



Minnesota
Pollution
Control
Agency

Environmental
Outcomes
Division

Citizens' Guide to Monitoring of Surface Waters

Water Quality/Surface #1.01, August 2003

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This fact sheet describes the Minnesota Pollution Control Agency's (MPCA) condition monitoring of lakes, streams and wetlands and includes the agency's current strategy to increase our understanding of Minnesota's surface waters.

Condition monitoring is designed to answer the question "How good is the quality of water for its intended uses?" This is usually accomplished by comparing observed water-quality conditions with criteria, standards or reference conditions. It is also used to track general trends and identify water quality problems in lakes, streams or wetlands.

The MPCA also conducts other monitoring to provide a more complete description of causes and sources of specific problems.

Stream Monitoring

Routine Stream Monitoring

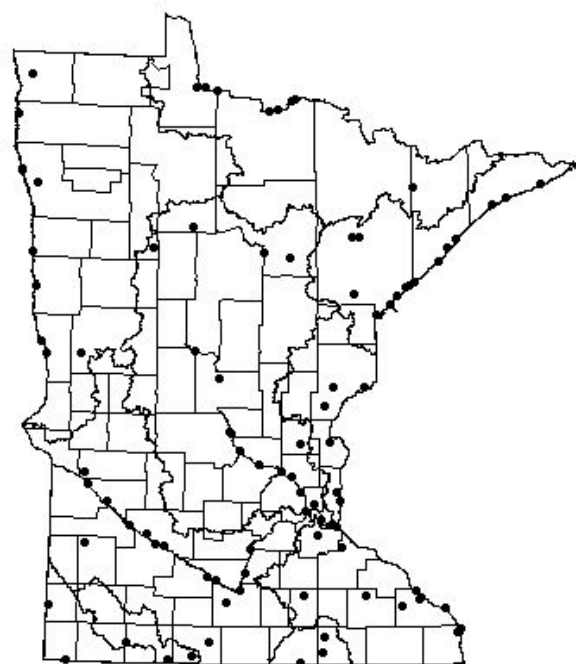
Routine monitoring of streams in Minnesota, which began in 1953, provides the largest source of computerized long-term water quality information in the state. The MPCA currently analyzes water samples for several conventional chemistry parameters at 80 locations, known as Milestone sites, throughout the state. These parameters are:

- pH
- Conductivity
- Ammonia
- Nitrite-nitrate
- Turbidity
- Temperature
- Dissolved Oxygen

At sites where stream flow measurements are available, total suspended solids, total phosphorus, stream flow and biochemical oxygen demand are also measured.

Sites are sampled once a month, February through November. Each year's monitoring focuses on certain river basins, resulting in four complete years of data for all sites during any 10-year period. Although this program has changed sites for many reasons over the years, 42 sites remain with more than 24 years of consistent data. A map of the 80 Milestone sites is shown below. Data from these sites is particularly useful in determining long-term trends.

Minnesota Milestone Sites





Integrated Stream Monitoring

Since 1996, the MPCA and the Minnesota Department of Natural Resources (MDNR) have cooperated to monitor rivers and streams using an integrated approach designed to provide a more holistic picture of river water quality. This approach uses biological, physical, and chemical indicators to assess the condition of rivers and streams. Sites selection is statistically based using guidance from the U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program.

Fish and other aquatic life are excellent indicators of river and stream health. Because they respond to physical, chemical, and biological stressors, they provide a composite measure of water quality throughout the year.

The MPCA uses a composite index of fish and invertebrate community characteristics to evaluate the biological integrity of a river reach. The index scores take into account local reference conditions and expectations. Generally, more species indicate better conditions. In addition, water samples are taken for dissolved oxygen, conductivity, nutrients and turbidity. Stream flow, bottom type, bank stability and other measures are used to rank the quality of the habitat. Examples of fish community characteristics used to measure stress include the number of species that are pollution tolerant or the number of fish with external abnormalities. All these measures provide a comprehensive view of the ecological health of the river.

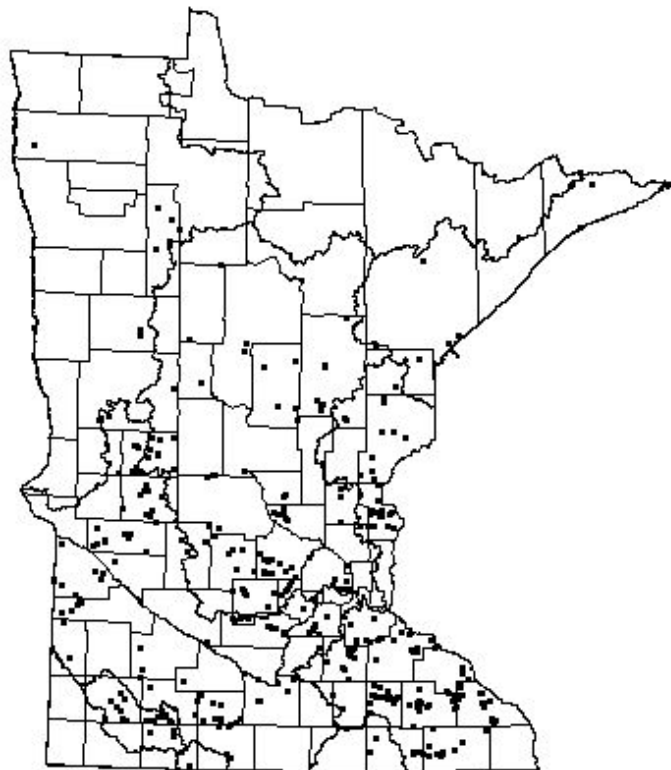
The integrated Stream Monitoring Program information is useful for assessments required by the Clean Water Act, evaluation of water quality permit limits, assessing trends and evaluating water quality standards.

Citizen Stream Monitoring

Volunteers in the MPCA's Citizen Stream Monitoring Program measure water clarity using a transparency tube, measure rainfall, and record perceptions of physical appearance, recreational suitability and stream stage. Data collected by volunteers provides the only data there is on many streams and has been used for watershed management efforts.

The Citizen Stream Monitoring Program began in 1998. During the 2001 monitoring season, 294 volunteers submitted data for 413 sites. By the end of the 2002 season, almost 500 volunteers monitored streams.

Citizen Stream Monitoring Sites



Stream Toxics Monitoring

The MPCA has monitored trace metals in streams in the state's major river basins since 1996. The monitoring is focused on five sites on the main stem and five tributary sites in each of the largest basins. Metals monitored include mercury, arsenic, cadmium, chromium, copper, lead, nickel and zinc. Elevated levels of metals are toxic to fish and other aquatic life, and can lead to fish consumption advisories.

Basin Flow and Chemistry Monitoring

In 2002, MPCA started basin-level flow and chemistry monitoring in the Upper Mississippi Basin. This monitoring is used to determine the flow and amount of pollutants coming from each tributary, and how these amounts vary at different times of the year. This type of water quality information is needed for setting management goals for rivers and for targeting areas where actions are expected to have the most effect.

The MPCA uses stream flow data collected by the U.S. Geological Survey (USGS) and Minnesota Department of Natural Resources (MDNR) throughout the state.



Lake Monitoring

Regional and Trend Monitoring

Each summer, the MPCA typically samples 30 lakes once or twice a month from June through September. This results in at least 12 visits to each lake over the course of two to three years. This data is added to the regional database and may be used for assessing trends. Regional monitoring provides insight into expected ranges in water quality for lakes in a given region.

Evaluating lake data with watershed information helps the agency gain an understanding of how land use in the watershed affects the lake. This information is also used to develop water-quality criteria for lakes.

Citizen Lake Monitoring

Volunteers in the MPCA's Citizen Lake Monitoring Program (CLMP) collect water clarity data using a secchi disk and record their perceptions of physical appearance and recreational suitability. Water clarity measurements indicate the amount of light penetration in a lake and are an indication of the amount of algae in the water.

The CLMP program, which was established in 1973, is the primary source of water quality information over time on lakes. Long-term clarity monitoring by CLMP volunteers helps scientists detect signs of degradation to a lake.

CLMP volunteers took Secchi disk readings at 1314 lake sites in 2002. A map of CLMP sites is shown on the opposite side of the page.

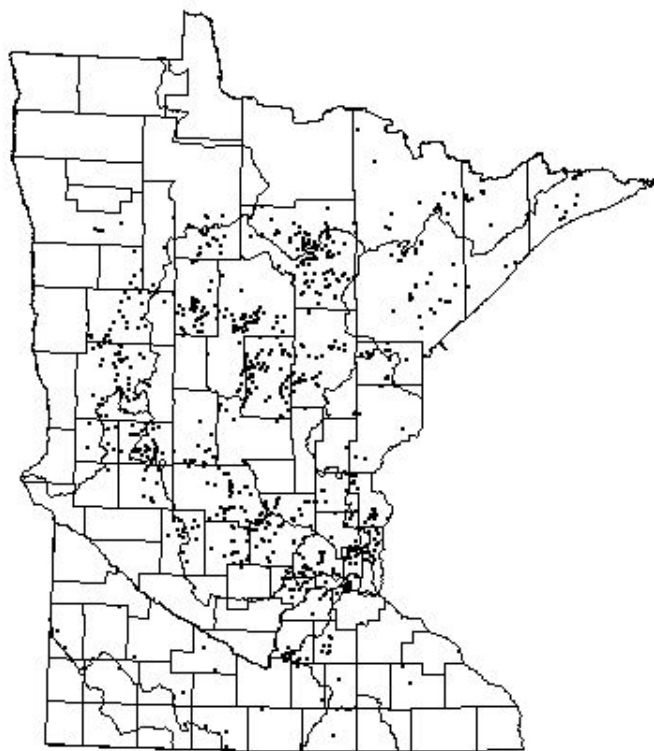
Lake Assessment Program Monitoring

MPCA staff work cooperatively with lake associations and local governments on in-depth studies of particular lakes and watersheds as part of the Lake Assessment Program (LAP). Working together, agency staff and local citizens sample the lake for nutrients, such as phosphorus and nitrogen, and chlorophyll as well as gather information about the lake's watershed. A report is written following the completion of each lake assessment, which is used in local lake management efforts. Since 1985, more than 160 LAP studies have been completed.

Lake and Stream Fish Contaminant Monitoring

The MPCA is working cooperatively with the Minnesota Department of Health and the MDNR to collect fish and analyze fish tissue for mercury and other contaminants.

Citizen Lake Monitoring Program Sites



Lake and Stream Short-Term Studies

In 2001, the MPCA, in cooperation with the USGS, began monitoring Minnesota streams to assess emerging issues associated with toxic contaminants. For example, pharmaceuticals, personal care products and wastewater compounds are monitored in three large rivers and six smaller streams affected by wastewater treatment plants.

The MPCA is also working with the USGS, National Park Service and the University of Wisconsin-LaCrosse on a study of mercury levels in northern pike and yellow perch in 17 lakes in Voyageur's National Park. This information will help scientists gain a better understanding of how mercury moves up the food chain.

Wetland Monitoring

The MPCA has developed an composite index of plant and macroinvertebrate characteristics based on wetlands in north central Minnesota. A plant-based index for streamside wetlands in the St. Croix River Basin is also underway.

Since 1997 the MPCA has worked with Dakota County and Hennepin County to develop and test wetland assessment methods for citizens and local government staff.



MPCA Condition Monitoring Strategy

Despite the monitoring activities described above, many data gaps still exist in our current monitoring system. To address these gaps, the MPCA has developed a condition monitoring strategy designed to increase the number of surface waters monitored across the state. This strategy involves detailed assessment, satellite remote sensing and volunteer monitoring. Each of these three pieces is critical to ensure that this approach will build sufficient understanding of the quality of Minnesota's surface water resources.

MPCA Monitoring

Under this strategy, the goal would be for the MPCA to visit each monitoring site at least once every 10 years and collect enough samples during the year to meet the federal requirement of "current" data necessary for assessments. Monitoring would include statistically based integrated monitoring, "grab" sampling for chemical analyses, and continuous flow monitoring for rivers and streams.

Remote Sensing Monitoring

The MPCA would supplement its more intensive monitoring with remote sensing overviews every five years. Covering more than 200 square miles, one Landsat satellite image can provide "snapshot" information on many hundreds of lakes and streams. This tool is a cost effective way to obtain an initial picture of lake and stream clarity.

This technology would help the MPCA determine if some characteristics of a lake or stream have changed significantly since the last detailed assessment. In addition, remote sensing could help us target our limited assessment resources toward waters that are or appear to be most threatened.

While remote sensing can be a very useful tool for targeting resources, it cannot replace the MPCA's on-site monitoring efforts since it does not provide the detail necessary to meet federal monitoring requirements and it doesn't provide information about many pollutants. Remote sensing is also dependent on calibration with actual water quality data.

Volunteer Monitoring

Finally, volunteer monitoring conducted every year at each monitoring site is critically important. Volunteers help fill in gaps in the MPCA monitoring frequency and alert the community and the MPCA of any changes that occur between assessments, while the MPCA's detailed monitoring helps to validate and support the volunteer monitoring effort. Even relatively simple volunteer efforts such as Secchi disk or transparency tube measurements provide valuable indications of any year-to-year changes at sites, and would provide early warning of potential or threatened impairments.

For More Information

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