# SECTION 02670 (32 71 00)

## CONSTRUCTED WETLANDS

1. GENERAL
	1. SUMMARY
		1. Furnish and install a biologically and hydrologically functional system, reviewed and approved by regulatory agencies having jurisdiction.
		2. This Section includes engineering, fabricating, furnishing, and installing for the following:

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***NOTE TO SPECIFER: Select one or both of the subparagraphs below to fit project.***

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* + - 1. Constructed wetlands for stormwater management.
				1. Surface Flow Wetlands
				2. Sub-Surface Flow Wetlands
			2. Constructed wetlands for wastewater treatment (black water).
				1. Surface Flow Wetlands
				2. Sub-Surface Flow Wetlands
		1. Related Sections:
			1. Section 02900-Planting.
	1. SUBMITTALS
		1. Product Data: For each type of product indicated, including soils.
		2. Product Certificates.
		3. Installer Qualifications.
		4. Operations and Maintenance Data.
		5. Soil Analysis.
			1. Site-specific information on the hydraulic conductivity and permeability of the site soils shall be made through field data collection.
			2. Laboratory soil analyses shall include clay content and type of clay, percent organic matter, and mineral content.
		6. Copy of NPDES Permit and Storm Water Pollution Prevention Plan.
		7. Field Quality Control Reports.
	2. QUALITY ASSURANCE
		1. Comply with the U.S. Environmental Protection Agency’s Guiding Principles For Constructed Treatment Wetlands: Providing For Water Quality And Wildlife Habitat, EPA 843-b-00-003; <http://www.epa.gov/owow/wetlands/constructed/>
		2. Comply with the U.S. Environmental Protection Agency’s Constructed Wetlands Treatment of Municipal Wastewaters, EPA/625/R-99/010; <http://www.epa.gov/owow/wetlands/pdf/hand.pdf>
		3. Pre-Installation Conference: After award of Contract and prior to the commencement of the Work of this Section, schedule and conduct meeting to discuss the Work of this Section and to coordinate with related Work.
			1. Notify all attendees at least two weeks prior to the conference.
			2. Require attendance of parties directly affecting Work of this Section, including, but not limited to:
				1. Owner
				2. Contractor
				3. Project Consultant
				4. Civil Engineer
				5. Sub Contractor
				6. Product Technical Representative
			3. Review methods and procedures related to installation and operation of Work of this Section, including coordination with related Work.
			4. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.
	3. SEQUENCING AND SCHEDULING
		1. Coordinate the Work with site clearing, grading, and installation of other landscape materials as the Work of this Section proceeds.
1. PRODUCTS
	1. WETLAND COMPONENTS
		1. Structure Cell Dike Soil: Approved fine-grained soil material easily compactable into stable an impervious embankment high enough to contain the design volumes with ample freeboard to accommodate occasional high flows as well as the buildup of litter and sediment over time.
		2. Planting Soil: The soil shall provide sufficient organic soil material to stimulate plant growth and microbial activity following plant installation. Dense soils, such as clays and shales, are not permitted.
			1. pH: between 6.5 and 8.5.
			2. EC: less than 4 mmho/cm.
			3. CEC: greater than 15 meq/l00 g of soil.
			4. Provide a reducing substrate to promote the removal of nitrate and ammonia.
		3. Wetland Liners:

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***NOTE TO SPECIFER: Select one of the subparagraphs below to fit project product requirements.***

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* + - 1. On-site soils or clay: Utilize on-site soils compactable to permeability of <108 ft/sec (<10-6 cm/sec).
			2. Synthetic liners: Synthetic liners may be fabricated from synthetic butyl rubber or 0.5 to 10.0 mil high density polyethylene. Asphalt liners are not permitted.
		1. Aggregate: Aggregate used to construct the system shall be defined by their ability to pass a given sieve size as indicated per AASHTO T 27-99.
		2. PVC pipe: ASTM D2241 SDR 26 or D1785 Schedule 40.
		3. Dosing Tank: Provide with locking basin cover, spice box, mercy float switch assembly, pump control panel with run time meter, trip counter, and check valve assemblies, and breakaway flanges with slide rails. All components shall be made of non-corrosive materials. Audio and visual alarms shall be connected to separate power circuits to be activated with pump failure or high water alarm.
1. EXECUTION
	1. EXAMINATION
		1. Examine substrates, areas, and conditions under which system will be installed, with Designer/Installer present, for compliance with requirements.
		2. Do not proceed with installation until unsatisfactory conditions have been corrected.
	2. INSTALLATION
		1. Install wetlands system as indicated, and in accordance with all federal, state, and local regulations.
		2. Planting:
			1. Plants assigned to each cell shall be planted in random distribution by type spaced as indicated.
			2. The effluent level in the gravel bed shall be within one to three inches of the surface at the time of planting and be maintained at that level at all times for the duration of the initial growing season.
			3. Provide temporary anchoring as necessary.
			4. Establishment: Maintain water level as appropriate to plant types and wetlands type (surface flow or sub-surface flow).
		3. Structure Cells:
			1. Dikes: Constructed into stable and impervious embankments as indiacted.
				1. Slope dikes no steeper than 2:1
				2. Protect slopes with riprap or erosion control fabric.
				3. If multiple cells are used, divider dikes may be used to separate cells and to produce the desired length-to-width ratios.
		4. Wetland Liner:
			1. Constructed wetlands shall be sealed to avoid possible contamination of groundwater and also to prevent groundwater from infiltrating into the wetland.
			2. Where on-site soils or clay provide an adequate seal, compaction of these materials may be sufficient to line the wetland.
			3. On-site soils may be used if they can be compacted to permeability of <108 ft/sec (<10-6 cm/sec).
			4. Synthetic liners: Synthetic liners may be fabricated from synthetic butyl rubber or 0.5 to 10.0 mil high density polyethylene. Asphalt liners are not permitted.
			5. If the site soils contain angular stones, place sand bedding or geotextile cushions under the liner to prevent punctures.
			6. Cover the liner with 3 - 4 inches of soil to prevent the roots of the vegetation from penetrating the liner.
	3. PROTECTION
		1. Provide mechanical protection as needed to prevent animals from damaging newly established plants.
			1. Preventive methods may include planting through chicken wire fence fastened over the surface of the substrate to prevent animals from excavating tubers and rhizomes.
	4. OPERATIONS AND MAINTENANCE
		1. Operations: Identify procedures to accomplish the following:
			1. Provide ample opportunity for contact of the water with the microbial community, litter, and sediment.
	5. Indicate setting of water depth control structures.
	6. Indicate depth of sediment accumulation before removal is required.
	7. Indicate operating range of water levels, including acceptable ranges of fluctuation.
	8. Indicate the supplemental water source to be used to ensure adequate water levels during establishment and operation wastewater application schedule, if this is part of the system design.
		* 1. Assure that flows reach all parts of the wetland.
			2. Assure a healthy environment for microbes and a vigorous growth of vegetation.
		1. Maintenance: Identify procedures to accomplish the following:
			1. Hydrology:
			2. Structures:
			3. Vegetation:
			4. Herbicides: Not permitted.
	9. WATER INTRODUCTION
		1. Allow plantings to become well established before the wastewater is introduced into the system.
		2. Verify that the water supplies enough nutrients to support plant growth. If not, a solution of commercial nutrient supplement may be added.
	10. FIELD QUALITY CONTROL
		1. System Inspection: Installer shall inspect system installation and submit reports to Owner. Notify Owner 48 hours in advance of the date and time of inspection.
			1. Provide site inspection of system at Substantial Completion two weeks prior to Occupancy.
			2. Provide site inspection of system immediately after storm event that may be severe enough to affect the system; provide inspection services for minimum 12 months after Final Completion.
			3. Provide site inspection of system seasonally, and not less than once every three months; provide inspection services for minimum 12 months after Final Completion.
		2. Pressure Test: Perform pressure test of the pressure distribution system prior to final cover. Confirm observation by local health department.
		3. Water Quality: Comply with federal, state, and local government requirements to provide water monitoring for influent and effluent of constructed wetlands.
			1. Establish baseline water quality for constructed wetland system for both influent and effluent.
			2. Provide comparison of test results with municipal water quality, and maintenance of system.
			3. Water testing shall be performed by a laboratory in compliance with agencies having jurisdiction.

END OF SECTION