

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**IRRIGATION LAND LEVELING**

(Ac.)

**CODE 464**

**Definition**

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

**Scope**

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).

**Purpose**

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

**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 of such that the requirements of all adjacent areas in the farm unit can be met.

**Design criteria**

**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 0.1-ft (0.03 m).

**Slope for graded irrigation methods.** The maximum slope in the direction of irrigation if rainfall erosion is not a significant problem shall be as follows:

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

In humid areas where potential for rainfall erosion is great, the maximum slope for furrows shall be 0.5 percent and 2 percent for borders for sod forming grasses and 0.5 percent for other crops.

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-foot (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 provide 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.

### **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.

### **Specifications**

#### **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 6 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 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.

#### Design Criteria

The National Engineering Handbook, Section 15, Chapter 12, and the Louisiana Irrigation Handbook contain tables, charts and other information of value in design.

#### Bench Leveling

Benches shall be parallel and point rows taken

up in point benches. The difference in elevation across an individual border shall not exceed 0.1 foot. The design grade along the length of the bench shall not exceed 0.5 percent, except the grade for erosive soils shall not exceed 0.3 percent.

Border levees shall be full bodied, have a minimum settled height of 0.8 foot, and a base width sufficient to maintain this height.

The width of benches shall be determined by soil conditions, characteristics of topography, water supply and farming equipment.

#### Field Leveling

Slopes may be uniform in the direction of irrigation, or may increase or decrease. Short level sections are permissible at the lower or upper ends of irrigation runs to facilitate water control, reduce runoff, or meet field requirements.

The maximum design grade in the direction of irrigation should not exceed 0.5 foot per 100 feet. Whenever natural grades steeper than 0.5 foot per 100 feet are encountered and reducing the natural slope would create a potential erosion hazard, grades steeper than 0.5 foot per 100 feet may be utilized. (Example – Excessive “benching” between graded cuts that could cause gully erosion if drainage field ditches are not properly maintained). A range of 0.1 to 0.3 foot per 100 feet is usually best. Design grades above 0.3 foot per 100 feet shall be used only on erosion resistant soils except under conditions mentioned above.

The maximum design cross grade shall be 0.5 percent.

The allowable cross slope for furrow irrigation depends largely upon the type and stability of the soil, the size of furrows that are expected to be used, and the planned row lengths. Cross slopes must be such that “break-through” from either irrigation water or from rainfall are held to a minimum.

#### Maximum Field Elevation

All leveling work shall be designed so 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 maximum field elevation shall be 0.4 foot below the water surface elevation at the point of delivery.

#### Requirements for Surface Drainage

Farm irrigation systems shall include plans for removing excess irrigation and rainfall water from the field. Land leveling designs must provide field elevations and field grades that will permit proper functioning of the planned drainage facilities. All planned drainage ditches which affect the field to be leveled shall be installed during or before the leveling operations.

#### Specification

See Engineering Specification, Irrigation Land Leveling.

#### WATER LEVELING IRRIGATED RICELAND

##### Definition

Reshaping the land surface of each area between border levees to a level or nearly level grade. Water leveling is accomplished by plowing or disking the land, flooding the area to be leveled, and moving the earth material while it is in a semi liquid or saturated state.

##### Purpose

The purpose of water leveling Riceland is to permit more efficient use of irrigation water and mechanized farming equipment, and to prevent excessive erosion, loss of water quality, or damage to land by water logging.

##### Condition Where Practice Applies

All lands to be leveled shall be suitable for use as irrigated Riceland as given in Field Office Technical Guides, and shall be suitable for the water leveling method.

Water supplies and irrigation deliveries to the area shall be sufficient to make rice irrigation practical.

Soils shall be deep enough so that after the leveling work is done and adequate usable root zone remains which will permit satisfactory crop production.

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

##### Design Criteria

##### Vertical Interval

The vertical interval for levees may vary in a field and shall be selected to (1) reduce the number of levees required on sloping land, (2)

establish areas between levees or adequate size to permit efficient use of mechanized farming equipment, and (3) permit earth-moving operations which can be accomplished in an economical and efficient manner.

For the normal field topography and slopes encountered on irrigated land, the maximum vertical interval between levees shall be 1 foot. However, for unusual conditions a greater vertical interval may be used if adequate erosion control structures are installed to handle irrigation flow and excess rainfall.

#### Levee Alignment

On sloping lands, levees shall be located to have curves with smooth alignment, or shall be straight.

On flat lands, levees shall be straight when topography permits. If curved levees must be used, curves shall have smooth alignment.

#### Spacing

When rice is to be water planted, damage to levees from wave erosion can be expected where distances between levees exceed 400 feet in the prevailing wind direction. However, longer distances may be used when the farmer has been informed of the erosion hazard.

#### Maximum Field Elevation

All leveling work shall be designed so the highest point in the field is far enough below the elevation of the water source to permit delivery of the needed irrigation stream onto the field surface. The highest field elevation after leveling shall be at least 0.4 foot below the water surface elevation in the irrigation canal at the point of delivery.

#### Requirements for Surface Drainage

Provisions shall be made to remove excess irrigation water or rainfall in time to prevent damage to crops.

#### Specification

See Engineering Specification Water Leveling Irrigated Riceland.

### SPECIFICATION

#### WATER LEVELING IRRIGATED RICELAND

#### Design

All water leveling shall be planned in accordance with the Service Standard for

Water Leveling Irrigated Riceland.

#### General Requirements

The suitability of the soils for leveling shall be determined on the basis of a soil survey or shall be determined by the technician. Cuts should not ordinarily exceed one-half of the planned vertical interval.

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

#### Specifications

- A. Levees shall be located to provide areas of adequate size for the use of mechanized farming equipment.
- B. Levees shall be straight, or shall have curves of smooth alignment.
- C. The maximum difference in elevation between the upper and lower boundaries of each leveled area shall be 0.2 foot.
- D. After leveling, low and high areas shall not be more than 0.1 foot above or below the adjacent land surface.

#### Construction

The following operations sequence is recommended:

- A. All land to be leveled shall be cleared of crop residue, trash, and vegetative material.
- B. All old levees shall be removed (plowed down or leveled).
- C. Permanent levees shall be established.
- D. Disc or plow area as needed.
- E. Flood each area to be leveled until only the clods on the high areas protrude.
- F. Move earth material from the high into the low areas until the entire area is approximately level.
- G. After a majority of the suspended soil has settled, the water shall be drained off, and the field allowed to dry.

NOTE: It may take several water leveling operations to get a satisfactory job.

On some soils such as Sharkey clay, it is not feasible to work the leveling equipment under

water. In such cases, the field can be leveled "in the dry" and checked "in the dry" to determine that specifications have been met. This applies only to fields to be planted to rice, a soybean-rice rotation, or a grass-rice rotation. In the event this method is used, items E and G above are eliminated. In addition, the leveled land surface must be floated with a land plane as needed to eliminate minor high and low areas. Where this method is used, specifications for water leveling must be met.

#### Drainage

Adequate surface drainage shall be provided.

#### Checking for Completion

This practice shall be checked for completion in accordance with procedures given in "Notekeeping – Water Leveling Irrigated Riceland."

### NOTEKEEPING

#### Design Survey and Design

Make a complete topographic survey by the grid method. Determine planned elevation and grades, cuts and fills, and yardage to be removed.

Follow procedures given in the National Engineering Handbook, Section 15, Chapter 12; or the Louisiana Irrigation Handbook.

Prepare cut sheet, which shows the planned cuts and fills, and give to farmer or contractor for his use in marking stakes, and for use during the earth moving process. Ordinarily, service personnel should not mark cuts and fills on grade stakes due to the excessive time required.

#### Construction Check

For fields which have been leveled with operator-guided equipment, as a minimum, check the leveling for completion by taking profile rod readings, adjacent to the original stakes, on each fifth row of stakes in a field. Fields which have been leveled with laser-guided equipment shall be checked by taking a

minimum of 5 rod readings per 20 acre plot. Rod readings shall be taken adjacent to stakes in the field in order to determine the finished plane of the field. The checker shall also determine by Visual observation and /or rod readings that a satisfactory job has been accomplished in the vicinity of the intersection of the diagonals.

Permissible variation of the finished grade from the planned grade shall be 0.10 foot, plus or minus. The elevation at the upper and lower ends of the field may exceed the permissible variation of 0.1 foot as long as and drainage will not be impeded. Isolated highs exceeding the 0.1 foot variation are acceptable as long as no pockets are created.

If payment is to be made on a yardage basis, and the original planned grades were changed after construction started, then the technician shall recomputed the yardage, based on final grades.

#### Recording Data

Record field notes and design data on Form LA-ENG-32, or LA-ENG-33, Land Leveling or Grading Data Sheet. For large fields the notes may be recorded in bound or loose-leaf field notebooks and design data placed on standard cross section sheets. Such cross section sheets shall be stapled to form LA-ENG-32 or LA-ENG-33.

Check the field notes carefully to determine all specifications have been met. Date and sign statement, "This practice meets specifications." Note any exceptions.

#### Recording Completed Practice

Outline area leveled with solid yellow line on field office copy of the conservation plan map, or, if not available, on aerial photograph or overlay. See Standard Conservation Symbols. An overlay may be used in lieu of the conservation plan map to avoid overcrowding. Number, if more than one area on the farm. Show acres and date work completed in black ink.

#### Filing Notes and Records

See National Handbook for Resource Conservation Planning, Louisiana Supplement.

WATER LEVELING IRRIGATED RICELAND

### Design Survey

Existing levees shall be identified on an aerial photo or sketched on an overlay map to be used as a contour map for planning the new levee system.

Check the vertical intervals of the permanent levees to be retained to determine that the maximum allowable V.I. of 1 foot has not been exceeded.

The technician and the farmer shall determine the area to be water leveled, and the area shall be recorded on the engineering map or overlay.

### Construction Layout

Enough levees should be laid out by the technician, when working with a landowner or cooperater for the first time, to ensure that correct layout procedures are understood. Ordinarily, the remaining levees should be laid out by the landowner or cooperater. In some cases it may be necessary for the technician to lay out all the levees to ensure proper location and alignment.

### Construction Check

The land surface after leveling must be smooth so a proper construction check can be made. It is preferred that the check be made before the field is planted, so any deficiencies can be corrected. However, the field may be checked before the growing rice is flooded, provided (1) the land surface is smooth and (2) the rice is small enough to permit observation of the ground surface. It is not permissible to check a field (1) that is flooded, (2) if the land is not reasonably dry.

As a minimum, run a profile down the slope, taking shots at 100-foot intervals, through the approximate center of the area that appears least likely to meet specifications. Additional normal ground shots will be taken immediately above and below the contour levee, and approximately half-way between the levees. As a minimum, take a profile on each field and on each 80 acres (approximately) on larger fields. In addition, the checker shall visually determine the entire field meets specifications.

A farmer cannot practically rework a field with growing rice that does not meet specifications since it would require destruction of the crop. The farmer may complete his leveling after

harvesting and before the next crop year. Leveling under these conditions may be reported after an instrument check has verified that a satisfactory job has been achieved.

### Recording Data

Record practice name, agreement number, ASCS referral number, survey data, dates, individuals making survey, a field or photo number; and draw sketch of field and location of surveys run on field notes.

Check the notes carefully to determine that all specifications have been met. Date and sign statement, "This practice meets specifications." Note any exceptions.

### Recording of Completed Practice

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### Filing of Notes and Records

See General Manual 120, Administrative Services; Part 408, Records; Subpart D, Exhibits; 210, Engineering; 210-11, Conservation Practices.

### Design

All water leveling shall be planned in accordance with the Service Standard for Water Leveling Irrigated Riceland.

### General Requirements

The suitability of the soils for leveling shall be determined on the basis of a soil survey or shall be determined by the technician. Cuts should not ordinarily exceed one-half of the planned vertical interval.

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

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farming equipment.

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