



Highland Lake:

The Lake, its Watershed and Past Stewardship Efforts

Wendy Garland
NPS Program Coordinator

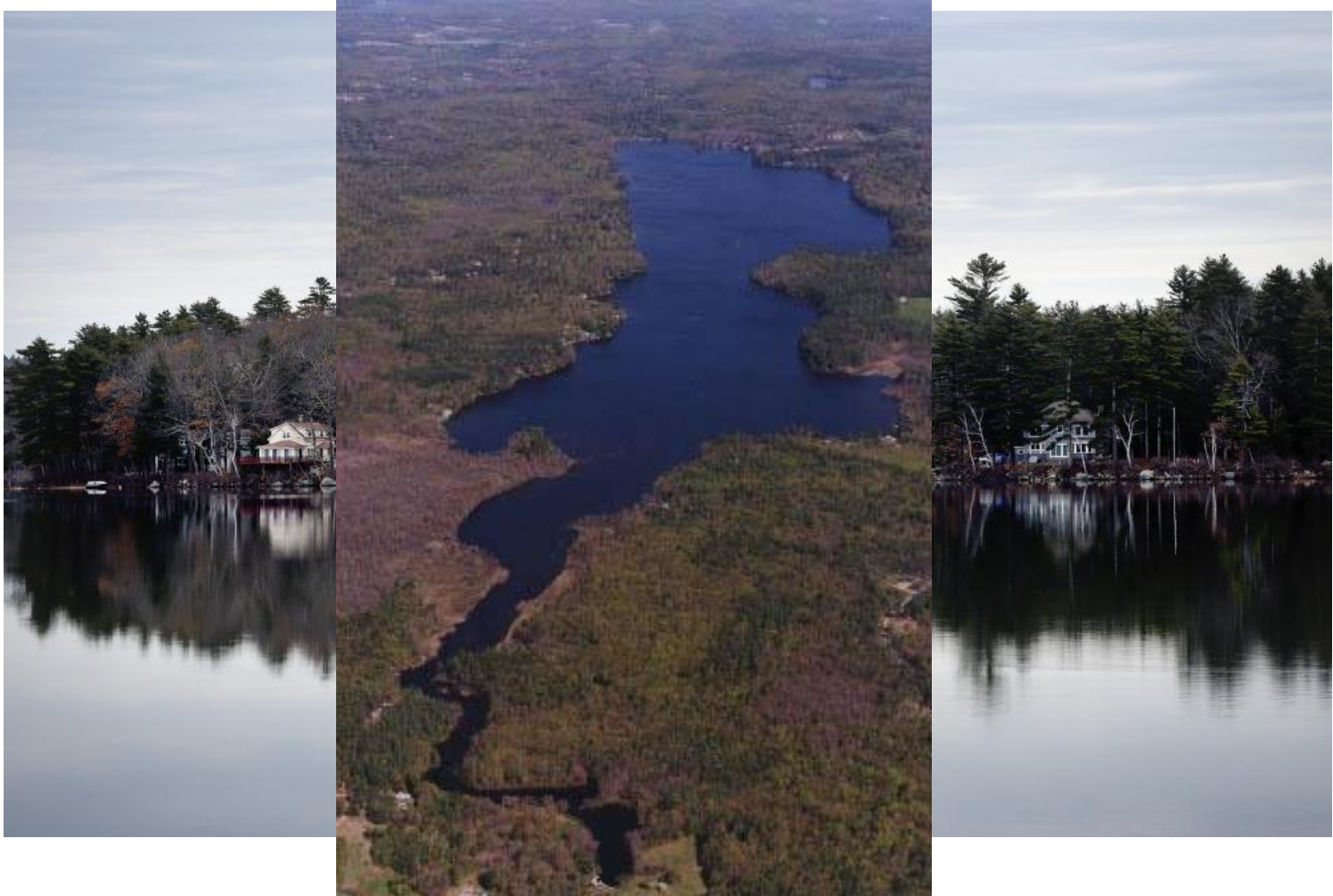
MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

Protecting Maine's Air, Land and Water

Highland Lake

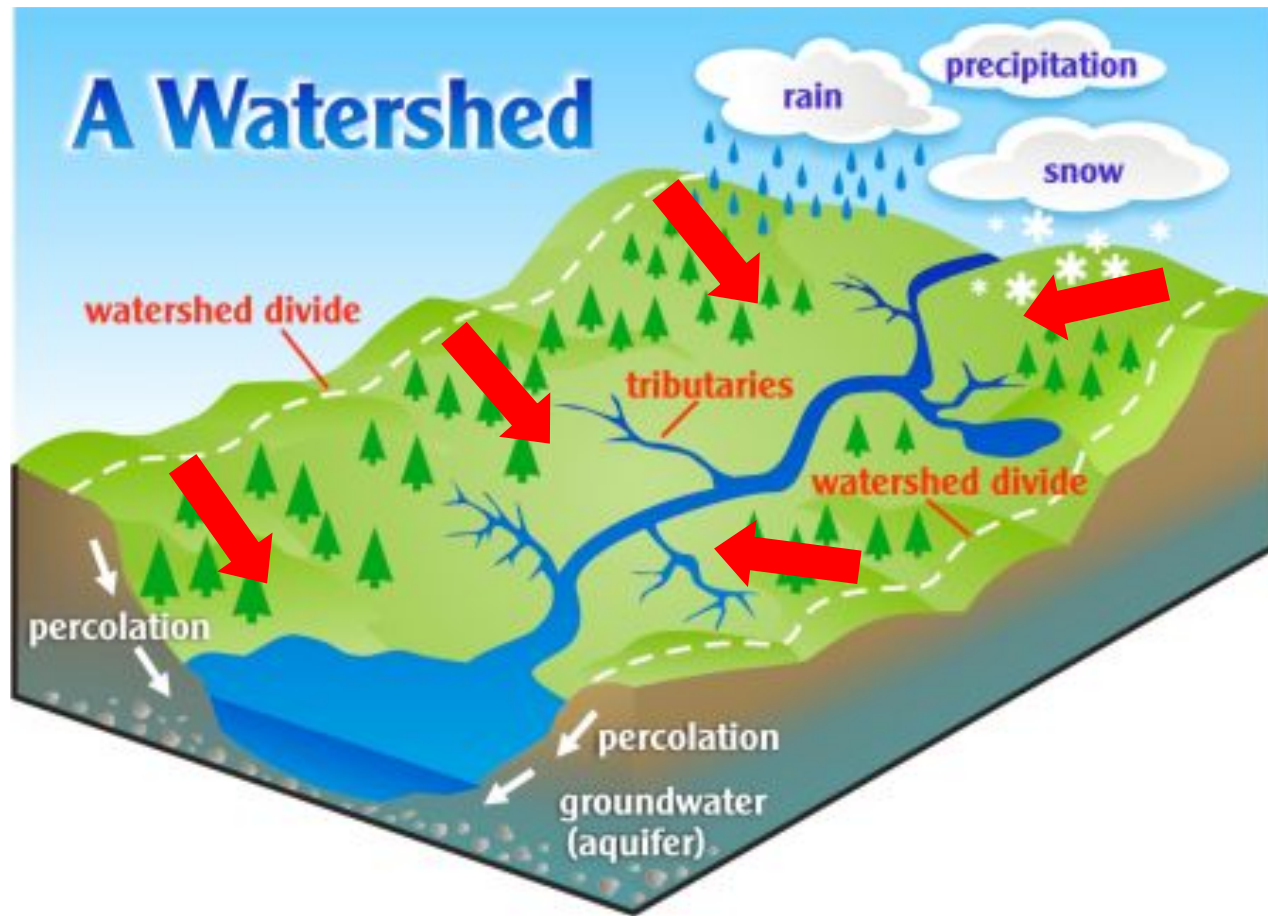


Highland Lake Watershed



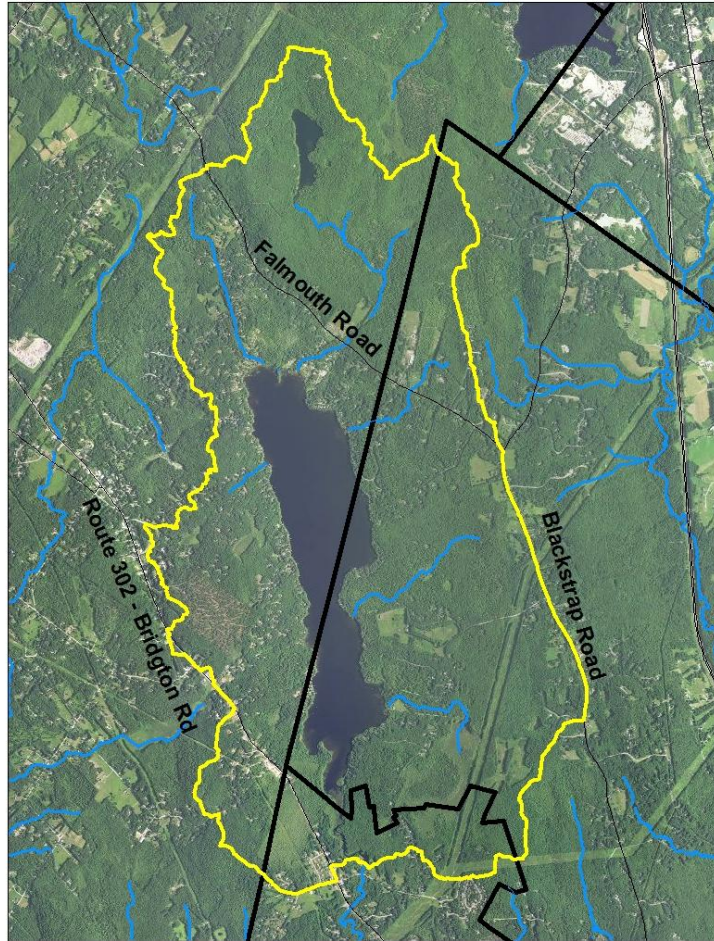
Watershed

All of the land that drains or sheds its water into the lake.



Watershed

All of the land that drains or sheds its water into the lake.



Pollution Sources

Past

Point source pollution
discharged from pipe

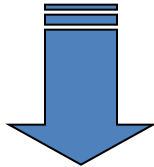


Present

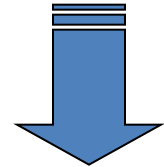
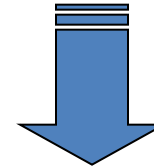
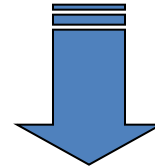
Now polluted runoff from
many smaller, diffuse
sources



Forested Watershed

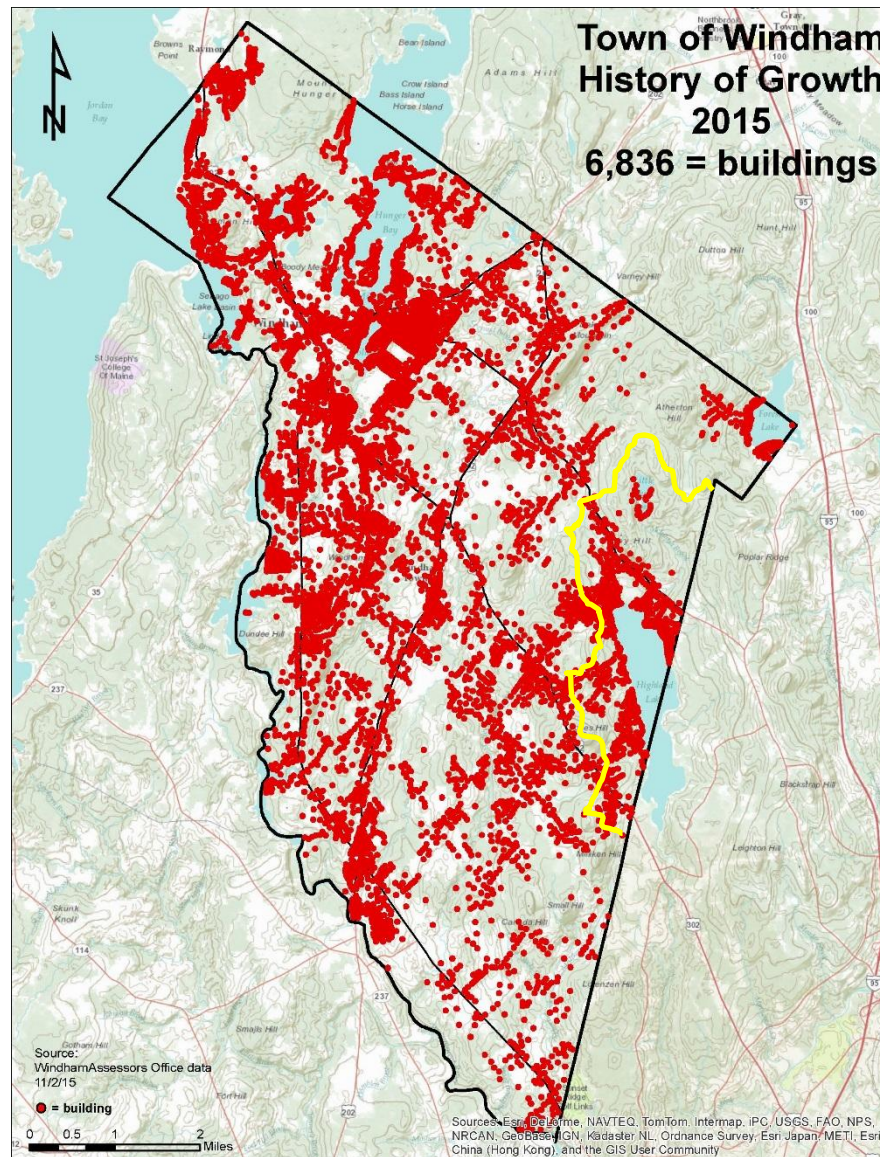


Developed Watershed



5 to 10 times the amount of **phosphorus**
in the runoff from the developed area.





Phosphorus Sources

Atmosphere

Manure

Pet waste

Fertilizers

Septic waste

Soil Erosion



Water Quality Impacts

Excess algae growth



Less clear water



Oxygen depletion



Internal loading

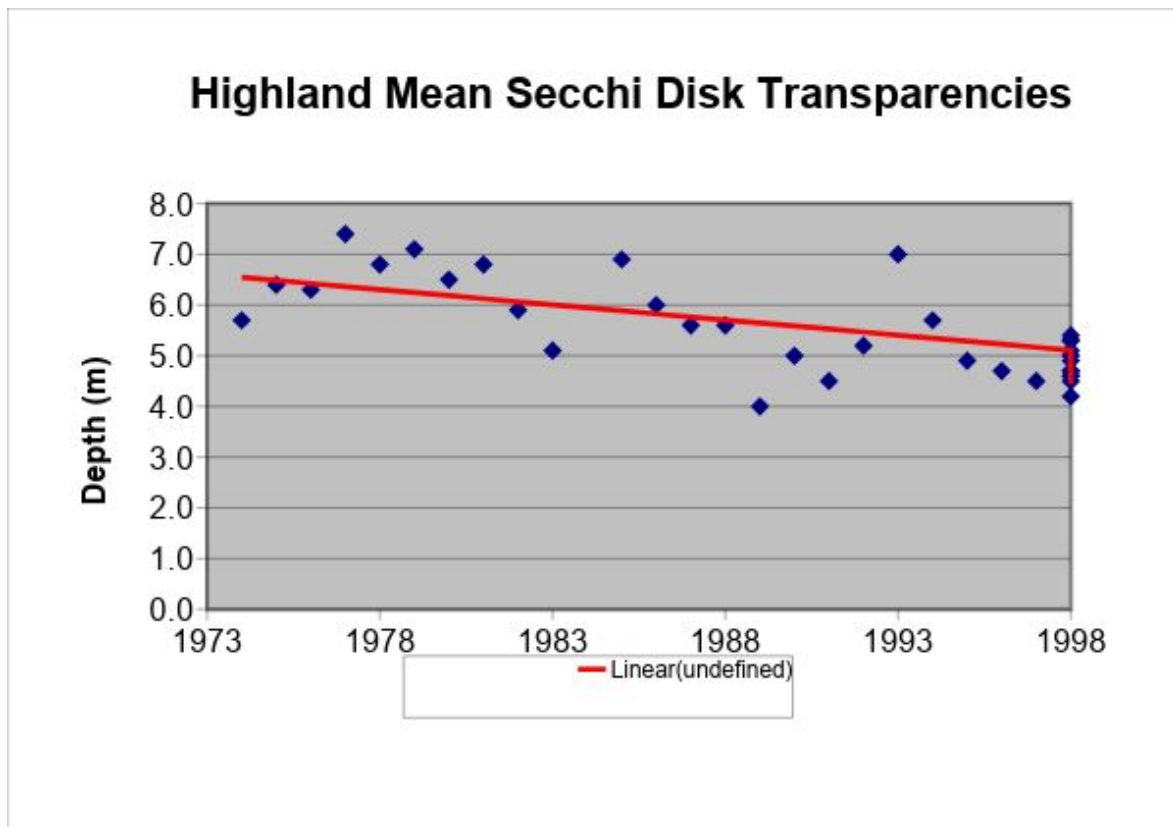


Algae blooms



Highland Lake Water Quality

1970s – 1990s



Watershed Stewardship



On-the-ground fixes—Road Projects

Overlook Road, Windham Right Fork

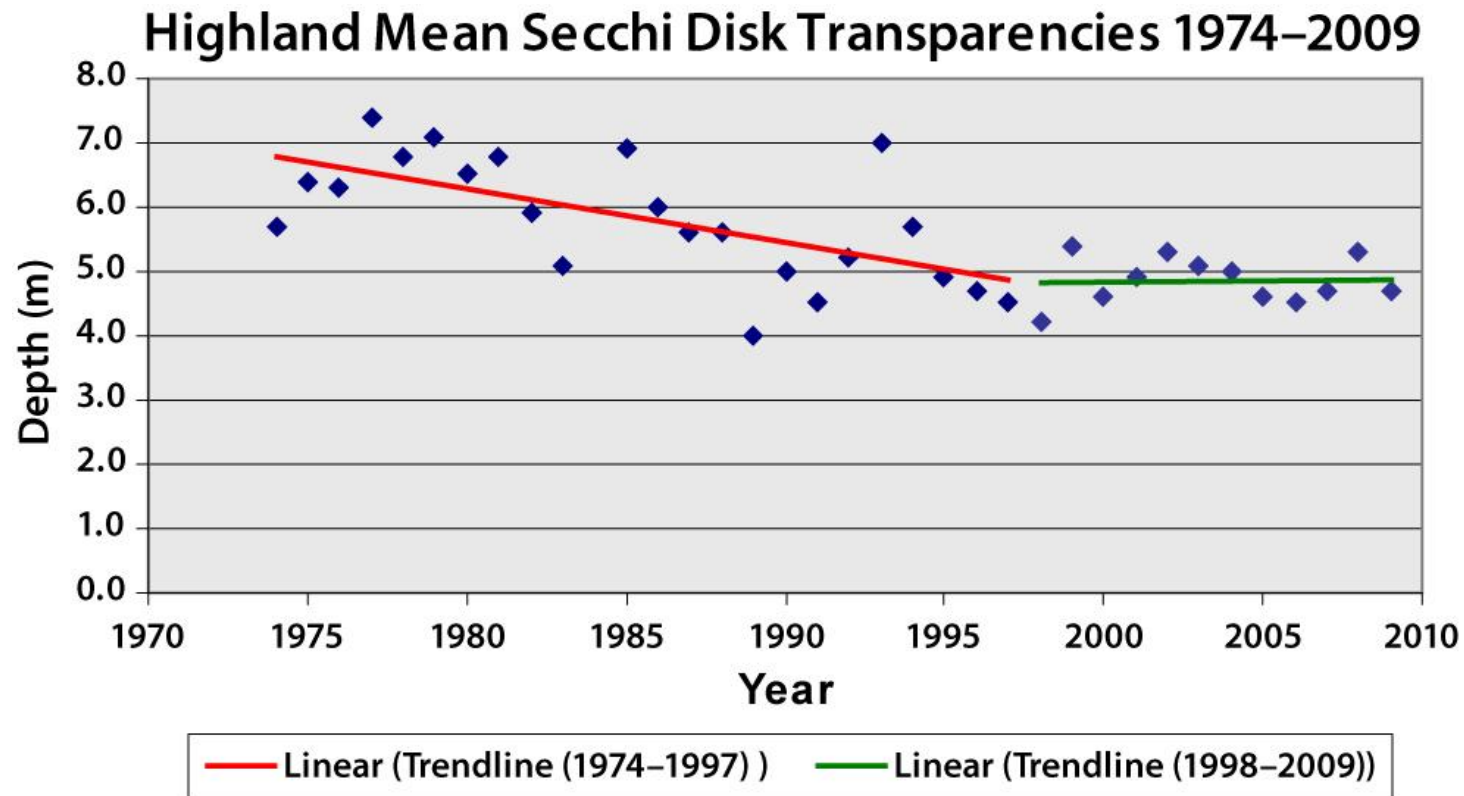


This high priority site experienced severe washouts with a direct flow to the lake. Installation of ditching on the west side of the road with new surface material and pavement mono-pitched towards the ditch. The Farley's also paved their severely eroding driveway which also contributed large amounts of sediment to the lake.



Highland Lake Water Quality

1995 - 2009



Highland Lake Water Quality 1995 - 2009


Home News & Opinion National Northeast

After 20 years, Maine lake taken off impaired list

By Associated Press
Friday, November 26, 2010 - Added 3 days ago

E-mail Print (0) Comments Text size Share Buzz up!

WINDHAM, Maine — Residents near a Maine lake in Windham and Falmouth that spent 20 years on a state and federal list of impaired waterways say the water is now so clean they can see the bottom.

 **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 620-acre lake in the towns of Windham and Falmouth and near Portland, Maine, attracts homeowners, boaters and anglers with its eight miles of scenic shore and 100+ waterfowl. The lake has a watershed area of 9.4 square miles and a mean depth of 26 feet. There are about 900 homes in the watershed, including about 300 homes along its developed shoreline. The lake's hand-carved 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 pollutant 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, creating 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, but act 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.

Average annual Secchi disk transparency readings measure water clarity in Highland Lake. During the 1980s, water about one meter less than during the 1980s due to increased algae bloom. Dissolved oxygen levels deep in the lake declined, threatening the lake's brown trout fishery. In 1990 Maine DEP designated Highland Lake as an 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 all of the water quality impacts (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.




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





Contact:

Wendy Garland
(207) 615-2451

wendy.garland@maine.gov

www.maine.gov/dep

