Constructed Wetlands for Improving Water Quality of Agricultural Runoff in Northwest Louisiana

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Introduction

Over 25,000 acres of agricultural crop land and 29,000 acres of pasture land reside within the Louisiana Department of Environmental Quality's (LDEQ) sub-segments 100402 and 100406. The Flat River and Red Chute Bayou drain these segments and, based on the 2000 Water Quality Inventory 305(b) Report, are only partially meeting their designated uses. The Flat River/Red Chute Bayou watershed is on the 1999 court-ordered 303(d) list of impaired waters in Louisiana. The primary suspected causes of this impairment are organic enrichment, low dissolved oxygen, nutrients, pesticides, suspended solids, siltation, and pathogen indicators resulting from non-irrigated crop production. LDEQ is currently developing total maximum daily loads (TMDLs) for this watershed.

Although agricultural practices such as conservation tillage help reduce non-point source discharges, they are only partially effective. However, limited information indicates that constructed wetlands have been used successfully for the treatment of non-point discharges from agricultural sources, removing 90 percent of total phosphorous and suspended solids, 80 percent of chlorpyrifos and metolachlor, and 50 percent of atrazine. Constructed wetlands remove sediment through physical means and pesticides and fertilizer through biological means provided by plants and microorganisms.

The LSU AgCenter's Red River Research Station consists of 573 acres of agricultural land located in the Red River Basin. Runoff water from the station (Figure 1) drains into the Flat River, which is located less than one-third mile away. Approximately 400 acres of discharge water from the station flows to the southeastern corner where it enters Lay's Bayou, then Flat River (Figure 2). The southeast corner of the station is therefore an ideal location to construct a wetland to demonstrate the potential for improving the water quality of discharge from agricultural lands prior to drainage into state water bodies.

Figure 1. One of the drainage ditches carrying runoff from over 400 acres of agricultural land.

This purpose of this project is to examine the potential of a constructed wetland to improve water quality of runoff from over 400 acres of agricultural land. The effectiveness of this system will be determined by sampling water at various points along the path of the system, from the point where runoff enters the wetland, to the point where it leaves.

Specific objectives to be determined include:

- With the guidance of engineers from the NRCS, construct a wetland in the Red River Basin that will accommodate discharge from 400 acres of agricultural land.
- Discern the efficacy of a constructed wetland in improving water quality of agricultural discharge prior to entering an impaired water body. Those constituents suspected of causing impairment to the Flat River will be examined at different points along the system to determine the efficacy of the constructed wetland in improving water quality.
- Develop and implement an educational outreach program to inform agricultural producers of the benefits that can be derived from the construction of a wetland.

Procedures

1. An area located in the southeast corner of the LSU AgCenter's Red River Research Station has been surveyed by personnel of the NRCS to identify the best location for a constructed wetland (Figure 2). Following the survey, NRCS engineers designed a constructed wetland that will accommodate runoff from approximately 400 acres.

2. The wetland consists of shallow and deep components (Figure 3). Runoff from over 400 acres will enter the wetland through drainage ditches.

Figure 2. Aerial photograph of the Red River Research Station showing the location of the constructed wetland and the Flat River.

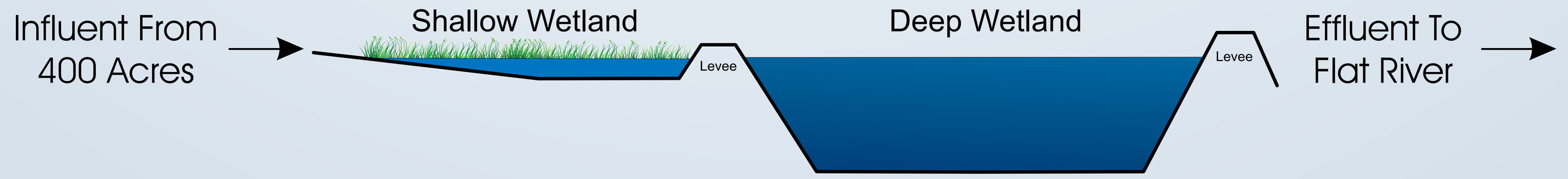

Figure 3.

3. Native aquatic plants have been collected (Figure 4) and placed in a nursery until they can be transplanted to the shallow wetland. Plants collected include rose mallow (*Hibiscus lasiocarpos* Cav.), delta duck potato (*Sagittaria platyphylla* (Engelm.) J. G. Smith), erect burhead (*Echinodorus rostratus* (Nutt.) Engelm. ex Gray), royal flatsedge (*Cyperus elegans* L.), march flatsedge (*Cyperus pseudovegetus* Steud.), and pickerel weed (*Pontedeia cordata* L.).

Figure 4. Youth from Shreveport Green help collect native plants for the constructed wetland.

Figure 5. Wetland construction began in late December, 2003.

Figure 6. Model of the constructed wetland showing the shallow and deep cells and drainage ditches that carry runoff from over 400 acres.

4. From the shallow wetland, water will enter a deep wetland that serves as a "polishing" pond.

5. To monitor changes in water quality through the system, automatic water sampling stations will be located at key points along the system. Samples will be analyzed to determine changes in the quality of runoff water as it flows through the system.