NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

IRRIGATION RESERVOIR

(Ac.-Ft.)

CODE 436

DEFINITION

An irrigation water storage structure made by constructing a dam, embankment, pit, or tank.

PURPOSE

This practice may be applied as part of a resource management system to achieve one or more of the following purposes:

- Store water to provide a reliable irrigation water supply or regulate available irrigation flows.
- Improve Water Use Efficiency on irrigated land.
- Provide storage for tailwater recovery and reuse.
- Provide irrigation runoff retention time to increase breakdown of chemical contaminants.
- Reduce energy use.
- Develop renewable energy systems (i.e., hydropower).

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to irrigation water storage structures that meet one or more of the following criteria:

- The existing available water supply is insufficient to meet irrigation requirements during all or part of the irrigation season.
- Water is available for storage from surface runoff, stream flow, irrigation canals, or a subsurface source.
- A suitable site is available for construction of a storage reservoir.

This practice applies to planning and functional design of storage capacity, and inflow/outflow capacity requirements for irrigation storage reservoirs. Storage reservoirs shall be planned and located to serve as an integral part of an irrigation system.

This practice applies to reservoirs created by embankment structures or excavated pits to store diverted surface water, groundwater, or irrigation system tailwater for later use, or reuse.

The practice also applies to reservoirs created by embankment structures or excavated pits and tanks constructed of concrete, steel, or other suitable materials used to collect and regulate available irrigation water supplies to accomplish the intended purpose.

CRITERIA

General Criteria Applicable to All Purposes

Structure type selection (excavated pit, embankment, or tank) shall be based on a site specific assessment involving hydrologic studies, engineering and geologic investigations, available construction materials, and natural storage.

Storage Capacity. Design capacity computations shall be based on planned inflow volumes and rates over the storage period, and outflow volumes and rates required to meet planned irrigation system needs.

Structure storage capacity must provide sufficient volume to meet variations in water demand within the irrigation period.

Compute demand flow rates based on the consumptive use-time relationship using anticipated irrigation efficiencies, conveyance losses, and other uses such as leaching, frost control, seepage, and evaporation.

Irrigation storage reservoirs planned primarily to regulate irrigation flows shall have adequate

capacity to provide design irrigation application flow rates.

Structure capacity shall provide adequate storage for inflow while maintaining sufficient water levels to insure proper operation of outlet works and provide uniform outflow rate during planned irrigation events.

Provide additional capacity as needed for sediment storage.

Foundation, Embankment, and Spillways. Earthen dams, embankments, pits, associated spillways, and appurtenant structures shall be designed to meet criteria in the applicable NRCS Conservation Practice Standards, Pond (378), or Dam (402).

Seepage. Prevent excessive seepage losses by use of an appropriate method of sealing or lining.

Overflow Protection. Overflow protection shall be provided if overflow of the irrigation storage reservoir is possible.

Inlet and Outlet Works. Design conduit and open spillways according to guidelines in appropriate chapters of the NRCS National Engineering Handbook.

Provide inlet works when needed to prevent erosion or control flows into the irrigation storage reservoir. Inlet works may consist of a direct pumping system, conduit, grassed channel, lined channel, chute, head gates, valves, or other appurtenances necessary to safely convey and control water entering the structure.

Outlet works shall be provided for controlled withdrawal, transfer, or release of irrigation water. Outlet works may consist of a direct pumping system or a conduit from the storage reservoir to an area of use. The capacity of the outlet works shall be adequate to provide the outflow rate needed to meet irrigation system demands.

Design and install specialized inlet or outlet works when needed to avoid entraining or impinging aquatic organisms.

Additional Criteria Applicable to Storage for Tailwater Recovery and Reuse

Capacity. When energy sources for tailwater pump back systems are subject to interruption and

- safe emergency bypass areas cannot be provided, or
- tailwater discharges violate local or state regulations,

Tailwater storage requirements shall, as a minimum, include a volume adequate to store all tailwater runoff from a single irrigation set.

Additional Criteria Applicable to Irrigation Runoff Retention Time to Increase Breakdown of Chemical Contaminants

Capacity. Where additional storage or flow regulation are required to provide adequate retention time for breakdown of chemicals in runoff waters, storage facilities shall be sized accordingly. Allowable retention times shall be site specific to the particular chemical of concern.

Additional Criteria Applicable to Reduce Energy Use

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

Reduction of energy use is calculated as average annual or seasonal energy reduction compared to previous operating conditions.

Additional Criteria Applicable to Develop Renewable Energy Systems

Renewable energy systems shall meet applicable design criteria in NRCS and/or industry standards, and shall be in accordance with manufacturer's recommendations. Hydropower systems shall be designed, operated, and maintained in accordance with the Microhydropower Handbook, Sections 4 and 5, as appropriate.

CONSIDERATIONS

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

- Potential energy savings resulting from regulation of irrigation flows, tailwater reuse, improved pumping plant efficiency, or management changes.
- Planting of critical areas at the completion of construction to protect the structure and borrow areas, and prevent erosion.
- Effects of soil physical and chemical properties, as well as potential soil limitations, relating to embankment

construction, compaction, stability, bearing strength, pool area seepage, and soil corrosivity. Refer to soil survey data as a preliminary planning tool for assessment of pool and borrow areas, and conduct

- On-site soil investigations during the final planning stage.
- Perimeter fences to prevent human and animal access, and emergency escape facilities to minimize human safety hazards.
- Construction-related effects on air quality and on water quality of downstream water courses.
- Potential for earth moving construction to uncover or redistribute toxic materials or on-site invasive species.
- Development of water budgets, to quantify sources of inflow (precipitation and withdrawals), and outflow (evapotranspiration and losses).
- Impacts on downstream flows or aquifers that could affect other water uses or users.
- Impacts on the quantity of downstream flows, which could have undesirable environmental, social, or economic effects.
- Impacts of erosion, sediment, soluble contaminants, seeds or vegetative materials of invasive species, and contaminants attached to sediment in runoff.
- The movement of dissolved substances to ground water.
- Effects of water temperature changes on aquatic and wildlife communities.
- Timing of vegetation-disturbing maintenance activities, to avoid grassland bird nesting seasons.
- Impacts on wetlands or water-related wildlife habitats.
- Impacts on the visual quality of water resources and the landscape.
- Impacts on cultural resources.
- Performing periodic water quality analysis to evaluate salinity, nutrients, pesticides, and pathogens.
- Opportunities to include variety in vegetation for embankment stabilization or revegetation maintenance, that would provide pollinator forage from early spring to late fall.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing irrigation storage reservoirs shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.

Plans and specifications for constructing earthen irrigation storage reservoirs shall be based on criteria found in NRCS Conservation Practice Standards, Pond (378), or Dam (402).

Plans and specifications for tanks constructed of non earthen materials shall be based on construction and materials specifications for NRCS Conservation Practice Standard, Watering Facility (614).

OPERATION AND MAINTENANCE

An Operation and Maintenance plan shall be prepared for landowner or operator use. The plan shall provide specific instructions for operating and maintaining facilities to ensure they function properly. The plan shall include the following provisions:

- Periodic cleaning and regrading of water storage facilities to maintain functionality.
- Periodic inspection, removal of debris, and repair if needed of trash racks and inlet and outlet structures to assure proper operation.
- Routine maintenance of mechanical components in accordance with manufacturer recommendations.
- Periodic inspection and maintenance of embankments and earth spillways to repair damage or control erosion and undesirable vegetation.
- Periodic removal of sediment from traps or storage facilities to maintain design capacity and efficiency.
- Periodic Inspection or testing of all pipelines and pumping plant components and appurtenances, as applicable.

REFERENCES

McKinney, J.D., et al. Microhydropower Handbook, IDO-10107, Volumes 1 & 2. U.S. Department of Energy, Idaho Operations Office.