

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
TECHNICAL STANDARD
VEGETATED DRY DETENTION POND
1011

DEFINITION

A vegetated dry detention pond has perennial, native vegetation on its bottom and side slopes and does not have a permanent pool of water. This constructed pond has designed dimensions, inlets, outlets and storage capacity necessary to detain, treat and release storm water runoff.

PURPOSE

The purpose of this practice is to manage runoff to accomplish the following:

- attenuate peak flow,
- capture sediment and associated pollutants while avoiding a permanent pool of water, and
- limit temperature impacts.

A vegetated dry detention pond, by itself, is unlikely to achieve 80% total suspended solid (TSS) control, though it may be used in conjunction with other storm water practices to meet TSS control and other storm water management requirements.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to urban sites where stormwater runoff pollution due to particulate solids loading and attached pollutants is a concern. It also applies where increased runoff from urbanization or land use change is a concern.

This practice is primarily applicable to sites where a vegetated dry detention pond is used in conjunction with other post-construction storm water practices but may be used independently where 80% TSS control is not required. The practice may require a liner when runoff comes from sources listed under s. NR 151.124(3)(a), Wis. Adm. Code and from areas listed under s. NR 151.124(4)(a), Wis. Adm. Code (See also WDNR Technical Standard 1001 Wet Detention Pond).

CRITERIA

General Criteria

This section contains requirements for the design of the practice to accomplish the identified purposes. For specified design storms, refer to local regulatory requirements or the most current version of NOAA Atlas 14, or its successor, to obtain precipitation frequency data.

Laws and Regulations. UComply with applicable federal, tribal, state, and local laws, rules, regulations, and permit requirements. This standard does not contain the text of federal, tribal, state, or local regulations. Requirements specific to peak flow control, runoff volume control, minimum pipe sizes, drainage easements, offsets from property lines, and separation from structures are examples of common local regulations applicable to this practice.

Design Parameters. Vegetated dry detention ponds may be used independently or as a component of a storm water treatment and storage system. Design the pond in accordance with the following measures:

Site Criteria

Meet the following site criteria when locating a vegetated dry detention pond including identification of potential site constraints, such as buildings, potable wells, karst geology, lot boundaries, site topography, drainage patterns, and existing or proposed public rights-of-way, easements, as well as other environmental and regulatory items of concern.

- (1) Provide at least the minimum separation from community water supply systems in accordance with s. NR 811.12(5)(d), Wis. Adm. Code and from private and non-community water supply wells in accordance with s. NR 812.08, Wis. Adm. Code.
- (2) Locate the practice so there is no hydraulic connection with structure foundations, pavement foundations, and provide a minimum of 50 feet private onsite wastewater treatment systems (POWTS) dispersal cells, or other wastewater disposal systems.
- (3) Do not locate the practice such that overflow from the practice could flood existing or proposed structures during design storm events. Local regulations may dictate design standards to protect structures or other property.
- (4) If required, locate in a permanent, legally established drainage easement or out-lot granting access for maintenance.
- (5) Direct runoff through pretreatment devices prior to entering the pond.
- (6) Provide a *stable* overland flow path from the pond's emergency spillway.
- (7) Locate the pond where there is adequate access for maintenance.

Pretreatment

Pretreat storm water prior to entering the pond to capture at least the 100-micron particle size, which equates to approximately 10% of the *NURP* TSS mass.

The pretreatment options identified below are intended to protect pond vegetation, and to allow for settling of larger particles that could impede the vegetation's ability to hold accumulated sediment and to maintain a soil condition that will not pond for prolonged periods. For vegetated dry detention ponds, implement pretreatment using one or more of the following practices that are properly designed to provide the necessary pretreatment:

- (1) *Vegetated Filter Strip* – Vegetated filter strips pretreat sheet flow. Use level spreaders, grading, and shaping to convert concentrated flow to sheet flow before reaching filter strips.
- (2) *Vegetated Swale* – Vegetated swales pretreat concentrated flow from point sources such as pipes and curb cuts. See DNR Technical Standard 1005 Vegetated Swale.
- (3) *Sedimentation Device* – Sedimentation devices accept sheet flow and/or concentrated flow for pretreatment. See DNR Technical Standard 1006 Method for Predicting the Efficiency of Proprietary Storm Water Sedimentation Devices.

Design and Geometry

- (1) Design vegetated dry detention ponds with a principal outlet or multi-stage outlet. Design the principal outlet to be a maximum of 0.1 feet above the bottom of the pond. Design and size outlets to minimize scour and erosion, limit clogging, and ease maintenance. Refer to local regulations for potential minimum outlet sizing.
- (2) Use a hydrograph producing method to determine storage volume for the pond.
- (3) Maximize the length to width ratio of the flow path within the pond to prevent short circuiting, with a length to width ratio no less than 2:1. Maintain an adequate slope to drain water from the inlet to the outlet but limit slopes to prevent erosion.

- (4) Design a rock channel, check dams, vegetated pilot channel, or other practice to reduce the potential for channelized erosion within the pond. Do not use a paved low-flow channel as it does not provide for energy dissipation and may result in erosion along the edges of the paved channel.
- (5) To increase trapping of particles in the runoff do not include a paved or concrete low flow channel along the flow path.
- (6) Design a stone weeper, gabion, or similar structure around the principal outlet within the pond interior to reduce scour and limit sediment movement to the outlet.
- (7) Design an emergency spillway to safely pass the portion of the 100-year, 24-hour storm that is directed to the pond.
- (8) Design the pond side slopes to be 3:1 (horizontal:vertical) or flatter, with vegetation that would not require regular mowing. Use flatter side slopes where feasible for slope stability, reduced erosion potential, and improved safety if mowing is necessary. Alternative side slope configurations, including but not limited to, riprap with geo-textile fabric or retaining walls, may be used as needed.
- (9) Design inlet and outlet energy dissipation to prevent scour for discharge events up to and including a 100-yr/24-hr design storm event.
- (10) Design the pond to have a maximum drawdown time of 24 hours from the end of a single 1-yr/24-hr design storm event, and no more than 72 hours for drawdown from a 100-yr/24-hr design storm event.

Vegetation

- (1) Plant the pond bottom and side slopes with dense native vegetation to enhance particle trapping, infiltration, and evapotranspiration. Use shallow-rooted vegetation if a liner is required, as identified in section: Conditions Where Practice Applies.
- (2) Provide site-specific vegetation planting and establishment plan. Use a landscaping firm, or contractor, with knowledge and experience in planting and maintaining native plantings.
- (3) Use an appropriate companion or cover crop to establish native vegetation. Cover crop suitability varies with the planting season.
- (4) Select vegetation that is tolerant of soil conditions, road salt, inundation, and variable soil moisture conditions.
- (5) Provide a planting medium which can support the selected vegetation or select vegetation that can grow within the existing planting medium.
- (6) Implement and maintain measures to prevent erosion of the vegetated area until the pond is stabilized.

Infiltration

Although this practice is not designed specifically as an infiltration device, some infiltration is expected to occur. To design a dry pond specifically for credit toward the infiltration requirements contained in NR 151, refer to WDNR Technical Standard 1002 and WDNR Technical Standard 1003..

Construction

- (1) Prepare a construction erosion and sediment control plan.
- (2) When possible, construct ponds off-line until vegetation is established, and the contributing watersheds are stabilized.
- (3) Where ponds cannot be constructed off-line, follow one of these approaches:
 - (a) Construct and stabilize the pond early in the construction process to allow the vegetation to establish before receiving significant runoff. Install and maintain effective erosion and

sediment controls to reduce the potential for the pond to receive construction site sediment. Refer to WDNR Technical Standards 1053 Channel Erosion Mat, 1059 Seeding for Construction Site Erosion Control, and other construction technical standards for further guidance.

- (b) Construct ponds as part of the overall grading plan, but do not complete ponds with native seeding until the contributing watershed has been stabilized. Remove sediment and prepare seedbed before planting native vegetation.

Modeling

Use *acceptable models* to quantify pollutant load reduction, infiltration, and peak flow attenuation provided by vegetated dry detention ponds. Refer to DNR [Modeling Post-Construction Storm Water Management Treatment](#) guidance document, as appropriate.

CONSIDERATIONS

The following considerations are intended to enhance the use of this practice, or to address special cases that may arise in the implementation of the practice:

- (1) Design ponds to have hydraulic capacities that meet applicable local government or state agency requirements for conveying runoff from large storms (i.e., storms greater than the requirements in s. NR 151.123, Wis. Adm. Code, and designed as part of a *major storm water management system* as defined in this standard.
- (2) Where adjacent lots are undeveloped, consider including minimum floor and opening elevations in subdivision documents to prevent backflow into structures.
- (3) Ponds with outlet control structure orifices smaller than 6-inch diameter will need additional maintenance and/or clogging protection.
- (4) Plant side slopes with vegetation that would not require regular mowing or use flatter side slopes where feasible.
- (5) Develop a vegetation establishment plan for the first 5 years after planting and retain a qualified landscape company to implement the vegetation establishment plan.
- (6) Underdrains may be added to ponds to reduce the duration of standing water. Refer to WDNR Technical Standard 1004 Bioretention for Infiltration for guidance with underdrains. Model ponds with underdrains as biofilters. If infiltration is a goal of the pond, mitigate pond compaction by one or more of the following methods:
 - (a) Incorporate four inches of compost to a depth of 12 inches per WDNR Specification S100 Compost. Keep vehicles and equipment out of the vegetated dry detention pond after mitigation is completed.
 - (b) After topsoil placement, fracture the bottom of the vegetated dry detention pond to a depth of at least 20 inches below the surface to loosen the soil. Keep vehicles and equipment out of the vegetated dry detention pond after mitigation is completed.

PLANS AND SPECIFICATIONS

Prepare plans and specifications in accordance with the criteria of this standard and describe the requirements for applying the practice to achieve its intended use. Specify the materials, construction processes, locations, size, and elevations of all components of the practice. Include the *seasonally high groundwater elevation* on a to-scale profile or cross-section view of the practice as well as the elevations of any conveyance structures or storm sewer systems entering or leaving the practice.

OPERATION AND MAINTENANCE

Prepare a site-specific inspection and maintenance plan for the vegetated dry detention pond that includes the following:

- (1) Responsible party for the pond,
- (2) Annual (or more often, if needed) inspections to detect and repair nuisance conditions such as standing water, weeds, woody growth, and trash,
- (3) Steps to maintain native vegetation species, including removal of undesirable species,
- (4) Sediment removal when infiltration rates are impeded, sediment accumulation is visible, or if standing water exists for 48 hours after a runoff event,
- (5) Soil compaction mitigation in the pond during sediment removal, and
- (6) Repair of damaged or eroded areas and reestablishment of vegetation that meets requirements of original design.
- (7) Repair or replacement of energy dissipation structures and level spreaders that are not functioning as designed.

GLOSSARY

Administering authority: State and/or local units of government with storm water management regulatory authority.

Acceptable model: A computer model that adequately accounts for the hydraulic nature of storm water control measures, including infiltration if appropriate, and that has been accepted by the applicable administering authority. Examples include WinSLAMM, P-8, and RECARGA, and a hydrograph producing model.

Karst geology: An area or surficial geologic feature subject to bedrock dissolution so that it is likely to provide a conduit to groundwater. May include caves, enlarged fractures, mine features, exposed bedrock surfaces, sinkholes, springs, seeps, swallets, fracture trace (linear feature, including stream segment, vegetative trend and soil tonal alignment), Karst pond (closed depression in a karst area containing standing water) or Karst fen (marsh formed by plants overgrowing a karst lake or seepage area).

Major storm water management system: The storm water management facilities that are intended to convey and/or store runoff in excess of the capacity of the minor system. The minor system is designed to function frequently to prevent nuisance flooding and is sized for a smaller storm than the major system, generally a 10-year design storm event. The major system is primarily designed to function infrequently to prevent flooding of buildings and ponding of runoff in locations where it could promote harmful infiltration and inflow to sanitary sewers. The major system is generally designed for a 100-year design storm event. It consists of the components of the minor system, such as overland flow, swales, curbs and gutters, storm sewers, and detention/retention ponds, and also includes the entire roadway cross section and associated overland flow paths ultimately discharging to receiving streams.

NURP: NURP stands for Nationwide Urban Runoff Program and in this document refers to the NURP particle size distribution.

Sedimentation device: Examples of sedimentation devices that could be used for pretreatment may include wet detention ponds (WDNR Technical Standard 1001), proprietary sedimentation devices (WDNR Technical Standard 1006), catch basin sumps, and hydrodynamic devices.

Sheet flow: A maximum ½-inch depth of flow evenly spread over the filter strip width, for runoff events using the average annual rainfall as defined in s. NR 151.002(3), Wis. Adm. Code.

Stable/Stabilized: A uniform perennial, vegetative cover with a density of at least 70% vegetative cover (for unpaved areas and areas not covered by permanent structures or that employ equivalent permanent stabilization measures), with less than 10% cover by ch. NR 40, Wis. Adm. Code, regulated invasive

species. *Vegetated filter strip*: Vegetated filter strips (grassed filter strips, filter strips, and grassed filters) are vegetated surfaces designed to treat sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities, filtering out pollutants, and infiltration a portion of the runoff.