NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WETLAND RESTORATION

(acre)

CODE 657

DEFINITION

A rehabilitation of a drained or degraded wetland where the soils, hydrology, vegetative community, and biological habitat are returned to the natural condition to the extent practicable.

PURPOSE

To restore hydric soil conditions, hydrologic conditions, hydrophytic plant communities, and wetland functions that occurred on the disturbed wetland site prior to modification to the extent practicable.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies only to sites with hydric soil, which were natural wetlands that have been previously degraded hydrologically and/or vegetatively.

Upon completion of the restoration the site will meet the current NRCS soil, hydrology, and vegetation criteria of a wetland.

This practice is applicable only if natural hydrologic conditions can be approximated by modifying drainage and/or artificial flooding of a duration and frequency similar to natural conditions that existed prior to conversion.

If the presence of hazardous waste materials in the sediment or fill is suspected, soil samples will be collected and analyzed for the presence of hazardous waste as defined by local, state, or federal authorities. Sites containing hazardous waste will not be restored under this standard.

This practice does not apply to: a constructed wetland (656) intended to treat point and non-point sources of water pollution; wetland enhancement (659) intended to rehabilitate a degraded wetland where specific functions and/or values are enhanced beyond original conditions; or wetland creation (658) for creating a wetland on a site location which historically was not a wetland or was formerly a wetland but will be replaced with a wetland type not previously occurring on the site naturally.

CRITERIA

General Criteria

The landowner shall obtain necessary local, state, and federal permits that apply before restoration.

Water rights shall be documented prior to restoration if required.

Establish vegetative buffers on surrounding uplands to reduce the movement of sediment, soluble and sediment-attached pollutants transported by runoff.

The soil, hydrology and vegetative characteristics existing on the site and the contributing watershed shall be documented before restoration of the site begins.

Where adjoining land is used for grazing or is open to livestock, the wetland shall be fenced to exclude the livestock. If grazing is planned in the wetland area, a prescribed grazing plan will be developed to ensure the planned wetland functions are maintained. See Prescribed Grazing (528A) standard.

Criteria for Hydric Soil Conditions

Restoration sites will be located on hydric soils.

If the hydric soil is covered by fill, sediment, spoil, or other depositional material, the material covering the hydric soil shall be removed to the surface of the buried (or original) hydric soil.

Reestablish an approximation of the original soil microtopography.

Criteria for Hydrology Restoration

A permanent water supply should be available approximating the needs of the wetlands. The hydrology of the site is defined as the rate, path, and timing of inflow and outflow, duration, frequency, and depth of flooding, ponding or saturation.

The maximum hydrology and the overall hydraulic variability of the restored site will approximate the conditions that existed before alteration, e.g., dynamic and static water levels, and soil saturation.

A water budget should be prepared to estimate restoration hydrology in an average year.

The standards and specifications for Dike (356) and Structure for Water Control (587) will be used as appropriate. Refer to the Engineering Field Handbook, Chapter 13, "Wetland Restoration, Enhancement, and Creation," and Chapter 6, "Structures," for additional design information.

Existing drainage systems will be utilized, removed, or modified as needed to achieve the intended purpose.

Criteria for Vegetation Restoration

The vegetation shall be restored as close to the original natural plant community as the restored site conditions will allow. Determination of the original plant community's species and percent composition shall be based upon reference wetlands of the type being restored or suitable technical references.

In soils where seed banks realistically exist, or where natural colonization of selected native species (identified from reference wetlands) will dominate within 5 years, then natural regeneration may be allowed.

Plantings, seeding, or other types of vegetative establishment will be comprised of native species that occur on the wetland type being restored.

Preference shall be given to native wetland plants with localized genetic material. Plant materials collected or grown from material collected within a 200-mile radius from the site are considered local ecotypes.

Adequate substrate material and site preparation necessary for proper establishment of the selected plant species shall be included in the design.

On sites which were predominantly herbaceous vegetation prior to modification and planting and/or seeding is necessary, the minimum number of native species to be established shall be

based upon the number of ecological sites present. Examples of ecological sites are: wet meadow, shallow marsh, deep marsh, slough, bottomland forest, scrub-shrub, swamp, etc. Sites restored to only one ecological site shall be established with at least three species adapted to the site. Sites with two or more ecological sites shall be established with at least two native species on each ecological site.

Herbaceous vegetation may be established by a variety of methods including: mechanical or aerial seeding, topsoiling, organic mat placement, wetland sod, vegetative sprigs, wetland hay, etc., over the entire site or a portion of the site and at densities and depths appropriate.

Forested wetland plantings and/or seeding will include a minimum of three tree or shrub species on each ecological site (e.g. bottomland forest, scrub-shrub, and swamp) where appropriate. At least two of the species will be hard mast producing species.

Tree (and shrub) planting will follow the criteria of Conservation Practice Tree Planting (612). Trees will be planted on the contour to facilitate placing the appropriate species at the contour which will have the optimum depth and duration of inundation.

Five years after planting, a bottomland hardwood restoration site shall have at least 100 hard mast and 100 soft mast stems per acre. Exceptions may be made for sites where root pruned container stock is used. In these cases, the original plantation should produce seed, and new seedlings, in 5 to 10 years.

Seed planting rates and site preparation will meet the criteria of Conservation Practice Woodland Direct Seeding (652). Seed viability will be determined prior to planting.

Forested wetland planting sites which are difficult to establish with seedlings or by direct seeding due to saturation or flooding during planting and/or long duration flooding less than two feet deep, may be fall planted with root pruned container stock. See Plans and Specifications for planting root pruned container stock.

Reforestation through natural regeneration may be used under the following conditions:

- Areas that are within 200 feet of existing mature woodlands and adjacent to desirable seed sources.
- Areas that experience flooding of a frequency and duration that make plantings unlikely to succeed.
- Depressional areas too wet to machine or hand plant.

Criteria for Wetland Functions

An assessment of the natural wetland functions of the site will be preformed prior to restoration.

Restoration goals and objectives shall be established which include the natural wetland functions of the site.

Post-project monitoring of the restoration will be performed periodically to determine if the restored wetland is providing the planned wetland functions, and to make recommendations for changes in the operation and management plan, which will allow the wetland to function better.

CONSIDERATIONS

Consider effect of volumes and rates of runoff, infiltration, evaporation, and transpiration on the water budget.

Consider the planned hydrologic conditions, including duration, depth, and timing which are primary factors in

vegetation establishment. The planned vegetation type and species should be compatible with the planned hydrologic condition.

Consider effects on downstream flows or aquifers that would affect other water uses or users.

Consider effects on wetlands or water-related resources and wildlife habitats that would be associated with the practice.

Consider as a high priority those sites adjacent to existing wetlands as they increase wetland system complexity and diversity, decrease habitat fragmentation, and ensure colonization of the site by wetland flora and fauna.

Consider linking wetlands by corridors wherever appropriate to enhance the wetland's use and colonization by the flora and fauna.

Consider the effects of varying water levels in response to potential climatic events such as wet or dry periods.

Consider changes in salt movement / concentrations in the soil resulting from hydrologic alterations.

The nutrient and pesticide tolerance of the plant species planned should be considered where known nutrient and pesticide contamination exists.

Consider effects of temperature on water resources to prevent undesired effects on aquatic and wildlife communities.

Habitat development for threatened and endangered species known to be in the area, should be considered in the restoration plan.

Embankments and excavated slopes should be located and shaped in a manner that is compatible with the existing landscape.

PLANS AND SPECIFICATIONS

General Specifications

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other documentation. Requirements for the operation and maintenance of the practice shall be incorporated into site specifications.

Specifications for Use of Root Pruned Potted Stock for Difficult Sites

Fall plant at a minimum rate of 40 foot X 40 foot spacing (approximately 27 trees per acre) using seedlings produced by a root pruning method and supplied in containers no less than 2 gallons in size. (These seedlings tend to be large, with thick, fibrous roots and capable of beginning nut or acorn production as early as 5 years after planting.) Seedlings will be at least 3 feet tall with at least 1/2-inch caliper. Seedlings will be planted on the contour by hand or using an auger at least 12 inches in diameter. Soil will be firmly packed around seedling roots. Planting will occur between October 1 and November 1 in Plant Suitability Zones I and II and between October 1 and November 15 in Zone III. Planting may continue in early spring as soon as the ground can be worked but no later than April 25 in all areas.

It is assumed that natural regeneration of light seeded species such as green ash, silver maple and cottonwood will occur to fill in gaps. If for any reason this is not likely to occur this method should not be used. Thinning to control fast growing woody competition may be necessary during the first 5 -10 years.

Specifications for Excavation

Where an area containing hydric soil has been covered by sediment, land shaping or other activities, the wetland hydrology may be restored by excavating (scraping) the fill material and/or the sediment from the site.

Soil borings should be conducted to determine the approximate original hydric soil surface.

Excavated areas (scrapes) may also be constructed to provide diversity of habitat and to provide a source of fill materials for embankments, ditch plugs, and habitat islands, within the same wetland area. In this case, excavation may occur below the original hydric soil surface.

All newly excavated spoil not used in embankment, ditch plug, or habitat island construction will be removed from the wetlands.

Wetland side slopes, shape, and size should approximate the original wetland configuration. When this cannot be determined, excavated scrapes shall have the following characteristics:

- side slopes of 8:1 or flatter,
- maximum depth of 4 feet,
- size range from 0.1 acre to 1.0 acre,
- a minimum 25-foot wide vegetated buffer area surrounding the scrape.

In addition, excavated scrapes generally should include:

- an irregular shape to adapt to the site,
- native hydrophytic plant seed banks preserved for re-vegetation.

Specifications for Subsurface Drain Removal or Destruction

The effects of a subsurface drainage system may be eliminated by performing one or more of the following:

- removing or rendering inoperable a portion of the drain,
- modifying the drain with a water control device, or
- Installing non-perforated pipe through the wetland site.

The minimum length of drain to be removed or rendered inoperable is shown in Table 1. Plan for additional tile removal based on an evaluation of land grade, drain grade, and depth of the drainage system. Also, consider lateral effects of the outlet ditch when determining tile removal locations. If present, underground reservoirs for drainage pumping plants shall be removed, crushed, or filled and capped according to state law.

If present, all sand and gravel bedding and filtering material or other flow enhancing material will also be removed. The trench will be filled or compacted to achieve a density equal to the adjacent material.

Where embankments will be constructed, all subsurface drains shall be removed starting at one-half the minimum distance shown on Table 1 downstream of the embankment center line and extending to 15 feet upstream from the upstream toe of the embankment. Or, the drain under the embankment shall be removed and a structure excavation with a 4 foot bottom width and not less than 1:1 side slopes shall be extended to one foot below the invert elevation of the drain, under the fill. The drain can be reinstalled (non-perforated material only) and the back fill in the trench shall be compacted in six

inch or smaller lifts, to the original ground elevation.

Installation of non-perforated subsurface drain around or through the wetland may be necessary to allow upstream drainage systems to continue to function properly.

Functional subsurface drains downstream of the wetland shall have an end cap installed on the upstream end or other satisfactory end seal to prevent soil from filling the drain.

Specifications for Surface Drain Filling

Where open channels and shallow surface drains provide surface and subsurface drainage, the channel or surface drain will be:

- Totally filled with earth, or
- Filled with a single ditch plug or a series of ditch plugs to the full depth of the ditch according to Table 1, or
- Filled with a ditch plug to a height less than the full depth of the ditch according to Table 1 and have an outlet designed according to NRCS Standard Grade Stabilization Structure (410) or, Structure for Water Control (587).

Where open channels and shallow surface drains provide only surface drainage, restoration may be achieved using an embankment. See criteria for Embankments.

Plan the number and spacing of ditch plugs based on an evaluation of land grade, drain grade, and depth of the drainage ditch. The end slopes on ditch plugs will be 3:1 or flatter on the down-stream side and 5:1 or flatter on the wetland side.

All fill will be compacted as needed to achieve the desired densities. To account for settlement, the earthfill height will be increased by at least 5% for mineral soils compacted by construction equipment operating over the fill area, and by at least 10% where fill is dumped, bulldozed, and shaped with limited compaction. The earthfill height will be increased by 20% where a mixture of mineral and organic soils is used. All fills using organic soils shall be increased by at least 33% to account for settlement.

Provisions will be made to store, pass, or divert the flow so that it does not cause erosion and flooding impacts where the flow enters any downstream facilities. Earthfill materials shall be placed such that there will be no flow over the ditch plug except where a grade stabilization structure or structure for water control is used. Earthfill materials shall be placed such that there will be no flow over the ditch plug. A minimum of 0.5 feet shall be included in the settled fill height of a ditch plug above the adjacent original ground surface for freeboard to insure that flows will be directed around the plug. A flow control device will be used where flow duration and rate would otherwise cause erosion and head cutting.

Table 1

Minimum length of subsurface drain to be removed or rendered inoperable or Minimum length of surface drain to be filled with ditch plug. (The length is measured parallel to the direction of the surface drain flow along the top of the settled ditch plug.)		
*Soil Permeability (inches per hour)	*Soil Texture	**Minimum Distance
> 2.0	Sandy & Organics	150 feet
0.6 - 2.0	Loamy	100 feet
< 0.6	Clayey	50 feet

* Soil Texture and permeability are for the general soil profile, not just the surface layer. Where the permeability and texture vary throughout the profile, consider the type of drainage system and which layer(s) are critical. Standard values for permeability and texture for each soil map unit are in the Field Office Technical Guide.

** Lateral effects of drainage features computed according to EFH Chapter 19 procedures can be substituted for the minimum distances shown in Table 1 (except for drains under embankments).

Specifications for Embankments

Earth embankments and appurtenances shall meet the requirements of Dikes (356), Ponds (378), Grade Stabilization Structure (410) and/or structure for Water Control (587), as applicable.

Embankments located on a floodplain, where overtopping of the embankment by flow from the floodway into the wetland is likely, may have the vegetated spillway area on level natural ground, in excavation, or on an area of the embankment where the height from the top of the embankment to the downstream toe is 2 feet or less. The embankment spillway area should have an embankment top width or 25 feet and a level section width of 100 feet as minimums. The design flow depth should be 0.5 feet or less. The embankment side slopes should be 5:1 or flatter in this area. Mulching or other types of mechanical protection should be required on embankment type spillways.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance):

Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals to assure the wetland restoration function shall not compromise the intended purpose.

Biological control of undesirable plant species and pests (e.g., using predator or parasitic species) shall be implemented where available and feasible.

Timing and level setting of water control structures required for the establishment of desired hydrologic conditions or for management of vegetation.

Inspection schedule for embankments and structures for damage assessment.

Depth of sediment accumulation to be allowed before removal is required.

Management needed to maintain vegetation, including control of unwanted vegetation.

Haying and livestock grazing plans will be developed so as to allow the establishment, development, and management of wetland and associated upland vegetation.

REFERENCES

Admiraal, A.N., M.J. Morris, T.C. Brooks, J.W. Olson, and M.V. Miller. 1997. Illinois Wetland Restoration and Creation Guide. Illinois Natural History Survey Special Publication 19. 188 pp.

Using Micro and Macrotopography in Wetland Restoration. Illinois Biology Technical Note No. 20. 2000. 7 pp.

Wetland Restoration, Enhancement, or Creation. Engineering Field Handbook (EFH), Part 650, Chapter 13. NRCS/USDA. 1992. 74 pp.