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

- To reduce downstream flood damage.
- To 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.
- To 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 upstream, 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.

Impact to cultural resources, wetlands and Federal and state protected species shall be evaluated and avoided or minimized to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

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 requirements in Florida NRCS conservation practice standard Critical Area Planting, Code 342.

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

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

earth dams and appurtenances may be designed to the criteria in Florida NRCS conservation practice standard Pond, Code 378, 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.

Dam Safety. The downstream area below the dam must be evaluated carefully to determine what impact a sudden breach of the proposed dam would have. This evaluation must consider all existing improvements and those improvements that my reasonably be expected to be made during the useful life of the structure. The results of this examination provides for the proper hazard class of the dam. A potential impact study shall be made and distributed in accordance with NEM Part 520.28 for inventory size dams.

Geological investigations. Geologic investigations shall be performed in accordance with the design criteria used (TR-60 or Florida NRCS conservation practice standard Pond, Code 378).

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 Florida NRCS conservation practice standard Irrigation Reservoir, Code 436.

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 Florida NRCS conservation practice standard Fishpond Management, Code 399. Also see Florida NRCS conservation practice standard Wetland Wildlife Habitat Management, Code 644, for criteria related to wildlife habitat.

Additional Criteria For Renewable Energy

Renewable energy systems shall meet applicable industry design standards and shall be in accordance with manufacturer's recommendations. Hydropower systems shall be operated and maintained in accordance with manufacturer's recommendations.

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.

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.

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 downstream impacts on federal and state protected species and other wildlife that may result from a sudden breach of the proposed dam. Evaluations should consider sudden discharge of large amounts of water resulting in downstream flooding and erosion, as well as release of sediment .

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. As a minimum, the plans and specifications shall include, but not limited to, the following items:

- Location of the dam.
- Plan and profile of the embankment and auxiliary spillway.
- Profile of principal spillway.
- Typical cross-section of embankment and structures.
- Borrow sources.
- Details of any structural items.
- Vegetative requirements.

OPERATION AND MAINTENANCE

A site specific operation and maintenance (O&M) plan will be prepared for each dam and provided to the landowner. All dams must be adequately maintained if their purposes are to be realized through the expected life. Special considerations shall be given for maintenance needs during the planning, design, and construction of the dam.

An emergency action plan shall be prepared when required by local or state regulations, and for all high hazard class structures.

The dam should be inspected periodically and especially after heavy rains to determine whether it is functioning properly or if repairs are needed. The O&M plan shall include as a minimum, but not limited to, the following requirements.

- Check appurtenances such as trash racks, outlet structures, and valves. Keep free of trash and replace when needed.
- Repair rills on the slopes of the dam and eroded areas in the earth spillway. Repair with suitable material, compacted, seeded and fertilized as needed.
- Check for seepage through or under the dam. If seepage is evident, take proper corrective measures immediately.
- Check vegetative cover on the dam and earth spillway. Maintained vegetative cover by mowing and fertilizing.
- Remove any trees from the embankment or in the auxiliary spillway.
- When needed, fencing and watering troughs will be provided to protect the dam and vegetation from livestock.

- Erosion at the principal spillway outlet shall be repaired and if necessary protected to prevent additional erosion.

REFERENCES

Florida NRCS Conservation Practice Standards:
- Critical Area Planting, Code 342
- Fishpond Management, Code 399
- Irrigation Storage Reservoir, Code 436
- Pond, Code 378
- Wetland Wildlife Habitat Management, Code 644

General Manual
- Title 420-Part 401
- Title 450-Part 401
- Title 190-Parts 410.22 and 410.26

National Cultural Resources Handbook
National Environmental Compliance Handbook
National Food Security Act Manual
National Planning Procedures Handbook
- Florida Supplements to Parts 600.1 and 600.6

Technical Release 60, Earth Dams and Reservoirs