

Knowing Our Waters:

An Introduction to the State of Vermont's Surface Water Monitoring and Assessment



The Department of Environmental Conservation's Watershed Management Division has monitored and assessed Vermont's surface waters since 1977. Monitoring and assessment are the foundation of the division's science-based decision-making used to implement regulations, identify surface water protection and restoration strategies and priorities, and evaluate effectiveness.

Division scientists and citizen volunteers monitor annually an average of 1,300 sites statewide, including wetlands, lakes and ponds, rivers and streams, and their surrounding watersheds. Monitoring and assessment are conducted in collaboration with federal, state, and local partners to leverage resources, increase geographic coverage, and promote consistency in monitoring and assessment methods and results reporting.

Monitoring and assessment enable the division to:

- Determine **status and trends** of individual surface waters, as well as waters statewide, and compare our waters regionally and nationally.
- Determine if surface waters are meeting **Vermont Water Quality Standards**.
- Inform and ensure compliance with **permit conditions**.
- Identify and track **known and emerging stressors** that threaten the integrity and uses of Vermont surface waters.
- Inform and evaluate effectiveness of **management actions** in achieving protection and restoration goals.
- Respond to **public concerns and local emergencies** regarding Vermont's surface waters.



The Approach

With more than 800 lakes and ponds, 23,000 miles of rivers and streams, and 300,000 acres of wetlands, the Watershed Management Division must be strategic in how it employs its monitoring resources.

A monitoring team comprising scientists from the Division's Lakes and Ponds, Rivers, and Wetlands Programs, with participation and facilitation by the Monitoring and Assessment Program, meets regularly to establish annual monitoring and assessment priorities and track progress implementing longer-term strategies. These meetings culminate in an annual Monitoring Summit during which field season plans are finalized, in collaboration with Tactical Basin Planners.

Monitoring and assessment results, combined with analysis of existing stressor mitigation tools, provide the basis for identifying division strategies and priorities, including additional monitoring and assessment needs. The Vermont Water Quality Monitoring Program Strategy, Vermont Surface Water Management Strategy, and Watershed Management Division Strategic Plan describe this work.

Beyond core monitoring and assessment programs, several of which are highlighted at right, the division's current monitoring and assessment priorities include:

- Identifying lakes and streams that meet **Very High Quality Waters** criteria in the Vermont Water Quality Standards.
- Assessing causes of **declining water quality** in Vermont's oligotrophic (low-nutrient) lakes.
- Identifying **critical source areas** for clean water project implementation.
- Supporting monitoring and assessment of **contaminants of emerging concern**, such as PFAS.
- Better aligning **citizen science programs** with state monitoring and assessment needs.

Monitoring and assessment strategies and priorities drive the development of annual and long-term monitoring projects. Project objectives determine the sampling parameters, design, and sites selected.

Watershed Management Division scientists measure chemical, physical, and biological parameters.

- **Chemical parameters** include nutrients, conductivity, salinity, pH, and priority metals.
- **Physical parameters** include lake shoreline condition, stream geomorphic condition, water levels and stream flow, and land use type and conversion.
- **Biological parameters** include macroinvertebrates, algae, fish species, and fish tissue contaminants.

Monitoring by Design

Monitoring designs are selected to achieve specific objectives, such as assessing waters against Vermont Water Quality Standards, understanding water quality trends and climate change impacts, identifying stressors, or establishing permit conditions. A few examples are:

- **Targeted, fixed station monitoring:** Fixed stations are selected to better understand status and trends of individual lakes, ponds, wetlands, rivers and streams. Within this category, the division conducts:
 - **Long-term monitoring projects:** Extensive lake, river, and stream monitoring networks designed to assess status and trends.
 - **Special and TMDL studies:** Used for stressor identification and when more data is necessary to develop a restoration plan called a TMDL or Total Maximum Daily Load.
 - **Rotational basin monitoring:** Systematic, comprehensive monitoring and assessment of select watersheds on a rotational basis, with statewide coverage achieved every five years.
- **Probability-based monitoring:** Conducted in coordination with EPA, randomly generated sites provide a statistically valid determination of statewide water quality conditions by surface water type.

Core Programs

Lakes, Ponds, and Wetlands

Spring Phosphorus



Since 1977, sampling conducted at spring turnover is used to monitor inland lake water quality trends.

Lake Champlain Long-Term Water Quality and Biological Monitoring



Lake Champlain water quality and biological health is monitored bi-weekly at fixed stations May through October, and at major tributaries on a flow-event basis.

Inland Lakes Assessment



State staff conduct summer sampling to assess current conditions and trends independently and with EPA as part of the National Lake Assessment.

Aquatic Invasive Species



Division staff and volunteers routinely sample Vermont waters for new infestations, to evaluate existing populations, and to determine management options.

Wetland Bioassessment



The condition, function, value, and quality of a variety of wetlands types are assessed with the goal of improving wetland protection and restoration.

Lake Monitoring



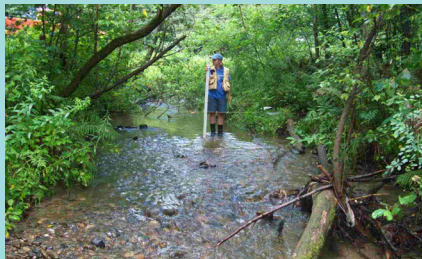
Volunteers have monitored water clarity, phosphorus, and chlorophyll at more than 90 inland lakes and 30 stations on Lake Champlain since 1979.

Stream Biomonitoring



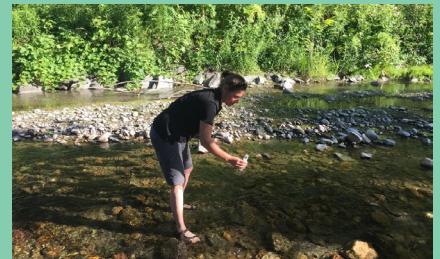
Macroinvertebrate and fish communities measure a waterbody's biological health. Biomonitoring staff also collaborate with EPA on the National Aquatic Resource Survey.

Geomorphic Assessment



Geomorphic assessments measure and assess the physical dynamics of an entire watershed or collection of river reaches.

LaRosa Partnership



Since 2003, the State of Vermont has supported surface water monitoring by watershed associations and volunteer groups through the LaRosa Partnership Program.

Rivers & Streams

Citizen Science

Learn More

Learn about the State of Vermont's surface water monitoring and assessment strategies, priorities, programs, and results from a variety of online resources.

Statewide Integrated Assessments

<https://dec.vermont.gov/watershed/map/assessment>

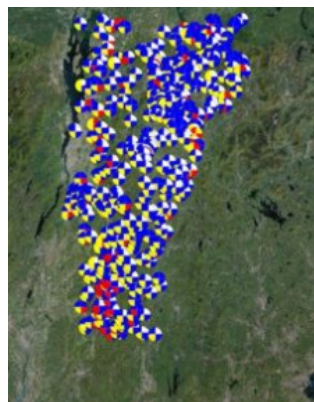
Section 305(b) of the federal Clean Water Act requires each state to submit a report on the quality of the State's surface and ground waters to EPA biennially. Vermont's 2018 Water Quality Integrated Assessment Report updates the known water quality conditions using the Vermont Surface Water Assessment and Listing Methodology. Building on this report, the Watershed Management Division is developing comprehensive, statewide integrated watershed assessments, which will aid in the prioritization of surface water protection and restoration actions. By adapting EPA's framework for conducting integrated assessments of watershed health and vulnerability, these assessments will integrate monitoring data from our Lakes, Rivers, Wetlands, and Monitoring and Assessment Programs to evaluate relative watershed condition.



Vermont Inland Lake Score Card

<https://dec.vermont.gov/watershed/lakes-ponds/data-maps>

The Vermont Inland Lake Score Card is a user-friendly interface developed by the Lakes and Ponds Program to share available data on overall lake health with lake users. Using Google Earth, viewers can select from more than 800 lakes in the state and learn about four key aspects of lake health:



nutrients, aquatic invasive species, shoreland and lake habitat, and mercury pollution. Links embedded in the score card open deeper views into the underlying data and point to steps Vermonters can take to protect their lakes.

Tactical Basin Plans

<https://dec.vermont.gov/water-investment/watershed-planning>

Tactical basin plans draw upon monitoring and assessment results, combined with sector-specific planning processes, to identify, prioritize, and track clean water implementation projects for each of the 15 major planning basins in Vermont. The Water Investment Division relies on tactical basin plans to ensure funds are directed to the highest-merit implementation opportunities based on the identification, targeting, and treatment of specific sites at greatest risk of delivering excess nutrients and sediment to surface waters.

Vermont Surface Water Management Strategy

<https://dec.vermont.gov/watershed/map/strategy>

The Surface Water Management Strategy describes the management of pollutants and stressors that affect the uses and values of Vermont's lakes and ponds, rivers, and wetlands. It also presents the division's goals, objectives, and approaches for the protection and management of Vermont's surface waters.

Vermont Water Quality Monitoring Program Strategy

<https://dec.vermont.gov/watershed/map/monitor>

The Vermont Water Quality Monitoring Strategy describes who, what, where, when, and why the State of Vermont monitors and assesses surface waters. This strategy evolves as knowledge of resource conditions changes and monitoring and assessment methods improve.

Vermont Integrated Watershed Information System

<https://anrweb.vt.gov/DEC/IWIS/>

The Vermont Integrated Watershed Information System (IWIS) is an online portal for water quality data. Users may search data by waterbody name, town, or location description, or view a map of monitoring sites using the Agency of Natural Resources Atlas.