

White Pond as a Resource for All: A Vision for Water Quality, Usage and Sustainability

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Town of Concord, Massachusetts

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Executive Overview

White Pond is a beloved natural resource enjoyed by local and out-of-town visitors. Its unique land rights management and geological features offer valued recreational opportunities. And yet, this same combination of factors is now contributing to repeated toxic algae blooms, making the pond unsafe for humans, fish and surrounding wildlife. The Town of Concord, neighboring residents and visitors have a short window of opportunity to remediate these harmful conditions and preserve White Pond for generations. Without intervention, science indicates that White Pond will be permanently closed for general purposes for most if not all of the warmer months going forward.

There are multiple contributing factors that can contribute and/or cause toxic algae blooms. These include an over-supply of nutrients for algae, as they are called in the scientific literature, or unnatural contaminants to the pond water. Nutrients arrive in the form of run-off/leaching from septic tanks and fertilizers, and over-use including trash and refuse left behind by visitors. Each one of these contributions have solutions and each require coordination and political will to resolve. Some are not easy, but following extensive research and consultation with scientific authorities, they appear to be the best and at times only way to end chronic pollution and closure of White Pond due to algae blooms.

This Vision document calls attention to the core problems and offers a roadmap for solutions. As a follow up to the 2015 White Pond Vision, “A Shared Resource for White Pond,” this document focuses on resource and people management, and considers four key areas: water quality, neighborhood issues, recreation and stewardship, and Town support. The element of time is also considered as some items are short-term concerns or opportunities while others are identified for the longer-term.

Along with the reduction of nutrients inflows to White Pond, this Vision promotes a monitoring and testing regime led by the Town of Concord, which now owns ~30% of the land surrounding the pond. The gift of the White Pond Associates beachfront and the development of that area has transformed the Town’s role in the pond’s management. The Town is the legal authority that has both the right and mandate to deliver a monitoring and testing program to ensure safe water conditions.

The ideas presented here are generally not new; most have been advanced before here or somewhere else. What is new is the immediacy of our call to action. Frequent beach closures in the last six years due to water quality show that toxic algae blooms are now a regular feature of the pond. Without remediation now, the Town of Concord, neighborhood residents and visitors should expect that White Pond will cease to be a usable local resource. However, with Town, neighborhood and visitor engagement, White Pond can remain a treasured area resource for generations to come. We invite the Town of Concord, neighborhood residents and other visitors to review the recommendations in this Vision to help enact a long-term, workable plan for management of White Pond.

Introduction

White Pond is a Concord jewel. Henry Thoreau knew it and wrote about it [THOREAU], asserting that “perhaps the most attractive, if not most beautiful, of all our lakes” is White Pond. Current Concord residents know it too, as White Pond has provided outstanding aesthetic and recreational opportunities for thousands of people. Boating, fishing, hiking, biking, skiing, skating, swimming, and wildlife viewing are just some of the pleasures of this great resource.

The White Pond Advisory Committee (WPAC) was formed by the Town of Concord in 1973 to advise the Select Board and relevant Town Committees on White Pond management. The value of the Committee is that it is comprised of frequent visitors to the pond: members see what is happening on a day-to-day basis. The WPAC’s mission is to preserve the beauty and wonder of White Pond for all visitors, respecting that there are natural capacity limits that any resource can endure. The publication of the 2015 White Pond Vision, “A Shared Resource for All,” promoted the “Guiding Principles for the Development of a Long-Term Vision for White Pond”. The intent of the 2015 Vision was to set a coupled water quality and people management plan for White Pond for implementation by the Town of Concord. A few of these recommendations were implemented; most were not.

The Town of Concord’s acquisition of the White Pond Associates’ beach property represents a turning point in the history of pond. For the first time, the Town of Concord has an environmental, social and economic incentive to preserve White Pond water quality. The Town must now take a proactive role in reducing or eliminating toxic algae blooms for the preservation of its beach investment, with attendant benefits for the overall well-being of the pond.

This 2021 update to the White Pond Vision was requested by the Town of Concord Select Board with the aim of creating a fresh set of perspectives on water and land use management. This document is a collection of many concerns that have been previously addressed with input from neighboring residents, the Town of Concord and scientific experts on ponds and algae blooms, along with targeted solutions. The objective, consistent with the 2015 Vision, is to maintain White Pond as a long-term natural resource for Concord and the surrounding community.

Water Quality Management

Concerns

The leading concern for the health of White Pond is the state of water quality. Excess nutrients (phosphorus and nitrogen) in the water have led to a dramatic increase in the number of Cyanobacteria (commonly known as blue-green algae, toxic algae or toxic algae blooms) that naturally exist in the water [STAGER]. Algae blooms flourish in warm weather, making the pond unsafe for any recreational use. A foul smell also develops that

negatively impacts surrounding communities and visitors. The public health concerns are potentially serious and range from dog fatalities [CLIFF] to a suspected link to ALS, also known as Lou Gehrig's Disease [SCIAM].

Other health risks related to algae blooms include:

- Rashes or other skin irritations from direct contact. Usually, these skin irritations are not associated with toxins, but rather other non-toxic compounds produced by blooms called lipopolysaccharides (LPSs).
- Inhalation of water droplets that have toxins in them may cause allergic-like reactions, runny noses, or sore throats.
- Irritation to eyes.
- Headaches from breathing in air near toxic blooms.
- Swallowing water with high levels of cyanobacterial toxins can cause:
 - Severe stomach problems like diarrhea and vomiting.
 - Liver damage which may take hours or days to show up in people or animals. Symptoms can include abdominal pain, diarrhea, and vomiting.
 - Numb lips, tingling fingers and toes, or dizziness.

Excessive Cyanobacteria growth robs aquatic life of essential food and oxygen needed for life. The decay of the algae directly causes oxygen depletion.

When a toxin-producing bloom dies and breaks up, toxins are released into the surrounding water. This is generally the time of highest concern for public health because the lack of a visual cue (i.e., water appears clear) to avoid the water is not present. While blooms cannot be seen visually, this is when they are most dangerous. Nothing can be stated accurately about the pond's water quality without cell or concentration counts of toxins.

The root causes of toxic algae blooms are inter-related, and it is unknown whether one factor is more influential than others. However, they must all be addressed in order to ensure a successful outcome. The major human factors are:

1. Septic systems. The basic design of a septic system, including those approved under Title V, is to leach wastewater into the surrounding soil. Approved septic systems remove harmful bacteria but do not remove nutrients. These nutrients move into the ground water and eventually leach into White Pond. The White Pond groundwater overlay district shows the flow of this wastewater through the soil (see Appendix B). Other Massachusetts communities have identified sewage treatment as a primary opportunity for improving pond water quality [SNEP].

2. Chemicals and natural fertilizers. Lawn and plant fertilizers in the watershed also find their way into the pond. This is especially true when heavy rains occur after a dry spell; the dry land absorbs less rain, which runs downhill into the pond carrying fertilizers along with it. Fertilizers not taken up by plants will also leach through the soil and end up in the pond. This is true for residential and agricultural areas that surround the pond.
3. Human and dog waste. A lack of public toilets and off-leash dogs has led to White Pond being used as a bathroom facility. Trash and suntan lotion from bathers is directly transmitted to the pond.
4. Erosion. Soil, chemical and trash run-off reach the pond after rainfalls. Erosion is cited in all studies as a contributor to excessive toxic algae in ponds.
5. Trout restocking. There are multiple results of trout stocking including imbalance of the local ecology and overstocking that results in dead fish decaying at the bottom of the pond. White Pond historically had no fishing of interest: Thoreau wrote that “This pond has rarely been profaned by a boat, for there is little in it to tempt a fisherman.” [THOREAU] There is a causal relationship but no data showing that rainbow trout deplete zooplankton, which itself feeds on algae [HERRERA].
6. Beachfront development. The development of the Town of Concord’s White Pond beach property has the opportunity to help or harm pond water quality. Development could hold water quality as a foremost priority, which would lead to less runoff opportunities and keeping in place factors like tree roots that absorb water. Or it could encourage runoff including from further areas of the watershed district. Development designs and people management policies could also reduce opportunities for trash or nutrients left behind.
7. Water levels. Visual observation shows pond levels at low levels compared to recent memory and the high levels seen at Walden Pond. A drawdown of the water table decreases the available amount of water to manage algae levels.

Solutions

Solutions are available for each contribution to toxic algae blooms:

- The Town of Concord has an existing wastewater treatment plan for White Pond developed in 2000 and republished in 2003. In the view of WPAC, implementing this plan is the single most important long-term action that can be taken.
- Inform groundwater overlay district residents of restrictions for chemical and natural fertilizer use. Similar to how the Town of Concord institutes lawn watering restrictions, the Town must issue guidelines to residents on how and when to apply

lawn fertilizer. The use of chemical fertilizers in the pond watershed area should be banned. The use of natural fertilizers should be managed proactively. Other communities in Massachusetts already have fertilizer laws in place for protection of wetlands and surface waters [ORLEANS].

- Human and dog waste. An increase in Ranger supervision and trash receptacles can work together to reduce, but not eliminate, human and dog waste at the pond.
- Erosion run-off. The Town has made great progress in reducing erosion run-off through building fencing and installing coir. We encourage these efforts and look for them to continue.
- Trout restocking. The Town of Concord has written two letters to the State of Massachusetts Department of Fish and Game to end rainbow trout restocking at White Pond. Fish and Game have not responded and again, following receipt of the first letter, stocked White Pond in March 2021 with only rainbow trout. This is counterproductive to the Fish and Game department’s own mission of helping visitors enjoy recreational activities: Analysis conducted by White Pond residents show that one ton of rainbow trout decay results in as much as 10.66 kg of phosphorous, or up to four times the amount of non-stocked lakes. This phosphorous speeds the decline of the pond. Further, summer temperatures seen to be speeding trout deaths due to poor habitats.
- Beach development. The Town of Concord should prioritize White Pond water quality in the design and construction of the beach area. For example, the 1200’ ramp should be paved with a permeable surface rather than an impermeable surface. Although this would require annual cleaning and hence a greater cost, the net benefit of less nutrients flowing into the pond will worth the cost. For the entire beach project, the logic should be that if White Pond is unusable then the Town’s investments will go to waste. It is a better plan to preserve water quality early in the design and build phases.
- Water levels. More study is needed to understand the impact of pumping on the pond and its impact to the ecology.

Problem	Solutions
Septic systems leach nutrients through soil	Neighborhood sewage treatment
Lawn treatment run off	Issue best practice guidelines to residents on when and how much fertilizer and chemicals to use on lawns. Longer-term, work to create Town bylaws for Groundwater fertilizer management.
Human and dog waste	Increase Ranger supervision. Install trash receptacles with regular pick up.

Trout restocking	Engage with State Rep to stop rainbow trout restocking by Mass Fish and Game. Engage with MA Secretary of Energy and Environmental Affairs as necessary.
Beach development	Prioritize pond water quality in beach design and construction decisions
Water levels	Further study needed to understand the impact of pumping

In the short-term, the Town has been successful in stabilizing efforts of recurring erosion and in cleaning out catch basins. The Town should continue these practices to maintain existing water quality. The Town should revise and update the regulations concerning White Pond Conservation and Reservation lands to disallow swimming from those properties. Current temporary signs can be made permanent, and fines can be implemented for rule-breakers.

The recent test by P-POD Technologies, LLC to physically remove toxic algae from White Pond is an excellent contribution to mitigating the problem once it is apparent. The Town is encouraged to continue to engage with P-POD to continue this project into commercial application. However, removal after-the-fact does not reduce the need to mitigate the initial contributors of nutrients to the pond. P-POD will be no replacement for corrective action.

Longer-term, the Town should regularly check the condition of erosion controls and repair as necessary. The Town should definitively clarify who is responsible for the ongoing catch basin maintenance. Once the responsible party is identified – Town or State – the Town should work with that party to establish a plan for annual catch basin cleaning along with a less frequent full maintenance check. The new system should recommend a maintenance program. A critical “minimum” water level should be established and if water is below that level, pumping from the White Pond well should be reduced until recovery.

One area where the Town and residents have no control is climate change. It is expected that climate change will further aggravate the degradation of pond water quality as temperatures warm and more extreme weather events occur.

Water Quality Detection, Prevention and Control

The Town of Concord must establish a pond-wide testing and notification program for all residents and visitors. The current protocol is to test and notify Beach permit holders only and post occasional signs around the pond that are often destroyed. This process leaves most residents and visitors unaware of pond water safety.

Algae blooms may appear or disappear from day to day, but this does not mean the water is safe for swimming or recreation. The US Environmental Protection Agency [EPA] notes that recreational bodies of water including managers and public health officials need to develop a risk based monitoring plan in place for waters that are potentially vulnerable to blooms that considers the following information:

- Existing and historical recreational water quality
- Sampling considerations
- Analytical methods
- Sampling/testing logistical considerations
- Use of predictive tools
- Frequency and number of people using the recreational water

The Town should establish concrete measurements goals and water quality be measured against those goals each year. This requires reasonable goal setting along with an efficient and effective water quality monitoring plan.

One potentially new issue to monitor is water level. Should the White Pond water level continue to fall, the effect of pumping from the nearby White Pond well should be studied to determine the extent to which it affects the water level. It may be necessary to reduce the pumping if it is determined that the withdrawals from the White Pond aquifer significantly contribute to the water level decline.

People Management

Concerns

The attractiveness of White Pond has become known throughout the region, with the pond appearing on social media sites as a top place to visit [TOP7] [50SWIMS]. A warm summer day will bring 200 visitors to Sachem's Cove, many of whom are out of town guests parking on neighborhood streets and some of whom reach the pond by sliding down already eroding hillsides. While early morning fishermen are welcome, it is normal to find discarded beer cans, cigarette butts, plastic wrappers, plastic bags, animal feces and fishing line later in the day. Human waste goes directly in the pond and swimming in prohibited areas is common. Combined, visitors to unmanaged areas of White Pond contribute to a degradation of water quality and the surrounding land areas.

People management concerns at White Pond in 2021 are identical to what was found in 2015, including substantial traffic for small residential neighborhoods abutting the pond, speeding, loud evening noise and trash left behind. People management has worsened since 2015: the extension of the Bruce Freeman Rail Trail to Powder Mill Road has made it easier for walkers, bikers and skateboarders to access entrance points to White Ave Beach, Stone Root Beach and Sachem's Cove [RASMUSSEN]. Trespassing by and personal confrontations with swimmers crossing private property have been reported to the WPAC. Large amounts of trash are often left behind by visitors including soiled diapers, drink bottles and cans, snack wrappers, styrofoam, clothing and cigarette butts.

People management concerns are not limited to Concord neighborhoods. Sudbury residents at Frost Farm, near the southwest corner of the pond, have reported similar issues especially noting speeding and nighttime disturbances. [MURPHY] it is expected that

the Cold Brook Crossing development on Route 117, with direct access to White Pond trails, will result in a surge of new visitors. There is no current communication plan between the Town of Concord and the Town of Sudbury on White Pond matters.

The imminent construction of the Bruce Freeman Rail Trail (BFRT) Section 2C threatens to exacerbate many of these issues since tens of thousands of additional trail users [BFRT] are anticipated and will view White Pond as a point of destination off the trail. The BFRT is aware of these issues and has proposed fencing to the Massachusetts Department of Transportation as part of the 75% design plan.

The most effective part of people management at White Pond is the public beach now managed by the Town of Concord. The sale of beach passes ensures that capacity limits are maintained, and lifeguards employed by the Town patrol for litter and other pond abuse. However, there is often poor understanding of where swimming is allowed, and residents and out-of-town visitors are known to use abutting and alternative areas to the beach for pond access. The Town is effective at notifying beach pass holders of pond closures due to water quality issues.

Solutions

Visitors to the pond, many of whom are well-meaning, have a cumulative impact on the negative health of White Pond's water quality and ultimately sustainability. For White Pond to thrive as a community and area resource going forward, the Town must be proactive in ensuring people management especially during weekends and evening hours. Individual people management policies will be ineffective if taken in isolation.

A holistic solution to White Pond people management begins with pinpointing the most problematic behavior areas and redirecting visitors to safer options. More Ranger patrols, especially on weekends and at night, can deter visitors from abusive behavior simply by an official presence. No parking signs on Dover, Alden and Anson Streets can prevent dangerous interactions and litter for surrounding communities. Coordination between the Town of Concord and Sudbury Police Departments can support safety at the pond especially once the Cold Brook Crossing development is complete.

Social media also plays a role. The Town, WPAC and neighboring residents can comment on social media sites that public access to White Pond is limited and that swimming is allowed only at the public beach. The Town's website and websites for the Bruce Freeman Rail Trail can include language that discourages visitors from taking a swimming or recreational break at the pond.

Similar to State of Massachusetts policies, the Town of Concord should implement fines for swimming outside of designated Town areas with exceptions only for private landowners. Prominent and permanent signage along with a Ranger presence can help deliver the message before fines are given.

Problem	Solutions
Overuse of the pond	More Ranger patrols Fines in no parking areas and installation of additional no parking signs Fines for littering Permanent and prominent signage
Uneven communication to town residents	White Pond-specific social media on swimming and fishing safety
Swimming in illegal areas	Permanent and prominent signage Fines for illegal swimming
Bruce Freeman Rail Trail and Sudbury Route 117 development will significantly increase public access	Effective fencing on the rail trail can deter visitors Close coordination with Sudbury police can help users understand the importance of safe behavior

Call to Action

The WPAC calls on the Select Board and Town Manager to make the safety of White Pond water a priority.

The Town has implemented several positive programs in the last six years, including erosion control, the hiring of a new Ranger and improved signage on trails and at Sachem’s Cove. However, these efforts are small compared to the larger task of reducing nutrient flow to the pond.

Neighborhood concerns also need greater attention. For example, citizen petitions for limiting parking on Anson and Alden streets, despite following established town protocols, have yet to be acted upon. The Town has long been aware of the various concerns surrounding White Pond access, including new opportunities arising from the Bruce Freeman Rail Trail and the Cold Brook Crossing development.

Several local organizations are active in managing and/or advocating for White Pond. Besides WPAC, the Friends of White Pond (FWP, an advocacy group that publishes an annual educational newsletter *Ponderings*); Preserve White Pond, a community group; and a Concord Carlisle High School group are active. All organizations stand ready to support the Town in delivering on the recommendations in this report. However, the Town of Concord is the only body that has the authority and resources to implement lasting change, some of which rely on coordination with the State of Massachusetts.

Clear mandates for water quality, testing and people management improvements must be made by the Select Board and Town Manager for White Pond to survive as a community and area resource. A failure to address these issues will mean the expected closure of the

pond and beachfront property during warm months going forward. WPAC recommends that the town consider these recommended and potential solutions in order to maintain and hopefully improve this valuable resource and preserve White Pond for future generations.

Appendix A: Guiding Principles

Guiding Principles for the Development of a Long-Term Vision for White Pond

White Pond Advisory Committee

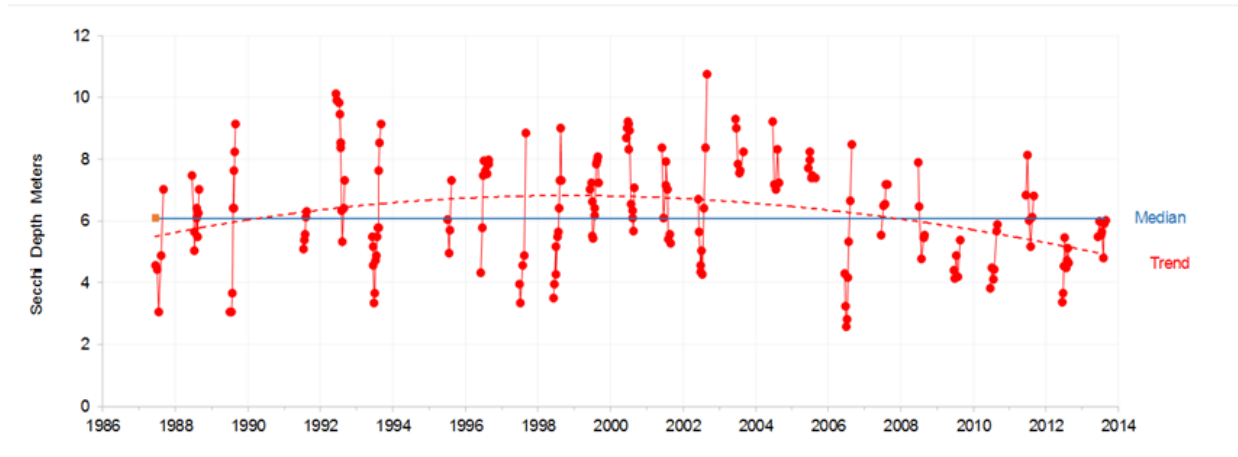
30 August 2021

1. Our commitment to White Pond is for today and the future.
2. We will strive to restore and maintain water quality to the highest previously measured levels.
3. We will strive to preserve and protect the watershed, its land, flora, and fauna.
4. We will seek to sustainably maintain a natural environment and a safe, clean, and enjoyable experience for all users of White Pond and its watershed.
5. We will advocate managed, public access to White Pond and its watershed for all Concord residents.
6. We will advocate solutions to White Pond neighborhood problems.
7. We will seek to build a broad base of support for White Pond in order to ensure effective long-term advocacy.
8. We will expect the town of Concord to make ongoing formal commitments to resources, budget, and enforcement in order to affect the above principles.

Appendix B: White Pond Testing and Water Level

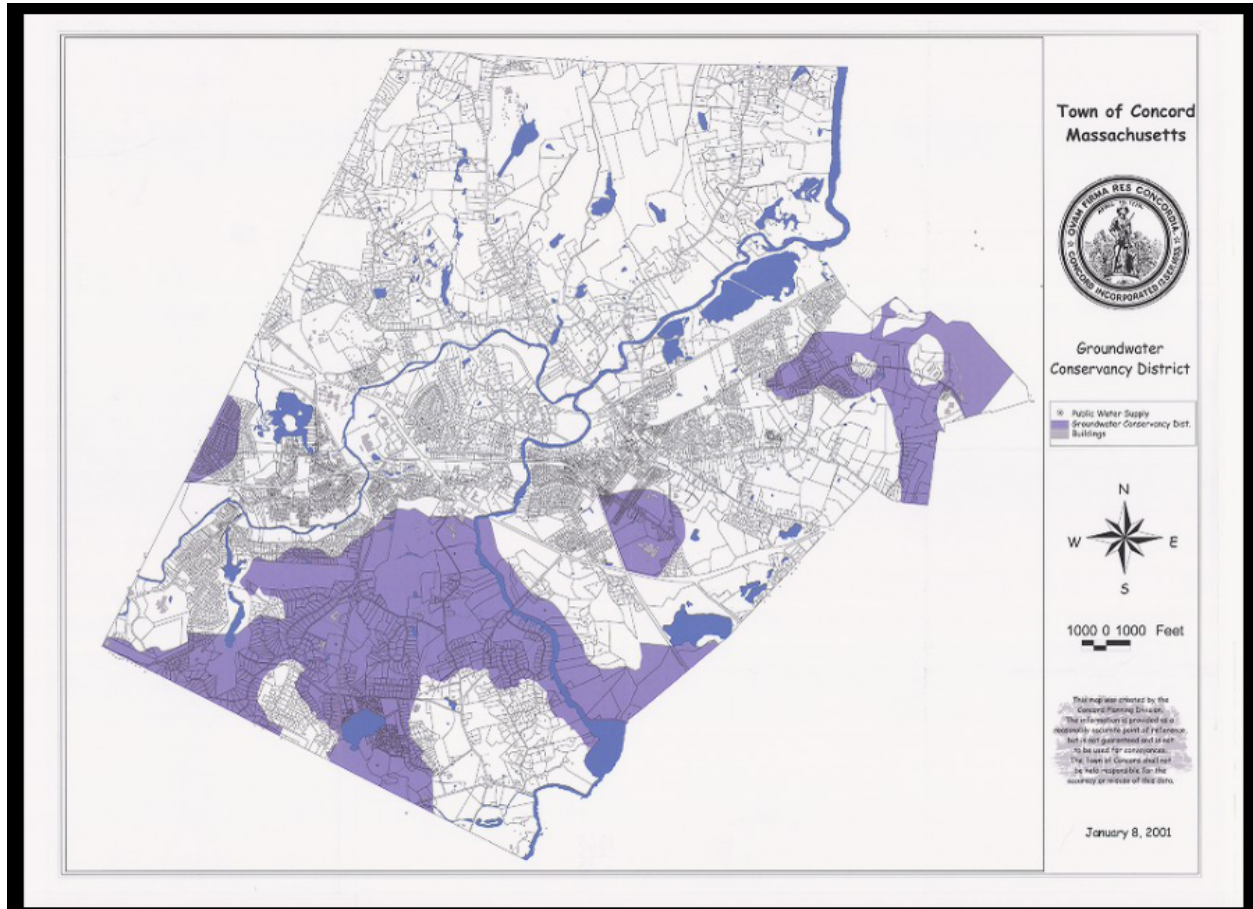
White Pond's historically clear and clean water is perhaps its greatest feature, providing a wide variety of recreational opportunities for Concord residents. Thanks to a long-term monitoring effort by Concord residents Dr. Bill Walker and Judith Sprott, we have a detailed record documenting key parameters such as dissolved oxygen, these efforts have been continued by Kate Blair, Carmen Jaquier and others to the present time on temperature, and especially transparency. Figure 1 below presents Secchi Depth measurement from 1987 to 2013 [WALKER], with water quality trending negatively for the last dozen years clearly indicated.

Figure 1: White Pond Long-Term Trends in Secchi Depth, June-August 1987–2013



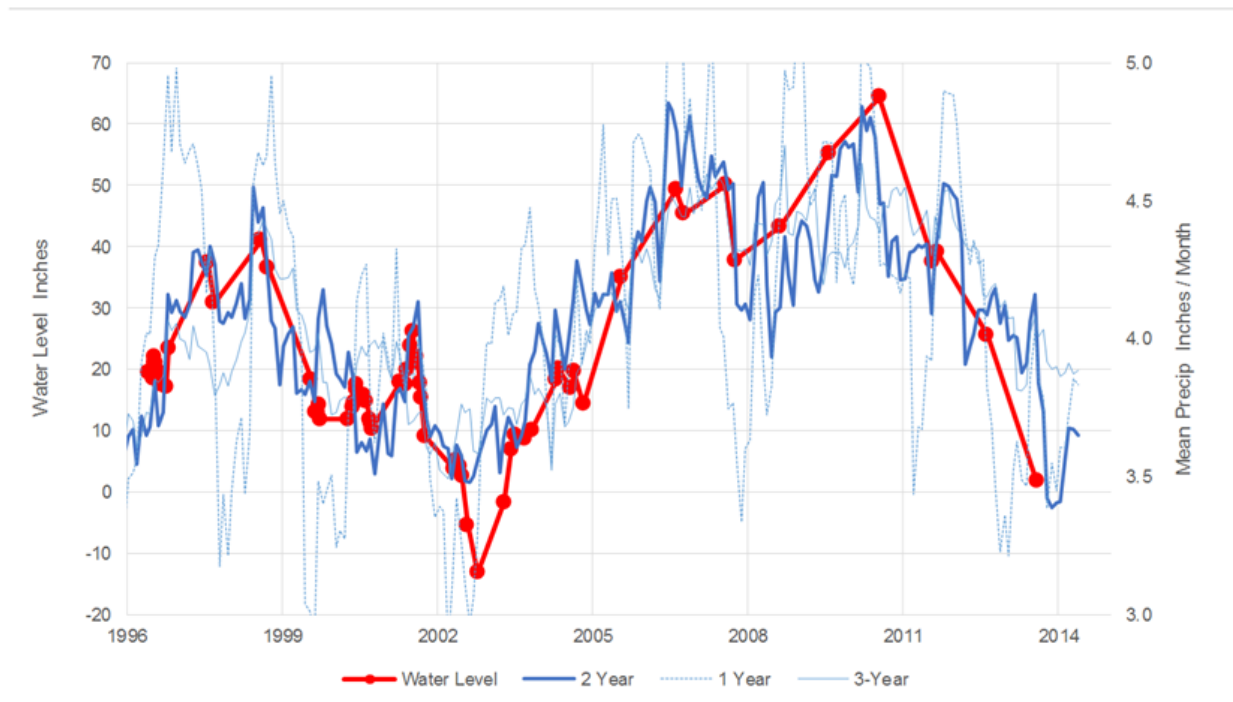
In the last six years, the frequent appearance of blue-green algae, or cyanobacteria, has forced closures of the pond. It is clear to all water scientists and public health officials that WPAC consulted that an over-provision of nutrients in the water is primarily responsible. New England kettle ponds have proven to be particularly susceptible to this type of algal bloom [CAPECOD]. The White Pond groundwater conservancy district in Figure 2 shows the area that must be elevated to priority status for nutrient contributions.

Figure 2: Town of Concord, Massachusetts ; groundwater conservancy district



White Pond's water level has been observed to vary dramatically over the years as shown in Figure 3 [WALKER]. In the last five years alone, we have observed both the highest and lowest levels in recent memory. During this same period of time, pumping rates from the White Pond well increased substantially, more than doubling the previous maximum pumping rates [ESS]. While it appears that the water level strongly correlates with precipitation, the effect of pumping from the White Pond well is not well understood. Prolonged periods of extremely low water level could have adverse effects on water quality and especially aquatic life. More study is needed to find the impacts of pumping.

Figure 3: White Pond Water Level vs. Precipitation 1996–2013



Appendix C: Causes and Effects of Cyanobacteria Blooms

The environmental conditions that allow toxic cyanobacteria blooms in water bodies such as white pond are somewhat specific.

First, water quality must be poor. Excessive cyanobacteria in itself is a sign of poor water quality. The water must have high levels of the contaminants like phosphorus and/or nitrogen for blooms to occur. These contaminants are often referred to as “nutrients” in the science literature because they nourish bacterial and algae growth.

Cultural eutrophication is the process by which water bodies acquire high concentrates of contaminants – eutrophication occurs naturally for all ponds but cultural factors - agricultural activities, human wastes, or industrial pollution – speed up the process. Substantial work has been conducted on natural and cultural eutrophication at Massachusetts ponds [Bennett].

Second, the water temperature must be high (> 10-15 deg C). Seasonally, this often occurs in the summer and early fall at white pond.

Third, water needs a long hydraulic retention time (> 1 month). White pond, like Walden Pond, has a very high hydraulic retention time, estimated to be 4 years. This is unusually

high due to the geomorphology of kettle ponds: there is minimal substantial surface inflows and outflows into kettle ponds like White pond.

The possible sources of White pond's cultural eutrophication include, but are not limited to, septic systems and fertilizer runoff. The subsurface infiltration of groundwater influenced by septic systems is known to carry nutrients at elevated levels. Drought conditions can also increase the likelihood of blooms where contaminant loading remains constant from septic systems into a lower volume of water of a pond for dilution. Runoff from animal feedlots and from fields containing mineral fertilizer or manure can also introduce similarly high nutrient loads.

A recent study on White Pond' eutrophication found that:

“Cyanobacterial blooms have become a frequent health hazard, and benthic anoxia has become more extreme than at Walden. The town and shoreline residents have recently increased the availability of sanitary facilities for visitors and stabilized some of the slopes and footpaths around White Pond, as was done previously at Walden (Maynard 2004). Nonetheless, anticipated long-term warming and increased runoff are likely to amplify the risk of water quality problems in both ponds. Monitoring the benthic macrophyte communities could represent an early warning system for such ecological changes in the future.” [STAGER]

Many septic systems are on the banks of white pond, and their drainage fields leach directly into the groundwater that recharges the water. In some limited instances, septic systems on the pond are so close to the water that they do not comply with current town standards for minimum setbacks from surface waters. In addition, it is unclear if all septic systems are being discharged correctly.

Agriculture operations have been limited recently and the agricultural fields near White Pond do not surface runoff into the pond, according to studies done by classes at CCHS. No manure or fertilizers have been applied to these fields for some years. There have been no agricultural activities on these lands in 2021.

Cyanobacteria blooms can have many detrimental effect on a pond's ecosystem. An overgrowth of algae consumes oxygen and blocks sunlight from underwater plants. When the algae eventually dies, the oxygen in the water is consumed. The level of dissolved oxygen in this water can fall to levels that are too low for many aquatic insects and fish to survive. This can cause extreme changes in habitat and lead to the “death” of the pond.

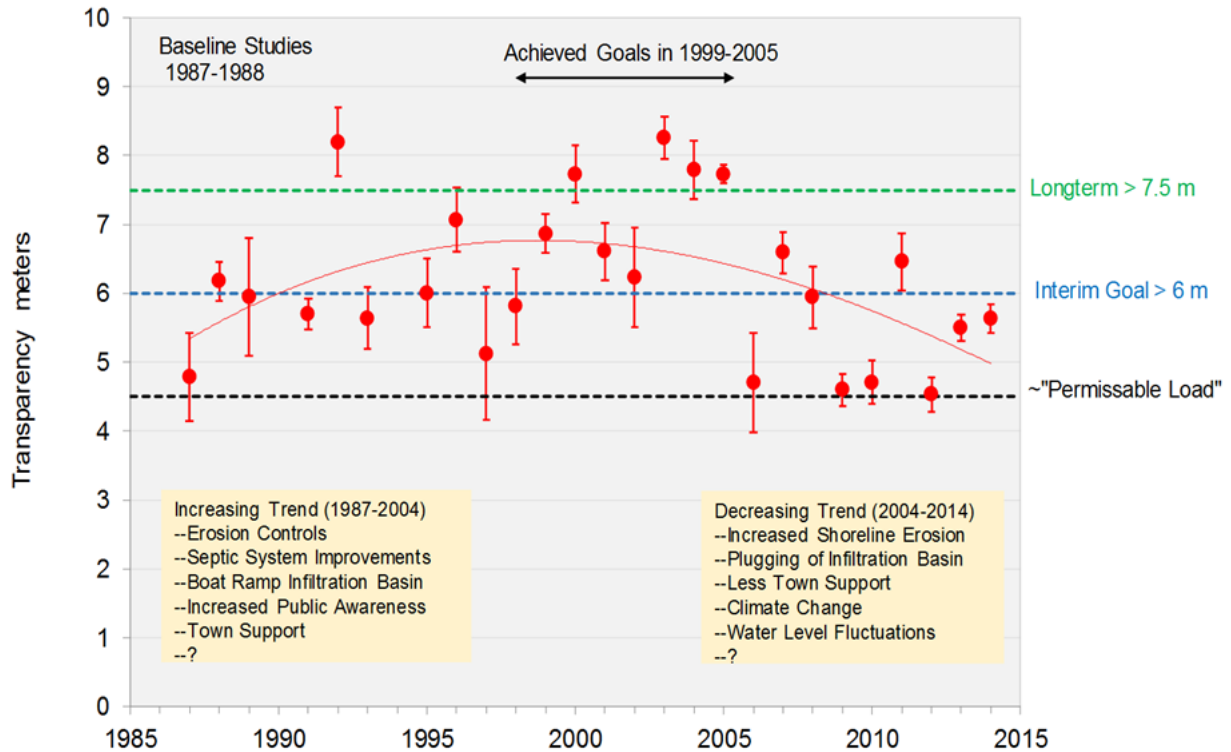
The impacts of these algae blooms on humans and can be significant, ranging from respiratory and gastrointestinal problems in people to the death of animals including family dogs. Skin exposure alone can cause severe problems to humans.

Appendix D: Monitoring, Testing and Pond Closures

As an initial step, WPAC recommends the adoption of Dr. Bill Walker's Water Quality Monitoring and Restoration proposal [WALKER]. He proposes using Secchi Depth Transparency as the key water quality metric and that the goal be the achievement of transparency depth of 7.5 meters – the measured transparency in the 2000-to-2005-time frame. This proposal is based on 27 years of measurements using the simple, low-cost Secchi depth measurement. Other metrics, such as phosphorous loading, are more complicated and costly and the related water quality goal derivation more complex. While additional measurements beyond Secchi depth would also be required, the measurement would be much less frequent, and less costly. Thus, measuring transparency better balances complexity, effort, and cost.

Under this proposal, transparency would be measured weekly as it has been for the last 27 years, thus ensuring data consistency. The effect of restorative efforts would be observed by comparing newly taken measurements to previous measurements as per Figure 4. The decision to apply restorative efforts should consider whether or not the restorative goal has been reached as well as the existing trends. Whether or not additional efforts are necessary can be directly judged by comparing the measurements and trends taken after the mitigation efforts have been completed to the historical data.

Figure 4: Proposed Restoration Goals for White Pond Water Quality



Symbols	June-August Mean Secchi Depth +/- 1 Standard Error	Approximate Percentile vs.
Solid Line	Long-Term Trend	Other Deep Lakes in Northeast
Dashed Lines	Goals Consistent with Anti-Degradation Standards for High-Quality Waters	
Longterm Goal	>7.5 meters or 25 feet, Best Observed over 3-Year Period (2003-2005)	91%
Interim Goal	>6.0 meters or 20 feet, Best Observed over 7-Year Period (1999-2005)	74%
Historical Min	4.5 meters or 15 feet, Approx. Equivalent to "Permissible Load"	45%

There are multiple options for how testing can be accomplished. As a different example from Secchi Depth Transparency, the Army Corps of Engineers manage Tully Lake in Athol, MA and have hired a contractor who conducts Weekly Cyanobacteria Monitoring Procedures including:

- Water Sample Location Testing sites
- Field Observation Form
- Water Sample Float Test
- Water Sample Toxin Test Strip
- Water Sample Secchi Disk Test
- Temperature, DO, pH

If cells are observed through field observation monitoring, then a Water Sample Fluorometer Analysis is conducted for Chlorophyll-a and Phycocyanin.

If trends are detected with the normal weekly monitoring, then the toxicity/concentration testing by a lab is performed. This is done for a confirmation of how toxic/dangerous the water is to humans and wildlife. At this point, if an intervention is needed, a treatment of copper sulfate may be deployed to prevent the bacteria from proliferating and to keep the beaches open. Tully uses copper sulfate but many water management programs treat with alum, which has a long-term effect but initial costs are more expensive.

The Town should establish clearer guidelines for beach closures and reopening's and extend these to the pond. The State of Vermont [VERMONT] for example will close any public beach if any of the following conditions are met:

- Visible known blue-green algae bloom/scum or an unknown, potentially blue-green algae (i.e., not pollen), bloom/scum
- Microcystin-LR (equivalents) concentration greater than or equal to 6 ug/L (ppb)
- Anatoxin-a concentration greater than or equal to 10 ug/L (ppb)

The State will reopen beaches only if all three of these conditions are met:

- No visible blue-green algae bloom/scum
- Microcystin-LR (equivalents) concentration is less than 6 ug/L (ppb)
- Anatoxin-a concentration is less than 10 ug/L (ppb)

Testing should not be limited to the beach but should incorporate all areas that create a health risk. There should be a universal plan with designated responsible parties and consistent funding. Ultimately, WPAC recommends that the Town take over testing of White Pond and incorporate the following criteria:

- Cell counts of the cyanobacteria including number of cells/ml. water
- Individual and composite samples
- Break out counts by species of Microcystis vs. other species

WPAC recommends that testing of some sort be immediately deployed and budgeted. Relying on only visual observation is not robust enough.

References

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