NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

STRUCTURE FOR WATER CONTROL

(No.)

CODE 587

DEFINITION

A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation or measures water.

PURPOSE

The practice may be applied as a management component of a water management system to control the stage, discharge, distribution, delivery or direction of water flow.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies wherever a permanent structure is needed as an integral part of a water-control system to serve one or more of the following functions:

1. Convey water from one elevation to a lower elevation within, to or from a water conveyance system such as a ditch, channel, canal or pipeline designed to operate under open channel conditions. Typical structures: drops, chutes, turnouts, surface water inlets, head gates, pump boxes and stilling basins.
2. Control the elevation of water in drainage or irrigation ditches. Typical structures: checks, flashboard risers and check dams.
3. Control the division or measurement of irrigation water. Typical structures: division boxes and water measurement devices.
4. Keep trash, debris or weed seeds from entering pipelines. Typical structure: debris screen.
5. Control the direction of channel flow resulting from tides and high water or back-flow from flooding. Typical structures: tide and water management gates.
6. Control the water table level, remove surface or subsurface water from adjoining land, flood land for frost protection or manage water levels for wildlife or recreation. Typical structures: water level control structures, flashboard risers, pipe drop inlets and box inlets.
7. Convey water over, under or along a ditch, canal, road, railroad or other barriers. Typical structures: bridges, culverts, flumes, inverted siphons and long span pipes.
8. Modify water flow to provide habitat for fish, wildlife and other aquatic animals. Typical structures: chutes, cold water release structures and flashboard risers.
9. Provide silt management in ditches or canals. Typical structure: sluice.
10. Supplement a resource management system on land where organic waste or commercial fertilizer is applied.
11. Create, restore or enhance wetland hydrology.

CRITERIA

General Criteria Applicable to All Purposes

Vegetation complying with Critical Area Planting standard (Code 342) shall be established on all disturbed earth surfaces. Where soil, climate or site specific conditions preclude establishing permanent vegetation, other protective means such as mulches or gravels, shall be used.

The structure shall be fenced, if necessary, to protect the vegetation.

Structures shall not be installed that have an adverse effect on septic filter fields.

The water level upstream of water control structures shall not be raised on adjacent landowners without their permission.

Prior to structure design, an investigation of site conditions will be done. This shall include, but not be limited to, soil borings, channel profile and x-sections, and other pertinent hydrologic data.

Whenever it is anticipated that conduit floatation will be a problem, such as with an inlet riser, low fill heights, larger barrel diameters, or a partially exposed barrel, it shall be anchored or additional weight will be added to equal 1.5 times the weight of the displaced water measure at the crest of the inlet.

There are many types of water control structures. Guidance on the design and installation of approved structures can be found in the Engineering Field Handbook for Conservation Practices, Chapter 6, "Structures". For structures not illustrated in the Handbook, contact the State Design Section for assistance in design, if needed, and for approval.

Culverts

Culverts are used to convey water across a road, railroad, or other barriers. New culverts installed in a drainage channels shall have a minimum capacity equal to 1.25 times the design capacity of the channel. Existing culverts shall be of significant size, as to pass the design flow under the allowable head without causing any overbank flow above the structure. Design head loss across culverts should be maintained at 0.5 feet or less. If greater head loss is required, consideration should be given to outlet protection against erosion or possibly open flow structures (i.e. bridges).

Floodgates

Floodgates are used to control the direction of water flow across a barrier. The floodgate will have a capacity equal to 1.5 times the design capacity of the system it serves when it is not subject to tidal action, or when it is subject to tidal action but only used to supplement pumping system. When the floodgate is the primary outlet and is subject to tidal action it shall have a capacity equal to 2.5 times the system it serves.

Open Channel Spillway (Marsh Weirs)

Marsh weirs are used for stabilizing water levels and reducing salinity levels within a marsh. The minimum length of weir crest will be the smaller of:

1 foot of weir crest equals 70 ac. of drainage area, or

1 foot of weir crest equals $13M^{5/6}$ (M=drainage area in sq. mi.)

In most cases the crest elevation of fixed crest weirs will be set 0.5 feet below normal marsh elevation, however drainage area, hydrologic conditions, and water management objectives need to be considered in determining final crest elevation.

The crest shall extend to within five (5) feet (minimum) of the top bank of both sides of the channel for channels fifty (50) feet or less in width. A minimum of ten (10) feet is allowed for larger channels.

In all cases where channel clearance exceeds the minimum design weir crest requirements, the crest will be extended to accommodate the larger channel.

Structural design of marsh weirs shall follow accepted engineering principles. Geotechnical investigations are necessary to determine the structural dimensions and allowable loading conditions. The design shall include appropriate safety factors against all anticipated loading conditions.

Channel Plug

A permanent barrier constructed across a natural or man-made channel to obstruct water flow. The channel must be a minimum 3 feet deep and have a top width between 15 and 200 feet to qualify for a channel plug.

All channel plugs must provide a positive cutoff (core trench) within the channel regardless of the type of materials used in construction. No increase in stage from the design storm shall occur on any property upstream of the structure.

Various types of channel plugs include earthen dams with or without armor plating earthen dams with sheet piling core, wooden, steel, concrete or PVC sheet piling bulkhead, etc.

All embankments with armor plating shall be shaped to the minimum side slope required to safely accommodate the type of armor to be used, however, no steeper than 2.5:1 is to be used.

The wingwalls of any channel plug must extend a minimum of 10 feet into each adjacent embankment. On single-wall structures, the earthen embankment on top of the wingwall should extend a minimum of 5 feet past the end of the wingwall. This is necessary to divert overflows away from the wingwall ends which can cause cutting and loss of soil material rendering the structure useless.

CONSIDERATIONS

When planning, designing, and installing this practice, the following items should be considered:

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
3. Effects on downstream flows or aquifers that would affect other water uses or users.
4. Effects on the field water table to ensure that it will provide a suitable rooting depth for the anticipated crop.
5. Potential use for irrigation management to conserve water.
6. Effect of construction on aquatic life.
7. Effects on stream system channel morphology and stability as it relates to erosion and the movement of sediment, solutes, and sediment-attached substances carried by runoff.
8. Effects on the movement of dissolved substances below the root zone and to ground water.
9. Effects of field water table on salt content in the root zone.
10. Short term and construction-related effects of this practice on the quality of downstream water.
11. Effects of water level control on the temperatures of downstream waters and their effects on aquatic and wildlife communities.
12. Effects on wetlands or water-related wildlife habitats.
13. Effects on the turbidity of downstream water resources.
14. Existence of cultural resources in the project area and any project impacts on such resources.
15. Conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

Design alternatives presented to the client should address economics, ecological concerns, and acceptable level of risk for design criteria as it relates to hazards to life or property.

PLANS AND SPECIFICATIONS

Plans and specifications for installing structures for water control shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

The plan shall specify the location, grades, quantities, dimensions, materials, and hydraulic and structural requirements for the individual structure. Provisions must be made for necessary maintenance. Care must be used to protect the surrounding visual resources. If watercourse fisheries are important, special precautions or design features may be needed to facilitate continuation of fish migrations.

OPERATION AND MAINTENANCE

An operation and management plan shall be provided to and reviewed with the land manager. The plan shall be site specific and include but not be limited to the following: Structures will be checked and necessary maintenance, including removal of debris, shall be performed after major storms and at least semi-annually. Water level management and timing shall be adequately described wherever applicable.