Section 319
NONPOINT SOURCE PROGRAM SUCCESS STORY
Vermont

Improved Agricultural Management Restores Crystal Brook

Waterbody Improved

Nutrient runoff from agricultural sources degraded the biological community in Vermont's Crystal Brook. As a result, Vermont placed the stream on its 2006 Clean Water Act (CWA) section 303(d) list for aquatic life use impairments due to excessive sediment and nutrients. Improvements to the waste management system on an adjacent farm brought the stream into compliance with Vermont's water quality standards. The state removed the stream from its CWA section 303(d) list in 2012.

Problem

Crystal Brook (Figure 1) is a 3-mile-long stream in north central Vermont that ultimately drains into Lake Memphremagog, a large lake that straddles the Vermont–Quebec border. The Vermont Department of Environmental Conservation (VTDEC) classifies the stream as a Class B water—a water that fully supports aquatic biota and wildlife, high-quality aquatic habitat, good aesthetic value, swimming and recreation, irrigation and agricultural uses, and public water supply uses with filtration and disinfection.

VTDEC monitored the macroinvertebrate community in the stream using several different metrics, including the EPT (short for the order names Ephemeroptera, Plecoptera and Trichoptera) index—a measure of the number and types of pollution-sensitive aquatic insects inhabiting a waterbody. Streams showing high EPT richness (i.e., a high number of EPT taxa in a sample) are less likely to be polluted than streams showing low EPT richness in the same geographic region. VTDEC also used the Vermont Biotic Index (BI), which measures the proportion of organic pollution-intolerant species to tolerant species in a community (range: 0 to 10, where 0 = excellent and 10 = poor), the percentage of pollutant-tolerant worms of the taxonomic class Oligochaeta in a macroinvertebrate sample, and other indicators to assess the health of aquatic life and water quality. High BI and Oligochaeta values characterize streams with poor water quality that are dominated by pollution-tolerant species.

Biological monitoring in 2004 and 2006 found that a short segment (0.3 mile) of the stream did not fully meet Vermont's Class B water quality standards for aquatic life. The segment had low EPT values as well as high BI and percent Oligochaeta values. These findings put the segment in noncompliance with Vermont Class B water quality standards for aquatic life support. As a result, Vermont placed the stream on its CWA section 303(d) list of impaired waters in 2006.

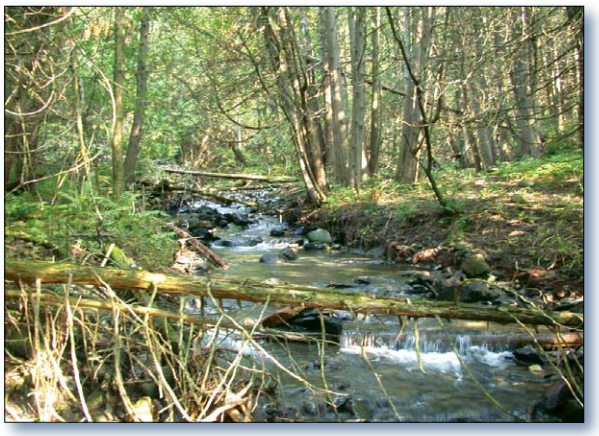

Figure 1. Vermont's Crystal Brook.

To help identify the cause of the impairment, VTDEC conducted a watershed assessment later in 2006 and worked with local partners to monitor phosphorus and nitrogen levels in the stream from 2006 through 2009. Although Vermont is still in the process of adopting water quality standards for nutrients in streams, the nutrient monitoring results from that time helped VTDEC identify the source of the problem as nutrient enrichment from agricultural runoff from a farm adjacent to the stream.

Project Highlights

Following the watershed assessment and the first year of nutrient monitoring, VTDEC coordinated with the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service and the Vermont Agency of Agriculture, which worked with a local farmer to address a leak in a manure storage structure on his farm. In 2007 the farmer replaced

the manure pit with a larger, sealed lagoon that could accommodate the volume and type of animal waste being generated. The farmer also installed a new drainage system that captured runoff from the silage area beginning in the summer of 2009. These actions helped to significantly reduce nutrient loading to the Crystal Brook.

Results

Biomonitoring results from 2009 and 2010 show that water quality has improved as a result of the agricultural waste management system changes. The biomonitoring data from Crystal Brook showed substantial increases in EPT richness along with marked decreases in the BI and percent Oligochaeta between the 2004 and 2010 sample dates (Figure 2 and Table 1). As a result, VTDEC assigned Crystal Brook a rating of "excellent–very good" in 2010, a rating that indicates that the stream not only complies with Vermont's water quality standards but also attains near-reference conditions. On the basis of these data, Vermont removed Crystal Brook from the CWA section 303(d) list of impaired waters in 2012.

Although they are not a measure of water quality standard compliance in Vermont streams, improvements in phosphorus data provide further indication of water quality improvements. Table 2 shows a dramatic decrease in median phosphorus concentrations at a sampling site just below the project site. The stream is scheduled for further biomonitoring in 2015.

Partners and Funding

The success outlined above is a reflection of VTDEC's Monitoring Assessment and Planning Process, which strategically deploys monitoring and assessment efforts to identify the highest-priority watershed projects on a five-year rotating basis. VTDEC completed the biological monitoring, guided the watershed assessment, and conducted some of the water quality monitoring using state resources and approximately $4,000 in CWA section 319 CWA funds. The NorthWoods Stewardship Center used $6,730 in CWA section 319 funds, $5,500 in Supplemental Environmental Project funds, and a LaRosa Analytical Services Partnership grant to assist with the water quality monitoring. Beck Pond, LLC, and the Memphremagog Watershed Association contributed to the water quality sampling efforts in 2008 and 2009 with support from a CWA section 604b grant ($3,000), a Memphremagog Conservation Inc. award ($8,393), a LaRosa Analytical Services Partnership grant, and local volunteers from the Memphremagog Watershed Association. The agricultural BMP work was funded with $182,992 from the USDA Natural Resources Conservation Service and $73,114 from the Vermont Agency of Agriculture. The Orleans County Conservation District and local farmers also contributed to BMP design and construction.

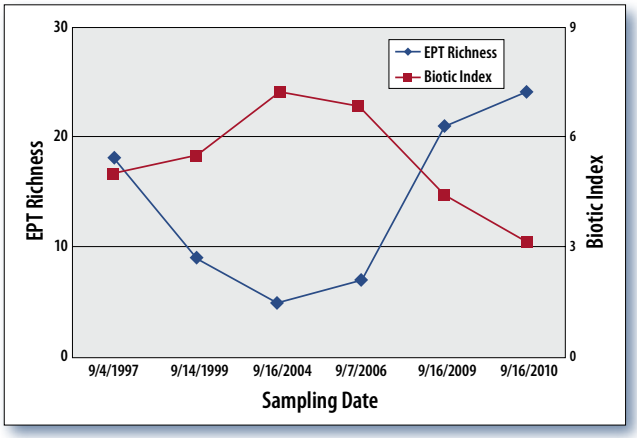

Figure 2. Changes in EPT richness and Biotic Index for Crystal Brook (1997–2010).

Table 1. Crystal Brook Biomonitoring Results[a] (2004–2010)

Sampling Site	Date	Assessment Rating	EPT Index Score	BI (Biotic Index)	Percent of Individuals from Oligochaeta
Mile 0.3	9/16/2004	Poor	**5**	**7.21**	**14.3**
	9/7/2006	Poor	**7**	**6.85**	**14.9**
	9/16/2009	Good–Fair	21	4.41	7.0
	9/16/2010	Excellent–Very Good	24	3.14	1.3
Class B Guideline			**≥ 16**	**≤ 4.50**	**≤ 12.0**

[a] Bold values indicate noncompliance.

Table 2. Crystal Brook Phosphorus Monitoring Results (2006–2009)

Sampling Site	Year	Median Phosphorus Concentration (µg/L)	Range of Phosphorus Concentration Values (µg/L)
Mile 0.3	2006	127.7	29–655
	2008	22.9	14–87
	2009	21.6	11–214

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