Water Control Structure

Definition/Purpose

A Water Control Structure means a permanent structure placed in a farm canal, ditch, or subsurface drainage conduit (drain tile or tube), which provides control of the stage or discharge of surface and/or subsurface drainage. The management mechanism on the structure may be flashboards, gates, valves, risers, or pipes.

The primary purpose of the water control structure is to improve water quality by elevating the water table and reducing drainage outflow. A secondary purpose is to restore hydrology in riparian buffers to the extent practical. Elevating the water table promotes denitrification and lower nitrate levels in drainage water from cropping systems and minimizes the effects of short-circuiting of drainage systems passing through riparian buffers. Other benefits may include reduced pollution from other dissolved and sediment-attached substances, reduced downstream sedimentation and reduced storm water surges of fresh water into estuarine area. (DIP)

This practice is not intended to be used to control water inflow from tidal influence (i.e., no tide gates).

Considerations

Management of drainage water is most effective where the topography is relatively uniform and flat to gently sloping. Water control structures can be used routinely where land slopes are less than 0.5 percent. As slopes exceed 0.5 percent, consideration should be given to the amount of land area that will be influenced by the structure and the resulting cost effectiveness of installing a water control structure under steeper slope conditions.

Slope considerations are also influenced by the intended purpose. Under cropland conditions, it will usually be cost prohibitive and insufficient water quality benefits derived from controlling water table elevations where slopes exceed 0.5 %. For managing short-circuiting through riparian buffers, water table control may be practical on steeper slopes because the control elevation at the structure can be raised to the surface thereby extending the zone of influence of the structure over a larger upslope area. When the water table will be maintained near the soil surface, vegetation suited to wet conditions must be planted in the areas with high water table.

Consideration must be given to the impact of the water control structure on land areas outside the intended zone of influence, especially neighboring landowners. The water table elevation should not be significantly raised on lands of adjacent landowners without written permission of the affected landowner.

When the land in the vicinity of the structure is cropped, the design head on the structure should not exceed 0.5 feet. The capacity of the structure shall be adequate to discharge the design flow rate of the drainage system with a maximum 0.5-foot head.

When the structure is located within a riparian buffer the design head should be limited only by conditions that result in excessive ponding in the vicinity of the structure. In

general, the objective is to raise the water table as high as practically possible and make the riparian buffer as wet as possible to encourage denitrification. With proper vegetative cover around the structure to control erosion resulting from concentrated surface runoff, ponding should not be a concern within a riparian buffer.

Recommended water control structure management elevations during cropped conditions are provided on the maintenance and management agreement (NC-ACSP-WCS). These management guidelines apply to water table conditions in the cropped area. The actual control elevation at the structure should take into account differences in elevation between the structure and the cropped area. Consequently, on sloping land where the control structure is installed in a downslope natural or riparian area, the control elevation at the structure may be raised to the land surface without adversely impacting the upslope crops. The values given on the maintenance agreement should be considered the target elevations at the edge of riparian buffer/cropped field interface.

Drainage beyond that necessary to provide adequate root zone aeration for an agricultural crop shall be kept to a minimum. During fallow periods or on non-cropped areas (riparian buffers), the water table elevation should be maintained near the land surface or to a designated maximum elevation to reduce the rate of soil organic matter oxidation and encourage denitrification.

Policies

1. The following policies apply to half-round, flash board risers installed in drainage canals or ditches:

    a. Flash board riser, cost of welding pipe to riser, installation and vegetation are included in average cost of riser

    b. Average cost includes a one (a) foot open well below the invert of the pipe and with the option of using a closed bottom without a well on 18” and 24” risers.

    c. Risers 48” wide to 84” wide will have a “H” Beam 3” wide with a 3: web welded vertically on the vertical centerline of the riser.

    d. Risers 96” wide and wider will have two (2) “H” Beams 3” wide with a 3” web equally spaced and welded vertically to the riser.

    e. All risers in excess of six (6) feet high will have a 3” x 3” channel welded horizontally and located half-way between the top of the riser and the invert of the pipe for lateral support.

    f. Cost share rate, gauges, and corrugations apply to all flashboard risers, whether corrugated aluminum or corrugated steel. All corrugated steel to be asphalt coated.

    g. Risers 102” and larger are built from structural plate (thickness – 0.175 in.)

2. The following policies apply to structures installed in-line with subsurface drainage tile or tubing referred to herewith as “in-line” structures:

a. In-line structure, solid pipe, cost of attaching pipe to riser, installation, and vegetation for stabilization are included in average cost of structure

b. A minimum of 20 feet of the perforated subsurface drain pipe shall be replaced with a corresponding length of non-perforated pipe connected to the water control structure. The 20 feet may be upslope or down slope or some combination of both and should be installed with an anti-seep collar.

c. Non-perforated pipe can be ductile iron, welded steel, corrugated steel, corrugated aluminum, or plastic. Average costs shall be based on corrugated plastic pipe. All buried steel pipe shall have protective coatings of asphalt, polymer over galvanizing, aluminized coating, or coal tar enamel as appropriate for the pipe type.

d. Coupling between the water control structure and the non-perforated pipe shall be secure and water tight.

e. Plastic risers should not be used where there is a danger of fire.

f. Where multiple drain lines discharge to a common submain, the water control structure should be installed on the submain to minimize the number of structures and costs. However, it this is not possible due to topography, a cost analysis should be performed considering the amount of land area influenced by the structure to determine the most cost effective placement of the in-line structure, i.e., individual drain line versus submain.

g. Where in-line structures are installed on single drains lines, the length of drain pipe upslope of the structure should exceed 500 feet.

3. Average cost for corrugated pipe includes the pipe, installation and vegetation (in accordance with PS 342.)

4. Concrete may be used in lieu of sand-cement bag headwall and for anti-floatation.

5. Structural geotextiles shall meet the requirements of “Construction Specification 217 – Geotextiles” and “Interim Material Specification 592 – Geotextiles”. Drainage geotextiles shall meet the requirements of NC Technical Guide, Section IV Practice Standard 606, as shown in paragraph 606-8-5.

6. Where an in-line water control structure is used to manage the water table elevation in a riparian buffer, a monitoring well may be installed at the upslope boundary of the buffer to ensure that water table elevation established at the structure does not result in excessively high water table elevations in the upslope cropped fields.

7. Operational records indicating date and elevation of water control structure adjustments shall be maintained and made available for inspection by district staff for the duration of the contract period.

WATER CONTROL STRUCTURE	
Maintenance Period	10 YEARS
BMP Units	EACH
Required Effects	ACRES_AFFECTED (drainage area) NITROGEN_SAVED PHOSPHORUS_SAVED
JAA/NRCS Standard unless otherwise noted	ENG – 587 – Structures for Water Control – flash board riser ENG – 378 – Pond – in-line structures
Supporting Practices	ENG – 554 – Drainage Water Management
CS2 Reference Materials	NC-ACSP-11 Signature Page Map with BMP location, fields, and roads. NC-CSPs-WCS form

Water Control Structure
Maintenance and Management Agreement

Addendum to NC-ACSP-2

This is an agreement between _____ and the _____ Soil and Water Conservation District for the purpose of managing the water level in a drainage system with a water control structure(s). Contract number: _____. Structure location: see attached map.

The objective for installing and managing water control structure(s) is to reduce the amount of agricultural pollutants leaving the farm through the drainage system. Controlled drainage may also improve crop yields and reduce short-circuiting through riparian buffers. In order to protect water quality and to ensure that the structures are being maintained and performing the function for which they were originally designed, the requirements listed below must be met.

1. Under cropped conditions, maintain the water level within 30 inches of the ground surface along at least 50% of the ditch reach immediately upstream of the structure all year in order to reduce nitrate losses and maximize water quality benefits. Short-term adjustments shall be permitted to accommodate field access (trafficability) and unusually high rainfall.

The chart below gives recommended depths from ground surface to water level for typical crops. Other crops may require a different schedule.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Corn	12-18"			24-36"			18-24"		24-36"		12-18"	
Wheat	12-24"		24-36		18-24"		24-36"					
Soybeans							24-36"	18-24"			24-36"	

2. When used to minimize short circuiting of a drainage system through a riparian buffer, the objective is to raise the water table as high as physically possible and make the riparian buffer as wet as possible in order to reduce drainage through the buffer and encourage denitrification within the buffer. Under this objective, the control level should be as near the surface as possible without elevating the water level in the upslope cropped fields above the values given in the above table.

3. An operation and maintenance plan shall be developed and included with this contract that defines the intended purpose(s) of this practice and describes the requirements for applying the practice to achieve its intended purpose(s). At a minimum, the operation and maintenance plan shall include:

a. Maximum, minimum, and normal water control elevations.
b. Guidelines on structure inspection.
c. Guidelines for clean out of the ditch as it fills with sediment.
d. Use of vegetated borders to reduce the input of sediment.

e. Guidelines covering removal of boards so as to not develop excessive head losses near drain tiles or ditch banks in unstable soils that would result in bank sloughing.

I agree to manage the water level in my drainage system as stated above, and as outlined in the attached operation and maintenance plan, and in accordance with recommendations and specifications outlined in NRCS Conservation Practice Standard #554. With the exception of maintenance and repairs, there will always be ____ inches of boards in the flashboard riser above the sediment level in the bottom of the ditch or ____ inches of boards in the in-line structure above the top of the subsurface drain pipe. The zone of influence for my water control structure extends _____ feet upstream of the structure

Applicant _____ Date_____

Landowner _____ Date _____

Chairperson _____ Date _____