

**PILOT-SCALE CONSTRUCTED WETLAND TREATMENT SYSTEMS
FOR OIL & GAS PRODUCED WATERS**

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Pilot-scale constructed wetland treatment systems (CWTSs) were designed and constructed to treat targeted constituents (metals, metalloids, and hydrocarbons) identified in oil and gas produced waters. The pilot-scale CWTSs were designed to promote preferred biogeochemical pathways (e.g. oxidation, reduction, sorption) for treatment of the targeted constituents. Hybrid CWTSs incorporating reverse osmosis can be used to treat produced waters with high concentrations of total dissolved solids. Monitoring of treatment performance considers goals for beneficial use or discharge of the water as well as goals for function of the system. Concentrations of iron, manganese, nickel, zinc, and oil & grease decreased to below guideline concentrations for irrigation and livestock watering after treatment in the pilot-scale CWTSs. The goal of 5 µg Se/L in outflow water was achieved and maintained in the pilot-scale CWTS using AquaSmart™ as an amendment. The design strategy for CWTSs represents a novel approach for renovating produced waters from a variety of sites. Based in fundamental biogeochemistry, the primary goal is to convert constituents of concern to less bioavailable and less toxic forms often sequestering them in sediments. The approach is to design the system for a specific site using sequential steps leading to effective and efficient treatment.

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