NATURAL RESOURCES CONSERVATION SERVICE - ILLINOIS

CONSERVATION PRACTICE GUIDANCE

656 – CONSTRUCTED WETLAND

Cropland Drainage Water Treatment

I. SCOPE

A constructed wetland may be used to treat water from a variety of different sources, including wastewater and contaminated runoff from livestock facilities, stormwater runoff and other water flows. The guidance in this document refers specifically to the treatment of drainage water from cropland.

In Illinois, the primary goal for installing constructed wetlands to treat drainage water from cropland is to reduce nitrate loading in receiving surface waters.

II. CRITERIA

All applicable criteria in Conservation Practice Standard 656 – Constructed Wetland must be met. In addition, the following criteria are important in the design of constructed wetlands for treating cropland drainage water.

The constructed wetland must be located out of the 100-year floodplain, unless the following measures are taken:

- Conduct significant design analysis to ensure that the practice will withstand flooding events and meet permit requirements;
- Ensure that the landowner/operator is in agreement with the additional Operation and Maintenance requirements that will be needed.

The constructed wetland must also not be located in a wetland under the jurisdiction of the Clean Water Act (Section 404) or identified as a wetland under the conservation compliance provisions of the Farm Bill.

A map of existing drainage tile on the site and in the watershed contributing to the proposed constructed wetland must be made available prior to planning the constructed wetland. The constructed wetland must receive discharge from at least one subsurface drain.

If a drainage tile map does not exist, the contributing acres of tile drainage can be estimated by using all of the watershed acres with soil drainage group A plus ½ of the watershed acres in soil drainage group B.

The constructed wetland must be located such that the flow line of the subsurface tile(s) supplying drainage flow to the wetland is at or above the proposed permanent pool of the wetland.

The treatment pool area of the constructed wetland should be at least 1% of the size of the contributing watershed.

- The contributing watershed is the acres drained by the tile system discharging into the treatment pool plus any contributing acres of surface flow that is entering the treatment pool.
- Treatment pool area is defined as the portion of the site that is 24” below to 12” above the design permanent wetland pool elevation.
- Areas that will be deeper than 24” are not counted when computing the wetland to watershed drainage area ratio.

Design the treatment pool so that at least 50% of the area flooded at design pool elevation has a depth of 12 inches or less.

The volume of the constructed wetland must accommodate an accretion rate of at least 1 inch per year for the design life of the practice, plus any expected sedimentation, to account for an expected buildup of organic matter.

The outlet structure for the constructed wetland should be located hydraulically distant from inflow locations, to maximize hydraulic retention time. If necessary, interior berms may be added to the design (Reference NRCS National Engineering Handbook 637.0306f). Maximum flow rate from inflow to outlet should not exceed 1.5 ft/sec during the 10 year frequency, 24 hour duration storm event, to allow settling of sediments.

If there are any tile intakes within the wetland area, they should be removed and capped, or replaced by an in-line water control structure, to

prevent them from draining the wetland. Any tile serving as an outlet for upstream properties which cannot be routed into the constructed wetland should be replaced with non-perforated tile at all locations within 100 feet of the wetland.

The soil on site should be capable of holding water without installation of a liner. The soil should also be capable of serving as a planting medium: medium textured or loamy soils are best suited for the constructed wetland.

Stabilize the embankment of the constructed wetland with vegetation according to Conservation Practice Standard 342 – Critical Area Planting. Plant a buffer area meeting the criteria of Conservation Practice Standard 393 – Filter Strip upstream of and adjacent to the constructed wetland to protect against excessive sedimentation.

Establish emergent herbaceous macrophyte vegetation in the wetland area for enhanced denitrification and nutrient adsorption. Special water management instructions will need to be followed for the establishment period (the first year after installation).

III. WETLAND VEGETATION ESTABLISHMENT

Wetland vegetation is essential for constructed wetlands to increase the amount of microbial activity both in the water and in the substrate. Microbes play a major role in the transformation of nutrients and contaminants that enter the constructed wetland. Constructed wetlands have average water depths that allow emergent wetland vegetation to grow after an establishment period.

Once the wetland is graded, and top soil replaced if required by the design, prepare the site for planting using disk, harrow or other methods. Slowly flood the site with a few inches of water to settle the soil. Allow the site to dry somewhat so that planting may begin, or keep the soil moist if natural regeneration will be used as the establishment method.

Three options are presented for establishing vegetation: transplanting, seeding, and natural regeneration. Not all of these options will work for every site; the conservation professional (typically an NRCS biologist) will determine which options are feasible for a site.

A. Transplanting Method

Species of emergent wetland vegetation that are hardy in Illinois, easy to establish and reproduce well at water depths typical for constructed wetlands are listed in Table 1. Not all species need to be used in the same wetland cell. Typically only one or two species are used in each wetland cell. If the wetland cell varies in depth, a greater diversity of species can be established.

Establishment of the wetland plant species by transplanting rhizomes, stolons and plants is the fastest and most reliable method. Transplants should be healthy pieces of rhizomes, stolons or plants that have live shoots or buds. The source should be from commercial nurseries, grown for a specific project or collected from a maintenance operation such as a ditch cleanout. Natural wetlands are not to be used as a donor site of plant material. If wild sources of plant material are used, the donor site must be inspected to ensure that unwanted exotic species do not exist at the site.

Transplant from early spring to mid-June. Wetland plants need a growing season to establish themselves before winter. If the wetland is constructed after the wetland vegetation planting season, keep the water control structure open until after the wetland plants have been planted.

Depending on the type and size of stock, modified tree planters can be used or hand planted with a dibble bar. Plant stock at a minimum of 4 foot by 4 foot spacing. Rhizomes and stolons should be placed in the ground with 1 inch of cover. Plants should be set with the entire root in the ground, with part of the shoot out of the ground.

B. Seeding Method

Species of emergent wetland vegetation that are suitable for Illinois seeding and will function well at water depths typical for constructed wetlands are listed in Table 1 with seeding rates.

Purchase seed from a Nursery or collect seed from desired species in paper bags when seeds are mature. Refer to plant guide sheets from the NRCS Plants Database for species-specific collection techniques and storage.

To allow for cold moist stratification of the seed, apply seed in the fall after the first killing frost and before March 1. After site preparation, broadcast the recommended amount of seed in

Table 1 over the seed bed and roll to ensure good seed to soil contact but keep the seed on or near the surface.

C. Natural Regeneration Method

Natural regeneration of wetland vegetation can be an option where the site can reasonably be expected to have a seed bank of desired emergent herbaceous macrophytes.

The top six inches of soil is where the majority of the seed bank exists. During construction of the wetland cell, remove the top six inches of soil in areas disturbed by construction and stock pile the surface layer. When construction is completed, spread out the stock piled soil over the wetland cell to provide a source of seed for natural regeneration.

IV. MANAGEMENT AND FOLLOWUP

As soon as the wetland is planted with transplants, seeded, or prepared for natural regeneration, the wetland should remain saturated to ponded 1 inch or less in depth for the first growing season. The following spring, as the plants grow in height, raise the water level, always leaving a minimum of 4 to 6 inches of plant tops out of the water. After the permanent pool water depth has been reached, the constructed wetland is ready for normal operation.

If the wetland vegetation establishment was done using the transplant or seeding method, and there is an area of the wetland without satisfactory vegetation larger than 20% of the wetland after the first growing season, then that part of the wetland should be replanted.

If the wetland vegetation establishment was attempted using natural regeneration, and natural regeneration does not occur during the first growing season, then the transplant or seeding method should be used for establishing emergent herbaceous macrophytes.

REFERENCES

USDA – Natural Resources Conservation Service, Illinois. September, 2010. Conservation Practice Standard 656 – Constructed Wetland.

USDA – Natural Resources Conservation Service Jimmy Carter Plant Materials Center. 1996. Guidelines For Establishing Aquatic Plants in Constructed Wetlands. Fort Valley State University Cooperative Extension Program.

USDA – Natural Resources Conservation Service. Plants Database *http://plants.usda.gov*

United States Environmental Protection Agency, A Handbook of Constructed Wetlands. May, 1995. Vol. 1 General Considerations.

Table 1. Emergent Species for Constructed Wetlands

Common Name	Scientific Name	Max Permanent Pool Depth *for Mature Plants* *(inches)*	Seed Rate	Notes
Arrowhead	*Sagittaria latifolia*	8	Not recommended	Can be established by transplanting.
Common threesquare	*Schoenoplectus pungens*	8	0.06-0.125 lb/acre	*See germination note. Tolerates 2 to 3 inches of standing water during the first growing season. Fluctuating water levels during the establishment period will increase the rate of spread. Tolerates periods of drought and total inundation as well as alkaline and saline conditions.
Prairie cordgrass	*Spartina pectinata*	8	0.5 – 2.0 lb/acre	Soil pH of 6.0+ required. Grows well on seasonally dry sites. Tolerates alkaline conditions and high water tables but is intolerant of prolonged flooding. Mowing more than once per season can reduce vigor. Periodic burning increases vigor.
Soft or common rush	*Juncus effusus*	8	0.25 lb/acre in a mix	*See germination note. Tolerates periods of drought and total inundation. Keep young seedlings moist until established. Water levels can then be managed to enhance or reduce spread.
Broad-leaved cattail	*Typha latifolia*	12	0.5 lb/acre	Germinates readily on moist soils. Full sun and warm temperatures (77-86 °F) required for maximum germination. Tolerates water level fluctuations and moderate salinity.
Hardstem bulrush	*Schoenoplectus acutus*	12	0.06-0.25 lb/acre	*See germination note. Young plants can handle deeper water, but not for an extended period of time. Tolerates periods of drought and total inundation (after mature). Will not tolerate long periods of very deep water. Benefits from burning.
Softstem bulrush	*Scirpus validus*	12	0.06-0.25 lb/acre	*See germination note. Mature plants can tolerate periodic draining and flooding, however vigor can be reduced if prolonged draining and flooding continuously occur. Tolerates a wide range of salinity.

Germination Note:

** For germination to occur, seed must be in contact with moist soil, receive direct sunlight, and over-winter on the soil surface. As long as moist conditions can be sustained and early competition reduced, seedlings will develop the following spring through summer.*