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
Apply this practice as a 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 to a permanent structure needed as an integral part of a water control system to serve one or more of the following functions:

- 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. Typical structures include drops, chutes, turnouts, surface water inlets, head gates, pump boxes, and stilling basins.
- Control the elevation of water in drainage or irrigation ditches. Typical structures include checks, flashboards, and check dams.
- Control the division or measurement of irrigation water. Typical structures include division boxes and water measurement devices.
• Keep trash, debris or weed seeds from entering pipelines. Typical structures include trash racks and debris screens.

• Control the direction of channel flow resulting from tides and high water or backflow from flooding. Typical structures include tide and water management gates.

• 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 include water level control structures, flashboard risers, pipe drop inlets, and box inlets.

• Convey water over, under, or along a ditch, canal, road, railroad, or other barriers. Typical structures include bridges, culverts, flumes, inverted siphons, and long span pipes.

• Modify water flow to provide habitat for fish, wildlife, and other aquatic animals. Typical structures include chutes, cold water release structures, and flashboard risers.

• Provide silt management in ditches or canals. Typical structures include sluice gates and sediment traps.

• Supplement a resource management system on land where organic waste or commercial fertilizer is applied.

• Create, restore, or enhance wetland hydrology.

CRITERIA

General Criteria Applicable to All Purposes

Planned work must comply with all applicable Federal, Tribal, state, and local laws, rules, and regulations. Plans for water control structures may need to be permitted by the appropriate Water Management District (WMD) and comply with the appropriate WMD rules contained in Chapter 40-2 Florida Administrative Code (F.A.C.), Consumptive Use: Chapter 40-4 F.A.C., Environmental Resource Permits: Chapter 40-20 F.A.C., General Water Use Permits: Surface Water Management Systems; Chapter 40-40 F.A.C., Standard General Environmental Resource Permits: Regulation of Stormwater Management Systems; Chapter 40-41 F.A.C., Environmental Resource Permits: Surface Water Management Basin Criteria; Chapter 40-42 F.A.C., Environmental Resource Permits: Regulation of Stormwater Management Systems; Chapter 40-44 F.A.C., Environmental Resource Permits: Regulation of Agricultural Surface Water Management Systems. Obtain all required permits before construction begins.

Evaluate the impact to cultural resources, wetlands and Federal and state protected species and avoid or minimize to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

Water control structures shall be designed and constructed in conformance with provisions contained in Part 650, Engineering Field Handbook for Conservation Practices, Chapter 6 - Structures, Chapter 14 - Drainage, and Chapter 15 - Irrigation. Detailed information and criteria about water control structures are contained in the National Engineering Handbook Part 623 - Irrigation, Chapter 3; and Part 624 - Drainage, Chapter 6 and Chapter 10. Structures shall be designed on an individual job basis to meet site conditions and functional requirements. They shall be part of an approved engineering plan for irrigation, drainage, wildlife, recreation, channel improvement, or similar purposes.

Structures must not create unstable conditions upstream or downstream. Water control structures installed in an open channel shall be designed to discharge the channel design flow at the designed channel hydraulic gradeline. Additional capacity needed under flood conditions shall be provided by "island" type installation. Provisions must be made for safe reentry of bypassed flow as necessary.

Where conduits are used, the diameter shall be based on design capacity but shall not be less than 6 inches in diameter. The length of the pipe shall be determined by the width and side slopes of the
required embankment or roadway over the pipe and shall extend a minimum of two feet beyond the toe of the designed fill except where headwalls are used.

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

Do not raise the water level upstream of water control structures on adjacent landowners without their permission.

**Safety.** Design measures necessary to prevent serious injury or loss of life in accordance with requirements of Title 210, National Engineering Manual (NEM), Part 503, Safety.

**Cultural Resources.** Evaluate the existence of cultural resources in the project area and any project impacts on such resources. Provide conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

If watercourse fisheries are important, special precautions or design features may be needed to facilitate continuation of fish migrations.

**Flashboard Riser and Culvert Structures.** Design these structures according to the hydraulic conditions under which they will function. Each condition will require a different design.

When this type structure is used for water stage control in a drainage ditch or irrigation canal and the flashboards should be removed to provide design discharge capacity, the pipe may be designed as a culvert with a riser width equal to or greater than the culvert diameter. If the boards are to remain in place during the design discharge, the structure will be designed to pass the design discharge with all the boards in place and will be designed as a drop inlet.

The maximum length of unsupported flashboards shall be 4 feet unless boards are resistant to bending and warping under anticipated use and loads.

When used for reservoir or lake level control, this structure shall be designed as a drop inlet.

Structures used to protect grade shall meet the requirements of Florida NRCS CPS Grade Stabilization Structure, Code 410. The portion of the flashboard riser opening below grade of the upstream channel bottom will be permanently closed with a headwall of steel across the bottom of the semi-circular riser.

**Earth embankment.** The minimum top width for an embankment shall be 6 feet. If the embankment top is to be used as a public or private road, the minimum width shall be 16 feet for one-way traffic and 26 feet for two-way traffic. Guardrails or other safety measures shall be used where necessary and shall meet the requirements of the responsible road authority.

To prevent erosion around the structure caused by overflow, extend the embankment each way at a minimum distance of 10 feet from the top of bank of the ditch. Topography of the area must be such that the path of overflow around the structure will return to the ditch a short distance below the structure without causing damage to the field or ditch bank.

**Freeboard.** The minimum elevation of the top of the settled embankment shall be 1 foot above the design water surface or natural ground, whichever is higher.

**Side slopes.** Preferably, the combined side slopes of the settled embankment should not be less than five horizontal to 1 vertical (5:1) with neither slope steeper than 2 horizontal to 1 vertical (2:1). However, in cases where the site conditions prevent a 5:1 combined slope, steeper side slopes are acceptable provided the slopes are designed to be stable and protected against sloughing and erosion. Protection may include sodding the slopes, using rock riprap, etc. Where embankments are to be mowed or used by the public for recreation; slopes will be 3 horizontal to 1 vertical (3:1) or flatter.

**Compaction.** The embankment fill material shall be compacted in accordance with the specified design requirements for compaction and moisture content. Allow an appropriate allowance for settlement to ensure that after settlement has taken place, the constructed height of embankment will equal or exceed the design height. The design height of the embankment shall be increased by the amount needed to ensure that after settlement has taken place, the constructed height of embankment will equal or exceed the design height. This settlement shall not be less than 3 percent for rubber tired pans and scrapers and 5 percent for track type equipment such as bulldozers, except where detailed soil testing and laboratory
analysis shows a lesser amount is adequate or field observations indicate a greater amount is needed to obtain the required level of compaction.

**Materials.** Structures installed under this standard shall be constructed of durable material with a life expectancy equal to the planned life of the structure.

Pipe conduits used shall meet the requirements as stated in Florida NRCS CPS Pond, Code 378.

Polyethylene, Type III, Class C, Category 4 or 5 conforming to ASTM and D 3350 and AASHTO M 252 or M 294, Type S, may be used for water control structures with a hydraulic head of 10 feet or less. Pipe connections must be water tight.

Concrete appurtenances used shall be designed for the anticipated loading and shall meet the requirements of National Engineering Handbook, Part 642, Specifications for Construction Contracting, Structure Concrete.

**Seepage control.** Include seepage control if (1) seepage will create unstable conditions downstream, (2) it is needed to ensure a stable embankment or (3) special circumstances require drainage for a stable structure. Seepage may be controlled by foundation, abutment or embankment drains.

Seepage along pipes extending through the embankment may be controlled by use of a filter and drainage diaphragm, unless it is determined that anti-seep collars will adequately serve the purpose. Anti-seep collars and drainage diaphragms shall meet the requirements of Florida NRCS CPS Pond, Code 378.

**Antivortex devices.** Closed conduit spillways designed for pressure flow must have adequate antivortex devices. Design antivortex devices in accordance with ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.

**Trash guard.** Where necessary to prevent clogging of the conduit, install an appropriate trash guard at the inlet or riser. Design and construct the trash guard in such a manner that flow to the inlet will not be adversely affected.

**Protection.** Establish a protective cover of vegetation on all disturbed earth surfaces. Where necessary, temporary vegetation will be used until permanent vegetation can be established. Seed or sod the exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in Florida NRCS Conservation Practice Standard (CPS) Critical Area Planting, Code 342. When necessary to provide surface protection where climatic conditions preclude the use of seed or sod, use the criteria in Florida NRCS CPS Mulching, Code 484 to install inorganic cover material such as gravel.

Fence the structure, if necessary, to protect vegetation.

Where needed to protect the outlet from erosion, protect with riprap or other means.

**CONSIDERATIONS**

Consider the following items when planning, designing, and installing this practice:

- Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
- Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
- Effects on downstream flows or aquifers that would affect other water uses or users.
- Effects on the field water table to ensure that it will provide a suitable rooting depth for the anticipated crop.
- Potential use for irrigation management to conserve water.
- Effect of construction on aquatic life as well as other wildlife, such as wading birds and shore birds.
- 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.

- Effects on the movement of dissolved substances below the root zone and to ground water.

- Effects of field water table on salt content in the root zone.

- Short term and construction-related effects of this practice on the quality of downstream water.

- Effects of water level control on the temperatures of downstream waters and their effects on aquatic and wildlife communities.

- Effects on wetlands or water-related wildlife habitats.

- Effects on the turbidity of downstream water resources.

- Conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

**PLANS AND SPECIFICATIONS**

Prepare plans and specifications that for installing structures for water control shall be in keeping with this standard and shall describe the requirements for applying the practice according to this standard. As a minimum, include—, but not limited to, the following:

- A plan view of the layout and location of the structure for water control.

- Ingress and egress routes.

- Typical profiles and cross sections including grades, elevations, and dimensions of the structure for water control.

- Type and quality of materials.

- Structural drawing details adequate to describe the construction requirements.

- Details for seepage control.

- Type of earthfill material and compaction requirements for construction.

- Location of earthfill borrow areas

- Staging areas for materials and equipment.

- Allowance for settlement.

- Requirements for vegetative establishment and mulching, as needed.

- Safety features.

- Site-specific construction and material requirements.

- Location of utilities and notification requirements.

**OPERATION AND MAINTENANCE**

Operation and maintenance (O&M) shall be in accordance with the requirements of this standard and in keeping in conformance with all local, state, and federal laws and regulations. Structures for water control must be adequately maintained if their purposes are to be realized through the expected life. Special considerations shall be given for maintenance needs during the planning, design, and construction of the structure.

A written O&M plan shall be provided to and reviewed with the landowner.

The O&M plan shall include, but not limited to, the following items:

- Inspect the water control structure periodically to ensure that the structure functions as planned.
• Periodic inspections of all structures, earthen embankments, spillways, and other significant appurtenances.

• For structures with flashboards, include instructions for setting the flashboard elevations or removing the flashboards to accomplish the purpose(s) of the structure.

• Inspect vegetation on all earthfills regularly. Mowing shall occur when vegetative growth becomes excessive. Replace damaged vegetation or reseed bare areas as needed in accordance with Florida NRCS CPS Critical Area Planting, Code 342.

• Prompt removal of sediment when it reaches predetermined storage elevations.

• Periodic removal of trees, brush, and undesirable species.

• Prompt repair or replacement of damaged components.

• Prompt removal of trash from pipe inlets and trash racks.

• Inspect structures after major rainfall events to check for erosion. Any erosion found will be repaired immediately.

• Inspect structures for deterioration and capacity. Any blockage of trash and debris that could affect flows through the structure shall be removed. Materials that have deteriorated, including rock used for outlet protection shall be replaced.

• Periodic inspection of safety components and immediate repair if necessary.

REFERENCES

AASHTO M 252 and M 294
ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.
ASTM D 3350
Florida Administrative Code Chapters 40-2, 40-4, 40-20, 40-40, 40-41, 40-42, 40-44
Florida NRCS Conservation Practice Standards:
  Critical Area Planting, Code 342
  Grade Stabilization Structure, Code 410
  Mulching, Code 484
  Pond, Code 378
General Manual
  Title 420-Part 401
  Title 450-Part 401
  Title 190-Parts 410.22 and 410.26
National Cultural Resources Handbook
National Engineering Manual,
  Part 503
National Environmental Compliance Handbook
National Food Security Act Manual
National Planning Procedures Handbook
  Florida Supplements to Parts 600.1 and 600.6
NEH, Part 650, Engineering Field Handbook, Part 650
  Chapter 6, Structures
  Chapter 14, Drainage
  Chapter 15, Irrigation
National Engineering Handbook
  Part 623, Irrigation
  Part 624, Drainage
  Part 642, Specifications for Construction Contracting, Structure Concrete