

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

WASTEWATER TREATMENT STRIP

(Ac.)

CODE 635

DEFINITION

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

PURPOSE

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 with:

- Rapid infiltration
- Overland flow
- The slow rate process

CONDITIONS WHERE PRACTICE APPLIES

This practice applies:

- Where a treatment strip is a component of a planned agricultural waste management system
- Where a treatment strip can be constructed, operated and maintained without polluting air or water resources
- To the treatment of contaminated runoff from such areas as feedlots, barnyards, and other livestock holding areas
- To the treatment of dilute wastewater such as milk house effluent and diluted silage leachate

CRITERIA

General Criteria Applicable To All Purposes

The installation and operation of the wastewater treatment strip shall comply with all federal, state, and local laws, rules, and regulations.

Inflow to wastewater treatment strips shall be pretreated with solid/liquid separation to reduce organic and nutrient loading, odor generation, and maintenance requirements as appropriate.

Discharge to and through treatment strips shall be either as sheet flow or applied with a sprinkler system. Where sheet flow is planned, some means, such as a ditch, curb, or gated pipe, shall be provided to disperse concentrated flow and ensure sheet flow across the width (dimension perpendicular to flow length) of the treatment strip. Land grading and structural components necessary to maintain sheet flow throughout the length (dimension parallel to the flow) of the treatment strip shall be provided as necessary.

Permanent herbaceous 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 strip. Vegetation shall be able to withstand anticipated wetting and/or submerged conditions.

Clean water shall be diverted from the treatment strip to the fullest extent possible unless needed to promote vegetation growth in the treatment strip.

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Treatment strips should be located outside of floodplains. However, if site restrictions require location within a floodplain, they shall be protected from inundation or damage from a 25-year flood event, or larger if required by law.

Designs shall be based on appropriate engineering and irrigation principals.

Additional Criteria for Rapid Infiltration Treatment

Rapid infiltration treatment refers to a specific remediation technique that utilizes the filtering capabilities of moderately and highly permeable soils. Treatment for this purpose shall consist of directing wastewater or contaminated runoff from a livestock holding area into a uniformly graded strip or area of herbaceous vegetation and allowing it to flow over and infiltrate the treatment strip. This method is not appropriate for treatment of wastewater containing high concentrations of nutrients.

Contaminated runoff shall be pretreated by solid/liquid separation utilizing a facility such as a settling basin prior to discharge of liquid to the treatment strip.

The treatment strip shall be a uniformly graded strip or wide bottomed trapezoidal channel.

The treatment strip design shall be based on the runoff volume from the 25-year, 24-hour storm event from the livestock holding facility. It may be designed to infiltrate a portion or the entire volume of the design storm. This determination will be based on management objectives. The portion of the design volume not infiltrated shall be transferred to a storage facility. The treatment strip's area requirements shall be based on the greater of, the soil's capacity to infiltrate and retain runoff within the root zone or, the vegetation's capability to utilize the nutrient loading. The soil's ability to infiltrate and retain runoff shall be based on its water holding capacity in the root zone, infiltration rate, permeability, and hydraulic conductivity. This determination shall be based on the most restrictive soil layer within the root zone regardless of its thickness. The anticipated nutrient loading shall not exceed

the vegetation's agronomic nutrient requirement.

The minimum area of the treatment strip, based on storage, should contain the design runoff within 50% of the Available Water Capacity in the root zone. AWC values can be found in the Nebraska Irrigation Guide for various soil types.

The minimum area of the treatment strip, based on nutrient removal, should be calculated by:

$$\text{Area} = (\text{AROV} \times \text{NC}) / \text{ACU}$$

Where:

AROV = Annual Runoff Volume, ac-in
NC = Nutrient Content in runoff, lb/ac-in
ACU = Annual Crop Uptake, lb/ac

For NC, use 22.5 lb/ac-in nitrogen, unless local data is available. The annual uptake of nutrients by various grasses can be found using the NRCS Plants Database, Nutrient Tool.

If runoff is discharged to the treatment strip as sheet flow, the flow rate and time of application shall be such that the applied runoff water does not result in runoff from the treatment area, or significant percolation below the root zone.

If runoff is discharged to the treatment strip with a sprinkler system, the rate of application shall not exceed the infiltration rate as listed in the Nebraska Irrigation Guide for the soil type(s) in the treatment area.

The infiltration strip design shall be such that the upper soil profile remains unsaturated except during storm events and returns to an unsaturated condition within two days following storm events. The water table shall be either naturally deep enough or artificially lowered so that the infiltrated runoff does not mingle with the native ground water. Infiltration strips 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.

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Additional Criteria for Overland Flow Treatment

Overland flow treatment refers to a specific microbial remediation technique that has minimal infiltration of wastewater. Treatment by overland flow shall consist of the application of wastewater along the upper portion of a uniformly sloped strip of herbaceous-vegetation, allowing it to flow over the vegetated surface for aerobic treatment to a collection ditch.

The design hydraulic loading rate and application rate shall be selected based on consideration of the anticipated levels of pretreatment, quality of effluent, temperature, and other climatic conditions. A maximum hydraulic loading rate of 2.0 inches per day and an application rate of eight gallons per hour per foot of slope width shall be used unless higher rates can be justified by on-site studies.

The application period shall not exceed 12 hours per day and the application frequency not exceed 5 days per week unless longer application periods and frequencies can be justified based on local conditions.

The nutrients anticipated to infiltrate the treatment strip shall not exceed the vegetation's agronomic nutrient requirement.

Overland flow treatment shall be constructed on soils with low permeability. The design shall be based on the most restrictive soil layer within the root zone. The maximum allowable permeability shall be 0.2 inches per hour unless a natural or constructed barrier within the soil profile mitigates the potential of ground water contamination.

The minimum slope length for the applied wastewater shall be 100 feet.

The sloped areas to receive wastewater shall be uniformly graded to eliminate wastewater ponding and short-circuiting for the length of the flow. Slopes shall be equal to or greater than 2.0% but shall not exceed 8.0%.

Wastewater discharged from the treatment strip shall be transferred to a waste storage facility, a waste treatment lagoon, or other facility for further treatment.

Additional Criteria for Treating Wastewater with the Slow Rate Process

The slow rate process refers to a specific remediation technique involving the application of wastewater to a vegetated surface for treatment as it flows down through the plant-soil matrix.

The design hydraulic loading shall be based on the more restrictive of two limiting conditions – the capacity of the soil profile to transmit water (soil permeability) or in nitrogen concentration in the water percolating below the root zone. The percolate nitrate-nitrogen concentration leaving the root zone shall not exceed 10 mg/L. The anticipated nutrient loading shall not exceed the vegetation's agronomic nutrient requirement.

Storage shall be provided when the amount of available wastewater exceeds the design hydraulic loading rate or for strip non-operating periods.

Wastewater shall be applied to the treatment strip utilizing a method that will result in an even application over the entire strip and at a rate that does not exceed the infiltration rate of the soil.

CONSIDERATIONS

- More than one overland flow treatment strip should be considered to allow for resting, harvesting vegetation, maintenance, and to minimize the potential for overloading.
- Consider the use of 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.
- Consideration should be given to installation of barriers to promote snow accumulation on the vegetative area. The insulating effect of the snow cover will promote function of the area during colder periods of the year.

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. Plans should include information about the location, construction sequence, and vegetation establishment.

Specifications will include:

- Length, width, and slope of the treatment strips to accomplish the planned purpose (length refers to flow length down the slope of the treatment strip)
- Herbaceous species selection will be based on the time of year that nutrient uptake is required/expected. Cool season species will be used if uptake is required early or late in the growing season. Warm season species will be used if uptake is needed during summer months when cool season grasses are dormant.
- Herbaceous species selected shall have a rooting depth consistent with the water holding capacity of the soil.
- Planting dates, seeding rates, care, and handling of the seed to ensure that planted materials have an acceptable rate of survival according to NRCS practice standard Pasture and Hayland Planting Code 512.
- Statement that only viable, certified weed free, high quality, and regionally adapted seed will be used according to seed and forb source requirements in FOTG Section II, Pasture and Hayland Interpretations.
- Site preparation sufficient to establish and grow selected species (Refer to NRCS practice standard Pasture and Hayland Planting Code 512 for requirements).
- Requirement that seeding operations will be in a direction perpendicular to the flow direction. This will minimize the likelihood of small, concentrated flow channels developing while vegetation is being established.

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 shall include the following as appropriate:

- Harvest treatment strip 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
- Control undesired weed species, especially state-listed noxious weeds
- Inspect and repair treatment strips after storm events to fill in gullies, remove flow disrupting sediment accumulation, re-seed disturbed areas, and take other measures to prevent concentrated flow
- Apply supplemental nutrients as needed to maintain the desired species composition and stand density of herbaceous vegetation
- Maintain or restore the treatment strip as necessary by periodically grading when deposition jeopardizes its function, and then reestablishing to herbaceous vegetation
- Routinely de-thatch and/or aerate treatment strips used for treating runoff from livestock holding areas in order to promote infiltration
- Conduct maintenance activities only when the treatment strip is dry and moisture content in the surface soil layer will not allow compaction
- Prevent grazing in treatment strips
- Irrigation of the treatment strip may be necessary to maintain actively growing vegetation during drought periods to ensure its ability to uptake nutrients during storm events.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service.

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

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