

**** DRAFT July 6, 2016****

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
VEGETATED TREATMENT AREA
CODE 635
(Ac.)**

DEFINITION

An area of permanent vegetation used for agricultural wastewater treatment.

PURPOSE

Improve water quality by using vegetation to reduce the loading of nutrients, organics, pathogens, and other contaminants associated with livestock, poultry, and other agricultural operations.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- A vegetated treatment area (VTA) can be constructed, operated and maintained to treat *contaminated runoff* from such areas as feedlots, *feed storage areas*, compost areas, barnyards, and other livestock holding areas; or to treat process milking center wastewater from agricultural operations.
- A VTA is a component of a planned agricultural waste management system in accordance with Natural Resources Conservation Service (NRCS) Agricultural Waste Management Field Handbook (AWMFH), Chapter 9.

This practice does not apply to:

- Treatment of *leachate*.
- Treatment of runoff from manure stacks or waste storage facilities.
- Treatment of wastewater using annually grown crops.

CRITERIA

General Criteria

Vegetated treatment area shall comply with all federal, tribal, state, and local laws, rules, or regulations. The operator is responsible for securing required permits. This standard does not contain the text of the federal, tribal, state, or local laws.

Management Assessment

A management assessment shall be performed with the owner/operator to determine planned management and explore design options. The assessment shall be conducted, documented, and incorporated into the design. In addition to the Waste Management System Inventory and Planning Worksheet contained in the Wisconsin supplement to Chapter 9 of the AWMFH, the management assessment for a vegetated treatment area shall address the following:

- 1) Animal Lot
 - a. Animal types and numbers
 - b. Cleaning methods and frequency
 - c. Drainage area contributing contaminated runoff
 - d. Feeding locations and methods
 - e. Animal time on lot

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service [State office](#) or visit the [Field Office Technical Guide](#).

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- 2) Feed Storage Area
 - a. Feed storage method (e.g. bunker, bag, pile)
 - b. Feed storage area dimensions
 - c. Drainage area contributing contaminated runoff
 - d. Feed type
 - e. Handling, cleaning methods and frequency
- 3) Milking Center Wastewater
 - a. Daily milking center wastewater volume
 - b. Existing handling of wastewater

Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment will determine physical site characteristics that may influence the placement, construction, maintenance, and environmental integrity of the vegetated treatment area. Site assessment shall include, but is not limited to, distance to wells, surface waters, subsurface drainage, *wetlands*, and *karst* features within 500 feet of the proposed VTA outlet. The assessment shall include input from the owner/operators. The site assessment for a VTA shall include the following:

- 1) Identification, location, and physical features of the contributing drainage area
- 2) Soil investigation, including:
 - a. The factors to identify subsurface saturation, as contained in WI FOTG Standard 313, Waste Storage Facility.
 - b. Soil boring logs to characterize the soils and to a minimum depth below the planned VTA grade to ensure separation distances are achieved. Minimum number of borings required is two in or within 50 feet of the footprint of the proposed VTA.
 - c. Depth to *bedrock* encountered in soil borings and bedrock type.
 - d. Depth to subsurface saturation encountered in the borings.

Tributary Water Exclusion

Divert uncontaminated water from the treatment area to the fullest extent possible. The design shall account for precipitation, runoff, or subsurface flow entering the treatment area up to the 25-year, 24-hour storm event. When planning to exclude outside tributary water with other conservation practices, their design shall be in accordance with WI Standards located in the FOTG.

Cattle Access

Exclude all livestock, including grazing, from the VTA.

Vegetation in Treatment Areas

Wastewater shall be diverted from the VTA until vegetation required in the design is *well established*.

Permanent vegetation shall be established in the treatment area, using a single species or a mixture of grasses, legumes, and other forbs adapted to the soil and climate. Select species to meet the current site conditions and intended use. Selected species will have the capacity to achieve adequate density, vigor, and yield within an appropriate time frame to treat contaminated runoff.

Vegetation in treatment areas shall be established and maintained in accordance with criteria specified in WI FOTG Standard 342, Critical Area Planting, or Standard 612, Tree/Shrub Establishment.

Harvest treatment area vegetation when appropriate to encourage dense growth, maintain upright growth, and remove nutrients and other contaminants that are contained in the plant tissue at least annually. Care shall be taken to minimize damage to the VTA during harvest.

Siting Parameters

The VTA shall be ≥ 400 feet from any conduit to groundwater.

The treatment area shall be situated or constructed with 2 foot minimum depth of soil with at least 20 percent passing the No. 200 sieve (i.e., P200 \geq 20 percent).

Care must be taken during construction to prevent soil compaction from construction machinery. Fill soil shall be lightly compacted and consist of topsoil of the same texture or finer as the in-place soil.

Separation is the closest distance from the finished VTA ground surface to the features listed below:

- 1) Minimum separation to bedrock shall be 4 feet. Excavation of bedrock is permitted to achieve the required separation distance. Bedrock shall not be removed by blasting. The exposed bedrock surface shall be evaluated to ensure a sound base for soil material. Fractures or voids shall be treated to prevent migration of soil material. The surface of excavated bedrock shall have a minimum slope of 1 percent under and away from the VTA to prevent significant ponding on the rock surface. If bedrock is excavated, the material placed between the liner and the bedrock shall have a minimum of 20 percent passing the No. 200 sieve.
- 2) Minimum separation to subsurface saturation shall be 2.5 feet for feed storage contributing areas and 3 feet for *animal lots* contributing areas and milkhouse wastewater.

Locate the VTA outside of regulated floodplains if possible. Provide protection from inundation or damage from a 25-year, 24-hour storm event.

Specific Criteria

Applicable to Concentrated Animal Feeding Operations (CAFOs) and Medium Animal Feeding Operations (Medium AFOs)

Limit the natural or constructed slope of the VTA from 0.3 to 6 percent.

The minimum size of the VTA shall be the area required to balance both the contributing site's 25-year, 24-hour water runoff and delivered nutrients.

- 1) Water balance is the soil's capacity to infiltrate and retain runoff within the *root zone*. Base the runoff determination on the most restrictive soil layer within the root zone regardless of its thickness. Use the soil's water holding capacity in the root zone, infiltration rate, permeability, and hydraulic conductivity to determine its ability to absorb and retain runoff.
- 2) Nutrient balance utilizes the nutrients from the waste runoff to meet the nutrient removal requirements in the harvested vegetation. Base the nutrient balance on the most limiting nutrient (i.e., nitrogen or phosphorus)

Waste transfer reception structures or wastewater storage facilities (used solely for wastewater) shall be sized based on the months of rainfall and runoff, 25-year, 24-hour rainfall, 25-year, 24-hour runoff and freeboard, when required to hold wastewater during the non-growing season. The specified freeboard for CAFOs is 1 foot and for Medium Animal Feeding Operations is 0.25 feet.

SITING

The VTA shall be:

- 1) ≥ 250 feet from any private well
- 2) ≥ 1000 feet from any community well
- 3) ≥ 35 feet from wetlands and navigable streams and rivers.
- 4) ≥ 75 feet from navigable lakes, ponds and flowages

WASTEWATER APPLICATION

- 1) Application by surface flow across the full width of a sloped VTA is not permissible. Distribute the effluent uniformly over the entire VTA through sprinkler irrigation or other uniform application system. Match the sprinkler nozzle(s) application rate to the most restrictive soil infiltration rate or other factors to prevent non-uniform effluent absorption and treatment in the VTA.

- 2) Wastewater may only be applied during the growing season of the VTA vegetation.
- 3) Wastewater may only be applied when soils are below *field capacity*.
- 4) Table 1 shall be used for *Available Water Capacity* (AWC) in the VTA's root zone (SCS 1997). The typical AWC shall be used unless lab data or specific soil map unit data found in NRCS Web Soil Survey are used. Water shall not be applied to the VTA to exceeded field capacity, to avoid percolation below the root zone.
- 5) Annual nutrient uptake of VTA vegetation shall be obtained from University of Wisconsin Extension publication A2809 "Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin."

Table 1. Available Water Capacity by Texture.¹

| Texture | Typical AWC (in/ft) |
|-----------------|------------------------|
| Loamy sand | 0.85 |
| Loamy fine sand | 1.25 |
| Sandy loam | 1.45 |
| Fine sandy loam | 1.70 |
| Loam | 2.00 |
| Silt loam | 2.40 |
| Silt | 2.00 |
| Sandy clay loam | 1.80 |
| Clay loam | 2.40 |
| Silty clay loam | 2.40 |
| Sandy clay | 1.90 |
| Silty clay | 1.90 |
| Clay | 1.80 |

¹Adapted from NRCS National Engineering Handbook, Part 652 Irrigation Guide (1997).

Specific Criteria Applicable to Small Animal Feeding Operations (Small AFOs)

Limit the natural or constructed slope of the VTA from 1 to 6 percent.

The treatment area shall be further than 100 feet from any private water well.

- A) Criteria for sites where the down gradient end of the VTA is
- ≥ 1000 feet from navigable lakes, ponds and flowages,
 - ≥ 300 feet from navigable rivers and streams,
 - ≥ 300 feet from wetlands,
 - ≥ 300 feet from conduits to groundwater,
 - ≥ 300 feet from surface inlets that discharge to navigable waters,
 - ≥ 150 feet from *channelized flow* (i.e., a drainage area of ≥ 5 acres), and
 - ≥ 150 feet from subsurface drains:

The following specific criteria applies to small AFOs to infiltrate and treat a portion of the 25-year, 24-hour storm event, provide a downstream buffer and prevent significant discharges of pollutants (Wisc. Admin. Code NR 243.26(2)).

Wastewater shall be uniformly applied across the full width of the VTA (e.g., level spreader, distribution pipe), or uniformly applied over the VTA. Additional devices should be considered to promote sheet flow as needed down the length of the treatment area.

Design shall use a Manning's $n = 0.30$ for shallow flow conditions.

Wastewater is allowed to be applied year round.

Animal Lot (PLACEHOLDER: link to rewritten VTA spreadsheet)

- 1) Use the Livestock Area Sediment Basins criteria contained within WI FOTG Standard 632, Waste Separation or Reception Structures, Channels, Hoppers, and Pumps criteria contained in WI FOTG Standard 634, Waste Transfer.
- 2) Design the VTA to treat $\leq 10,000$ square feet of animal lot area and not more than 98 *animal units*.
- 3) Design the VTA for a flow depth of 0.5 to 1.0 inches for the waste separation and holding facility's flood-routed 25-year, 24-hour storm event.
- 4) Design the minimum VTA size to be 150% of the animal lot size for paved lots and 100% of the animal lot size for earth lots.
- 5) The annual output of phosphorus from the VTA shall be 5 pounds or less as determined based on potentially affected resources documented in the site assessment.

Feed Storage

- 1) Design flow rate from the feed storage area/collection system to achieve the release of wastewater at ≤ 1.75 inch flow depth on the VTA for the 10-year, 24-hour storm event.
- 2) Design contact time on the VTA to be ≥ 22 minutes.
- 3) The maximum VTA width shall not be greater than 200 feet.
- 4) All leachate and the initial runoff volume of 0.10 inches from each rain event shall be conveyed to a transfer and/or storage system in accordance with the criteria contained in WI FOTG Standard 634, Waste Transfer.

Milking Center Wastewater

VTA treatment is applicable for operations producing a maximum of 500 gallons of wastewater per day.

Pretreatment tanks shall be provided and shall be sized to provide a minimum three-day hydraulic retention time prior to discharge to the VTA. The outlet from the pretreatment tank shall be gravity flow to a dosing tank or chamber which shall be separate from the pretreatment tank. A pump or siphon for pressure distribution of wastewater shall be located in the dosing tank or chamber.

VTA size shall be based on the greater of either:

- 1) A minimum flow through time of 20 minutes at a maximum flow depth of 0.5 inch
- 2) A minimum area to accommodate the design loading rate, up to a maximum of 0.9 inches per week.

The allowable soil dosing rate is shown in Table 2.

Table 2. Allowable soil dosing rates (gal/ft² of VTA)

| Soil Drainage Class | Depth >40" | Depth 24"-40" |
|-------------------------|------------|---------------|
| Well Drained | 0.300 | 0.250 |
| Moderately Well Drained | 0.250 | 0.200 |
| Somewhat Poorly Drained | 0.125 | 0.075 |

Wastewater shall be evenly distributed to the VTA between 1.0 feet and 1.5 feet above the ground.

B) Criteria for sites where the down gradient end of the VTA (x) is between:

- 250 ≤ x < 1000 feet from navigable lakes, ponds and flowages,
- 150 ≤ x < 300 feet from navigable rivers and streams,
- 150 ≤ x < 300 feet from wetlands,
- 150 ≤ x < 300 feet from conduits to groundwater,
- 150 ≤ x < 300 feet from surface inlets that discharge to navigable waters,
- 50 ≤ x < 150 feet from channelized flow (i.e., a drainage area of ≥ 5 acres), and
- 50 ≤ x < 150 feet from subsurface drains:

Wastewater shall be uniformly applied across the full width of the VTA (e.g., level spreader, distribution pipe), or uniformly applied over the VTA. Additional devices should be considered to promote sheet flow as needed down the length of the treatment area.

Animal Lot (PLACEHOLDER: link to rewritten VTA spreadsheet)

Design a waste separation and holding facility to retain 100% of the runoff of the 25-year, 24-hour storm event during the growing season or waste transfer reception structures or wastewater storage facilities (used solely for wastewater) based on the months of rainfall and runoff, 25-year, 24-hour rainfall, 25-year, 24-hour runoff and 0.25 feet of freeboard, when required to hold wastewater and manure during the non-growing season, whichever is greater.

- 1) Apply wastewater only during the growing season for the VTA vegetation.
- 2) Apply wastewater not to exceed the 25-year, 24-hour storm event volume per application.
- 3) Allow the VTA to rest 3 days between applications of wastewater collected during the non-growing season.
- 4) Commence VTA application at least 24 hours after cessation of a ≥ 0.5 inch rain event (i.e., sunny day release), or immediately after cessation of a < 0.5 inch rain event.
- 5) Design the VTA to treat ≤ 10,000 square feet of animal lot area and not more than 98 animal units.
- 6) Design the VTA for a flow depth of 0.5 to 1.0 inches for the water separation facility's flood-routed 25-year, 24-hour storm event.
- 7) Design the minimum VTA size to be 150% of the animal lot size for paved lots and 100% of the animal lot size for earth lots.
- 8) The annual output of phosphorus from the VTA shall be 5 pounds or less as determined based on potentially affected resources documented in the site assessment.

Feed Storage

- 1) Design flow rate from the feed storage area to achieve the release of wastewater at ≤ 1.75 inch flow depth on the VTA.
- 2) Design contact time on the VTA to be ≥ 22 minutes.
- 3) Size the VTA to a 25-year, 24-hour storm event.
- 4) The maximum VTA width shall not be greater than 200 feet.
- 5) Wastewater can be applied year-round.
- 6) All leachate and the initial runoff volume of 0.20 inches from each rain event shall be conveyed to a transfer and/or storage system in accordance with the criteria contained in WI FOTG Standard 634, Waste Transfer.

Milking Center Wastewater

VTA treatment is applicable for operations producing a maximum of 500 gallons of wastewater per day.

Pretreatment tanks shall be provided and shall be sized to provide a minimum three-day hydraulic retention time prior to discharge to the VTA. The outlet from the pretreatment tank shall be gravity flow to

a dosing tank or chamber which shall be separate from the pretreatment tank. A pump or siphon for pressure distribution of wastewater shall be located in the dosing tank or chamber.

VTA size shall be based on the greater of either:

- 1) A minimum flow through time of 30 minutes at a maximum flow depth of 0.5 inch.
- 2) A minimum area to accommodate the design loading rate, up to a maximum of 0.9 inches per week.

The allowable soil dosing rate is shown in Table 2.

Wastewater shall be distributed to the buffer through a level perforated plastic pipe suspended between 1.0 feet and 1.5 feet above the ground.

C) Discharging VTAs are not allowed if the down gradient end of the VTA is:

- < 250 feet from navigable lakes, ponds and flowages,
- < 150 feet from navigable rivers and streams,
- < 150 feet from wetlands,
- < 150 feet from conduits to groundwater,
- < 150 feet from surface inlets that discharge to navigable waters,
- < 50 feet from channelized flow (i.e., a drainage area of ≥ 5 acres), or
- < 50 feet from subsurface drains.

See criteria for CAFOs and medium AFOs.

CONSIDERATIONS

Provide more than one vegetated treatment area to allow for resting, harvesting vegetation, and maintenance, and to minimize the potential for overloading.

To maximize nutrient uptake, use warm and cool season species in separate areas to ensure that plants are actively growing during different times of the year.

Supplement water as necessary to maintain plants in a condition suitable for the treatment purpose.

Direct contaminated effluent to a waste storage facility during excessively wet or cold climatic conditions.

Consider suspension of application to treatment area when weather conditions are not favorable for aerobic activity or when soil temperatures are lower than 39° F. When soil temperatures are between 39° F and 50° F, consider reducing application rate and increasing application period while maintaining a constant *hydraulic loading rate*.

Manage the VTA to maintain vegetative treatment effectiveness throughout the growing season. Time the harvest of the VTA plants so vegetation can regrow to a sufficient height to effectively filter effluent late in the growing season.

Consider installing a berm and/or a pumping system at the bottom of the VTA to contain and/or recirculate the effluent to the top of the VTA or transfer to a waste storage facility for Small AFOs.

Effluent from the VTA may be stored for land application, recycled through the wastewater management system, or otherwise used in the agricultural operation.

Install fences or other measures to exclude or minimize access of the VTA to humans or animals.

Additional recommendations relating to design which may enhance the use of, or avoid problems with, this practice, but are not required to ensure its basic conservation function, are as follows:

- Secondary Storage - Consider collecting a portion or all of the discharge from vegetated treatment areas and storing in a waste storage facility.

- Consider storage of lot discharge rather than application to a treatment area when vegetation is dormant or the ground is frozen.
- Consider suspension of application to treatment area when weather conditions are not favorable for aerobic activity or when soil temperatures are lower than 39°F. When soil temperatures are between 39°F and 50°F, consider reducing application rate and increasing application period while maintaining a constant hydraulic loading rate.
- Manage the vegetated treatment area to maintain effectiveness throughout the growing season. Time the harvest of the vegetated treatment area plants so vegetation can regrow to a sufficient height to effectively filter effluent late in the growing season.

PLANS AND SPECIFICATIONS

Prepare plans and specifications in accordance with the criteria of this standard that describe the requirements for applying the practice to achieve its intended use. Include critical construction perimeters, necessary construction sequence, vegetation establishment requirements, and nutrient removal

Plans and specifications will include:

- A plan view showing the location of the vegetated treatment area
- Details of the length, width, and slope of the treatment area to accomplish the planned purpose (length refers to flow length down the slope of the treatment area)
- Herbaceous species, seed selection, and seeding rates to accomplish the planned purpose
- Planting dates, care, and handling of the seed to ensure that planted materials have an acceptable rate of survival
- Site preparation sufficient to establish and grow selected species

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The plan may include the following items as appropriate:

- Control undesired weed species, especially state-listed noxious weeds, and other pests that could inhibit proper functioning of the VTA
- Inspect and repair vegetated treatment areas after storm events to address gullies, remove flow-disrupting sediment accumulation, reseed disturbed areas, and take other measures to prevent concentrated flow
- Apply supplemental nutrients and soil amendments as needed to maintain the desired species composition and stand density of herbaceous vegetation
- Maintain or restore the treatment area as necessary by periodically grading or removing excess material when deposition jeopardizes its function. Reestablish herbaceous vegetation
- Routinely dethatch or aerate a treatment area used for treating runoff from livestock holding areas in order to promote infiltration
- Conduct harvesting and other maintenance activities only when the vegetated treatment area is dry and moisture content in the surface soil will not allow compaction or rutting
- Clean the animal lot and/or settling areas as needed to prevent migration of solids to the vegetated treatment area
- Maintain the wastewater spreader to the initial design function
- Harvest treatment area vegetation as appropriate to encourage dense growth, maintain upright

growth, and remove nutrients and other contaminants that are contained in the plant tissue. Controlled grazing can be an acceptable method of harvest

- Prior to construction, the owner/operator shall sign the operation and maintenance plan to indicate an understanding of the requirements and a commitment to operate and maintain the practice as specified

Monitor treatment areas in arid or semiarid regions that potentially could be affected by high salinity or sodium content for excessive salt and sodium buildup. Take corrective action if excessive salt or sodium is found.

Monitor all treatment areas to maintain optimal crop growth and environmental protection. Ensure that neither phosphorus is accumulating in the soil profile, nor nitrogen is leaching below the root zone.

REFERENCES

Koelsch, R., B. Kintzer, and D. Meyer. (ed.) 2006. Vegetated Treatment Systems for Open Lot Runoff – A Collaborative Report. USDA, NRCS.

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Young, R.A., Otterby M.A., and Roos, A. 1982. An Evaluation System to Rate Feedlot Pollution Potential, Agricultural Research Service, USDA, ARM-NC-17.

DEFINITIONS

Animal lots – An animal lot is an area, a building, or combination of contiguous areas and buildings intended for the confined feeding, breeding, raising or holding of beef and/or dairy cattle. An animal lot is specifically designed as a confinement area in which beef/dairy waste may accumulate, or where the concentration of beef or dairy animals is such that a vegetative cover is denuded and cannot be maintained within the enclosure.

Animal Units – A unit of measurement used to determine the total number of single animal types or combination of animal types, as specified in NR 243, which are fed, confined, maintained or stabled in an animal feeding operation. One animal unit is equivalent to one head of beef or slaughter cattle weighing more than 1000 pounds.

Available water capacity (AWC) – The portion of water in a soil that can be readily absorbed by plant roots of most crops, expressed in inches per inch, inches per foot, or total inches for a specific soil depth. It is the amount of water stored in the soil between field capacity (FC) and *permanent wilting point* (PWP). Also called available water holding capacity (AWHC)

Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in the above definition

Category I unacceptable practice – A practice or facility at an animal feeding operation that causes a point source discharge of pollutants to navigable waters by either of following means:

1. Pollutants are discharged into navigable waters through a man-made ditch, flushing system or other similar man-made device.
2. Pollutants are discharged into navigable waters that originate outside of the operation and pass over, across or through the operation or otherwise come into direct contact with the animals confined at the operation.

Concentrated animal feeding operation (CAFO) – An animal feeding operation to which any of the following apply:

1. The operation has 1,000 animal units or more at any time and stores manure or process wastewater in a below or at grade level storage structure or land applies manure or process wastewater.
2. The operation has 300 to 999 animal units and has a *category I unacceptable practice* under s. NR 243.24 (1) (a) of the Wisconsin Administrative Code.
3. Under s. NR 243.26 (2) of the Wisconsin Administrative Code, the operation is designated by the Wisconsin Department of Natural Resources as having a significant discharge of pollutants to navigable waters or has caused the fecal contamination of water in a well.

Channelized flow – Water movement in a surface drainage feature including, but not necessarily limited to: swales, draws, grassed waterways, ditches, gullies, creeks, or rivers.

Contaminated Runoff – Runoff that has come through or across a barnyard or animal lot or feed storage area. It generally includes the runoff and any manure, sediment, feed, or other material carried in the runoff. It contains lower concentrations of contaminants than leachate from feed or manure.

Feed Storage Area – An area used to store livestock feed. Livestock feed may include corn silage, haylage, and industrial by-products (i.e., distillers grain, brewers grain, candy, pizza crust, bakery waste, cotton seed, soy bean meal, animal fats, blood meal, fish meal, cannery waste, beet pulp, citrus pulp, soy hulls, corn midlings, whey, potatoes, grocery store vegetables). This is the area defined by the outside edge of the surface of where the feed is stored, including the apron.

Field capacity – The amount of water retained by a soil after it has been saturated and has drained freely by gravity. Can be expressed as inches, inches per inch, bars suction, or percent of total available water.

Hydraulic Loading Rate – Considered as the flow rate distributed over the surface area calculated as:
HLR = Flow Rate / Surface Area

Karst – Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document in Chapter 10 of the AWMFH for additional discussion of karst features.

Leachate – Concentrated liquid which has percolated through or drained from animal feed. It contains much higher concentrations of contaminants than Contaminated Runoff.

Medium Animal Feeding Operation (Medium AFO) – An animal feeding operation with 300 to 999 animal units that is not otherwise designated by the Wisconsin Department of Natural Resources as a CAFO under s. NR 243.26 (2).

Permanent wilting point (PWP) – The moisture percentage, on a dry weight basis, at which plants can no longer obtain sufficient moisture from the soil to satisfy water requirements. Plants will not fully recover when water is added to the crop root zone once permanent wilting point has been experienced. Classically, 15 atmosphere (15 bars) or 1.5 mPa, soil moisture tension is used to estimate PWP.

Root Zone – Depth to which the roots of mature crops will extract available soil water.

Small Animal Feeding Operation (Small AFO) – An animal feeding operation with less than 300 animal units that is not otherwise designated by the Wisconsin Department of Natural Resources as a CAFO under s. NR 243.26 (2) of the Wisconsin Administrative Code.

Well Established – Vegetation is well established when there is 100% ground cover. This can be achieved by adequate existing sod, installed sod that is rooted and growing, or newly established vegetation that has gone through a growing season and provides 100% ground cover.

Wetlands – For the purposes of this technical standard, this includes all wetlands, including areas determined as prior converted (PC) in accordance with the 1985 Food Security Act (or similar FSA determinations), which retain wetland characteristics. This includes areas that may be exempt under the Wetland Conservation (WC) provisions, but that meet wetland criteria.