**Should the draw down of Bare Hill Pond be stopped? No. Should it be questioned, of course!**

Please take a few minutes to read on and learn more about Bare Hill Pond, its ecology, and the strategy for managing invasive species, the risk of algal blooms and the opportunities we have to protect the Pond and its watershed.

The short answer is that over 15 years of data indicate that the draw down has helped to control invasive species (milfoil and fanwort), substantially reduced the phosphorous in the Pond that put it at risk for algal blooms, and helped to avoid and delay, recently, the occurrence of algal blooms. Bare Hill Pond was put on the state list on endangered lakes and ponds by Mass DEP in 1998 for excessive phosphorous loading and invasive species. Since starting draw downs, phosphorous in the water column has been reduced by approximately 50% and invasive species significantly controlled and replaced by native species that are not subject to the draw down’s effects.

Let’s drill down on a few of the key questions folks have raised.

**We did a draw down last winter and now we have more weeds than ever?**

 This past winter just as the draw down achieved its target depth in November, the pump’s electronic system failed, leading to an early end to the draw down before there was time for freezing and drying of invasive plants, making it as if it had not occurred. In effect, the draw down was “stopped.” If the next draw down is stopped, the data shows invasive species get even more out of control. This is very similar to the decision in 2013-14 after finding invasives were brought under control to see if alternating year draw downs would allow for control. The following summer there was significant growth like this year, because the invasive species were given the opportunity grow and take over.

It is important to note that due to weather conditions, the efficacy of each draw down will vary and some years will have limited effect on the invasive species when the temperatures do not freeze the plants exposed in the draw down zone or there is significant rainfall in January. This has happened during several years and is evident in the data the following summer. The draw down in 2019-20 was impaired to some extent by weather and when that combines with the absence of the draw down freeze in 2020-21, it is not surprising to see the significant growth this year. For this reason, annual draw downs appear to the be the best approach to avoid missing years with sufficient cold weather freezing.

If you want to take a deeper dive, take a look at the Bare Hill Pond Watershed Management Committee reports to the Conservation Commission each year that show the impact of the draw down on invasive species, repopulation of native species, and on phosphorous. [Annual & Other Reports | Town of Harvard MA (harvard-ma.gov)](https://www.harvard-ma.gov/bare-hill-pond-watershed-management/pages/annual-other-reports) The report for 2021 was submitted last week and should be posted shortly by the Town.

**We never had algal blooms like this before we did draw downs?**

This is a fair question and one that warrants some discussion of Bare Hill Pond ecology, the prevalence of algal blooms in Massachusetts lakes and ponds, and the impact of our changing climate. Bare Hill Pond was determined to be endangered in 1998 by the MA DEP because of its excessive phosphorous. That that time, the water column has found to have readings at or above 0.44*u*/l . A healthy pond has phosphorous at half that level. What drives phosphorous is development of the watershed, its shoreline and behavior in the watershed. The more homes, the less forest, the more lawns, and the greater use of fertilizers results in an increase in the baseline phsophorous level. Thank you to so many in the watershed who have taken personal action to avoid use of fertilizers, reduce lawns, increase native plantings around the Pond and in the watershed.

 While invasive plants were the driver for many in our Community at the time draw downs were initiated, a major rationale for MA DEP and the Bare Hill Pond Watershed Management Committee was also to control phosphorous. We were at significant risk of algal blooms in 1998 according to MA DEP, and as a result of the draw downs, may have avoided them or more recently delayed, by building resiliency into our watershed. By reducing the level of phosphorous in the Pond, it now takes significantly more phosphorous, from storm water or from internal loading (more on that later) to trigger an algal bloom.

To help address this issue and add more resiliency, the Bare Hill Pond Watershed Management designed and had constructed rain gardens to capture and treat stormwater from Town Center, the Library and the schools and from the stream flowing in the Pond from the Bare Hill. While not commonly known, motor vehicle exhaust contains phosphorous that washes from roads and parking lots into Ponds during rain events unless captured and treated.

These actions added a significant margin of resiliency during the past 20 years helping avoid the dangers of algal blooms.

That said, in the past 20 years algal blooms have become increasingly common on lakes and ponds in MA. As of Aug. 19 this year, per the DEP, its appears that over 20 lakes and ponds have reported algal blooms closing a lake or pond. Many of these were reported in July, not August, such as White Pond in Concord and Boon Lake in Stow. The increasing prevalence of algal blooms in our region has now caught up with Bare Hill Pond’s resiliency even with the benefit of conducting draw downs.

**Why are algal blooms becoming so common in MA?**

Several factors drive algal blooms: phosphorous loading, temperature, and loss of oxygen in the deeper zones of the water body coupled with the ubiquitous presence of cyanobacteria (blue green algae).

Bare Hill Pond has a very fertile bottom, in part because it covered former flooded sheep pasture, but also because the watershed for years transported phosphorous from the surrounding homes and farms. Phosphorous fortunately binds tightly to pond sediment and remains inert and out of the water column in natural pond settings, but is released into the water column when Pond temperatures rise. When that occurs, oxygen is not retained in the water. We have 15 or more years of data showing a significant temperature dependent declines in oxygen in lower depths of the Pond during the summer. When oxygen declines, anerobic cell life takes over and this activity creates what is known as anoxic conditions. When the lower level of a Pond becomes anoxic, bound phosphorous is released from the sediment. This is known as internal loading and is likely the major driver of algal blooms last year and this year This is indicated by significantly higher Pond temperatures and loss of oxygen last year and this year by the end of July,

According to the regional scientists at the EPA, cyanobacteria are everywhere. In normal conditions, they may remain on the Pond bottom and have limited impact, but when phosphorous is released, when temperatures increase and oxygen is limited, they rise to the surface, and bloom. Cyanobacteria are highly evolved species over hundreds of millions of years. They were some of the first organisms on earth and are responsible for converting carbon dioxide to oxygen to create our atmosphere and make life possible on earth. They can be found living or in spore form everywhere, including according to scientists, in the Sahara desert waiting for the right conditions to bloom.

With the change in climate, and increasing temperatures, algal blooms have become more and more commonplace in Massachusetts. Perhaps less so on Bare Hill Pond until recently due to our increased resiliency. That said, the temperature this year of the Pond, like last year, was often over 80 degrees, and the oxygen levels declined significantly in the deeper zones of the Pond, likely leading to significant release of bound phosphorous into the Pond in August and algal blooms. This year, the heavy storms in July may also have provided a significant watershed dose of phoshorous and was not enough to reduce temperatures below 80 degrees except for week or so. The reduction of phosphorous from the draw downs may no longer be enough during these warm periods, to prevent algal blooms even if they are occurring later than on other lakes and Ponds.

**So are there actions we can take to create more resiliency and avoid algal blooms in the future?**

Yes. We can all do our part to continue to reduce the size of lawns, the use of fertilizer and other sources of phosphorous in the Bare Hill Pond Watershed. Because our algal blooms are occurring later than on other lakes and ponds (lakes and ponds that like Bare Hill Pond did not have a history of algal blooms) we may be at a “tipping point”. It may be that if we all do our part, adding some more resiliency to our watershed could help the Pond tolerate the increased temperatures.

We can encourage our community to protect our forests and natural landscape in the watershed. There is no dispute among watershed scientists that development is one of the primary causes of increased phosphorous pollution, and the more we can do to preserve the watershed, the more likely we will protect and preserve Bare Hill Pond for enjoyment by all.

Because of the algal bloom last year, the Bare Hill Pond Watershed Management Committee also engaged its expert advisor this year to do additional studies of the deeper areas of the Pond and help identify if there are potential actions in addition to the draw down that could stave off anoxic phosphorous release. The data is still being collected and it could point to additional solutions to build resiliency into our Pond’s habitat. There are no magic bullets for algal blooms in large part due to their 100’s of millions of years of evolution making them incredibly hardy. That said, there may be options, perhaps there are the deep zones can be identified where aeration or phosphorous locking solutions might be explored to prevent in lake phosphorous loading. The challenge though is Bare Hill Pond is 350 acres, not a typical small Pond where technologies have been found to be helpful. Its premature to speculate ahead of the data, but expect more to come later this year.

This essentially leaves us right now with the one action that data indicates is helping: the draw down. In years when there is a significant freeze, it has significantly controlled invasive species; and equally and perhaps more importantly, it reduces the level of phosphorous in the water column providing a level of protection against the impact of climate change and in lake phosphorous loading.