

13.0 Wet Ponds



13.2 Wet Pond Design Summary

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 and this document.

Table 13.2 Wet Pond Design Summary

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| <p>Feasibility Criteria (Section 13.3)</p> | |
| <p>Conveyance Criteria (Section 13.4)</p> | <ul style="list-style-type: none"> • Principal spillway must be accessible by dry land • Principal spillway must include trash racks and watertight joints • Small low flow orifices must be protected from clogging • Outfall channel designed to be stable for the Cv • Emergency spillway designed to safely convey the Fv • Emergency spillway must be in cut material or reinforced • Inflow points and forebays stable for the Cv • Secure necessary dam safety permits, if applicable |
| <p>Pretreatment Criteria (Section 13.5)</p> | <ul style="list-style-type: none"> • Forebays at major inlets – those conveying >10% of runoff volume • Forebays sized for 10% of RPv • Non-erosive discharge from forebay to pond pool • Direct access provided to facilitate forebay maintenance |
| <p>Design Criteria Storage (Section 13.6)</p> | <ul style="list-style-type: none"> • Store RPv (2.7") to a maximum of 1" of runoff within the permanent pool and extended detention • Storage >5' above permanent pool requires design enhancements • Detention time based on time of initial inflow to time of final outflow • Peak discharge < 5x average discharge |

Table 13.2 Wet Pond Design Summary

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| Design Criteria Geometry (Section 13.6) | <ul style="list-style-type: none"> • Minimum length to width ratio = 1.5:1 • Minimum depth = 4'; maximum depth = 8' • Side slopes no steeper than 3H:1V • Ten foot wide safety bench constructed 1' above permanent pool when side slopes are steeper than 4:1 • Ten foot wide aquatic bench constructed 1' below permanent pool |
| Design Criteria Appurtenances (Section 13.6) | <ul style="list-style-type: none"> • Low Flow ED orifice protected from clogging • Riser structure must be accessible for maintenance • Trash racks provided on enclosed structure openings • Materials meet Small Pond Code 378 specifications |
| Design Criteria Safety (Section 13.6) | <ul style="list-style-type: none"> • Restrict entry to principal spillway • One foot of freeboard above the Fv elevation (2' if no emergency spillway) • Emergency spillway located to not impact downstream structures • Safety and aquatic benches landscaped to discourage access to permanent pool |
| Design Criteria Maintenance (Section 13.6) | <ul style="list-style-type: none"> • Provide access to forebays, safety bench, riser and outlet structure • Access roads built to withstand the expected frequency of use • Minimum width of access roads = 15', profile grade < 10:1 with 10:1 cross slope • Maintenance set aside area provided |
| Landscaping Criteria (Section 13.7) | <ul style="list-style-type: none"> • No woody vegetation within 15' of the embankment and 10' on either side of principal spillway or inflow pipes • Detailed planting plan required |

13.3 Wet Pond Feasibility Criteria

Soils. Soil investigations must be conducted to determine the suitability of the soils to support a permanent pool

Perennial Streams. Locating Wet Ponds within perennial streams will require all appropriate state or federal permits.

13.4 Wet Pond Conveyance Criteria

Wet Ponds, including their conveyance systems, 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 and this document.

Principal Spillway. The principal spillway must be accessible from dry land. A structure-pipe spillway shall be designed with anti-flotation, anti-vortex and trash rack devices on the structure. The outfall pipe and all connections to the outfall structure shall be made watertight. Soil tight joints are not acceptable. Anti-seep collars shall be used in accordance with Pond Code 378 as amended. When the principal spillway is composed of a weir wall discharging to a channel, the channel below the weir must be reinforced (with riprap, for example) to prevent scour of the channel.

Non-Clogging Low Flow Orifice. 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.

Adequate Outfall Protection. 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. 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.

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. 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.

Emergency Spillway. 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. 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.

Inflow Points Stabilization. Inflow points into the Wet Pond must be stabilized to ensure that non-erosive conditions exist during storm events up to the conveyance storm (i.e., the 10-year storm event). A forebay (See 13.5 Wet Pond Pretreatment Criteria) shall be provided at each inflow location, unless the inlet provides less than 10% of the total RPv inflow to the Wet Pond.

Dam Safety Permits. 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.

13.5 Wet Pond Pretreatment Criteria

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:

- 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.
- A safety bench is required at the pond shoreline for forebay depths greater than 3 feet. The forebay must be sized to contain ten percent of the volume of runoff from the contributing drainage area for the Resource Protection event.
- Exit velocities from the forebay shall be non-erosive or an armored overflow shall be provided.

13.6 Wet Pond Design Criteria

Wet Pond Sizing: In order to receive the credits outlined in Table 13.1b, the permanent pool must be sized to store a volume equivalent to the R_{Pv} and 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 5X the average discharge rate.

Permanent Pool Depth: The minimum depth to prevent the normal pool area from being overtaken by undesirable vegetation is 4'. The maximum depth of the permanent pool shall not exceed 8' for safety reasons unless approved by the Department and/or Delegated Agency.

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

Wet Pond Benches:

- **Safety Bench.** When Wet Pond side slopes above permanent pool are steeper than 4H:1V, a 10 foot wide safety bench shall be constructed one foot above the permanent pool.
- The maximum slope of the safety bench shall be 5%.
- A 10 foot wide aquatic bench shall be provided one foot below permanent pool.

Liners: A clay liner must meet the specifications outlined in Table 13.3.

Table 13.3. Clay Liner Specifications

| Property | Test Method | Unit | Specification |
|--------------------------|----------------|--------|---------------------------------|
| Permeability | ASTM D-2434 | Cm/sec | 1×10^{-6} |
| Plasticity Index of Clay | ASTM D-423/424 | % | Not less than 15 |
| Liquid Limit of Clay | ASTM D-2216 | % | Not less than 30 |
| Clay Particles Passing | ASTM D-422 | % | Not less than 30 |
| Clay Compaction | ASTM D-2216 | % | 95% of standard proctor density |

Source: VA DCR (1999).

Non-clogging Low Flow (Extended Detention) Orifice: The low flow ED orifice shall be protected from clogging by an external trash rack.

Riser: 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.

Trash Racks: Trash racks shall be provided for low-flow pipes and for all riser structure openings. All metal trash racks shall be coated with a rust inhibitor to increase longevity of the device.

Pond Drain: The Department or the Delegated Agency shall be notified before a Wet Pond is drained.

Material Specifications: 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.

Safety Features:

- **Any opening 12” or greater discharging to a closed drainage system shall include safety grates.**
- **Wet Ponds must incorporate an additional 1 foot of freeboard above the emergency spillway for the maximum design storm (e.g., Fv) unless more stringent Dam Safety requirements apply.**
- **The emergency spillway must be located so that downstream structures will not be impacted by spillway discharges. The emergency spillway exit channel must be designed to direct runoff to a point of discharge without impact to downstream structures.**

Maintenance Reduction Features: The following Wet Pond maintenance issues can be addressed during the design, in order to make on-going maintenance easier:

- **Maintenance Access. All Wet Ponds must be designed so as to be accessible to annual maintenance**
 - **Adequate maintenance access must extend to the forebay, safety bench, riser, and outlet structure.**
 - **A maintenance right-of-way or easement must extend to the Wet Pond from a public or private road.**
 - **Maintenance access must have a minimum width of 15 feet, have a profile grade that does not exceed 10:1, and a minimum 10:1 cross slope.**
- **Maintenance Set-Aside Area:**
 - **The maintenance set-aside area shall accommodate the volume of 50% of the collective forebay volume.**
 - **The maximum depth of the set aside volume shall be one foot.**
 - **The slope of the set aside area shall not exceed 5%; and**

13.7 Wet Pond Landscaping Criteria

Woody Vegetation: Woody vegetation shall not be planted or allowed to grow within 15’ of the embankment and 10’ on either side of principal spillway or inflow pipes.

Planting Plan: 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:

- **Delineation of zones within both the Wet Pond and vegetated perimeter area**
- **Selection of corresponding plant species**
- **The planting plan shall include size and spacing of plant material and/or application rate of seed mixes**
- **The sequence for preparing the aquatic bench (including soil amendments, if needed)**
- **Native plant material shall be specified by botanical and common name**
- **Seed mixes shall be specified by botanical and common names as well as percentages by weight or volume**

13.8. Wet Pond Construction

Use of Wet Ponds for Erosion and Sediment Control. A Wet Pond may serve as a sediment basin during project construction. **If this is done, the volume of the sediment basin must be based on the more stringent sizing rule (erosion and sediment control requirement vs. storage volume requirement). Appropriate procedures must be implemented to prevent discharge of turbid waters when the sediment basin is being converted into a Wet Pond.**

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. The Sediment and Stormwater Plan must include conversion steps from sediment basin to permanent Wet Pond in the construction sequence. 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.

Construction Review. **Construction reviews are required during the following stages of construction, and noted on the plan in the sequence of construction:**

- **Pre-construction meeting**
- **Initial site preparation (including installation of E&S controls)**
- **Construction of the embankment, including installation of the principal spillway and the outlet structure**
- **Excavation/Grading (interim and final elevations)**
- **Implementation of the planting plan and vegetative stabilization**
- **Final inspection (develop a punch list for facility acceptance)**

Construction Sequence.

Step 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.

Step 11: All areas above the normal pool elevation must be permanently stabilized in accordance with the vegetative stabilization specifications on the approved Sediment and Stormwater Management Plan.

Post Construction Verification. **Following construction, the constructed Wet Pond depth at three areas within the permanent pool (forebay, mid-pond, and prior to the principal spillway) must be included in accordance with the post construction verification document checklist.**

13.9 Wet Pond Maintenance Criteria

Inspection of critical structural features (e.g., embankments and risers) shall be performed by a CCR or licensed professional who has experience in the construction, inspection, and repair of these features. Repair of critical structural features (e.g., embankments and risers) shall be performed by responsible personnel that have successfully completed the DNREC Contractor Training Program.

Sediment removal in the Wet Pond pretreatment forebay must occur when 50% of total forebay capacity has been lost.

An Operation and Maintenance Plan for the project must be approved by the Department or the Delegated Agency prior to project closeout. Wet Ponds that are, or will be, owned and maintained by a joint ownership such as a homeowner's association must be located in common areas, community open space, community-owned property, jointly owned property, or within a recorded easement dedicated to public use.