Draft Implementation Plan for Crystal Lake TMDL

Best management Practices for reducing phosphorus and algal blooms

Introduction

Crystal Lake, adjacent to the city of Lake Crystal in Blue Earth County, Minn., is severely impacted by excess phosphorus, causing potentially dangerous blue-green algal blooms (Figure 1) and rendering the lake unusable for most recreation. Phosphorus concentrations and resulting transparency and algae levels cause the lake to be "impaired" according to Minnesota water quality standards.

Figure 1: When blue-green algae are present in Crystal Lake, the lake poses a risk to human and animal health (MPCA photo).

To address this impairment, local partners and the MPCA conducted a study called a Total Maximum Daily Load (TMDL), which determines the amount of a pollutant that a lake can accept and still meet water quality standards. The study also examined sources of the pollutant and how to reduce pollutant levels.

According to this draft TMDL, there are two main concerns regarding phosphorus sources to Crystal Lake: 1) contributions from the surrounding watershed, which is the area of land draining to the lake; and 2) internal contributions, which is phosphorus that enters the lake water from its bottom sediment. These two sources are inherently connected in that nearly all internal phosphorus is the accumulation of decades of excess watershed phosphorus contributions.

For more information, see the draft TMDL report on the MPCA website at www.pca.state.mn.us/foyp9ba.

Phosphorus sources and pathways

Knowing where phosphorus comes from, how it travels, and how it can be used helps farms and cities understand how to better manage phosphorus. Sources of phosphorus include fertilizer, animal manure, human waste, decomposing organic matter, and soil.

Phosphorus from these sources moves in either a water-dissolved form or a sediment-attached form. In either form, rain and snowmelt carry the phosphorus downstream to Crystal Lake. Once in the lake, the phosphorus can directly feed plants and algae, can attach and settle into the lake bottom sediments, or can travel further downstream via Minneopa Creek.

Adoption rates and costs

Once the U.S. Environmental Protection Agency approves the draft TMDL, the MPCA and local partners can use the load reductions and source allocations to estimate adoption rates for Best Management Practices (BMPs). Once these adoption rates and the associated number of projects and acres are calculated, a total restoration cost can be estimated.

Best Management Practices to address the Crystal Lake impairment

Best Management Practices (BMPs) refer to practices that reduce pollution. BMPs are often organized and presented by pollutant source type and include BMPs to address agriculture, urban stormwater, lake shores, industry, or other areas. However, the underlying principles (or how these BMPs reduce pollutants) are similar. This document refers to BMPs collectively as better watershed management practices to highlight the importance of collectively addressing phosphorus in the watershed.

Every person, every farm, and every yard within the watershed has a role to fill to improve Crystal Lake. Together, watershed citizens need to address excess phosphorus by learning and implementing better watershed management practices.

Figure 2 shows the comprehensive changes that must occur on the land, both farm and city. The larger the pyramid layer, the more changes are needed in watershed management. By first addressing watershed practices on the bottom of the pyramid, efforts further up the pyramid will be more effective in terms of cost and phosphorus reductions.

The information on the following pages describes the reasoning for the recommended practices. Each section includes examples of specific BMPs associated with these watershed management principles. Note that not all BMPs are applicable in all situations and that some should be planned and designed by experienced conservation professionals.

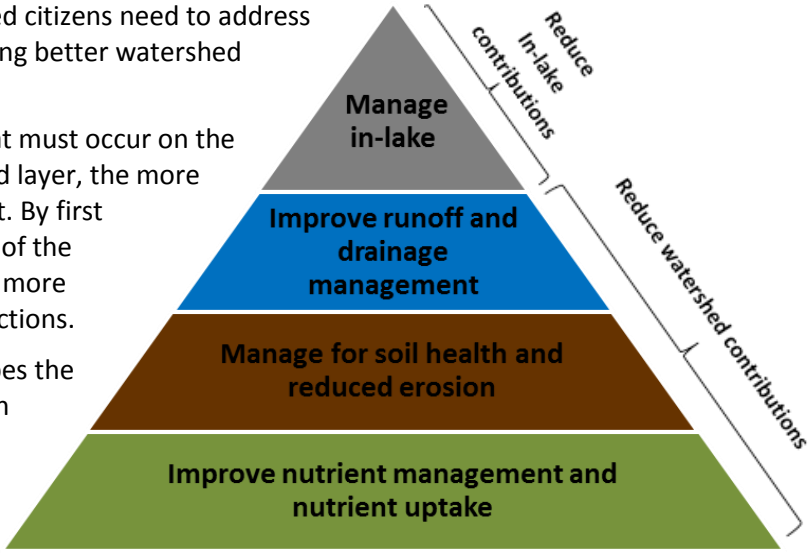

Figure 2: To improve Crystal Lake, better management practices must be comprehensively adopted throughout the watershed.

Nutrient management and uptake

The adage "an ounce of prevention is worth a pound of cure" applies to lake restoration, too. The most effective way to reduce watershed phosphorus contributions is to ensure that phosphorus is added to the landscape only when needed and only at the amount needed. This general principle is called nutrient management, which can be done either simplistically or scientifically. For instance, people can simply choose to use phosphorus-free fertilizer on their yard or apply less fertilizer on their farm. On the other hand, a farm may test the soil and plants to understand where phosphorus levels are high or low, and use this information to strategically apply fertilizer to match the nutrient needs of the plant by growth stage.

Improving nutrient uptake refers to strategies that rely on nutrient management principles along with strategies that increase the use of phosphorus throughout the landscape. Practices that increase the use of phosphorus work by intercepting phosphorus-laden soil or water with plants that use the phosphorus before it can be further washed downstream. Examples include using buffer strips around fields, trapping yard runoff in a rain garden, or restoring the lake shoreline with deep-rooted plants.

Nutrient Management & Nutrient Uptake BMPs

- Nutrient management based on soil content and plant needs
- Reduced fertilizer application
- Fertilizer application setbacks
- Properly store and dispose of waste/manure
- Maintain septic systems
- Vegetative filter strips
- Rain gardens
- Riparian/lake buffers
- Treatment wetlands
- 2-stage ditch
- Saturated buffer

Soil health and erosion

Soil health refers to many factors that improve the soil's productivity and sustainability, including organic content, water-holding capacity, and biodiversity of microorganisms. Healthy soils benefit both crop production and water quality for several reasons. Soils that are managed for health: 1) require less nutrient inputs because the microorganisms allow a more efficient use of nutrients; 2) hold more water and hence have less nutrient loss; 3) have substantially less surface erosion and hence less nutrient and soil loss,\; and because of this 4) provide sustainable land for future generations to use. Examples of soil health principles include cover crops to maintain permanent cover over soil, using no-till planting methods to minimize the disturbance of soil, and rotating crops to increase the diversity of plants.

Soil Health & Soil Erosion BMPs

- No/strip-till
- Cover crops
- Diverse plantings, crops
- Mulch and crop residue
- Perennial plants
- Grassed waterways

In addition to actively managing farmed or otherwise disturbed soils for soil health, there are several other ways to reduce soil erosion. Examples include planting sensitive areas such as gullies, lakeshore and frequently flooded land to permanent vegetation. The permanent vegetation reduces the loss of soils and the attached phosphorus. In addition, vegetated areas can be used as filters, trapping and using sediment and phosphorus from adjacent areas and preventing it from traveling further downstream.

Runoff and drainage management

Using nutrient management and soil health principles to keep water – and the sediment and nutrients carried with – from leaving the landscape builds the basis of restoration. However, farming and urban uses still require some drainage, whether by runoff over land or by subsurface systems such as tile systems and storm sewers to lakes and streams.

To allow drainage while protecting water quality, people must implement BMPs to reduce the amount of drainage and to remove pollutants from drainage water. Practices that hold and treat runoff and drainage water provide an important secondary foundation to restoring Crystal Lake.

Surface Runoff & Drainage Management BMPs

- Filter strips and buffers
- Water retention basins
- Sedimentation basins
- Treatment wetlands
- Controlled drainage
- Woodchip bioreactors
- Saturated buffer
- Remove open intakes

In-lake management

The last step toward restoring Crystal Lake is to control the accumulated internal phosphorus load. In most cases, in-lake treatments are not recommended until the watershed phosphorus load is first controlled. In-lake treatments are typically expensive and provide only short-term results unless the watershed phosphorus contributions are reduced. Developing an in-lake management plan requires input from multiple disciplines, including fisheries, engineering, water quality science, and recreation to understand the nuances and challenges of in-lake management.

In-Lake Management

- Develop and implement an in-lake plan after watershed sources are addressed
- Develop plan with experts and implement in accordance with any rules/regulations
- Biomanipulation
- Invasive species control
- Chemical treatments
- Dredging