



Section 319

NONPOINT SOURCE PROGRAM SUCCESS STORY

Maine

Controlling Erosion Helps Restore Echo Lake

Waterbody Improved

Echo Lake's water quality began to decline in the late 1960s. Stormwater runoff carried phosphorus-laden soil from the watershed's potato cropland, roads, and residential areas and deposited it in the lake. In-lake phosphorus levels increased, eventually leading to persistent annual algal blooms and occasional fish kills. As a result, in 1986 the Maine Department of Environmental Protection (DEP) added Echo Lake to the state's Clean Water Act (CWA) section 303(d) list of impaired waters. From 2003 to 2007, DEP and the Central Aroostook Soil and Water Conservation District helped landowners install sediment and erosion control best management practices (BMPs) at high-priority sites. Installing the BMPs, combined with a substantial decline in active cropland in the watershed, reduced the sediment and phosphorus loads entering the lake. Water quality improved and now meets the state's water quality standards, prompting DEP to remove Echo Lake from the state's list of impaired waters in 2012.

Problem

Echo Lake is in the city of Presque Isle in northern Maine (Figure 1). Created in 1864 by the damming of Arnold Brook, the 90-acre lake has a drainage area of 936 acres (1.5 square miles). Land use within the watershed is 41 percent undeveloped, 33 percent forest, 9 percent surface water, 9 percent agriculture, 4 percent non-shoreline development, and 4 percent shoreline development. A portion of the lake is in Aroostook State Park (Maine's first state park), which draws as many as 16,000 to 19,000 people to the area every year to enjoy camping, boating, and other activities.

Echo Lake's vulnerability to water quality problems is due in part to the lake's shallow depth—a maximum depth of 9 feet and a mean depth of 5 feet—and its nutrient-rich sediments, as well as the watershed's highly erodible soils. Beginning in the 1960s, the considerable amount of agricultural land (potato cropland) in production, combined with an increasing number of roads and homes along the lake's shoreline, gave rise to poor water quality. Between 1965 and 1975, local residents noticed changes in the water quality of Echo Lake, including noxious smells, turbid water, algal blooms, and occasional fish kills. DEP and the Maine Volunteer Lake Monitoring Program began regular water quality monitoring in 1976. DEP collected five lake water chemistry samples in the 1970s and 1980s, all of which showed elevated phosphorus levels (two grab samples: 19 and 35 parts per billion [ppb];



Figure 1. Echo Lake is in northern Maine.

three epilimnion core samples: 19, 21, and 41 ppb). In 1986 DEP added Echo Lake to Maine's CWA section 303(d) list of impaired waters for nuisance algal blooms.

Nutrient contamination, which gives rise to algal blooms, is due in large part to nonpoint source inputs of phosphorus from eroding soils. An Echo Lake watershed survey completed in 2001 documented 315 eroding sites; of these, 66 percent were in residential areas, 24 percent were associated with state parkland, and 7 percent were along

municipal roads. In 2007 DEP developed a total maximum daily load (TMDL) for phosphorus in Echo Lake. The TMDL estimated that 136 kilograms (kg) of phosphorus was exported annually from the watershed into Echo Lake, and that this amount would need to be reduced by 42 kg annually to meet the numeric (in-lake) water quality target of 15 ppb total phosphorus. Meeting that target would, in turn, allow the lake to comply with Maine's narrative water quality standard, which requires that lakes have a stable or decreasing trophic state and be free of culturally induced algal blooms.

Project Highlights

From 2004 to 2007, stakeholders installed erosion and sediment control BMPs at 60 percent of the high-priority erosion sites documented in the 2001 watershed survey. The BMPs were installed on five town roads, 19 residential lots, two private roads, and four state park sites. The city of Presque Isle improved gravel-surface roads by reestablishing and stabilizing road ditches; adding ditch turnouts to buffers; and installing new cross-drain culverts, plunge pools, and road surface crowning. BMPs installed in Aroostook State Park included stabilizing an eroding embankment, grading and resurfacing the main parking area with non-erodible permeable aggregate, installing water bars (a ridge of material, like a speed bump, that runs diagonally to divert stormwater into a stabilized area) on campground roads and foot trails, and grading and resurfacing a boat landing.

The phosphorus and sediment that had previously contributed to Echo Lake's algal blooms were also reduced through a gradual reduction in agricultural cropland throughout the watershed. Over the past 20 years, the amount of acreage involved in farming in the watershed has declined from approximately 70 acres (8 percent of the watershed) to 20 acres (2 percent of the watershed).

Results

After gradual improvement, the lake now meets Maine's lake water quality standards. The lake has a stable or decreasing (improving) trophic state and has been free of culturally induced algal blooms for at least six of the last 10 years (Figure 2). Algal blooms are considered to have occurred when the annual minimum Secchi disk transparency falls below 2 meters. The CWA section 319-funded project reduced the annual sediment load to Echo Lake by 30.5 tons

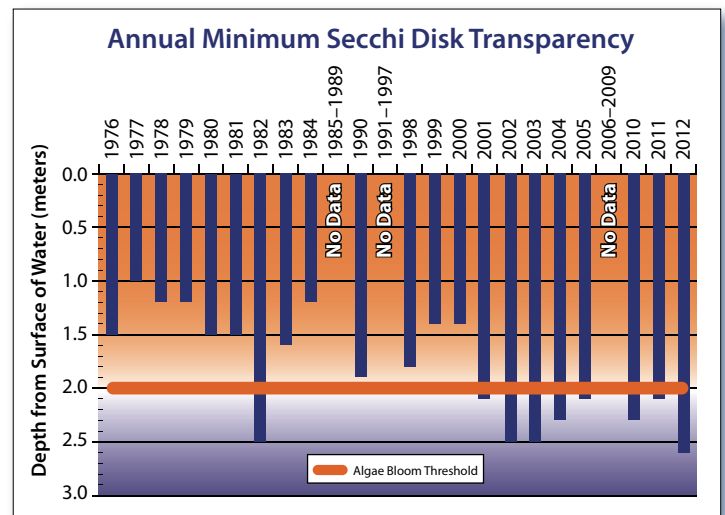


Figure 2. Annual minimum Secchi disk transparency.

per year and reduced the phosphorus load by 30 pounds per year. From the 1990s to the present, total phosphorus has decreased, ranging from 13 to 24 ppb for epilimnion core samples and 12 to 19 ppb for surface grab samples. In 2012 DEP removed Echo Lake from Maine's CWA section 303(d) list of impaired waters. Despite the improvements, the lake is considered vulnerable to future phosphorus inputs and will continue to be watched closely.

Partners and Funding

The Central Aroostook Soil and Water Conservation District coordinated work to reduce sediment and erosion from town roads, the state park, and residential lands. Key project partners included the city of Presque Isle, Aroostook State Park, the Echo Lake Improvement Association, the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), the Maine Department of Agriculture (MDOA), DEP, and the U.S. Environmental Protection Agency (USEPA). USEPA provided \$54,000 in CWA section 319 funds, and MDOA provided \$18,000 in state grant funds. The NRCS Central Aroostook Office provided technical assistance, including surveying and designing BMPs. Presque Isle donated labor and equipment valued at \$18,463 to address road-related erosion problems. The Maine Department of Conservation-Aroostook State Park invested \$21,400 to address erosion-related issues during the CWA section 319 project. Two private road associations invested \$7,935 to install road-related erosion control BMPs.



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