

Constructed Wetlands

Structural Stormwater Best Management Practice

This factsheet is part of our structural stormwater BMP series. To access this series and many other educational resources, please visit: spcwater.org.

Constructed Wetlands (CWs), also known as stormwater wetlands, are shallow aquatic systems planted with emergent vegetation. They are highly effective at removing pollutants from stormwater; they also mitigate peak flow rates and reduce runoff volume. Beyond stormwater management, CWs provide wildlife habitat and aesthetic value. Design and maintenance is critical for the ability of this BMP to function and be sustainable over time.

Detention Basins, another Best Management Practice (BMP) that temporarily stores stormwater, are often retrofitted into CWs in order to maximize stormwater management function of the space and obtain the added benefits.

Types of Constructed Wetlands

CWs can be designed as either online (hydrologically connected to existing waterway) or offline (not hydrologically connected to an existing waterway). They are often used in conjunction with other stormwater BMPs that mitigate flow and sediment. They are grouped into the following categories:

- Shallow Wetlands
- Extended Detention Shallow Wetlands
- Pocket Wetlands
- Pond/Wetland Systems

Water Quality Improvement

CWs improve water quality through a variety of mechanisms that include settling, filtration, biological decomposition, and more. They are effective at removing many common stormwater pollutants such as phosphorus, nitrogen, suspended solids, and petroleum products.

Pollutant removal capacity can be affected by seasonal variations. Performance is typically highest during the growing season and lowest during the winter months.

Examples of Wetland Plants

A variety of native wetland plants should be used in the various vegetation zones. Below are native plants that thrive in a variety of the vegetation zones required for optimal performance of constructed wetlands. Constructed wetlands improve water quality, control peak flows, provide wildlife habitat, and much more. They can be used in a variety of land use situations, including retrofit and recreational spaces.

Sensitive Fern
Onoclea sensibilis



Joe Pye Weed
Eupatorium fitulosum, PA Ecotype



Cotton Grass
Eriophorum L. Cottongrass



BMP Profile

Name:
Constructed Wetland

Type:
Structural

Primary Stormwater Function:
Runoff Quality and Peak Rate BMP

Stormwater Management Benefits:

- Water Quality
- Peak Rate Control
- Groundwater Recharge
- Flow Rate Reduction

Potential Applications:

- Residential
- Commercial
- Industrial
- Retrofit



DESIGN AND MAINTENANCE CONSIDERATIONS

Proper design and maintenance are critical for the long-term viability of constructed wetlands. Key considerations are listed below:

<p>Hydrology Water conditions associated with CWs, including flow, depth, drainage area, etc.</p>	<ul style="list-style-type: none"> • Flow contributions from rain, runoff, and groundwater are essential for long term performance • Deeper areas should have a permanent water surface except during intense drought • Drainage area should be 5 acres for pocket wetlands or 10 acres for other types of constructed wetlands • A constant source of inflow can improve the health and functioning of constructed wetlands as well as reduce the drainage area requirements
<p>Underlying Soils Existing soils below CWs</p>	<ul style="list-style-type: none"> • Underlying soils must be identified, tested, and amended if necessary • Synthetic or highly-compacted soil liners may be needed to avoid excessive infiltration
<p>Planting Soil Soils used to plant vegetation</p>	<ul style="list-style-type: none"> • Soils with very high organic content should be used due to their ability to serve as a sink for pollutants, retain high amounts of water, and support plant growth
<p>Vegetation Plants in CWs provide many functions such as slowing water velocity & evapotranspiring water</p>	<ul style="list-style-type: none"> • Vegetation serves many functions, including reduction of flow velocity, promoting settling of suspended solids, limiting erosion, promoting filter, and much more • A diverse variety of tough, non-invasive perennial plants should be used • Several zones of vegetation are necessary; see table 6.6.1-1* in PA Stormwater BMP Manual for details
<p>Configuration Design and placement considerations</p>	<ul style="list-style-type: none"> • Ideal length to width ratio is at least 2:1 • Construction should occur at least 10 feet from property lines and at least 50 feet from private wells • Critical components include forebay/inflows, vegetation and open water zones, outlets, and safety benches; see Chapter 6.6.1* in PA Stormwater BMP Manual for more detail
<p>Buffer Undeveloped area around CWs</p>	<ul style="list-style-type: none"> • Including a 25-foot buffer around the CW will improve habitat value, aesthetics, and wetland health • Buffer should include trees, shrubs, and native ground covers; existing trees should be preserved
<p>Maintenance Access</p>	<ul style="list-style-type: none"> • Stabilized and permanent maintenance access is needed at the forebay, outlet, and embankment
<p>Maintenance Vegetation and engineered systems need to be inspected and maintained to sustain CWs performance over time</p>	<ul style="list-style-type: none"> • A maintenance plan is necessary • Private facilities may require an easement, deed restriction, and/or legal measures to prevent neglect or removal • Vegetation inspections should occur every 2 to 3 weeks during the first growing season • Full inspections should occur 4x/year and after major storms during the first 2 years • Vegetation and sediment problems should be promptly corrected • Once established, inspections should occur semiannually and after major storms

Constructed wetlands can be sited in a variety of conditions, including residential, commercial, industrial, and retrofit situations to improve water quality, control peak flows, provide wildlife habitat, and much more.



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