Section 319
NONPOINT SOURCE PROGRAM SUCCESS STORY
Illinois

Erosion Control Projects Reduce Manganese Levels in Reservoir

Waterbody Improved

Erosion from agriculture and other land-based activities resulted in elevated levels of manganese, sediment and phosphorus in the Charleston Side Channel Reservoir (CSCR). The pollutants contributed to excess algal growth. Illinois Environmental Protection Agency (Illinois EPA) added the CSCR to the state's Clean Water Act (CWA) section 303(d) list of impaired waters beginning in 1998 for a variety of pollutants, including phosphorus, sediment and manganese (added in 2004). To reduce erosion and manage nutrients, project partners installed shoreline stabilization structures and other best management practices (BMPs). Manganese levels dropped, prompting Illinois EPA to remove the reservoir from the 2008 CWA section 303(d) list for manganese.

Problem

The CSCR is a 346-acre public water supply in Coles County, Illinois, which serves Eastern Illinois University and the city of Charleston (population 21,149). The reservoir also serves as a public recreational area (Figure 1).

In 1895 Charleston constructed a channel dam in the Embarras River to create its first water supply reservoir. In 1947 the city constructed a second dam to create a larger reservoir (Lake Charleston) to serve a growing population. In the early 1950s Charleston began addressing the problem of sedimentation in the reservoir. In 1982 Charleston created a side-channel reservoir (the CSCR) to use as its public water supply by building a dike in Lake Charleston to create two separate waterbodies.

Adding the CSCR greatly reduced the city's problems with siltation, but it did not alleviate all the water quality problems. In 1992 the city completed a U.S. Environmental Protection Agency (EPA) Clean Lakes Program (CWA section 314) Diagnostic/Feasibility report on the CSCR—just 10 years after it was built. The report identifies land use activities in the 1,133-acre CSCR watershed as a significant source of sediment, nitrate and phosphorus. It also pinpoints shoreline erosion as a significant source of the phosphorus and sediment.

When phosphorus, nitrate and manganese reach the reservoir in the form of eroded soil and excess fertilizers, they support excess algae growth. Decomposing aquatic plants consume dissolved oxygen and release manganese into the lake.

Figure 1. A boat is docked in the CSCR near a shoreline stabilization site.

Excess manganese in water can cause objectionable discoloration effects and odors of the drinking water supply. When reduced oxygen and warmer temperatures combine, fish and macroinvertebrates that are less pollutant tolerant die, only to be replaced by those that are less desirable.

The applicable Illinois water quality standard for total phosphorus (TP) in lakes is 0.05 milligrams per liter (mg/L). In 1998 the reservoir's average TP concentration was 0.10 mg/L, prompting Illinois EPA to add the CSCR to the impaired waters list. In 2003 Illinois EPA developed a total maximum daily load for the CSCR that addressed dissolved oxygen, excess algal growth, TP, sedimentation/siltation and total suspended solids. In its 2004 Integrated Report, Illinois EPA noted that the reservoir was also impaired by manganese and excess algal growth.

Project Highlights

Since 1993 CWA section 319 funds supported three restoration projects in the CSCR and Embarras River watersheds. Numerous traditional erosion control projects were sponsored by the U.S. Department of Agriculture Natural Resources Conservation Service, Illinois Department of Agriculture, and the Coles County Soil and Water Conservation District. Projects included stabilizing 5,731 lineal feet of shoreline (Figure 2) and 1,650 lineal feet of streambank, planting 4.5 acres of grassed waterways, installing 3 grade stabilization structures, and building an in-lake sediment detention basin (Figure 3). Also, partners worked with landowners to implement 184 acres of conservation tillage and nutrient management planning to further control erosion.

Figure 2. The city used a barge designed specifically for shoreline stabilization, complete with riprap conveyor belt, to install both the in-lake basin and the shoreline stabilization practices.

Figure 3. The city installed an in-lake sediment detention basin; note the difference in water clarity between the upstream side (left) and lake side (right).

Partners installed BMPs on city property and on privately owned land in the two watersheds. All the practices were designed to control erosion and reduce sediment delivery to the lake and river and, in turn, reduce the amount of nutrients being transported by the sediment to the lake.

Project partners relied on many of the practices to serve as demonstration sites where neighboring landowners could watch and learn. The city experimented with different types of shoreline erosion control practices and compared not only the ease of application, but also the erosion control benefits, wildlife habitat benefits and safety issues.

Results

The BMPs installed in the CSCR watershed reduced the pollutant load by an estimated 1,627 tons of sediment per year, 1,371 pounds of phosphorus per year and 2,738 pounds of nitrogen per year. Reservoir monitoring showed a decrease in manganese concentrations to levels below the state water quality standard, which requires concentrations to be less than 150 micrograms per liter (µg/L) for a public water supply (Table 1).

Table 1. CSCR manganese (Mn) concentrations met water quality standards in 2007

Sample Date	Mn (µg/L)
4/19/2007	50
7/10/2007	130
9/4/2007	120
10/23/2007	92

On the basis of those data, Illinois EPA removed the CSCR from the state's 2008 CWA section 303(d) list of impaired waters for manganese. The reduced levels of manganese in the lake will lead to a smaller algal population and will help decrease objectionable discoloration effects and odors in the drinking water. In addition, the projects implemented in the watershed will continue to benefit the community by further reducing soil, nitrogen and phosphorus entering the lake, thus improving wildlife habitat.

Partners and Funding

EPA provided $194,449 in CWA section 319 funding to Illinois EPA to support implementation of BMPs that reduced sediment and nutrient loads, including streambank and lake shore stabilization and installation of an in-lake sediment detention basin. The city of Charleston, Coles County Soil and Water Conservation District, Illinois Department of Agriculture, and Eastern Illinois University also used section 319 funding to install BMPs.

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