

Enhancing Phosphorus Reduction Strategies in the Kalamazoo River Basin Project

Volunteer Water Quality Monitoring Results

2006 Growing Season

What is this project about?

The *Enhancing Phosphorus Reduction Strategies in the Kalamazoo River Basin* project is an effort to aid phosphorus (P) reduction efforts through research, education and extension. The project is led by the Michigan State University Extension Land & Water Program at Kellogg Biological Station (KBS) and funded by the USDA CSREES National Water Program. The project attempts to further the understanding of the sources, fate and transport of P in the Kalamazoo River Watershed and help strategize reduction activities.

One major water quality problem within this region is nutrient enrichment of Lake Allegan. Studies by the U.S. Environmental Protection Agency (USEPA) and the Michigan Department of Environmental Quality (DEQ), identified P enrichment as the primary cause of lake eutrophication. The impoundment Lake Allegan is on Michigan's 303(d) list of impaired waters. Under the provisions of the Clean Water Act, the USEPA and DEQ approved a Total Maximum Daily Load (TMDL) that specifies the maximum amount of P the Kalamazoo River system can receive and continue to meet water quality standards in Lake Allegan. The TMDL was defined for the growing season April 1 to Sept. 30. Since 1998, the Lake Allegan/Kalamazoo River TMDL effort has been a community-based, collaborative effort of landowners, industry, government, community organizations and citizens.

Why volunteer monitoring?

Volunteer water quality monitoring can provide additional cost effective P data at targeted locations within the Kalamazoo River watershed. These data can assist the TMDL Implementation Committee (IC) as it targets P reduction efforts upstream of Lake Allegan.

Why transparency tubes?

The transparency tube is a method of measuring water clarity in streams. It is gaining popularity with volunteer stream monitors due to low cost, low maintenance and ease of use. Studies indicate that transparency tubes can also be used to estimate particulate-related water quality parameters such as turbidity and total suspended solids.

Since P is often associated with sediment in streams, the question arose, "Can volunteer transparency tube readings estimate total P within the TMDL watershed?"

Why pilot studies?

Watersheds vary in how they assimilate, store and transport pollutants, including excess phosphorus. Over the 2005 TMDL growing season, KBS conducted a weekly, side-by-side pilot study to explore the relationship between transparency and total P. Results indicated a correlation at nine out of 13 locations. Could volunteers with transparency tubes provide a sustainable, cost effective method to estimate total P?



Taking a transparency tube reading. Proper training of volunteers becomes even more important when estimating water quality parameters other than transparency.

To better understand the potential for volunteer P monitoring using transparency tubes, a second pilot study was conducted in 2006. Six municipal waste water treatment plants (point sources) volunteered to expand their total P grab sampling routes to include targeted locations. They were paired with twelve citizen volunteers specially trained to take transparency tube readings. The larger KBS study monitored dissolved and particulate P forms.

To accommodate work-day schedules, the 2006 protocol did not require side-by-side sampling. Citizen and point source pairs simply sampled on the same assigned day of the week, every other week, April through September. Data were entered into an on-line database and analyzed to determine:

- Strength of relationships between total P and transparency at targeted locations
- The importance of side-by-side vs. same-day sampling in correlating the two parameters
- The influence of P forms (dissolved vs. particulate) on transparency tube readings
- The importance of water body-response to precipitation events in the sampling protocol

What did we learn about transparency and phosphorus in the Kalamazoo River watershed?

Findings of the 2006 pilot study led to TMDL recommendations on the feasibility of volunteer P monitoring using transparency tubes. It involved:

- 23 locations
- 273 total P samples collected by point sources
- 251 transparency readings taken by volunteers

Finding: The use of transparency tubes in estimating total P is limited by the tube itself. We used the tallest model tube on the market (120 cm), but were unable to correlate the two parameters at seven locations because of high water transparency. These locations (mostly tributaries) exhibited a predominance of 120 cm readings and so failed to provide enough variability with which to correlate the two parameters.

Finding: Of the remaining 16 locations, only five demonstrated strong ($R^2 > 0.6$) relationships between transparency and total P. The rest were influenced by fluctuations in P forms, most likely caused by:

- proximity to waste water dischargers (effluents are characterized by dissolved P)
- late season biological activity in reservoirs (particulate P in the form of algae)
- presence of filter feeding stream invertebrates (conversion of particulate P to dissolved P)

Finding: Of the five locations demonstrating a strong relationship between transparency and total P, four exhibited extenuating circumstances. For example, Wanandoga Creek's relationship was based on a unique "sedimentation event" during which transparency decreased significantly and total P increased significantly. This episode produced a strong correlation

and demonstrated the potential for transparency tubes to identify sedimentation events and estimate P in low transparency waters. However, for the remainder of the 2006 study, the creek flowed too clear to establish a reliable estimate of total P.

Finding: Transparency tubes hold promise for estimating phosphorus during runoff events in tributary streams that normally run too clear and are not influenced by major sources of dissolved P. However, the flashiness of these streams may require side-by-side sampling to determine the relationship followed by a monitoring protocol impractical for volunteers.

Can volunteer transparency tube readings estimate total P in the TMDL watershed?

No. Not under a biweekly protocol and not at locations influenced by high concentrations of dissolved P. Event sampling on tributaries may hold promise, but require higher frequency sampling and may be impractical for volunteers. It is recommended that total P data for targeted Kalamazoo TMDL watershed locations be collected by "volunteer" point source laboratories.

Can volunteer transparency tubes estimate particulate-related water quality parameters in other watersheds?

Perhaps. Transparency tubes are becoming a favorite of volunteer water quality monitoring programs. Use of this simple low-cost method to estimate additional water quality parameters is of interest. Rigorous site specific study is necessary to characterize potential relationships. Volunteer stream monitoring organizations considering this method to estimate particulate-related water quality parameters, must do their "homework" and then pay special attention to the training of volunteers.

Where can I go for more information?

Contact Jane Herbert or Dean Baas at the MSU Extension Land & Water Program. 269-671-2412
Additional TMDL information is available at www.kbs.msu.edu/kzoonps and www.kalamazooriver.net

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