NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION SYSTEM, TAILWATER RECOVERY

(No.)

CODE 447

DEFINITION

An irrigation system designed to collect, store, and convey irrigation tailwater and/or rainfall runoff for reuse in irrigation.

PURPOSE

- Improve irrigation water use efficiency
- Improve offsite water quality
- Reduce energy use

CONDITIONS WHERE PRACTICE APPLIES

A tailwater recovery system is suitable for use on lands that have a properly designed and installed irrigation system where recoverable irrigation runoff and/or rainfall runoff flows can be anticipated under current or expected management practices.

The components of the system may include, but are not limited to, ditches, water control structures, sumps, collecting basins, pumping plants and pipelines. It does not apply to detailed design criteria or construction specifications for individual structures or components of the recovery system.

CRITERIA

General Criteria Applicable To All Purposes

Use appropriate NRCS standards and specifications in the design and construction of components needed for a tailwater recovery system. Use sound engineering principles for the design of components not addressed in NRCS Conservation Practice Standards.

The collection, storage, and conveyance of irrigation tailwater and rainfall runoff can be an integral part of irrigation systems covered by NRCS Conservation Practice Standards.

Collection. Tailwater and/or rainfall collection components may include, but are not limited to, ditches, culverts, pipelines, water control and/or grade stabilization structures or other erosion control measures, as needed.

Storage. Storage components are needed to store the collected water until it is redistributed in the irrigation system. Include the runoff volume, runoff rate and the required level of water control at the point where the tailwater is returned to the irrigation system in the storage capacity design calculations.

For systems where tailwater is discharged into a collecting basin, irrigation reservoir or pipeline that has components for regulating fluctuating flows (e.g. a float valve), small sumps with frequently cycling pumping plants may be used. If the storage component is not designed to regulate flows, ensure the capacity of the tailwater

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the Field Office Technical Guide.

sumps or collection basins is large enough to provide the regulation needed to permit efficient use of the water.

Design the tailwater recovery system to store, at a minimum, the complete runoff from a single irrigation set, if one or more of the following conditions apply:

- The energy sources for tailwater pump back systems are subject to interruption,
- Safe emergency bypass areas cannot be provided, or
- Tailwater discharge violates local or state regulations.

Equip sumps and collecting basins with inlets designed to protect the side slopes and the collection components from erosion. Where required by state law, provide a diversion, dike, or water control structure to limit entrance of rainfall runoff into the designed inlet structure.

Install sediment traps as needed.

Where tailwater recovery systems are used to collect rainfall runoff for storage and use as irrigation reservoir replenishment, base the size and capacity of collection and storage on expected runoff volumes and rates. Provide an adequate outlet for rainfall runoff that exceeds the expected runoff volume.

Conveyance. All tailwater recovery systems require components that convey water from the storage component to a point of entry in the irrigation system. These components may consist of a pumping plant and pipeline to return the water to the upper end of the field, or a gravity outlet having a ditch or pipeline to convey the water to a lower elevation in the irrigation system. Other components or combinations of components may be necessary as determined on a site-specific basis.

Determine the capacity of conveyance components by an analysis of the expected runoff rate, the planned tailwater irrigation collecting basin or irrigation reservoir storage capacity, and the anticipated irrigation application. If the return flow is used as an independent irrigation supply rather than as a supplement to the primary irrigation water supply, ensure the rate and volume of flow is adequate for the irrigation system supplied.

Additional Criteria Applicable To Improving Offsite Water Quality

Storage Components. Where additional storage is required to provide adequate retention time for the breakdown of chemicals in runoff water, size the storage components accordingly. Use site specific information about the chemical of concern to determine allowable retention times.

Where additional storage is required to provide for sediment deposition, base additional storage volumes on site specific information of the contributing watershed.

Additional Criteria Applicable to Reduce Energy Use

Provide analysis to demonstrate reduction of energy use from practice implementation.

Calculate the reduction of energy use as the average annual or seasonal energy reduction compared to previous operating conditions.

CONSIDERATIONS

Water Quantity

Good irrigation system design and management will limit tailwater volume to that needed for effective operation. This may reduce the capacity of the collection, storage, and conveyance components.

Changes in irrigation water management may be necessary to optimize the use of return flows.

Downstream flows and aquifer recharge dependent on tailwater and rainfall runoff will be reduced and may cause undesirable environmental, social, or economic effects.

Water Quality

Effects on surface and groundwater quality by the movement of sediment and soluble and sediment-attached substances should be considered.

Chemical-laden water can create a potential hazard to wildlife, especially waterfowl that are drawn to ponded water.

Treatment of tailwater to eliminate pathogens that cause food-borne illnesses may be necessary if it is used to irrigate fruits and vegetables.

Plan nutrient and pest management measures to limit chemical-laden tailwater when practical.

Protect system components from storm events and excessive sedimentation.

Other Considerations

Effects on the visual quality of water resources should be considered.

To the extent possible, control seepage from the storage component when it is expected to receive chemical-laden waters. Control may be in the form of natural soil liners, soil additives, commercial liners, or other approved methods.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for irrigation tailwater recovery systems in accordance with this standard and describe the requirements for applying the practice to achieve its intended purpose.

At a minimum, include the following in the plans and specifications:

- Site plan layout of the tailwater recovery system and associated components,
- Cross sections and profiles,
- Type, quality, and quantity of the various system components, and
- Location of utilities and notification requirements.

OPERATION AND MAINTENANCE

Prepare an Operation and Maintenance plan specific to the components installed for use by the landowner or operator responsible for operation and maintenance. Provide specific instructions for operating and maintaining components to ensure they function properly.

The plan shall include provisions to address the following, at a minimum:

- Periodic cleaning and re-grading of collection components to maintain proper flow lines and functionality.
- Periodic checks and removal of debris as necessary from trash racks and structures to assure proper operation.
- Periodic removal of sediment from traps and/or storage components to maintain design capacity and efficiency.

- Inspection or testing of all pipeline and pumping plant components and appurtenances, as applicable.
- Routine maintenance of all mechanical components in accordance with the manufacturer's recommendations.

REFERENCES

Natural Resources Conservation Service (NRCS). 1997. National Engineering Handbook. Part 652. Irrigation Guide.

Natural Resources Conservation Service (NRCS). 1983. National Engineering Handbook. Section 15 Chapter 8. Irrigation Pumping Plants.

Natural Resources Conservation Service (NRCS). 1993. National Engineering Handbook. Part 623 Chapter 2. Irrigation Water Requirements.

Natural Resources Conservation Service (NRCS). 1983. National Engineering Handbook. Part 650. Engineering Field Handbook, Chapter 15, Irrigation.