

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD  
SOUTH DAKOTA SUPPLEMENTS ITALICIZED**

**IRRIGATION LAND LEVELING**

(ac.)  
CODE 464

**DEFINITION**

Reshaping the surface of land to be irrigated to planned grades.

**PURPOSE**

To permit uniform and efficient application of irrigation water without causing erosion, loss of water quality, or damage to land by waterlogging and at the same time to provide for adequate surface drainage.

This standard applies to the design criteria and construction requirements for leveling irrigated land on the basis of detailed engineering survey and layout. It does not include Precision Land Forming (462) or Land Smoothing (466).

**CONDITIONS WHERE PRACTICE APPLIES**

All land to be leveled shall be suitable for irrigation and for the proposed methods of water application.

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

Soils shall be deep enough so that after leveling work is done an adequate, usable root zone remains that will permit satisfactory crop production with proper conservation measures. Limited areas of shallower soils may be leveled to provide adequate irrigation grades or a better field arrangement. The finished leveling work must not result in exposed areas of highly permeable materials that can inhibit proper distribution of water over the field.

All leveling work shall be planned as an integral part of an overall farm irrigation system to facilitate the conservation use of soil and water resources. The

boundaries, elevations, and direction of irrigation of individual field leveling jobs shall be such that the requirements of all adjacent areas in the farm unit can be met.

**CRITERIA**

*The design shall be based upon a survey which adequately represents the ground-surface elevation.*

**Field grades.** If more than one method of water application or more than one kind of crop is planned, the land must be leveled to meet the requirements of the most restrictive method and crop.

All leveling work must be designed within the slope limits required for the methods of water application to be used, to provide for the removal of excess surface water, and to control erosion caused by rainfall.

Reverse grades in the direction of irrigation shall not be permitted.

**Slope to control erosion caused by rainfall.** Design field grades shall be such that erosion caused by rainfall can be controlled within the limits permissible for conservation farming.

**Slope for level irrigation methods.** The maximum fall in the length of run shall not exceed one-half the design depth of application for a normal irrigation.

The difference in elevation across an individual border strip shall not exceed 0.10 ft. (0.03 m).

**Slope for graded irrigation methods.** The maximum slope in the direction of irrigation shall be as follows:

1. Furrows — 2.0 percent,
2. Corrugations — 3.5 percent,

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3. Borders for nonsod-forming crops, such as alfalfa or grain — 2.0 percent,
4. Borders for erosion-resistant grass or grass-legume crops or for nonsod-forming crops on sites where water application by the border method will not be required until after good crop stands have been established — 4.0 percent.

Slopes may be uniform in the direction of irrigation or may increase or decrease. On slopes of more than 0.5 percent where leveling designs provide for increasing or decreasing slopes, the maximum grade in an irrigation run shall be no more than twice the minimum. Short, level sections are permissible at the upper or lower ends of irrigation runs to facilitate water control or to reduce runoff.

The maximum cross slope for borders shall be 0.1 ft. (0.03 m) per border strip width. The allowable cross slope for furrows and corrugations depends on the stability of the soil, the size of furrows that are to be used, and the rainfall pattern in the area. Cross slopes must be such that “breakthroughs” from both irrigation water and runoff from rainfall are held to a minimum.

**Slope for subsurface irrigation methods.** In areas where irrigation is practiced through ground-water level control, it may be desirable to grade the surface to a plain having no slope.

**Surface drainage.** Farm irrigation systems shall include plans for removing or otherwise providing for control of excess irrigation and storm water. Leveling designs must provide field elevations and field grades that will permit proper functioning of the planned drainage facilities.

**Maximum field elevation.** All leveling work shall be designed so that the highest point in the field is far enough below the elevation of the water source to permit delivery of needed irrigating streams onto the field surface. The field elevation shall be at least 4 in. (101 mm) below the water surface elevation at the point of delivery.

**Borrow computations.** Excavation and fill material required for or obtained from such structures as ditches, ditch pads, and roadways shall be considered part of the overall leveling design, and the appropriate yardage shall be included when balancing cuts and fills and determining borrow requirements.

*The volume of cuts generally should exceed the volume of fills by 30 to 100 percent. The*

*percentage of shrink must be determined locally for each field. Some of the variables are: depth of cuts and fills, soil texture, soil moisture content, and type of earth moving equipment used.*

## CONSIDERATIONS

### **Water Quantity**

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration evaporation, transpiration, and deep percolation.
2. Potential for a change in plant growth and transpiration because of changes in the volume of soil water.
3. Potential to manage irrigation water through root zone management.

### **Water Quality**

1. Effects on erosion and the movement of sediment and soluble and sediment-attached substances carried by runoff.
2. Effects of nutrients and pesticides on surface and ground water quality.
3. Effects on the movement of dissolved substances below the root zone or to ground water.
4. Effects of water level control on the salinity of soils, soil water or downstream water.
5. Short-term and construction-related effects on the quality of downstream water courses.
6. Potential of uncovering or redistributing such toxic material as saline soil.
7. Effects on the visual quality of downstream water.

### **Laws and Regulations**

*This practice must conform to all federal, state, and local laws and regulations. Laws and regulations of particular concern include those involving water rights, land use, pollution control, property easements, wetlands, preservation of cultural resources and endangered species.*

## PLANS AND SPECIFICATIONS

Plans and specifications for irrigation land leveling shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.

*The following items must be included in the specifications for this practice:*

**Site preparation**

The land to be leveled shall be cleared of brush, crop residue, trash, and vegetative material that can materially reduce the effectiveness of leveling operations.

**Borrow location**

Soil for leveling operations shall be obtained from the designated cut areas in the field or from other designated borrow areas as specified in the plan.

**Leveling operations**

The land shall be leveled to the designed grade or grades. Fills of more than six in. (152 mm) shall be constructed by placing the soil in successive layers. Leveling operations shall not be performed if the ground is frozen or if soil moisture conditions will excessively damage soil structure, which could result in poor crop growth or detrimental settlement.

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

After cuts and fills are completed, the land shall be smoothed to remove minor irregularities.

**Finished grade**

All leveling work shall be finished according to the design and to the tolerances specified. The completed job shall be workmanlike and present a good appearance.

***OPERATION AND MAINTENANCE***

*A plan of operation and maintenance shall be prepared for use by the owner or others responsible for the system to insure that each component functions properly.*