

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

IRRIGATION LAND LEVELING

(acre)  
Code 464



**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 include Florida NRCS conservation practice standards Precision Land Forming, Code 462 or Land Smoothing, Code 466. Procedures for design and layout of irrigation land leveling are contained in National engineering Handbook (NEH), Part 623, Irrigation, Chapter 12.

**CRITERIA**

Planned work shall comply with all federal, state, and local laws, rules, and regulations.

Impact to cultural resources, wetlands and Federal and state protected species shall be

evaluated and avoided or minimized 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).

Level the land so that it is suitable for irrigation and for the proposed methods of water application. Soils shall be of sufficient depth so that after leveling, an adequate, usable root zone remains that will permit satisfactory crop production with proper conservation measures. Limit leveling areas of shallower soils 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 leveling work as an integral part of an overall farm irrigation system to enhance the conservation of soil and water resources. The boundaries, elevations, and direction of irrigation of individual fields shall be such that the requirements of all adjacent areas in the farm unit can be met.

**Field grades.** If more than one method of water application or more than one kind of crop is planned, level the land to meet the requirements of the most restrictive method and crop. Design all leveling work 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.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Do not permit reverse grades in the direction of irrigation.

**Surface drainage.** Include provisions for removing or otherwise controlling excess irrigation and storm water. Provide field elevations and field grades in the leveling designs that will permit proper operation of the planned surface drainage facilities.

**Maximum field elevation.** Design all leveling work to permit delivery of required irrigation water to the highest point on the irrigated field surface. For gravity fed irrigation systems, the field elevations shall be at least 0.33 feet below the irrigation water surface elevation at the point of delivery into the field.

**Slope for level irrigation methods.** The maximum fall in the direction of irrigation shall not exceed one-half the design depth of application for normal irrigation. The difference in elevation across an individual border strip shall not exceed 0.1 feet.

**Slope.** If rainfall erosion is not a significant problem, the maximum slope in the direction of irrigation shall be as follows:

1. Furrows - 3 percent
2. Corrugations - 8 percent
3. Borders for non-sod forming crops, such as alfalfa or grain - 2 percent
4. Borders for erosion-resistant grass or grass-legume crops or for non-sod 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 where potential for rainfall erosion is great, the maximum slope for furrows is 0.5 percent, the maximum slope for sod forming grass borders is 2 percent, and the maximum slope for borders made up of all other crops is 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:

1. The change in slope in any reach of 100 feet shall not exceed one-half the maximum permissible change along the length of run. In these circumstances, short, level sections

are permissible at the upper or lower ends of irrigation runs, to facilitate water control or to reduce runoff.

2. 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 borders shall be 0.10 foot per foot of 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, shape the field surface to parallel the expected subsurface water (water table) elevations. The design shall consider the desired depth from the soil surface to the elevation of the water table.

The permissible slope ranges in the direction of irrigation shall be 0.00 to 0.0050 foot per foot. The cross slope shall range from 0.00 to 0.0050 foot per foot except that cross slopes of up to 0.01 foot per foot may be allowed where the size of furrows is such that break throughs from rainfall runoff are held to a minimum.

## CONSIDERATIONS

Consider the excavation and/or fill material required, or obtained from constructing structures such as ditches and/or roadways, in the design. Determine the appropriate soil volume and include the quantity in the design, when cuts, fills, and/or borrow material are being proposed under this practice.

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/or 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 irrigation efficiencies, especially on volumes and rates of runoff, infiltration, evapotranspiration, and deep percolation.

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

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.

As a minimum, the plans and specifications will include, but not limited to, the following items:

- Location of field drainage system and/or irrigation water distribution system with plotted survey data, including any water control structures,
- Field boundaries,
- Planned cuts and fills,
- Grades for each subunit or segment,
- Earthwork volumes and cut/fill ratio,
- Direction of irrigation,
- Design down slope and cross slope,
- Required water surface and location of irrigation water delivery and tailwater disposal, and;
- Appurtenant structures
- Location of utilities and notification requirements.

### OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for use by the landowner or operator responsible for the land leveling practice. The O&M plan shall document needed actions to ensure the practice performs adequately throughout its expected life.

O&M requirements shall be included as an identifiable part of the design. Depending on the scope of the project, this may be accomplished by brief statements in the plans and specifications, the conservation plan narrative, or as a separate O&M plan.

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

- Check grades after every major storm event.
- Periodically remove or grade mounds and/or depressions.
- Periodically land grade to restore the design gradient.

### REFERENCES

Florida NRCS Conservation Practice Standards  
Land Smoothing, Code 462  
Precision Land Forming, Code 466  
General Manual  
Title 420-Part 401  
Title 450-Part 401  
Title 190-Parts 410.22 and 410.26  
National Cultural Resources Handbook  
National Engineering Field Handbook, Part 623,  
Irrigation, Chapter 12  
National Engineering Field Handbook, part 650,  
Chapter 5  
National Engineering Manual, Parts 541 and 542  
National Environmental Compliance Handbook  
National Food Security Act Manual  
National Planning Procedures Handbook  
Florida Supplements to Parts 600.1 and  
600.6