NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WETLAND RESTORATION

(Ac.)

CODE 657

DEFINITION

The return of a wetland and its functions to a close approximation of its original condition as it existed prior to disturbance on a former or degraded wetland site.

PURPOSE

To restore wetland function, value, habitat, diversity, and capacity to a close approximation of the pre-disturbance conditions by restoring:

Conditions conducive to hydric soil maintenance.

Wetland hydrology (dominant water source, hydroperiod, and hydrodynamics).

Native hydrophytic vegetation (including the removal of undesired species, and/or seeding or planting of desired species).

Original fish and wildlife habitats.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies only to natural wetland sites with hydric soils which have been subject to the degradation of hydrology, vegetation, or soils.

This practice is applicable only where the natural hydrologic conditions can be approximated by actions such as modifying drainage, restoring stream/floodplain connectivity, removing diversions, dikes, and levees, and/or by using a natural or artificial water source to provide conditions similar to the original, natural conditions.

This practice does not apply to:

The treatment of point and non-point sources of water pollution (Constructed Wetland - 656);

The rehabilitation of a degraded wetland, the reestablishment of a former wetland, or the modification of an existing wetland, where specific wetland functions are augmented beyond the original natural conditions; possibly at the expense of other functions.(Wetland Enhancement - 659);

The creation of a wetland on a site location which was historically non-wetland (Wetland Creation - 658).

The management of fish and wildlife habitat on wetlands restored under this standard.

CRITERIA

General Criteria Applicable to All Purposes

All necessary local, state and federal permits that apply shall be obtained before restoration begins. These include, but are not limited to, Section 401 and 404 of the Clean Water Act, as well as the Swampbuster Provision of the National Food Security Act.

Also, all federal, state and local regulations pertaining to cultural resources, threatened and endangered species and any other issues must be addressed prior to beginning any construction activities.

The purpose, goals, and objectives of the restoration shall be clearly defined in the restoration plan, including soils, hydrology, vegetation, and fish and wildlife habitat criteria that are to be met and are appropriate for the site and the project objectives.

These planning steps shall be done with the use of a functional assessment-type procedure, or a state approved equivalent. The objectives will be determined by an analysis of current and historic site functions. They will be based on those functions which can reasonably be supported by current site constraints. Data from historic and recent aerial photography and/or other remotely

sensed data, soil maps, topographic maps, stream gage data, intact reference wetlands, and historical records shall be gathered.

The soils, hydrology and vegetative conditions existing on the site, the adjacent landscape, and the contributing watershed shall be documented in the planning process.

The nutrient and pesticide tolerance of the plant and animal species likely to occur shall be evaluated where known nutrient and pesticide contamination exists. Sites suspected of containing hazardous material shall be tested to identify appropriate remedial measures. If remedial measures are not possible or practicable, the practice shall not be planned.

The availability of sufficient water rights should be reviewed prior to restoration.

Upon completion, the site shall meet soil, hydrology, vegetation and habitat conditions of the wetland that previously existed on the site to the extent practicable.

Where offsite hydrologic alterations or the presence of invasive species impact the site, the design shall compensate for these impacts to the extent practicable.

Invasive species, federal/state listed noxious plant species, and nuisance species (e.g., those whose presence or overpopulation jeopardize the practice) shall be controlled on the site as necessary to restore wetland functions. The establishment and/or use of non-native plant species shall be discouraged.

If re-vegetation is required due to construction or other restoration activities, preference shall be given to stockpiling existing topsoil for re-vegetation unless it potentially contains invasive or potentially invasive species.

Criteria for Hydric Soil Restoration

Restoration sites will be located on soils that are hydric.

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 extent needed to restore the original soil functions.

Soil hydrodynamic and bio-geochemical properties such as permeability, porosity, pH, or soil organic carbon levels shall be restored to the extent needed to restore hydric soil functions.

Criteria for Hydrology Restoration

The hydroperiod, hydrodynamics, and dominant water source of the restored site shall approximate the conditions that existed before alteration. The restoration plan shall document the adequacy of available water sources based on groundwater investigation, stream gage data, water budgeting, or other appropriate means.

The work associated with the wetland shall not adversely affect adjacent properties or other water users unless agreed to by signed written letter, easement or permit.

Timing and level setting of water control structures, if needed, will be based on the actions needed to maintain a close approximation of the original, natural hydrologic conditions.

The original natural water supply should be used to reestablish the site's hydrology to approximate the hydrologic conditions of the wetland type. If this is not possible, an alternate natural or artificial water supply can be used; however, these sources shall not be diverted from other wetland resources. If the alternate water source requires energy inputs, these shall be estimated and documented in the restoration plan.

To the extent technically feasible reestablish macrotopography and/or microtopography. Use reference sites within the local area to determine desired topographic relief. The location, size, and geometry of earthen structures, if needed, shall match that of the original macrotopographic features to the extent practicable.

Macrotopographic features, including ditch plugs installed in lieu of re-filling surface drainage ditches, shall meet the requirements of other practice standards to which they may apply due to purpose, size, water storage capacity, hazard class, or other parameters. If no other practice standard applies, they shall meet the requirements for Dike – 356 unless there is no potential for damage to the feature or other areas on or off site due to erosion, breaching, or overtopping.

Excavations from within the wetland shall remove sediment to approximate the original

topography or establish a water level that will compensate for the sediment that remains.

Water control structures shall function to exclude fish or other unwanted organisms from restored wetlands.

Wetland restoration sites that exhibit soil oxidation and/or subsidence, resulting in a lower surface elevation compared to pre-disturbance, shall take into account the appropriate hydrologic regime needed to support the original wetland functions.

Specific Criteria For Structural Measures

Shallow Water Development

Restored wetlands containing permanent or semi-permanent shallow water should be constructed to approximate the pre-conversion hydrologic site conditions to the fullest extent practical. As part of wetland restoration, shallow water areas may also be developed to improve the wetland wildlife habitat function of the site but should not exceed 30% of the restoration area unless historic site conditions supported such conditions. On sites where historic site conditions do not support shallow water in excess of 30%, increased shallow water shall be planned and restored according to the NRCS Wetland Enhancement (659) practice standard. Restored wetlands shall be managed according to the NRCS conservation practice Wetland Wildlife Habitat Management (644) practice standard.

Dike Breach

Hydrology restoration on sites that are diked may require that existing dikes be breached.

Breaching shall be carried out by removing sections of existing dikes. Each breach section shall be at least 50 feet long. For erosion control, section lengths shall be increased where necessary to insure sheet flow of floodwaters back into the stream. Where concentrated flow or head cutting may occur, a Structure for Water Control (587), Grade Stabilization Structures (410), and/or Critical Area Planting (342) may be required.

The number of sections to be removed will depend on site and landform conditions. Areas containing historic meanders shall have a section removed at each point where the meander scar meets the stream channel. For diked fields of uniform slope that do not contain meander scars, a minimum of two sections along the stream shall be removed. These sections should be removed from opposite ends of the restoration area. Restoration areas located in a ridge and swale complex may require dike removal where each swale would enter the stream.

Soil material removed during breaching shall be placed in old borrow areas whenever possible. Excess material may be stockpiled by mounding, placing on remaining levees, hauled out of the wetland, or spread evenly if the hydrology and seed source of the site would not be impacted. Stockpiled material may be utilized as “island” habitat. The soil material must be placed on stable slopes of 4:1 or flatter.

Surface Drainage Removal (Ditch Plugging)

In areas where open channels or shallow surface drains were used to provide surface and subsurface drainage, wetland hydrology may be restored by filling the channel with earth, installing a structure for water control according to the Addition Criteria for Providing Restoration of Wetlands in the Structure for Water Control practice standard (587), or a Grade Stabilization Structure (410) according to the practice standard. Provisions shall be made to store, pass through, or divert excess runoff so that it does not cause erosion or off site flooding.

When filling the channel with an earthen ditch plug, the minimum length of the channel to be filled will be based on the hydraulic conductivity of the soil on the site. The minimum length to be filled is 50 feet for soils with an average hydraulic conductivity of less than 0.6 inches per hour, 100 feet for 0.6 to 2.0 inches per hour and 150 feet for greater than 2.0 inches per hour. The side slopes on ditch plugs shall be 4:1 or flatter. All fill will be compacted to achieve the density of adjacent materials. The fill for the ditch plug will be crowned a minimum of one foot above the top of the lowest existing channel bank to account for settlement and to prevent concentrated flow over the ditch plug. For ditch plugs with over 30 acres of drainage area or over three feet of water against the fill, use the Pond (378) standard to design appropriate cutoff trenches and auxiliary spillways. Immediately after

construction, the ditch plug and any disturbed ground shall be seeded according to the Critical Area Standard (342).

Subsurface Drainage Removal (Tile Breakage)

In areas where subsurface drains were used to lower the water table, wetland hydrology may be restored by removing or plugging the drain or replacing the perforated drain with a non-perforated drain. Review of drainage records, interviews, and site investigations will be needed to determine the extent of the existing system.

The effects of the subsurface drainage system may be eliminated by the following methods:

1) Removing a portion of the drain at the downstream edge of the site.

- A minimum of 25 feet of subsurface drain is to be removed for soils with an average hydraulic conductivity of less than 0.6 inches per hour and 50 feet for soils with 0.6 to 2.0 inches per hour or faster. All envelope filter material or other flow enhancing material will also be removed for this length. If possible the end of the tile can be raised to the surface level of the existing ground. The trench will be filled and compacted to achieve suitable blending to adjacent material.
- When a dike is to be a component of the wetland, the subsurface drain should be removed completely from under the dike. The subsurface drain should be removed from upstream toe to the downstream toe, plus any additional length as specified for removal in the above bullet).

2) Installing non-perforated pipe.

- 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 system 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 in 1) above. Drains may also be re-routed around the wetland at the same minimum distances from the wetland stated in 1) above.
- Anti-seep collars should be installed around the non-perforated conduit approximately two to four feet from the connection to existing subsurface drain at both the upstream and downstream area of the non-perforated conduit. The anti-seep collars should have a minimum projection of 18 inches beyond the conduit perimeter.

3) Installing a water control structure that blocks the drain.

- A water control device 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 pipe to be removed in 1).
- The connections of the structure and the non-perforated pipe shall be watertight.
- The outlet conduit for the water control structure will be non-perforated for a minimum length as specified for length of drain to be removed.

Wetland Topography Restoration

Wetland topography restoration can be done through the development of basins and mounds. Basins may also be used to provide surface water in areas not suitable for dikes or structure for water control. Basins shall only be developed in areas that will result in the ponding of water. Applicable areas include somewhat poorly drained soils and poorly drained soils and soils that have low permeability, a restrictive under-lying layer, or high water table. Basins should not be developed on well-drained soils.

Basins shall have various widths and depths and be in the shape of an oxbow, slough or meander scar. When possible basin size and

shape should be characteristic of existing basins in the watershed. Basin widths should be between 10 and 150 feet wide. Basin depths shall vary between 6 and 18 inches deep over at least 75% of a basin area. The remainder of the basin can be between 2 and 4 feet deep to provide some semipermanent to permanent water. Basin side slopes shall be as flat as feasible and shall not be steeper than 4:1. At least one-third of basin side slopes should be between 10:1 and 20:1 to optimize habitat for shore and wading birds.

Material excavated during the formation of basins should be used to form habitat mounds adjacent to or within the basins. Habitat mounds placed in areas with designed water levels should vary in elevation between 0.5 feet below the full pool elevation and 3 feet above the full pool elevation. Habitat mounds placed in areas that do not have a designed water level should vary in elevation between 0.5 feet to 3 feet above the normal ground elevation. Mounds may be shaped in a linear fashion to form ridges or in a circular or elliptical fashion to form islands or upland areas. Side slopes should be as flat as possible and shall not be steeper than 4:1. Basins and mounds will be rough graded with rough side slopes and ragged shorelines.

Storage Volume Replacement

Sediment deposition or other fill materials to be excavated for hydrology restoration will only be removed to the top of the buried hydric soil. Dredged material will be removed and placed only on upland sites, spread evenly or stockpiled using stable slopes of at least 3:1 to control erosion and deposition reentry to the site.

Criteria for Vegetative Restoration

Hydrophytic vegetation restoration shall be of species typical for the wetland type(s) being established and the varying hydrologic regimes and soil types within the wetland. Preference shall be given to native wetland plants with localized genetic material.

Where natural colonization of acceptable species can realistically be expected to occur within 5 years, sites may be left to revegetate naturally. If not, the appropriate species will be established by seeding or planting.

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

Where planting and/or seeding is necessary, the minimum number of native species to be established shall be based on a reference wetland with the type of vegetative communities and species planned on the restoration site.

Where the dominant vegetation will be herbaceous community types, a subset of the original vegetative community shall be established within 5 years, or a suitable precursor to the original community will be established within 5 years that creates conditions suitable for the establishment of the native community. Species richness shall be addressed in the planning of herbaceous communities. Seeding rates shall be based upon the percentage of pure live seed and labeled with a current seed tag from a registered seed laboratory identifying the germination rate, purity analysis, and other seed statistics.

Where the dominant vegetation will be forest or woodland community types, vegetation establishment will include a mix of woody species (trees and/or shrubs) adequate to establish the reference wetland community.

Where the dominant vegetation will be forest or woodland community types, vegetation establishment will include a minimum of six species. No variety of tall fescue shall be utilized in conjunction with this standard.

Areas that were historically bottomland hardwoods shall be restored to the extent possible utilizing native bottomland hardwood species.

Bottomland hardwood restoration by planting, seeding, or natural regeneration will be done according to the NRCS Tree/Shrub Establishment (612) practice standards with the following requirements:

- Except where hydrologic conditions are limiting, eighty-percent of the species in the restored wetland area shall be composed of at least 3 hard mast producing species. One of the hard mast species must be from the

white oak family and one must be from the red oak family.

- Species should be selected based on planned hydrologic conditions of the restoration site. And shall have wetland status indicators of Facultative or wetter. (i.e. FAC, FACW or OBL)
- Rows may contain the same species but shall not exceed a maximum of three contiguous rows of the same species. To achieve optimum interspersion, plant at least 2 species per row alternating species within the row.
- When selecting species groupings for planning interspersion, consider the species growth habits, requirements, and shade tolerances.
- See the NRCS Tree/Shrub Establishment (612) practice standard for inter-planting patterns and a summary of growth characteristics and species suitable for bottomland hardwood restoration.
- Planting rate for trees should be at least 435 seedlings per acre (approximately 10' x 10' spacing).

CONSIDERATIONS

Soil Considerations

Consider making changes to physical soil properties, including:

- Increasing or decreasing saturated hydraulic conductivity by mechanical compaction or tillage, as appropriate.
- Incorporating soil amendments.
- The effect of construction equipment on soil density, infiltration, and structure.

Consider changes in soil bio-geochemical properties, including:

- Increasing soil organic carbon by incorporating compost.

Increasing or decreasing soil pH with lime, gypsum, or other compounds

Hydrology Considerations

Consider the general hydrologic effects of the restoration, including:

- Impacts on downstream stream hydrographs, volumes of surface runoff, and groundwater resources due to changes of water use and movement created by the restoration.

Consider the impacts of water level management, including:

- Increased predation due to concentrating aquatic organisms, including herptivores, in small pool areas during draw downs
- Increased predation of amphibians due to high water levels that can sustain predators.
- Decreased ability of aquatic organisms to move within the wetland and from the wetland area to adjacent habitats, including fish and amphibians as water levels are decreased.
- Increases in water temperature on-site, and in off-site receiving waters.
- Changes in the quantity and direction of movement of subsurface flows due to increases or decreases in water depth.
- The effect changes in hydrologic regime have on soil bio-geochemical properties, including: oxidation/reduction; maintenance of organic soils; and salinity increase or decrease on site and on adjacent areas.

Vegetation Considerations

Consider:

- The relative effects of planting density on fish and wildlife habitat versus production rates in woody plantings.
- The potential for vegetative buffers to increase function by trapping sediment, cycling nutrients, and removing pesticides.
- The selection of vegetation for the protection of structural measures that is appropriate for wetland function.
- The potential for invasive or noxious plant species to establish on bare soils after

construction and before the planned plant community is established.
- The use of prescribed burning to restore wetland and adjacent upland plant communities.

Fish and Wildlife Habitat Considerations

Consider:

- The addition of coarse woody debris on sites to be restored to woody plant communities for an initial carbon source and fish and wildlife cover.
- The potential to restore habitat capable of supporting fish and wildlife with the ability to control disease vectors such as mosquitoes.
- The potential to establish fish and wildlife corridors to link the site to adjacent landscapes, streams, and water bodies and to increase the sites colonization by native flora.
- The need to provide barriers to passage for unwanted fish or predatory species.
- The effects on restoration by wetland dependent animals such as beaver and muskrat, especially where water control structures are installed.

PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared for each site. Plans and specifications shall be recorded using approved specifications sheets, job sheets, or other documentation. The plans and specifications for structural features will include, at a minimum:

- A plan map and view with any appropriate on-site resources identified (i.e. soils, planned structures, existing and planned vegetative communities, reference sites, etc.)
- Sufficient profiles and cross sections to define the location, line and grade for stakeout and checkout.
- Any off-site concerns identified as impacting restoration. (e.g. utilities, property boundaries, etc.)
- Presence, types and extent of all artificial drainage measures;
- Number, acreage and type of wetlands to be restored
- Any component practices required to restore the wetland;
- For vegetative restoration, indicate the species, stock type, planting date, spacing, rates and planting depths
- Documentation of required permits and any environmental evaluation required including the CPA-52; and
- Any structural specification that is developed for individual components of the wetland system

Plans and specifications shall be reviewed and approved by staff with appropriate job approval authority.

OPERATION AND MAINTENANCE

A separate Operation and Maintenance Plan will be prepared for sites that have structural features. The plan will include specific actions for the normal and repetitive operation of installed structural items, especially water control structures, if included in the project. The plan will also include the maintenance actions necessary to assure that constructed items are maintained for the life of the project. It will include the inspection schedule, a list of items to inspect, a checklist of potential damages to look for, recommended repairs, and procedures for documentation.

Management and monitoring activities needed to ensure the continued success of the wetland functions may be included in the above plan, or in a separate Management and Monitoring Plan. In addition to the monitoring schedule, this plan may include the following:

The timing and methods for the use of fertilizers, pesticides, prescribed burning, or mechanical treatments.

Circumstances when the use of biological control of undesirable plant species and pests (e.g. using predator or parasitic species) is appropriate, and the approved methods.

Actions which specifically address any expected problems from invasive or noxious species.

The circumstances which require the removal of accumulated sediment.

Conditions which indicate the need to use haying or grazing as a management tool, including timing and methods.

Any acceptable uses including the timing and intensities (e.g. grazing, haying, timber removal). For wildlife habitat purposes, haying and grazing, if justified as a necessary wildlife/wetland management tool, may be used for management of vegetation. Disturbance to ground nesting species shall be minimized (May 15th – August 1st). If utilizing grazing as a management tool, the timing and intensity shall be specified.

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NRCS, KY

February, 2013

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