NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

POND

(No.)

Code 378

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:

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

1. The 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 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.
3. The effective height of the dam is 35 feet or less.

CRITERIA

General Criteria Applicable to All Purposes

All planned work shall comply with all Federal, state, and local laws, rules, and regulations. Ponds may need to be approved or permitted by the appropriate Florida Water Management District (WMD) or other permitting agency.

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).

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 Florida 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 Florida NRCS CPS Mulching, Code 484, to install inorganic cover material such as gravel.

Site conditions. Select or modify the site to allow runoff from the design storm to safely 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.

Reservoir area. 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.

Criteria Applicable for Embankment Ponds

Dam Safety. Evaluate the downstream area below the embankment or dam to determine what impact a sudden breach of the proposed dam would have. This evaluation must consider all existing improvements and those improvements that may reasonably be expected to occur during the useful life of

the structure. The results of this examination provides for determining the proper hazard class of the dam. Only low hazard dams, as defined in NEM Part 520.21, are to be designed under this standard.

Geological investigations. Geologic investigations shall be in accordance with NEM Part 531, Geology, Subpart A – Geological Investigations. Use pits, trenches, borings, 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 (USCS) ASTM D2487.

Maintain a permanent record of all soil borings and test pits in the design folder.

Foundation cutoff. Design a 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 to intercept flow and connect with a relatively impervious layer. 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 (1:1).

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 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 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 embankment, feet	Top width, feet
< 10	6
10 - 14.9	8
15 - 19.9	10
20 - 24.9	12
25 - 34.9	14
≥ 35	15

Side slopes. Design each side slope with a ratio of two horizontal to one vertical (2:1) or flatter. Design the sum of the upstream and downstream side slopes of the settled embankments with a ratio of five horizontal to one vertical (5:1) 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) 56, “A guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments” and TR 69, “Riprap for Slope Protection Against Wave Action”, as applicable.

Freeboard. Design a minimum of 1.0 foot of freeboard between design high-water flow elevation in 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 show 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 foot 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.

Provide an antivortex device for a pipe conduit designed for pressure flow. Design the inlet and outlet for the full range of flow and hydraulic head anticipated. Design antivortex devices in accordance with ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.

Design adequate pipe conduit capacity to discharge long-duration, continuous, or frequent flows without causing flow through the auxiliary spillway. Design a principal spillway pipe with a minimum inside diameter of 6-inches. Design pipe with a minimum inside diameter of 1-¼ 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 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.

The minimum acceptable plastic pipe shall be as shown in Table 2.

The minimum thickness of corrugated metal pipe shall be as shown in Table 3.

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.

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 4000 ohms-cm or soil pH less than 5. Protective coatings may include be 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.

Table 2 - Acceptable Plastic Pipe for use in Earth Dams [1/]

Type of plastic pipe	Nominal pipe size, inches	Maximum depth of fill over pipe, feet
Smooth Wall PVC Pipe [2/]		
SDR 26 [1/]	4 - 12	10
SDR 21 [1/]	4 - 12	13
SDR 17 [1/]	4 - 12	17
SDR 13.5 [1/]	4 - 12	20
Schedule 40 [1/]	4	15
Schedule 40 [1/]	6 - 12	10
Schedule 80 [1/]	4	20
Schedule 80 [1/]	6 - 12	15
Corrugated Smooth-Lined Polyethylene and PVC [3/]		
PVC, HDPE	4 - 18	15
PVC, HDPE	24 - 36	10

1/ Plastic pipe manufactured to conform to ASTM Specifications other than those listed may be used with the maximum fill limits shown provided the pipe meet or exceed the requirements of the listed pipes for materials, wall thickness, and joint water tightness. Pipe having a wall thickness different from the listed pipes may be used provided the calculated long term deflection for the designed fill height and installation conditions does not exceed 5 percent.

2/ Polyvinyl chloride pipe, PVC 1120 or PVC 1220, conforming to ATSM-D1785 or ATSM-D2241.

3/ Polyethylene, Type III, Class C, Category 4 or 5 conforming to ASTM D1248 and D3350 and AASHTO M252 or M294, Type S: PVC; ASTM F949.

Table 3 - Minimum Gage/Thickness for Corrugated Metal Pipe (2-2/3-in x ½-in corrugations)[1/] and Smooth Steel Pipe

Fill Height Over Pipe feet	Steel CMP [2/] Diameter in inches					Aluminum CMP [3/] Diameter in inches						Smooth Steel [4/] Diameter in inches		
	≤ 24	30	36	42	48	≤ 21	24	30	36	42	48	≤ 21	21-34	34-48
1 to < 15	16	16	14	12	10	16	16	14	14	12	10	0.125	0.188	0.250
15 to < 20	16	16	14	12	10	16	14	12	12	10	10	0.188	0.250	0.250
20 to ≤ 25 [5/]	16	14	12	10	10	16	12	10	--[6/]	--[6/]	--[6/]	0.250	0.312	0.375

1/ Pipe with 6-, 8-, and 10-inch diameters has 1-1/2 in x ¼-in corrugations.

2/ Pipe conforming to ASTM A760, A761, and A762.

3/ Riveted or helical fabrication. Pipe conforming to ASTM B745.

4/ Pipe conforming to ASTM A53.

5/ When fill height over pipe exceeds 25 feet, individually design the pipe using procedures in National Engineering Handbook (NEH) Part 636, Chapter 52, Structural Design of Flexible Conduits.

6/ Not Permitted

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 diaphragm. 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.

To improve filter diaphragm performance, provide a drain outlet for the filter diaphragm at the downstream toe of the embankment. Protect the outlet from surface erosion and animal intrusion.

Ensure filter diaphragm functions both as a filter for adjacent base soils and as a drain for seepage that it intercepts. 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.

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.

Extend metal anti-seep collars and their connections to the pipe a minimum of 18 inches in all directions from the pipe. Design reinforced concrete collars with a minimum thickness of 6 inches and extend a minimum of 2.0 feet in all directions from the pipe except when the pipe is bedded on rock. Do not use concrete collars with corrugated metal pipe. Use flexible collars of 30 mil or thicker plastic, PVC, or rubber sheeting attached with stainless steel clamps or waterproof tape and caulked to ensure water tightness on plastic pipes.

The following formula may be used to calculate the number of collars.

$$\text{No. of collars} = \frac{\text{Length of Conduit Within Normal Saturation Zone}}{14 \times \text{Minimum Projection of Collar}} - 1$$

The length of conduit within normal saturation zone shall be taken along the pipe barrel from the upstream toe to the midpoint between the centerline of the dam and downstream slope of the dam at the pipe outlet.

Trash Guard. Install a trash guard at the riser inlet to prevent clogging of the conduit, unless the watershed does not contain trash or debris that could clog 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 or local law, rules, or regulations. 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 are:

1. a conduit with a cross-sectional area of 3 ft^2 or more,
2. an inlet that will not clog, and
3. 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 4, less any reduction creditable to conduit discharge and detention storage.

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 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 be 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 Dams, Chapter 50, Earth Spillway Designs.

Structural auxiliary spillways. When used for principal spillways or auxiliary spillways, design chute spillways or drop spillways according to the principles set forth in the NEH, Part 650, Engineering Field Handbook and the NEH, Section 5, Hydraulics; Section 11, Drop Spillways; and Section 14, Chute Spillways. Design a structural spillway with the minimum capacity to pass the peak flow expected from a total design storm of the frequency and duration shown in Table 4, less any reduction creditable to conduit discharge and detention storage.

Table 4 - Minimum Spillway Capacity

			Minimum Design Storm Frequency 2/		
Drainage Area	**Effective Height of Dam 1/**	**Storage**	**Principal spillway**	**Auxiliary Spillway**	**Minimum duration**
acre	feet	acre feet	year	year	hour
≤ 20	≤ 20	< 50	2	10	24
≤ 20	> 20	< 50	2	25	24
> 20 to ≤ 100	≤ 20	< 50	2	25	24
> 20 to ≤ 100	> 20	< 50	5	50	24
> 100 to < 250	≤ 20	< 50	5	25	24
> 100 to < 250	> 20	< 50	5	50	24
≥ 250	≤ 20	< 50	10	25	24
All Others			10	50	24

1/ As defined under “Conditions”
2/ Select rainfall distribution based on climatological region

Criteria for Excavated Ponds

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 4. Consider runoff flow patterns when locating the excavated pond and placing the spoil.

Side slopes. Design stable side slopes in the excavated area no steeper than one horizontal to one vertical (1:1).

Watering ramp. When wildlife or livestock need access to stored water, use the criteria in Florida NRCS CPS Watering Facility, Code 614, 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 will not endanger the stability of the pond side slopes and it will not wash back into the pond by rainfall. Disposed of excavated material in one of the following ways:

1. Uniformly spread to a height that does not exceed 3 feet, with the top graded to a continuous slope away from the pond.
2. Uniformly placed or shaped 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.
3. Shaped to a designed form that blends visually with the landscape.
4. Provide for low embankment construction and leveling of surrounding landscape.
5. Haul material offsite.

CONSIDERATIONS

Maintenance. Consider the type of mowing equipment that will be utilized when designing the side slopes of the embankment. A side slope ratio of four horizontal to one vertical (4:1) or flatter is recommend when mowing by tractor.

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, islands may be added for 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 Florida NRCS CPS Fishpond Management, Code 399.

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

Consider selecting and placing vegetation to improve fish, 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 ground water 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 water courses.
- 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.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to the standard. The plans and specifications shall include as a minimum, but not limited to, the following:

- Location and plan view of pond and appurtenant features.
- Structural drawings adequate to describe the construction requirements.
- Profiles and cross-sections of the embankment, spillway(s), cutoff trench, and borrow areas for embankment ponds.
- Profiles and cross-sections of excavated ponds, along with appurtenant features as needed.
- Location of geologic soil boring and plot of USCS classification.
- Size and type of conduits and appurtenances.
- Foundation preparation and compaction requirements.
- Details of seepage control.
- Embankment earthfill zoning.
- Requirements of diverting water, dewatering site and waste/spoil disposal.
- Requirements for vegetative requirements establishment and/or mulching, as needed.
- Safety features
- Site-specific construction and material requirements.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for the operator. The O&M plan shall be provided to and reviewed with the landowner. All ponds must be adequately maintained through their expected life. Special considerations shall be given for maintenance needs during the planning, design, and construction of the pond.

The minimum requirements to be addressed in the O&M plan include, but are not limited to, the following items:

- Periodic inspections of all structures, earthen embankments, spillways, and other significant appurtenances and especially after heavy rains to determine whether it is functioning properly or if repairs are needed.
- Prompt repair or replacement of damaged components
- Prompt removal of sediment when it reaches predetermined storage elevations
- Appurtenances such as trash racks, outlet structures, and valves shall be kept free of trash and replaced when needed.
- Rills on the slopes of the dam and eroded areas in the earth spillway shall be filled with suitable material, compacted, seeded and fertilized as needed.
- If seepage through or under the dam occurs, proper corrective measures shall be taken immediately.
- Periodic removal of trees, brush, and undesirable species.

- When needed, fencing and watering troughs will be provided to protect the pond and vegetation from livestock.
- Erosion at the principal spillway outlet shall be repaired and if necessary protected to prevent additional erosion.
- Maintenance of vegetative protection and immediate seeding of bare areas as needed.
- Periodic inspection of safety components and immediate repair if necessary

REFERENCES

ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV
AASHTO Standards
M252, M294
ASTM Standards
A53, A760, A761, A762, B745, D1248, D1785,D2244, D2487, D3350, F949
Florida NRCS Conservation Practice Standards
Critical Area Planting, Code 342
Dry Hydrant, Code 432
Fish Pond Management, Code 399
Mulching, Code 484
Nutrient Management, Code 590
Pest Management, Code 595
Watering Facility, Code 614
General Manual
Title 420-Part 401
Title 450-Part 401
Title 190-Parts 410.22 and 410.26
National Cultural Resources Handbook
National Engineering Handbook, Part 628 Dams, Chapter 45, Filter Diaphragms
National Engineering Handbook, Part 628 Dams, Chapter 50, Earth Spillway Designs
National Engineering Handbook, Part 633, Soil Engineering
National Engineering Handbook, Part 636, Structural Engineering, Chapter 52, Structural Design of Flexible Conduits
National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 11
National Engineering Handbook, Section 5, Hydraulics
National Engineering Handbook, Section 11, Drop Spillways
National Engineering Handbook, Section 14, Chute Spillways
National Engineering Manual (NEM) Part 503, 520.21, 520.28, and 531
National Environmental Compliance Handbook
National Food Security Act Manual
National Planning Procedures Handbook
Florida Supplements to Parts 600.1 and 600.6
NRCS Technical Release 56, 60, and 69