

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

CONSERVATION PRACTICE STANDARD

VEGETATED SWALE

CODE 1005

RESPONSE TO COMMENTS - 8/23/2016

Reviewers' comments are listed below under the appropriate section. Reviewers are identified in parentheses by a **blue letter**. Words to be added are in **red** and words to be deleted are in ~~strikeout~~.

Responses to reviewers are listed directly below each comment in **blue**.

General

(**Reviewer C**) The standard should be clear as to where a roadway ditch would be considered a vegetated swale for infiltration purposes, i.e., designated areas shown in the plans.

To address this comment, the team added item V.B.6 in the Site Layout section: "In site plans, identify which swales are designated in accordance with this Standard."

I. Definition

(**Reviewer G**) Consider clarifying if this includes dry detention ponds and natural wetlands.

To clarify that dry detention ponds and natural wetlands are *not* included, we updated the Definition, Section I: "Vegetated swales are **constructed** storm water conveyance systems designed to achieve water quality and quantity benefits. ~~Vegetated swales can be natural elongated depressions or constructed channels.~~"

III. Conditions where Practice Applies

(**Reviewer G**) The 5-ac threshold may not be necessary since the velocity and depth criteria in V.D. will determine where swales are appropriate.

The 5-acre threshold is not a requirement, but included as general guidance. To clarify this, we added the word "generally": "Swales are intended to treat relatively flat drainage areas with contributory areas **generally** less than 5 acres."

(**Reviewer G**) Change: "Swales are not suitable in areas of steep topography **longitudinal slope** or..."

This section was revised as recommended.

V. Criteria

B. Site Layout

(Reviewer A) Add word: "...water supply wells, karst geology, lot boundaries..."

This section was revised as recommended.

1. (Reviewer G) Add word: "...locate the swale in permanent legally-established drainage easement..."

This section was revised as recommended.

2. (Reviewer G) Add word: "Do not hydraulically connect swales to basement foundations..."

Given that connections to other foundations (e.g., bridge) are also not allowed, this section was not edited to limit applicability to basement foundations.

3. (Reviewer A) Phrase "commensurate with the degree of hazard" is not clear.

To clarify, this section was revised as follows: "Do not locate swales such that overflow from the swale could cause flooding of existing or proposed buildings, roads, or adjacent properties during storm events (refer to applicable regulatory requirements for drainage design) ~~storms with recurrence intervals commensurate with the degree of hazard.~~"

4.a. (Reviewer A) Change word: "Sheet flow off from road surface to road shoulder..."

This section was revised as recommended.

5. (Reviewer G) It may also be appropriate to set the infiltration rate to zero if the seasonal groundwater level is below the swale bottom by 12 inches or less.

Section B above (Site Layout) refers to NR 151 Wis. Adm. Code with regard to minimum separation distances. Users can find more detail regarding minimum separation distances in section NR 151.124 Wis. Adm. Code.

6. (Reviewer C, General Comment addressed here) The standard should be clear as to where a roadway ditch would be considered a vegetated swale for infiltration purposes, i.e., designated areas shown in the plans.

We added "In site plans, identify which swales are designated in accordance with this Standard."

C. Modeling Parameters

1. (Reviewer G) Consider clarifying what constitutes one defined point source versus multiple defined point sources. For instance, if 75% or 50% of the drainage area or flow enters the swale at the upstream point source, is it necessary to use the “average of half of each swale segment length” or can the “average swale length” be used. Using the models, a sensitivity analysis may be helpful to also name the two methods and give each method a separate section number (i.e., V.C.1.a. and b.).

We recognize that swale systems are variable and may not fit neatly into one of the two scenarios. In these cases, applicants commonly model swale segments in series or parallel (as appropriate) and/or model the system conservatively. For complex scenarios not specifically addressed in guidance, users can present a defensible approach. We considered the suggestions and slightly modified the text for clarification and added subsections a. and b. as suggested, but to avoid over-complicating this item we did not add more detail within the standard.

(Reviewer A) Update language: “...then the average swale length is defined as the average total of half of each swale segment length in the drainage area served by swales divided by the number of swale segment lengths.”

This section was revised as recommended.

2. (Reviewer G) Consider adding imported topsoil (high clay content)

A new item was added to section V.I.3., Static Infiltration Rate, to specifically address imported topsoil:

“If imported topsoil is used, use the infiltration rate commiserate with the textural class of the topsoil and use the WDNR Conservation Practice Standard “Site Evaluation for Stormwater Infiltration” (1002).”

4. (Reviewer G) Consider clarifying that culvert lengths should be subtracted from the total swale length. Driveway culverts are ditch enclosures and can be ¼ to ½ of a residential lot width. Driveway culverts to not allow for water quality or infiltration.

To address this, we added this sentence at the end of this Section V.C.4: “Exclude culvert lengths from total swale length.”

5. (Reviewer A) Add word: “Swale densities (linear feet/acre)...”

Because a foot is implicitly a linear unit of measurement, “linear” was not included.

6. (Reviewer A) Add word: “Swales with significant variations in width, longitudinal slope, bottom width, and/or drainage area along their length should be divided into segments and modeled in series to account for these variations.”

This section was revised as recommended.

9. (Reviewer A) Same as comment for V.C.4 above. (Consider clarifying that culvert lengths should be subtracted from the total swale length. Driveway culverts are ditch enclosures and can be ¼ to ½ of a residential lot width. Driveway culverts to not allow for water quality or infiltration.)

The change to section V.C.4 will address the issue of culverts not being counted as swales.

D. Velocity and Depth

3. (Reviewer A) Avoid ponding behind the ditch check to buildup such that a blowout could occur.

In Section V.D.3, we refer users to the Ditch Check standard (1062), which contains design parameters for ditch checks, including specifications to avoid failure, such as blowouts. Therefore, the additional statement about ponding was not included.

4. (Reviewer G) Consider clarifying that a flatter slope maybe needed for soil slope stability. Please coordinate section V.H.1. maximum slope with section V.E.1.

Since the swale side slopes and filter strip are the same part of a swale, we agree with your comment that a consistent slope was appropriate and changed the sections accordingly. In V.E.1, we added the statement, “Use flatter side slopes if possible to reduce erosion and increase infiltration.”

E. Swale Geometry

2. (Reviewer D) Add reference: “If widths are greater than 8 feet are needed, use a triangular cross-section with shallow side slopes (as flat as 20:1) with appropriate erosion control matting (Refer to WDNR Conservation Practice Standard “Channel Erosion Mat” (1053)), or...”

This section was revised as recommended.

3. (Reviewer G) Consider clarifying if a 5% longitudinal slope can be used if the velocity and depth criteria contained in section V.D. is satisfied if ditch checks are used.

This standard will allow the use of ditch checks to manage steeper slopes. Therefore, we added the following guidance to this section: “Ditch checks may be used to mitigate for steeper slopes. Refer to WDNR Conservation Practice Standard “Ditch Checks” (1062) for design requirements.”

F. Vegetation

(Reviewer A) Add a section stating that the site must contain established vegetation.

We decided that dense vegetation (90% coverage) was most suitable to meet the Purpose of the standard, so updated section V.F.2. to, "Provide site-specific planting information with project plans and specifications for establishment of dense vegetation."

1. (Reviewer G) Move this sentence to section V.C.2: "If sod grown in muck soils is used for infiltration swales, use a static infiltration rate of no more than 0.05 inches per hour."

This sentence was moved to Section V.I.3., as this section discusses static infiltration rates in more detail.

6. (Reviewer A) Add words: "To maintain typical swale vegetation, design swales to drain and to have no standing water..."

This section was revised as recommended.

(Reviewer G) Consider issues associated with sump pump or other dry weather discharges into a swale. Sump pumps can sometimes run for days in spring or for days after rain.

A phrase was added to V.F.6.: "If sump pump discharges to a swale are expected, use wet-tolerant vegetation."

G. Construction

4.a. (Reviewer D) Add references: "Install and maintain effective erosion and sediment controls to prevent swales from receiving construction site sediment, which is difficult to remove from an established swale without destroying the vegetation (refer to WDNR Conservation Practice Standards "Channel Erosion Mat" (1053) and "Seeding for Construction Site Erosion Control" (1059) for further guidance.)"

This section was revised as recommended.

b. (Reviewer A) Define stabilized

Stabilized was added in the Definitions section. However, the last sentence in this section was updated as follows: "Protect and ~~stabilize~~ vegetate the swale as specified in V.G.4.c. below."

c.ii. (Reviewer A) Change to "~~Then,~~ Stabilize the swale..."

This section was revised as recommended.

c.iii. (Reviewer A) Change to “If the swale infiltration capacity has been reduced ~~from~~ due to silt or clay sediment...”

This section was revised as recommended.

5.b. (Reviewer D) Add references: “Stabilize the swales following road construction using topsoil, temporary seeding, and erosion control matting (refer to WDNR Conservation Practice Standards “Channel Erosion Mat” (1053) and “Seeding for Construction Site Erosion Control” (1059) for further guidance).

This section was revised as recommended.

6.b. (Reviewer C) Something needs to be added to require compaction testing and allowable limits before deep ripping or other compaction mitigation is required. A test method should be specified for compaction testing. MinDOT has used this type of testing for years and may be able to offer some advice.

We considered this suggestion and determined that at this time we will not require compaction testing after construction due to challenges with the permitting process. The standard was written assuming incidental compaction will occur on most sites, and it provides incentive for applicants to specify compaction mitigation in plans.

(Reviewer G) Consider clarifying if P credit is provided for soil amendments with compost or Code 1004 engineered soil. WDNR guidance currently rates Codes 1004 engineered soil at 0% P removal.

The DNR “Modeling-Post Construction Storm Water Management Treatment” (May 2015) guidance would apply for soil amendments. It states:

“The current engineered soil mixture specified in Technical Standard 1004 with 15% to 30% compost has not shown a reduction in TP that is filtered. DNR allows 100% TP removal credit for the volume of runoff that is infiltrated into the underlying soil and 0% removal credit for the remaining runoff volume. USGS and DNR are working to try to develop an engineered soil mixture that will reduce TP in filtered runoff. For instance, there are phosphorus sorbing materials such as iron filings that might be added to enhance phosphorus removal.”

If soil remains compacted beneath engineered soil, runoff seeping into the engineered soil will follow the compacted soil surface and resurface downslope as runoff, probably near a culvert or other compacted area.

Compaction should be avoided or mitigated as stated in the modified Section V.G.6. We modified Section V.G.6.b.ii. to remove reference to engineered soil, and modified Section V.I. to remove the special infiltration rate for use of engineered soil. Section V.I., Infiltration, was restructured to direct users to follow the WDNR “Site Evaluation for Infiltration” Conservation Practice Standard (1002), with additional consideration for muck soils, imported soils, and (unmitigated) compacted soils. Applicants seeking any benefits of engineered soil should design and model those areas in accordance with WDNR Conservation Practice Standard “Bioretention for Infiltration” (1004).

Also, section V.I.D. implies that an underdrain is allowed. An underdrain may not allow the infiltration performance standard to be met or the water quality performance standard. 100% P removal is provided for infiltrated volumes, but the P removal for filtered volumes is 0% for engineered soil and 35% for pure sand (see DNR post-construction guidance).

In Section VI, Considerations, the following sentences were added regarding underdrains:

“If using underdrains, refer to WDNR Conservation Practice Standard “Bioretention for Infiltration” (1004) for guidance. Model areas with underdrains separately to determine appropriate surface water pollutant removal credit; specifically related to soluble pollutants.”

V.H.1.d. (Reviewer A) Note this in Attachment 3.

The Attachment was updated as recommended.

V.H.2. (Reviewer B) I think some clarification on using a vegetated swale to pretreat a vegetated swale would be helpful. I think I understand it now, but I could see how it could cause some confusion.

We intended that Attachment 2 would clarify the various pretreatment options for different runoff scenarios, and had no ideas for further clarification in response to this comment.

(Reviewer A) is “80 feet of swale length...” site specific? E.g., “For example, multiply 80 feet..?”

This calculation is not site-specific. To clarify, footnote #3 will be updated as follows: “The 80’ length of swale is based on a Stokes’ law calculation using approximately 1 foot flow depth... and applies for each drainage area of 5 acres or smaller.” In other words, 80 feet of pretreatment swale can serve a drainage area of up to 5 acres in size. Similar explanation was also added as a note in Attachment 2.

V.I.2. (Reviewer F) The term pollutant reduction is slightly misleading because there will also be a resultant increase in pollutant loading as a result of the practice. In some cases, dissolved contaminants will be minimally treated. Perhaps a term such as “TSS and particulate pollutant reduction” should be substituted.

We modified this item as follows: “Use an approved model to quantify the volume of water infiltrated and the resulting pollutant reduction to surface water.” This clarifies that pollutant reduction is expected in surface water, not necessarily ground water.

V.I.3.b. (Reviewer E) For consistency with V.I.3.d, delete “and infiltrometer test results may be used for the static infiltration rate.”

Section V.I.3. was restructured to address this inconsistency and to refer users to the WDNR Conservation Practice Standard “Site Evaluation for Stormwater Infiltration” (1002).

V.I.3.c. (Reviewer A) Add word, “If conducting site-specific infiltration tests at the design bottom elevation...”

This section was revised as recommended.

(Reviewer A) Omit “except that the WDNR modified (2-hour) double ring infiltrometer test may be used” to allow for 1002 standard options?

We decided not to make this change, and to allow use of the 2-hour double ring infiltrometer test. If Standard 1002 is revised to address use of methods other than the 24-hour double-ring infiltrometer, then a ‘minor revision’ of the Vegetated Swale standard would be completed to refer to the revised standard.

V.I.3.d. (Reviewer G) Runoff seeping into soil amendment fills the void space, but if the underlying soil is still too compacted or naturally low infiltration rate, then the method may not produce accurate results. Infiltrated runoff may resurface again downslope as discussed in comment for V.G.6.b.

This section was restructured to direct users to follow the WDNR “Site Evaluation for Infiltration” Conservation Practice Standard (1002), with additional consideration for muck soils, imported soils, and (unmitigated) compacted soils. The allowance for special infiltration rates for engineered soils was removed. Applicants seeking any benefits of engineered soil should design and model those areas in accordance with WDNR Conservation Practice Standard “Bioretention for Infiltration” (1004).

VI. Considerations

H. (Reviewer A) Add word: “Public education is recommended to inform local residents of the swales’ purpose...”

This section was revised as recommended.

I. (Reviewer A) Remove word: "...can be reduced or eliminated by using alternative de-icers or using clean sand."

This section was revised as recommended.

VIII. Operation and Maintenance

C. (Reviewer A) Change wording: "Annually ~~inspect~~ swales annually to detect..."

This section will be revised as recommended.

E. (Reviewer A) Add reference: "If compaction occurs, restore the swale infiltration capacity by mitigating for compaction as described in V.G.6.b."

This section was revised as recommended with appropriate reference.

(Reviewer G) Add reference: "Mitigation practices can include chisel plowing, or soil aeration as described in V.G.6.b."

This section was revised as recommended with appropriate reference.

IX. Definitions

(Reviewer A) Add definition for *stabilized*.

We added a definition for *stabilized*.

(Reviewer A) Add definition for *shank*.

We did not add a definition for *shank*, but tried to improve the sentence in which it is used: "~~At a minimum, line up shanks behind the vehicle tracks.~~ Use at least one shank behind each vehicle track or rear wheel to mitigate compaction."

(Reviewer A) [Detailed description of *subsoiled* is] not for definition section. Insert this item in V.G.6.b.2.

We considered moving the detailed description of subsoil out of the definition section, but thought the alternate locations were not an improvement, so we did not to make a change in response to this comment.
