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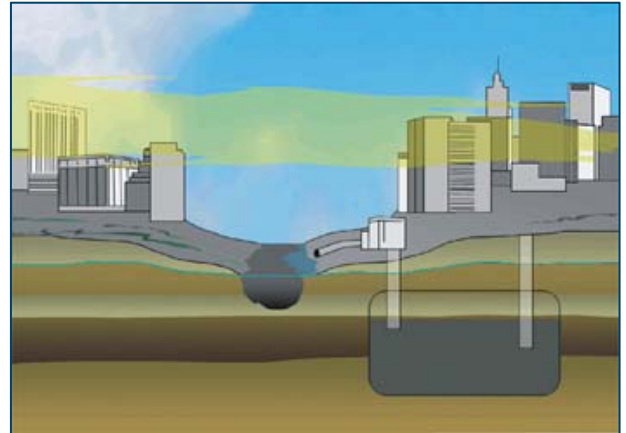
Constructed Wetlands in Support of Riparian Restoration: Water Quality Benefits and Habitat Restoration

Introduction

Point and nonpoint source pollution is adversely affecting water quality in receiving water bodies (i.e., streams rivers, ponds, lakes, reservoirs, and estuaries). Green technologies, such as constructed wetlands, are being proposed and used in place of more traditional options, such as waste water treatment facilities or underground storage tank facilities.

Constructed wetlands are effectively being used in a dual role of point and nonpoint source pollution control and mitigation of lost wetlands habitat in order to encourage use by wildlife (e.g., waterfowl, shorebirds, and mammals). Primarily focused on reductions of nutrients and suspended solids, constructed wetlands receive inputs of other types of potentially persistent pollutants (e.g., poly aromatic hydrocarbons polychlorinated biphenyls, pesticides, herbicides, metals, and pharmaceuticals). Unanswered questions include:

- What is happening to these persistent pollutants that enter these wetland systems?
- Are they being processed, transformed, sequestered, or bioaccumulated?
- Will these green technology solutions today become tomorrow's new Superfund sites?



Background

Three types of source pollution were evaluated in constructed wetlands: municipal effluent, agricultural and concentrated animal feeding operation effluent, and industrial effluent.

These effluents were chosen because they are three environmental stressors that are common across many ecosystems. EPA researchers hope to evaluate the long-term effect of the stressors by shortening the lag time relative to systems that receive higher concentrations of inputs, typical in nonpoint source systems. Through this assessment, the basis for a cost-benefit analysis will be established.

Objectives

- Investigate the fate and effect of non-target stressors (contaminants) in municipal wastewater effluents, animal feedlot agricultural runoff, and industrial waste water effluent entering cells of constructed wetlands
- Develop an understanding of the interaction between ground water and surface water in the selected constructed wetlands
- Assess the long-term potential for using constructed wetlands to attenuate nonpoint source pollution, in support of riparian zone restoration
- Evaluate the costs and benefits of using green technology (such as constructed wetlands) versus traditional technologies (such as underground storage tanks)

The National Risk Management Research Laboratory's mission is to advance scientific and engineering solutions that enable EPA and others to effectively manage current and future environmental risks.

NRMRL possesses unique strengths and capabilities and is dedicated to providing credible technological information and scientific solutions that support national priorities and protect human health and the environment.

Approach

Three constructed wetlands receiving effluent were selected as study sites:

- A large municipality (population greater than 80,000)
- An animal feedlot operation (3,000 feeder pigs)
- An industrial (oil production) facility

This study was conducted in an integrated fashion, loosely following the Sediment Quality Triad Approach. This approach is a weight-of-evidence approach that typically incorporates data from measures of sediment chemistry, laboratory toxicity, and assessments of resident biota. Sampling stations were located in the wetlands from the top of the wetland (where the effluent enters the wetland) to the bottom of the wetland (where the water leaves the wetland). The following analyses/assessments were conducted:

- Sediment chemical analysis
- Surface water chemical analysis
- Sediment toxicity assessment
- Limnological assessment
- Benthic invertebrate assessment
- Aquatic plant assessment
- Ground water assessment

Laboratory and field-based research will be conducted collaboratively among scientists from EPA and the U.S. Geological Survey.

Accomplishments

Sampling of all wetlands sites is completed. Samples are currently being analyzed and data is being entered into the project database. Preliminary analysis on early data is being conducted. Early patterns of data response are being evaluated and reassessed as additional data become available.

Future Tasks

Near-term activities will include the completion of sample processing and data analysis, and the completion of a final report that has been identified as a fiscal year 2004 Annual Performance Measure. Concurrent activities will include initiating discussions with EPA economists to develop a roadmap for monetizing ecosystem benefits of constructed wetlands management options.

Investigators

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