Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

IRRIGATION LAND LEVELING

Code 464

(Ac)

DEFINITION

Reshaping the surface of land to be irrigated, to planned lines and grades.

PURPOSE

To facilitate the efficient use of water on irrigated land.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to the leveling of land irrigated by surface or subsurface irrigation systems. The leveling is based on a detailed engineering survey, design, and layout. This standard does not apply to Conservation Practice Standards (CPS) Precision Land Forming (Code 462) or Land Smoothing (Code 466).

CRITERIA

Before land is leveled ensure it will be suitable for irrigation and for the proposed methods of water application. Also ensure that soils will be deep enough that, after leveling, an adequate usable root zone remains that will permit satisfactory crop production with proper conservation measures. Limited areas of shallow soils may be leveled to provide adequate irrigation grades or an improved field alignment. The finished leveling work must not result in exposed areas of highly permeable soil materials that would inhibit proper distribution of water over the field.

Plan all land leveling work as an integral part of an overall farm irrigation system to enhance the conservation of soil and water resources. Also plan the boundaries, elevations, and direction of irrigation of individual fields so that the requirements of all adjacent areas in the farm unit can be met.

Design

Design grades, slopes, and field configurations will be determined using local irrigation guides; CPS Surface Irrigation (Code 443); NRCS National Engineering Handbook (NEH) Part 623, Chapter 4, “Surface Irrigation;” and Section 15, Irrigation, Chapter 12, “Land Leveling.”

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 will not be permitted.

Slope for Level Irrigation Methods

The maximum fall in the direction of irrigation will not exceed one-half the design depth of application for a normal irrigation. The difference in elevation across an individual basin or border strip will not exceed 0.1 foot.

Slope for Graded Irrigation Methods

The maximum slope in the direction of irrigation, if rainfall erosion is not a significant problem, will be—

- Furrows - 3 percent.
- Corrugations - 8 percent.
- Borders for non-sod forming crops, such as alfalfa or grain - 2 percent.
- 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 percent.

In areas that contain soils that are classified as erosive, the maximum slope will be—

- Furrows - 0.5 percent.
- Borders with sod-forming grasses, 2 percent.
- Other crops - 0.5 percent.

Apply the following limits on slopes in the direction of irrigation of more than 0.5 percent, and where leveling designs provide for increasing or decreasing slopes:

- The change in slope in any 100-foot reach will not exceed one-half the maximum permissible change along the length of run. However, short-level sections are permissible at the upper or lower ends of irrigation runs to facilitate water control or to reduce runoff.
- The maximum permissible slope change is the difference between the flattest and steepest design slope along the length of run.

Cross Slope

The maximum cross slope for basin or borders will be 0.1 foot 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 subsurface irrigation is practiced through groundwater level control, shape the field surface to parallel the expected subsurface water elevations. Base the design on the desired depth from the soil surface to the elevation of the groundwater.

Surface Drainage

Include provisions for removing or otherwise controlling excess irrigation and storm water in farm irrigation systems. Provide field elevations and field grade for leveling designs that will permit proper functioning of the planned surface drainage system facilities.

Maximum Field Elevation

All leveling work will be designed to permit the delivery of required irrigation flows to the highest point on the field surface. Field elevations will be at least 0.33 foot below the water surface elevation at the point of delivery.

CONSIDERATIONS

Consider the excavation and fill material required for or obtained from such structures as ditches, ditch pads, and roadways. The appropriate yardage will be included when balancing cuts and fills, and determining borrow requirements.

Consider related structures and measures needed to control irrigation water and/or storm water runoff.

Consider crops, method of irrigation, soil-intake rates, field slope, irrigation stream size and resulting deep percolation and runoff when determining or evaluating length of irrigation runs.

Consider the depth of cuts and the resulting available plant rooting depths to saline soils and to shallow water tables.

In areas with sediment-laden irrigation water, consider increasing the required height of the water surface at the point of delivery.

Consider effects on water flows and aquifers, and the effect to other water uses and users.

Consider the effects on adjacent wetlands.

PLANS AND SPECIFICATIONS

Develop site specific plans and specifications for irrigation land leveling and show the requirements for installing the practice to achieve its intended purpose.

As a minimum the plans and specifications will include, but not limited to—

- Field boundaries.
- Planned cuts and fills.
- Earthwork volumes.
- Cut/fill ratio.
- Direction of irrigation.
- Design run slope and cross slope.
- Required water surface and location of irrigation water delivery.
- Tailwater return/disposal.
- Appurtenant structures.
- Location of utilities, State and local notification requirements.

OPERATION AND MAINTENANCE

Develop a site-specific operation and maintenance (O&M) plan for use by the landowner or operator responsible for the irrigation land-leveling practice. Ensure the O&M plan documents the required actions to ensure the practice performs adequately throughout its expected life.

Ensure O&M requirements are included as an identifiable part of the design. Depending on the scope of the project, this may be accomplished in a brief statement in the plans and specifications or a separate O&M plan.

The O&M plan will include, but not limited to—

- Checking grades after major storm event.
- Periodically removing or grading mounds and depressions.
- Periodically land grading to restore the design gradient.