



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

# Missouri

## Implementing Best Management Practices Reduces Herbicide Concentrations in Monroe City Route J Lake

### Waterbody Improved

Herbicides applied to row crops, combined with subsequent stormwater runoff, led to periodic high concentrations of atrazine and cyanazine in the Monroe City Route J Lake, a drinking water source in northeastern Missouri. As a result, the Missouri Department of Natural Resources (MDNR) placed the lake on the state's Clean Water Act (CWA) section 303(d) list of impaired waters for atrazine (1996) and cyanazine (1998). Through an outreach program, farmers were encouraged to apply herbicides more carefully and implement best management practices (BMPs). Herbicide concentrations in the lake declined and began to meet Missouri's water quality standards, prompting MDNR to remove the lake from the CWA section 303(d) list of impaired waters in 2006.

### Problem

The 94-acre Monroe City Route J Lake is the larger of two lakes that provide the drinking water supply for Monroe City and three rural water districts in northeast Missouri (Figure 1). Located within the Salt River Basin, the reservoir's subwatershed includes 5,000 acres of primarily agricultural land.

State records indicate that, beginning in 1990, the lake water contained elevated levels of atrazine and cyanazine, two agricultural herbicides that were commonly applied in Missouri on corn and grain sorghum for broadleaf weed control. As the result of a U.S. Environmental Protection Agency (EPA) Special Review, cyanazine was gradually withdrawn from use by 2002 after being linked to a range of adverse health effects. Since then, cyanazine in Missouri waters has virtually disappeared.

Since 1993, atrazine use has been restricted, but it continues to be widely used in Missouri. Atrazine is considered a human carcinogen, so the state standard is set at a low level, 3.0 micrograms per liter ( $\mu\text{g}/\text{L}$ ). Unlike many herbicides, atrazine is weakly adsorbed (attached) to soil particles; therefore, the herbicide is readily transported off a field by runoff, regardless of the erosion control measures in place. In the 1990s, MDNR measured high levels (as high as 20  $\mu\text{g}/\text{L}$ ) of both cyanazine and atrazine in the lake. As a result, MDNR added the Monroe City Route J Lake to the state's CWA section 303(d) list of impaired waters for atrazine (1996) and cyanazine (1998). The lake was restored before a TMDL was developed.

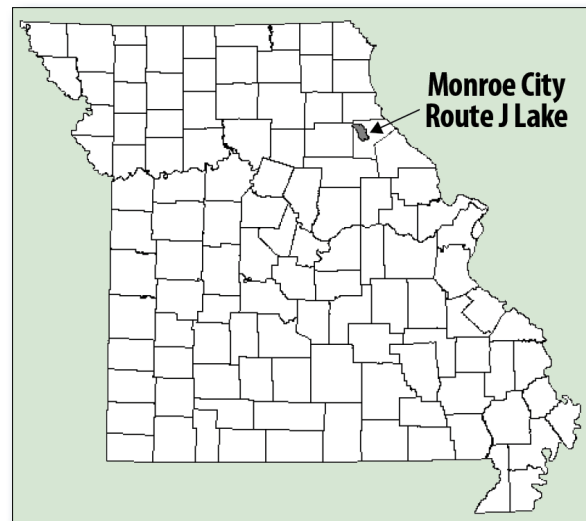


Figure 1. The Monroe City Route J Lake is in an agricultural area in northeast Missouri.

### Project Highlights

In 1998, a group of watershed partners (including city residents, elected officials, farm owners and producers, representatives of agricultural business and manufacturing, and government) completed the Monroe City Water Resources Management Plan, which identified action items needed to protect drinking water reservoirs and address atrazine and other contaminants. The following year, the Missouri Food and Agriculture Policy Research Institute (FAPRI) developed a Monroe City Route J Watershed Farm Level Environmental Assessment

using \$151,000 in CWA section 319 funding. The study provided baseline information for several water quality concerns in the watershed and found that single-pass herbicide applications (one application after the crop emerges from the ground) were typical for farms in the study area.

Also, in 1999, the Ralls County Soil and Water Conservation District (SWCD) received \$5,000 in CWA section 319 funds to implement demonstration projects and educational efforts targeting atrazine runoff. A strong partnership of stakeholders helped to ensure the project's success. The Clarence Cannon Wholesale Water Commission received additional CWA section 319 funds (\$136,000) in 2000 to develop a watershed-based Watershed Restoration Action Strategy (WRAS) for the North Fork Salt River, which included conducting outreach to identify and promote alternative herbicide management practices. Although focused on the North Fork Salt River watershed, outreach efforts regarding herbicides extended to other basins in the geographic area, including the Salt River.

The education and outreach projects convinced farmers to implement changes in their herbicide application procedures. Before the outreach efforts, agricultural producers treated about 95 percent of corn acres in the subbasin with a 3:1 pre-mix of cyanazine and atrazine applied in the spring of each year. The average amount of active ingredient applied per acre was 1.5 pounds atrazine and 2.25 pounds cyanazine. After the outreach effort, farmers applied only 1.0 pound of atrazine per acre and applied it post-emergence—after the spring rains and as part of a two-pass program, which involved treating fields both before and after new crops emerge from the ground. Reduced application rates and partial treatment of fields provided excellent weed control and reduced costs to growers. Landowners also implemented other BMPs, including installing filter strips, planting buffer zones, moving tile outlets and improving terrace/outlet construction practices.

## Results

Atrazine concentrations in Monroe City Route J Lake declined as a result of outreach and consensus-building programs that promoted improved herbicide management practices and BMP implementation throughout the watershed.

Data show that atrazine levels in raw or untreated water at the Route J reservoir during the critical period of April through July were reduced

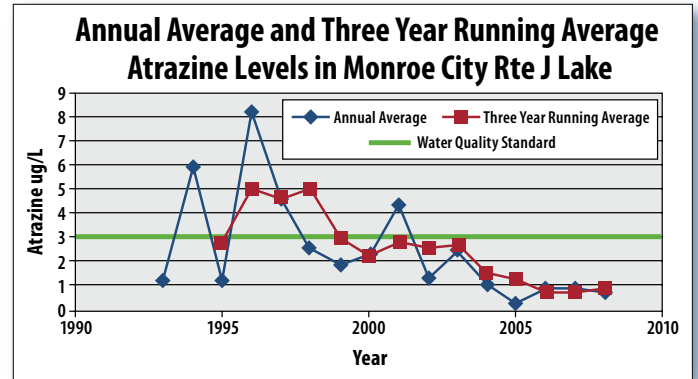


Figure 2. The lake has met standards for atrazine since 2002.

by 72 percent in 2000 as compared to average concentrations during the same time period from 1995–1998 (Figure 2). Once EPA had phased out cyanazine in 2002, levels dropped in lakes across Missouri, including Route J Lake. Because the lake now meets water quality standards for atrazine and cyanazine, MDNR removed it from the state's CWA section 303(d) list of impaired waters in 2006.

## Partners and Funding

Over a six- to eight-year period, collaborative efforts involving many partners changed approaches to agricultural atrazine use and improved water quality in portions of northeast Missouri.

Strong partnerships in the efforts described in the preceding sections helped to reduce herbicide levels in the Monroe City Route J Lake. Watershed partners included the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS); Lincoln University Extension; University of Missouri–Columbia; University Outreach and Extension–Columbia; Mark Twain Water Quality Initiative; Quinn Farm Supply; Monroe City COOP; EPA and MDNR.

Funding for the 1998 Monroe City Water Resources Management Plan was provided by the NRCS, University of Missouri Outreach and Extension, and Missouri Department of Conservation. A number of CWA section 319 grants supported the project implementation, including (1) \$151,000 to the University of Missouri FAPRI for the Monroe City Route J Watershed Farm Level Environmental Assessment, (2) a \$5,000 mini-grant to the Ralls County SWCD for outreach and demonstration projects, and a (3) \$136,000 sub-grant to the Clarence Cannon Wholesale Water Commission for outreach and WRAS development. Farmers received cost-share funding from the SWCD to help implement BMPs.



U.S. Environmental Protection Agency  
Office of Water  
Washington, DC

EPA 841-F-12-001UU  
November 2012

### For additional information contact:

**Greg Anderson**  
Missouri Department of Natural Resources  
Water Protection Program  
573-751-7144 • [greg.anderson@dnr.mo.gov](mailto:greg.anderson@dnr.mo.gov)