Irrigation System, Surface and Subsurface (No. and Ac.) 443

DEFINITION

A system in which all necessary water-control structures have been installed for the efficient distribution of water by surface means, such as furrows, borders, contour levees, or contour ditches, or by subsurface means.

PURPOSE

This practice is applied as part of a conservation management system to achieve one or more of the following:

- Efficiently convey and distribute irrigation water to the surface point of application without causing excessive water loss, erosion, or water quality impairment.
- Efficiently convey and distribute irrigation water to the subsurface point of application without causing excessive water loss or water quality impairment.
- Apply chemicals and/or nutrients as part of an irrigation system.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to the planning and design of an irrigation water distribution system or a chemical and/or nutrient application system.

Areas must be suitable for irrigation with water of suitable quality for the purpose intended. Water supplies must be sufficient in quantity and quality to make irrigation practical for the crops to be grown and the application methods to be used.

This standard does not apply to detailed design criteria and construction specifications for individual structures or components of the system.

This standard does not apply to practice standard, Irrigation System, Microirrigation (441) and Irrigation System, Sprinkler (442).

CRITERIA

General Criteria Applicable to All Purposes

Irrigation Systems, Surface and Subsurface, shall be planned, designed, and installed to meet all federal, state, local and tribal laws and regulations.

The criteria for the design of components not addressed in NRCS practice standards shall be consistent with sound engineering principles.

Conservation irrigation methods. All irrigation systems must be designed as an integral part of an overall plan of conservation land use and treatment for the farm that is based on the capabilities of the land and the needs of the irrigated area.

All agricultural irrigation system designs shall be based on the use of sound irrigation water application methods that are suited to site conditions (combination of soil and slope) and crops to be grown. Adapted methods are those methods that will provide efficient use of water without destructive soil erosion or degradation of water quality. Detailed design criteria from applicable irrigation guides shall be followed where available.

Capacity. The irrigation system shall have adequate capacity to meet the intended purpose(s).

If more than one irrigation method will be used on the same field, the system capacity shall be adequate for the method requiring the highest rate of water delivery.

All structures and water delivery components shall be designed for maximum flow conditions expected and shall have adequate capacity and/or freeboard. All structures and water delivery components shall be designed according to appropriate NRCS practice standards.

Design application rate. The design rate of application shall be within a range established by the minimum practical application rate for local climatic conditions and the maximum rate consistent with the intake rate of the soil and conservation practices used on the land.

Water control. Agricultural irrigation systems shall include structures needed for water control such as measuring devices, division boxes, checks, turnouts, pipelines, lined ditches, valves, and gates to control and regulate water for efficient application.

Irrigation water management. An irrigation water management plan meeting the requirements of conservation practice standard Irrigation Water Management (449) shall be developed for this practice.

Additional Criteria Applicable to Surface Irrigation Systems

Capacity. The system shall have either (1) a design capacity adequate to meet water demands of all crops to be irrigated in the design area or (2) enough capacity to meet the requirements of water application during critical crop growth periods when less than full irrigation is planned. In computing capacity requirements, allowance must be made for reasonable water losses during application and any leaching requirements.

Water surface elevation. All systems for irrigation by surface methods shall be designed so that the water surface elevation at field takeout points is sufficient to provide the required flow onto the field surface. A head of at least 4 inches (100 mm) shall be provided.

Location of head ditches or pipelines. Head ditches or pipelines used for surface irrigation shall be located so that irrigation water can be applied uniformly over the entire field without causing erosion. Ditch or pipeline spacing shall be such that irrigation run lengths are not longer than the maximums specified in the local irrigation guide or those determined by field evaluation. If more than one crop is to be grown or more than one method of irrigation used, the ditch or pipeline spacing shall not exceed the allowable run length determined for the limiting crop or method.

Erosion control. The design of agricultural irrigation systems shall provide for conveying and distributing irrigation water without causing damaging soil erosion. All unlined ditches shall have nonerosive gradients. If water is conveyed on slopes steep enough to cause excessive flow velocities, the irrigation system design shall provide for the installation of such erosion-control structures as drops, chutes, buried pipelines, or erosion-resistant ditch linings. Polyacrylamide may be utilized for erosion control according to NRCS national conservation practice standard Anionic Polyacrylamide (PAM)-Erosion Control (450) in lieu of or in combination with structural measures.

Seepage control. For surface irrigation systems, ditches shall not traverse highly permeable soils without adequate measures for seepage control. If site conditions require conveyance of water across excessively permeable areas, the irrigation system design shall provide for pipelines, flumes, or lined ditches as needed to prevent excessive seepage losses.

Tailwater and Excess Runoff Removal. Irrigation system designs shall include facilities of adequate capacity as needed for the safe removal of irrigation tailwater and storm water runoff from the field surface. Collection facilities (ditches) constructed for this purpose shall be on nonerosive gradients or be stabilized by lining or structural measures if erosion is a hazard. If field elevations do not permit the safe disposal of excess water by gravity flow, the design shall provide for installation of pumping plants and other needed appurtenant structures. Ditches shall be protected from bank erosion. If excess water will be reused for irrigation, the irrigation system design shall provide for collection facilities so that water does not flow directly from furrows or borders into irrigation head ditches. Tailwater systems shall be installed according to NRCS national conservation practice standard Irrigation System, Tailwater Recovery (447).

Additional Criteria Applicable to Subsurface Irrigation Systems

Subsurface irrigation systems shall be designed to maintain the water table at or between predetermined elevations below the ground surface at all points in the design area.

Feeder ditches or conduits for subsurface irrigation shall be spaced so that the variation in depth from the land surface to the water table is not greater than is permissible for adequate irrigation of the most limiting crop to be grown.

Additional Criteria Applicable to Chemical and/or Nutrient Application

The installation and operation of an irrigation system for the purpose of chemical and/or nutrient application shall include backflow and anti-siphon prevention measures, as appropriate. Additionally, surface waters shall be protected from direct application and runoff.

Nutrient and pest management. Chemicals, fertilizers, wastewater, and liquid manure shall be applied in accordance with appropriate practice standards for Nutrient Management (590), Pest Management (595), and/or Waste Utilization (633).

CONSIDERATIONS

Consider the potential effects of installation and operation of Irrigation System, Surface and Subsurface, on the cultural, archeological, historic and economic resources.

When planning this practice the following items should be considered, where applicable:

- Effects of nutrients and pesticides and other dissolved substances on surface and ground water quality.
- Effects of water level control on the salinity of soils, soil water, or downstream water quality.
- Effects of water levels on such soil nutrient processes as plant nitrogen use or denitrification.
- Impact of salt leaching on system management and capacity requirements.
- Effects on:
  - the water budget, especially volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
  - plant growth and transpiration because of changes in the volume of soil water.
  - downstream flows or aquifers that impact other water uses or users.
  - the volume of downstream flow that could have environmental, social, or economic impacts.
  - field water table in providing a suitable rooting depth for anticipated land uses.
  - erosion and the movement of sediment and soluble and sediment-attached substances carried by runoff.
  - temperature of downstream waters.
  - aquatic and wildlife communities, wetlands or water-related wildlife habitats.
  - the visual quality of water resources.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Support data documentation requirements are as follows:

- Inventory and evaluation records
  - Assistance notes or special report
- Survey notes, where applicable
  - Design survey
  - Construction layout survey
  - Construction check survey
- Design records
  - Physical data, functional requirements and site constraints, where applicable
  - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
  - Location map
  - "Designed by" and "Checked by" names or initials
  - Approval signature
  - Job class designation
  - Initials from preconstruction conference
  - As-built notes
- Construction inspection records
  - Assistance notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable.

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.