

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

CONSTRUCTED WETLAND

(Ac.)

CODE 656

DEFINITION

An artificial ecosystem with hydrophytic vegetation for water treatment.

PURPOSE

For treatment of wastewater and contaminated runoff from agricultural processing, livestock, and aquaculture facilities, or

For improving the quality of storm water runoff or other water flows lacking specific water quality discharge criteria.

CONDITIONS WHERE PRACTICE APPLIES

- Constructed wetlands for the purpose of wastewater treatment apply where a constructed wetland is a component of an agricultural wastewater management system.
- Constructed wetlands for the purpose of water quality improvement apply where wetland effluent is not required to meet specific water quality discharge criteria.

This standard should not be used in lieu of NRCS Conservation Practice Standards, Wetland Restoration (657), Wetland Creation (658), or Wetland Enhancement (659), when the main purpose is to restore, create, or enhance, wetland functions other than wastewater treatment or water quality improvement.

GENERAL CRITERIA APPLICABLE TO ALL PURPOSES

Laws and Regulations. Constructed wetland components must be planned, designed, and constructed to meet all federal, state, and local

laws and regulations, including the Illinois Livestock Management Facilities Act (LMFAct, 510 ILCS 77/1 et seq.) and provisions of Title 35E, State of Illinois Rules and Regulations as applicable.

Utilities and Permits. The landowner and/or contractor shall be responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

The landowner shall obtain all necessary permissions from regulatory agencies, including the Illinois Department of Agriculture, US Army Corps of Engineers, US Environmental Protection Agency, Illinois Environmental Protection Agency and Illinois Department of Natural Resources – Office of Water Resources, or document that no permits are required.

Location. Locate the wetland to minimize the potential for contamination of ground water resources and to protect aesthetic values.

Inlet and Outlet. Provide appropriate inlet control structures to prevent debris from entering the wetland, to control the rate of inflow during normal operations, and to control inflow as necessary for operation and maintenance.

Provide an outlet control structure capable of maintaining appropriate water depths to achieve the desired water treatment, and to meet the requirements of the hydrophytic vegetation.

Wetland Volume. The minimum height of interior embankments shall contain the design water depth and a sufficient depth for the accretion of settleable solids, decayed plant litter and microbial biomass. In the absence of an accretion rate analysis, the minimum depth

for accretion shall be 1 inch per year for either the design life of the practice or between scheduled debris and sediment removal maintenance operations.

Auxiliary Spillway. Provide an auxiliary spillway or inlet bypass with sufficient capacity to pass the peak flow of the 25-year frequency, 24-hour duration storm and provide erosion protection for the perimeter embankment.

Embankment and Spillway. Unless otherwise specified, the spillway requirements, embankment configurations, excavated side slopes, protective cover on disturbed soils and disposal of excavated material shall comply with the general criteria, criteria for embankment ponds, and criteria for excavated ponds as appropriate as contained in Illinois NRCS Conservation Practice Standard, Pond (378).

Soils used in constructing the embankment shall be suitable for that purpose according to the Unified Soil Classification System.

Vegetation. Use a planting medium that has a cation exchange capacity, pH, electrical conductivity, organic matter, and textural class that is conducive to wetland plant growth and retention of targeted contaminants.

Select wetland plants suitable for local climatic conditions and tolerant of concentrations of nutrients, pesticides, salts and other contaminants flowing into the wetland. Do not use invasive or non-native species that could be a problem in native habitats.

Provide supplemental water as necessary to establish and maintain plants in a condition suitable for the water treatment purpose.

CRITERIA APPLICABLE TO WASTEWATER TREATMENT

Location. Locate outside the boundary area of natural wetlands of any classification.

When located in a floodplain, provide protection from inundation or damage from a 25-year frequency flood event, or larger if required by laws or regulations.

Design. Pretreat water flowing to the wetland to reduce the concentrations of solids, organics, and nutrients to levels that will be

tolerated by the wetland system and to prevent excessive accumulation of solids within the wetland.

Provide sufficient storage upstream of the wetland to contain the wastewater and runoff from a 25-year frequency, 24-hour duration storm. The outlet of this storage shall deliver water to the wetland at a rate consistent with the treatment objectives of the wetland.

Design the wetland system with a minimum of two rows of functionally parallel cells.

Determine the surface area using design procedures in NRCS National Engineering Handbook, Part 637, Chapter 3, Constructed Wetlands, or alternative design procedures recognized by regulatory and academic conservation partners in the state.

Construct wetland cells with a sufficient length-to-width ratio to assure uniform and predictable hydraulic retention times. See NRCS National Engineering Handbook, Part 637, Chapter 3, Constructed Wetlands for design procedures.

Control seepage as necessary for similar wastewater management facilities. Measures for controlling seepage shall be designed according to the procedures in NRCS National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook, Appendix 10d, "Geotechnical Design and Construction Guidelines."

Exclude livestock from the wetland.

CRITERIA APPLICABLE TO WATER QUALITY IMPROVEMENT

Location. When located in a floodplain or watercourse, provide protection from damage from a 10-year frequency flood event.

Design. When used to improve water quality of surface water runoff, design the wetland so that it will return to design operating levels within 72 hours after a 10-year frequency, 24-hour duration storm event.

Safety and Maintenance. When used in populated areas, install safety fences and warning signs forbidding access by unauthorized persons.

Provide an adequate access for cleanout and maintenance.

CONSIDERATIONS

Consider the impact a constructed wetland could have on existing wetlands or other significant features in the landscape ecosystem.

Consider bat boxes, mosquito fish, and other measures to control vectors and nuisance insects when locating the wetland near residences, commercial buildings, and public use areas.

Consider seasonal storage of contaminated water upstream of the wetland during cold, dry, or excessively wet climatic conditions when the function of the wetland may be compromised.

Effluent from the wetlands may be stored for land application, recycled through the wastewater management system, or otherwise used in the agricultural operation.

Where wetland performance may be compromised by large, infrequent storm events, consider providing an inlet that captures the first flush of storm water runoff and allows excess flow to bypass the wetland.

Consider a sedimentation basin, and reaches of shallow and deep water within the wetland.

Provide inflow and outflow structures and cell geometries that promote cross-sectional mixing of water flowing through the wetland cell.

Consider the potential of pollutants entering the wetland that may cause environmental problems due to accumulation, biological uptake, or release during maintenance operations.

When selecting vegetative species, give priority to native wetland plants collected or grown from material within the Major Land Resource Area (MLRA) of the Constructed Wetland location, and consider the potential to transport chemical contamination from the wetland plant site to the constructed wetland.

Fences or other measures may be needed to exclude or minimize access of humans or animals that could be adversely affected by the

constructed wetland or that would inhibit its function.

Consider access for animals that might be attracted to the wetland, and egress for fish that could be entrained and trapped. Flatter side slopes generally provide better habitat for wildlife. If there is a desire to use the constructed wetland for wildlife habitat, consult Illinois NRCS Conservation Practice Standards, Wetland Restoration (657), Wetland Enhancement (659), Wetland Creation (658), Wetland Wildlife Habitat Management (644), and Shallow Water Development and Management (646).

Consider providing embankment protection against burrowing animals.

Consider vegetative buffers (herbaceous and woody) around the perimeter of constructed wetland for additional filtering of pollutants entering and leaving wetland areas during precipitation events.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each specific field site where a constructed wetland will be installed. Define the purpose, goals, and objectives of the practice and the soils, hydrology and vegetation criteria. Include information about the location, construction sequence, and vegetation establishment.

Plans shall include:

- A site specific plan view of the practice.
- Dimensions of the constructed wetland, including berm dimensions, if applicable.
- Location, size, and type of any structural practice (water control structure, pipe, etc.).

Specifications shall include:

- Materials and earthwork specifications, if applicable.
- Vegetation species selection.
- Seeding rates, sprigging rates or planting density of containerized plants.

- Planting dates, care and handling of the seed to ensure planted materials have an acceptable rate of survival.
- Site preparation such as stabilizing crop, mulching, or mechanical means of stabilizing, fertilizer, and pH adjustment sufficient to establish and grow selected species.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan consistent with the purposes and intended life of the practice. Include requirements for safety, water management, cleanout of sediment, maintenance of structures, embankments, and vegetation, control measures for vectors and pests, and containment of potential pollutants during maintenance operations.

The plan shall specify that treated areas and associated practices are to be inspected annually and after significant storm events to identify repair and maintenance needs.

Operational requirements include:

- Maintenance of water level in wetland cells appropriate for vegetation
- Control flow to wetland according to water budget

- Monitoring of wetland performance
- Sampling effluent for nutrients prior to utilization
- Surveillance of inlet and outlet

Maintenance requirements should include:

- Repair of embankments
- Control density of desirable vegetation.
- Removal of invasive and/or non-native species that could be a problem in native habitats
- Repair of fences or other ancillary features
- Replacement of wetland plants
- Repair of pipelines and spillways
- Control of unwanted animals (varmints) or vectors (mosquitoes)

REFERENCES

USDA, NRCS. National Engineering Handbook, Part 637, Chapter 3. Constructed Wetlands.

USDA, NRCS. National Engineering Handbook, Part 651. Agricultural Waste Management Field Handbook.

NATURAL RESOURCES CONSERVATION SERVICE
ILLINOIS CONSTRUCTION SPECIFICATION
CONSTRUCTED WETLAND

Scope

The work shall consist of constructing a constructed wetland, and excavating, filling and shaping as required by the construction plans.

Location

The location of the constructed wetland shall be as shown on the construction plans or as staked in the field.

Site Preparation

The area under any fills and in the borrow area(s) shall be cleared and grubbed of any woody vegetation and other items, such as fence rows. Topsoil from under the footprint of any fill and the borrow area shall be stripped to a minimum depth of 6", and the topsoil shall be stockpiled.

For fill heights of 6 feet and greater, the foundation area of the ridge will be thoroughly scarified to a minimum depth of 4 inches before placement of the fill material and before moisture is added, if necessary, so that the first layer of fill material can be bonded to the foundation.

Material

Earthfill material shall be free from frozen particles, roots, sod, brush, and other objectionable materials that might endanger the performance of the basin. The fill material shall have no rock particles larger than 6 inches in diameter.

Moisture content of earthfill material shall be sufficient to permit satisfactory compaction. Moisture content can generally be considered as satisfactory if the fill material can be molded into a round ball between the hands without readily separating or squeezing out free water.

Earthfill material shall come from a designated borrow area(s) as shown on the plans and/or as staked in the field.

Placement of Earthfill

All embankments shall be constructed to the planned alignment, grade and cross-section shown on the plans, with the specified overfill for settlement. Maximum lift thickness shall be 9 inches. The embankment fill shall be compacted by routing the hauling and spreading equipment over the fill material in such a manner that the entire surface of the completed fill will be traversed by not less than one tread/track of equipment. The side slopes, top of fill, and all other fill areas shall be finished to a smoothness so the surface can be readily traveled upon by farm-type equipment.

When topsoil salvaging is specified, areas to receive topsoil shall be brought to within 4 inches of final grade, or as specified on the construction plans. Topsoil shall be evenly placed and spread over specified area to bring it to final grade.

Pipes/Water Control Structures

Pipes and/or water control structures shall be placed at the elevations and locations as shown on the plans. Earthfill within 2 feet of the pipe or structure shall be carefully compacted by hand or manually directed power tampers. Maximum lift thickness within 2 feet of the pipe or structure shall be 4 inches.

Couplers or fittings shall conform to the details as shown on the plans.

Liner

If required in the construction plans, a liner shall be installed in the constructed wetland as designated in the construction plans. Separate specifications for the liner will be provided.

Planting Medium

Topsoil stockpiled on the site shall be used to fill the bottom of the wetland cells, unless otherwise specified in the construction plans. The topsoil shall not be placed in the wetland until the liner has been inspected and

approved by the engineer. Topsoil shall be placed to the depth specified in the construction plans. Equipment operation shall be controlled to minimize compaction of the topsoil, and to prevent damage to the liner. Care shall be taken to finish the top of the soil to the grades shown on the drawings.

Vegetation

A protective cover of vegetation shall be established on constructed embankments and other non-wetland areas as specified in the design plans. Refer to Construction Specification (342), Critical Area Seeding, for detailed seeding requirements.

The wetland cells shall be pre-wetted with fresh (non-waste) water so that the topsoil is thoroughly moist, but not saturated or flooded with standing water. Planting of selected

wetland plants shall take place immediately after the soil is pre-wetted. Plant sources, types, spacing and planting methods shall be as specified in the construction plans.

The topsoil shall be kept moist to saturated with fresh water, but without standing water, until 75% of the plants show new growth. Wastewater can then be introduced, but the water level shall not exceed one half of the shortest plant height. Water levels shall be gradually increased to the normal operating level(s) as the wetland plants mature.

Utilities

The landowner and/or contractor shall be responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

NATURAL RESOURCES CONSERVATION SERVICE

ILLINOIS OPERATION AND MAINTENANCE

CONSTRUCTED WETLAND

Follow the operation and maintenance plan below to keep your constructed wetland functioning as intended:

- Inspect structures and berms at least annually and after significant storm events to identify repair and maintenance needs.
- Depending on the level of water treatment and vegetation desired, water levels may be maintained at certain elevations during different time periods. Inflow to the wetland may also be controlled. See additional details below.
- The wetland shall be monitored to ensure the intended objectives are met. Take action if necessary to remedy issues encountered.
- If effluent is to be utilized, sample effluent for nutrients prior to utilization.
- Fill and repair any rills, holes, or cracks in the embankment and vegetated spillway and reseed filled areas.
- Remove accumulated trash away from inlet pipes, water control structures, riprap and vegetated spillways.
- Check frequently for burrowing animals. If found, remove unwanted animals, fill damaged areas and reseed.
- Prevent woody vegetation from growing in or around the embankment and vegetated spillway areas. Control tree and brush growth by hand cutting, mowing, or chemicals. Avoid damaging other desirable vegetation.
- Maintain vegetation on embankment by regular mowing and fertilizing.
- Monitor and control invasive and/or non-native species that could be a problem in native habitats.
- Repair fences or other ancillary features as needed.
- Monitor pipes/structures for damage. If damage is found, repair or ask for assistance from a qualified professional.

Additional Details:
