

## ASSESSMENT OF THE WATER QUALITY OF DELAVAN LAKE, WALWORTH COUNTY, WISCONSIN

U.S. Geological Survey, Wisconsin Water Science Center  
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Monitoring of Delavan Lake is needed to be done in a systematic manner to document changes in the water quality of the lake and to determine whether or not goals for the lake are being met. Results from this type of monitoring also provide information to other types of managers (fish, etc.). Long-term changes in lake water quality cannot be conducted without a consistent long-term monitoring program.

Based on results from over 25 years of monitoring, the USGS will conduct the following monitoring activities to understand the changes occurring in the Delavan Lake. All sampling will be conducted by USGS trained Hydrologic Technicians, except for the collection of additional samples, which will be collected by volunteers, to be analyzed for total phosphorus between USGS samplings. All costs of analyses will be paid by the USGS, and are included in the budget described below.

The following monitoring activities will be conducted at three locations in the lake (deep hole site near the center of the lake, the north end of the lake and the south end of the lake) to determine inter-annual variability in lake water quality and the success of all upstream activities in the watershed. These analyses are similar to what has been done historically and thus will enable proper long-term trend evaluations to be conducted.

- A. Chemical sampling: Sampling frequency will be monthly in February, April, May, June, July, August, September, and November. At the deep hole site, in each month listed two depths will be sampled (lake top and lake bottom) for total phosphorus and dissolved orthophosphate. In addition, top sample will also be analyzed for dissolved nitrite plus nitrate-nitrogen, dissolved ammonia nitrogen, and total Kjeldahl nitrogen. When anoxia is determined, four depths will be sampled for total phosphorus and dissolved orthophosphate, except during August when 4 extra total phosphorus samples will be collected (to quantify internal phosphorus release). At the north and south ends of the lake, only total phosphorus will be measured to describe spatial variability in water quality. During April sampling, full spring analyses will be performed on the surface sample (color, turbidity, hardness, alkalinity, calcium, magnesium, sodium, potassium, sulfate, chloride, fluoride, silica, iron, and manganese) at the deep hole site. This information will be used to examine long-term trends in these various water-quality constituents. All data will be analyzed by either the State Laboratory of Hygiene or the U.S. Geological Survey laboratory. For each sampling period, total phosphorus: total nitrogen ratios will be estimated.
- B. Additional water samples will be collected at 0.5 meter depth in the lake (between monthly lake sampling by the USGS) by DLSD staff or volunteers and analyzed for total phosphorus. All samples should be stored in a refrigerator until the USGS picks up the samples.
- C. Profiles: Depth profiles will be taken for water temperature, dissolved oxygen, pH, and specific conductance at all three locations during each visit.

- D. Chlorophyll samples: A chlorophyll a sample will be collected from the upper 0.5-m composite during all USGS sampling visits at each of the three sites (note: chlorophyll samples at the north and south ends of the lake will only be collected in June, July, August, and September). These samples will be analyzed by the Wisconsin State Laboratory of Hygiene.
- E. Plankton samples: Phytoplankton and zooplankton samples could be collected from all three locations in June, July, and August. Analyses will be done by PhycoTech, Michigan to maintain consistency.
- F. All data will be stored in the USGS NWIS database and published in the Annual USGS- Water-quality and Lake-stage Data for Wisconsin Lakes publication.

**Presentations:** At the end of each year, a presentation will be given describing the water-quality conditions if requested.

**Budget:**

All analyses will be conducted by the Wisconsin State Laboratory of Hygiene, except plankton analyses, which will be conducted by PhycoTech.:

Total costs for the entire project:

Component	Analytical Costs	Plankton Costs	Operational Costs	Personnel Costs	Total Costs
Lake Sampling	\$4,367	\$4,398	\$1,185	\$10,050	\$20,000

Total costs (including analytical costs) incurred by each group:

Cost Breakdown	Delavan		Total
	Community	USGS	
	\$15,000	\$5,000	\$20,000

The total cost of the project would be \$20,000, with the cost to the Delavan community being \$15,000.

### Delavan Lake Water Quality Monitoring Resumes

The water quality monitoring program for Delavan Lake instituted in 1983 by the U.S. Geological Survey (USGS) and continued through 2009, has resumed this year. In February the Town approved a proposal ("Assessment of the Water quality of Delavan Lake...") solicited from the USGS to restart the program after a two year hiatus. On Thursday March 15, Ben Siebers a Hydrologic Technician with the USGS began the initial sampling, the first of a series of monthly samplings to be done between March and November. In order to understand the changes that occur in the lake each year and why these changes have occurred, it is important to continually sample the lake throughout the entire year. Therefore, it is important to sample the lake from shortly after the ice leaves the lake until it freezes. By starting the sampling program in March, we will be better able to compare the water quality of 2012 with the data collected in previous years.



The monitoring program calls for periodic (Delavan Lake Sampling-2012 Water Year) testing for some 25 physical, chemical, and biological parameters. Ben, a USGS employee since 2004, will take samples from three locations in the lake, identified by GIS and GPS technology, using advanced sampling and testing equipment. Water samples will be taken at various depths at each site using rigorous USGS testing protocols.



The overall in-lake water quality monitoring program was designed by USGS Research Hydrologist Dale Robertson with input from Mr. Peter Berrini of HDR Inc., the firm retained by the Town to provide advice and guidance on questions dealing with lake questions. Both Berrini and Robertson recently discussed the monitoring program with the Town's Lake Committee.



The testing will be conducted monthly from March to November. The samples will be analyzed by the Wisconsin State Laboratory of Hygiene. The resultant data will mirror those that the USGS collected over the years and will provide "diagnostic" information on long-term changes in the Lake's ecology. Accurate diagnostic information is predicated on the thoughtful, systematic, long-term data, which the Lake Committee is convinced the USGS's monitoring program will produce. Detailing and understanding these changes will help guide the Lake Committee and the Town's future efforts to take actions which promise to keep our Lake clean and healthy.

The effort will cost a total of \$20,000 annually. The Town will provide \$15,000 and the USGS will match that investment with an additional \$5,000. The results will be posted, as the information becomes available on the USGS Web page:

[http://nwis.waterdata.usgs.gov/wi/nwis/qwdata/?site\\_no=423556088365001&](http://nwis.waterdata.usgs.gov/wi/nwis/qwdata/?site_no=423556088365001&)