



NONPOINT SOURCE SUCCESS STORY

Rhode Island

Removing Beaver Dams Reduces Phosphorus Impairment in the Chickasheen Brook Watershed

Waterbody Improved

Chickasheen Brook, Yawgoo Pond, and Barber Pond are interconnected waterways in southern Rhode Island. Water quality monitoring data collected between 1998 and 2002 showed elevated phosphorus concentrations attributed to the inundation of Arrow Swamp, which flows into Chickasheen Brook, due to beaver activity. As a result, the Rhode Island Department of Environmental Management (RIDEM) added the three waterbodies to the state's Clean Water Act (CWA) section 303(d) list of impaired waters: Barber Pond for low dissolved oxygen (DO) (1998), Yawgoo Pond for low DO (1998) and total phosphorus (TP) (2002), and Chickasheen Brook for TP (2002). Removal of beavers and their dams restored the flow regime to Chickasheen Brook, reducing phosphorus levels in the brook and downstream ponds. Monitoring results show reduced phosphorus levels, indicating that management efforts have made significant progress toward meeting water quality standards.

Problem

Chickasheen Brook, Yawgoo Pond, and Barber Pond are in southern Rhode Island within the towns of Exeter and South Kingstown (Figure 1). The headwaters of Chickasheen Brook originate in Maple Swamp and flow approximately 1.6 miles, entering Arrow Swamp just upstream of 143.4-acre Yawgoo Pond. The brook flows for approximately 1,600 feet from Yawgoo Pond to another wetland before entering the approximately 28.5-acre Barber Pond. Chickasheen Brook from its headwaters to Yawgoo Pond is designated a Class A waterbody, suitable as a source of public drinking water supply, for primary and secondary contact recreation, and for fish and wildlife habitat. The remainder of Chickasheen Brook, Yawgoo Pond, and Barber Pond are designated as Class B waterbodies, suitable for primary and secondary recreation and fish and wildlife habitat.

The surrounding watershed is predominately undeveloped; approximately 48 percent of the watershed is forested. Other land uses include low- to medium-density residential development (11 percent), agriculture (11 percent), and industrial/commercial (3 percent). Trained volunteers from the University of Rhode Island's Watershed Watch program have monitored sites in the watershed since 1988. By 1990, water quality deterioration was documented in both ponds, with clarity declining and chlorophyll (indicating algal growth) increasing to hypereutrophic levels. Prompted by local complaints

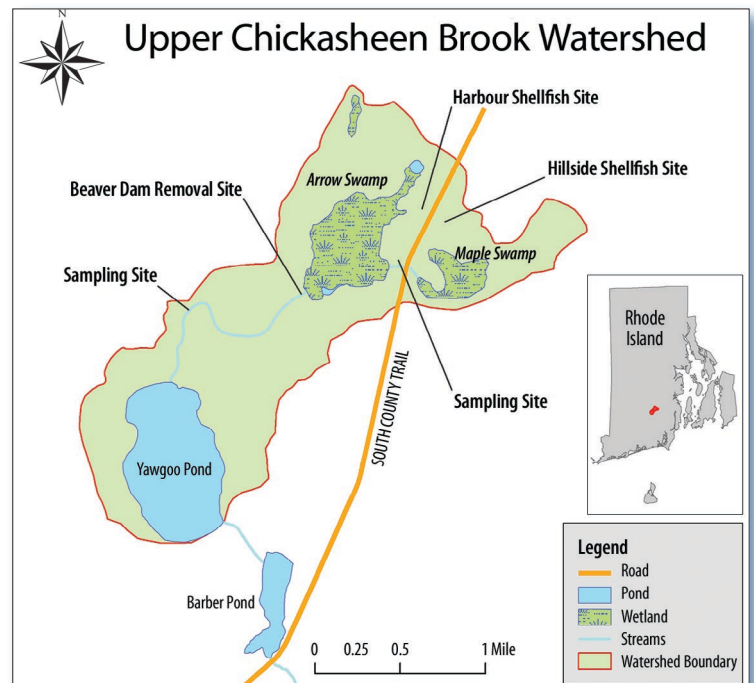


Figure 1. The Chickasheen Brook watershed is in southern Rhode Island.

and Watershed Watch data, RIDEM investigations identified two shellfish processing facilities located near Chickasheen Brook, between Maple and Arrow Swamps, as causes of high phosphorus loadings to the groundwater, brook, and downstream ponds.

RIDEM remediation, enforcement, and the closure of the two facilities resulted in improved water quality in the brook and ponds between 1991 and 1997.

Beginning in 1998, conditions in the brook and ponds again worsened with a dramatic increase in TP entering Yawgoo Pond from Chickasheen Brook—causing algal blooms and a shift to blue-green algae in the pond. Data collected by Watershed Watch between 1998 and 2002 showed that at the points where it enters Yawgoo and Barber Ponds, Chickasheen Brook consistently exceeded Rhode Island's TP criterion of 25 micrograms per liter ($\mu\text{g/L}$) and had excess algal growth. Yawgoo Pond consistently failed Class B standards for DO, total phosphorus, and also had excess algal growth. Barber Pond also failed to meet the DO standard. Based on these data, RIDEM added the three waterbodies to the state's list of impaired waters: Barber Pond for low DO (1998), Yawgoo Pond for low DO (1998) and TP (2002), and Chickasheen Brook for TP (2002).

Project Highlights

In response to the increasing phosphorus concentrations in Yawgoo Pond, Watershed Watch conducted a survey of the watershed in the summer of 2001. Surveyors identified a sizable beaver dam flooding Arrow Swamp, the principal receiving waterbody of the former shellfish processing plants, upstream from Chickasheen Brook (Figure 2).

RIDEM developed a TP total maximum daily load (TMDL) for the three waterbodies in 2004. The TMDL attributed high phosphorus levels to beaver dams in the waters of Arrow Swamp, which led to the suspension of phosphorus-enriched sediment from historic phosphorus loadings from the shellfish processing facilities. As a result, when the swamp flooded and spilled out of the dam, the phosphorus-enriched water traveled downstream to Chickasheen Brook, Yawgoo Pond, and Barber Pond.

The Arrow Swamp beaver dam was removed in the fall of 2001 and the property owner committed to maintaining the breach of this dam. The beavers built another dam downstream, which did not cause flooding of Arrow Swamp and has since been abandoned. Removal of the beaver dam has returned Arrow Swamp to its previous regime of periodic flooding and draining, avoiding conditions that led to phosphorus impairment.

Results

Since the beaver dam removal, phosphorus concentrations in Chickasheen Brook have decreased dramatically. Average annual phosphorus concentrations decreased from more than $200 \mu\text{g/L}$ (1998–2002) to $22 \mu\text{g/L}$ (2006–2010). At the sampling location just upstream of Yawgoo Pond, Chickasheen Brook now meets RIDEM's water quality criterion for phosphorus. As a result, average annual phosphorus concentrations at the surface of Yawgoo Pond decreased from $35 \mu\text{g/L}$ (2001) to $15\text{--}20 \mu\text{g/L}$ (2006–2010). Phosphorus concentrations at the pond bottom remain elevated due to a high internal phosphorus and nitrogen load, which could be addressed through alum treatments. Watershed Watch continues to monitor Chickasheen Brook, Yawgoo Pond (Figure 3), and Barber Pond.

Partners and Funding

Watershed Watch is led by the University of Rhode Island's (URI) Department of Natural Resource Sciences and URI Cooperative Extension through collaboration with URI Coastal Fellows, URI College of the Environmental and Life Sciences, RIDEM, the Wood-Pawcatuck Watershed Association, local sponsors, and the federal government. The program is aimed at providing training and equipment to volunteer "citizen scientists" who conduct multi-year surface water quality monitoring according to strict quality assurance procedures. For more than two decades, Watershed Watch has used CWA section 319 funds under a contract with RIDEM. RIDEM currently provides approximately \$50,000 annually in CWA section 319 funds to support the Watershed Watch program.



Figure 2. An algal bloom is visible behind a beaver dam constructed at the outlet of Arrow Swamp.



Figure 3. Phosphorus levels in Yawgoo Pond have declined.

Photo by Linda Green.



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