

11.0 Post Construction BMP Standards and Specifications

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 RPv runoff reduction performance credit for this variant is 0%.

11.13.1.1.2 The Cv runoff reduction performance credit for this variant is 0%.

11.13.1.1.3 The Fv 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 0%.

11.13.1.1.5 The total phosphorus pollutant reduction performance credit for this variant is 0%.

11.13.1.1.6 The total suspended solids pollutant reduction performance credit for this variant is 0%.

11.13.1.2 Wet Extended Detention (ED) Pond

11.13.1.2.1 The RPv runoff reduction performance credit for this variant having 48 hours of extended detention is 100%.

11.13.1.2.2 The Cv runoff reduction performance credit for this variant having 48 hours of extended detention is 1%.

11.13.1.2.3 The Fv 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 30%.

11.13.1.2.5 The total phosphorus pollutant reduction performance credit for this variant having 48 hours of extended detention is 55%.

11.13.1.2.6 The total suspended solids pollutant reduction performance credit for this variant having 48 hours of extended detention is 60%.

11.13.2 Wet Ponds constructed to meet regulatory stormwater management requirements in the State of Delaware shall be designed and constructed in accordance with the USDA NRCS Small Pond Code 378 as amended.

11.13.3 Wet Pond Feasibility Criteria

11.13.3.1 Soil investigations must be conducted in accordance with Soil Investigation Procedures to determine the suitability of the soils to support a permanent pool.

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 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 of the channel.

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 that may allow for smaller diameters.

11.13.4.2 Outfall Protection

11.13.4.2.1 The design must specify an outfall that shall be stable for the conveyance storm (Cv) and flooding event (Fv) if a separate emergency spillway is not provided.

11.13.4.2.2 If necessary, the channel immediately below the Wet Pond outfall must be modified to prevent erosion and conform to natural dimensions in the shortest possible distance.

11.13.4.2.3 When the discharge is to a manmade pipe or channel system, the system must be adequate to convey the required design storm peak discharge in a non-erosive manner.

11.13.4.2.4 The final release rate of the facility shall be modified if any increase in flooding or stream channel erosion would result at a

downstream structure, highway, or natural point of restricted streamflow unless downstream improvements are made to accommodate the increase.

11.13.4.3 Emergency Spillway

11.13.4.3.1 Wet Ponds must be designed to pass the maximum design storm event (Fv) if the Fv is being routed through the Wet Pond rather than bypassing. An emergency spillway designed to convey the Fv shall be cut in natural ground or, if cut in fill, must be lined with stabilization geotextile and riprap.

11.13.4.3.2 When the maximum design storm passes through the principal spillway, the principal spillway outlet pipe must have a minimum cross sectional area of 3 square feet.

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 3 feet.

11.13.5.2.3 The forebay must be sized to contain ten percent of the volume of runoff from the contributing drainage area for the Resource Protection event.

11.13.5.2.4 Exit velocities from the forebay shall be non-erosive or an armored overflow shall be provided.

11.13.6 Wet Pond Design Criteria

11.13.6.1 The pond must:

11.13.6.1.1 Store a volume equivalent to the RPv to a maximum of one inch of runoff, and

11.13.6.1.2 Provide 48 hours extended detention. 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.

11.13.6.2 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 Side slopes for Wet Ponds both above and below permanent pool shall be no steeper than 3H:1V.

11.13.6.5 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%.

11.13.6.6 A ten foot wide aquatic bench shall be provided one foot below permanent pool.

11.13.6.7 Liners

11.13.6.7.1 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 pond designer chooses not to follow the recommendations of the geotechnical professional, a signed and sealed letter from the designer providing justification for removal of the liner from the design shall be provided to DNREC or their delegated Agency.

11.13.6.7.2 When the geotechnical engineer recommends a liner, acceptable options include the following:

11.13.6.7.2.1 a clay liner having a minimum 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:

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| 11.13.6.7.2.1.1 | Permeability of 1×10^{-6} cm/sec using ASTM D-2434 procedure |
| 11.13.6.7.2.1.2 | Plasticity index of not less than 15% using ASTM D-423/424 procedures |
| 11.13.6.7.2.1.3 | Liquid limit of not less than 30% using ASTM D-2216 procedure |
| 11.13.6.7.2.1.4 | Clay particles passing not less than 30% using ASTM D-422 procedure |
| 11.13.6.7.2.1.5 | Compaction of 95% of standard proctor density using ASTM D-2216 procedure |
| 11.13.6.7.2.2 | a 30 mil poly-liner; |
| 11.13.6.7.2.3 | bentonite; |
| 11.13.6.7.2.4 | use of chemical additives; |
| 11.13.6.7.2.5 | other acceptable measures as recommended by a qualified geotechnical professional; or |

11.13.6.7.2.6 other synthetic liners if the designer supplies supporting documentation that the material will achieve the required performance.

11.13.6.8 Trash racks shall be provided for low-flow pipes and for all riser structure openings.

11.13.6.8.1 All metal trash racks shall be coated with a rust inhibitor to increase longevity of the device.

11.13.6.8.2 The low flow extended detention orifice shall be protected from clogging by an external trash rack.

11.13.6.9 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.

11.13.6.10 All materials used in construction of a Wet Quantity Management Pond or Wet ED Pond shall meet the material specifications in USDA NRCS Small Pond Code 378 as amended.

11.13.6.11 Safety Features

11.13.6.11.1 Any opening twelve inches or greater discharging to a closed drainage system shall include safety grates.

11.13.6.11.2 The emergency spillway must be located so that downstream structures will not be impacted by spillway discharges.

11.13.6.11.3 The emergency spillway exit channel must be designed to direct runoff to a point of discharge without impact to downstream structures.

11.13.6.12 All Wet Ponds must be designed so as to be accessible to annual maintenance.

11.13.6.12.1 Adequate maintenance access must extend to the forebay, safety bench, riser, and outlet structure.

11.13.6.12.2 A maintenance right-of-way or easement must extend to the Wet Pond from a public or private road.

11.13.6.12.3 Maintenance access must meet the following criteria:

11.13.6.12.3.1 Minimum width of fifteen feet.

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

11.13.6.12.3.3 Minimum 10H:1V cross slope.

11.13.6.13 Maintenance Set-Aside Area

11.13.6.13.1 The maintenance set-aside area shall accommodate the volume of 50% of the collective forebay volume.

11.13.6.13.2 The maximum depth of the set aside volume shall be one foot.

11.13.6.13.3 The slope of the set aside area shall not exceed 5%.

11.13.7 Wet Pond Landscaping Criteria

11.13.7.1 Woody vegetation shall not be planted or allowed to grow within fifteen feet of the embankment and ten feet on either side of principal spillway or inflow 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

11.13.7.2.3 Size and spacing of plant material and/or application rate of seed mixes

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

11.13.7.2.4 The sequence for preparing the aquatic bench including soil amendments, if needed

11.13.8 Wet Pond Construction

11.13.8.1 Use of Wet Ponds for Erosion and Sediment Control

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 All areas above the permanent pool elevation must be permanently stabilized in accordance with the vegetative stabilization specifications on the approved Sediment and Stormwater Management Plan.

11.13.8.5 Upon project completion, the owner shall submit Post Construction verification documents to demonstrate that the wet pond 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 wet pond practices are as follows:

11.13.8.5.1 The acceptable top of bank elevation may be no lower than the design elevation for top of bank.

11.13.8.5.2 The allowable tolerance from the design volume of the wet pond surface storage is ten percent less than the design volume.

11.13.8.5.3 The allowable tolerance for elevations on any structure is 0.1 foot.

11.13.8.6 When the allowable tolerances are exceeded for wet pond 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.