NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WETLAND ENHANCEMENT

(Ac.)

CODE 659

DEFINITION

The augmentation of wetland functions beyond the original natural conditions on a former, degraded, or naturally functioning wetland site; sometimes at the expense of other functions.

PURPOSE

To increase the capacity of specific wetland functions (such as habitat for targeted species, and recreational and educational opportunities) by enhancing:

- Hydric soil functions (changing soil hydrodynamic and/or bio-geochemical properties).
- Hydrology (dominant water source, hydroperiod, and hydrodynamics).
- Vegetation (including the removal of undesired species, and/or seeding or planting of desired species).
- Enhancing plant and animal habitats.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any degraded or non-degraded wetland sites with hydric soils, where the objective is to enhance selected wetland functions to conditions different than those that originally existed on the site.

This practice does **not** apply to:

- Indiana (IN) FOTG (FOTG) Standard (657) **Wetland Restoration** intended to restore wetland function, value, habitat, diversity, and capacity to a close approximation of the pre-disturbance conditions.
- INFOTG Standard (656) **Constructed Wetland** intended for treatment of wastewater and contaminated runoff from agricultural processing, livestock, and aquaculture facilities, or for improving the quality of storm water runoff.
- IN FOTG Standard (658) **Wetland Creation** to establish wetland hydrology, vegetation, and wildlife habitat functions on a site location which historically was not a wetland.
- Sites containing T**hreatened or Endangered (T&E) Species**, unless it can be demonstrated that the proposed practices will not negatively impact the species at risk. Utilize the T&E Tool within Customer Service Toolkit, or contact the NRCS State Biologist.
- **Sites containing hazardous waste**. If the presence of hazardous waste materials is suspected, soil samples will be collected and analyzed as defined by local, state, or federal regulations. If remedial measures are not possible or practicable, the practice will not be planned. The nutrient and pesticide tolerance of the plant and animal species likely to occur will also be evaluated where known nutrient and pesticide contamination exists.
- Existing **non-degraded wetlands** with intact native plant communities.
- The **management** of wildlife habitat on wetlands restored under this standard.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service State Office or download it from the Field Office Technical Guide for your state.

CRITERIA

General Criteria Applicable to All Purposes

Use of this standard will comply with all applicable federal, state, and local laws and regulations.

The purpose, goals, and objectives of the enhancement will:

- Identify the target wildlife species or the intended habitat type.
- Document the existing soils, hydrology and vegetative characteristics on the site.
- Describe the soils, hydrology and vegetation criteria that are to be met.
- Minimize adverse impacts to wetland functions not specifically targeted for enhancement, including potential negative effects on non-target wildlife habitat.
- Not include fish production unless recommended by the NRCS State Biologist.

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

Upon completion, the site will meet the appropriate wetland criteria and provide wetland functions as defined in the project's objectives.

Excessive sediment, nutrient, pesticide, or other pollutant inflows will be controlled prior to site enhancement.

The landowner will obtain necessary applicable local, state, and federal permits prior to enhancement.

Criteria for Hydric Soil Enhancement

Enhancement sites will be located on soils that are hydric.

Changes to soil hydrodynamic and bio-geochemical properties such as permeability, porosity, pH, or soil organic carbon levels will be made as needed to meet the planned objectives.

Criteria for Hydrology Enhancement

The hydroperiod, hydrodynamics, and dominant water source of the enhanced site will meet the project objectives. The enhancement plan will document the adequacy of available water sources based on groundwater investigation, stream gage data, water budgeting, or other appropriate means.

If an artificial water supply is used, these sources will not be diverted from other wetland resources such as pothole wetlands or springs.

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

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

Soil borings will be conducted to determine the feasibility of excavation, dike or embankment construction to enhance hydrology.

Timing and level setting of water control structures required for the establishment and maintenance of vegetation, soil, and wildlife habitat functions will be determined.

Wetland hydrology will be enhanced using one, or any combination of, the following four methods:

1. Subsurface Drain Removal or Destruction

Performing one or more of the following may eliminate the effects of a subsurface drainage system:

- 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.

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

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 approximating that of adjacent material.

The minimum length of drain to be removed or rendered inoperable is shown in Table 1.

Table 1. Minimum Length of Drain to be Plugged, Removed or Rendered Inoperable.

Soil Texture	Minimum Length* (ft.)
Sandy or Organic	150
Loamy	100
Clayey	50

* For a ditch plug, the length is measured parallel to the direction of the surface drain flow along the top of the settled fill.

2. Surface Drain Filling

Where open channels and shallow surface drains provide surface and subsurface drainage, and a compacted embankment will not be used, the channel or surface drain will be:

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

3. Embankments, Dikes or Structures

Where a grade stabilization structure will be used to create a wetland, design according to the IN FOTG Standard (410) Grade Stabilization Structure.

Where embankments will be constructed, all subsurface drains will be removed starting at one-half the minimum distance, shown on Table 1, downstream of the embankment centerline.

Pond-type embankments and spillways will be designed and installed according to the IN FOTG Standard (378) Pond, *Additional Criteria for Embankment Ponds,* with the exceptions listed below.

Dikes will be designed and constructed according to the IN FOTG Standard (356) Dike, with the exceptions listed below.

- *Site Preparation*. Vegetation, topsoil and debris will be removed from under the embankment.
- *Cutoff Trench*. Include a cutoff trench for all embankments with a fill height greater than four (4) feet and if necessary for seepage control on embankments less than or equal to four (4) feet in height.
- *Side Slopes*. Front slopes on embankments or dikes will be 6:1 or flatter and back slopes will be 3:1 or flatter.
- *Top Width*. The minimum top width will be six (6) feet, or the minimum top width listed under the appropriate standard, whichever is greater.
- *Fill Height.* Fill height will be less than 10 feet.
- *Organic soils*. Organic soils will not be used for fill exceeding five (5) feet in structural height. Top width will be increased to a minimum of 15 feet for organic soils.
- *Seeding*. Dikes and embankments will follow seeding guidelines in the Indiana Seeding Tool and the IN FOTG Standard (342) Critical Area Planting.

4. Excavation

Excavation within the enhancement area will only be used to:

a. Provide a source of fill material for embankments, dikes or ditch plugs used in the enhancement

b. Remove some of the fill and sediment covering the original hydric soil to enhance hydrology

c. Create additional wetland features **that did not previously exist on the site** to meet the needs of the target wildlife species.

Excavation to provide a source of fill material or to remove fill and sediment covering hydric soils:

- Will approximate the side slopes, shape, depth and size of historic wetland features on the site if known.
- Will have side slopes of 8:1 or flatter if historic slope cannot be determined.
- Will be obtained over a large area, to keep depths to a minimum, but will have a maximum excavated depth of 30 inches (See H_2 in Figure 1).

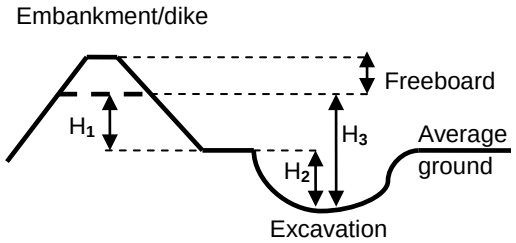
- Will be at least 20 feet from the front toe of the embankment.
- May occur below the original hydric soil surface if necessary to achieve the intended purpose.

Excavation to create additional wetland features:

- Will identify the target wildlife species for each excavated feature.
- Will be configured to meet the needs of the target wildlife species. See Table 2 in Indiana Biology Technical Note *Wetland Macrotopography* for design guidance.
- Includes microtopography with a maximum depth of less than six (6) inches.
- Includes macrotopography with a maximum excavated depth of six (6) to 30 inches.
- May occur below the original hydric soil surface if necessary to achieve the intended purpose.
- Will be designed with a 30 foot distance between the nearest water surface and the base of any habitat mound when geese are expected to be a nuisance.
- Includes excavation of drained organic (a.k.a. muck) soils intended to enhance hydrology by lowering the soil surface. However, the purpose must be to establish an approximation of the historic vegetative community, and will only be allowed where typical hydrology enhancement methods (see methods #1-3 above) are not feasible because of the presence of existing legal drains, or because of unavoidable negative impacts on adjacent landowners. The target vegetative community will be identified. The maximum excavated depth of 30 inches includes both the depth of removed soil plus any macrotopography or microtopography (See H_2 in Figure 1).
- Will be at least 20 feet from the front toe of any embankment/dike.
- Will incorporate the excavated fill into habitat mounds for the target wildlife species where appropriate.

Excavation within the enhancement area will not exceed 60 inches for the total combined water depth (H_3) resulting from excavation (H_2) and embankment/dike construction (H_1). H_3 does not include freeboard. See Figure 1. No more than 25% of the total surface area of the restored wetland will exceed 30 inches in water depth.

Figure 1



See Indiana Biology Technical Note *Wetland Macrotopography* for additional guidance.

Criteria for Vegetative Enhancement

This practice will be established to species of permanent vegetation that accomplish the design objective, are adapted to the site, and do not function as hosts for field crop diseases or become a source of weeds in the crop field. Refer to the IN NRCS Seeding Tool, or IN Biology Technical Note Wetland Plantings for Wildlife, for acceptable shrub, tree, grass, and forb species. See IN FOTG Standard (644) Wetland Wildlife Habitat Management for planting rates. Seeding rates will 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.

Established vegetation will be as close to the historic natural plant community (including species and percent composition) as the enhanced site conditions will allow. Determination of the historic plant community will be based upon reference wetlands of the type being enhanced, or suitable technical reference.

Native plant species will be used whenever possible. When practical, only local genotypes of native species will be used. Known invasive species will not be used.

Invasive species, federal/state listed noxious plant species, and nuisance species (e.g., those whose presence or overpopulation jeopardize the practice) will be controlled.

In normal situations, rely on existing seed banks in the soil, and seed colonization from

nearby wetlands and ditches, to re-vegetate the wetland.

When regeneration of a diverse and native plant community is unlikely to occur within five (5) years, a planting plan will be developed. Situations where regeneration is unlikely include isolated areas that have been in crop production for many years, or where invasive or aggressive plant species will likely invade the enhancement site.

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

Herbaceous vegetation may be established by a variety of methods including: mechanical or aerial seeding, topsoiling, organic mats, etc., over the entire site, or a portion of the site and at densities and depths appropriate.

Habitat mounds, spoil piles, etc. will be seeded according to the seeding appendix, or will be planted to trees.

Refer to IN FOTG Standard (645) Upland Wildlife Habitat Management for species selection and seeding rates when planting the upland component of the wetland enhancement.

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.
- Mitigating 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

Some soil types will hold water longer in the spring if compacted by a sheepsfoot roller. The resulting longer hydroperiod will increase wetland use by extending the metamorphosis period for some amphibians.

On gently sloping sites (1% or less), consider using spoil placement to create linear mounds as an efficient means of providing shallow, “sheet” water habitat. Material from an excavated basin is used to form a low, meandering ridge on the down slope side of the basin. Typical heights for the ridge range from one (1) to two (2) feet. By using the spoil in a creative manner, the total shallow water on a project site can be substantially increased. The impounded sheet water provides seasonal or ephemeral water for shallow feeders such as shorebirds, while the excavated basins provide longer hydroperiod wetland habitats.

Consider the general hydrologic effects of the enhancement, including:

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

Consider the impacts of water level management, including:

- Increased predation due to concentrating aquatic organisms in small pool areas during draw downs.
- Increased predation of amphibians due to high water levels that can sustain predator fish.
- Decreased ability of aquatic organisms to move within the wetland and from the wetland area to adjacent habitats, including amphibians, as water levels are decreased.
- Increases in water temperature on-site, and in off-site receiving waters.
- The effect changes in anaerobic conditions have on soil bio-geochemical properties; including oxidation/reduction, and maintenance of organic soils.
- The potential for water control structures, dikes, and macrotopographic features to negatively impact the movement of non-target aquatic organisms.

Vegetation Considerations

When a planting plan is to be developed, consider consulting with a professional biologist or person knowledgeable in wetland ecosystems and plant establishment. Vegetation may also be predicted from historic records or existing vegetation on similar soils on nearby sites.

Consider:

- The relative effects of planting density on 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 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 maintain wetland and adjacent upland plant communities.
- Out-letting upstream drains at the upper end of the wetland to increase nutrient assimilation where nutrient loading is a concern.
- Preserving native hydrophytic plant seed banks by stockpiling existing topsoil to increase plant diversity during re-vegetation.
- Establishing vegetative buffers on surrounding uplands to filter runoff and to provide wildlife habitat. Refer to IN FOTG Standard (645) Upland Wildlife Habitat Management or (393) Filter Strip for further guidance.
- Giving preference to native wetland plants with localized genetic material. Plant materials collected or grown from material collected within a 200-mile radius from the site is considered local. These plants may:
    1. Provide better wildlife habitat.
    2. Be better adapted to local ecosystems.
    3. Be less likely to become invasive.

Wildlife Habitat Considerations

Consider:

- Adding a dead snag, tree stump or log, 10” or greater in DBH, to each restored basin to provide structure and cover for wildlife and a carbon source for food chain support. Trees removed as a part of site access or preparation should be used for this purpose.
- Prioritizing enhancement 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.
- Linking wetlands by corridors wherever appropriate to enhance the wetland’s use and colonization by the flora and fauna.
- Increasing the top width of embankments to a minimum of 10 feet or increasing the front slope to 8:1 or flatter where burrowing animals may be a problem. Also consider other control methods.
- Providing passage barriers for unwanted or predatory fish and wildlife species.

To increase the value to wetland wildlife, especially **amphibians and reptiles**, consider the following options when excavating borrow areas or creating macrotopography:

1. Create wetlands with side slopes of 20:1 or flatter.
2. Create basins with increased winding perimeters.
3. Create macrotopographic features with rough surfaces on all side slopes and top, an undulating bottom, and a ragged shoreline.

PLANS AND SPECIFICATIONS

Plans and specifications will be prepared for the practice site. Plans will include the following:

- Plan view
- Profile
- Cross section (typical or other)
- Location of excavation or borrow
- Species of plants to be established.

- Seeding rates.
- Seeding dates.
- Establishment procedure.
- Planned rates and timing of nutrient application.
- Other information pertinent to establishing and managing the species or species of plants to be established.

Plans and specifications for the establishment and management of the species or species of plants to be established may be recorded in narrative form, on job sheets, or on other forms.

OPERATION AND MAINTENANCE

Any plant species, whose presence or overpopulation may jeopardize this practice, will be controlled. Spraying or other control methods will be performed on a "spot" basis to protect forbs/legumes that benefit native pollinators and other wildlife.

Any use of fertilizers, mechanical treatments, prescribed burning, pesticides or other chemicals will not compromise the intended purpose of the enhancement.

Management practices and activities will not disturb cover during the primary nesting period of April 1 through August 1.

An operation and maintenance plan will be provided to and reviewed with the landowner. The plan will include the following items and others as appropriate.

1. Fertilize to maintain a vigorous vegetative cover in the protected area. Caution should be used with fertilization to maintain water quality.
2. Promptly repair eroded areas.
3. Reestablish vegetative cover immediately where scour erosion has removed established seeding.
4. Periodically inspect area for any new maintenance items and take immediate action to protect from further damage or deterioration.
5. Actions which specifically address any expected problems from invasive or noxious species. Nuisance species (e.g., those whose presence or overpopulation jeopardize the practice) will be controlled on the site as necessary to restore wetland functions.
6. The circumstances which require the removal of accumulated sediment.

REFERENCES

Federal Register: Vol.64, No.25. Feb. 8, 1999. Executive order 13112, *Invasive Species*, February 3, 1999.

Kingsbury, Bruce & Joanne Gibson, 2002. Habitat Management Guidelines for Amphibians and Reptiles of the Midwest. Partners in Amphibian & Reptile Conservation, Ft Wayne IN, 57 pp.

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USDA-NRCS. 2000. Indiana Biology Technical. *Wetland Macrotopography*, November, 2008

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