

## CONSERVATION PRACTICE STANDARD

# IRRIGATION SYSTEM, SPRINKLER

(No. and Acre)

Code 442

### DEFINITION

A planned irrigation system in which all necessary components are installed for efficiently land applying water, chemicals, or manure by means of nozzles operated under pressure.

### PURPOSE

To efficiently and uniformly apply irrigation water, chemicals, or manure without causing excessive water loss, erosion, or water quality impairment, for the following uses;

- To maintain adequate soil moisture content for the desired level of plant growth and production.
- Applying chemicals, nutrients, and/or waste water.

### CONDITIONS WHERE PRACTICE APPLIES

This standard applies to the planning and design of the overall application through a sprinkler discharge system.

The sprinkler method for water application is suited to most crops, irrigable lands, and climatic conditions where irrigated agriculture is feasible.

Areas must be suitable for sprinkler water application, and have an adequate supply of suitable quality water available for the intended purpose(s).

Other components associated with this practice shall meet the appropriate NRCS practice standards.

### CRITERIA

#### **General Criteria Applicable to All Purposes**

Each sprinkler discharge system must be designed as an integral part of an overall plan

of conservation land use and treatment for the intended purpose(s) based on the capabilities of the land and the needs of the operator. The selected system shall be based on a site evaluation, expected operating conditions and verification that soils and topography are suitable for the intended purpose(s).

#### **Site Conditions.**

The slope of any site may limit or restrict the use of this practice.

For wastewater application the area to be irrigated shall be determined according to the Wastewater Treatment Strip Standard (635), and the Natural Resources Conservation Service (NRCS) Agricultural Waste Management Field Handbook, Design Guide #PA-3, Section 10.66.1.

**Depth of Application.** Net depth of application shall meet criteria for the intended purpose, not exceeding the available soil water holding capacity and meeting the land user's management plan for the intended purpose.

For application of wastewater, soil conditions must be investigated to determine the maximum allowable depth of application. Natural Resources Conservation Service (NRCS), Agricultural Waste Management Field Handbook (AWMFH), Design Guide #PA-3, Section 10.66.1, provides guidance selecting the depth of application based on soil types and conditions.

**Design Application Rate.** The design rate of application shall be within a range established by the minimum practical application rate under local climatic conditions and the maximum rate consistent with the intake rate of the soil and the conservation practices used on the land. AWMFH Design Guide #PA-3, Section 10.66.1, provides guidance selecting the application rate for wastewater based on soil types and conditions.

Rates shall be selected such that runoff, translocation, and unplanned deep percolation are minimized when using clean water to irrigate crops.

There shall be no runoff from the designated application area when irrigating wastewater, chemicals, or manure.

**Capacity.** The sprinkler irrigation system shall be designed with adequate capacity to accomplish the primary purpose(s) of the system. The system shall have either (1) a design capacity adequate to meet the moisture demands of all crops to be irrigated in the design area or (2) enough capacity to meet the requirements of several selected irrigations 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 periods.

Wastewater irrigation systems shall be designed with a capacity to apply a stated amount of water to the design area in a specified net operating period.

**Distribution Patterns, Nozzle Spacing and Height.** A combination of sprinkler spacing, nozzle size, and operating pressure that provides the design application rate and distribution shall be selected.

If available from the manufacturers, uniformity coefficient data shall be used in selecting sprinkler spacing, nozzle sizes, and operating pressure.

The uniformity coefficient shall not be less than as shown below:

70% for orchards

75% for deep-rooted (4 ft. or more)  
field and forage crops

85% for high-value or shallow-rooted crops  
and for any crop where fertilizer or  
pesticides are applied through the  
system

In the absence of such data, sprinkler performance tables provided by the manufacturers shall be used in selecting nozzle sizes, operating pressure, and wetted diameter for the required sprinkler discharge. The maximum spacing shall comply with the following criteria:

1. For low (2-35 pounds/square inch (psi)-), moderate (36-50 psi.-), and medium (51-75 psi.-) pressure sprinkler nozzles, the spacing along lateral lines shall not exceed 50 percent of the wetted diameter, as given in the manufacturer's performance tables, when the sprinkler is operating at design pressure. The spacing of laterals along the main line shall not exceed 65 percent of this wetted diameter.

If winds that can affect the distribution pattern are likely, spacing should be reduced to 60 percent for average velocities of 1 to 5 miles per hour (mph), to 50 percent for average velocities of 6 to 10 mph, and to 45 percent for average velocities greater than 10 mph.

2. For high-pressure sprinklers (>75 psi.), the maximum distance (diagonal) between two sprinklers on adjacent lateral lines shall not exceed two-thirds of the wetted diameter under favorable operating conditions

If winds that can affect the distribution pattern are likely, the diagonal spacing should be reduced to 50 percent of the wetted diameter for average velocities of 5 to 10 mph and to 30 percent for average velocities greater than 10 mph.

3. Sprinkler spacing requirements for orchards, including subtropical fruits:

- a) Triangular pattern. The spacing along lateral lines shall not exceed 65 percent of the effective wetted diameter. The spacing of laterals along the main line shall not exceed 70 percent of the effective wetted diameter.

- b) Square or rectangular pattern. The nozzle spacing along the lateral and the lateral spacing along the main

line shall not exceed 65 percent of the effective wetted diameter at the design operating pressure.

- c) Spacing between sprinklers and lateral lines shall be reduced by 2.5 percent for each mph over 3 mph average wind velocity normally occurring during planned hours of operation.

**Pipelines.** Irrigation pipe shall be chosen so that the design pressure of the irrigation system will not exceed seventy-two percent (72%) of the pipes pressure rating. Pipes shall meet or exceed the criteria in Standard 430, Irrigation Water Conveyance. Flow velocity in the pipe should not exceed five feet per second (5 ft./sec.)

Main lines, submains, and supply lines shall insure that the quantities of water required are conveyed to all lateral lines at the maximum required pressure. If the pressure required for sprinkler system operation is provided by pumping, main line pipe sizes shall insure that there is an economical balance between the capitalized cost of the pipe and annual pumping costs.

Lateral lines shall be designed so that the total pressure variation at the sprinkler heads, resulting from friction head and elevation differential, does not exceed twenty percent (20%) of the design operating pressure or ten percent (10%) of the design flow of the sprinklers, unless pressure reducers or regulators, or other pressure compensating or flow control devices are used.

Riser pipes shall be high enough to prevent interference with the distribution pattern when the tallest crop is irrigated. Riser pipes that are subject to under-tree operation, shall extend to the height necessary, so that the distribution pattern is not interfered with by the tree canopy. Where permissible, riser heights shall not be less than as follows:

Sprinkler discharge (gallons/minute)	Riser length (inches)
Less than 10	6
10-25	9
25-50	12
50-120	18
More than 120	36

Risers over 3 feet in height shall be anchored and stabilized.

To prevent freezing, riser pipes shall be designed to fully drain when the pumping operation stops. A bleeder valve in conjunction with an underground gravel envelope, or other such devices may be used.

A method of cleaning out settled solids in the pipe lines, may be required. Capped cleanout pipes or other means of removing solids may be installed at trouble areas; sharp bends, sudden rises or falls, etc..

All pipe lines shall be buried a minimum of three feet (3') for frost protection, unless other means of freeze protection is installed.

**Pump and power unit.** The pump capacity and the power unit shall be adequate to operate the sprinkler system efficiently when maximum capacity is being pumped against the maximum required total dynamic head. The pump and power unit shall be designed to meet or exceed the requirements in Standard 533, Pumping Plant.

Automatic timers may be installed to allow irrigation to be done during a desired time period. If a timer is installed, an alarm system with a control switch shall be installed to take precedence over the timer based system, if problems arise.

**Other Components.** Sprinkler irrigation systems used to apply wastewater shall be designed with a means of separating and removing solids before irrigating. Treatment of the wastewater can be accomplished using solid separators, two stage lagoons and holding ponds, filters, or any combination thereof. Other methods, as approved by the engineer, may also be used for reducing the percent solids.

Caution shall be taken when trying to irrigate sand bedded manure or sand laden wastewater. Sand will prematurely wear out equipment, and plug nozzles and pipelines if not properly accounted for.

A check valve or directional control device shall be installed to restrict water flow from draining back through the pump, once the pumping operation stops.

For medium and high pressure irrigation systems, thrust control shall be installed at all bends, and sudden rises or falls greater than 22.5 degrees.

### **CONSIDERATIONS**

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

The velocity of prevailing winds and the timing of occurrence should be considered when planning a sprinkler irrigation system. Systems designed to operate in varied time increments aid in balancing the effects of day and night wind patterns.

The location of down-wind structures should be considered. Over-spray or odor problems may arise if the system is not placed in the proper location.

The location of water sources should be evaluated and considered when planning an irrigation system. The location of the system may cause contamination to drinking water sources.

Low pressure systems (35 psi. or less) are sensitive to small changes in nozzle pressure. Consider using pressure regulators on all low pressure systems where elevation differences and/or pumping depth variations can significantly change nozzle discharge, sprinkler uniformity, and the water budget.

Consider installing a pressure gauge at both ends of the sprinkler system to monitor system pressure.

In areas of high visibility, irrigating at night should be considered.

Consider separating different sources of wastewater before irrigating. Combining different sources of wastewater in a common settling tank and/or pump tank may cause compatibility problems, such as; jelling, curdling, chemical reactions, or producing harmful gases.

### **PLANS AND SPECIFICATIONS**

Sprinkler irrigation plans shall be developed and based on an evaluation of the site and the expected operating conditions.

An Irrigation Water Management Plan shall be developed for the purpose of applying water to crops. A Nutrient Management Plan shall be developed if the purpose of this practice is wastewater application, as a component of a Comprehensive Nutrient Management Plan.

Specifications for constructing irrigation sprinkler systems shall be in keeping with this standard and shall describe the requirements for properly installing the practice to achieve its intended purpose.

### **OPERATION AND MAINTENANCE**

An operation and maintenance plan must be prepared for use by the owner or others responsible for operating the system. The plan should provide specific instructions for operating and maintaining the system to insure that it functions properly. It should also provide for periodic inspections and removal of debris and settled solids as necessary from nozzles, pipe lines, filters, sediment tanks or other areas of sediment collection. Prompt repair or replacement of damaged components shall also be addressed in the plan.

