FAQs about Bone Lake's Water Clarity

The Bone Lake Management District is considering alum treatments to improve water clarity in Bone Lake. Bone Lake typically experiences algae blooms in the mid- to late-summer that can affect the safety and enjoyment of the water. Alum treatments can reduce these blooms; however, they are costly. The funding would primarily come from a special assessment on Bone Lake properties which would need to be approved by majority vote of Bone Lake property owners at an annual District meeting. We know you have questions. The following are frequently asked questions about Bone Lake and water clarity.

Why does Bone Lake turn green?

The simple answer is that phosphorus is released from the bottom sediments and triggers algae growth. In the spring and fall the water is basically the same temperature on the top and bottom of the lake and there is oxygen available at all levels of the lake. During the summer the lake stratifies and the upper layer is much warmer than the bottom of the lake. This does not allow oxygen to get to the bottom. Without oxygen, the phosphorus moves from the bottom of the lake. The phosphorus reaches the top layers when the lake loses its stratification and mixes. In the top layers of the lake, algae has what it needs to grow: phosphorus and plenty of light from sunshine.

The timing and concentration of algae growth depends on many factors: current lake environment, weather, and the timing of lake mixing. Bone Lake algae may bloom from late summer to early fall. It varies in intensity—from green flecks floating in the water to thick blue-green mats that can be toxic—and in lake location. Algae impact water clarity differently every year.

Why does water quality matter?

Poor water quality can cause many problems:

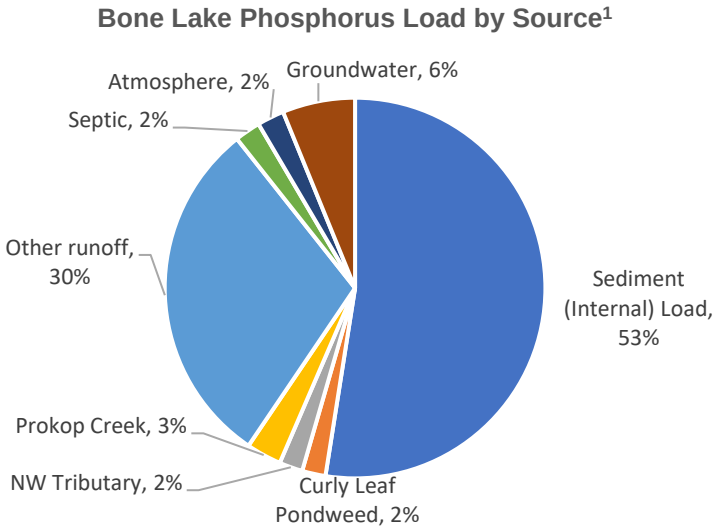
- Nuisance algal blooms
- Harmful algal toxins
- Low water clarity
- Noxious odors
- Low oxygen levels
- Potential fish kills
- Reduced recreational value
- Reduced property values

What are the sources of phosphorus in Bone Lake?

The sources of phosphorus in Bone Lake are the internal sediments, land runoff, groundwater, creeks and tributaries, curly leaf pondweed, septic systems, and the atmosphere. A study commissioned by the Bone Lake Management District was updated in the winter of 2018/2019. The sources of phosphorus in Bone Lake are shown on the following table:

Phosphorus Source	**Kg**
Internal Sediment Load	1,596.0
Curly Leaf Pondweed	171.0
Other Land Runoff	937.7
Septic	67.0
Atmosphere	69.0
Groundwater	189.0
Total Estimate	3,029.7

Our largest sources of phosphorus are the internal sediment load at over 50%--this is part of our lake bed's natural makeup, and the annual incoming "other land runoff" at 30%.[1]



What have we done to reduce phosphorus in Bone Lake?

The Bone Lake Management District has been working on improving water clarity for many years. The controllable "other land runoff" source has been the focus of BLMD commissioners and volunteers through runoff mitigation projects.

Many properties on Bone Lake are on sloping lots. These lots allow phosphorus-rich water to drain into the lake, especially on lots that are mowed to the lake's edge and have no other natural buffer.

The BLMD provides funding of 75% of the cost for shoreline planting of 10 X 35 feet. Shoreline plantings help catch runoff before it reaches the lake. About 38 of the 435 waterfront lots have installed district-funded, runoff-mitigating plantings. In lieu of or in addition to shoreline plantings, some owners have stopped mowing right up to the lake edge which also helps reduce the runoff.

Our highest impact for the dollars spent is mitigating runoff on any lots that have the ability for water to run from the lot to the lake. By not cutting the last 10 feet of your lot at the shoreline, you can greatly reduce the runoff potential!

In addition to reducing runoff, we annually spray for curly leaf pondweed (CLP). The phosphorus from CLP is fairly static.

Finally, the BLMD has provided financial assistance to owners needing to replace failing septic systems.

Aren't our efforts to reduce phosphorus in Bone Lake working?

Our efforts to reduce phosphorus in Bone Lake have been working. These efforts help to keep the lake clean before it mixes. However, some of the sources we can control contribute to less than 2% of the lake's phosphorus. Even a major reduction in these sources has a minor impact on overall phosphorus in the lake.

Reducing phosphorus from "other land runoff", the source for 31% of Bone Lake's phosphorus, takes ongoing cooperation and effort from hundreds of landowners. Working with individual landowners helps reduce runoff from individual properties and may inspire other landowners to mitigate runoff from their properties.

What is internal loading?

Internal load refers to the amount of phosphorus coming from the lake's sediment. The sediment plays an important role in the overall nutrient dynamics of shallow lakes. In lakes where the external loading has been reduced, internal phosphorus loading may hamper improvements in lake water quality.

Why are we considering using alum?

After learning that over half of our phosphorus loading comes from internal loading, it was clear that without addressing phosphorus already in the lake sediment, it would be difficult to make significant improvements in Bone Lake's water clarity. By using alum, the internal load can be mitigated. Alum binds with the phosphorus in the sediment for a period of 5 to 15 years and reduces the phosphorus available in the water which feeds algae.

What water quality treatments were explored for Bone Lake?

The alum committee, formed by a vote of lake property owners at the 2018 BLMD annual meeting, investigated the use of alum for controlling phosphorus coming from internal loading as well as other available technologies for controlling phosphorus.

The committee's search for alternative treatments found several methods that have had some success. However, only two methods were found to be sufficiently documented and actually available now for lake treatment. The two methods were alum and aeration. Both had compelling successes.

Aeration was ruled out as a treatment for Bone Lake as it had not been used on a lake as large and the overall the cost of operating the equipment needed to pump air to the bottom of the lake would be higher than using alum. The committee found no lakes in Wisconsin or Minnesota that were using aeration for other than winter oxygen improvement to diminish fish kills.

Alum has been and is being used in a number of nearby lakes in Wisconsin and Minnesota. It has been successful and cost effective for cities and lake districts for improving lake clarity. Although many of these lakes are smaller than Bone Lake, alum has been used to treat water in large reservoirs.

The Wisconsin DNR lists Bone Lake as an "impaired water." What does that mean?

Every two years, the Clean Water Act requires states to publish a list of all waters that are not meeting water quality standards. Bone Lake is on Wisconsin's list of impaired lakes due to its high phosphorus content and excess algal growth.[2]

After alum treatments, will Bone Lake be removed from the "impaired water" list?

Even if the water clarity improves from alum treatments, it is uncertain that we would be removed from the WI DNR list of impaired lakes. The WI DNR states that waters are delisted from the state's impaired waters list when the state determines, and the EPA approves, that the waters are no longer impaired, or that a particular pollutant impairment combination should be removed.

How could effective alum treatments affect the value of my Bone Lake property?

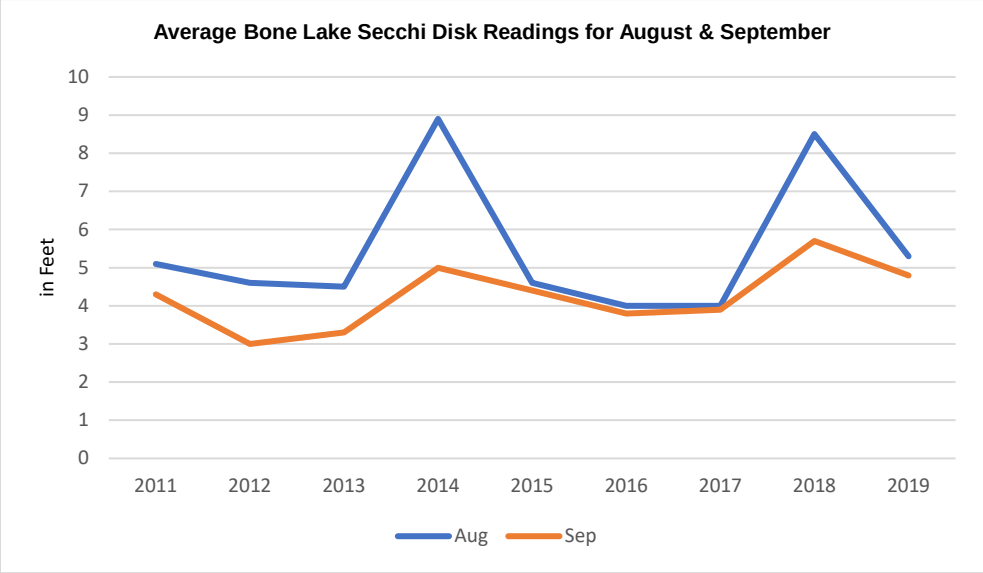
A study done by the University of Wisconsin-Eau Claire examined 324 lake properties in northern Wisconsin and reported a 3-16% increase in property value with a 3-feet increase in water clarity. This was an average increase of $26,000.[3] A study from Ohio State University indicated Buckeye Lake, Ohio, lost $101M in home values in the six years of 2011 to 2016 due to algal blooms.[4]

What is Bone Lake's water clarity?

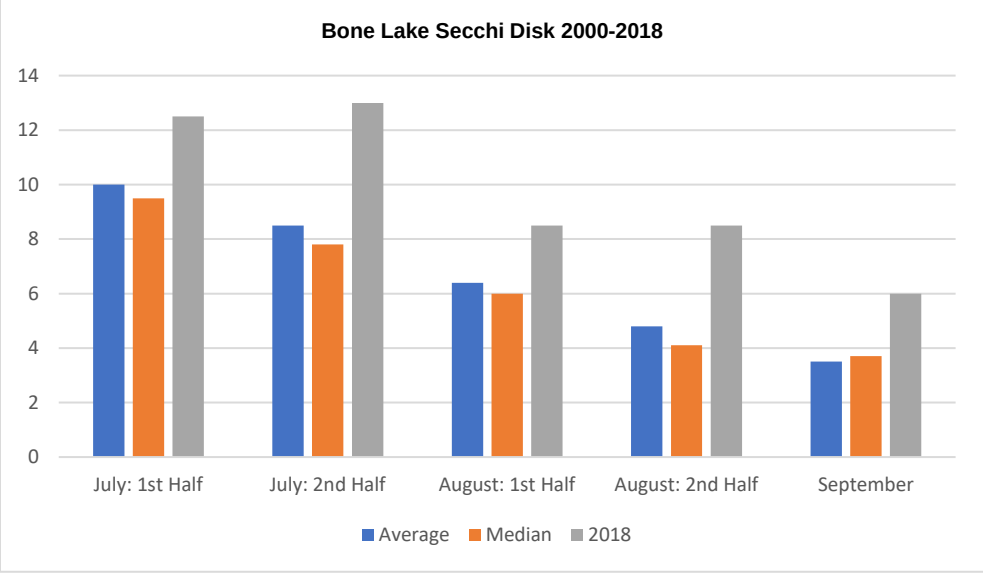
Water clarity is measured by taking readings of the depth of visibility of a 12-inch white disk known as Secchi disk. Bone Lake volunteers measure this depth from spring till late fall. Lower readings mean less water clarity and indicate algae blooms.

Average Secchi Disk Readings (in feet) for the Ten-Year Period 2010 through 2019[5]											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Ave for Month
Jun	12.5	8.5	8.8	12.5	10.3	11.3	11.1	10.5	14.5	9.3	10.9
Jul	5.6	8.3	7.3	11.5	8.6	7.5	5.5	6.8	12.8	7.1	8.1
Aug	4.2	5.1	4.6	4.5	8.9	4.6	4.0	4.0	8.5	5.3	5.4
Sep		4.3	3.0	3.3	5.0	4.4	3.8	3.9	5.7	4.8	4.2
Average: May-Sep	7.4	6.5	5.9	7.9	8.2	7.0	6.1	6.3	10.4	6.6	

Year-to-date data for 2020 is available online.[5]



Bone Lake typically sees a degradation of water quality as the summer progresses. In 2018, Bone Lake had much better water clarity throughout the summer months. The following table shows the Secchi average and median readings from one of the testing locations broken down by half months for July and August.[5] It shows the average and median readings for the period 2000-2018 against the 2018 readings.



How does Bone Lake's water clarity compare with other lakes using alum?

The following chart compares Bone Lake water clarity, based on Secchi disk readings, with those from Bald Eagle Lake in Minnesota, currently being treated with alum, and East Balsam Lake, recently approved to be treated with alum. The Secchi data are summarized below; low readings correlate with poor water clarity while high readings correlate with high water clarity:

Average (in feet) For	Bone Lake	East Balsam[5]	Bald Eagle Lake[6]	
			Before Alum	After Alum
May	12.28	13.00	7.86	9.68
June	10.92	8.73	6.46	10.53
July	8.09	4.46	3.57	7.92
August	5.36	2.68	2.68	5.11
September	4.22	2.67	2.78	5.94
Average Overall	8.17	6.30	4.67	7.84

Bald Eagle Lake (prior to alum treatments) and East Balsam were both more severely impaired lakes than Bone Lake. Their average lake clarity in August and September was less than 3 feet.

Alum worked in Bald Eagle after two alum treatments with water clarity increasing by about 2.5 feet in August and 3 feet in September. Bald Eagle Lake covers 1,047 acres, East Balsam Lake 550 acres, and Bone Lake 1,781acres.

[1] "Bone Lake Aquatic Plant Management Plan", Bone Lake Polk County, WI, 2020, Bone Lake Management District, Harmony Environmental and Ecological Integrity Service.

[2] https://dnr.wi.gov/topic/impairedwaters/2018IR_IWList.html

[3] https://www.wpr.org/clearing-murkey-lake-water-has-impact-nearby-property-values

[4] https://eurekalert.org/pub_releases/2017-08/osu-abc081617.php

[5] https://dnr.wi.gov/lakes/clmn/ under Polk County

[6] https://www.pca.state.mn.us/sites/default/files/wq-iw11-12e.pdf with additional information available at https://files.dnr.state.mn.us/natural_resources/water/lakes/aquatic_veg_reports/bald-eagle-lake_62000200.pdf

This is one in a series of four handouts answering frequently asked questions about Bone Lake's water quality, alum treatments, costs and funding alum treatments, and voting in a lake management district.