

**NATURAL RESOURCES CONSERVATION SERVICE**  
**CONSERVATION PRACTICE STANDARD**  
**VEGETATED TREATMENT AREA**

(Ac.)

**CODE 635**

**DEFINITION**

An area of permanent vegetation used for agricultural wastewater treatment.

**PURPOSE**

To improve water quality by reducing loading of nutrients, organics, pathogens, and other contaminants associated with livestock, poultry, and other agricultural operations.

**CONDITIONS WHERE PRACTICE APPLIES**

Where a vegetated treatment area (VTA) can be constructed, operated, and maintained to treat contaminated runoff from such areas as feedlots, compost areas, barnyards, and other livestock-holding areas or to treat processed wastewater from agricultural operations.

A vegetated buffer strip (VBS) may be used in place of a VTA where the pollution potential is not significant.

**CRITERIA**

**General Criteria**

This practice shall comply with all applicable laws, rules, regulations, and permit requirements including those applicable to the discharge of wastewater to waters of the state.

Divert uncontaminated water from the feedlot and treatment area to the fullest extent possible unless additional water is needed to maintain plants in a condition suitable for wastewater treatment.

Permanent vegetation consisting of a single species or a mixture of grasses, legumes, and/or other forbs adapted to the soil and

climate shall be established in the treatment area if current vegetation is not adequate. Selected species shall be suited to 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 type, site preparation, and seeding shall be according to [Conservation Practice Standard 342, Critical Area Planting](#).

Vegetation shall be able to withstand anticipated wetting and/or submerged conditions. Harvest the vegetation as appropriate to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue

Exclude livestock access to the vegetated treatment area and/or buffer strip.

**Criteria for the Vegetated Treatment Area**

Base the total treatment area for the VTA on the soil's capacity to infiltrate and retain runoff within the root zone and the vegetation's agronomic nutrient requirements. The root zone shall have a minimum depth of 2 feet. 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. Base the runoff determination on the most restrictive soil layer within the root zone regardless of its thickness. The maximum moisture storage volume shall be 50 percent of the available water capacity in the soil profile. VTAs shall not be installed in sandy soils where the infiltration (or intake family) equals or exceeds 1.5 inches per hour.

Pre-treat the influent to reduce organic loading,

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service or download it from the electronic Field Office Technical Guide (eFOTG).

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odor generation, and nutrients to levels that will be tolerated by the VTA and to prevent excessive accumulation of solids in the treatment area. Utilize a solid/liquid separation facility such as a settling basin prior to discharge of the influent to the VTA. The minimum influent detention time in the settling basin shall be 15 hours.

Utilize inlet control structures to prevent undesirable debris from entering the VTA, to control the rate and timing of inflow during normal operations, and to control inflow as necessary for operation and maintenance.

Design the VTA based on the need to treat the runoff volume from the 25-year, 24-hour storm event from the agricultural animal management facility. Infiltrate a portion or the entire volume of the design storm (based on management objectives), but the minimum infiltration shall be the runoff from a 2-year, 24-hour storm. The portion of the design volume not infiltrated shall be stored for utilization or treatment unless discharge is permitted by applicable regulations. The 25-year, 24-hour storm runoff flow through the VTA shall have a travel time greater than 1 hour, a flow depth of less than 6 inches, and a velocity of less than 1.5 feet per second (fps).

The VTA design for processed water shall be based on the nutrient contents of the processed water and the VTA's ability to hold and uptake the nutrients.

Nutrient loading of VTAs shall be based on crop removal of the vegetation used in the VTA.

The VTA shall be designed so that the upper soil profile remains unsaturated except during storm events and returns to an unsaturated condition within 2 days following storm events.

Discharge into and through treatment areas shall be applied as sheet flow. Where sheet flow is planned, some means (such as a ditch, curb, gated pipe, level spreader, or a sprinkler system) shall be provided to disperse concentrated flow and ensure sheet flow across the width of the treatment area. Land grading and structural components necessary to maintain sheet flow throughout the length of the treatment area shall be provided as necessary.

Locate VTAs outside of flood plains. However, if site restrictions require location within a flood plain, they shall be protected from inundation or damage from a 25-year flood event or larger if required by regulation.

The water table shall be either naturally deep enough or artificially lowered so that the infiltrated runoff does not mingle with the groundwater at the bottom of the root zone. The water table shall not be closer than 10 feet to the ground surface of the constructed treatment area. Subsurface drainage shall not be provided within the VTA. Subsurface drainage may be used to lower the seasonal high water table to an acceptable level provided the subsurface drain lines are at least 10 feet away from the VTA.

Infiltration areas shall not be planned where soil features such as cracking will result in preferential flow paths that transport untreated runoff from the surface to below the root zone, unless the soil moisture can be maintained to prevent drying and cracking.

The treatment area shall be a uniformly graded border strip or wide-bottomed trapezoidal channel with zero slope from side to side. VTAs shall have a minimum flow length of 100 feet and a maximum flow length of 1000 feet. The natural or constructed slope of the VTA shall be a minimum of 0.3 percent for soils in the 0.5 inch/hour or greater intake families and a minimum of 0.5 percent for lesser intake soils. The maximum slope shall be 4 percent. The entrance slope to the VTA shall not be flatter than 1 percent.

The VTA shall be separated into border strips with maximum widths as follows:

Slope	Border Width
0.3 - 1.0%	50 feet
1.1 - 2.0%	40 feet
2.1 - 4.0%	30 feet

The minimum ridge height of the ridge between the borders shall be 0.5 foot. Ridges and borders strips are not required if 4-inch (minimum) deep furrows that are 12 inches (maximum) apart are installed for the length of the VTA and the contact time, flow depth, and velocity requirements mentioned above are met.

### **Criteria for the Vegetated Buffer Strip**

The situations where a VBS may be acceptable are:

1. Where an individual drainage area from an open lot is 1 acre or less (including foreign drainage); and 100 animal units or less utilizing the lot in question; and the animals are in the lot for 6 months or less per year.

OR

2. Where Section D, Evaluation, of the Feedlot Assessment Worksheet for Kansas ([Figure KS2-1 in Section KS651.0280 in the National Engineering Handbook Part 651 \(NEH 651\)](#), [Agricultural Waste Management Field Handbook](#)) shows no significant groundwater or surface water concern for the lot in question.

If possible, utilize a solid/liquid separation facility such as a settling basin prior to discharge of the influent to the VBS. However, if the number of AFO animal units is under 300 and does not pose a significant pollution potential, the addition of a settling basin may require the facility to obtain a permit.

The outlet from the settling basin, if used, should spread out the discharge to allow the wastewater to be applied uniformly to the VBS.

The VBS shall be a naturally or uniformly graded area of permanent vegetation (existing or planned) which will allow for sheet flow over the area.

A minimum sheet flow length of 100 feet must be maintained throughout any point in the treatment area before concentrated flow is allowed. Where flow from the treatment area enters directly into any water body or perennial stream, a minimum sheet flow length of 200 feet must be maintained at that point.

### **CONSIDERATIONS**

Install the VTA where the number of animal units in the drainage area is 500 or less.

Construct more than 1 treatment area to allow for resting, harvesting vegetation, and providing maintenance and to minimize the potential for overloading.

Install flow redistribution devices every 400 feet across (perpendicular to flow) the width of the strip.

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

Store seasonal contaminated water upstream of the VTA during excessively wet or cold climatic conditions.

Consider suspension of application to the 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 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.

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

Fences or other measures may be needed to exclude or minimize access of the VTA to humans or animals that would inhibit its function.

### **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 the following:

- A plan view showing the location of the VTA
- 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**

Develop an operation and maintenance plan that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design.

The plan shall include the following 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 treatment areas after storm events to fill in gullies, remove flow-disrupting sediment accumulation, and re-seed 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 when deposition jeopardizes its function and then reestablishing to herbaceous vegetation
- Routinely de-thatch and/or aerate treatment areas used for treating runoff from livestock-holding areas in order to promote infiltration
- Conduct maintenance activities only when the surface layer of the VTA is dry enough to prohibit compaction
- Rebuild furrows and ridges (if used) to their design height if harvesting equipment compacts them

Treatment areas in arid or semiarid regions that potentially could be affected by high salinity and/or sodium content should be monitored for excessive salt and sodium buildup. If excessive salt or sodium is found, an appropriate corrective action shall be taken.

### **REFERENCES**

USDA/NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook. Part KS651.1082, Vegetated Treatment Area. 1992, Revised, June 1999.

Koelsch, R., B. Kintzer, and D. Meyer. (ed.) 2006. Vegetated Treatment Systems for Open Lot Runoff - A Collaborative Report. USDA, NRCS.  
<http://www.heartlandwq.iastate.edu/ManureManagement/AlternativeTech/Avtsguidance/>