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WERF "Small Scale Constructed Wetlands Wastewater Treatment Systems" Project 01-CTS-5

ABSTRACT

There is a demonstrated need for better wastewater alternatives, even in the United States. On-site septic systems serve approximately 25% of the US population (USEPA 1997), and in 1995 alone, over 2.5 million septic systems malfunctioned (NODP). Contrary to the belief that regional wastewater facilities are solving the nation's problems, more Americans are using septic systems now than in 1990 (NODP). Many areas currently served by failed or non-existent septic systems cannot be corrected through regionalization due to low population densities, low per-capita income, rugged terrain, and other barriers, leaving on-site and small cluster facilities as the only viable wastewater option (Drake, 2000). In addition, residential clusters are becoming more widespread as a land-planning tool (Arendt, 1999), resulting in the increasing need for community wastewater treatment facilities (Sykes & Kopischke, 1996).

Constructed wetlands have many unique benefits as a wastewater treatment process, including the ability to operate on ambient solar energy, self-organize and increase treatment capacity over time, create wildlife habitat, produce oxygen and consume carbon dioxide, and achieve high levels of treatment with minimal maintenance (Wallace, 1998). The simplicity of constructed wetlands makes them an attractive alternative to more complex mechanical wastewater systems.

However, most databases on constructed wetland performance focus exclusively on larger systems (Knight et.al. 1993), as do most design documents (USEPA 1988, Reed et. Al., 1995, WPCF, 1990). More recent texts such as *Treatment Wetlands* (Kadlec & Knight, 1996) present information in a thorough, albeit complex format, not readily available to designers and regulators facing the need for small-scale facilities. Resources targeted specifically to small-scale systems, such as TVA (Steiner & Watson, 1993), only address one type of treatment technology and fail to account for regional differences in technology requirements.

All of these factors limit access to accurate, up-to-date design information on constructed wetlands. Consequently, many regulators are unwilling to accept wetland treatment systems, and existing code requirements may be based on obsolete variants of the technology (IDNR). In an attempt to provide technical guidance, many outreach programs are forced to synthesize information from various publications (Sievers, 1993, Davis, 1995). However, this approach often does not take into account field conditions,

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with actual wetland performance failing to live up to design expectations (Mankin & Powell, 1998).

There is a clear need to establish accurate, up-to-date design information on surface and subsurface flow constructed wetlands. Design equations need to be established based on the actual performance of operating wetland systems. Finally, this information needs to be available in an understandable format this is readily accessible to designers and regulators attempting to solve small community wastewater problems. Providing greater access to accurate design information would result in more successful treatment wetlands being built, with the following societal benefits:

- Treatment wetlands are simple to construct and can easily be scaled up or down between single-family treatment units and residential clusters. Consequently wetlands can solve intractable problems when more traditional treatment technologies are a poor fit.
- Treatment wetlands have very low operation and maintenance requirements, making them ideal for rural areas.
- Treatment wetlands create green space, providing habitat for plants, wildlife, and humans.

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