



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

## Maine

### Community-based Erosion Control Efforts Stop Water Quality Decline

#### Waterbody Improved

In the 1980s and 1990s, Highland Lake showed troubling signs of declining water quality that threatened the loss of the lake's brown trout fishery. Excessive soil erosion throughout the watershed contributed to significant declines in water clarity and dissolved oxygen levels, prompting the Maine Department of Environmental Protection (DEP) to add Highland Lake to Maine's 1990 Clean Water Act (CWA) section 303(d) list of impaired waters for aquatic life support. Locally led restoration work over the past 13 years has addressed significant erosion sites and reduced polluted runoff. Highland Lake water clarity has gradually stabilized and now meets water quality standards, prompting the Maine DEP to remove the lake from the CWA section 303(d) impaired waters list in 2010.

#### Problem

Highland Lake, a 623-acre lake in the towns of Windham and Falmouth and near Portland, Maine, attracts homeowners, boaters and anglers with its eight miles of scenic shoreland and warm and cold-water fisheries. The lake has a watershed area of 8.4 square miles and a mean depth of 25 feet. There are about 900 homes in the watershed, including about 300 homes along its developed shoreline. The lake's hand-carry public boat launch makes it an accessible and popular destination for visitors.

Beginning in the 1980s, erosion became more prevalent in the Highland Lake watershed due to changes in land use, especially the conversion of forest to developed land. These changes increased polluted runoff and caused a gradual decline in water quality. Stormwater runoff eroded soil from both the newly developed and existing developed lands, and moved sediment with attached phosphorus into the streams flowing to the lake. Excess phosphorus "fertilized" the lake, causing an increase in trophic state (biological productivity) followed by reduced water clarity and dissolved oxygen.

Maine's water quality standards require that lakes have a stable or decreasing trophic state, subject only to natural fluctuations. In Maine, a lake's trophic state is based on measures of chlorophyll *a*, Secchi disk transparency (clarity), concentration of dissolved oxygen and total phosphorus concentration.



Figure 1. Homeowners and volunteers planted over 1000 shrubs, trees and groundcovers to reduce polluted runoff.

Average annual Secchi disk transparency readings (measures of water clarity) in Highland Lake during the 1990s were about one meter less than during the 1980s due to increased algae and sediment. Dissolved oxygen levels deep in the lake declined, threatening the lake's brown trout fishery. In 1990 Maine DEP designated Highland Lake as impaired for aquatic life support on Maine's CWA section 303(d) list.

The total maximum daily load (TMDL) assessment developed for Highland Lake in 2003 identified suburban residential properties as the largest source (60 percent) of phosphorus. Highly developed shoreland areas with numerous homes and networks of gravel-surface roads increased stormwater runoff and erosion. Private roads accounted for nearly half of the water quality impact sites (42 percent). The TMDL estimated that the annual external loading of phosphorus needed to be reduced by about 24 percent to attain state water quality standards.

## Project Highlights

In 1997, outreach to landowners began with a watershed survey that documented 104 erosion sites including private camp roads, town roads and residential properties. The Highland Lake Watershed Management Plan (1999) described actions needed to restore the lake. From 1999 to 2010, best management practices (BMPs) were installed at numerous erosion sites. Cost share agreements with public and private landowners resulted in BMPs being installed at priority nonpoint source sites on 42 private and public roads to stop excessive erosion and sediment from thousands of feet of gravel surface roads. A residential matching grant program prompted 51 landowners to install erosion control practices including plantings, waterbars, infiltration steps, rain gardens and riprap (see Figure 1).

Technical staff provided assistance to landowners during more than 300 site visits. The Highland Lake Youth Conservation Corps (YCC) installed BMPs on 176 sites in the watershed and generated remarkable community interest in reducing polluted runoff to the lake. Landowners learned how to care for their lake through extensive outreach efforts, including: camp road, septic system and raingarden workshops; Highland Lake Association newsletters and Web site; *Cruise the Buffers* boat rides, which toured examples of good and poor lake shore buffers; a *Guide to Living Responsibly in the Highland Lake Watershed*; watershed boundary signs; annual *State of the Lake* meetings; and a watershed forum for the community to plan for the lake's future.

## Results

After 13 years of restoration projects, including installing erosion control practices, the amount of sediment and phosphorus exported to Highland Lake has declined significantly. Through 2009, pollutant loading was reduced by an estimated 278 tons of sediment and 1,070 pounds of phosphorus per year. After declining significantly from 1980 to 1998, water clarity stabilized (Figure 2) as watershed partners implemented erosion control efforts. The water quality data trend from 1998 through 2009 indicates a persistent stabilization of trophic state, and now Highland Lake meets Maine's water quality standards. As a result, Maine DEP removed Highland Lake from its 2010 CWA section 303(d) list of impaired waters.

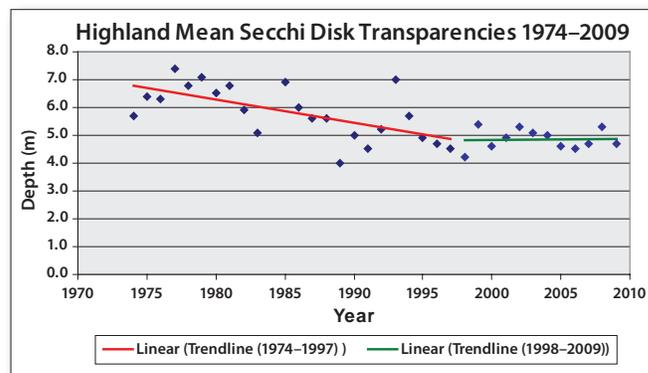


Figure 2. Highland Lake Mean Secchi Disk Transparencies from 1974 to 2009. Annual mean depth readings from 1974 to 1998 indicate a trend (red line) toward reduced water clarity. Secchi readings from 1998 to 2009 indicate a trend (green line) toward stable water clarity.

## Partners and Funding

Cumberland County Soil and Water Conservation District (CCSWCD) and the Highland Lake Association (HLA) collaborated to raise awareness about the impacts of polluted runoff and to help the community implement erosion and sediment control practices. CCSWCD prepared a watershed management plan and provided extensive technical assistance, outreach services, grants administration and projects management. HLA advocated for the lake, persuading landowners and neighborhoods to do erosion control work and supporting development and funding of the YCC. The towns of Falmouth and Windham provided substantial YCC operational funds. Other key partners included Maine DEP, Maine Department of Transportation, Casco Bay Estuary Partnership and the U.S. Environmental Protection Agency (EPA).

From 1999 to 2010, partners used approximately \$970,000 to install erosion control practices at polluted runoff sites in the watershed. An EPA CWA section 604(b) grant (\$10,500) funded the watershed survey. In 1999 Maine DEP provided \$206,975 in state bond funds for a priority watershed project that fueled the start-up of work in the watershed. From 2004 to 2010, EPA provided \$339,865 in CWA section 319 grant funds for two watershed implementation projects (Phases 2 and 3). The three grants attracted local matching contributions exceeding \$380,000 from landowners, the towns of Windham and Falmouth and the HLA. Lake Stormwater Compensation Funds through Maine DEP also provided \$36,033.



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

EPA 841-F-10-001BB  
September 2010

## For additional information contact:

**Donald Kale**  
Maine Department of Environmental Protection  
207-822-6300 • donald.kale@maine.gov

**Betty Williams**  
Cumberland County Soil and Water Conservation  
District  
207-892-4700 • betty-williams@cumberlandswcd.org