Introduction: The History of Volunteer Monitoring

As we lay in our hammock by the pond, it's as close to heaven as we can be.

Harriet Mitchell,
Perch Pond Lay Monitor

Volunteer citizen monitoring is a critical component in understanding and educating Vermonters about water quality issues. This Guide will walk groups and organizations through the steps of designing an appropriate monitoring program for lakes, streams, rivers and wetlands. This Guide will also provide helpful information, resources and contacts for volunteers who are monitoring and protecting Vermont's surface waters.

A few decades ago, U.S. waters were becoming alarmingly impaired by pollutants. In 1972, Congress responded to citizens' pressure to clean up U.S. waters by passing the Clean Water Act, a mandate to protect and restore the physical, chemical and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." This legislation gave agencies, local governments, environmental groups, universities, citizens and other organizations the clout to implement and enforce the Clean Water Act.

Volunteers have taken an active role in monitoring Vermont's waters since the 1970s, and in recent years have gained more attention from state and federal agencies as their methods have improved. In Vermont, volunteers have shown that their monitoring results are valuable for the assessment of our waters. Under the Clean Water Act, every state submits a biennial report to the U.S. Environmental Protection Agency (EPA), which provides information about the quality of the state's surface and ground waters. The information in this report, called the 305(b) Report, is used to make recommendations and decisions for managing Vermont's waters. Relevant and quality control checked volunteer data are included in this report.

- To view Vermont's most current 305(b) Report, visit the Water Quality Division homepage at **www.vtwaterquality.org**.

History of volunteer monitoring nationwide

Across the country, volunteers monitor the condition of streams, rivers, lakes, reservoirs, estuaries, coastal waters, and wetlands. People volunteer to monitor because they have questions about a stream, lake, bay, or wetland near where they work, live, or play. The data they collect provides information to public and private organizations, enhances community education, and builds stewardship of local waters.

Since the 1970s, the number of volunteer monitoring programs in the United States has grown. Not surprisingly, the distribution of these programs tends to follow the distribution of surface waters in the country. Volunteer lake and stream monitoring began in the Northeast and Great Lakes regions, and many of these programs are still going strong after 20 or more years. Vermont is one of the pioneers in volunteer lake monitoring with the Lay Monitoring Program beginning in 1979 (the fourth oldest in the country).

Volunteer monitoring in Vermont

Three factors have benefited volunteer monitoring in Vermont. First, Vermonters have a strong environmental ethic and concern for the quality of their environment. Second, you can drive to and from any location in Vermont in a day, making it easier to share information from different, but neighboring waterbodies and logistically aiding in any sample transport. Third, there has always been good collaboration between different water interest groups, e.g., the Vermont Department of Environmental Conservation (VTDEC), the University of Vermont (UVM), nonprofit organizations and citizen monitors.

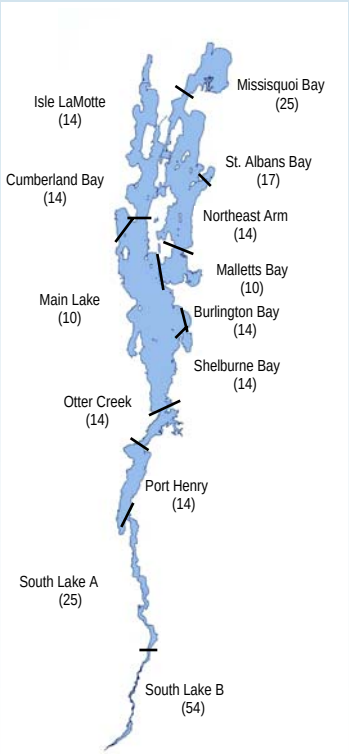
Volunteer lake monitoring in Vermont began in 1979, with the inception of the Lay Monitoring Program (LMP), a statewide citizen lake monitoring program. The Lake Champlain Committee, a nonprofit organization that has been helping to protect Lake Champlain since 1963, played an important role in helping the Vermont Water Quality Division launch the LMP. Volunteers in the LMP test lakes for water clarity (Secchi depth), chlorophyll-*a* (algae growth), and phosphorus (nutrient enrichment). The LMP has helped to establish baseline water conditions, document changes in water quality, and educate and involve local residents in lake protection.

- For more information on the LMP, visit **www.vtwaterquality.org/lakes/htm/lp_lmp.htm**.
- For more information on the Lake Champlain Committee, visit **www.lakechamplaincommittee.org**.

River Watch Network (RWN) was formed in 1987, based on a successful 20-year program on Vermont's Ottauquechee River. Under RWN, citizens and students living in the Ottauquechee watershed gathered and used monitoring information to trigger community support to successfully clean up polluted rivers. The creation of RWN established a network of programs providing river volunteers with tools to measure the health of their river. In 1999, RWN merged with River Network, a national program that helps volunteers turn concern and information into action.

- For more information on River Network, visit **www.rivernetwork.org**.

Lake Champlain



Phosphorus concentration criteria (µg/L) in Vermont Water Quality Standards for Lake Champlain segments.

Vermont's Clean and Clear Action Plan

In 2003, Vermont Governor Jim Douglas introduced one of the most significant water quality initiatives ever undertaken in Vermont, the "Clean and Clear Action Plan." The goals of this Plan are to provide leadership, financial resources, and a sustained commitment to efforts designed to ensure that Vermont's waterways meet water quality standards.

The Lake Champlain Basin encompasses nearly one-half of Vermont, including Lake Champlain and its numerous tributaries. This area is one of the main targets of the Clean and Clear Action Plan. One aspect of the Plan establishes limits, a Total Maximum Daily Load (TMDL), for phosphorus runoff into Lake Champlain. Volunteer data from the Lay Monitoring Program were used to establish the phosphorus water quality standards for Lake Champlain that the TMDL is designed to achieve. Phosphorus is a pollutant that promotes excessive growth of algae and poses a serious water quality problem for Vermont's waterways. In some areas, significant algae growth causes massive floating mats that close beaches, impact tourism, impede recreation, and release dangerous toxins.

Many of the actions of this Plan reduce other pollutants in addition to phosphorus. The cleanup plan includes measures to protect Vermont's surface waters with stream bank stabilization, implementation of erosion control measures at construction sites, maintenance of backroads, and better management of agricultural lands. The estimated long-term cost of this initiative is $150 million, shared by federal, state, local, and private resources. Volunteer monitoring will be encouraged to help document current and future water quality conditions as basinwide clean up efforts take hold.

- For more information on Governor Douglas' Clean and Clear Action Plan, visit www.anr.state.vt.us/cleanandclear.

In the 1980s, St. Michael's College, located in Colchester, offered a statewide outreach program that trained teachers in school group monitoring. More recently, the University of Vermont Watershed Alliance and the Lake Champlain Basin Program (LCBP) have provided specific support to school water quality monitoring groups.

- For more information on the UVM Watershed Alliance, visit **www.uvm.edu/~watershd**.
- For more information on the LCBP, visit **www.lcbp.org**.

National and International Volunteer Monitoring Events

1. The Great North American Secchi Dip-In is an annual event, which began in 1994 to promote and encourage volunteer monitoring, to map regional water quality differences and to detect trends. Individuals may be monitoring lakes, reservoirs, estuaries, rivers, or streams. The concept of the Dip-In is simple: individuals in volunteer monitoring programs take a transparency measurement (using a black and white Secchi disk) on one day in a period surrounding Canada Day and July Fourth and report their results online to the Kent State University Coordinators of this event. For more information and to see results of past years' Dip-Ins, visit the Dip-In web site at http://dipin.kent.edu/index.htm.

Volunteers at Nelson Pond in East Montpelier prepare for the Dip-In

2. World Water Monitoring Day is an international event for local groups to participate in to celebrate the efforts of volunteer monitors. This event is celebrated on October 18, the anniversary of the enactment of the U.S. Clean Water Act, and is coordinated by America's Clean Water Foundation (ACWF). Volunteers are invited to register a monitoring site with ACWF, then test their site during the designated dates for key indicators of water quality (temperature, pH, dissolved oxygen, and turbidity), and report their results online. For information and results of this event, visit www.worldwatermonitoringday.org.

In 2003, the Vermont Water Quality Division initiated a partnership program to offer analytical services on a competitive basis to volunteer monitoring groups. These lab services have supported a variety of monitoring efforts, including lake eutrophication studies and several watershed-scale assessment programs. Under this laboratory partnership program, all monitoring projects are required to submit a Quality Assurance Project Plan (QAPP) and take full responsibility for all aspects of their monitoring work.

Despite Vermont's history of successful monitoring efforts, there remains a gap in volunteer monitoring in the state. There is no umbrella group that provides statewide coordination for all the volunteer monitoring programs. The Water Quality Division is producing the *Vermont Volunteer Surface Water Monitoring Guide* as a start to fill the gap in statewide services offered to volunteer monitoring groups. This Guide is intended to assist Vermont volunteer monitoring efforts in program development; provide information and resources; and encourage effective, credible, and sustainable monitoring programs throughout Vermont.

What volunteer monitors do

Volunteer monitors record observations of habitat, land uses, and the impacts of human activities; measure the physical and chemical characteristics of water; and assess the abundance and diversity of living things - aquatic critters (such as macroinvertebrates), plants, birds, and other wildlife.

What is monitored depends on the type of environment. For rivers and streams, the most common parameters to test are water temperature, pH, bacteria, macroinvertebrates, dissolved oxygen, nitrogen, flow, and phosphorus. With

the exception of macroinvertebrates, nitrogen and flow, lakes are most often tested for the same parameters with the addition of chlorophyll-*a*, transparency/clarity, aquatic vegetation, and exotic/invasive species.

Using various procedures, volunteer monitors can discover problems in streams, lakes, and wetlands that otherwise may not be brought to the attention of natural resource professionals and policy makers. Volunteer monitors can also highlight the need to protect waterbodies that are still healthy ecosystems and join others who have provided data to understand the long-term changes that occur in lakes and streams as a result of population growth and development.

Once high quality, reliable volunteer data are collected, they can be entered into water quality databases where they become accessible to citizens, local governments, consultants and agencies for retrieval and decision-making. In this manner, the data volunteer monitors collect can be widely distributed.

How groups use volunteer data

At a minimum, monitoring programs will help educate those involved and others about water quality problems and will promote awareness and stewardship. Monitoring programs can also choose to go beyond education, awareness and stewardship to seek a role in shaping policy and management decisions.

Groups typically use volunteer data, in addition to educational purposes to:

- Compare regions of the state.
- Measure progress toward goals.
- Document water quality conditions.
- Identify sites for cleanup.
- Develop public policy.
- Determine where to direct limited resources.
- Analyze how and why a waterbody is changing over time.

Local, state, federal and other organizations benefit greatly from volunteer data that complement their monitoring programs. Many local organizations and agencies have a long record of promoting volunteer monitoring. Some programs include:

- VTDEC Lay Monitoring Program.
- Vermont lake and watershed associations.
- River Network.
- VTDEC Aquatic Nuisance Species Watchers.
- Lake Champlain Basin Program.
- VTDEC Analytical Services Partnership.
- UVM Watershed Alliance.
- The Vermont Monitoring Cooperative.

The uses and value of volunteer monitoring will continue to evolve as the condition of Vermont's and the nation's surface water draws more federal, state, and local attention.

Using this Guide

On the next four pages, you will find a worksheet that will walk you through the process of answering essential questions (the why, what, where, when, and how to monitor) related to your monitoring program. The worksheet is designed to be progressively filled out as each Section is read. When the worksheet is completed, it will provide a clear plan for your specific monitoring program.

Monitoring Design Worksheet

Name of Group:
Date:

This Worksheet is intended to help you with the basic design of your monitoring program. It should not be considered inclusive of all questions you will need to answer related to your monitoring program, nor will all of the questions here pertain to every program. This worksheet also is designed to help those groups interested in completing the U.S. EPA Quality Assurance Project Plan, hence the reference in parenthesis to the different "elements" of the U.S. EPA QAPP.

Answer these questions after reading the corresponding Section of this Guide.

Section 2: Defining Your Questions: Why, What and Who *(Element 5, EPA QAPP)*

A. State your "why" question:_____

_____

B. State the purpose of your monitoring program (your "what" question):_____

_____

C. "Who" will be your data user(s): _____

_____

D. Is your program realistic (available volunteer time and resources) for your group/organization?

_____

Section 3: Choosing Parameters to Support Your Questions *(Element 6, EPA QAPP)*

A. What waterbody will you be monitoring? _____

B. What watershed is that waterbody a part of (see map, pg. 13)? _____

C. What topics will you need to conduct background research on? _____

D. Choose parameters to monitor, and fill in the following table (for wetland monitoring and geomorphic assessments see also *Section 5* for more specific monitoring information):

Monitoring Parameter	Why: Your question about the waterbody (from 2A)	What: I'm asking this question because (from 2B)
example: *E. coli*	Is the water safe to swim in?	The town wants to post warnings, if necessary

Monitoring Design Worksheet

Section 4: Data Quality *(Elements 7, 11, 14, 15, EPA QAPP)*

A. Fill in the table below:

Matrix	Parameter	Sampling Equipment	Sample Holding Containers	Maximum Time Sample Can Be Held Before Being Analyzed
example: lake water	total phosphorus	hose, 5 gallon bucket, 500 mL sample bottle	50 mL glass test tube	28 days

B. Which laboratory, or field kits and meters will you use? _____

C. Who will maintain and calibrate your equipment and how will that be documented?

_____

D. For biomonitoring:

Who will identify (or verify) your samples?_____

To what taxonomic level will your samples be identified (i.e., order, family)? _____

E. For chemical monitoring: use the following table to assess whether the laboratory, field kit or field meter will meet your detection requirements.

Monitoring Parameter	Lab, Kit or Meter's Detection Limit	Detects Natural Range in Vermont Waters?
example: total phosphorus (TP)	5 µg/L (minimum reported value in micrograms per liter from the LaRosa Laboratory in Waterbury, VT)	yes (natural range is <5 -100 µg/L as TP)

F. Will you need to develop a QAPP? If so, who will write the QAPP? _____

Monitoring Design Worksheet

Section 5: Where, When and How to Monitor *(Element 8, EPA QAPP)*

A. Fill in the table below describing safety issues and risks involved in the type of monitoring you will do and the precautions you will take to prevent or reduce any problems:

Safety Issue	Safety Precautions
example: spring high water levels	start sampling in June

B. What are the starting and ending dates of this program? *(Element 6, EPA QAPP)* _____

C. Fill in the table below for sampling location(s), parameters, and frequency of sampling. If you have more than two sampling sites, make a larger version of this table. *(Element 10, EPA QAPP)*

Sampling Frequency	SITE #1 Description: Global Positioning System Units (GPS): Parameter(s):											SITE#2 Description: Global Positioning System Units (GPS): Parameter(s):										
	Temp	DO	E. coli	pH	Turbidity	Macros	Nitrate	TP	TSS	Plants	Other	Temp	DO	E. coli	pH	Turbidity	Macros	Nitrate	TP	TSS	Plants	Other
Daily																						
Weekly																						
Monthly																						
After rain event																						

Section 6: Data Management *(Elements 9, 19 EPA QAPP)*

A. What output (charts, graphs, reports) will you need from your data management system? _____

_____

B. What system (binders, spreadsheet, database) will you use to store and manage your data? ___

_____

C. For computer data management, what programs (software) will you use? _____

_____

D. Who will be inputting the data? _____

Monitoring Design Worksheet

E. Who will be checking the data entered and how will that be documented? _____

F. Where and how will field data sheets be archived? _____

Section 7: Converting Data to Information *(Element 21, EPA QAPP)*

A. Identify graphs, charts, tables, etc. that you will generate to explain your data findings and conclusions.

_____

_____

Section 8: Evaluating Monitoring Program Performance

Most of the questions in this Section need to be answered AFTER your first round of monitoring. Evaluating your program performance will help sustain your efforts as well as improve them. Therefore, below are a few questions to refer back to when the time comes.

A. Was your monitoring program's "why" question answered? _____

B. Which of your monitoring program's goals and objectives were met? Which were not met? ____

_____

C. Identify what was successful in your monitoring program: _____

_____

D. Identify any problems with your project in the areas of: *(Element 22, EPA QAPP)*

Collecting and analyzing samples	Storing, disseminating and interpreting data	Reporting the information to managers and the public	Identifying gaps and inefficiencies

E. Describe any changes and/or follow-up work that needs to be done, or new questions that need to be addressed: _____

_____

_____