT TO SCALE

EDITION

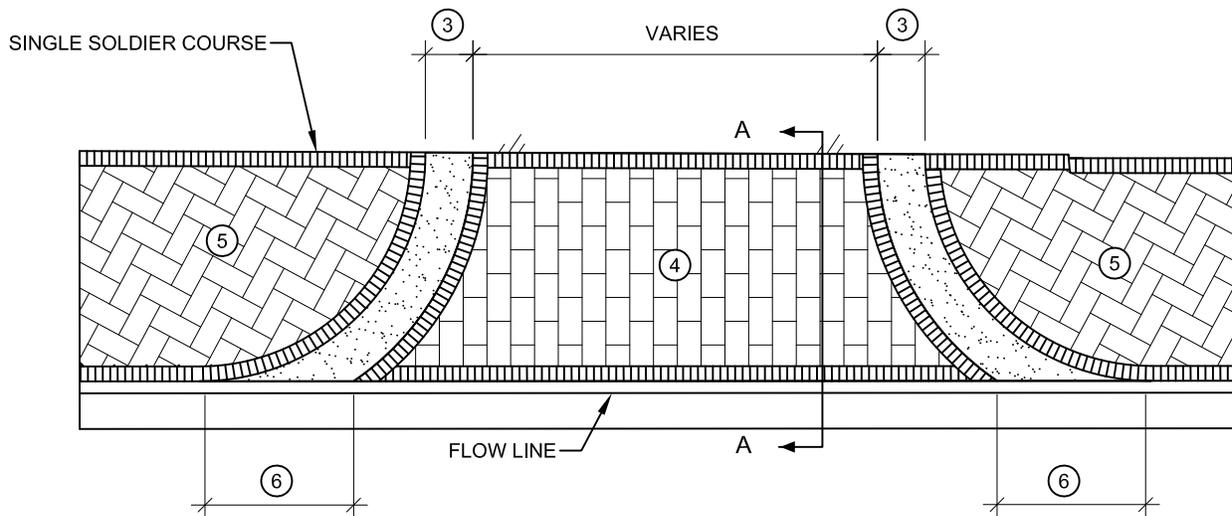
NCDS2013.7

REVISED

DECEMBER 2007



SECTION A - A



NOTES

- ① APRONS SHALL BE CONSTRUCTED AT LEAST 3 FEET FROM ALL UTILITY POLES, FIRE HYDRANTS, TELEPHONE PEDESTALS, ETC.
- ② APRON FLARES AND ANY OTHER PART OF THE DRIVEWAY, SHALL NOT ENCR OACH ONTO ADJACENT PROPERTY.
- ③ 24" WIDE CONCRETE TRANSITION STRIP; RADIUS AS PER PLANS.
- ④ HEAVY VEHICULAR PAVERS
 SIZE: 4" X 8' X 2 3/4", TYPE F
 COLOR: ENGLISH EDGE DARK ACCENT
 PATTERN: RUNNING BOND
 MANUFACTURED BY: PINE HALL BRICK COMPANY, WINSTON SALEM, NC OR APPROVED EQUAL
- ⑤ SIDEWALK BRICK PAVER
 SIZE: 4" X 8' X 2 1/4"
 COLOR: PATHWAY FULL RANGE (FR)
 PATTERN: 45° HERRINGBONE
 MANUFACTURED BY: PINE HALL BRICK COMPANY, WINSTON SALEM, NC OR APPROVED EQUAL
- ⑥ WIPE DOWN CURB ALONG CONCRETE STRIP

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

COMMERCIAL BRICK DRIVEWAY APRON

DESIGNATION

HS-210

SCALE

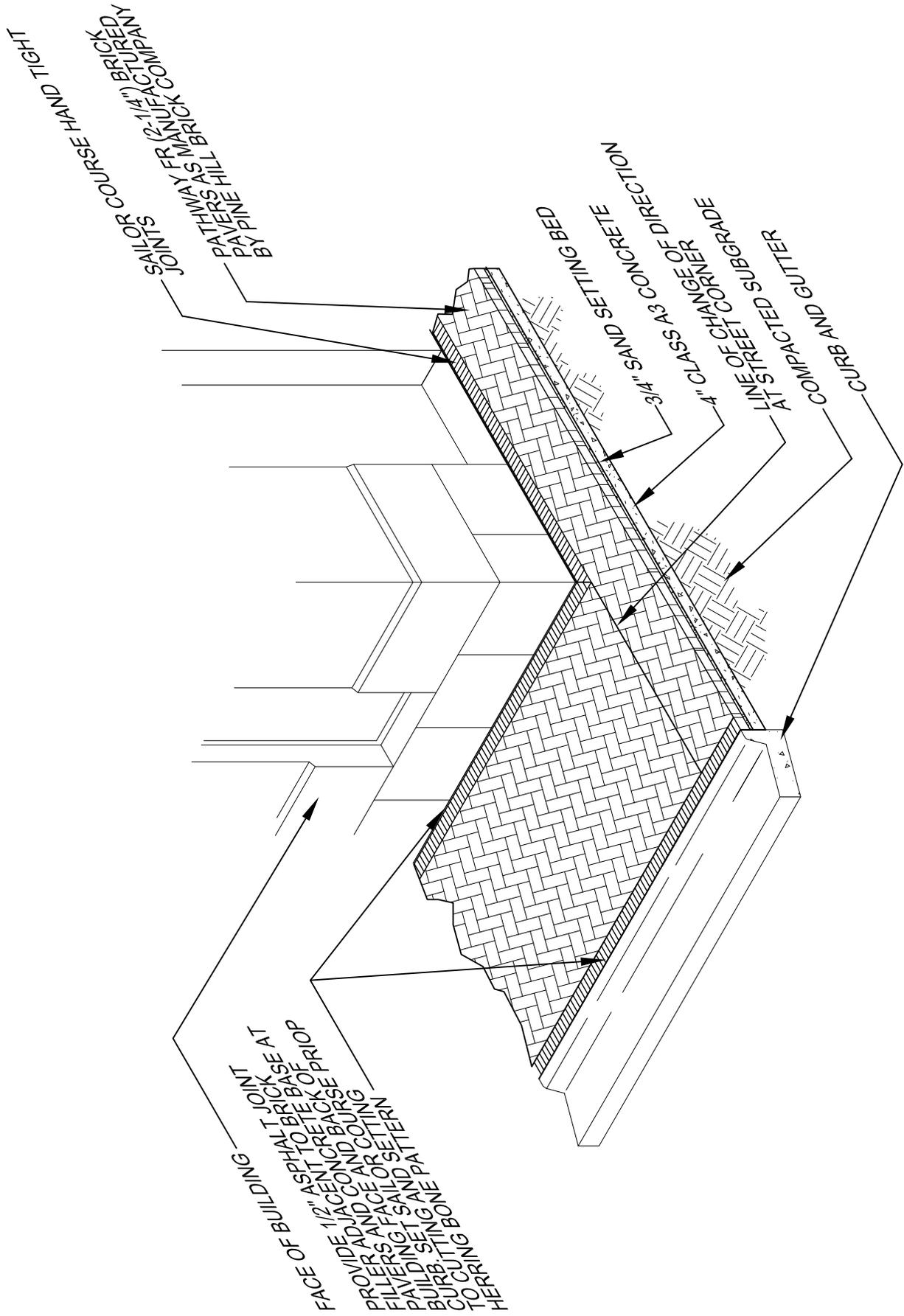
NOT TO SCALE

EDITION

NCDS2013.7

REVISED

DECEMBER 2007



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

STANDARD DOWNTOWN BRICK SIDEWALK

DESIGNATION

HS-211

SCALE

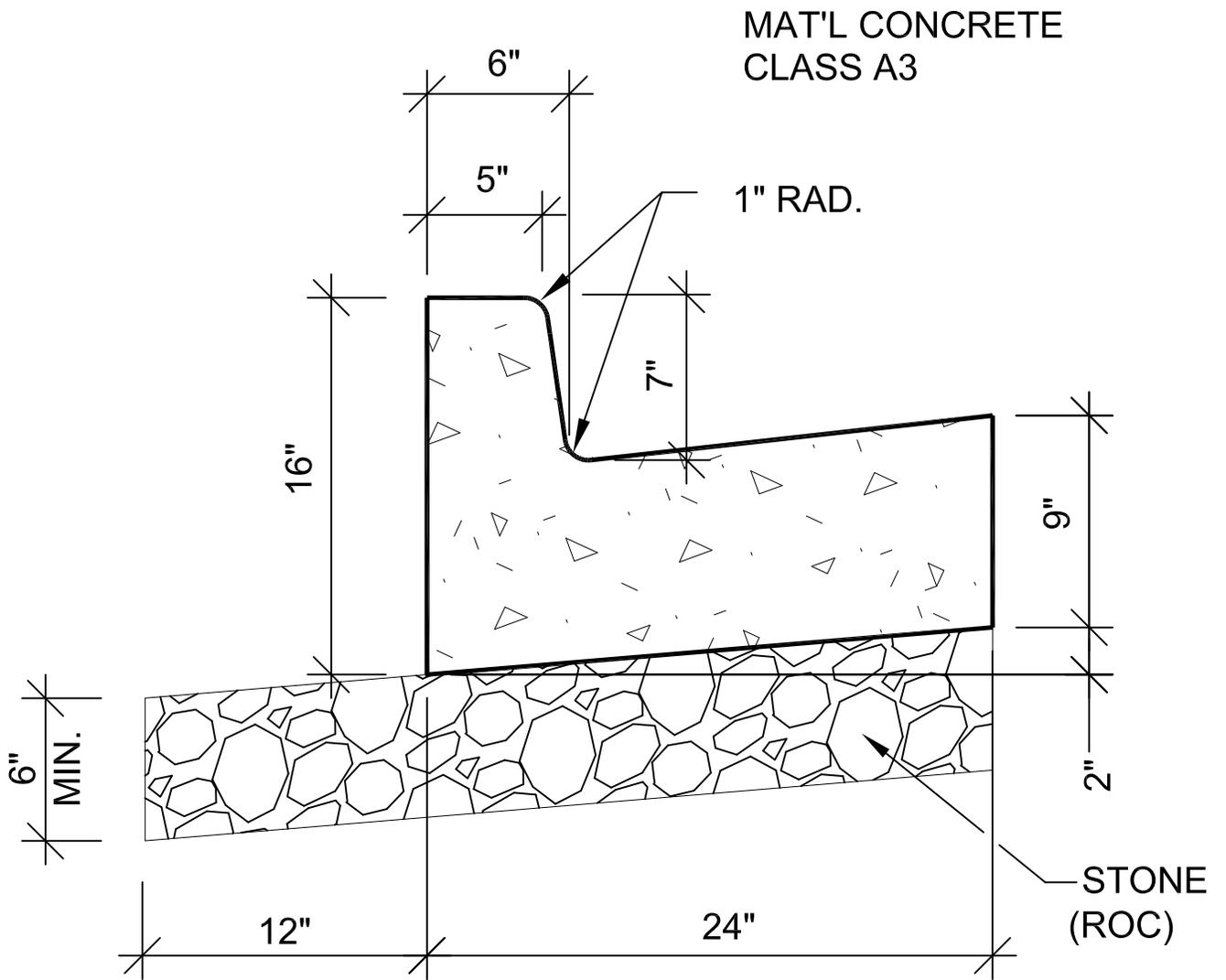
NOT TO SCALE

EDITION

NCDS2013.7

REVISED

DECEMBER 2007



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

MODIFIED 7" CURB AND GUTTER

DESIGNATION

HS-212

SCALE

NOT TO SCALE

EDITION

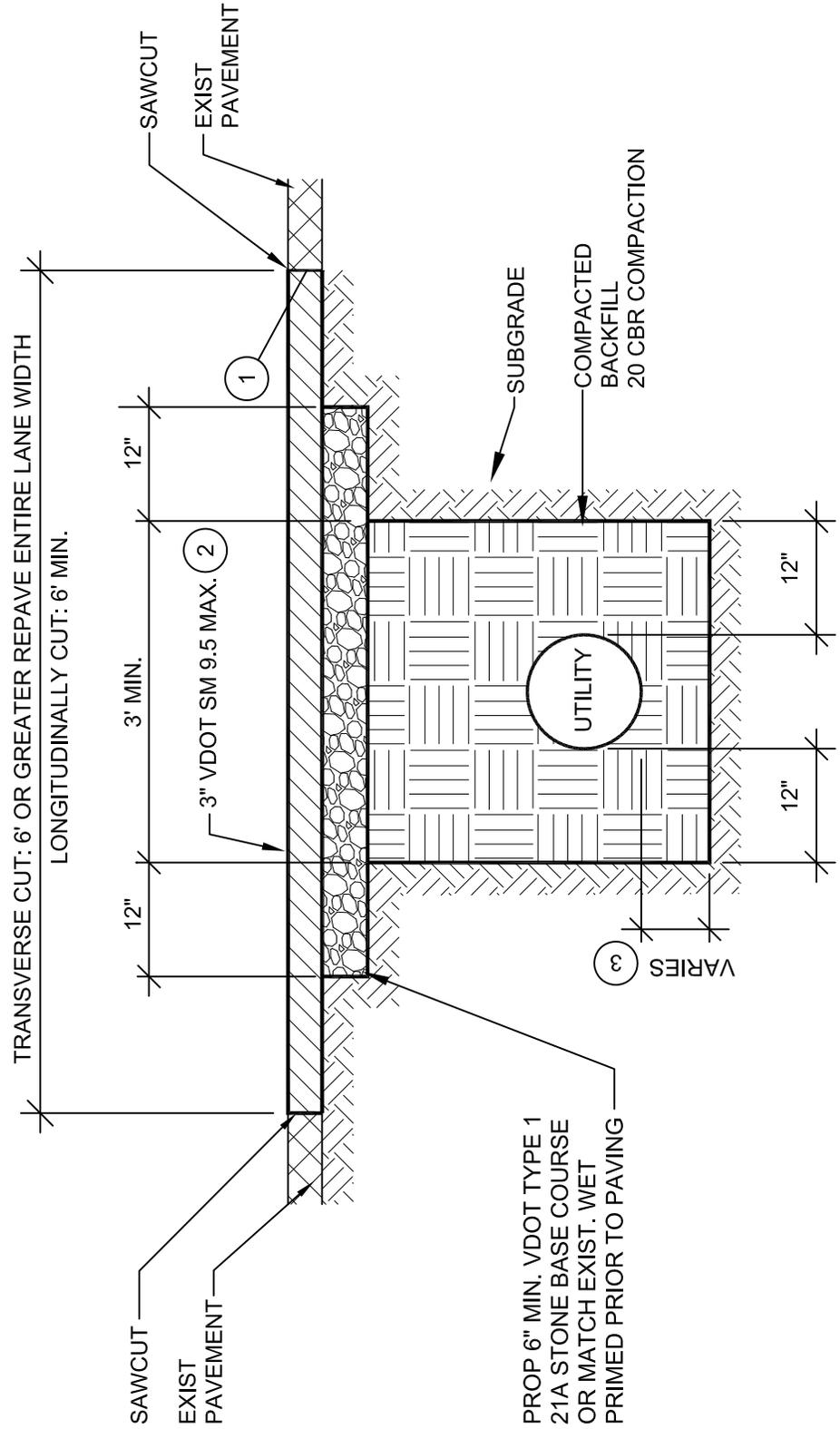
NCDS2013.7

REVISED

JULY 2013

NOTES

- ① TACK COAT: CRS-1 OR RC-250 @ 0.10 GAL. PER SQUARE YARD ALL VERTICAL SURFACES.
- ② SM-9.5A SHALL BE USED ON ALL RESIDENTIAL. SM 9.5D SHALL BE USED ON ALL COLLECTORS AND ARTERIALS.
- ③ REFER TO UTILITY BURIAL SPECIFICATIONS.



TYPE I
(BITUMINOUS ASPHALT OVER STONE)

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

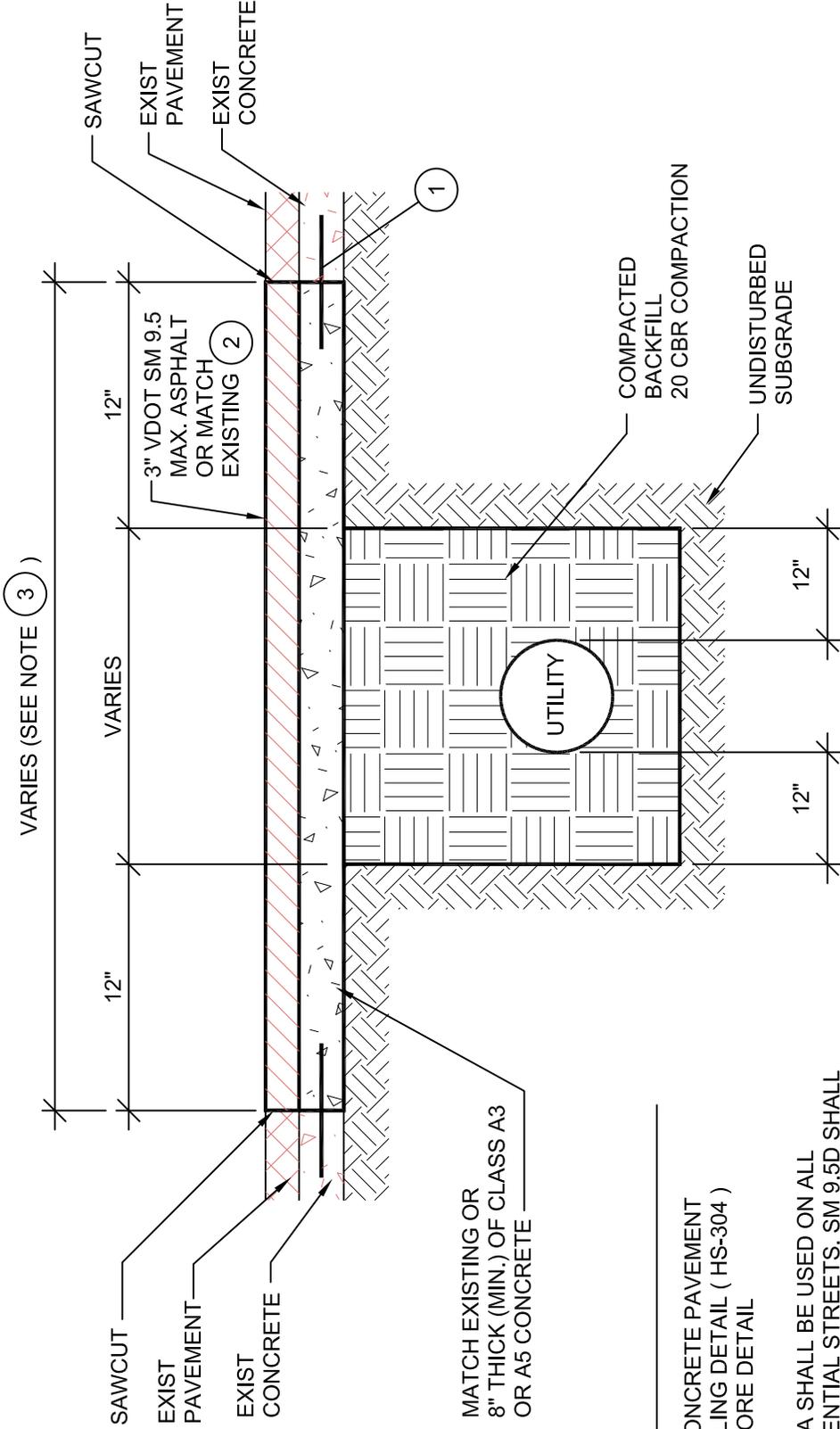
DESCRIPTION
**STANDARD PAVEMENT REPLACEMENT
ASPHALT OVER STONE**

DESIGNATION
HS-301

SCALE
NOT TO SCALE

EDITION
NCDS2013.7

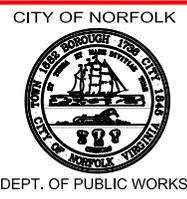
REVISED
JULY 2013



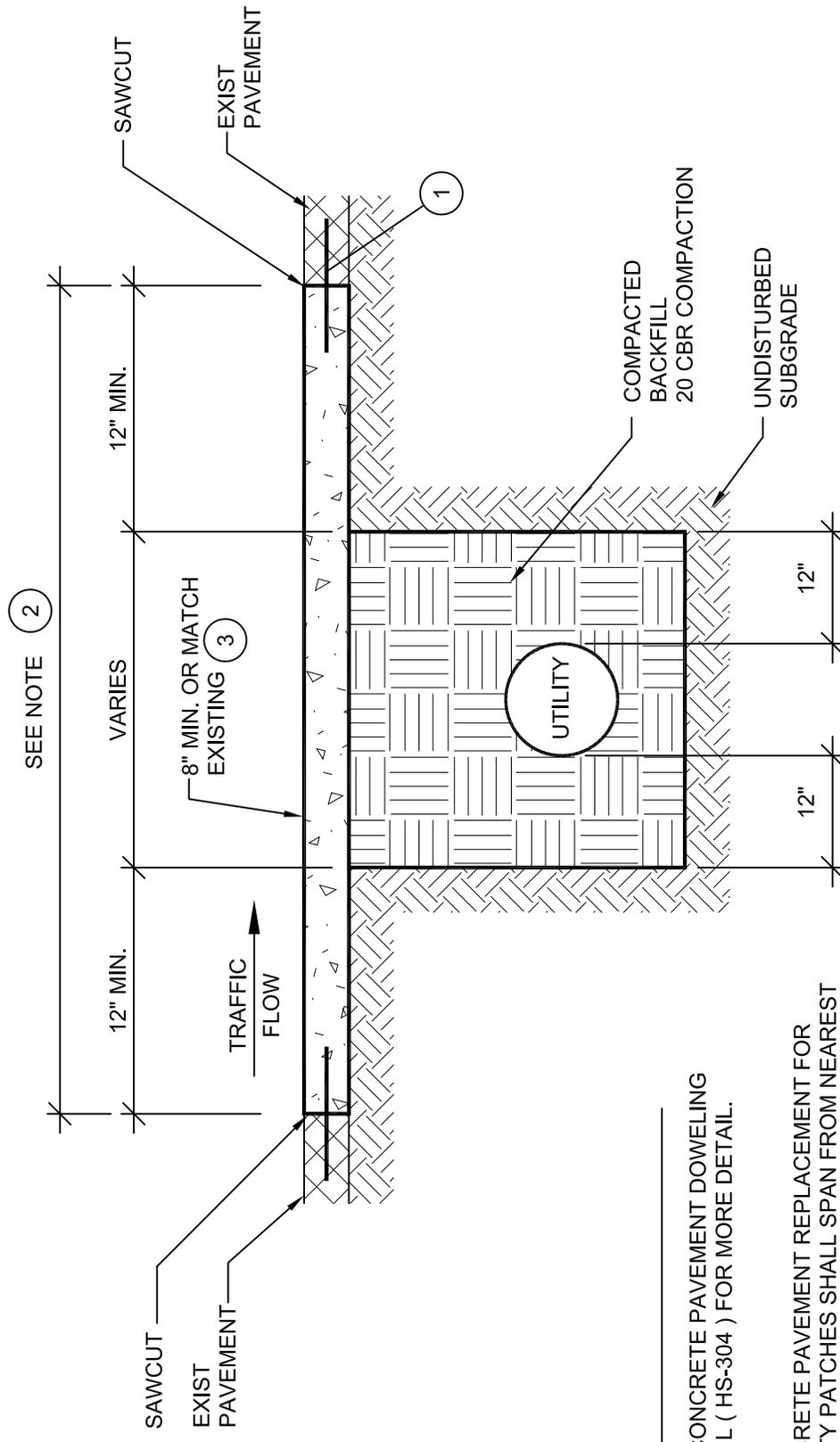
NOTES

- 1 SEE CONCRETE PAVEMENT DOWELING DETAIL (HS-304) FOR MORE DETAIL
- 2 SM 9.5A SHALL BE USED ON ALL RESIDENTIAL STREETS. SM 9.5D SHALL BE USED ON ALL COLLECTORS AND ARTERIAL STREETS
- 3 LIMITS OF RESTORATION ARE DEFINED IN THE RIGHT-OF WAY EXCAVATION AND RESTORATION MANUAL.
- 4 CONCRETE SHALL BE CLASS A3 OR CLASS A5 EARLY STRENGTH CONCRETE.

**TYPE II
(BITUMINOUS ASPHALT OVER CONCRETE)**



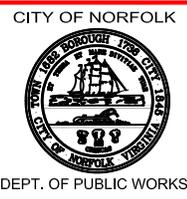
DESCRIPTION		DESIGNATION
STANDARD PAVEMENT REPLACEMENT ASPHALT OVER CONCRETE		HS-302
SCALE NOT TO SCALE	EDITION NCDS2013.7	REVISED JULY 2013



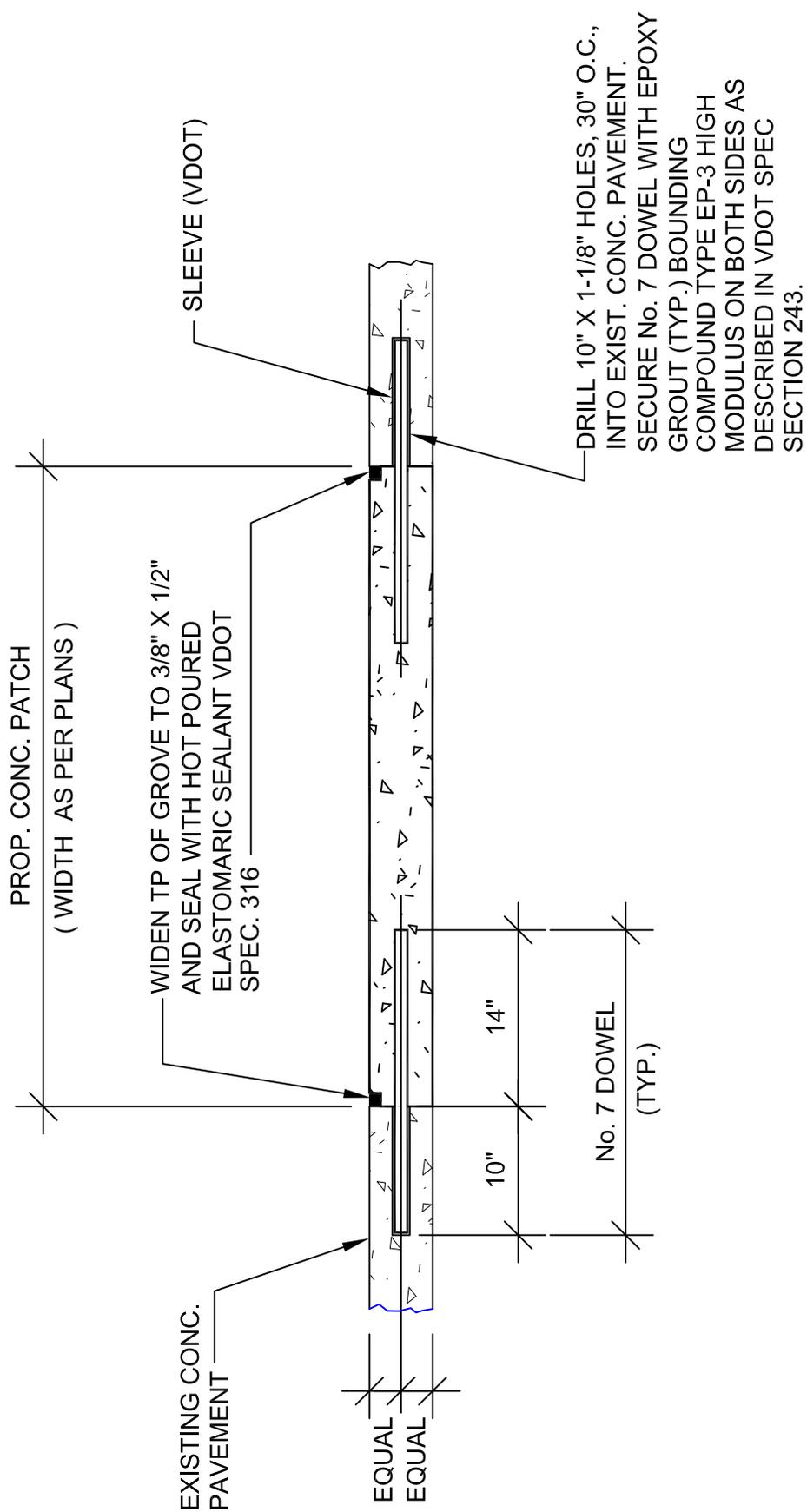
**TYPE III
(CONCRETE)**

NOTES

- ① SEE CONCRETE PAVEMENT DOWELING DETAIL (HS-304) FOR MORE DETAIL.
- ② CONCRETE PAVEMENT REPLACEMENT FOR UTILITY PATCHES SHALL SPAN FROM NEAREST TRAVERSE JOINT TO TRAVERSE JOINT AND FROM LONGITUDINAL JOINT TO LONGITUDINAL JOINT. DEFINED IN THE RIGHT-OF-WAY EXCAVATION AND RESTORATION MANUAL.
- ③ CONCRETE SHALL BE CLASS A3 OR CLASS A5 EARLY STRENGTH CONCRETE.



DESCRIPTION		DESIGNATION
STANDARD PAVEMENT REPLACEMENT CONCRETE		HS-303
SCALE NOT TO SCALE	EDITION NCDS2013.7	REVISED JAN. 2004



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

CONCRETE PAVEMENT DOWELING DETAIL

DESIGNATION

HS-304

SCALE

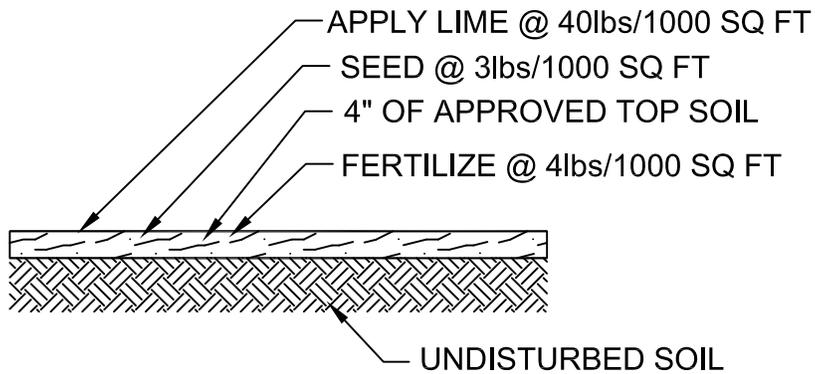
NOT TO SCALE

EDITION

NCDS2013.7

REVISED

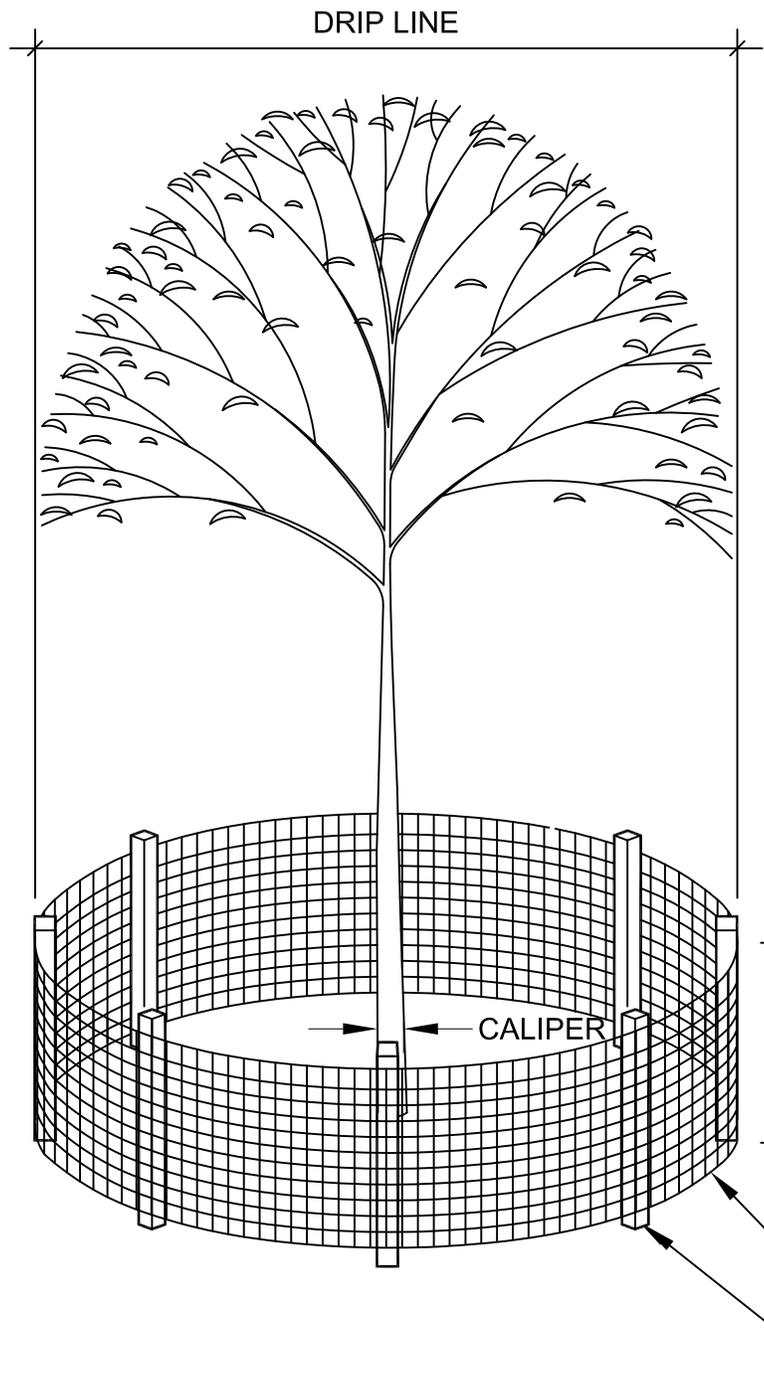
JAN. 2004



NOTES:

1. UNDISTURBED SOIL SHALL BE TILLED TO A DEPTH OF 3 INCHES PRIOR TO THE PLACEMENT OF APPROVED TOPSOIL
2. LIME SHALL BE FINELY GROUND DOLOMITIC AGRICULTURAL LIMESTONE CONTAINING AT LEAST 85% OF TOTAL CARBONATES.
3. FERTILIZER SHALL BE 13-25-12 FORMULA & SHALL CONFORM TO VDOT STANDARDS.
4. AFTER SEEDING, THE AREA SHALL BE RAKED, ROLLED, WATERED AND MULCHED IN AN APPROVED MANNER.
5. THE CONTRACTOR SHALL MAINTAIN ALL GRASSED AREAS TO PROVIDE FOR A SMOOTH UNIFORM TURF UPON COMPLETION OF THE CONTRACT.

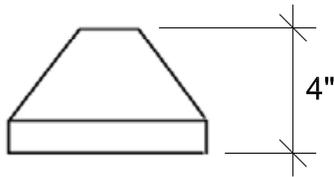
 CITY OF NORFOLK DEPT. OF PUBLIC WORKS	DESCRIPTION			DESIGNATION
	STANDARD GRASS PLANTING DETAIL			HS-601
SCALE	EDITION	REVISED		
NOT TO SCALE	NCDS2013.7	JAN. 2004		



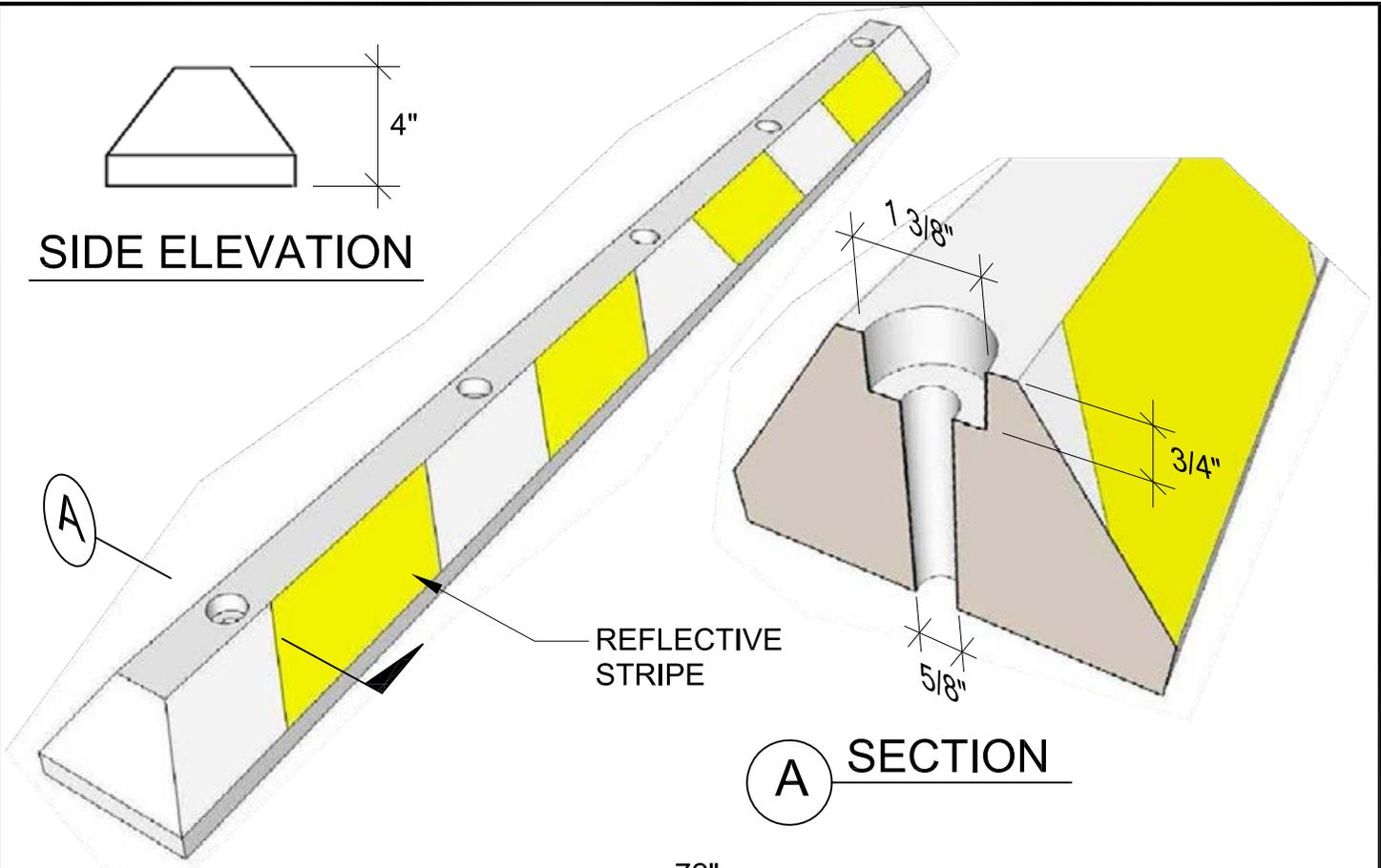
NOTE

THE FENCE RADIUS SHALL BE DETERMINED BY MATCHING THE DRIP LINE EXPANSE OR BY MULTIPLYING THE TREE CALIPER (EXPRESSED IN INCHES) BY 12. THE GREATER OF THE TWO MEASUREMENTS SHALL BE USED.

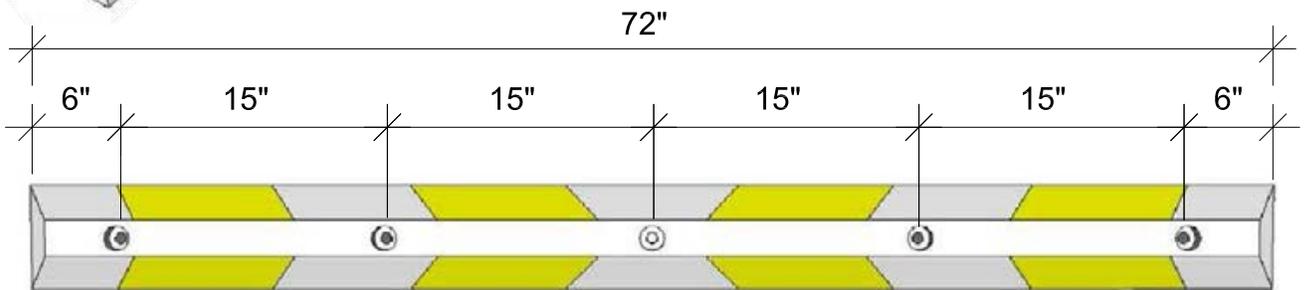
DESCRIPTION		DESIGNATION
STANDARD TREE PROTECTION DETAIL		HS-602
SCALE NOT TO SCALE	EDITION NCDS2013.7	REVISED MARCH 2012



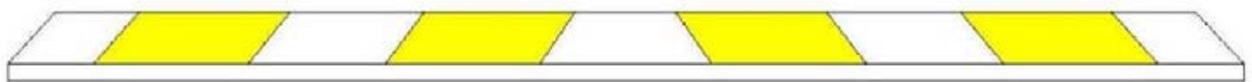
SIDE ELEVATION



A SECTION



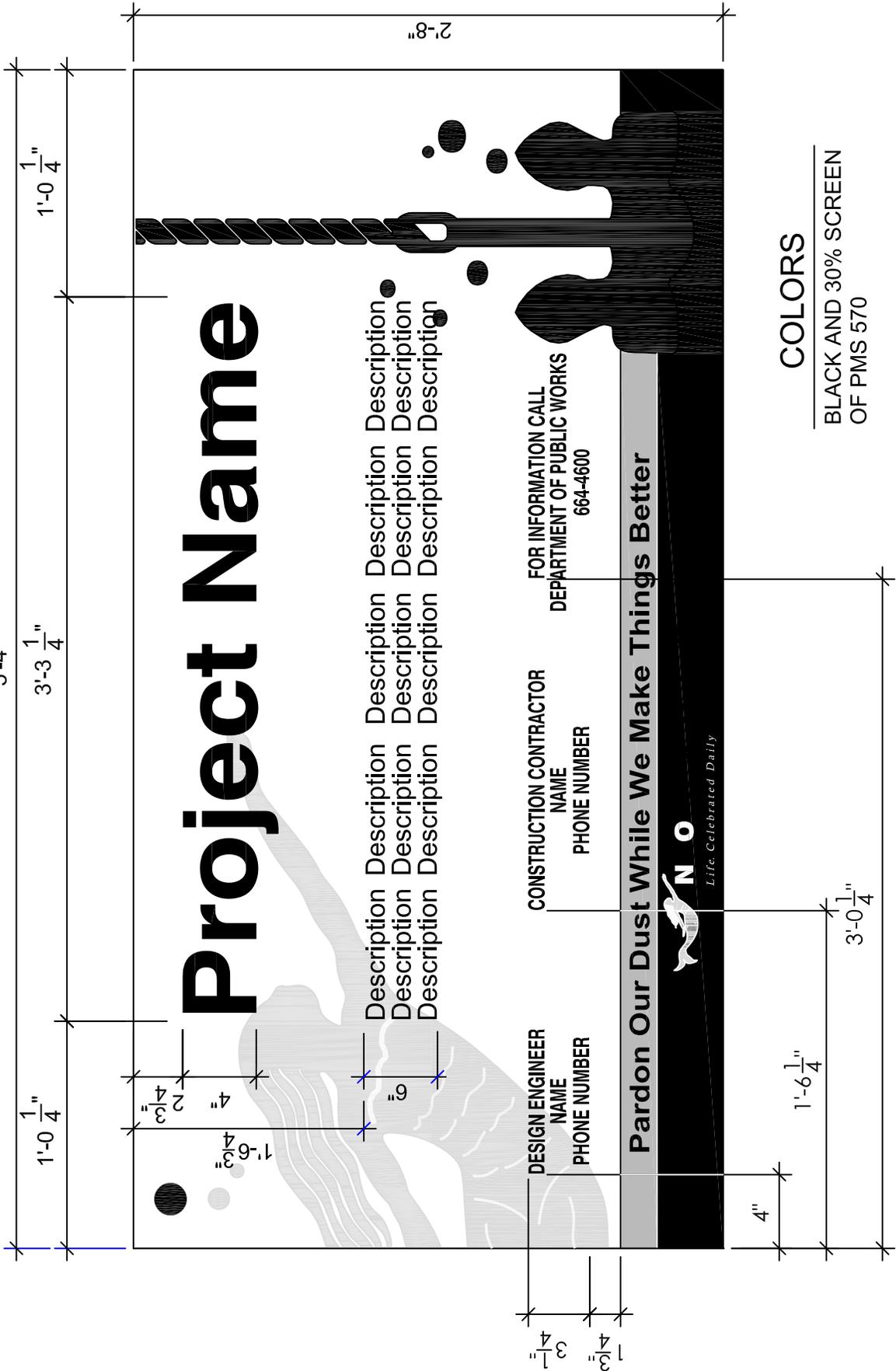
PLAN VIEW



FRONT ELEVATION

1. MATERIAL SHALL BE 100% RECYCLED RUBBER.
2. REFLECTIVE STRIPES SHALL BE YELLOW EXCEPT AT HANDICAP STALLS; THEN THE COLOR SHALL BE BLUE
3. ANCHORS SHALL BE 1/2" X 8" LAG BOLTS WITH METAL SHIELDS (APPLICABLE TO ASPHALT AND CONCRETE PAVEMENT). 1/2" X 14" REBAR SPIKES MAY BE USED WITH ASPHALT PAVEMENT ONLY.

 CITY OF NORFOLK DEPT. OF PUBLIC WORKS	DESCRIPTION		DESIGNATION
	RECYCLED RUBBER WHEEL STOP (BUMPER LOG)		HS-603
SCALE NOT TO SCALE	EDITION NCDS2013.7	REVISED MARCH 2013	



COLORS
 BLACK AND 30% SCREEN
 OF PMS 570

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION
**STANDARD CITY CONSTRUCTION SIGN
 (SMALL)**

DESIGNATION

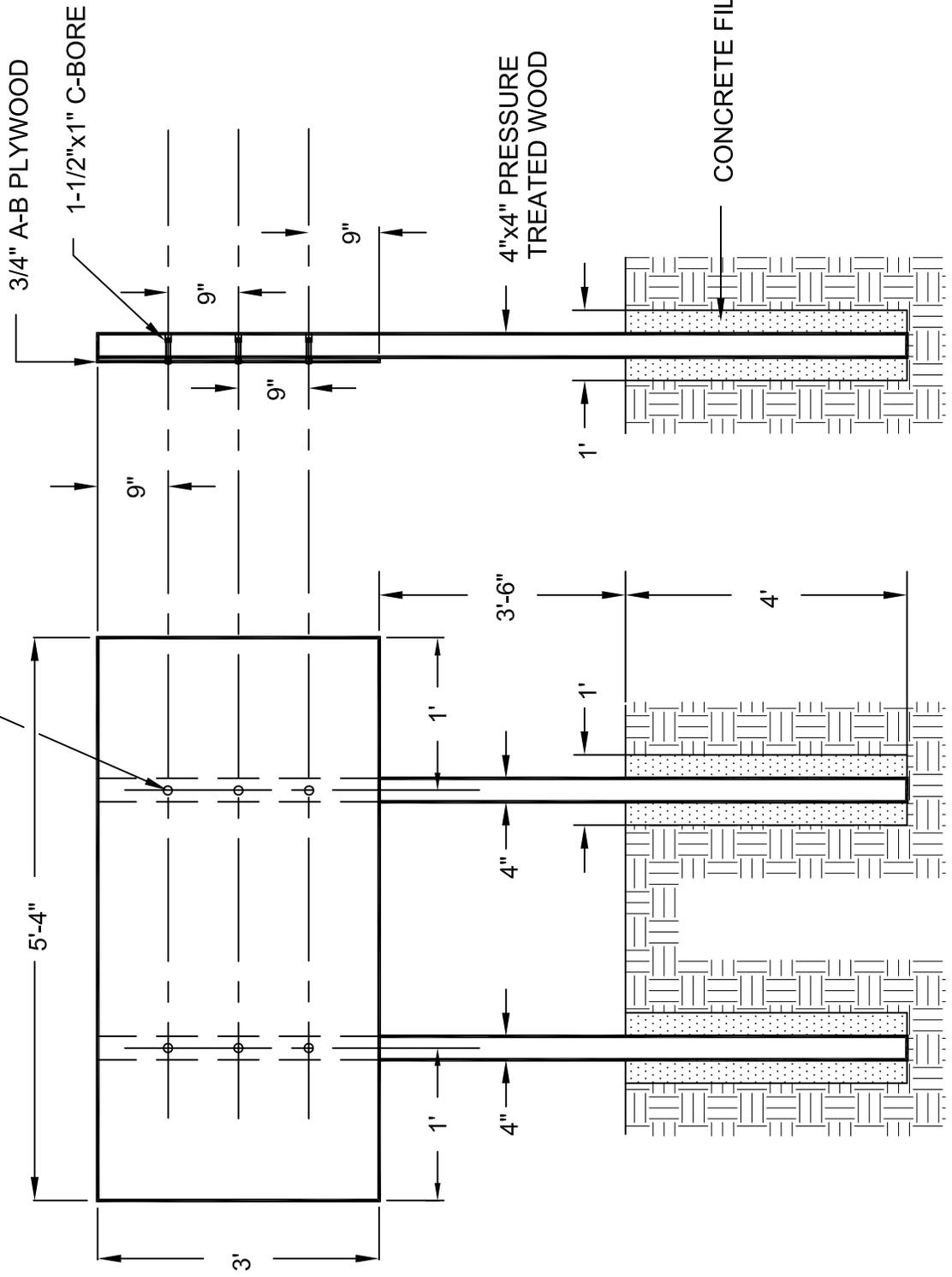
HS-604

SCALE
 NOT TO SCALE

EDITION
 NCDS2013.7

REVISED
 JAN. 2004

(6) 3/4" x 4" GALVANIZED CARRIAGE BOLTS
w/ WASHERS @ 12" O.C.



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

CONSTRUCTION SIGN INSTALLATION (SMALL)

DESIGNATION

HS-605

SCALE

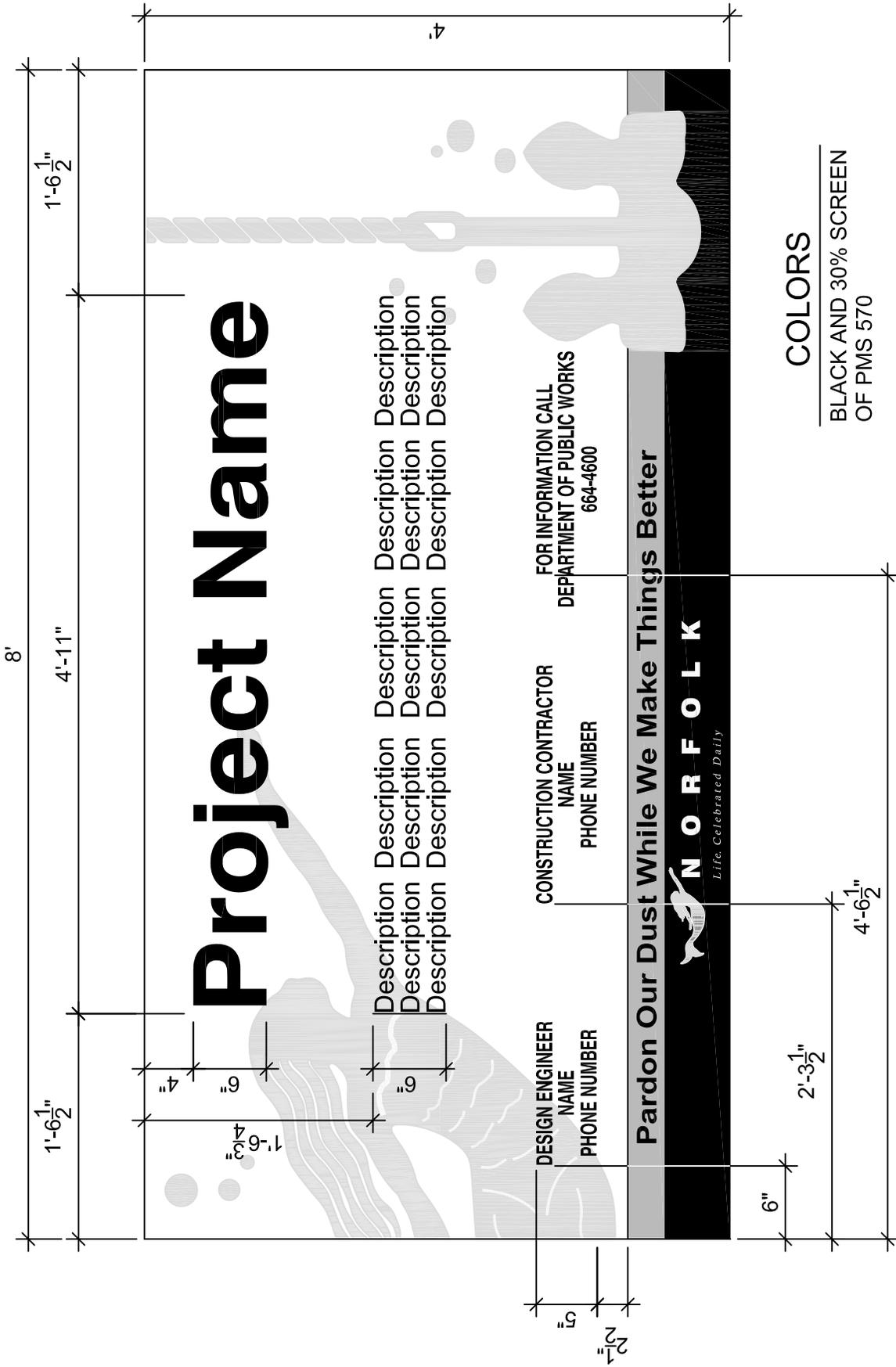
NOT TO SCALE

EDITION

NCDS2013.7

REVISED

JAN. 2004



CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

**STANDARD CITY CONSTRUCTION SIGN
(LARGE)**

DESIGNATION

HS-606

SCALE

NOT TO SCALE

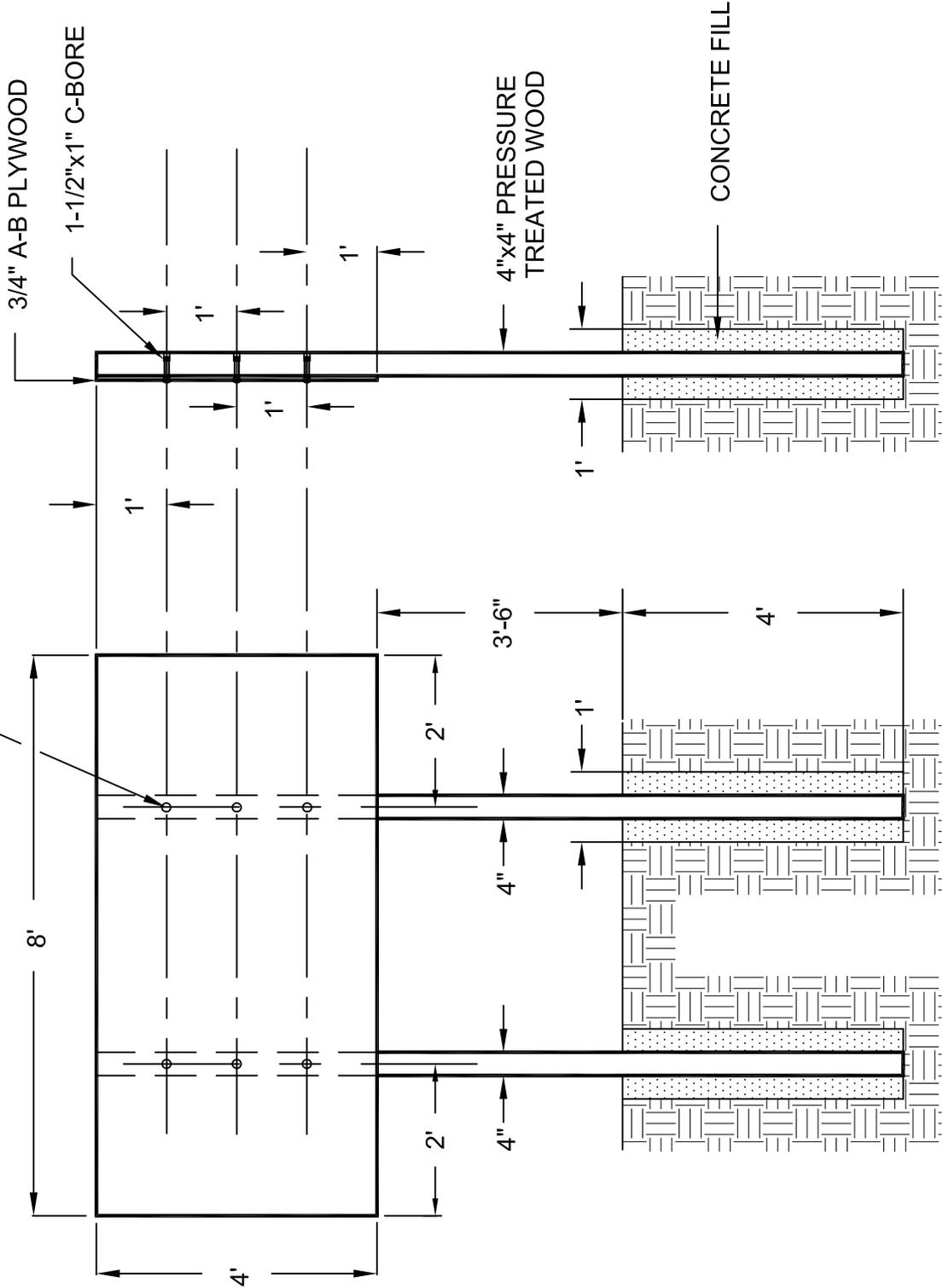
EDITION

NCDS2013.7

REVISED

JAN. 2004

(6) 3/4"x4" GALVANIZED CARRIAGE BOLTS
w/ WASHERS @ 12" O.C.



SIDE VIEW

FRONT VIEW

CITY OF NORFOLK



DEPT. OF PUBLIC WORKS

DESCRIPTION

CONSTRUCTION SIGN INSTALLATION (LARGE)

DESIGNATION

HS-607

SCALE

NOT TO SCALE

EDITION

NCDS2013.7

REVISED

JAN. 2004

2B – Norfolk Standard Notes



City of Norfolk

City of Norfolk Standard Erosion & Sediment Control Notes

1. Unless otherwise indicated, all vegetative and structural erosion and sediment control practices will be constructed and maintained according to minimum standards and specifications of the Virginia Erosion and Sediment Control Handbook (3rd Edition, 1992) and the City of Norfolk erosion and sediment control ordinance.
2. The contractor shall contact the City of Norfolk, Bureau of Environmental Services (664-4368) at least 48 hours prior to any land disturbing activity (including demolition) so that a preconstruction conference can be scheduled.
3. The contractor shall apply permanent or temporary soil stabilization to all denuded or disturbed areas within 7 days after final grade is reached on any portion of the site. Soil stabilization must also be applied to denuded or disturbed areas which may not be at final grade but which will remain undisturbed for longer than 14 days. Soil stabilization measures include vegetative establishment, mulching and the early application of gravel base material on areas to be paved.
4. All erosion and sediment control measures are to be placed prior to or as the first step in construction.
5. The contractor shall inspect all erosion control measures periodically and after each runoff producing rainfall event. Any necessary repairs to maintain the effectiveness of the erosion control devices and cleanup of sedimentation are the responsibility of the contractor and shall be made immediately.
6. The contractor shall limit site access by construction vehicles to entrances protected by a stone construction entrance (VESCH Std. & Spec. 3.02) or an approved comparable control measure. Sediment shall be removed from paved areas on a daily basis.
7. Stock piles of soil and other erodible materials shall be stabilized or protected with sediment trapping measures. The contractor is responsible for the temporary protection and permanent stabilization for stockpiles on site as well as for materials transported from the project site.
8. The contractor shall monitor and take precautions to control dust including (but not limited to) use of water, mulch, or chemical dust adhesives and control of construction site traffic.
9. Effluent from de-watering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect adjacent properties, wetlands, waterways or the storm drainage system.
10. The contractor is responsible for installation and maintenance of any additional control measures necessary to prevent erosion and sedimentation as determined necessary by the plan approving authority.
11. Temporary erosion and sediment control measures are not to be removed until all disturbed areas are stabilized. After stabilization is complete, all measures shall be removed within 30 days. Trapped sediment shall be spread and seeded.

Appendix 3: Section 1 from the Hampton Roads Planning District
Commission Report Land and Water Quality in Hampton Roads, Phase
II, November 2013

INTRODUCTION

In October 2012, the Hampton Roads Planning District Commission (HRPDC) was awarded a grant under Section 309 of the Coastal Zone Management Act, as amended, from the Virginia Coastal Zone Management Program to continue efforts to assist local governments in Hampton Roads in implementing required and recommended land development and environmental protection practices in response to the Chesapeake Bay Total Maximum Daily Load (TMDL) and revised Virginia Stormwater Management Regulations. This project was included as part of the Land and Water Quality Protection section of Virginia's Section 309 Cumulative and Second Impacts Strategies for 2011-2016 and is part of a five-year planned program. This specific grant project builds upon work done in the previous year, which assessed the potential impacts of these new requirements on local governments and identified some tools currently available to help develop effective responses.

This project consists of three parts, each of which is described in a section of the following report. The first part provides a series of specific findings and recommendations related to stormwater best management practices (BMPs) and land development practices, including how they are treated by the stormwater spreadsheet now mandated by the Virginia Department of Environmental Quality. This section describes the relative benefits of various common stormwater management BMPs and assesses if and how they should be discounted when used in the coastal plain. The first section also describes the potential for using site design to reduce nutrient loads.

The second section describes an assessment of local codes and ordinances for two cities in Hampton Roads, Norfolk (representing urban, developed communities) and Suffolk (representing growing, suburban or transitional communities). The local development regulations for both cities were analyzed using a tool identified during the previous grant year, the Center for Watershed Protection's Code and Ordinance Worksheet. This section also includes several specific recommendations that were developed based on ordinance assessments and discussions with locality staff.

The third section demonstrates the use of a geographic information systems (GIS) approach to model potential development impacts on stormwater runoff in order to inform the site design process. Two case study sites are used: a redevelopment site in Norfolk and a reimagining of an existing subdivision in Suffolk as a cluster development. This approach combines a typical GIS analytical approach with the

Virginia Runoff Reduction Method spreadsheet to calculate the impacts of various development scenarios on specific sites.

This report is intended to guide discussions between HRPDC staff and locality staff from the Cities of Norfolk and Suffolk in deciding which policy changes to pursue and what specific changes to make during 2013 and 2014.

SECTION 1: COASTAL PLAIN STORMWATER BMP GUIDE

Virginia has developed statewide stormwater standards to protect water quality that will be implemented by local governments beginning July 1, 2014. Developers will need to employ a mix of site design, runoff reduction, and pollutant control practices in order to comply with the water quality and quantity criteria in the regulations. The physiographic characteristics of the coastal plain can make it challenging to meet the criteria in a cost effective way. The purpose of this document is to highlight the practices that are well suited for the coastal plain and summarize the design modifications that may be necessary. The Virginia Stormwater Handbook is the official guidance document for compliance with the Virginia Stormwater Management Law and Virginia Stormwater Management Permit (VSMP) Regulations. Design specifications for the BMPs that can be utilized to meet the standard are located on the [BMP Clearinghouse website](#)¹ and reflect the most recent research on BMP sizing, design and performance.

SUMMARY OF VIRGINIA STORMWATER MANAGEMENT PERMIT (VSMP) REGULATIONS

The revisions to the Virginia Stormwater Management Regulations (SWM) became effective on September 13, 2011 after a significant stakeholder process that began in 2004 with legislation that transferred stormwater regulatory programs for construction activity and municipal permits from the Department of Environmental Quality (DEQ) to the Department of Conservation and Recreation (DCR) and required DCR to issue regulations to establish statewide post construction stormwater criteria to protect water quality. Starting on July 1, 2014, all development subject to permitting under the Virginia Stormwater Management Program (and sites greater than 2,500 square feet in Chesapeake Bay Preservation Act (CBPA) areas) must meet the new water quality and quantity criteria for post construction stormwater runoff. Local governments will be responsible for reviewing site plans for compliance with these post construction criteria. These regulations are also an important part of the state's efforts to protect and restore the Chesapeake Bay.

Virginia's revised water quality criteria of 0.41 pounds of phosphorus per acre per year will be implemented beginning on July 1, 2014. The criteria was developed to be protective of local water

¹ <http://vwrrc.vt.edu/swc/>

quality and to achieve no net increase in nutrients for new development. The new criterion was calculated using the Runoff Reduction Method rather than the Simple Method and translates to a land cover condition of 10% impervious cover, 30% turf, and 60% forest.

The Runoff Reduction Method for Virginia is focused on site compliance to meet site-based load limits. This means that the proposed Virginia stormwater regulations are aimed at limiting the total load leaving a new development site. This is a departure from water quality computations of the past, in which the analysis focused on comparing the post-development condition to the pre-development, or an average land cover condition.

The central component of the Runoff Reduction method is treatment volume (Tv). The runoff reduction method incorporates recent research that shows that some BMPs are quite effective at reducing the volume of runoff that reaches surface waters. By applying site design, structural, and nonstructural practices, the designer can reduce the treatment volume by reducing the overall volume of runoff leaving a site. Virginia developed a compliance spreadsheet to help designers and plan reviewers quickly evaluate the implementation of BMPs on a given site and verify compliance with the State stormwater requirements. Appendix B of the *Technical Memorandum for the Runoff Reduction Method* describes this research in greater detail and explains the basis for the runoff reduction rates of each BMP. The report, [Land and Water Quality Protection in Hampton Roads, Phase I](#)², explains the new stormwater regulations and the runoff reduction method in greater detail.

OBSTACLES TO MANAGING STORMWATER IN THE COASTAL PLAIN

Traditional stormwater practices were developed for the Piedmont physiographic region and often require adaptations to properly function in the coastal plain. Implementation of these stormwater practices in the coastal plain is constrained by the flat terrain, high water table, and low permeable soils. These characteristics make stormwater management more complex and limit the BMPs that can be implemented to control the quality and quantity of runoff in the coastal plain. This report aims to inform developers about the challenging conditions in the coastal plain, environmental site design techniques, important factors to consider during BMP selection, and design modifications to make

² <http://hrpdca.gov/uploads/docs/HRPDCAgendas/2013/March/Website/03212013-PDC-E8G.pdf>

certain BMPs feasible in the coastal plain. With careful BMP selection, design, and implementation, development in Hampton Roads can occur without flooding, groundwater contamination, and water quality degradation caused by improper stormwater management.

FLAT TERRAIN

The flat terrain (zero to 3 percent slopes) of the coastal plain creates several site design challenges. Flat terrain increases surface water/groundwater interactions and reduces the hydraulic head available to treat the quantity of stormwater produced during the intense rainstorms that are common throughout the region. Many of the stormwater practices discussed in the Structural BMP Implementation section of this report require minimum slopes in order to ensure that runoff will flow to the device and that if an underdrain is present, it will function properly.

Figure 1 illustrates the range of slopes throughout Hampton Roads. Most of the land is classified as flat with 63 percent of the area having a slope less than 3 percent. Twenty five percent of the land area is classified as undulating with slopes between 3 and 8 percent.

Slopes were calculated by applying the ArcGIS slope function to the Seamless Regional Digital Elevation Model documented in Appendix B of [Hampton Roads Coastal Resources Technical Assistance Program Fiscal Year 2011-2012](#)³. The slope function in ArcGIS calculates a single representative value for each cell using its eight neighboring cells. The result is the maximum rate of change between the cell and its neighbors. For this exercise, slope was calculated as a percentage using ten-foot square cells.

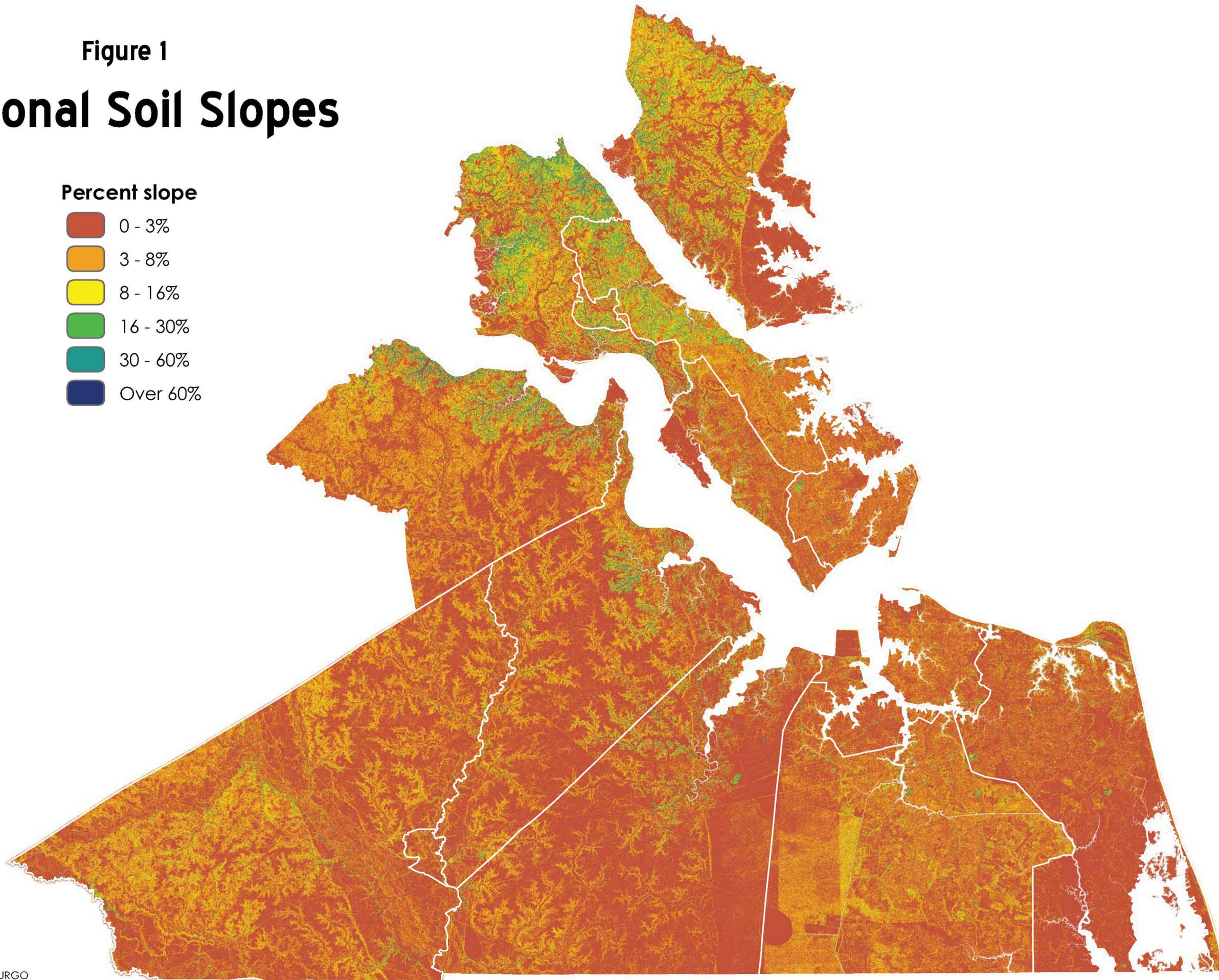
³ <http://hrpdca.gov/uploads/docs/HRPDCAgendas/2013/April/04182013-PDC-E9K.pdf>

Figure 1

Regional Soil Slopes

Percent slope

- 0 - 3%
- 3 - 8%
- 8 - 16%
- 16 - 30%
- 30 - 60%
- Over 60%



POORLY DRAINED SOILS

Soil regulates the processes of surface runoff, infiltration and percolation, and is a major controlling factor in evapotranspiration through the capacity of the soil to store and release water. The characteristics of soils on site should be carefully considered during the development of a stormwater management strategy because runoff volumes and flow rates can be reduced through infiltration and storage in the pore space of the soil substrata and pollutants can be removed from the water column via sorption to soil particles.

The ability of surface soil layers to infiltrate and their capacity to store stormwater are important design parameters that are represented by the hydraulic conductivity and the storage capacity of the soil type. A Regional map of NRCS hydrologic soil groups is provided as Figure 2. This map should only serve as a general guide because soils can be highly heterogeneous. A site specific soils investigation should be conducted to fully evaluate the feasibility of infiltration at a site.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of following four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms:

- **Group A** soils have a high infiltration rate and low runoff potential. These consist mainly of deep, well drained to excessively drained sands or gravelly sands.
- **Group B** soils have a moderate infiltration rate. These consist primarily of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture.
- **Group C** soils have a slow infiltration rate. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture.
- **Group D** soils have a very slow infiltration rate and high runoff potential when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. Only soils that in their natural condition are in group D are assigned to dual classes. The first letter is for drained areas and the second is for undrained areas.

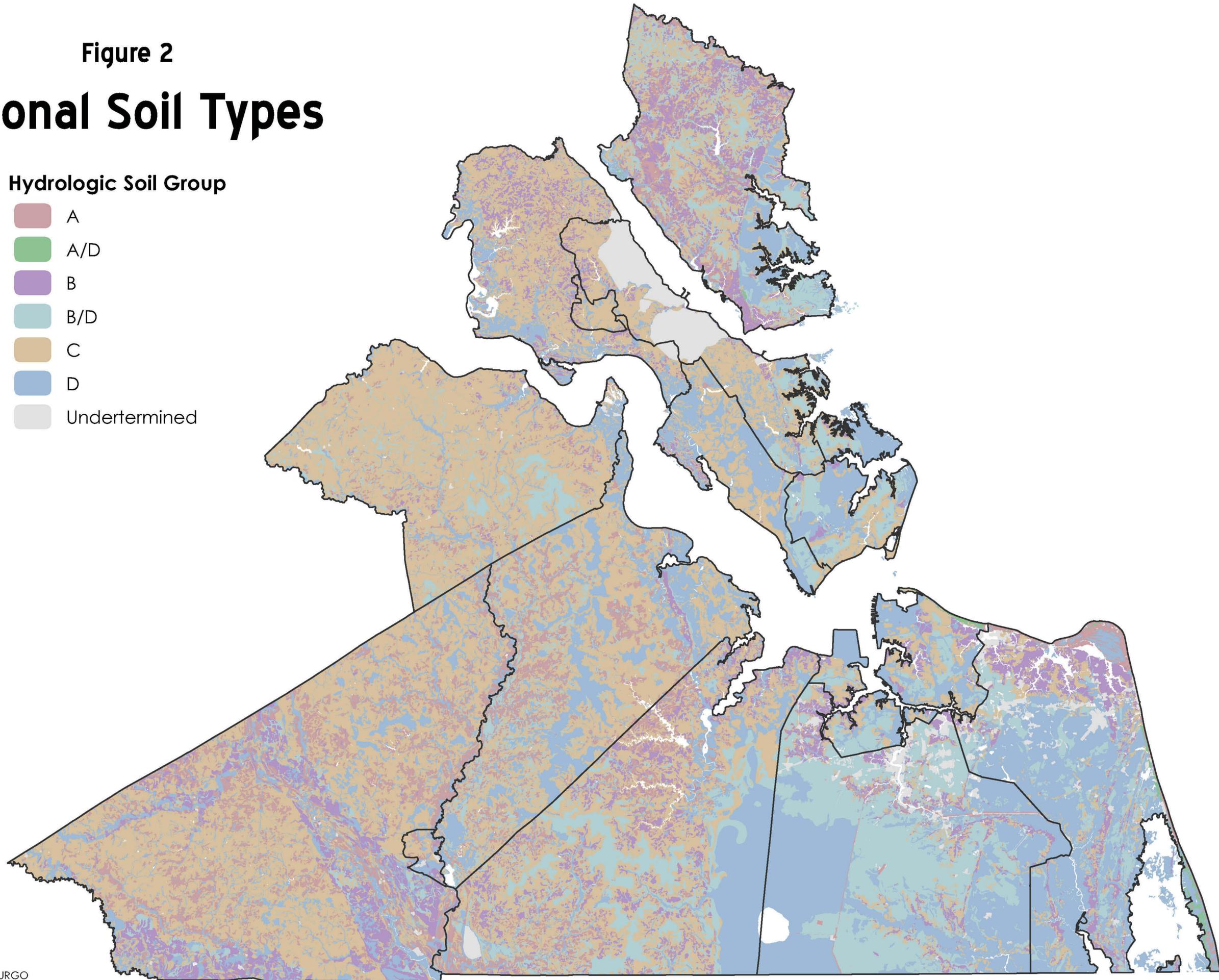
Seventy percent of the soils in Hampton Roads are of hydrologic class C and D, and the majority of the C soils are found in the western half of the Region. Unfortunately, these soils have limited ability to infiltrate stormwater and make large scale infiltration BMPs infeasible. However, small scale infiltration can still be effective at reducing runoff volumes even when native soils have low permeability. The following modifications can be implemented to prevent the BMP from remaining saturated with water: local soils may be amended; alternative outlets, such as underdrains, can be installed; and a gravel layer beneath the underdrain can be added to provide subsurface pore storage.

Figure 2

Regional Soil Types

Hydrologic Soil Group

-  A
-  A/D
-  B
-  B/D
-  C
-  D
-  Undertermined



HIGH WATER TABLE

Groundwater is an important element in the hydrologic cycle. During long periods of dry weather, groundwater is the source of baseflow in rivers, canals, and stormwater drainage systems especially in shallow groundwater regions like Hampton Roads. The depth to groundwater is an important factor to consider when selecting and designing a stormwater BMP. Throughout the coastal plain, the water table is within a few feet of the surface (Figure 3). The proximity of the groundwater table to the surface increases the potential for groundwater contamination from stormwater infiltration and diminishes the performance and feasibility of many stormwater BMPs.

The distance between the bottom of the stormwater control practice and the groundwater table, depth and direction of groundwater flow, seasonal groundwater variation, regional geology, and the slope of the water table are important factors to consider when evaluating a site's potential for stormwater infiltration. The soil infiltration properties, groundwater use, and groundwater flow characteristics must all be considered to ensure that the water quality of the groundwater resource is not negatively impacted.

Figure 3 illustrates that 40 percent of the Hampton Roads area has a separation of less than 1 foot between the land surface and the seasonal high groundwater table and 60 percent of land is within 2 feet. Depth to seasonal high groundwater table was calculated using data from the Soil Survey Geographic (SSURGO) Database and assuming that groundwater levels would be highest between January and April. Site specific data should be acquired prior to BMP selection and design.

POLLUTANTS OF CONCERN

Virginia's stormwater regulations are tied to phosphorus control which is frequently the limiting nutrient for fresh water. However, the most common impairment of local water quality in Hampton Roads is bacteria. In addition, coastal plain localities also need to reduce nitrogen and sediment loads in order to comply with the Chesapeake Bay TMDL. In order to protect water quality in the coastal plain and meet TMDL requirements, the ability of a BMP to control pollutants other than phosphorus should be considered when deciding which stormwater practices should be implemented to meet the stormwater regulations. The capacity of each BMP to remove bacteria and nitrogen is presented in the

Structural BMP Implementation section of this report, but the following considerations and modifications can reduce bacteria and nitrogen concentrations in runoff:

- Maintain setbacks from septic drainfields and connect household waste discharges to the local sanitary sewer system when feasible.
- Use dry or wet swales rather than grass channels.
- Minimize site runoff by utilizing infiltration and filtration practices.
- Avoid using turf around ponds and wetlands. Consider planting taller native vegetation to make shoreline access more difficult for geese and waterfowl.
- Use vegetated filter strips at the edge of riparian buffer areas.
- Use shallow wetlands and benches to create natural micro-predators for bacteria.
- Enhance sand filter media with a layer of organic matter.
- Create high light conditions to promote UV in areas of standing water.
- Design treatment systems to prevent re-suspension of bottom sediments.

Figure 3

Depth to Water Table

Depth in feet

- Less than 1 ft
- 1 - 2 ft
- 2 - 3 ft
- 3 - 4 ft
- More than 4 feet
- Highly variable
- Not assessed

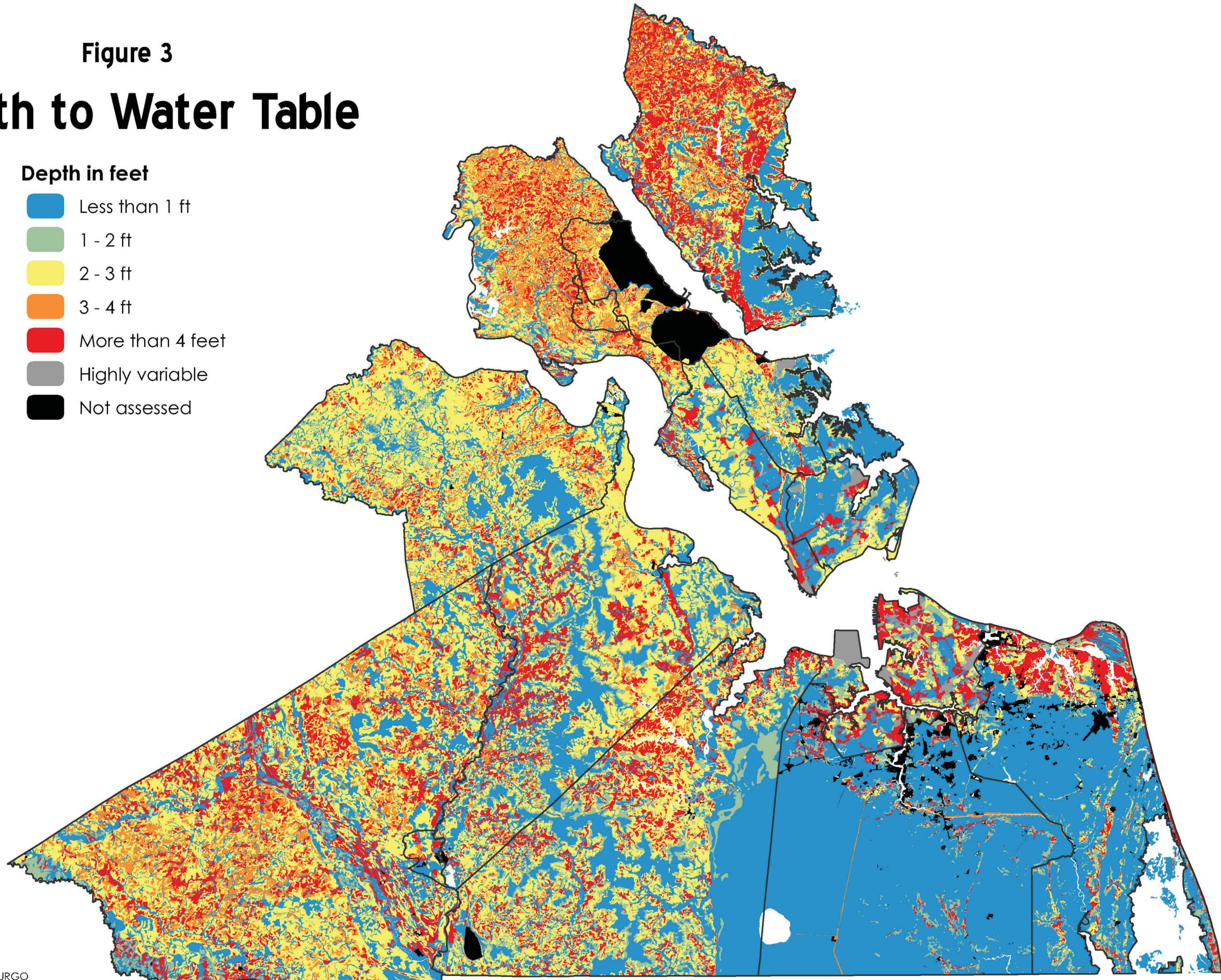
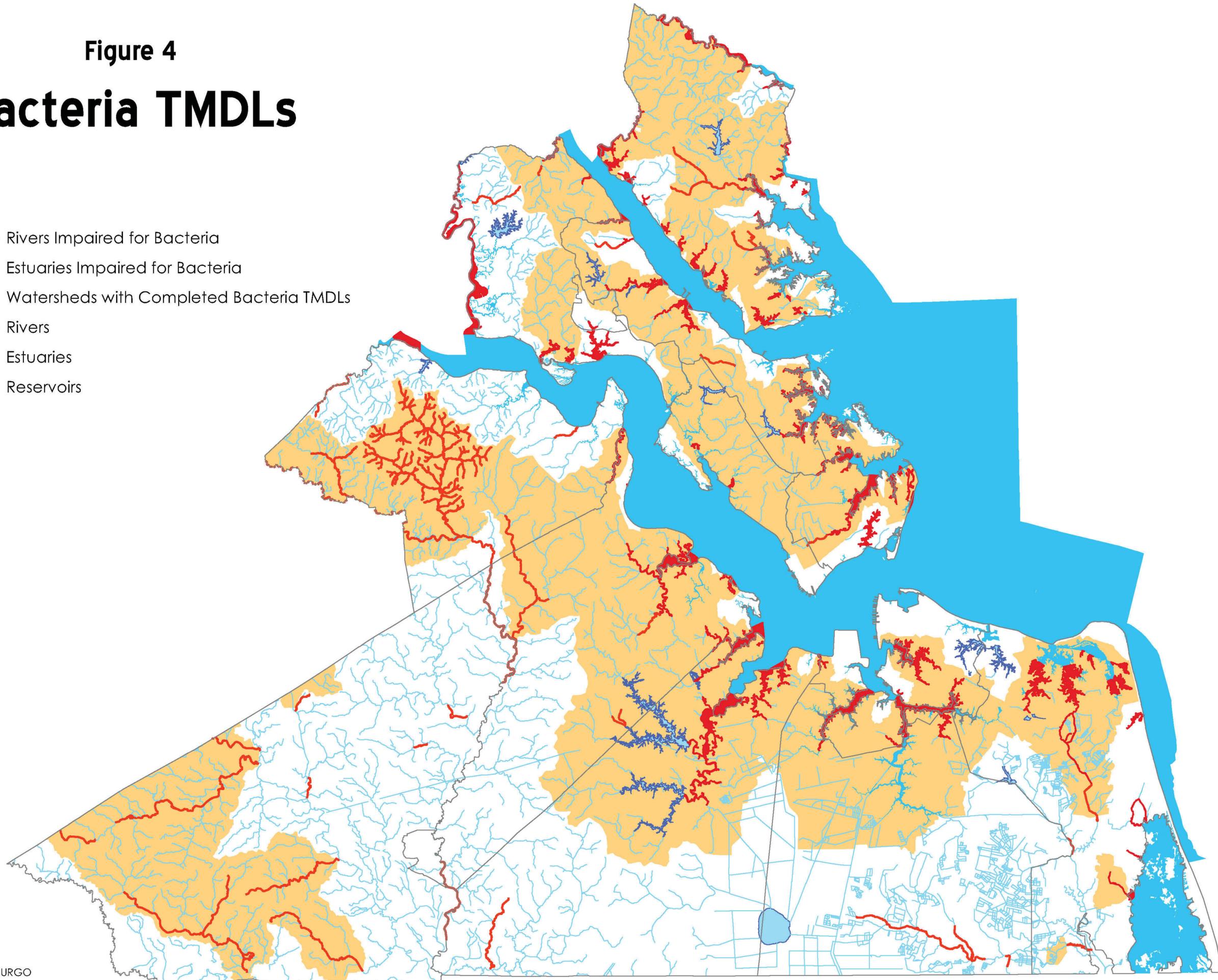


Figure 4

Bacteria TMDLs

-  Rivers Impaired for Bacteria
-  Estuaries Impaired for Bacteria
-  Watersheds with Completed Bacteria TMDLs
-  Rivers
-  Estuaries
-  Reservoirs



Appendix 4: Approved Stormwater Management Practices

4A – Norfolk Modifications to the Approved Virginia BMP Clearinghouse Practices

4B – Encased Falling Head Infiltration Testing Procedure for use in the City of Norfolk

4A – Norfolk Modifications to the Approved Virginia BMP Clearinghouse Practices

The following modifications, additions, or deletions to the Approved Practices from the Virginia BMP Clearinghouse are hereby incorporated into the Norfolk Design Criteria. For all practices requiring a separation from groundwater, the seasonal high groundwater shall be the point of measurement for separation of practices to groundwater. The groundwater elevation must be determined by on-site measurement and seasonally adjusted.

1. Rooftop (and Impervious Area) Disconnection
 - a. **Table 1.4, Revise the following**
 - i. **Media Source, Revise to read “Vendor Supplied”**
 - ii. **Required Soil Borings, revise to read ”Minimum one soil test per lot”**
2. Sheetflow to Open Space and Grass Filter Areas – **No modification**
3. Grass Channels – **No modification**
4. Soils Compost Amendments – **No modification**
5. Vegetated Roofs – **No modification**
6. Rainwater Harvesting – **No modification**
7. Permeable Pavement – **No modification**
8. Infiltration
 - a. **Replace Appendix 8-A of the Infiltration Practice Standard with the Encased Falling Head Test Criteria from Appendix 4**
9. Bioretention (including Urban Bioretention)
 - a. **Table 9.3**
 - i. **Subsoil Testing – Level 2 Design Criteria shall be utilized**
 - ii. **Underdrain – Level 2 Design shall incorporate an underdrain**
 - b. **Section 6.2 (pg. 18 of 54) – Notwithstanding the following sentence: ”Soil testing is not needed for Level 1 bioretention areas where an underdrain is used.” all infiltration and bioretention practices in the City of Norfolk must include site specific infiltration testing at the proposed location of the practice.**
 - c. **Section 6.7 (pg. 25 of 54)- Notwithstanding the following sentence: “Some Level 2 designs will not use an underdrain (where soil infiltration rates meet minimum standards; see Section 6.2 and Section 6.3 design tables).” all bioretention and infiltration practices proposed in the City of Norfolk must incorporate an appropriately sized underdrain.**
10. Dry Swales
 - a. **Table 10.2**
 - i. **Subsoil Testing – Level 2 Design Criteria shall be utilized**

11. Wet Swales – **No modification**

12. Filtering Practices – **No modification**

13. Constructed Wetlands – **No modification**

14. Wet Ponds – **Table 14.2**

- i. **For either Level I or Level II pond design, landscaping around the pond shall be designed to deter waterfowl.**

15. Dry Extended Detention Ponds – **No modification**

4B – Encased Falling Head Infiltration Testing Procedure for use in the City of Norfolk

Encased Falling Head Test Protocol for use in Norfolk, Virginia

The encased falling head procedure is performed with a 6-inch casing that is embedded approximately 6 inches into the native soil. The goal of this field test is to evaluate the vertical infiltration rate through a 6-inch plug of soil, without allowing any lateral infiltration. The test is not appropriate in gravelly soils or in other soils where a good seal with the casing cannot be established.

1. Embed a solid 6 inch diameter casing into the native soil at the elevation of the proposed facility bottom. Ensure that the embedment provides a good seal around the pipe casing so that percolation will be limited to the 6-inch plug of the material with the casing. The method can also be used when testing within hollow stem augers, provided the driller and tester are reasonably certain that a good seal has been achieved between the soil and auger.
2. Fill the pipe with clean water a minimum of 1 foot above the soil to be tested, and maintain this depth for at least 4 hours (or overnight if clay soils are present) to presoak the native material. Any soil that sloughed into the hole during the soaking period should be removed. In sandy solid with little or no clay or silt, soaking is not necessary. If after filling the whole twice with 12 inches of water, the water seeps completely away in less than 10 minutes, the test can proceed immediately.
3. To conduct the first trial of the test, fill the pipe to approximately 12 inches above the soil and measure the water level to the nearest 0.01 foot (1/8 inch). Alternative water head heights may be used for testing provided the presaturation height is adjusted accordingly and the water head height used in infiltration testing is 50 percent or less than the water head height in the proposed Stormwater system during the design storm event. The level should be measured with a tape or other device with reference to a fixed point. The top of the pipe is often a convenient reference point. Record the exact time.
4. Measure the water level to the nearest 0.01 foot (1/8 inch) at 10- minute intervals for a total period of 1 hour (or 20-minute intervals for 2 hours in slower soils) or until all the water has drained. In faster draining soils (sand and gravels), it may be necessary to shorten the measurement interval in order to obtain a well-defined infiltration rate curve. Constant head test may be substituted for falling head test at the discretion of the professional overseeing the infiltration rate between two successive trials is minimal. The trial should be discounted if the infiltration rate between successive trials increases. At least three trials must be conducted. After each trial, the water level is readjusted to the 12 inch level. Enter results into the data table (see **Exhibit 4B-1**).
5. The average infiltration rate over the last trial should be used to calculate the unfactored infiltration rate. Alternative, the infiltration rate measured over the range of water head applicable to the project Stormwater system design may be used at the discretion of the professional overseeing the testing. The final rate must be reported in inches per hour.
6. Upon completion of the testing, the casing should be pulled and the test pit backfilled.

Reporting requirements

The following information should be included in the Infiltration Testing Report. The Infiltration Testing Report should be attached to the project's Stormwater Management Report.

1. Statement of project understanding (proposed Stormwater system).
2. Summary of subsurface conditions encountered.
3. Summary of infiltration testing including location and number of tests and testing methods used. Discussion on how the test were preformed (i.e. pipe type or diameter or test pit dimensions).
4. Infiltration testing results in inches per hour.
5. Recommended design infiltration rate.

6. Groundwater observations within exploration and an estimate of the depth to seasonal high groundwater.
7. Site plan showing location of infiltrations tests.
8. Boring or test pit logs. The logs should include an associated soil classification consistent with ASTM D2488-00, Standard Practice for classification for description and identification of soils (visual-Manual Procedure). The logs should also include any additional pertinent subsurface information, such as soil moisture conditions, depth and description of undocumented or engineered fill, soil color and mottling conditions, soil stiffness or density, and approximate depth of contact between soil types.
9. Infiltration Test Data Tables (see following pages for example and blank tables)

Exhibit 4B-1: Example Infiltration Test Data Table

Location: Lot 105, Point Heights Subdivision		Date: 6/28/2008		Test Hole Number: 3	
Depth to bottom of hole: 57 inches		Dimension of hole: 0.5 feet diameter		Test Method: Encased Falling Head	
Tester's Name C.J. Tester					
Tester's Company: Tester Company					
Tester's Contact number: 555-1212					
Depth (Feet):			Soil Texture:		
0-0.5			Black Top Soil		
0.5-1.0			Brown SM		
1.0-2.2			Brown ML		
2.2-5.1			Brown CL		
Presaturation Start Time:					
Presaturation End Time:					
Time	Time interval (minutes):	Measurements (feet):	Drop in water level, (feet):	Infiltration rate, (inches per hour):	Remarks:
9:00	0	3.75	-		Filled with 6"
9:20	20	3.83	0.08		
9:40	20	3.91	0.08	2.88	
10:00	20	3.98	0.07	2.52	
10:20	20	4.04	0.06	2.16	
10:40	20	4.11	0.07	2.52	
11:00	20	4.17	0.06	2.16	
11:20	20	4.225	0.055	1.98	
					Adjust to 6" level for Trial #2

Calculation is performed for each water level drop
 = (Drop in water level/Time interval) x (conversion)
 = 0.055ft/20min x (12in/ft.) x (60min/hr.)
 = 1.98 inches per hour

Appendix 5: BMP Maintenance Standards

5A – Standard Declaration of Covenants

5B – Subdivision Declaration of Covenants

5C – Pollutant Reduction Declaration of Covenants

5D – BMP Inspection Agreement

5E – Appendix 9-C VSWMH Sample BMP Inspection Checklists

5A – Standard Declaration of Covenants

Site Plan Number:

DECLARATION OF COVENANTS
For Storm and Surface Water Facility
And System Maintenance

THIS DECLARATION OF COVENANTS made this _____ day of _____, 20____, by _____, hereinafter referred to as the “covenantor” to and for the benefit of the City of Norfolk, Virginia and its successors and assigns, hereinafter referred to as the “City.”

WITNESSETH:

WHEREAS, the City is authorized and required to regulate and control the disposition of storm and surface waters within the City of Norfolk as set forth in the City’s ordinances; and

WHEREAS, the Covenantor is the owner of a certain tract or parcel of land more particularly described as: _____ and legally described in **Exhibit A** attached hereto and made a part hereof; and

WHEREAS, the Covenantor and/or its assigns desire to construct certain improvements on its property which will alter extant storm and surface water conditions on both the property and adjacent lands; and

WHEREAS, in order to accommodate and regulate these anticipated changes in existing storm and surface water flow conditions, the Covenantor and/or its assigns desire to build and maintain at its expense, a storm and surface water management facility and system more particularly described and shown on plans titled _____, and dated _____ day of _____, 20____; and

WHEREAS, the City has reviewed and approved these plans subject to the execution of this agreement.

NOW, THEREFORE, in consideration of the benefits received by the Covenantor and/or its assigns as a result of the City’s approval of his plans, Covenantor and/or its assigns, with full authority to execute deeds, deeds of trust, other covenants, and all rights, title and interest in the property described above does hereby covenant with the City as follows:

1. Covenantor and/or its assigns shall construct and perpetually maintain, at its sole expense, the above referenced storm and surface management facility and system in strict accordance with the plan approval granted by the City, so that it continues to operate as designed and approved.
2. Covenantor and/or its assigns shall, at its sole expense, make such changes or modifications to the storm drainage facility and system as may, in the City’s discretion, be determined accordance with the specifications included in the plans which have which have been reviewed and approved by the City.

3. The City, its agents; employees and contractors shall have the perpetual right of the ingress and egress over the property of the Covenantor and/or its assigns and the right to inspect at reasonable times and in reasonable manner, the storm and surface water facility and system in order to insure that the system is being properly maintained and is continuing to perform in an adequate manner.
4. The Covenantor and/or its assigns agree that should it fail to correct any defects in the above-described facility and system within ten (10) days from the receipt of written notice, or shall fail to maintain the facility in accordance with the approved design standards and with the law and applicable regulations or, in the event of an emergency as determined by the City in its sole discretion, the City is authorized to enter the property to make all repairs, and to perform all maintenance, construction and reconstruction the City deems necessary. The City shall then assess the Covenantor and/or its assigns and/or all landowners served by the facility and such assessment may be placed on the property tax bills of said properties and collected as ordinary taxes by the City.
5. Covenantor and/or its assigns shall indemnify, save harmless and defend the City from and against any and all claims, demands, suits, liabilities, losses, damages and payments including attorney fees claimed or made by persons not parties to the Declaration against the City that area alleged or proven to result or arise from the failure of the Covenantor and/or its assigns to comply with the appropriate construction, operation, or maintenance of the storm and surface water facility and system that is the subject of this Covenant.
6. The covenants contained herein shall run with the land and the Covenantor and/or it assigns further agree that whenever the property shall be held, sold and conveyed, it shall be subject to the covenants, stipulations, agreements and provisions of this Declaration, which shall apply to, bind and be obligatory upon the Covenantor hereto, its heirs, successors and assigns and shall bind all present and subsequent owners of the property served by the facility.
7. The Covenantor and/or its assigns shall promptly notify the City when the Covenantor and/or its assigns legally transfer any of the Covenantor's and/or its assigns responsibilities for the facility. The Covenantor and/or its assigns shall supply the Department of Public Works, Division of Environmental Storm Water Management, 2233 McKann Avenue, Norfolk, VA 23509, with a copy of this document of transfer, executed by both parties and a copy this document acknowledged by both parties. Upon the City's receipt of the document to transfer, the conveying owner of the property (whether the Covenantor or its assigns) shall be released from all liability arising under this Declaration of Covenants subsequent to the date of conveyance, but such conveying owner shall remain liable for any and all obligations that accrue prior to such date.
8. The provisions of the Declaration shall be severable and, if any phrase, clause, sentence of provision is declared unconstitutional, or the applicability thereof to the Covenantor and/or its assigns is held invalid, the remainder of the Covenant shall not be affected thereby.

9. The Declaration shall be recorded at the Clerk's Office of the Circuit Court of the City of Norfolk, Virginia at the Covenantor's or its assign's expense.

10. In the event that the City shall determine at its sole discretion at any future time that the facility is no longer required, then the City shall at the request of the Covenantor and/or its assigns execute a release of this Declaration of Covenants which the Covenantor and/or its assigns shall record at its expense.

IN WITNESS WHEREOF, the Covenantor has executed this Declaration of Covenants of the day of _____, 20____. The Covenantor represents and warrants as of the date of this Agreement that:

1. The Covenantor has the right, title, and authority to enter into this Agreement and to perform its obligations hereunder; and
2. The person signing this Agreement has the full and complete authority to do so.

By: _____
(Signature)

Print Name: _____

Title: _____

Mailing Address: _____

STATE OF VIRGINIA
CITY OF NORFOLK, to wit:

The foregoing instrument was acknowledged before me this _____ day of _____, 20____.

REGISTRATION NUMBER

NOTARY PUBLIC

My Commission Expires: _____

TRANSFER OWNERSHIP OF
DECLARATION OF COVENANTS

To: SUBSEQUENT PURCHASERS OF THE ABOVE-MENTIONED PROPERTY
SEEN AND AGREED:

By: _____
(Signature)

Print Name: _____

Title: _____

Mailing Address: _____

STATE OF VIRGINIA
CITY OF NORFOLK, to wit:

The foregoing instrument was acknowledged before me this _____ day of
_____, 20_____.

REGISTRATION NUMBER

NOTARY PUBLIC

My Commission Expires: _____



Site Plan Number:

EXHIBIT A

LEGAL DESCRIPTION OF THE PROPERTY
SET FORTH IN THE DECLARATION OF COVENANTS



LAND RECORD INSTRUMENT
COVER SHEET – FORM A

TAX EXEMPT: YES NO

CITATION: _____

DATE OF INSTRUMENT: [] []
INSTRUMENT TYPE: [] []
NUMBER OF PARCELS: [] []
NUMBER OF PAGES: [] []

CITY OF NORFOLK

First & Second Grantors

Last Name (ALL CAPS)	First Name	Middle Name/Initial	Suffix
[] []	[] []	[] []	[] []
[] []	[] []	[] []	[] []

First & Second Grantees and/or Trustees

Last Name (ALL CAPS)	First Name	Middle Name/Initial	Suffix
[] []	[] []	[] []	[] []
[] []	[] []	[] []	[] []

Grantee and/or Trustee Address:
(Name) [] []
(Address) [] []
(City, State, Zip) [] []

Consideration [] Existing Debt [] Assumption Balance []

Assessed Value [] []

Prior Inst. Recorded at: City of Norfolk

Book [] Page [] Instrument No. []

Short Property Description:

Current Property Address

(Address) [] []

(City, State, Zip) [] []

Instrument Prepared By: [] []

Return Recording to:

(Name) [] []

(Address) [] []

(City, State, Zip) [] []

5B – Subdivision Declaration of Covenants

Site Plan Number:

DECLARATION OF COVENANTS
For Storm and Surface Water Facility
And System Maintenance

THIS DECLARATION OF COVENANTS made this _____ day of _____, 20_____, by _____, hereinafter referred to as the “covenantor” to and for the benefit of the City of Norfolk, Virginia and its successors and assigns, hereinafter referred to as the “City.”

WITNESSETH:

WHEREAS, the City is authorized and required to regulate and control the disposition of storm and surface waters within the City of Norfolk as set forth in the City’s ordinances; and

WHEREAS, the Covenantor is the owner of a certain tract or parcel of land more particularly described as: _____, legally described in **Exhibit A**, and included in the subdivision plat described in **Exhibit B** attached hereto and made a part hereof; and

WHEREAS, the Covenantor and/or its assigns desire to construct certain improvements on its property which will alter extant storm and surface water conditions on both the property and adjacent lands; and

WHEREAS, in order to accommodate and regulate these anticipated changes in existing storm and surface water flow conditions, the Covenantor and/or its assigns desire to build and maintain at its expense, a storm and surface water management facility and system more particularly described and shown on plans titled _____, and dated _____ day of _____, 20_____; and

WHEREAS, the City has reviewed and approved these plans subject to the execution of this agreement.

NOW, THEREFORE, in consideration of the benefits received by the Covenantor and/or its assigns as a result of the City’s approval of his plans, Covenantor and/or its assigns, with full authority to execute deeds, deeds of trust, other covenants, and all rights, title and interest in the property described above does hereby covenant with the City as follows:

1. Covenantor and/or its assigns shall construct and perpetually maintain, at its sole expense, the above referenced storm and surface management facility and system in strict accordance with the plan approval granted by the City, so that it continues to operate as designed and approved.
2. Covenantor and/or its assigns shall, at its sole expense, make such changes or modifications to the storm drainage facility and system as may, in the City’s discretion, be determined accordance with the specifications included in the plans which have which have been reviewed and approved by the City.

3. The City, its agents; employees and contractors shall have the perpetual right of the ingress and egress over the property of the Covenantor and/or its assigns and the right to inspect at reasonable times and in reasonable manner, the storm and surface water facility and system in order to insure that the system is being properly maintained and is continuing to perform in an adequate manner.
4. The Covenantor and/or its assigns agree that should it fail to correct any defects in the above-described facility and system within ten (10) days from the receipt of written notice, or shall fail to maintain the facility in accordance with the approved design standards and with the law and applicable regulations or, in the event of an emergency as determined by the City in its sole discretion, the City is authorized to enter the property to make all repairs, and to perform all maintenance, construction and reconstruction the City deems necessary. The City shall then assess the Covenantor and/or its assigns and/or all landowners served by the facility and such assessment may be placed on the property tax bills of said properties and collected as ordinary taxes by the City.
5. Covenantor and/or its assigns shall indemnify, save harmless and defend the City from and against any and all claims, demands, suits, liabilities, losses, damages and payments including attorney fees claimed or made by persons not parties to the Declaration against the City that area alleged or proven to result or arise from the failure of the Covenantor and/or its assigns to comply with the appropriate construction, operation, or maintenance of the storm and surface water facility and system that is the subject of this Covenant.
6. The covenants contained herein shall run with the land and the Covenantor and/or it assigns further agree that whenever the property shall be held, sold and conveyed, it shall be subject to the covenants, stipulations, agreements and provisions of this Declaration, which shall apply to, bind and be obligatory upon the Covenantor hereto, its heirs, successors and assigns and shall bind all present and subsequent owners of the property served by the facility.
7. The Covenantor and/or its assigns shall promptly notify the City when the Covenantor and/or its assigns legally transfer any of the Covenantor's and/or its assigns responsibilities for the facility. The Covenantor and/or its assigns shall supply the Department of Public Works, Division of Environmental Storm Water Management, 2233 McKann Avenue, Norfolk, VA 23509, with a copy of this document of transfer, executed by both parties and a copy this document acknowledged by both parties. Upon the City's receipt of the document to transfer, the conveying owner of the property (whether the Covenantor or its assigns) shall be released from all liability arising under this Declaration of Covenants subsequent to the date of conveyance, but such conveying owner shall remain liable for any and all obligations that accrue prior to such date.
8. The provisions of the Declaration shall be severable and, if any phrase, clause, sentence of provision is declared unconstitutional, or the applicability thereof to the Covenantor and/or its assigns is held invalid, the remainder of the Covenant shall not be affected thereby.

9. The Declaration shall be recorded at the Clerk's Office of the Circuit Court of the City of Norfolk, Virginia at the Covenantor's or its assign's expense.

10. In the event that the City shall determine at its sole discretion at any future time that the facility is no longer required, then the City shall at the request of the Covenantor and/or its assigns execute a release of this Declaration of Covenants which the Covenantor and/or its assigns shall record at its expense.

IN WITNESS WHEREOF, the Covenantor has executed this Declaration of Covenants of the day of _____, 20_____. The Covenantor represents and warrants as of the date of this Agreement that:

1. The Covenantor has the right, title, and authority to enter into this Agreement and to perform its obligations hereunder; and
2. The person signing this Agreement has the full and complete authority to do so.

By: _____
(Signature)

Print Name: _____

Title: _____

Mailing Address: _____

STATE OF VIRGINIA
CITY OF NORFOLK, to wit:

The foregoing instrument was acknowledged before me this _____ day of _____, 20_____.

REGISTRATION NUMBER

NOTARY PUBLIC

My Commission Expires: _____

TRANSFER OWNERSHIP OF
DECLARATION OF COVENANTS

To: SUBSEQUENT PURCHASERS OF THE ABOVE-MENTIONED PROPERTY
SEEN AND AGREED:

By: _____
(Signature)

Print Name: _____

Title: _____

Mailing Address: _____

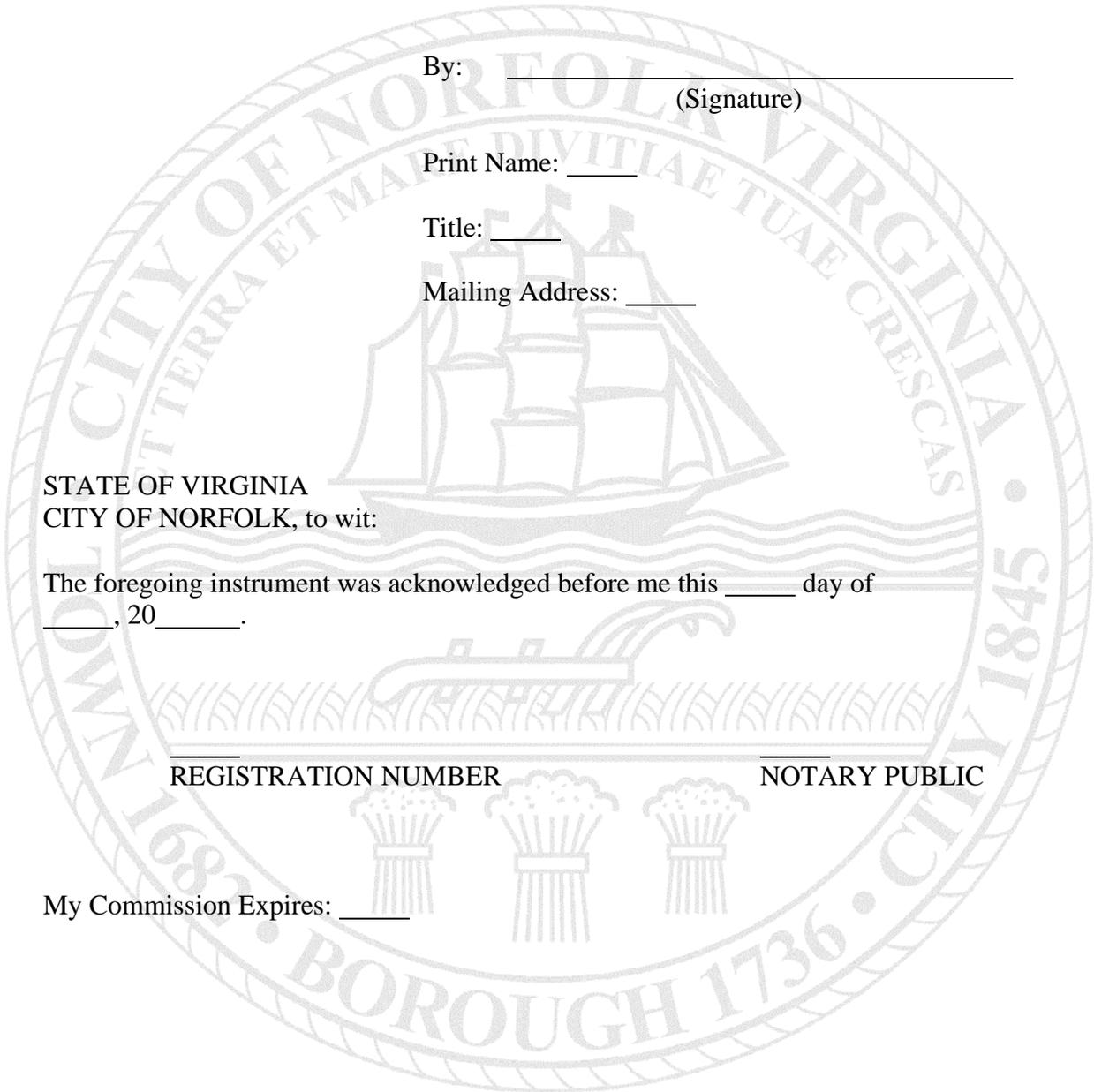
STATE OF VIRGINIA
CITY OF NORFOLK, to wit:

The foregoing instrument was acknowledged before me this _____ day of _____, 20_____.

REGISTRATION NUMBER

NOTARY PUBLIC

My Commission Expires: _____



Site Plan Number:

EXHIBIT A

LEGAL DESCRIPTION OF THE PROPERTY
SET FORTH IN THE DECLARATION OF COVENANTS



Site Plan Number:

EXHIBIT B

SUBDIVISION PLAT OF THE PROPERTY
SET FORTH IN THE DECLARATION OF COVENANTS



LAND RECORD INSTRUMENT
COVER SHEET – FORM A

TAX EXEMPT: YES NO

CITATION: _____

DATE OF INSTRUMENT: [] []
INSTRUMENT TYPE: [] []
NUMBER OF PARCELS: [] []
NUMBER OF PAGES: [] []

CITY OF NORFOLK

First & Second Grantors			
Last Name (ALL CAPS)	First Name	Middle Name/Initial	Suffix
[] []	[] []	[] []	[] []
[] []	[] []	[] []	[] []

First & Second Grantees and/or Trustees			
Last Name (ALL CAPS)	First Name	Middle Name/Initial	Suffix
[] []	[] []	[] []	[] []
[] []	[] []	[] []	[] []

Grantee and/or Trustee Address:

(Name) [] []
(Address) [] []
(City, State, Zip) [] []

Consideration [] Existing Debt [] Assumption Balance []

Assessed Value [] []

Prior Inst. Recorded at: City of Norfolk

Book [] Page [] Instrument No. []

Short Property Description:

Current Property Address

(Address) [] []
(City, State, Zip) [] []

Instrument Prepared By: [] []

Return Recording to:

(Name) [] []
(Address) [] []
(City, State, Zip) [] []

5C – Pollutant Reduction Declaration of Covenants

Site Plan Number: _____

DECLARATION OF COVENANTS
10% Reduction of Pollutant Load

THIS DECLARATION OF COVENANTS made this _____ day of _____, 20_____, by _____, hereinafter referred to as the “covenantor” to and for the benefit of the City of Norfolk, Virginia and its successors and assigns, hereinafter referred to as the “City.”

WITNESSETH:

WHEREAS, the City is authorized and required to regulate and control the disposition of storm and surface waters within the City of Norfolk as set forth in the City’s ordinances; and

WHEREAS, the Covenantor is the owner of a certain tract or parcel of land more particularly described as: _____ and legally described in **Exhibit A** attached hereto and made a part hereof; and

WHEREAS, the Covenantor and/or its assigns desire to construct certain improvements on its property which will alter extant storm and surface water conditions on both the property and adjacent lands; and

WHEREAS, in order to accommodate and regulate these anticipated changes in existing storm and surface water flow conditions, the Covenantor and/or its assigns desire to maintain a 10% reduction in pollutant load as described in **Exhibit B**, Performance Base Water Quality Calculations, attached hereto and made a part hereof, and as shown on city-approved plans titled _____, and dated _____ day of _____, 20_____, in-lieu of construction of a storm and surface water management facility; and

WHEREAS, the City has reviewed and approved these plans subject to the execution of this agreement.

NOW, THEREFORE, in consideration of the benefits received by the Covenantor and/or its assigns as a result of the City’s approval of his plans, Covenantor and/or its assigns, with full authority to execute deeds, deeds of trust, other covenants, and all rights, title and interest in the property described above does hereby covenant with the City as follows:

1. Covenantor and/or its assigns shall ensure the 10% reduction in strict accordance with the plan approval granted by the City, so that it remains as designed and approved.
2. Covenantor and/or its assigns shall, at its sole expense, make such changes or modifications to the site as may, in the City’s discretion, be determined accordance with the specifications included in the plans which have been reviewed and approved by the City to incorporate the 10% reduction in pollutant removal either by impervious area or the installation of a storm and surface water management facility.

3. The City, its agents; employees and contractors shall have the perpetual right of the ingress and egress over the property of the Covenantor and/or its assigns and the right to inspect at reasonable times and in reasonable manner, the site in order to insure that the site has remained as designed and approved to include the 10% reduction requirements.
4. The Covenantor and/or its assigns agree that should it fail to maintain the designated site in accordance with the approved design standards in the above-described site within ten (10) days from the receipt of written notice, the City is authorized to enter the property to make all repairs, and to perform all maintenance, construction and reconstruction the City deems necessary. The City shall then assess the Covenantor and/or its assigns and/or all landowners served by the facility and such assessment may be placed on the property tax bills of said properties and collected as ordinary taxes by the City.
5. Covenantor and/or its assigns shall indemnify, save harmless and defend the City from and against any and all claims, demands, suits, liabilities, losses, damages and payments including attorney fees claimed or made by persons not parties to the Declaration against the City that area alleged or proven to result or arise from the failure of the Covenantor and/or its assigns to comply with the appropriate construction, operation, or maintenance of the site that is the subject of this Covenant.
6. The covenants contained herein shall run with the land and the Covenantor and/or it assigns further agree that whenever the property shall be held, sold and conveyed, it shall be subject to the covenants, stipulations, agreements and provisions of this Declaration, which shall apply to, bind and be obligatory upon the Covenantor hereto, its heirs, successors and assigns and shall bind all present and subsequent owners of the property served by the facility.
7. The Covenantor and/or its assigns shall promptly notify the City when the Covenantor and/or its assigns legally transfer any of the Covenantor's and/or its assigns responsibilities for the facility. The Covenantor and/or its assigns shall supply the Department of Public Works, Division of Environmental Storm Water Management, 2233 McKann Avenue, Norfolk, VA 23509, with a copy of this document of transfer, executed by both parties and a copy this document acknowledged by both parties. Upon the City's receipt of the document to transfer, the conveying owner of the property (whether the Covenantor or its assigns) shall be released from all liability arising under this Declaration of Covenants subsequent to the date of conveyance, but such conveying owner shall remain liable for any and all obligations that accrue prior to such date.
8. The provisions of the Declaration shall be severable and, if any phrase, clause, sentence of provision is declared unconstitutional, or the applicability thereof to the Covenantor and/or its assigns is held invalid, the remainder of the Covenant shall not be affected thereby.
9. The Declaration shall be recorded at the Clerk's Office of the Circuit Court of the City of Norfolk, Virginia at the Covenantor's or its assign's expense.

10. In the event that the City shall determine at its sole discretion at any future time that the 10% reduction is no longer required, then the City shall at the request of the Covenantor and/or its assigns execute a release of this Declaration of Covenants which the Covenantor and/or its assigns shall record at its expense.

IN WITNESS WHEREOF, the Covenantor has executed this Declaration of Covenants of the ____ day of ____, 20 _____. The Covenantor represents and warrants as of the date of this Agreement that:

1. The Covenantor has the right, title, and authority to enter into this Agreement and to perform its obligations hereunder; and
2. The person signing this Agreement has the full and complete authority to do so.

By: _____
(Signature)

Print Name: _____

Title: _____

Mailing Address: _____

STATE OF VIRGINIA
CITY OF NORFOLK, to wit:

The foregoing instrument was acknowledged before me this ____ day of _____, 20_____.

REGISTRATION NUMBER

NOTARY PUBLIC

My Commission Expires: _____

TRANSFER OWNERSHIP OF
DECLARATION OF COVENANTS

To: SUBSEQUENT PURCHASERS OF THE ABOVE-MENTIONED PROPERTY
SEEN AND AGREED:

By: _____
(Signature)

Print Name: _____

Title: _____

Mailing Address: _____

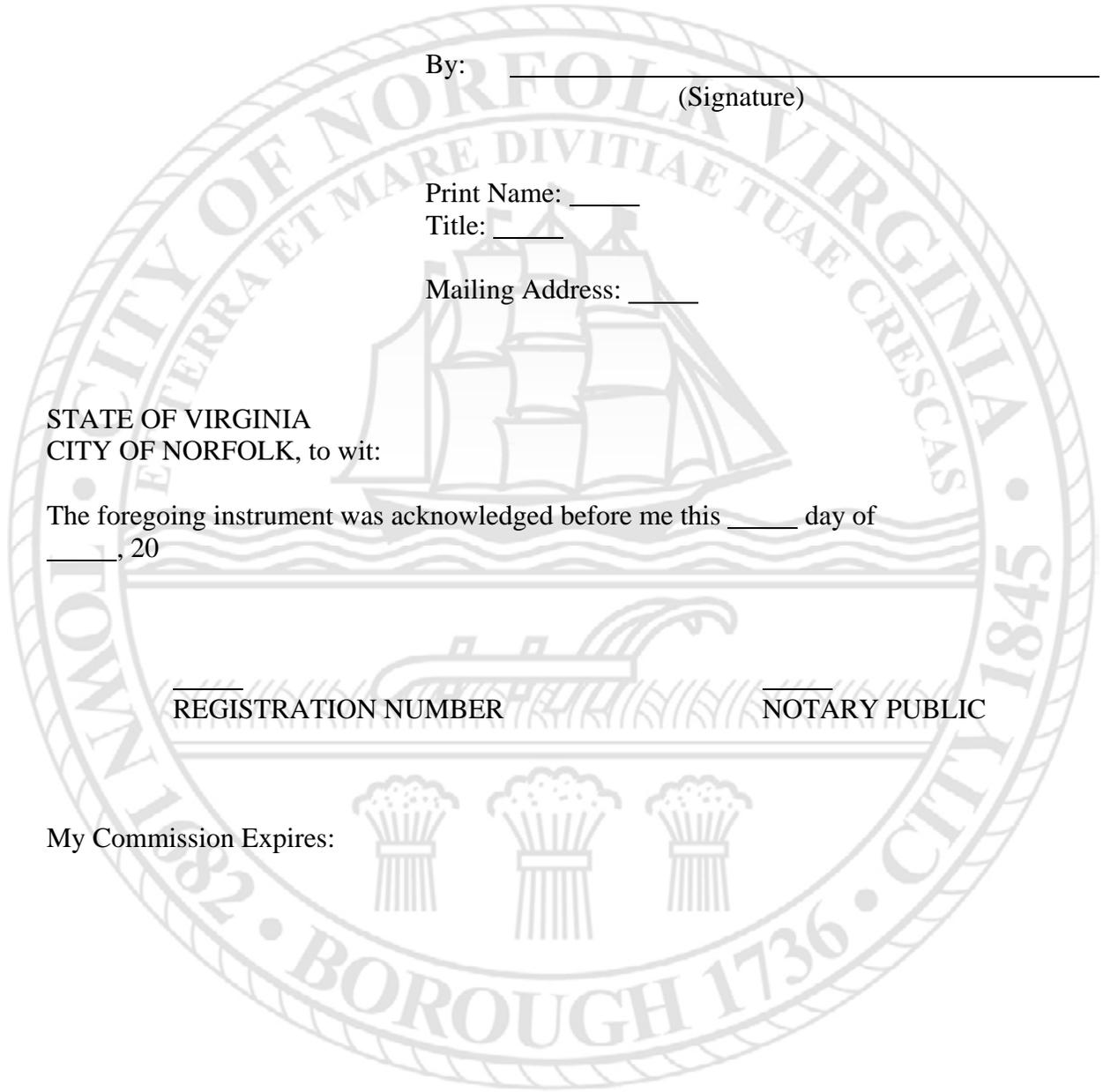
STATE OF VIRGINIA
CITY OF NORFOLK, to wit:

The foregoing instrument was acknowledged before me this _____ day of
_____, 20

REGISTRATION NUMBER

NOTARY PUBLIC

My Commission Expires:



Site Plan Number: _____

EXHIBIT A

LEGAL DESCRIPTION OF THE PROPERTY
SET FORTH IN THE DECLARATION OF COVENANTS



Site Plan Number: _____

EXHIBIT B

PERFORMANCE BASED WATER QUALITY CALCULATIONS
SET FORTH IN THE DECLARATION OF COVENANTS



LAND RECORD INSTRUMENT
COVER SHEET – FORM A

TAX EXEMPT: YES NO CITATION: _____

DATE OF INSTRUMENT: []
INSTRUMENT TYPE: []
NUMBER OF PARCELS: []
NUMBER OF PAGES: []

CITY OF NORFOLK

First & Second Grantors

Last Name (ALL CAPS)	First Name	Middle Name/Initial	Suffix
[]	[]	[]	[]
[]	[]	[]	[]

First & Second Grantees and/or Trustees

Last Name (ALL CAPS)	First Name	Middle Name/Initial	Suffix
[]	[]	[]	[]
[]	[]	[]	[]

Grantee and/or Trustee Address:
(Name) []
(Address) []
(City, State, Zip) []

Consideration [] Existing Debt [] Assumption Balance []

Assessed Value []

Prior Inst. Recorded at: City of Norfolk

Book [] Page [] Instrument No. []

Short Property Description:

Current Property Address

(Address) []

(City, State, Zip) []

Instrument Prepared By: []

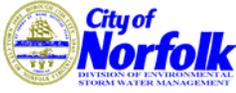
Return Recording to:

(Name) []

(Address) []

(City, State, Zip) []

5D – BMP Inspection Agreement



Storm Water Pre-Construction Meeting

Site Plan # _____ Date of Meeting: _____

Site Plan Name: _____

Name, Company & Phone of Contractor attending Pre-Construction Meeting: _____

Failure to install a storm water best management practice as shown on an approved site plan is a class 1 misdemeanor as per City Code 41.1.

Based on the requirement outlined on your approved site plan, 48 hours prior to installation of any storm water best management practice, a pre-construction meeting must be arranged with the Division of Environmental Storm Water Management at 757-823-4000. During this meeting the following items are addressed:

- Type & Location of BMP** reviewed _____
 - Deviations from the approved site plan** - All deviations must be approved by the Division of Environmental Storm Water Management Engineer and Project Design Engineer prior to work being completed.
 - “Tie-In” to City Storm Water System from Private Storm Water System** - Prior to covering any “tie-in” to the City storm water system from a private storm water system, the contractor must notify the Division to arrange on-site inspection of the pipes at 757-823-4000. The Division’s Civil Engineer II or his designee will perform the inspection to any tie-in from a private storm water system to the city storm water system. If the tie-in is covered prior to inspection, Division staff may require the tie-in to be uncovered for inspection purposes.
 - BMP must be installed based on the set of city-approved site plans** - The Division Environmental Specialist must inspect the site to ensure the storm water BMPs are installed based on approved site plans and working properly as designed. If the storm water BMP is installed based on the approved site plan, but is not working properly as designed, the Project Design Engineer must be consulted for possible redesign of the BMP. Deviations or revisions to the plans must be approved by the Project Design Engineer and the Division’s Storm Water Engineer. A revised set of plans must be submitted to the Division prior to issuance of the final occupancy permit.
 - Declaration of Covenants or BMP Maintenance Agreement must be on file.** A copy of the signed BMP Maintenance Agreement (Declaration of Covenants) must be on file with the City Clerk’s Office, and a copy must be supplied to the Division, prior to issuance of the final occupancy permit. If the document is not on file with the Division, a final occupancy permit will not be issued.
 - Grading & Drainage** - Grading & Drainage for the site must correlate with compliance worksheet “C”. If the grading on the site does not drain to the BMP as designed on the approved site plan or sheet flows to adjacent properties, the site will not be approved by the Division. It may be necessary to install swales along the parameters to prevent runoff to adjacent properties or to divert water flow to the BMP. If a property’s drainage is not correct, a final occupancy permit will not be issued until the issue has been resolved.
 - Policy on Inspection of BMP** - Prior to installation of any underground BMP, the contractor shall notify the Division at 823-4000 to arrange an on-site inspection of the BMP **PRIOR** to covering it with any fill material. If an underground BMP is installed prior to inspection, the BMP may need to be uncovered to ensure compliance. This may include removing concrete or landscaping.
- Infiltration or any other type of underground BMP will be inspected multiple times by the Division’s Environmental Specialist throughout the installation process.

1. Once the BMP is dug to the final depth, an inspection will need to be performed by the Environmental Specialist.
 - a. Check to ensure depth & location on site is accurate.
 - b. The BMP must be in a soil layer that is impermeable. If the BMP is in a soil layer that is impermeable such as clay at the dept designated on the site plan, the contractor must go back to the Engineer who designed the plan for further instruction.
 - c. The BMP cannot be in the ground water table. If there is water entering the BMP at the designated depth on the site plan, you must go back to the Engineer who designed the plans for further instruction.

2. Material-Filled BMP (stone or sand)
 - a. Check to ensure filter fabric is installed based on approved plans.
 - b. Check to ensure fill material is correct size and type (stone or sand).
 - c. Check to ensure pipe is installed based on approved plans when applicable.
 - d. Check to ensure monitoring well is installed based on approved plans when applicable.
3. Completion of BMP
 - a. Final grade is correct
 - b. Stabilization of property to prevent runoff has been completed.
 - c. Drainage to adjacent property is not occurring.

Review details for BMP installation based on approved site plan (i.e. – filter fabric, monitoring wells, stone size, fill material, etc.) If the contractor does not understand the details as drawn on the approved site plan, he/she must go to the engineer who designed the plans for further instruction.

BMP not working as designed (Ex: Dry pond, dry 48 hours after a rain event to work properly)
 The Division of Environmental Storm Water Management inspectors are required to ensure the storm water BMPs are installed based on approved site plans and working properly as designed. If the storm water BMP is installed based on the approved site plan, but is not working properly as designed, the Project Design Engineer must be consulted for possible redesign of the BMP.

“As-Built” Submission - An “As-Built” must be submitted to the Division for any open BMPs (i.e. Retention Ponds, Detention Ponds, Dry Ponds, etc.) AND for any structures that fall along the property lines. The as-built must show elevations at the base of the BMP, along the banks of the BMP and at the structures within the BMP such as the inlet or outflow structures. The as-built must be submitted to the Division’s Civil Engineer II for review and comparison to the approved site plan. Discrepancies noted must be corrected prior to the issuance of a final occupancy permit.

Open BMPs will be inspected by the Division’s Environmental Specialist at the end of the construction process, prior to issuance of the final occupancy permit. The following items will be inspected.

- a. Check to ensure depth & location on site is accurate.
- b. Check to ensure the BMP is functioning as designed. (i.e. Dry Ponds must be dry, Wet Ponds must hold water)
- c. Check Inlet / Outlet structures are installed properly, cleaned and free from debris.
- d. Check to ensure the banks are stabilized to prevent erosion.
- e. Check to ensure there is no erosion or animal burrows.

Manufactured BMPs - For manufactured BMPs or proprietary BMPs (i.e. Vortech, Filterra, etc.) a signed and dated letter must be submitted to the Division’s Environmental Specialist certifying that the structure is installed and functioning as designed. If the letter is not submitted, the final occupancy permit will not be issued.

Policy on Final Occupancy Inspection for BMP
 Prior to receiving a final occupancy permit from the City of Norfolk, the contractor must set up a meeting 48-hours in advance with the Division of Environmental Storm Water Management to conduct a BMP Inspection for final occupancy release. The BMP must be installed according to the approved site plan and must be working as designed. For all BMPs that require special equipment to inspect (i.e. – large tops removed, special bolts removed, etc.), the contractor must ensure the BMP is accessible for scheduled inspection

Other Comments

I here-by certify that all the items described above were reviewed by me during a pre-construction meeting with a representative/inspector from the City of Norfolk, Division of Environmental Storm Water Management. I understand and acknowledge all the pre-construction requirements described, and agree to abide by those requirements set forth. I also agree failure to abide by the requirements in this agreement could result in a delay of final occupancy permits issued by the City of Norfolk, Planning Department (757-664-6513).

 Signature of Contractor

 Date Signed

 Signature of Representative/Inspector for the
 Division of Environmental Storm Water Management

 Date Signed

5E – Appendix 9-C VSWMH Sample BMP Inspection Checklists

Appendix 9-C

EXAMPLE BMP INSPECTION & MAINTENANCE CHECKLISTS

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9-C.1.0. INTRODUCTION

Once construction is completed, the SWM BMP takes on the role for which it was intended. Periodic site inspections are essential in order to monitor the effectiveness and to anticipate the maintenance needs of the BMP. When conducting inspections, attention should be given not only to the BMP installed for stormwater control, but also to the conveyance system carrying runoff to the BMP and the receiving channel immediately downstream of the BMP. The conveyance channel, curbing and/or storm sewer that convey flow to the BMP or, by design, intentionally divert flows around it are all considered BMP components and must function as intended.

The necessary frequency of inspections will vary with each BMP based on the type of facility, the size of the contributing drainage area, and the land use conditions within the contributing drainage area. The Virginia Stormwater Management Regulations ([4 VAC 50-60-114](#)) provide criteria governing local government BMP inspection programs. There is some flexibility provided for inspection frequency for BMPs treating stormwater from an individual residential lot and those BMPs for which schedules are established in individual BMP Maintenance Agreements. Other BMPs must be inspected at least once every five years. However, DEQ recommends that, if feasible, a full inspection should be performed at least once a year, at least for highly engineered facilities such as ponds, constructed wetlands and filters. Localities can take into account the property owners track records pertaining to inspection and maintenance of BMPs on their properties. Ideally, periodic inspections for trash and debris accumulation and general aesthetics should be performed more frequently, after significant storm events.

The first example form provided on the next page is a generic inspection checklist developed by the Center for Watershed Protection. This form allows one to quickly assess urban BMP performance using simple visual indicators. This approach was refined and tested through an extensive analysis of hundreds of BMPs located in the James River Basin of the Chesapeake Bay watershed. More detail on the methods and results can be found in Hirschman et al (2009). It is recommended that these rapid investigations be conducted during every other routine stormwater BMP inspection conducted by a locality in order to verify BMP performance. In many cases, the locality may choose to sub-sample their existing inventory of stormwater practices to gain better information. This basic form can be modified, simplified or customized to meet the unique BMP terminology and design criteria employed in the locality. As well, the locality may elect to develop or adapt your own indicators, checklists and field inspection procedures.

This Appendix also provides a series of individual BMP example checklists for local governments and others to use to guide inspection and maintenance of specific stormwater control measures. Users should feel free to customize these templates, as appropriate, to more effectively address the situations typically encountered during inspection and maintenance activities and to make them easier for inspectors to use. The checklists are detailed enough for an inexperienced inspector or homeowner not familiar with the specific components of the facility. Checking the column provided under the *Investigate* heading for any given item indicates a potential problem that requires attention by a qualified individual to interpret the visual indicators for possible maintenance. The checklists should be signed, dated, and maintained at an accessible location such as with an official representative of the homeowners association, the individual or company contracted for maintenance, owner, etc.

FACILITY ID: _____	DATE: ___/___/___	ASSESSED BY: _____
---------------------------	--------------------------	---------------------------

NAME: _____	HANDHELD/ GPS ID:
ADDRESS: _____	
PHOTO IDS: _____	

SECTION 1- BACKGROUND INFORMATION (GIS)	
BMP TYPE : <input type="checkbox"/> Dry Detention Pond <input type="checkbox"/> Dry Swale <input type="checkbox"/> Wetland <input type="checkbox"/> Extended Detention Pond <input type="checkbox"/> Wet Swale <input type="checkbox"/> Level Spreader <input type="checkbox"/> Wet Pond <input type="checkbox"/> Grass Channel <input type="checkbox"/> WQ Inlet <input type="checkbox"/> Filter (specify: _____) <input type="checkbox"/> Dry Well <input type="checkbox"/> Proprietary Device <input type="checkbox"/> Infiltration (specify: _____) <input type="checkbox"/> Permeable Pavement <input type="checkbox"/> Other _____ <input type="checkbox"/> Check if structure is underground <input type="checkbox"/> Bioretention _____	YEAR CONSTRUCTED: _____ OWNERSHIP <input type="checkbox"/> Public <input type="checkbox"/> Private <input type="checkbox"/> Unknown

SITE CHARACTERIZATION	
DRAINAGE AREA: _____(acres) IMPERVIOUS COVER: _____(acres) Discerned from: <input type="checkbox"/> Plan <input type="checkbox"/> County Data <input type="checkbox"/> GIS <input type="checkbox"/> Field	
CONTRIBUTING DRAINAGE AREA (% land use): <i>Note – All percentages should sum up to 100%.</i> _____Industrial _____Commercial _____Urban/Residential _____Suburban/Res _____Forested _____Institutional _____Golf course _____Park _____Crop _____Pasture _____Other: _____	WATER QUALITY VOL (FROM DESIGN PLAN): _____(ft ³)

SECTION 2- FIELD VISIT	
Rain in last 48 hrs? <input type="checkbox"/> Yes <input type="checkbox"/> No	Evidence of high water table (e.g., excessive soil saturation)? <input type="checkbox"/> Yes <input type="checkbox"/> No

DESIGN ELEMENTS			
FACILITY SIZE: Length: _____(ft) Width: _____(ft) Surface Area: _____(ft ²) Depth of WQ storage _____(ft)	OBSERVED WQ STORAGE VOL: _____(ft ³)	HYDRAULIC CONFIGURATION <input type="checkbox"/> On-line Facility <input type="checkbox"/> Off-line Facility	DESIGN STORM(S): <input type="checkbox"/> Water Quality <input type="checkbox"/> Flood Control <input type="checkbox"/> Channel Protection <input type="checkbox"/> Unknown

BMP SIGNAGE: (check all that apply)				
<input type="checkbox"/> None	<input type="checkbox"/> Flood Warning	<input type="checkbox"/> Stormwater Education	<input type="checkbox"/> No Trespassing	<input type="checkbox"/> Wildlife Habitat
<input type="checkbox"/> Public Property	<input type="checkbox"/> Do Not Mow	<input type="checkbox"/> Other: _____		

OUTLET CHARACTERISTICS	
PRIMARY OUTLET STRUCTURE:	<input type="checkbox"/> N/A – infiltration w/ no outlet <input type="checkbox"/> Pipe <input type="checkbox"/> Riser <input type="checkbox"/> Weir <input type="checkbox"/> Large Storm Overflow <input type="checkbox"/> Open channel <input type="checkbox"/> Large Storm By-pass <input type="checkbox"/> Other: _____
OUTLET FEATURES:	<input type="checkbox"/> N/A <input type="checkbox"/> Trash Rack <input type="checkbox"/> Pond Drain <input type="checkbox"/> Inverted outlet pipe <input type="checkbox"/> Hooded outlet <input type="checkbox"/> Anti-vortex device <input type="checkbox"/> Perforated pipe <input type="checkbox"/> Gravel Diaphragm <input type="checkbox"/> Micropool outlet <input type="checkbox"/> Multiple outlet levels <i>Outlet includes restrictor?</i> <input type="checkbox"/> Yes <input type="checkbox"/> No
OUTLET STRUCTURE CONDITIONS:	Erosion at Outlet: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Outlet Clogging: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Structural Problems: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe
CONDITIONS AT OUTFALL:	<input type="checkbox"/> Stream <input type="checkbox"/> Closed storm sewer <input type="checkbox"/> Surface channel <input type="checkbox"/> Road ditch <input type="checkbox"/> Other: _____ <input type="checkbox"/> Unknown
Active Erosion:	<input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Odor: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe
Trash:	<input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Algae: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe
Sedimentation:	<input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Other WQ Problems: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe

Emergency Spillway Type: <input type="checkbox"/> Channel <input type="checkbox"/> Riser Overflow <input type="checkbox"/> Weir <input type="checkbox"/> Other: _____

SOIL OR FILTER MEDIA		
TYPE OF FILTER/INFILTRATION MEDIA: (check all that apply) <input type="checkbox"/> Soil mix _____(in) <input type="checkbox"/> Sand _____(in) <input type="checkbox"/> Gravel _____(in) <input type="checkbox"/> Large Stone _____(in) <input type="checkbox"/> Organic material _____(in) <input type="checkbox"/> Other _____ <input type="checkbox"/> N/A <input type="checkbox"/> Unknown		
Avg. depth of sediment build-up on surface? _____ (in)		
SOIL MEDIA SAMPLE: <i>Note – Complete during site investigation, if applicable</i> Dominant Soil Type <input type="checkbox"/> Clay <input type="checkbox"/> Loam <input type="checkbox"/> Sand <input type="checkbox"/> Sand/Loam Is the soil homogenous? <input type="checkbox"/> Yes <input type="checkbox"/> No		Comments:
VEGETATION		
GENERAL OBSERVATIONS: <input type="checkbox"/> Landscaped <input type="checkbox"/> Aquatic Bench <input type="checkbox"/> Invasive Species <input type="checkbox"/> Plant Diversity	TYPE OF GROUND COVER (% of Surface Area in Plan View up to low Outlet): <i>Note – All percentages should sum up to 100 %.</i> _____ Trees _____ Grasses/Perennials _____ Pondered water _____ Other: _____ _____ Managed Turf _____ Bare Soil _____ Shrubs _____ N/A _____ Gravel/stone _____ Mulch _____ Emergent wetland	
	Depth of mulch, if present: <input type="checkbox"/> Hardwood _____(in) <input type="checkbox"/> Pine Straw _____(in) <input type="checkbox"/> Other _____(in) Rate degree of shading of BMP Surface Area by trees: <input type="checkbox"/> Well Shaded <input type="checkbox"/> Some Shading <input type="checkbox"/> No Shading <input type="checkbox"/> N/A	
INLET CHARACTERISTICS		
INLET #1: Diameter/Width: _____(in)	TYPE OF INLET: <input type="checkbox"/> Open Channel <input type="checkbox"/> Closed Pipe <input type="checkbox"/> Sheet Flow <input type="checkbox"/> Curb Cut <input type="checkbox"/> Other: _____	Elevation difference between bottom of inlet and BMP surface: _____ (in)
INLET SUBMERSION: <input type="checkbox"/> Complete <input type="checkbox"/> Partial <input type="checkbox"/> None	INLET CONDITIONS: Inlet Erosion <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Inlet Clogging <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Structural Problems <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe	Comments:
INLET #2: Diameter/Width: _____(in)	TYPE OF INLET: <input type="checkbox"/> Open Channel <input type="checkbox"/> Closed Pipe <input type="checkbox"/> Sheet Flow <input type="checkbox"/> Curb Cut <input type="checkbox"/> Other: _____	Elevation difference between bottom of inlet and BMP surface: _____ (in)
INLET SUBMERSION: <input type="checkbox"/> Complete <input type="checkbox"/> Partial <input type="checkbox"/> None	INLET CONDITIONS: Inlet Erosion <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Inlet Clogging <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Structural Problems <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe	Comments:
PRETREATMENT		
TYPE OF PRETREATMENT (check all that apply) <input type="checkbox"/> None <input type="checkbox"/> Grass Filter Strip <input type="checkbox"/> Sediment Forebay (_____ ft ³) <input type="checkbox"/> Plunge Pool? <input type="checkbox"/> Grass Channel <input type="checkbox"/> Stone Diaphragm <input type="checkbox"/> Riprap Channel or Apron <input type="checkbox"/> Other: _____		PRETREATMENT FUNCTION <input type="checkbox"/> By design <input type="checkbox"/> Incidental Is pretreatment functioning? <input type="checkbox"/> Yes <input type="checkbox"/> No Is sediment removal necessary? <input type="checkbox"/> Yes <input type="checkbox"/> No Signs of pretreatment bypass? <input type="checkbox"/> Yes <input type="checkbox"/> No Signs of flow of sediment from pretreatment to BMP? <input type="checkbox"/> Yes <input type="checkbox"/> No Severity: <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe
GENERAL DESIGN		
BMP FEATURES (check all that apply) <input type="checkbox"/> Maintenance Access <input type="checkbox"/> Underdrain <input type="checkbox"/> Fence <input type="checkbox"/> Clean Out <input type="checkbox"/> Pond Drain <input type="checkbox"/> Multi-cell <input type="checkbox"/> Observation Well <input type="checkbox"/> Other: _____ <input type="checkbox"/> Micropool Is water present in observation well? <input type="checkbox"/> Impermeable Liner <input type="checkbox"/> Yes <input type="checkbox"/> No Depth: _____ ft		
CONVEYANCE THROUGH BMP <input type="checkbox"/> No Defined Channel <input type="checkbox"/> Low Flow Channel <input type="checkbox"/> Concrete <input type="checkbox"/> Eroded <input type="checkbox"/> Earthen <input type="checkbox"/> Other _____ Length of Shortest Flow Path: _____ (ft)		Is BMP designed with a Permanent Pool? <input type="checkbox"/> Yes <input type="checkbox"/> No

PERFORMANCE																												
GENERAL PROBLEMS: (check all that apply) <table style="width:100%; border: none;"> <tr> <td style="width:33%; border: none;"><input type="checkbox"/> Maintenance Needed</td> <td style="width:33%; border: none;"><input type="checkbox"/> Erosion at Embankments</td> <td style="width:33%; border: none;"><input type="checkbox"/> Permanent Pools not stable</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Water Bypass of Inlet</td> <td style="border: none;"><input type="checkbox"/> Erosion within Facility</td> <td style="border: none;"><input type="checkbox"/> Inadequate vegetation</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Water Bypass of Outlet</td> <td style="border: none;"><input type="checkbox"/> Deposition within Facility</td> <td style="border: none;"><input type="checkbox"/> Dead or Diseased Vegetation</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Incorrect Flow Paths</td> <td style="border: none;"><input type="checkbox"/> Inappropriate Ponding of Water</td> <td style="border: none;"><input type="checkbox"/> Too many invasive plants</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Short-circuiting of treatment mechanism</td> <td style="border: none;"><input type="checkbox"/> Clogged Pond Drain/Underdrain</td> <td style="border: none;"><input type="checkbox"/> Trees on Embankment</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> No or ineffective treatment</td> <td style="border: none;"><input type="checkbox"/> Clogged Media</td> <td style="border: none;"><input type="checkbox"/> Failing structural components</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Ineffective pretreatment</td> <td style="border: none;"><input type="checkbox"/> Inappropriate media material</td> <td style="border: none;"><input type="checkbox"/> Safety issue (Note: _____)</td> </tr> <tr> <td style="border: none;"><input type="checkbox"/> Others _____</td> <td style="border: none;"><input type="checkbox"/> Inappropriate underlying soil (infiltration)</td> <td></td> </tr> </table>					<input type="checkbox"/> Maintenance Needed	<input type="checkbox"/> Erosion at Embankments	<input type="checkbox"/> Permanent Pools not stable	<input type="checkbox"/> Water Bypass of Inlet	<input type="checkbox"/> Erosion within Facility	<input type="checkbox"/> Inadequate vegetation	<input type="checkbox"/> Water Bypass of Outlet	<input type="checkbox"/> Deposition within Facility	<input type="checkbox"/> Dead or Diseased Vegetation	<input type="checkbox"/> Incorrect Flow Paths	<input type="checkbox"/> Inappropriate Ponding of Water	<input type="checkbox"/> Too many invasive plants	<input type="checkbox"/> Short-circuiting of treatment mechanism	<input type="checkbox"/> Clogged Pond Drain/Underdrain	<input type="checkbox"/> Trees on Embankment	<input type="checkbox"/> No or ineffective treatment	<input type="checkbox"/> Clogged Media	<input type="checkbox"/> Failing structural components	<input type="checkbox"/> Ineffective pretreatment	<input type="checkbox"/> Inappropriate media material	<input type="checkbox"/> Safety issue (Note: _____)	<input type="checkbox"/> Others _____	<input type="checkbox"/> Inappropriate underlying soil (infiltration)	
<input type="checkbox"/> Maintenance Needed	<input type="checkbox"/> Erosion at Embankments	<input type="checkbox"/> Permanent Pools not stable																										
<input type="checkbox"/> Water Bypass of Inlet	<input type="checkbox"/> Erosion within Facility	<input type="checkbox"/> Inadequate vegetation																										
<input type="checkbox"/> Water Bypass of Outlet	<input type="checkbox"/> Deposition within Facility	<input type="checkbox"/> Dead or Diseased Vegetation																										
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<input type="checkbox"/> Ineffective pretreatment	<input type="checkbox"/> Inappropriate media material	<input type="checkbox"/> Safety issue (Note: _____)																										
<input type="checkbox"/> Others _____	<input type="checkbox"/> Inappropriate underlying soil (infiltration)																											
WATER QUALITY IN FACILITY: <input type="checkbox"/> N/A Algae <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Odor <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Turbidity <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Severe Color <input type="checkbox"/> Normal <input type="checkbox"/> Abnormal: _____		EVIDENCE OF: <input type="checkbox"/> Geese <input type="checkbox"/> Animal Burrows <input type="checkbox"/> Mosquitoes <input type="checkbox"/> BMP Alteration																										
PROBLEM	1=NONE	2 - FEW	3 – SEVERAL	4-SEVERE																								
TRASH	No evidence of trash	A few pieces of trash throughout BMP	Trash accumulation near inlet/outlet	Lots of trash in BMP or BMP used for storage																								
BMP BANK EROSION	No noticeable erosion	Slight erosion < 5% of bank affected	Moderate erosion ~15% of bank affected	Banks severely eroded, >25% of bank affected																								
SEDIMENT DEPOSITION	No sediment deposition	Areas of minor sediment deposition	Areas of some deposition, may be severe near inlet/outlets	Lots of deposition resulting in pond bottom clogging																								
SURFACE SLOPE	0-1% BMP surface slope	1-3% BMP surface slope or steeper slopes with check dams,	3-5% BMP surface slope with no check dams,	>5% surface slope;																								
SIDE SLOPES	BMP side slopes 3:1 or flatter	BMP side slopes 2:1	Steep BMP side slopes	Risk of side slope failure																								
STRUCTURAL	No evidence of structural damage	Minor problems (e.g., bank slump, eroded channels)	Moderate structural problems –failure pending	Structural failures (e.g., bank failure, blowout)																								
VISIBILITY	High visibility, near high-traffic areas	Some visibility, near traffic areas	Limited visibility, near low traffic areas	No visibility, behind buildings or fences																								
ACCESSIBILITY	Maintained access area for vehicles	Access area designated, but not maintained	Access for vehicles not designated	Access for vehicles not possible																								
VEG COVER	No mowing in/around BMP	Mowing along BMP edges but areas of no mow in BMP bottom	Mowed turf vegetation	BMP bottom has large areas of bare soil																								
	Dense plant cover (>75%)	Plant cover, 50-75%	Some plant cover, 25-50%	Sparse vegetative cover (<25%),																								
VEG HEALTH	TREES	Healthy and established	Slightly stressed	Stressed	Dead																							
	GROUND COVER	Healthy and established	Slightly stressed	Stressed	Dead																							
	SHRUBS	Healthy and established	Slightly stressed	Stressed	Dead																							
	EMERGENT WETLAND	Healthy and established	Slightly stressed	Stressed	Dead																							
OVERALL PERFORMANCE SCORE (circle one number)																												
Excellent design and function, no general problems with performance	BMP is well designed, but is undersized or has a few performance problems		BMP is adequately designed, several problems with performance are noted		Poor BMP design, severe performance problems or failure																							
10	9	8	7	6	5	4	3	2	1																			

FIELD NOTES

GOOD OR INTERESTING DESIGN FEATURES:

PHOTO #'S:

POOR OR PROBLEMATIC DESIGN FEATURES:

PHOTO #'S:

SECTION 3 – DESIGN PLAN VERIFICATION

PLAN AVAILABLE: As-built Other: _____

Do field observations match design plans/as-builts? Describe any differences.

- Soil type in facility N/A Yes No If no, describe:
- Pretreatment type and size N/A Yes No If no, describe:
- Signage N/A Yes No If no, describe:
- Low-flow channel N/A Yes No If no, describe:
- Dimensions/volume N/A Yes No If no, describe:
- Inlet type, #, and sizing N/A Yes No If no, describe:
- Outlet type, #, and sizing N/A Yes No If no, describe:
- Vegetation composition N/A Yes No If no, describe:
- Other features N/A Yes No If no, describe:

9-C.2.0. ROOFTOP DISCONNECTION: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Compensatory device type (include if the pervious area flow path is less than the required minimum length): **(NOTE: See the separate plan review checklist for the compensatory device)**

- Dry Well
- French Drain
- Rain Garden
- Other: _____

Element of BMP	Potential Problem	Problem? Y/N	Investigate? Y/N	Repaired? Y/N	How to Fix Problem	Who Will Address Problem	Comments
Piping, Gutters, Drains and Pre-Treatment Sumps	Fluid from a different practice is being piped near pervious areas				Prevent adjacent uses from piping through or around pervious area.	Professional	
	Sediment and debris accumulation				Correct the source of sediment and debris and remove it immediately	Owner or professional	
	Mosquito proliferation				Correct gutter flow to eliminate standing water; treat for mosquitoes, as needed	Owner or professional	
	Runoff is not entering the receiving pervious area				Check to see if connection spout or overflow pipe is clogged. Remove the sediment.	Owner or professional	
	The downspouts remain disconnected				Restore disconnection	Owner or professional	
Manufactured Products	Product or component is broken or not functioning correctly.				Follow the manufacturer's maintenance recommendations, and repair or replace as needed.	Owner or professional	
Downstream Treatment	The compensatory treatment units have not been maintained				Correct identified problems, according to the maintenance guidelines for the specific supplementary BMP.	Owner or professional	
	Stormwater discharge is ponding at point of disconnection				Dry wells or french drains may be needed, if not already present. Clean out manually, and reconstruct or replace when no longer functioning.	Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Downstream Treatment (continued)	Erosion is evident at the simple disconnection, bioretention/rain gardens, filter paths, or foundation planter				Remove the sediment and debris build-up at the points where runoff enters the pervious area. Then re-stabilize.	Owner or professional	
	Practices to which the disconnection discharges are not functioning				Reference that practice's checklist for instructions to fix problems.	Professional	
	Practices to which the disconnection discharges are disturbed or have been converted				Correct identified problems and stabilize as needed	Owner or professional	
	The receiving pervious area(s) retain dimensions as shown on plans and are in good condition				Restore dimensions and make needed repairs	Owner or professional	
	There is encroachment on the receiving pervious area(s) or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

9-C.3.0. SHEET FLOW TO VEGETATED FILTER AREAS AND CONSERVED OPEN SPACE: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Ideally, these BMP areas should be inspected annually, with the inspection conducted during the non-growing season when it is easier to observe the flow path. Once established, vegetated filter strips have minimal maintenance needs outside of the Spring clean up: regular mowing, repair of check dams and other measures to maintain the hydraulic efficiency of the filter strip and a dense, healthy grass cover. Grass filter strips and boundary zones must be mowed at least twice a year to prevent woody growth. A conservation easement may be required to ensure that the vegetated filter strip area and any newly established or restored forest cover may not be cleared. Also, a responsible party should ensure that routine forest improvements are made over time (i.e., thinning, invasive plant removal, etc.).

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	There is excessive trash and debris				Remove immediately.	Owner or professional	
	There is evidence of erosion and/or bare or exposed soil				Stabilize immediately.	Owner or professional	
Inlet	Inlets provide stable conveyance into facility				Stabilize immediately, as needed.	Owner or professional	
	Excessive trash / debris / sediment accumulation at the inlet				Remove trash and debris immediately	Owner	
	Evidence of erosion at / around the inlet				Correct the source problem and stabilize immediately	Owner or professional	
Channel	Scour and erosion are present within the vegetated filter area				Sediments are to be cleaned out of Level Spreader forebays and flow splitters	Owner or professional	
	Debris and sediment build-up is present at the top of the vegetated filter area				Check conveyance(s) to the filter area for trouble spots and correct any problems immediately. Manually remove the deposited sediment.	Owner or professional	
Gravel Diaphragm	Foot or vehicular traffic is compromising the gravel diaphragm.				Block foot and vehicular traffic. Re-stabilize the area immediately.	Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Level Spreader	The level spreader is performing properly. Flows are not concentrating on the down-gradient side of the element				Search the spreader for chips, cracks, or any other fundamental compromise of the structure. Repair immediately.	Professional	
	There is excessive landscape waste and yard clippings				Remove immediately.	Owner or professional	
Vegetation	Vegetative density is less than 90% cover in the boundary zone or grass filter				Reseed and fertilize (if necessary) the exposed soil	Owner or professional	
	The plant composition is consistent with the approved plans				Make a judgment regarding whether plants need to be replaced, and replace if necessary	Professional	
	Invasive species or weeds are present				Correctly destroy and/or remove the invasive species; make a judgment regarding whether other weeds need to be removed, and remove if necessary	Owner or professional	
	There is troublesome pest infestation				Use integrated pest management (IPM) techniques to minimize the use of pesticides and herbicides. Minimize use of organic (not chemical) fertilizer, as needed.	Owner or professional	
	There is dead vegetation and/or exposed soil				Reseed or replace dead vegetation on exposed soil areas	Owner or professional	
Overflow Area	Flows through the filter area short-circuit the overflow control section				Check that the structure is not clogged. If so, manually clean out debris immediately.	Owner or professional	
Outlet	The outlet provides stable conveyance away from the filter area				Stabilize immediately, as needed.	Professional	
Overall	There is adequate access to the level spreader and filter area				Establish adequate access	Professional	
	There is evidence of standing water				Fill in low spots and stabilize; correct flow problems causing ponding	Owner or professional	
	There is excessive trash and debris				Remove immediately	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overall (continued)	Mosquito proliferation				Eliminate stagnant pools and establish vegetation; treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> .	Owner or professional	
	Complaints from local residents				Correct real problems	Owner or professional	
	Encroachment on the filter area or easement by buildings/structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

9-C.4.0. GRASS CHANNELS: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Type of pretreatment facility:

- Sediment Forebay
- Check Dam
- Grass Filter Strip
- Stone Diaphragm
- Other: _____
- None

Ideally, these BMP areas should be inspected annually, with the inspection conducted spring when the health of the grass channel lining should be evident. Once established, Grass Channels have minimal maintenance needs outside of the Spring clean up: regular mowing, repair of check dams and other measures to maintain the hydraulic efficiency of the channel and a dense, healthy grass cover.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	There is excessive trash and debris				Remove immediately	Owner or professional	
	There is evidence of erosion and / or bare or exposed soil				Stabilize immediately	Owner or professional	
Pre-treatment	There is adequate access to the pre-treatment facility				Establish adequate access	Professional and, perhaps, the locality	
	There is excessive trash / debris / sediment in the facility				Remove immediately	Owner or professional	
	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	There is evidence of diaphragm or other clogging				Identify and eliminate the source of the problem; . If necessary, remove and clean or replace the stone.	Professional	
	There is dead vegetation and evidence of erosion and / or exposed soil				Repair erosion damage, and reseed or otherwise restabilize with vegetation	Owner or professional	
Inlets	The inlet is not maintaining a calm flow of water entering the channel or the conveyance capacity is blocked				Remove trash and sediment accumulated at the inflow. Sources of sediment and debris must be identified and corrected. Stone splash pads must be replenished to prevent erosion.	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
	There is evidence of erosion at / around inlet				Repair erosion damage, and reseed or otherwise restabilize with vegetation.	Owner or professional	
Vegetation	Native soil is exposed or erosion channels are forming				If sediment deposits are thick enough to damage or kill vegetation, remove the sediment by hand, while protecting the vegetation.	Owner or Professional	
	Grass height does not reach standards				Grass channels must be mowed to keep grass at a height of 4" to 9". Remove grass clippings after mowing.	Owner or Professional	
	Vegetation requires fertilizer or pest control				Fertilize according to specifications. Use organic rather than chemical fertilizer. If feasible, use compost. Use integrated pest management (IPM) techniques to minimize the use of pesticides and herbicides.	Owner or Professional	
	The plant composition is consistent with the approved plans				Make a judgment regarding whether plants need to be replaced, and replace if necessary	Professional	
	Invasive species or weeds are present				Correctly destroy and/or remove the invasive species; make a judgment regarding whether other weeds need to be removed, and remove if necessary	Owner or professional	
	There is dead vegetation and/or exposed soil				Reseed or replace dead vegetation and exposed soil areas	Owner or professional	
Side Slopes	Evidence of erosion on side slopes, introducing sediment into the swale.				Repair erosion damage immediately. Stabilize slopes using appropriate erosion control measures and plant appropriate vegetation.	Owner or Professional	
Check Dams	Dam is not functioning properly.				Check upstream and downstream sides of check dams for evidence of undercutting, side cutting or erosion and repair immediately.	Professional	
	There is a large accumulation of sediment or trash/debris behind the check dam.				Remove sediment when the accumulation exceeds 25% of the original Tv. Remove trash/debris and clear blockages of weep holes.	Professional	
Channel Bottom	Undesirable plant species, accumulations of fallen leaves, and other debris from deciduous plant foliage are present.				Remove woody vegetation from the channel. Prune adjacent trees and shrubs to keep the channel clear. Remove/replace invasive veg. or weeds if they cover < 25% of the channel area. Remove accumulated organic matter and debris immediately.	Owner or Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Channel Bottom (continued)	Base soils are compacted. The practice does not draw down within 48 hours after a storm.				De-thatch and aerate the channel. Remove sediment when the accumulation exceeds 25% of channel volume. Restore the original cross section and revegetate the channel.	Owner or Professional	
	There is unhealthy or dead grass cover or evidence of erosion, braiding, or excessive ponding in the channel bottom				Fill in low spots, repair erosion, and add reinforcement planting to maintain 90% turf cover. Reseed any salt killed vegetation and stabilize immediately. Keep the grass in a healthy, vigorous condition at all times, since it is the primary erosion protection for the channel.	Owner or Professional	
Channel Outlet	The outlet does not maintain sheet flow of water exiting the channel (unless a collection drain is used).				The source of erosion damage must be identified and controlled when native soil is exposed or erosion channels are forming. Check the channel outlet and all road crossings for bank stability and evidence of piping or scour holes.	Owner or professional	
	The outlet provides stable conveyance out of the channel				Stabilize immediately, as needed.	Professional	
	There is excessive trash, debris or sediment accumulation at outlet				Check inflow points for clogging and remove any trash and sediment deposits	Owner or professional	
	There is dead vegetation and/or exposed soil				Reseed or replace dead vegetation and exposed soil areas	Owner or professional	
Pest Control	There is evidence of standing water and mosquito habitat or rodent damage				Pest control measures must be taken when mosquitoes and/or rodents are found to be present. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> . Holes in the ground located in and around the swale must be filled and stabilized with vegetation.	Professional	
Overall	Access to the Grass Channel is adequate				Establish adequate access	Professional and, perhaps, the locality	
	Complaints from local residents				Correct real problems	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overall (continued)	Encroachment by buildings or other structures				Clearly mark BMP and inform those involved of the BMPs.	Owner, pro (and perhaps the locality)	

9-C.5.0. SOIL COMPOST AMENDMENTS: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Ideally, the amended soil area should be watered once every 3 days for the first month, and then weekly during the first growing season (April-October), depending upon rainfall. The area should be inspected at least after each storm event that exceeds 1/2-inch of rainfall during the first six months following the incorporation of soil amendments. Depending on the results of a soil test for the amended area, a one-time spot fertilization may be needed in the fall after the first growing season to increase plant vigor. The area should be de-thatched every few years to increase permeability.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
	There is excessive trash and debris				Remove immediately	Owner or professional	
	There is evidence of erosion and / or bare or exposed soil				Stabilize immediately with grass cover	Owner or professional	
	Evidence of excessive use of fertilizer or lawn chemicals				Develop and implement a nutrient and pest control management plan	Owner or professional	
	Runoff is ponding, creating rills, and/or causing erosion				Dethatch or aerate the soil. Introduce more compost amendments and/or lime. Restabilize eroded areas by replanting vegetation.	Owner or professional	
	Access to the amended soil area for maintenance is adequate.				Establish adequate access	Professional	
	Absence of signs designating the area as a Conservation Area				Obtain or create and post appropriate signage	Owner (and perhaps the locality)	
	There is evidence of erosion and / or bare or exposed soil				Stabilize immediately	Owner or professional	
	Encroachment on the amended area or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

NOTE: Soil compost amendments do not need to be addressed in a maintenance agreement if they are incorporated to reduce lawn runoff volume or improve a residential rooftop disconnection. They probably should be addressed in a simple maintenance agreement if the soil restoration/improvement is associated with more than 10,000 square feet of reforestation. Soil compost amendments within a vegetated filter strip or grass channel should be located in a public right of way or within a dedicated stormwater or drainage easement.

9-C.6.0. VEGETATED ROOFS: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Ideally, following construction, this practice should be inspected monthly during the vegetation establishment period, and then every six months thereafter to assess the state of vegetative cover and to look for leaks, drainage problems and other functional or structural concerns. Maintenance may include watering, hand-weeding to remove invasive or volunteer plants, and to add plant materials to repair bare areas. The use of herbicides, insecticides, fungicides, and fertilizers should be avoided, since their presence could hasten degradation of the waterproof membrane. Also, power-washing and other exterior maintenance operations should be avoided so that cleaning agents and other chemicals do not harm the vegetated roof plant communities.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Vegetation	Plant cover is less than 90% plant cover				During establishment period, replace dead plants as needed. During the long-term period, dead plants must generally be replaced once per year in the fall.	Owner or professional	
	Plants are wilting				Water more frequently to promote growth and survival. Annual application of slow-release fertilizer is recommended in the fall during the first five years following installation. After that, fertilizer is generally not necessary and should not be applied.	Owner or professional	
	Plants are choking on excess vegetation				Fallen leaves and debris from deciduous plant foliage must be removed and should be recycled or composted.	Owner or professional	
	Invasive and nuisance plant species are present				Completely remove invasive plant species. Weeding must be done by hand, without the use of herbicides or pesticides. Remove weeds regularly and do not allow them to accumulate.	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Vegetation (continued)	Drought conditions are present				Mulch or shade cloth may be applied to prevent excess solar damage and water loss	Professional	
	There is troublesome pest infestation				Use integrated pest management (IPM) techniques to minimize the use of pesticides and herbicides. Minimize use of organic (not chemical) fertilizer, as needed.	Owner or professional	
	There is excessive trash and debris				Remove immediately	Owner or professional	
	Grass has become unruly				Grass should be mowed as needed. Clippings must be removed and should be recycled or composted.	Owner or professional	
Vegetation Irrigation	During the establishment period (initial 1-3 years)				Water sufficiently to assure plant establishment, but do not exceed 1/4-inch of water once every 3 days	Owner or professional	
	During the long-term period (3+ years)				Water sufficiently to maintain plant cover, but do not exceed 1/4-inch of water once every 14 days. For automatic sprinklers, use manufacturers' instructions for operation and maintenance.	Owner or professional	
Structural Components	Waterproof membrane is leaking or cracked				Make necessary repairs immediately	Professional	
	Root barrier is perforated				Replace swatch	Professional	
Drainage Layer/Inlet Pipes	Soil substrate, vegetation, debris, litter or other materials clog the roof drain inlet, scuppers or gutters				Sources of organic matter, debris, litter, and other sediment must be identified and materials removed to prevent clogging drainage structures	Professional	
	Drain inlet pipe is in poor condition				Repair as needed	Professional	
Soil Substrate/ Growing Medium	Evidence of erosion from wind or water				If erosion channels are evident, they must be stabilized with additional soil substrate/growth medium and covered with additional plants	Professional	
	Growth media has become clogged with sediment				Manually remove sediment so as not to damage plant materials.	Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overall	Access to the vegetated roof is adequate.				Egress and ingress routes must be restored to design standards. Walkways must be clear of obstructions and maintained to design standards.	Professional	
	There is evidence of damage or vandalism				Maintain the vegetated roof's aesthetics as an asset to the property owner and community.	Owner or professional	
	Mosquitoes or other insects are breeding/ abundant at the practice				Standing water creating an environment for development of insect larvae must be eliminated manually. Chemical sprays must not be used.	Owner or professional	
	Threat of a spill is imminent				Spill prevention measures must be exercised for mechanical systems located on roofs when substances that can contaminate stormwater are used. Releases of pollutants must be corrected as soon as they are identified.	Owner or professional	

9-C.7.0. RAINWATER HARVESTING: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Ideally, this practice should be inspected each Spring and Fall by the owner, with an extensive inspection every three years by a qualified third party inspector.

Element of BMP	Potential Problems	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to fix problem	Who Will Address Problem	Comments
Overall <i>(Every third year)</i>	A component of the system is leaking or damaged				Make necessary repairs or replace damaged components	Professional	
	Water is flowing out of the overflow pipe during the design rainfall or smaller storm (1-1.5 inch)				Check for clogging or damage and ensure the pump is operating correctly. Ensure water is being used at the volume for which the system was designed.	Owner or professional	
	Electric system is flawed				Make any necessary repairs/adjustments	Professional	
	Sediment accumulation in cistern exceeds 5% of the design volume				Remove sediment	Professional	
	Excessive overhanging vegetation/trees present				Trim branches back to meet standards	Professional	
Captured roof area <i>(Twice a year)</i>	Excess debris/sediment on the rooftop				Remove debris immediately	Owner or professional	
Gutter system <i>(Twice a year)</i>	Gutters are clogged and water is backed up				Unclog/remove leaves and debris. May need to install gutter screens.	Owner or professional	
	Rooftop runoff is not reaching the gutter system				Correct the positioning or installation of gutters. May need to replace the system	Owner or professional	
	Algae growth				Do not allow sunlight to penetrate cistern. Treat the water to remove/prevent algae	Owner or professional	
	Mosquitoes are present in the cistern				Check screens for damage and repair/ replace. Treat with mosquito dunks if necessary	Owner or professional	
	Lids are damaged. Be sure to check vents and screens on inflow and outflow spigots and mosquito screens				Repair immediately. Ensure that lid damage has not led to any of the aforementioned problems with the cistern	Owner or professional	

Element of BMP	Potential Problems	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to fix problem	Who Will Address Problem	Comments
Screens and filters <i>(Twice a year)</i>	Debris/sediment accumulation. Screens are clogged				Find the source of debris and sediment and remedy. Clear the screen/filter. Replace if necessary	Professional	
Pump <i>(Twice a year)</i>	Not operating properly				Check for clogging. Flush if needed. May need to be replaced	Professional	
Pre-screening devices and first flush devices <i>(Every 3 months)</i>	Dirty/clogged				Have a professional ensure screens have not caused bacterial growth within the gutters or downspouts. The owner may remove the clean out plug from the first flush device and manually wipe it clean.	Owner or Professional	
Backflow preventer <i>(Every third year)</i>	Pressure is uneven and is causing backpressure or back-siphonage				Immediately stop use of the indoor water supplied by the tank and call a professional.	Professional	
Secondary water supply <i>(Every third year)</i>	Not operating properly				Consult an expert only	Professional	
Overflow pipe <i>(Annually)</i>	Erosion is evident at overflow discharge point, along the filter path/secondary runoff reduction practices				Stabilize immediately. It may be necessary to refer to inspection checklists for other BMPs.	Professional	
	Overflow pipe in poor condition				Repair or replace pipe	Professional	

9-C.8.0. PERMEABLE PAVEMENT: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Ideally, each permeable pavement installation should be inspected in the Spring of each year, especially at large-scale installations.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	There is excessive trash and debris				Remove immediately.	Owner or professional	
	There is evidence of erosion and/or bare or exposed soil				Stabilize immediately.	Owner or professional	
	There is excessive landscape waste and yard clippings				Remove immediately.	Owner or professional	
Adjacent Vegetation	Trees and shrubs are within 5 feet of the pavement surface				Check that tree roots have not penetrated the pavement and leaf residue has not clogged the pavement. Vegetation that limits access or interferes with the permeable pavement operation must be pruned or removed.	Owner or Professional	
Inlets, Pre-Treatment Cells and Flow Diversion Structures	There is excessive trash, debris or sediment accumulation				Remove immediately	Owner or Professional	
	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	Evidence of clogging				Clean out sediment or debris. Remove and wash or replace stone, as needed	Professional	
Pavement Surface	Mosquito proliferation				Eliminate standing water and establish vegetation; treat for mosquitoes as needed. If sprays are considered, then use a licensed pest controller to apply an approved mosquito larvicide (<i>only if absolutely necessary</i>).	Owner or professional	

Pavement Surface	There is evidence of erosion and / or bare or exposed soil in grid paver areas			Stabilize immediately. Mow, irrigate and apply organic (not chemical) fertilizer, as needed to keep grass healthy and dense enough to provide filtering while protecting the underlying soil. Remove any grass clippings.	Owner or professional	
	There is loose material (e.g., bark, sand, etc.) stored on the pavement surface			Remove immediately and vacuum sweep the area to prevent clogging the pavement pores.	Professional	
	Pavement is stained and/or clogged or water is ponded, indicating the pavement is not draining properly. Measure the drawdown rate in the observation well for three (3) days following a storm event that exceeds 1/2-inch of rain. If standing water is still observed in the well after three days, this is a clear sign that the pavement is clogged. There are significant amounts of sediment have accumulated between the pavers.			The surface must be kept clean and free of leaves, debris, and sediment by vacuum sweeping (without brooms or water spray) immediately and, otherwise, at a frequency consistent with the use and loadings encountered (at a minimum, annual dry-weather sweeping in the Spring). Where paving blocks are installed, the sweeper must be calibrated so it does <i>not</i> pick up the stones between the paver blocks. Following the vacuum sweeping, test pavement sections by pouring water from 5 gallon buckets, to ensure proper drainage.	Professional	
Structural Integrity	There is evidence of surface deterioration, such as slumping, cracking, spalling or broken pavers.			Repair or replace affected areas, as necessary.	Professional	
Observation Wells	Is each observation well still capped?			Repair, as necessary.	Professional	
Outlet	Outlets are obstructed or erosion and soil exposure is evident below the outlet.			Remove obstructions and stabilize eroded or exposed areas.	Owner or Professional	

9-C.9.0. INFILTRATION PRACTICES: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Facility Location:

- Surface
- Underground

Hydraulic Configuration:

- On-line facility
- Off-line facility

Filtration Media:

- No filtration (e.g., dry well, permeable pavement, infiltration facility, etc.)
- Sand
- Bioretention Soil
- Peat
- Other: _____

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Sedimentation chamber
- Plunge pool
- Stone diaphragm
- Grass filter strip
- Grass channel
- Other: _____

Ideally, infiltration facilities should be inspected annually. Spill Prevention measures should be used around infiltration facilities when handling substances that contaminate stormwater. Releases of pollutants should be corrected as soon as identified.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	There is excessive trash and debris				Remove immediately	Owner or professional	
	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	Vegetative cover is adequate				Supplement as needed	Owner or professional	
	There are excessive landscape waste or yard clippings				Remove immediately and recycle or compost	Owner or professional	
Pre-Treatment Facility	There is adequate access to the pre-treatment facility				Establish adequate access	Professional and, perhaps, the locality	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Pre-Treatment Facility (continued)	There is evidence of erosion and/or exposed soil				Stabilize immediately	Owner or professional	
	There is evidence of clogging (standing water, noticeable odors, water stains, algae or floating aquatic vegetation)				Identify and eliminate the source of the problem. If necessary, remove and clean or replace the clogged material.	Professional	
	There is dead vegetation or exposed soil in the grass filter				Restabilize and revegetate as necessary	Owner or professional	
Inlets	Inlets provide a stable conveyance into facility				Stabilize immediately, as needed.	Owner or professional	
	There is excessive trash/debris/sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion at or around the inlet				Repair erosion damage and reseed or otherwise restabilize with vegetation	Owner or professional	
Embankment, Flow Diversion Structures (e.g., Dikes, Berms, etc.) and Side Slopes	There is evidence of erosion or bare soil				Identify the source of erosion damage and prevent it from recurring. Repair erosion damage and reseed or otherwise restabilize with vegetation	Owner or professional	
	There is excess sediment accumulation				Remove immediately	Owner or professional	
	Water is not detained in the infiltration basin				Check for a breach in the containment structure and repair immediately.	Professional	
	Side slopes support nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from area.	Professional	
Maintaining Facility Capacity and Proper Drainage	Look for weedy growth on the stone surface indicating sediment accumulation and potential clogging				Identify and control sources of sediment and debris. Remove sediment and debris in excess of 4" in depth every 2-5 years (or sooner if performance is affected).	Professional	
	Measure the draw-down rate of the observation well for three days following a storm event in excess of 1/2 inches in depth. If standing water is still observed after three days, this is a clear sign that clogging is a problem.				Immediately clear debris from the underdrain. Replace the underdrain if necessary. If needed, regrade and till to restore infiltration capacity (the need for this can be prevented by preventing upstream erosion and subsequent sediment transport to the facility).	Professional	
	There is excessive trash/debris				Remove immediately	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Vegetation	Grass within the practice is overgrown				Grass must be mowed to a height of 4"-9" and grass clippings removed (ideally recycled or composted).	Owner or professional	
	Pioneer trees are sprouting in the base of the facility				Remove trees to prevent roots from puncturing the filter fabric, allowing sediment to enter		
	Vegetation forms an overhead canopy that may drop leaf litter, fruit and other vegetative materials that may cause clogging.				Prune or remove vegetation as necessary	Owner or professional	
Observation Well	Is each observation well still capped?				Repair, as necessary.	Professional	
Outlet	Outlets are obstructed or erosion and soil exposure is evident below the outlet.				Remove obstructions and stabilize eroded or exposed areas.	Owner or Professional	
	Evidence of flow bypassing facility				Repair immediately	Professional	
	There is excessive trash, debris, or sediment at the outlet				Remove immediately	Owner or professional	
Overflow or Emergency Spillway	The pipe or spillway is not effectively conveying excess water to an adequate receiving system				Clear sediment and debris whenever 25% or more of the conveyance capacity is blocked. When damaged pipe is discovered, it must be repaired or replaced immediately. Identify and control sources of erosion damage. Replace or reinforce stone armament whenever only one layer of stone remains.	Professional	
Structural Components	Evidence of structural deterioration				Repair as necessary	Professional	
	Evidence of spalling or cracking of structural components				Repair or replace, as necessary	Professional	
	Grates are in good condition				Repair or replace, as necessary	Owner or professional	
Overall	Access to the Infiltration facility or its components is adequate				Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that manholes, valves and/or locks can be opened and operated.	Professional and, perhaps, the locality	
	There is evidence of standing water				Fill in low spots and stabilize; correct flow problems causing ponding	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overall (continued)	Mosquito proliferation				Eliminate standing water and establish vegetation; treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> .	Owner or professional	
	Complaints from local residents				Correct real problems	Owner or professional	
	Encroachment on the infiltration area or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

9-C.10.0. BIORETENTION PRACTICES: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Facility Location:

- Surface
- Underground

Hydraulic Configuration:

- On-line facility
- Off-line facility

Filtration Media:

- No filtration (e.g., dry well, permeable pavement, infiltration facility, etc.)
- Sand
- Bioretention Soil
- Peat
- Other: _____

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Sedimentation chamber
- Plunge pool
- Stone diaphragm
- Grass filter strip
- Grass channel
- Other: _____

Ideally, Bioretention facilities should be inspected and cleaned up annually, preferably during the Spring. During the first 6 months following construction of a bioretention facility, the site should be inspected at least twice after storm events that exceed 1/2-inch of rainfall. Watering is needed once a week during the first 2 months following installation, and then as needed during the first growing season (April-October), depending upon rainfall. If vegetation needs to be replaced, one-time spot fertilization may be needed, preferably using an organic rather than a chemical fertilizer. Each facility should have a customized routine maintenance schedule addressing issues such as the following: grass mowing, weeding, trash removal, mulch raking and maintenance, erosion repair, reinforcement plantings, tree and shrub pruning, and sediment removal.

Element of BMP	Potential Problem	Problem? Y / N			How to fix problem	Who Will Address Problem	Comments
		Investigate? Y / N	Repaired? Y / N				
Contributing Drainage Area	Adequate vegetation				Supplement as necessary	Owner or professional	
	There is excessive trash and debris				Remove immediately	Owner or professional	
	There is evidence of erosion and / or bare or exposed soil				Stabilize immediately	Owner or professional	
	There are excessive landscape waste or yard clippings				Remove immediately and recycle or compost	Owner or professional	
	Oil, grease or other unauthorized substances are entering the facility				Identify and control the source of this pollution. It may be necessary to erect fences, signs, etc	Owner or professional	
Pre-Treatment	There is adequate access to the pre-				Establish adequate access	Professional and, perhaps,	

Element of BMP	Potential Problem	Problem? Y / N			How to fix problem	Who Will Address Problem	Comments
		Investigate?	Y / N	Repaired?			
	treatment facility					the locality	
	Excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
Pre-Treatment (continued)	There is evidence of clogging (standing water, noticeable odors, water stains, algae or floating aquatic vegetation, or oil/grease)				Identify and eliminate the source of the problem. If necessary, remove and clean or replace the clogged material.	Professional	
	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	There is dead vegetation or exposed soil in the grass filter				Restabilize and revegetate as necessary	Owner or professional	
Inlets	Check for sediment build-up at curb cuts, gravel diaphragms or pavement edges that prevent flow from getting into the bed, and check for bypassing.				Remove sediment and correct any other problems that block inflow.	Owner or professional	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion at or around the inlet				Repair erosion damage and reseed or otherwise restabilize with vegetation	Owner or professional	
	Inflow is hindered by trees and/or shrubs.				Remove woody vegetation from points of inflow and directly above underdrains. (Trees and shrubs may be located closer to the perimeter.)	Owner or professional	
Side Slopes (Annually, after major storms)	There is evidence of rill or gully erosion or bare soil				Identify the source of erosion damage and prevent it from recurring. Repair erosion damage and reseed or otherwise restabilize with vegetation	Owner or professional	
	There is excess sediment accumulation				Remove immediately	Owner or professional	
	Side slopes support nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from the area.	Professional	
Vegetation (monthly)	Plant composition is consistent with the approved plans and any stakes or wires are in good condition.				Determine if existing plant materials are at least consistent with general Bioretention design criteria and replace inconsistent species.	Professional	
	There should be 75-90% cover (mulch plus vegetation), and the mulch cover should be 2-3 inches deep.				Supplement vegetation and mulch as needed.		

Element of BMP	Potential Problem	Problem?	Investigate?	Repaired?	How to fix problem	Who Will Address Problem	Comments
		Y / N	Y / N	Y / N			
Vegetation <i>(monthly)</i> (continued)	There is evidence of hydrocarbons or other deleterious materials, resulting in unsatisfactory plant growth or mortality,				Replace contaminated mulch. If problem persists, test soils for hydrocarbons and other toxic substances. If excess levels are found, the soils, plants and mulch may all need to be replaced in accordance with the approved construction plans.	Professional	
	Invasive species or weeds make up at least 10% of the facility's vegetation				Remove invasive species and excessive weeds immediately and replace vegetation as needed.	Owner or professional	
	The grass is too high				Mow within a week. Grass species should be selected that have dense cover, are relatively slow growing, and require the least mowing and chemical inputs. Grass should be from 6-10 inches high.	Owner or professional	
	Vegetation is diseased, dying or dead				Remove and replace. Increase watering, but avoid using chemical fertilizers, unless absolutely necessary.	Professional	
	Winter-killed or salt-killed vegetation is present.				Replace with hardier species.	Owner or professional	
Filter Media <i>(Annually)</i>	The filter media is too low, too compacted, or the composition is inconsistent with design specifications				Raise the level, loosen and amend or replace the media, as needed, to be consistent with the state design criteria for Bioretention (85-88% sand 8-12% soil fines 3-5% organic matter in form of leaf compost). Other remediation options are described in the maintenance section of the state design criteria for Bioretention	Professional	
	The mulch is older than 3 years or is otherwise in poor condition				The mulch must be replaced every 2-3 years	Professional	
	There is evidence that chemicals, fertilizers, and/or oil/grease are present				Remove undesirable chemicals from media and facility immediately, and replace mulch or media as needed	Professional	
	There is excessive trash, debris, or sediment.				Remove trash and debris immediately. Check plant health and, without damaging plants, manually remove the sediment, especially if the depth exceeds 20% of the facility's design depth.	Owner or professional	
	There is evidence of concentrated flows, erosion or exposed soil				Identify the source of erosion damage and prevent it from recurring. Repair the erosion damage and reseed or otherwise restabilize with vegetation.	Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to fix problem	Who Will Address Problem	Comments
Filter Media (Annually) (continued)	The filter bed is clogged and/or filled inappropriately				Redistribute the soil substrate and remove sediment within 2 weeks.	Professional	
	The topsoil is in poor condition (e.g., the pH level is not 6-7, the composition is inappropriate, etc.)				Ensure a 3-inch surface depth of topsoil consistent with the state design criteria for Bioretention (loamy sand or sandy loam texture, with less than 5% clay content, and organic matter content of at least 2%). If the pH is less than 6.5, spread limestone.	Professional	
Underdrain/ Proper Drainage	The perforated pipe is not conveying water as designed				Determine if the pipe is clogged with debris or if woody roots have pierced the pipe. Immediately clean out or replace the pipe, as necessary.	Professional	
	The underlying soil interface is clogged (there is evidence on the surface of soil crusting, standing water, the facility does not dewater between storms, or water ponds on the surface of basin for more than 48 hours after an event).				Measure the draw-down rate of the observation well for three days following a storm event in excess of 1/2 inches in depth. After three days, if there is standing water on top but not in the underdrain, this indicates a clogged soil layer. If standing water is both on the surface and in the underdrain, then the underdrain is probably clogged. This should be promptly investigated and remediated to restore proper filtration. Grading changes may be needed or underdrain repairs made. The filter media may need to be raked, excavated and cleaned or replaced to correct the problem. Holes that are not consistent with the design and allow water to flow directly through a planter to the ground must be plugged.	Professional	
Planters	The planter is unable to receive or detain stormwater prior to infiltration. Water does not drain from the reservoir within 3-4 hours of after a storm event.				Identify and correct sources of clogging. Topsoil and sand/peat layer may need to be amended with sand or replaced all together.	Owner or professional	
	The planter has structural deficiencies, including rot, cracks, and failure, or the planter is unable to contain the filter media or vegetation				Make needed repairs immediately.	Owner or professional	
Outlet/ Overflow Spillway	Outlets are obstructed or erosion and soil exposure is evident below the outlet.				Remove obstructions and stabilize eroded or exposed areas.	Owner or Professional	

Element of BMP	Potential Problem	Problem? Y / N			How to fix problem	Who Will Address Problem	Comments
		Investigate?	Y / N	Repaired?			
Outlet/ Overflow Spillway (continued)	There is excessive trash, debris, or sediment at the outlet				Remove immediately, and keep the contributing area free of trash and debris.	Owner or professional	
	Any grates present are in good condition				Repair or replace as necessary	Owner or professional	
Observation Well	Is the observation well still capped?				Repair, as necessary.	Professional	
Overall	Access to the Infiltration facility or its components is adequate				Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	
	There is evidence of standing water				Fill in low spots and stabilize; correct flow problems causing ponding.	Owner or professional	
	Mosquito proliferation				Eliminate stagnant pools and establish vegetation; treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> .	Owner or professional	
	Complaints from local residents				Correct real problems	Owner or professional	
	Encroachment on the bioretention area or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

9-C.11.0. DRY SWALES: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Facility Location:

- Surface
- Underground

Hydraulic Configuration:

- On-line facility
- Off-line facility

Filtration Media:

- No filtration (e.g., dry well, permeable pavement, infiltration facility, etc.)
- Sand
- Bioretention Soil
- Peat
- Other: _____

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Sedimentation chamber
- Plunge pool
- Stone diaphragm
- Grass filter strip
- Grass channel
- Other: _____

Ideally, Dry Swales should be inspected annually in the Spring, triggering such maintenance activities as sediment removal, spot revegetation, inlet stabilization, and repairs to check dams, underdrains and outlets.

Element of BMP	Potential Problem	Problem? Y / N			How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	There is excessive trash and debris				Remove immediately	Owner or professional	
	There is evidence of erosion and / or bare or exposed soil				Stabilize immediately	Owner or professional	
	There are excessive landscape waste or yard clippings				Remove immediately and recycle or compost	Owner or professional	
Pre-Treatment and Flow Spreaders	There is adequate access to the pre-treatment facility.				Establish adequate access	Professional and, perhaps, the locality	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	There is evidence of clogging (standing water, noticeable odors, water stains, algae or floating aquatic vegetation)				Identify and eliminate the source of the problem. If necessary, remove and clean or replace the clogged material.	Professional	

Element of BMP	Potential Problem	Problem? Y / N			How to Fix Problem	Who Will Address Problem	Comments
Pre-Treatment and Flow Spreaders (continued)	There is dead vegetation or exposed soil in the grass filter				Restabilize and revegetate as necessary	Owner or professional	
	The pea gravel diaphragm is at the correct level				Correct the installation, as needed	Professional	
Inlet and Swale Sides and Base	The inlet provides a stable conveyance into the swale				Stabilize immediately, as needed, and clear blockages.	Owner or professional	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion at or around the inlet				Repair erosion damage and reseed	Owner or professional	
Check Dams	A check dam is not functioning properly.				Check upstream and downstream sides of check dams for evidence of undercutting, side cutting or erosion and repair immediately.	Professional	
	There is a large accumulation of sediment or trash/debris behind the check dam.				Remove sediment when the accumulation exceeds 25% of the original Tv. Remove trash/debris and clear blockages of weep holes.	Professional	
Vegetation	Invasive species or weeds make up at least 10% of the facility's vegetation				Remove invasive species and excessive weeds immediately and replace vegetation as needed.	Owner or professional	
	Trees form an overhead canopy that may drop leaf litter, fruit and other vegetative materials that may cause clogging.				Prune or remove vegetation and organic litter as necessary.	Owner or professional	
	Grass height is not consistent with standards.				Dry Swales must be mowed to keep grass at a height of 4" to 9". Remove grass clippings after mowing.	Owner or professional	
	The grass cover is not dense enough or is dead or dying				Increase watering and reseed, if necessary, to maintain 95% turf cover, but avoid using chemical fertilizers unless absolutely necessary. Replace salt-killed vegetation with salt-tolerant species.	Professional	
Filter Media/ Soil	There is evidence that chemicals, fertilizers, and/or oil are present				Remove undesirable chemicals from media and facility immediately, and replace mulch or media as needed	Professional	

Element of BMP	Potential Problem	Problem? Y / N			How to Fix Problem	Who Will Address Problem	Comments
Filter Media/ Soil (continued)	There is excessive trash, debris, or sediment.				Remove trash and debris immediately. Check plant health and, without damaging plants, manually remove the sediment, especially if the depth exceeds 20% of the facility's design depth.	Owner or professional	
	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	There is evidence that chemicals, fertilizers, and/or oil are present				Remove undesirable chemicals from media immediately, and replace mulch or media as needed	Professional	
Underdrain	The perforated pipe is not conveying water as designed				Determine if the pipe is clogged with debris or if woody roots have pierced the pipe. Immediately clean out or replace the pipe, as necessary.	Professional	
	The underlying soil interface is clogged (there is evidence on the surface of soil crusting, standing water, the facility does not dewater between storms, or water ponds on the surface of basin for more than 48 hours after an event).				Measure the draw-down rate of the observation well for three days following a storm event in excess of 1/2 inches in depth. After three days, if there is standing water on top but not in the underdrain, this indicates a clogged soil layer. If standing water is both on the surface and in the underdrain, then the underdrain is probably clogged. This should be promptly investigated and remediated to restore proper filtration. Grading changes may be needed or underdrain repairs made.	Professional	
Outlet	Outlets are obstructed or erosion and soil exposure is evident below the outlet.				Remove obstructions and stabilize eroded or exposed areas.	Owner or Professional	
	There is excessive trash, debris, or sediment at the outlet				Remove immediately, and keep the contributing area free of trash and debris.	Owner or professional	
Overall	Access to the Infiltration facility or its components is adequate				Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	

Element of BMP	Potential Problem	Problem? Y / N			How to Fix Problem	Who Will Address Problem	Comments
Overall (continued)	Mosquito proliferation				Eliminate stagnant pools and establish vegetation; treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> .	Owner or professional	
	Complaints from local residents				Correct real problems.	Owner or professional	
	Encroachment on the swale or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

9-C.12.0. WET SWALES: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Facility Location:

- Surface
- Underground

Hydraulic Configuration:

- On-line facility
- Off-line facility

Filtration Media:

- No filtration (e.g., dry well, permeable pavement, infiltration facility, etc.)
- Sand
- Bioretention Soil
- Peat
- Other: _____

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Sedimentation chamber
- Plunge pool
- Stone diaphragm
- Grass filter strip
- Grass channel
- Other: _____

Wet Swales have maintenance needs similar to Dry Swales, although woody wetland vegetation may need to be removed periodically.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	There is excessive trash and debris				Remove immediately	Owner or professional	
	There is evidence of erosion and / or bare or exposed soil				Stabilize immediately	Owner or professional	
	There are excessive landscape waste or yard clippings				Remove immediately and recycle or compost	Owner or professional	
Pre-Treatment	There is adequate access to the pre-treatment facility				Establish adequate access	Professional and, perhaps, the locality	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	There is evidence of clogging (standing water, noticeable odors, water stains, algae or floating aquatic vegetation)				Identify and eliminate the source of the problem. If necessary, remove and clean or replace the clogged material.	Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Pre-Treatment (continued)	There is dead vegetation.				Replace dead vegetation as necessary	Professional	
Inlets	The inlet provides a stable conveyance into the swale				Stabilize immediately, as needed, and clear blockages.	Owner or professional	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion at or around the inlet				Repair erosion damage and reseed	Owner or professional	
Check Dams	A check dam is not functioning properly.				Check upstream and downstream sides of check dams for evidence of undercutting, side cutting or erosion and repair immediately.	Professional	
	There is a large accumulation of sediment or trash/debris behind the check dam.				Remove sediment when the accumulation exceeds 25% of the original Tv. Remove trash/debris and clear blockages of weep holes.	Professional	
Vegetation (monthly)	Plant composition is consistent with the approved plans				Replace inconsistent species	Professional	
	Invasive species (e.g., phragmites) are present.				Remove invasive species immediately and replace vegetation as needed.	Professional	
	Vegetation is dead or dying				Replace dead vegetation as needed.	Professional	
Outlet	Outlets are obstructed or erosion and soil exposure is evident below the outlet.				Remove obstructions and stabilize eroded or exposed areas.	Owner or Professional	
	There is excessive trash, debris, or sediment at the outlet				Remove immediately, and keep the contributing area free of trash and debris.	Owner or professional	
Overall	Access to the Infiltration facility or its components is adequate.				Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	
	Mosquito proliferation				Eliminate stagnant pools if feasible, and treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurensensis or Altoside formulations can be applied <i>only if absolutely necessary</i> .	Owner or professional	
	Complaints from local residents				Correct real problems.	Owner or professional	
	Encroachment on the swale or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

9-C.13.0. FILTERING PRACTICES: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Facility Location:

- Surface
- Underground

Hydraulic Configuration:

- On-line facility
- Off-line facility

Filtration Media:

- No filtration (e.g., dry well, permeable pavement, infiltration facility, etc.)
- Sand
- Bioretention Soil
- Peat
- Other: _____

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Sedimentation chamber
- Plunge pool
- Stone diaphragm
- Grass filter strip
- Grass channel
- Other: _____

An inspection and clean-up should be scheduled annually to remove trash and floatables that accumulate in the pre-treatment cells and filter bed. Frequent sediment cleanouts in the dry and wet sedimentation chambers are recommended every 2-3 years to maintain the function and performance of the filter. If the filter treats runoff from a hotspot, crews may need to test the filter bed media before disposing of the media and trapped pollutants. If the filter does not treat runoff from a hotspot, the media can be safely disposed by either land application or land filling, without prior testing.

Warning: *If the filtering facility has a watertight cover; be careful regarding the possibility of flammable gases within the facility. Care should be taken lighting a match or smoking while inspecting facilities that are not vented. If the filtering facility is in a completely enclosed vault, the **OSHA Confined Space Entry** procedures must be followed.*

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area and Side Slopes	Adequate vegetation				Supplement as necessary	Owner	
	There is excessive trash and debris				Remove immediately	Owner or professional	
	There is evidence of erosion and / or bare or exposed soil				Stabilize immediately	Owner or professional	
	There are excessive landscape waste or yard clippings				Remove immediately and recycle or compost	Owner or professional	
Pre-Treatment	There is adequate access to the pre-treatment facility				Establish adequate access	Professional and, perhaps, the locality	
	Excessive trash,				Remove immediately	Owner or	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
	debris, or sediment.					professional	
Pre-Treatment (continued)	There is evidence of erosion and / or exposed soil				Stabilize immediately	Owner or professional	
	There is dead vegetation.				Replace dead vegetation as necessary	Professional	
	Perimeter turf (or a grass filter strip) is too high.				Mow at least 4 times a year to keep the grass at a height of 4" to 9". Remove grass clippings after mowing.	Owner or professional	
	There is evidence of oil, grease, clogging (standing water, noticeable odors, water stains, algae)				Identify and eliminate the source of the problem. If necessary, remove and clean or replace the clogged material.	Professional	
Inlets	The inlet provides a stable conveyance into the swale				Stabilize immediately, as needed, and clear blockages.	Owner or professional	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion at or around the inlet				Repair erosion damage and reseed	Owner or professional	
Sedimentation Chambers	Sediment or debris accumulations are excessive				Clean out the wet and dry sedimentation chambers	Professional	
Filter Media	If facility takes longer than 48 hours to drain or filter media is discolored, the media is probably clogged				Replace the top sand layer of an enclosed filter (typically done every 5 years). Till or aerate the surface to improve infiltration and grass cover of an open filter (also typically done every 5 years).		
Oil and Grease	Evidence of filter surface clogging				Clean or replace filter media, as necessary.	Professional	
Underdrain	The underdrain is not conveying water as designed				To determine if the pipe is clogged, measure the draw-down rate of the observation well for three days following a storm event in excess of 1/2 inches in depth. After three days, if there is standing water on top but not in the underdrain, this indicates a clogged sand layer that must be replaced. If standing water is both on the surface and in the underdrain, then the underdrain is probably clogged. Immediately clean out the pipe manually or, if needed, use a high-pressure hose. Replace the underdrain if it is structurally damaged.	Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Observation Well (every 2 years)	Is the observation well still capped?				Repair, as necessary.	Professional	
Outlet	The outlet provides stable conveyance				Remove blockages and stabilize, as needed.	Professional	
	Evidence of flow bypassing facility				Repair immediately	Professional	
	Outlets are obstructed or erosion and soil exposure is evident below the outlet.				Remove obstructions and stabilize eroded or exposed areas.	Owner or Professional	
Structural Components	Evidence of structural deterioration				Repair as necessary	Professional	
	Evidence of spalling or cracking of structural components				Repair or replace, as necessary	Professional	
	Grates are in good condition				Repair or replace, as necessary	Owner or professional	
Pump (where applicable)	Catalog cuts and wiring diagram for pump available				If missing, obtain replacements	Owner	
	Waterproof conduits for wiring appear to be intact				Repair as necessary	Professional	
	Panel box is well marked				If not, mark it correctly	Professional	
	No evidence of pump failure (excess water in pump well, etc.)				Repair as necessary	Professional	
Overall	Access to the facility or its components is adequate.				Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	
	Condition of hydraulic control components				Repair, as necessary.	Professional	
	Complaints from local residents				Correct real problems.	Owner or professional	
	Noticeable odors outside facility				Determine source and eliminate it.	Professional	
	Mosquito proliferation				Eliminate stagnant pools if feasible, and treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> .	Owner or professional	
	Encroachment on the filter or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

9-C.14.0. CONSTRUCTED WETLANDS: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Hydraulic Configuration:

- On-line facility
- Off-line facility

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Vegetated buffer area
- Grass filter strip
- Grass channel
- Other: _____

Type of wetland

- Emergent
- Forested

During the first 6 months following construction, the wetland should be inspected twice after storm events that exceed 1/2 inch of rainfall. Bare or eroding areas in the CDA or around the wetland buffer should be stabilized immediately with grass cover. Trees planted in the buffer and on wetland islands and peninsulas need to be watered every 3 days for the first month, and then weekly during the remainder of the first growing season (April-October), depending on rainfall. Due to typical vegetation survival problems, it is typical to plan and budget for a round of reinforcement planting after one or two growing seasons. Constructed wetlands should be inspected and cleaned up annually. A wetland professional should inspect the facility every 5 years, especially to determine if there is any significant negative change in the wetland species composition from the design or an otherwise healthy wetland.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	Adequate vegetation				Supplement as needed	Owner	
	There is excessive trash and debris				Remove immediately.	Owner or professional	
	There is evidence of erosion and/or bare or exposed soil				Stabilize immediately.	Owner or professional	
	There are excessive landscape waste and yard clippings				Remove immediately and recycle or compost	Owner or professional	
Pre-Treatment	There is adequate access to the pre-treatment facility				Establish adequate access	Professional and, perhaps, the locality	
	There is excessive trash and debris				Remove immediately.	Owner or professional	
	There is evidence of erosion and/or exposed soil.				Immediately identify and correct the cause of the erosion and stabilize the eroded or bare area.	Owner or professional	
	Sediment deposits are 50% or more of forebay capacity.				Dredge the sediment to restore the design capacity; sediment should be dredged from forebays at least every 5 years.	Professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Pre-Treatment (continued)	The sediment marker is not vertical.				Adjust the sediment depth marker to a vertical alignment	Professional	
	There is dead vegetation				Revegetate, as needed	Owner or professional	
Inlets	The inlet provides a stable conveyance.				Stabilize immediately, as needed; clear blockages.	Owner or professional	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion/undercutting at or around the inlet				Repair erosion damage and reseed	Owner or professional	
	There is cracking, bulging, erosion or sloughing of the forebay dam.				Repair and restabilize immediately.	Professional	
	There is woody growth on the forebay dam.				Remove within 2 weeks of discovery.	Professional	
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from area	Professional	
Vegetation (trees, shrubs, aquatic plants)	Plant composition is consistent with the approved plans				Determine if existing plant materials are at least consistent with the general Constructed Wetland design criteria, and replace inconsistent species.	Professional	
	Invasive species are present.				Remove invasive species immediately and replace vegetation as needed. As a general rule, control of undesirable invasive species (e.g., cattail and Phragmites) should commence when their coverage exceeds more than 15% of a wetland cell area. Although the application of herbicides is not recommended, some types, such as Glyphosate, have been used to control cattails with some success. Extended periods of dewatering may also work, since early manual removal provides only short-term relief from invasive species.	Professional	
	Vegetation is dead or reinforcement planting is needed.				Remove and replace dead or dying vegetation.	Professional	
	Trees planted in the buffer and on wetland islands and peninsulas need watering during the first growing season				Consider watering every 3 days for first month, and then weekly during first year (April – October), depending on rainfall.	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Vegetation (trees, shrubs, aquatic plants) (continued)	Practice has become overgrown and is not developing into a mature wetland.				Harvest vegetation periodically if the wetland becomes overgrown or to guide maturing of forested wetlands (typically 5 and 10 years after constr.).	Owner or professional	
Wetland Cells and Pools	Sediment accumulation is 50% or more of capacity.				Dredge the sediment to restore the design capacity	Professional	
	There is evidence of floating debris, sparse vegetative cover, erosion or slumping of side slopes.				Remove debris. Repair and stabilize.	Owner or professional	
	Open water is becoming overgrown.				Harvest the unwanted vegetation.	Professional	
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from the area.		
Riser/Principle Spillway and Low-Flow Orifice(s)	There is adequate access to riser for maintenance.				Establish adequate access	Professional and, perhaps, the locality	
	Pieces of the riser are deteriorating, misaligned, broken or missing.				Repair immediately.	Professional	
	Adjustable control valves are accessible and operational.				Repair, as needed.	Professional	
	Reverse-slope pipes and flashboard risers are in good condition.				Repair, as needed.	Professional	
	There is excessive trash, debris, or other obstructions in the trash rack.				Remove immediately.	Owner or professional	
	Seepage into conduit				Seal the conduit	Professional	
Berm/Dam/ Embankment and Abutments	There is sparse veg. cover, settlement, cracking, bulging, misalignment, erosion rills deeper than 2 inches, or sloughing of the dam.				Repair and restabilize immediately.	Professional	
	There are soft spots, boggy areas, seepage or sinkholes present.				Reinforce, fill and stabilize immediately.	Professional	
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed frm area.	Professional	
	There is woody vegetation on the embankment.				Removal of woody species near or on the embankment and maintenance access areas should be done when discovered, but at least every 2 years.		

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Emergency Spillway	There is woody growth on the spillway.				Removal of woody species near or on the emergency spillway should be done when discovered, but at least every 2 years.	Owner or professional	
	There is excessive trash, debris, or other obstructions.				Remove immediately.	Owner or professional	
	There is evidence of erosion/back-cutting				Repair erosion damage and reseed	Owner or professional	
	There are soft spots, seepage or sinkholes.				Reinforce, fill and stabilize immediately.	Owner or professional	
Outlet	The outlet provides stable conveyance from the wetland.				Stabilize as needed.	Professional	
	There are excessive sediment deposits.				Remove sediment.	Professional	
	Released water is causing undercutting, erosion or displaced rip-rap at or around the outlet				Repair, reinforce or replace rip rap as needed, and restabilize.	Professional	
	Woody growth within 5 feet of the outlet pipe barrel.				Prune vegetation back to leave a clear discharge area.	Owner or Professional	
	There is excessive trash, debris, or other obstructions.				Remove immediately.	Owner or professional	
Overall	Access to the facility or its components is adequate.				Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	
	Water levels in one or more cells are abnormally high or low.				Clear blockages of the riser or orifice(s) and make other adjustments needed to meet the approved design specifications.	Professional	
	Complaints from local residents				Correct real problems.	Owner or professional	
	Mosquito proliferation				Eliminate stagnant pools if feasible, and treat for mosquitoes as needed. If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied <i>only if absolutely necessary</i> . Can also stock the basin with mosquito fish to provide natural mosquito & midge control.	Owner or professional	
	Encroachment on the wetland or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overall (continued)	Safety signage is not adequate.				Provide sufficient, legible safety signage.	Owner or professional	

9-C.15.0. WET PONDS: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

- Pond characteristics and functions
 (check all that apply)
- Water quality treatment
 - Extended detention included
 - Channel protection
 - Ties into groundwater
 - Single cell pond
 - Multiple-cell pond system
 - Pond with one or more wetland cells

- Hydraulic Configuration:
- On-line facility
 - Off-line facility
- Type of Pre-Treatment Facility:
- Sediment forebay (above ground)
 - Vegetated buffer area
 - Grass filter strip
 - Grass channel
 - Other: _____

During the first 6 months following construction, the pond should be inspected twice after storm events that exceed 1/2 inch of rainfall. The aquatic benches should be planted with emergent wetland species, consistent with the Wet Pond design specifications. Bare or eroding areas in the CDA or around the pond buffer should be stabilized immediately with grass cover. Trees planted in the buffer need to be watered every 3 days for the first month, and then weekly during the remainder of the first growing season (April-October), depending on rainfall. Due to typical vegetation survival problems, it is typical to plan and budget for a round of reinforcement planting during the second growing season after construction. Wet Ponds should be inspected and cleaned up annually.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	Adequate vegetation				Supplement as needed	Owner	
	There is excessive trash and debris				Remove immediately.	Owner or professional	
	There is evidence of erosion and/or bare or exposed soil				Stabilize immediately.	Owner or professional	
	There are excessive landscape waste and yard clippings				Remove immediately and recycle or compost	Owner or professional	
Pre-Treatment	There is adequate access to the pre-treatment facility				Establish adequate access	Professional and, perhaps, the locality	
	There is excessive trash and debris				Remove immediately.	Owner or professional	
	There is evidence of erosion and/or exposed soil.				Immediately identify and correct the cause of the erosion and stabilize the eroded or bare area.	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Pre-Treatment (continued)	Sediment deposits are 50% or more of forebay capacity.				Dredge the sediment to restore the design capacity; sediment should be dredged from forebays at least every 5-7 years, and earlier if performance is being affected.	Professional	
	The sediment marker is not vertical.				Adjust the sediment depth marker to a vertical alignment	Professional	
	There is evidence of clogging				Clear blockages of the riser or orifice(s) and make other adjustments needed to meet the approved design specifications	Professional	
	There is dead vegetation				Revegetate, as needed	Owner or professional	
Inlet	The inlet provides a stable conveyance into the pond				Stabilize immediately, as needed, and clear blockages.	Owner or professional	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion/undercutting at or around the inlet				Repair erosion damage and restabilize	Owner or professional	
	There is cracking, bulging, erosion or sloughing of the forebay dam.				Repair and restabilize immediately.	Professional	
	There is woody growth on the forebay dam.				Remove within 2 weeks of discovery.	Professional	
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from the area.	Professional	
	There is more than 1 inch of settlement.				Add fill material and compact the soil to the design grade	Owner or Professional	
	The inlet alignment is incorrect.				Correct immediately.	Owner or Professional	
Vegetation	Plant composition is consistent with the approved plans				Determine if existing plant materials are consistent with the general Wet Pond design criteria, and replace inconsistent species.	Professional	
	Invasive species are present.				Remove invasive species immediately and replace vegetation as needed.	Professional	
	Trees planted in the buffer and on wetland islands and peninsulas need watering during the first growing season				Consider watering every 3 days for first month, and then weekly during first year (April – October), depending on rainfall.	Owner or professional	
	Grass around the facility is overgrown				Mow (at least twice a year) to a height of 4"-9" high and remove grass clippings	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Vegetation (continued)	Vegetation is dead or reinforcement planting is needed.				Remove and replace dead or dying vegetation.	Professional	
Permanent Pool and Side Slopes	There is excessive trash and/or debris.				Remove immediately	Owner or professional	
	There is evidence of sparse vegetative cover, erosion or slumping side slopes.				Repair and stabilize physical damage, and reseed or plant additional vegetation.	Owner or professional	
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Remove burrowing animals humanely from the area.		
	There is significant sediment accumulation.				Conduct a bathymetric study to determine the impact to design volumes, and dredge if necessary.	Professional	
Riser/Principle Spillway and Low-Flow Orifice(s)	There is adequate access to the riser for maintenance.				Establish adequate access	Professional and, perhaps, the locality	
	Pieces of the riser are deteriorating, misaligned, broken or missing.				Repair immediately.	Professional	
	Adjustable control valves are accessible and operational.				Repair, as needed.	Professional	
	Reverse-slope pipes and flashboard risers are in good condition.				Repair, as needed.	Professional	
	There is evidence of clogging				Clear blockages of the riser or orifice(s) and make other adjustments needed to meet the approved design specs.	Professional	
	Seepage into conduit				Seal the conduit	Professional	
	There is excessive trash, debris, or other obstructions in the trash rack.				Remove immediately.	Owner or professional	
Dam/ Embankment and Abutments	There is sparse veg. cover, settlement, cracking, bulging, misalignment, erosion rills deeper than 2 inches, or sloughing of the dam.				Repair and restabilize immediately, especially after major storms.	Professional	
	There are soft spots, seepage, boggy areas or sinkholes present.				Reinforce, fill and stabilize immediately.		
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed frm area.		
	There is woody vegetation on the embankment.				Removal of woody species near or on the embankment and maintenance access areas should be done when discovered, but at least every 2 years.		

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overflow/ Emergency Spillway	There is woody growth on the spillway.				Removal of woody species near or on the emergency spillway should be done when discovered, but at least every 2 years.	Owner or professional	
	There is excessive trash, debris, or other obstructions.				Remove immediately.	Owner or professional	
	There is evidence of erosion/backcutting				Repair erosion damage and reseed	Owner or professional	
	There are soft spots, seepage or sinkholes.				Reinforce, fill and stabilize immediately.	Owner or professional	
	Only one layer of stone armoring exists above the native soil.				Reinforce rip-rap or other armoring materials.	Professional	
Outlet	The outlet provides a stable conveyance from the pond.				Stabilize immediately, as needed, and clear blockages.	Owner or professional	
	There is woody growth within 5 feet of the outlet pipe barrel.				Prune vegetation back to leave a clear discharge area.	Owner or Professional	
	There is excessive trash, debris, or other obstructions.				Remove immediately.	Owner or professional	
	There are excessive sediment deposits at the outlet.				Remove sediment.	Professional	
	Discharge is causing undercutting, erosion or displaced rip-rap at or around the outlet.				Repair, reinforce or replace rip rap as needed, and restabilize.	Professional	
Overall	Access to the facility or its components is adequate.				Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	
	Fences are inadequate				Collapsed fences must be restored to an upright position. Jagged edges and damaged fences must be repaired or replaced.	Professional	
	Water levels in one or more cells are abnormally high or low.				Clear blockages of the riser or orifice(s) and make other adjustments needed to meet the approved design specifications.	Professional	
	Complaints from local residents				Correct real problems.	Owner or professional	
	Mosquito proliferation				Eliminate stagnant pools and stock the basin with mosquito fish to provide natural mosquito & midge control. Treat for mosquitoes as needed. If spraying, then use mosquito larvicide, (e.g., Bacillus thurendensis or Altoside formulations) <i>only if absolutely necessary.</i>	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overall (continued)	Encroachment on the pond or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	
	Safety signage is not adequate.				Provide sufficient, legible safety signage.	Owner or professional	

9-C.16.0. EXTENDED DETENTION PONDS: O&M CHECKLIST

Inspection Date _____
 Project _____ Site Plan/Permit Number _____
 Location _____ Date BMP Placed in Service _____
 Date of Last Inspection _____ Inspector _____
 Owner/Owner's Representative _____
 As-Built Plans available: Y / N

Facility Type: Level 1 _____ Level 2 _____

Pond characteristics and functions
(check all that apply)

- Water quality treatment
- Channel protection
- Ties into groundwater

Type of Pre-Treatment Facility:

- Sediment forebay (above ground)
- Vegetated buffer area
- Grass filter strip
- Grass channel
- Other: _____

Hydraulic Configuration:

- On-line facility
- Off-line facility

Ideally, Extended Detention Ponds should be inspected annually. ED Ponds are prone to a high clogging risk at the ED low-flow orifice. Ideally, the orifice should be inspected at least twice a year after initial construction. The constantly changing water levels in ED Ponds make it difficult to mow or manage vegetative growth. The bottom of ED Ponds often become soggy, and water-loving trees such as willows may invade and will need to be managed. Periodic mowing of the stormwater buffer is only required along maintenance rights-of-way and the embankment. The remaining buffer may be managed as a meadow (mowing every other year) or forest. Frequent removal of sediment from the forebay (every 5-7 years, or when 50% of the forebay capacity is filled) is essential to maintain the function and performance of the ED Pond. Sediments excavated from ED Ponds are usually not considered toxic or hazardous, so they can be safely disposed of either by land application or land filling.

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Contributing Drainage Area	Adequate vegetation				Supplement as needed.	Owner	
	There is excessive trash and debris				Remove immediately.	Owner or professional	
	There is evidence of erosion and/or bare or exposed soil				Stabilize immediately.	Owner or professional	
	There is excessive landscape waste and yard clippings				Remove immediately.	Owner or professional	
Pre-Treatment	There is adequate access to the pre-treatment facility				Establish adequate access	Professional and, perhaps, the locality	
	There is excessive trash and debris				Remove immediately.	Owner or professional	
	There is evidence of erosion and/or exposed soil.				Immediately identify and correct the cause of the erosion and stabilize the eroded or bare area.	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Pre-Treatment (continued)	Sediment deposits are 50% or more of forebay capacity.				Dredge the sediment to restore the design capacity; sediment should be dredged from forebays at least every 5-7 years, and earlier, as needed.	Professional	
	The sediment marker is not vertical.				Adjust the sediment depth marker to a vertical alignment	Professional	
	There is evidence of clogging				Clear blockages of the riser or orifice(s) and make other adjustments needed to meet the approved design specifications	Professional	
	There is dead vegetation				Revegetate, as needed	Owner or professional	
Inlet	The inlet provides a stable conveyance into the pond				Stabilize immediately, as needed, and clear blockages.	Owner or professional	
	There is excessive trash, debris, or sediment.				Remove immediately	Owner or professional	
	There is evidence of erosion/undercutting at or around the inlet				Repair erosion damage and restabilize	Owner or professional	
	There is cracking, bulging, erosion or sloughing of the forebay dam.				Repair and restabilize immediately.	Professional	
	There is woody growth on the forebay dam.				Remove within 2 weeks of discovery.	Professional	
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from the area.	Professional	
	There is more than 1 inch of settlement.				Add fill material and compact the soil to the design grade	Owner or Professional	
	The inlet alignment is incorrect.				Correct immediately.	Owner or Professional	
Vegetation	Plant composition is consistent with the approved plans				Determine if existing plant materials are consistent with the general Wet Pond design criteria, and replace inconsistent species.	Professional	
	Invasive species are present.				Remove invasive species immediately and replace vegetation as needed.	Professional	
	Trees planted in the buffer and on wetland islands and peninsulas need watering during the first growing season				Consider watering every 3 days for first month, and then weekly during first year (April – October), depending on rainfall.	Owner or professional	
	Grass around the facility is overgrown				Mow (at least twice a year) to a height of 4"-9" high and remove grass clippings.	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Vegetation (continued)	Vegetation is dead or reinforcement planting is needed.				Remove and replace dead or dying vegetation.	Professional	
Permanent Pool and Side Slopes	There is excessive trash and/or debris.				Remove immediately	Owner or professional	
	There is evidence of sparse vegetative cover, erosion or slumping side slopes.				Repair and stabilize physical damage, and reseed or plant additional vegetation.	Owner or professional	
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed frm area.	Owner or professional	
	There is significant sediment accumulation.				Conduct a bathymetric study to determine the impact to design volumes, and dredge if necessary.	Professional	
Riser/Principle Spillway and Low-Flow Orifice(s)	There is adequate access to the riser for maintenance.				Establish adequate access	Professional and, perhaps, the locality	
	Pieces of the riser are deteriorating, misaligned, broken or missing.				Repair immediately.	Professional	
	Adjustable control valves are accessible and operational.				Repair, as needed.	Professional	
	Reverse-slope pipes and flashboard risers are in good condition.				Repair, as needed.	Professional	
	Seepage into conduit				Seal conduit	Professional	
	There is evidence of clogging				Clear blockages of the riser or orifice(s) and make other adjustments needed to meet the approved design specs.	Professional	
	There is excessive trash, debris, or other obstructions in the trash rack.				Remove immediately.	Owner or professional	
Dam/ Embankment and Abutments	There is sparse veg. cover, settlement, cracking, bulging, misalignment, erosion rills deeper than 2 inches, or sloughing.				Repair and restabilize immediately, especially after major storms.	Professional	
	There are soft spots, seepage, boggy areas or sinkholes.				Reinforce, fill and stabilize immediately.		
	There is evidence of nuisance animals.				Animal burrows must be backfilled and compacted. Burrowing animals should be humanely removed from the area.		
	There is woody vegetation on the embankment.				Removal of woody species near or on the embankment and maintenance access areas should be done when discovered, but at least every 2 years.		

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overflow/Emergency Spillway	There is woody growth on the spillway.				Removal of woody species near or on the emergency spillway should be done when discovered, but at least every 2 years.	Owner or professional	
	There is excessive trash, debris, or other obstructions.				Remove immediately.	Owner or professional	
	There is evidence of erosion/backcutting				Repair erosion damage and reseed	Owner or professional	
	There are soft spots, seepage or sinkholes.				Reinforce, fill and stabilize immediately.	Owner or professional	
	Only one layer of stone armoring exists above the native soil.				Reinforce rip-rap or other armoring materials.	Professional	
Outlet	The outlet provides a stable conveyance from the pond.				Stabilize immediately, as needed, and clear blockages.	Owner or professional	
	There is woody growth within 5 feet of the outlet pipe barrel.				Prune vegetation back to leave a clear discharge area.	Owner or Professional	
	There is excessive trash, debris, or other obstructions.				Remove immediately.	Owner or professional	
	There are excessive sediment deposits at the outlet.				Remove sediment.	Professional	
	Discharge is causing undercutting, erosion or displaced rip-rap at or around the outlet.				Repair, reinforce or replace rip rap as needed, and restabilize.	Professional	
Overall	Access to the facility or its components is adequate.				Establish adequate access. Remove woody vegetation and debris that may block access. Ensure that hardware can be opened and operated.	Professional and, perhaps, the locality	
	Fences are inadequate				Collapsed fences must be restored to an upright position. Jagged edges and damaged fences must be repaired or replaced.	Professional	
	Water levels in one or more cells are abnormally high or low.				Clear blockages of the riser or orifice(s) and make other adjustments needed to meet the approved design specifications.	Professional	
	Complaints from local residents				Correct real problems.	Owner or professional	
	Mosquito proliferation				Eliminate stagnant pools and stock the basin with mosquito fish to provide natural mosquito & midge control. Treat for mosquitoes as needed. If spraying, then use mosquito larvicide, (e.g., Bacillus thurendensis or Altoside formulations) <i>only if absolutely necessary.</i>	Owner or professional	

Element of BMP	Potential Problem	Problem? Y / N	Investigate? Y / N	Repaired? Y / N	How to Fix Problem	Who Will Address Problem	Comments
Overall (continued)	Encroachment on the pond or easement by buildings or other structures				Inform involved property owners of BMPs status ; clearly mark the boundaries of the receiving pervious area, as needed	Owner or professional (and perhaps the locality)	
	Safety signage is not adequate.				Provide sufficient, legible safety signage.	Owner or professional	

9-C.17.0. REFERENCES

Center for Watershed protection (CWP). July, 2008b. *Post-Construction Guidance Manual: Tool 6 – Plan Review, BMP Construction, and Maintenance Checklists*. Ellicott City, MD.

City of Gresham, Oregon. 2003. *Inspection Checklist for Infiltration Systems*. Gresham, OR.

City of Gresham, Oregon. 2003. *Inspection Checklist for Ponds*. Gresham, OR.

Minnesota Pollution Control Agency. September, 2006. *Minnesota Stormwater Manual, Ver. 1.1, Appendix D: Operations and Maintenance Checklists*. St. Paul, MN.

Virginia Department of Conservation and Recreation (DCR). 2009. Various stormwater management BMP specifications. *Virginia Stormwater BMP Clearinghouse* web site: <http://www.vwrrc.vt.edu/swc/>. Richmond, VA.

Appendix 6: Norfolk Sample Forms

- 6A – Land Disturbance Permit Application
- 6B – Agreement in Lieu of a Plan
- 6C – Stormwater Pre-Construction Checklist

6A – Land Disturbance Permit Application

6B – Agreement in Lieu of a Plan



City of Norfolk

Department of City Planning Bureau of Environmental Services

Agreement in Lieu of an Erosion and Sediment Control Plan

Type of Project (circle one): Single Family Residence Construction or Demolition

Address of Project: _____

For the projects listed above, an Agreement in Lieu of a Plan is an acceptable alternative to the preparation of an individual erosion and sediment control plan. This agreement is meant to streamline and expedite the permit approval process by eliminating the plan preparation requirement for applicants. This agreement is a contract between the City of Norfolk and the applicant which specifies erosion and sediment control measures and standards that must be implemented. Prior to issuance, the applicant must first read, understand, accept, and sign the following declaration:

I agree to comply with the limitations and conditions of this agreement as outlined in the attached *City of Norfolk Standard Erosion and Sediment Control Notes*, and to limit and control off-site sedimentation. In addition, I agree to comply with any and all requirements determined necessary by any City of Norfolk Inspector if, upon field inspection, the measures employed on-site are found to be ineffective at controlling off-site sedimentation. Such requirements shall be based on the standards contained in the City of Norfolk's Erosion and Sediment Control Ordinance (City Code, Chapter 15), the Virginia Erosion and Sediment Control Laws and Regulations, and the latest edition of the Virginia Erosion and Sediment Control Handbook. These standards represent the minimum practices necessary to provide adequate control of erosion and sedimentation resulting from this project.

I have read and am familiar with the erosion and sediment control standards contained in the *City of Norfolk Standard Erosion and Sediment Control Notes* (attached). I also understand that failure to comply with the conditions of this agreement could result in citations for violations of the Uniform Statewide Building Code, Erosion and Sediment Control Ordinance (City Code, Chapter 15), and other applicable City codes.

Signature of Applicant: _____

Name of Applicant (Please Print): _____ Owner Contractor Agent

Address of Applicant: _____
(Street) (Apt #) (City) (State) (Zip)

Applicant's Telephone Number: _____

Applicant's Fax Number: _____

Applicant's E-mail Address: _____



City of Norfolk

Responsible Land Disturber Notification

Project name: _____ Date: _____

Project Address: _____

Site Plan Number: _____ Land Disturbance: _____

Responsible Land Disturber (R.L.D.) Notification

The following person _____ *print,*

_____ *sign,*

Is identified as responsible for carrying out the land disturbing activity associated with the above- referenced project. This person meets the applicable requirements of Virginia Code Section 62.1-44.15:55 and 62.1-44.15:58 by virtue of the following:

Check the category that applies & Fill in Certificate Number:

_____ Responsible Land Disturber Certificate #: _____

OR

_____ DEQ Certification for Combined Administrator, Plan Reviewer, Inspector

OR

_____ VA Professional Engineer, Land Surveyor, Landscape Architect, or Architect.

R.L.D. contact information:

Company Name: _____

Address: _____

City / State / Zip: _____

Phone #: _____ Cell #: _____

Fax #: _____ Email: _____



City of Norfolk

City of Norfolk Standard Erosion & Sediment Control Notes

1. Unless otherwise indicated, all vegetative and structural erosion and sediment control practices will be constructed and maintained according to minimum standards and specifications of the Virginia Erosion and Sediment Control Handbook (3rd Edition, 1992) and the City of Norfolk erosion and sediment control ordinance.
2. The contractor shall contact the City of Norfolk, Bureau of Environmental Services (664-4368) at least 48 hours prior to any land disturbing activity (including demolition) so that a preconstruction conference can be scheduled.
3. The contractor shall apply permanent or temporary soil stabilization to all denuded or disturbed areas within 7 days after final grade is reached on any portion of the site. Soil stabilization must also be applied to denuded or disturbed areas which may not be at final grade but which will remain undisturbed for longer than 14 days. Soil stabilization measures include vegetative establishment, mulching and the early application of gravel base material on areas to be paved.
4. All erosion and sediment control measures are to be placed prior to or as the first step in construction.
5. The contractor shall inspect all erosion control measures periodically and after each runoff producing rainfall event. Any necessary repairs to maintain the effectiveness of the erosion control devices and cleanup of sedimentation are the responsibility of the contractor and shall be made immediately.
6. The contractor shall limit site access by construction vehicles to entrances protected by a stone construction entrance (VESCH Std. & Spec. 3.02) or an approved comparable control measure. Sediment shall be removed from paved areas on a daily basis.
7. Stock piles of soil and other erodible materials shall be stabilized or protected with sediment trapping measures. The contractor is responsible for the temporary protection and permanent stabilization for stockpiles on site as well as for materials transported from the project site.
8. The contractor shall monitor and take precautions to control dust including (but not limited to) use of water, mulch, or chemical dust adhesives and control of construction site traffic.
9. Effluent from de-watering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect adjacent properties, wetlands, waterways or the storm drainage system.
10. The contractor is responsible for installation and maintenance of any additional control measures necessary to prevent erosion and sedimentation as determined necessary by the plan approving authority.
11. Temporary erosion and sediment control measures are not to be removed until all disturbed areas are stabilized. After stabilization is complete, all measures shall be removed within 30 days. Trapped sediment shall be spread and seeded.

6C – Stormwater Pre-Construction Checklist



Storm Water Pre-Construction Meeting

Site Plan # _____ Date of Meeting: _____

Site Plan Name: _____

Name, Company & Phone of Contractor attending Pre-Construction Meeting: _____

Failure to install a storm water best management practice as shown on an approved site plan is a class 1 misdemeanor as per City Code 41.1.

Based on the requirement outlined on your approved site plan, 48 hours prior to installation of any storm water best management practice, a pre-construction meeting must be arranged with the Division of Environmental Storm Water Management at 757-823-4000. During this meeting the following items are addressed:

- Type & Location of BMP** reviewed _____
 - Deviations from the approved site plan** - All deviations must be approved by the Division of Environmental Storm Water Management Engineer and Project Design Engineer prior to work being completed.
 - “Tie-In” to City Storm Water System from Private Storm Water System** - Prior to covering any “tie-in” to the City storm water system from a private storm water system, the contractor must notify the Division to arrange on-site inspection of the pipes at 757-823-4000. The Division’s Civil Engineer II or his designee will perform the inspection to any tie-in from a private storm water system to the city storm water system. If the tie-in is covered prior to inspection, Division staff may require the tie-in to be uncovered for inspection purposes.
 - BMP must be installed based on the set of city-approved site plans** - The Division Environmental Specialist must inspect the site to ensure the storm water BMPs are installed based on approved site plans and working properly as designed. If the storm water BMP is installed based on the approved site plan, but is not working properly as designed, the Project Design Engineer must be consulted for possible redesign of the BMP. Deviations or revisions to the plans must be approved by the Project Design Engineer and the Division’s Storm Water Engineer. A revised set of plans must be submitted to the Division prior to issuance of the final occupancy permit.
 - Declaration of Covenants or BMP Maintenance Agreement must be on file.** A copy of the signed BMP Maintenance Agreement (Declaration of Covenants) must be on file with the City Clerk’s Office, and a copy must be supplied to the Division, prior to issuance of the final occupancy permit. If the document is not on file with the Division, a final occupancy permit will not be issued.
 - Grading & Drainage** - Grading & Drainage for the site must correlate with compliance worksheet “C”. If the grading on the site does not drain to the BMP as designed on the approved site plan or sheet flows to adjacent properties, the site will not be approved by the Division. It may be necessary to install swales along the parameters to prevent runoff to adjacent properties or to divert water flow to the BMP. If a property’s drainage is not correct, a final occupancy permit will not be issued until the issue has been resolved.
 - Policy on Inspection of BMP** - Prior to installation of any underground BMP, the contractor shall notify the Division at 823-4000 to arrange an on-site inspection of the BMP **PRIOR** to covering it with any fill material. If an underground BMP is installed prior to inspection, the BMP may need to be uncovered to ensure compliance. This may include removing concrete or landscaping.
- Infiltration or any other type of underground BMP will be inspected multiple times by the Division’s Environmental Specialist throughout the installation process.

1. Once the BMP is dug to the final depth, an inspection will need to be performed by the Environmental Specialist.
 - a. Check to ensure depth & location on site is accurate.
 - b. The BMP must be in a soil layer that is impermeable. If the BMP is in a soil layer that is impermeable such as clay at the dept designated on the site plan, the contractor must go back to the Engineer who designed the plan for further instruction.
 - c. The BMP cannot be in the ground water table. If there is water entering the BMP at the designated depth on the site plan, you must go back to the Engineer who designed the plans for further instruction.

2. Material-Filled BMP (stone or sand)
 - a. Check to ensure filter fabric is installed based on approved plans.
 - b. Check to ensure fill material is correct size and type (stone or sand).
 - c. Check to ensure pipe is installed based on approved plans when applicable.
 - d. Check to ensure monitoring well is installed based on approved plans when applicable.
3. Completion of BMP
 - a. Final grade is correct
 - b. Stabilization of property to prevent runoff has been completed.
 - c. Drainage to adjacent property is not occurring.

Review details for BMP installation based on approved site plan (i.e. – filter fabric, monitoring wells, stone size, fill material, etc.) If the contractor does not understand the details as drawn on the approved site plan, he/she must go to the engineer who designed the plans for further instruction.

BMP not working as designed (Ex: Dry pond, dry 48 hours after a rain event to work properly)
 The Division of Environmental Storm Water Management inspectors are required to ensure the storm water BMPs are installed based on approved site plans and working properly as designed. If the storm water BMP is installed based on the approved site plan, but is not working properly as designed, the Project Design Engineer must be consulted for possible redesign of the BMP.

“As-Built” Submission - An “As-Built” must be submitted to the Division for any open BMPs (i.e. Retention Ponds, Detention Ponds, Dry Ponds, etc.) AND for any structures that fall along the property lines. The as-built must show elevations at the base of the BMP, along the banks of the BMP and at the structures within the BMP such as the inlet or outflow structures. The as-built must be submitted to the Division’s Civil Engineer II for review and comparison to the approved site plan. Discrepancies noted must be corrected prior to the issuance of a final occupancy permit.

Open BMPs will be inspected by the Division’s Environmental Specialist at the end of the construction process, prior to issuance of the final occupancy permit. The following items will be inspected.

- a. Check to ensure depth & location on site is accurate.
- b. Check to ensure the BMP is functioning as designed. (i.e. Dry Ponds must be dry, Wet Ponds must hold water)
- c. Check Inlet / Outlet structures are installed properly, cleaned and free from debris.
- d. Check to ensure the banks are stabilized to prevent erosion.
- e. Check to ensure there is no erosion or animal burrows.

Manufactured BMPs - For manufactured BMPs or proprietary BMPs (i.e. Vortech, Filterra, etc.) a signed and dated letter must be submitted to the Division’s Environmental Specialist certifying that the structure is installed and functioning as designed. If the letter is not submitted, the final occupancy permit will not be issued.

Policy on Final Occupancy Inspection for BMP
 Prior to receiving a final occupancy permit from the City of Norfolk, the contractor must set up a meeting 48-hours in advance with the Division of Environmental Storm Water Management to conduct a BMP Inspection for final occupancy release. The BMP must be installed according to the approved site plan and must be working as designed. For all BMPs that require special equipment to inspect (i.e. – large tops removed, special bolts removed, etc.), the contractor must ensure the BMP is accessible for scheduled inspection

Other Comments

I here-by certify that all the items described above were reviewed by me during a pre-construction meeting with a representative/inspector from the City of Norfolk, Division of Environmental Storm Water Management. I understand and acknowledge all the pre-construction requirements described, and agree to abide by those requirements set forth. I also agree failure to abide by the requirements in this agreement could result in a delay of final occupancy permits issued by the City of Norfolk, Planning Department (757-664-6513).

 Signature of Contractor

 Date Signed

 Signature of Representative/Inspector for the
 Division of Environmental Storm Water Management

 Date Signed

Appendix 7: Stormwater Program Fees (As set forth annually by the Norfolk City Council)

VSMP Authority Permit Issuance Fee:

The following fees are assessed to an applicant that is applying for coverage under the VSMP Authority Permit. 50% of the total fees shall be due at the time that a stormwater management plan is submitted to the City for review. The remaining total fee balance shall be paid by an applicant prior to the issuance of the coverage under the VSMP Authority Permit.

When a site or sites are purchased for development within a previously permitted common plan of development or sale, the applicant shall be subject to fees in accordance with the disturbed acreage of their site or sites according to the following table:

Permit Issuance Fee:

Fee Type	Permit Fee
Single Family Residential Home with land disturbance greater than 1 acre, but less than 5 acres.	\$290
Small Construction Activity / Land Clearing within common plan of development or sale with land disturbance less than 1 acre.	\$290
Small Construction Activity / Land Clearing with land disturbance greater than 1 acre, but less than 5 acres.	\$2,700
Large Construction Activity / Land Clearing with land disturbance greater than 5 acres, but less than 10 acres.	\$3,400
Large Construction Activity / Land Clearing with land disturbance greater than 10 acres, but less than 50 acres.	\$4,500
Large Construction Activity / Land Clearing with land disturbance greater than 50 acres, but less than 100 acres.	\$6,100
Large Construction Activity / Land Clearing with land disturbance greater than 100 acres.	\$9,600

The City shall furnish the following administrative portion of the VSMP Authority Permit Issuance Fees, based on land disturbance associated with the site, to the Department of Environmental Quality, on a routine basis:

Fee Type	DEQ Fee
Single Family Residential Home with land disturbance greater than 1 acre, but less than 5 acres.	\$0
Small Construction Activity / Land Clearing within common plan of development or sale with land disturbance greater than 2500 square feet, but less than 1 acre.	\$81
Small Construction Activity / Land Clearing with land disturbance greater than 1 acre, but less than 5 acres.	\$756
Large Construction Activity / Land Clearing with land disturbance greater than 5 acres, but less than 10 acres.	\$952
Large Construction Activity / Land Clearing with land disturbance greater than 10 acres, but less than 50 acres.	\$1,260
Large Construction Activity / Land Clearing with land disturbance greater than 50 acres, but less than 100 acres.	\$1,708
Large Construction Activity / Land Clearing with land disturbance greater than 100 acres.	\$2,688

VSMP Authority Permit Modification or Transfer Fee:

The following fees apply to modifications or transfer of individual VSMP Authority permits. If the VSMP Authority Permit modifications result in changes to the storm water management plans that require additional review by the City, such reviews shall be subject to the fees set out in this section. The fee assessed shall be based on the total disturbed acreage of the site. In addition to the VSMP Authority Permit modification fee, modifications resulting in an increase in total disturbed acreage shall pay the difference in the initial VSMP Authority permit fee paid and the VSMP Authority permit fee that would have applied for the total disturbed acreage.

Permit Modification or Transfer Fee:

Fee Type	Permit Fee
Single Family Residential Home with land disturbance greater than 1 acre, but less than 5 acres.	\$20
Small Construction Activity / Land Clearing within common plan of development or sale with land disturbance less than 1 acre.	\$20
Small Construction Activity / Land Clearing with land disturbance greater than 1 acre, but less than 5 acres.	\$200
Large Construction Activity / Land Clearing with land disturbance greater than 5 acres, but less than 10 acres.	\$250
Large Construction Activity / Land Clearing with land disturbance greater than 10 acres, but less than 50 acres.	\$300
Large Construction Activity / Land Clearing with land disturbance greater than 50 acres, but less than 100 acres.	\$450
Large Construction Activity / Land Clearing with land disturbance greater than 100 acres.	\$700

VSMP Authority Permit Annual Maintenance Fee:

The following annual permit maintenance fees apply to each VSMP Authority permit identified below, including expired permits that have been administratively continued. With respect to the VSMP Authority Permit activities, these fees shall apply until the VSMP Authority Permit coverage is terminated. The following annual maintenance fees shall be applied on the permit anniversary date and based on the land disturbance activity of the site:

Permit Maintenance Fee:

Fee Type	Permit Fee
Single Family Residential Home with land disturbance greater than 1 acre, but less than 5 acres.	\$0
Small Construction Activity / Land Clearing within common plan of development or sale with land disturbance less than 1 acre.	\$50
Small Construction Activity / Land Clearing with land disturbance greater than 1 acre, but	\$400

less than 5 acres.	
Large Construction Activity / Land Clearing with land disturbance greater than 5 acres, but less than 10 acres.	\$500
Large Construction Activity / Land Clearing with land disturbance greater than 10 acres, but less than 50 acres.	\$650
Large Construction Activity / Land Clearing with land disturbance greater than 50 acres, but less than 100 acres.	\$900
Large Construction Activity / Land Clearing with land disturbance greater than 100 acres.	\$1,400

Virginia Stormwater Management Program (VSMP) Fund

The fees collected for the VSMP Authority Permit shall be deposited in the stormwater utility fund. The fees collected under the terms of the VSMP Authority Permit shall be used exclusively to provide services and facilities related to the administration and implementation of the VSMP Authority Permit compliance. The deposited monies shall be used for the following expenditures:

- (a) Costs associated with the administration and implementation of the VSMP Authority Permit.
- (b) Costs associated with erosion and sediment control and storm water management site plan review.
- (c) Costs associated with erosion and sediment control, construction and post-construction storm water best management practice, and VSMP Authority Permit compliance inspections.
- (d) Administrative, accounting and overhead costs related to tracking and reporting the VSMP.