

DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
Division of Watershed Stewardship

5101 Sediment and Stormwater Regulations

1.0 General Provisions

1.1 Findings of Fact

1.1.1 It is determined that:

- 1.1.1.1 Erosion and sedimentation and delivery of other nonpoint source pollutants such as nutrients through stormwater runoff continue to present serious problems throughout the State.
- 1.1.1.2 The removal of a stable ground cover in conjunction with the decrease in the infiltration capability of soils resulting from the creation of additional impervious areas such as roads and parking lots has accelerated the process of soil erosion and sediment deposition and nonpoint source runoff of other pollutants resulting in pollution of waters of the State. This damages domestic, agricultural, industrial, recreational, fish and wildlife and other resource uses.
- 1.1.1.3 Accelerated stormwater runoff increases flood flows and velocities, contributes to erosion, sedimentation and degradation of water quality, overtaxes the carrying capacity of streams and storm sewers, greatly increases the cost of public facilities in carrying and controlling stormwater, undermines floodplain management and flood control efforts in downstream communities, reduces groundwater recharge, and threatens public health, welfare and safety.

- 1.1.2 The regulation of stormwater runoff from land development activities will control stormwater runoff, soil erosion and nonpoint source pollution and will mitigate the adverse effects of stormwater runoff from development and will reduce threats to public health and safety.

- 1.2 The intent of this regulation is to enhance and extend the present erosion and sediment control activities and programs of the State for both rural and urban lands and to provide for control and management of stormwater runoff consistent with sound water and land use practices. These activities will reduce, to the maximum extent practicable, adverse effects of stormwater runoff on the water and lands of the State.

1.3 Applicability

- 1.3.1 Unless a particular activity is exempted by these regulations, a person shall not disturb land without an approved Sediment and Stormwater Management Plan from the Department or Delegated Agency. A Sediment and Stormwater Management Plan shall not be approved for a property unless it is consistent with the following items:

- 1.3.1.1 These regulations;
- 1.3.1.2 7 **Del.C.** Ch. 40, relating to erosion and sediment control and stormwater management; and
- 1.3.1.3 7 **Del.C.** Ch. 60, relating to the development, utilization, and control of the land, water, underwater and air resources of the State, including the current Delaware Construction General Permit (CGP).

- 1.3.2 Applicability of these regulations for plans that have been approved to comply with previous regulations shall be consistent with the following:

- 1.3.2.1 Plans approved to comply with previous regulations where construction has not commenced on January 1, 2014 may have the plan approval extended under the requirements of the previous regulations in subsequent three-year approval periods. Any plan approved to comply with previous regulations must commence construction no later than December 31, 2019. A plan approved to comply with previous regulations where construction has not commenced by December 31, 2019 shall expire and a new plan in compliance with these regulations shall be submitted to the Department or Delegated Agency for review and approval before commencement of construction.

- 1.3.2.2 Plans approved to comply with regulations in effect prior to January 1, 2014 where construction has commenced may be extended based on the requirements in place at the time of original Plan approval. In no case shall the plan extension supersede the sunset provisions of the county or local government.

- 1.3.2.2.1 Project phases that have not commenced construction may be extended when the Sediment and Stormwater Management Plan for that phase has been approved with the overall plan.

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- 1.3.2.2.2 Phases shown on a conceptual plan that are not included on the approved Sediment and Stormwater Management Plan will not be eligible for extension. A Sediment and Stormwater Management Plan must be developed for conceptual phases separately.
- 1.3.2.3 Commencement of construction means that the construction of the approved Plan is visible with the construction of a structure or infrastructure, including but not limited to roads, water and sewer lines, and stormwater management systems. General earth moving is not considered commencement of construction.
- 1.3.2.4 An individual building pad site, outparcel or future phase which was considered in an overall master plan stormwater management design and where the stormwater management facility has been constructed based upon regulations in effect prior to January 1, 2014 shall be grandfathered under the regulations in place at the time of approval of the master plan project.
 - 1.3.2.4.1 The Department or Delegated Agency shall verify that the proposed development of the individual building pad site, outparcel or future phase meets the original design assumptions for the stormwater management facility. If the proposed development of the individual building pad site, outparcel or future phase does not meet the original design assumptions for the regional stormwater management facility, the individual building pad site, outparcel or future phase plan must comply with these regulations.
 - 1.3.2.4.2 The Department or Delegated Agency shall verify that the stormwater management facility functions in accordance with the approved design. If the stormwater management facility fails to function in accordance with the approved design it may be restored to its design condition as part of the proposed development of the individual building pad site, outparcel or future phase.
 - 1.3.2.4.3 The applicant shall submit a Sediment and Stormwater Plan for the proposed development of the individual building pad site, outparcel or future phase. The Plan may be approved without additional stormwater management requirements.
- 1.4 The following activities are exempt from both sediment control and stormwater management requirements established by these regulations:
 - 1.4.1 Agricultural land management practices having a soil and water conservation plan unless the Department or Delegated Agency determines that a new or updated soil and water conservation plan is required, and the Owner or operator of the land has refused either to apply to a Conservation District for the development of a conservation plan, or to implement a conservation plan developed by a Conservation District.
 - 1.4.2 Developments or construction that disturbs less than 5,000 square feet. Individual disturbances of less than 5,000 square feet that accumulate to exceed 5,000 square feet are not exempt and may be subject to the provisions of these regulations as determined by the Department or Delegated Agency on a case-by-case basis.
 - 1.4.3 With written agreement of the Department, land development activities which are regulated with respect to erosion and sediment control and stormwater management under other specific State or Federal laws.
 - 1.4.4 Commercial forest harvesting operations that meet the requirements of the Department of Agriculture under 3 **Del.C.** Ch. 10, Subchapter VI.
 - 1.4.5 Permitted land application of biosolids and residuals.
- 1.5 Variances
 - 1.5.1 The Department may grant a variance from any requirement of these regulations in accordance with the provisions of 7 **Del.C.** §6011.
 - 1.5.2 The Department may grant a temporary emergency variance from any requirement of these regulations in accordance with the provisions of 7 **Del.C.** §6012.
 - 1.5.3 The Department shall consider and decide applications for a variance from the provisions of these Regulations if all of the following are established by the applicant.
 - 1.5.3.1 The variance sought will not be detrimental to the environment or contrary to law, or these Regulations.
 - 1.5.3.2 Owing to special conditions or an unusual situation, a literal interpretation of these Regulations will result in hardship to the owner of the property in question.
 - 1.5.3.3 If the variance were granted, the goals of these Regulations will be met with respect to the property in question.

- 1.5.4 The applicant must submit a request for a variance to the Sediment and Stormwater Program of the Department that sets forth and explains the need for the variance.
- 1.5.5 The Secretary or his designee shall publish his decision on the requested variance and the decision shall be effective immediately.
- 1.5.6 Any person whose interests are substantially affected may appeal to the Environmental Appeals Board within 15 days of publication of the Secretary's decision.
- 1.5.7 The variance shall be effective from the date of its approval, not to exceed one year.
- 1.6 Fees and Financial Guarantees
 - 1.6.1 Fees
 - 1.6.1.1 The Delegated Agency has the authority to require fees to support local program implementation, including overall program management, plan review, construction review, enforcement, and maintenance responsibilities. An Owner seeking approval of a Sediment and Stormwater Management Plan shall pay a fee as prescribed by the Department or Delegated Agency. When the Department is the approval agency, the fees shall not exceed \$80.00 per disturbed acre per project.
 - 1.6.1.2 The establishment of fees, not involving stormwater utilities, shall be in accordance with the following items:
 - 1.6.1.2.1 The number of needed personnel and the direct and indirect expenses associated with those personnel shall be developed by the agencies requesting delegation in a specific jurisdiction in conjunction with and with the concurrence of the Department. Those expenses will then form the basis for determining plan review, construction review and maintenance review costs.
 - 1.6.1.2.2 The fee schedule and revisions to the fee schedule of the Delegated Agency, with the concurrence of the Department, shall be subject to applicable State or local public notice requirements. State public notice requirements shall be governed by 7 **Del.C.** §6004.
 - 1.6.2 Financial Guarantee
 - 1.6.2.1 The Department or Delegated Agency may require and implement a financial guarantee for construction of the elements of the approved Sediment and Stormwater Management Plan.
 - 16.2.1.1 The Owner shall submit when required to the Department or Delegated Agency a financial guarantee before the onset of construction activities. The financial guarantee will ensure that action can be taken by the Department or Delegated Agency to complete required elements of the approved Sediment and Stormwater Management Plan, at the Owner's expense, should the Owner fail to initiate, complete, or maintain those measures identified in the approved Sediment and Stormwater Management Plan after being given proper notice and within a reasonable time specified by the Department or Delegated Agency.
 - 1.6.2.1.2 The financial guarantee may be extended beyond the time period specified to cover a reasonable period of time, not less than one year, for testing the practices during storm events and for initial maintenance activities. However, the Department or Delegated Agency may adopt provisions for a partial release of the financial guarantee upon the completion of specified stages or phases of development as outlined in accepted procedures.
 - 1.6.2.2 Following approval of the Department, the financial guarantee provisions of the Delegated Agency shall be subject to applicable State or local public notice requirements. State public notice requirements shall be governed by 7 **Del.C.** §6004.
- 1.7 These regulations are adopted pursuant to authority conferred by and in accordance with 7 **Del.C.** Ch. 40 and 7 **Del.C.** Ch. 60.
- 1.8 These regulations are not intended to interfere with, abrogate, or annul any other ordinance, rule or regulation, statute, or other provision of law. The requirements of these regulations should be considered minimum requirements, and where any provision of these regulations imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law, whichever provisions are more restrictive or impose higher protective standards for human health or the environment shall be considered to take precedence.
- 1.9 If any section, subsection, sentence, clause, phrase or portion of these regulations is for any reason held invalid or unconstitutional by any court or competent jurisdiction, such provision and such holding shall not affect the validity of the remaining portions of these regulations.

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- 1.10 Any person who undertakes or causes to be undertaken any land disturbing activities shall ensure that soil erosion, sedimentation, increased pollutant loads and changed water flow characteristics resulting from these activities are controlled so as to minimize pollution of state waters. The requirements of these regulations are minimum standards and a person's compliance shall not relieve the person from the duty of enacting all measures necessary to minimize pollution of, or detrimental impacts to state waters.
- 1.11 The conduct of all hearings conducted pursuant to these regulations shall be in accordance with the relevant provisions of 7 **Del.C.** Ch. 60.
- 1.12 The Department is responsible for the implementation and supervision of the sediment and stormwater program which is established by 7 **Del.C.** Ch. 40. The program shall be administered pursuant to these regulations.

18 DE Reg. 396 (11/01/14)

22 DE Reg. 680 (02/01/19)

2.0 Definitions

The following words and terms, when used in this regulation, shall have the following meaning unless the context clearly indicates otherwise:

"Adequate conveyance" means any system having sufficient capacity to transport the runoff generated during the Resource Protection Event, Conveyance Event, and Flooding Event; functions and discharges in a non-erosive manner; and does not adversely impact any offsite properties, conveyance system, stormwater facility, or State Waters.

"Adverse impact" means a negative impact resulting from a construction or development activity. The negative impact may include, but is not limited to, increased risk of flooding; degradation of water quality; increased sedimentation; reduced groundwater recharge; negative impacts on aquatic habitat; or threatened public health and safety.

"Agricultural land management practices" means those methods and procedures generally accepted by the Conservation Districts and used in the cultivation of land in order to further crop and livestock production and conservation of related soil and water resources.

"Agricultural structure" means a structure on a farm used solely for agricultural purposes in which the use is exclusively in connection with the production, harvesting, storage, drying, or raising of agricultural commodities, including the raising of livestock. Structures used for human habitation, public use, or a place of employment where agricultural products are processed, treated, or packaged are not considered agriculture structures for the purposes of these regulations.

"Applicant" means a person who has requested approval of a Sediment and Stormwater Management Plan through submittal of an application in accordance with these regulations or who has requested permission to conduct any activity subject to these regulations.

"Best available technology" or **"BAT"** means a level of technology based on the very best (state of the art) sediment and stormwater control and treatment measures that have been developed or are capable of being developed and that are economically achievable.

"Best management practices" or **"BMPs"** means schedules of activities, prohibition of practices, maintenance procedures, and other management practices or measures to prevent or reduce the discharge of pollutants. BMPs include the following, among other practices and measures: structural and non-structural controls; treatment requirements; operating procedures and practices to control site runoff.

"Biosolids" means solid or semi-solid material obtained from treated wastewater or animal manure.

"Brownfield" means any vacant, abandoned or underutilized real property the development or redevelopment of which may be hindered by the reasonably held belief that the real property may be environmentally contaminated.

"Certified Construction Reviewer" or **"CCR"** means those individuals, having passed a Departmental sponsored or approved training course and holding current certification, which provide on-site construction review for sediment control and stormwater management in accordance with these regulations.

"Conservation plan" means a customized document that outlines the use and best management practices of the natural resources on a parcel of land.

"Conveyance event" means the runoff event produced by a storm having an annual probability of occurrence of 10%.

“**Conveyance event volume**” or “**Cv**” means the volume of runoff generated by the Conveyance Event that is not otherwise reduced for the Resource Protection Event.

“**Dedication**” means transferring ownership of a stormwater management system to a delegated agency, public utility, municipality, stormwater utility, or private entity, along with all associated easements, escrow funds, and maintenance responsibilities.

“**Delegated Agency**” means the Conservation District, county, municipality, or State agency that has accepted responsibility in a jurisdiction for implementation of one or more elements of the Sediment and Stormwater Program within that jurisdiction.

“**Delegation**” means the acceptance of responsibility by a Conservation District, county, municipality, or State agency for the implementation of the Sediment and Stormwater Program.

“**Department**” means the Department of Natural Resources and Environmental Control.

“**Designated watershed or subwatershed**” means a watershed or subwatershed proposed by a conservation district, county, municipality, or State agency and approved by the Department. The Department may establish additional requirements due to existing water quantity or water quality problems. These requirements shall be implemented on an overall watershed or subwatershed master plan developed for water quality or water quantity protection.

“**Detailed plan**” means a plan developed by a Licensed Professional in the State of Delaware which does not meet standard plan criteria.

“**Drainage area**” means that area contributing runoff to a single point measured in a horizontal plane, which is enclosed by a ridge line.

“**Easement**” means a grant or reservation by the Owner of land for the use of land by others for a specific purpose or purposes, and which must be included in the conveyance of land affected by the easement.

“**Effective imperviousness**”, for the purposes of these Regulations, means the equivalent percentage of a site’s impervious area that directly contributes stormwater runoff during the Resource Protection Event after all runoff reduction practices have been implemented.

“**Erosion and sediment control**” means the control of solid material, both mineral and organic, during a land disturbing activity, to prevent its transport out of the disturbed area by means of wind, water, gravity, or ice.

“**Final stabilization**” means that:

- (1) All soil disturbing activities at the site have been completed and either of the two following criteria are met:
 - (a) A uniform (e.g. evenly distributed, without large bare areas) perennial vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or
 - (b) Equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed.
- (2) When background native vegetation will cover less than 100% of the ground (e.g., arid areas, beaches), the 70% coverage criteria is adjusted as follows: if the native vegetation covers 50% of the ground, 70% of 50% ($0.70 \times 0.50 = 0.35$) would require 35% total coverage for final stabilization. On a beach with no natural vegetation, no stabilization is required.
- (3) For individual lots in residential construction, final stabilization means that either:
 - (a) The homebuilder has completed final stabilization as specified above, or
 - (b) The homebuilder has established temporary stabilization including perimeter controls for an individual lot prior to occupation of the home by the homeowner and informing the homeowner of the need for, and benefits of, final stabilization.
- (4) For construction projects on land used for agriculture purposes (e.g., pipelines across crop or range land, staging areas for highway construction, etc.) final stabilization may be accomplished by returning the disturbed land to its preconstruction agriculture use. Areas disturbed that were not previously used for agricultural activities, such as buffer strips immediately adjacent to a “water of the United States” and areas which are not being returned to their preconstruction agricultural use must meet the final stabilization criteria (1) or (2) above.

“**Financial guarantee**” means a bond, security, letter of credit, etc. provided by the Owner to serve as a payment source should the Owner fail to meet the obligations and requirements of the approved Sediment and Stormwater Management Plan.

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"Flooding event" means the runoff event produced by a storm having an annual probability of occurrence of 1.0%.

"Flooding event volume" or **"Fv"** means the volume of runoff generated by the Flooding Event that is not otherwise reduced for the Resource Protection Event and the Conveyance Event.

"Forest" means a biological community dominated by trees and other woody plants covering a land area of one contiguous acre or greater, and that have at least 100 trees per acre with at least 50% of those trees having a two inch or greater diameter at 4.5 feet above the ground and larger. Forest does not include orchards or other stands of trees having a curve number equivalent to "woods-grass combination". To determine whether a site meets the definition of a forest at the baseline condition of 2017, the Department or its authorized Delegated Agency may use data from various sources, including but not limited to Land Use/Land Cover data, historic and recent aerial photography, field collected data, etc.

"Functional equivalency" means alternative measures that are consistent with the policies, procedures, technical specifications, and advisory provisions found in the regulatory guidance documents, and which satisfy these Regulations.

"Impervious surface" means a surface which either prevents or retards the entry of water into the soil.

"Infiltration" means the passage or movement of water into the soil profile.

"Inspection port" means an appurtenance installed within a stormwater management system to allow for observation of conditions, including water level, located below the surface.

"Land disturbing activity" means a land change or construction activity for residential, commercial, industrial, and institutional land development which may result in soil erosion from water or wind, or the movement of sediments or pollutants into state waters or onto lands in the State; or which may result in accelerated stormwater runoff, including, but not limited to, clearing, grading, excavating, transporting and filling of land.

"Licensed Professional in the State of Delaware" means a design professional licensed under 24 Del.C. Ch. 2, 24 Del.C. Ch. 27, or 24 Del.C. Ch. 28.

"Maintenance" means the work of keeping stormwater management systems including access routes and appurtenances (grade surfaces, walls, drains, dams and structures, vegetation and other protective devices) in a safe and functioning condition as the system was designed. Routine or minor maintenance includes grass mowing and trimming, debris removal, minor sediment removal, filling eroded areas and animal burrows, and removal of trees and shrubs on embankments. Non-routine or major maintenance includes structural repair, major sediment removal and major erosion repair, and invasive aquatic vegetation removal.

"Maximum extent practicable" or **"MEP"** means, for the purpose of these Regulations, using stormwater management measures, techniques and methods that are available and capable of being implemented while taking into consideration cost, available technology, and project site constraints.

"Notice of Completion" means a document issued by the Department or Delegated Agency at the end of project construction when all items and conditions of the approved Sediment and Stormwater Management Plan have been satisfied, post construction verification documents demonstrate that the stormwater management systems have been constructed in accordance with the approved Sediment and Stormwater Management Plan, and final stabilization of disturbed areas on the site has been achieved.

"Offset" means an alternate to strict adherence to the regulations including, but not limited to trading, banking, fee-in-lieu, or other similar program that serves as compensation when the requirements of these regulations cannot be reasonably met on an individual project basis.

"Operation and Maintenance Plan" means the plan which identifies required maintenance for stormwater management systems.

"Owner" means a person who has a legal interest in lands of this State, or who has an equitable interest in lands of this State, except when a person holds an interest in those lands as a security interest, unless through foreclosure or other action the holder has taken possession of those lands, and who undertakes, or for whose benefit, activities subject to these regulations are commenced or carried out on those lands, or the person responsible for maintenance of stormwater management systems constructed to comply with these regulations on those lands.

"Person" means a State or federal agency, individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, municipality or other political subdivision of this State, an interstate body or any other legal entity.

"Permanent stabilization" means the establishment of perennial vegetation by application of soil amendments, seed, and mulch in accordance with methods accepted by the Department on disturbed areas

that have reached final grade in order to stabilize the soil, prevent erosion, and reduce sediment and runoff to downstream or offsite areas.

"Post construction verification documents" means a set of surveyed plans reflecting the as-built condition of stormwater management measures and may also include supporting computations and specifications as required by the Department or the Delegated Agency.

"Pretreatment" means a mechanism at or before an inlet to a stormwater management practice that reduces gross pollutants and sediment from compromising the performance and to maximize the maintenance interval of the practice.

"Redevelopment", including brownfield development, means a construction, alteration or improvement, including but not limited to the demolition or building of structures, filling, grading, paving, or excavating, where existing land use is residential, commercial, industrial, or institutional. Ordinary maintenance activities, remodeling of existing buildings, resurfacing of paved areas, and exterior changes or improvements are typically not considered redevelopment activities for the purposes of these regulations.

"Resource protection event" means the runoff event produced by a storm having an annual probability of occurrence of 99%.

"Resource protection event volume" or **"RPv"** means the annualized volume of runoff generated by the Resource Protection Event.

"Responsible personnel" means a foreman or superintendent who is in charge of on-site clearing and land disturbing activities for sediment and stormwater control associated with a construction project.

"Runoff reduction practices" means stormwater best management practices that reduce total runoff volume from a developed site through canopy interception, surface recharge, evaporation, rainfall harvesting, engineered infiltration, or evapotranspiration and may include practices that delay the delivery of stormwater to a surface discharge.

"Sediment" means soils or other surficial materials transported or deposited by the action of wind, water, ice or gravity as a product of erosion.

"Sediment and Stormwater Management Plan" means a plan for the control of soil erosion, sedimentation, stormwater quantity, and water quality impacts resulting from a land disturbing activity, through both the construction and post construction phases of development.

"Standard plan" means a set of pre-defined standards or specifications for minor land disturbing activities that may preclude the need for the preparation of a detailed plan under specific conditions.

"State waters" means any and all waters, public or private, on the surface of the earth which are contained within, flow through or border upon the State or any portion thereof.

"Stone" means a hard non-metallic mineral building material, and for the purposes of this regulation shall be interchangeable with "gravel" and "aggregate".

"Stormwater" means the runoff of water from the surface of the land resulting from precipitation, or snow or ice melt.

"Stormwater management" means:

- (a) For water quantity control, a system of vegetative, structural, and other measures that controls the volume and rate of stormwater runoff which may be caused by land disturbing activities upon the land; and
- (b) For water quality control, a system of vegetative, structural, and other measures that controls adverse effects on water quality that may be caused by land disturbing activities upon the land.

"Stormwater management offset" means an alternative method of compliance to the regulations including, but not limited to, trading, banking, fee-in-lieu, or other similar program.

"Stormwater management offset district" means an organization established to administer stormwater management offsets established under Department authorization.

"Stormwater management system" means vegetative, structural, and other facilities or measures, singularly or in combination, as defined in Section 11.0, that provide stormwater management.

"Stormwater utility" means an administrative organization that has been established for the purposes of funding sediment control, stormwater management or flood control planning, design, construction, maintenance, and overall resource needs by authorized and imposed charges.

"Temporary stabilization" means planting quick-growing vegetation and applying anchored straw mulch or other means to stabilize the soil and prevent erosion of a disturbed area until permanent vegetation or other stabilization measures can be established.

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"Third party CCR" means, for the purposes of these regulations, any individual CCR that is not an employee of the owner or a contractor of the construction activity, excluding the site designer.

"Tidal waters" means any water that alternately rises and falls in a predictable and measurable rhythm or cycle due to the gravitational attraction of the moon and sun and is under the regulatory authority of 7 **Del.C.** Ch. 72.

"Transfer" means to convey responsibility for maintenance of a stormwater management system to a new Owner.

"Variance" means a permitted deviation from an established rule or regulation, or plan, or standard or procedure.

"Water quality" means those characteristics of stormwater runoff from a land disturbing activity that relate to the chemical, physical, biological, or radiological integrity of water.

"Water quantity" means those characteristics of stormwater runoff that relate to the rate, volume and duration of flow to downstream areas resulting from land disturbing activities.

"Watershed" means the drainage area contributing stormwater runoff to a single point.

"Watershed plan" means a comprehensive study of the activities and sources that contribute to water quality or water quantity problems and identifies the location of those problem areas within a specific watershed boundary. It also serves as a framework for how, where and what stormwater management tools will be applied to address those water quality or water quantity problems.

18 DE Reg. 396 (11/01/14)

22 DE Reg. 680 (02/01/19)

3.0 Plan Approval Procedures and Requirements

- 3.1 All projects requiring approval of a detailed Sediment and Stormwater Management Plan are subject to a three-step approval process. Step 1 of the plan approval process is scheduling and conducting the Project Application Meeting. Step 2 of the plan approval process is submission of the Preliminary Sediment and Stormwater Management Plan. Step 3 of the plan approval process is submission of the Sediment and Stormwater Management Plan.
 - 3.1.1 Authorization from the Department or Delegated Agency is required to proceed from the current step to the subsequent step in the plan approval process.
 - 3.1.2 If significant changes, as determined by the Department or Delegated Agency, are proposed on the subsequent submittal from the submittal that received authorization to proceed, the Owner may be required to repeat the previous step in the plan approval process.
 - 3.1.3 Step 2 and Step 3 of the three-step approval process may be combined as determined by the Department or Delegated Agency on a case-by-case basis. This determination may be made at the Project Application Meeting.
- 3.2 Project Application Meeting
 - 3.2.1 All Owners are required to hold a Project Application Meeting with the Department or Delegated Agency, unless the requirement for a project application meeting is waived in writing by the Department or Delegated Agency as determined on a case-by-case basis.
 - 3.2.2 Before scheduling the Project Application Meeting, the Owner shall submit a Stormwater Assessment Study (SAS) to the Department or Delegated Agency.
 - 3.2.3 At the Project Application Meeting the Stormwater Assessment Study will be reviewed as well as potential approaches for stormwater management and opportunities to reduce runoff rates, volumes, and pollutant loads.
 - 3.2.4 Project Application Meeting discussion and agreement items will be documented in meeting minutes prepared by the Owner or the Owner's Representative and distributed to all in attendance.
- 3.3 Preliminary Sediment and Stormwater Management Plan
 - 3.3.1 The Preliminary Sediment and Stormwater Management Plan submittal shall include preliminary plans for the site, as well as the schematic erosion and sediment control plan, with supporting hydrologic and hydraulic calculations necessary for the Department or Delegated Agency to determine compliance with these regulations.

- 3.3.2 If significant changes are proposed on the Preliminary Sediment and Stormwater Management Plan from the plan that was discussed at the Project Application Meeting, such as a change in land use, the Owner may be required to repeat the Project Application Meeting step of the process.
- 3.4 Sediment and Stormwater Management Plan
- 3.4.1 The Sediment and Stormwater Management Plan submittal shall consist of the following elements: Construction Site Stormwater Management Plan including pollution prevention elements, Post Construction Stormwater Management Plan, final hydrologic and hydraulic computations, Operation and Maintenance Plan, and a copy of the preliminary Record Plan as required by the local land use approval agency. The plan shall also include the following notes:
- 3.4.1.1 The Department or Delegated Agency shall be notified in writing five days prior to commencing with construction. Failure to do so constitutes a violation of the approved Sediment and Stormwater Management Plan.
- 3.4.1.2 Review and or approval of the Sediment and Stormwater Management Plan shall not relieve the contractor from his or her responsibilities for compliance with the requirements of the Delaware Sediment and Stormwater Regulations, nor shall it relieve the contractor from errors or omissions in the approved plan.
- 3.4.1.3 Following soil disturbance or re-disturbance, permanent or temporary stabilization shall be completed for all perimeter sediment controls, soil stockpiles, and all other disturbed or graded areas on the project site within 14 calendar days unless more restrictive Federal requirements apply.
- 3.4.1.4 All erosion and sediment control practices shall comply with the Delaware Erosion and Sediment Control Handbook, latest edition.
- 3.4.1.5 At any time a dewatering operation is used, it shall be previously approved by the Agency Construction Site Reviewer for a non-erosive point of discharge, and a dewatering permit should be approved by the Department's Well Permits Branch.
- 3.4.1.6 Post construction verification documents shall be submitted to the Department or Delegated Agency within 60-days of stormwater management facility completion.
- 3.4.1.7 The Notice of Intent for Storm Water Discharges Associated with Construction Activity under a NPDES General Permit for this project is # (to be filled in once received). The permittee of record shall not be relieved of their responsibilities until a Notice of Termination has been processed by the Department.
- 3.4.1.8 The owner shall be familiar with and comply with all aspects of the NPDES Construction General Permit.
- 3.4.1.9 The contractor shall at all times protect against sediment or debris laden runoff or wind from leaving the site. Perimeter controls shall be checked daily and adjusted or repaired to fully contain and control sediment from leaving the site. Accumulated sediment shall be removed when it has reached half of the effective capacity of the control. In addition, the contractor may need to adjust or alter measures in times of adverse weather conditions, or as directed by the Agency Construction Site Reviewer.
- 3.4.2 If significant changes are proposed on the Sediment and Stormwater Management Plan from the Preliminary Sediment and Stormwater Management Plan, such as a change in the size or location of proposed BMPs, the Owner may be required to repeat the Preliminary Sediment and Stormwater Plan step of the process.
- 3.4.3 Failure by the Owner to demonstrate that the Sediment and Stormwater Management Plan meets the requirements of these regulations, as determined by the Department or Delegated Agency, shall be reason to deny approval of the Sediment and Stormwater Management Plan.
- 3.5 Review Procedures for Plan Submittals
- 3.5.1 The Department or Delegated Agency shall have 30 calendar days from receipt of either the Preliminary Sediment and Stormwater Management Plan or final Sediment and Stormwater Management Plan to complete the review and have either the approval or review comments transmitted to the Owner, unless the 30-calendar day period cannot be met, in which case the Department or Delegated Agency shall notify the Owner in writing of the reasons for delay, and an expected time period not to exceed an additional 30 calendar days, for when that review will be completed.

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- 3.5.2 The Department or Delegated Agency shall have the right to reject an incomplete application at any time during the 30-calendar day review period. If an application is rejected for incompleteness, the Owner will be informed in writing of the information necessary to complete the application.
- 3.5.3 In cases where modifications are required to approve the plan, the Department or Delegated Agency shall have an additional 30 calendar days to review the revised plan from the initial and any subsequent resubmission dates.
- 3.5.4 The sediment and stormwater management plan shall not be considered approved without the inclusion of an original approval stamp on the plans with signature and date by the plan approval agency. If the plan is approved, a minimum of one (1) copy bearing the signed approval stamp shall be returned to the Owner or Owner's agent. If the plan is not approved, the Owner shall be notified in writing of the reasons.
- 3.5.5 No changes shall be made to an approved plan without review and written approval by the Department or Delegated Agency. The Department or Delegated Agency may request additional data with a plan amendment as may be necessary for a complete review of the plan and to ensure that changes to the plan will comply with the requirements of these regulations.
- 3.6 Expiration of Plan Approval
- 3.6.1 Approved plans remain valid for five years from the date of an approval, unless specifically extended by the Department or Delegated Agency. The basis for extension may include, but is not limited to, the following items:
- 3.6.1.1 Failure to initiate the approved project for reasons acceptable to the Department or Delegated Agency such as funding or other agency permit delays; or
- 3.6.1.2 Time duration for a type of activity that typically exceeds five years.
- 3.6.2 The Department or Delegated Agency may extend plan approval following a written request for extension providing justification for the extension request. Plan approval extension may be granted no more than 90 days before plan expiration, and will be granted for a maximum extension of an additional five years. In no case shall the plan extension supersede the sunset provisions of the county or local government.
- 3.6.3 Plan extension requests for projects that have not commenced construction shall be granted for a maximum of one additional five-year period.
- 3.6.4 Plan extension requests for projects that have commenced and have been actively under construction within the latest approval or extension period will not be limited in the number of extensions that may be approved.
- 3.7 Standard Plans
- 3.7.1 In the event that a project meets the Standard Plan Applicability Criteria for the project type, that project has the option to comply with Standard Plan Conditions for the project type in lieu of developing a detailed Sediment and Stormwater Management Plan for the project. Project types for which Standard Plan Applicability Criteria has been developed include:
- 3.7.1.1 residential construction less than 1.0 acre disturbed;
- 3.7.1.2 residential construction greater than or equal to 1.0 acre disturbed;
- 3.7.1.3 non-residential construction less than 1.0 acre disturbed;
- 3.7.1.4 tax ditch maintenance;
- 3.7.1.5 minor linear utility disturbances;
- 3.7.1.6 stormwater facility maintenance;
- 3.7.1.7 agricultural structure construction;
- 3.7.1.8 poultry house construction;
- 3.7.1.9 demolition;
- 3.7.1.10 BMP construction or retrofit;
- 3.7.1.11 minor bridge and culvert construction; and
- 3.7.1.12 sidewalk, trail or other linear impervious surfaces.
- 3.7.2 All standard plans shall contain standard conditions for construction site stormwater management and may contain standard conditions for post construction stormwater management.
- 3.7.3 The inclusion of an activity into the standard plan classification does not exclude that activity from the requirements of 7 Del.C. Ch. 40. Rather, the standard plan precludes that activity from the necessity of a detailed plan review for a qualifying project.

- 3.7.4 Failure to implement control practices pursuant to conditions included in the standard plan may necessitate appropriate enforcement action as provided in 7 Del.C. Ch. 40 and these regulations.
- 3.7.5 A detailed plan may be required for a site that would otherwise meet standard plan criteria but does not meet the intent of the regulations as determined by the Department or Delegated Agency on a case-by-case basis. The Department or Delegated Agency may require a detailed plan prior to approval or at any time during construction.
- 3.7.6 Parcels that have previously received approval under a Standard Plan may not be eligible for a Standard Plan in the future, as determined by the approval agency on a case-by-case basis.
- 3.7.7 A project that does not meet all Standard Plan Applicability Criteria but does meet the intent of the regulations may be considered for approval under the Standard Plan as determined by the Department or Delegated Agency on a case-by-case basis.
- 3.7.8 Approval of a standard plan does not relieve the applicant from complying with any and all federal, state, county, or municipal laws and regulations.
- 3.7.9 Construction projects exceeding 1.0 acre of total disturbance require submittal of a Notice of Intent (NOI) for Stormwater Discharges Associated with Construction Activity. A plan fulfilling Stormwater Pollution Prevention Plan (SWPPP) requirements must be developed to obtain general permit coverage for Stormwater Discharges Associated with Construction Activity.
- 3.7.10 Construction site stormwater management best management practices shall be used throughout construction.
- 3.7.11 Residential construction less than 1.0 acre disturbed
 - 3.7.11.1 For the purposes of standard plan criteria for residential construction less than 1.0 acre disturbed, residential construction means residential and auxiliary structures such as detached garages, sheds, pole barns, and other structures that create additional imperviousness.
 - 3.7.11.2 Applicability criteria:
 - 3.7.11.2.1 The total land disturbance will not exceed 1.0 acre on any individual lot within the proposed project.
 - 3.7.11.2.2 The proposed construction is for residential development that does not create common lands, common open space, or a public street.
 - 3.7.11.3 Conditions. Standard Detail and Specification DE-ESC-3.7.1 ESC For Minor Development will be followed during construction.
- 3.7.12 Residential construction greater than or equal to 1.0 acre disturbed
 - 3.7.12.1 For the purposes of standard plan criteria for residential construction greater than or equal to 1.0 acre disturbed, residential construction means single family residence and auxiliary structures such as detached garages, sheds, pole barns, accessory dwelling units, and other structures that create additional imperviousness.
 - 3.7.12.2 Applicability criteria:
 - 3.7.12.2.1 The proposed construction is for residential construction that does not create common lands, common open space, or a public street.
 - 3.7.12.2.2 The total land disturbance will not exceed 5.0 acres on any individual lot within the proposed project.
 - 3.7.12.2.3 One of the following will be met on any individual lot:
 - 3.7.12.2.3.1 Clearing of forest areas will not exceed 1.0 acre, or
 - 3.7.12.2.3.2 Equivalent forest area will be retained on the parcel for the portion of the forest clearing that exceeds 1.0 acre.
 - 3.7.12.3 Conditions:
 - 3.7.12.3.1 Standard nutrient management plan recommendations will be followed for the project, during construction and throughout the life of the project.
 - 3.7.12.3.1.1 Application of lawn nutrients will be based upon the recommendations of a soil test.
 - 3.7.12.3.1.2 Nutrients will be applied only to turf areas, not impervious surfaces.
 - 3.7.12.3.1.3 Nutrients will not be applied directly before a runoff event.
 - 3.7.12.3.2 Discharges from rooftops will be disconnected to the maximum extent practicable using a method approved by the Department or Delegated Agency. For example:

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- 3.7.12.3.2.1 Individual downspouts that discharge to lawn, landscape area, or preserved open space or forested area.
- 3.7.12.3.2.2 Discharges from downspouts can be collected in rain barrels or cisterns for reuse.
- 3.7.12.3.3 Driveways, sidewalks, patios, and other impervious surfaces will be graded to sheet flow to lawn or other pervious areas to the maximum extent practicable.
- 3.7.12.3.4 Standard Detail and Specification DE-ESC-3.7.1 ESC For Minor Development will be followed during construction.
- 3.7.13 Non-residential construction less than 1.0 acre disturbed
 - 3.7.13.1 Applicability criteria:
 - 3.7.13.1.1 The disturbed area for construction of the improvements will not exceed 1.0 acre.
 - 3.7.13.1.2 Within the disturbed area, the pre-development land use is not classified as forest.
 - 3.7.13.1.3 For project site locations within an area previously managed for stormwater quantity and quality under an approved Sediment and Stormwater Plan, the post construction condition meets the original stormwater design criteria.
 - 3.7.13.1.4 For project site locations within an area previously unmanaged for stormwater quantity and quality under an approved Sediment and Stormwater Plan, one of the following is met:
 - 3.7.13.1.4.1 Comparison of the existing parcel curved number (CN) based upon the Department's 2017 aerial photography to the proposed CN for the parcel after non-residential construction results in less than one whole number change in the CN, or
 - 3.7.13.1.4.2 No new impervious area is proposed as a result of construction.
 - 3.7.13.2 Conditions:
 - 3.7.13.2.1 Discharges from rooftops will be disconnected to the maximum extent practicable using one of the following methods or another method approved by the Department or Delegated Agency:
 - 3.7.13.2.1.1 Individual downspouts will discharge to lawn or landscape area.
 - 3.7.13.2.1.2 Discharges from downspouts will be collected to discharge to a rain garden.
 - 3.7.13.2.1.3 Discharges from downspouts will be collected in rain barrels or cisterns for reuse.
 - 3.7.13.2.2 Driveways, sidewalks, patios, and other impervious surfaces will be graded to sheet flow to lawn or other pervious areas to the maximum extent practicable.
 - 3.7.13.2.3 Unless waived in writing by the Department or Delegated Agency a construction site stormwater management plan in accordance with Department or Delegated Agency guidance for this Standard Plan shall be followed.
- 3.7.14 Tax Ditch Maintenance
 - 3.7.14.1 Applicability criteria. Land disturbance is for maintenance of a recorded tax ditch having a design on file with the Department.
 - 3.7.14.2 Conditions:
 - 3.7.14.2.1 Construction will follow "Principles and Guidelines for Planning, Constructing, and Maintaining Drainage Ditches in the State of Delaware", June 1995.
 - 3.7.14.2.2 Following maintenance the tax ditch elevations will be returned to design elevations.
- 3.7.15 Minor Linear Utility Disturbance
 - 3.7.15.1 Applicability criteria.
 - 3.7.15.1.1 Disturbance will be for linear utility construction, having a maximum width of disturbance of 40 feet.
 - 3.7.15.1.2 One of the following is met:
 - 3.7.15.1.2.1 Total disturbance is 1.0 acre or less; or
 - 3.7.15.1.2.2 Total disturbance is 5.0 acres or less, and
 - 3.7.15.1.2.2.1 No greater than 1.0 acre will be disturbed at any time throughout the course of construction, and
 - 3.7.15.1.2.2.2 Land cover will be restored to the pre-construction hydrologic condition. In the case of forest clearing, land cover will be restored to an equivalent meadow condition.
 - 3.7.15.2 Conditions:

- 3.7.15.2.1 Stabilization with seed and mulch or seed and stabilization matting will occur daily so that no greater than one acre will be disturbed at any one time.
- 3.7.15.2.2 Construction through sensitive areas, including stream and wetland crossings, will be accomplished through directional drilling, with land disturbance happening outside of the sensitive area.
- 3.7.16 Stormwater Facility Maintenance
 - 3.7.16.1 Applicability criteria. Land disturbance is for maintenance of a stormwater management facility having a design on file with the Department or Delegated Agency.
 - 3.7.16.2 Conditions:
 - 3.7.16.2.1 Construction will follow an Operation and Maintenance Plan in place for the stormwater management facility if one exists.
 - 3.7.16.2.2 Following maintenance the stormwater management facility elevations will be returned to design elevations.
- 3.7.17 Agricultural Structure Construction
 - 3.7.17.1 Applicability criteria.
 - 3.7.17.1.1 Construction is for an agricultural structure as defined in Section 2.0 of these regulations.
 - 3.7.17.1.2 The total land disturbance will not exceed 5.0 acres.
 - 3.7.17.1.3 The pre-construction land use at the location of the agricultural structure is historically agricultural use (farmstead, crop field, pasture). Within the disturbed area, the pre-development land use is not classified as forest. If any portion of the pre-construction land use is forest, a detailed plan is required.
 - 3.7.17.1.4 The proposed impervious area as a result of construction of an agricultural structure is less than 10% of the watershed area to the point of discharge from the parcel.
 - 3.7.17.2 Conditions:
 - 3.7.17.2.1 Nutrient management plan recommendations will be followed for the project, during construction and throughout the life of the project.
 - 3.7.17.2.2 Discharges from rooftops will be disconnected from impervious surfaces to the maximum extent practicable. Downspouts, if applicable, will discharge to a stabilized area, such as grass or gravel.
 - 3.7.17.2.3 Impervious surfaces, including compacted gravel roadways, will be graded to sheet flow to pervious areas to the maximum extent practicable.
- 3.7.18 Poultry House Construction
 - 3.7.18.1 Applicability criteria.
 - 3.7.18.1.1 Construction is for one or more poultry houses and associated structures including generator and pump structures, composter structures and manure storage structures. Other agricultural structures shall comply with subsection 3.7.17.
 - 3.7.18.1.2 Poultry house layout, including the general dimensions of structures, roadways and loading areas, as well as spacing between structures will adhere to Department or Delegated Agency guidance for this Standard Plan.
 - 3.7.18.2 Conditions.
 - 3.7.18.2.1 Nutrient management plan recommendations will be followed for the project, during construction and throughout the life of the project.
 - 3.7.18.2.2 To the maximum extent practicable, runoff from impervious surfaces including roof, roadways, and loading areas will be conveyed to an ephemeral wetland forebay. Ephemeral wetland forebay volume calculations based on Department or Delegated Agency guidance for this Standard Plan will be submitted.
 - 3.7.18.2.3 A detention basin will be provided to manage the runoff from the Conveyance (Cv) and Flooding (Fv) events. For poultry houses constructed where there is no forest clearing, the volume of the detention basin may be included in the ephemeral wetland forebay to make one detention structure. Detention basin volume calculations based on Department or Delegated Agency guidance for this Standard Plan will be submitted.
 - 3.7.18.2.4 Vegetated stabilization will be completed in accordance with Department or Delegated Agency guidance for this Standard Plan.

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3.7.19 Demolition

3.7.19.1 Applicability criteria.

3.7.19.1.1 Land disturbance is for demolition and removal of a structure, building foundation, building slab, roadway, driveway, parking lot, sidewalk, or other amenity resulting in exposed soil, including access and staging for demolition activities.

3.7.19.1.2 Total disturbance is 5.0 acres or less, and no greater than 1.0 acre will be disturbed at any time throughout the course of construction.

3.7.19.1.3 Disturbed land will be restored to a stabilized surface. No additional impervious surfaces shall be created as part of the demolition project.

3.7.19.2 Conditions. Stabilization with seed and mulch or seed and stabilization matting will occur within 14 days of completion of demolition.

3.7.20 BMP Construction and Retrofit

3.7.20.1 Applicability criteria:

3.7.20.1.1 The construction will provide either:

3.7.20.1.1.1 RPv, Cv or Fv reduction by implementing Post Construction Stormwater BMP, retrofitting a degraded BMP, or creating a floodplain;

3.7.20.1.1.2 Stabilization of an eroding area.

3.7.20.1.2 The total land disturbance will not exceed 5.0 acres.

3.7.20.1.3 Within the disturbed area, the pre-development land use is not classified as forest.

3.7.20.1.4 The total impervious area proposed (roof, driveway, sidewalks, auxiliary structures, etc.) will not exceed the lesser of 7,500 square feet or 15% of the disturbed area.

3.7.20.2 Conditions:

3.7.20.2.1 The area must be returned grassed or vegetated condition (excluding permeable pavement installation and the allowable impervious areas), after construction and throughout the life of the project.

3.7.20.2.2 Discharges from added impervious areas will be disconnected to the maximum extent practicable using one of the following methods or another method approved by the Department or Delegated Agency:

3.7.20.2.2.1 Impervious areas will discharge to grassed or vegetated area.

3.7.20.2.2.2 Discharges from impervious area will be collected to discharge to a rain garden.

3.7.20.2.2.3 Discharges from impervious areas will be collected in rain barrels or cisterns for reuse.

3.7.21 Minor Bridge and Culvert Construction

3.7.21.1 Applicability criteria:

3.7.21.1.1 The disturbed area for construction of the improvements will not exceed 1.0 acre.

3.7.21.1.2 The net increase in impervious area will not exceed 5,000 square feet.

3.7.21.1.3 Land cover will be restored to the pre-construction hydrologic condition or better.

3.7.21.2 Conditions:

3.7.21.2.1 Impervious surfaces will be graded to sheet flow to pervious areas to the maximum extent practicable.

3.7.21.2.2 All non-impervious disturbed area will be vegetated to original or better condition.

3.7.22 Sidewalk, Trail, or Other Linear Impervious Surfaces

3.7.22.1 Applicability criteria:

3.7.22.1.1 Disturbance will be for construction of a sidewalk, trail or other linear impervious surface with total disturbance not to exceed 5.0 acres.

3.7.22.1.2 No greater than 1.0 acre disturbed at any one time throughout the course of construction.

3.7.22.1.3 Within the disturbed area, the pre-development land use is not classified as forest.

3.7.22.1.4 For project site locations within an area previously managed for stormwater quantity and quality under an approved Sediment and Stormwater Plan, the post construction condition meets the original stormwater design criteria.

3.7.22.1.5 For project site locations within an area previously unmanaged for stormwater quantity and quality under an approved Sediment and Stormwater Plan, one of the following is met:

3.7.22.1.5.1 Comparison of the existing parcel curve number (CN) based upon the Department's 2017 aerial photography to the proposed CN for the parcel after non-residential construction results in less than one whole number change in the CN, or

3.7.22.1.5.2 No new impervious area is proposed as a result of construction.

3.7.22.2 Conditions:

3.7.22.2.1 Impervious surfaces will be graded to sheet flow to lawn or other pervious areas to the maximum extent practicable.

3.7.22.2.2 Stabilization of exposed soil areas with seed and mulch or seed and stabilization matting will occur daily so that no greater than one acre will be disturbed at any one time.

3.8 Plan Certifications

3.8.1 All detailed plans submitted for review shall be prepared, signed, dated, and sealed by a Licensed Professional in the State of Delaware. It is the obligation of the Licensed Professional in the State of Delaware to ensure that the design of construction site stormwater management best management practices (BMPs) and post construction stormwater management systems meet the requirements in these regulations.

3.8.2 All Sediment and Stormwater Management Plans submitted for approval shall contain certification by the Owner stating that clearing, grading, construction, and development will be accomplished pursuant to the plan.

3.8.3 All Sediment and Stormwater Management Plans for projects having a land disturbance greater than or equal to one acre shall contain a certification by the Owner stating that responsible personnel involved in the land disturbance will have attended and successfully completed the Departmental-sponsored Contractor Training Program before initiation of the project.

3.8.4 All Sediment and Stormwater Management Plans shall contain certification by the Owner granting the right of either the Department or Delegated Agency or both to conduct on-site reviews.

3.9 Before project completion the Owner shall submit a final post construction stormwater management Operation and Maintenance Plan for the entire stormwater management system. Operation and Maintenance Plans remain valid for the life of the stormwater management system.

3.10 Post construction verification documents shall be submitted to the Department or Delegated Agency within 60 calendar days of completion for stormwater management systems. The post construction verification documents shall compare the designed and constructed elements of the stormwater management system, and bear the seal of a Licensed Professional in the State of Delaware. A final construction review and approval by the Department or Delegated Agency is required before a financial guarantee shall be released, and before a Notice of Completion may be issued.

18 DE Reg. 396 (11/01/14)

22 DE Reg. 680 (02/01/19)

4.0 Performance Criteria for Construction Site Stormwater Management

4.1 All construction site stormwater management practices shall be consistent with the current version of the Delaware Erosion and Sediment Control (ESC) Handbook. A proposal to use temporary control measures that are not included in the current version of the Delaware ESC Handbook shall be submitted to the Department for approval. The proposal shall be accompanied by supporting documentation as necessary to determine appropriateness of the proposed temporary control measure for the proposed use.

4.2 A sequence of construction shall be provided on plans describing the relationship between the implementation and maintenance of erosion and sediment controls, including permanent and temporary stabilization and the various stages or phases of earth disturbance and construction.

4.3 Best available technology (BAT) shall be employed to manage turbid discharges in accordance with requirements of 7 Del.C. Ch. 60, and the current Delaware Construction General Permit (CGP).

4.4 Limits on Land Disturbance

4.4.1 Unless an exception is approved on a case by case basis for a specific type of activity by the appropriate plan approval agency, not more than 20 acres may be disturbed at any one time. This will necessitate the phasing of construction on sites in excess of 20 acres to minimize areas exposed of ground cover and reduce erosion rates. Disturbance of a second 20 acre section may not proceed until temporary or permanent stabilization of the first 20 acre section is accomplished.

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- 4.4.2 If approved by the Department or Delegated Agency sites may disturb greater than 20 acres. Sites having disturbed areas greater than 20 acres shall comply with the following:
- 4.4.2.1 Construction site stormwater management BMPs shall be designed for disturbed drainage areas greater than 20 acres and shall have supporting design computations, including but not limited to storage, conveyance, stability, and treatment capabilities based on the 2-year storm event with bare earth conditions.
 - 4.4.2.1.1 Conveyance measures shall be designed to have adequate capacity for conveyance of flow in a non-erosive manner.
 - 4.4.2.1.2 Storage practices shall be designed to adequately contain the volume of the design storm event.
 - 4.4.2.2 Reasonable precautions shall be taken to control dust at all times. Dust shall be controlled by applying adequate amounts of water, chemical stabilizer, or other effective dust suppressant.
- 4.4.3 All plans shall include a limit of disturbance line (L.O.D.) establishing the maximum necessary extent of land disturbance required to implement and accomplish the permitted site construction for land disturbing activities subject to these Regulations.

4.5 Stabilization

- 4.5.1 Following soil disturbance or re-disturbance, Permanent or Temporary Stabilization shall be completed for perimeter sediment controls, topsoil stockpiles, and all other disturbed or graded areas on the project site within 14 calendar days unless more restrictive Federal requirements apply.
- 4.5.2 Documentation of soil testing and materials used for temporary or permanent stabilization including but not limited to soil test results, seed tags, soil amendment tags, etc. shall be provided to the Department or Delegated Agency to verify that the permanent or temporary stabilization has been completed in accordance with the approved plan.
- 4.5.3 The Department or Delegated Agency may require additional soil testing and reapplication of permanent or temporary stabilization in accordance with the specifications in the Delaware Erosion and Sediment Control Handbook, or alternative measures that provide functional equivalency.
- 4.5.4 Release of either a financial guarantee or issuance of Notice of Completion or both shall not occur until final stabilization of exposed areas is achieved.

18 DE Reg. 396 (11/01/14)**22 DE Reg. 680 (02/01/19)****5.0 Performance Criteria for Post Construction Stormwater Management**

- 5.1 Post construction stormwater management plans shall be designed in accordance with the following:
- 5.1.1 Stormwater management designs shall reduce runoff, mimic natural watershed hydrologic processes, and cause no adverse impact to property. This shall be accomplished by treating runoff at the source, disconnecting impervious surfaces, preserving or enhancing natural flow paths and vegetative cover, conserving or enhancing natural open spaces and riparian areas, and other measures that simulate natural watershed hydrologic processes.
 - 5.1.2 Land disturbance including but not limited to residential, commercial, institutional, agricultural structures, or industrial developments shall apply these stormwater management criteria to land development as a whole. Smaller sites, such as individual residential lots in new subdivisions that are part of a larger, common plan of development or sale shall be subject to these requirements as part of that larger plan.
 - 5.1.3 No portion of a stormwater system that is owned and maintained by a joint ownership such as a homeowner's association or maintenance corporation in a residential development shall be located on private property, except for those areas designated as common areas, community open space, community-owned property, or jointly owned property. Shared facilities located on private property shall be within a recorded easement. A stormwater system owned by a single Owner, as in the case of a commercial, institutional or industrial development, may be located on that Owner's private property.
 - 5.1.4 If runoff from a land development will flow to a permitted or non-permitted municipal separate storm sewer system (MS4) or other publicly maintained drainage infrastructure, the land development applicant shall notify the system's owner of the intent to discharge into the system before plan approval. The Department, Delegated Agency, or system's owner may require the land development applicant to demonstrate that the system has adequate conveyance.

- 5.1.5 All applications that propose to use infiltration or natural recharge shall include a soils investigation in accordance with subsection 12.1 of these regulations to determine the appropriate design criteria.
- 5.1.6 Water quality and water quantity management shall be provided in accordance with the requirements set forth in this section unless the proposed project is limited to reconstruction of existing paved areas, re-grading and replacement of existing pervious areas, or rebuilding or repairing of structures damaged by fire, flood, wind, or other natural disaster and where the disturbed area will return to the original hydrologic condition and land cover at the conclusion of the project.
- 5.1.7 Post construction stormwater management BMPs shall meet the following requirements:
 - 5.1.7.1 Post construction stormwater management BMPs shall be designed and constructed in accordance with all applicable subsections of Section 11.0 and Section 12.0 of these regulations.
 - 5.1.7.2 A single BMP may require compliance with more than one subsection of Section 11.0 based upon its function and design.
- 5.2 Resource Protection Event Criteria
 - 5.2.1 The Resource Protection Event criteria provide runoff management measures to reduce the volume of stormwater runoff generated on a site, recharge groundwater, minimize impacts to downstream channels from runoff leaving the site, and reduce pollutant loads discharged into receiving waters.
 - 5.2.2 The Resource Protection Event Volume (RPv) is the post-development annualized volume of runoff produced by the storm having a ninety-nine percent (99%) probability of occurrence, or the 1-year, 24-hour rainfall event. It is equal to the runoff volume generated by a 2.7" storm event.
 - 5.2.3 Compliance with subsection 5.2 shall be accomplished to the maximum extent practicable through the following provisions:
 - 5.2.3.1 Treatment of runoff from the RPv event with Best Management Practices (BMPs) as set forth in Section 11.0 shall meet the following requirements:
 - 5.2.3.1.1 For forested areas within the site Limit of Disturbance (LOD), the treatment volume shall be the difference in the post-developed condition and an equivalent wooded condition, up to a maximum of 1" of runoff.
 - 5.2.3.1.2 For non-forested areas within the site LOD, the treatment volume shall be the difference in the post-developed condition and an equivalent grassed open space condition, up to a maximum of 1" of runoff.
 - 5.2.3.1.3 The treatment volume for existing impervious areas within the site LOD shall meet the requirements for redevelopment in accordance with subsection 5.6 of these regulations.
 - 5.2.3.1.4 BMPs that treat more than 1" of runoff may be used to over-manage LOD subareas within a site that are untreated or partially treated.
 - 5.2.3.1.5 Any additional runoff volume treated by BMPs in excess of that necessary to achieve site compliance in accordance with subsection 5.2 may be used as a credit in accordance with Section 13.0 Offset Provisions.
 - 5.2.3.2 If additional measures are necessary to manage the remainder of runoff from the RPv to achieve the pre-development runoff rate from the RPv, then additional BMPs shall be utilized to achieve the pre-development runoff rate.
 - 5.2.3.3 An offset shall be provided in accordance with Section 13.0 of these regulations for any portion of the RPv that does not meet the requirements of subsection 5.2.3.1 above.
 - 5.2.4 Projects that qualify for and meet standard plan criteria in accordance with subsection 3.7 of these regulations shall be considered in compliance with the Resource Protection Event criteria.
- 5.3 Conveyance Event Criteria
 - 5.3.1 The Conveyance Event criteria provide runoff management measures to minimize impacts to downstream properties, channels, and structures by optimizing watershed conveyance and hydrograph timing.
 - 5.3.2 The Conveyance Event Volume (Cv) is the volume of runoff produced by the post-development storm having a ten percent (10%) annual probability of occurrence, or the 10-year, 24-hour rainfall event.
 - 5.3.3 Compliance with subsection 5.3 shall be accomplished through the following provisions:
 - 5.3.3.1 The Cv shall be managed using BMPs as set forth in Section 11.0 such that there is no adverse impact by limiting the increase in the downstream post-developed water surface elevation to no more than 0.05 feet; or

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- 5.3.3.2 Improving the existing downstream conveyance system to the point where the downstream condition meets the "no adverse impact" criteria of subsection 5.3.3.1; but no farther than the point where the LOD is less than 10% of the contributing drainage area; or
 - 5.3.3.3 Provisions will be made or exist for a non-erosive conveyance system to tidal waters by either a closed drainage system or by open channel flow that has adequate conveyance for the Cv; or
 - 5.3.3.4 Demonstration that the location of a project within a watershed would aggravate flooding or channel erosion by the imposition of peak control requirements, as evidenced by a downstream analysis that shows the inflection point of the site hydrograph occurs prior to and is less than the peak of the upstream hydrograph; or
 - 5.3.3.5 The site LOD comprises 10% or less of the total upstream contributing drainage area at the point of discharge for sites that discharge directly to a natural stream, waterbody, or tax ditch; or
 - 5.3.3.6 The proposed project will generate only a de minimis discharge and will have no adverse impact on the receiving wetland, watercourse or downstream property as determined on a case-by-case basis.
- 5.3.4 Projects that qualify for and meet standard plan criteria in accordance with subsection 3.7 of these regulations shall be considered in compliance with the Conveyance Event criteria.
- 5.4 Flooding Event Criteria
- 5.4.1 The Flooding Event Criteria provide runoff management measures to reduce downstream flooding by optimizing watershed storage and hydrograph timing.
 - 5.4.2 The Flooding Event Volume (Fv) is the volume of runoff produced by the post-development storm having a one percent (1%) probability of occurrence, or the 100-year, 24-hour rainfall event.
 - 5.4.3 Compliance with subsection 5.4 shall be accomplished through the following provisions:
 - 5.4.3.1 The Fv shall be managed using BMPs as set forth in Section 11.0 such that there is no adverse impact by limiting the increase in the downstream post-developed water surface elevation to no more than 0.05 feet; or
 - 5.4.3.2 Improving the existing downstream conveyance system so that the downstream condition meets the "no adverse impact" criteria of subsection 5.4.3.1; or
 - 5.4.3.3 Provisions will be made or exist for a non-erosive conveyance system to tidal waters by either a closed drainage system or by open channel flow that has adequate conveyance for the Fv; or
 - 5.4.3.4 Demonstration that the location of a project within a watershed would aggravate downstream flooding or channel erosion by the imposition of peak control requirements, as evidenced by a downstream analysis that shows the inflection point of the site hydrograph occurs prior to the peak of the upstream hydrograph; or
 - 5.4.3.5 The site LOD comprises 10% or less of the total upstream contributing drainage area at the point of discharge for sites that discharge directly to a natural stream, waterbody, or tax ditch; or
 - 5.4.3.6 The proposed project will generate only a de minimis discharge and will have no adverse impact on the receiving wetland, watercourse, or downstream property as determined on a case-by-case basis.
 - 5.4.4 Projects that qualify for and meet standard plan criteria in accordance with subsection 3.7 of these regulations shall be considered in compliance with the Flooding Event criteria.
- 5.5 Alternative Criteria
- 5.5.1 Land development that discharges to State Waters included in a Designated Watershed, or other watershed management plan approved in accordance with these Regulations, shall meet the alternative criteria identified in the approved watershed plan.
 - 5.5.2 The Department may require alternative stormwater treatment practices or criteria if a receiving waterbody has been identified as impaired, or designated with a specific pollutant reduction target necessary to meet State of Delaware water quality regulations. Such requirements shall be adopted in accordance with Title 29.
 - 5.5.3 The Department may require alternative stormwater treatment practices designed to reduce pollutant loading from a specific source, including but not limited to the discharge from an industrial site regulated under the National Pollutant Discharge Elimination System (NPDES).
- 5.6 Redevelopment Criteria

- 5.6.1 The Department recognizes the benefits of redevelopment. The requirements under subsection 5.6 are intended to encourage redevelopment while establishing compliance criteria that meet the overall goals and intent of these regulations.
- 5.6.2 Compliance with the Resource Protection Event as defined in subsection 5.2.2 shall be accomplished to the maximum extent practicable for redevelopment projects through the following provisions:
 - 5.6.2.1 In the case of redevelopment of a contaminated or Brownfield site, a remediation plan approved by the Department shall meet the stormwater management goals and the intent of these regulations with prior consent and subsequent approval by the Department or Delegated Agency.
 - 5.6.2.2 Redevelopment resulting in less than one acre of disturbed area shall adhere to subsection 3.7 of these Regulations. Projects that cannot adhere to subsection 3.7 shall comply with the applicable subsections of 5.6.2.
 - 5.6.2.3 Redevelopment on sites with stormwater management systems designed and functioning in accordance with the Delaware Sediment and Stormwater Regulations first promulgated on January 23, 1991:
 - 5.6.2.3.1 Redevelopment resulting in a reduction of impervious surface where no known drainage issues exist or will be created and there are no outstanding stormwater-related maintenance issues to be resolved or addressed shall be considered in compliance with these Regulations.
 - 5.6.2.3.2 Redevelopment resulting in an increase in impervious surface where no known drainage issues exist or will be created shall employ treatment or runoff reduction practices to achieve an equivalent open space in good condition for the increased impervious surface.
 - 5.6.2.4 Redevelopment on sites without stormwater management systems designed and functioning in accordance with the Delaware Sediment and Stormwater Regulations first promulgated on January 23, 1991:
 - 5.6.2.4.1 Redevelopment resulting in a reduction of 15% or greater in impervious surface shall be considered in compliance with these Regulations.
 - 5.6.2.4.2 Redevelopment resulting in a reduction of less than 15% impervious surface where no known drainage issues exist or will be created shall employ treatment or runoff reduction practices to achieve an equivalent 15% reduction in effective imperviousness.
 - 5.6.2.4.3 Redevelopment resulting in an increase in impervious surface shall employ treatment or runoff reduction practices to achieve an equivalent 15% reduction in effective imperviousness for existing impervious areas and an equivalent open space in good condition for an area equivalent to the increase in impervious surface.
 - 5.6.2.5 For those cases in which the minimum runoff reduction requirements are not met an offset in accordance with Section 13.0 shall be provided for any portion of the Rpv that does not meet the requirements of subsections 5.6.2.3 and 5.6.2.4 above.
- 5.6.3 Any redevelopment project, including a contaminated or Brownfield site, that increases the rate or duration of flow to a new or existing point of discharge during the Conveyance Event shall comply with the requirements of subsection 5.3.
- 5.6.4 Any redevelopment project, including a contaminated or Brownfield site, that increases the rate or duration of flow to a new or existing point of discharge during the Flooding Event shall comply with the requirements of subsection 5.4.

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6.0 Construction Review of Sediment and Stormwater Management Plan

6.1 Owner Responsibilities

- 6.1.1 The Owner shall ensure that all elements of the approved Sediment and Stormwater Management Plan are implemented and construction site stormwater management BMPs and post construction stormwater management systems are installed and maintained in accordance with that plan. All construction sites shall comply with these regulations.
- 6.1.2 The Owner shall comply with the requirements contained in Chapter 60 of Title 7 including the current Delaware Construction General Permit (CGP).

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- 6.1.3 The Department or Delegated Agency shall have the authority to require revisions to the approved Sediment and Stormwater Management Plan. The Owner is responsible for implementation of plan revisions when deficiencies are noted on the site by the Department or Delegated Agency.
- 6.1.4 The Owner shall certify to the Department or Delegated Agency that responsible personnel involved in the construction project have successfully completed the Contractor Training Program before initiation of a land disturbing activity. Responsible personnel shall implement the Sediment and Stormwater Management Plan fully through daily oversight of the construction site and guidance of construction personnel while a land disturbing activity is taking place.
- 6.1.5 When directed by the Department or Delegated Agency, the Owner shall acquire the services of a third party Certified Construction Reviewer to perform weekly construction reviews of the approved Sediment and Stormwater Management Plan elements as well as construction reviews of installation of stormwater management systems. The Department or Delegated Agency may, at its discretion and following a written request, modify Certified Construction Reviewer reporting frequency for a particular site if site conditions warrant.
- 6.1.6 Sediment and Stormwater Management Plans approved by the Department shall have a Certified Construction Reviewer.
- 6.1.7 All costs and fees associated with the use of Certified Construction Reviewers shall be the responsibility of the Owner.
- 6.1.8 The Owner shall notify the Department or Delegated Agency any time a new Certified Construction Reviewer begins providing construction review for the site.
- 6.1.9 Upon written notice by the Department, Delegated Agency, or Certified Construction Reviewer, any portion of the work which does not comply with the approved Sediment and Stormwater Management Plan or these regulations shall be corrected by the Owner within the time period specified in the written notice.
- 6.2 Contractor Training Requirements
 - 6.2.1 A certificate of attendance shall be issued to Responsible Personnel who have attended and successfully completed the Contractor Training Program sponsored or approved by the Department.
 - 6.2.2 Contractor Training shall be required of a foreperson or superintendent who is in charge of on-site clearing and land disturbing activities for construction projects subject to the requirements of these regulations.
 - 6.2.3 The Contractor Training Program certification shall be valid until the Department notifies the individual or announces in local newspapers that additional training is required due to a change in course content.
 - 6.2.4 The Department shall provide public notification of the date and location of training programs for attendance by responsible personnel and other interested persons.
 - 6.2.5 Enrollment of existing and future responsible personnel is the responsibility of individuals or their employers.
 - 6.2.6 Responsible personnel shall, during active land disturbance, provide daily oversight for site compliance with Chapters 40 and 60 of Title 7 and these regulations.
 - 6.2.7 Responsible personnel shall attend the pre-construction meeting.
- 6.3 Certified Construction Reviewer Requirements
 - 6.3.1 The Certified Construction Reviewer shall be responsible for reviewing construction activities and reporting on the adequacy of construction in accordance with the approved Sediment and Stormwater Management Plan, in addition to the following items:
 - 6.3.1.1 Provision of a construction review on at least a weekly basis until released from review responsibility by the Department or Delegated Agency.
 - 6.3.1.2 The Department or Delegated Agency may, at its discretion and following a written request, modify Certified Construction Reviewer reporting frequency for a particular site if site conditions warrant.
 - 6.3.1.3 Provision of a construction review of stormwater management system construction at a frequency as needed to accurately complete the stormwater BMP construction checklist.
 - 6.3.1.4 Inform the Department or Delegated Agency, the Owner, and the contractor, by a written construction review report of site conditions including any inconsistencies with or inadequacies of the approved plan within five calendar days of the construction review.
 - 6.3.1.5 Referral of the project through the Delegated Agency to the Department for appropriate enforcement action if the Owner fails to address the items contained in the written construction

review report. Verbal notice shall be made to the Department within two calendar days and written notice shall be provided to the Department within five calendar days.

6.3.1.6 Prior to the CCR halting reporting activities the CCR must contact the Department or Delegated Agency.

6.3.2 The Certified Construction Reviewer shall function under the direction of a registered professional engineer (P.E.) licensed to practice engineering in the State of Delaware. The following applies to the P.E.'s responsibilities:

6.3.2.1 The P.E. shall be responsible for overseeing and verifying the accuracy of the CCR review.

6.3.2.2 The P.E. shall be responsible for maintaining an ongoing knowledge of the site conditions through periodic site visits or discussions with the CCR.

6.3.2.3 The P.E. shall sign the CCR reports. The P.E. shall only sign CCR reports that were prepared under their direct supervision for sites where the P.E. has knowledge of the site conditions.

6.3.3 Certified Construction Reviewers shall attend and successfully complete the Departmental sponsored or approved Certified Construction Reviewer course. The Certified Construction Reviewer shall be responsible for reviewing construction activities and reporting on the adequacy of construction in accordance with the approved Sediment and Stormwater Management Plan, these regulations, and training received in the Certified Construction Reviewer training course.

6.3.4 Certification as a CCR shall be valid for five years. Recertification may extend certification for an additional five years.

6.3.5 A Certified Construction Reviewer who is not performing the duties prescribed by subsection 6.3 of this regulation may be referred by the local Delegated Agency to the Department for action by providing written notification to the Department and supporting documentation.

6.3.6 In a situation where a Certified Construction Reviewer's certification is being suspended or revoked, an opportunity for hearing before the Secretary or his designee shall be provided. During a suspension, the Certified Construction Reviewer shall not be allowed to provide construction reviews in accordance with these regulations on any construction sites within the state.

6.4 Department or Delegated Agency Construction Reviews

6.4.1 The Department or Delegated Agency may, at a reasonable time, visit a site subject to these regulations to determine compliance with these regulations, including implementation of the Sediment and Stormwater Management Plan.

6.4.2 The Department or Delegated Agency shall conduct regular reviews of the construction site at a frequency to ensure that all elements of the approved Sediment and Stormwater Management Plan are implemented and all construction site stormwater management BMPs and post construction stormwater management systems are installed and maintained in accordance with that plan.

6.4.3 All Department or Delegated Agency construction reviews shall be documented in writing with a copy provided to the Owner. The review report shall document site conditions relevant to the Sediment and Stormwater Management Plan, identify deficiencies that warrant correction, and provide a time period for the Owner to complete corrective action.

6.4.4 When the Department or Delegated Agency determines a deficiency in the approved Sediment and Stormwater Management Plan, a revision to the approved plans may be required. A change to the approved Sediment and Stormwater Management Plan shall be approved by the Department or Delegated Agency before construction.

6.5 Required Construction Reviews and Notification Steps

6.5.1 The Owner shall notify the Department or Delegated Agency in writing at least five calendar days before the initiation of construction. The notification shall include the contact information for the responsible person. The notification shall verify that the Sediment and Stormwater Management Plan for the project has been approved and that permit coverage for Storm Water Discharges Associated with Construction Activity has been gained through submittal of a Notice of Intent to the Department. If there is a Certified Construction Reviewer requirement for the site, the application for Certified Construction Reviewer shall be included with the notification.

6.5.2 A pre-construction meeting shall be required. The pre-construction meeting shall be held on site, unless another location is approved by the Department or Delegated Agency on a case-by-case basis. The required attendees for a pre-construction meeting are the owner or owner's representative, the site project

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manager, site contractor, Certified Construction Reviewer (if required), the Responsible Person, and the Department or Delegated Agency representative.

- 6.5.3 The Department or Delegated Agency shall determine when Standard Plan applications require a pre-construction meeting and construction reviews based on the project type and land disturbance on a case-by-case basis.
- 6.5.4 Upon completion of installation of perimeter controls, the Department or Delegated Agency shall conduct a perimeter control review before commencement of bulk grading or other construction activities on the site.
- 6.5.5 All stormwater management systems shall be reviewed during construction with enough frequency to document that the system has been constructed in accordance with the approved Sediment and Stormwater Management Plan, the design specifications, and the appropriate stormwater management system construction checklist. The Owner shall provide adequate notice to the Department or Delegated Agency and Certified Construction Reviewer, if applicable, before initiating construction of stormwater management systems. The Department, Delegated Agency, or Certified Construction Reviewer shall be responsible for conducting and documenting these reviews, as required. Photographic documentation of construction of the stormwater management system is required.
- 6.5.6 Upon project completion a final construction review shall be conducted and a final review report shall be completed by the Department or Delegated Agency to ensure compliance with the approved Sediment and Stormwater Management Plan. The Department or Delegated Agency shall issue a Notice of Completion for a project when all of the following criteria have been met:
 - 6.5.6.1 All items and conditions of the approved Sediment and Stormwater Management Plan have been satisfied.
 - 6.5.6.2 Post construction verification documents demonstrate that the stormwater management systems have been constructed in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.
 - 6.5.6.3 Operation and Maintenance Plan has been approved by the Department or Delegated Agency.
 - 6.5.6.4 Final stabilization of disturbed areas on the site has been achieved.
 - 6.5.6.5 A copy of the approved Record Plan showing easements or maintenance notes associated with the approved Sediment and Stormwater Management Plan has been submitted to the Department or Delegated Agency.

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7.0 Post Construction Maintenance of Stormwater Management Systems

- 7.1 Stormwater management systems constructed to comply with 7 **Del.C.** Ch. 40 and these regulations shall be maintained in accordance with the provisions of this section.
 - 7.1.1 Maintenance responsibility lies with the Owner until the time that a legal transfer of ownership has been executed. Prior notice of the transfer shall be provided to the Department or Delegated Agency 30 business days before the transfer occurs.
 - 7.1.2 The stormwater management system shall run with the land and be binding upon the landowner and any successors in interest. Maintenance of these systems shall ensure that the stormwater management system is performing in accordance with the approved engineered design, within the tolerances of the accepted post construction verification documents, and in compliance with these regulations.
 - 7.1.3 The Owner of a stormwater management system established in accordance with these regulations may offer for dedication to a delegated agency, public entity, municipality, stormwater utility, or private entity, a stormwater management system, together with the easements and appurtenances as may be reasonably necessary for the proper functioning of the system.
 - 7.1.4 All stormwater management systems must be designed so as to be accessible for maintenance. If required, a maintenance right-of-way or easement must extend to the stormwater management system from a public or private road. The easement or right of way shall specify the ownership and party responsible for maintenance.
- 7.2 Owner Responsibilities
 - 7.2.1 The Owner shall ensure that the stormwater management system is functioning in accordance with the approved engineering design, within the tolerances of the accepted post construction verification

documents, and in compliance with these regulations. The Owner will promptly repair and restore stormwater management systems.

7.2.1.1 Such repairs, restoration, or maintenance shall be conducted in accordance with the approved Sediment and Stormwater Management Plan, the Operation and Maintenance Plan, Standard Guidelines for Operation and Maintenance of Stormwater Management Systems, and directions provided by the Department or Delegated Agency.

7.2.1.2 When the Department or Delegated Agency gives direction for maintenance, those maintenance activities shall be conducted by the Owner within the time period established by the Department or Delegated Agency.

7.2.2 Any change made to the stormwater management system shall require the Owner to obtain approval of the Department or Delegated Agency, including updating of the Operation and Maintenance Plan and Planting Plan details as necessary.

7.2.3 The Owner shall submit a scope of work for non-routine maintenance to the Department or Delegated Agency for approval prior to implementation.

7.2.4 Maintenance responsibilities may be shared through a legal agreement between the Owner and another entity such as a delegated agency, public utility, municipality, stormwater utility, maintenance company, or other private entity. Responsibility for maintenance shall be joint and several among the parties to the agreement to share those responsibilities.

7.2.5 If the Sediment and Stormwater Management Plan includes structural or nonstructural stormwater management measures located within a tax ditch right-of-way the Owner shall enter into an agreement with the tax ditch organization for maintenance of those stormwater management measures.

7.2.6 The Owner shall provide the Department or Delegated Agency with the contact information for the current person responsible for receiving the Department or Delegated Agency maintenance review reports.

7.3 Maintenance Reviews

7.3.1 The Department, Delegated Agency, or duly authorized agent shall conduct maintenance reviews of completed stormwater management systems. The Department, Delegated Agency, or duly authorized agent shall have the right of entry and access at reasonable times to perform stormwater management system maintenance reviews.

7.3.2 The maintenance review performed by the Department, Delegated Agency, or duly authorized agent shall document maintenance and repair needs and any discrepancies from the Operation and Maintenance Plan. A copy of the review shall be provided to the Owner.

7.3.3 The Owner of the stormwater management system shall comply with the conditions of the maintenance review within the timeframe specified by the Department or Delegated Agency.

7.4 Minimum Maintenance Requirements

7.4.1 A properly functioning stormwater management system shall be free of excessive sediment deposition.

7.4.2 A properly functioning stormwater management system shall have well stabilized slopes, swales, and other vegetated areas in accordance with the approved engineered design.

7.4.3 A properly functioning stormwater management system containing trash racks, inlets, outlets, and low flow orifices, where applicable, shall be clear of trash, debris, and sediment.

7.4.4 A properly functioning stormwater management system shall be free of woody vegetation that could impede the performance of any structural component of the stormwater management system.

7.4.5 A properly functioning stormwater management system shall comply with final post construction stormwater management Operation and Maintenance Plan and the applicable BMP Standards and Specifications sheet. The Operation and Maintenance Plan of a stormwater management system shall be composed of the stormwater management BMP facility sheet including the final accepted PCVD.

7.4.6 Trees shall be removed if found growing, on or within 15 feet of all pond embankments, on pond slopes or safety benches, and within 10 feet of structural components, such as pipe inlets.

7.4.7 When the facility is excavated to remove accumulated sediment, the disposal area shall be permanently stabilized so that so that it does not recreate an erosion problem.

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8.0 Enforcement and Penalties

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- 8.1 Any action or failure to act, which violates any of the following: the provisions of this regulation, the requirements of an approved Sediment and Stormwater Management Plan, permit, Notice of Intent, construction review report, notice of violation, or the requirements of a final Operation and Maintenance Plan, may be subject to the provisions of any of the following: 7 Del.C. §§4012, 4013, 4015, and 4016; 7 Del.C. §§6005, 6013, and 6018.
- 8.2 The Delegated Agency may, in addition to local enforcement options, refer a site violation to the Department for additional enforcement action. Referral of a site violation to the Department may initiate a Departmental construction review of the site to verify site conditions. That construction review may result in the following actions:
- 8.2.1 Notification through appropriate means to the Owner and the contractor to comply with the approved Sediment and Stormwater Management Plan within a specified time frame; or
- 8.2.2 Notification of plan inadequacy and the establishment of a date for the Owner to submit a revised Sediment and Stormwater Management Plan to the Department or Delegated Agency and to receive its approval with respect thereto. The Department shall notify the Delegated Agency in a timely manner of what enforcement action is taken on the site.
- 8.3 Failure of the person engaged in the land disturbing activity or the contractor to comply with Departmental requirements may result in the following actions in addition to other penalties as provided in Chapter 40 of Title 7 of the Delaware Code.
- 8.3.1 The Department shall have the power to issue a cease and desist order to a person violating any provision of Chapter 40 of Title 7 of the Delaware Code or these Regulations by ordering the person to cease and desist from any site work activity other than those actions necessary to achieve compliance with any administrative order.
- 8.3.2 The Department may request that the appropriate plan approval agency refrain from issuing any further building or grading permits to the person having outstanding violations until those violations have been remedied.

22 DE Reg. 680 (02/01/19)**9.0 Delegation of Program Elements**

- 9.1 The provisions of these regulations may be delegated to the Conservation Districts, counties, municipalities, or State agencies. Initial consideration regarding delegation of program elements shall be given to the Conservation Districts.
- 9.1.1 Program elements that are delegated shall be implemented according to Chapters 40 and 60 of Title 7 of the Delaware Code and these Regulations.
- 9.1.2 Any Delegated Agency may submit documentation to the Department for determination of functional equivalency to the requirements contained in these regulations.
- 9.2 A Conservation District, county, municipality, or State agency requesting or renewing delegation shall submit a written request to the Secretary on or before January 1 of the year immediately preceding the fiscal year for which delegation or renewal of delegation is sought. The request for delegation shall contain sufficient information to determine whether the agency may be considered capable of implementing program elements in accordance with Chapter 40 and these regulations. The Department shall provide guidance to agencies requesting delegation of program elements as to information that shall be submitted with the delegation request.
- 9.3 The Secretary shall grant delegation of program elements to a Conservation District, county, municipality, or State agency seeking delegation that is found capable of implementing program elements in accordance with Chapter 40 and these regulations.
- 9.4 The Secretary shall, in writing, grant or deny delegation on or before April 1 of the year during which delegation is sought. The Secretary shall not deny a request for delegation unless opportunity has been afforded to the appropriate officials from the agency requesting delegation to present arguments. Delegation shall be effective July 1 of that year and extend no more than five years, unless renewed. In the event that the Department does not act on the renewal request by April 1, the Delegated Agency submitting the request would be entitled to continue operating for a subsequent five year time period unless action is taken by the Department to suspend the program.
- 9.5 Delegation of program elements shall be granted for a maximum time period of five years. After five years a new application to the Department must be made. During the period for which delegation has been granted,

the Department will evaluate delegation implementation, coordinate review findings with the Delegated Agency, and determine if the new delegation should be granted.

- 9.6 Based on the Department's evaluation of Delegated Agency performance, the Department may determine that re-delegation of program elements may be granted for a time period of less than five years. A delegation period of less than the maximum of five years shall be considered a probationary delegation and specific improvement items shall be provided to the Delegated Agency. If program implementation is not improved during the probationary delegation, delegation may not be renewed beyond the probationary delegation period.
- 9.7 A Delegated Agency may establish alternative requirements which are compatible with or are more stringent than Departmental requirements. These alternative requirements may be established through local ordinance or statutes. Alternative requirements that are not codified in local statute must have approval of the Department following compliance with the public notice of 7 **Del.C.** §6004.
- 9.8 A Delegated Agency may enter into a cooperative agreement or contract with a third party to assist with program implementation only after Departmental concurrence.

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10.0 Criteria for Implementation of a Stormwater Utility

- 10.1 The implementation of a stormwater utility will necessitate the development of a local utility ordinance prior to its implementation.
- 10.2 The financing of a stormwater utility must be reasonable and equitable so that each user within the stormwater utility jurisdiction, including state agencies, contributes to the financing according to the users' pro rata share of runoff.
- 10.3 The intent of the utility must be clearly defined regarding program components that are to be funded through the utility. Those components may include but are not limited to the following: program administration, planning and engineering, maintenance operations, regulation and enforcement, and capital construction.
- 10.4 The authority for the creation of the stormwater utility and the imposition of charges to finance sediment and stormwater activities is conferred in 7 **Del.C.** Ch. 40. The implementation of a stormwater utility by means of a local ordinance shall not be deemed a limitation or repeal of any other powers granted by State statute.

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11.0 Post Construction BMP Standards and Specifications

- 11.1 Infiltration Practices
- 11.1.1 Infiltration practices are defined as practices that capture and temporarily store the design storm volume before allowing it to infiltrate into the soil over a two day period. Design variants include:
- 11.1.1.1 Infiltration Trench;
 - 11.1.1.2 Infiltration Basin; and
 - 11.1.1.3 Underground Infiltration.
- 11.1.2 Infiltration practices receive 100% retention volume credit (Rv) for the volume stored and infiltrated by the practice.
- 11.1.2.1 The Rpv runoff reduction performance credit for stormwater infiltration is 100% of the retention storage.
 - 11.1.2.2 The Cv runoff reduction performance credit for stormwater infiltration is 100% of the retention storage.
 - 11.1.2.3 The Fv runoff reduction performance credit for stormwater infiltration is 100% of the retention storage.
 - 11.1.2.4 The total nitrogen pollutant reduction performance credit for stormwater infiltration is 100% of the load reduction.
 - 11.1.2.5 The total phosphorus pollutant reduction performance credit for stormwater infiltration is 100% of the load reduction.
 - 11.1.2.6 The total suspended solids pollutant reduction performance credit for stormwater infiltration is 100% of the load reduction.
- 11.1.3 Infiltration Feasibility Criteria

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- 11.1.3.1 Infiltration practices shall be located a minimum horizontal distance of 200 feet from down-gradient slopes greater than 20% unless slope stability calculations demonstrate stable conditions.
- 11.1.3.2 A minimum vertical distance of two feet must be provided between the bottom of the infiltration practice and the seasonal high water table as determined by subsection 12.1 or bedrock layer. The minimum vertical distance of two feet may be relaxed if a groundwater mounding analysis or piezometer testing has been performed by a qualified professional.
- 11.1.3.3 Native soils, in proposed infiltration areas, must have a minimum infiltration rate of one inch per hour. Designers must verify soil permeability by using the on-site soil investigation methods provided in subsection 12.1.
- 11.1.4 Infiltration Conveyance Criteria
 - 11.1.4.1 Infiltration practices must be designed to pass the maximum design storm event (Fv) if the Fv is being routed through the practice rather than bypassing. An earthen emergency spillway designed to convey the Fv shall be cut in natural ground or, if cut in fill, shall be constructed and stabilized with methods to prevent erosion and structural failure.
 - 11.1.4.2 Infiltration basins constructed to meet regulatory stormwater management requirements in the State of Delaware shall be designed and constructed in accordance with the USDA NRCS Pond Code 378, as amended.
- 11.1.5 Infiltration Pretreatment Criteria
 - 11.1.5.1 Every inlet into an infiltration system shall have pretreatment.
 - 11.1.5.2 Exit velocities from the pretreatment shall be non-erosive during the largest design storm that is routed through the facility.
- 11.1.6 Infiltration Design Criteria
 - 11.1.6.1 Infiltration basin side-slopes shall be no steeper than 4H:1V.
 - 11.1.6.2 Stone, when used for infiltration trenches or underground infiltration systems, shall consist of clean, washed aggregate with a maximum of 2.0% passing the #200 sieve. Stone shall have a maximum diameter of 2.5 inches and a minimum diameter of 0.5 inches. A porosity value of 0.4 shall be used in the design of stone reservoirs, although a larger value may be used if underground retention chambers are installed within the reservoir.
 - 11.1.6.3 Infiltration trenches and underground infiltration practices shall include an inspection port to facilitate periodic inspection and maintenance.
 - 11.1.6.4 Geotextile fabric, when used to separate stone from native soil, in an infiltration trench or underground infiltration system shall have a flow rate of 110 gallons per minute per square foot (gal/min/sf) or greater.
 - 11.1.6.5 For design purposes, the field verified infiltration rate shall have a factor of safety applied in accordance with subsection 12.1 to account for potential compaction during construction and to approximate long term infiltration rates.
 - 11.1.6.6 Infiltration practices shall be designed so that the Rpv infiltrates within 48 hours.
 - 11.1.6.7 Infiltration practices shall be designed so that they will:
 - 11.1.6.7.1 Infiltrate the Fv within 72 hours, or
 - 11.1.6.7.2 Dewater the Fv within 72 hours, or
 - 11.1.6.7.3 Manage the Fv on site with no adverse impact.
 - 11.1.6.8 All Infiltration practices must be designed so as to be accessible for maintenance.
 - 11.1.6.8.1 A maintenance right-of-way or easement must extend to the Infiltration practice from a public or private road.
 - 11.1.6.8.2 Adequate maintenance access must extend to the perimeter of the Infiltration practice and outlet structure, if applicable.
 - 11.1.6.8.3 Maintenance access must meet the following criteria:
 - 11.1.6.8.3.1 Minimum width of fifteen feet;
 - 11.1.6.8.3.2 Profile grade that does not exceed 10H:1V; and
 - 11.1.6.8.3.3 Minimum 10H:1V cross slope.
- 11.1.7 Infiltration Construction Criteria

- 11.1.7.1 During site construction, steps shall be taken to prevent compaction and sedimentation of the infiltration practice unless extensive design and construction methods are employed to protect the infiltration practices' ability to infiltrate.
- 11.1.7.2 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.1.7.2.1 Pre-construction meeting.
 - 11.1.7.2.2 Initial site preparation including installation of erosion and sediment controls and sensitive area protection surrounding infiltration practice locations.
 - 11.1.7.2.3 Construction of the embankment, including installation of the principal spillway and the outlet structure. as applicable for infiltration basins.
 - 11.1.7.2.4 Excavation and grading including interim and final elevations. Confirmatory infiltration testing and verification must be completed prior to stone placement for infiltration trenches and underground infiltration.
 - 11.1.7.2.5 Implementation of required stabilization.
 - 11.1.7.2.6 Final construction review including development of a punch list for facility acceptance.
- 11.1.7.3 The infiltration rate and separation from groundwater of the constructed infiltration practice shall be verified prior to completion of construction in accordance with subsection 12.1. The results shall be included with the Post Construction Verification Documentation upon project completion.
- 11.1.7.4 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the infiltration practice has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for infiltration practices are as follows:
 - 11.1.7.4.1 The constructed top of bank elevation may be no lower than the design elevation for top of bank.
 - 11.1.7.4.2 The constructed area of the infiltrating surface shall be no less than 90% of the design surface area.
 - 11.1.7.4.3 The constructed volume of the infiltration practice surface storage shall be no less than 90% of the design volume.
 - 11.1.7.4.4 The constructed elevation of any structure shall be within 0.15 foot of the design.
- 11.1.8 The infiltrating surface shall never be covered by an impermeable material, such as asphalt or concrete.
- 11.2 Bioretention
 - 11.2.1 Bioretention is defined as practices that capture and store stormwater runoff and pass it through a bed of engineered soil media comprised of sand, lignin and organic matter, known as biosoil. Filtered runoff may be collected and returned to the conveyance system, or allowed to infiltrate into the soil. Design variants include:
 - 11.2.1.1 Traditional Bioretention;
 - 11.2.1.2 In-Situ Bioretention including Rain Gardens;
 - 11.2.1.3 Streetscape Bioretention;
 - 11.2.1.4 Engineered Tree Boxes;
 - 11.2.1.5 Stormwater Planters; and
 - 11.2.1.6 Advanced Bioretention systems.
 - 11.2.2 Bioretention Stormwater Credit Calculations
 - 11.2.2.1 The volume management credit for bioretention practices shall be based upon the volume of runoff that is either slowly released or infiltrated from the practice.
 - 11.2.2.2 Advanced Bioretention Systems shall be evaluated on a case-by-case basis and assigned performance credits as deemed appropriate by the Department.
 - 11.2.2.3 Bioretention with underdrain
 - 11.2.2.3.1 The R_{Pv}, C_v and F_v runoff reduction performance credits for bioretention with underdrain is 100% of the detention storage.
 - 11.2.2.3.2 The total nitrogen pollutant reduction performance credit for bioretention with underdrain is not less than 30% removal efficiency.

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- 11.2.2.3.3 The total phosphorus pollutant reduction performance credit for bioretention with underdrain is not less than 40% removal efficiency.
- 11.2.2.3.4 The total suspended solids pollutant reduction performance credit for bioretention with underdrain is not less than 80% removal efficiency.
- 11.2.2.4 Bioretention with infiltration
 - 11.2.2.4.1 The RPv, Cv and Fv runoff reduction performance credits for bioretention with infiltration is 100% of the retention storage.
 - 11.2.2.4.2 The total nitrogen, total phosphorous and total suspended solids pollutant reduction performance credits for bioretention with infiltration is 100% of the load reduction.
- 11.2.3 Bioretention Feasibility Criteria
 - 11.2.3.1 A minimum vertical distance of two feet must be provided between the bottom of the infiltrating bioretention practice and the seasonal high water table as determined by the procedures in subsection 12.1 or bedrock layer. The minimum vertical distance of two feet may be relaxed if a groundwater mounding analysis or piezometer testing has been performed by a qualified professional.
 - 11.2.3.2 Underdrains are required if the permeability of the underlying soils does not have a minimum field-verified infiltration rate of one inch per hour.
 - 11.2.3.3 An impermeable bottom liner and an underdrain system must be employed when a bioretention facility will receive untreated hotspot runoff.
 - 11.2.3.4 Infiltrating bioretention practices shall be located a minimum horizontal distance of 200 feet from down-gradient slopes greater than 20% unless slope stability calculations demonstrate stable conditions.
- 11.2.4 Bioretention Conveyance Criteria
 - 11.2.4.1 Bioretention practices must be designed to pass the maximum design storm event (Fv) if the Fv is being routed through the practice rather than bypassing. An earthen emergency spillway designed to convey the Fv shall be cut in natural ground or, if cut in fill, shall be constructed and stabilized with methods to prevent erosion and structural failure.
 - 11.2.4.2 Bioretention practices constructed to meet regulatory stormwater management requirements in the State of Delaware shall be designed and constructed in accordance with the USDA NRCS Pond Code 378 as amended.
 - 11.2.4.3 An overflow structure shall be incorporated into on-line designs to safely convey larger storms through the bioretention facility.
 - 11.2.4.4 The maximum design discharge velocity shall be checked for a non-erosive condition at the outlet point. Outlet protection shall be provided as necessary.
- 11.2.5 Bioretention Pretreatment Criteria
 - 11.2.5.1 Every inlet into a bioretention practice shall have pretreatment.
 - 11.2.5.2 Exit velocities from the pretreatment shall be non-erosive during the largest design storm that is routed through the facility.
- 11.2.6 Bioretention Design Criteria
 - 11.2.6.1 Bioretention practices shall have energy dissipation provided at all inlets.
 - 11.2.6.2 Bioretention practices shall be designed so that the RPv either infiltrates or discharges within 48 hours.
 - 11.2.6.3 Bioretention practices shall be designed so that they will:
 - 11.2.6.3.1 Infiltrate the Fv within 72 hours, or
 - 11.2.6.3.2 Dewater the Fv within 72 hours, or
 - 11.2.6.3.3 Manage the Fv on site with no adverse impact.
 - 11.2.6.4 Traditional and advanced bioretention facilities and rain gardens shall be constructed with side slopes above biosoil media of 3:1 or flatter.
 - 11.2.6.5 Biosoil Media
 - 11.2.6.5.1 The Biosoil-14 soil mixture shall have the following volumetric composition:
 - 11.2.6.5.1.1 60% coarse concrete sand having a Fineness Modulus > 2.75
 - 11.2.6.5.1.2 30% triple shredded hardwood mulch

- 11.2.6.5.1.3 10% aged, STA certified compost, meeting the requirements of Delaware Erosion and Sediment Control Handbook Appendix A-6 Compost Material Properties.
- 11.2.6.5.2 Bio soil media must be obtained from a Department approved vendor.
- 11.2.6.5.3 The design permeability rate for bio soil media shall be 2.83 inches per hour.
- 11.2.6.5.4 The bio soil media bed depth shall be a minimum of 24 inches for traditional bioretention and advanced bioretention systems.
- 11.2.6.5.5 Gravel layers used for extending the bioretention facility into a more permeable layer shall meet the same requirements as those for an underdrain design.
- 11.2.6.6 A surface cover shall be provided over the bio soil media.
 - 11.2.6.6.1 Mulch, if used as a surface cover, shall be triple shredded hardwood aged for a minimum of six months.
 - 11.2.6.6.2 Use of alternative surface cover shall be shown on the approved plan.
- 11.2.6.7 Underdrains
 - 11.2.6.7.1 For bioretention designs that require an underdrain, the underdrain shall be a minimum of 4-inch perforated corrugated polyethylene pipe (CPP).
 - 11.2.6.7.2 The underdrain shall be encased in a layer of clean, washed nominal ¼ inch gravel with a maximum of 2.0% passing the #200 sieve with a minimum of 3" of cover.
 - 11.2.6.7.3 The gravel layer in traditional bioretention shall be extended a minimum of 2' below the invert of the underdrain.
- 11.2.6.8 All traditional and advanced bioretention systems shall include at least one inspection port or cleanout pipe.
- 11.2.6.9 Traditional sizing approaches using design volume considering void ratio of the stone and bio soil media shall be used when sizing bioretention.
- 11.2.6.10 All Bioretention practices must be designed so as to be accessible for maintenance.
 - 11.2.6.10.1 A maintenance right-of-way or easement must extend to the Bioretention practice from a public or private road.
 - 11.2.6.10.2 Adequate maintenance access must extend to the perimeter of the bioretention practice and outlet structure.
 - 11.2.6.10.3 Maintenance access must meet the following criteria:
 - 11.2.6.10.3.1 Minimum width of fifteen feet.
 - 11.2.6.10.3.2 Profile grade that does not exceed 10H:1V.
 - 11.2.6.10.3.3 Minimum 10H:1V cross slope.
- 11.2.7 Bioretention Landscaping Criteria
 - 11.2.7.1 A planting plan shall be provided for all bioretention facilities. Minimum elements of a planting plan include the following:
 - 11.2.7.1.1 The proposed bioretention template to be used;
 - 11.2.7.1.2 Delineation of planting areas;
 - 11.2.7.1.3 Size and spacing of plant material; and
 - 11.2.7.1.4 The planting sequence, including post-nursery care and initial maintenance requirements.
 - 11.2.7.2 Planting plans must be certified by a qualified professional.
- 11.2.8 Bioretention Construction Criteria
 - 11.2.8.1 When a bioretention system is used as a sediment trap or basin during construction, the Sediment & Stormwater Plan must include notes and graphic details specifying that:
 - 11.2.8.1.1 The maximum excavation depth of the trap or basin at the construction stage must be at least one foot higher than the final invert or bottom of the facility, and
 - 11.2.8.1.2 The bottom of the facility shall be ripped, tilled or otherwise scarified upon final excavation.
 - 11.2.8.2 The plan shall include the proper procedures for converting the temporary sediment control practice to a permanent bioretention facility, including dewatering, cleanout and stabilization.
 - 11.2.8.3 For infiltrating bioretention systems, confirmatory infiltration testing and verification must be completed prior to completion of construction in accordance with subsection 12.1. The results shall be included with the Post Construction Verification Documentation upon project completion.

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- 11.2.8.4 The final bottom elevation of any bioretention facility shall not be traversed by construction equipment.
- 11.2.8.5 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.2.8.5.1 Pre-construction meeting.
 - 11.2.8.5.2 Initial site preparation including installation of erosion and sediment controls, sensitive area protection surrounding bioretention locations, and blockage of inlets to bioretention locations
 - 11.2.8.5.3 Excavation and grading including interim and final elevations. For infiltrating bioretention systems, confirmatory infiltration testing and a verification must be completed prior to gravel and biosoil media placement.
 - 11.2.8.5.4 Construction of the underdrain, including inspection ports and installation of the overflow structure, as applicable.
 - 11.2.8.5.5 Installation of gravel and biosoil media.
 - 11.2.8.5.6 Implementation of required stabilization and planting plan.
 - 11.2.8.5.7 Final construction review including development of a punch list for facility acceptance.
- 11.2.8.6 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the bioretention practice has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for bioretention practices are as follows:
 - 11.2.8.6.1 The constructed top of bank elevation may be no lower than the design elevation for top of bank.
 - 11.2.8.6.2 The constructed area of the bioretention surface shall be no less than 90% of the design surface area.
 - 11.2.8.6.3 The constructed volume of the bioretention storage shall be no less than 90% of the design volume.
 - 11.2.8.6.4 The constructed elevation of any structure shall be within 0.15 foot of the design.
- 11.2.9 Supplemental fertilizer applications shall consist of a 0% phosphorus formulation only as needed to maintain plant vigor.
- 11.3 Permeable Pavement Systems
 - 11.3.1 Permeable Pavement Systems are defined as paving surfaces that capture and temporarily store stormwater by filtering runoff through voids in the pavement surface into an underlying reservoir. Design variants include:
 - 11.3.1.1 Porous Asphalt (PA)
 - 11.3.1.2 Pervious Concrete (PC)
 - 11.3.1.3 Permeable interlocking concrete Pavers (PP) or Concrete grid Pavers (CP)
 - 11.3.1.4 Plastic Grid Pavers (GP)
 - 11.3.2 Permeable Pavement Systems receive 100% retention volume credit (Rv) for the volume stored and infiltrated by the practice.
 - 11.3.2.1 The R_{Pv} runoff reduction performance credit for permeable pavement is 100% of the retention storage.
 - 11.3.2.2 The C_v runoff reduction performance credit for permeable pavement is 100% of the retention storage.
 - 11.3.2.3 The F_v runoff reduction performance credit for permeable pavement is 100% of the retention storage.
 - 11.3.2.4 The total nitrogen pollutant reduction performance credit for permeable pavement is 100% of the load reduction.
 - 11.3.2.5 The total phosphorus pollutant reduction performance credit for permeable pavement is 100% of the load reduction.
 - 11.3.2.6 The total suspended solids pollutant reduction performance credit for permeable pavement is 100% of the load reduction.
 - 11.3.3 Permeable Pavement Feasibility Criteria
 - 11.3.3.1 Drainage Area. For parking lots and roadways configurations:

- 11.3.3.1.1 The contributing drainage area to permeable pavement shall not exceed five times the surface area of the permeable pavement.
- 11.3.3.1.2 Pervious areas shall be diverted from the permeable pavement area such that the total contributing drainage area is at least 80% impervious.
- 11.3.3.2 Soils and Overdrains. Parking lot and roadway configurations utilizing permeable pavement shall meet the following requirements:
 - 11.3.3.2.1 Infiltration testing in accordance with subsection 12.1 shall be required.
 - 11.3.3.2.2 Overdrains are required if the permeability of the underlying soils does not have a minimum infiltration rate of one inch per hour.
- 11.3.3.3 The surface slope shall be no greater than 5.0%.
- 11.3.3.4 The bottom slope of a permeable pavement installation shall be no greater than 1.0%.
- 11.3.3.5 If an overdrain is not provided, a separation distance of two feet is required between the bottom of the reservoir layer and the seasonal high water table as determined in accordance with subsection 12.1.
- 11.3.3.6 Permeable pavements shall not be used to treat hotspot runoff.
- 11.3.4 Permeable pavement designs shall include methods to safely convey the Cv and Fv.
- 11.3.5 Permeable Pavement Design Criteria
 - 11.3.5.1 Permeable pavement shall be designed according to DelDOT specifications or the product manufacturer's recommendations as applicable.
 - 11.3.5.2 Internal Geometry and Drawdown
 - 11.3.5.2.1 For design purposes, the field verified infiltration rate shall have a factor of safety applied in accordance with subsection 12.1 to account for potential compaction during construction and to approximate long term infiltration rates.
 - 11.3.5.2.2 Permeable pavement practices shall be designed so that the RPv infiltrates within 48 hours.
 - 11.3.5.2.3 Permeable pavement practices shall be designed so that they will:
 - 11.3.5.2.3.1 Infiltrate the Fv within 72 hours, or
 - 11.3.5.2.3.2 Dewater the Fv within 72 hours, or
 - 11.3.5.2.3.3 Manage the Fv on site with no adverse impact.
 - 11.3.5.3 Reservoir layer
 - 11.3.5.3.1 The suitability of the soil subgrade shall be determined by a qualified geotechnical engineer.
 - 11.3.5.3.2 The reservoir layer shall be composed of clean, washed gravel with a maximum of 2.0% passing the #200 sieve and sized for both the maximum storm event to be managed and the structural requirements of the expected traffic loading.
 - 11.3.5.3.3 The depth of the reservoir layer shall be a minimum of six inches.
 - 11.3.5.3.4 If an overdrain is not provided, a separation distance of two feet is required between the bottom of the reservoir layer and the seasonal high water table as determined in accordance with subsection 12.1.
 - 11.3.5.3.5 Overdrains shall be a minimum of four inches in diameter.
 - 11.3.5.4 All parking lot and roadway configurations shall include inspection ports.
 - 11.3.5.5 The permeable pavement shall be designed to support the maximum anticipated traffic load.
 - 11.3.5.6 The reservoir layer shall be sized to temporarily store and then infiltrate the RPv.
- 11.3.6 Permeable Pavement Construction
 - 11.3.6.1 All permeable pavement areas shall be fully protected from sediment intrusion by silt fence or construction fencing to prevent construction traffic tracking.
 - 11.3.6.2 During site construction, steps shall be taken to prevent compaction of the underlying soil and sedimentation of the permeable pavement practice.
 - 11.3.6.3 The infiltration rate and separation from groundwater of the constructed permeable pavement practice shall be verified prior to completion of construction in accordance with subsection 12.1. The results shall be included with the Post Construction Verification Documentation upon project completion.

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- 11.3.6.4 During construction, care shall be taken to avoid tracking sediments onto any permeable pavement surface to avoid clogging.
- 11.3.6.5 When locating a sediment basin on an area intended for permeable pavement is unavoidable, the invert of the sediment basin must be a minimum of one foot above the final design elevation of the bottom of the reservoir course.
- 11.3.6.6 Permeable pavement shall be installed according to DelDOT specifications or the product manufacturer's recommendations as applicable.
- 11.3.6.7 Construction of the permeable pavement shall only begin after the entire contributing drainage area has been stabilized.
- 11.3.6.8 The proposed permeable pavement area shall be kept free from sediment during the entire construction process.
- 11.3.6.9 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.3.6.9.1 Pre-construction meeting;
 - 11.3.6.9.2 Initial site preparation including installation of erosion and sediment controls, sensitive area protection surrounding permeable pavement locations;
 - 11.3.6.9.3 Excavation and grading including interim and final elevations. Observation of infiltrating surface and permeable pavement practice verification must be completed prior to gravel placement;
 - 11.3.6.9.4 Construction of the overdrain, including inspection ports and installation of the overflow structure, as applicable;
 - 11.3.6.9.5 Installation of gravel;
 - 11.3.6.9.6 Implementation of required stabilization; and
 - 11.3.6.9.7 Final construction review including development of a punch list for facility acceptance.
- 11.3.6.10 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the permeable pavement has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for permeable pavement are as follows:
 - 11.3.6.10.1 The constructed permeable pavement surface area shall be no less than the design permeable pavement surface area.
 - 11.3.6.10.2 The contributing drainage area as constructed shall be no greater than the design contributing drainage area.
 - 11.3.6.10.3 The constructed storage volume of the reservoir layer shall be no less than 90% of the design volume.
 - 11.3.6.10.4 The constructed elevation of the overdrain or any structure shall be within 0.15 foot of the design.
- 11.3.6.11 In the event that the allowable tolerances are exceeded for permeable pavement surface area or volume or structure elevations, supplemental calculations and provisions of adequate maintenance must be submitted to the approval agency to determine if the permeable pavement, as constructed, meets the design requirements.
- 11.3.7 Activities that have the potential to clog the permeable pavement surface, including but not limited to sanding, re-sealing, re-surfacing, storage of snow piles containing sand, storage of mulch or soil material, or construction staging, shall be prohibited.

11.4 Vegetated Roofs

- 11.4.1 Vegetated Roofs are defined as practices on top of buildings that capture and store rainfall in an engineered growing media, which is designed to support plant growth. A portion of the captured rainfall evaporates or is taken up by plants, which helps reduce runoff volumes, peak runoff rates, and pollutant loads on development sites. Design variants include:
 - 11.4.1.1 Extensive Vegetated Roofs which contain shallow growth media with drought resistant plants, such as Sedum.
 - 11.4.1.2 Intensive Vegetated Roofs which contain deep growth media with a wide range of plant varieties and typically include irrigation.

- 11.4.2 Vegetated Roofs receive annual runoff reduction credit (RR) for the contributing roof area, along with associated pollutant removals as follows:
- 11.4.2.1 The R_{Pv} runoff reduction performance credit for Extensive Vegetated Roof is 50% annual runoff reduction.
 - 11.4.2.2 The C_v runoff reduction performance credit for Extensive Vegetated Roof is 5% of the R_{Pv} allowance.
 - 11.4.2.3 The F_v runoff reduction performance credit for Extensive Vegetated Roof is 1% of the R_{Pv} allowance.
 - 11.4.2.4 The R_{Pv} runoff reduction performance credit for Intensive Vegetated Roof is 75% annual runoff reduction.
 - 11.4.2.5 The C_v runoff reduction performance credit for Intensive Vegetated Roof is 8% of the R_{Pv} allowance.
 - 11.4.2.6 The F_v runoff reduction performance credit for Intensive Vegetated Roof is 2% of the R_{Pv} allowance.
 - 11.4.2.7 The total nitrogen pollutant reduction performance credit for Extensive Vegetated Roof and Intensive Vegetated Roof is not less than 0%.
 - 11.4.2.8 The total phosphorus pollutant reduction performance credit for Extensive Vegetated Roof and Intensive Vegetated Roof is not less than 0%.
 - 11.4.2.9 If the phosphorous (P) content of mature growth media is 2.0 mg/l (Saturated Paste Extraction), or less, then the Vegetated Roof will be assumed to be neutral with respect to P loadings. If the P content of mature growth media exceeds 2.0 mg/l, a supplemental phosphorus-reducing BMP, such as an activated alumina or hematite filter, will be required.
- 11.4.3 Vegetated Roof Feasibility Criteria
- 11.4.3.1 The designer shall demonstrate that the building will be able to support the additional live and dead structural load. Structural capability of the roof must be assessed by a qualified licensed professional and included with building permit documentation.
 - 11.4.3.2 Safe access to the Vegetated Roof shall be available to allow for delivery of construction materials and performance of routine maintenance reviews and maintenance operations.
 - 11.4.3.3 A permanent source of water shall be provided to all Vegetated Roof areas.
 - 11.4.3.4 A minimum one foot wide vegetation-free zone is required along the perimeter of all Vegetated Roofs and around all roof penetrations.
 - 11.4.3.5 The Vegetated Roof design must comply with all federal, state and local building codes.
- 11.4.4 Vegetated Roof Conveyance Criteria
- 11.4.4.1 The Vegetated Roof drainage layer shall convey flow from under the growth media layer to an outlet or overflow system.
 - 11.4.4.2 All drains and scuppers shall be accessible through enclosures that include lids that are level with the surface of the growth media layer.
 - 11.4.4.3 Emergency drains or emergency scuppers shall have inverts that are high enough above the waterproofing surface to prevent discharge during the R_{Pv} event.
- 11.4.5 Vegetated Roof Design Criteria
- 11.4.5.1 All Vegetated Roof systems must include an effective and reliable waterproof membrane to prevent water damage to the building structure.
 - 11.4.5.2 Protection Layer shall have a puncture resistance in accordance with ASTM D4833 >220 lbs.
 - 11.4.5.3 Waterproof membranes designed for burial in Vegetated Roofs do not require supplemental root barriers; however root barriers are required in combination with some waterproof membranes.
 - 11.4.5.3.1 Chemical root barriers or physical root barriers that have been impregnated with pesticides, metals or other chemicals shall not be used as those chemicals can leach into stormwater runoff and will slowly lose effectiveness over time.
 - 11.4.5.3.2 To insure that a building is adequately protected against damage from roots, the waterproof membrane or the root-barrier shall be certified as root-resistant based on the two-year ANSI/SPRI VR-1; Procedure for Investigating the Root Penetration Resistance of Vegetated Roofs or the two-year European FLL root-security test (Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V., Richtlinien fuer die Planung, Ausfuehrung und

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- Pflege von Dachbegruenung). If certification is not available at the time the system is permitted, an HDPE membrane, 30 mil or thicker, with seams overlapped at least three inches and continuously hot-air welded shall be provided as a root barrier.
- 11.4.5.4 A drainage layer shall underlie the growth media to control the release of water that percolates into the Vegetated Roof assembly.
- 11.4.5.5 Roof drains and any emergency overflow shall be designed in accordance with state and local building codes.
- 11.4.5.6 Growth Media
- 11.4.5.6.1 The growth media shall be the uppermost layer in a Vegetated Roof assembly.
- 11.4.5.6.2 The designer shall certify that growth media meets or exceeds all required specifications prior to placement.
- 11.4.5.6.3 The growth media must maintain minimum 6.0% air filled porosity (ASTM E2399) to avoid anoxic conditions when wetted.
- 11.4.5.6.4 The upper one inch of a growth media profile shall consist of an engineered mineral soil. To minimize the potential for clogging of fabrics and migration of fine particles, the silt-size fraction (0.063mm) of engineered mineral soils shall not exceed 15% and the clay fraction (2 micron) shall not exceed 5.0%.
- 11.4.5.6.5 Organic amendments used in preparing growth media must be stable. The respiration rate of organic ingredients must be 3.0 mg CO₂-C/g OM/day (TMECC 05.08.B), or less.
- 11.4.5.6.6 For a Vegetated Roof to be regarded as neutral with respect to phosphorous (P) loading in runoff, the P content of the growth media must be controlled.
- 11.4.5.6.6.1 The initial available P content of the growth media may not exceed 200 ppm dry weight (Mehlich III).
- 11.4.5.6.6.2 Chemical fertilizers containing phosphorous may not be added to the growth media during blending or used subsequently during maintenance unless a phosphorus deficiency in the plants has been documented. Only nitrogen fertilizers may be used and these must be applied according to soil test. If the P limit for the media layer cannot meet compliance, the Vegetated Roof must be treated as a P source and a supplemental water quality BMP must be introduced.
- 11.4.5.6.7 If trees are included in the Vegetated Roof landscape plan, the growth media must be at least 30 inches deep.
- 11.4.5.7 Plant cover
- 11.4.5.7.1 Initial planting plan shall be designed such that mature plant coverage within 24 months of initial planting shall be:
- 11.4.5.7.1.1 Minimum 75% warm season plant coverage for Extensive Vegetated Roofs.
- 11.4.5.7.1.2 Minimum 90% plant coverage for turf intensive Vegetated Roofs.
- 11.4.5.7.1.3 Uniform cover with vigorous plants conforming to the design plant density for non-turf Intensive Vegetated Roofs.
- 11.4.5.7.2 The planting plan for Vegetated Roofs must be certified by a qualified professional.
- 11.4.5.8 Vegetated Roof sizing
- 11.4.5.8.1 The size of the Vegetated Roof, both Extensive and Intensive, shall be a minimum 66% of the total contributing drainage area.
- 11.4.5.8.2 No runoff reduction credit shall be given for runoff from bare areas of the roof that do not come in contact with root zone.
- 11.4.6 Vegetated Roof Landscaping Criteria
- 11.4.6.1 Irrigation is required for Vegetated Roofs for the first year after planting.
- 11.4.6.2 The minimum plant coverage shall be achieved 24 months after initial planting and maintained throughout the life of the Vegetated Roof.
- 11.4.7 Vegetated Roof Construction
- 11.4.7.1 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
- 11.4.7.1.1 Pre-construction meeting;

- 11.4.7.1.2 During placement of the waterproof membrane, to ensure that it is properly installed and watertight;
- 11.4.7.1.3 During placement of the drainage layer and drainage system, to prevent future ponding water;
- 11.4.7.1.4 During placement of the growing media, to confirm that it meets the approved plan;
- 11.4.7.1.5 Upon installation of plants, to ensure they conform to the planting plan; and
- 11.4.7.1.6 Final construction review including development of a punch list for facility acceptance.

11.4.7.2 Post Construction Verification Documentation

- 11.4.7.2.1 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the Vegetated Roof has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for Vegetated Roofs are as follows:

- 11.4.7.2.1.1 Growth media thickness within 15% of design thickness.
- 11.4.7.2.1.2 Plant density no less than specified on the planting plan.
- 11.4.7.2.1.3 No less than 66% of the total contributing drainage area shall be Vegetated Roof.

- 11.4.7.2.2 The post construction verification shall confirm that temporary or permanent irrigation has been installed in accordance with the approved plan.

- 11.4.7.2.3 Certification of growth media shall be submitted with post construction verification.

11.4.8 Vegetated Roof Maintenance Criteria

11.4.8.1 Maintenance Reviews

- 11.4.8.1.1 A minimum of one maintenance review is required each year for Vegetated Roofs.
- 11.4.8.1.2 Maintenance reviews shall be performed by a qualified reviewer.
- 11.4.8.1.3 The completed maintenance review report shall be sent to the Department or the appropriate Delegated Agency.
- 11.4.8.1.4 Vegetated Roofs must be reviewed at the end of the first 24 months to confirm minimum vegetated surface cover specified in the Operation and Maintenance Plan has been achieved, and to look for leaks, drainage problems and any rooftop structural concerns.

- 11.4.8.2 Growth media shall be routinely tested for P as part of the Operation and Maintenance Plan. Phosphorous-removing BMPs (e.g., activated alumina or hematite filters) must be installed for Vegetated Roofs, 24 months and older, with phosphorous concentrations that are consistently higher than 2.0 mg/l.

11.5 Rainwater Harvesting

- 11.5.1 Rainwater harvesting is defined as systems that intercept, divert, store and release rainfall for future use. Rainwater that falls onto impervious surfaces is collected and conveyed into an above- or below-ground cistern, where it can be used for non-potable water uses and on-site stormwater disposal or infiltration. Runoff collected and temporarily stored in more traditional stormwater management practices constructed in accordance with the Post Construction Stormwater BMP Standards and Specifications, such as wet ponds, can also be used for irrigation purposes to achieve these same goals. Design variants include:

- 11.5.1.1 Seasonal Rainwater Harvesting Systems; and
- 11.5.1.2 Continuous Rainwater Harvesting Systems.

11.5.2 Rainwater Harvesting Stormwater Credit Calculations

- 11.5.2.1 If not protected from freezing, Rainwater Harvesting systems must be taken offline for the winter and credited as seasonal systems.

11.5.2.2 Seasonal Rainwater Harvesting Performance Credits

- 11.5.2.2.1 The R_{Pv} runoff reduction performance credit for Seasonal Rainwater Harvesting systems is 50% of the retention storage.
- 11.5.2.2.2 The C_v and F_v runoff reduction performance credit for Seasonal Rainwater Harvesting systems is 0%.
- 11.5.2.2.3 The total nitrogen, total phosphorus, and total suspended solids pollutant reduction performance credits for Seasonal Rainwater Harvesting is 100% of the load reduction.

11.5.2.3 Continuous Rainwater Harvesting Performance Credits

- 11.5.2.3.1 The R_{Pv} runoff reduction performance credit for Continuous Rainwater Harvesting systems is 75% of the retention storage.

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- 11.5.2.3.2 The Cv and Fv runoff reduction performance credit for Continuous Rainwater Harvesting systems is 0%.
- 11.5.2.3.3 The total nitrogen, total phosphorus, and total suspended solids pollutant reduction performance credits for Continuous Rainwater Harvesting is 100% of the load reduction.
- 11.5.3 Rainwater Harvesting Feasibility Criteria
 - 11.5.3.1 Designers and plan reviewers shall consult all applicable local, State and Federal regulations to determine the allowable indoor uses and required treatment for harvested rainwater.
 - 11.5.3.2 Pipes and spigots using rainwater must be clearly labeled as non-potable.
 - 11.5.3.3 The final invert of the outlet pipe from the cistern must be at an elevation that will not allow water from the discharge point to backflow into the cistern.
 - 11.5.3.4 In areas where a below-ground cistern will be buried partially below the water table, buoyancy calculations must be conducted for the empty cistern and special design features must be employed, as applicable, to secure the cistern.
 - 11.5.3.5 Cisterns must be installed according to the manufacturer's specifications.
 - 11.5.3.6 The bearing capacity of the soil upon which the full cistern will be placed must be considered.
 - 11.5.3.7 Cisterns shall be designed to be watertight.
- 11.5.4 Rainwater Harvesting Conveyance Criteria
 - 11.5.4.1 All conveyance pipes to the cistern, including gutters and downspouts, must be kept clean and free of sediment, debris and rust.
 - 11.5.4.2 Overflow
 - 11.5.4.2.1 An overflow mechanism must be included in the Rainwater Harvesting system design to handle flows that exceed the capacity of the cistern.
 - 11.5.4.2.2 Overflow pipes must have a capacity equal to or greater than the total capacity of the inflow pipes and have a diameter and slope sufficient to drain the cistern before it reaches full capacity.
 - 11.5.4.2.3 The overflow pipe must be screened to prevent access to the cistern by rodents and birds.
- 11.5.5 Rainwater Harvesting Pretreatment Criteria
 - 11.5.5.1 Pretreatment is required to keep sediment, leaves, and other debris from the system.
 - 11.5.5.2 Small cistern systems of 2,500 gallons or less shall have leaf screens or gutter guards for pretreatment as a minimum.
 - 11.5.5.3 Large cistern systems of greater than 2,500 gallons shall include a pretreatment system capable of treating and conveying the flow rate generated by the Rpv from the contributing impervious surface drainage area without creating a backup or bypass condition.
- 11.5.6 Rainwater Harvesting Design Criteria
 - 11.5.6.1 The following factors that must be considered when designing a Rainwater Harvesting system and selecting a cistern:
 - 11.5.6.1.1 Rainwater Harvesting Systems shall comply with all applicable local, State, and Federal regulations.
 - 11.5.6.1.2 Above-ground cisterns must be impact resistant or protected from impact using bollards or other physical barriers.
 - 11.5.6.1.3 Below-ground cisterns must be designed to support the overlying soil and any other anticipated loads.
 - 11.5.6.1.4 Below-ground cisterns must have a standard size manhole or equivalent opening to allow access for cleaning, inspection, maintenance, and repair purposes.
 - 11.5.6.1.5 Cisterns must be screened to discourage mosquito breeding and reproduction.
 - 11.5.6.1.6 A suitable foundation must be provided to support the cistern when it is filled to capacity.
 - 11.5.6.1.7 Dead storage below the outlet to the distribution system and an air gap at the top of the cistern must be added to the total volume.
 - 11.5.6.1.8 Any hookup to a municipal backup water supply must have a backflow prevention device to keep municipal water separate from stored rainwater.
 - 11.5.6.2 Distribution Systems

- 11.5.6.2.1 The Rainwater Harvesting system must be equipped with an appropriately-sized pump, if necessary, that produces sufficient pressure for all intended end-uses.
- 11.5.6.2.2 A backflow preventer is required to separate harvested rainwater from the main potable water distribution lines.
- 11.5.6.2.3 Distribution lines for Continuous Rainwater Harvesting Systems must be buried beneath the frost line.
- 11.5.6.2.4 A drain plug or cleanout sump, also draining to a pervious area, must be installed to allow the system to be completely emptied, if needed.
- 11.5.6.2.5 Above-ground outdoor pipes must be insulated or heat-wrapped to prevent freezing and ensure uninterrupted operation during winter.
- 11.5.6.2.6 Distribution lines and above ground outdoor pipes for Seasonal Rainwater Harvesting Systems shall be drained or otherwise winter-proofed during the non-operational period.
- 11.5.6.3 Rainwater Harvesting Material Specifications
 - 11.5.6.3.1 Cisterns must be structurally sound, watertight, and sealed using a water-safe, non-toxic material. Re-purposed tanks used to store rainwater for reuse must be acceptable for potable water or food-grade products.
 - 11.5.6.3.2 Above-ground cisterns must be UV resistant and opaque to prevent the growth of algae in the tank.
 - 11.5.6.3.3 Below-ground cisterns shall be located below the frost line.
- 11.5.6.4 Sizing of Rainwater Harvesting Systems
 - 11.5.6.4.1 For seasonal rainwater harvesting systems, weekly irrigation demand shall be at least 50% of the stored volume.
 - 11.5.6.4.2 For Continuous Rainwater Harvesting Systems, a minimum of 50% of the demand shall be met through non-irrigation needs, such as plumbing, process water, car washing, or other uses that are present throughout the year.
- 11.5.6.5 All Rainwater Harvesting Systems must be designed so as to be accessible for maintenance.
 - 11.5.6.5.1 A maintenance right-of-way or easement must extend to the Rainwater Harvesting System from a public or private road.
 - 11.5.6.5.2 Adequate maintenance access must extend to all components of the Rainwater Harvesting System.
 - 11.5.6.5.3 Maintenance access must meet the following criteria:
 - 11.5.6.5.3.1 Minimum width of fifteen feet.
 - 11.5.6.5.3.2 Profile grade that does not exceed 10H:1V.
 - 11.5.6.5.3.3 Minimum 10H:1V cross slope.
- 11.5.7 If the harvested rainwater is to be used for irrigation, the design plan must include the delineation of the proposed planting areas to be irrigated and quantification of the expected water demand based upon the area to be irrigated.
- 11.5.8 Rainwater Harvesting Construction
 - 11.5.8.1 Rainwater Harvesting system components connecting to the internal plumbing system shall be installed by a licensed plumber.
 - 11.5.8.2 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.5.8.2.1 Pre-construction meeting;
 - 11.5.8.2.2 Initial site preparation including installation of erosion and sediment controls;
 - 11.5.8.2.3 Excavation and grading including interim and final elevations for cistern foundations;
 - 11.5.8.2.4 Installation of cistern, pretreatment system and conveyance system;
 - 11.5.8.2.5 Implementation of required stabilization; and
 - 11.5.8.2.6 Final construction review including development of a punch list for facility acceptance.
 - 11.5.8.3 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the rainwater harvesting practice has been constructed in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Items to be checked and verified are as follows:

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- 11.5.8.3.1 Presence of a pretreatment device.
- 11.5.8.3.2 Capacity of any cisterns matches the design plan.
- 11.5.8.3.3 For ponds, the constructed volume shall be no less than 90% of the design volume.
- 11.5.8.3.4 For continuous systems, all pumps, controls, and other appurtenances installed in accordance with the plan.
- 11.5.8.3.5 For irrigation systems, area of coverage is within 90% of that shown on the plan.
- 11.5.9 Operation and Maintenance Plans shall clearly outline how Rainwater Harvesting Systems will be managed taking into account seasonal variations and cistern location.
- 11.6 Restoration Practices
 - 11.6.1 Restoration Practices include Regenerative Stormwater Conveyance Systems (RSCS), also known as Coastal Plain Outfalls, and other practices that restore existing degraded natural systems to their former functional condition. Streambank stabilization is also included as a Restoration Practice.
 - 11.6.2 Design variants for Restoration Practices include:
 - 11.6.2.1 Step Pool RSCS
 - 11.6.2.2 Seepage Wetland RSCS
 - 11.6.2.3 Streambank Stabilization
 - 11.6.3 Runoff reduction and pollutant reduction performance credits for Restoration Practices shall be determined by the Department on a case-by-case basis.
 - 11.6.4 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the restoration practice has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.
- 11.7 Rooftop Disconnection
 - 11.7.1 Rooftop Disconnection involves managing runoff close to its source by intercepting, infiltrating, filtering, treating, or reusing it as it moves from the rooftop to the drainage system. Rooftop Disconnection can reduce the volume of runoff that enters the combined or separate storm sewer systems.
 - 11.7.2 Rooftop Disconnection that meets the minimum full disconnection length shall receive the following annual runoff reduction and pollutant reduction credits:
 - 11.7.2.1 Rooftop Disconnection receives 100% annual runoff reduction performance credit for the Rpv.
 - 11.7.2.2 The Cv runoff reduction performance credit for Rooftop Disconnection is 10% of the Rpv allowance.
 - 11.7.2.3 The Fv runoff reduction performance credit for Rooftop Disconnection is 1% of the Rpv allowance.
 - 11.7.2.4 The total nitrogen pollutant reduction performance credit for Rooftop Disconnection is 100% of the load reduction.
 - 11.7.2.5 The total phosphorus pollutant reduction performance credit for Rooftop Disconnection is 100% of the load reduction.
 - 11.7.2.6 The total suspended solids pollutant reduction performance credit for Rooftop Disconnection is 100% of the load reduction.
 - 11.7.3 Partial Rpv runoff reduction credit shall be based on the ratio of the disconnection length provided to the full disconnection length.
 - 11.7.4 Rooftop Disconnection Feasibility Criteria
 - 11.7.4.1 If being used for Rpv credit in a residential subdivision, a Record Plan shall include a not identifying Rooftop Disconnection as a BMP.
 - 11.7.4.2 The disconnection area shall have a maximum slope of 25%.
 - 11.7.4.3 The maximum impervious rooftop area treated may not exceed 1,000 square feet per downspout.
 - 11.7.4.4 Receiving area shall be graded away from the structure per local requirements.
 - 11.7.5 Rooftop Disconnection areas shall be designed to safely convey all design storm events (Rpv, Cv, and Fv) over the receiving area without causing erosion.
 - 11.7.6 A downspout energy dissipater shall be located at the discharge point of the downspout.
 - 11.7.7 Rooftop Disconnection Design Criteria
 - 11.7.7.1 Regardless of rooftop area collected the available pervious disconnection area at the point of discharge for any downspout must be at least 15 feet wide.

- 11.7.7.2 A five foot long transition section from the downspout point of discharge shall be provided prior to the beginning of the disconnection area.
- 11.7.7.3 The minimum full disconnection lengths shall be as follows:
 - 11.7.7.3.1 For projects above the C&D Canal, the full disconnection length shall be 75 feet.
 - 11.7.7.3.2 For projects below the C&D Canal, the full disconnection length shall be 60 feet.
- 11.7.7.4 Impervious areas shall not be constructed within the area designated as the pervious rooftop disconnection area.
- 11.7.7.5 The pervious rooftop disconnection area must be stabilized with vegetation for a non-erosive condition.
- 11.7.8 All pervious disconnection areas receiving rooftop runoff shall be vegetatively stabilized to prevent erosion or transport of sediment to receiving practices or drainage systems.
- 11.7.9 The post construction verification for Rooftop Disconnection shall visually verify that no impervious surface exists within the rooftop disconnection area.
- 11.7.10 The Sediment and Stormwater Plan shall include the following operation and maintenance notes for Rooftop Disconnection:
 - 11.7.10.1 The rooftop disconnection area shall be maintained in a stabilized vegetative condition.
 - 11.7.10.2 Ensure that downspouts remain disconnected and pervious filtering or infiltrating areas are not converted to impervious surface.
- 11.8 Vegetated Channels
 - 11.8.1 Vegetated channels are open conveyances planted with grass or other suitable vegetation and having a shallow depth of flow to allow runoff to be filtered and recharged along the length of the channel. Design variants include:
 - 11.8.1.1 Bioswale
 - 11.8.1.2 Grassed Channel
 - 11.8.2 Vegetated channels receive the following annual runoff reduction and pollutant reduction credits.
 - 11.8.2.1 The RPv runoff reduction performance credit for a Bioswale on A/B soil or compost amended C soil is 50% annual runoff reduction.
 - 11.8.2.2 The RPv runoff reduction performance credit for a Grassed Channel on A/B soil or compost amended C soil is 20% annual runoff reduction.
 - 11.8.2.3 The RPv runoff reduction performance credit for a Bioswale on C/D soil is 25% annual runoff reduction.
 - 11.8.2.4 The RPv runoff reduction performance credit for a Grassed Channel on C/D soil is 10% annual runoff reduction.
 - 11.8.2.5 The Cv runoff reduction performance credit for Vegetated Channels is 10% of the RPv allowance.
 - 11.8.2.6 The Fv runoff reduction performance credit for Vegetated Channels is 1% of the RPv allowance.
 - 11.8.2.7 The total nitrogen pollutant reduction performance credit for Vegetated Channels is 100% of the load reduction.
 - 11.8.2.8 The total phosphorous pollutant reduction performance credit for Vegetated Channels is 100% of the load reduction.
 - 11.8.2.9 The total suspended solids pollutant reduction performance credit for Vegetated Channels is 100% of the load reduction.
 - 11.8.3 Vegetated Channel Feasibility Criteria
 - 11.8.3.1 The bottom of vegetated channels shall be above the seasonal high water table.
 - 11.8.3.2 Approval from the applicable utility company or agency is required if utility lines will run below the vegetated channel.
 - 11.8.4 Vegetated Channel Conveyance Criteria
 - 11.8.4.1 The bottom width and slope of a vegetated channel shall be designed such that the flow depth based on 50% of RPv peak flow rate, does not exceed four inches.
 - 11.8.4.2 Vegetated channels shall convey the Cv and Fv peak flow rate at non-erosive velocities for the soil and vegetative cover provided.
 - 11.8.5 Every inlet into a vegetated channel system shall have pretreatment.

11.8.6 Vegetated Channel Design Criteria**11.8.6.1 Channel Geometry**

11.8.6.1.1 The bottom width of a trapezoidal channel shall be a minimum of two feet wide to ensure that an adequate surface area exists along the bottom of the channel for filtering.

11.8.6.1.2 If a channel bottom will be wider than eight feet, benches, check dams, level spreaders, or multi-level cross sections shall be incorporated to prevent braiding and erosion along the channel bottom.

11.8.6.1.3 Vegetated channel side slopes shall be no steeper than 3H:1V.

11.8.6.2 Check Dams

11.8.6.2.1 Check dams must be firmly anchored into the side-slopes to prevent outflanking; check dams must also be anchored into the channel bottom to prevent hydrostatic head from pushing out the underlying soils.

11.8.6.2.2 Check dams must be designed to pass the Cv design storm peak flow.

11.8.6.2.3 Check dams shall be composed of wood, concrete, stone, or other non-erodible material.

11.8.6.2.4 Each check dam shall have a weep hole or similar drainage feature, to allow for dewatering following a storm event.

11.8.6.3 All seeded vegetated channels require a minimum SSM-III biodegradable erosion control matting conforming to Delaware Erosion and Sediment Control Handbook.

11.8.6.4 The soil amendments, when used, shall extend over the length and width of the channel bottom, and the compost shall be incorporated to the depth as shown on the approved plan.

11.8.6.5 Adequate conveyance and treatment capacity shall be provided in accordance with the following guidelines:

11.8.6.5.1 Hydraulic capacity shall be verified using Manning's equation or an accepted equivalent method, such as tractive forces and vegetal retardance.

11.8.6.5.2 Design storm flow depth based on 50% of RPv peak flow rate shall be maintained at four inches or less.

11.8.6.5.3 Manning's "n" value for vegetated channels shall be 0.2 for flow depths up to four inches, decreasing to 0.03 above four inches of flow depth. If alternative vegetation is used to increase the Manning's "n" value and decrease the resulting channel width, material specifications and construction oversight shall be provided to ensure that the denser vegetation is actually established.

11.8.6.5.4 Peak flow rates for the Cv and Fv storms shall be non-erosive.

11.8.6.5.5 The Cv peak flow rate shall be contained within the channel banks.

11.8.6.5.6 If the Fv storm event is not contained within the channel, the area of inundation shall be shown.

11.8.6.5.7 The total peak discharge at the outlet shall be used to calculate the depth of flow and velocity for the channel unless lateral flow along the channel is calculated incrementally.

11.8.6.5.8 Hydraulic residence time is the time for runoff to travel the full length of the channel. For both Bioswales and Grassed Channels hydraulic residence time is computed based upon 50% of the RPv peak flow rate.

11.8.6.5.8.1 For Bioswales, the hydraulic residence time shall be a minimum of nine minutes. If flow enters the channel at several locations, a nine minute minimum hydraulic residence time shall be demonstrated for each entry point.

11.8.6.5.8.2 For Bioswales, adjusted RPv runoff reduction credit based on the ratio of the computed residence to the minimum residence time shall be applied to Bioswales that meet the maximum depth of flow criteria. The maximum adjusted RPv runoff reduction credit is 75% for HSG A/B soils and 40% for HSG C/D soils. Adjusted RPv reduction credit shall not be granted for computed residence times of less than five minutes.

11.8.6.5.8.3 For Grassed Channels, the hydraulic residence time for concentrated flow entering the Grassed Channel shall be a minimum of five minutes.

11.8.6.5.8.4 Lateral flow entering the Grassed Channel as sheet flow may be excluded from residence time calculations but shall be accounted for in the channel depth and velocity calculations.

- 11.8.6.5.8.5 For Grassed Channels with in-line culverts, the proportion of grassed channel flow length shall be a minimum of 80% of the total flow length.
- 11.8.6.6 All Vegetated Channels must be designed so as to be accessible for maintenance.
 - 11.8.6.6.1 A maintenance right-of-way or easement must extend to the Vegetated Channel from a public or private road.
 - 11.8.6.6.2 Adequate maintenance access must extend to the full Vegetated Channel length.
 - 11.8.6.6.3 Maintenance access must meet the following criteria:
 - 11.8.6.6.3.1 Minimum width of 15 feet.
 - 11.8.6.6.3.2 Profile grade that does not exceed 10H:1V.
 - 11.8.6.6.3.3 Minimum 10H:1V cross slope.
- 11.8.7 Vegetated Channel Landscaping Criteria
 - 11.8.7.1 A planting plan must be provided that indicates the methods used to establish and maintain vegetative stabilization of the vegetated channel.
 - 11.8.7.2 Vegetated channels shall be established at such a density to achieve a 90% vegetated cover for project completion.
 - 11.8.7.3 All seeded vegetated channels require a minimum SSM-III biodegradable erosion control matting conforming to Delaware Erosion and Sediment Control Handbook.
- 11.8.8 Vegetated Channel Construction
 - 11.8.8.1 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.8.8.1.1 Pre-construction meeting;
 - 11.8.8.1.2 Initial site preparation including installation of erosion and sediment controls, sensitive area protection surrounding vegetated channel locations, and blockage of inlets to vegetated channels;
 - 11.8.8.1.3 Excavation and grading including interim and final elevations;
 - 11.8.8.1.4 Construction of check dams and pretreatment practices, as applicable;
 - 11.8.8.1.5 Implementation of required stabilization and planting plan; and
 - 11.8.8.1.6 Final construction review including development of a punch list for facility acceptance.
 - 11.8.8.2 Post Construction Verification Documentation.
 - 11.8.8.2.1 Upon facility completion, the owner shall submit post construction verification documents as follows to demonstrate that the vegetated channel has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency:
 - 11.8.8.2.1.1 Spot elevations of top of bank, bottom of bank, and centerline of the vegetated channel every 25 feet throughout the length of the channel;
 - 11.8.8.2.1.2 Additional spot elevations that demonstrate positive downstream drainage beyond the end of the vegetated channel;
 - 11.8.8.2.1.3 Cross section of the vegetated channel at the midpoint; and
 - 11.8.8.2.1.4 Photo documentation of the vegetated channel depicting the channel bottom width and verification of achievement of the required 90% vegetated cover.
 - 11.8.8.2.2 The constructed slope, bottom width, depth, and length of the vegetated channel shall be within 90% of the design geometrics for those parameters.
 - 11.8.8.2.3 In the event that the constructed allowable tolerances are exceeded for the vegetated channel, supplemental calculations shall be submitted to determine if the vegetated channel, as constructed, meets the design requirements. The computed residence time rounded to the nearest minute shall be no less than the minimum design residence time.
 - 11.8.8.2.4 Performance of a vegetated channel shall be evaluated by the Department or Delegated Agency if requested in writing to determine if reconstruction of a vegetated channel that exceeds allowable tolerances is necessary.
- 11.9 Sheet Flow to Vegetated Filter Strip or Vegetated Open Space

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- 11.9.1 Vegetated areas can treat sheet flow delivered from adjacent impervious and managed turf areas by slowing runoff velocities and allowing sediment and attached pollutants to settle or be filtered by the vegetation. Vegetation can consist of grasses, planted trees, or existing forest. Design variants include:
- 11.9.1.1 Sheet Flow to Grassed Filter Strip;
 - 11.9.1.2 Sheet Flow to Afforested Filter Strip;
 - 11.9.1.3 Sheet Flow to Forested Filter Strip;
 - 11.9.1.4 Sheet Flow to Grassed Open Space;
 - 11.9.1.5 Sheet Flow to Afforested Open Space; and
 - 11.9.1.6 Sheet Flow to Forested Open Space.
- 11.9.2 Sheet Flow practices receive the following annual runoff reduction and pollutant reduction credits.
- 11.9.2.1 The R_{Pv} runoff reduction performance credit for a Vegetated Filter Strip on A/B soil or compost amended C soil is as follows:
 - 11.9.2.1.1 Grassed filter strips receive 25% annual runoff reduction performance credit.
 - 11.9.2.1.2 Afforested filter strips receive 30% annual runoff reduction performance credit.
 - 11.9.2.1.3 Forested filter strips receive 40% annual runoff reduction performance credit.
 - 11.9.2.2 The R_{Pv} runoff reduction performance credit for a Vegetated Filter Strip on C/D soil is as follows:
 - 11.9.2.2.1 Grassed filter strips receive 10% annual runoff reduction performance credit.
 - 11.9.2.2.2 Afforested filter strips receive 15% annual runoff reduction performance credit.
 - 11.9.2.2.3 Forested filter strips receive 20% annual runoff reduction performance credit.
 - 11.9.2.3 The R_{Pv} runoff reduction performance credit for Sheet Flow to Vegetated Open Space on A/B soil or compost amended C soil is as follows:
 - 11.9.2.3.1 Grassed open space receives 50% annual runoff reduction performance credit.
 - 11.9.2.3.2 Afforested open space receives 60% annual runoff reduction performance credit.
 - 11.9.2.3.3 Forested open space receives 65% annual runoff reduction performance credit.
 - 11.9.2.4 The R_{Pv} runoff reduction performance credit for Sheet Flow to Vegetated Open Space on C/D soil is as follows:
 - 11.9.2.4.1 Grassed open space receives 20% annual runoff reduction performance credit.
 - 11.9.2.4.2 Afforested open space receives 30% annual runoff reduction performance credit.
 - 11.9.2.4.3 Forested open space receives 40% annual runoff reduction performance credit.
 - 11.9.2.5 The C_v runoff reduction performance credit for all Sheet Flow practices is 10% of the R_{Pv} allowance.
 - 11.9.2.6 The F_v runoff reduction performance credit for all Sheet Flow practices is 1% of the R_{Pv} allowance.
 - 11.9.2.7 The total nitrogen pollutant reduction performance credit for all Sheet Flow practices is 100% of the load reduction.
 - 11.9.2.8 The total phosphorous pollutant reduction performance credit for all Sheet Flow practices is 100% of the load reduction.
 - 11.9.2.9 The total suspended solids pollutant reduction performance credit for all Sheet Flow Practices is 100% of the load reduction.
- 11.9.3 Sheet Flow Feasibility Criteria
- 11.9.3.1 To maintain sheet flow through the practice, maximum slope for Filter Strips shall be 8.0% unless additional calculations are submitted showing the maximum depth and minimum residence time can be met.
 - 11.9.3.2 Filter Strips shall not be used in structural fill areas where material must be compacted to meet specific structural criteria.
 - 11.9.3.3 To maintain sheet flow through the practice, maximum slope for Open Space shall be 3.0%.
- 11.9.4 Sheet Flow Design Criteria
- 11.9.4.1 Stormwater shall enter the filter strip or open space as sheet flow.
 - 11.9.4.1.1 Sheet flow length from impervious surfaces shall be limited to 150 feet.
 - 11.9.4.1.2 A gravel diaphragm or other level spreading device shall be provided for impervious sheet flow lengths greater than 75 feet.

- 11.9.4.1.3 When the inflow is from a pipe or channel, an engineered level spreader or other device shall be used to convert the concentrated flow to sheet flow.
 - 11.9.4.2 Vegetated Filter Strip
 - 11.9.4.2.1 The maximum length of a Vegetated Filter Strip shall be 100 feet.
 - 11.9.4.2.2 Vegetated Filter Strips shall have the following minimum lengths, measured in the direction of flow, unless calculations are provided in accordance with the Computational Method of Compliance.
 - 11.9.4.2.2.1 Vegetated Filter Strips having slopes less than 3.0% shall have a minimum length of 20 feet.
 - 11.9.4.2.2.2 Vegetated Filter Strips having slopes between 3.0% and 8.0% shall have a minimum length of 30 feet.
 - 11.9.4.3 Vegetated Open Space
 - 11.9.4.3.1 Vegetated Open Space shall have a maximum slope of 3.0%.
 - 11.9.4.3.2 The minimum area of the Vegetated Open Space shall be equivalent to the impervious area of the contributing drainage area to the Vegetated Open Space.
 - 11.9.4.4 Computational Method of Compliance.
 - 11.9.4.4.1 Vegetated Filter Strips using the Computational Method of Compliance shall meet the following criteria in order to receive RPv runoff reduction credits listed above:
 - 11.9.4.4.1.1 The maximum depth of flow shall be 0.5 inches (0.04 feet).
 - 11.9.4.4.1.2 The minimum residence time shall be 2.5 minutes.
 - 11.9.4.4.2 Adjusted RPv runoff reduction credit based on the ratio of the computed residence to the minimum residence time shall be applied to Vegetated Filter Strips that meet the maximum depth of flow criteria.
 - 11.9.4.4.2.1 The maximum adjusted RPv runoff reduction credit is 75% for HSG A/B soils and 30% for HSG C/D soils.
 - 11.9.4.4.2.2 RPv runoff reduction credit shall not be adjusted for lengths greater than 100 feet.
 - 11.9.4.5 Soil amendments, when used, shall extend over the length and width of the Vegetated Filter Strip or Vegetated Open Space, and compost shall be incorporated to the depth as shown on the approved plan.
 - 11.9.4.6 All Vegetated Filter Strips and Vegetated Open Spaces must be designed so as to be accessible for maintenance.
- 11.9.5 Sheet Flow Landscaping Criteria
- 11.9.5.1 Grassed Filter Strips and Grassed Open Space shall be established at such a density to achieve a 90% vegetated cover for project completion.
 - 11.9.5.2 Afforested Filter Strips and Afforested Open Space shall be planted in accordance with Afforestation requirements.
 - 11.9.5.3 Forested Filter Strips and Forested Open Space shall have no grading or clearing of native vegetation and shall have at least 80% tree canopy coverage.
 - 11.9.5.4 All Vegetated Filter Strips and Vegetated Open Spaces must be stabilized to prevent erosion or transport of sediment to receiving practices or drainage systems.
 - 11.9.5.5 A planting plan shall be provided that indicates the methods used to establish and maintain vegetative stabilization of the Vegetated Filter Strip or Vegetated Open Space.
- 11.9.6 Sheet Flow Construction
- 11.9.6.1 No clearing or grading shall take place in Vegetated Open Space except temporary disturbances associated with incidental utility construction, restoration operations, or management of nuisance vegetation. The Vegetated Open Space area shall not be stripped of topsoil.
 - 11.9.6.2 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.9.6.2.1 Pre-construction meeting;
 - 11.9.6.2.2 Initial site preparation including installation of erosion and sediment controls and sensitive area protection surrounding vegetated filter strip locations;
 - 11.9.6.2.3 Excavation and grading including interim and final elevations;

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- 11.9.6.2.4 Implementation of required stabilization and planting plan; and
- 11.9.6.2.5 Final construction review including development of a punch list for facility acceptance.
- 11.9.6.3 Post Construction Verification Documentation.
 - 11.9.6.3.1 Upon facility completion, the owner shall submit Post Construction Verification Documents at the discretion of the Department or Delegated Agency as follows to demonstrate that the Vegetated Filter Strip or Vegetated Open Space has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. The following items, as applicable, shall be included in the Post Construction Verification Documentation for Sheet Flow Practices:
 - 11.9.6.3.1.1 Dimensions of Vegetated Filter Strips (length and width).
 - 11.9.6.3.1.2 Area of Vegetated Open Space.
 - 11.9.6.3.1.3 Cross-slope.
 - 11.9.6.3.1.4 Elevations of any structural components, such as gravel diaphragms or engineered level spreaders.
 - 11.9.6.3.1.5 Photo documentation of the grassed filter strip or grassed open space providing verification of achievement of the required 90% vegetated cover.
 - 11.9.6.3.2 Constructed allowable tolerances for vegetated filter strips and vegetated open spaces, if disturbed, shall be within the tolerances of design geometrics for the following parameters:
 - 11.9.6.3.2.1 Slope shall be no greater than 2.0% steeper than design slope;
 - 11.9.6.3.2.2 Length shall be no less than 90% of design length;
 - 11.9.6.3.2.3 Width shall be no less than 90% of design width; and
 - 11.9.6.3.2.4 Elevations of any structural components shall be within 0.15 feet of design elevation.
 - 11.9.6.3.3 In the event that the constructed allowable tolerances are exceeded for the vegetated filter strip, supplemental calculations shall be submitted to determine if the vegetated filter strip, as constructed, meets the minimum residence time. The computed residence time rounded to the nearest minute shall be no less than the minimum design residence time.
 - 11.9.6.3.4 Performance of a vegetated filter strip shall be evaluated by the Department or Delegated Agency if requested in writing to determine if reconstruction of a vegetated filter strip that exceeds allowable tolerances is necessary.
- 11.10 Detention Practices
 - 11.10.1 Detention Practices are storage practices that are explicitly designed to provide stormwater detention for the Conveyance Event, Cv (10-year) and Flooding Event, Fv (100-year). Design variants include:
 - 11.10.1.1 Dry Detention Pond
 - 11.10.1.1.1 The Rpv runoff reduction performance credit for this variant is 0%.
 - 11.10.1.1.2 The Cv runoff reduction performance credit for this variant is 0%.
 - 11.10.1.1.3 The Fv runoff reduction performance credit for this variant is 0%.
 - 11.10.1.1.4 The total nitrogen pollutant reduction performance credit for this variant is not less than 5%.
 - 11.10.1.1.5 The total phosphorous pollutant reduction performance credit for this variant is not less than 10%.
 - 11.10.1.1.6 The total suspended solids pollutant reduction performance credit for this variant is not less than 10%.
 - 11.10.1.2 Dry Extended Detention (ED) Basin
 - 11.10.1.2.1 The Rpv runoff reduction performance credit for this variant is 100%.
 - 11.10.1.2.2 The Cv runoff reduction performance credit for this variant is 1%.
 - 11.10.1.2.3 The Fv runoff reduction performance credit for this variant is 0%.
 - 11.10.1.2.4 The total nitrogen pollutant reduction performance credit for this variant is not less than 20%.
 - 11.10.1.2.5 The total phosphorous pollutant reduction performance credit for this variant is not less than 20%.
 - 11.10.1.2.6 The total suspended solids pollutant reduction performance credit for this variant is not less than 60%.
 - 11.10.1.3 Underground Detention Facilities

- 11.10.1.3.1 Underground Detention Facilities not achieving 48-hour ED of the full R_{Pv} shall have R_{Pv}, C_v, and F_v runoff reduction performance credits and total nitrogen, total phosphorous, and total suspended solids pollutant reduction performance credits in accordance with that of Dry Detention Pond.
- 11.10.1.3.2 Underground Detention Facilities achieving 48-hour ED of the full R_{Pv} shall have R_{Pv}, C_v, and F_v runoff reduction performance credits and total nitrogen, total phosphorous, and total suspended solids pollutant reduction performance credits in accordance with that of Dry Extended Detention (ED) Basin.
- 11.10.2 Full runoff reduction credit is given for detention practices that provide 48-hour extended detention of the full R_{Pv}.
- 11.10.3 Detention Practices Feasibility Criteria
 - 11.10.3.1 Depth-to-Water Table and Bedrock.
 - 11.10.3.1.1 Dry Detention Ponds or Dry ED Basins shall not be allowed if the seasonal high water table or bedrock will be within one foot of the floor of the pond.
 - 11.10.3.1.2 Non-watertight Underground Detention Facilities shall be no lower than the seasonal high water table and two feet above bedrock.
 - 11.10.3.1.3 For watertight Underground Detention Facilities, an anti-flotation analysis is required to check for buoyancy problems in seasonal high water table areas.
 - 11.10.3.1.4 Subsection 12.1 shall be followed for testing.
 - 11.10.3.2 Underground Detention Facilities must meet structural requirements for bearing capacity, overburden support, and traffic loading as determined by a licensed design professional, and based upon manufacturer's recommendations where applicable.
- 11.10.4 Detention Practice Conveyance Criteria
 - 11.10.4.1 Principal Spillway
 - 11.10.4.1.1 The principal spillway must be accessible from dry land.
 - 11.10.4.1.2 A structure-pipe spillway shall be designed with anti-flotation, anti-vortex and trash rack devices on the structure.
 - 11.10.4.1.3 The outfall pipe and all connections to the outfall structure shall be made watertight. Soil tight only joints are not acceptable.
 - 11.10.4.1.4 Anti-seep collars shall be used in accordance with USDA NRCS Delaware Pond Code 378, as amended.
 - 11.10.4.1.5 When the principal spillway is composed of a weir wall discharging to a channel, the channel below the weir must be reinforced with riprap or other acceptable material to prevent scour.
 - 11.10.4.2 Non-Clogging Outlet
 - 11.10.4.2.1 For Dry ED Basins, the control structure must include an outlet that will slowly release the R_{Pv} over a 48-hour period.
 - 11.10.4.2.2 When a low flow orifice is specified, it must be adequately protected from clogging by either an acceptable external trash rack or by internal orifice protection. Orifice diameters shall not be less than three inches unless internal orifice control is provided.
 - 11.10.4.3 The design shall specify an outfall that can discharge the maximum design storm event in a non-erosive manner at the project point of discharge.
 - 11.10.4.4 Emergency Spillway.
 - 11.10.4.4.1 Dry Detention Ponds and Dry ED Basins must be designed to pass the maximum design storm event (F_v) if the F_v is being routed through the Dry Detention Ponds and Dry ED Basins rather than bypassing.
 - 11.10.4.4.2 An earthen emergency spillway designed to convey the F_v shall be cut in natural ground or, if cut in fill, shall be constructed and stabilized with methods to prevent erosion and structural failure.
 - 11.10.4.5 Inflow Points.
 - 11.10.4.5.1 Inflow points into the Dry Detention Ponds and Dry ED Basins must be stabilized to ensure that non-erosive conditions exist during storm events up to the conveyance event (C_v).

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- 11.10.4.5.2 A forebay shall be provided at each inflow location that provides 10% or greater of the total RPv inflow to the Dry Detention Ponds and Dry ED Basins.
- 11.10.4.6 In the event that the embankment is a regulated dam, the designer must verify that the appropriate Dam Safety Permit has been approved by the Department's Dam Safety Program.
- 11.10.4.7 For Underground Detention Facilities, an internal or external high flow bypass or overflow shall be included in the design to safely pass the Fv.
- 11.10.5 Detention Practices Pretreatment Criteria
- 11.10.5.1 A forebay must be located at each major inlet to trap sediment and preserve the capacity of the main treatment cell. The following criteria apply to forebay design:
- 11.10.5.1.1 A major inlet is defined as an individual storm drain inlet pipe or open channel conveying at least 10% of the Dry Detention Pond's and Dry ED Basin's contributing RPv runoff volume.
- 11.10.5.1.2 The forebay shall be no deeper than three feet.
- 11.10.5.1.3 The forebay must be sized to contain 10% of the volume of runoff from the contributing drainage area for the Resource Protection event.
- 11.10.5.1.4 Discharge from the forebay shall be non-erosive.
- 11.10.5.2 Every underground detention practice shall have pretreatment mechanisms to protect the long term integrity of the practice.
- 11.10.6 Detention Practices Design Criteria
- 11.10.6.1 Dry Detention Ponds and Dry ED Basins constructed to meet regulatory stormwater management requirements in the State of Delaware shall be designed and constructed in accordance with the USDA NRCS Delaware Pond Code 378 as amended.
- 11.10.6.2 Detention Practice Sizing.
- 11.10.6.2.1 For RPv compliance, a Dry ED Basin or Underground Detention Facility must provide 48 hours extended detention for the RPv runoff volume.
- 11.10.6.2.2 Detention time shall be based on the time of initial inflow to time of final outflow from the facility. In order to simulate a baseflow condition to the extent practicable, the peak discharge for the outflow hydrograph shall not exceed five times the average discharge rate.
- 11.10.6.3 Earthen side slopes shall be designed and constructed no steeper than 3H:1V.
- 11.10.6.4 Retaining walls around Dry Detention Ponds and Dry ED Basins shall be limited to no more than 50% of the pond perimeter based upon the peak elevation of the Cv. In order to maintain the safety requirements, retaining walls shall be configured as follows:
- 11.10.6.4.1 The retaining wall shall have a maximum height of three feet.
- 11.10.6.4.2 Any additional retaining walls shall have a maximum height of two feet and provide a minimum 10-foot level terrace from a lower retaining wall.
- 11.10.6.5 Safety Features
- 11.10.6.5.1 Any inflow opening 12 inches or greater discharging to a closed drainage system shall include safety grates.
- 11.10.6.5.2 The emergency spillway must be located so that downstream structures will not be adversely impacted by spillway discharges.
- 11.10.6.5.3 The emergency spillway exit channel must be designed to direct runoff to a point of discharge without adverse impact to downstream structures.
- 11.10.6.6 All Detention Practices shall be designed so as to be accessible for maintenance.
- 11.10.6.6.1 Adequate maintenance access must extend to the pretreatment, riser, and outlet structure. Adequate maintenance access must also be provided for all Underground Detention Facilities.
- 11.10.6.6.2 A maintenance right-of-way or easement must extend to the Detention Practice from a public or private road.
- 11.10.6.6.3 Maintenance access must meet the following criteria:
- 11.10.6.6.3.1 Minimum width of 15 feet.
- 11.10.6.6.3.2 Profile grade that does not exceed 10H:1V.
- 11.10.6.6.3.3 Minimum 10H:1V cross slope.
- 11.10.6.7 Maintenance Set-Aside Area

- 11.10.6.7.1 The maintenance set-aside area shall accommodate the volume of 50% of the collective forebay volume.
- 11.10.6.7.2 The maximum depth of the set aside volume shall be one foot.
- 11.10.6.7.3 The slope of the set aside area shall not exceed 5.0%.
- 11.10.6.8 Detention Vault and Tank Materials. All construction joints and pipe joints shall be water tight. Cast-in-place wall sections must be designed as retaining walls.
- 11.10.6.9 For watertight Underground Detention Facilities, anti-flotation analysis is required to check for buoyancy problems in the high water table areas. Anchors shall be designed to counter the pipe and structure buoyancy by at least a 1.2 factor of safety.
- 11.10.7 Detention Practices Landscaping Criteria
 - 11.10.7.1 Woody vegetation shall not be planted or allowed to grow within 15 feet of the embankment and 10 feet on either side of principal spillway or inflow pipes.
 - 11.10.7.2 For Dry Detention Ponds and Dry ED Basins, a planting plan shall be provided that indicates the methods used to establish and maintain vegetative coverage within the Detention Practice and its vegetated perimeter area. Minimum elements of a plan include seed mixes by botanical and common names as well as percentages by weight or volume.
- 11.10.8 Detention Practices Construction
 - 11.10.8.1 Construction of proprietary Underground Detention Facilities must be in accordance with manufacturer's specifications.
 - 11.10.8.2 Underground Detention Facilities must be inspected and cleaned of sediment after the site is stabilized.
 - 11.10.8.3 Use of Dry Detention Pond or Dry ED Basin for Erosion and Sediment Control.
 - 11.10.8.3.1 Approval from the Department or the appropriate Delegated Agency must be obtained before any planned Dry Detention Ponds and Dry ED Basins can be used as a sediment basin.
 - 11.10.8.3.2 If a Dry Detention Pond or Dry ED Basin serves as a sediment basin during project construction, the volume of the sediment basin must be based on the more stringent sizing rule.
 - 11.10.8.3.3 When the sediment basin is being converted into a Dry Detention Pond or Dry ED Basin, the sediment basin shall be dewatered in accordance with the approved plan and appropriate details from the Delaware Erosion and Sediment Control Handbook prior to removing accumulated sediment and regrading the pond bottom.
 - 11.10.8.3.4 The Sediment and Stormwater Plan must include conversion steps from sediment basin to permanent Dry Detention Ponds and Dry ED Basins in the construction sequence.
 - 11.10.8.3.4.1 The Department or Delegated Agency must be notified and provide approval prior to conversion from sediment basin to the final configuration of the Dry Detention Pond or Dry ED Basin.
 - 11.10.8.3.4.2 Appropriate procedures must be implemented to prevent discharge of turbid waters when the sediment basin is being converted into a Dry Detention Pond or Dry ED Basin.
 - 11.10.8.4 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.10.8.4.1 Pre-construction meeting.
 - 11.10.8.4.2 Initial site preparation including installation of erosion and sediment controls.
 - 11.10.8.4.3 Construction of the embankment, including installation of the principal spillway and the outlet structure.
 - 11.10.8.4.4 For Dry Detention Pond and Dry ED Basin, excavation and grading including interim and final elevations.
 - 11.10.8.4.5 For Underground Detention, subgrade, placement of stone, system components in accordance with manufacturer's recommendations and backfill.
 - 11.10.8.4.6 Implementation of the planting plan and vegetative stabilization.
 - 11.10.8.4.7 Final inspection including development of a punch list for facility acceptance.
 - 11.10.8.5 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the Detention Practice has been constructed within allowable tolerances and in

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accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.

11.10.8.5.1 Allowable tolerances for Dry Detention Pond and Dry ED Basin are as follows:

11.10.8.5.1.1 The constructed top of bank elevation may be no lower than the design elevation for top of bank.

11.10.8.5.1.2 The constructed volume of the dry pond surface storage shall be no less than 90% of the design volume.

11.10.8.5.1.3 The constructed elevation of any structure shall be within 0.15 foot of the design.

11.10.8.5.2 Allowable tolerances for Underground Detention Facilities are as follows:

11.10.8.5.2.1 Grate and invert elevations of all structures, including weirs shall be within 0.15 foot of the design.

11.10.8.5.2.2 Diameter of all pipes or dimensions of chambers within underground detention facility shall be as shown on the plan.

11.10.8.5.2.3 Dimension of any weirs shall be within 10% of the design.

11.10.8.5.3 When the allowable tolerances are exceeded for volume or structure elevations, supplemental calculations must be submitted to the approval agency to demonstrate that the Detention Practice, as constructed, meets the design requirements.

11.10.9 Detention Practices Maintenance Criteria

11.10.9.1 Repair of critical structural features such as embankments and risers shall be performed by responsible personnel that have successfully completed the Department Contractor Training Program.

11.10.9.2 Sediment removal in the Dry Detention Pond or Dry ED Basin pretreatment practice must occur when 50% of total forebay capacity has been lost.

11.11 Stormwater Filtering Systems

11.11.1 Stormwater Filter Systems are practices that capture and temporarily store the design storm volume and pass it through a filter media or material. Filtered runoff may be collected and returned to the conveyance system, or allowed to partially infiltrate into the soil. Design variants include:

11.11.1.1 Non-Structural Sand Filter;

11.11.1.2 Surface Sand Filter;

11.11.1.3 Three-Chamber Underground Sand Filter; and

11.11.1.4 Perimeter Sand Filter.

11.11.2 Stormwater Filtering Systems shall be combined with a separate facility to provide stormwater detention.

11.11.3 Proprietary stormwater filtering systems shall be verified by the Department for adequate performance, sizing, and longevity.

11.11.4 Stormwater Filtering Systems Stormwater Credits

11.11.4.1 Stormwater Filtering Systems receive no runoff reduction performance credit.

11.11.4.2 Stormwater Filtering Systems sized in accordance with the design criteria shall receive the following pollutant reduction performance credits:

11.11.4.2.1 The total nitrogen pollutant reduction performance credit for Stormwater Filtering Systems is not less than 40% removal efficiency.

11.11.4.2.2 The total phosphorus pollutant reduction performance credit for Stormwater Filtering Systems is not less than 60% removal efficiency.

11.11.4.2.3 The total suspended solids pollutant reduction performance credit for Stormwater Filtering Systems is not less than 80% removal efficiency.

11.11.5 Stormwater Filtering Systems Feasibility Criteria

11.11.5.1 Depth to Water Table and Bedrock

11.11.5.1.1 A minimum vertical distance of two feet must be provided between the bottom of the non-structural sand filter or surface sand filter and the seasonal high water table as determined by the procedures in subsection 12.1 or bedrock layer.

11.11.5.1.2 The minimum vertical distance of two feet may be relaxed if a groundwater mounding analysis or piezometer testing has been performed by a qualified professional.

- 11.11.5.1.3 Three-chamber underground sand filter and perimeter sand filter require no minimum separation to seasonal high water table or bedrock.
- 11.11.5.2 Stormwater Filtering Systems shall not be located on slopes greater than 6.0%.
- 11.11.6 Stormwater Filtering Systems Conveyance Criteria
 - 11.11.6.1 On-line stormwater filtering systems' designs, shall demonstrate that the filter will safely pass the largest design storm event to a stabilized water course without resuspending or flushing previously trapped material.
 - 11.11.6.2 All Stormwater Filtering Systems shall be designed to drain or dewater within 48 hours after a storm event.
- 11.11.7 Every inlet into a Stormwater Filtering System shall have a pretreatment mechanism to trap sediment, preserve the capacity of the main treatment area, and protect the long term integrity of the practice.
- 11.11.8 Stormwater Filtering Systems Design Criteria
 - 11.11.8.1 Stormwater Filtering Systems shall be designed to drain the design storm volume from the filter chamber within 48 hours after each rainfall event.
 - 11.11.8.2 Filter
 - 11.11.8.2.1 The filter media shall consist of clean, washed AASHTO M-6/ASTM C-33 medium aggregate concrete sand with individual grains between 0.02 and 0.04 inches in diameter.
 - 11.11.8.2.2 A minimum filter bed depth of 12" is required.
 - 11.11.8.3 Underdrain
 - 11.11.8.3.1 The underdrain shall be a minimum of four inch perforated corrugated polyethylene pipe (CPP).
 - 11.11.8.3.2 The underdrain shall be encased in a layer of clean, washed nominal ¼ inch gravel with a maximum of 2.0% passing the #200 sieve with a minimum of three inches of cover.
 - 11.11.8.3.3 When an underdrain is specified a needled, non-woven, polypropylene geotextile having a flow rate (ASTM D4491) ≥110 gallons per minute per square foot (gal/min/sf) and an apparent opening size (ASTM D4751) of US #70 or #80 sieve shall be placed beneath the filter media and above the underdrain gravel layer.
 - 11.11.8.4 All Stormwater Filtering Systems must be designed so as to be accessible for maintenance.
 - 11.11.8.4.1 A maintenance right-of-way or easement must extend to the Stormwater Filtering System from a public or private road.
 - 11.11.8.4.2 Adequate maintenance access must extend to the perimeter of the Stormwater Filtering System pretreatment area and the filter bed
 - 11.11.8.4.3 Maintenance access must meet the following criteria:
 - 11.11.8.4.3.1 Minimum width of fifteen feet.
 - 11.11.8.4.3.2 Profile grade that does not exceed 10H:1V.
 - 11.11.8.4.3.3 Minimum 10H:1V cross slope.
 - 11.11.8.4.4 Access to Underground Sand Filters must be provided by manholes at least 30 inches in diameter, along with steps to the areas where maintenance will occur.
 - 11.11.8.5 The Stormwater Filtering System including pretreatment shall be sized to contain a minimum of 75% of the R_{Pv} prior to filtration.
- 11.11.9 Vegetative cover shall be established over the contributing pervious drainage areas before runoff can be accepted into the Stormwater Filtering System.
- 11.11.10 Stormwater Filtering Systems Construction Criteria
 - 11.11.10.1 Erosion and Sediment Control.
 - 11.11.10.1.1 No runoff shall be allowed to enter the Stormwater Filtering System prior to completion of all construction activities, including revegetation and final site stabilization.
 - 11.11.10.1.2 Construction runoff shall be treated in separate sedimentation basins and routed to bypass the filter system. Should construction runoff enter the filter system prior to final site stabilization, all contaminated materials shall be removed and replaced with new clean filter materials before a regulatory inspector approves its completion.
 - 11.11.10.1.3 The approved Sediment & Stormwater Plan shall include specific measures to provide for the protection of the filter system before the final stabilization of the site.

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11.11.10.2 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:

11.11.10.2.1 Pre-construction meeting.

11.11.10.2.2 Initial site preparation including installation of erosion and sediment controls, sensitive area protection, and blockage of inlets to stormwater filtering system locations.

11.11.10.2.3 Excavation and grading to design dimensions and elevations.

11.11.10.2.4 Installation of the filter structure, including the water tightness test as applicable.

11.11.10.2.5 Installation of the underdrain and filter bed.

11.11.10.2.6 Check that stabilization in contributing area is adequate to bring the stormwater filtering system online.

11.11.10.2.7 Final construction review after a rainfall event to ensure that it drains properly and all pipe connections are watertight. Develop a punch list for facility acceptance.

11.11.10.3 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the stormwater filtering system has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for stormwater filtering systems are as follows:

11.11.10.3.1 The constructed surface area of the filter bed shall be no less than 90% of the design surface area.

11.11.10.3.2 The constructed volume of the surface storage shall be no less than 90% of the design volume.

11.11.10.3.3 Depth of filter media shall be no less than 12 inches.

11.11.10.3.4 The constructed elevation of any structure shall be within 0.15 foot of the design.

11.12 Constructed Wetlands

11.12.1 Constructed Wetlands are practices that mimic natural wetland areas to treat urban stormwater by incorporating permanent pools with shallow storage areas. Constructed Wetlands may provide stormwater detention for larger storms (Cv and Fv) above the RPv storage. Design variants include:

11.12.1.1 Traditional Constructed Wetlands;

11.12.1.2 Wetland Swales;

11.12.1.3 Ephemeral Constructed Wetlands; and

11.12.1.4 Submerged Gravel Wetlands.

11.12.2 Constructed Wetland Stormwater Credits

11.12.2.1 Traditional Constructed Wetlands Performance Credits

11.12.2.1.1 Traditional Constructed Wetlands receive 100% runoff reduction credit for the RPv.

11.12.2.1.2 Traditional Constructed Wetlands receive not less than 1% of the RPv allowance for the Cv.

11.12.2.1.3 Traditional Constructed Wetlands receive not less than 0% runoff reduction credit for the Fv.

11.12.2.1.4 Traditional Constructed Wetlands receive not less than 30% pollutant removal efficiency for total nitrogen reduction.

11.12.2.1.5 Traditional Constructed Wetlands receive not less than 40% pollutant removal efficiency for total phosphorous reduction.

11.12.2.1.6 Traditional Constructed Wetlands receive not less than 80% pollutant removal efficiency for total suspended solids reduction.

11.12.2.2 Wetland Swale Performance Credits

11.12.2.2.1 Wetland Swales receive the following runoff reduction credits:

11.12.2.2.1.1 Wetland Swales located in HSG A or B soils receive 15% annual runoff reduction for the RPv.

11.12.2.2.1.2 Wetland Swales located in HSG C or D soils receive 10% annual runoff reduction for the RPv.

11.12.2.2.1.3 Wetland Swales receive not less than 1% of the RPv allowance for the Cv.

11.12.2.2.1.4 Wetland Swales receive not less than 0% runoff reduction credit for the Fv.

11.12.2.2.2 Wetland Swales receive 100% of the load reduction plus not less than 20% pollutant removal efficiency for total nitrogen reduction.

- 11.12.2.2.3 Wetland Swales receive 100% of the load reduction plus not less than 30% pollutant removal efficiency for total phosphorous reduction.
- 11.12.2.2.4 Wetland Swales receive 100% of the load reduction plus not less than 60% pollutant removal efficiency for total suspended solids reduction.
- 11.12.2.3 Ephemeral Constructed Wetland Performance Credits
 - 11.12.2.3.1 Ephemeral Constructed Wetlands receive the following runoff reduction credits:
 - 11.12.2.3.1.1 Ephemeral Constructed Wetlands located in HSG A or B soils receive 40% annual runoff reduction for the RPv.
 - 11.12.2.3.1.2 Ephemeral Constructed Wetlands located in HSG C or D soils receive 10% annual runoff reduction for the RPv.
 - 11.12.2.3.1.3 Ephemeral Constructed Wetlands receive not less than 1% of the RPv allowance for the Cv.
 - 11.12.2.3.1.4 Ephemeral Constructed Wetlands receive not less than 0% runoff reduction credit for the Fv.
 - 11.12.2.3.2 Ephemeral Constructed Wetlands receive 100% of the load reduction plus not less than 20% pollutant removal efficiency for total nitrogen reduction.
 - 11.12.2.3.3 Ephemeral Constructed Wetlands receive 100% of the load reduction plus not less than 30% pollutant removal efficiency for total phosphorous reduction.
 - 11.12.2.3.4 Ephemeral Constructed Wetlands receive 100% of the load reduction plus not less than 60% pollutant removal efficiency for total suspended solids reduction.
- 11.12.2.4 Submerged Gravel Wetland Performance Credits
 - 11.12.2.4.1 The RPv, Cv and Fv runoff reduction performance credit for Submerged Gravel Wetlands is 100% of the detention storage.
 - 11.12.2.4.2 Submerged Gravel Wetlands receive not less than 30% pollutant removal efficiency for total nitrogen reduction.
 - 11.12.2.4.3 Submerged Gravel Wetlands receive not less than 40% pollutant removal efficiency for total phosphorous reduction.
 - 11.12.2.4.4 Submerged Gravel Wetlands receive not less than 80% pollutant removal efficiency for total suspended solids reduction.
- 11.12.3 Constructed Wetlands shall not be located within existing jurisdictional wetlands.
- 11.12.4 Constructed Wetland Conveyance Criteria
 - 11.12.4.1 Principal Spillway
 - 11.12.4.1.1 The principal spillway must be accessible from dry land.
 - 11.12.4.1.2 A structure-pipe spillway shall be designed with anti-flotation, anti-vortex and trash rack devices on the structure.
 - 11.12.4.1.3 The outfall pipe and all connections to the outfall structure shall be made watertight. Soil tight only joints are not acceptable.
 - 11.12.4.1.4 Anti-seep collars shall be used in accordance with Pond Code 378, as amended.
 - 11.12.4.1.5 When the principal spillway is composed of a weir wall discharging to a channel, the channel below the weir must be reinforced with riprap or other acceptable material to prevent scour.
 - 11.12.4.1.6 When a low flow orifice is specified, it must be adequately protected from clogging by either an acceptable external trash rack or by internal orifice protection. Orifice diameters shall not be less than three inches.
 - 11.12.4.2 The design shall specify an outfall that can discharge the maximum design storm event in a non-erosive manner at the project point of discharge.
 - 11.12.4.3 Constructed Wetlands must be designed to pass the maximum design storm event (Fv) if the Fv is being routed through the Constructed Wetland rather than bypassing. An earthen emergency spillway designed to convey the Fv shall be cut in natural ground or, if cut in fill, shall be constructed and stabilized with methods to prevent erosion and structural failure.
 - 11.12.4.4 Inflow Points
 - 11.12.4.4.1 Inflow points into the Constructed Wetland must be stabilized to ensure that non-erosive conditions exist during storm events up to the conveyance event (Cv).

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- 11.12.4.4.2 For Submerged Gravel Wetlands, the inflow volume shall enter the gravel substrate directly via a pipe manifold or inflow chimneys or as sheet flow through connected gravel layer.
- 11.12.5 Constructed Wetland Pretreatment Criteria
- 11.12.5.1 Every inlet into a Constructed Wetland shall have pretreatment.
- 11.12.5.2 Exit velocities from the pretreatment shall be non-erosive during the largest design storm that is routed through the Constructed Wetland.
- 11.12.5.3 A forebay shall be located at each major inlet to trap sediment and preserve the capacity of the main treatment cell.
- 11.12.5.4 The following criteria apply to forebay design:
- 11.12.5.4.1 A major inlet is defined as an individual storm drain inlet pipe or open channel conveying at least 10% of the Constructed Wetland's contributing RPv runoff volume.
- 11.12.5.4.2 The forebay must be sized to contain 10% of the volume of runoff from the contributing drainage area for the Resource Protection event.
- 11.12.5.4.3 Discharge from the forebay shall be non-erosive.
- 11.12.6 Constructed Wetland Design Criteria
- 11.12.6.1 Constructed Wetlands constructed to meet regulatory stormwater management requirements shall be designed and constructed in accordance with the USDA NRCS Pond Code 378 as amended.
- 11.12.6.2 Constructed Wetlands shall be designed so that they will:
- 11.12.6.2.1 Dewater the Fv within 72 hours, or
- 11.12.6.2.2 Manage the Fv on site with no adverse impact. The extents of the Fv shall be clearly delineated.
- 11.12.6.3 The lowest discharge elevation on the outlet device shall be located no lower than the seasonal high groundwater table as determined by subsection 12.1.
- 11.12.6.4 Liners
- 11.12.6.4.1 All Traditional Constructed Wetlands shall be evaluated for feasibility and ability to maintain permanent pool, including the need for a liner, by a qualified, licensed geotechnical engineer or geologist. If the design professional chooses not to follow the recommendations of the geotechnical professional, a signed, sealed and dated letter from the design professional providing justification for removal of the liner from the design shall be provided to the Department or Delegated Agency.
- 11.12.6.4.2 When the geotechnical engineer recommends a liner, acceptable options include the following:
- 11.12.6.4.2.1 A clay liner having a minimum compacted thickness of six inches with an additional six inch layer of engineered wetland soil mix containing a minimum of 35% organic material above it. Clay used as a liner must meet the following specifications:
- 11.12.6.4.2.1.1 Permeability of 1×10^{-6} centimeters per second (cm/sec) using ASTM D-2434 procedure;
- 11.12.6.4.2.1.2 Plasticity index of not less than 15% using ASTM D-423/424 procedures;
- 11.12.6.4.2.1.3 Liquid limit of not less than 30% using ASTM D-2216 procedure;
- 11.12.6.4.2.1.4 Clay particles passing not less than 30% using ASTM D-422 procedure; and
- 11.12.6.4.2.1.5 Compaction of 95% of standard proctor density using ASTM D-2216 procedure.
- 11.12.6.4.2.2 Other acceptable measures as recommended by a qualified geotechnical professional.
- 11.12.6.5 Trash Racks.
- 11.12.6.5.1 Trash racks shall be provided for low-flow pipes and for all riser structure openings.
- 11.12.6.5.2 All metal trash racks shall be coated with a rust inhibitor to increase longevity of the device.
- 11.12.6.6 When a riser is used, it must be located such that it is accessible from the side slope for the purposes of inspection and maintenance.
- 11.12.6.7 Safety Features
- 11.12.6.7.1 Any opening 12 inches or greater discharging to a closed drainage system shall include safety grates.

- 11.12.6.7.2 The emergency spillway must be located so that downstream structures will not be adversely impacted by spillway discharges.
- 11.12.6.7.3 The emergency spillway exit channel must be designed to direct runoff to a point of discharge without adverse impact to downstream structures.
- 11.12.6.8 All Constructed Wetlands must be designed so as to be accessible for maintenance.
 - 11.12.6.8.1 Adequate maintenance access must extend to the forebays, micropools, riser, and outlet structure.
 - 11.12.6.8.2 A maintenance right-of-way or easement must extend to the Constructed Wetland from a public or private road.
 - 11.12.6.8.3 Maintenance access must meet the following criteria:
 - 11.12.6.8.3.1 Minimum width of 15 feet.
 - 11.12.6.8.3.2 Profile grade that does not exceed 10H:1V.
 - 11.12.6.8.3.3 Minimum 10H:1V cross slope.
- 11.12.6.9 Maintenance Set-Aside Area
 - 11.12.6.9.1 The maintenance set-aside area shall accommodate the volume of 50% of the collective forebay volume.
 - 11.12.6.9.2 The maximum depth of the set aside area shall be one foot.
 - 11.12.6.9.3 The slope of the set aside area shall not exceed 5.0%.
- 11.12.6.10 Traditional Constructed Wetlands
 - 11.12.6.10.1 The permanent pool volume, or the volume below the normal water surface elevation, shall be equivalent to a minimum of 50% of the R_{Pv} volume.
 - 11.12.6.10.2 Traditional Constructed Wetlands shall be sized so that the R_{Pv} has a maximum ponding depth of 12 inches above the normal water surface elevation.
 - 11.12.6.10.3 The R_{Pv} shall dewater within 48 hours.
 - 11.12.6.10.4 The C_v maximum ponding depth shall not exceed 12 inches above the normal water surface elevation for more than 12 hours.
 - 11.12.6.10.5 Flow Path
 - 11.12.6.10.5.1 The total length of the flow path compared to the linear length through the Traditional Constructed Wetland shall be a minimum ratio of 2:1.
 - 11.12.6.10.5.2 When an inlet is located near the outlet, the ratio of the shortest flow path through the system to the overall length shall be a minimum of 0.5:1.
 - 11.12.6.10.5.3 The drainage area served by any inlets located less than a 0.5:1 ratio shall constitute no more than 20% of the total contributing drainage area.
 - 11.12.6.10.6 Traditional Constructed Wetlands shall be composed of the following zones:
 - 11.12.6.10.6.1 Zone 1: Deep Pools.
 - 11.12.6.10.6.1.1 The volume of water stored in the deep pools, also referred to as micropools, shall be a minimum of 20% of the R_{Pv} volume.
 - 11.12.6.10.6.1.2 A minimum of two deep pools in addition to the forebay shall be provided, one of which shall be located prior to the outlet location to provide for additional sediment deposition.
 - 11.12.6.10.6.1.3 Deep pools shall range from a minimum of 30 inches to a maximum of six feet in depth below the normal water surface elevation and shall be designed to remain permanently saturated.
 - 11.12.6.10.6.1.4 The deep pools shall be hydraulically connected within the water flow path.
 - 11.12.6.10.6.1.5 The deep pools shall be designed with a side slope not steeper than 3:1.
 - 11.12.6.10.6.1.6 A safety bench is required for deep pool depths greater than four feet.
 - 11.12.6.10.6.2 Zone 2: Transition Zone.
 - 11.12.6.10.6.2.1 Zone 2 is a short transition zone between the deeper pools and the low marsh zone, and ranges from a minimum of six inches to a maximum of 30 inches below the normal water surface elevation.

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- 11.12.6.10.6.2.2 The volume of water stored in the transition zone shall be a minimum of 20% of the RPv volume.
- 11.12.6.10.6.2.3 The transition zone shall have a maximum side slope of 3:1 from the deep pool to the low marsh zone.
- 11.12.6.10.6.3 Zone 3: Low Marsh Zone.
 - 11.12.6.10.6.3.1 The low marsh zone ranges from a maximum of six inches below the normal water surface elevation to the normal water surface elevation.
 - 11.12.6.10.6.3.2 The volume of water stored in the low marsh zone shall be a minimum of 10% of the RPv volume.
 - 11.12.6.10.6.3.3 The side slope within the low marsh zone shall not be steeper than 4:1.
- 11.12.6.10.6.4 Zone 4: High Marsh Zone.
 - 11.12.6.10.6.4.1 The upper end of the marsh zone is the high marsh zone, which ranges from the normal water surface elevation to a maximum of 12 inches above the normal water surface elevation, allowing the RPv to inundate to the top of the high marsh zone.
 - 11.12.6.10.6.4.2 The side slope within the high marsh zone shall not be steeper than 4:1.
- 11.12.6.10.6.5 Zone 5: Floodplain.
 - 11.12.6.10.6.5.1 A low floodplain shall range between a minimum of 12 inches and a maximum of 18 inches above the normal water surface elevation and be planted with plants suited for infrequent to temporary saturations.
 - 11.12.6.10.6.5.2 The side slope within the floodplain shall not be steeper than 4:1.
- 11.12.6.10.7 A minimum 10-foot-wide vegetated perimeter around the wetland area shall be planted with appropriate grasses, trees, and shrubs.
- 11.12.6.10.8 A simple water balance calculation shall be performed to ensure that the deep pools will not go completely dry during a 30-day summer drought.
- 11.12.6.11 Wetland Swales
 - 11.12.6.11.1 Wetland Swale Sizing.
 - 11.12.6.11.1.1 Wetland swales shall contain the Cv event.
 - 11.12.6.11.1.2 If the Fv event is not contained within the Wetland swale top of bank, then the area of inundation and discharge route shall be delineated.
 - 11.12.6.11.1.3 The maximum RPv water surface elevation shall be no greater than six inches above the normal water surface elevation.
 - 11.12.6.11.2 The average groundwater elevation as determined by subsection 12.1 shall be below the bottom of the Wetland Swale. Only the seasonal high groundwater as determined by the Soil Investigation Procedures may intersect the bottom of the Wetland Swale.
 - 11.12.6.11.3 Wetland Swales shall not have side slopes steeper than 3:1.
 - 11.12.6.11.4 The maximum longitudinal slope shall be an average of 1.0%.
 - 11.12.6.11.5 A minimum 10-foot-wide vegetated perimeter on both sides of the wetland swale shall be planted with appropriate grasses, trees and shrubs.
- 11.12.6.12 Ephemeral Constructed Wetlands
 - 11.12.6.12.1 Ephemeral Constructed Wetland Sizing.
 - 11.12.6.12.1.1 The RPv event shall pond a minimum of six inches and a maximum of 12 inches of water above the ground surface of the Ephemeral Constructed Wetland.
 - 11.12.6.12.1.2 The Fv water surface shall be a maximum of 30 inches above the ground surface of the Ephemeral Constructed Wetland.
 - 11.12.6.12.1.3 The average groundwater elevation as determined by the Soil Investigation Procedures shall be below the wetland bottom of the Ephemeral Constructed Wetland. Only the seasonal high groundwater as determined by subsection 12.1 may intersect the bottom of the Ephemeral Constructed Wetland. If the seasonal high groundwater intersects the bottom of the Ephemeral Constructed Wetland, the wetland shall be modeled considering the elevation of the seasonal high groundwater.
 - 11.12.6.12.2 The side slopes of the buffer area and within the wetland shall be 4:1 or flatter.

- 11.12.6.12.3 A minimum 10-foot-wide vegetated perimeter around the wetland area shall be planted with appropriate grasses, trees, and shrubs.
- 11.12.6.13 Submerged Gravel Wetlands
 - 11.12.6.13.1 Submerged Gravel Wetland Sizing.
 - 11.12.6.13.1.1 The maximum surface ponding depth for the R_{Pv} shall not be greater than the tolerance depths of the wetland plantings selected, or two feet, whichever is less.
 - 11.12.6.13.1.2 The Submerged Gravel Wetland shall store the R_{Pv} volume within the stone substrate and wetland soils and above the soils in surface ponding.
 - 11.12.6.13.1.3 Submerged Gravel Wetlands shall have no minimum detention time.
 - 11.12.6.13.2 Gravel substrate.
 - 11.12.6.13.2.1 The gravel substrate shall be a minimum of two feet and a maximum of four feet in depth.
 - 11.12.6.13.2.2 The gravel substrate shall be sized to contain a minimum of 25% of the R_{Pv} volume considering 40% void ratio.
 - 11.12.6.13.2.3 The gravel substrate shall be composed of clean washed gravel, with a maximum of 2.0% passing the #200 sieve. Gravel shall have a maximum diameter of 2.5 inches and a minimum diameter of 0.5 inches. A porosity value of 0.4 shall be used for areas of stone in the design of gravel substrate. Sand shall not be an acceptable substitute for gravel.
 - 11.12.6.13.3 An engineered wetland soil layer containing a minimum of 15% organic material and a maximum of 15% clay content shall be included on the surface of the Submerged Gravel Wetland. The wetland soil layer shall be a minimum of eight inches thick.
 - 11.12.6.13.4 A minimum four inch thick layer of clean, washed nominal ¼ inch gravel with a maximum of 2.0% passing the #200 sieve shall be installed between the gravel substrate and the wetland soil layer.
 - 11.12.6.13.5 Underdrain.
 - 11.12.6.13.5.1 An underdrain shall be provided at an elevation three inches above the invert of the gravel substrate.
 - 11.12.6.13.5.2 The underdrain shall be a minimum of four inch perforated high density polyethylene pipe (HDPE) or polyvinyl chloride pipe (PVC).
 - 11.12.6.13.5.3 The underdrain shall connect to the outlet structure. The discharge elevation shall be four inches below the wetland soil surface.
 - 11.12.6.13.6 There shall be a minimum of 15 feet separation distance between all gravel substrate inflow points and all underdrain outlet points.
 - 11.12.6.13.7 Side slopes above the gravel substrate shall not be steeper than 3:1.
- 11.12.7 Constructed Wetland Landscaping Criteria
 - 11.12.7.1 A planting plan is required for all Constructed Wetlands. Invasive species shall not be specified within Constructed Wetlands.
 - 11.12.7.2 The planting plan shall be certified by a qualified professional with demonstrated knowledge in wetland species.
 - 11.12.7.3 Plants used in Constructed Wetlands shall be supplied by a certified wetland nursery using plants selected for the region.
- 11.12.8 Constructed Wetland Construction
 - 11.12.8.1 Approval from the Department or the appropriate Delegated Agency must be obtained before any planned Constructed Wetlands can be used as a sediment basin. If a Constructed Wetlands serves as a sediment basin during project construction, the volume of the sediment basin must be based on the more stringent sizing rule.
 - 11.12.8.2 The Sediment and Stormwater Plan must include conversion steps from sediment basin to permanent Constructed Wetlands in the construction sequence.
 - 11.12.8.2.1 The Department or Delegated Agency must be notified and provide approval prior to conversion from sediment basin to the final configuration of the Constructed Wetlands.
 - 11.12.8.2.2 Appropriate procedures must be implemented to prevent discharge of turbid waters when the sediment basin is being converted into a Constructed Wetland.

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- 11.12.8.3 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
- 11.12.8.3.1 Pre-construction meeting;
 - 11.12.8.3.2 Initial site preparation including installation of erosion and sediment controls;
 - 11.12.8.3.3 Construction of the embankment, including installation of the principal spillway and the outlet structure as applicable;
 - 11.12.8.3.4 Excavation and grading including interim and final elevations;
 - 11.12.8.3.5 Construction of wetland features including grading of the various zones, introduction of soil amendments and staking of planting zones;
 - 11.12.8.3.6 Construction of the underdrain, installation of gravel substrate and wetland soils as applicable;
 - 11.12.8.3.7 Implementation of the planting plan and vegetative stabilization; and
 - 11.12.8.3.8 Final inspection including development of a punch list for facility acceptance.
- 11.12.8.4 All areas surrounding the Constructed Wetlands that are graded or denuded during construction must be planted with turf grass, native plantings, or other approved methods of soil stabilization.
- 11.12.8.5 Outside of optimum seeding and planting dates, temporary seed, such as annual rye or winter wheat, may be used to stabilize the soil within the Constructed Wetland, but permanent species shall then be planted or seeded during the next optimum planting period.
- 11.12.8.6 Stabilization matting shall be utilized in Wetland Swales and in all areas of concentrated flow or slopes 3:1 or steeper.
- 11.12.8.7 Upon facility completion, the owner shall submit Post Construction verification documents to demonstrate that the Constructed Wetlands has been constructed within allowable tolerances in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for Constructed Wetlands practices are as follows:
- 11.12.8.7.1 The constructed top of bank elevation may be no lower than the design elevation for top of bank.
 - 11.12.8.7.2 The constructed volume of the Constructed Wetlands surface storage and any other required volumes shall be no less than 90% of the design volume.
 - 11.12.8.7.3 The constructed volume of the gravel substrate storage for Submerged Gravel Wetlands shall be no less than 90% of the design volume.
 - 11.12.8.7.4 The constructed elevation of any structure shall be within 0.15 foot of the design.
- 11.12.8.8 When the allowable tolerances are exceeded for Constructed Wetlands surface area or volume or structure elevations, supplemental calculations must be submitted to the approval agency to determine if the Constructed Wetlands, as constructed, meets the design requirements.
- 11.12.9 Constructed Wetland Maintenance Criteria
- 11.12.9.1 During the first two years following construction, the Constructed Wetland shall be reviewed twice each year by a qualified professional with demonstrated knowledge of wetland species, once in the spring and once in the fall after a storm event that exceeds one-half inch of rainfall. The Operation and Maintenance Plan shall outline a detailed schedule for the monitoring and possible reinstallation of vegetation in the wetland and its buffer for the first two years of establishment.
 - 11.12.9.2 Repair of critical structural features such as embankments and risers shall be performed by responsible personnel that have successfully completed the Department Contractor Training Program.
 - 11.12.9.3 Project closeout shall not occur until a minimum of 70% of the wetland area is permanently vegetated.
 - 11.12.9.4 Sediment removal in the pretreatment forebay shall occur when 50% of total forebay capacity has been lost.
 - 11.12.9.5 The Department or the Delegated Agency shall be notified before a Constructed Wetland is drained.

11.13 Wet Ponds

- 11.13.1 Wet Ponds are stormwater storage practices that consist of a combination of a permanent pool, micropool, or shallow marsh that promote a good environment for gravitational settling, biological uptake and microbial activity. Wet Ponds are widely applicable for most land uses and are best suited for larger drainage areas. Runoff from each new storm enters the wet pond and partially displaces pool water from

previous storms. The pool also acts as a barrier to re-suspension of sediments and other pollutants deposited during prior storms. When sized properly, Wet Ponds have a residence time that ranges from many days to several weeks, which allows numerous pollutant removal mechanisms to operate. Wet Ponds can also provide storage above the permanent pool to help meet stormwater management requirements for larger storms. Design variants include:

- 11.13.1.1 Wet Quantity Management Pond
 - 11.13.1.1.1 The R_{Pv} runoff reduction performance credit for this variant is 0%.
 - 11.13.1.1.2 The C_v runoff reduction performance credit for this variant is 0%.
 - 11.13.1.1.3 The F_v runoff reduction performance credit for this variant is 0%.
 - 11.13.1.1.4 The total nitrogen pollutant reduction performance credit for this variant is not less than 0%.
 - 11.13.1.1.5 The total phosphorus pollutant reduction performance credit for this variant is not less than 0%.
 - 11.13.1.1.6 The total suspended solids pollutant reduction performance credit for this variant is not less than 0%.
- 11.13.1.2 Wet Extended Detention (ED) Pond
 - 11.13.1.2.1 The R_{Pv} runoff reduction performance credit for this variant having 48 hours of extended detention is 100%.
 - 11.13.1.2.2 The C_v runoff reduction performance credit for this variant having 48 hours of extended detention is 1%.
 - 11.13.1.2.3 The F_v runoff reduction performance credit for this variant having 48 hours of extended detention is 0%.
 - 11.13.1.2.4 The total nitrogen pollutant reduction performance credit for this variant having 48 hours of extended detention is not less than 30%.
 - 11.13.1.2.5 The total phosphorus pollutant reduction performance credit for this variant having 48 hours of extended detention is not less than 55%.
 - 11.13.1.2.6 The total suspended solids pollutant reduction performance credit for this variant having 48 hours of extended detention is not less than 60%.
- 11.13.2 Wet Ponds constructed to meet regulatory stormwater management requirements shall be designed and constructed in accordance with the USDA NRCS Pond Code 378 as amended.
- 11.13.3 Wet Pond Feasibility Criteria
 - 11.13.3.1 Soil investigations must be conducted in accordance with subsection 12.1 to determine the suitability of the soils to meet recommended embankment and permanent pool criteria.
 - 11.13.3.2 Locating Wet Ponds within perennial streams will require all appropriate state or federal permits.
- 11.13.4 Wet Pond Conveyance Criteria
 - 11.13.4.1 Principal Spillway
 - 11.13.4.1.1 The principal spillway must be accessible from dry land.
 - 11.13.4.1.2 A structure-pipe spillway shall be designed with anti-flotation, anti-vortex and trash rack devices on the structure.
 - 11.13.4.1.3 The outfall pipe and all connections to the outfall structure shall be made watertight. Soil tight only joints are not acceptable.
 - 11.13.4.1.4 Anti-seep collars shall be used in accordance with Pond Code 378, as amended.
 - 11.13.4.1.5 When the principal spillway is composed of a weir wall discharging to a channel, the channel below the weir must be reinforced with riprap or other acceptable material to prevent scour.
 - 11.13.4.1.6 When a low flow orifice is specified, it must be adequately protected from clogging by either an acceptable external trash rack or by internal orifice protection. Orifice diameters shall not be less than three inches unless internal orifice control is provided.
 - 11.13.4.2 The design shall specify an outfall that can discharge the maximum design storm event in a non-erosive manner at the project point of discharge.
 - 11.13.4.3 Wet Ponds must be designed to pass the maximum design storm event (F_v) if the F_v is being routed through the Wet Pond rather than bypassing. An earthen emergency spillway designed to convey the F_v shall be cut in natural ground or, if cut in fill, shall be constructed and stabilized with methods to prevent erosion and structural failure.

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- 11.13.4.4 Inflow Points
 - 11.13.4.4.1 Inflow points into the Wet Pond must be stabilized to ensure that non-erosive conditions exist during storm events up to the conveyance event (Cv).
 - 11.13.4.4.2 A forebay shall be provided at each inflow location that provides 10% or greater of the total RPv inflow to the Wet Pond.
 - 11.13.4.5 In the event that the embankment is a regulated dam, the designer must verify that the appropriate Dam Safety Permit has been approved by the Department's Dam Safety Program.
- 11.13.5 Wet Pond Pretreatment Criteria
 - 11.13.5.1 A forebay must be located at each major inlet to trap sediment and preserve the capacity of the main treatment cell.
 - 11.13.5.2 The following criteria apply to forebay design:
 - 11.13.5.2.1 A major inlet is defined as an individual storm drain inlet pipe or open channel conveying at least 10% of the Wet Pond's contributing RPv runoff volume.
 - 11.13.5.2.2 A safety bench is required at the pond shoreline for forebay depths greater than three feet.
 - 11.13.5.2.3 The forebay must be sized to contain 10% of the volume of runoff from the contributing drainage area for the Resource Protection event.
 - 11.13.5.2.4 Discharge from the forebay shall be non-erosive.
- 11.13.6 Wet Pond Design Criteria
 - 11.13.6.1 For RPv compliance, a Wet ED Pond must provide 48 hours extended detention for the RPv runoff volume. Detention shall be based on the time of initial inflow to time of final outflow from the facility. In order to simulate a base flow condition to the extent practicable, the peak discharge for the outflow hydrograph shall not exceed five times the average discharge rate.
 - 11.13.6.2 The minimum depth to prevent the permanent pool area from being overtaken by undesirable vegetation is four feet.
 - 11.13.6.3 The maximum depth of the permanent pool shall not exceed eight feet for safety reasons.
 - 11.13.6.4 Earthen side slopes for Wet Ponds both above and below permanent pool shall be no steeper than 3H:1V.
 - 11.13.6.5 Excluding areas containing retaining walls, when Wet Pond side slopes above permanent pool are steeper than 4H:1V, a ten foot wide safety bench shall be constructed one foot above the permanent pool. The maximum slope of the safety bench shall be 5.0%.
 - 11.13.6.6 A 10 foot wide aquatic bench shall be provided one foot below permanent pool.
 - 11.13.6.7 Retaining walls
 - 11.13.6.7.1 Retaining walls around Wet Ponds shall be limited to no more than 50% of the pond perimeter based upon the peak elevation of the Cv.
 - 11.13.6.7.2 In order to maintain the safety requirements, retaining walls shall be configured as follows:
 - 11.13.6.7.2.1 The retaining wall at the permanent pool shall have a maximum height of three feet above the aquatic bench.
 - 11.13.6.7.2.2 Any additional retaining walls shall have a maximum height of two feet and provide a minimum 10-foot level terrace from a lower retaining wall.
 - 11.13.6.8 Liners
 - 11.13.6.8.1 All Wet Ponds shall be evaluated for feasibility and ability to maintain permanent pool, including the need for a liner, by a qualified, licensed geotechnical engineer or geologist. If the design professional chooses not to follow the recommendations of the geotechnical professional, a signed, sealed and dated letter from the design professional providing justification for removal of the liner from the design shall be provided to the Department or Delegated Agency.
 - 11.13.6.8.2 When the geotechnical engineer recommends a liner, acceptable options include the following:
 - 11.13.6.8.2.1 A clay liner having a minimum compacted thickness of 12 inches with an additional 12 inch layer of compacted soil above it. Clay used as a pond liner must meet the following specifications:

- 11.13.6.8.2.1.1 Permeability of 1×10^{-6} centimeters per second (cm/sec) using ASTM D-2434 procedure.
- 11.13.6.8.2.1.2 Plasticity index of not less than 15% using ASTM D-423/424 procedures.
- 11.13.6.8.2.1.3 Liquid limit of not less than 30% using ASTM D-2216 procedure.
- 11.13.6.8.2.1.4 Clay particles passing not less than 30% using ASTM D-422 procedure.
- 11.13.6.8.2.1.5 Compaction of 95% of standard proctor density using ASTM D-2216 procedure.
- 11.13.6.8.2.2 A 30 mil poly-liner; or
- 11.13.6.8.2.3 Other acceptable measures as recommended by a qualified geotechnical professional.
- 11.13.6.9 Trash racks shall be provided for low-flow pipes and for all riser structure openings.
 - 11.13.6.9.1 All metal trash racks shall be coated with a rust inhibitor to increase longevity of the device.
 - 11.13.6.9.2 The low flow extended detention orifice shall be protected from clogging by an external trash rack.
- 11.13.6.10 When a riser is used, it must be located such that it is accessible from the pond side slope or safety bench for the purposes of inspection and maintenance.
- 11.13.6.11 All materials used in construction of a Wet Quantity Management Pond or Wet ED Pond shall meet the material specifications in USDA NRCS Pond Code 378 as amended.
- 11.13.6.12 Safety Features
 - 11.13.6.12.1 Any opening 12 inches or greater discharging to a closed drainage system shall include safety grates.
 - 11.13.6.12.2 The emergency spillway and exit channel must be designed to direct runoff to a point of discharge without adversely impacting downstream structures.
- 11.13.6.13 All Wet Ponds must be designed so as to be accessible for maintenance.
 - 11.13.6.13.1 Adequate maintenance access must extend to the pretreatment, safety bench, riser, and outlet structure.
 - 11.13.6.13.2 A maintenance right-of-way or easement must extend to the Wet Pond from a public or private road.
 - 11.13.6.13.3 Maintenance access must meet the following criteria:
 - 11.13.6.13.3.1 Minimum width of 15 feet.
 - 11.13.6.13.3.2 Profile grade that does not exceed 10H:1V.
 - 11.13.6.13.3.3 Minimum 10H:1V cross slope.
- 11.13.6.14 Maintenance Set-Aside Area
 - 11.13.6.14.1 The maintenance set-aside area shall accommodate the volume of 50% of the collective forebay volume.
 - 11.13.6.14.2 The maximum depth of the set aside area shall be one foot.
 - 11.13.6.14.3 The slope of the set aside area shall not exceed 5.0%.
- 11.13.7 Wet Pond Landscaping Criteria
 - 11.13.7.1 Woody vegetation shall not be planted or allowed to grow within 15 feet of the embankment and 10 feet on either side of principal spillway or pipes.
 - 11.13.7.2 A planting plan must be provided that indicates the methods used to establish and maintain vegetative coverage in the Wet Pond and its vegetated perimeter. Minimum elements of a planting plan include the following:
 - 11.13.7.2.1 Delineation of zones within both the Wet Pond and vegetated perimeter area;
 - 11.13.7.2.2 Selection of corresponding plant species; and
 - 11.13.7.2.3 Size and spacing of plant material or application rate of seed mixes, as applicable.
 - 11.13.7.2.3.1 Native plant material shall be specified by botanical and common name.
 - 11.13.7.2.3.2 Seed mixes shall be specified by botanical and common names as well as percentages by weight or volume.
- 11.13.8 Wet Pond Construction
 - 11.13.8.1 Use of Wet Ponds for Erosion and Sediment Control

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- 11.13.8.1.1 Approval from the Department or the appropriate Delegated Agency must be obtained before any planned Wet Quantity Management Pond or Wet ED Pond can be used as a sediment basin.
- 11.13.8.1.2 If a Wet Pond serves as a sediment basin during project construction, the volume of the sediment basin must be based on the more stringent sizing rule.
- 11.13.8.1.3 The Sediment and Stormwater Plan must include conversion steps from sediment basin to permanent Wet Pond in the construction sequence.
 - 11.13.8.1.3.1 The Department or Delegated Agency must be notified and provide approval prior to conversion from sediment basin to the final configuration of the Wet Quantity Management Pond or Wet ED Pond.
 - 11.13.8.1.3.2 Appropriate procedures must be implemented to prevent discharge of turbid waters when the sediment basin is being converted into a Wet Pond.
- 11.13.8.2 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.13.8.2.1 Pre-construction meeting.
 - 11.13.8.2.2 Initial site preparation including installation of erosion and sediment controls.
 - 11.13.8.2.3 Construction of the embankment, including installation of the principal spillway and the outlet structure.
 - 11.13.8.2.4 Excavation and grading including interim and final elevations.
 - 11.13.8.2.5 Implementation of the planting plan and vegetative stabilization.
 - 11.13.8.2.6 Final construction review including development of a punch list for facility acceptance.
- 11.13.8.3 All areas surrounding the Wet Pond that are graded or denuded during construction must be planted with turf grass, native plantings, or other approved methods of soil stabilization.
- 11.13.8.4 Upon facility completion, the owner shall submit post construction verification documents to demonstrate that the wet pond has been constructed within allowable tolerances and in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency. Allowable tolerances for wet pond practices are as follows:
 - 11.13.8.4.1 The constructed top of bank elevation may be no lower than the design elevation for top of bank.
 - 11.13.8.4.2 The constructed volume of the wet pond surface storage shall be no less than 90% of the design volume.
 - 11.13.8.4.3 The constructed elevation of any structure shall be within 0.15 foot of the design.
- 11.13.8.5 When the allowable tolerances are exceeded for wet pond surface area or volume or structure elevations, supplemental calculations must be submitted to the approval agency to determine if the wet pond, as constructed, meets the design requirements.
- 11.13.9 Wet Pond Maintenance Criteria
 - 11.13.9.1 Repair of critical structural features, such as embankments and risers, shall be performed by responsible personnel that have successfully completed the Department Contractor Training Program.
 - 11.13.9.2 The Department or the Delegated Agency shall be notified before a Wet Pond is drained.
 - 11.13.9.3 Sediment removal in the Wet Pond pretreatment forebay must occur when 50% of total forebay capacity has been lost.
- 11.14 Soil Amendments
 - 11.14.1 Soil Amendment, also called soil restoration, is a technique applied after construction to till compacted soils and restore their porosity by amending them with compost. Soil amendments reduce the generation of runoff from compacted urban lawns and may also enhance the performance of impervious cover disconnections and grass channels.
 - 11.14.2 Soil Amendment Stormwater Credit Calculations
 - 11.14.2.1 Soil Amendments receive the following runoff reduction performance credits. Runoff reduction allowances are applied to the amendment area only.
 - 11.14.2.1.1 The R_{Pv} runoff reduction performance credit for Soil Amendments is based upon the hydrologic soil group (HSG) of the existing soil:

- 11.14.2.1.1.1 HSG A receives 48% annual runoff reduction credit.
- 11.14.2.1.1.2 HSG B receives 50% annual runoff reduction credit.
- 11.14.2.1.1.3 HSG C receives 29% annual runoff reduction credit.
- 11.14.2.1.1.4 HSG D receives 13% annual runoff reduction credit.
- 11.14.2.1.2 The Cv runoff reduction performance credit for soil amendments is 10% of the RPv allowance.
- 11.14.2.1.3 The Fv runoff reduction performance credit for soil amendments is 1% of the RPv allowance.
- 11.14.2.2 The total nitrogen, total phosphorus, and total suspended solids pollutant reduction performance credit for soil amendments is 100% of the load reduction.
- 11.14.3 Soil Amendments shall not be applied where:
 - 11.14.3.1 The water table or bedrock is located within two feet of the soil surface. Subsection 12.1 shall be followed for determination of depth to the limiting layer.
 - 11.14.3.2 Slope of soil to be amended exceeds 10%.
 - 11.14.3.3 Soil to be amended is saturated or seasonally wet.
- 11.14.4 Soil Amendment Design Criteria
 - 11.14.4.1 Soil testing shall be conducted during two stages of the Soil Amendment process.
 - 11.14.4.1.1 The first test shall be performed to determine soil properties to a depth one foot below the proposed soil amendment area, with respect to saturation, bulk density, pH, salts, and soil nutrients. The initial test shall determine what soil amendments are needed.
 - 11.14.4.1.2 The second soil test shall be conducted at least one week after compost has been incorporated into the soils to determine whether any further nutritional requirements, pH adjustment, and organic matter adjustments are necessary for plant growth.
 - 11.14.4.2 When Soil Amendments are used to either adjust the hydrologic soil group of the amended area to lower the curve number of the site, or receive the annual runoff reduction performance credits for the amendment area, the soil amendment area shall receive no impervious cover runoff and shall place three inches of compost into the soil amendment area to a minimum incorporation depth of six inches using a tiller.
 - 11.14.4.3 When Soil Amendments are used within the footprint of a BMP such as sheet flow to filter strip, sheet flow to open space, or vegetated channels to adjust the hydrologic soil group of the amended area and receive the runoff reduction performance credits for those BMPs, the following criteria apply:
 - 11.14.4.3.1 Soil amendment areas having a contributing impervious cover (square feet) to surface area of compost amendment (square feet) ratio of up to 0.5 shall place four inches of compost into the soil amendment area to a minimum incorporation depth of eight inches using a tiller.
 - 11.14.4.3.2 Soil amendment areas having a contributing impervious cover (square feet) to surface area of compost amendment (square feet) ratio of 0.51 to 0.75 shall place six inches of compost into the soil amendment area to a minimum incorporation depth of 15 inches using an excavation and mixing method.
 - 11.14.4.3.3 Soil amendment areas having a contributing impervious cover (square feet) to surface area of compost amendment (square feet) ratio greater than 0.75 shall place eight inches of compost into the soil amendment area to a minimum incorporation depth of 20 inches using an excavation and mixing method.
 - 11.14.4.4 Compost incorporation depths greater than 12 inches require removal of the existing soil down to the incorporation depth and physically mixing existing soil with compost.
 - 11.14.4.5 Compost used for soil amendment shall be STA certified compost, meeting the requirements of Delaware Erosion and Sediment Control Handbook Appendix A-6 Compost Material Properties.
- 11.14.5 Soil Amendment Construction Criteria
 - 11.14.5.1 For compost incorporation depths up to 12 inches:
 - 11.14.5.1.1 The proposed incorporation area shall be deep tilled to a depth of two to three feet using a tractor and sub-soiler. This deep-tilling step may be omitted when soil amendment is used for filter strip widths of 20 feet or less in the direction of flow.
 - 11.14.5.1.2 Existing soils shall be in dry condition prior to incorporating compost.

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- 11.14.5.1.3 The compost layer shall be placed on surface of proposed amendment area to the depth specified and then incorporated into the soil using a roto-tiller or similar equipment.
 - 11.14.5.1.4 Conduct soil test to determine whether any further nutrient requirements, pH adjustment, and organic matter adjustments are necessary for plant growth.
 - 11.14.5.2 For compost incorporation depths 12 inches or greater:
 - 11.14.5.2.1 The proposed amendment area shall be excavated to the required incorporation depth, as follows:
 - 11.14.5.2.1.1 Remove topsoil and stockpile for later use.
 - 11.14.5.2.1.2 Excavate subsoil working in strips perpendicular to the slope and flow path using multiple lifts.
 - 11.14.5.2.1.3 Separate and remove a minimum of 25% of the subsoil, taking the most densely compacted soils for removal. Stockpile remaining subsoil next to excavated area, separately from topsoil.
 - 11.14.5.2.1.4 Scarify bottom of excavated area.
 - 11.14.5.2.2 Amended soil shall be returned to the soil amendment area as follows. The number of lifts may vary depending on the capabilities of the equipment being used, but a minimum of two lifts is required.
 - 11.14.5.2.2.1 Replace subsoils by loosening, aerating, and mixing subsoil.
 - 11.14.5.2.2.2 Replace stockpiled topsoil.
 - 11.14.5.2.2.3 Incorporate required layer of compost, such that compost is uniformly incorporated throughout. Existing soils shall be in dry condition prior to incorporating compost.
 - 11.14.5.2.2.4 Repeat above steps for each lift.
 - 11.14.5.2.3 Rake to level and remove surface woody debris and rocks larger than one inch.
 - 11.14.5.2.4 The finished grade of the combination of replaced subsoil, topsoil and compost shall be a minimum of four inches above the existing grade to account for settlement, but must be adjusted to account for field conditions and soil texture, such that a final settled grade at three months post-installation matches the original grade.
 - 11.14.5.2.5 Conduct soil test to determine whether any further nutritional requirements, pH adjustment, and organic matter adjustments are necessary for plant growth.
 - 11.14.5.3 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.14.5.3.1 Pre-construction meeting;
 - 11.14.5.3.2 Initial site preparation including installation of erosion and sediment controls;
 - 11.14.5.3.3 Deep tillage using subsoiler or excavation of existing subsoil;
 - 11.14.5.3.4 Incorporation of compost amendment into existing soil including verification of the depth of compost amendment;
 - 11.14.5.3.5 Implementation of required stabilization and planting plan; and
 - 11.14.5.3.6 Final construction review including development of a punch list for facility acceptance.
 - 11.14.5.4 Upon project completion, the owner shall submit Post Construction verification documents, including but not limited to compost delivery tickets and photo documentation of construction, to demonstrate that the soil amendment has been constructed within in accordance with the approved Sediment and Stormwater Management Plan and accepted by the approving agency.
- 11.15 Proprietary Practices
- 11.15.1 Proprietary Practices are manufactured stormwater treatment practices that utilize settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, or other appropriate technology to manage the impacts caused by stormwater runoff.
 - 11.15.2 Proprietary Practices Stormwater Credit Calculations
 - 11.15.2.1 Proprietary Practices receive no runoff reduction credits unless approved by the Department.
 - 11.15.2.2 Practices may receive pollutant reduction credits as determined by the Department on a case-by-case basis.
 - 11.15.3 All proprietary practices shall be designed to safely overflow or bypass flows from larger storm events to downstream drainage systems.

- 11.15.4 Pretreatment shall be provided in accordance with manufacturer's recommendations for individual Proprietary Practices.
- 11.15.5 Proprietary Practice Design Criteria
 - 11.15.5.1 Design criteria for Proprietary Practices shall be proposed by the manufacturer and approved by the Department.
 - 11.15.5.2 All Proprietary Practices must be designed so as to be accessible for maintenance.
 - 11.15.5.2.1 A maintenance right-of-way or easement must extend to the Proprietary Practice from a public or private road.
 - 11.15.5.2.2 Adequate maintenance access must extend to the all components of the Proprietary Practice.
 - 11.15.5.2.3 Maintenance access must meet the following criteria:
 - 11.15.5.2.3.1 Minimum width of fifteen feet.
 - 11.15.5.2.3.2 Profile grade that does not exceed 10H:1V.
 - 11.15.5.2.3.3 Minimum 10H:1V cross slope.
- 11.15.6 Landscaping shall be provided in accordance with manufacturer's recommendations for individual Proprietary Practices.
- 11.15.7 Proprietary Practice Construction Sequence
 - 11.15.7.1 Construction and installation of Proprietary Practices shall be conducted in accordance with manufacturer's recommendations for individual Proprietary Practices.
 - 11.15.7.2 Construction reviews are required during the following stages of construction, and shall be noted on the plan in the sequence of construction:
 - 11.15.7.2.1 Pre-construction meeting;
 - 11.15.7.2.2 Initial site preparation including installation of erosion and sediment controls;
 - 11.15.7.2.3 Construction of the Proprietary Practice in accordance with manufacturer's recommendations;
 - 11.15.7.2.4 Implementation of required stabilization and planting plan as applicable; and
 - 11.15.7.2.5 Final construction review including development of a punch list for facility acceptance.
 - 11.15.7.3 Upon project completion, the owner shall submit Post Construction verification documents to demonstrate that the Proprietary Device has been installed in accordance with manufacturer's recommendations.
 - 11.15.7.4 All Proprietary Practices shall be inspected and maintained in accordance with the manufacturer's instructions and recommendations.
- 11.16 Source Controls
 - 11.16.1 Source Control consists of measures to prevent pollutants from coming into contact with stormwater runoff. Preventing pollutant exposure to rainfall and runoff is an important management technique that can reduce the amount of pollutants in runoff and the need for stormwater treatment.
 - 11.16.2 Design variants for Source Controls include:
 - 11.16.2.1 Nutrient Management
 - 11.16.2.2 Street Sweeping
 - 11.16.3 Source Controls Stormwater Credit Calculations
 - 11.16.3.1 Source controls receive no runoff reduction credits.
 - 11.16.3.2 Nutrient Management receives the following pollutant reduction credits:
 - 11.16.3.2.1 The total nitrogen pollutant reduction performance credit is not less than 17%.
 - 11.16.3.2.2 The total phosphorous pollutant reduction performance credit is not less than 22%.
 - 11.16.3.2.3 The total suspended solids pollutant reduction performance credit is not less than 0%.
 - 11.16.3.3 Street Sweeping receives the following pollutant reduction credits:
 - 11.16.3.3.1 The total nitrogen pollutant reduction performance credit is not less than 3%.
 - 11.16.3.3.2 The total phosphorous pollutant reduction performance credit is not less than 3%.
 - 11.16.3.3.3 The total suspended solids pollutant reduction performance credit is not less than 9%.
 - 11.16.4 Source Controls Design Summary
 - 11.16.4.1 To receive nutrient management pollutant reduction performance credits, sites must fully comply with the requirements of the Delaware Nutrient Management Law through implementation of a nutrient management plan.

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11.16.4.2 To receive street sweeping pollutant reduction performance credits, sites must submit to the Department or Delegated Agency a plan documenting the street sweeping frequency. Annual street sweeping tracking shall be submitted to the Department or Delegated Agency.

11.17 Afforestation

11.17.1 Afforestation includes practices that mimic the hydrologic benefits of a natural forest utilizing a regeneration process within the landscape by selectively planting tree seedlings (less than one inch DBH) or saplings (greater than one inch DBH). Afforestation can be used as both a runoff reduction practice by converting non-forested areas to forested areas as well as a mitigation practice for offsetting the clearing of forested areas during the development process. Design variants for afforestation include:

11.17.1.1 Afforestation. R_{PV} credit based on runoff reduction from open space (good) condition to wooded (good) condition.

11.17.1.2 Urban Tree Planting. For areas planted in trees that do not meet the design criteria for afforestation, credit shall be an equivalent 1/200th of an acre per tree.

11.17.2 Afforestation Design Criteria

11.17.2.1 The minimum size of the afforestation area shall be 10,000 square feet with a minimum width of 50 feet.

11.17.2.2 The proposed afforestation area shall be upland.

11.17.2.3 At the end of the second year there shall be at least 200 live plants six inches or higher.

11.17.3 Afforestation Landscaping Criteria

11.17.3.1 The planting density shall account for mortality, which over time can result in more random arrangement of the trees.

11.17.3.2 Final stabilization shall meet EPA requirements at the end of the second year.

11.17.4 Afforestation Construction Sequence

11.17.4.1 The sizes and types of plantings shall be in accordance with the planting schedule developed for the site.

11.17.4.2 Construction reviews are necessary for the success of any phase of a project, including Pre-construction meeting; Planting Phase (with designer and installation contractor); and Final Review (punch list of corrections for acceptance).

11.17.5 Afforestation Maintenance Criteria

11.17.5.1 Following planting, a period of maintenance and monitoring will begin. The afforestation planting will be considered successful if the survival of trees at the end of the second year is at least 200 combined live, planted or volunteer, trees per acre.

22 DE Reg. 680 (02/01/19)**12.0 Supplemental Requirements for Best Management Practices****12.1 Soil Investigation Procedures for Stormwater Best Management Practices (BMPs)**

12.1.1 All applicable federal, state and local laws, rules, regulations or permit requirements governing soil investigations shall be followed.

12.1.2 General Soil Investigations

12.1.2.1 Borings and pits shall be excavated to verify soil profile and to determine depth to limiting layer.

12.1.2.2 Soil Characterization

12.1.2.2.1 The minimum number of borings or pits shall be conducted for each BMP as follows:

12.1.2.2.1.1 For surface area BMPs, two (2) borings or pits required for the first 8,000 square feet, three (3) borings or pits required for up to 16,000 square feet, four (4) borings or pits required for up to 25,000 square feet and one (1) additional boring or pit required for each additional 25,000 square feet. Boring or pit locations shall be distributed within the facility and sufficient to determine variability.

12.1.2.2.1.2 For linear BMPs, two (2) borings or pits required up to 500 linear feet and one (1) additional boring or pit per 500 linear feet of trench, and sufficient to determine variability.

12.1.2.2.2 Borings or test pits must be advanced to the depth of the limiting layer or a minimum of three (3) feet below bottom of a proposed facility, whichever is encountered first.

12.1.3 Infiltration Testing Procedures

- 12.1.3.1 Planning and Design Phase
 - 12.1.3.1.1 Any deviation from these procedures must be approved by the Department or Delegated Agency having jurisdiction.
 - 12.1.3.1.2 Individuals in responsible charge of infiltration testing shall possess a Class D On-Site License issued by DNREC Division of Water Groundwater Discharges Section or be licensed in the State of Delaware as a Professional Engineer or Professional Geologist.
 - 12.1.3.1.3 An initial screening of readily available data is required to determine feasibility of infiltration practices. Screening shall include at a minimum:
 - 12.1.3.1.3.1 Site topography;
 - 12.1.3.1.3.2 Soil characteristics as defined in the USDA NRCS Web Soil Survey;
 - 12.1.3.1.3.3 Depth to groundwater and seasonal high water table; and
 - 12.1.3.1.3.4 Historical groundwater level data from the nearest Delaware Geological Survey (DGS) monitoring well or wells.
 - 12.1.3.1.4 Separation to a limiting layer such as bedrock or groundwater shall be at least two (2) feet.
 - 12.1.3.1.5 Field Permeability Testing shall be done in accordance with ASTM-D5126 "Comparison of Field Methods for Determining Hydraulic Conductivity in the Vadose Zone".
 - 12.1.3.1.5.1 Single Ring or Double Ring Infiltrometer are preferred test methods.
 - 12.1.3.1.5.2 Cased Borehole Permeameter method is allowable only in cases where test pit excavation depths or site constraints pose safety or other concerns. Results from tests conducted using the Cased Borehole Permeameter method will only be accepted when approval is granted by the Department or Delegated Agency to use the Cased Borehole Permeameter method prior to conducting the test. Casing for Cased Borehole test shall have a minimum four (4) inch diameter.
 - 12.1.3.1.6 The minimum number of field measured infiltration tests are based on the proposed facility's dimensions as follows:
 - 12.1.3.1.6.1 For an infiltration trench with less than 10,000 square feet of impervious drainage area, one (1) test required up to 500 linear feet and one (1) additional test per 250 linear feet of trench, and sufficient to determine variability.
 - 12.1.3.1.6.2 For an infiltration trench with greater than 10,000 square feet of impervious drainage area, one (1) test required up to 250 linear feet and one (1) additional test per 250 linear feet of system, and sufficient to determine variability.
 - 12.1.3.1.6.3 For an infiltration trench used with roadway perforated pipe layouts, one (1) test required up to 500 linear feet and one (1) additional test per 500 linear feet of trench, and sufficient to determine variability.
 - 12.1.3.1.6.4 For an infiltrating bioretention system, one (1) test required for the first 8,000 square feet, two (2) tests required for up to 16,000 square feet, three (3) tests required for up to 25,000 square feet and one additional test required for each additional 25,000 square feet. Test locations shall be distributed within the facility and sufficient to determine variability.
 - 12.1.3.1.6.5 For a surface infiltration basin, one (1) test required for the first 8,000 square feet, two (2) tests required for up to 16,000 square feet, three (3) tests required for up to 25,000 square feet and one additional test required for each additional 25,000 square feet. Test locations shall be distributed within the facility and sufficient to determine variability.
 - 12.1.3.1.6.6 For a subsurface infiltrating practice, one (1) test required per infiltration area with an additional test for every 8,000 square feet of infiltration area, and sufficient to determine variability.
 - 12.1.3.1.7 A saturation period of one hour or a drop of 12 inches or 30.5 centimeters is required. The saturation period shall not be used in determining field verified infiltration rate.
 - 12.1.3.1.8 After the saturation period, a minimum of two (2) test periods, are required. or until at least two (2) consecutive test periods are consistent. Each test period shall have a maximum reading interval of 15 minutes and meet one (1) of the following criteria:
 - 12.1.3.1.8.1 A minimum of one hour,
 - 12.1.3.1.8.2 A drop of at least 12 inches in 15 minutes or less for a minimum of 30 minutes, or
 - 12.1.3.1.8.3 A stabilized infiltration rate as defined below:

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- 12.1.3.1.8.3.1 A difference of 0.25 inches or less of drop between the highest and lowest reading of four (4) consecutive readings for infiltration rates greater than two (2.0) inches per hour.
- 12.1.3.1.8.3.2 A difference of 0.125 inches or less of drop between the highest and lowest reading of four (4) consecutive readings for infiltration rates equal to or less than two (2.0) inches per hour.
- 12.1.3.1.9 When using the constant head test method, the water level inside the casing shall be maintained at a constant level or refilled to the starting level after each reading throughout the test period at no more than 15 minute intervals.
- 12.1.3.1.10 When using the falling head test method each test period shall start with the same initial head of six (6) inches to normalize the effect of head on the measured drop.
- 12.1.3.1.11 The field verified infiltration rate shall be the final steady state reading of the test performed.
- 12.1.3.1.12 Reporting requirements shall be in accordance with Soil Investigation Report.
- 12.1.3.2 Construction Phase
 - 12.1.3.2.1 For all infiltration facilities, confirmatory field verified infiltration testing shall be performed during facility construction. Unless recommended by a soil professional and approved by the Department or Delegated Agency prior to conducting the tests, the minimum number of confirmatory infiltration tests shall be in accordance with the original testing procedures used for design.
 - 12.1.3.2.2 The confirmatory infiltration testing rate shall be no less than 150% of the approved design rate for the facility. If a deviation of less than 150% is observed, the design calculation for the facility shall be rerun by the design engineer based upon 50% of the measured confirmatory infiltration testing rate to demonstrate that the facility will function as originally designed. The computations that confirm performance shall be provided with the Post Construction Verification Documents.
 - 12.1.3.2.3 In addition to confirmatory infiltration testing, a hand auger shall be performed adjacent to the confirmatory infiltration test location or at locations recommended by the soils professional to a minimum depth of three (3) feet below the bottom of the facility to confirm that a limiting layer is not present and to log the soils conditions. If a limiting layer is observed at a depth less than two (2) feet, the licensed professional shall re-evaluate the design and submit recommendations and any required design changes to the Department or Delegated Agency for review and approval.
 - 12.1.3.2.4 If confirmatory infiltration testing is not required by the Department or Delegated Agency, hand augers shall be performed within the proposed practice to log the soils and groundwater conditions within three (3) feet of the bottom of the practice.
- 12.1.4 Soil Investigation for Embankments
 - 12.1.4.1 A detailed review of the existing site conditions and proposed embankment construction shall be performed by the responsible geotechnical engineer as part of the design process.
 - 12.1.4.2 Site Investigation
 - 12.1.4.2.1 The soil investigation for the embankment plan shall include the following:
 - 12.1.4.2.1.1 Development of performance criteria, which may include but not be limited to allowable settlement, time available for construction, and seismic design requirements.
 - 12.1.4.2.1.2 Identification of potential geologic hazards or areas of concern such as soft soils, and potential variability of local geology.
 - 12.1.4.2.1.3 Identification of engineering analyses to be performed which may include but not be limited to: limit equilibrium slope stability analyses, liquefaction susceptibility, lateral spreading and slope stability deformations, and settlement evaluations.
 - 12.1.4.2.1.4 Identification of engineering properties required for these analyses.
 - 12.1.4.2.1.5 Determination of methods to obtain parameters and assess the validity of such methods for the material type.
 - 12.1.4.2.1.6 Determination of the number of tests or samples needed and appropriate locations for them.
 - 12.1.4.3 Methods of Subsurface Exploration

- 12.1.4.3.1 The subsurface exploration method shall be selected by the design professional based on the existing and proposed site conditions.
 - 12.1.4.3.2 Minimum Number of Explorations
 - 12.1.4.3.2.1 Embankments shall have explorations every 200 feet on center along the length of the embankment.
 - 12.1.4.3.2.2 Pond bottom explorations shall follow the Soil Investigation Procedures. Exploration locations shall be distributed as uniformly as possible within the facility.
 - 12.1.4.3.3 Minimum Depth of Explorations
 - 12.1.4.3.3.1 Unless bedrock is encountered at a shallower depth, explorations shall be at a depth twice the proposed height from bottom of pond to top of embankment.
 - 12.1.4.3.3.2 If bedrock is encountered, a minimum five (5) foot rock core shall be performed. If organic, plastic, or soils with an actual or estimated N-value less than four (4) are encountered, extended exploration to a depth of four (4) times the proposed embankment height.
 - 12.1.4.3.4 If there is a potential for a significant groundwater gradient beneath an embankment or surface water levels are significantly higher on one side of the embankment than the other, the effect of reduced soil strength caused by water seepage shall be evaluated.
 - 12.1.4.3.5 Seepage effects shall be considered when an embankment is placed on or near the top of a slope that has known or potential seepage through it.
- 12.1.5 Soil Investigation Report
- 12.1.5.1 Soil investigation reports shall include the following:
 - 12.1.5.1.1 The signature, seal and date of a professional engineer or professional geologist experienced in soils licensed in the State of Delaware. Reports for embankments must be signed, sealed and dated by a professional engineer licensed in the State of Delaware.
 - 12.1.5.1.2 A general description of the project, project elements, and project background.
 - 12.1.5.1.3 Project site surface conditions and current use.
 - 12.1.5.1.4 Regional and site geology.
 - 12.1.5.1.5 Borehole or test pit logs must provide the following information:
 - 12.1.5.1.5.1 Project name;
 - 12.1.5.1.5.2 Name of individual collecting the field data;
 - 12.1.5.1.5.3 Date field data was collected;
 - 12.1.5.1.5.4 Type of boring or test pit excavation method and equipment used;
 - 12.1.5.1.5.5 Air temperature and precipitation, including significant precipitation prior to investigation;
 - 12.1.5.1.5.6 Elevation of boring location based on site benchmark;
 - 12.1.5.1.5.7 Visual description of soil profile layers, and depths below grade encountered;
 - 12.1.5.1.5.8 Sample numbers;
 - 12.1.5.1.5.9 Depths of instability such as cave in, sloughing, flowing sands, or obstructions;
 - 12.1.5.1.5.10 Blow counts if Standard Penetration Test (SPT) borings are performed;
 - 12.1.5.1.5.11 Depth of seasonal high water table indicators such as mottling;
 - 12.1.5.1.5.12 Depth of encountered free water during and after excavation;
 - 12.1.5.1.5.13 Depth to bedrock if encountered;
 - 12.1.5.1.5.14 General observations; and
 - 12.1.5.1.5.15 Testing standards.
 - 12.1.5.1.6 Depth and type of field testing performed. A summary of the laboratory testing conducted, if applicable.
 - 12.1.5.1.7 Project soil and rock conditions shall include a description of the soil and rock units encountered, and how the units tie into the site geology.
 - 12.1.5.1.8 Groundwater conditions shall be described, including the identification of any confined aquifers, artesian pressures, perched water tables, potential seasonal variations, if known,

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- any influences on the ground water levels observed, and direction and gradient of groundwater, if known.
- 12.1.5.1.9 If rock slopes are present, the report shall discuss rock structure, including but not limited to the results of any field structure mapping using photographs as needed, joint condition, rock strength, and potential for seepage.
- 12.1.5.1.10 Summary of geological hazards identified and their impact on the project design, if any. Describe the location and extent of the geological hazard.
- 12.1.5.1.11 For analysis of unstable slopes including existing settlement areas, cuts, and fills, include background regarding the analysis approach, assessment of failure mechanisms, and determination of design parameters. A description of any back-analyses conducted, the results of those analyses, comparison of those results to any laboratory test data obtained, and the conclusions made regarding the parameters that shall be used for final design shall be included in this section.
- 12.1.5.1.12 Geotechnical recommendations for structural earthwork shall include:
- 12.1.5.1.12.1 Embankment design recommendations, if any are present, such as the slope required for stability, the need and extent of removal of any unsuitable materials beneath the proposed fills, and any other measures that need to be taken to provide a stable embankment, embankment settlement magnitude and rate.
- 12.1.5.1.12.2 Cut design recommendations, if any are present, such as the slope required for stability, seepage and piping control, erosion control measures needed, and any special measures required to provide a stable slope.
- 12.1.5.1.12.3 Determination of adequacy of excavated material for use as structural fill or spoil and include data for structural designs of BMP outlet works.
- 12.1.5.1.13 Long-term or construction monitoring needs if applicable. Provide recommendations on the types of instrumentation needed to evaluate long-term performance or to control construction, the reading schedule required, how the data should be used to control construction or to evaluate long-term performance, and the zone of influence for each instrument.
- 12.1.5.1.14 Address issues of construction staging, shoring needs and potential installation difficulties, temporary slopes, potential foundation installation problems, earthwork constructability issues, and dewatering, as applicable.
- 12.1.5.1.15 Appendices to support geotechnical recommendations.
- 12.1.5.2 Infiltration test reports shall include the following:
- 12.1.5.2.1 Description of approved infiltration testing method performed.
- 12.1.5.2.2 Summary table of location of test, depth of test, elevation of test if available and field verified infiltration rate.
- 12.1.5.2.3 Infiltration test log must state:
- 12.1.5.2.3.1 Name of individual performing test;
- 12.1.5.2.3.2 Date test was performed;
- 12.1.5.2.3.3 Type of test method;
- 12.1.5.2.3.4 Air temperature and precipitation;
- 12.1.5.2.3.5 Depth of test below ground surface and elevation;
- 12.1.5.2.3.6 Diameters of boring and casing;
- 12.1.5.2.3.7 Depth of casing penetration; and
- 12.1.5.2.3.8 Time and depth from reference point for each time increment.
- 12.1.5.2.4 Infiltration rate graph for each test. The graphs shall be field verified infiltration rate versus elapsed time of test. Appended to each graph shall be a table of the testing results.
- 12.1.5.2.5 Geotechnical recommendations shall be provided for each stormwater management facility, including design infiltration rate, impact of infiltration on adjacent facilities, effect of infiltration on slope stability, if the facility is located on a slope, stability of slopes within the facility, and foundation bearing resistance.
- 12.1.5.2.5.1 A minimum factor of safety of 2.0 shall be applied to field results from Single Ring or Double Ring Infiltrometer testing.

- 12.1.5.2.5.2 A minimum factor of safety of 2.5 shall be applied to field results from Cased Borehole Permeameter testing.
- 12.1.5.2.5.3 The report shall provide an elevation range over which the recommended design rates are applicable.
- 12.1.5.2.5.4 The maximum design infiltration rate shall be less than or equal to 15 inches per hour.
- 12.1.5.2.6 If steady state conditions for a given test are not achieved, the professional in responsible charge of infiltration testing shall provide an explanation as to why steady state could not be achieved and their professional opinion regarding the use of the results for design purposes. If steady state is not achieved for a given test and a reasonable professional opinion is not provided, the Department or Delegated Agency may require additional testing.
- 12.1.5.3 Geotechnical reports for embankments shall include the following:
 - 12.1.5.3.1 Summary of design analyses, which provide the project description and basis of the design recommendations.
 - 12.1.5.3.2 Summary of stability analysis, which provide the results of the stability analyses performed for the given embankment dimensions.
 - 12.1.5.3.3 Summary of settlement analyses, including design assumptions and settlement results for above-grade embankments.
 - 12.1.5.3.4 Design recommendations for embankment construction shall identify the following actions:
 - 12.1.5.3.4.1 Construction procedures for placement of material in embankment widening areas;
 - 12.1.5.3.4.2 Embankment cut-off and core trench materials for above-grade embankments;
 - 12.1.5.3.4.3 Special notes for excavation of unsuitable material, with specific backfill requirements.
 - 12.1.5.3.4.4 Specific measures required prior to placing embankment material.
 - 12.1.5.3.4.5 Installation of appropriate erosion control and vegetative cover.
- 12.2 Setbacks
 - 12.2.1 All applicable federal, state and local laws, rules, regulations or permit requirements governing setbacks shall be followed.
 - 12.2.2 Where multiple setbacks exist, the greatest setback requirement shall apply.
 - 12.2.3 Horizontal setback distances for all applicable best management practices (BMPs) shall be shown on the design plans with dimensions. The setback distances shall be measured from the BMP's water surface elevation for the Cv event to the following:
 - 12.2.3.1 Center of a public or domestic well;
 - 12.2.3.2 Closest point of a drainfield or components of a septic system;
 - 12.2.3.3 Outer edge of pipe or conduit for utilities;
 - 12.2.3.4 Outside edge of slabs or vertical walls of buildings or structures; and
 - 12.2.3.5 Closest point of a property line.
 - 12.2.4 Applicable Setbacks
 - 12.2.4.1 Public and Domestic Wells
 - 12.2.4.1.1 Setbacks from public and domestic wells are applicable to the following stormwater BMPs: infiltration practices, bioretention, permeable pavement systems, constructed wetlands, detention practices, and wet ponds.
 - 12.2.4.1.2 The minimum setback from a public well as defined by the Office of Drinking Water shall be 150 feet.
 - 12.2.4.1.3 The minimum by right setback from a domestic well as defined by the DNREC Water Supply Section shall be 100 feet.
 - 12.2.4.1.4 In cases where the 100-foot setback cannot be met for a domestic well, the Department or Delegated Agency may consider an alternative method of compliance (AMC). The AMC shall consist of the following:
 - 12.2.4.1.4.1 Developer shall notify owner of adjacent domestic well that a stormwater BMP is proposed on an adjacent property.
 - 12.2.4.1.4.2 Developer shall offer to sample adjacent domestic well prior to installation of the stormwater BMP and two years after installation of the stormwater BMP.

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- 12.2.4.1.4.3 Developer shall install a monitoring well between the proposed BMP and the adjacent well in accordance with Delaware regulations governing the construction and use of wells.
- 12.2.4.1.4.4 Prior to plan approval, developer shall perform a minimum of one (1) test of the groundwater from both the monitoring well and the adjacent domestic well, if access is granted. If accepted by the adjacent domestic well owner, developer shall perform a minimum of one (1) test of the groundwater from the adjacent domestic well two years after installation of the stormwater BMP.
- 12.2.4.1.4.5 All tests of groundwater shall monitor for the following constituents:
- 12.2.4.1.4.5.1 pH;
 - 12.2.4.1.4.5.2 Total Dissolved Solids;
 - 12.2.4.1.4.5.3 Total Phosphorus;
 - 12.2.4.1.4.5.4 Total Chloride;
 - 12.2.4.1.4.5.5 Specific Conductance;
 - 12.2.4.1.4.5.6 Nitrate Nitrogen;
 - 12.2.4.1.4.5.7 Total Nitrite/Nitrate;
 - 12.2.4.1.4.5.8 Total Carbon(Particulate Total Carbon);
 - 12.2.4.1.4.5.9 Total Organic Carbon;
 - 12.2.4.1.4.5.10 Total Petroleum Hydrocarbons;
 - 12.2.4.1.4.5.11 Turbidity;
 - 12.2.4.1.4.5.12 Total Coliform;
 - 12.2.4.1.4.5.13 Sodium;
 - 12.2.4.1.4.5.14 Antimony;
 - 12.2.4.1.4.5.15 Arsenic;
 - 12.2.4.1.4.5.16 Barium;
 - 12.2.4.1.4.5.17 Beryllium;
 - 12.2.4.1.4.5.18 Cadmium;
 - 12.2.4.1.4.5.19 Chromium;
 - 12.2.4.1.4.5.20 Lead;
 - 12.2.4.1.4.5.21 Nickel;
 - 12.2.4.1.4.5.22 Selenium;
 - 12.2.4.1.4.5.23 Silver;
 - 12.2.4.1.4.5.24 Thallium;
 - 12.2.4.1.4.5.25 Mercury;
 - 12.2.4.1.4.5.26 Fluoride;
 - 12.2.4.1.4.5.27 Nitrite Nitrogen;
 - 12.2.4.1.4.5.28 Cyanide, Total;
 - 12.2.4.1.4.5.29 Benzene;
 - 12.2.4.1.4.5.30 Carbon Tetrachloride;
 - 12.2.4.1.4.5.31 Chlorobenzene;
 - 12.2.4.1.4.5.32 o-Dichlorobenzene;
 - 12.2.4.1.4.5.33 p-Dichlorobenzene;
 - 12.2.4.1.4.5.34 1,2-Dichloroethane;
 - 12.2.4.1.4.5.35 1,1-Dichloroethene;
 - 12.2.4.1.4.5.36 cis-1,2-Dichloroethylene;
 - 12.2.4.1.4.5.37 trans--1,2-Dichloroethylene;
 - 12.2.4.1.4.5.38 Dichloromethane;
 - 12.2.4.1.4.5.39 1,2-Dichloropropane;
 - 12.2.4.1.4.5.40 Ethylbenzene;
 - 12.2.4.1.4.5.41 Styrene;

- 12.2.4.1.4.5.42 Tetrachloroethene;
 - 12.2.4.1.4.5.43 Toluene;
 - 12.2.4.1.4.5.44 1,2,4-Trichlorobenzene;
 - 12.2.4.1.4.5.45 1,1,1-Trichloroethane;
 - 12.2.4.1.4.5.46 1,1,2-Trichloroethane;
 - 12.2.4.1.4.5.47 Trichloroethene;
 - 12.2.4.1.4.5.48 Vinyl Chloride;
 - 12.2.4.1.4.5.49 m-Xylene;
 - 12.2.4.1.4.5.50 o-Xylene; and
 - 12.2.4.1.4.5.51 p-Xylene.
- 12.2.4.1.4.6 Developer shall submit testing results of monitoring well and the adjacent domestic well, if applicable, to DNREC Source Water Assessment and Protection Program (SWAPP) and the Department Sediment & Stormwater Program or Delegated Agency.
- 12.2.4.1.5 The minimum setback distances for domestic wells with alternative method of compliance from applicable BMPs are as follows:
- 12.2.4.1.5.1 For Infiltration Practices, Bioretention, Permeable Pavement Systems, Constructed Wetlands and Wet Ponds into the water table:
 - 12.2.4.1.5.1.1 50 feet for residential, commercial or institutional land uses.
 - 12.2.4.1.5.1.2 100 feet for highway land uses.
 - 12.2.4.1.5.2 For Detention Practices and Wet Ponds above the water table:
 - 12.2.4.1.5.2.1 10 feet for residential, commercial or institutional land uses.
 - 12.2.4.1.5.2.2 50 feet for highway land uses.
- 12.2.4.2 Septic Systems
- 12.2.4.2.1 Setbacks from septic system drainfields and components are applicable to the following stormwater BMPs: infiltration practices, bioretention, permeable pavement systems, constructed wetlands, detention practices, wet ponds, restoration practices, rooftop disconnection, vegetated channels, sheet flow, stormwater filtering systems, proprietary practices and afforestation.
 - 12.2.4.2.2 The minimum setbacks for septic system drainfields and components from applicable BMPs shall be as follows
 - 12.2.4.2.2.1 For Infiltration Practices, Bioretention, Permeable Pavement Systems, Detention Practices, Restoration Practices, Rooftop Disconnection, Vegetated Channels, Sheet Flow, Stormwater Filtering Systems, Proprietary Practices and Afforestation, the setback distances for both the drainfield and components shall be 10 feet.
 - 12.2.4.2.2.2 For Constructed Wetlands and Wet Ponds, the setback distance shall be 50 feet for the drainfield and 25 feet for components.
- 12.2.4.3 BMPs shall not be located within a non-blanket utility easement unless a letter of no objection from the utility owner is provided. Utilities shall not impact existing BMPs unless a letter of no objection from the BMP owner is provided.
- 12.2.4.4 Buildings and Structures
- 12.2.4.4.1 Setbacks from buildings or structures are applicable to the following stormwater BMPs: Infiltration Practices, Bioretention, Permeable Pavement Systems (excluding sidewalks or minor linear paved areas), Detention Practices, Constructed Wetlands, and Wet Ponds.
 - 12.2.4.4.2 BMPs shall be setback from buildings or structures having a below-grade crawl space or basement such that the below-grade crawl space or basement of the building or structure is outside of the calculated or assumed 4:1 phreatic zone of the BMP unless the building or structure is designed to be waterproof.
 - 12.2.4.4.3 Building and structure setback distances shall be no less than that needed for maintenance.
- 12.2.4.5 Property line setback distances shall be no less than that needed for maintenance unless a shared use agreement exists between property owners.

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13.0 Stormwater Management Offsets

13.1 Stormwater Management Offset Provisions

13.1.1 For the purpose of achieving project compliance, a stormwater management offset may be used as an alternative method to full or partial compliance with one or both of the following:

13.1.1.1 The Resource Protection Event (RPv) requirements as provided in subsections 5.2 and 5.6.3 of these regulations.

13.1.1.2 The Conveyance Event (Cv) and Flooding Event (Fv) requirements as per subsections 5.3 and 5.4 of these regulations provided compliance is achieved through the participation in a Stormwater Management Offset District.

13.1.2 A stormwater management offset may be used as an alternative to full or partial compliance on projects that:

13.1.2.1 Are governed by a Stormwater Management Offset District, or

13.1.2.2 Demonstrate an inability to provide on-site best management practices due to physical site constraints including, but not limited to, soil characteristics and high water table.

13.1.3 With the exception of fees-in-lieu as managed in accordance with subsection 13.2, stormwater management offsets shall be utilized in the same ten digit hydrologic unit code as defined by the United States Geological Survey as the permitted site, or adjacent ten digit hydrologic unit code within the same eight digit hydrologic unit code.

13.2 Stormwater Management Fee-in-lieu

13.2.1 Owner Responsibilities

13.2.1.1 When the fee-in-lieu offset is utilized for full or partial compliance, the owner shall pay a fee-in-lieu in an amount not less than \$20 per cubic foot of volume of runoff adjusted to current value to the nearest dollar. The \$20 per cubic foot of volume of runoff value is based on the estimated cost to construct and maintain a bioretention stormwater BMP as of January 2018 and shall be adjusted annually using Engineering News Record's building and construction cost indexes for Philadelphia.

13.2.1.2 The fee-in-lieu amount for the phase of the project beginning construction shall be submitted to the Department or the Stormwater Management Offset District prior to commencement of construction.

13.2.2 Disbursements of fees-in-lieu collected by the Department will be managed through the Water Infrastructure Advisory Council (WIAC) (29 Del.C. Ch. 80 Subchapter 1, Section 8011).

13.3 Stormwater Management Trading

13.3.1 Stormwater management trading allows the use of a "credit" for one project to offset a "debit" condition on another project to gain RPv compliance.

13.3.2 A trading agreement shall be established between each debit project and its associated credit project.

13.3.3 Department or Delegated Agency will review both the credit and debit projects to ensure compliance.

13.3.4 The credit project shall be completed prior to commencement of construction of the debit project, including approval of all applicable Post Construction Verification Documents.

13.4 Stormwater Management Banking

13.4.1 Currency used for banking projects shall be based on the volume of runoff to be treated for the RPv.

13.4.2 A Stormwater Management Bank shall not have a negative balance.

13.4.3 Stormwater Management Bank Owner Responsibilities

13.4.3.1 Develop a banking framework for approval by the Department.

13.4.3.2 Develop a documentation process to be used for each project transaction.

13.4.3.3 Develop an accounting process to track project transactions.

13.4.4 Department or delegated agency responsibilities.

13.4.4.1 Banking framework documents, documentation process and accounting process shall be subject to review and approval by the Department.

13.4.4.2 Documentation for each project transaction shall be subject to review and approval by the Department or delegated agency.

13.4.4.3 Each stormwater management banking account shall be subject to periodic review by the Department or delegated agency.

13.5 Stormwater Management Offset District

13.5.1 The creation of a Stormwater Management Offset District will necessitate the development of public governance authorized to manage established Stormwater Management Offsets.

13.5.2 Stormwater Management Offset District authorization shall be subject to Departmental review and approval as well as to the public notice requirements of 7 **Del.C.** §6004.

13.5.3 The intent of the Stormwater Management Offset District must be clearly defined regarding program components. Those components must include:

13.5.3.1 Program administration;

13.5.3.2 Planning;

13.5.3.3 Maintenance operations;

13.5.3.4 Regulation and enforcement; and

13.5.3.5 Offset implementation and verification.

13.5.4 A Stormwater Management Offset District may submit for authorization a Stormwater Management Fee-in-lieu Offset that is no less than the fee-in-lieu per cubic foot rate amount established in subsection 13.2.1.1. Disbursements of fees-in-lieu collected and managed by the Stormwater Management Offset District in accordance with program components.

7 DE Reg. 1147 (03/01/04)

8 DE Reg. 1172 (02/01/05)

10 DE Reg. 735 (10/01/06)

17 DE Reg. 240 (08/01/13)

18 DE Reg. 396 (11/01/14)

22 DE Reg. 680 (02/01/19)