NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

DAM

(No. and Ac-Ft.)

CODE 402

DEFINITION

An artificial barrier that can impound water for one or more beneficial purposes.

PURPOSE

- Reduce downstream flood damage.
- Provide permanent water storage for one or more beneficial uses such as irrigation or livestock supply, fire control, municipal or industrial uses, develop renewable energy systems, or recreational uses.
- Create or improve habitat for fish and wildlife.

CONDITION WHERE PRACTICE APPLIES

This practice applies only to sites meeting all the following criteria:

1. Topographic, geologic, hydrologic and soil conditions at the proposed site are satisfactory for constructing a dam and reservoir.
2. The watershed is protected from erosion to the extent that the sediment yield will not significantly shorten the planned life of the reservoir.
3. Water is available in sufficient quantity and adequate quality to satisfy the intended purposes without impairing downstream or adjacent use or function.

CRITERIA

General Criteria Applicable To All Purposes

All dams designed under this standard shall comply with applicable local, state, and federal laws, rules and regulations. All required permits must be obtained before construction begins.

A protective cover of vegetation shall be established on all exposed areas of embankments, spillways and borrow areas as climatic conditions allow, according to the guidelines in conservation practice standard 342, Critical Area Planting.

Dams shall be classified as a low, significant or high hazard potential in accordance with NRCS Technical Release 60, Earth Dams and Reservoirs (TR-60), and other references as appropriate for the site-specific conditions.

Design criteria for all dams are contained in TR-60, with the exception that low hazard potential earth dams and appurtenances may be designed to the criteria in Conservation Practice Standard 378, Pond, when:

1. Failure of the dam will not result in loss of life; damage to homes, commercial or industrial buildings, main highways, or railroads; or interruption of the use or service of public utilities.
2. The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway. The effective height of the dam is the difference in elevation, in feet, between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam. If there is no auxiliary spillway, the top of the dam is the upper limit; and
3. The effective height of the dam is 35 feet or less.

A principal and auxiliary spillway(s) with needed appurtenances shall be provided, except where the rate and duration of flow can be safely handled by a single spillway for all intended purposes.

The outlet works shall have adequate capacity to release the flow resulting from the combined demands at any time.

Additional outlets may be required to satisfy the supply for downstream water uses such as livestock water, irrigation, or fish and wildlife needs.

Additional Criteria To Reduce Downstream Flood Damage

Flood control storage may be designed into the permanent storage volume if provisions are made to operate the reservoir for this purpose.

The flood retarding storage capacity requirements shall be sufficient to contain the runoff expected to occur at a frequency consistent with the level of protection to be provided to the downstream benefited area, with proper allowance for discharge through the principal spillway. The flood-retarding storage capacity shall be sufficient to limit the use of the auxiliary spillway to a permissible frequency and duration based upon consideration of the erosion resistance of the spillway material and vegetative protection to be provided.

Additional Criteria For Permanent Water Storage Uses

The reservoir shall include adequate storage volume to meet user demands for all intended purposes of the reservoir. Seasonal variations in demand and the expected losses from seepage and evaporation must be considered to determine the permanent storage volume required for the intended use(s).

The methods, materials, location and capacity of spillways and outlet works shall be selected to safely pass flood discharges and address all functional requirements necessary to facilitate the use of the stored water for the intended purpose(s).

Spillways and other outlet works shall be fenced or otherwise secured to limit human access as necessary to provide for public safety and prevent their use for other than the intended purposes.

If permanent storage is provided for irrigation, the dam and appurtenances shall meet all applicable requirements of NRCS Conservation Practice Standard 436, Irrigation Storage Reservoir.

Site-specific design criteria shall be developed that reflect the functional requirements of the reservoir, dam and appurtenances for the intended recreational benefits.

Additional Criteria For Wildlife Habitat Creation Or Improvement

Site-specific design criteria shall be developed that reflect the functional requirements of the reservoir, dam and appurtenances for the intended wildlife benefits.

When feasible, existing habitat structure or features shall be retained, such as trees in the upper reaches of the reservoir or stumps in the pool area. Upper reaches of the reservoir can be shaped to provide shallow areas, aquatic bed, emergent or scrub-shrub wetland habitat.

If fish are to be stocked, see criteria and guidance in Practice Standard 399, Fishpond Management. Also see Practice Standard 644, Wetland Wildlife Habitat Management for criteria related to wildlife habitat.

CONSIDERATIONS

The plan should consider the potential for changes in the form or function of the watercourse and associated riparian corridor resulting from installation of the dam. Unacceptable negative impacts to natural resources or other uses of the water or areas affected should be mitigated by the design or by imposed operation requirements of the dam.

Visual resource design. The visual design of dams and the reservoir area should be carefully considered in areas of high public visibility and those associated with recreation. The underlying criterion for all visual design is appropriateness. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

The embankment may be shaped to blend with the natural topography. The edge of the reservoir may be shaped so that it is generally curvilinear rather than rectangular. Excavated material can be shaped so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, both submerged and exposed (above normal water elevation) islands may be added for visual interest and to attract wildlife.

Cultural Resources. Dam installation results in significant ground disturbance. Consider the potential to affect cultural resources in the project area.

Water Quantity. Consider the potential effects on downstream flows and impacts to the environment such as wetlands and aquifers, and also social and economic impacts to downstream uses or users.

Consider the potential for depletion of downstream surface water resources resulting from runoff storage, evaporation from the reservoir surface and seepage from the pool bottom or lake bed.

Consider the potential for increases in surface water volume during normal low flow periods caused by prolonged duration of reservoir releases.

Consider the potential for increase in deep percolation to the ground water resulting from seepage from the reservoir sides and bottom.

Water Quality. Consider the potential for improving downstream surface water quality resulting from trapping of suspended sediments, bedload material, and associated nutrients and pesticides in the pool area.

Consider the potential for increased instability of channel bed and banks. Water discharged from the dam will have reduced sediment content and therefore will have increased sediment transport capacity in the reach downstream from the dam when compared to the pre-dam condition.

Consider the potential for degradation of surface water quality during construction by sediments, fuels, oils, and other chemicals.

Consider the potential influence of the low water outlet elevation on the amount of absorbed nutrients and pesticides in deposited sediments and the potential for their discharge from the reservoir.

Consider the potential for changes in downstream water temperatures and dissolved oxygen content that could result from the design of the outlet structure. Adverse changes should be mitigated if possible in the design of the structure. Where dissolved oxygen may be reduced by outlet placement, plan some means of causing rapid dissolved oxygen recovery.

Consider the potential for increases in soluble nutrients, pesticides, and other contaminants in deep percolating waters caused by seepage through reservoir sides and bottom. Natural or human-induced contaminants may originate from those used in the structure and reservoir area, or may be dissolved in waters from the watershed area.

Consider the potential effects on wetlands and water-related wildlife habitats.

Consider the potential effects of water levels on soil nutrient processes such as plant nitrogen use or denitrification.

Consider the potential effects of soil water level control on the salinity of soils, soil water, or downstream water.

Consider the potential to uncover or redistribute toxic materials such as saline soils at the dam site and borrow areas as a result of earth moving operations.

Fish and Wildlife Habitat. Where fish and wildlife habitat creation or enhancement is not a primary purpose of the structure, the plan should still consider maintaining habitat for fish and wildlife and the potential effects of installing the dam such as:

- Project location and construction should minimize the impacts to existing fish and wildlife habitat.
- When feasible, structure should be retained, such as trees in the upper reaches of the pond, stumps in the pool area. Upper reaches of the pond can be shaped to provide shallow areas and wetland habitat.
- If fish are to be stocked, consider criteria and guidance in Practice Standard 399, Fishpond Management.

Consider the potential for altering fish and wildlife habitat resulting from changes in the quality, quantity, timing, or duration of streamflows after installation of the dam.

Consider the potential for creating a competitive advantage for non-native or undesirable animals or plants resulting from changes in the quality, quantity, timing, or duration of streamflows after installation of the dam.

PLANS AND SPECIFICATIONS

Plans and specifications for installing dams shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Provisions shall be made as necessary for operation and maintenance requirements and may include a formal plan for larger, more complex dams. The operation and maintenance plan should include an emergency action plan when required by local or state regulations, and for all high hazard class structures.