



**Goose Lake Discussion:
Decision making tools for the future of Goose Lake
VLAWMO Board Meeting – Vadnais Heights City Hall
June 26th, 2019**

Goose Lake is an example of a waterbody surrounded with contrasting interests. While decision-making in such intractable spaces is challenging and difficult, VLAWMO's goal is to provide local leaders with research and data-based tools to assist in making informed policy decisions. The following is a summary of VLAWMO's staff consensus pertaining to the June 26th, 2019, Board meeting. A presentation from the meeting and public discussion are recorded and will be posted on the VLAWMO website and YouTube channel on July 1, 2019.

While an alum treatment alone isn't sufficient to remove Goose Lake off of the State List of Impaired Waters, we recognize that multiple tactics must act in concert to be effective.

In addition to alum treatment, lake improvement tactics include:

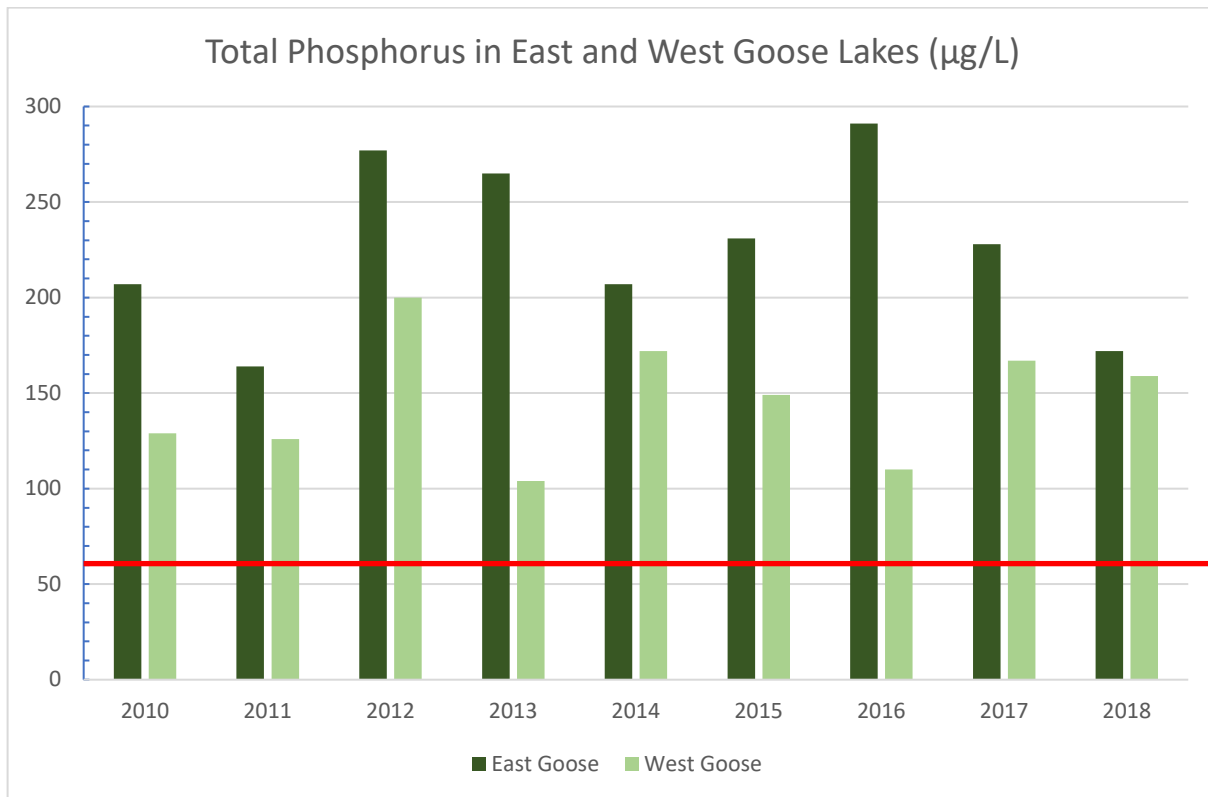
- Reducing the nutrients added to the lake from incoming stormwater through the creation of best management practices (BMPs) such as raingardens, bioswales, and retention basins.
- Reestablishing native plant species in the sub-watershed, particularly along shoreline
- Controlling invasive Curly-leaf pondweed
- Encouraging public participation in voluntary Adopt-a-Drain program (Adopt-a-Drain.org)
- Continuing maintenance alum doses as needed

Several of these efforts are currently underway in partnership with the City of White Bear Lake. VLAWMO and the City have coordinated a targeted Adopt-a-Drain effort in the Goose Lake subwatershed, cost-share projects with native plant species and increased infiltration have been built with support from VLAWMO, the City has built large native planting areas to pre-treat stormwater and upgraded their stormwater system, and additional large BMPs are funded and in permit and design stages. All of these efforts reduce external nutrient load being delivered to the lake. These do not and cannot address the internal load existing in the lake from historical wastewater sources. VLAWMO is grateful for volunteers and participants who have elected to be leaders in the Adopt-a-Drain effort. More emphasis on the program is coming up this fall to continue expanding the effort.

In weighing an alum treatment with other lake improvement tactics, it is documented that alum is 50 times more effective per dollar spent in improving water quality than building structures to reduce nutrients. Even with a reduction in nutrients in stormwater, a lake with high internal load can take decades, if at all, to recover if the internal load is not addressed.

Water resources have multiple uses and benefits, which creates a variety of interests and priorities among the users of the resource. VLAWMO recognizes that changing one aspect in this web of uses has a ripple effect on others. While the process of social change regarding water-resource use has been shown to be difficult, such as in the case of Half Moon Lake in Wisconsin, Water Management Organizations such as VLAWMO must inherently focus on its mission and goals to strive for improved water quality, especially in State-listed impaired waters, and to use the best available science to do so. Improving Goose Lake is not only a task that requires flexibility among stakeholders, it requires broad understanding and support from stakeholders and all entities involved to be successful.

Data summary:



Phosphorus trends through time:

Total phosphorus correlates with the amount of algae growth in the water column. The water-quality standard for shallow lakes is 60 µg/L. Goose Lake reached record high phosphorus levels in 2016 at 291 µg/L. Phosphorus levels are lower than they were prior to bullhead removal, but they remain at 3 times the impaired water standard. The internal phosphorus load came from historical wastewater discharge. However, phosphorus is usually deposited into waterbodies bound to sediment. The illicit discharge of gravel into the wetland immediately adjacent to West Goose Lake and semi-annual deposits of sand and gravel on West Goose Lake, done without permitting from the City or the MN DNR, are likely sources of continued external phosphorus load being contributed to the both lakes. The gravel is also providing illegal fill into the wetland.

Bullheads:

Bullhead removal was done in 2013 and 2014 (It was not done in 2016 as stated in the Board meeting). Bullheads feed by rooting in the sediment, causing disturbance and mixing phosphorus actively into the water column, where it stimulates algal growth. Bullheads were not eradicated from the lake. Population abundance was reduced by 75%. A follow-up survey in 2017 showed that bullhead population levels were sustained following removal and remained at reduced density in the lake (i.e., 80 fish per trapnet in 2012 versus 22 fish per trapnet in 2017).

A look into bullhead ecology will help inform recent observations of large schools of bullhead. Large schools of bullheads are often seen in the late spring/early summer. In bullheads, males take care of the young and actively school them together when they are small. As they get bigger, males stop actively protecting them, while the young continue to school together temporarily. While the presence of juvenile bullhead schools may seem alarming, this does not mean that the population in the lake has exploded. It means young are growing,

and the school is no longer being tended by an adult. In a balanced lake ecology, predator fish such as bass and mature panfish feed on the juvenile bullhead. The most recent fish survey completed in 2017 suggests the presence of predator fish to enable this balance in the fish population. Based on phosphorous trends shown in the graph above, we do not see evidence of a rebounded bullhead population. However, because the bullhead population may be growing, another follow-up survey would show the current fish population status.

Fish kills were also discussed at the board meeting. Fish kills are relatively common in urban lakes with low dissolved oxygen (caused by decomposition of high amounts of algae). This past winter, the MN DNR reported a much higher number of fish kills than normal, especially in south-central Minnesota but also in the metro (<https://www.mprnews.org/story/2019/04/16/winter-fish-kills-reported-on-southern-mn-lakes>). The preceding warm summer and fall with high algal growth, which uses oxygen when it decomposes, likely led to low dissolved oxygen. Low dissolved oxygen is a common culprit of fish kills especially in shallow, stressed waterbodies in the winter. This cycles back to the need to address nutrients in Goose Lake.

Plants:

Water quality has improved following bullhead removal, but phosphorus levels remain at 3 times the impaired standard. Additional evidence for how extreme the impairment is in Goose Lake is the near total absence of vegetation. Shallow lakes tend to exist in 2 possible states: high turbidity dominated by algae or clear water dominated by plants. Algae cloud the water and prevent light from reaching plants that would otherwise grow in these waterbodies. The situation is so extreme in East Goose Lake that there was no vegetation detected at all 94 points during a plant survey conducted by Ramsey County Soil and Water Conservation Division this summer. Algae growth is dominating the system and preventing growth of plants that would allow clear water.

Motorboats and Water Quality:

Peer-reviewed research indicates that motorboat activity has no correlation with improved water quality. While VLAWMO welcomes additional evidence, it also encourages local leaders to prioritize peer-reviewed consensus established through a scientific community. In a related theme, VLAWMO is often presented with questions concerning decorative fountains in ponds. VLAWMO's position on them is that they may aerate and allow the pond to look better in that area, but they don't fundamentally improve the water quality. As such, VLAWMO's grant programs does not fund fountains. Similarly, motorboat traffic is comparable to the stirring of a fountain, providing aeration and mixture that may skew the appearance from the lake data.

VLAWMO recommends 2 published journal articles, one regarding this issue of motorboats and another that is an overall review of alum treatments. One shows a case study comparing 2 similar lakes differing by the presence or absence of motorboats and one reviews alum treatments and summarizes understanding to date.

Citations for 2 recommended papers:

Huser, B.J., S. Egemose, H. Harper, M. Hupfer, H. Jensen, K.M. Pilgrim, K. Reitzel, E. Rydin, and M. Futter, 2016. Longevity and effectiveness of aluminum addition to reduce sediment phosphorus release and restore lake water quality. *Water Research*. 97: 122-132.

Nedohin, D. and P. Elefsiniotis, 1997. The effects of motor boats on water quality in shallow lakes. *Toxicological and Environmental Chemistry*. 61: 127-133.