NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

FLOODWATER DIVERSION

(ft)
CODE 400

DEFINITION

A graded channel with a supporting embankment or dike on the lower side constructed on lowland subject to flood damage.

SCOPE

This standard applies to the construction of a channel and embankment to divert floodwater. It does not apply to Diversions (362) or Floodways (404).

PURPOSE

To divert floodwater from lowlands by the construction of a graded channel on the lowlands.

CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable if:

1. Floodwater originating outside the lowland area to be protected is causing damage to agricultural land, crops, or improvements or is expected to cause damage to improvements to be made in the area.

2. An adequate outlet for the design flow is available, either by gravity flow or by pumping. The outlet shall be suitable for the quality and quantity of water and sediment to be disposed of, with consideration of possible damages above or below the point of discharge that might involve legal actions under state law. The outlet can be a Floodway (404) or a natural channel, river, lake, bay, or tidal estuary.

3. Land to be protected is suitable for agriculture within its capabilities after installation of required conservation practices.

DESIGN CRITERIA

Location. The floodwater diversion shall be located to protect the maximum area of lowland, consistent with economic limitations, topographic requirements, and the desired slope of the hydraulic gradeline.

In selecting the location for floodwater diversions, consideration shall be given to the preservation of existing fish and wildlife habitat, trees of significant value for wildlife food, dens or shelter, and existing visual resources.

Capacity. Floodwater diversions that are to protect agricultural land shall have the capacity to carry the peak runoff to be expected from a 10-year frequency storm. If farmsteads, public roads, or other improvements are within the area to be protected, the design capacity shall be consistent with the hazard involved but shall not be less than the peak flow from a 25-year frequency storm.

Hydraulic gradeline. The hydraulic gradeline of the floodwater diversion shall tie in to the elevation of water in the outlet expected for the frequency storm selected for design, and shall be established with due regard for damages that may occur on the opposite side of the floodwater diversion from the supporting embankment. It shall have a slope in the

direction of flow that will result in a velocity that will not cause excessive erosion or sedimentation.

Cross section. The design cross section shall be set below the design hydraulic gradeline and shall include the total cross-sectional area bounded by the embankment, the berm between embankment and channel, the channel, and the flow area on the opposite side of the channel from the embankment.

Velocity. If site conditions indicate that erosion is likely to be a hazard because of a higher velocity resulting from a lower roughness coefficient immediately after construction and before establishment of vegetation, such lower value of roughness coefficient shall be estimated. The resultant velocities shall be considered in designing the channel and planning protective measures. The criteria for Open Channels (582) regarding channel stability, velocity, and roughness coefficient shall be followed.

The maximum permissible design velocity shall be based on site conditions and determined by procedures described in TR-25, Planning and Design of Open Channels. A desirable minimum velocity is 1.5 ft/s. On flat grades where the design velocity is below this value, the cross section shall be adjusted to obtain the most efficient section that depth and maintenance methods permit.

Berm and embankment. The minimum berm width between channel and embankment shall be based on the depth of the channel.

Depth of channel	Minimum berm
ft	*ft*
2 - 4	4
4 - 6	6
6 - 8	10
More than 8	15

Wider berms than indicated should be used if site conditions permit.

The embankment may be constructed from the channel excavation or from suitable borrow.

The design height of the embankment shall be the design water depth plus a freeboard of at least 2 ft. The constructed height shall be the design height plus an allowance for settlement based on consideration of soil material and the anticipated compaction during construction, but such allowance shall be no less than 5 percent of the design height.

The minimum requirements for the cross section of the embankment where fill is compacted by hauling or special equipment shall be:

Design water height	Minimum top width	Steepest side slope
ft	*ft*	*ft*
0-6	6	1.5:1
6-12	8	2:1

If because of soils or water conditions it is impractical to compact the embankment with hauling or special equipment, dumped fill may be used. Dumped fill shall have minimum cross section dimensions incorporated within the fill as follows:

Design water height	Minimum top width	Steepest side slope
ft	*ft*	*ft*
0-6	10	2:1
6-12	14	2.5:1

Side slopes of 3:1 on waterside and 2:1 on landside may be used instead of 2.5:1 for both slopes.

Vegetative cover. If needed, an adequate cover of grasses shall be established on the embankment to protect it against erosion by flood flows, wave action, or rainfall and runoff. Seedbed preparation, seeding, sprigging or sodding, fertilizer, mulching, and fencing shall comply with recommendations in applicable technical guides.

Maintenance access. Maintenance access shall be provided as specified in the standard for Open Channels (582).

PLANS AND SPECIFICATIONS

Plans and specifications for constructing floodwater diversions shall be in keeping with this standard and shall describe the

requirements for construction to achieve the intended purpose.

FLOODWATER DIVERSION SPECIFICATIONS

SITE PREPARATION

The entire width of the site for the floodwater diversion, including channel, berm, and embankment, shall be cleared of stumps, roots, brush, and debris and selectively cleared of trees and boulders. All channel banks and sharp breaks shall be sloped no steeper than 1:1 unless such sloping would likely result in changing a stable slope into an unstable slope. Topsoil high in organic matter shall be removed. The ground surface where the embankment is to be placed shall be thoroughly scarified before placement of the embankment material.

EXCAVATION AND CONSTRUCTION OF EMBANKMENT

Excavation of the channel and placement of spoil in the embankment shall progress simultaneously from the outlet in an upstream direction. The channel shall be excavated to the lines and grades shown in the plans and as staked in the field, and the embankment shall be built to the dimensions specified in the plans and as staked in the field. If the excavation and fill required do not balance, the responsible technician shall specify the areas where borrow is to be obtained for fill or the place and manner of disposition of excess excavated material.

Construction operations shall be carried out in such a manner that erosion and air and water pollution are minimized and held within legal limits.

Vegetation shall be established as specified in the plans.

Planning considerations for quantity and quality

Quantity

1. Effect on the water budget, especially on volumes and rates of runoff, evaporation, infiltration, deep percolation, and ground water recharge.

2. Effects of changes in plant growth and transpiration because of changes in the amount of soil water in the vicinity of the structure.

3. Effects of eliminating filling of depressions and potholes on the flood plain.

Quality

1. Effects of the movement of sediment and soluble and sediment-attached substances or other toxics carried by runoff.

2. Effects of erosion, including the downstream stability of streambanks and streambeds.

3. Effects of changes in ground water contamination by soluble substances because of decreases in infiltrating floodwater.

4. Effects on the visual quality of downstream water resources.