



# NONPOINT SOURCE SUCCESS STORY

## Pennsylvania

### Restoring Tributaries and Shoreline Areas While Managing Urban Runoff Improves Harveys Lake

**Waterbody Improved** Nutrients in runoff from urban areas impaired Pennsylvania's Harveys Lake, prompting the Pennsylvania Department of Environmental Protection (PADEP) to add it to the state's Clean Water Act (CWA) section 303(d) list of impaired waters in 1996. In Harveys Lake and two of its tributaries, project partners stabilized degraded portions of shoreline and stream channels, managed urban runoff and deployed floating wetland islands to reduce nutrient levels. Water quality improved in Harveys Lake, allowing PADEP to remove it from the list of impaired waters in 2014.

#### Problem

Harveys Lake is a 256-hectare (632.8-acre) waterbody located northeast of Wilkes-Barre in Luzerne County, Pennsylvania (Figure 1). Harveys Lake is designated for cold-water fishery support. Runoff from urban lands and erosion of stream banks and shorelines delivered nutrients and sediment to Harveys Lake. High nutrient levels in the lake contributed to algal blooms.

A Phase I Diagnostic Feasibility Study conducted by Coastal Environmental in 1994 identified Harveys Lake as impaired due to large algal blooms. To support its aquatic life designated use, the lake must maintain at least mesotrophic conditions. As a result, PADEP included the entire lake on the state's CWA section 303(d) list of impaired waters in 1996 for not meeting the aquatic life designated use. The causes of impairment were high nutrient loads from lawn fertilizer use, mowing, pet waste and erosive runoff, combined with a loss of riparian buffers, and the introduction of alewife to the lake, which consumed zooplankton that historically kept algae levels in check.

PADEP developed a total maximum daily load (TMDL) in 2002 to serve as a "pollution diet" for the entire Harvey Lake watershed. The TMDL was based on the total phosphorus (TP) Trophic State Index (TSI). To determine a TSI for TP, grab samples were taken through the seasons for TP and analyzed using the Carlson's TSI formula, which estimates algal biomass in relation to the TP concentrations of the samples. A TSI value of 50 was used as a reference to set the TMDL limits because it marks

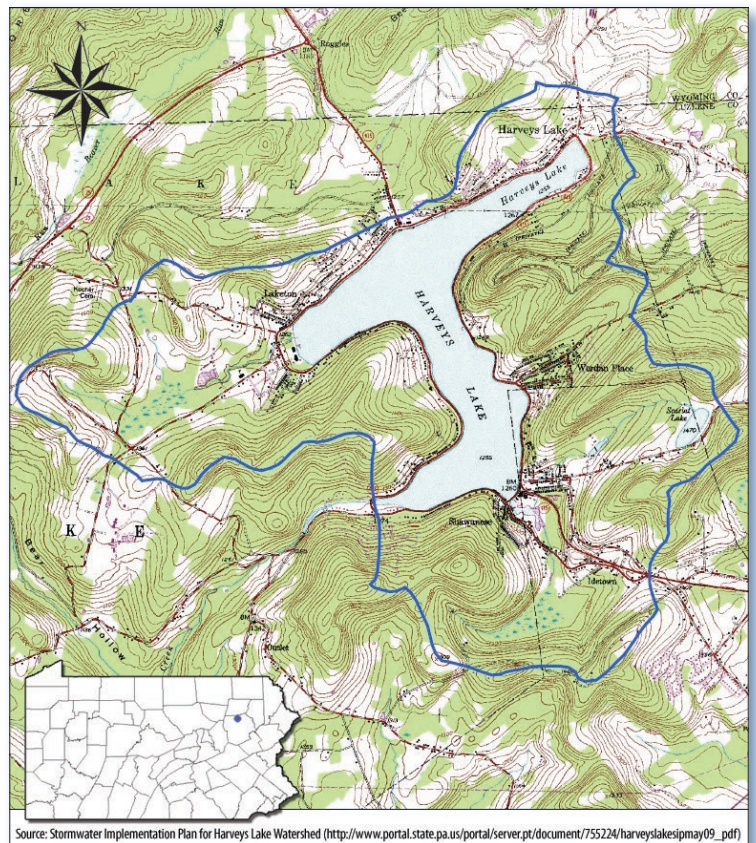


Figure 1. The Harvey's Lake watershed (outlined in blue) is in Luzerne County, Pennsylvania.

the breakpoint between eutrophic and mesotrophic lake systems. At the time the TMDL was developed (2002), Harvey Lake had a TSI of 53.7. To reach a TSI of 50, the TMDL set limits for nutrient loads (i.e., TP)



Figure 2. Watershed partners reduced the in-lake total phosphorus of Harveys Lake by installing floating wetland islands that absorb nutrients from the water.

to reduce the fuel source for algal blooms and bring the lake back into a healthy mesotrophic state. To meet the TMDL water quality goals, TP in the lake needed to be reduced by 22 percent (230 pounds per year).

In 2009 Princeton Hydro, LLC, developed a stormwater implementation plan (SIP) for Harveys Lake. Recommended practices included implementing a number of structural urban runoff projects throughout the watershed.

## Project Highlights

From 2000 to 2014, state and local partners cooperated to address the water quality problems identified in the TMDL and the SIP. First, the partners designed and constructed two natural stream channel projects restoring 500 linear feet of tributaries and reducing the sediment and nutrient loads entering the lake. Next, a series of 38 urban runoff BMPs, including nutrient separating devices and roadside infiltration, were installed in areas immediately adjacent to the lake to further reduce the loads of nutrients and other pollutants reaching the lake. Finally, four floating wetland islands were installed in the lake to assimilate and reduce nutrients already in the lake (Figure 2). A floating wetland island is a manmade raft of soil and native plants that is anchored in place and sits on the water's surface. Like a natural wetland, the plants uptake nutrients from the surrounding water, while bacteria associated with the wetlands also increase denitrification.

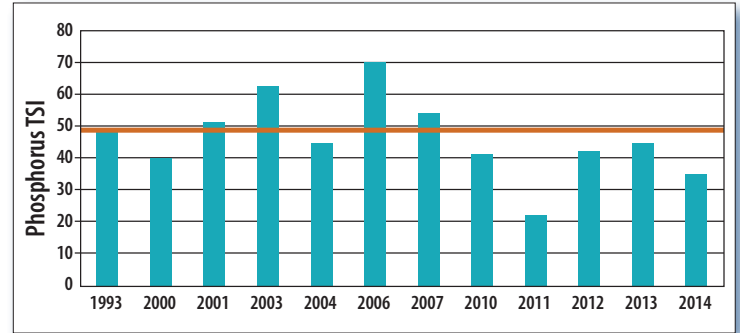


Figure 3. Phosphorous TSI values for Harveys Lake from the original Phase I Study (1993) as well as from various NPS (319) Implementation Grants. Each TSI calculation is based on the mean growing season concentration of total phosphorous. The red line is the TSI value for total phosphorous under the TMDL.

## Results

Restoration efforts helped reduce nutrient loads to Harveys Lake by the estimated 22 percent (230 pounds per year), meeting the reduction goal called for in the TMDL. PADEP's Watershed Support Section surveyed Harveys Lake in 2013 to determine its chemical and biological condition after BMPs were implemented. Data showed a TSI value of 44.2, indicating the lake had been remediated from a eutrophic to a mesotrophic system—and further indicating that the nutrient reductions achieved were meeting the goals of the TMDL (Figure 3). On the basis of these data, PADEP removed Harveys Lake from its 2014 list of impaired waters. Project partners attribute the recovery of this lake to the stream restoration, urban runoff BMP implementation and the use of in-lake nutrient reduction strategies.

## Partners and Funding

Project partners included the Harveys Lake Borough, the Harveys Lake Environmental Advisory Council, the League of Women Voters of Pennsylvania, PADEP and Princeton Hydro, LLC. From 2000 to 2014, the partners used \$1,690,364 from a CWA section 319 grant to restore the Harveys Lake watershed—\$125,595 to restore two tributaries draining to the lake and the remainder to install 38 urban runoff BMPs and four floating wetland islands.



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