

State Actions for Water Quality Improvement at Grand Lake St. Marys

July 30, 2010

Introduction

Grand Lake St. Marys (GLSM), Ohio's largest inland lake, continues to struggle with degraded water quality as manifested by fluctuating levels of cyanobacteria (blue-green algae) that can produce neurotoxins (which affect the nervous system) and hepatotoxins (which affect the liver). The State of Ohio recognizes the historical recreational value afforded by the lake to Ohio's citizens and the significant role GLSM plays in the local economy. The state further recognizes the need to attempt find short and long-term solutions to help fix the impaired lake.

The Ohio Departments of Natural Resources (ODNR), Health (ODH), Agriculture (ODA) and Ohio EPA have worked diligently to identify the following actions intended to address both internal phosphorus loading and external nutrient and sediment loading, which together causes the unstable and degraded water quality in the lake.

These actions reflect a start to the process of restoring GLSM, but are by no means an exhaustive list. The State of Ohio remains committed to the GLSM communities and will continue to analyze new ideas and possible remedies. In addition, the State of Ohio looks forward to continuing its existing relationships with federal and local agencies, as well as forming unique public-private partnerships with citizen groups and landowners throughout the GLSM watershed to implement the actions outlined below (and any further appropriate actions) in an effort to restore this valuable shared resource.

Internal Loading

Problem: The lake already contains an excessive amount of reactive phosphorus that is continually recycled during the normal life cycle of cyanobacteria species present in the lake. The phosphorus is absorbed by cyanobacteria as they grow and is released upon the death and decomposition of the cyanobacteria, thereby becoming available again for up-take by newly growing algae. The very large amount of reactive phosphorus contributes to explosive growth (or blooms) of cyanobacteria species. This continual recycling of phosphorus already in the lake by cyanobacteria is considered to be a problem of "internal loading", as opposed to the continual addition of phosphorus to the lake from external sources in the watershed, which is considered "external loading".

Action: Nutrient stabilization/neutralization (Alum Treatment)

Recommended initially as pilot project(s) in discrete areas (20-40 acres) with consideration of whole lake application only after completion and positive evaluation of pilot studies.

Two pilot projects will be implemented to test the effectiveness of aluminum sulfate (alum) for Grand Lake St. Marys. Alum has been used to inactivate phosphorus in lake sediments in more than 300 lakes worldwide since its first application in 1960. Results demonstrate improved water quality, reduced harmful algae blooms and increased water clarity in all but a very small number of these previous projects. *Tetrattech Inc.* recently completed a draft report titled: “*Recommended Actions for Grand Lake St. Marys, Ohio*” which estimates the potential duration of effectiveness of a whole lake alum treatment on Grand Lake to be eight to ten years. The recommended projects are designed to test alum’s effectiveness on issues directly contributing to Grand Lake’s decline, as well as to evaluate potential shortcomings and provide needed data for future decisions regarding a whole-lake alum treatment. The two demonstration sites of 20-40 acres in size will be selected during August 2010, with actual treatment targeted for September 2010. Costs associated with the recommended demonstration projects are estimated to be approximately \$250,000 and would be paid through a Section 319(h) subgrant from Ohio EPA to ODNR’s Division of Parks & Recreation.

Action: Replace cyanobacteria with non-harmful algae (diatoms) capable of being harvested for energy generation purposes

Recommended as a larger pilot project in a two-acre area of the lake.

The state, through ODNR, is already participating in a small pilot project to determine whether it would be feasible to replace the cyanobacteria in GLSM by creating conditions more conducive to the development of non-harmful algae (i.e., diatoms). This would be accomplished by adding a silica material that would theoretically give rise to a population of silica-based diatoms. Theoretically, rather than fostering cyanobacteria blooms, the lake would instead foster the growth and development of non-harmful diatoms. In turn, the diatoms could be harvested for energy purposes. The state’s current partner in this pilot project is already operating under a special use permit granted by ODNR’s Division of Parks & Recreation. The current project is utilizing a withdrawal from the lake of 10 gallons per day for off-site laboratory demonstration. This pilot study is testing whether lake conditions can actually be manipulated to foster the growth of non-harmful algae in Grand Lake St. Marys. Once this off-site demonstration is complete, the state will review the results to determine whether an in-lake pilot project is feasible. If it is feasible, the in-lake pilot project will be sized appropriately and funded through ODA.

The larger scale project is estimated to cost approximately \$25,000. ODA will coordinate implementation of the larger pilot project with ODNR’s Division of Parks and Recreation.

Action: Dredging of lake sediments

Recommended in certain discrete areas only.

The Division of Parks & Recreation will strategically focus dredging activities in and around the mouths of tributaries leading into Grand Lake St. Marys. Removal of the phosphorus-enriched layer of sediment on the bottom of the lake through suction dredging is probably the most permanent solution to reduce internal phosphorus loading. Unfortunately, dredging is the most expensive of all lake restoration practices with some estimates for dredging all of Grand Lake reaching as high as \$90 million. However, when strategically focused on areas in and around the mouths of tributaries where sediment deposition is happening most regularly, dredging can be a cost-effective and efficient tool to help contribute to water quality improvements. For example, as a component of “wetland treatment train systems”, targeted dredge activities will remove nutrient-laden sediments prior to or shortly after they are deposited into the lake.

This practice should be implemented in conjunction with installation of wetland treatment train systems that are already proposed for installation, beginning with Prairie Creek.

Action: Increase levels of oxygen in the lake

Recommend deploying additional aeration devices within GLSM.

Currently, local partners have installed a number of aeration devices within GLSM in an effort to provide additional oxygen to the lake’s waters. As part of this effort, the stakeholders have established a contract with Battelle Memorial Institute to review operational data from the aeration devices to determine how effective they are in reducing algal growth. The state, through ODNR, will request that Battelle review their findings with appropriate state agencies and provide a recommendation on whether further strategic aeration implementation would be of benefit.

No Action: Mechanically harvest or chemically destroy the algae in the lake

Mechanical harvesting of the cyanobacteria from Grand Lake St. Marys and/or the use of chemical algaecides to control or eliminate harmful algal blooms (HABs) is not recommended given the current levels of cyanotoxins detected across the lake. Cyanotoxins are stored and isolated within the cyanobacterial cells and they do not readily diffuse or leak into the surrounding water as long as the individual bacterial cell is alive and intact. Under normal environmental conditions during a reproducing active toxin-producing bloom event, 95-98% of the toxins would be intracellular. Cyanotoxins are released to the water as the result of the natural cell rupture (“lysis”) upon the death of the cyanobacterial organism or as the result of “artificial lysis” due to the use of mechanical collection devices or algaecides. Use of algaecides can be effective prior to the occurrence of a visible algal bloom but is not recommended after the bloom has occurred. The process of “artificial lysis” could rapidly release a major slug of cyanotoxin into a lake already containing cyanotoxins, thereby increasing the potential for harm from water contact or ingestion and potentially generating an amount of cyanotoxin capable of exceeding the treatment capacity at the Celina drinking water plant.

External Loading

Problem: External loading to GLSM includes the addition of phosphorus, other nutrients, and sediment to the lake from a number of external sources, including agricultural operations. External nutrient loading adds to the potential for cyanobacteria to grow and proliferate.

Action: Request additional assistance from the U.S. Department of Agriculture

Governor Ted Strickland has recently requested assistance from the U.S. Department of Agriculture to help address GLSM's external loading problems. Thankfully, Secretary Tom Vilsack has already responded, recently announcing additional funding and other assistance for the watershed.

Federal cost-share programs through USDA's Natural Resource Conservation Service (USDA-NRCS) have provided \$2.5 million in funding over the past two years for critical work throughout the watershed. Secretary Vilsack's announcement was for an additional \$1 million to fund practices in 2010 that will help livestock producers better manage manure during the coming winter. Agricultural landowners have been actively participating in cost share programs, to the point that there are waiting lists for landowners who are seeking to implement conservation practices to aid the watershed. To ensure that all landowners have the opportunity to participate, and to address those who are already on the waiting lists, the state, through ODNR, will continue to seek additional federal cost-share funding for:

- installation of filter strips that meet USDA-NRCS Standard 393,
- installation of cover crops on low residue crop fields,
- transfer or export of manure outside the watershed, and
- installation of manure storage and treatment practices to aide in the implementation of the regulatory recommendations described below.

In addition, USDA-NRCS has established a stream gauge monitoring station on Chickasaw Creek which has provided valuable data. USDA-NRCS currently plans to continue collecting data from this monitoring station over the next two years. The data collected will be used to analyze how land use practices could be changed to minimize the amount of nutrients reaching Grand Lake St. Mary's. The data and analysis will also provide information on how effective changes in land use practices are in reducing the nutrient loading. Secretary Vilsack also announced that an additional stream gauge monitor will be placed in the watershed to provide broader data. The state, through ODNR, will assist USDA-NRCS in placing the additional stream gauge monitor in an appropriate sub-watershed.

Finally, USDA-NRCS is developing Soil & Water Assessment Tool (SWAT) teams for impaired watersheds throughout the country. These teams can quickly develop threat abatement strategies within a watershed, and work with landowners to implement those abatement strategies. The state, through ODNR, will request that USDA-NRCS establish a SWAT team as early as possible for the Grand Lake St. Mary's watershed, and will commit departmental staff to work with a SWAT team.

Action: Promote manure hauling practice improvements

One of the primary causes for surplus nutrients entering the lake is the amount of animal manure being applied to land in the lake's watershed. One of the most effective means to reduce nutrients delivered to the lake is to reduce the amount of land application of manure in the watershed. Larger, permitted farm operations, especially poultry operations, have had strong success in being able to find ways to ship their manure outside of the watershed to other crop farmers that can beneficially use the manure on their fields. However, smaller operations throughout the watershed, especially dairies (since over 90% of their manure is water which is expensive to haul) have found this difficult given their lower economies of scale. The USDA-NRCS Environmental Quality Incentive Program (EQIP) has assisted producers wanting to transport manure outside of the watershed. However, there are program obstacles when an Ohio farmer makes arrangements for exporting manure to nearby areas in Indiana. Therefore, the state, through ODNR, will request that USDA-NRCS establish greater flexibility under EQIP cost share to allow for transportation of manure outside of the watershed, including to Indiana. Also, ODNR will request USDA-NRCS to allow EQIP funding eligibility for crop farmers outside the watershed to construct manure storage facilities that would allow them to accept exported manure for utilization during appropriate times for crop production under a nutrient management plan.

Action: In-stream nutrient abatement

Currently, the state is working with federal partners to develop a "treatment train" on Prairie Creek. Its goal is to establish beneficial land use practices, particularly re-establishing wetlands, along the creek that will filter sediment and nutrients out of the waters that reach Grand Lake St. Marys. The state, through Ohio EPA, will continue this effort but expand its implementation to all of the Grand Lake St. Marys feeder tributaries.

Similarly, additional stream and near-stream mitigation practices can reduce the amount of nutrients entering the lake. This includes restoring a stream's natural meander with appropriate land buffers and wetland features that will trap nutrients. The state, through ODNR, should request cooperation with USDA-NRCS and local Soil and Water Conservation Districts to identify upstream landowners to immediately implement appropriate stream and near-stream mitigation projects on the lake's feeder tributaries utilizing public and private funding.

Action: Implement phosphorus limits on wastewater treatment plants in the Grand Lake St. Marys watershed

Currently permitted wastewater treatment plants discharging into tributaries leading to Grand Lake St. Mary are estimated to contribute 5 to 10% of phosphorus loads to the lake. Ohio EPA will impose, if appropriate, phosphorus discharge limits on wastewater treatment plants when their discharge permits are renewed.

Action: Educate home septic system owners

The state recently passed household sewage legislation under SB 110. While rule development and implementation is not expected to be completed until after extensive stakeholder involvement, the state, through the ODH, will work with local health departments to provide homeowners with educational material regarding proper sewage treatment system maintenance and repair/replacement.

Action: Improve homeowner and commercial turf management practices

Although private homeowner contributions of phosphorus to Grand Lake are relatively small, individual homeowners in the watershed, especially lakefront homeowners and commercial operations such as golf courses should revise turf management practices to eliminate phosphorus and other nutrient inputs into the lake. The state, through Ohio EPA, will encourage the use of phosphorus-free lawn fertilizers and work with the Ohio Lake Management Society (OLMS) to develop and present workshops and educational materials for improving landowner and commercial operator's awareness of nutrient-free turf management practices that can be readily implemented.

Action: Establish Ohio General Assembly's support for additional state regulatory authority

The state's current regulatory program to address agricultural runoff is focused both on larger, permitted facilities and on incentive-based cooperation with medium and smaller facilities (with an enforcement backstop). Now, however, the state will seek legislative support through the Joint Committee on Agency Rule Review (JCARR) for authority that would allow it to respond in additional, quicker ways to nutrient runoff issues and work to prevent them in the first place. First, the state, through ODNR's Division of Soil and Water Resources, will seek to adopt rule revisions in the Agricultural Pollution Abatement Program that will allow the division, and its local soil and water conservation district partners, to expedite orders when pollution problems occur and timely voluntary cooperation cannot be achieved. Second, ODNR will also seek to adopt rules that will restrict land application of manure in the winter and that require non-permitted farms generating or using manure to only do so under an approved nutrient management plan.

The latter two proposed rules for which ODNR will seek legislative support would apply to the Grand Lake St. Marys watershed and other Ohio watersheds in the future if they have similar water quality issues. The two proposed rules are:

- Restrictions on Manure Applications

The first rule will amend the current rule for land application of manure. If enacted, the rule would prohibit manure application between December 15 and March 1 without special approval for each application. Outside of those dates, no manure application could occur if ground is frozen or snow-covered. Because many livestock owners or operators will need to make significant changes to their operations and construct additional storage, the rule would phase in the prohibition. However, between the

effective date of the new requirement and March 1, 2012, the rule would require compliance with the USDA NRCS standards and conditions for land application of manure established in Standard 633, Waste Application. Moreover, after March 1, 2012, each owner or operator of a livestock facility would need to ensure a minimum of 120 days of manure storage capacity, by November 15 of each year (unless special approval for winter application has been obtained) and maintain related records.

- Requirement for Nutrient Management Plan

The second rule would require the owners or operators of any farm generating or utilizing in excess of 350 tons of manure annually to develop a nutrient management plan addressing all sources of nutrients used in the operation, and operate in conformance with the plan. These nutrient management plans would need to be submitted to the Division of Soil and Water Resources for review and approval. The division expects to implement this rule, and the first rule above, in close cooperation with local soil and water conservation districts. The Mercer and Auglaize SWCDs cover the Grand Lake St. Marys watershed. The plans would need to be based on soil tests conducted at least every three years, and annual manure tests. The plans would need to preclude land application when weather forecasts have a prediction of certain precipitation events. The plan requirement would pertain to any operation applying more than 350 tons of manure per year which covers the vast majority of operations which actually apply any manure in the GLSM watershed. The nutrient management plans will be in the form of the Ohio Nutrient Management Workbook, a USDA NRCS Comprehensive Nutrient Management Plan, or equivalent approved format. Record-keeping would be required. Plans would need to be submitted for re-approval once every three years. Between the effective date of the new rule and December 15, 2012 (when every operation would be required to have an approved plan) operations must comply with the USDA-NRCS Standard 633. Moreover, agencies will encourage and assist with earlier plan development and approval.

Action: Look for additional ways to implement the phosphorus task force recommendations in the GLSM watershed, which will help to reduce phosphorus loading

In consultation with Heidelberg University, Ohio EPA convened the Ohio Lake Erie Phosphorus Task Force in 2007 to review and evaluate the increasing dissolved reactive phosphorus (DRP) loading trends and the connection to the deteriorating conditions in Lake Erie. The Task Force was charged to identify and evaluate potential point and nonpoint sources and related activities that might be contributing to the increasing trends in DRP. The Task Force included a wide range of participants and presentations by invited experts in a variety of disciplines. This report presents the findings of the Task Force along with recommendations for future management actions for Ohio. More information on the task force can be found online at:

<http://www.epa.state.oh.us/dsw/lakeerie/ptaskforce/index.aspx>

Action: Ohio EPA will work with local, state and federal partners to implement the TMDL recommendations

The Beaver Creek and Grand Lake St. Marys TMDL report was approved by U.S. EPA on September 28, 2007. The TMDL report identifies and evaluates water quality problems in impaired water bodies and propose solutions to bring those waters into attainment with water quality standards. TMDLs were calculated for fecal coliform bacteria, total phosphorus and nitrate. Some of the recommendations for improvement include managing livestock manure to reduce nutrient runoff, improving erosion and sediment control in all areas, and eliminating the pervasive bacteria problems. More information on the TMDL can be found online at:
<http://www.epa.ohio.gov/dsw/tmdl/BeaverCreekWabashTMDL.aspx>

Other Actions/Considerations

Human health protection

Ohio EPA and the City of Celina are currently conducting sampling of the lake's waters. Ohio EPA collects samples at the three State Park public beach areas and the City collects samples of raw and treated water near its drinking water intake pipes. Ohio EPA has established a process to make its sampling results public, including direct distribution to interested media outlets and stakeholders and postings on its website. For the remainder of the recreational season, Ohio EPA (in consultation with other the other state agencies) has established a finalized sampling protocol. The sampling data will continue to be provided to update the public.

Action: While the World Health Organization has a recreational contact standard for microcystin, no such standard is available to determine the threshold of threat to human health for other toxins that have been found in Grand Lake St. Marys this summer. The state, through Ohio EPA and ODH, will request that the U.S. EPA and U.S. Department of Health & Human Services develop a national standard that states can use as guidance for determining when to post health advisories when these toxins appear. Specifically, U.S. EPA and HHS should develop standards for anatoxin-a, cylindrospermopsin and saxitoxin. In addition, U.S. EPA and HHS should provide guidance on whether the presence of these toxins in water bodies poses an additional human health threat if fish from these water bodies are consumed.

Consideration of other/alternative technologies

A number of companies and stakeholders have provided information to the state on how a product or technology may benefit the lake's nutrient levels or algal growth. However, state agencies do not necessarily have the appropriate expertise, experience or resources to determine which, if any, of the proposals have merit in regards to Grand Lake St. Marys.

Action: The state, via Ohio EPA, will request U.S. EPA's assistance in reviewing the incoming proposals to determine which, if any, should be further pursued for either demonstration or full scale implementation.