Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

PHOSPHORUS REMOVAL SYSTEM

CODE 782

(no)

DEFINITION

A system installed to intercept subsurface (tile) flow, ground water or surface runoff flow, and reduce the concentration of phosphorus.

PURPOSE

This practice is used to accomplish the following purpose:

- To improve water quality by reducing dissolved phosphorus loading to surface water through the sorption of phosphate (dissolved) P from drainage and runoff water.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to reducing the amount of phosphorus from subsurface drain (tile) flows and other subsurface and surface phosphorus- containing runoff outflows. Sources of agricultural outflows may include agricultural tile drains, ditches and animal heavy use areas such as milkhouse wastewater, feed bunks, and silage leachate runoff.

CRITERIA

General Criteria Applicable to All Purposes

Design the system to achieve a reduction in the phosphorous concentration of the water flowing through the system.

Provide a hydraulic retention time through the phosphorous removal system sufficient to achieve the planned reduction in phosphorous concentration at the design flow rate.

Determine the phosphorous removal system size and configuration using the design procedures based on the design flow rate, permeability of the media, phosphorus retention capacity of the media and the desired hydraulic retention time.

Design the system for an expected life of at least 10 years unless provisions are made for periodic media replacement.

Do not subject the system to pressure greater then needed to provide gravity flow.

Use geotextile lining, sediment basin or a containment vessel to prevent the migration of soil particles into the phosphorous removal system, based on the soils and geology of the site.

Design water control structures' as needed, to maintain the water level in the system at desired elevations. See Structure for Water Control (587).

Construct the surface of the system to shed water from the top of the system and to allow for settlement. Excess soil removed during the installation of the system shall be disposed of by blending with the adjacent landscape or hauling away.

For safety and to prevent compaction of the system, identify the system location with appropriate signage or fence the site to avoid equipment travel over the system.

Protect all disturbed areas from erosion within 14 days of construction by seeding and mulching. See Critical Area planting (342) for criteria on seed selection, seedbed preparation, fertilizing, and seeding.

Ensure that the media has a phosphorus retention capacity of at least 0.50 percent by weight of materials, or 10 pounds of phosphorus per ton of media. Ensure that the particle diameter of the media provides sufficient permeability for the anticipated flow. Use material that is recyclable and/or disposable when it has used up its phosphorus removal capacity. Ensure all used media is disposed of in a proper manner following applicable permits, which may include disposal in a landfill.

Restore the pH of the discharge water leaving the treatment to acceptable levels.

Use media for restoring pH levels that is recyclable and disposable, according applicable permits, when it has used up its pH restoration capacity.

Package systems will be installed according to manufacturer's recommendations.

Depending on the site specific conditions, the phosphorus reducing filter

1. Can be housed in either Polyethylene or Polypropylene tanks, where:

2. The tank manufacturing facility for the Phosphorus Removal System shall be ISO 9002 certified. Proof of certification shall be required as part of the submittals. If the plant is not ISO 9002 certified then the contractor shall submit material testing as defined in the submittals or it can be excavated in ground (as a trench filled with phosphorus reducing media and pH reducing media).In both cases there will be an access ports for a filter cleanout and inspection as appropriate.

Additional Criteria for Treating Subsurface Drain Flow

Design the phosphorus removal system with capacity to treat subsurface base flow using either a minimum drainage coefficient of 0.125 inches from the serviced area, or a minimum of 20 percent of the calculated peak subsurface drain flow.

Base the surface flow peak discharge calculations on storm frequency records (or available discharge data) and phosphorus and suspended solids concentrations if available. If these are not available, size the phosphorus filter system according to standard peak flow equations (e.g. using the Rational formula, Cook's method, Curve Number method, Soil Conservation Service method etc.).

Design the phosphorus filter system with a maximum design capacity of the 10-year 24 hour storm frequency event.

CONSIDERATIONS

Other practices and management systems can achieve a reduction of phosphorous levels separately or in conjunction with this practice. Examples include Nutrient Management (590), Cover Crop (340), and Drainage Water Management (554).

Consider the effects on downstream water bodies or groundwater that may affect other water uses or users. For example the initial flow from the system at start up may contain undesired contaminants.

Consider impacts of system installation on the proper flow and function of drainage systems such as tile systems and surface ditches.

PLANS AND SPECIFICATIONS

Plans and specifications for phosphorus removal system shall describe the requirements for applying the practice to achieve its intended purpose.

The following list of Construction Specifications in intended as a guide to selecting the appropriate specifications for each specific project

The list contains most, but may not contain all, of the specification that are needed for a specific project:

VT-1 Site Preparation VT-5 Pollution Control VT-11 Earthwork

VT-41 Pipe Conduits and Drains VT-54 Geotextile

As a minimum the plans and specifications shall include:

• A plan view of the layout of the Phosphorus Removal System and associated components

• Typical cross sections of the Phosphorus Reducing System (s)

• Profile(s) of the Phosphorus Reducing System (s) including inlet(s) and outlet(s)

• Details of required structures for water level control

• Seeding requirements, if needed

• The type of phosphorus removal media to be used, its phosphorus retention capacity, life expectancy and planned method of recycling or disposal.

• Construction specifications that describe in writing site specific installation requirements of the Phosphorus Reducing System and associated components

OPERATION AND MAINTENANCE

Review the provided operation and management (O&M) plan with the land manager. Include normal repetitive activities in the application, use, and repair and upkeep of the practice. Keep the plan site specific and include a description of the following as appropriate:

• Anticipated flow rates, phosphorus and total suspended solids concentrations, reduction targets, etc.

• Planned water level management and timing.

• Inspection and maintenance requirements of the Phosphorus Removal System and contributing drainage system, especially upstream surface inlets.

Monitoring and reporting is required to confirm system performance and provide information to improve the design and management of this practice. Monitoring shall include water testing for phosphorus (both dissolved and total P) in milligrams per liter, at the Phosphorus Removal System inlet and outlet, at certain frequencies or specific dates, with a corresponding record of water level elevations.

REFERENCES

Drizo, Aleksandra, 2010. Innovative Technologies for Phosphorus Reduction From Non Point Pollution Sources. ASA, CSSA, SSSA 2010 International Meetings, held in Long Beach, CA, 10/31-11/3, 2010.

Drizo, Aleksandra, 2011, “Phosphorous and Suspended Solids Reduction from Agricultural Tile Drainage via Passive Filtration Systems” final report.

Drizo, Aleksandra, 2011, Phosphorus and E. Coli Reduction from Silage Leachate via Innovative Passive Filtration Systems, final report