PLM
LAKE & LAND
MANAGEMENT CORP

June 2, 2022

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

Re: Nutrient Mitigation, Fenner's Ditch

Based on the continued noxious algae problems observed in Bear Lake, and more specifically Fenner's Ditch, over the last several years, nutrient mitigation/management is recommended. After much research and consideration for costs and effectiveness, PLM has developed 2 practical options to strip phosphorus from the canal, in turn reducing overall algal production.

## Phoslock Treatments – Recommended

Treatments using Phoslock would greatly reduce the overall phosphorus concentration in Fenner's Ditch. 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. It is designed to lock 90-95% of suspended phosphorus from the water column to precipitate and bind to the substrate, where it will be made inactive and no longer bioavailable. Along with any suspended phosphorus, once the Phoslock makes its way to the sediment, Phoslock is designed to create a thin layer on the bottom of the lake. This thin layer will lock any phosphorus released from the substrate which can contribute to the algae issues throughout the canal. Phoslock is environmentally friendly and is commonly used throughout the United States, Canada and many other countries throughout the world.

An adaptive management approach for Fenner's Ditch, including a split application is recommended. A least one year of treatment is recommended, but a few years of treatment with testing will show even great results longer term. 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.

**Phoslock Treatment Program: $6,400.00/season**

If Phoslock is used, the need for algaecide applications should decrease due to phosphorus being the main cause of algal blooms. The use of Phoslock does require a separate permit, which to date has no fee due with the application.

## Alum Treatment

An Alum treatment applied to Fenner's Ditch would reduce the overall phosphorus concentration in the canal. Alum (aluminum sulfate) when added to lake water removes phosphates through precipitation, forming a heavier than water particulate known as a floc. This floc then settles to the lake bottom to create a barrier that has the ability to lock the nutrients in the sediment, preventing its release during peak summer months.

There are a couple different alum management approaches that may be considered for Bear Lake. The first treatment approach, Phosphorus Inactivation, would be a 1-time treatment conducted in spring or early summer. When applied over the canal's surface, it quickly reacts with the phosphorus in the sediments to make it unreactive. The big hindrance to this approach is the unstable cost of alum. Over the last ten years, the cost per gallon of Alum has increased significantly.

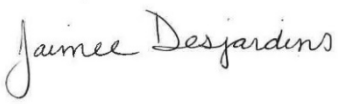
The other alum approach, Phosphorus Stripping, is similar to that being proposed using Phoslock. Phosphorus stripping refers to a treatment using alum over the canal's surface, where it quickly settles and, in the process, adsorbs phosphorus from the lake water (not sediment as in the first approach). Phosphorus stripping treatments are conducted throughout the season at a rate determined by current water quality results, but overall, they require a lower alum dose than the Phosphorus Inactivation Alum Treatment.

**Alum Treatment Program: TBD, based on current alum prices.** However, would be significantly more expensive than Phoslock.

PO Box 132 · Caledonia, Michigan 49316
phone 616.891.1294 · fax 616.891.0371
www.plmcorp.net

After reviewing both of the nutrient mitigation options, PLM recommends the use of Phoslock in Fenner's Ditch. Phoslock is more environmentally friendly, easier to permit and less costly. Also, PLM is aware that there are other issues plaguing the ditch, such as the oil contamination. The nutrient mitigation plan is the first step to improve the immediate conditions of the canal for residents. Further discussion, research and investigation will be needed to develop a plan for the oil mitigation.

For further clarification or modifications please contact.



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