

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

IRRIGATION WATER CONVEYANCE

GALVANIZED STEEL DITCH AND CANAL LINING

(feet)
CODE 428C

DEFINITION

A fixed lining of impervious material installed in an existing or newly constructed irrigation field ditch or irrigation canal or lateral.

Scope

This standard applies to linings made of galvanized steel installed in a preformed ditch or canal section.

Linings to which this standard apply are restricted to ditches having characteristics as follows:

Bottom width.....Not to exceed 30 in.
Velocity.....Not to exceed 15 ft/s

This standard applies to both the ditch and the steel lining.

PURPOSES

To prevent waterlogging of land, to maintain water quality, to prevent erosion, and to reduce water losses.

CONDITIONS WHERE PRACTICE APPLIES

Ditches and canals to be lined shall serve as integral parts of an irrigation water distribution or conveyance system designed to facilitate the conservation use of soil and water resources on a farm or group of farms.

Water supplies and irrigation deliveries for the area served shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application methods to be used.

Lined ditches and canals shall either be located where they will not be susceptible to damage from side drainage flooding or be protected from such damage.

Steel linings shall not be installed in areas high in salt or other chemical concentrations injurious to

galvanized steel unless the liners are protected with coatings or anodic protection specifically designed to protect the liner from these chemicals.

CRITERIA

Capacity

A lined ditch or canal shall have enough capacity to meet its requirement as part of the planned irrigation water distribution or conveyance system without danger of overtopping. Design capacity shall be based upon the following, whichever is greater.

1. The capacity shall be adequate to deliver the volume of water required to meet the peak consumptive use of the crops.
2. The capacity shall be large enough to provide an adequate irrigation stream for all methods of irrigation planned.

For design purposes, the carrying capacity of steel-lined ditches and canals shall be considered to be equal to the capacity as computed by Manning's Formula, using a coefficient of roughness n of not less than 0.013.

Velocity

A design velocity in excess of 1.7 times the critical velocity shall be restricted to straight reaches that discharge into a section or structure designed to reduce the velocity to less than the critical velocity. The maximum velocity in these straight reaches shall be 15 ft/s.

Freeboard

The required freeboard varies with the size of the ditch or canal, the velocity of the water, the horizontal and vertical alignment, the amount of storm or waste water that may be intercepted, and the change in the water

surface elevation that may occur when any control structure is operating. The minimum freeboard for any lined ditch or canal shall be 3 in.

If the velocity is within \pm 30 percent of critical, the freeboard shall be at least 6 in. The minimum freeboard requirement is based on the assumption that the finished channel bottom elevations will vary no more than 0.1 ft. from the design elevations. Construction deviations greater than 0.2 ft. shall not be permitted. If a construction deviation greater than 0.1 ft is permitted, the minimum freeboard shall be increased an additional 3 in.

Additional freeboard shall be provided as required by slope, velocity, depth of flow, alignment, obstructions, curves, and other site conditions.

Water surface elevations

All lined ditches and canals shall be designed so that the water surface elevations at field takeout points are high enough to provide the required flow onto the field surface. If ditch checks or other control structures are to provide the necessary head, the backwater effect must be considered in computing freeboard requirements. The required elevation of the water surface above the field surface varies according to the type of takeout or device used and the amount of water to be delivered. A minimum head of 4 in. shall be provided.

Ditch or canal pad or foundation

Ditch and canal banks shall be built up with earth to a height sufficient to support the full height of the lining and to provide an anchorage for the top edge of the lining. In cut sections, other than in rock, a berm shall be constructed not less than 2 in. above the top of the lining.

Berms and ditch banks shall be wide enough to prevent excessive deposition in cut sections to insure support of the lining in fill sections. The minimum width shall be 1 ft. If the bank or berm is to be used as a roadway, the minimum top width shall be adequate for the purpose.

Outside bank slopes and slopes above the berm elevation in cut sections must be flat enough to insure stability.

Related structures

Plans for ditch or canal lining installations shall provide for adequate inlets, outlets, turnouts, checks,

crossings, and other related structures needed for successful conservation irrigation.

Structures shall be constructed or installed in such a way that the capacity or the freeboard of the ditch is not reduced and the effectiveness of the lining is not impaired.

All structures shall meet NRCS standards and specifications for the type of structure used.

Bulkheads, formed to fit the lining and of sufficient size to extend at least 12 in. into the earthen ditch pad for the entire width of the ditch lining, shall be installed at the beginning and end of the lining section and at intervening points, as needed, to provide adequate anchorage.

Materials

Galvanized lining material shall meet the requirements detailed for materials in the specifications 428C Material Specifications.

CONSIDERATIONS

Water Quantity

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, and deep percolation and ground water recharge.
2. Effects on downstream flows or aquifers that would affect other water uses or users.
3. Potential use for irrigation management.
4. Potential changes in growth and transpiration of vegetation located next to the conveyance because of the elimination of leakage from the system.

Water Quality

1. Effects of installing the lining on the erosion of the earth conveyance and the movement of sediment and soluble and sediment-attached substances carried by water.
2. Effects on the movement of dissolved substances to ground water.
3. Effects on wetlands or water-related wildlife habitats.

4. Effects on the visual quality of water resources.

Endangered Species Considerations

Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

PLANS AND SPECIFICATIONS

Plans and specifications for installing galvanized steel irrigation ditches and canal linings shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes

OPERATION AND MAINTENANCE

An operation and maintenance plan must be prepared by the Designer for use by the owner or other responsible for operating this practice. The plan should provide specific instructions for operating and maintaining the system to insure that it functions properly. It should also provide for periodic inspections and prompt repair or replacement of damage components.