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Surface Irrigation Runoff Reuse Systems

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1 Purpose and Scope

1.1 This Engineering Practice is a guide to engineers, technicians and farmers designing and operating systems to collect runoff from surface irrigated fields for subsequent use on the same or other fields. Tailwater runoff reuse is most commonly applied to furrow irrigation, but the concepts apply to any irrigation system that produces runoff and to the reuse of subsurface drain water. This Engineering Practice is not intended to serve as a complete set of design criteria and specifications for construction. All systems should be designed in conformance with local regulations (i.e., construction, safety, and water quality standards).

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies unless noted. For undated references, the latest approved edition of the referenced document (including any amendments) applies.

ANSI/ASAE EP302.4, *Design and Construction of Surface Drainage Systems on Agricultural Lands in Humid Areas*

ANSI/ASAE S376.2, *Design, Installation and Performance of Underground, Thermoplastic Irrigation Pipelines*

ANSI/ASAE S397.4, *Electrical Service and Equipment for Irrigation*

ASAE EP267.7, *Prevention of Mosquito Problems Associated with Irrigation and Drainage Systems*

ASAE S318.17, *Safety for Agricultural Field Equipment*

ASAE EP369.1, *Design of Agricultural Drainage Pumping Plants*

ASAE S442.1, *Water and Sediment Control Basins*

ASAE S526.3, *Soil and Water Terminology*

3 Benefits

3.1 Irrigation runoff reuse systems can improve irrigation efficiency, improve downstream water quality, reduce irrigation labor, and conserve soil and nutrient resources. Reuse systems enable irrigators (farm irrigation water managers) to meet surface water discharge restrictions.

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3.2 Water savings. Irrigation practices to uniformly distribute water on sloping, open-ended, furrow-irrigated fields usually result in 20 to 50% of the applied water running off. Water may also run off from border-irrigated fields. Runoff reuse reduces water loss from the farm.

3.2.1 Basin-wide water savings from on-farm reuse may be much less than on-farm savings. Runoff from a farm often reenters a downstream irrigation delivery system and is reused. If on-farm reuse decreases downstream water supplies, water deliveries may have to be adjusted to satisfy downstream water rights, including reduced deliveries to farmers who reuse their runoff.

3.2.2 For maximum water and labor savings, runoff reuse systems should be integrated with the total farm irrigation system. Pumping capacities, delivery points, storage locations, and storage capacities should be designed to give the farmer flexibility in the use of water and allow efficient conjunctive use with other irrigation water supplies.

3.3 Water quality. Collection and reuse of runoff keeps eroded soil, and water- and soil-borne pollutants on the originating farm. Potential pollutants include sediment, plant residues, nutrients, agricultural chemicals, plant pathogens, nematodes, and weed seeds. The irrigated farm benefits from conservation of soil and nutrients. Downstream irrigators and other water users benefit from cleaner, safer water supplies. Downstream water quality improvement is a primary reason for runoff reuse in some areas.

3.4 Chemical application. When agricultural chemicals or nutrients that have potential to cause economic or environmental damages downstream are applied in surface irrigation water, a runoff reuse system should be used to prevent transport of those chemicals to downstream users and water bodies.

4 System Components

4.1 Irrigation runoff reuse systems have four basic components:

— runoff collection and conveyance channels (tailwater ditches, drains);

— storage reservoir (tailwater pit, pond, sump);

— pumping plant (reuse, return, pumpback pump);

— delivery pipe (return, pumpback pipe).

4.2 Collection. Runoff from irrigated fields is intercepted by a system of open channels or pipelines and conveyed by gravity to a storage reservoir or pumping plant.

4.2.1 Capacity of the channels and pipelines should be sufficient to convey the maximum expected runoff rate from irrigation. Also, the collection system should be able to safely convey or bypass runoff from precipitation.

4.2.2 Runoff collection channels should be designed to minimize channel erosion. In erodible soils, flow velocities greater than 0.5 m/s may result in erosion. Erosion potential can be reduced by reducing flow velocity with check/drop structures, shallow cross sections, or rough surfaces; or by protecting the soil surface with vegetation or other erosion resistant materials. ANSI/ASAE S302 describes some aspects of channel design for erosion control.

4.2.3 Sedimentation. Runoff water carrying sediments increase maintenance requirements for conveyance channels and pipelines, the storage reservoir, and the pump. On-field practices that reduce erosion and sediment runoff (improved water management, reduced tillage, residue management, and vegetated filter strips at the outflow ends of fields) should be applied.

4.2.3.1 If erosion is not adequately controlled at the field, a sediment collection basin should be constructed in the runoff collection system. The sediment basin should provide a one-to-two hour flow detention time to

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