

Results learned from recent water level data in terms of Phosphorus

After rain falls in the St. Cloud to Clear Lake area it begins to flow from the surrounding farm's and city homes into Mayhew lake watershed where Benton county's system of ditches direct runoff near County Rd. 45 and joins with the Elk River about 2 miles to the east. The rough area of Benton's drainage is a rectangle representing the majority of our >100,000 acre sub watershed (per modelmywatershed.org). Many ponding projects done in this area would likely help control the water level in the Briggs chain after a rain. Elk river starts much further north than Benton, (watershed includes Mille Lacs and Morrison counties) but water levels are assumed to be much smaller in area and are ignored for this evaluation. It should be noted that the Wenck report of 2018 indicated the drainage area to be about 6k acres but later referred to the watershed as around 140k acres in 2020.

Water measured on County Rd. 62 near the Airport have been measured to surge from 4 inches to 10 feet at this point and anecdotally have predicted high water in the Briggs chain within 30 hours (The same bubble takes about 72 hours more to reach the gauge in Big Lake). The Elk river is clearly out of control when it enters Sherburne county near the Airport. The MPCA has some monitor sites in the Benton part of the watershed but it has not been added to the 3 Lake Lid data. (a potential future project). The watershed in this area is very complex and Benton county likely has helpful data (I understand the Elk River watershed board employed an assistant from Benton making them a good start for contact.) At the Sherburne Benton Border many changes took place in the early 2000's notably the Airport and Golf course improvements reducing the wetland area. These projects tended to require drainage plans which may contain helpful information about available water storage locations. Briggs chain high water has increased in frequency since then but so has the average rain levels.

The 2020 water level measurements verified the Wenck report statement: Should the watershed receive a 1-in rainfall in an hour, the Briggs chain will exceed the No Wake Zone elevation by 1 foot. Measurements in 2019 and 2022 showed a rise in the river level of less than 2 feet will begin the flow from Elk river to Briggs through the channel. Once rain has saturated the wetlands less than 1/2 inch rain created measurable flow into Briggs from Elk river. The river exceeded a 2-foot rise over a dozen times each in both 2019 and 2022. Removal of the carp barrier in 2019 appeared to reduce high water events from 3 to 2 days due to faster outflow.

The phosphorus levels in Elk river are typically 2 times that of the Briggs upper lakes. This means the phosphorus levels increase proportionally to the amount of water that comes into the upper lakes. Looking at the graphs the calculated values match up pretty well explaining the differences between the lakes when taking lake volume/area and flow rate into account. Rush runs about 82 ug/L more than the 70 ug/L of Briggs where Rush is about 2.5 times smaller and almost 1/5 the volume compared to Briggs. A good flow model would be nice to plug into the data, but it is clear that Rush's 8-foot average depth can be more overwhelmed by the flow than Briggs (The flow to Rush travels out after spreading across about 1/2 Briggs.) Julia is at the far end of the flow and far less mixing is likely to take place making it the lowest P value at 60/ug/L. Since the water has less flow more time is allowed for algae growth and the "cleaner lake" is also greener.

Lakes like Julia with an average depth of 10 feet will have more mixing than the deeper Briggs due to a smaller hypolimnion. This indicates reducing flow from the river could reduce Julia's greening effects as well. In recent years the P levels in Elk (lake/river) has increased with the upper lakes following shortly after high water mixing events ended in late July.

The 2015 TMDL report assumes in models that water from the Briggs Bayou 1,212 ac-ft/yr.

The 2022 water level data implies over 19,000 ac-ft/yr. or about 16 times the model which would increase the phosphorus flow through by the same amount (Manning calc even 4x more). This is a good example

to show that the models should be updated with more accurate data. See TMDL reports assumed watershed map for lakes below where Briggs, Rush and Julia show tiny watersheds due to not including the Bayou flow from Elk river into Briggs. In spite of yearly extreme events, the TMDL report notes that the large elk river watershed may contribute to the flow no effort was made to quantify, study or make allowance for it!

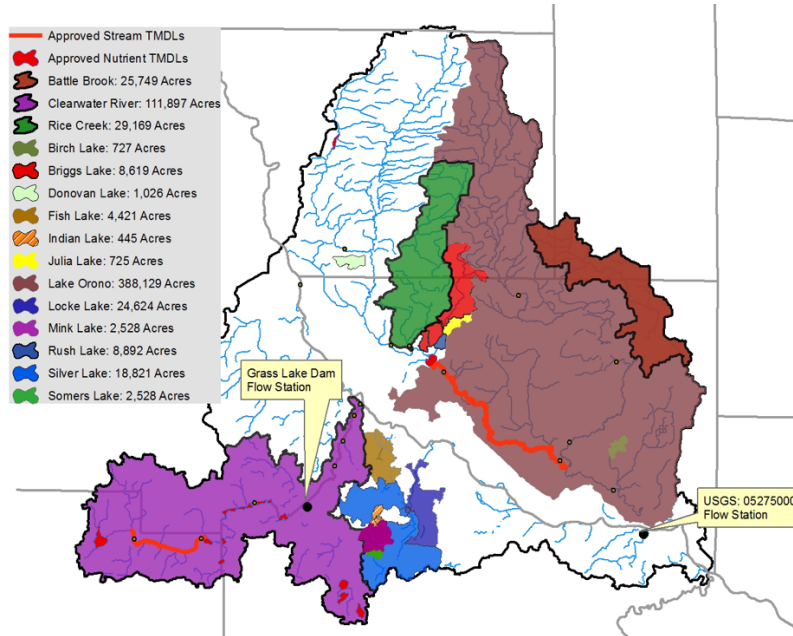


Figure 1 - Above map indicates in red Briggs direct watershed and area in white above Briggs chain represents 140K watershed of which about 30-40% passed through upper lakes in 2022 summer – 20 inches in summer high water a & 37 inches year total. Calculations do not include watershed part in red due to relative insignificance.

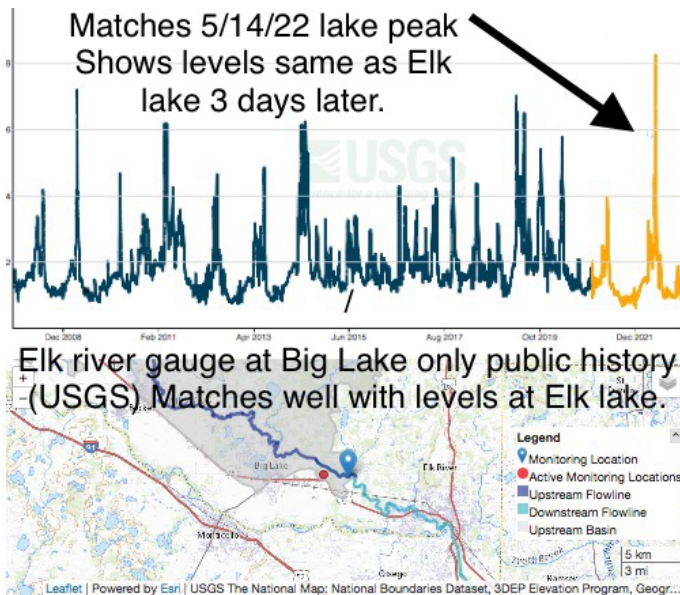


Figure 2 – 05275000 USGS flow station history 2007 to 2021 shows increasing Frequency of > 2 foot peaks that likely indicate high water in Briggs chain.

The unexpected fertilizer calculation:

This spring, I watched as several people spread fertilizer on lakeshore lawns and noticed some bags being used were "Seed Starter". One bag I looked up recommended amounts to achieve 1 lb. of phosphorus 3 times per year per 1000 sq ft area. (Another bag was 20% phosphorus which would easily double the amount to 2 lb. per 1000 sq ft.)

Each lot was about 1/2 acre in size. And the rain came within hours after they applied. I watched the driving rain turn the fertilizer into a fluffy foam which washed into the lake and floated near the shore before dissolving. (Some lots observed are on steep grades where the driveways cut off the ditches and direct water from the road into the lakes which is common in the area. One lot easily calculates shunting over 10,000 gallons of water per 1 inch of rain. No buffers exist between the lawn and the water allowing the bulk of the fertilizer to be washed into the lake.

So, I had to ask the question. How much did that one wasted treatment add to the phosphorus in this lake? Doing the math for one application of smallest phosphorus content bag... Each 1/2-acre lot added 22 lbs. of phosphorus to the lakes average 200 lb. level increasing the lake P pollution by 11 percent! If 10 lots, each around 1/2 acre applied seed starter to their lawns on Julia the phosphorus level would be at 60 ug/liter (level considered as impaired water) even if there contained zero phosphorus in the water to begin with. I wrote a letter to the MPCA and requested they check my calculations and was sad to hear back from them my numbers were correct.

Minnesota Statute 18C.60 Phosphorous turf fertilizer use restrictions:

A person may not apply a fertilizer containing the plant nutrient phosphorus to turf statewide.

It appears common that this law is ignored. When I have mentioned the law to people, I often get the response "It does not affect the lake very much". Ten percent damage in a single day is enough for one person to keep the lake impaired...

We need all lawns to have a buffer strip.

Soil testing should be done to determine lawn needs should be done by the University of Minnesota before fertilizing.

If you want phosphorus added to your lawn, just water the grass with lake water instead of breaking the law – its cheaper and better for the lake by removing phosphorus instead of adding to the water.... Effect of a 16-foot buffer as required by law in most areas typically reduces runoff by ten percent.

Septic leakage (several known sources)

In 2021 early Spring there was a huge Bloom in Rush Lake. Large amounts of Cladophora and Spirogyra were observed in the southern 1/2 of Rush. These algae plants were specified in our ground truthing training. Alan Cibuzar said it indicated the presence of either growth is a strong likelihood of a septic leak.

Cladophora is highly correlated with the presence of E. coli a fecal indicator bacterium, used to locate defective septic systems (as noted in several white papers).

One long term goal is to change the CRV rules for Sherburne county to match those of Benton County. This would allow for Septic inspection upon most property transfers. Some 1930's era pits will continue to pollute until this flaw is fixed. One leaking system can overwhelm a lake...



Chladophora



Spirogyra

Figure 2- Both fecal indicators were found abundant throughout lake and new drain field noticed near problem area by end of year. MPCA rep mentioned seeing bloom suggested I call county. County would not come out saying it was likely natural.

Curley Leaf summer degradation affects phosphorus levels.

Effect from curly leaf is minimal across total of year but early die off in summer increases the chance of algae bloom concentrating around July 4th. Curley leaf, unlike most other aquatic plants die in the beginning of July creating an algae bloom at the peak of summer activity.

Effect from farm runoff (from past measurements) are small due to Phosphorus in from streams less than outgoing.

High traffic stirring sediment cycle sediment back into water increasing algae at the surface. Wake boats in shallow lakes are a likely contributor to this.

Use of home sources of Phosphorus should be reduced. High Phosphorus laundry detergents (mostly the related surfactants) have shown up in our lake tests. Laundry detergents with phosphates are not widely available to the public anymore due to environmental concerns. Some products are designed for heavy duty commercial cleaning applications and contain phosphates that should be avoided.

Some 2022 BLCA statements that should be clarified.

The statement that Phosphorus comes from the air. (2/6,23 Walt Munsterman presentation.) Unlike the compounds of other matter cycles phosphorus cannot be found in air in the gaseous state. This is because phosphorus is usually liquid at normal temperatures and pressures. It is mainly cycling through water, soil and sediments. This misconception comes from the fact that the nitrogen cycle does move through air but not Phosphorus. (www.lenntech.com/phosphorus - GOOGLE TOP RESULT)

July BLCA president letter was presented: We went over the high-water ordinance mark with just rain, before any run-off reached us.

The lake level data shows that all rises in the lake levels were preceded by a large inflow from the Elk river. Should this actually happen it would require over a foot of rain in about an hour. The lake would quickly reach flood stage within the coming days doing severe damage to many roads and bridges.

October president letter statement was presented: Lawn fertilizer has virtually no impact on our lakes, compared to the farmland runoff. The best thing property owners on the lake can do is: Pay for extra treatment. Both statements are false.

The MPCA reports lawn fertilizer application as a major issue causing the greening of our lakes. Briggs lake chain has had many tests in the past that show water leaving the lakes contains more phosphorus than water entering from local farms. Farmers till the phosphorus when applying causing it to bind to the soil and stay in place where turf application is applied to the surface and easily moves from rain. Nitrogen moves more easily through the soil without binding and we have a high nitrate level in our drinking water especially in the shallow wells. (high nitrate water can be harmful for babies.) This is the issue that has been blamed on farmers over many years. Currently farming practices have improved and due to simple economics, they apply only the amounts needed to grow their crops. The buffer law of 16 feet allows for decreased runoff on farmlands by about 20%. Lake owners do not need to follow that rule and lots with no buffer have zero runoff protection.

Extra treatment for lake weeds removes phosphorus absorbing plants from the lake and the result is extra algae growth. Extra treatment of shore to kill weeds is subtracted from the overall amount allowed by the DNR to treat Curley-leaf and we are trading off having a weed free shore by allowing more invasive plant growth in most cases.

The BLCA president letter has implied most water in the upper lakes comes from Foley area.

Water from the direction of Foley is so small relative to what comes through the Bayou it can be ignored when predicting rain affected lake levels.

The direct watershed from Foley is Briggs Creek with 8619 Acres represents about 5% of the area that feeds the chain of lakes. Rice creek at 29169 acres comes from the direction of Foley but flows into Elk river, effectively adding about 21% to Elk watershed. Water from the Elk river enters the upper lakes through the Bayou when the river rises about 1.5 feet after a rain. About

20-30 percent of the river flow goes through the upper lakes and out Lilly creek on Rush depending on the method of calculation.

It has been mentioned that slow-release fertilizers are better to use around the lake.

The opposite is true. Farmers till fertilizer and it quickly binds to the soil reducing loss. A slow-release type will stay on top of the soil and quickly float away with the rain and upon entering the lake quickly dissolves. The lack of shoreland buffer strips (as required for farmland) is also a significant contributor. The most harmful runoff comes from those green lawns that are mowed right to the water's edge.

1 Watershed: Briggs lake Chain technical needs for clean water and flood control.

Five water data collection points WENCK recommended - Change to:

Only one real time monitor for Elk river exists at Big Lake.
(This shows lake flooding 3 days after it happened. – Not helpful)
Elk river on county rd 62 near Airport would give a 30-hour warning before lake starts to rise. Or at CSAH 6 for within hour.

Big Elk Lake -
Bayou bridge on county -
Elk River at Big Elk Lake Outlet -

Bayou Berm as recommended in 1987 Army Corp and again in Wenck report.

Adding flow to lakes to end confinement effect which builds up lake silt.

Culverts on 42nd street to Julia.
Culvert on 42nd at Briggs creek.
Culvert at 49th street from Julia to Rush.

Wetland Storage needs 700 Acre feet. – That's a lot of 1 Million dollar 40 acre projects. So they are planning one? What is the cost and # acre feet involved...

ALUM treatment – Only useful when/if flooding is under control...

