Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

POND

Code 378

(No.)

DEFINITION

A pond is a water impoundment made by constructing an embankment, by excavating a dugout, or by a combination of both.

In this standard, NRCS defines ponds constructed by the first method as embankment ponds, and those constructed by the second method as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the auxiliary spillway elevation is 3 feet or more above the lowest original ground along the centerline of the embankment.

PURPOSE

A pond stores water for livestock, fish and wildlife, recreation, fire control, erosion control, flow detention, and other uses such as improving water quality.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all excavated ponds. It also applies to embankment ponds that meet all of the criteria for low-hazard dams as listed below:

- The failure of the dam will not result in loss of life, damage to homes, commercial or industrial buildings, main highways, or railroads, or in interruption of the use or service of public utilities.
- The product of the storage times the effective height of the dam is less than 3,000 acre-feet^2. Storage is the capacity of the reservoir in acre-feet below the elevation of the crest of the lowest auxiliary spillway or the elevation of the top of the dam if there is no open channel auxiliary spillway. The effective height of the dam is the difference in elevation, in feet, between the lowest open channel auxiliary spillway crest and the lowest point in the original cross section taken on the centerline of the dam. If there is no open channel auxiliary spillway, use the lowest point on the top of the dam instead of the lowest open channel auxiliary spillway crest.
- The effective height of the dam is 35 feet or less.

CRITERIA

General Criteria Applicable to All Purposes

All federal, State and local requirements shall be addressed in the design. It is the responsibility of the designer to check to see if the proposed dam will require a construction permit from ODNR, Dam Safety Program. Generally, a construction permit is not required for:

- A dam that is or will be less than ten feet in height and that has or will have a storage capacity of not more than fifty acre-feet at the elevation of the top of the dam. The height of a dam shall be measured from the natural stream bed or lowest ground elevation at the downstream or outside limit of the dam to the elevation of the top of the dam.
- A dam, regardless of height, that has or will have a storage capacity of not more than fifteen acre-feet at the elevation of the top of the dam;
- A dam, regardless of storage capacity, that is or will be six feet or less in height.

Design a minimum sediment storage capacity equal to the design life of the structure, or provide for periodic cleanout. Protect the drainage area above the pond to prevent sedimentation from adversely affecting the design life.

Design measures necessary to prevent serious injury or loss of life in accordance with requirements of NRCS National Engineering Manual (NEM), Part 503, Safety.

Seed or sod the exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in NRCS Conservation Practice Standard (CPS) Code 342, Critical Area Planting. When necessary to provide surface protection where climatic conditions preclude the use of seed or sod, use the criteria in CPS Code 484, Mulching, to install inorganic cover material such as gravel.

Cultural resources. Evaluate the existence of cultural resources in the project area and any project impacts on such resources. Provide conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

Site conditions. Select or modify the site to allow runoff from the design storm to safety pass through (1) a natural or constructed auxiliary spillway, (2) a combination of a principal spillway and an auxiliary spillway, or (3) a principal spillway.

Select a site that has an adequate supply of water for the intended purpose via surface runoff, groundwater, or a supplemental water source. Water quality must be suitable for its intended use.

Ponds shall be protected from contaminated runoff from barnyards, discharge from sewage disposal systems, excessive sedimentation, or other sources. Runoff of unsuitable water quality will be diverted around the pond, however, all diverted flow must be returned to its natural watercourse before it leaves the owners property. The pond will be designed using the natural drainage area regardless of the amount of runoff diverted away from the structure.

Reservoir. Provide adequate storage volume to meet user demands for all intended purposes. Account for sedimentation, season of use, evaporation loss, and seepage loss when computing the storage volume.

Where fish production is a purpose, design at least 25 percent of the pond area at normal water level to have a minimum depth of 8 ft., or a minimum depth of 6 ft. for spring fed ponds. Design the pond to have at least 50 percent of the pond area with a minimum depth of 6 ft., when excavating is restricted by underlying material.

Criteria Applicable to Embankment Ponds.

Geological investigations. Use pits, trenches, borings, and reviews of existing data or other suitable means of investigation to characterize materials within the embankment foundation, auxiliary spillway, and borrow areas. Classify soil materials using the Unified Soil Classification System (ASTM D2487). The exploration must be in sufficient detail to determine that the reservoir area is sufficiently impermeable to prevent excessive seepage losses, or the soils are suitable for the type of pond sealing that is specified. If borrow is planned to be removed from within the pool area, potential leakage zones must be identified.

The material planned to be excavated from the auxiliary spillway should be evaluated for suitability for use in constructing the embankment. If it is unsuitable for use a waste location must be found.

Earthfill. Refer to NRCS-Ohio construction and material specification OH-23 “Earthfill” for placement and compaction requirements for embankments and foundations.

Foundation cutoff. Design a continuous cutoff of relatively impervious material under the dam and up the abutments as required for preventing seepage. Locate the cutoff at, or upstream from, the centerline of the dam. Extend the cutoff deep enough to intercept flow and connect with a relatively impervious layer. In all cases the minimum depth shall be 3 feet. Combine seepage control with the cutoff as needed. Use a cutoff bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Design cutoff side slopes no steeper than one horizontal to one vertical.

Seepage control. Include seepage control if (1) foundation cutoff does not intercept pervious layers, (2) seepage could create undesired wet areas, (3) embankment stability requires seepage control, or (4) special problems require drainage for a stable dam. Control seepage by (1) foundation, abutment, or embankment filters and drains; (2) reservoir blanketing; or (3) a combination of these measures.

Top width. Table 1 provides the minimum top widths for dams of various total heights. Total height is the vertical distance between the settled top of the dam and the lowest elevation at the downstream toe.

Design a minimum width of 12 feet if the embankment top may be crossed by farm equipment. Design a minimum width of 16 feet for one-way traffic and 26 feet for two-way traffic for the top of dams used as public roads. Design guardrails or other safety measures where necessary and follow the requirements of the responsible road authority. For dams less than 20 feet in total height, maintenance considerations or construction equipment limitations may require increased top widths from the minimum shown in Table 1.

Table 1. Minimum top width for dams.

Total height of dam *(feet)*	Top width *(feet)*
Less than 10	6
10–14.9	8
15–19.9	10
20–24.9	12
25–34.9	14
35 or more	15

Side slopes. Design each side slope with a ratio of two horizontal to one vertical or flatter. Design the sum of the upstream- and downstream-side slopes with a ratio of five horizontal to one vertical or flatter. As required, design benches or flatten side slopes to assure stability of all slopes for all loading conditions.

Slope protection. Design special measures such as berms, rock riprap, sand-gravel, soil cement, or special vegetation as needed to protect the slopes of the dam from erosion. Use NRCS Engineering Technical Release (TR) 210-56, A Guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments, and TR-210-69, Riprap for Slope Protection against Wave Action, as applicable. Design a sloping berm when the pond surface area is greater than 6 acres.

Freeboard. Design a minimum of 1.0 feet of freeboard between design high-water-flow elevation in the auxiliary spillway and the top of the settled embankment. Design a minimum 2.0 feet of elevation difference between the crest of the auxiliary spillway and the top of the settled embankment when the dam has more than a 20-acre drainage area or more than 20 feet in effective height. Design a minimum of 1.0 feet of freeboard above the peak elevation of the routed design hydrograph to the top of the settled embankment, when the pond has no auxiliary spillway.

Settlement. Increase the height of the dam by the amount needed to ensure that the settled top elevation of the dam equals or exceeds the design top elevation. Design a minimum of 5 percent of the total height of the dam associated with each dam cross section, except where detailed soil testing and laboratory analyses or experience in the area shows that a lesser amount is adequate.

Principal spillway and pipe conduit through the embankment. Design a pipe conduit with needed appurtenances through the dam, except where rock, concrete, or other types of lined spillways are used, or where a vegetated or earth spillway can safely handle the rate and duration of base flow.

Design a minimum of 0.5-feet difference between the crest elevation of the auxiliary spillway and the crest elevation of the principal spillway when the dam has a drainage area of 20 acres or less. Design a minimum of 1.0-foot difference when the dam has a drainage area of over 20 acres. Current approved NRCS routing software or an equivalent procedure must be used for the hydraulic design of ponds built under this standard. (See references at the end of the standard for routing tools.).

Provide an antivortex device for a pipe conduit designed for pressure flow. Design the inlet and outlet to function for the full range of flow and hydraulic head anticipated. When the drainage area exceeds 10 ac., the pipe conduit shall be provided with a standard riser or a hooded type inlet. The dimensions of either type must meet the design requirements for efficient hydraulic flow. Either type of inlet must be provided with an adequate baffle.

Design adequate pipe conduit capacity to discharge long-duration, continuous, or frequent flows without causing flow through the auxiliary spillway. A minimum 4 inch diameter principal spillway pipe may be used for drainage areas that are 10 acres or less. The minimum pipe diameter of smooth wall pipe shall be 6 inches and the minimum diameter for corrugated metal pipe shall be 8 inches.

Drainage Area (acres)	Effective Fill[1] Height (feet)	Storage [1/] (acre-feet)	Minimum Design Frequency [2/] (24-hour Duration Storm) Principal Spillway (year)	Auxiliary Spillway (year)
0-20	0-20	Less than 50	2	10
0-20	20-35	Less than 50	2	25
20-100	0-20	Less than 50	5	25
20-100	20-35	Less than 50	5	50
All Others	0-35	All	10	50

1/ Defined under “Conditions Where Practice Applies”
2/ Select rain distribution based on climatological region

Design pipe with a minimum inside diameter of 1-1/4 inches for water supply pipes or for pipes used for any other purpose.

Design pipe conduits using ductile iron, welded steel, corrugated steel, corrugated aluminum, reinforced concrete (pre-cast or site-cast), or plastic. Do not use cast iron or unreinforced concrete pipe if the dam is 20 feet or greater in total height.

Design and install pipe conduits to withstand all external and internal loads without yielding, buckling, or cracking. Design rigid pipe for a positive projecting condition. Design flexible pipe conduits in accordance with the requirements of NRCS National Engineering Handbook (NEH), Part 636, Chapter 52, Structural Design of Flexible Conduits.

Design connections of flexible pipe to rigid pipe or other structures to accommodate differential movements and stress concentrations. Design and install all pipe conduits to be watertight using couplings, gaskets, caulking, water stops, or welding. Design joints to remain watertight under all internal and external loading including pipe elongation due to foundation settlement.

Design a concrete cradle or bedding for pipe conduits if needed to reduce or limit structural loading on pipe and improve support of the pipe.

Design outlet structures, such as cantilever pipe outlet sections and impact basins, to dissipate energy as needed. The invert of the pipe at the outlet end shall be a minimum of 1 foot above a constructed channel or gully bottom. The pipe shall project beyond the toe of the fill in all cases.

Corrosion protection. Provide protective coatings for all steel pipe and couplings in areas that have traditionally experienced pipe corrosion or in embankments with saturated soil resistivity less than 4,000 Ohm-cm or soil pH less than 5. Protective coatings may include asphalt, polymer over galvanizing, aluminized coating, or coal tar enamel.

Ultraviolet protection. Use ultraviolet-resistant materials for all plastic pipe or provide coating or shielding to protect plastic pipe exposed to direct sunlight.

Cathodic protection. Provide cathodic protection for coated welded steel and galvanized corrugated metal pipe where soil and resistivity studies indicate that the pipe needs a protective coating and where the need and importance of the structure warrant additional protection and longevity. If the original design and installation did not include cathodic protection, consider establishing electrical continuity in the form of joint-bridging straps on pipes that have protective coatings. Add cathodic protection later if monitoring indicates the need.

Filter diaphragms. When the effective height of the dam is 15 feet or greater and the effective storage of the dam is 50 acre-ft. or more, provide filter diaphragms to control seepage on all pipes extending through the embankment with inverts below the peak elevation of the routed design hydrograph. Design filter diaphragms or alternative measures as needed to control seepage on pipes extending through all other embankments or for pipes with inverts above the peak elevation of the routed design hydrograph.

Design the filter diaphragm in accordance with the requirements of NEH, Part 628, Chapter 45, Filter Diaphragms. Locate the filter diaphragm immediately downstream of the cutoff trench, but downstream of the centerline of the dam if the foundation cutoff is upstream of the centerline or if there is no cutoff trench.

The drainage diaphragm shall be a minimum of 2 feet thick and extend vertically upward and horizontally at least three times the outside pipe diameter, and vertically downward at least 18 inches beneath the conduit invert. Ensure filter diaphragm functions both as a filter for adjacent base soils and as a drain for seepage that it intercepts. The drainage diaphragm shall consist of sand meeting the requirements of ASTM C-33, for fine aggregate or ODOT Construction and Materials Specification 703.02. If unusual soil conditions exist such that this material may not meet the required filter or capacity requirements, a special design analysis shall be made. Materials for the filter diaphragm shall meet the requirements of NEH Part 628, Chapter 45, Filter Diaphragms, Section 628.4503(d), Filter and Drain Gradation.

The drainage diaphragm shall have an outlet at the embankment downstream toe using a drain backfill envelope continuously along the pipe to where it exits the embankment. Drain fill shall be protected from surface erosion and animal intrusion with rock large enough to be stable for site conditions. Where large rock riprap is required to protect the outlet, a transition section may be required to prevent movement of the drain material through voids in the riprap.

Anti-Seep Collars. When using anti-seep collars in lieu of a filter diaphragm, ensure a watertight connection to the pipe. Limit the maximum spacing of the anti-seep collars to 14 times the minimum projection of the collar measured perpendicular to the pipe, or 25 feet, whichever is less. Locate anti-seep collars no closer than 10 feet apart. Use a collar material that is compatible with the pipe material.

When using anti-seep collars, design the collars to increase the seepage path along the pipe within the fill by at least 15 percent.

Anti-seep collars are installed on pipe conduits, pond drain, or water supply pipes that are located in the normal saturation zone of the embankment. The normal saturation zone extends from the riser to the drainage system. When a drainage system is not used, the saturation zone will be considered as extending to the downstream toe of the dam. Where the downstream slope is flatter than 2:1, the 2:1 slope may be used for calculating the length of the seepage zone. Refer to worksheets OH-ENG 197 and OH-ENG-198 for anti-seep collar sizing.

Supply pipes to watering troughs and other appurtenances shall have a minimum inside diameter of 1 ¼ in. A minimum of 2 anti-seep collars of at least 24-in. diameter or 2 ft. x 2 ft. square shall be firmly attached to the pipeline when pipe is placed under or through the fill.

Trash guard. Install a trash guard at the riser inlet to prevent clogging of the conduit.

Pool Drain. Provide a pipe with a suitable valve to drain the pool area if needed for proper pond management or if required by State law. The designer may use the principal spillway conduit as a pond drain if it is located where it can perform this function.

Auxiliary spillways. A dam must have an open channel auxiliary spillway, unless the principal spillway is large enough to pass the peak discharge from the routed design hydrograph and the trash that comes to it without overtopping the dam. The minimum criteria for acceptable use of a closed conduit principal spillway without an auxiliary spillway consist of a conduit with a cross-sectional area of 3 feet^2 or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash.

Design the minimum capacity of a natural or constructed auxiliary spillway to pass the peak flow expected from a total design storm of the frequency and duration shown in Table 2, less any reduction creditable to the conduit discharge and detention storage. If the pipe conduit diameter is 10 inches or greater, its design discharge may be considered when calculating the peak outflow rate through the auxiliary spillway.

Design the auxiliary spillway to safely pass the peak flow through the auxiliary spillway or route the storm runoff through the reservoir. Start the routing either with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days' drawdown, whichever is higher. Compute the 10-day drawdown from the crest of the auxiliary spillway or from the elevation attained from impounding the entire design storm, whichever is lower. Design the auxiliary spillway to pass the design flow at a safe velocity to a point downstream where the flow will not endanger the dam.

A constructed auxiliary spillway consists of an inlet channel, a control section, and an exit channel. Design the auxiliary spillway with a trapezoidal cross section. Locate the auxiliary spillway in undisturbed or compacted earth or in-situ rock. Design for stable side slopes for the material in which the spillway is to be constructed. Design a minimum bottom width of 10 feet for dams having an effective height of 20 feet or more.

Design a level inlet channel upstream from the control section for the distance needed to protect and maintain the crest elevation of the spillway. If necessary, curve the inlet channel upstream of the level section to fit existing topography. Design the exit channel grade in accordance with NEH Part 628, Chapter 50, Earth Spillway Design, or with equivalent procedures.

Structural auxiliary spillways. When used for principal spillways or auxiliary spillways, design chute spillways or drop spillways according to the principles set forth in NEH, Part 650, Engineering Field Handbook; and NEH, Section 5, Hydraulics; Section 11, Drop Spillways; and Section 14, Chute Spillways. Design a structural spillway with the minimum capacity required to pass the peak flow expected from a total design storm of the frequency and duration shown in Table 2, less any reduction creditable to the conduit discharge and detention storage.

Criteria for Excavated Ponds

Site Selection. A soils exploration shall be made in sufficient detail to determine that the reservoir area is sufficiently impermeable to prevent excessive seepage losses or if the soils are suitable for the type of pond sealing that is specified.

Runoff. Design a minimum of 1.0 feet of freeboard above the peak elevation of the routed design hydrograph. Design a pipe and auxiliary spillway that will meet the capacity requirements of Table 2. Consider runoff flow patterns when locating the excavated pond and placing the spoil.

If the drainage area is less than 10 acres, and where the spoil is placed on the low side of the pond to raise the water surface above natural ground level, the pond may be designed using one of the three procedures listed here:

1. Set normal water level at crest elevation of earth auxiliary spillway. Design the auxiliary spillway to carry peak flow of a 10-year frequency, 24-hour duration storm. Add 1 ft. of freeboard to the design flow elevation of spillway to set minimum elevation of top of spoil. (Do not use this procedure for ponds with spring flow or sustained base flow).

2. Set normal water level at invert elevation of pipe spillway (4-in. minimum diameter). Set crest elevation of earth auxiliary spillway at least 0.5 ft. above normal water elevation. Design the auxiliary spillway to carry the peak flow of a 10-year frequency, 24-hour duration storm. Set top of spoil at the design flow elevation of the auxiliary spillway, or 0.5 ft. above the crest elevation of the auxiliary spillway, whichever is greater.

3. Set normal water level at invert elevation of pipe spillway (4-in. minimum diameter). Construct spoil to serve as an overflow section with a crest elevation at least 1.0 ft. above pipe invert, with a minimum top width of 12 ft. and with a downstream slope of 6:1 or flatter extending to natural ground.

If the drainage area is greater than 10 acres and where the spoil is placed on the low side of the pond to raise the water surface above natural ground level, design the pond using criteria for embankment ponds.

Side slopes. Design stable side slopes in the excavated area no steeper than one horizontal to one vertical. If livestock will water directly from the pond, a watering ramp of ample width shall be provided. The ramp shall extend to the anticipated low water elevation and a slope of no steeper than 3 horizontal to 1 vertical.

Watering Ramp. When wildlife or livestock need access to stored water, use the criteria in NRCS CPS Code 614, Watering Facility, to design a watering ramp.

Inlet protection. Protect the side slopes from erosion where surface water enters the pond in a natural or excavated channel.

Excavated material. Place the material excavated from the pond so that its weight does not endanger the stability of the pond side slopes and so that the soil will not wash back into the pond by rainfall. Dispose of excavated material in one of the following ways:

- Uniformly spread to a height that does not exceed 3 feet, with the top graded to a continuous slope away from the pond.
- Uniformly place or shape reasonably well, with side slopes assuming a natural angle of repose. Place excavated material at a distance equal to the depth of the pond, but not less than 12 feet from the edge of the pond.
- Shape to a designed form that blends visually with the landscape.
- Provide for low embankment construction and leveling of surrounding landscape.
- Haul material offsite.

Criteria for Fire Protection Ponds

Dry hydrants shall be designed according to Practice Standard, Dry Hydrant, 432.

The minimum capacity of the reservoir will be sufficient to store the volume of water required to permit the local firefighting equipment to pump at least two hours. To take care of evaporation and ice, the volume will be computed from 1 ft. below the normal water elevation.

The minimum depth of 25 percent of the surface area, or 0.1 ac., whichever is smaller, will be 8 ft.

The pond or hydrant (either pressure or dry) will be located adjacent to an all-weather road. The minimum distance from the nearest building shall be 75 ft. The maximum distance from the farthest building to be protected shall be 500 ft.

Access to the water will be provided by the installation of a suitable hydrant (pressure or dry), or by a brine barrel, greased plug or other acceptable method.

Criteria for Upground Reservoirs

Upground reservoirs are defined as those ponds formed by constructing an embankment completely around the pond, and maintaining a water level above the natural ground elevation by artesian flows or by pumping.

Upground reservoirs will be designed using the same criteria as specified for embankment ponds.

Pipe spillways are required for all ponds with continuous inflow such as artesian wells, and where inflow is unregulated such as roof water or by pumping from windmills. The minimum size of the pipe spillway shall be 4 in.

A vertical interval will be provided for flood storage above the normal water elevation that is at least equal to a 10-year frequency 24-hour duration rainfall. A minimum freeboard of 1.0 ft. will be provided above the design storm elevation to establish the settled top of dam. The design height of dam shall be increased by the amount needed to ensure that the design top of dam elevation will be maintained after all settlement has taken place. This increase shall not be less than 5 percent.

The minimum top width is 8 ft. for embankments with heights of 10 ft. or less. The combined upstream and downstream side slopes of the settled embankment shall not be less than five horizontal to one vertical with neither slope steeper than 2:1. Slopes must be designed to be stable in all cases.

Where needed to protect the face of the embankment, berms, rock riprap or special vegetation shall be provided.

CONSIDERATIONS

Visual resource design. Carefully consider the visual design of ponds in areas of high public visibility and those associated with recreation. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

Shape the embankment to blend with the natural topography. Shape the edge of the pond so that it is generally curvilinear rather than rectangular. Shape excavated material so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, add islands to provide visual interest and to attract wildlife.

Fish and wildlife. Locate and construct ponds to minimize the impacts to existing fish and wildlife habitat.

When feasible, retain structures such as trees in the upper reaches of the pond and stumps in the pool area. Shape upper reaches of the pond to provide shallow areas and wetland habitat.

If operations include stocking fish, use CPS Code 399, Fishpond Management.

Vegetation. Stockpile topsoil for placement on disturbed areas to facilitate revegetation.

Consider selecting and placing vegetation to improve fish habitat, wildlife habitat and species diversity.

Water quantity. Consider effects upon components of the water budget, especially—

- Effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and groundwater recharge.
- Variability of effects caused by seasonal or climatic changes.
- Effects on downstream flows and impacts to environment such as wetlands, aquifers, and social and economic impacts to downstream uses or users.

Water quality. Consider the effects of:

- Erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that runoff carries.
- Short-term and construction-related effects of this practice on the quality of downstream watercourses.
- Water-level control on the temperatures of downstream water to prevent undesired effects on aquatic and wildlife communities.
- Wetlands and water-related wildlife habitats.
- Water levels on soil nutrient processes such as plant nitrogen use or denitrification.
- Soil water level control on the salinity of soils, soil water, or downstream water.
- Potential for earth moving to uncover or redistribute toxic materials.
- Livestock grazing adjacent to the pond. Consider fencing to keep livestock activities out of direct contact with the pond and dam.

Site Conditions. Consider having at least a 6:1 ratio of the watershed area to the pond area at normal water level except where an auxiliary means of water supply is provided. Water for upground reservoirs shall be supplied by artesian flows, pumping, or by other suitable methods.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. Requirements for all drawings prepared by NRCS/SWCD as well as by others (Professional Engineer or Registered Architect) are contained in the National Engineering Manual (NEM) Part 541- Drafting and Drawings. As a minimum, include the following items:

- A plan view of the layout of the pond and appurtenant features
- Topographic map (where applicable). Show low ground elevations at property lines near pooled water areas when they are near design high water level
- Pertinent elevations as applicable (normal pool, maximum high water (water control structure), auxiliary spillway crest, top of embankment, pipe inlet and outlet invert elevations
- Profile along centerline of embankment showing existing ground and proposed fill and core trench. Soil boring 'Unified Classification' logs will be added if required by the applicable Ohio Practice Standard
- Cross-section along centerline of foundation drain (where applicable)
- Soil boring or test pit locations and ‘Unified Classification’ logs
- Borrow area location along with proposed typical cross section of borrow area with ‘Unified Classification’ logs
- Location and dimensions of principal and auxiliary spillways
- Profiles of principal and auxiliary spillways
- Structural drawings adequate to describe the construction requirements
- Details of principal spillway appurtenances (i.e., trash racks, animal guards, anti-seep collars, etc.)
- Fill cross-section showing side slopes, top width, elevations of top of fill, berms, ground line, core trench, etc.
- Earthfill compaction requirements
- Stationing along centerline of fill; show stations of intersections of principal and auxiliary spillway centerlines; establish stationing ground control
- Erosion and sediment control measures
- Seeding and fertilizing requirements
- Site preparation requirements (as necessary), i.e., topsoil scalping depth and stockpiling; waste material disposal; work limits
- Quantities - bill of materials
- Safety features
- Site-specific construction and material requirements

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator.

As a minimum, include the following items in the operation and maintenance plan:

- Periodic inspections of all structures, earthen embankments, spillways, and other significant appurtenances
- Prompt repair or replacement of damaged components
- Prompt removal of sediment when it reaches predetermined storage elevations
- Periodic removal of trees, brush, and undesirable species
- Periodic inspection of safety components and immediate repair if necessary
- Maintenance of vegetative protection and immediate seeding of bare areas as needed

REFERENCES

American Society for Testing and Materials. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM D2487. West Conshohocken, PA.

USDA NRCS. Engineering Technical Release, TR-210-60, Earth Dams and Reservoirs. Washington, DC.

USDA NRCS. National Engineering Handbook (NEH), Part 628, Dams. Washington, DC.

USDA NRCS. NEH, Part 633, Soil Engineering. Washington, DC.

USDA NRCS. NEH, Part 636, Structural Engineering. Washington, DC.

USDA NRCS. NEH, Part 650, Engineering Field Handbook. Washington, DC.

USDA NRCS. National Engineering Manual. Washington, DC.

USDA NRCS- WinPOND software program for pond design and user's guide:
https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/ndcsmc/?cid=stelprdb1042198

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/mo/technical/engineering/?cid=nrcs144p2_013014

USDA NRCS. Engineering Field Tools
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/engineering/?cid=stelprdb1186070

USDA-NRCS-Ohio specification OH-23 "Earthfill"

DEFINITIONS

Effective Fill Height: The difference in elevation in feet between the lowest open channel auxiliary spillway crest and the lowest point in the original cross section on the centerline of the dam. If there is no open channel auxiliary spillway, the top of the dam becomes the upper limit.

Fill Height: The difference in elevation in feet between the top of the dam and the lowest point in the original cross section on the centerline of the dam.

Total (Overall) Height: The difference in elevation in feet between the top of the dam and the lowest elevation at the downstream toe.

Storage: The capacity, in acre-feet, below the elevation of the crest of the lowest auxiliary spillway or the top of the dam if there is no open channel auxiliary spillway.

Retarding Storage: The volume allotted to the temporary impoundment of floodwater. Its upper limit is the elevation of the crest of the auxiliary spillway. Its lower limit is the principal spillway crest. Aerated storage is deducted from the volume between the principal spillway crest and the auxiliary spillway crest.