Wastewater Treatment Strip (Acre) 635

DEFINITION

A treatment component of an agricultural waste management system consisting of a strip or area of herbaceous vegetation.

PURPOSES

The purpose of this practice is to improve water quality by reducing loading of nutrients, organics, pathogens, and other contaminants associated with animal manure and other wastes, and wastewater by treating agricultural wastewater and runoff from livestock holding areas.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where all the following conditions apply:

1. Wastewater is generated by runoff from areas where livestock are concentrated, runoff and leachate from silage storage areas, runoff and leachate from waste storage facilities for solid manures, runoff from composting areas, or runoff from feed handling areas;

2. *The area generating polluted runoff is configured such that the* polluted runoff (stormwater and snowmelt) *can be directed to the* wastewater treatment strip *collection system*;

3. Manure and/or silage solids from the contributing drainage area can be effectively trapped prior to discharge to the wastewater treatment strip; and

4. The area contributing runoff and/or leachate to the wastewater treatment strip is less than 1 acre and confines less than 200 animal units (1 animal unit = 1,000 pounds live weight).

This practice does not apply to the Field Borders (386) practice standard or the Filter Strips (393) practice standard.

This practice standard does NOT apply to:

- The control or treatment of milking center wastewater or any other process washwater, and
- *The treatment of discharge from waste storage ponds or tanks*.

CRITERIA

General Criteria Applicable To All Purposes

Wastewater treatment strips shall be planned, designed, and installed to meet all federal, state, local, and tribal laws and regulations.

The term “silage” as used in this standard includes haylage, wheatlage, and any other ensiled livestock feed stored on the farm.

Location and use. To minimize the potential for contamination of streams, wastewater treatment strips, including the outlet storage area, should be located outside of floodplains. However, if site restrictions require location within a floodplain, the wastewater treatment strip, including the outlet storage area, shall be protected from inundation or damage from a 25-year flood event, or larger if required by laws and regulations.

Wastewater treatment strips shall not be constructed within an area that typically has a seasonal high water table within 1 foot (0.3 m) of the surface. Subsurface drainage shall NOT be provided within the wastewater treatment strip. 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 (3 m) away of from the wastewater treatment strip. All other field tile (subsurface drains) within 10 feet (3 m) of a wastewater treatment strip shall be removed and capped.

Wastewater treatment strips must limit access and control grazing, where appropriate. Grazing shall be Flash Grazing in accordance with the Additional Criteria To Improve Or Maintain The Health And Vigor Of Plant Communities section of the Prescribed Grazing (528) practice standard.

Do not use wastewater treatment strips as a travelway for livestock or farm equipment.

Dilution of the runoff to be treated in the wastewater treatment strip is not needed if the contributing drainage area is managed to minimize pollution of the runoff by manures and/or silage. Where suitable management is not provided, the runoff shall be diluted by combining clean runoff with the polluted runoff. The clean runoff contributing area shall be at least equal in area to the polluted runoff contributing drainage area. The combined drainage area from both shall not exceed 1 acre.

Suitable management to minimize pollution of runoff includes the following actions by source area:

- Livestock areas - scraped at least weekly.
- Silage storage areas - have impermeable covers over stored silage, scrape and/or sweep the storage floor and apron at least weekly to collect feed that is spilled, and the silage is kept nearly vertical where it is being removed for feeding.
- Waste storage facilities for solid manure or composting facility - manure or compost is stacked as high as possible (based on design height) and in as small an area as possible; the area where manure or compost has not yet been stacked is scraped and/or swept at least weekly to collect manure that has been spilled.

Collection system. A collection system shall be provided to settle and collect solids, collect dry weather leachate (where applicable), and control the discharge of runoff to the wastewater treatment strip. The collection system shall be designed to facilitate clean-out. Where dry weather silage leachate is anticipated, the collection system shall be designed to minimize deterioration from exposure to the leachate. Collection systems that may erode during an overflow event shall have a freeboard of 6 inches (150 mm). Collection systems that will not erode during an overflow event are not required to have a freeboard.

Refer to the Waste Storage Facility (313) practice standard for collection system structural design criteria. Structures shall be designed to withstand the anticipated static and dynamic loading. Settling facilities shall be installed above the water table. When curbs are needed in conjunction with collection systems, they shall be constructed of either concrete or pressure-treated wood and shall be adequately anchored. Curbs shall be of sufficient height to ensure flow control up to the design discharge. Refer to the Manure Transfer (634) practice standard for safety criteria and for design criteria for pipes associated with the collection system. Livestock shall be excluded from the collection system, as appropriate, to prevent damage and to avoid harm to the animals.

The minimum collection system design volume shall be the *detention storage volume necessary to control the peak discharge* from the 25-year, 24-hour rainfall event on the contributing drainage area *(Qp_{25}). Detention storage volume may be determined using flood routing procedures, such as Urban Hydrology for Small Watersheds, Technical Release No. 55, NRCS, June 1986. Flood routing shall use Qp_{25} as the inflow, and the selected wastewater treatment strip* design discharge *as the outflow*. The outflow discharge from the collection system to the wastewater treatment strip shall not exceed the peak discharge from a 2-year, 24-hour rainfall event on the contributing drainage area.

The collection system design volume shall include a solids and dry weather leachate storage area with a minimum capacity equivalent to the volume of 0.15 inches (4 mm) of runoff from the contributing drainage area.

When leachate has accumulated during periods of dry weather, the solids and dry weather leachate storage area shall be emptied at least weekly. Collected dry weather leachate may not be directed to the wastewater treatment strip. The collected solids and dry weather leachate shall be transferred to a storage facility or utilized in accordance with the Nutrient Management (590) practice standard.

The solids and dry weather leachate storage area shall be emptied within 72 hours following a runoff event. If the runoff event has produced enough runoff to fill the solids and dry weather leachate storage area and produce a flow into the treatment strip, the solids and dry weather leachate storage area may be dewatered prior to removal of collected solids. Dewatering of accumulated solids may be done by directing the liquid in the solids and dry weather leachate storage area to the wastewater treatment strip after the runoff event has ended. The collected solids shall be transferred to a storage facility or utilized in accordance with the Nutrient Management (590) practice standard.

Design discharge and dimensions. Wastewater treatment strip dimensions shall be based on the *outflow discharge from the collection system which shall not exceed the* peak *discharge* from a 2-year, 24-hour rainfall on the contributing drainage area. A level spreader, gated pipe, sprinklers, or other facilities shall be provided across the upstream end of the wastewater treatment strip to establish sheet flow.

The wastewater treatment strip shall not allow discharge to surface waters for up to the 25-year, 24-hour storm event. The wastewater treatment strip shall prevent lateral discharge to surface waters as the water passes along the length of the wastewater treatment strip up to the 25-year, 24-hour storm event. This may be accomplished by natural or artificial boundaries.

Use the following equation to compute the design peak discharge from the contributing drainage area. (Tabular hydrograph method maximum unit peak discharge of 1,000 csm (cfs/mi^2/in runoff) for Type II storms in Urban Hydrology for Small Watersheds, Technical Release No. 55, NRCS, June 1986.)

Peak Discharge Qp (cfs):
Qp = R x A x 0.000036
R = Runoff depth (in.)
Compute using a curve number of 90 for unpaved areas and 98 for paved areas or roof areas
A = Contributing drainage area (sq. ft.)

The wastewater treatment strip shall be a relatively uniform grassed area or grassed channel. Wastewater treatment strips shall be designed for natural or constructed slopes of 0.3 to 6 percent. The first 100 feet at the upstream end should not be flatter than 1 percent. Where constructed slopes are required, salvage existing topsoil and spread at final grade.

Grass area (overland) wastewater treatment strips shall be *configured so that the flow direction is* generally *perpendicular to* the contour *lines* and sufficiently wide to pass the peak flow at a depth of 0.5 inches (13 mm) or less. Maximum flow width (perpendicular to the direction of flow) shall be 100 feet (30 m). Flow length (parallel to the direction of flow) shall be sufficient to provide at least 15 minutes of flow-through time. Flow-through time equals the wastewater treatment strip length divided by the average velocity. Average flow velocity shall be determined using Manning's equation with an "n" value of 0.3.

Grass channel (channelized) wastewater treatment strips shall be designed to carry the peak flow at a depth of 0.3 feet (0.1 m) or one-half the planned minimum vegetation height, whichever is less. The channel cross-section shall be trapezoidal. Maximum bottom width shall be 40 feet (12 m) and side slopes shall be 8:1 or flatter. Flow length shall be sufficient to provide at least 30 minutes of flow-through time. Average flow velocity shall be determined using Manning's equation with an "n" value of 0.25.

To minimize the development of flow concentrations which will short-circuit the sheet flow needed to maintain the effectiveness of the grass wastewater treatment channel, rock checks will be installed at 100 foot intervals along the length of the channel.

A rock check is a shallow trench filled with MDOT 6A or 17A coarse aggregate. The trench should be 1 to 1.5 feet (0.3 to 0.5 m) deep, extend 2 to 4 feet (0.6 to 1.2 m) in the direction of flow, and extend the full width of the channel up to the design depth. The top of the stone in the trench should be flush with the bottom of the channel.

Preventing discharge to surface water. The outlet of the wastewater treatment strip shall be designed to prevent discharge to surface water. To accomplish this, the wastewater treatment strip must outlet into an outlet storage area or must maintain a minimum outlet setback distance to surface water.

Outlet storage areas shall have the capacity to contain the entire runoff volume from the 25-year, 24-hour storm from the contributing drainage area plus the wastewater treatment strip area. The outlet storage area capacity may be reduced by the volume of runoff captured by the solids and leachate collection system. The outlet storage area may be a natural depressional area, or a constructed depressional area. The outlet storage area shall NOT be a wetland. The outlet storage area shall be able to infiltrate the collected water within 72 hours based on the permeability of the most restrictive layer in the root zone regardless of its thickness. Earth berms used for constructed depressional areas shall be less than 3 feet (1 m) in height, have a freeboard of at least 0.3 (0.1 m) feet above the design high water elevation, have a top width of at least 4 feet (1.2 m), and side slopes at least 3:1 or flatter.

Minimum outlet setback distance is 150 feet (45 m) measured along the flow path from the outlet of the wastewater treatment strip to surface water. *If necessary, a berm or earth grading and shaping may be utilized to increase the length of the flow path, but must not create a man-made channel or ditch to convey the flow*. Surface water may be a stream, surface drain, surface inlet, road ditch, or other conveyance. The slope on any portion of the outlet setback distance may not exceed 12 percent. The flow path must be either established permanent vegetation (such as hayland, pastureland, grassland, or vegetated buffer) or cropland.

Establishment of vegetation. Runoff shall be diverted away from the wastewater treatment strip channel until the vegetation is well established. A minimum height of 4 inches (0.1 m) and 90 percent ground cover is desirable. Select one of the seed mixtures in Table 1, depending on soil type and drainage conditions. Limed and fertilized in accordance with the Critical Area Planting (342) practice standard.

TABLE 1 - Vegetative Mixtures for Wastewater Treatment Strips

Well and moderately well drained coarse to fine textured soils		
Species or Seeding Mixtures	**Seeding Rate (lb./ac.)**	**Established Stem Density (stems/ft.^{2})**
• Reed Canarygrass	10	50
• Smooth Brome	20	50
• Tall Fescue *	20	60
• Smooth Brome • Tall Fescue *	12 10	60
• Orchardgrass • Timothy • Red Clover • Alfalfa	5 5 6 6	70
Somewhat poorly drained or poorly drained soils without artificial drainage		
Species or Seeding Mixtures	**Seeding Rate (lb./ac.)**	**Established Stem Density (stems/ft.^{2})**
• Garrison Creeping Foxtail	10	70
• Reed Canarygrass	10	50
• Tall Fescue *	20	60
• Orchardgrass • Redtop • Alsike Clover • White Dutch Clover	5 2 3 2	70

* Do not include Endophyte fungus susceptible Tall Fescue varieties if area is planned for grazing or forage.

Use vegetation adapted to the site that will accomplish the desired purpose. Preference shall be given to native species in order to reduce the introduction of invasive plant species; provide management of existing invasive species; and minimize the economic, ecological, and human health impacts that invasive species may cause. If native plant materials are not adaptable or proven effective for the planned use, then non-native species may be used. Refer to the Field Office Technical Guide, Section II, Invasive Plant Species for plant materials identified as invasive species.

CONSIDERATIONS

Consider the potential effects of installation and operation of wastewater treatment strips on the cultural, archeological, historic, and economic resources.

Consider the ability of the landowner/operator to manage and operate the wastewater treatment strip in accordance with the operation and maintenance plan.

Consider excluding roof runoff water and outside surface runoff as much as practicable unless needed to dilute the polluted runoff prior to entering the wastewater treatment strip.

Consider locating the *collection system* outside the livestock area, where possible.

Consider using crushed limestone in rock checks to enhance phosphorus immobilization.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Support data documentation requirements are as follows:

- Inventory and evaluation records
  - Assistance notes or special report
- Survey notes, where applicable
  - Design survey
  - Construction layout survey
  - Construction check survey
- Design records
  - Physical data, functional requirements, and site constraints, where applicable
  - Soils/subsurface investigation report, where applicable

- Design and quantity calculations
- Construction drawings/specifications with:
  - Location map
  - "Designed by" and "Checked by" names or initials
  - Approval signature
  - Job class designation
  - Initials from preconstruction conference
  - As-built notes
- Construction inspection records
  - Assistance notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.

REFERENCES

NRCS, Technical Release No. 55, Urban Hydrology for Small Watersheds, June 1986.