

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

DRAINAGE WATER MANAGEMENT

(Ac.)

CODE 554

DEFINITION

The process of managing water discharges from surface and/or subsurface agricultural drainage systems.

PURPOSE

The purpose of this practice is:

- Reduce nutrient, pathogen, and/or pesticide loading from drainage systems into downstream receiving waters
- Improve productivity, health, and vigor of plants
- Reduce oxidation of organic matter in soils
- Reduce wind erosion or particulate matter (dust) emissions
- Provide seasonal wildlife habitat

CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable to agricultural lands with surface or subsurface agricultural drainage systems that are adapted to allow management of drainage discharges.

The practice may not apply where saline or sodic soil conditions require special considerations.

This practice does not apply to the management of irrigation water supplied through a subsurface drainage system. For that purpose, use NRCS Conservation Practice Standard, Irrigation Water Management (449).

CRITERIA

General Criteria Applicable to All Purposes

The management of gravity drained outlets shall be accomplished by adjusting the elevation of the drainage outlet.

The management of pumped drainage outlets shall be accomplished by raising the on-off elevations for pump cycling.

Structures and pumps shall be located where they are convenient to operate and maintain.

Raising the outlet elevation of the flowing drain shall result in an elevated free water surface within the soil profile.

When operated in free drainage mode, water control structures shall not restrict the flow of the drainage system.

Drainage discharges and water levels shall be managed in a manner that does not cause adverse impacts to other properties or drainage systems.

Release of water from control structures shall not allow flow velocities in surface drainage system components to exceed acceptable velocities prescribed by NRCS Conservation Practice Standard, Surface Drainage, Main or Lateral (608).

The effect of drainage systems on wetlands shall be evaluated.

The effect of managing the drainage system on adjacent fields shall be evaluated. The installation and operation of a water level control structure should not impact adjacent fields or drainage systems.

Release of water from flow control structures shall not allow flow velocities in subsurface drains to exceed velocities prescribed by

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service or download the standard from the electronic Field Office Technical Guide for Missouri.

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NRCS Conservation Practice Standard, Subsurface Drain (606).

Additional Criteria to Reduce Nutrient, Pathogen, and/or Pesticide Loading

During non-cropped periods, the system shall be in managed drainage mode within 30 days after the season's final field operation, until at least 30 days before commencement of the next season's field operations, except during system maintenance periods or to provide trafficability when field operations are necessary.

The drain outlet shall be raised prior to and during liquid manure applications to prevent direct leakage of manure into drainage pipes through soil macro pores (cracks, worm holes, root channels).

Manure applications shall be in accordance with NRCS Conservation Practice Standards, Nutrient Management (590) and Waste Utilization (633).

Additional Criteria to Improve Productivity, Health, and Vigor of Plants

When managing drainage outflow to maintain water in the soil profile for use by crops or other vegetation, the elevation at which the outlet is set shall be based on root depth and soil type.

The combined capacity of the surface and subsurface facilities shall satisfy the appropriate drainage coefficient for the crops to be grown. (Refer to NRCS Conservation practice standard Subsurface Drain (606) for guidance.)

If using this practice to control rodents, apply in conjunction with NRCS Conservation Practice Standard, Pest Management (595).

Additional Criteria to Reduce Oxidation of Organic Matter in Soils

Drainage beyond that necessary to provide an adequate root zone for the crop shall be minimized.

To reduce oxidation of organic matter, the outlet elevation shall be set to enable the water table to rise to the ground surface, or to a

designated maximum elevation, for sufficient time to create anaerobic soil conditions. The implementation of this practice must result in a reduced average annual thickness of the aerated layer of the soil.

Additional Criteria to Reduce Wind Erosion or Particulate Matter (Dust) Emissions

When the water table is at the design elevation, the system shall provide a moist field soil surface, either by ponding or through capillary action from the elevated water table.

Additional Criteria to Provide Seasonal Wildlife Habitat

During the non-cropped season, the elevation of the drainage outlet shall be managed in a manner consistent with a habitat evaluation procedure that addresses targeted species.

CONSIDERATIONS

In-field water table elevation monitoring devices can be used to improve water table management.

Reducing mineralization of organic soils may decrease the release of soluble phosphorus, but water table management may increase the release of soluble phosphorus from mineral soils.

The concept of drainage water management is based on the premise that the same drainage intensity is not required at all times during the year.

Elevated water tables may increase the runoff portion of outflow from fields. Consider conservation measures that control sediment loss and associated nutrient discharge to waterways.

Elevate the drainage outlet for subsurface drains during and after manure applications to decrease potential for nutrient and pathogen loading to receiving waters.

Consider manure application setbacks from streams, flowing drain lines, and sinkholes, to reduce risk of contamination.

In order for the practice to be economical and practical, each control structure needs to influence a significant amount of the field.

Drainage water management is generally limited to very flat fields with slopes typically less than 0.5 percent. It is possible to apply the practice on very moderate slopes if the tile system is designed with the laterals on the contour and a series of control structures are installed to step down the control elevations. This increases both drainage system cost and management.

Drainage water management may affect the water budget, especially volumes and rates of runoff, infiltration, evaporation, transpiration, possible deep percolation and groundwater recharge because of the increase in the amount of water stored in the field.

To maintain proper root zone development and aeration, downward adjustments of the drainage outlet control elevation may be necessary, especially following significant rainfall events.

Drainage water management may increase base flow because of increased gradient from fields to surface water conduits. Higher field water tables may also increase deep seepage and lateral losses. Since this soil water will pass through reduced (low oxygen) zones it will be somewhat denitrified before leaving the field. Drainage water management may increase runoff, which would reduce tile flow and lower nitrate loading to surface water, since runoff generally has a lower concentration of nitrate than tile flow water.

Avoid traffic on finer textured wet soil to minimize soil compaction.

Monitoring of root zone development may be necessary if the free water surface in the soil profile is raised during the growing season.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard as necessary and shall describe the requirements for applying the practice to achieve its intended purpose(s).

OPERATION AND MAINTENANCE

An Operation and Maintenance plan shall be provided that identifies the intended purpose of the practice, practice life safety requirements,

and water table elevations and periods of operation necessary to meet the intended purpose. If in-field water table observation points are not used, the relationship of the control elevation settings relative to critical field water table depths shall be provided in the operation plan.

The Operation and Maintenance Plan shall include instructions for operation and maintenance of critical components of the drainage management system, including instructions necessary to maintain flow velocities within allowable limits when lowering water tables and should address the following objectives as applicable:

1. Prior to tillage, harvest, and other field operations, the water table should be at depth to provide trafficability throughout the field.
2. After planting and other necessary field operations, the water table control device can be set to allow infiltration from rainfall to bring the water table to the desired level and provide capillary water to the plant root zone. This level will vary with the crop and stage of growth.
3. Operation of the water level control structure during the crop season should be such that prolonged saturation of the root zone does not occur.
4. During the fallow period, the control structure should be operated to allow the water table to rise to the soil surface or to a designated maximum control elevation.
5. Field water table observation wells should be installed and the water table levels observed as part of the operation plan.
6. To prevent leakage of liquid manure applications into drain pipes, the plan shall specify the elevation of the raised drainage outlet and the number of days prior to and after the application that a raised outlet elevation is to be maintained.

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7. Replace warped flashboards that cause structure leakage.

USDA, NRCS. 2001. National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, Water management (Drainage).

REFERENCES

USDA, NRCS. 2001. National Engineering Handbook, Part 624, Sec. 16, Drainage of agricultural land.