EXECUTIVE SUMMARY[1]

Internal Phosphorus Loading and Alum Dosage Considerations for Long Lake

University of Wisconsin – Stout

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This executive summary is intended to provide the Long Lake Protection and Rehabilitation District Board and residents with an overview of the alum study objectives and results. Technical terms and project methodology are omitted to make project results more readily understandable. They can be found in the full report.

Project Objectives

A recent lake study and management plan (Polk County Land and Water Resources Department, 2013) identified that lake sediments contributed over half of the phosphorus that fuels algae blooms in Long Lake. Blue-green algae blooms are of particular concern in Long Lake because of the toxins they produce. An alum treatment is a method to control release of phosphorus from lake sediments. Phosphorus tends to be released in deep areas of the lake when water oxygen levels become very low.

The study was aimed at:

1) Determining how much phosphorus is released from samples of lake sediments collected from deep areas of the lake, both when oxygen is present and when it is lacking.
2) Estimating where alum should be applied (how deep) and in what concentration.
3) Providing a cost estimate for the recommended alum treatment.
4) Identifying further considerations and concerns.

Approach

Sediment cores (10 cm deep) were collected from four locations in the lake and analyzed in the laboratory. The analysis identified the forms and amounts of sediment phosphorus that can be controlled by alum. Sediment density, organic matter, and moisture content were also measured. The study found that phosphorus is most available for release into the water column in the top 6 cm of sediment, so this is the sediment zone that is targeted for treatment.

An appropriate alum application rate was derived by dosing one of the sediment cores with alum until 90 percent of the available phosphorus was bound to the alum. The area of the lake to be treated was selected by reviewing records of the depth where oxygen levels are depleted during the summer.

[1] Prepared by Cheryl Clemens, Harmony Environmental and reviewed by study author Bill James, UW-Stout.

Alum dosing can lead to aluminum toxicity if water becomes very acidic (pH falls below 4). As a measure of safety, pH is maintained above 6 when alum is applied. Buffering agents are sometimes added to maintain pH levels, or doses can be split if a pH concern is predicted.

Results

Long Lake sediments release most phosphorus when oxygen is not present. However, some phosphorus is also released when oxygen is present. This is significant to understanding algae blooms in the lake and the potential results of an alum treatment.

Long Lake does not have the alkalinity to buffer the recommended alum dose. As a result, buffering agents would need to be used, or the alum application would need to be split. Additional spring and summer testing of alkalinity in various areas of the lake would be needed to refine the maximum allowable alum dose.

A recommended dose of 105 g/m2 at depths 15 feet and greater would cost approximately $260,000. Adding a buffering agent or splitting the dose would add additional cost.

Identified Concerns

Alum needs to be denser than lake sediments so that it can sink to its desired treatment depth (in this case 6 cm). In Long Lake, alum may not sink rapidly enough to be effective. A late fall application is recommended to maximize sinking of alum.

High pH that occurs during an algae bloom can lead to release of phosphorus bound to alum.

Sediment from watershed runoff can reduce effectiveness of an alum treatment by covering the sediment surface. *[While efforts are currently underway to reduce runoff from agricultural and residential sources, more work needs to be done.]*

Sediment may also be suspended from shallow areas from wind and boating activity. *[Sediment suspension can be made worse by lack of adequate aquatic plant growth.]*

Further Analysis Recommended[2]

- Additional alkalinity testing throughout the lake
- Modeling to assess the potential results of an alum treatment, considering impacts of sediment release of phosphorus when oxygen is present
- A treatment strategy including methods for monitoring results in between a split treatment

[2] The current lake protection grant allocates funds for additional analysis up to $3,000.