PLM
LAKE & LAND
MANAGEMENT CORP

March 20, 2023

Bear Lake Improvement Board
c/o Darrell VanFossen
138 N. Bear Lake Rd
Muskegon, MI 49445

The following proposal is for your review for Bear Lake for the 2023 season. Bear Lake has an excessive amount of phosphorus as outlined in the study conducted by Grand Valley State University. Based on these findings, nutrient mitigation/management is an important part of the long-term management plan for the lake. After much research and consideration for costs and effectiveness, PLM has developed a practical option to strip phosphorus from the lake, using the product Phoslock. This will in turn reduce overall algal production and improve the overall health of the lake.

Bear Lake Phosphorus Mitigation Plan – Deep Hole

The primary goal of the Bear Lake Phosphorus Mitigation Plan is to significantly reduce phosphorus concentrations in the deeper water of the lake on an annual basis. The best method to achieve this reduction is through the use of Phoslock. Phoslock is a bentonite clay product containing lanthanum, a naturally occurring low toxicity earth element. Phoslock has the ability to permanently and rapidly remove, "strip", phosphorus from the water column. Phoslock is environmentally friendly and is commonly used throughout the United States, Canada and many other countries throughout the world.

The testing from the GVSU study indicates that the average total phosphorus concentration in the water column is ~50 ug/L. A majority of the phosphorus is pooling in the deeper water of the lake (>10 feet). This deeper water will be the primary focus of the proposed mitigation plan. Using the acre feet of the deep water, as well as the accessible pounds of phosphorus, PLM was able to calculate the amount of Phoslock required to bind the available phosphorus in the water column, in addition to some in the sediments.

Phoslock Calculations:

130 ac-ft of water (>10 feet as indicated by GVSU bathymetry map, attached)

50 ug/l of Phosphorus x .00271936 (constant)= .136 lbs/ac-ft

130 ac-ft x .136 lbs/ac-ft= 17.68 lbs of Phosphorus

100 lbs of Phoslock binds 1 lb of Phosphorus

17.68 lbs of Phosphorus x 100 lbs. of Phoslock= 1,768 lbs of Phoslock required to bind the internal water column Phosphorus

Cost of Phoslock Program:

Two treatments would be conducted each season (June & August) with 50% of the product applied at each application. Please see attached map that shows treatment area.

Annual Total Cost (>10ft Deep Holes): $9,100.00

The Phoslock Program will provide significant reduction in phosphorous levels over the duration of the plan. However, it should be stated that elevated phosphorus levels may still exist due to external loading and the significant levels of phosphorus within the sediment. Sediment phosphorus levels may support a considerable higher application rate, if funding was available.

PO Box 132, Caledonia, Michigan 49316
Phone 800.382.4434 · fax 616.891.0371
www.plmcorp.net

Water Quality Monitoring – Deep Hole:

An essential part of the Phoslock Program will be water quality monitoring. Surface and deep sample testing for Total Phosphorus and Soluble Reactive Phosphorus will be taken throughout the summer with an annual review of the data. Phoslock dose rates for future years may be adjusted if water quality results indicate a change is needed. Phosphorus concentrations can be influenced by rain events and other external nutrient loading sources.

Cost of Water Quality Program: $600.00/annually

* The Water Quality Program, noted above, may not be needed, if sampling is already included in a more extensive sampling program (GVSU).

Phosphorus Mitigation Plan – Fenner's Ditch

An adaptive management approach for Fenner's Ditch, including a split application is recommended. This should be viewed as a long-term management approach, with annual monitoring of water quality parameters such as Total Phosphorus in the canal. Annual monitoring may adjust dosage rates but 110 lbs/acre is the recommended approach, determined by SePRO (manufacturer) scientists.

Cost of Phoslock Program Fenner's Ditch: $6,400.00

For further clarification or modifications please contact.

Sincerely,

Jaimee Desjardins

Jaimee Desjardins, Environmental Scientist
West MI Regional Manager
PLM Lake & Land Management Corp.
jaimeed@plmcorp.net
616-891-1294 ext 2005