

USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

WETLAND CREATION

CODE 658
(Reported by Acre)

DEFINITION

The creation of a wetland on a site which historically was not a wetland.

PURPOSE

To provide wetland functions and values.

**CONDITIONS WHERE PRACTICE
APPLIES**

This standard applies to creating wetlands on sites where, historically, no natural wetlands occurred.

This practice does not apply to:

1. Sites where, historically, natural wetlands occurred, and the intent is to restore the wetland. (Refer to the Maryland conservation practice standard for Wetland Restoration, Code 657.);
2. Sites where a wetland will be constructed to treat significant point and non-point sources of water pollution. (Refer to the conservation practice standard for Constructed Wetland, Code 656.)

CONSIDERATIONS

Consider the long-term land use objectives of the client. If the land user is interested in providing wildlife habitat, consider the wildlife species or groups of species to be supported and the habitat needs which can be met on the managed area.

Consider the natural availability of plant species in the soil seed bank vs. the need for planting in the created wetland and upland buffer.

Consider the need for temporary water level management to promote seedling survival when vegetation is planted in the wetland area.

Consider the effects of the natural topography and soils of the site on the water regime and vegetation.

Consider designing the site to maintain permanent or semi-permanent shallow surface water in at least 20% of the wetland. This will benefit resident wildlife such as waterfowl, wading birds, frogs, toads, salamanders, and turtles that need a long-term water supply.

For sites in existing woodland, consider the adverse impacts on forest conservation, including species adaptability to wetland hydrology, maturity of the woodland, amount of potential loss of existing woody species, and regulatory requirements and constraints (e.g., Maryland Forest Conservation Act).

Consider the adverse impacts of nearby populations of nuisance wildlife such as muskrats, beavers, or resident geese, on the establishment and maintenance of the site. Also consider the potential for attracting nuisance wildlife into an area.

Take note of other constraints such as economic feasibility, access, regulatory or program requirements, social effects, and visual aspects, such as compatibility with the natural landscape. Specific cost-sharing programs or other funding sources may impose criteria in addition to, or more restrictive than, those specified in this standard.

Consider long-term maintenance requirements of the created wetland.

Refer to Chapter 13 of the Engineering Field Handbook for further discussion of these planning considerations. Refer to the Maryland Wildlife Biology and Management Handbook and the NRCS-Maryland Biology Technical

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the [Natural Resources Conservation Service - Maryland](#) or visit the [electronic Field Office Technical Guide \(eFOTG\)](#).

Resources website for additional habitat considerations for wildlife species.

CRITERIA

General Criteria

Wetland Area – The wetland hydrology, soils, and vegetation shall provide the desired wetland functions and values.

Permits - Federal, state, and local regulations may significantly limit activities in or adjacent to streams, wetlands and other aquatic areas. Laws pertaining to protection of streams, wetlands and water bodies, and erosion and sediment control may be applicable. Permits or approvals from federal, state, or local government agencies, if needed, shall be obtained before any work is performed.

Hazardous Materials - If hazardous wastes are suspected on the site, collect soil samples and test for the presence of hazardous waste in accordance with local, state, and federal requirements. Sites containing hazardous wastes shall not be restored under this standard unless the appropriate hazardous waste authority determines that the site can be decontaminated.

Criteria to Provide Hydrology

General Requirements - On at least 70 percent of the wetland area, wetland hydrology (including natural microtopography of the soil surface in wetlands) shall be created. The minimum hydrologic conditions of the created wetland shall meet current NRCS criteria for wetland hydrology. The depth, duration, and frequency of surface and/or ground water in the wetland shall be capable of supporting a prevalence of hydrophytic vegetation.

Up to 30 percent of the wetland area may be designed and maintained as shallow open water. The purpose of this modification shall be to support a diverse plant and animal community.

The size and character of the watershed above the site shall be assessed under present and future conditions in order to determine available hydrology.

The hydrology of the site shall not adversely affect adjacent properties unless agreed to by a signed agreement.

Wetland hydrology may be provided by using a variety of measures, including but not limited to embankments, surface drain plugs, subsurface drain plugs, removal of fill material, and shallow excavation.

On sites that have been in long-term agricultural use, grading and shaping shall be used as needed to create the diverse microtopography that occurs naturally in wetlands.

A soils investigation shall be performed to determine conditions for minimizing seepage losses; suitability of materials for embankment construction; adequacy of subsurface water supply; and capability to support desired plant materials, as applicable.

Criteria to Establish Vegetation

General Requirements - Select vegetative cover to accomplish the intended purpose of the practice and the objectives of the client. Plant types and species shall be selected based on their compatibility in growth rates, shade tolerance, moisture requirements, and other characteristics. Herbaceous and/or woody plants may be appropriate. For best results, use species and varieties with proven conservation traits.

Select plant species that are native to Maryland, or are introduced and are non-invasive (i.e., not likely to spread beyond the planted area and displace native species). In the wetland area, the use of Maryland native species is required for all permanent plantings (not including temporary seedlings or nurse crops). In the buffer area, the use of species native to Maryland and/or beneficial to wildlife shall be encouraged when feasible.

Site preparation and planting to establish vegetative cover shall be done at a time and manner to insure survival and growth of selected species. Provide supplemental moisture if and when necessary to assure early survival and establishment of selected species.

Only viable, high quality seed and planting stock shall be used. The method of planting shall include hand or machine planting techniques,

suited to achieving proper depths and placement for the selected plant species.

All plant materials shall be correctly handled before planting. In general, plant rooted and unrooted materials as soon as possible after receiving them from the supplier. For bare-root seedlings, keep the roots moist at all times and keep the plants out of direct sunlight as much as possible.

Keep seed cool and dry until planting. Except for grasses, seeding is usually not a preferred method for wetland plant establishment, due to the lack of information about seed viability, germination, and seedling growth requirements for the majority of wetland plant species.

In the wetland and buffer, natural regeneration may be used if all of the following conditions are met:

1. There is an adequate natural seed source of desired species in adjacent areas or in the soil seedbank;
2. Site conditions are favorable for establishing the desired number and distribution of plants within a specified time period; and,
3. Noxious or invasive species are not likely to jeopardize the natural regeneration process.

Use planting as appropriate to hasten establishment of desired species or supplement the natural regeneration process.

Protect vegetation from unacceptable impacts due to pests, wildlife, livestock, or fire. Exclude livestock as needed to establish vegetative cover.

Control noxious weeds as required by state law. Control undesirable invasive species and nuisance species to the extent possible.

Wetland Area - Design the created wetland so that at least 70 percent of the wetland area will support a natural wetland plant community that is typically found in the same physiographic region and similar landscape position.

Up to 30 percent of the created wetland area may be designed to provide shallow open water. The purpose of this modification shall be to support a diverse plant and animal community.

Vegetation shall be established by planting or by natural regeneration methods, or a combination of the two. Vegetation may include trees, shrubs, and/or herbaceous species, depending on site conditions, planned functions of the site, and the desires of the client.

Areas within the created wetland that need short-term herbaceous cover to control erosion and to help build the organic components of the soil shall be stabilized with an appropriate seed mix for wetlands. Temporary or non-competitive permanent mixes may be needed in areas where natural regeneration is planned, woody species will be planted, or other permanent plantings will be delayed. Plantings for short-term cover shall be non-competitive to the introduction and establishment of the desired species.

Refer to Figure 1 and Tables 1 to 5 of Maryland conservation practice standard for Wetland Restoration, Code 657, for recommended planting dates, and selected lists of herbaceous and woody species suitable for planting in wet sites.

Buffer Area - An upland buffer, consisting primarily of perennial vegetation, shall be established (or maintained, if already present) a minimum 35 feet wide around the wetland. Vegetation may include trees, shrubs, and/or herbaceous species.

For optimum wildlife habitat on most sites, seeding mixes and woody vegetation shall be specified for the buffer in accordance with the Maryland conservation practice standard for Conservation Cover, Code 327. When severe site conditions are present or anticipated, or significant erosion control is needed, the Maryland conservation practice standard for Critical Area Planting, Code 342, shall be used to specify the appropriate plantings.

For purposes of this standard, the buffer criteria do not apply to the portion of the site occupied by structural measures such as embankments or surface drain plugs.

Establishment Goal for Vegetation - Buffer areas and wetland areas that are planned to support vegetation shall meet the following minimum requirements for vegetative cover, based on the primary purpose of the practice:

Primary Purpose of the Wetland and Buffer	Establishment Goal (minimum cover requirements after five years)
Create or Enhance Wildlife Habitat	<i>Herbaceous vegetation areas:</i> Minimum 85% areal cover of desired species
	<i>Woody vegetation areas:</i> Minimum 200 trees and/or shrubs per acre (5 plants/1,000 SF) of desired species
Improve Water Quality	<i>Herbaceous vegetation areas:</i> Minimum 85% areal cover of desired species
	<i>Woody vegetation areas:</i> Minimum 300 trees and/or shrubs per acre (7 plants/1,000 SF) of desired species

Criteria to Provide Organic Matter

Topsoiling - Spread topsoil to a depth of 4 to 6 inches where needed to provide a suitable medium for plant growth. Do not redistribute topsoil that is known to contain invasive or noxious weeds.

Organic Matter Amendments for Inundated Areas - If an insufficient quantity of topsoil is available, organic matter such as straw, composted manure, or wood chips shall be added where needed on portions of the site that will be inundated with shallow water. Organic matter (organic carbon) is necessary to support the natural functions of a wetland, including sustaining beneficial microbes and aquatic invertebrates.

If the soil surface horizon (the 'A' horizon) has a Munsell value and chroma ≤ 3 , it will normally contain at least 1% organic matter, and does not need to be augmented. However, if the surface layer has a Munsell value or chroma > 3 , then use one of the following options to add organic matter to the wetland area:

1. **Straw** - Spread straw over the soil surface to a minimum thickness of 3 inches (1.5 to 2 tons per acre); or,
2. **Composted Manure** - Spread composted cow or horse manure to a minimum thickness of 4 inches (500 cubic yards per acre); or,

3. **Wood Chips** - Spread aged hardwood chips (not bark) to a minimum thickness of 4 inches (500 cubic yards per acre).

It is not necessary to incorporate the organic matter into the soil if the inundated areas are intended to remain as shallow open water, or if they will be allowed to revegetate naturally. If the inundated areas will be revegetated by planting, mix the organic matter into the top 4 to 6 inches of soil.

Criteria for Structural Measures

Shallow Excavation - A wetland may be created by excavating below the existing ground surface to create a shallow basin that will hold surface water and/or intercept groundwater. The basin shall permit storage of water at a depth, frequency, and duration to support the desired plant community and provide other wetland functions.

Surface Drain Plugs - In areas where open ditches were constructed to provide drainage, wetland hydrology may be created by constructing surface drain plugs, using a pipe riser or other structures within the ditch to control the water level, or by filling a surface drain to the original ground line. Refer to the criteria for Embankments when fill will be placed on the ditch banks.

Provisions shall be made to store, pass through or divert excess runoff. Use the Engineering Field Handbook, Chapter 14, to design the structure capacity.

All fill shall be relatively impermeable and be compacted to achieve the density of adjacent materials. Crown the fill a minimum of one foot above the top of the lower existing channel bank to account for settling.

The minimum length of surface drain plugs shall be $(6H + 4)$ feet. "Minimum length" refers to the length as measured along the top of the plug. "H" is measured from the settled top of the plug to the low point along the centerline of the surface drain.

Subsurface Drain Plugs - In areas where subsurface drains were used to lower the water table, wetland hydrology may be created by

removing or plugging the drain or replacing the perforated drain with a non-perforated drain.

The minimum length of drain to be removed or plugged shall be as follows:

Length of Drain	Average Hydraulic Conductivity of Soil
50 feet	<0.6 inches/hour
100 feet	0.6 to 2.0 inches/hour
150 feet	>2.0 inches/hour

All envelope filter material or other flow enhancing material shall also be removed for this length. The trench used to alter the drain shall be filled and compacted to achieve a density equal to adjacent natural soil material.

When subsurface drains also function as outlets for other drained areas where drainage is still desired, appropriate measures must be incorporated to keep the upstream drainage systems functional. A non-perforated pipe shall replace the perforated pipe through the wetland area to be restored, and shall extend beyond the wetland in all directions at least the minimum length previously specified for length of drain to be removed or plugged. Drains may also be re-routed around the wetland at the same minimum distances from the wetland, or where topography permits, setting a water control structure at a level that does not affect upstream drainage.

A water control structure may be placed on the inlet of an existing drain. The water control structure shall be attached to a non-perforated conduit that extends at least the minimum length previously specified for length of drain to be removed. The connections of the water control structure and the non-perforated pipe shall be watertight.

Embankments - Embankments may be used to impound water and provide wetland hydrology. Embankments that meet the definition and criteria for an embankment pond (as described in the Maryland conservation practice standard for Pond, Code 378) are not included as components of this standard. Fills that will be entirely within a surface drainage ditch shall be designed

according to the criteria for Surface Drain Plugs, as described in the next section of this standard.

Embankments shall be no more than 4 feet in height, with a minimum top width of 4 feet. On embankments with top widths of 6 feet or more, the combined upstream and downstream side slopes shall be a minimum of 5:1. On embankments with top widths of less than 6 feet, the combined upstream and downstream side slopes shall be a minimum of 6:1. Side slopes shall not be steeper than 2:1 in either case.

When necessary, appropriate measures shall be taken to minimize seepage losses through the embankment and subsoil.

Spillways - Spillways shall be provided for safe passage of water. Pipe conduits and vegetated spillways shall be designed according to the Engineering Field Handbook. The minimum diameter for pipe conduit spillways is 6 inches. Trash racks are required on inlets to pipe conduit spillways.

Spillway(s) shall be designed to pass the 10-year, 24-hour storm. Provide a minimum of 0.5 foot of freeboard above the 10-year flow depth, and a minimum of 1 foot between the normal pool elevation and the top of the embankment.

When there is no surface inflow entering the wetland from off-site (i.e., no drainage area), spillway(s) shall be designed to release the volume of the 10-year, 24-hour storm within an appropriate amount of time for survival of the wetland plant community. The amount of time needed for release of excess water from a specific site shall be determined based on the depth of inundation and the species of wetland plants desired on the site. Generally, wetland plants can tolerate excess inundation for periods of five consecutive days or more during the growing season. A minimum of 0.5 foot of freeboard shall be provided above the 10-year flow depth.

Stabilization of Structural Measures - Embankments and surface drain plugs shall be vegetated according to the following criteria:

1. Slopes in woodland planned for natural regeneration to trees and shrubs - Use mix 4 of the Maryland conservation practice standard for Critical Area Planting, Code 342

with Virginia Wildrye (*Elymus virginicus*) and without Deertongue. Apply mulch per the criteria in the Critical Area Planting standard, Code 342.

2. Slopes other than in 1 (above), steeper than 4:1, and vegetated spillways - Specify site treatment and plantings according to the Maryland conservation practice standard for Critical Area Planting, Code 342. When feasible, select plant species that are native to Maryland and/or beneficial to wildlife;
3. Slopes other than in 1 (above), 4:1 or flatter - For optimum wildlife habitat on most sites, specify seeding mixes in accordance with the Maryland conservation practice standard for Conservation Cover, Code 327. In lieu of permanent seeding, natural regeneration may be used if all of the following conditions are met:
 - a. There is an adequate natural seed source of desired species in adjacent areas or in the soil seedbank;
 - b. Site conditions are favorable for establishing the desired number and distribution of plants within a specified time period;
 - c. Noxious or invasive species are not likely to jeopardize the natural regeneration process; and,
 - d. A nurse crop of 20 pounds per acre of annual ryegrass (not cereal rye), or 40 pounds per acre of oats, wheat, or barley, is planted to provide temporary cover.

If dense permanent cover is needed in a short period of time (e.g., the site will be intensively used, severe site conditions are present, or significant erosion control is needed), then use the Maryland conservation practice standard for Critical Area Planting, Code 342, to specify the appropriate site treatment and plantings.

Erosion and Sediment Control - Construction operations shall be carried out in such a manner that erosion will be controlled and water and air pollution minimized both on-site and off-site. State and local laws concerning pollution abatement shall be followed. Construction plans

shall detail erosion and sediment control measures to be employed during the construction process.

Site Preparation - Areas designated for borrow areas, embankment, and structural works shall be cleared, grubbed and stripped of topsoil. All trees, vegetation, roots and other debris shall be removed from embankment fill.

All cleared and grubbed material shall be disposed of outside the limits of the wetland and wetland buffer. When specified, stockpile a sufficient quantity of topsoil in a suitable location for use on the embankment and other designated areas. Selected woody debris shall also be stockpiled for use within the created wetland, when specified.

Final Grading - All upland borrow areas shall be graded to provide proper drainage and left in a stable condition.

Pipe Conduits - Pipe conduits shall conform to the requirements in the Maryland conservation practice standard for Pond, Code 378. Anti-seep collars are not required on embankments with a height of less than 4 feet.

Concrete - Concrete shall meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 902.10, Mix No. 3.

Rock Riprap - Rock riprap shall meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specification for Construction and Materials, Section 901.02.

Geotextile - Geotextile materials shall meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 921.09.

Note: Specific cost-sharing programs or other funding sources may dictate criteria in addition to, or more restrictive than, those specified in this standard.

PLANS AND SPECIFICATIONS

Plans and specifications for wetland creation shall be prepared for specific field sites, according to the Considerations, Criteria, and Operation and Maintenance described in this standard, and will normally be part of the overall conservation plan. Plans and specifications shall include construction plans, photographs, drawings, job sheets, construction specifications, narrative statements in the conservation plan, and other similar documents, as appropriate. Documentation shall be in accordance with the section "Supporting Data and Documentation" in this standard.

All components of the completed measures shall conform to the lines, dimensions, grades, and slopes shown on the plans or staked on the site. All materials shall be as specified on the construction drawings. The contractor shall be responsible for furnishing materials certification. These certification slips shall be retained with the "as-built" plans.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be prepared for each wetland creation site. Appropriate Job Sheet(s) may be used to serve as the management plan as well as supporting documentation, and shall be provided to the client. At a minimum, the following components shall be addressed in the O&M plan, as applicable:

Structures

Describe what inspections are required to assess the integrity of the structure and determine whether it is functioning properly. Describe the purpose and extent of management if the structure is to be actively managed (e.g., temporary drawdown for seedling development).

Removal of Sediment and Other Repairs

Describe locations where sediment removal is acceptable (e.g., designed sediment basins, open water areas); conditions under which sediment may be removed and repairs made (e.g., time of year restrictions, permits needed, etc.).

Vegetation in the Wetland Area

Describe what inspections are required to determine whether the desired vegetation is present in suitable quantity, quality, and distribution to meet objectives of the project. Describe the extent of management needed to maintain vegetation in the desired species composition or age class (if applicable), or no management required (e.g., natural area).

Vegetation on Structures and in Buffer Areas

Describe the extent of vegetative management that will be allowed/needed after the practice is established. Management may consist of mowing, burning, selective cutting, or other actions, as appropriate.

When optimum wildlife habitat is desired, vegetation on structures and in buffers shall not be mowed, burned, or otherwise disturbed during the nesting season of the desired wildlife species. For Maryland, the primary nesting season is generally from April 15 through August 15.

Nuisance Plants and Animals

Describe the extent to which plant and animal pest species, including noxious weeds, will need to be controlled.

Acceptable Uses

Describe the acceptable uses (e.g., timber production, grazing, hunting, nature preserve, etc.) and time of year/frequency of use restrictions, if any.

Frequency of Inspections

At a minimum, require annual inspections of structural and vegetative components.

SUPPORTING DATA AND DOCUMENTATION

Planning Information, Field Data, and Survey Notes

Record on survey note paper, SCS-ENG-28 & 29, and/or in the conservation plan folder, as appropriate. The following is a list of the minimum data and documentation to be recorded in the case file:

1. Field location of the project, acres, and assistance notes. Also note the location of the project on the conservation plan map. Assistance notes shall include dates of site visits, name or initials of the person who made the visit, specifics as to alternatives discussed, decisions made, and by whom;
2. Description of the objectives of the project, including the desired functions that the wetland is expected to provide;
3. Soil investigation logs and notes;
4. Inventory of existing vegetation on the site. If applicable and available, note the agrichemicals that have been used on the site during the past 5 years;
5. Topographic survey of the site, as appropriate for site conditions and the proposed design;
6. Description of existing drains and extent of existing blockage (if any).

Design Data

Record on appropriate engineering paper. For guidance on the preparation of engineering plans see Chapter 5 of the Engineering Field Handbook, Part 650. The following is a list of the minimum required design data:

1. Hydrologic and hydraulic design computations;
2. Normal and design storm water surface elevations;
3. Cross-section(s) of embankment for quantities determination;
4. Profile of vegetated spillway;

5. Detail of water control structure, including profile, elevations, and materials specifications with type and gauge/thickness of pipes;
6. Planned blockage of drainage systems, including cross sections and lengths of drain plugs;
7. Plan view(s) to scale with north arrow and stationing showing topographic contours, planting zones for vegetation, and locations of other features, as appropriate;
8. Seeding and/or planting requirements, including species selected for each planting zone, stocking/seeding rates, and the size and type of planting stock to be used (e.g., bare-rooted seedlings, containerized stock, etc.), shown on plans;
9. Quantities estimate;
10. Show job class on plans;
11. Operation and maintenance plan.

Construction Check Data/As-Built

Record on survey notepaper, SCS-ENG-28, or other appropriate engineering paper. Survey data shall be plotted on plans in red. The following is a list of minimum data needed for as-builts:

1. Documentation of site visits on CPA-6. Include the date, who performed the inspection, specifics as to what was inspected, all alternatives discussed, and decisions made and by whom;
2. Check notes recorded during or after completion of construction, and plans showing as-built conditions of all structures;
3. Note plant species as-installed, including species used, quantities, date(s) planted, and arrangement of plants within each planting zone;
4. Final quantities, and documentation for quantity changes and materials certification;
5. Sign and date checknotes and plans by a person with appropriate approval authority. Include statement that practice meets or exceeds plans and NRCS practice standards.

REFERENCES

1. Maryland Department of Transportation, State Highway Administration, January 2001. *Standard Specifications for Construction and Materials*. Baltimore, Maryland.
2. USDA, Natural Resources Conservation Service. *Conservation Practice Standards*. Maryland Field Office Technical Guide, Section IV.
3. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 14, "Drainage."*
4. USDA, Natural Resources Conservation Service. *Maryland Wildlife Biology and Management Handbook*.
5. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 11, "Ponds and Reservoirs"*.
6. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 5, "Preparation of Engineering Plans."*
7. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 6, "Structures."*
8. USDA, Natural Resources Conservation Service. *National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 13, "Wetland Restoration, Enhancement or Creation."*
9. U.S. Fish and Wildlife Service, Chesapeake Bay Field Office with the Natural Science Center and Adkins Arboretum, 1995. *Native Plants for Wildlife Habitat*. Annapolis, MD.