XVII[th] World Congress of the International Commission of Agricultural and Biosystems Engineering (CIGR)

Hosted by the Canadian Society for Bioengineering (CSBE/SCGAB)
Québec City, Canada June 13-17, 2010

INFLUENCE OF HUMMOCKS AND EMERGENT VEGETATION ON HYDRAULIC PERFORMANCE IN A SURFACE-FLOW WASTEWATER-TREATMENT WETLAND

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CSBE101176 – Presented at the 10[th] American Ecological Engineering Society Annual Meeting (AEES) symposium

ABSTRACT Proper design and operation of constructed treatment wetlands is critical to the success and sustainability of the systems. Hummocks (shallow planting beds) are a design feature that promotes sustainability by providing a means to manage long term vegetation patterns more than other treatment wetland designs. Through the use of biannual tracer tests, we investigated the hydraulic characteristics of a wetland containing hummocks and emergent vegetation. Our goal was to determine whether vegetated hummocks increased hydraulic mixing and solute retention to ultimately improve sustainable treatment performance. Following reconfiguration of a wetland from alternating shallow emergent marsh areas with deep open water zones to one which included open water and hummocks, vegetative coverage was relatively low (maximum of 37% of total shallow marsh area). However, these changes in vegetation spatial distribution did influence wetland hydraulics. Hummocks are intended to promote flow distribution through multiple tortuous flow paths that effectively increase the length to width ratio of the wetland and reduce short-circuiting. In this study, the density and spatial pattern of emergent vegetation influenced hydraulics and led to desirable non-uniform flow velocities (deviation from plug flow). The hummocks also enhanced volumetric efficiencies as well as recirculation zones. The tracer response curves had multiple secondary peaks suggesting the formation of both short and long pathways. Based on data collected at this site, as the wetland matures, development of healthy, upright emergent vegetation that spatially cover the hummocks and other shallow emergent zones will likely further enhance mixing and hydraulic performance, and thereby treatment efficiency.

Keywords: constructed wetlands, solute transport, hummocks, aquatic vegetation