

**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).

Release of water from flow control structures shall not allow flow velocities in subsurface drains to exceed velocities prescribed by NRCS Conservation Practice Standard, Subsurface Drain (606).

Existing subsurface drainage systems considered for conversion to drainage water management must be investigated to

determine that the system can be modified without causing failure.

**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, and to within 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.

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.

In order for the practice to be economical and practical, each control structure needs to influence a significant amount of the field; therefore, drainage water management is generally limited to nearly flat fields with slopes typically less than 1.0 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 may increase both drainage system and management costs.

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

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.

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.

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

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

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). At a minimum, the following components shall be included:

- Farm and field information that includes field boundaries, soil map unit boundaries, drainage system layout, and delineation of the area served by the drainage system.
- A topographic map with 0.5- or 1.0-ft contours, depending on field slope, at the same scale as the drainage system map.
- A map showing the location, size, and impacted area of each planned control structure.
- Profile(s) showing the elevations of the subsurface drains, control structures, control elevation, ground surface, etc.

The control elevation shall be defined as the elevation of the soil surface at the lowest spot in the area of the field impacted by the operation of the structure for water control.

The drained area shall be defined by the lateral spacing recommendations specified in the Iowa Drainage Guide based on predominant soil type, or the actual lateral spacing, whichever is less. The outer boundary of the drained area shall be a distance of  $\frac{1}{2}$  the recommended or actual lateral spacing away from the tile line(s).

The impacted area shall be defined as the drained area contained within the control elevation of the given structure, up to the control elevation of the structure immediately above the given structure, on the same drain

line, or 2 feet above the control elevation for the given structure, whichever is less.

## 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.

The management plan should address the following objectives as applicable:

1. Shallow water table observation wells shall be installed as needed in each control zone so the producer can monitor water table elevations. Reference points on the observation wells shall be tied to the outlet elevation of the water control structure (weir).
2. Prior to tillage, harvest, and other field operations, the outlet elevation should be set at a depth to provide trafficability throughout the field (typically the designed depth of the drainage outlet).
3. After planting and other necessary field operations, the outlet elevation should be set to allow infiltration from rainfall to potentially bring the water table to the desired level to provide capillary water to the plant root zone. This will vary, depending on crop, stage of growth, and soil.
4. Operation of the outlet elevation in the control structure during the crop season should be such that prolonged saturation of the root zone does not occur (as observed in the water table observation wells).

5. During the fallow period, the outlet elevation in the control structure should be operated to allow the water table to potentially rise to near the soil surface or to an elevation which meets the objectives of the plan.

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.

Replace warped flashboards that cause structure leakage.

#### **REFERENCES**

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

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