

11.0 Post Construction BMPs Standards and Specifications

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 5%.

11.10.1.1.5 The total phosphorous pollutant reduction performance credit for this variant is 10%.

11.10.1.1.6 The total suspended solids pollutant reduction performance credit for this variant is 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 20%.

11.10.1.2.5 The total phosphorous pollutant reduction performance credit for this variant is 20%.

11.10.1.2.6 The total suspended solids pollutant reduction performance credit for this variant is 60%.

11.10.1.3 Underground Detention Facilities

11.10.1.3.1 Underground Detention Facilities not achieving 48-hour ED of the full RPv shall have RPv, Cv, and Fv 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 RPv shall have RPv, Cv, and Fv 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 RPv.

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 1 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 2 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 Soil Investigation Procedures 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 RPv 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 3 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 (Fv) if the Fv 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 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.

11.10.4.5 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 (Cv).

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 3 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 3 feet.

11.10.6.4.2 Any additional retaining walls shall have a maximum height of 2 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.

10H:1V. 11.10.6.6.3.2 Profile grade that does not exceed

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%.

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 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 10% 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.