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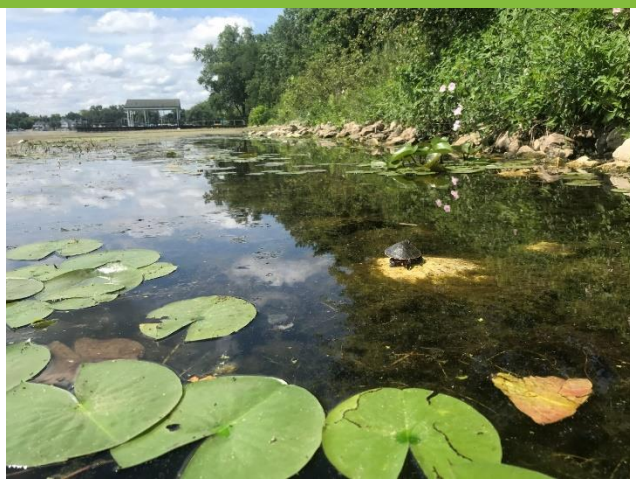
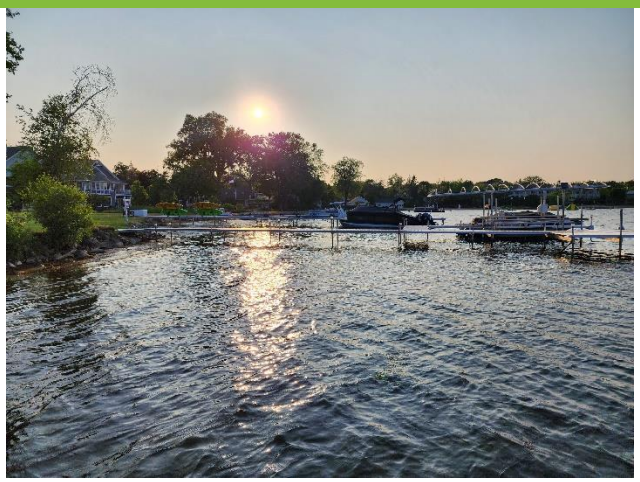
BANGS LAKE

LAKE MANAGEMENT PLAN

2024-2028





Acknowledgements

Thank you to the following for their participation in creating this document:

- The Village of Wauconda staff for providing information regarding current and past management activities.
- The Lake County Health Department for collaborative data collection.
- The Village of Wauconda community members who participated in the community survey.
- Bangs Lake lakefront property owners and Lindy's Landing Restaurant and Marina, who provided lake access for data collection.
- Joe Rush, Owner, JadEco Lake and Natural Resources Consultation and Management who reviewed this document for scientific accuracy.

We also appreciate access to historical information on Bangs Lake, which provided substantial baseline information for this plan. Information provided by the 2014 *9-Lakes Watershed Based Plan* and other reference materials offered valuable components related to the recommendations in this lake management plan.

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Introduction

Bangs Lake is a 306-acre natural glacial lake in the Village of Wauconda, Illinois. The lake serves as a recreational resource for residents and tourists, with the added benefits of providing flood control and habitat for wildlife. The lake also serves as an economic driver for the community, including enhanced property values. Studies conclude, however, that waterfront property values decline by 8% to16% as invasive aquatic plants dominate a lake (Horsch and Lewis, 2009; Zhang and Boyle, 2010). Protecting and improving this critical recreational, natural, and economic resource is a high priority for the Village of Wauconda, which manages a significant portion of the lake.

Village of Wauconda leaders recognize the ongoing challenges of invasive species, land development, shifting climate patterns, and the accumulation of nutrients & sediment in the lake. This has led to the development of this lake management plan to ensure that Bangs Lake continues to serve the needs of the community as a high-quality recreational and environmental resource.

The purpose of this lake management plan is to provide a road map for stakeholders who have an influence on how Bangs Lake is used and managed. The plan includes detailed recommendations for management and restoration with the goals of "establishing a healthy and sustainable lake, and an enjoyable lake experience" in a manner that is sensitive to the needs and available resources of the Village and the community. Recommendations along with associated budgets provided in this plan span five years from 2024 to 2028.

How to Use This Plan

Lake management plans rely on data to draw conclusions upon which recommendations are made. Data collected in the field as well as historical data used to formulate this plan are extensive. Stakeholder feedback was also used to develop the recommendations in this plan. Extensive data was collected in the form of community surveys, in-person interviews, published village goals, historical monitoring records, recent sample collection/analysis, and regulatory policies. Given the volume and complexity of the information analyzed to draw conclusions, a summary of recommendations is presented at the beginning of this plan with supporting data, community feedback, and specifications are presented as Appendices.

Each recommendation is tagged with reference(s) to supporting information within the appendices that follow the recommendations section of this plan.

There are multiple factors that can affect the implementation of the recommendations presented here. An important feature of this deliverable is the plans' built-in flexibility to consider these factors and the commitment of ILM staff to work with Village representatives for up to 90 days after submittal to adjust the plan as needed.

Goals and Recommendations

The goals of the Village of Wauconda as it relates to Bangs Lake are:

Goal One: Maintain a healthy lake environment.

Goal Two: Ensure the sustainability of Bangs Lake as the Wauconda area develops.

Goal Three: Provide a safe and enjoyable lake experience for all stakeholders.

Goal Four: Enhance the positive economic impact Bangs Lake has on the Village and its residents.

The following recommendations aim to balance the preservation of the lake's ecological integrity with the community's need for recreational opportunities and sustainable growth. In addition, these recommendations strive to highlight and enhance Bangs Lake as a critical economic driver for the Village of Wauconda and its residents. Ongoing monitoring and adaptive management will be essential to ensure the effectiveness of these recommendations over time.

Based on field observations and data collection (water quality, sediment, and plant composition), historical information, community survey results, and Village input, the top eight recommendations to achieve the above stated goals in order of priority are:

1. Control Excessive Aquatic Plant Growth

2. Improve Education and Communication

3. Determine Lake Carrying Capacity and Update Lake Use Regulations

4. Conduct Regular Lake Monitoring and use data to drive future management activities

5. Ensure Sustainable Management and Funding

6. Restore High Profile Shorelines

7. Slow or Reduce the Flow of Nutrients into the Lake from the Watershed (External Loading)

8. Reduce the Recycling of Nutrients from Channel Sediment (Internal Loading)

Considering all lake management “best management practices” commonly available (Appendix 1), and results from the community survey (Appendix 10), recommendations to achieve the stated goals are described in more detail below. Estimates for implementation are based on 2023 costs and may be affected by inflation and other factors over time.

Recommendation Descriptions

1. Control Excessive Aquatic Plant Growth

The Village presently administers an aquatic plant harvesting program intended to improve the boating experience in Bangs Lake and an annual cost-share program with lake-front property owners for targeted chemical treatments. The combined cost of these practices is approximately $110,000/year (Appendix 11).

Plant surveys indicate that the results of these practices, as currently performed, are ineffective. The number of native plant species in the lake is *decreasing* while the density and footprint of non-native/invasive aquatic plant species is *increasing* (Appendix 7). Operation of the Village-owned harvester has also resulted in significant amounts of uncollected aquatic plant material that not only allows for the spread of certain plant species through fragmentation but also creates issues with plant material accumulating along private lakefront shorelines.

In addition, the management of the current aquatic herbicide application cost-share program has proven to be only moderately effective. Ill-timed applications made in the middle of the growing season instead of early in the season cause more harm than good. The formation of harmful algae blooms result from the decomposition of decaying mature plants after late herbicide applications, adding excess nutrients to the water. Also, the sudden absence of plants at a time of year when juvenile fish require plant cover to avoid being vulnerable to predation also negatively impacts fish populations.

It is recommended that the Village suspend the harvesting and aquatic herbicide cost-share program and replace them with a three-year whole-lake aquatic plant herbicide treatment regime validated by a monitoring program to track effectiveness. This aquatic plant herbicide management approach will need to be reevaluated after the third year (at that point a whole lake treatment is typically not necessary, and program can transition to a less costly spot treatment regime of invasive plants in years four and five). This whole lake herbicide treatment should result in immediate improvements to the lake ecology by targeting unwanted non-native aquatic plants that grow early in the spring and allow for desirable native plant species that grow later in the season. The resulting condition of fewer aquatic plants and the absence of plant fragments caused by the harvester should give early credibility to the Villages' efforts to improve the lake. It can be expected that this highly visible success will lead to greater cooperation and acceptance of other lake improvement initiatives.

Estimated Cost: $110,000/year for three years. (See Appendix 17 for specifications)

2. Improve Stakeholder Communication, Education and Engagement

Results from the community survey (Appendix 10) show that stakeholders want more information to better understand the issues facing Bangs Lake. When asked what they would like to learn more about, the top three responses were:

- Ways they can help improve the quality of Bangs Lake (71%)
- Factors contributing to poor water quality (69%)
- Understanding lake ecology and management (60%)

Developing and implementing a strategy to effectively educate stakeholders and communicate information and data that drives decision-making is recommended. An educated constituency will help limit resistance to improvement efforts based on inaccurate or misinterpreted information and encourage behavior change. Educational efforts can also help build support and grass-roots advocacy, leading to policy adherence.

An example of a successful education campaign that promotes behavior change is the national *Stop Hitchhikers* program. The program educates lake users (primarily boaters) about the threat of unknowingly bringing invasive species attached to boats, trailers, or fishing gear (Appendix 9). Similar campaigns can be developed for issues specifically impacting Bangs Lake, like shoreline erosion and nutrient pollution.

Educational approaches can include presentations, webinars, e-newsletters, social media campaigns, interpretive signage, and printed collateral. Budget will depend on the extent of these campaigns. **It is recommended that the Village of Wauconda designate a Communication Coordinator to oversee these programs.**

Estimated Cost: $35,000/year (Village run or contractual) (Grant fundable)

Local Lake County stakeholder meeting to discuss dredging (photo source: ILM Environments)

3. Determine Lake Carrying Capacity and Update Lake Use Regulations

According to the results of the community survey shared with Village of Wauconda stakeholders in the summer of 2023, lake use satisfaction has declined over time (Appendix 10). Poor boating experience and boating safety were called out as specific concerns. The perception is also that the quality of the fishing experience is not what it used to be. Forty percent of the survey respondents wanted more information on regulations regarding using Bangs Lake.

As watercraft concentration and lake use increases, environmental quality, user enjoyment, and safety can be expected to decrease. In the long run, less enjoyable, unhealthy lakes can translate to less recreational opportunities leading to economic losses due to less local tourism, and declining property values. **A recreational carrying capacity study is recommended as a key first-step leading to a plan to keep Bangs Lake safe and available for multiple uses and to address constituent concerns raised in the survey.**

Recreational carrying capacity is the amount of development and activity a body of water can withstand before lake conditions deteriorate. The results of the study will offer suggested limitations, requirements, and regulations to protect the health of the lake and ensure safe boating operations leading to a satisfactory recreational experience.

Determining the carrying capacity of Bangs Lake will require an evaluation of the physical characteristics of the lake (useable lake area, pier locations, pier lengths, etc.) and an entire season of inventorying lake activities and lake user behaviors. The data collected can lead to guidelines for boat sizes, uses, and the number or type of vessels active on the lake simultaneously.
An added study component should clarify the roles and responsibilities of the various entities involved in managing Bangs Lake. Lack of a clear understanding of roles was a concern expressed in the survey.

Estimated Cost: $15,000

Concerns with boat traffic can be addressed with a Carrying Capacity Study (photo source: Les Palenik)

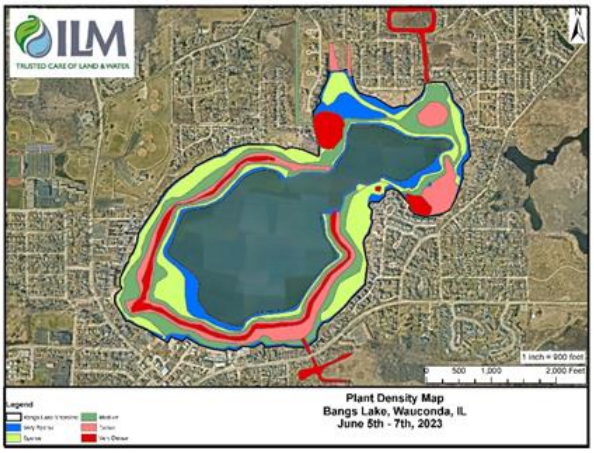
4. Conduct Regular Lake Monitoring

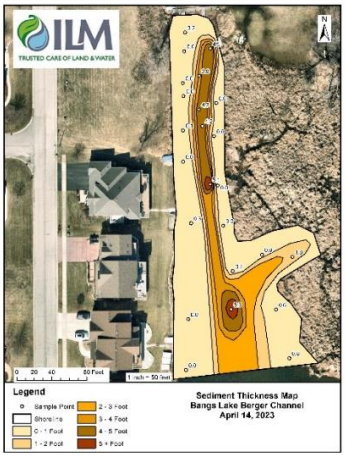
Lakes and ponds are complex ecosystems with numerous inputs and outputs that can impact lake quality. Understanding the dynamic hydrological conditions contributing to a lake's health is essential for proper management.

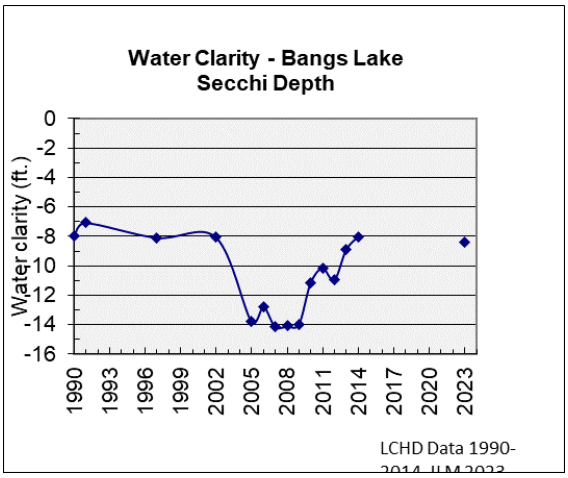
A robust monitoring program enables lake management professionals to stay abreast of key indicator parameters and address potential issues before they develop into more significant problems. These issues may be related to sediment and turbidity, thermal stratification, internal and external nutrient loading, and algal blooms, among others (examples below). **A multi-faceted monitoring program is recommended to allow for adaptive lake management practices that reflect changes in watershed characteristics in addition to community priorities, regulations, and budgets.**

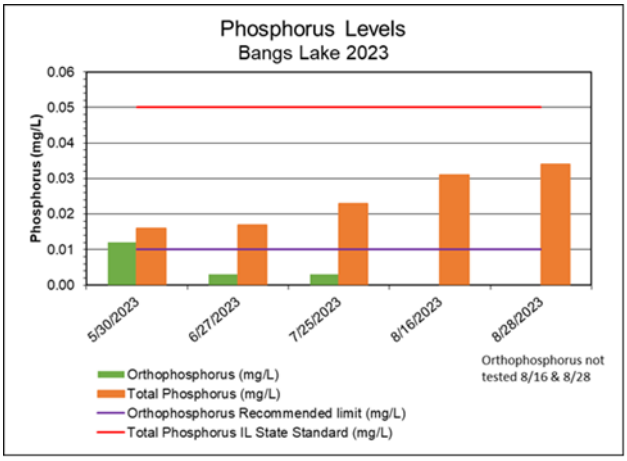
Based on the Bangs Lake data collection process developed by ILM as preparation for this lake management plan, an outline for a suggested monitoring program is described in Appendix 14.

Estimated Cost: $45,000/year (Adjustable relative to availability of existing resources)









5. Ensure Sustainable Management and Funding

The intentional and thoughtful management of a lake requires investments of time, resources, and money. Current staff resources and funding levels to manage Bangs Lake cannot support the recommendations in this plan (Appendix 11). Additional sources of funding need to be explored and evaluated to increase revenue in support of the stated goals (Appendix 12).

While direct tax assessment through a new SSA or existing property taxing bodies is one option to meet the growing funding requirements for improvement efforts to be sustainable, increasing taxes through traditional means is something that the Village must carefully consider. Additional options include, but are not limited to:

- Additional fundraising events.
- Implementing or increasing lake access or boat fees.
- Grant funding for qualifying projects.
- Bonding.
- Establishing a not-for-profit for private donations directed towards lake improvement efforts.
- Implementing a Village 'lake' tax or fee restricted to lake improvement efforts.

It is recommended that the Village invest in a fundraising position with experience in growth-oriented fundraising to fulfill this critical role.

Estimated Cost: $35,000/year (Village run or contractual)

6. Restore High Profile Shorelines

Eroding shorelines add nutrients to the lake and reduce the ability of lake users to enjoy lake activities as it leads to a soft and mucky lake bottom.

Adequate shoreline management is an issue throughout Bangs Lake (Appendix 5). A demonstration project is an effective way to educate the public on best management practices for shoreline restoration of Bangs Lake and encourage routine maintenance of native shorelines. Shoreline restoration will also prevent further erosion that adds to sediment accumulation and degraded water quality. Two suggested restoration locations are described below.

A restored *Wauconda Park District Cook Memorial Park* lakefront will serve as an example of a successful shoreline stabilization installation. The shoreline had been stabilized and some effort made to improve the vegetation immediately upland but subsequently neglected. Unintentionally, this has communicated to stakeholders that 'naturalized' shorelines are ineffective and unattractive. Constituents voiced this complaint in the community survey (Appendix 10). Restoring this site, planning for ongoing maintenance, installing interpretive signage about the

benefits of native shorelines, and communicating this project through regular communication outlets like e-blasts and social media posts would serve as the model project to inspire other lakefront property owners to consider a naturalized shoreline that would help improve lake water quality.

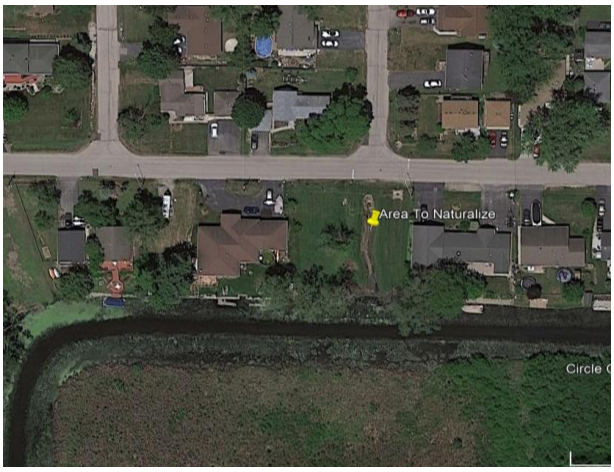
Estimated Cost: $20,000 for restoration and $4,500/year for ongoing maintenance (Grant fundable)

Cook Memorial Park Shoreline (buckthorn dominated)

Example of a Well-Maintained Shoreline

Village-owned vacant land located North of Circle Channel exhibits severe erosion along the channel shoreline as well as the conveyance that feeds into Circle Channel**. It is recommended that the Village naturalize this 0.15-acre property, including shoreline and conveyance restoration.** This will support reduced nutrient loading into the lake, deter geese, and improve aesthetics. This will also serve as another example of best management practices regarding shoreline restoration (Appendix 1) for stakeholders on their properties.

Estimated Cost: $14,000-$20,000 for restoration and $2,400/year for ongoing maintenance (grant fundable).



Vacant land North of Circle Channel

Degraded conveyance

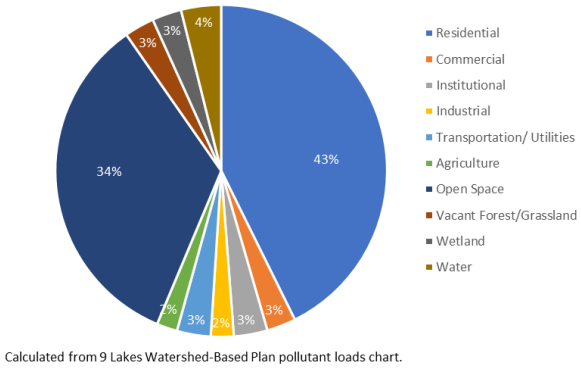
7. Slow or Reduce the Flow of Nutrients into the Lake from the Watershed (External Loading)

The process where nutrients enter a body of water through runoff from the surrounding land is called external loading. These nutrients can come from human-caused sources, such as agriculture, septic systems, and fertilizers. They can also originate from natural sources, like branches, leaves, and bird droppings. The extent of external nutrient loading is influenced by the quality and quantity of water flowing into Bangs Lake.

Excess nutrients entering Bangs Lake can negatively impact water quality. Bangs Lake presently ranks “high” for water quality among all monitored lakes in Lake County by the Lake County Department of Health (Appendix 2). The Lakes’ “high” water quality is mainly due to the land uses in the watershed. Nearly 40% of the Bangs Lake watershed is comprised of undeveloped open space and wetlands (Appendix 3, Figure 3-5 & Table 3-1). In addition, a large amount of runoff from developed areas first flows through wetlands before reaching the Lake (Appendix 3, Figure 3-11). These wetlands filter out sediment and excess nutrients demonstrated by the water quality data taken at lake entry (Appendix 3, Figure 3-6).

It is important to acknowledge that wetlands can lose their functionality over time. A degraded wetland can lose its capacity to remove excess sediments, nutrients, and other pollutants. It can also lose its habitat value for fish and wildlife. While wetlands may have tremendous capacities to provide environmental benefits, they are not indestructible. **Maintaining existing high-functioning wetlands and restoring additional degraded wetland habitat is required to increase nutrient and sediment interception before they enter Bangs Lake.** However, most wetland habitat in the watershed draining into Bangs Lake is not under the control of the Village of Wauconda. Much of the watershed is publicly owned ‘open space’ (that may qualify for grant funding) while nearly 50% of the watershed is privately owned. **Utilizing a Watershed Coordinator is recommended to involve public and private landowners in watershed-wide resource protection efforts, including securing non-Village funds for improvement and maintenance.** This position would focus on building local partnerships (including homeowners) charged with ultimately protecting Bangs Lake.

Estimated cost: $35,000/year for part-time Watershed Coordinator.



Runoff Flowing into Bangs Lake by Land Use (source: 9 Lakes Watershed Plan).

8. Reduce the Recycling of Nutrients from Channel Sediment (Internal Loading)

The process where phosphorus is introduced into the water from nutrient rich lake sediment is referred to as “internal loading”. While sediment accumulation is insignificant within the main body of Bangs Lake, the five channels connecting to the lake have substantial sediment build-up. This sediment, in conjunction with a low-oxygen environment, is serving as a source of internal loading that leads to poor water quality and algae blooms (Appendices 4, 5, 6, 7, 8, 10).

When significant rainfall events occur, stagnant channel water migrates to the main lake carrying with it high concentrations of phosphorus. **It is recommended to remove sediment from the channels by dredging** which will result in the following benefits:

- Slow the release of phosphorus into the main lake (less algae, improved clarity)
- Allow for habitat establishment for fish spawning (improving the fishery or reducing the need for stocking)
- Improve accessibility for property owners living on the channels.
- Offer more options for recreational boaters (improve lake use satisfaction)

When channels are fully dredged, installation of aeration equipment would be the next recommended phase of channel improvement. Aeration should be implemented as the dredging of channel sections is completed.

Estimated cost: $6,500,000 (2023 estimate) to dredge five channels.* (Funding options are discussed in Appendix 12)

***Timeline dependent on available funds. The cost of dredging increases when equipment and staff need to be mobilized multiple times to complete a project.

Example of a channel filled with sediment (photo source: ILM Environments)

OPTION TO CONSOLIDATE DUTIES RECOMMENDED IN THIS PLAN

An option to consolidate duties and gain financial efficiencies is to combine the responsibilities described in recommendations 4, 5, 6 and 7 into a single Lake Improvement Coordinator position. Creating a *Lake Improvement Coordinator*, an individual with training and experience in lake ecology and management, would offer economic efficiencies in addition to consolidated oversight of Bangs Lake (see Appendix 15 for detailed position description). The Lake Improvement Coordinator would make decisions that affect the quality and use of Bangs Lake. They can offer recommendations to the Village or non-technical final decision-makers. The Lake Improvement Coordinator would also be responsible for conducting certain services as appropriate.

The Lake Improvement Coordinator would also be responsible for identifying partners and stakeholder communications and working with the Development Coordinator on fundraising initiatives. This position would oversee the creation and execution of a monitoring program to track changes in lake health and ensure effective best management practices. Other duties may include ongoing assessment of carrying capacity, regular inspections of external nutrient loading sources and conducting or contracting monitoring programs. Writing bid/contractor specifications and selecting and managing outside contractors are among the many potential responsibilities of this position.

Estimated Cost: $90,000/year.

Budget Options and Priorities

The following table summarizes the costs associated with the recommendations made:

	Year 1	Year 2	Year 3	Year 4	Year 5	Priority
Budget for Recommendations	$321,400	$266,900	$266,900	$206,900	$206,900	1, 2, 3
Control Excessive Aquatic Plant Growth	$110,000	$110,000	$110,000	$50,000	$50,000	1
Improve Stakeholder Communication, Education and Engagement	$35,000	$35,000	$35,000	$35,000	$35,000	1
Determine Lake Carrying Capacity and Update Lake Use Regulations	$15,000	$0	$0	$0	$0	1
Monitoring	$45,000	$45,000	$45,000	$45,000	$45,000	1
Ensure Sustainable Management and Funding	$35,000	$35,000	$35,000	$35,000	$35,000	2
Restore High Profile Shorelines	$46,400	$6,900	$6,900	$6,900	$6,900	2
Slow or Reduce the Flow of Nutrients into the Lake from the Watershed (External Loading)	$35,000	$35,000	$35,000	$35,000	$35,000	2
Reduce the Recycling of Nutrients from Channel Sediment (Internal Loading)	*	*	*	*	*	3

OPTION: Substituting the costs for contracted services with the cost for a dedicated Lake Improvement Coordinator:

	Year 1	Year 2	Year 3	Year 4	Year 5	Priority
Budget for Recommendations	$276,400	$241,900	$241,900	$181,900	$181,900	1, 2, 3
Control Excessive Aquatic Plant Growth	$110,000	$110,000	$110,000	$50,000	$50,000	1
Hire a Lake Improvement Coordinator	$90,000	$90,000	$90,000	$90,000	$90,000	1
Ensure Sustainable Management and Funding	$35,000	$35,000	$35,000	$35,000	$35,000	1
Restore High Profile Shorelines	$46,400	$6,900	$6,900	$6,900	$6,900	2
Reduce the Recycling of Nutrients from Channel Sediment (Internal Loading)	*	*	*	*	*	3

*Total cost to dredge the five channels is estimated at $6,500,000. Timeline for dredging will be dependent upon available funds, planning, permitting, and potential secondary uses of dredged material and therefore is not included in this budget estimate.

APPENDIX 1. Common Lake Management Practices

Appendix 1 – Common Lake Management Practices

There are a wide variety of lake management practices used to maintain and improve the health and quality of lakes and other water bodies. These practices are typically aimed at preserving water quality, controlling aquatic vegetation, preventing erosion, and enhancing recreational opportunities.

Described below the most used lake management techniques. The intention is NOT to imply that all these techniques are required to manage Bangs Lake effectively, but instead to demonstrate that all options to improve the water quality in Bangs Lake have been considered.

Ultimately, recommendations for using any of these techniques rely on multiple variables such as the area of focus, focus area depth, season, target plant or algae species, timing, and available funding. Typically, no single management technique is effective as a 'silver bullet' and often multiple management techniques need to be employed to produce desired results.

Herbicides/Algaecides/Pesticides

Herbicides are commonly used to control nuisance aquatic plants and algae. In Illinois, where lake bottom ownership is allowed, state permits and in some cases owner permission is required to conduct most chemical treatment programs. Unless contiguous property owners all employ the same program, the treatment results may be spotty or short-lived as plants in untreated areas can propagate and spread to the treated areas. While it is possible to target the application through various delivery techniques or the use of different physical forms of a chemical product (i.e. granular vs. liquid), 'drift' and dilution still occurs that can cause unintended results. Additionally, there are 'block-out' fish spawning periods where herbicide applications are prohibited.

Most aquatic plants can be successfully treated twice annually to gain control of growth and spread while algae may require more frequent applications throughout the growing season to control its growth. Chemical applications are one of the most effective and immediate methods to return a water body to a higher ecological state if done correctly and is relatively inexpensive compared to most other management techniques. However, gaining public acceptance to use chemicals can present a challenge and must be considered. In these cases, well-written articles backed with credible data communicated to the public is highly recommended. Lake Managers or contractors who understand the uses and nuances of water body being treated, understand/adhere to regulatory guidelines concerning applications, and understand the impacts of large-scale treatments on the waterbody are important factors for this method of aquatic plant and algae control to be successful.

Contact herbicides require the target vegetative growth to be visible for treatment. The goal is to prevent plants from interfering with lake uses or reaching the water surface. A well-timed treatment with a contact herbicide may provide season long results while minimizing biomass die-off.

Pros: if timed correctly, future seed production can be prevented, but the plant population remains at the same level since the roots of the plants treated are left intact. Plants are essentially chemically mowed. No disposal costs.

Cons: The target plant must be visible to be treated. Dead or dying plants can cause a drop in the dissolved oxygen level after treatment which may have a detrimental effect on the fishery. Not as cost effective in lakes with high pass-through flow. Killing the growth only recycles the nutrients for future growth (its effect is temporary). It may take several days to weeks to see results. Can be non-selective in the plants affected by the treatment.

Systemic herbicide application can be timed to anticipate growth thereby avoiding the plant die-off experienced with the use of contact herbicides. In addition, the dose can be managed to target specific plants leaving desirable plants unaffected.

Pros: When applied in the early season keeps water free of unwanted growth and occurs before fish spawning block-out dates. Can be plant species selective.

Cons: More costly than contact herbicide treatments since it generally requires a whole-lake treatment. Heavy in-flows following the application may require re-treatment at an added cost.

Harvesting

Harvesting is the removal of unwanted plant growth from the aquatic ecosystem. Harvesting these plants helps manage and control their density, spread, or growth, preventing them from negatively impacting the ecosystem or impeding navigation and recreational activities. Unlike chemical control of growth that kills the target plant only to have it sink, decompose, and release nutrients back into the water (fueling future vegetative growth), harvesting removes from the water body the nutrients contained in the plants thereby reducing the bank of nutrients available for future growth. Harvesting of aquatic plants provides immediate results with the added benefit of nutrients being permanently removed from the system. However, harvesting tends to be more costly per acre than chemical treatment mostly because of considerable equipment, labor, transport, and disposal costs.

Mechanical harvesting utilizes floating equipment to pull or cut target plants and convey them into a hopper that is then unloaded on shore for off-site disposal. These machines require operational expertise, ongoing maintenance and carry some amount of safely risk to the operator.

Pros: Highly efficient. Produces immediate results.

Cons: This technique ‘mows’ the plants and does not kill them. The practice of harvesting using this type of equipment must be on-going. For certain aquatic plants that spread through fragmentation (like Eurasian water milfoil), it can exacerbate an infestation problem. Desirable wildlife can be inadvertently caught in the process and removed from the lake.

ILM's Truxor Machine Mechanically Removing Invasive Plants

Diver Assisted Suction Harvesting (DASH) is a selective plant removal process in which divers identify unwanted non-native or invasive plants that need to be removed, pull them out by the roots and feed them into a suction tube that transports the plants to a boat to be hauled away. Depending on the vendor, plants can be sorted on a sorting table allowing wildlife to be returned safely to the water.

Pros: The process can be very selective, preserving native plants while removing non-native and invasive plants. It is an excellent removal method for plants that spread through fragmentation if done carefully. The effects are long-lasting since the entire plant and root are removed,. Key nutrients are removed from the ecosystem which would otherwise fuel unwanted growth in the future. DASH is chemical-free.

Cons: Higher costs compared to mechanical harvesting or chemical treatment and relatively slow compared to these methods due to the selective nature of the process.

ILM's DASH Boat with Sorting Table for Wildlife Removal

Habitat Creation/Restoration

Creating habitat in and around lakes is a key aspect of lake management that supports biodiversity, ecological health, and overall ecosystem resilience. By establishing and maintaining a variety of habitats in and around lakes the natural balance of the ecosystem can be protected. Strategies for creating habitat in and around lakes include:

Wetland creation/wetland restoration. Wetlands can have a positive impact on lake water quality and overall ecosystem health by serving as a natural buffer and filtration system. Wetlands are ecologically valuable areas that can act as a "kidney" for the surrounding landscape, benefiting lake water quality.

Pros: Scientifically documented as one of the best ways to reduce negative water quality impacts from external sources. Creation and restoration projects are typically grant fundable.

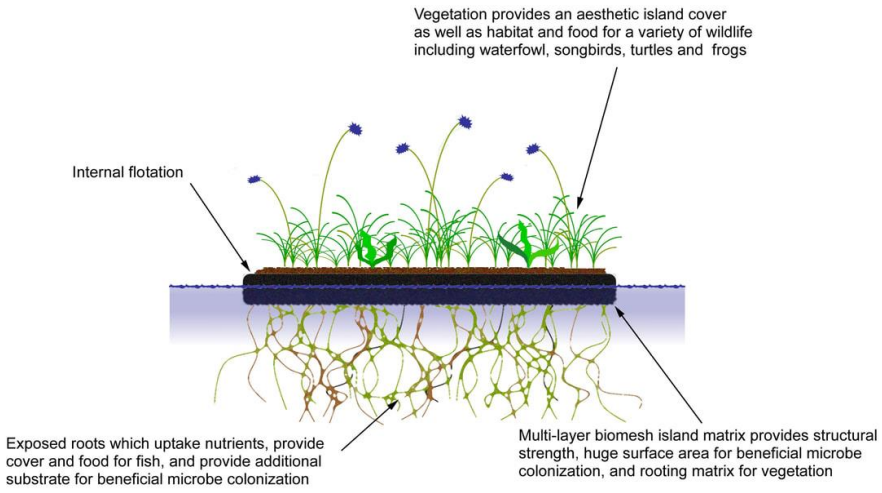
Cons: Can be expensive and requires commitment to perpetual management of the wetland to ensure proper native plant composition. Degraded wetlands lose their functionality as water filtration systems; unmaintained wetlands can *introduce* nutrients into Bangs Lake during major rain events by flushing sediment into open water.

Wetlands Under Restoration (photo source: Sally Minnick)

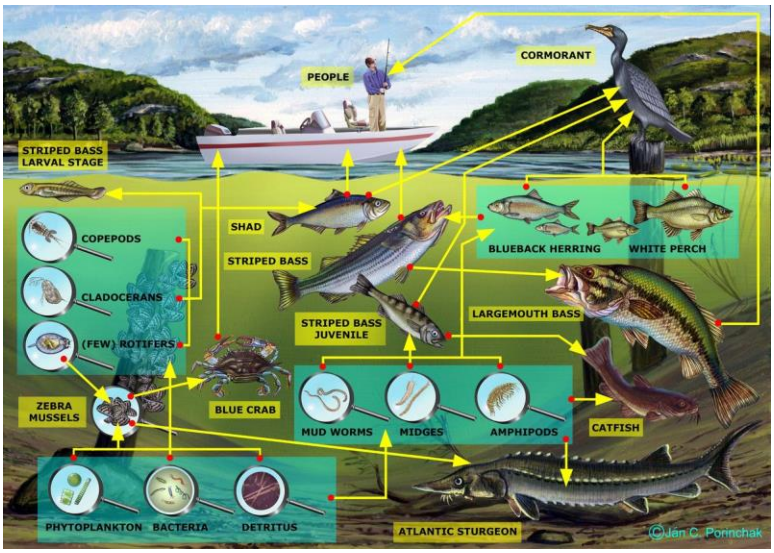
Bio-islands are floating/artificial islands populated with native plants whose roots extend down into the water. While the plant matter housed by the island helps to secure nutrients, the greater benefit is from the subsurface habitat these bio-islands create. Bio-islands support the growth of a foundational food chain organisms which, in turn support proliferation of small fish that attract larger fish. Fish are tremendous nutrient sinks (i.e., high concentrations of phosphorus) that can be harvested from the lake to remove those nutrients that would otherwise fuel unwanted algae growth.

Pros: Create high-quality fish habitat which can also be aesthetically pleasing. Supports a healthy fishery.

Cons: Expensive and challenging to maintain in the Midwest. Can impact recreational use of a waterbody if placement is not carefully considered. May attract nesting geese.



Typical Bio-Island (exhibit source: Floating Island International)



Freshwater Food Web (exhibit source: Cary Institute of Ecological Studies)

Aeration

Increasing oxygen in lakes and ponds is beneficial for aquatic life, can increase the rate of decomposition of organic matter on the lake bottom, and assist in the reduction of floating aquatic plant growth at the surface of the water. With proper oxygenation, the nutrients contained in the decomposing organic matter are more likely to become less available for future nuisance algae growth. There are several types of aeration systems that increase oxygen by moving water in aquatic ecosystems. The type of aeration system used depends on the specific characteristics and needs of the lake and include:

Fountains draw water from around the unit and propel it up into the air. The movement of cold water drawn from deep areas of the lake to the surface allows for atmospheric oxygen to be absorbed by the water and dispersed to a wider area within the water body.

Pros: Fountains are most effective in providing circulation in shallow waters. They can serve as an aesthetic feature especially if lit. They are useful in shallow waters where diffusers may not be as effective.

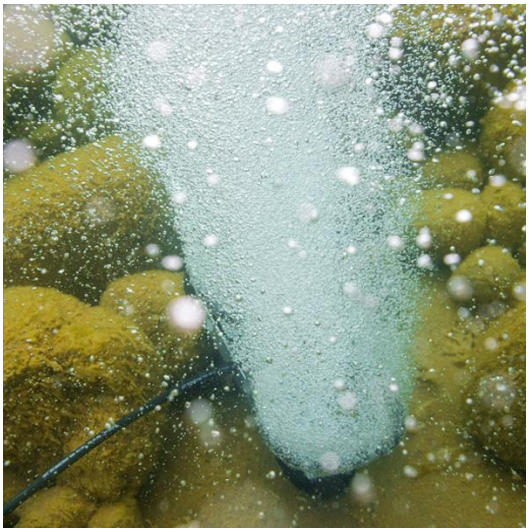
Cons: Generally speaking, the ratio of increased oxygen produced to electrical power consumed is lower for fountains than other options. Fountains are also prone to clogging with debris, dense algal mats, and pondweed growth. Certain wildlife or boat traffic may damage power cables, and electric cords in recreational waters can pose a potential hazard. In the Midwest, fountains must be installed each spring and removed every fall which requires labor and storage. This method of aeration is usually appropriate for smaller waterbodies, or stagnant bays and channels.

Fountains can offer different spray patterns for aesthetics (photo source: ILM Environments).

Air Diffusers use air pumped from the atmosphere to the lake bottom where it is released through small holes creating very small gas bubbles that rise to the water surface. Like a fountain, this mixing effect of bringing cold water void of oxygen from the lake bottom to the top helps de-stratify the body of water while increasing oxygen levels.

Pros: This method of mixing is highly efficient and has the lowest purchase and operating cost of all aeration options. The motor and pump are land based, making service easy. There is no electricity in the water column and therefore much safer than fountains when boat traffic is a consideration. .

Cons: Diffusers lose their effectiveness in shallow waters less than seven feet deep. Operation in extremely warm weather can warm the water and diminish the waters' ability to retain oxygen. Multiple diffuser heads may be required to get adequate oxygenation.

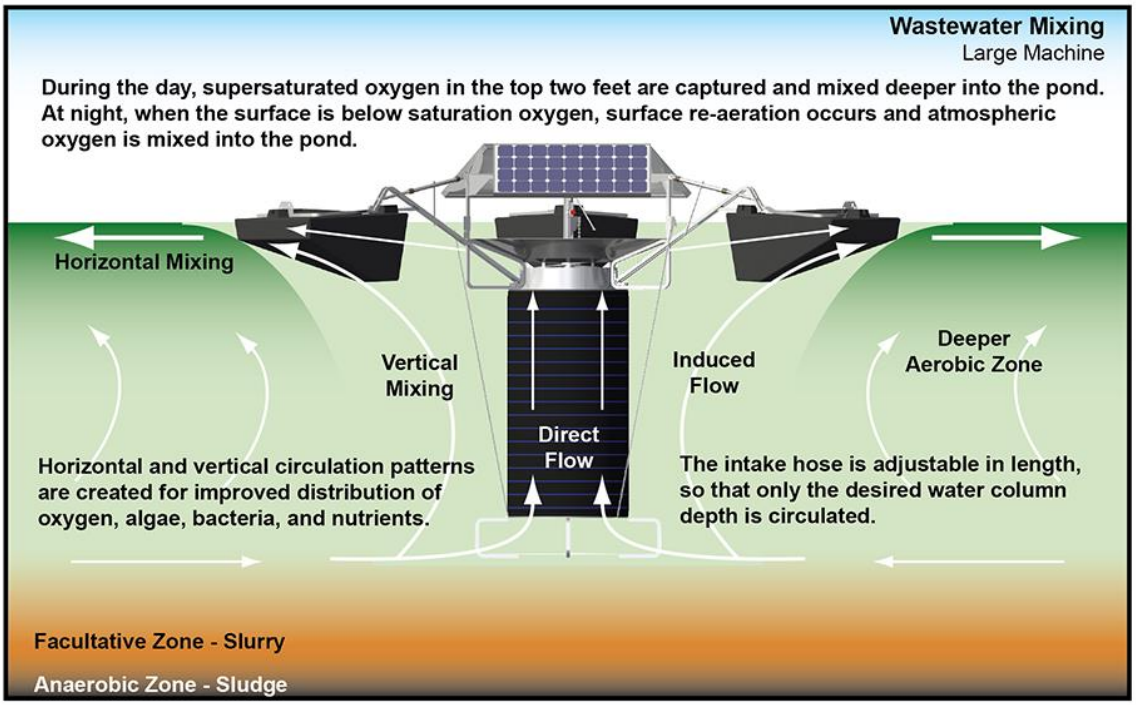


Typical pond diffuser (photo source: Kasco Marine).

Mixers are specialized mechanical devices used in lake and pond management to improve water quality, enhance circulation, and promote aeration. Aeration mixers are typically installed at various depths within a lake or pond and are designed to create vertical water movement, which helps distribute oxygen and promote the mixing of water layers (destratification). The subsurface water movement is unseen and many cases slow, providing a more natural aesthetic than fountains. While more efficient than fountains, they are less efficient than diffusers.

Pros: Very quiet. Powered units are below surface and out of site. Solar units are available.

Cons: Hard-wired units can be interfered with by wildlife and or severed by boat traffic. Solar units are very costly to buy, are quite large, and rely on sunlight to operate. Mixers can easily clog with trash, algae, and other debris.

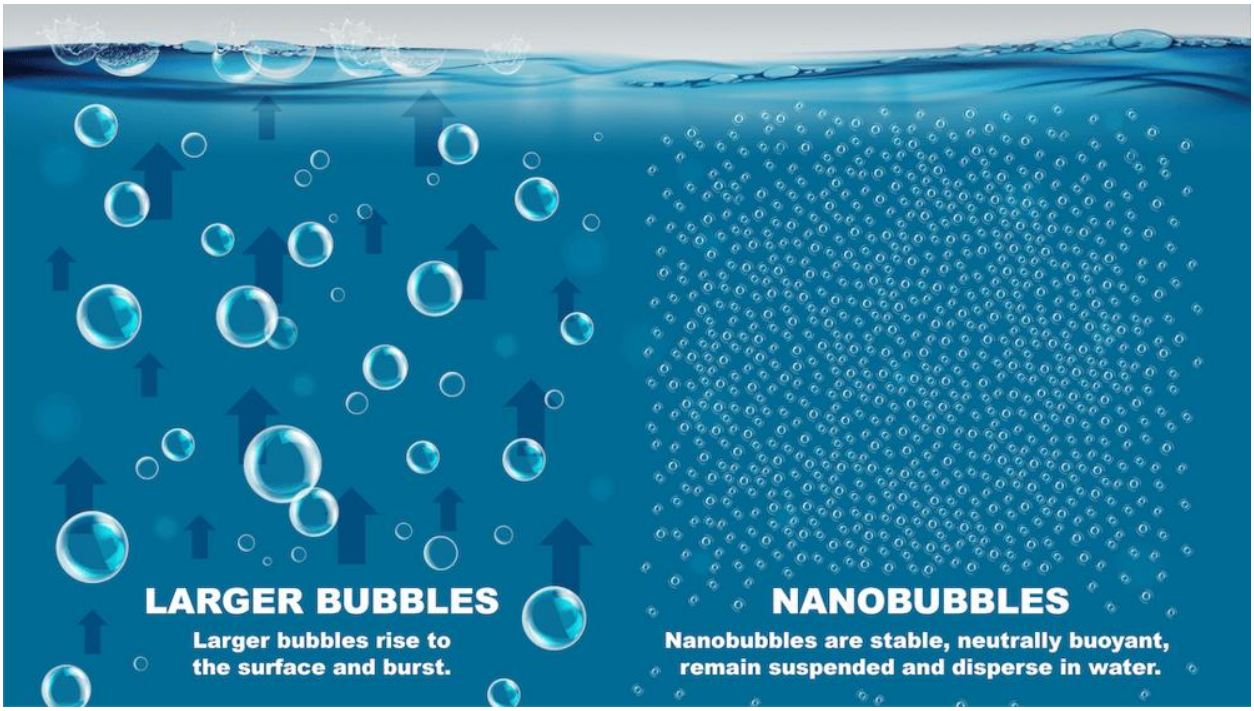


Mixer moving water throughout the water column (exhibit source: Solar Bee)

Nanobubble generators are machines that pull atmospheric oxygen through a compressor, and then in a land-based tank air mixes with drawn-in lake water before returning it to the lake as tiny, oxygenated bubbles. The mixture can be directed or discharged to a very targeted area and with the bubbles being so small the oxygen remains suspended in the water column where it is most beneficial.

Pros: Targeted discharge. Land based for ease of service.

Cons: Potential clogging issues in using lake water intake. High power usage. Unproven technology.



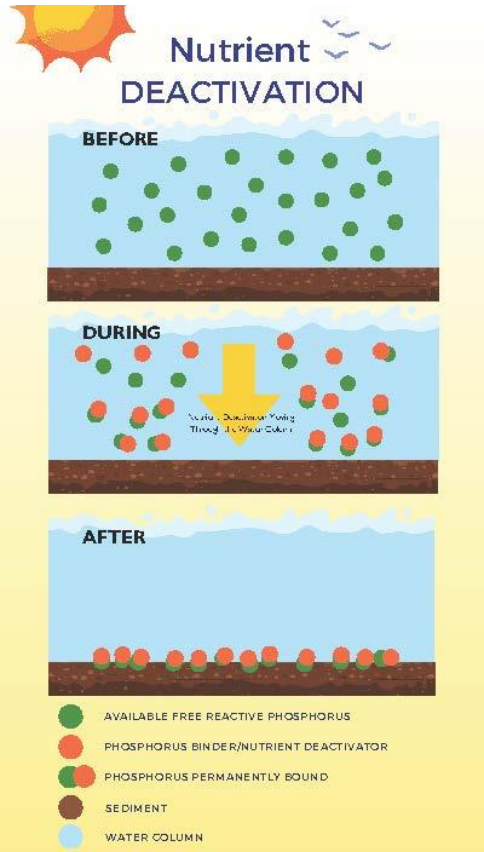
Nanobubbles compared to traditional aeration bubbles (exhibit source: Molear)

Nutrient Deactivation

Nutrient deactivation utilizes one of a variety of commercially available compounds applied to the water to bind with the nutrients that allow for algae growth. The newly bound material sinks to the bottom of the lake where it is unavailable for algae to use.

Pros: This is a pro-active approach as opposed to a reactive approach to algae control. Cost effective when compared to other options. Environmentally safe.

Cons: Requires whole-lake applications. Not suitable when there are high nutrient inputs. Not effective with new inflows of nutrients. Works best when there is adequate oxygenation at the lake bottom. Effective for algae only, this does not reduce rooted aquatic plant growth.



The process of unwanted nutrients binding with nutrient deactivation product (exhibit source: ILM)

Alum (aluminum sulfate) is a common and low-cost nutrient deactivator that can be used to bind phosphorus in water. It can come in granular or liquid forms.

Pros: Lowest cost nutrient deactivation agent.

Cons: Bond between alum and phosphorus can be broken under certain conditions. Un-buffered alum can cause pH drops which can be dangerous to fish and wildlife.

Lanthanum Chloride (Trade names: EutroSORB, Phoslock) is a naturally occurring rare earth mineral which creates a permanent bond with Phosphorus that cannot be broken.

Pros: requires lower doses than alum and has a longer functional effect in lower oxygen conditions.

Cons: higher product costs.

Biological Control

Biological control of plants and algae relies on predation of the control species or make key nutrients that target species needs to flourish unavailable. Biological control is chemical free and sustainable under ideal conditions. Biological techniques may be fundable through grants. However, biological agents can be difficult and costly to manage. This technique may require additional investment in

habitat restoration. Results are not immediate, and attention must be paid to changing conditions and new growth that may result from its use.

Weevils (specifically bred in production laboratories) have been used to control Eurasian watermilfoil in midwestern lakes and ponds. These tiny creatures burrow into the plant thereby killing it.

Pros: can reduce herbicide use.

Cons: Highly variable results and only targets one species of concern. More expensive than other options.

Milfoil weevil (photo source: University of Minnesota)

Bivalves, such as freshwater mussels, are nature's water filters and are very efficient at sequestering many of the nutrients that fuel unwanted algae growth. They require a specific habitat with good oxygenation that may have to be achieved artificially.

Pros: Improve water clarity for native plant and animal species

Cons: Improve water clarity for invasive species, which can quickly outcompete native aquatic plants if left unmanaged.

Enzymes and Bacteria are products intended to accelerate the breakdown of organic matter that can present itself as 'muck' on a lake bottom. In all cases, excellent oxygenation is required for this approach to be effective, and the beneficial activity these perform slow as water temperatures cool.

Pros: Could be a less invasive and less costly means of organic sediment control than dredging. Invisible to observers.

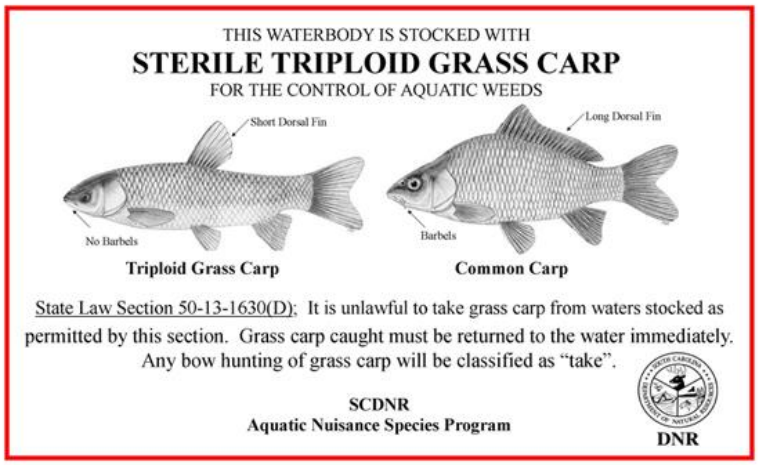
Cons: Has not yet been proven to be consistently effective in this region through objective case studies. Decomposition of sediment is a very slow process therefore taking a very long time to

produce results. Most recent independent studies show that for significant sediment removal, dredging is a more cost-effective option.

Carp (Non-Reproducing Triploid) are used to graze on aquatic vegetation in lakes and ponds for weed control.

Pros: No chemical use. Cost effective. Long-lasting benefits.

Cons: Not permitted in glacial lakes. The carp are not discriminating in what they eat (they may feed on desirable vegetation) and can disrupt reproduction habits of game fish. Grass carp are also less effective at managing vegetation the bigger they get. The smaller younger ones have the largest impact on vegetation.



Triploid grass carp compared to Common carp (source South Carolina Dept. of Natural Resources)

Sonic Destruction

Sonic destruction of some nuisance algae species can be disrupted with the use of inaudible sonic waves. This technology is evolving and has not yet been proven effective through comprehensive case studies.

Pros: Chemical free.

Cons: Requires utility power. Limited effectiveness. Can be damaged by wildlife or boating traffic.

Ultrasonic Algae Control Unit (photo source: LG Sonic)

Exclusion

Exclusion is the practice of eliminating one of the three key needs (water, light, and nutrients) for plants to grow. Since water is the environment and nutrients will always be present at some level, sunlight is the easiest one to eliminate.

Benthic matting is often used in small/high traffic areas such as boat docks, swim areas, and around piers. A dense mat (usually rubber or synthetic) is anchored into the lake bottom which then blocks any sunlight from supporting plant growth in that area.

Pros: Chemical-free. Results are instant.

Cons: Difficult to install and maintain covering large areas. This has no effect on the plant growth in the immediately surrounding areas. Gas formation beneath the mat may cause it to float or ‘bubble’.

Weighted sheet mat (photo source: Wayne County, NY Soil and Water Conservation District)

Dyes

Dyes (usually blue or black) can be added to the water body to reduce the sunlight from reaching the lake bottom thereby prohibiting plant growth in those areas.

Pros: Good for small water bodies. Dyes are a pro-active method of management as opposed to reactive.

Cons: Dyes are non-targeting (i.e., a whole lake must be treated). Re-applications must occur when the dye becomes diluted from rain or other inputs to be effective. The water may look unnatural. It may interfere with the food chain as wading birds and large fish may not be able to find prey as easily. May affect desirable plants from establishing.

Nutrient Removal

Dredging is the removal of sediment that provide three major improvements:

1. Nutrient Reduction. The material removed is often very high in nutrients that would otherwise fuel unwanted vegetative growth.

2. Increased Water Depth. Since material is removed from the bottom of the water body, more water depth means that less sunlight will penetrate to the bottom, supporting less vegetative growth.

3. Decreased Water Temperatures: By having more water depth and less sunlight penetration, the water will be cooler and able to hold more oxygen creating an environment for less nutrients dissolved in the water. This in-turn reduces algae growth and supports a more robust and healthier fishery that sequesters many key nutrients.

Sediment removal of material from the lake bottom is accomplished through two basic techniques - mechanical or hydraulic.

Mechanical dredging is the 'scooping out' of material using a bucket usually attached to a dragline or to an excavator arm. It can be done in the wet (while water is present) or dry (after the water is drained out of the work area).

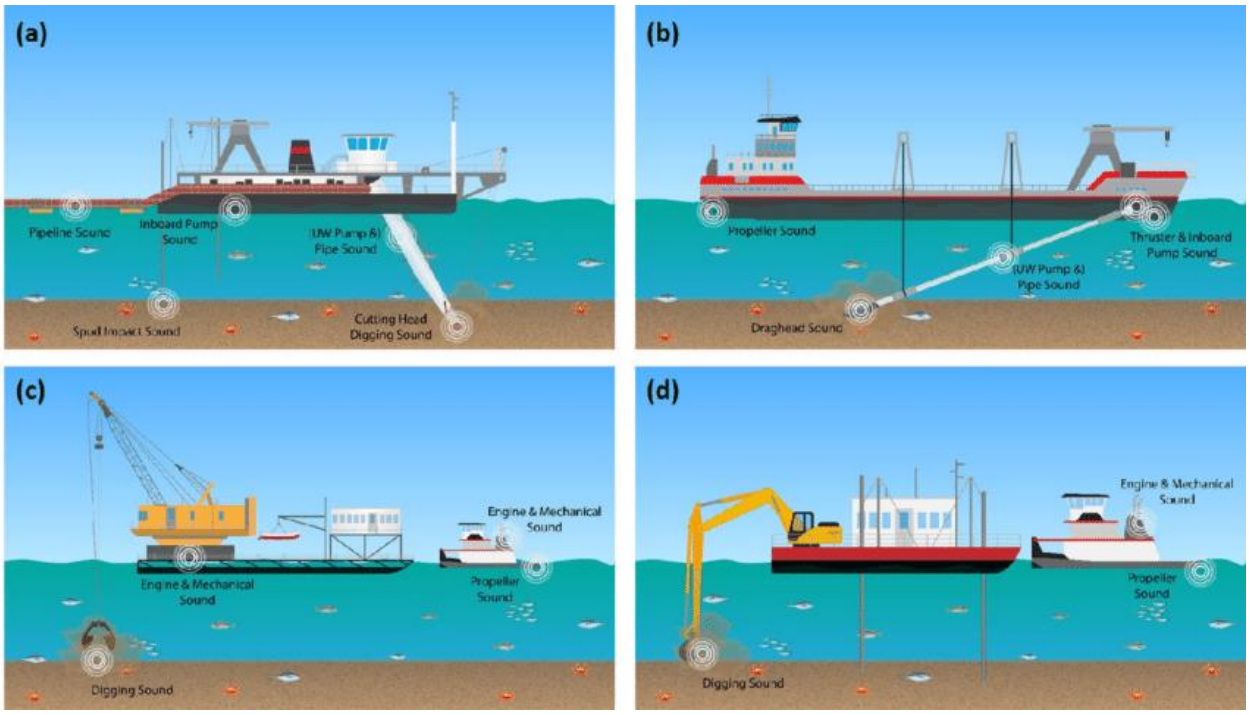
Pros: Material is generally hauled off for secondary use immediately. Sunken debris is generally not a factor in sediment removal productivity. Permitting can be much less burdensome than other methods. Work can sometimes be completed in cold weather when lake use is at a minimum.

Cons: Equipment access challenges can increase cost. Can be more labor intense than hydraulic dredging.

Hydraulic dredging utilizes water-based equipment that vacuums sediment from the bottom of the water body and pumps it with water to a land-based dewatering facility (dewatering bag or settling lagoon) where the solids are retained, and water is allowed to flow back to the source.

Pros: Water based; land access issues are minimized. Dewatering can occur a great distance away from the work area eliminating the need for heavy truck traffic to/from the work area. The dewatering

site may be the final resting place for the sediment, eliminating the need for trucking of the material. *Cons*: Can operate only above freezing conditions. Level ground is required for dewatering. Multiple permits are required. Unseen debris can slow the process and/or add to the cost.



Two types of dredging methods. Hydraulic (a and b) and Mechanical (c and d) (exhibit source: Western Dredging Association).

Mechanical Dredging Operation (photo source: ILM Environments)

Controlling Inputs

Controlling inputs is the term used to describe the practice of minimizing the detrimental contributions into a water body.

Inputs come from three broad sources:

Internal cycling is the cycling of the nutrients that exist in any aquatic ecosystem. The process of vegetative growth as a result of nutrients present, die-off of the growth (as a result of management practices or naturally), decomposition of the growth matter into basic nutrients, and the fueling of new growth, with the cycle repeating is an on-going condition fueling aquatic growth especially under stratified and oxygen deficient conditions.

Point-source pollution are contributing factors to lake eutrophication that can be easily identified, some on a large scale (i.e. shoreline erosion) while others such as discharges from water treatment systems are much more easy to pin-point. There are existing regulations at many levels (local, county, state, federal) intended to protect public water resources with varying degrees of enforcement.

Watershed-wide non-point-source pollution describes things such as the deposition of pollen within the watershed that eventually wash into the water body, road grit, naturally occurring plant material (leaves in the fall), etc. While these influences on any water body should be considered in a comprehensive lake management plan, the ability to manage them is extremely difficult.

Lake management methods that are very effective in the improvement or protection of surface water generally identifies effective management of inputs with the use of *Wetland/Green Infrastructure* (*commonly known as 'Stormwater Best Management Practices' or 'BMP's*). BMP's may rely on highly vegetated and managed areas as retention areas or conveyances of surface water flow to remove and sequester sediment and nutrients before hitting the water body. Bioreactors can provide the same benefit for smaller and more controlled inflows. In many cases, these techniques are cost effective and as a result attract the most grant funding. While the pollutants within a water body can't be ignored, focusing solely on them while adverse inputs continue to flow into the lake is not sustainable.

Pros: Controlling inputs is one of the most scientifically proven and effective way to manage sediment and nutrients entering a body of water. This can reduce the need for dredging and nutrient control within the receiving water body.

Cons: Results are not immediate, and projects take time to identify and engage partners, design, permit execute, and maintain. Requires perpetual management to prevent invasive plant encroachment.

Tributary Restoration Project (photo source: Bethlehem Township, PA)

Monitoring

Monitoring is utilized to ensure progress is being made in areas of concern. Some aspects of management may require more monitoring than others.

Pros: Monitoring ensures resources are being well spent by developing and determining if defined goals are being achieved in the timeframe recommended. Results from monitoring can aid lake managers and the community in deciding if current management should be altered to meet community goals.

Cons: This is not a “visible” expenditure of funding (unless done from a social/marketing perspective for community involvement) as only data collection/analysis is performed and does not involve any sort of treatment.

Enhancements

Improving ecological awareness is a grassroots method of education with the goal of broad-scale ecological enhancement. This can include a variety of efforts through stakeholder collaboration and community involvement, such as developing informational signage, creating lake-based advocacy groups, involving youth in recreational activities around the lake, community clean-up days and many more. The goal of this process is to engage the public more effectively, leading to greater conservation efforts and stronger financial support for lake improvement efforts. Organizing around a singular lake management entity such as a Lake Committee with some authority or an appropriately titled individual with the responsibility of addressing all lake issues allows for a more fluid and collaborative approach.

Pros: This is an essential part of creating a sustainable lake ecosystem through direct community efforts and the continued financial backing required to perform such enhancements.

Cons: This method takes time, results are not immediate, and should be seen as an investment with a return down the line.

Regulation is an approach to encourage or force behaviors that support progress toward the desired result. The differences between ‘policy’, ‘guidelines’, ‘laws’, ‘ordinances’, ‘rules’, and other descriptors that define limitations must be fully understood. Determining which person or entity has the authority to endorse or enforce a limitation, the process by which the limitation is adopted, and how the limitation is enforced must also be considered. Overlaying is the issue of public acceptance which can be directly related to how well the intention of the limitations are conveyed and received.

Pros: Once implemented, can produce immediate effects. Society expects and accepts that elected leaders are given the authority to ‘regulate’ for the common good.

Cons: Can be a very slow process. If not handled carefully, can be a lightning rod for dissent toward separate beneficial efforts. Often comes with administrative or enforcement costs.

APPENDIX 2. Lake Overview and History

Appendix 2 – Lake Overview and History

Bangs Lake is a natural glacial lake created as the glaciers that covered the region retreated approximately 10,000 years ago. Glacial lakes are very different than surface impoundments, in that they are generally deeper and do not necessarily rely on a significant water source to maintain level. For these reasons, water quality is generally better in a glacial lake than a surface impoundment. In Lake County, IL, Bangs Lake consistently ranks near the top in terms of water quality.

The lake covers an area of about 300 acres with an estimated average water depth of 10.9 feet (Table 2-1). Bangs Lake is located near the "top" of the watershed, and receives its headwaters from the north, east, and southeast. Flow proceeds to flow into Slocum Creek, which discharges into Slocum Lake, and ultimately to the Fox River.

The lake is named after Justus Bangs who settled in the area in 1836. In 1913 a railroad connecting Wauconda to Chicago was completed, making Bangs Lake a popular weekend destination. Many lake resorts were converted to homes and condominium associations, each managing their own beaches and boat launches. Buildable land along the lakefront is completely developed, and some areas have been filled or modified to provide more developable land around the lake. The natural outlet to Bangs Lake was modified in the early to middle 1900's with the installation of a dam/culvert on the southwest end of the lake (LCHD 2002). Public (paid) access to the lake is available through several private beaches, boat launches, and through the park district property.

Five channels were created to increase user access to the lake. Washington Channel is the first to appear on the 1939 aerial. The stem section of the Circle Channel is apparent in the 1939 aerial, but the remaining sections are not constructed until 1952. The Kimball Channel is visible as a wetland stream in the 1939 aerial, and as a constructed channel by the 1961 aerial. The Berger Channel appears to be under construction in the 1961 aerial. The Peninsula Channel first appears on the 1993 aerial photo. Even though they are connected directly to the lake, the physical (lake bottom, shorelines) and ecological aspects (plant and fish life present) of the channels are very different than those of the lake.

Much of the lake bottom is privately owned. Approximate current property boundaries are shown in Figure 2.2 with detailed maps appearing at the end of this Appendix.

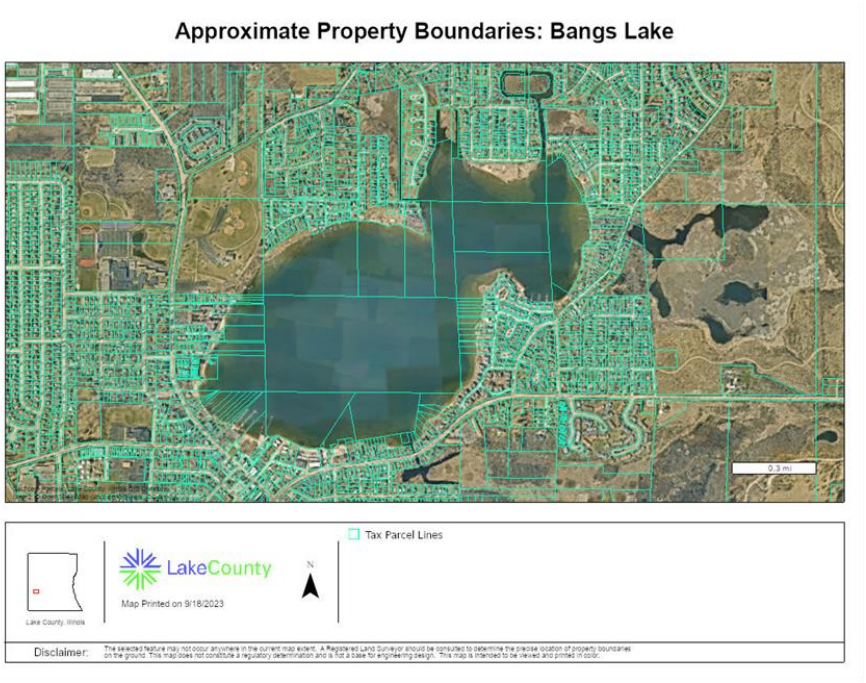


Figure 2-2: Bangs Lake Approximate Property Boundaries.

Because lakes are the lowest point in the landscape, they accumulate sediment and nutrients. For this reason, water exiting the lake tends to be cleaner than the water that enters. As the lake ages, it is natural for it to change from a clear lake with little sediment and few plants, to one becoming dominated by plants or algae as depth is lost and nutrients accumulate in the sediment and water. This eutrophication process is natural; usually taking thousands of years. This is discussed further in Appendix 4.

Humans can greatly accelerate that process by land and surface water mismanagement and increased lake use or activities beyond carrying capacity. Reversing or slowing the eutrophication process can be achieved by removing the nutrient-rich sediment or by minimizing the inflow of nutrients into the water body. Reducing nutrient loading in the water can take years and positive effects in the lake may be difficult to quantify. Additionally, internal loading of nutrients is a recurring source of unwanted pollutants in the water. As the lake bottom becomes anoxic (void of oxygen), nutrients are released from the sediment and decaying plants back into the water. The effects of lake eutrophication observed at Bangs Lake and the channels are discussed individually with potential solutions and cost projections for their implementation.

The Village maintains the water level by manipulating a series of boards at the main outlet of the lake. The pre-2020 standard operating procedure for lake level management was:

Village staff measure the water level approximately once a week between May and October, by using a graduated rod and rounding the measured level to the nearest half inch. The data is recorded along with recent rainfall data and a decision is made to add or remove bars to maintain the lake water level. The SOP (Standard Operating Procedure) states:

Level ≥ 7.0 inches – remove all six bars.

Level ≤ 4.5 inches – reinstall all six bars.

Level 10.0 – 11.5 inches above Normal Water Level (NWL) – restrict the lake to 'No Wake'

According to the Village Engineer (in 2013), an estimate of 1 inch of rain falling on the Bangs Lake watershed could cause the lake to rise as much as 9.3 inches (0.78 feet), which requires 11 days to drain and return to NWL. This scenario will vary, depending on current lake volume and how dry the soil is before the rain event occurs. In 2020 an automated water level measuring device was installed to provide consistent and accurate readings more frequently. The only automated part of this apparatus is a water level monitoring device which provides current measurements, and in no way "automatically controls" lake levels.

Harvesting of nuisance aquatic plants began in 1982 (LCHD 2002) and has continued through the present. Harvesting has been performed mostly to increase navigability through the extensive growth of non-native Eurasian watermilfoil (EWM) *(Myriophyllum spicatum*), which has dominated Bangs Lake since 1990. Curly leaf pondweed (CLPW) (*Potamogeton crispus*), another aggressive non-native species, is also prevelent in the lake. Zebra mussels (*Dreissena polymorpha*) have been documented in Bangs Lake starting in 2003 and were common by 2005 (LCHD, 2005). Aquatic growth has also been partially controlled by spotty herbicide treatments.

Parameter	
Surface Area (acres)	306.1
Maximum Depth (feet)	32.0
Average Depth (feet)	10.9
Volume (acre-feet)	3,323.6
Shoreline Length (linear feet)	33,264
Lake Elev. (feet above sea level)	766.2
Watershed Area (acres draining to the lake)	2858.7
Avg. Water Residence Time	1.27 yrs. (462 days)

Table 2-1: Bangs Lake morphometric information. Adapted from the 9-Lakes Plan.

Lake Uses and Restrictions

- Swimming is available to Wauconda residents at the Wauconda Park District. The beach is open June 1st – Labor Day and requires a pass. Swimming also occurs at many private beaches.
- There is no set limit for the number of boats allowed on the lake each day.
- Boating – the Wauconda Park District operates a marina and many private boat launches are also available. Fees apply and are based on boat motor horsepower.
- Regulations for boating are:
    - 30 mph maximum speed is radar enforced by the Wauconda Police Department.
    - No wake (speed of < 5 mph) occurs between sunset and 10 am.
    - Boat traffic must run counterclockwise.
    - Water skiing, aquaplaning, or similar activities and operation of personal watercraft and specialty prop-craft are permitted between 10 am and sunset and are prohibited when the waters are too crowded and announced by a Police Official.
    - Sailing is permitted.
    - Kayaking and Canoeing are permitted.
- Regulations are listed on the 'Welcome to Bangs Lake in Wauconda, Illinois' brochure found on the Village website under the Police Department Marine Unit https://files4.1.revize.com/wauconda/Document_Center/Services/Department/Police/MarineUnitBrochure2021.pdf .
- Lake Management practices are restricted due to requirements in place protecting Threatened and Endangered species. These requirements dictate that habitat must be allocated for such species. This is discussed further in Appendix 8.

Jurisdictional Authorities

Several agencies are involved in the regulation or the oversight the lake depending on the concern. These agencies include:

- Village of Wauconda
    - General lake issues and permitting.
    - Monitors the water level in the lake and oversees the weed control efforts, including weed harvesting.
- Wauconda Police – boating regulations.
- US Army Corps of Engineers (USACOE) – permitting for shoreline restoration, wetland impacts, dredging, beach replenishment, and others.
- Illinois Department of Natural Resources (IDNR) – potential impacts to Threatened & Endangered species, permitting.
- Illinois Environmental Protection Agency – water quality concerns and permitting.
- Lake County Health Department

    - Issues bathing beach licenses.
    - Conducts inspections.
    - Collects water samples at the licensed beaches twice per month from May through September.
- Lake County Stormwater Management (LCSMC) – permitting wetland impacts.
- Wauconda Park District - maintains the community's public beach and its facilities and organizes events.

Fishing/Bangs Lake Alliance/Bangs Lake Advisory Committee

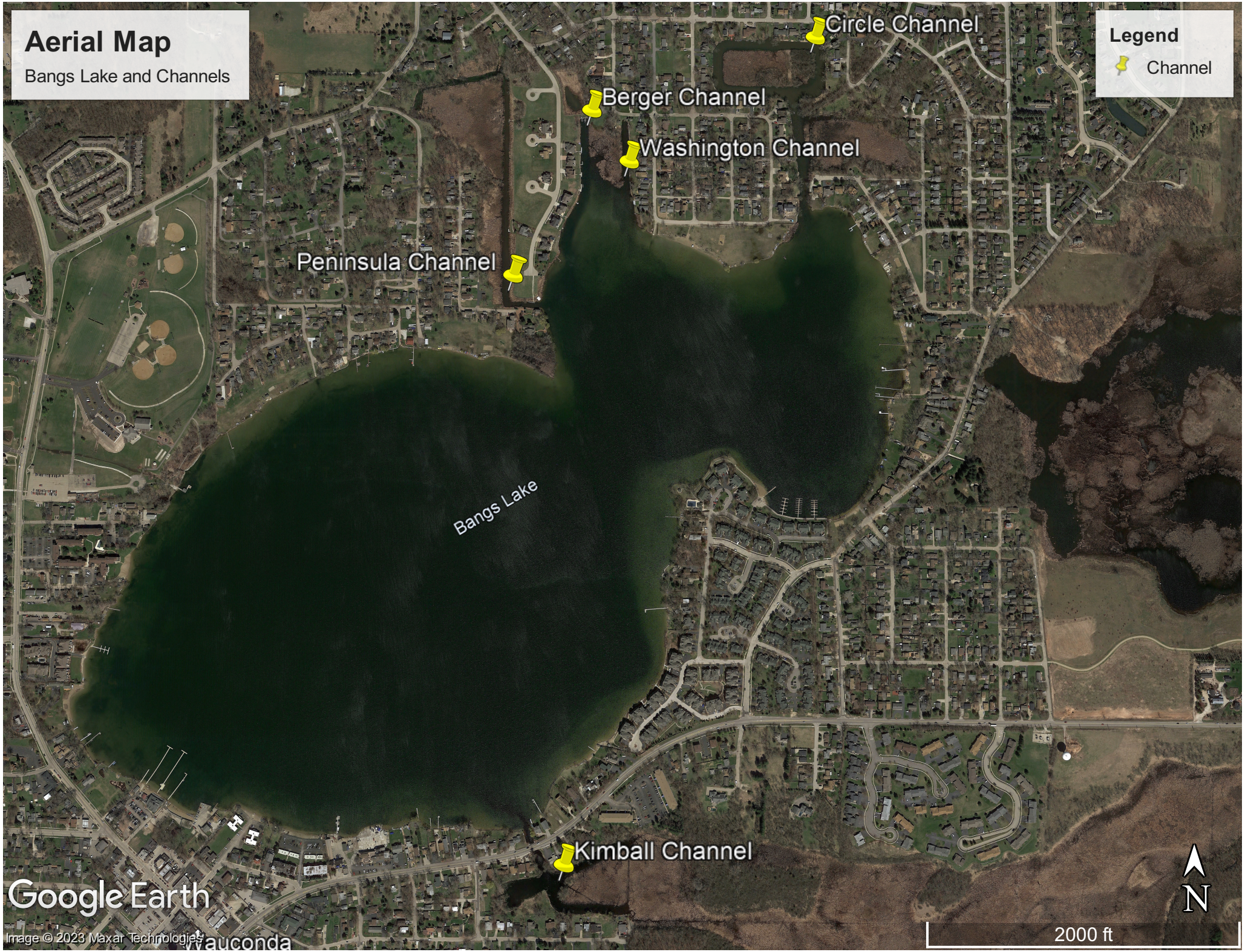
Fishing is a very popular lake use. General fishing regulations in effect on Bang's Lake are detailed in Appendix 8. Currently, the lake supports 23 different species of fish, 20 species of aquatic plants and a wide variety of other living organisms that make up the base of the lakes' food chain (aquatic invertebrates, insects, different forms of algae, etc.). Fish stocking has occurred through the Bangs Lake Advisory Committee and Village, with intermittent fish studies driving the stocking frequency, rates, and species.

For approximately 20 years, fish stocking was administered by the Bangs Lake Advisory Committee (appointed by the Village) and funded through events such as the Leprechaun Plunge and boat parades raising $2,000-$3,000 annually. These funds were deposited in a Village escrow account. Fundraising tapered off by 2019. In 2021, the Bangs Lake Advisory Committee became the recognized not-for-profit renamed the Bangs Lake Alliance (BLA). This same year, the Village transferred the escrow account to the BLA. The Village continued financial support of BLA in 2022 of $5,000.

Monitoring

The Illinois Volunteer Lake Monitoring Program is a former Illinois Environmental protection Agency program that utilized volunteer citizens to collect lake data. Unfortunately, this program lost funding and was discontinued at Bangs Lake in 2019. The need to collect data that measures progress towards lake improvement goals continues, however, and is reflected in the recommendation to create an ongoing monitoring program (that includes sediment, plant, water quality and fishery assessments) conducted by a knowledgeable and stable source for at least five years.

Previous bathymetric data is also provided in Figure 2-3.


Aerial Map
Bangs Lake and Channels
Legend
Channel
Circle Channel
Berger Channel
Washington Channel
Peninsula Channel
Bangs Lake
Kimball Channel
Google Earth
Image © 2023 Maxar Technologies
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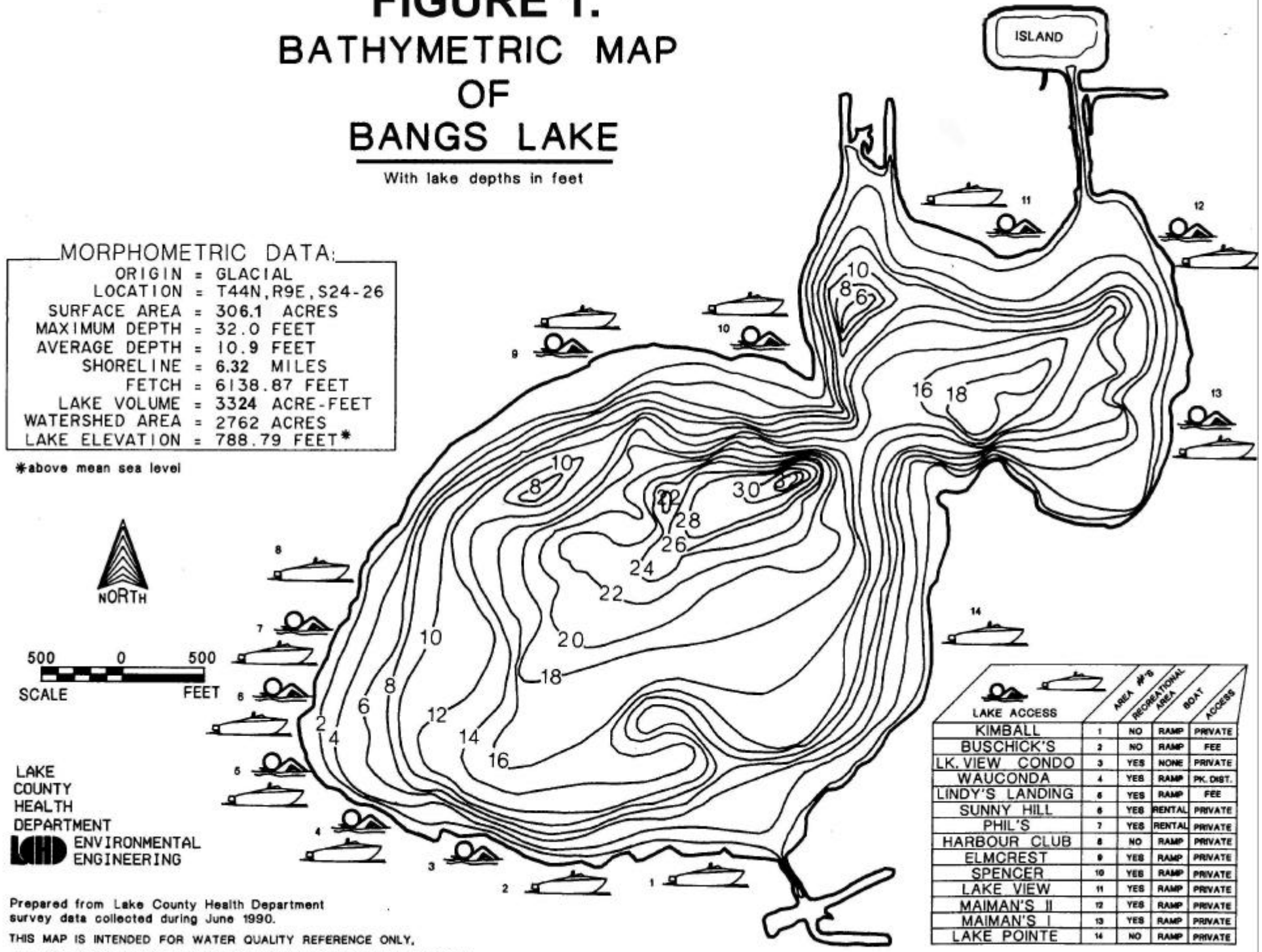
2000 ft

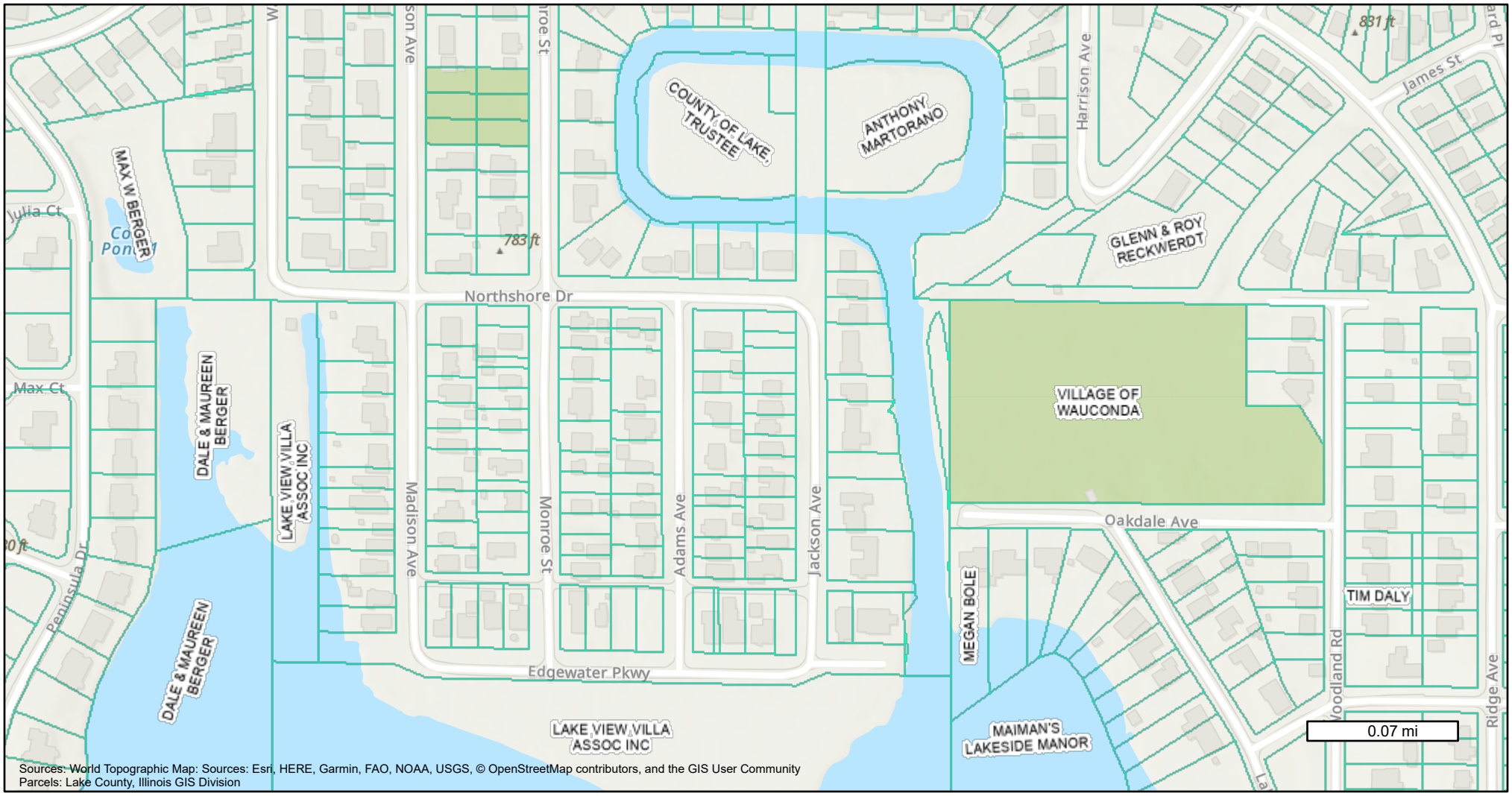
FIGURE 1.
BATHYMETRIC MAP OF BANGS LAKE

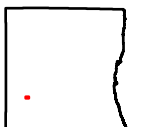
With lake depths in feet



LAKE ACCESS	AREA #'S	RECREATIONAL AREA	BOAT ACCESS	ACCESS
KIMBALL	1	NO	RAMP	PRIVATE
BUSCHICK'S	2	NO	RAMP	FEE
LK. VIEW CONDO	3	YES	NONE	PRIVATE
WAUCONDA	4	YES	RAMP	PK. DIST.
LINDY'S LANDING	5	YES	RAMP	FEE
SUNNY HILL	6	YES	RENTAL	PRIVATE
PHIL'S	7	YES	RENTAL	PRIVATE
HARBOUR CLUB	8	NO	RAMP	PRIVATE
ELMCREST	9	YES	RAMP	PRIVATE
SPENCER	10	YES	RAMP	PRIVATE
LAKE VIEW	11	YES	RAMP	PRIVATE
MAIMAN'S II	12	YES	RAMP	PRIVATE
MAIMAN'S I	13	YES	RAMP	PRIVATE
LAKE POINTE	14	NO	RAMP	PRIVATE

Bangs Lake Parcel Lines





Lake County, Illinois

LakeCounty

Map Printed on 7/26/2023

N

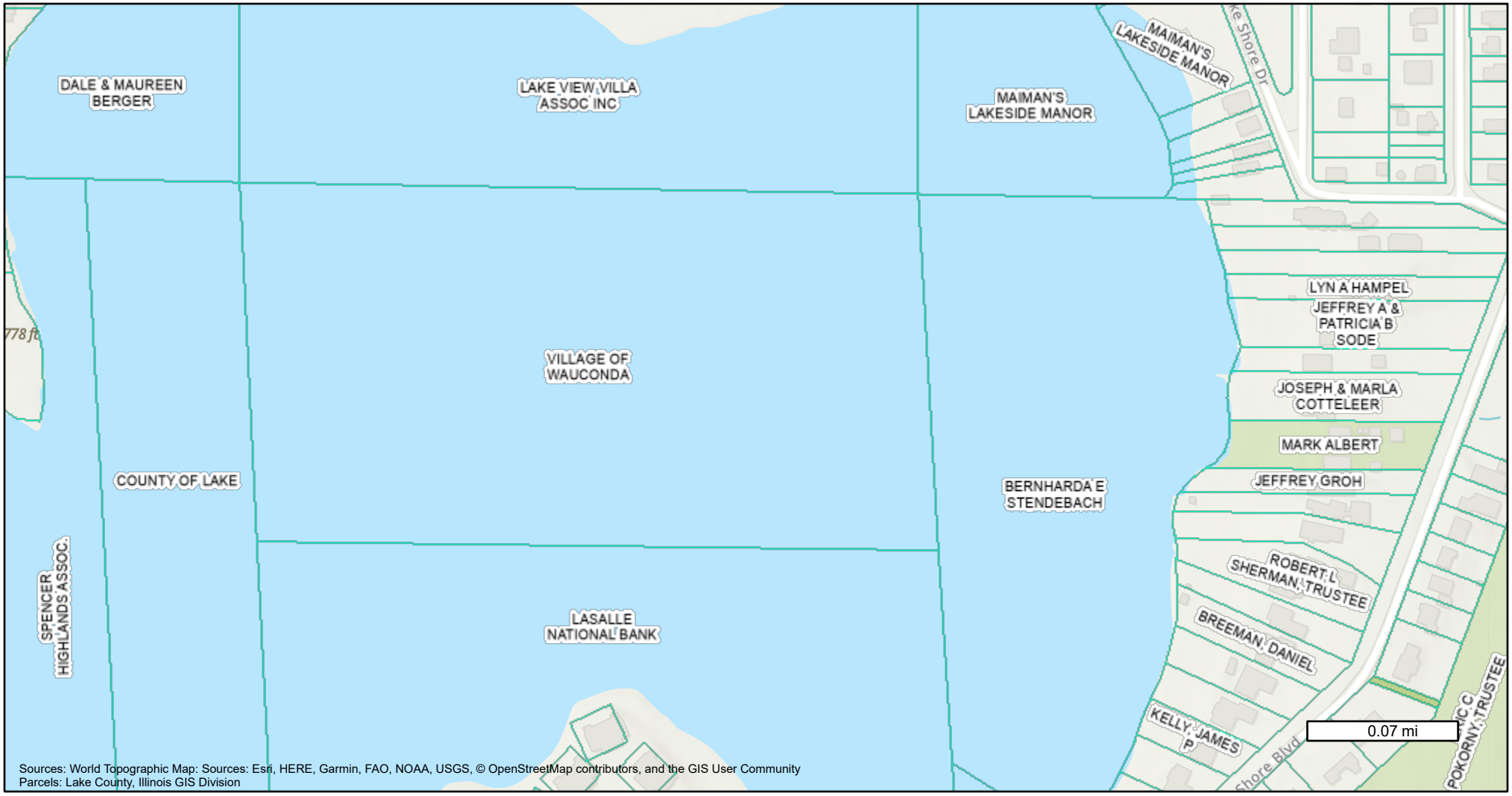
Taxpayer Name Labels

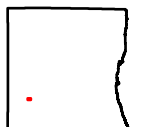
Tax Parcel Lines

Tax Parcel Information

Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

Bangs Lake Parcel Lines





Lake County, Illinois

LakeCounty

Map Printed on 7/26/2023

N

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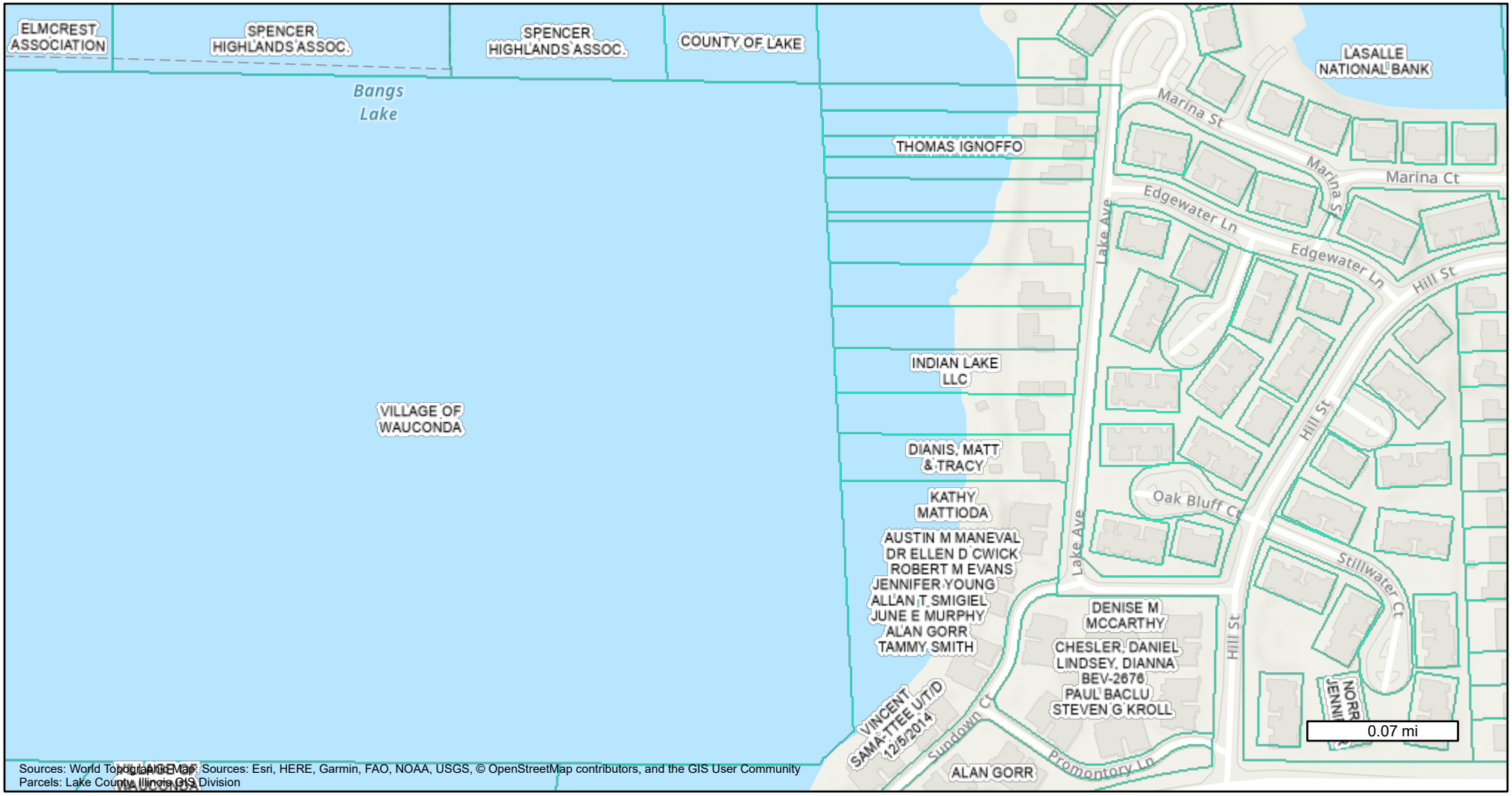
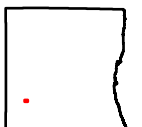
Bangs Lake Parcel Lines - East





Lake County, Illinois

LakeCounty

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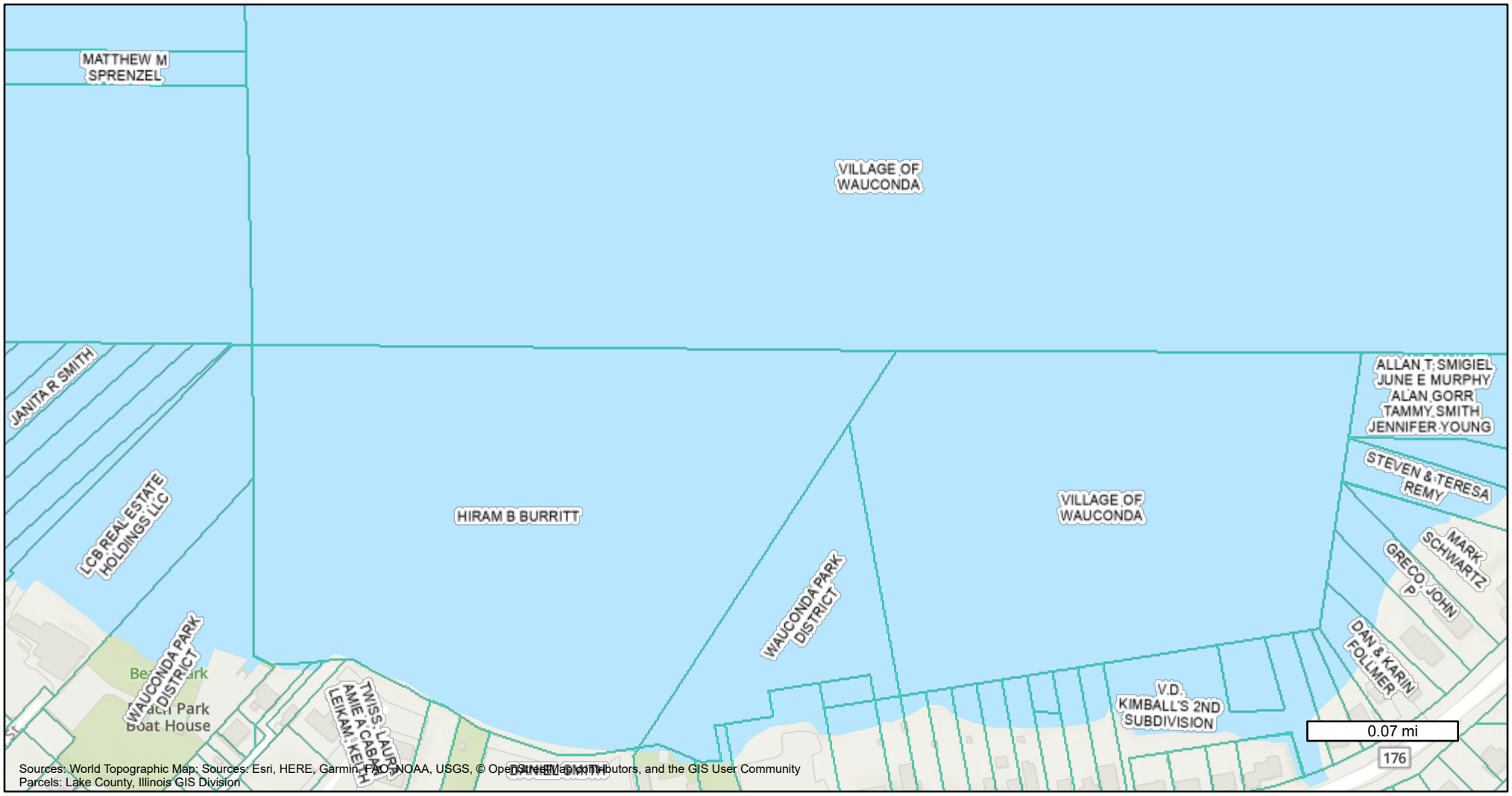
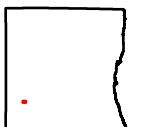
Bangs Lake Parcel Lines - South





Lake County, Illinois

LakeCounty

Map Printed on 7/26/2023

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Taxpayer Name Labels

Tax Parcel Lines

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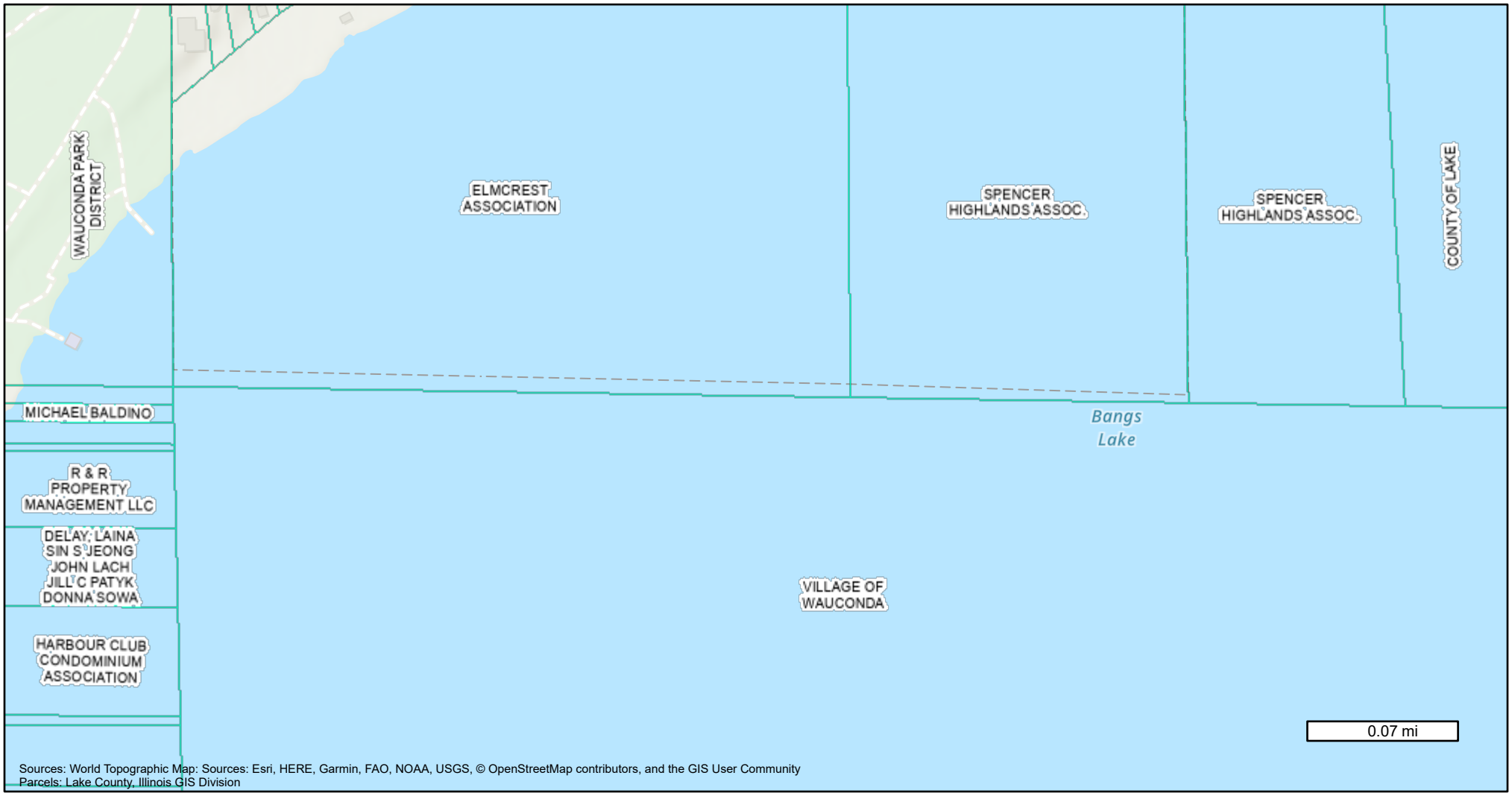
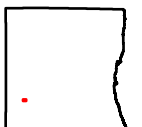
Bangs Lake Parcel Lines - West





Lake County, Illinois

LakeCounty

Map Printed on 7/26/2023

N

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APPENDIX 3. Watershed and Pollutant Loading

Appendix 3. Watershed and Pollutant Loading

Bangs Lake has a watershed (area where rainfall eventually flows into Bangs Lake) of approximatley 3,000 acres. (see Figure 3.1)

Bangs Lake drains to Slocum Creek which flows into Slocum Lake and then to the Fox River.

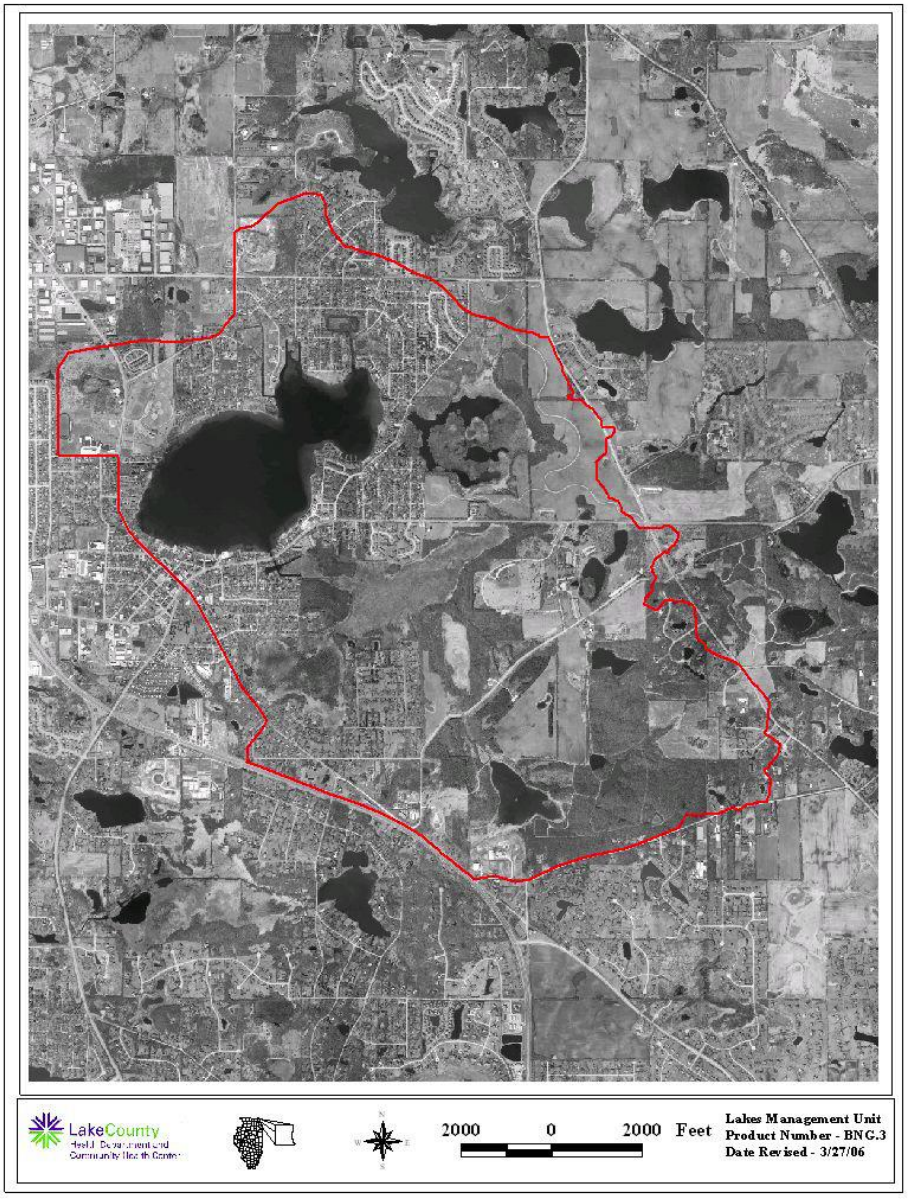


Figure 3-1: Bangs Lake Watershed. From Lake County Health Department Lakes Management Unit 2006.

Inflows

The watershed draining into Bangs Lake has a watershed to lake ratio of 9:1. Typically, lakes need a 20:1 ratio or greater to support adequate water flow to the lake. In drier years, a smaller watershed like Bangs Lake may not have sufficient flow to maintain traditional lake water levels.

No major streams enter Bangs Lake. *The 9-Lakes Plan* identifies two channelized streams that flow mostly through wetlands (Figure 3) before flowing into Bang's Lake. These are identified as BLT01 (Bangs Lake tributary-01) entering in the north through the Peninsula Channel and SC04 and SC05 (Slocum Creek stream sections), which flows through Wauconda Bog (ADID Wetland 123) and enters the lake through the Kimball Channel. ADID refers to a planning process to:

"Provide improved awareness of the locations, functions and values of wetlands and other waters of the U.S. More specifically, it is intended to inform landowners, developers, and local governments that it may not be appropriate to fill or drain certain high quality wetland sites. ADID projects also can provide guidance on strategies for long-term protection and management of aquatic resources in an area." http://dewprojects.countyofkane.org/adid/adid.htm

Both "streams" are channelized wetlands with little flow except after heavy rain events. *The 9-Lakes Plan* has these inlet streams labeled as being in fair (BLT01) to good (SC-04 & 05) for their riparian (proximal to wetlands/rivers etc.) condition, and both streams have little erosion (Figure 3.2).

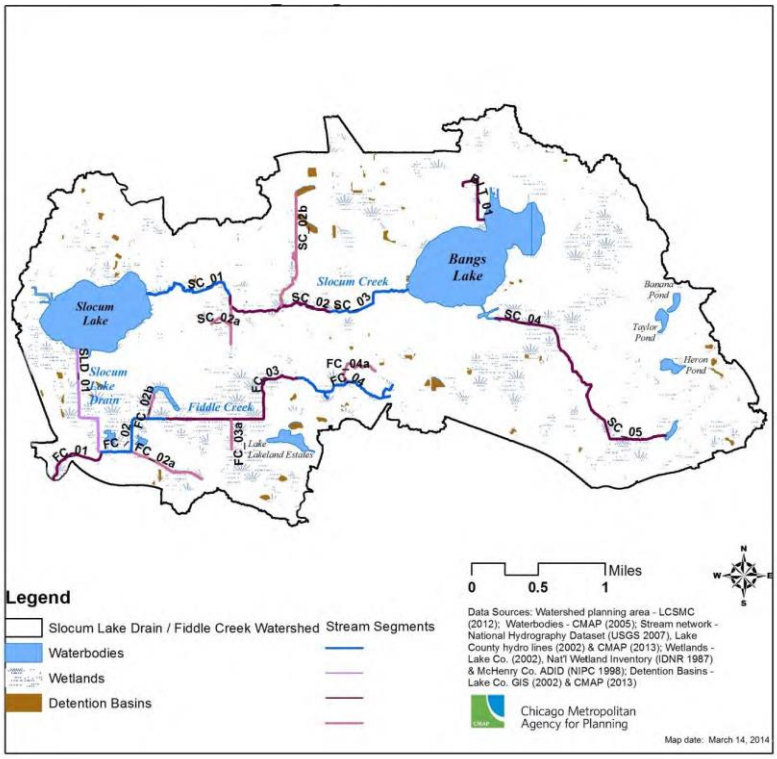


Figure 3-2: Slocum Lake Drain watershed, which includes Bangs Lake. Note that BLT01 and SC04 & 05 drain to Bangs Lake. (From 9-Lakes Plan.)

Drainage into Bangs Lake is shown with pink lines (streams less than 5 feet wide) in Figure 3-3. Note that SC05 appears to drain into Lakewood Marsh and that SC04 drains ADID Wetland 123, which is called Wauconda Bog. ADID wetlands have been determined by the IEPA to be high quality.

Wauconda Bog (ADID #123), is an Illinois Natural Areas Inventory Site (INAI) and was dedicated as a National Natural Landmark in 1974 (https://dnr.illinois.gov/inpc/area.area2lakewaucondabog.html). It has a high-quality plant community consisting of a forested tamarack bog and marsh. The bog is an ADID wetland due to its effective removal of sediment, toxicants, and nutrients from runoff.

Additional drainage areas have also been observed flowing into the Circle Channel, areas north of Bangs Lake and from Broberg Marsh, which is also listed as ADID 116. Flow from Broberg Marsh appears to occur only during high flows via a storm sewer pipe under Lakeshore Boulevard and a residential yard.

Broberg Marsh has high quality wildlife habitat in a hemi marsh community (emergent wetland). It is listed as an ADID wetland for stormwater storage and effective removal of sediment and toxicants. The Lake County Health Department performed water quality testing of Broberg Marsh in 2000 https://www.lakecountyil.gov/DocumentCenter/View/10605/2000-Broberg-Lake-Report-PDF. This report mentions that the marsh had relatively high nutrients levels.

Bangs Lake is also listed as ADID wetland #115 due to the presence of four threatened and endangered fish species and two aquatic plants.

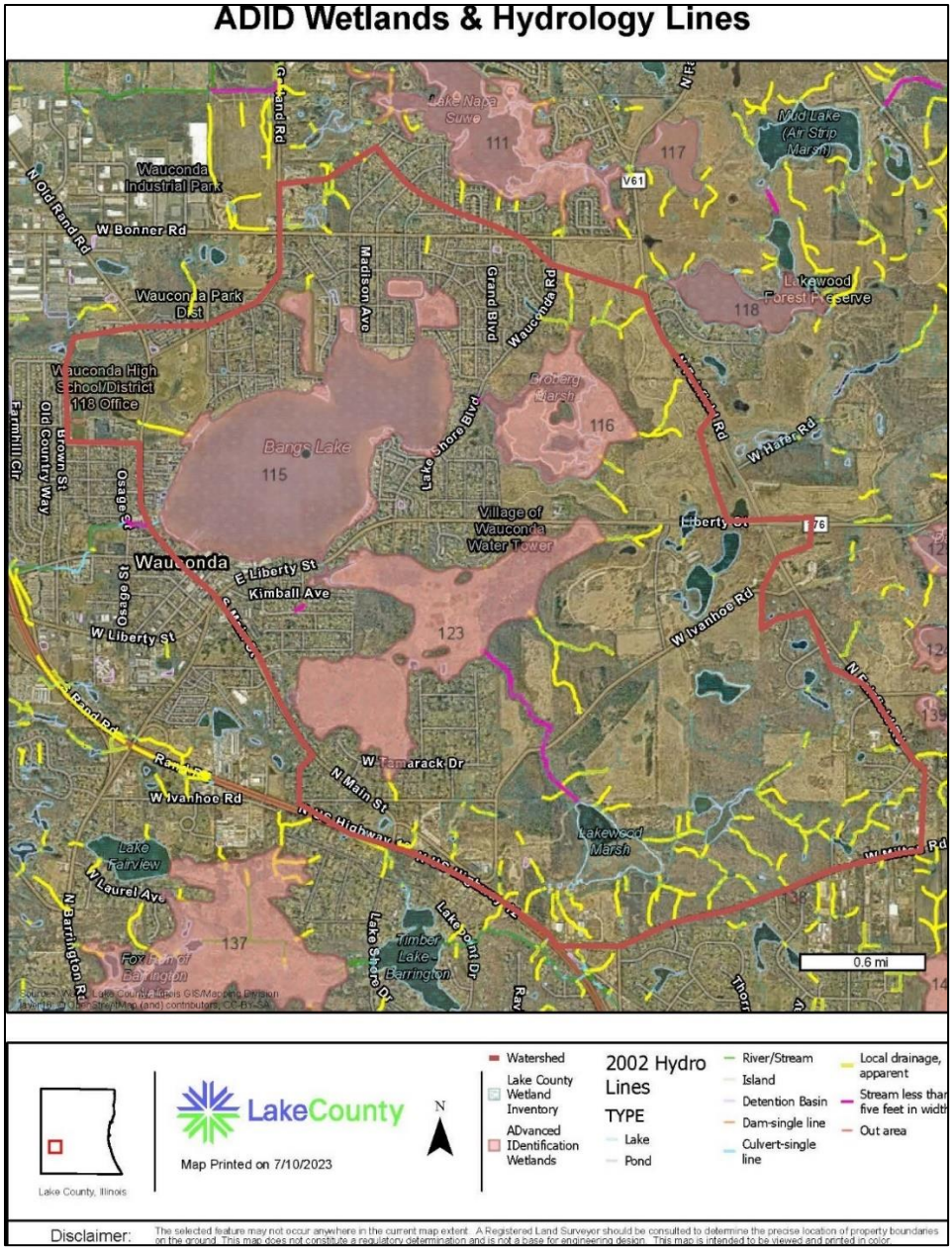


Figure 3-3: Note that the drainage into Bangs Lake from the watershed is mostly disconnected (yellow and pink lines). From Lake County Maps Online.

A closer analysis of the local drainage into Bangs Lake using the floodplain map, shows that the inlet at SC O4 (Figure 3-2) which is called the Kimball Channel, has a dam preventing water flowing into Bangs Lake until it reaches an elevation of 766 feet (Figure 3-4 & Photo 3-1).

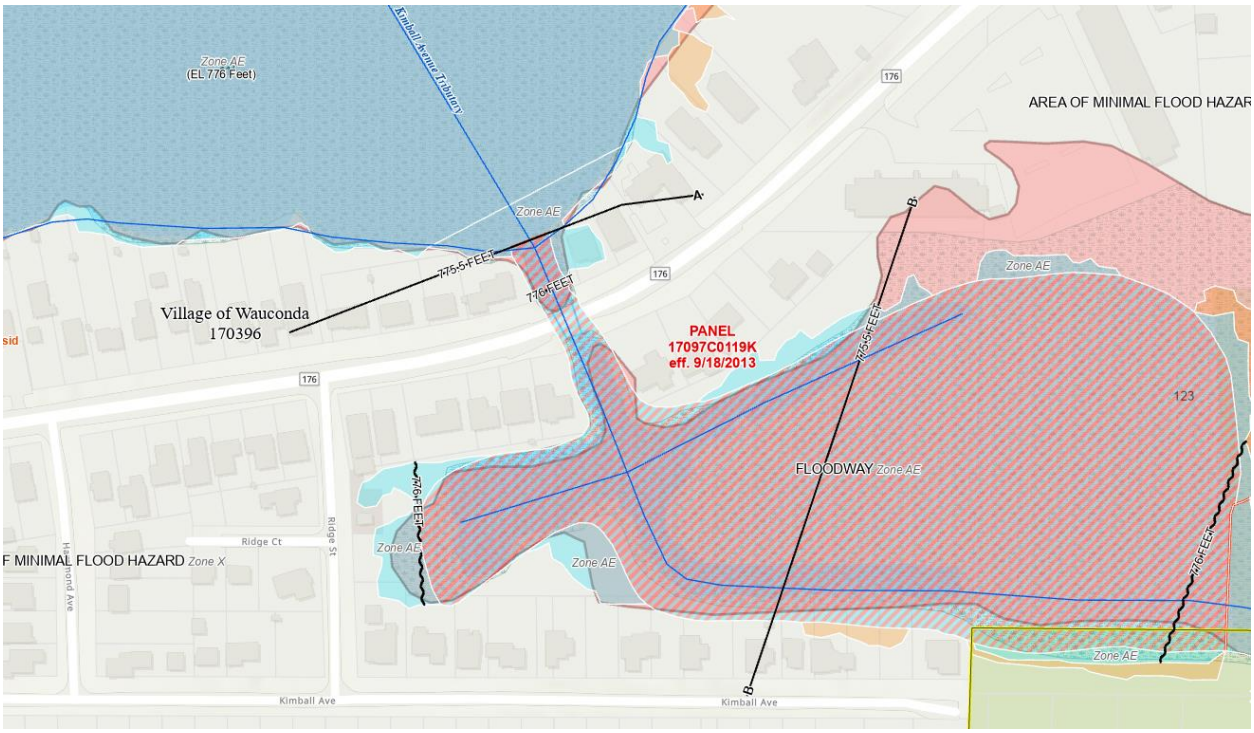


Figure 3-4: Floodplain map of Kimball channel flowing into Bangs Lake. Note that Kimball Channel (pink) has an elevation of 775.5 feet while Bangs Lake (blue) is at 776 feet. A small dam under Rt. 176 blocks the flow from this inlet except during high flows. This allows the wetland to "cleanse" water before discharging into Bangs Lake.

Photo 3-1: Rt. 176 bridge with dam underneath blocking the flow from Kimball Channel to Bangs Lake. Photo is facing north from Kimball Channel.

Land Use

Most of the land near Bangs Lake's shoreline was developed into residential or commercial areas prior to 1939. However, significant development within the watershed occurred from about 1950 through the early 1990s (See historical aerial photos).

A significant reason Bangs Lake has good water quality is due to the large portion of the watershed that consists of undeveloped areas such as: open space, vacant land, agriculture, wetlands, and water. Cumulatively, these areas add up to 65% of the Bangs Lake watershed (Figure 3-5 & Table 3-1). In addition, a large amount of flow coming from developed areas first flows through the wetlands before reaching Bangs Lake.

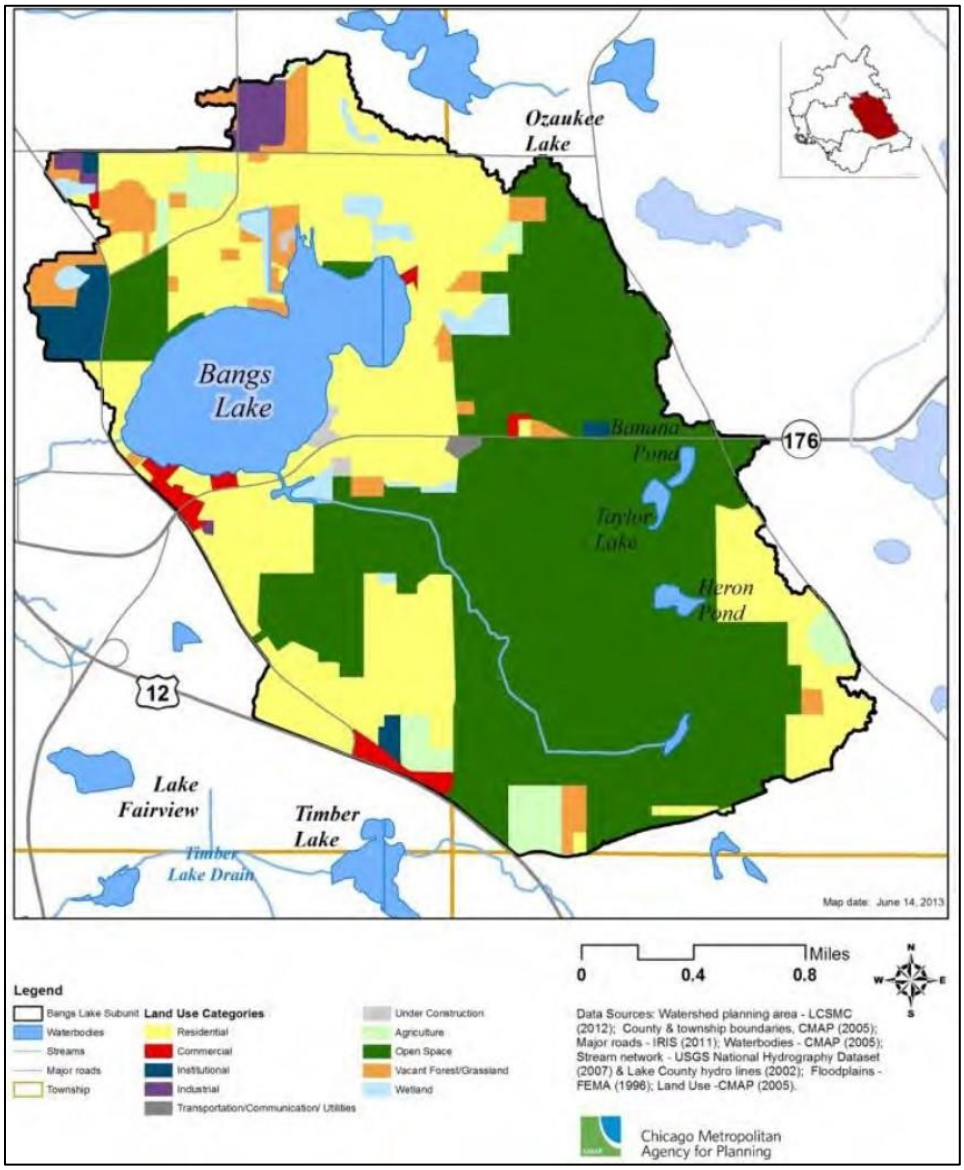


Figure 3-5: Land use within the Bangs Lake watershed – 2013. Note the large portion of the Bangs Lake watershed consists of open space. From *9-Lakes Plan*.

Land Use Category	*Area (acres)*	*Area (Sq.mi.)*	*Percent of Subunit*
Residential	969.2	1.5	30.6
Commercial	37.4	0.06	1.2
Institutional	51.8	0.08	1.6
Industrial	35.6	0.06	1.1
Transportation/ Communication/ Utilities	4.7	0.01	0.1
Under Construction	10.7	0.02	0.3
Agriculture	91.4	0.1	2.9
Open Space	1,439.9	2.2	45.6
Vacant Forest/Grassland	138.0	0.2	4.3
Wetland	63.3	0.1	2.0
Water	39.9	0.06	1.3
Bangs Lake	282.1	0.4	8.9
Totals	3,164.8	4.9	100.0

Table 3-1: Land use percentages from 2014. Table from *9-Lakes Plan*.

When developed areas (residential, commercial, institutional, industrial, and transportation) are combined, these land uses occupy 38% of the watershed. According to the *9-Lakes Plan,* runoff from these areas is 54% of the runoff flowing into Bangs Lake. The undeveloped areas (agriculture, open space, vacant, wetland, and water (excluding Bangs Lake)) comprise 62% of the watershed and produce 46% of the runoff.

The *9-Lakes Plan* shows data generated from the SWAMM (Spatial Watershed Assessment and Management Model) to calculate runoff and pollutant loading for the Bangs Lake watershed (Figure 3-6).

Although the land use may have changed slightly within the watershed since 2014 when *the 9 Lakes Plan* was finalized, these changes have not altered these ratios significantly, since most of the open land is protected against development.

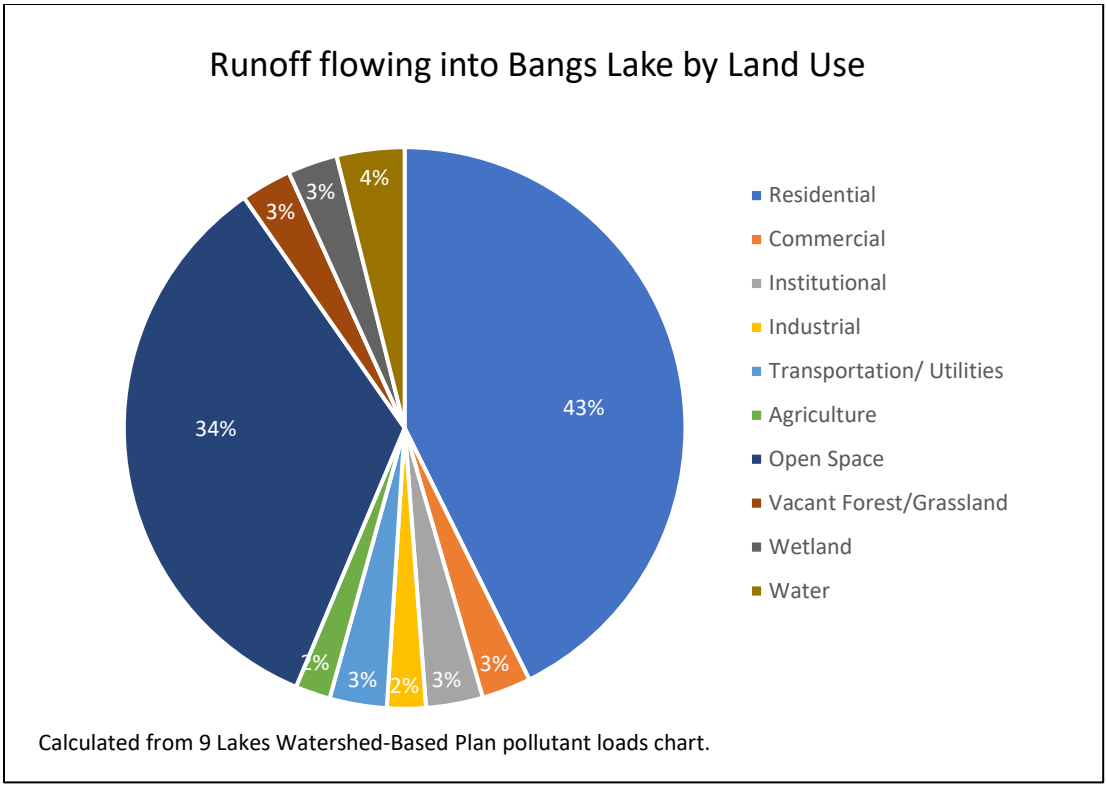


Figure 3-6: Note that most of the runoff comes from residential areas with open space as the second largest contributor (Data calculated from *9-Lake Plan*).

The *9-Lakes Plan* estimates that the Bangs Lake watershed has about 12.4% impervious area. This is predicted to increase to 13.6% by 2040. According to Figure 3-7, these percentages would fall within the impacted range. Impervious areas are land areas that prevent infiltration, such as roads and rooftops. These areas result in more runoff and lead to increases of suspended sediments, nutrients, and contaminants being carried into the lake.

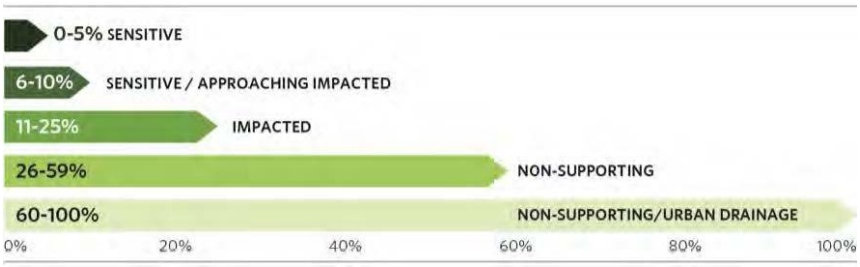


Figure 3-7: Stream / lake health as a function of the watershed's impervious cover. Center for Watershed Protection (2003) as shown in the *9-Lakes Plan*.

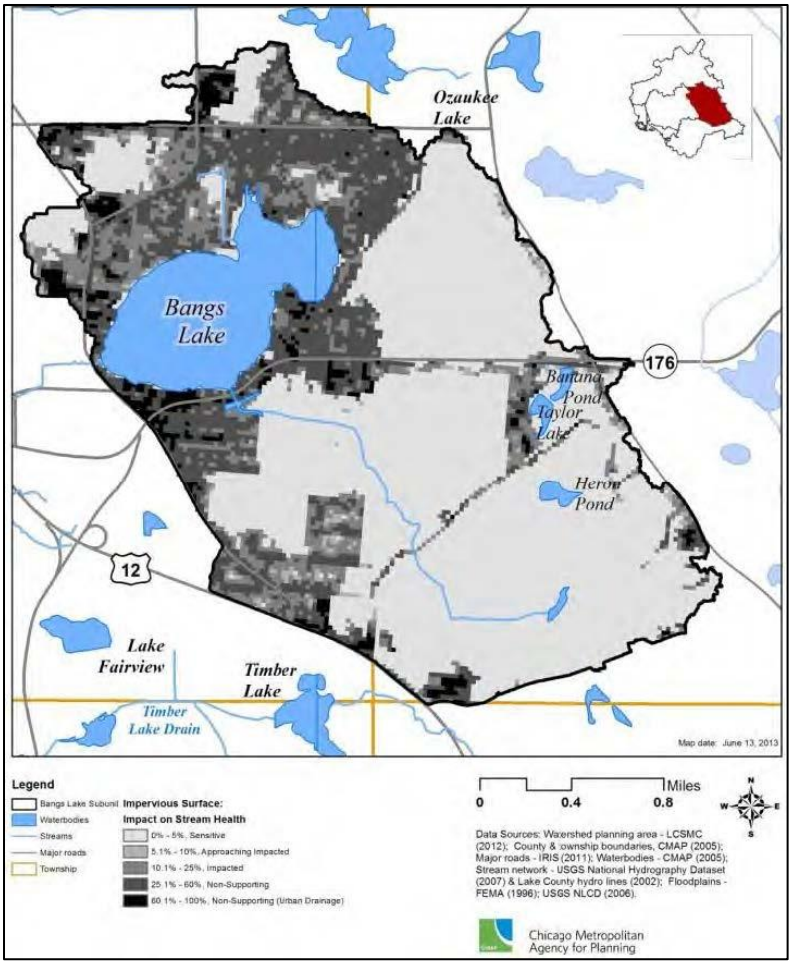


Figure 3-8: Impervious Cover within the Bangs Lake watershed. From 9-Lakes Plan.

Although the majority of the Bangs Lake watershed is developed or protected, some changes are predicted in future decades. These include converting some single-family residential areas to multifamily units, especially in the downtown and eastern sections near the lake as shown in orange (Figure 3-9). Other areas will be converted from open land to residential, especially along Peninsula Drive.

The Village of Wauconda Comprehensive Plan from 2012 estimated future growth of 1,000 – 5,000 new dwelling units within the next 20 – 25 years. The Village boundaries extend beyond the Bangs Lake watershed, but some of this growth will inevitably occur near the lake. Increased development in the commercial areas is also predicted.

https://files4.1.revize.com/wauconda/Document_Center/Services/Department/Community%20Development/Related%20Documents/2012%20Comprehensive%20Land%20Use%20Plan%20(PDF)_20150504104351053 4.pdf

Future Land Use

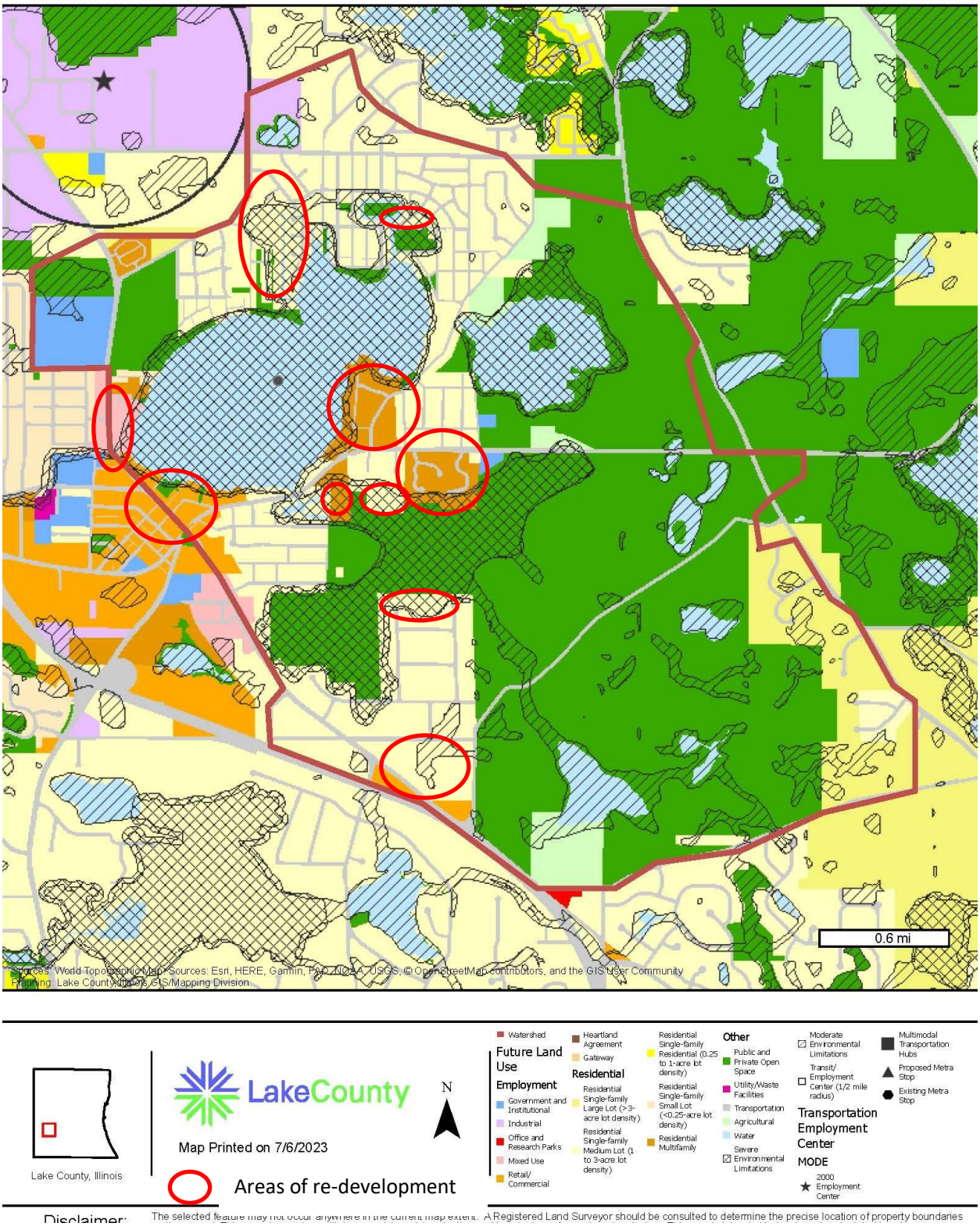


Figure 3-9: Estimated Future Land Use for the Bangs Lake watershed. From Lake County Maps Online.

Pollutant Loading

Residence time is the time it takes for water that flows into the lake to leave the lake. The residence time for Bangs Lake is estimated at 1.27 years at 462 days (*9-Lakes Plan*). This means that any pollutants or nutrients entering the lake tend to accumulate. Compare this to lakes having a higher inflow, such as nearby Lake Napa Suwe with a residence time of 0.21 years, and Slocum Lake at 0.17 years. A longer residence time provides a longer period in which pollutants can settle in the lake.

Phosphorous and Nitrogen

The *9-Lakes Plan* estimates an annual pollutant load of 8,493 lbs./yr. of nitrogen and 1,018 lbs./yr. of phosphorus flows into Bangs Lake from all land uses within the watershed. Based on modeling, up to 85 % of this phosphorus may settle in Bangs Lake. It is this ratio, discussed in more detail later in this section, which dictates the need for controlling phosphorous inputs instead of nitrogen. Residential areas account for 55% of the nitrogen and 45% of the phosphorus flowing into the lake (Figure 3-10). Phosphorous concentrations from Kimball Channel are significantly lower after moving through nearby wetlands. This supports evidence that nearby wetlands act as a "nutrient sink", filtering water before it reaches Bangs Lake (Figure 3-11).

Because the *9-Lakes Plan* focuses on the watershed, it doesn't consider any internal phosphorous cycling of Bangs lake. This concept is discussed in further detail in Appendix 4.

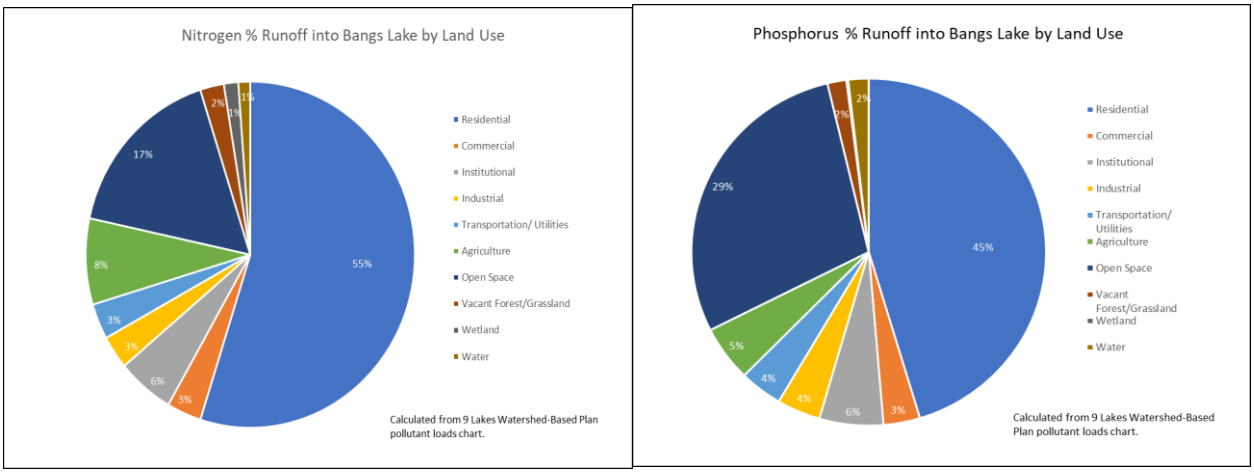


Figure 3-10: Percent of runoff for nutrients flowing into Bangs Lake as calculated from 9-Lakes Plan.

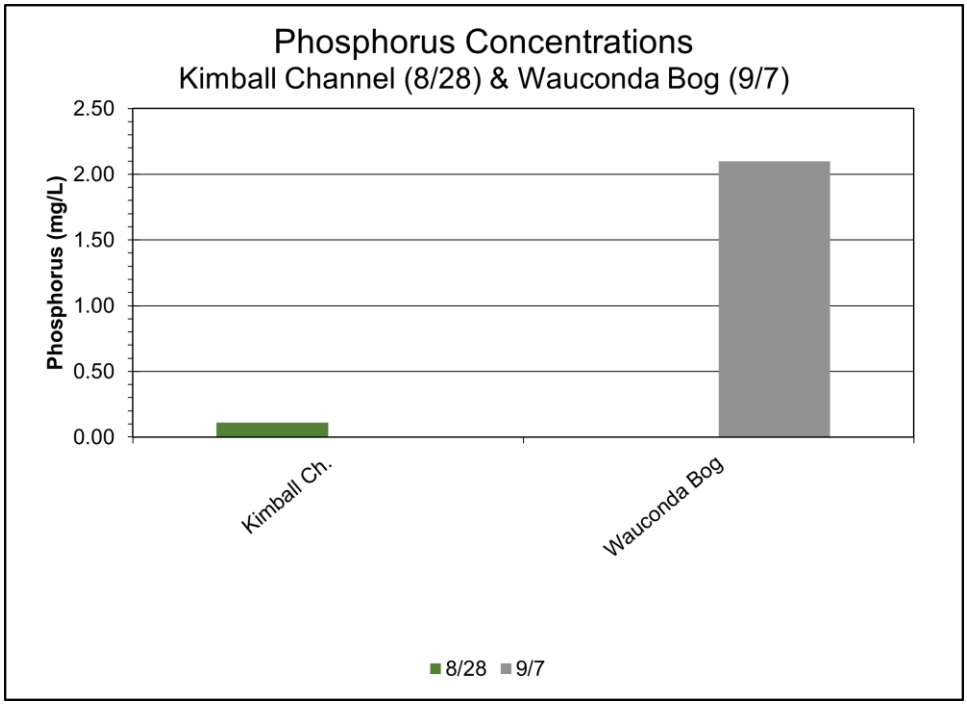


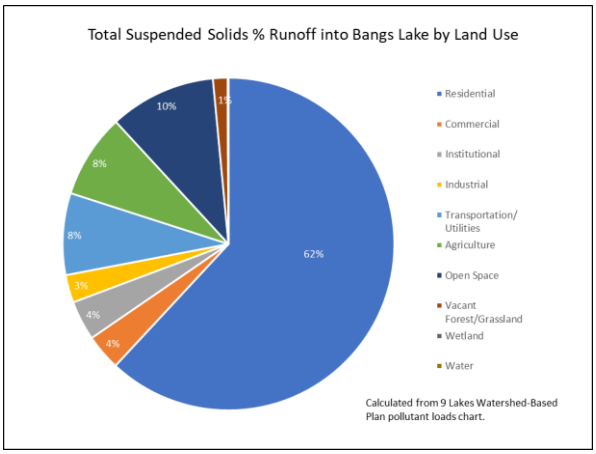
Figure 3-11: Phosphorous concentrations from Kimball Channel and Wauconda Bog.

Suspended Solids

Total suspended solids (TSS) enter the lake primarily from soil erosion, of which the majority comes from residential areas as calculated from the *9-Lakes Plan* (Figure 3-12). Many pollutants, such as phosphorus or metals, become attached to suspended particles, which can then flow into the lake.

Chloride

Chloride is a pollutant of concern as it disrupts the natural cycling of body fluids in many aquatic organisms, such as fish, amphibians, beneficial insects and more. Most of the chloride comes from the application of de-icing salts during the winter. Again, the highest concentrations come from residential areas.



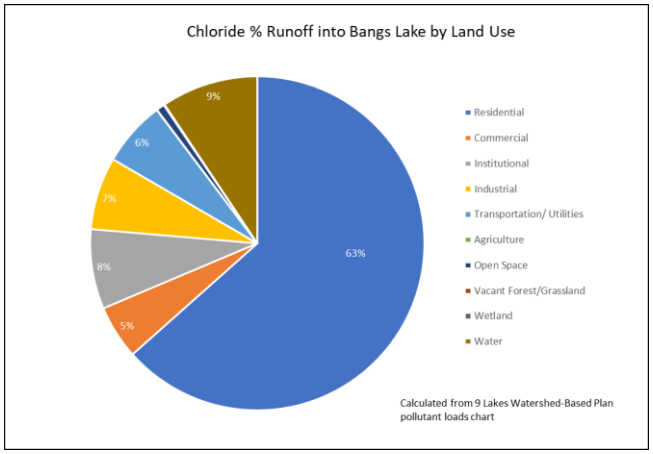


Figure 3-12: Percent of runoff for contaminants flowing into Bangs Lake as calculated from 9-Lakes Plan.

Septic Systems

Most of the Village of Wauconda is on a public sewer system (Figure 3-13, dark blue), however, some unincorporated areas within the watershed use septic systems (black circles). Areas near the Bangs Lake shoreline and channels may be of concern, as leaking septic systems have been known to seep into nearby lakes causing contamination.

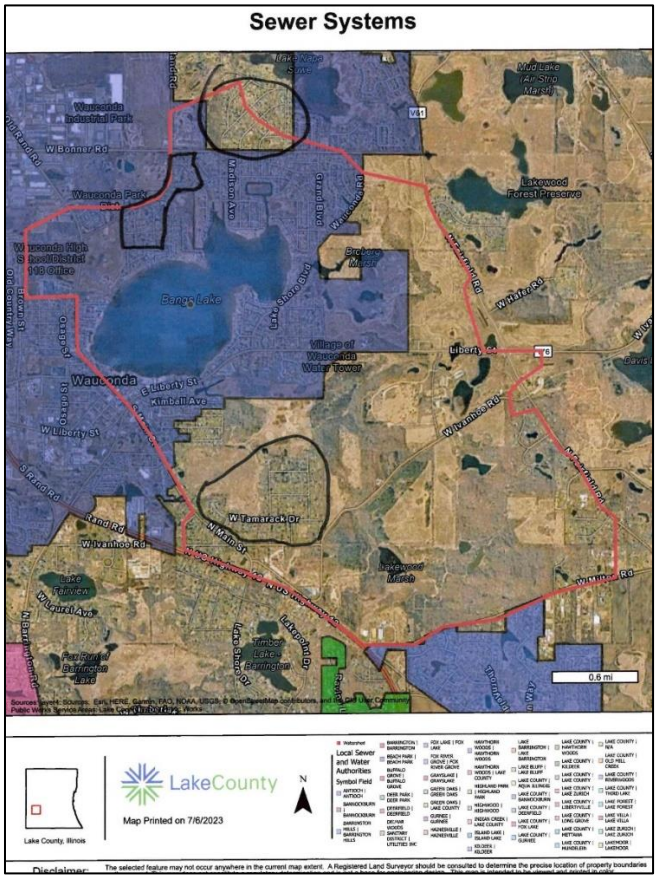
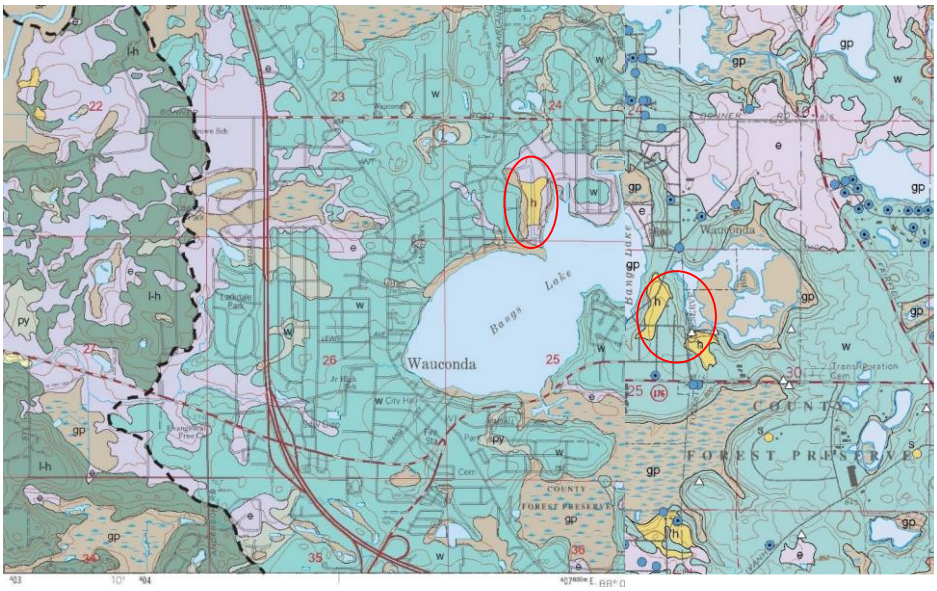
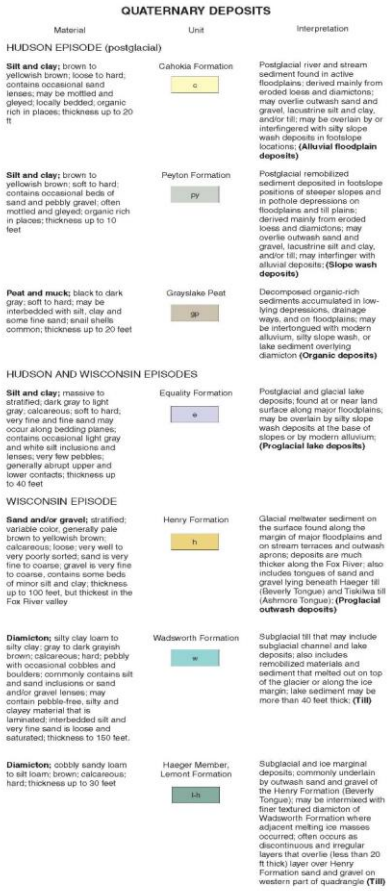


Figure 3-13: The blue area represents the Village public sanitary sewer system within the watershed (red line). Circled areas contain septic systems (provided by the Village of Wauconda Public Works Department).





QUATERNARY DEPOSITS

Material	Unit	Interpretation
HUDSON EPISODE (postglacial)		
Silt and clay; brown to yellowish brown; loose to hard; contains occasional sand lenses; may be mottled and gleyed; locally bedded; organic rich in places; thickness up to 20 ft	Cahokia Formation	Postglacial river and stream sediment found in active floodplains; derived mainly from eroded loess and diamictons; may overlie outwash sand and gravel, lacustrine silt and clay, and/or till; may be overlain by or interfingered with silty slope wash deposits in footslope locations; **(Alluvial floodplain deposits)**
Silt and clay; brown to yellowish brown; soft to hard; contains occasional beds of sand and pebbly gravel; often mottled and gleyed; organic rich in places; thickness up to 10 feet	Peyton Formation	Postglacial remobilized sediment deposited in footslope positions of steeper slopes and in pothole depressions on floodplains and till plains; derived mainly from eroded loess and diamictons; may overlie outwash sand and gravel, lacustrine silt and clay, and/or till; may interfinger with alluvial deposits; **(Slope wash deposits)**
Peat and muck; black to dark gray; soft to hard; may be interbedded with silt, clay and some fine sand; snail shells common; thickness up to 20 feet	Grayslake Peat	Decomposed organic-rich sediments accumulated in low-lying depressions, drainage ways, and on floodplains; may be intertongued with modern alluvium, silty slope wash, or lake sediment overlying diamicton **(Organic deposits)**
HUDSON AND WISCONSIN EPISODES		
Silt and clay; massive to stratified; dark gray to light gray; calcareous; soft to hard; very fine and fine sand may occur along bedding planes; contains occasional light gray and white silt inclusions and lenses; very few pebbles; generally abrupt upper and lower contacts; thickness up to 40 feet	Equality Formation	Postglacial and glacial lake deposits; found at or near land surface along major floodplains; may be overlain by silty slope wash deposits at the base of slopes or by modern alluvium; **(Proglacial lake deposits)**
WISCONSIN EPISODE		
Sand and/or gravel; stratified; variable color, generally pale brown to yellowish brown; calcareous; loose; very well to very poorly sorted; sand is very fine to coarse; gravel is very fine to coarse, contains some beds of minor silt and clay; thickness up to 100 feet, but thickest in the Fox River valley	Henry Formation	Glacial meltwater sediment on the surface found along the margin of major floodplains and on stream terraces and outwash aprons; deposits are much thicker along the Fox River; also includes tongues of sand and gravel lying beneath Haeger till (Beverly Tongue) and Tiskilwa till (Ashmore Tongue); **(Proglacial outwash deposits)**
Diamicton; silty clay loam to silty clay; gray to dark grayish brown; calcareous; hard; pebbly with occasional cobbles and boulders; commonly contains silt and sand inclusions or sand and/or gravel lenses; may contain pebble-free, silty and clayey material that is laminated; interbedded silt and very fine sand is loose and saturated; thickness to 150 feet.	Wadsworth Formation	Subglacial till that may include subglacial channel and lake deposits; also includes remobilized materials and sediment that melted out on top of the glacier or along the ice margin; lake sediment may be more than 40 feet thick; **(Till)**
Diamicton; cobbly sandy loam to silt loam; brown; calcareous; hard; thickness up to 90 feet	Haeger Member, Lemont Formation	Subglacial and ice marginal deposits; commonly underlain by outwash sand and gravel of the Henry Formation (Beverly Tongue); may be intermixed with finer textured diamicton of Wadsworth Formation where adjacent melting ice masses occurred; often occurs as discontinuous and irregular layers that overlie (less than 20 ft thick) layer over Henry Formation sand and gravel on western part of quadrangle **(Till)**

Surficial Geology of Wauconda and Grayslake Quadrangles by ISGS

Image 3-1: Red circles by the Peninsula Channel and near Broberg Marsh have shallow deposits of sand and gravel. These areas also have wells. Shallow deposits of sand and gravel are more likely to convey pollutants to Bangs Lake from septic systems, lawn fertilizers, etc. indicating they can be a significant contributor to high phosphorous levels.

Additional Figures:

Additional information is presented below with associated exhibits found at the end of this Appendix.

Historical Aerial Photos:

- 1939 Aerial of Bangs Lake Watershed
    - Note development is mostly along the lake shoreline. Most of the watershed is either farmland or marsh (Broberg Marsh and Wauconda Bog). Washington Channel is visible. Kimball Channel is a marshy stream.
- 1946 Aerial of Bangs Lake Watershed
    - No significant changes from the 1939 aerial.
- 1961 Aerial of Bangs Lake Watershed
    - Many more homes are visible north of the lake and near the southwestern watershed boundary. Circle channel has been added. Both Berger and Kimball channels are visible.
- 1974 Aerial of Bangs Lake Watershed

    - More development north and west of the lake.
- 1980 Aerial of Bangs Lake Watershed
    - This aerial is an infrared photo, which is based on temperature, so water shows up as black. Development appears denser than in the 1974 aerial. More development occurs along Main Street southwest of the lake.
- 1993 Aerial of Bangs Lake Watershed
    - Peninsula channel first appears. More development occurs along Fairfield Road, south of the lake. The ball fields northwest of the lake are visible.
- 2002 Aerial of Bangs Lake Watershed
    - Development appears denser.
- 2012 Aerial of Bangs Lake Watershed
    - Not many changes since the previous aerial.
- 2022 Aerial of Bangs Lake Watershed
    - No significant new development since the previous two aerial photos.

Other Figures:

- Floodplain Map
    - The FEMA Flood Insurance Rate Map for the Bangs Lake watershed identifies flood hazard zones.
- Flood of Record
    - Identifies the historic floods as measured by the USGS.
- Municipalities and Forest Preserves
    - This map shows the incorporated, unincorporated (no color), and forest preserve areas (green). Wauconda is shown as light brown.
    - Unincorporated areas occur around and west of Peninsula channel and a few blocks north of the Circle channel. Another unincorporated area occurs near Main St. and Tamarack Dr., also the far southeast section of the watershed is unincorporated.
- Existing Nutrient Transformation (P-Focus)
    - Is the ability of a water body to remove nutrients (phosphorus) and improve water quality. Short-term phosphorus retention is through plant uptake. Deposition in the soil indicates long-term phosphorus retention as described in the Wetland Restoration and Preservation Plan (WRAPP) Vol. 1 Technical Report, Section 4-Methods (https://www.lakecountyil.gov/DocumentCenter/View/31746/WRAPP-Vol-1-Tech-Report-Final-PDF?bidId=)
    - Note that Wauconda Bog (Lakewood Forest Preserve), portions of Lakewood Marsh, and Broberg Marsh along with miscellaneous wetlands are labeled orange with moderate phosphorus retention. Bangs Lake and most of Broberg Marsh have low retention.

Nutrient Transformation (Phosphorus-focus)	High	• Isolated wetlands (excluding vernal pools and farmed wetlands)
	Moderate	• Throughflow and outflow-type riparian wetlands that are seasonally saturated or seasonally flooded (excluding ditched wetlands and farmed wetlands) • Isolated farmed wetlands that are Terrene Basin or Terrene Flat
	Low	• All remaining wetlands (e.g., slope wetlands, vernal pools, remaining ditched wetlands) and water bodies (e.g., open water portions of lakes, ponds, and rivers and intermittent streams)
	N/A	--

Table 1: Nutrient Transformation key for map. From WRAPP Vol 1 Technical Report.

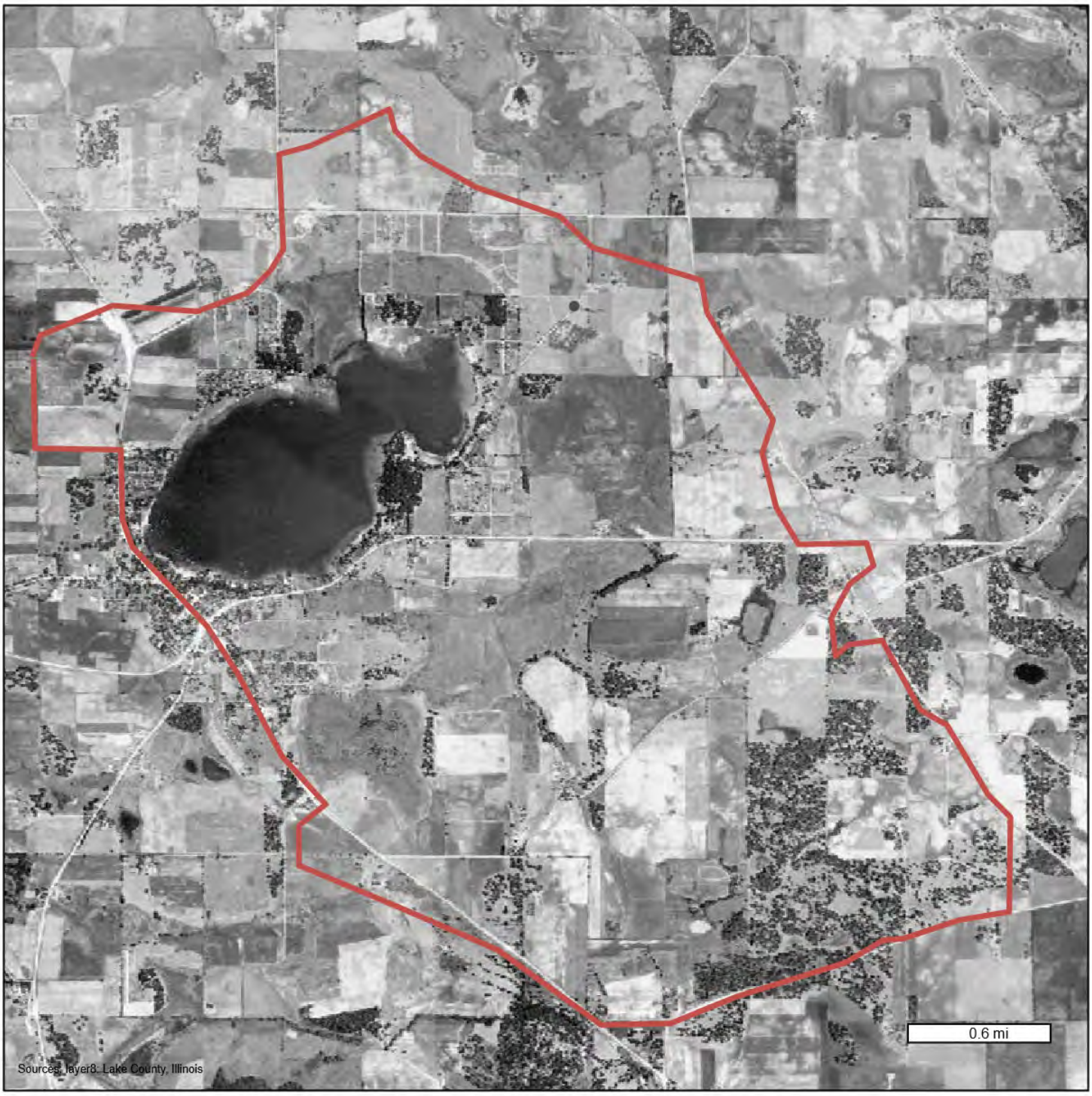
- Potential Nutrient Transformation (P-Focus)
    - Additional areas within the Bangs Lake watershed that could be restored to retain phosphorus. The areas around Bangs Lake are shown in orange (moderate).
- Existing Sediment Retention
    - Retaining sediment will prevent it from moving downstream. The amount of plant cover, water slow rates, and depth influence an area's sediment retention capacity.
    - Note that Bangs Lake has a high level of sediment retention as do many of the wetlands surrounding it. The shoreline is shown as lower, likely due to resuspension of bottom sediments from wave action. Most of the large wetlands are shown as having moderate sediment retention capacity.

Sediment and Other Particulate Retention	High	• Basin, Fringe, and Island wetlands associated with lakes (excluding unconsolidated shore types) • Floodplain wetlands (excluding unconsolidated shore types) • Terrene Basin Isolated wetlands • Lacustrine Limnetic systems (depth > 2m)
	Moderate	• Island wetlands (other than those associated with lakes) • Throughflow or Throughflow-Intermittent Lotic Stream Basin, Flat, and Fringe wetlands • Lotic River Basin, Flat and Fringe Throughflow wetlands • Throughflow or Throughflow-Intermittent Ponds • Throughflow-Intermittent, Outflow, Outflow-Intermittent, or Outflow Artificial Terrene Basin wetlands • Lacustrine Littoral systems (excluding unconsolidated shore types) • All wetlands associated with a pond
	Low	• All remaining wetlands and water bodies
	N/A	--

Table 2: Sediment retention key for map. From WRAPP Vol 1 Technical Report.

- Potential Sediment Retention
    - Note that many of the same areas that could be restored to have additional phosphorus retention, are also good for retaining sediment. Many shoreline wetlands have high retention capabilities.
- Potentially Restorable Wetlands
    - Wetlands that could be restored are color coded by the size of the wetland. This information is from the Wetland Restoration and Preservation Plan (WRAPP).
    - Locations close to Bangs Lake are of interest. These include areas along the north shore of Bangs Lake as well as along many of the channels. Our assessment of these PRW's is they are very conservatively assessed, with much greater restoration acreage available in the immediate vicinity.

1939 Aerial of Bangs Lake Watershed



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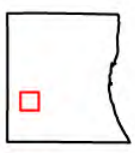


Lake County, Illinois

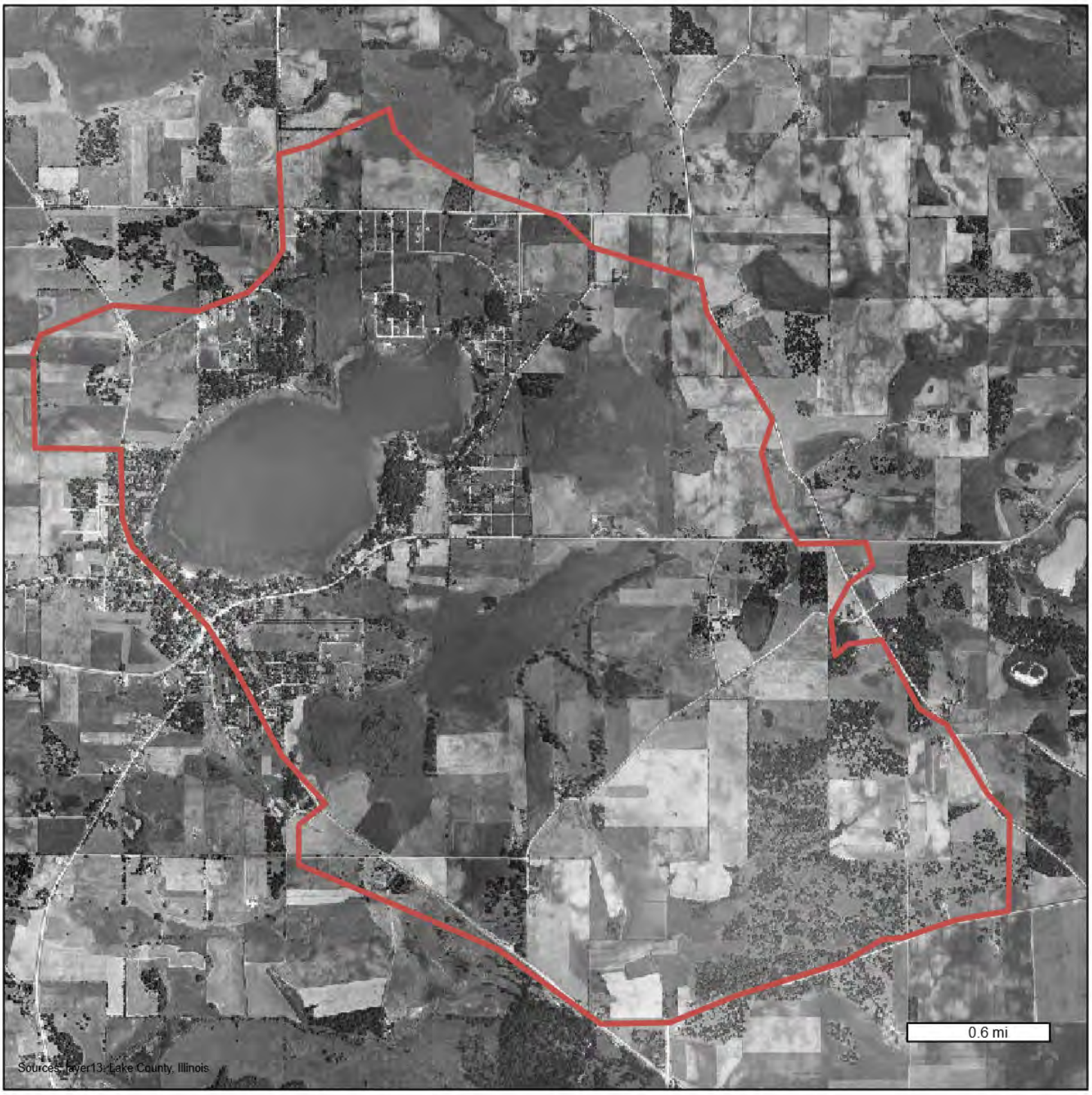
LakeCounty

N

Map Printed on 7/3/2023

Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

1946 Aerial of Bangs Lake Watershed



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Lake County, Illinois

LakeCounty

N

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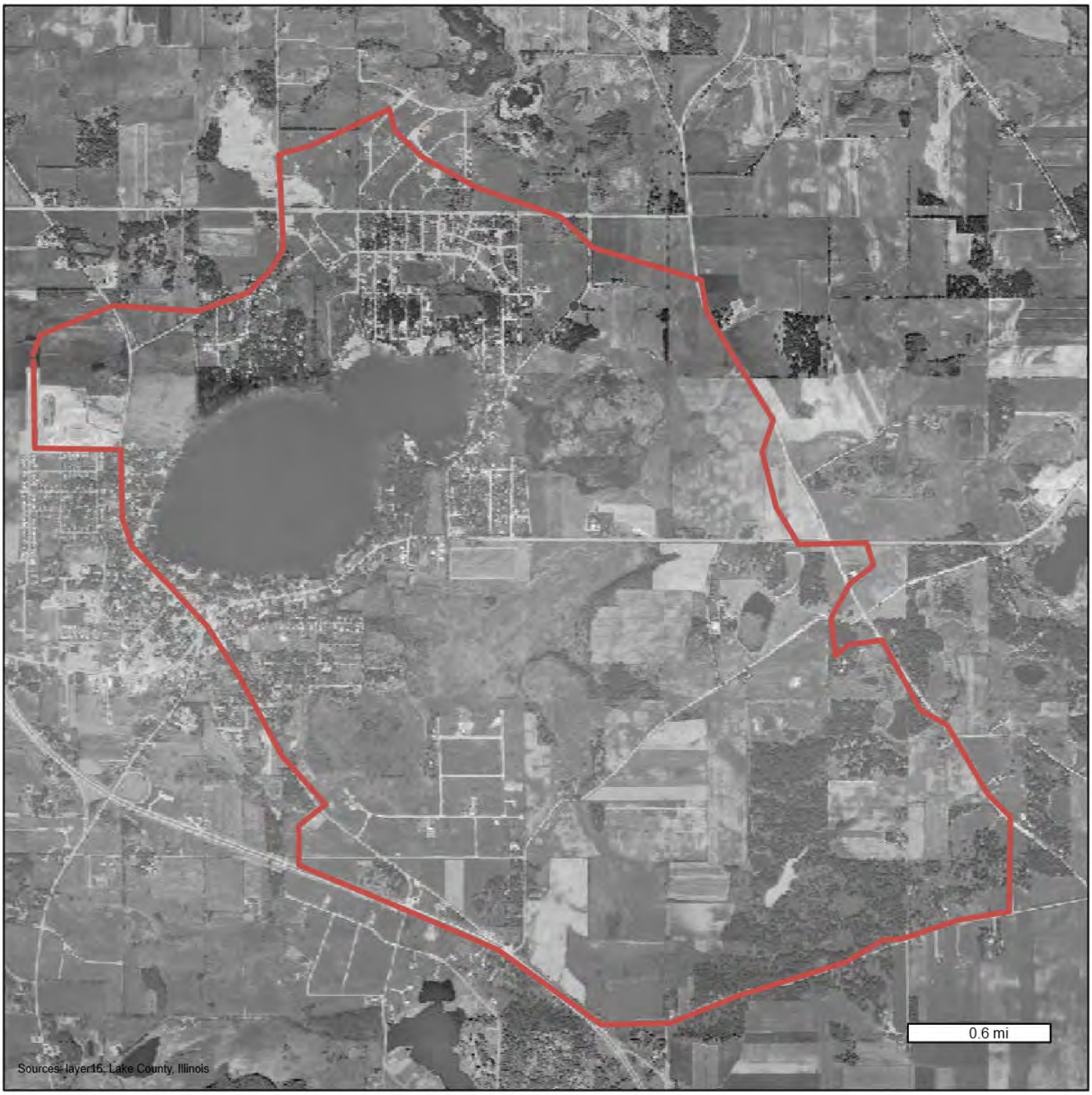
1961 Aerial of Bangs Lake Watershed



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Lake County, Illinois

LakeCounty

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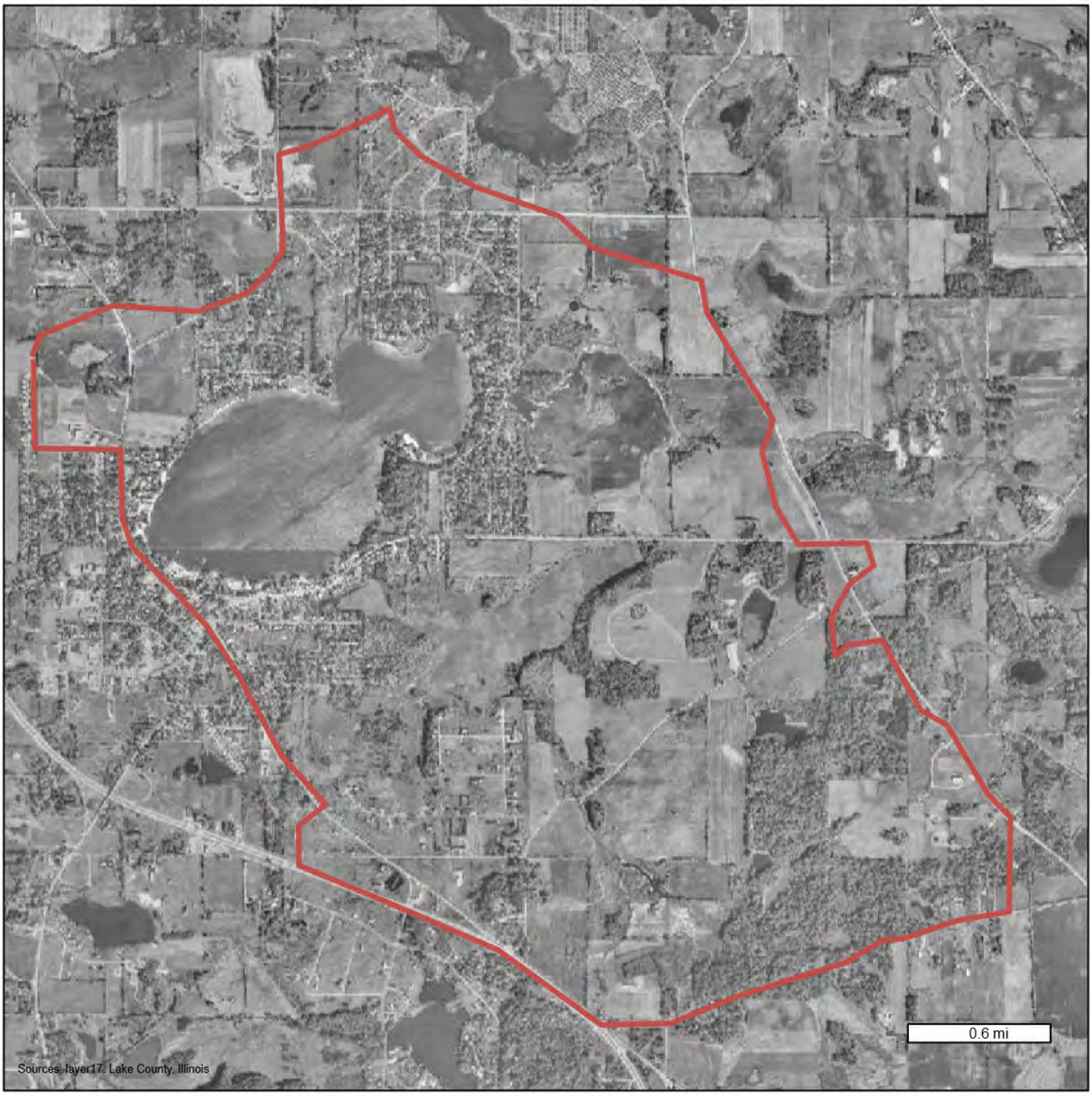
1974 Aerial of Bangs Lake Watershed



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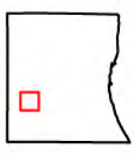

Lake County, Illinois

LakeCounty

N

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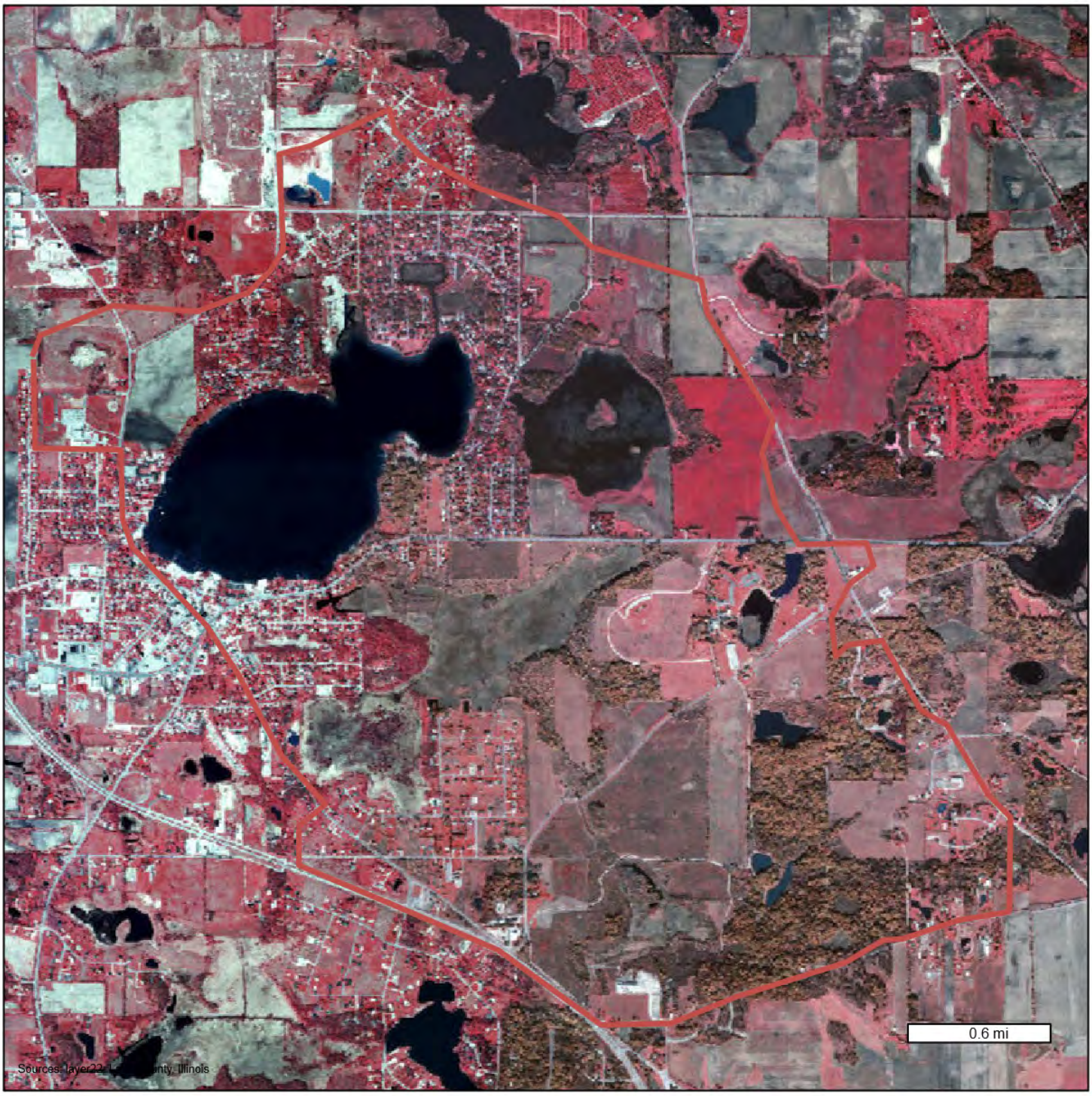
1980 Aerial of Bangs Lake Watershed



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Lake County, Illinois

LakeCounty

N

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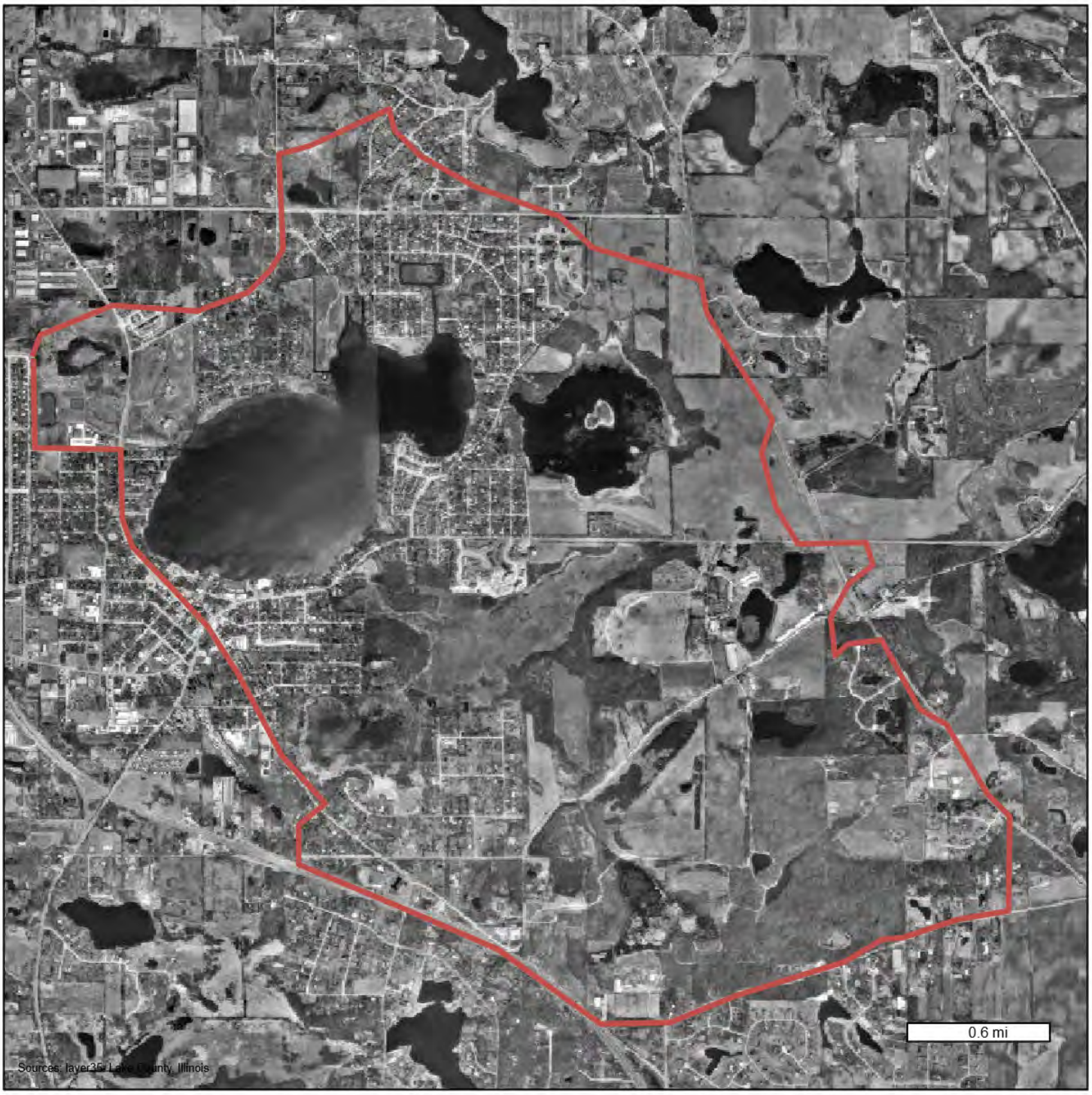
1993 Aerial of Bangs Lake Watershed



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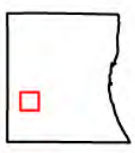

Lake County, Illinois

LakeCounty

N

Map Printed on 7/3/2023

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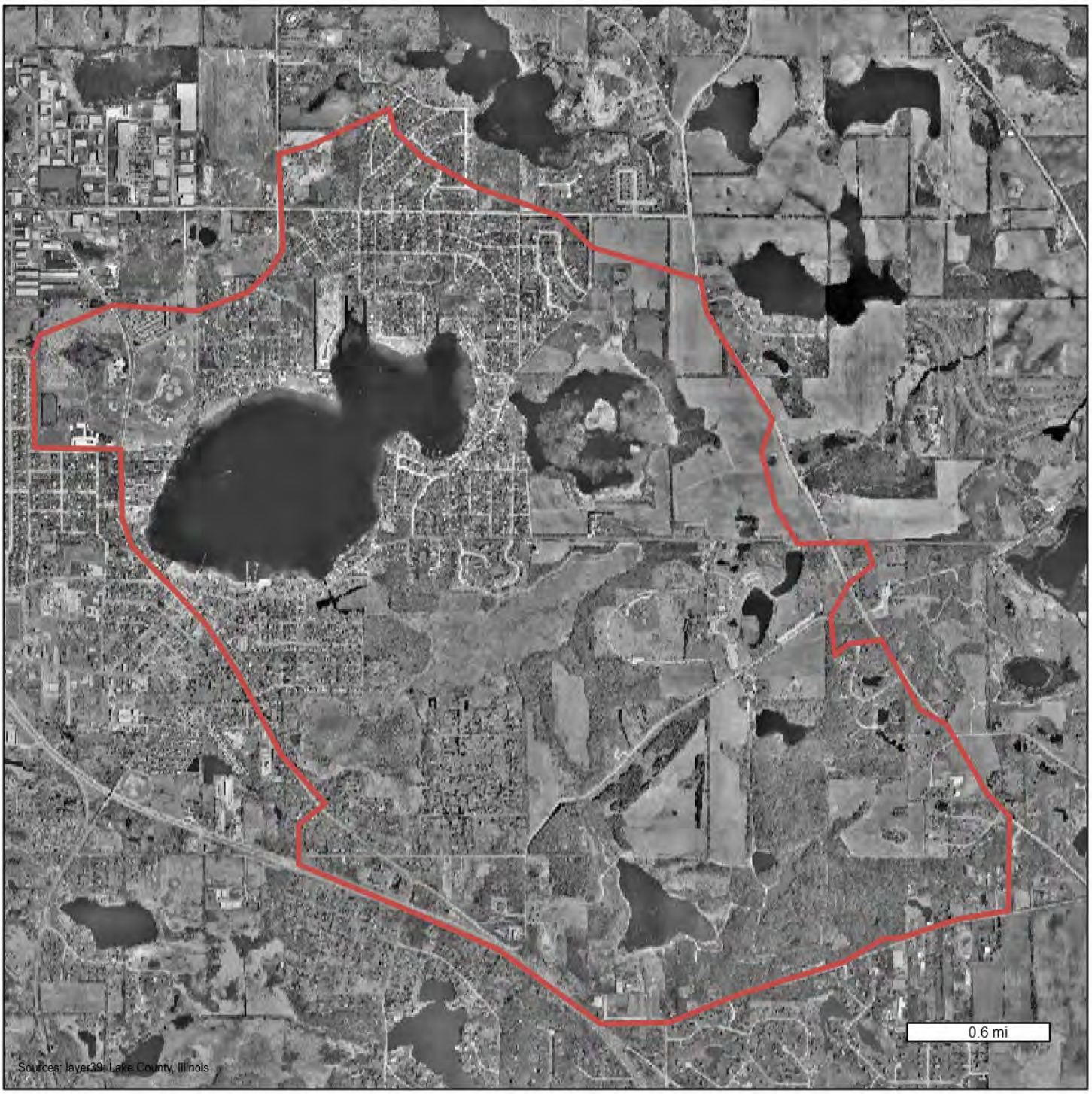
2002 Aerial of Bangs Lake Watershed



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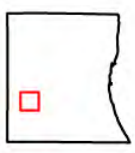

Lake County, Illinois

LakeCounty

N

Map Printed on 7/3/2023

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2012 Aerial of Bangs Lake Watershed

Override 1

Lake County, Illinois

LakeCounty

N

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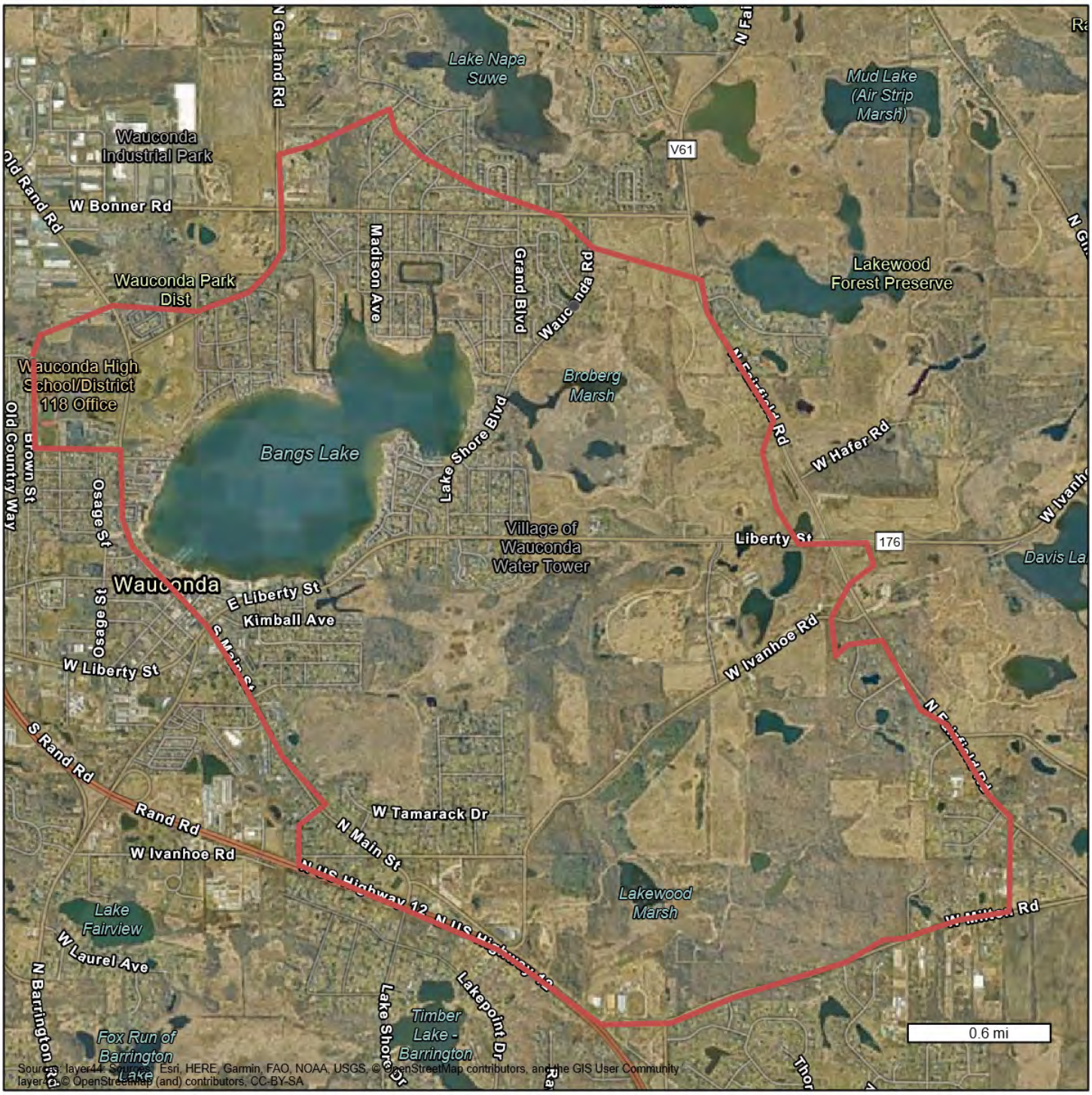
2022 Aerial of Bangs Lake Watershed



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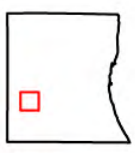

Lake County, Illinois

LakeCounty

N

Map Printed on 7/3/2023

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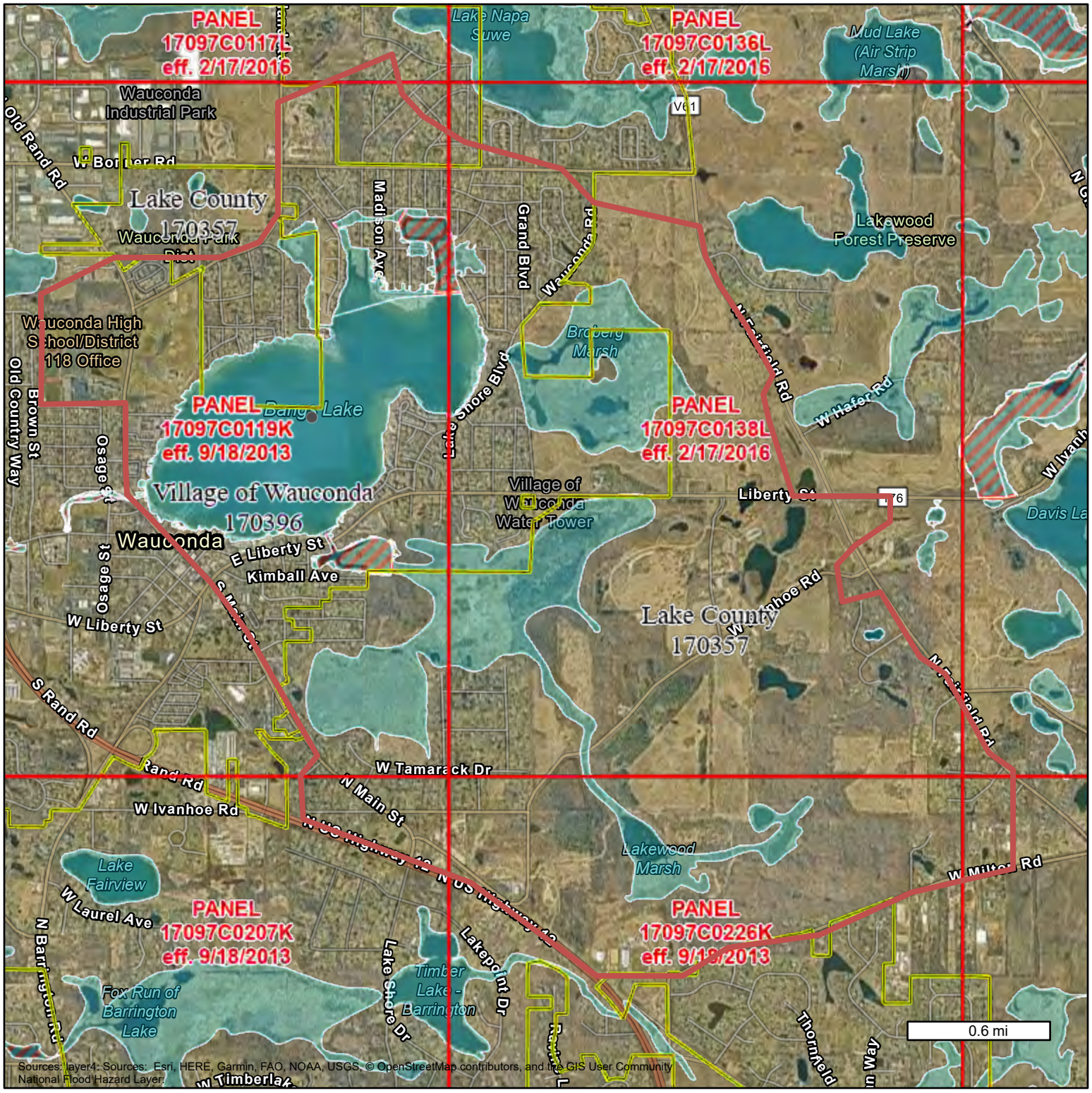
Floodplain Map



Lake County, Illinois

LakeCounty

Map Printed on 7/6/2023

N

- Watershed
- FIRM Panels

Flood Hazard Zones

Zone Type

- 1% Annual Chance Flood Hazard
- Regulatory Floodway
- Special Floodway
- Area of Undetermined Flood Hazard
- 0.2% Annual Chance Flood Hazard
- Future Conditions 1% Annual Chance Flood Hazard
- Area with Reduced Risk Due to Levee

Flood Hazard Boundaries

Line Type

- Limit Lines
- SFHA / Flood Zone Boundary
- Other Boundaries

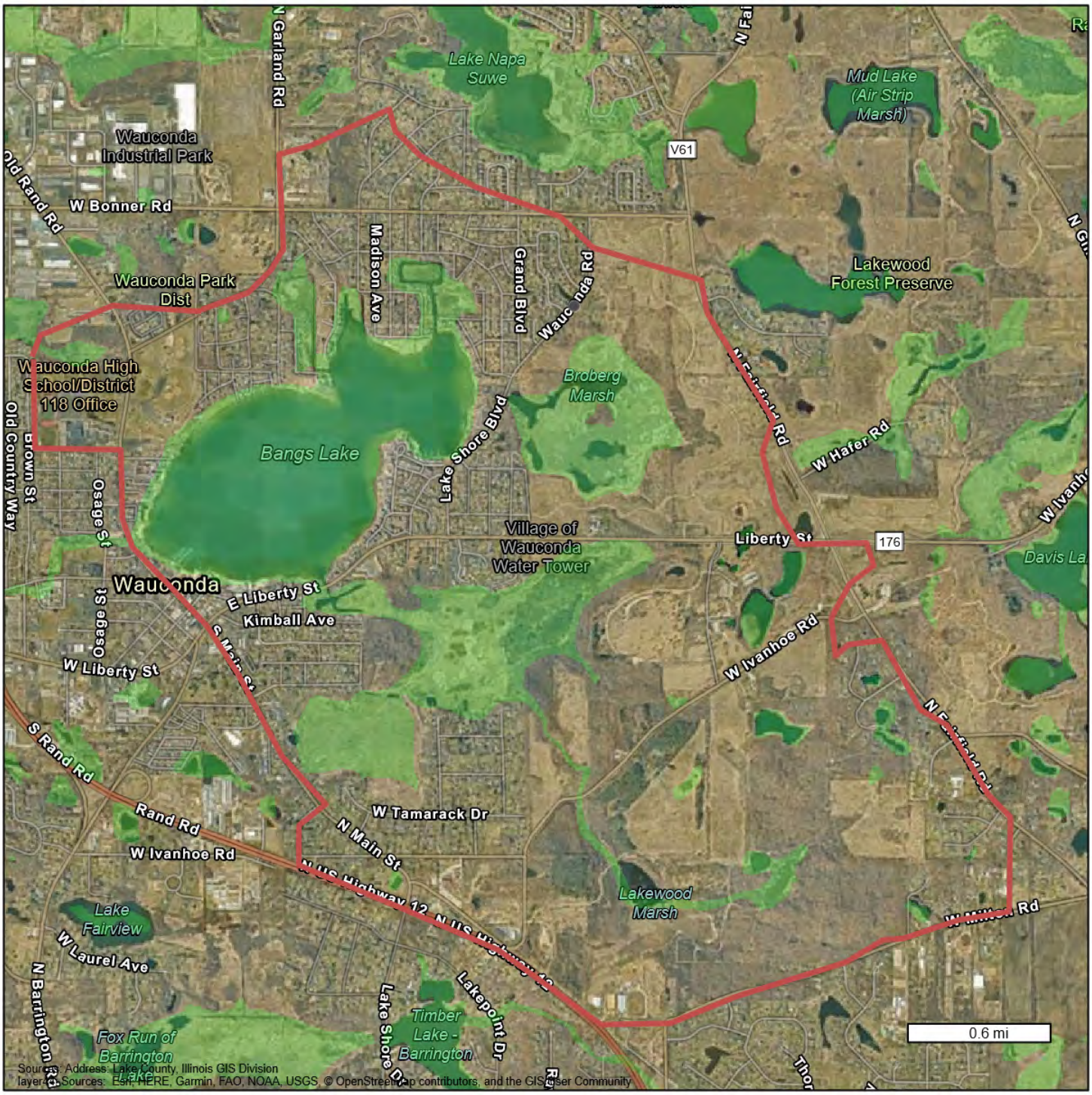
General Structures

Structure Type

- Flood Structure
- Bridge
- Dam, Weir, Jetty
- Other Structure
- Levees
- Political Jurisdictions

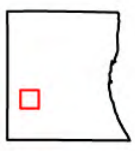
Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

Flood of Record



Override 1

USGS Flood of Record



Lake County, Illinois

LakeCounty

N

Map Printed on 7/3/2023

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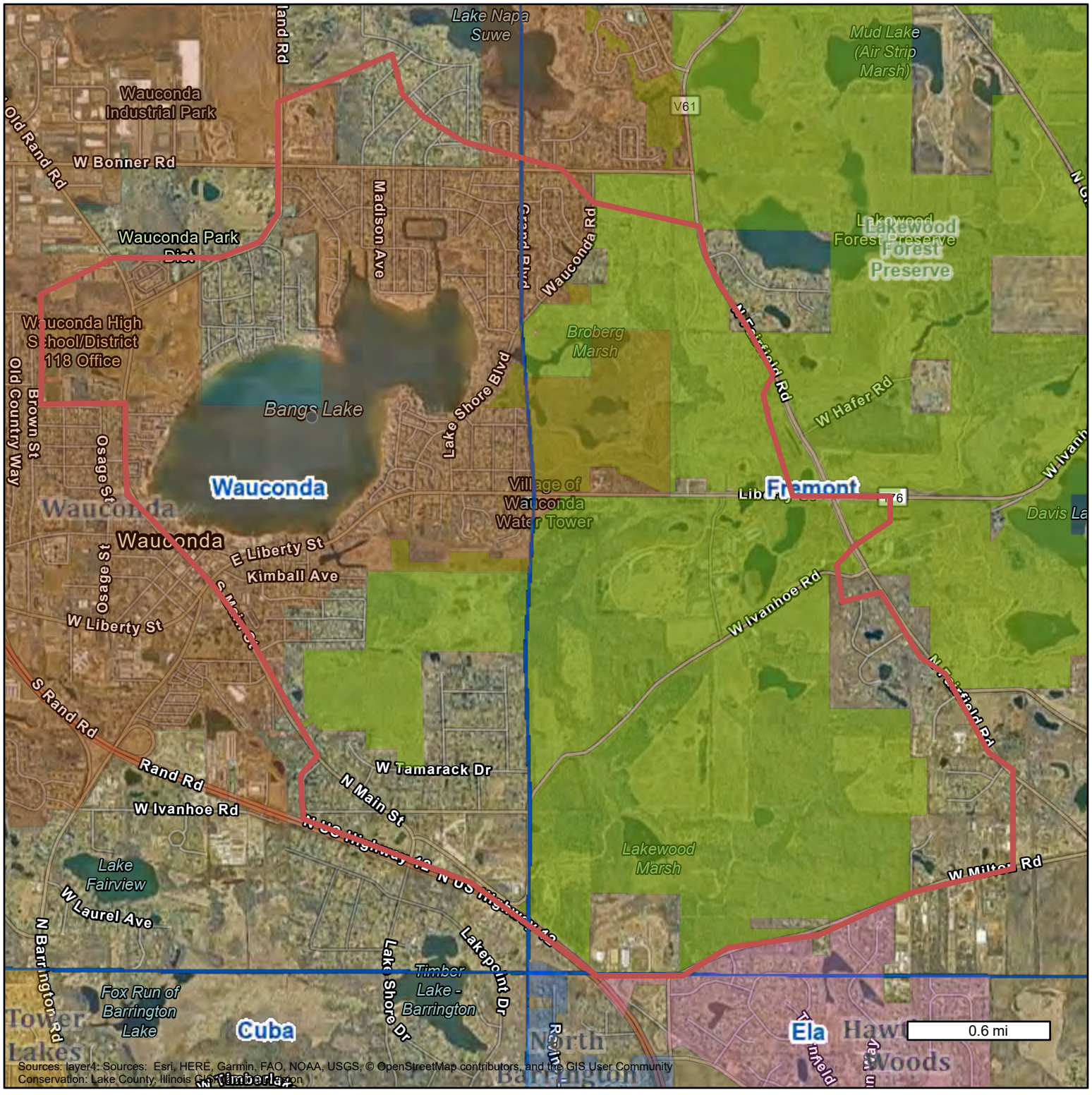
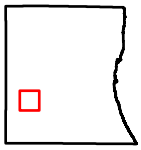
Municipalities & Forest Preserves





Lake County, Illinois

LakeCounty

Map Printed on 7/6/2023

N

Watershed
Township Boundaries

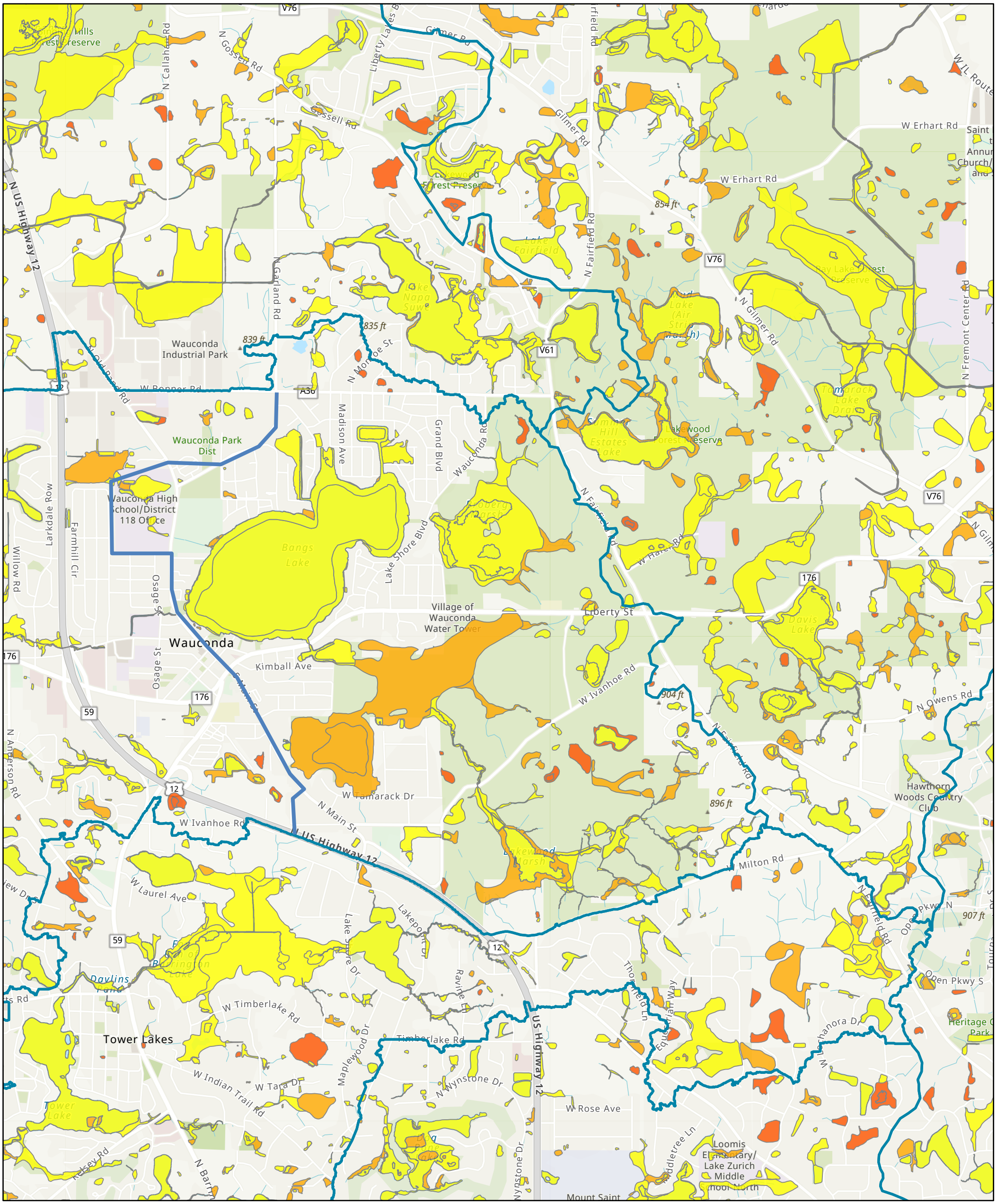
Municipalities

NAME

City of Highland Park
City of Highwood
City of Lake Forest
City of North Chicago
City of Park City
City of Waukegan
City of Zion
Village of Antioch
Village of Arlington Heights
Village of Bannockburn
Village of Barrington
Village of Barrington Hills
Village of Beach Park
Village of Buffalo Grove
Village of Deer Park
Village of Deerfield
Village of Fox Lake
Village of Fox River Grove
Village of Grayslake
Village of Green Oaks
Village of Gurnee
Village of Hainesville
Village of Hawthorn Woods
Village of Indian Creek
Village of Island Lake
Village of Kildeer
Village of Lake Barrington
Village of Lake Bluff
Village of Lake Villa
Village of Lake Zurich
Village of Lakemoor
Village of Libertyville
Village of Lincolnshire
Village of Lindenhurst
Village of Long Grove
Village of Mettawa
Village of Mundelein
Village of North Barrington
Village of Northbrook
Village of Old Mill Creek
Village of Palatine
Village of Port Barrington
Village of Riverwoods
Village of Round Lake
Village of Round Lake Beach
Village of Round Lake Heights
Village of Round Lake Park
Village of Third Lake
Village of Tower Lakes
Village of Vernon Hills
Village of Volo
Village of Wadsworth
Village of Wauconda

Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

Existing Nutrient Transformation (P-focus)



7/19/2023, 1:59:26 PM

Lake County Boundary

Boundary - SMC Sub-watersheds

Bangs Lake

Nutrient Transformation (P-focus) (EWI)

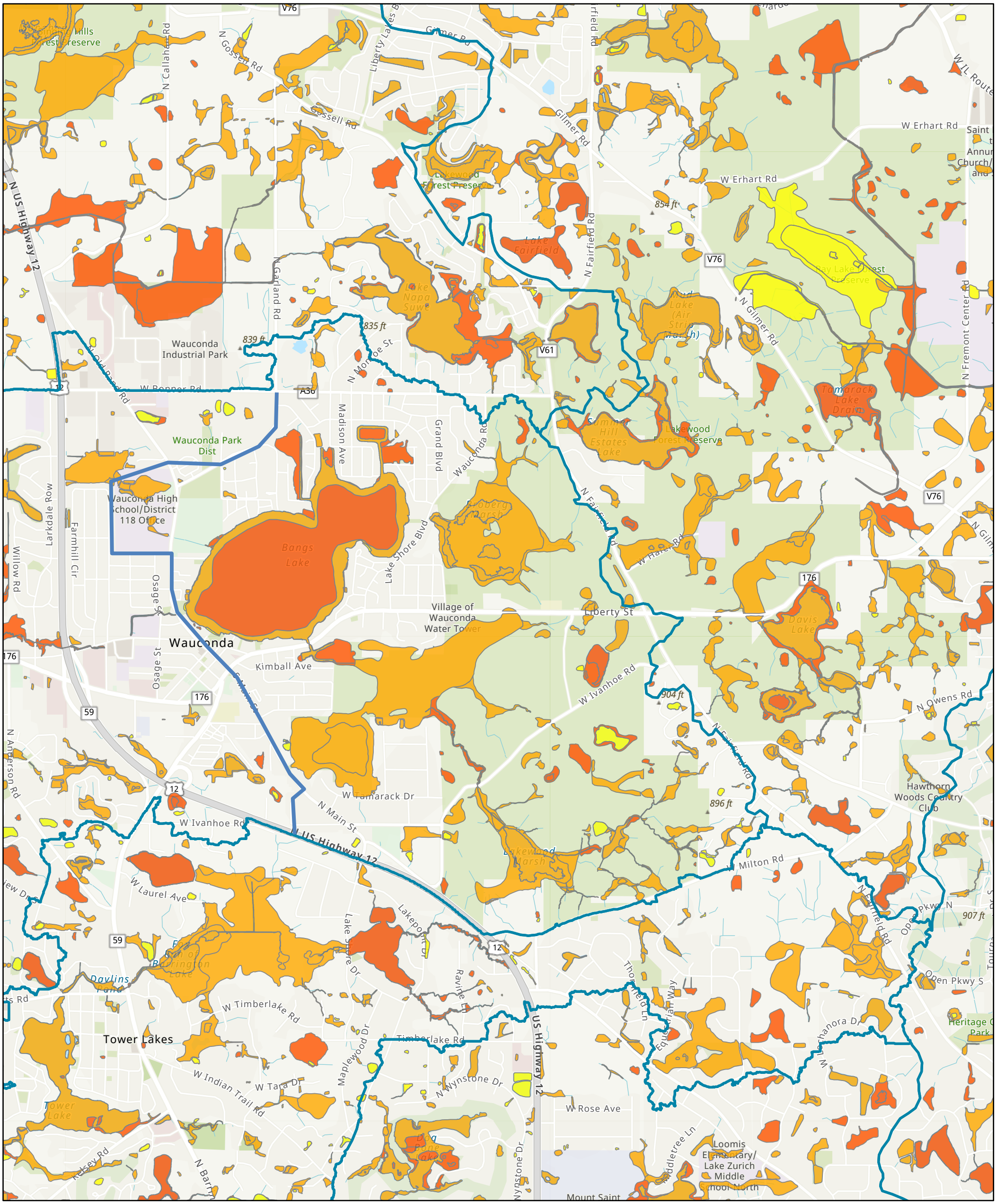
- High
- Moderate
- Low

1:36,112

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

Existing Sediment Retention



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Lake County Boundary

Boundary - SMC Sub-watersheds

Sediment & Other Particulate Retention (EWI)

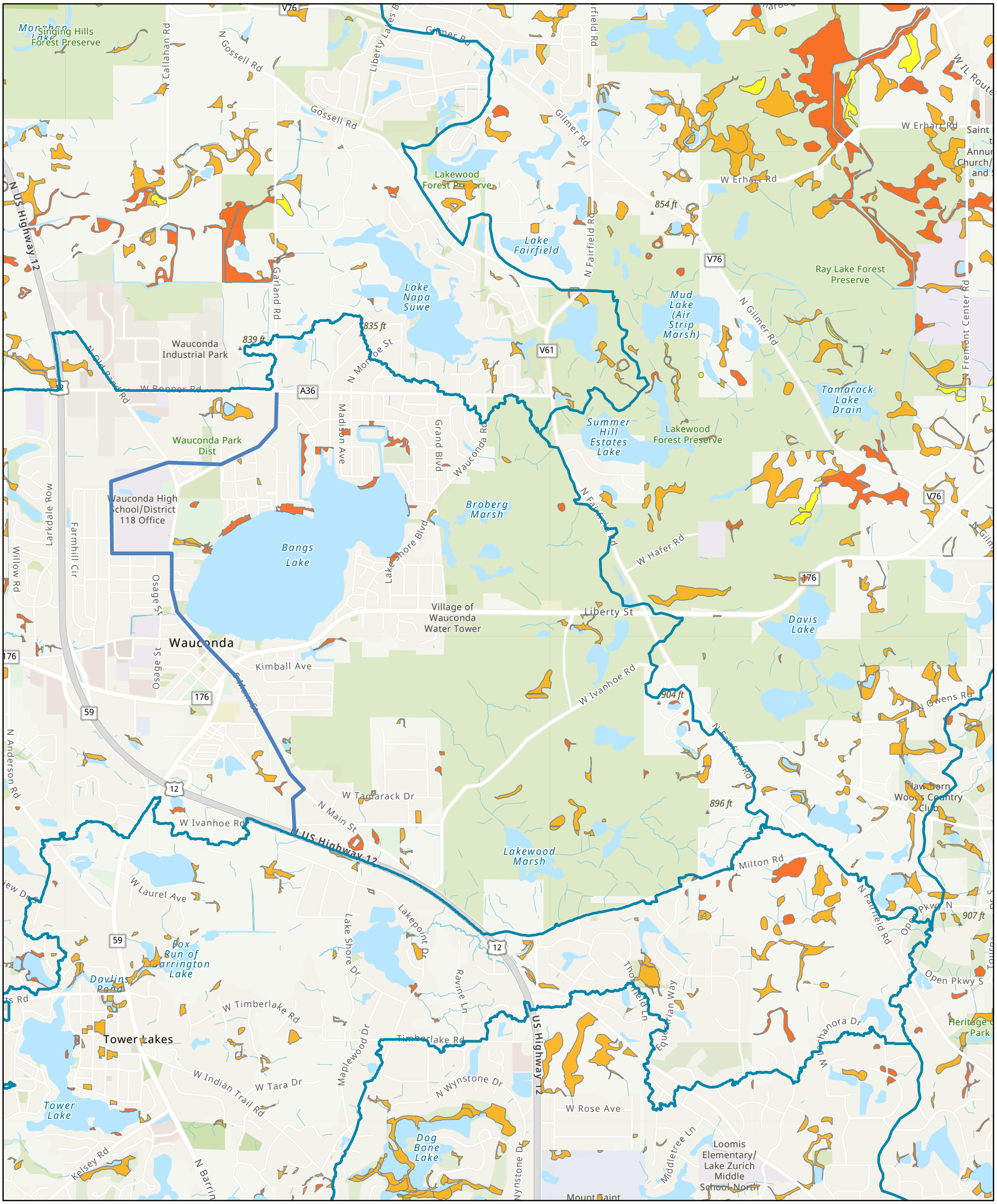
- High
- Moderate
- Low

1:36,112

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

Potential Sediment Retention



7/19/2023, 2:11:12 PM

Lake County Boundary

Boundary - SMC Sub-watersheds

Bangs Lake

Sediment & Other Particulate Retention (PRW)

High

Moderate

Low

1:36,112

0 0.3 0.6 1.2 mi

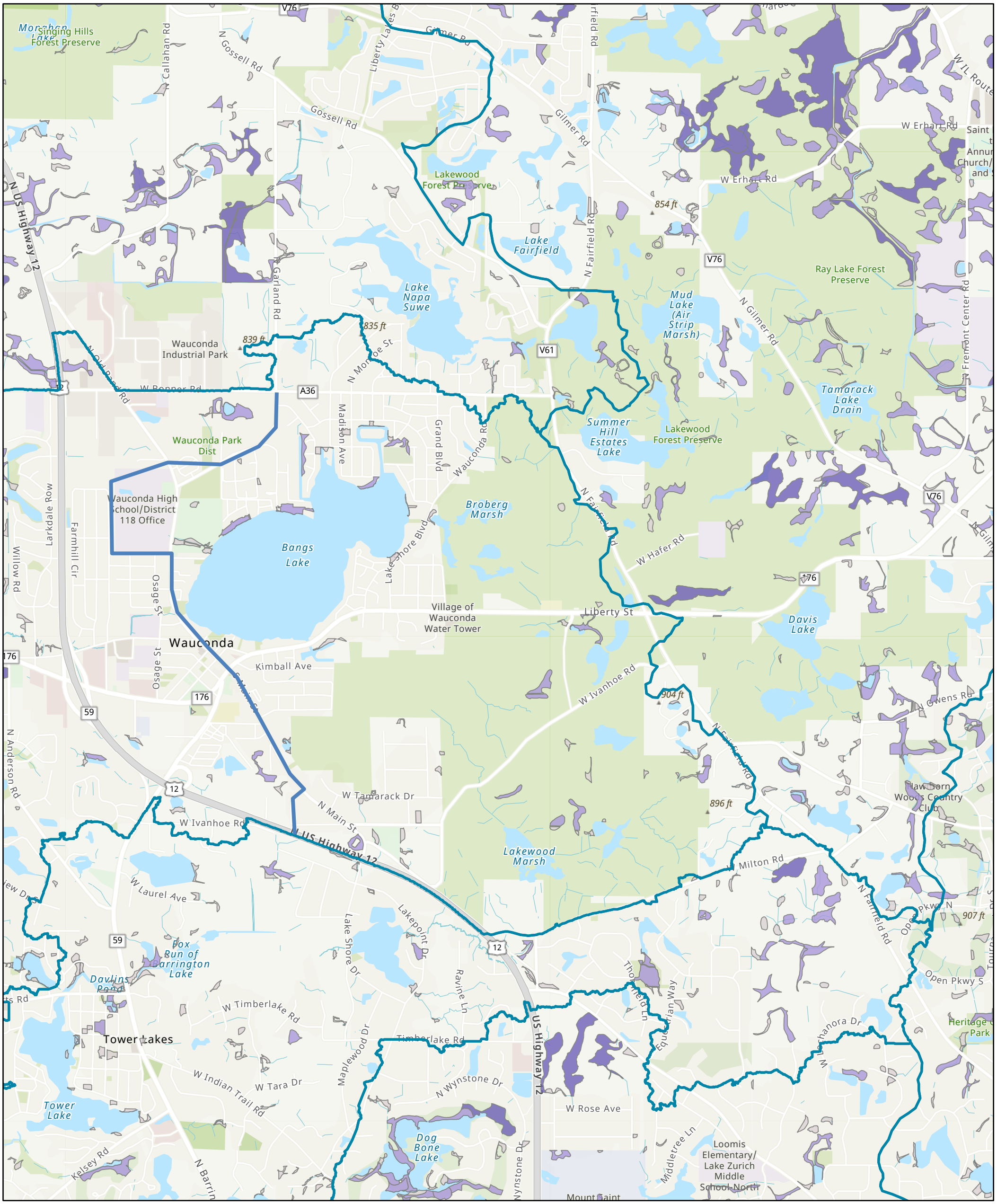
0 0.5 1 2 km

County of Lake, IL, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Lake County SMC

County of Lake, IL, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA | Illinois State Water Survey | Lake County, Illinois | Lake County GIS Division |

Potentially Restorable Wetlands



7/19/2023, 2:18:31 PM

Lake County Boundary

Boundary - SMC Sub-watersheds

Bangs Lake

Potentially Restorable Wetlands (PRW)

<1

1-5

>5

1:36,112

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

County of Lake, IL, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Lake County SMC

County of Lake, IL, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA | Illinois State Water Survey | Lake County, Illinois | Lake County GIS Division |

Watershed Photo Log

Photo #3: Tributary along the eastern side of circle channel. Overgrown and invaded.

Photo #4: Heavily degraded inlet north of circle channel. Restoration of this area is highly suggested.

Photo #5: Property for sale along previous photo. Procuring such property and creating more wetland in this area could reduce sediment and pollutant loading more than just a basic restoration plan.

Photo #6: Swale leading to the northwest corner of circle channel. Has native and non-native vegetation present, but is currently being mowed.

Watershed Photo Log

Photo #7: Construction area on the same property from photo 4. There is a dewatering pipe set up to dewater the construction site without the constraint of the silt fence. The intention of the silt fence is to collect sediment before it enters the lake. This drainage prevents that from occurring.

Photo #8: Property just south of photo 5. A conveyance system exists within the invasive vegetation, carrying water into circle channel.

Photo #9: Tributary along the southwestern section of circle channel. Overgrown and degraded.

Photo #10: Where the tributary from photo 7 enters circle channel.

Watershed Photo Log

Photo #11: Culvert draining stormwater into the wetland between washington and berger channel.

Photo #12: Swale from culvert in photo 9. Overgrown and invaded.

Photo #13: Swale located on or partially on park district property near the community center.

Photo #14: Investments have been made into this property to build and maintain this structure; however the vegetation has been unmanaged, and blocks a view of the lake. This offers little ecological or aesthetic value.

APPENDIX 4. Water Quality/In-Lake Nutrients

Appendix 4- Water Quality/In-Lake Nutrients

Phosphorus

Phosphorus is a vital nutrient for regulating plant and algae growth. It comes from various sources, including years of fertilizer runoff, atmospheric deposition, decomposing vegetation, soil erosion, animal waste, and internal loading from the lake bottom sediment. When excessive concentrations build up in a waterbody, phosphorus can lead to nuisance aquatic plant and algae growth and degrade the ecological health of the system. Additionally, increases in toxic cyanobacteria blooms are linked directly to nutrient pollution. Excess plant growth caused by high nutrient concentrations can lead to a hazardous depletion in dissolved oxygen levels when plants die off and decompose, causing a fishkill.

Several different forms of phosphorus are typically studied in lakes. Total phosphorus (TP) represents a sum of all forms of phosphorus in the water, both dissolved and particulate. Total phosphorus includes phosphorus contained within organisms, phosphorus attached to sediments, and dissolved reactive phosphorus (often called orthophosphorus or SRP (soluble reactive phosphorus)). Orthophosphorus is the dissolved inorganic form of phosphorus that can be easily utilized by plants and algae. Only very small amounts of phosphorous are needed to stimulate aquatic plant growth.

Although it is important to know the various forms of phosphorus and how each may affect water quality, the interplay between these forms is complicated, dynamic, very difficult (in some cases impossible) and costly to measure. As such, it is common practice among limnologists (those who study lakes) to focus on total phosphorus as the key indicator for lake nutrients.

The Illinois State Standard for total phosphorus for lakes greater than 20 acres is 0.05 mg/L. No standard exists for orthophosphorus; however, many lake studies have noted that levels above 0.01 mg/L frequently cause an algae bloom. The Lake County Health Department (LCHD) has monitored soluble reactive phosphorus and routinely observed levels below detection limits during their testing from 1990 – 2012.

ILM performed monthly testing at Bangs Lake during the summer of 2023 (see figures 4-1 through 4-4) with data collection sites shown in Figure 4-5. The LCHD is also performing testing in 2023.

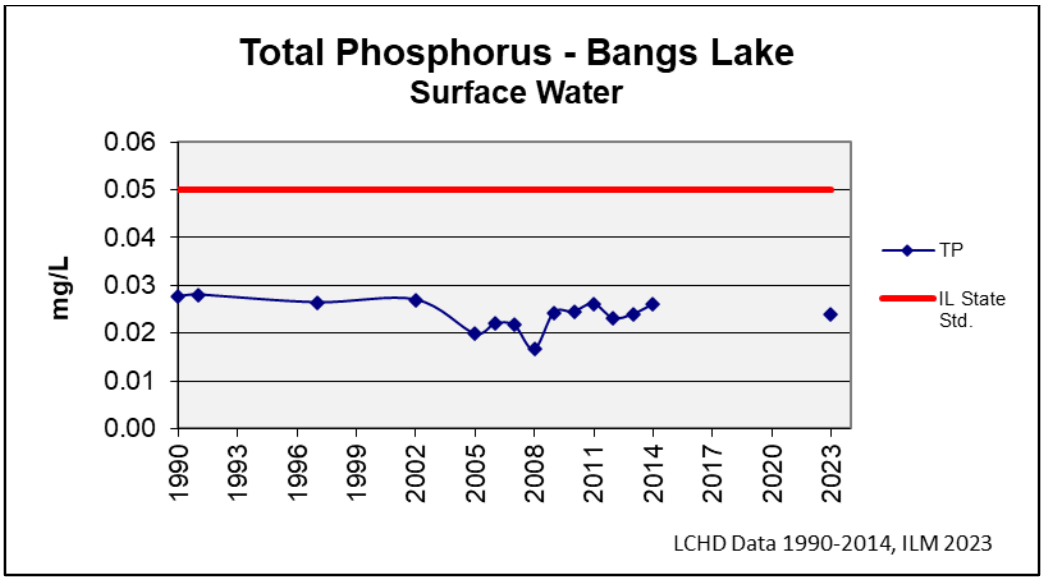


Figure 4-1: Total phosphorus results near the surface at Bangs Lake.

Note that the total phosphorus levels in Bangs Lake near the surface have consistently been well below the Illinois State Standard of 0.05 mg/l.

ILM performed three water quality testing visits at Bangs Lake. These dates were during late May, late June, and late July. The results indicate that total phosphorus has increased during the summer. This may be due to release from the sediment and decaying vegetation from a large-scale herbicide treatment in early June. Orthophosphorus, which is utilized by algae, decreased during the June visit. This corresponded with the increased planktonic algae growth that was observed.

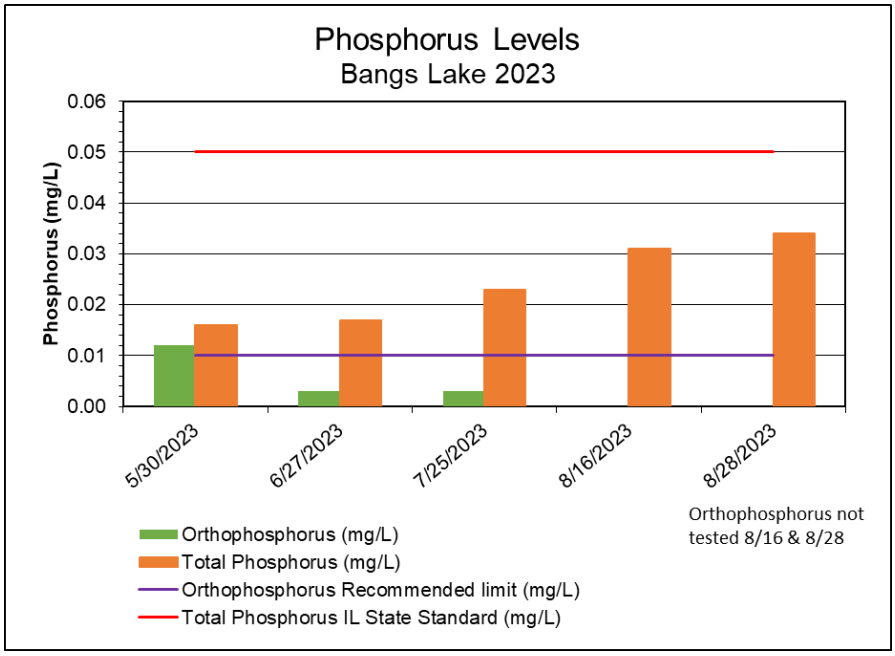


Figure 4-2: Total phosphorus measured near the surface in the center of Bangs Lake.

Internal Phosphorus Loading

Total phosphorus often clings to sediment particles, sinks, and accumulates at the lake bottom. Rooted aquatic plants utilize the nutrients in the sediment but can release the nutrients when they die and decay. Disturbance of the lake bottom by wave action, bottom foraging fish, or boat motors can resuspend the sediment and increase phosphorus in the water, which may then be used by algae.

As the lake stratifies during the summer, the cooler, deeper water does not mix with the upper layer. Deep water becomes anoxic, causing the release of total phosphorus from the lake bottom sediment into the water column. During turnover in the spring and fall, when the top and bottom of the lake mixes, higher phosphorus concentrations near the bottom will mix throughout the lake water leading to favorable conditions for algae growth.

All lakes have some amount of phosphorus in the water. During the summer, either rooted aquatic plants become dominant, providing clear water, or planktonic algae (a suspended form) becomes dominant, creating more turbid conditions.

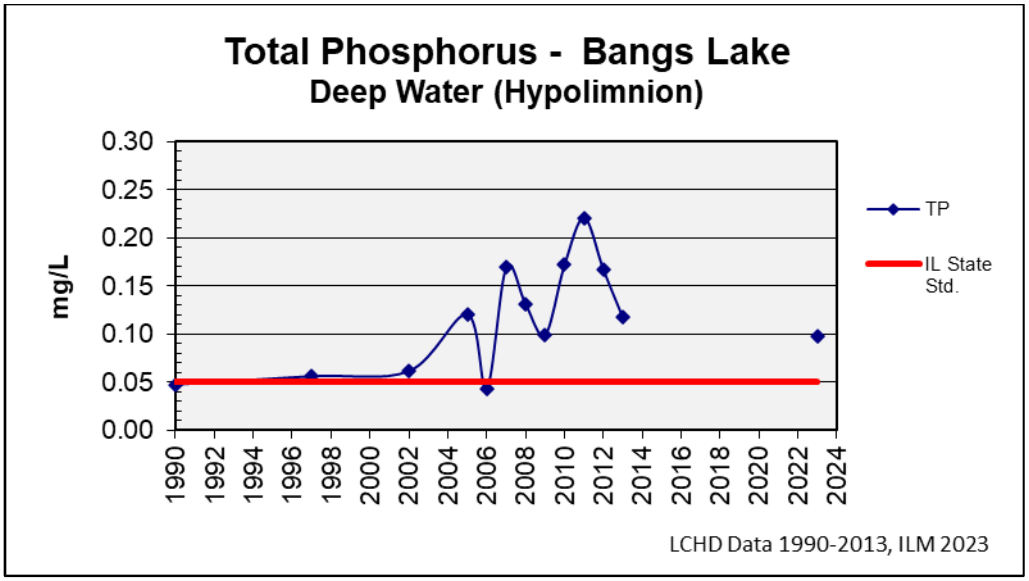


Figure 4-3: Phosphorus concentrations near the bottom of Bangs Lake. Data provided by LCHD. Note that total phosphorus collected a few feet off the lake bottom almost always exceeded the IL State Standard of 0.05 mg/l.

Phosphorus in the Channels

ILM performed water quality sampling in each of the five channels during the June 27th visit. All the channels have been artificially created out of wetlands, and thus have mucky bottoms with higher nutrient levels, which lead to nuisance aquatic growth in many areas.

Additional total phosphorus testing was conducted on August 16th, the day after a 1.5-inch rain event, and on August 28th during a dry period.

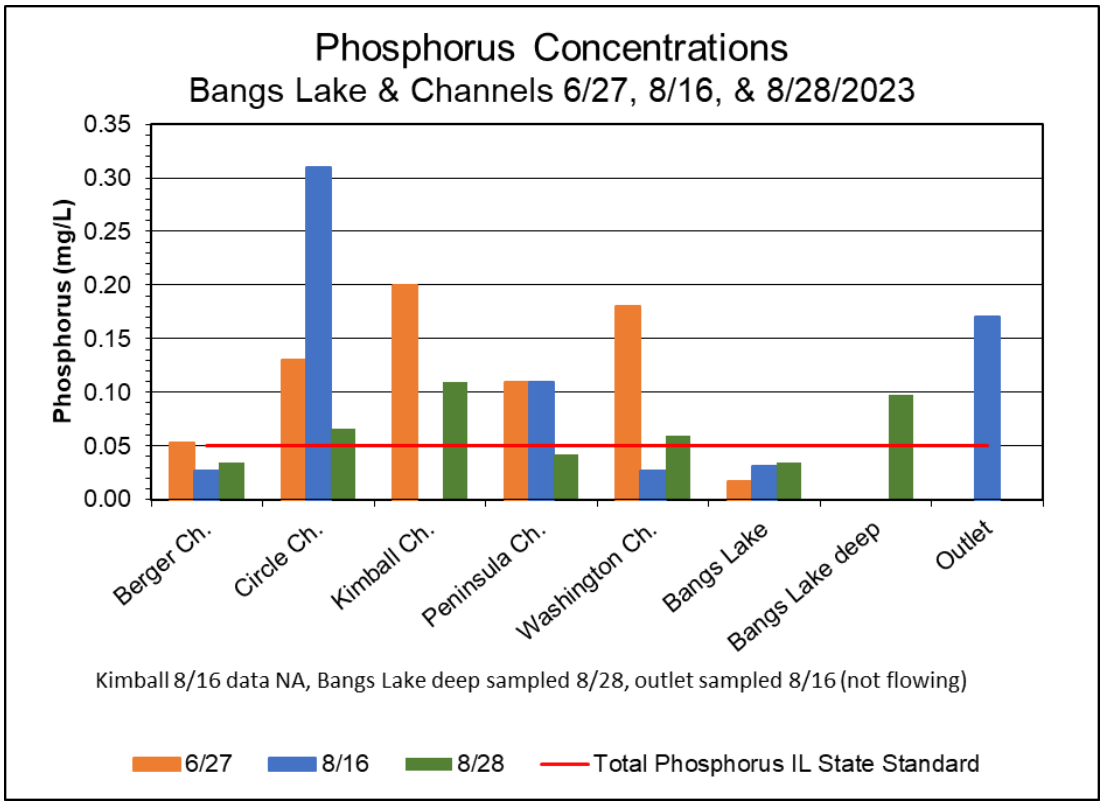


Figure 4-4: Phosphorus in the channels compared to Bangs Lake.

Sample sites for the channels were chosen based on the location of the deepest point (Figure 4-5). However, the more mixing/direct exchange of water the channels have with the main lake, the "better" the water quality (ex. Berger Channel). This does not reflect enhanced water quality, more so the reduced ability of these channels to sequester nutrients before they reach the main lake such as Circle Channel and Peninsula Channel. If more sampling occurred within the channels, it's likely this trend would be evident. This is especially true with longer channels such as the Circle Channel and Peninsula Channel. Kimball Channel water level was below the dam, no mixing with lake water occurred to skew results.

Figure 4-5: Sample site locations for 6/27/23.

Several of the channels had growth of the floating plant *Wolffia* sp., which is an indicator of high nutrient loading and low water movement. Wolffia was dominant in the Kimball Channel (Photo 4-1) and Circle Channel. Wolffia was noted in the stagnant sections on all the channels.

Photo 4-1: Kimball Channel contained heavy growth of Wolffia on 6/27/23.

Nitrogen

Nitrogen is another nutrient that often regulates plant growth and can be a pollutant in excessive quantities. Animal droppings (waterfowl, domestic animals), agricultural runoff from manure, the atmosphere and fertilizer are common sources of nitrogen pollution.

Like phosphorus, nitrogen has several different forms that are important for lake studies. Ammonia nitrogen (NH3) occurs from human and animal waste products and decomposing organic matter. Kjeldahl nitrogen includes organic nitrogen plus ammonium. Organic nitrogen is nitrogen that occurs in living organisms. All inorganic forms of nitrogen, nitrate (NO3-) nitrite (NO2-), and ammonia (NH3) are used by aquatic plants and algae for growth. Total nitrogen is the sum of nitrate, nitrite, and Kjeldahl nitrogen.

No water quality standards exist for nitrogen except for ammonia nitrogen, which varies depending on the temperature and pH of the water. Bangs Lake typically has a pH between 7.5 and 8.5. For warm water temperatures up to 30°C, the ammonia nitrogen concentration would need to exceed 0.40 mg/l to be above the standard. Surface ammonia concentrations in Bangs Lake have usually been much lower.

Figure 4-6 shows the ammonia concentrations measured by the LCHD for both surface and deep water. ILM collected only surface water samples since fish typically do not inhabit the hypolimnion (deeper water) where the dissolved oxygen levels are very low. The following nitrogen data figures are included for reference, as focusing on phosphorous inputs is necessary based on the N:P ratio results (Figure 4-9).

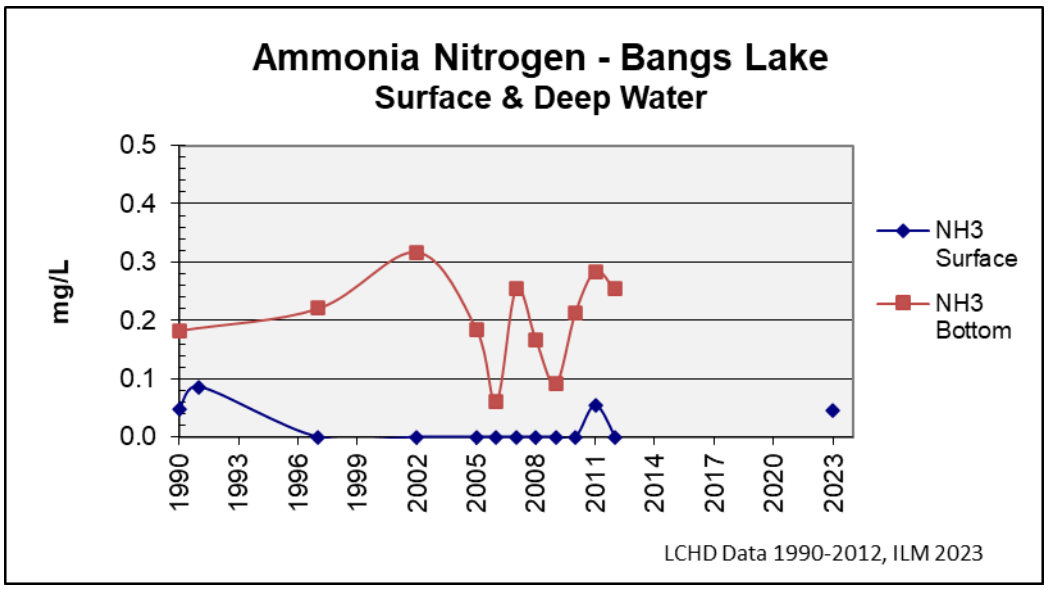


Figure 4-6: Ammonia nitrogen as measured in Bangs Lake.

Total Kjeldahl nitrogen (TKN) levels include all organic forms of nitrogen. These values have remained stable over the years (Figure 4-7) since monitoring began in the 1990's.

Nitrate and Nitrite nitrogen concentrations are typically tested during water quality analysis. These values have also remained very low, often near the detection limit.

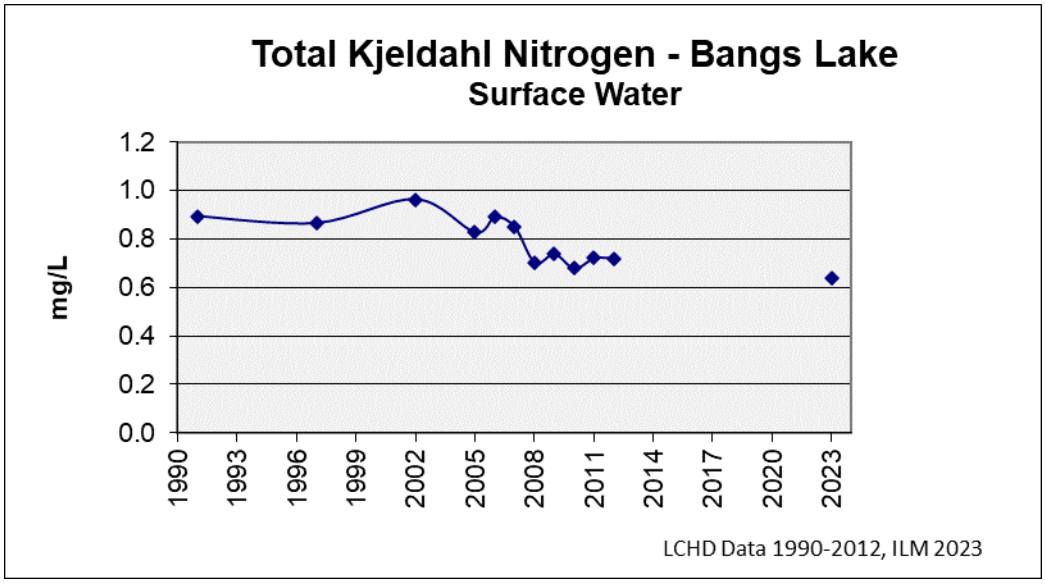


Figure 4-7: TKN results for Bangs Lake.

Comparing the amount of total nitrogen (Kjeldahl nitrogen plus nitrate/nitrite) to total phosphorous yields an N:P ratio. This ratio can determine which nutrient is limiting algae and plant growth. Lakes with N:P ratios above 15:1 are limited by phosphorus, while lakes with ratios below 10:1 are limited

by nitrogen. Lakes with ratios between 10:1 and 15:1 vary between nitrogen and phosphorus as the limiting nutrient. Most lakes in the Chicago area are limited by phosphorus. Knowing what nutrient is limiting can help determine which management strategies will be successful. For example, if the limiting nutrient in a lake is phosphorous, then reducing phosphorous availability would likely have more of an impact in improving water quality than reducing nitrogen.

Averaging the data for total nitrogen and total phosphorus in all the data since 2002, yields an N:P ratio of 34. The 2023 results measured by ILM have yielded an average N:P ratio of 38. This means that phosphorus is the limiting nutrient in Bangs Lake.

Nitrogen in the Channels

Nitrogen concentrations were also tested in the channels and compared to Bangs Lake. Note in Figure 4-8 that Total Kjeldahl nitrogen (the organic portion) was much lower in Bangs Lake than in the channels. Ammonia nitrogen was low in all areas.

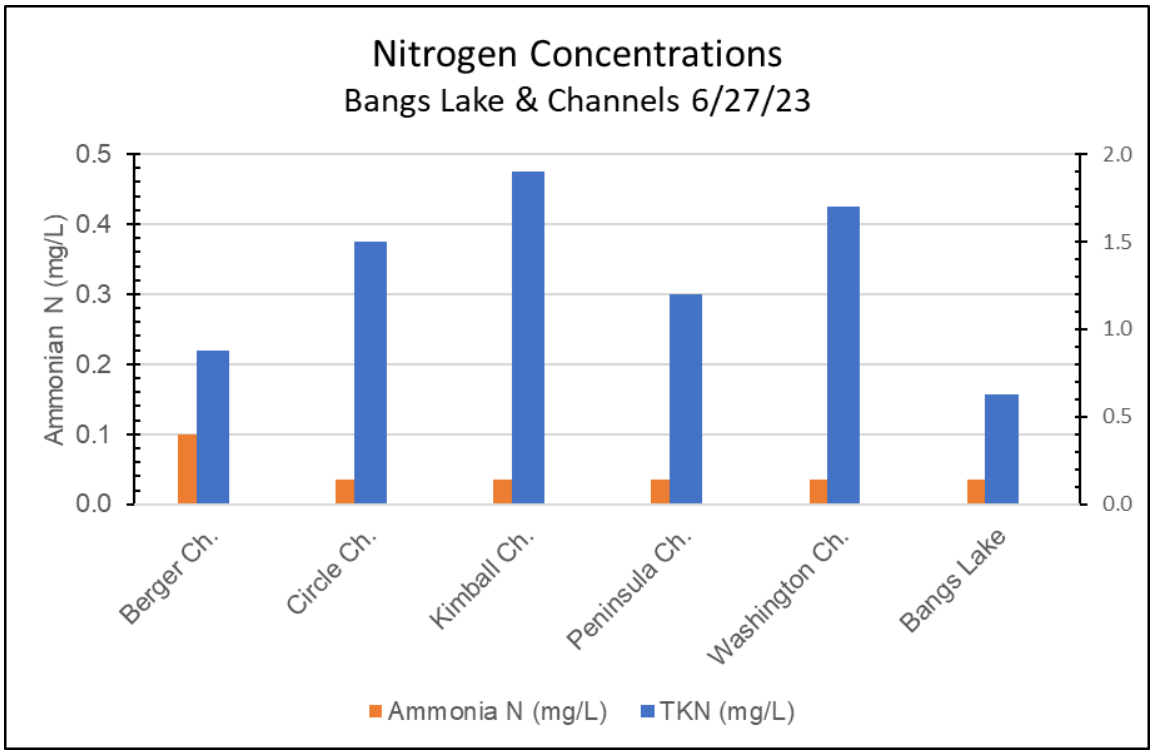


Figure 4-8: Nitrogen concentrations in the channels compared to Bangs Lake.

Due to the high phosphorous concentrations in the channels (Figure 4-4), the nitrogen to phosphorus level is limited by the nitrogen concentrations in all the channels except for Berger. Bangs Lake and Berger Channel have phosphorus as the limiting nutrient (Figure 4-9).

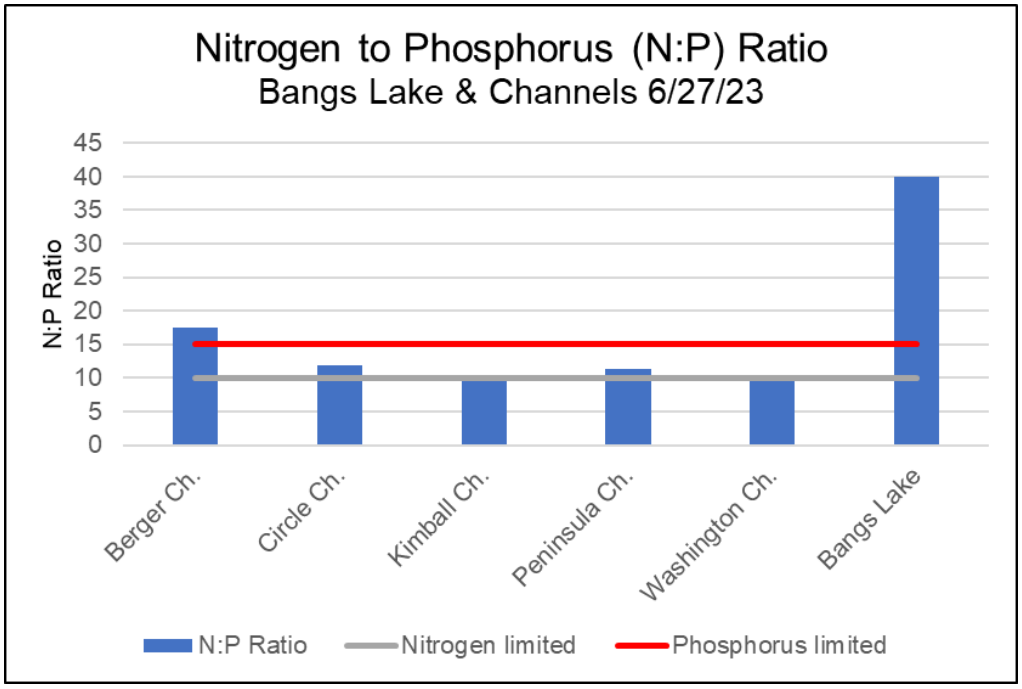


Figure 4-9: Nitrogen to Phosphorus ratios greater than 15 have phosphorus as the limiting nutrient. Ratios between 10-15 can switch between nitrogen and phosphorus as their limiting nutrient. N:P ratios at 10 and below has nitrogen as the limiting nutrient.

Trophic State Index

The Trophic State Index (TSI) indicates the productivity (the lakes ability to support the building blocks of a food chain) of a lake (Figure 4-10). In general, lower productivity in lakes is desirable for aesthetics, as there is less nuisance aquatic plant and algae growth. More productive "eutrophic" lakes can support more fish, but these fish tend to be more adapted to lower oxygen and lower quality conditions that occur with excess nutrient buildup. The TSI can be calculated in multiple ways. Ideally, the concentrations of total phosphorus, chlorophyll, and transparency of the water are used. Sometimes one of these values can be skewed, yielding misleading ratings. For this reason, the LCHD data only used total phosphorus to calculate TSI.

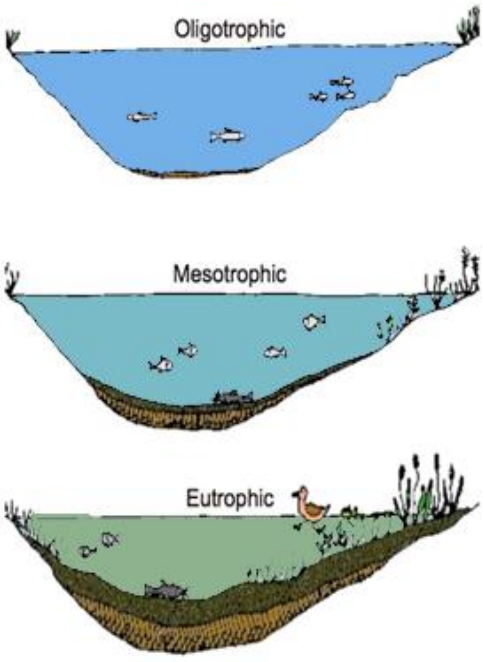


Figure 4-10: Varying states of lake productivity.

A lake with low phosphorus and chlorophyll levels and high water clarity, is considered oligotrophic and has a TSI of less than 40. Such lakes tend to have little aquatic plant or algae growth. Lakes with elevated levels of nutrients and a TSI greater than 50 are considered eutrophic and have high productivity.

TSI has varied from a low of 44 in May 2023 to a high of 53 in 2005 with an average of 49.4 (Figures 4-11 and 4-12). These values indicate the lake is considered mesotrophic to eutrophic.

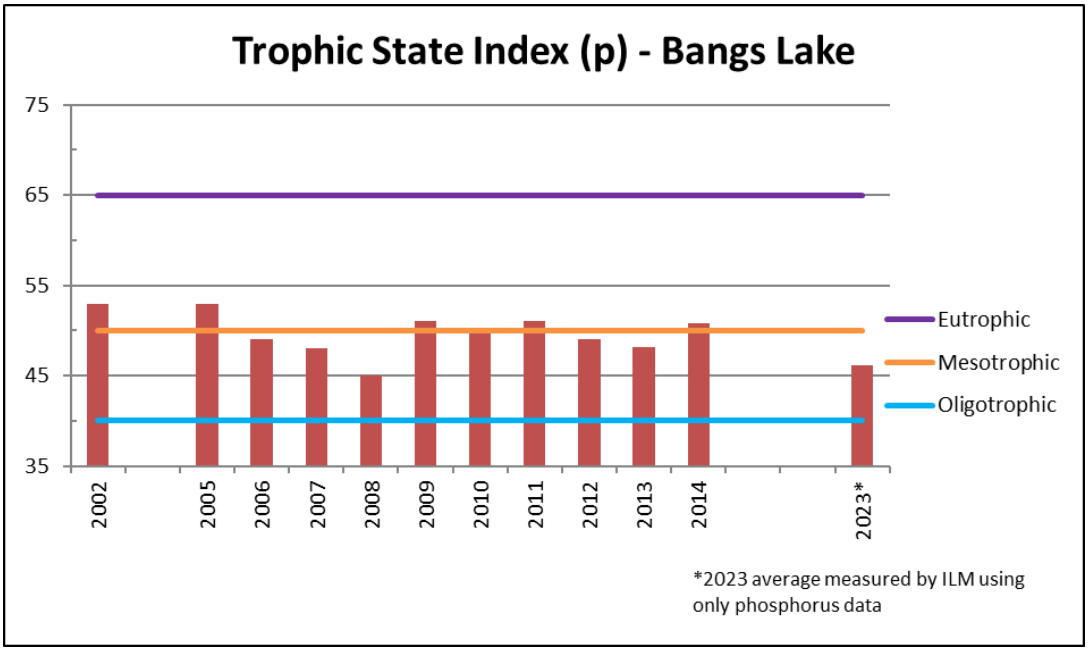
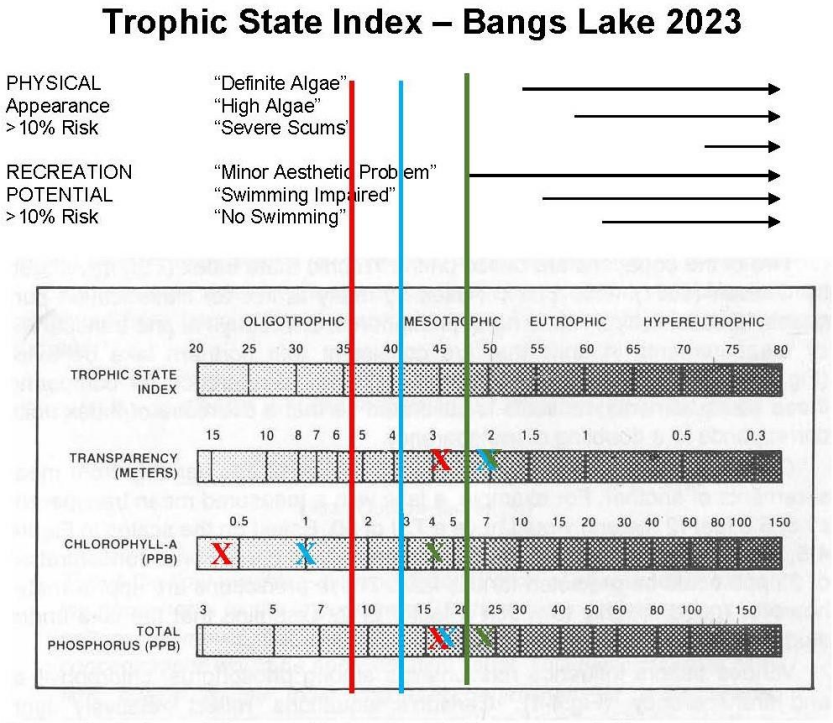


Figure 4-11: Trophic State Index for Bangs Lake from LCHD data & ILM.



From: ***The Lake and Reservoir Restoration Guidance Manual***. Second Edition, U.S. Environmental Protection Agency, August 1990.

Figure 4-12: Shows the different components of a TSI and where the different categories occur. Note that low chlorophyll *a* results have skewed the TSI.

Based on total phosphorus, chlorophyll *a*, and water clarity for June 27th, Bangs Lake is in the mesotrophic range as is the Berger Channel. Washington Channel is in the hypereutrophic range and all the others are in the eutrophic range (Figure 4-13). Channel sampling in August indicated Circle, Kimball, Peninsula, and sometimes Washington Channels are often in the eutrophic range using the TSI(p) methodology(Figure 4-14).

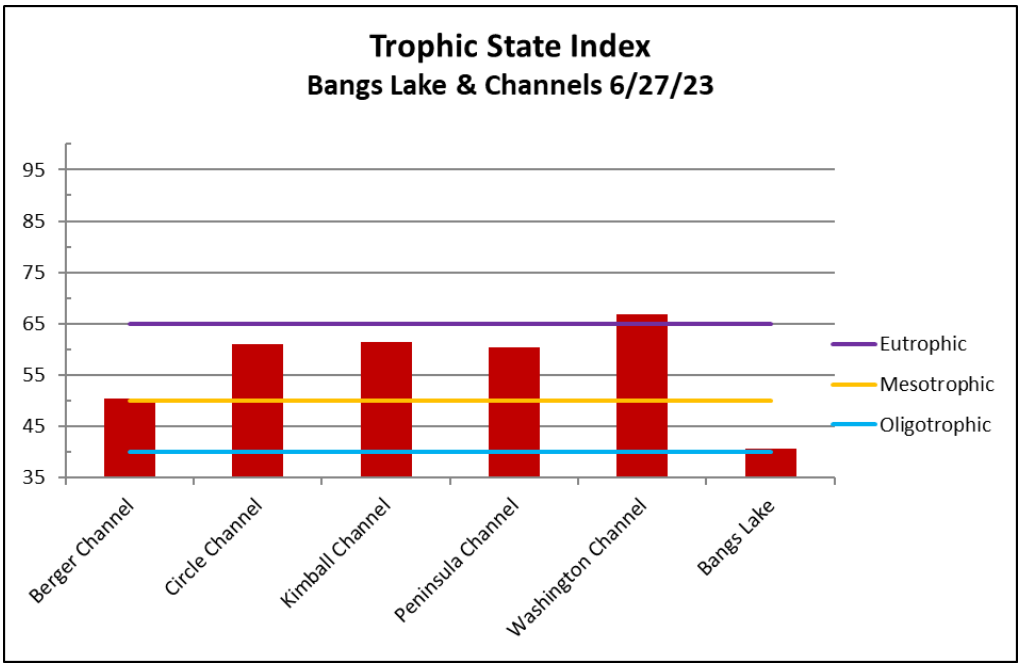


Figure 4-13: A comparison of the TSI determined for June 27th from the channels and Bangs Lake.

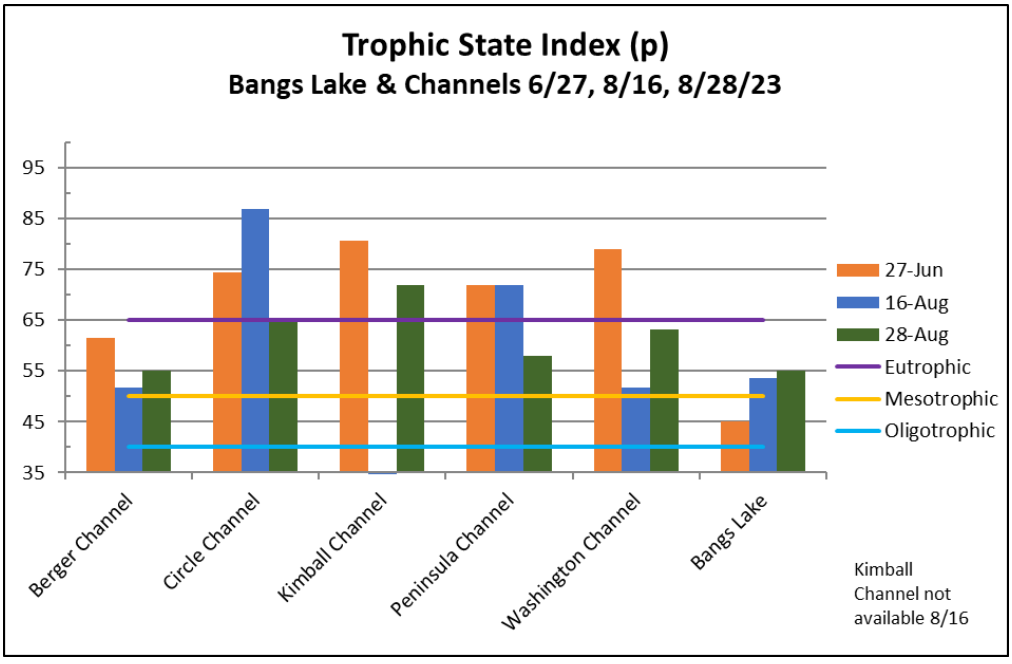


Figure 4-14: Comparison of the TSI(p) using only total phosphorus for the channels on multiple dates. A heavy rain event occurred the day prior to the 8/16 sampling period.

Chloride and Conductivity

Road salts are applied in the winter to keep roads safe. These salt applications can cause harm to freshwater systems when it is washed off roads in the spring (http://hdl.handle.net/11250/193946). Chloride accumulates in water bodies since it is denser than water. Data shows efforts to reduce chloride inputs into Bangs Lake have been moderately effective (Figure 4-15).

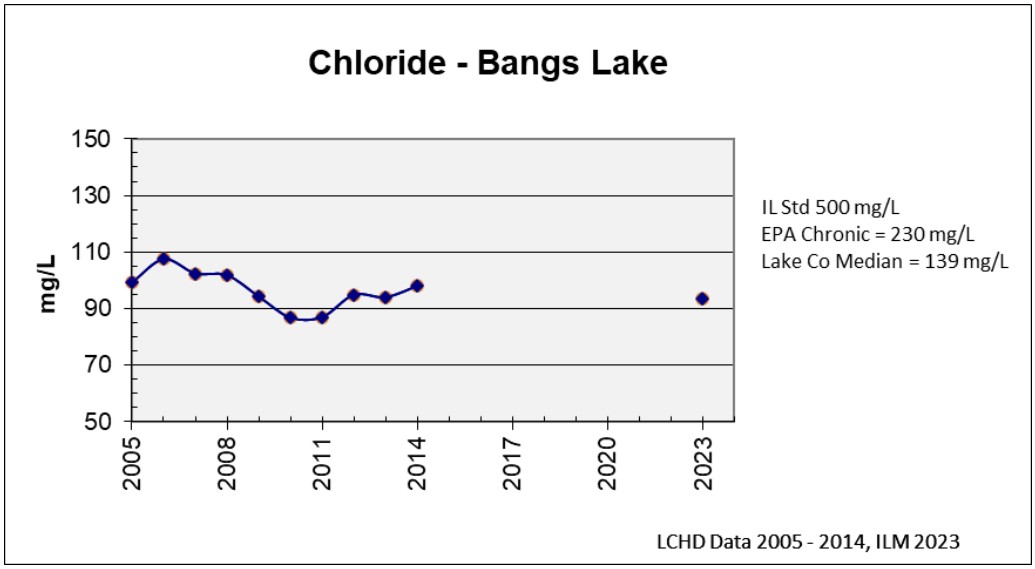


Figure 4-15: Chloride concentrations in Bangs Lake from LCHD data and ILM.

Chloride concentrations averaged 96 mg/l in Bangs Lake during the period from 2005 - 2023.

Conductivity measures the water's ability to conduct an electric current and is related to the total dissolved inorganic chemicals in the water (i.e., chloride). Distilled water has a conductivity concentration near zero, while seawater has around 50,000 µS/cm. Most lakes and ponds in the area are lower than 1,200 µS/cm in midsummer but may be higher in the spring due to road salt runoff. Conductivity of bangs Lake is shown in Figure 4-16.

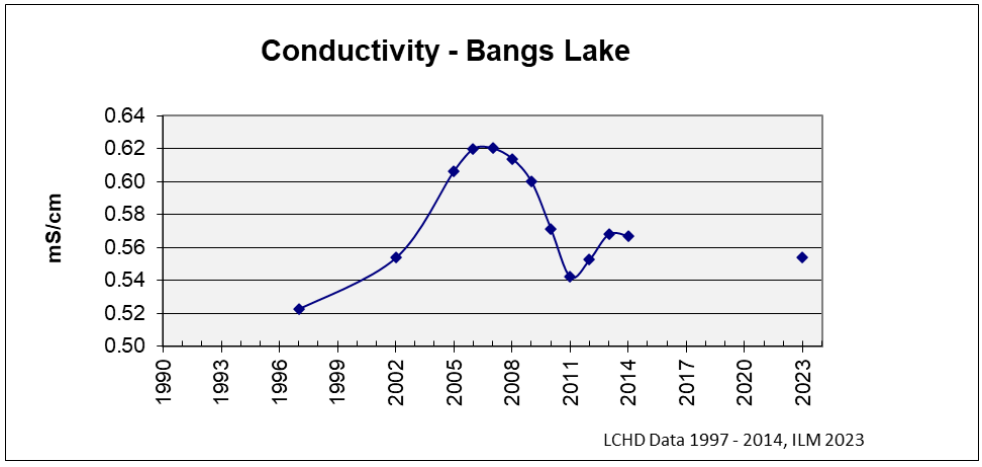


Figure 4-16: Water conductivity near the surface in Bangs Lake from LCHD and ILM data.

Note that both chloride and conductivity were highest between 2005 – 2008 and then dropped. This same phenomenon has been observed in many lakes in the county as road salt applications have changed and some years had little snowfall requiring de-icing.

A comparison of the three site visits made by ILM shows that neither the chloride nor the conductivity concentrations changed much during the three visits, even with the drought conditions early in the summer (Figures 4-18 & 4-18).

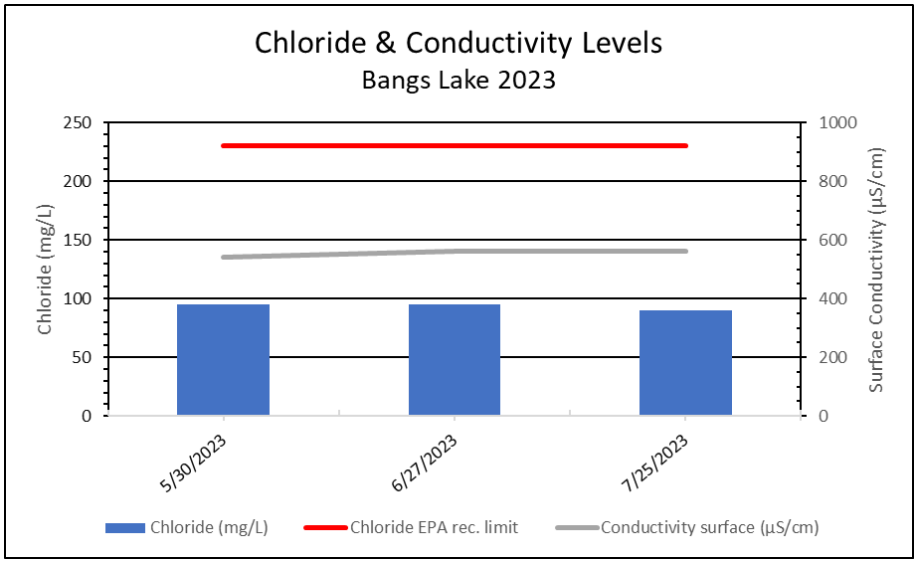


Figure 4-17: Chloride and conductivity measured by ILM.

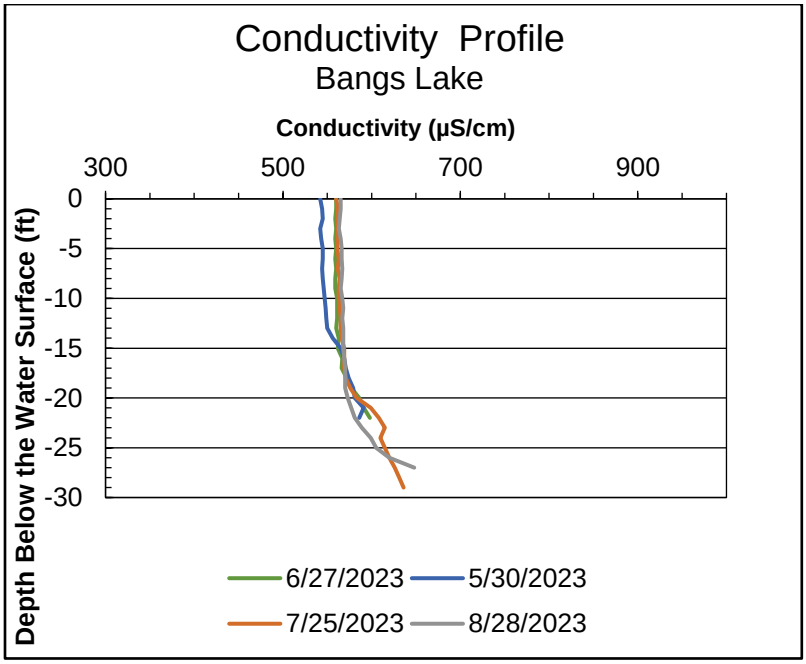


Figure 4-18: Depth profile for conductivity in Bangs Lake. Note that conductivity increases below about twenty feet.

Chloride and Conductivity in the Channels

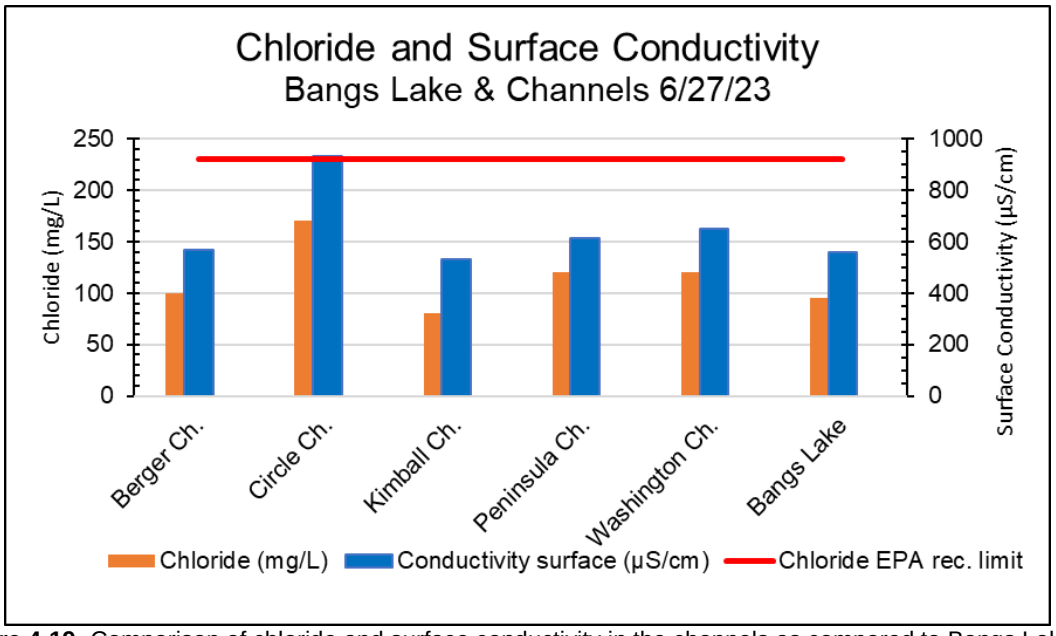


Figure 4-19: Comparison of chloride and surface conductivity in the channels as compared to Bangs Lake on 6/27/23.

Note that the Kimball Channel has the lowest chloride and conductivity levels (Figure 4-19). This is expected as it receives less runoff from roads that are salted in the winter. It is even slightly lower than Bangs Lake. The highest concentrations were in the Circle Channel, almost twice that of the Kimball Channel. The Circle Channel has a long residence time because of its length and more roads and drainage swales that flow into it (Figure 4-20).

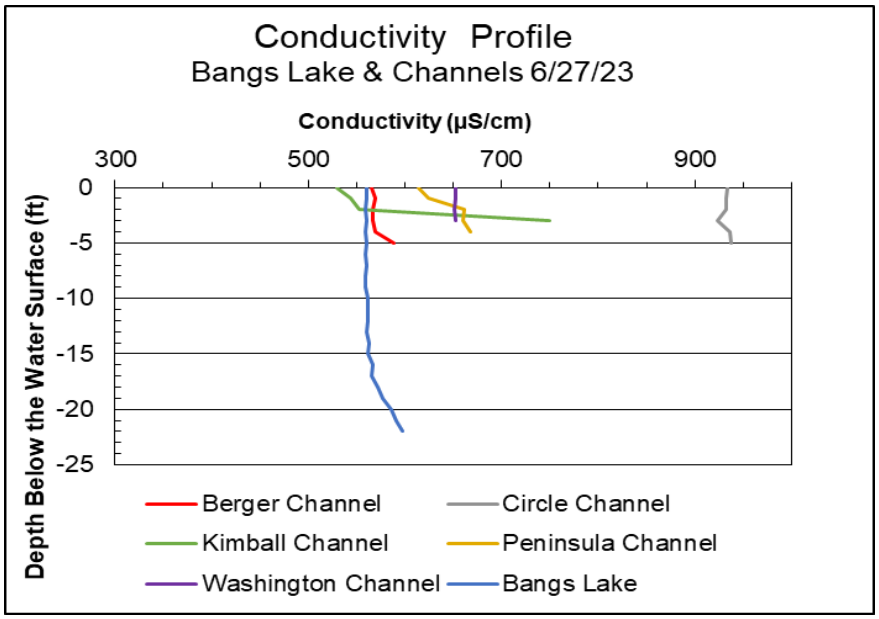


Figure 4-20: Conductivity depth profiles for Bangs Lake and the channels. Note that Circle channel has the highest conductivity.

Total Suspended Solids and Water Clarity

Water clarity is one component of the TSI measurement and an indicator of water quality in a lake. Lakes with low water clarity are considered turbid. Planktonic algae growth (green) as well as suspended sediment (brown) can lead to low water clarity. The measure of suspended material in the water is measured as total suspended solids (TSS).

As upstream areas within the watershed erode, stormwater transports sediment to the lake. Sediment can also be resuspended in shallow lakes by wind and waves. Bottom-feeding fish, such as carp, can also disturb sediment while they forage. High TSS levels often indicate poor water quality, and typically means other pollutants that originate on the land are also being deposited in the lake.

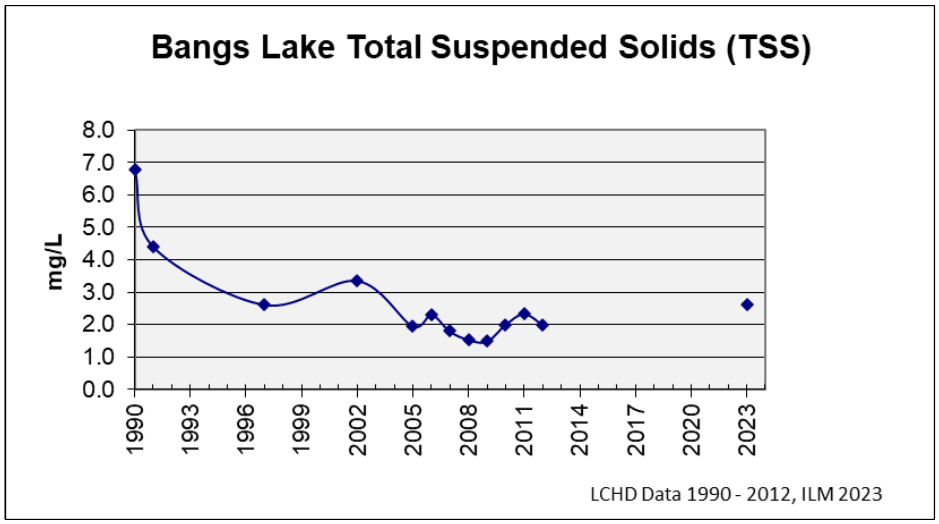


Figure 4-21: Total suspended solids in Bangs Lake from LCHD and ILM data.

Collected data indicates that Bangs Lake has had very good water clarity ever since monitoring began in 1990 (Figures 4-21 & 22).

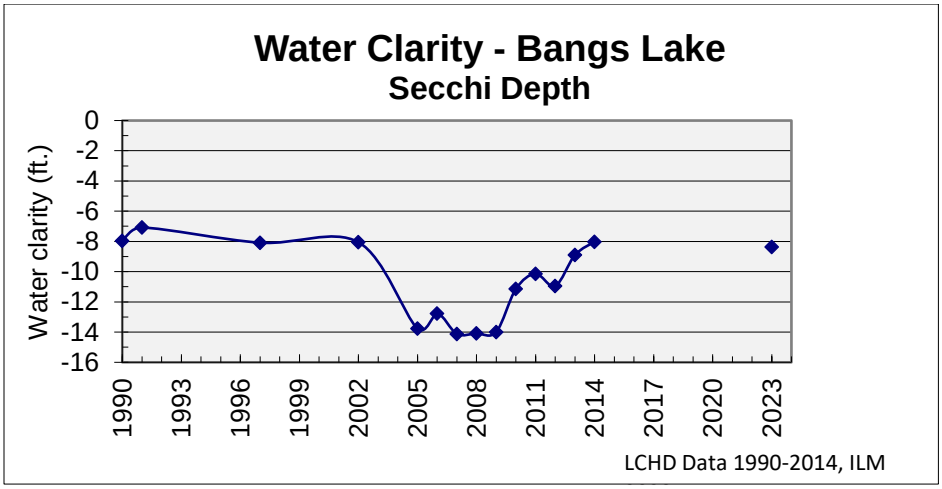


Figure 4-22: Water clarity and chlorophyll *a* in Bangs Lake from LCHD and ILM data.

Secchi disk readings are a measure of water clarity and are considered a low-cost tool to track the health of a water body. A painted disk is lowered in the water until it is no longer visible, and that depth is recorded as the secchi reading. Clearer water generally means lower levels of nuisance algae growth or suspended sediment. A reading of over 4.0 feet is recommended for recreational lakes. The average secchi reading in Bangs Lake was 10.5 feet over the 1990 – 2023 time-period as measured by Lake County through 2014 and by ILM in 2023.

Local citizens measured secchi depth through the Volunteer Lake Monitoring Program (VLMP) sponsored by the IEPA. Similar data was collected by the LCHD. The VLMP program was discontinued in 2019.

In 2003 zebra mussels were first observed in Bangs Lake. Zebra mussels are an invasive species that filter plankton out of the water, increasing water clarity. As the lakes' ecosystem adjusts to the presence of zebra mussels, water clarity may decrease as the plankton concentration increases, as is indicated in Figure 4-21.

In Figure 4-23, water clarity decreased later in the summer as chlorophyll a concentrations increased. Increased algae growth was observed after the early June herbicide treatment significantly reduced aquatic plant growth in the lake.

Chlorophyll

There is an inverse relationship between water clarity and total suspended solids plus chlorophyll *a*. Total suspended solids represent inorganic particles (brown sediment), while chlorophyll *a* (a key component of planktonic algae) represents the organic particles (algae) floating in the water. Water clarity in relation to suspended solids and chlorophyll *a* is visualized in Figure 4-22.

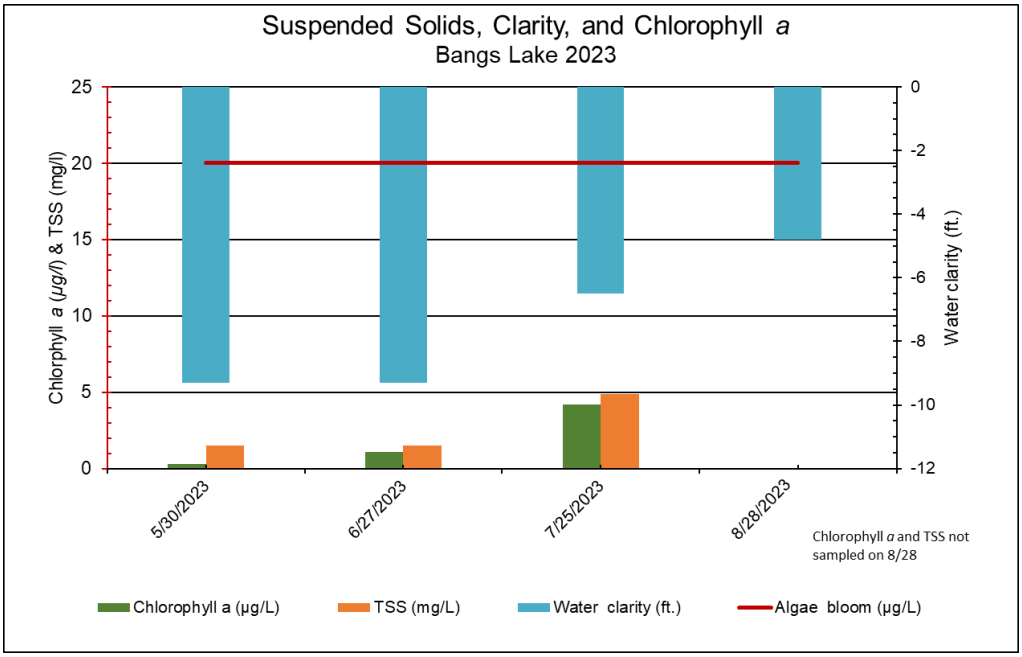


Figure 4-23: Comparison of water clarity to suspended particles both inorganic (TSS) and organic (algae as measured with chlorophyll *a*).

The amount of chlorophyll present in the water is directly related to the concentration of algae present. Algal blooms occur when chlorophyll *a* concentration exceed 20 µg/L. The chlorophyll *a* concentration on the May 30th visit was 0.32 µg/l, which was much lower than during later season visits. An algae bloom during the July 25th visit significantly reduced water clarity.

Suspended Particles in the Channels

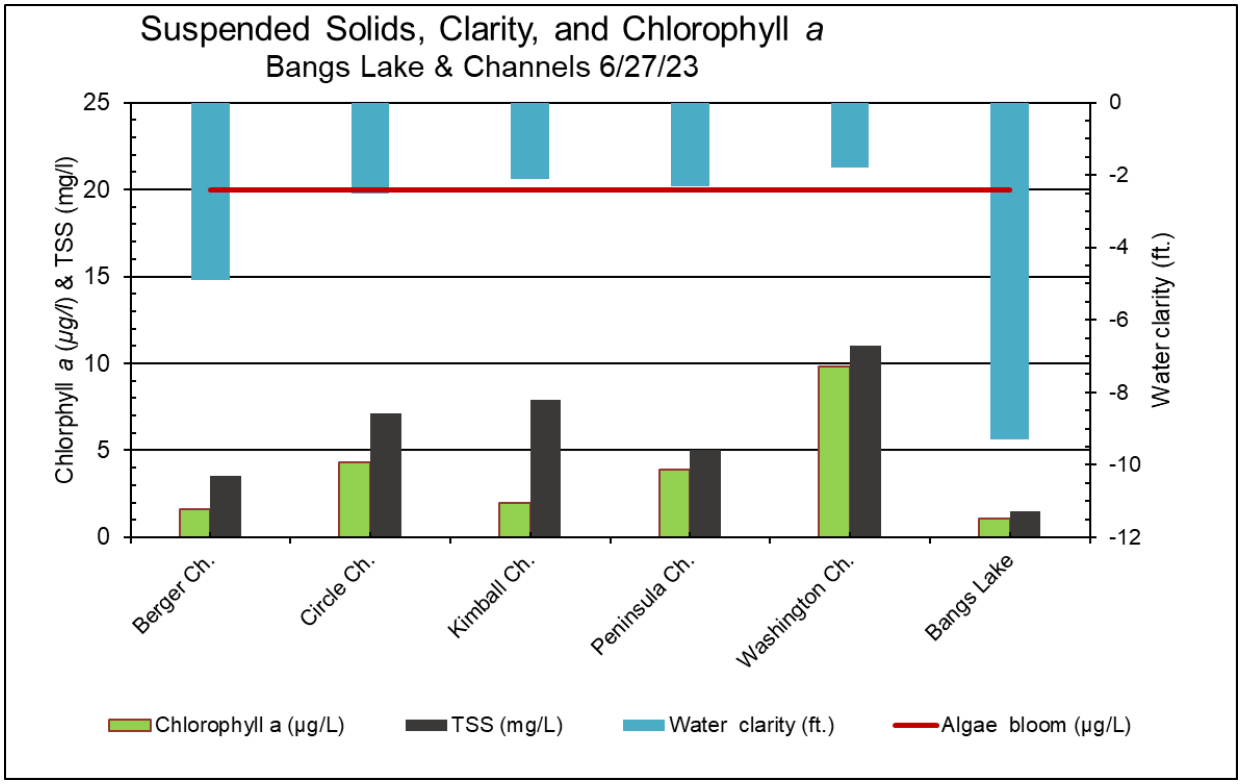


Figure 4-24: Comparison of suspended solids in the channels compared to Bangs Lake.

Note in Figure 4-24 above that both the chlorophyll *a* and suspended solids concentrations were much higher in the channels than in Bangs Lake. Washington Channel had the highest concentration and the lowest water clarity, while Berger Channel had water quality that was more similar to Bangs Lake.

Plankton Analysis

A plankton tow was used to collect microbial specimens in a water sample from the middle of Bangs Lake during each of the water quality visits. This sample was observed under a microscope and a sample was also submitted to a laboratory for further analysis.

- From the May 30th visit, the dominant plankton included:
    - *Ochromonas sp.*, a single celled- flagellated algae in the Chrysophyceae or golden brown algae, representing 90% of the sample.
        - The Cyanobacteria, *Microcystis* sp. represented almost 9% of the sample. Microcystis in large amounts can be toxic to wildlife.

- Zooplankton was dominated by immature copepods (41%) and rotifers (*Polyarthra* sp. at 36%).

- The June 27th plankton sample included:
  - *Fragilaria* sp., which are diatoms, had an abundance of 63% of the sample. the Cyanobacteria, *Lyngbya* sp., which can form toxins usually from biomagnification up the food chain represented 18% of the sample.
  - Tiny green floating colonies were observed and identified as the Cyanobacteria, *Gloeotrichia* sp., which can also form toxins. They only represented 0.2% of the sample but became dominant by the July sampling.
  - The dominant zooplankton included immature copepods (66%) and rotifers (*Keratella* sp. at 16%).

These observations were considered within healthy ranges for this time of the year.

- The July 25th plankton included the following:
  - A bloom of the Cyanobacteria *Gloeotrichia* sp. Was observed. It was very dense in some areas (Photo 4-2). This contributed to lower water clarity.
  - *Ceratium* sp., a dinoflagellate, was also found in high concentrations.
  - Zooplankton was dominated by Keratella rotifers and various copepod species.

Although copepods and rotifers are desirable at the base of the food chain, the concentrations of cyanobacteria should be monitored. It had reached algae bloom levels during the July 25th visit.

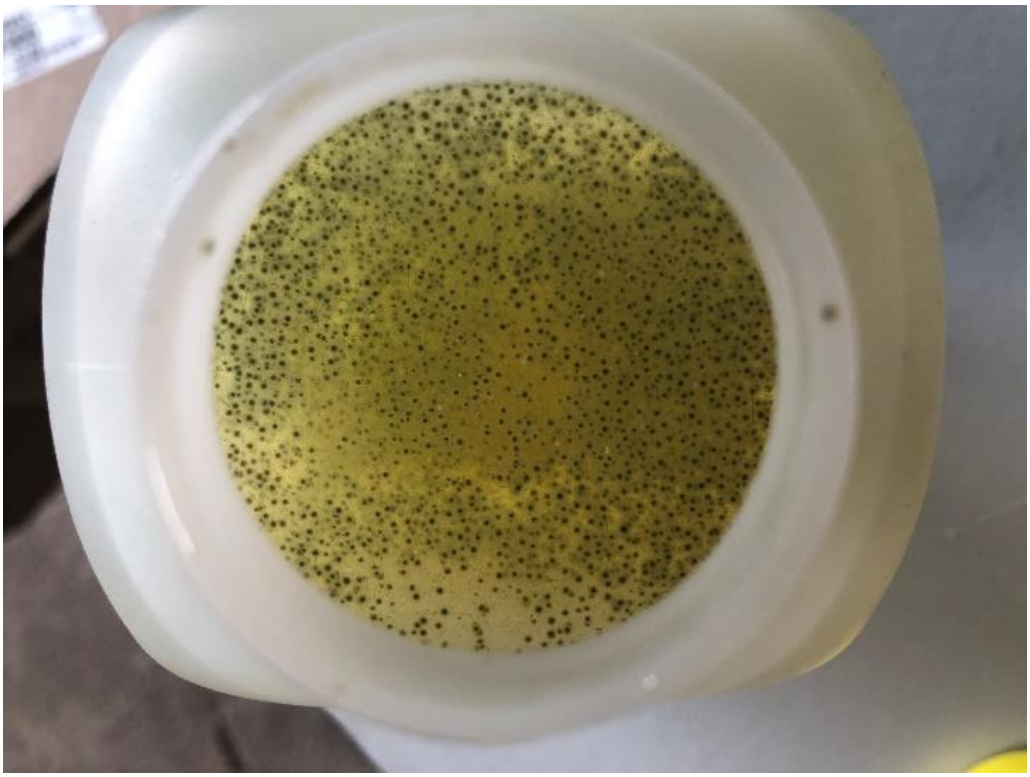


Photo 4-2: Plankton tow collected on 7/25 showing dominance of the Cyanobacteria, Gloeotrichia.

The graph below (Image 4-1) shows the succession of some algae/planktonic algae families which can be indicators of water quality.

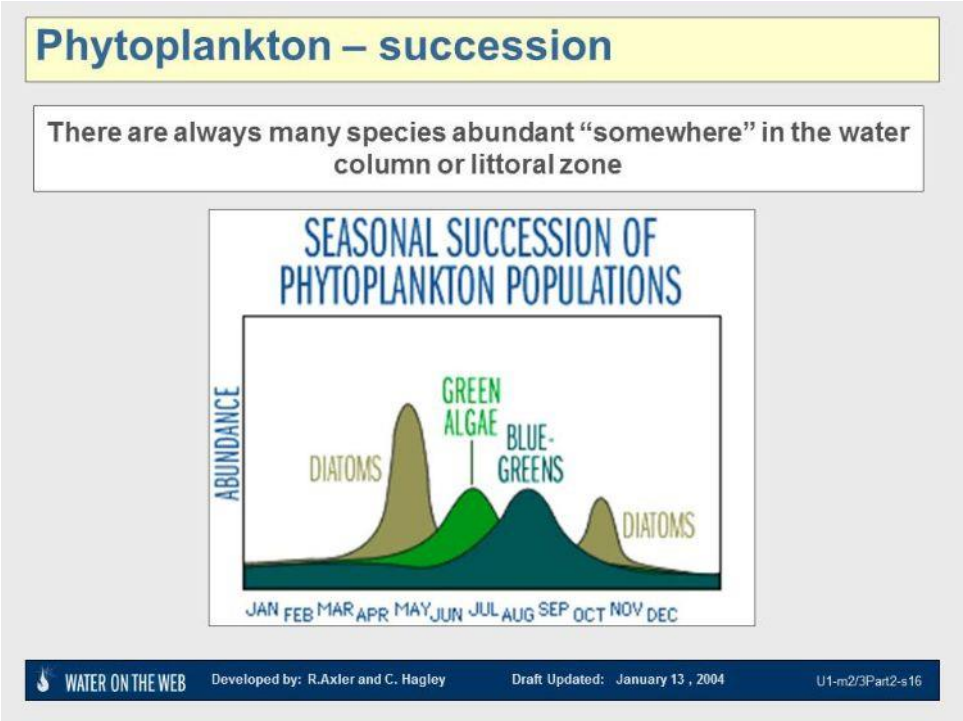


Image 4-1: Seasonal Succession of Phytoplankton. (Exhibit source: Michigan State University)

Dissolved Oxygen

Dissolved oxygen (DO) levels are generally lowest in the morning and continue to rise until sunset. For beneficial aquatic life to thrive, oxygen levels should be 5.0 mg/L or higher. Many variables such as water temperature, time of day, amount of sunlight, density of aquatic plants, turbidity, and wave action can affect the dissolved oxygen concentration in the water. Dissolved oxygen in the deep section of Bangs Lake collected by ILM during four of the site visits. Notice that the lake has become more strongly stratified with dissolved oxygen later in the summer. Dissolved oxygen dipped below the state standard (Figure4-25).

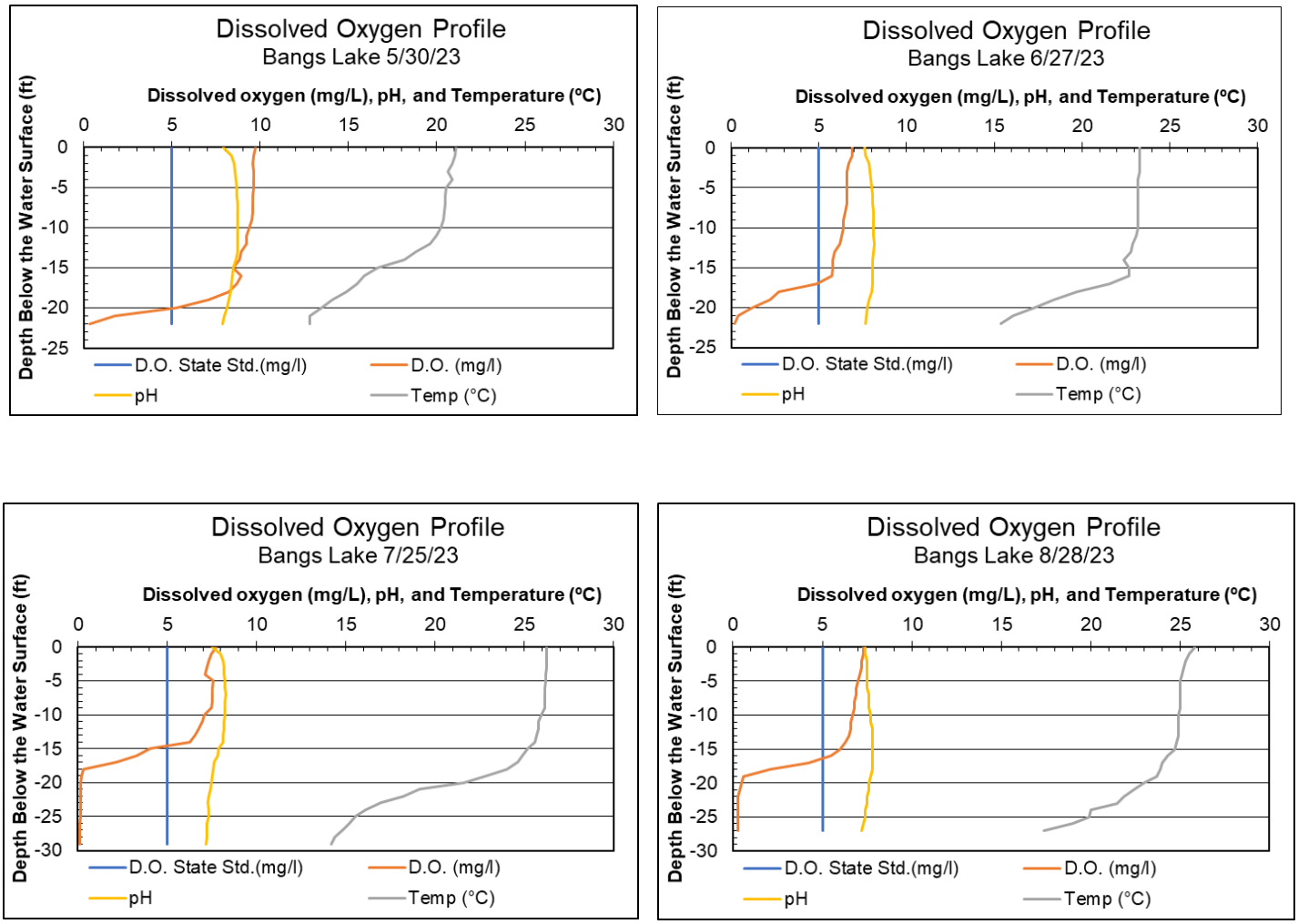


Figure 4-25: Dissolved oxygen levels in Bangs Lake.

Dissolved Oxygen in the Channels

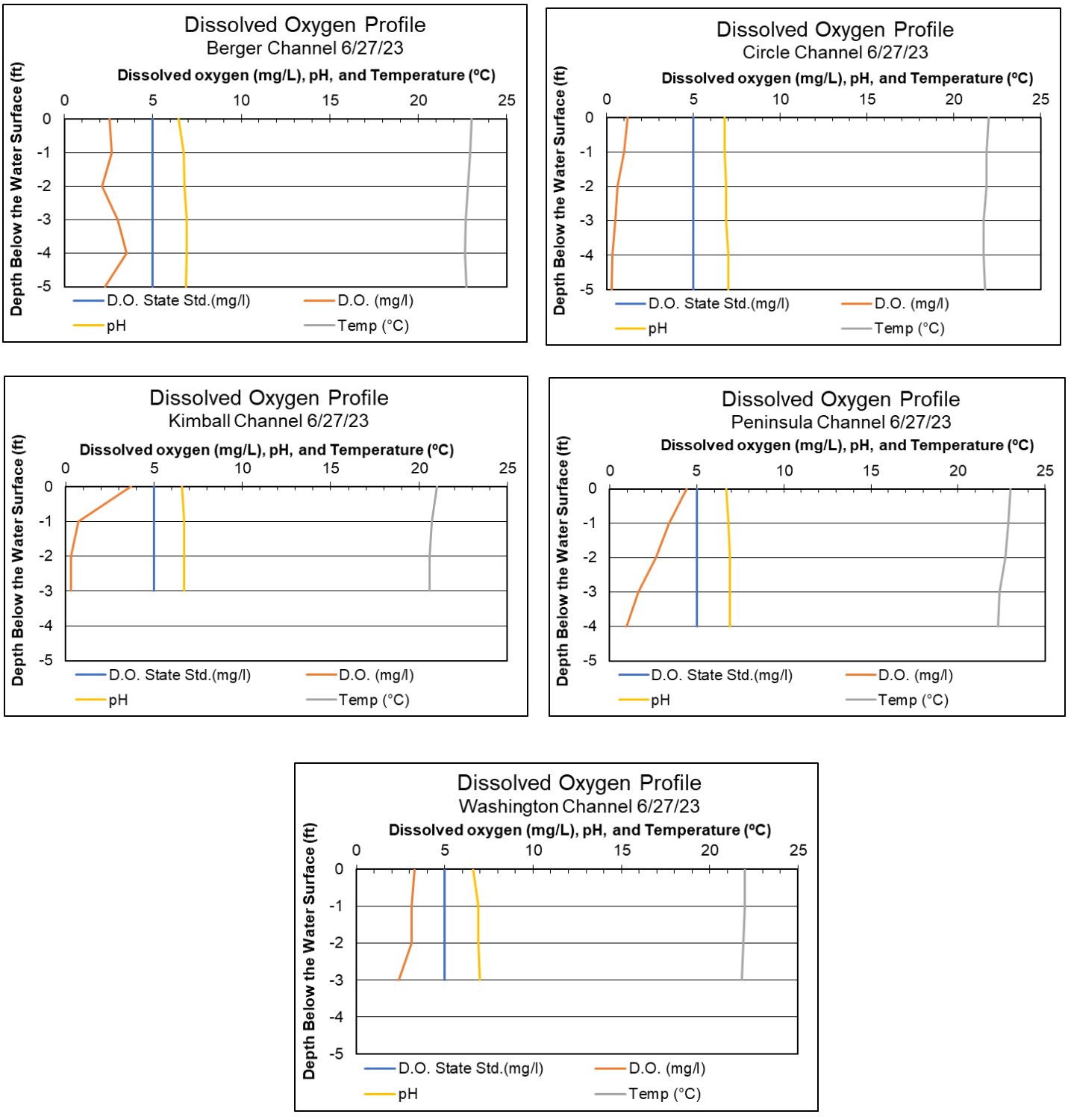


Figure 4-26: Dissolved oxygen profiles in the channels.

In the channels, the dissolved oxygen is never above the 5 mg/L required for most fish to survive (see Figure 4-26 above). The channels were too shallow to show stratification. pH was slightly lower than in the main lake, but the temperatures were very similar to that in the main body. The waters in each channel are uninhabitable to any fish, and livable only to low quality microorganisms and some reptiles.

The cause of the low dissolved oxygen was due to the heavy growth of Wolffia (a tiny floating plant that can reproduce at an alarming rate offering complete surface coverage in less than 30 days), which impedes atmospheric oxygen from being mixed into the water and blocks sunlight that reduces or eliminates any appreciable rooted aquatic plant growth. These hypoxic conditions are uninhabitable to most aquatic wildlife, as portrayed in Image 4-2 below.

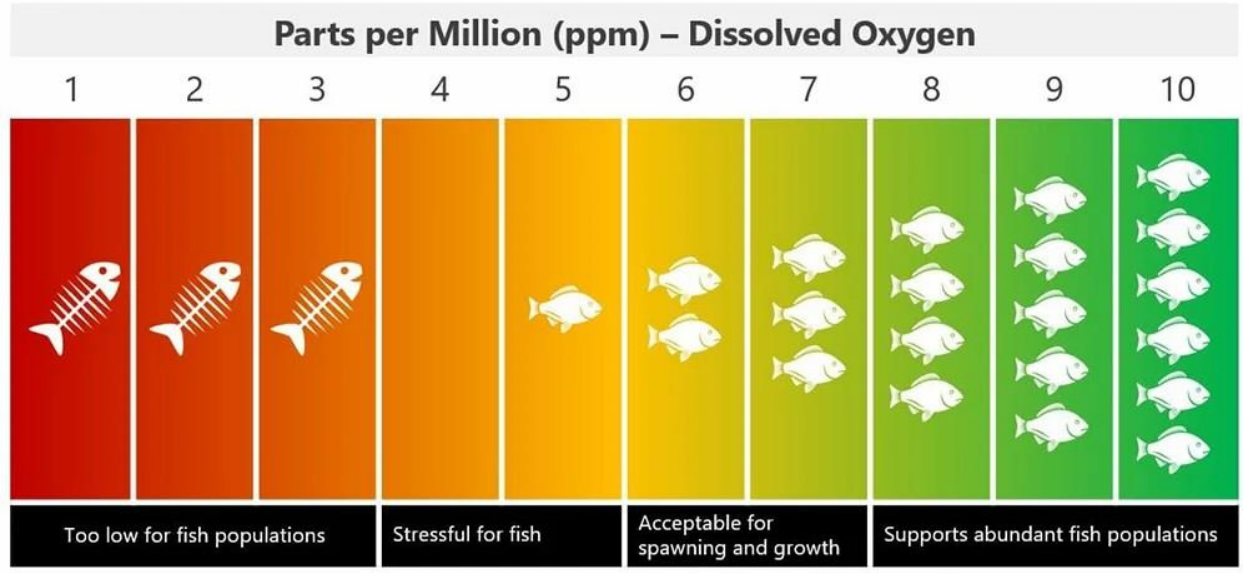


Image 4-2: Impact of Dissolved Oxygen on Fish.

Other Contaminants

Although the concentration of nutrients measured in the lake water have been below the Illinois State Standards as measured by the Lake County Health Department and ILM, the Illinois Environmental Protection Agency, Bureau of Water sited Bangs Lake as having high phosphorus and mercury levels on their annual Section 303(d) list.

Appendix A-2. Specific Assessment Information for Lakes, 2020/2022

Water Body Name	Assessment Unit ID	Hydrologic Unit Code	Category	ALU	AQU	FCU	PCU	PFPWS
ACORN	IL_WGD	0712000405	3	X	X	X	X	
ADALYN	IL_VTN	0712000612	3	X	X	X	X	
ALBERT LAKE (outlet)	IL_VGG	0712000405	5	DO, TP, TSS	TP, TSS	X	X	
ALTAMONT NEW	IL_RCJ	0512011404	5	F	TP	Hg	X	F
ALTAMONT OLD	IL_RCI	0512011404	3	X	X	X	X	
AMES PIT	IL_VGA	0712000403	5	F	CauseUnk	X	X	
ANDERSON & CARLTON	IL_RDA	0713000310	5	F	Algae, AqPlants, TP, TSS	X	X	
ANGLERS MILLSTADT S	IL_ROZN	0714020406	3	X	X	X	X	
ANGLERS ROACHTOWN	IL_ROH	0714020406	3	X	X	X	X	
ANNA STATE HOSPITAL	IL_RIC	0714010506	5	X	X	Hg	X	
ANTIOCH	IL_RTT	0712000610	5	F	TP, TSS	X	X	
APPLE CANYON	IL_RMJ	0706000506	5	F	TP	X	X	
ARBOR	IL_RGZI	0712000408	3	X	X	X	X	
ARGYLE	IL_RDE	0713001003	5	F	F	Hg	X	
ARLANN	IL_RDZB	0713000303	3	X	X	X	X	
ARROWHEAD (COOK)	IL_RHZE	0712000304	5	F	CauseUnk	Hg	X	
ARROWHEAD (WILLIAMSON)	IL_RNZX	0714010605	4A	F	TP	X	X	
ASHLAND-NEW LAKE	IL_SDZO	0713001101	2	F	F	X	X	
ASHLAND-OLD	IL_SDH	0713001101	3	X	X	X	X	
ASHLEY RESERVOIR	IL_RNZB	0714010602	5	DO, Sed/Silt, TP, TSS	TP, TSS	X	X	
ATWOOD(HOLLOWS CONS)	IL_VTS	0712000611	2	F	F	X	X	
AUGUSTA	IL_RDZH	0713001008	3	X	X	X	X	
AVONDALE	IL_RDZD	0713000509	3	X	X	X	X	
AXEHEAD	IL_RGZQ	0712000405	2	F	F	X	X	
BAKER	IL_VTC	0712000611	3	X	X	X	X	
BALDWIN	IL_ROW	0714020409	3	X	X	X	X	
BANANA	IL_WTC	0712000611	2	F	F	X	X	
BANGS	IL_RTG	0712000611	5	F	TP	Hg	X	
BARRINGTON	IL_RTZT	0712000611	5	F	TP, TSS	X	FC	
BASS	IL_RPJ	0709000702	3	X	X	X	X	

Figure 4-27: IEPA 303(d) list for 2020-2022 (Source: Illinois Environmental Protection Agency 2022)

Mercury (Hg) was first listed at Bangs Lake (Water ID RL_RTG) for fish consumption in the 2010 IEPA 303(d) list and has continued through the 2022 report (Figure 4-27). The Illinois Environmental Protection Agency (IEPA) Bureau of Water has confirmed that multiple fish species were last tested in 2018 and that the IDNR has also confirmed mercury contamination for fish in Bangs Lake. A fish consumption advisory has been recommended by both IDNR and IEPA.

Total phosphorus was first listed in the 2018 303(d) report. The IEPA stated that surface samples have been collected near the shoreline and in the hypolimnion (deep sample). The last sample collected for Bangs Lake was in 2018. The LCHD also tested the hypolimnion during their routine testing and found that from 1990 through 2013, the average total phosphorus concentration was 0.117 mg/L, or 2X the Illinois State Standard of 0.05 mg/L for lakes over 20 acres. Section 302.205 Phosphorus in Title 35 Part 302 Water Quality Standards does not state if the phosphorus sample should be at the surface or deep.

All other lakes in the 9-Lakes Plan are also listed in the 2020-2022 303(d) list for total phosphorus (TP) and total suspended sediment (TSS). These lakes include Lake Napa Suwe, Slocum Lake, Island Lake, Lake Barrington, Lake Fairview, Timber Lake, Tower Lake, and Woodland Lake. Total phosphorus and total suspended solids are very common contaminants due to fertilizer runoff and soil erosion. None of the other lakes in the report have been tested for mercury contamination in fish.

Common sources of mercury in lakes occur from atmospheric deposition from coal burning power plants or industrial uses, neither of which are located near Bangs Lake. Mercury can also occur naturally in soil and rocks. This listing does enhance the ability to allocate grant funding towards general lake management when applied for.

Swimmers' Itch

Swimmers' itch (*cercarial dermatitis*) has been documented at some beaches at Bangs Lake. Swimmers' itch occurrence is unrelated to water quality and cannot be controlled by improving (or not improving) lake health. This is a skin rash that is caused by an allergic reaction to microscopic parasites that are released from infected snails into fresh water. The snails become infected by the parasite from the feces of infected ducks, geese, gulls, muskrats, and raccoons, etc. The parasites cannot develop inside humans, so they soon die after breaching the skin layer of its host. Symptoms include a rash that may develop within hours or days and could last up to a week.

To avoid swimmers' itch, avoid swimming in areas where it is a problem. Typically, this occurs early in the summer and in shallow water. Vigorously towel off or shower immediately after swimming to remove any parasites. Chemical treatments can be performed to kill mollusks, a host of this organism, but this will not eliminate swimmers' itch in its entirety and would be detrimental to the general ecosystem potentially leading to other issues.

Fecal Coliform

Fecal contaminants are the reason Bangs Lake, and many other beaches in this region, will experience temporary beach closures (Figure 4-28). As discussed previously, these totals are elevated when there is potential leakage of septic systems or excessive waterfowl waste deposited near shore/on docks. This year did not have exceedances, resulting in limited closures for the Wauconda Park District. Other seasons have had multiple closures.

Sample Year	Sample Date	Sample Type	Result Value
2023			
1	08/28/2023	Individual	57.3 cfu/100ml
1	08/28/2023	Individual	67.7 cfu/100ml
1	08/14/2023	Individual	39.3 cfu/100ml
1	08/14/2023	Individual	47.9 cfu/100ml
1	07/31/2023	Individual	16.1 cfu/100ml
1	07/31/2023	Individual	24.1 cfu/100ml
1	07/17/2023	Individual	9.6 cfu/100ml
1	07/17/2023	Individual	11 cfu/100ml
1	07/05/2023	Individual	21.3 cfu/100ml
1	07/05/2023	Individual	15.8 cfu/100ml
1	06/20/2023	Individual	103.6 cfu/100ml
1	06/20/2023	Individual	60.9 cfu/100ml
1	06/05/2023	Individual	3.1 cfu/100ml
1	06/05/2023	Individual	2 cfu/100ml

Figure 4-28: Results for Bangs Lake on this year's Beach guard system. Provided by the Illinois Department of Public Health.

Water Quality Photo Log

Photo #1: Circle Channel on 6/27 at the sampling point, facing east. Note the dense Wolffia growth.

Photo #2: Circle Channel facing west from the sample point. Note Wolffia is not as dense.

Photo #3: Kimball Channel on 7/25 at the sampling site. Wolffia growth is very dense.

Photo #4: Peninsula Channel facing east from the sample site. Wolffia growth was dominant.

Water Quality Photo Log

Photo #5: Peninsula Channel on 6/27 facing north. Note that the channel is not overgrown with Wolffia.

Photo #6: Washington Channel facing north from the sample point. Note Wolffia occurs at the north tip.

Photo #7: Bangs Lake shoreline from Cook Memorial Park boat launch on 7/25. Note some shoreline plants are visible, but much fewer than during the initial visit on 5/30.

Photo #8: Blue-green algae, duckweed, and Wolffia growth near the boat pier at Cook Memorial Park on 7/25.

Water Quality Photo Log

Photo #9: This area in the northeastern lobe consisted of cut EWM, which proceeded to flower and seed. The entire section was non-navigable.

APPENDIX 5. Shoreline Erosion

Appendix 5- Shoreline Erosion

Shoreline conditions have direct impacts on water quality and potential recreational use within Bangs Lake. As slopes erode, lake access is impeded, and native shoreline plants lose their ability to filter pollutants in stormwater before reaching the lake, resulting in nutrient and pollutant deposition in the waterbody (Image 5-1). This leads to nuisance aquatic growth, directly impacting water quality, recreation and reducing habitat for desirable fish species. Erosion is a concern for almost every waterbody in Northern Illinois. While mild erosion is a natural result of moving water, recreational lake use, establishment of non-native plants and changes in land use have impacted Bangs Lake's ability to retain soil along the shorelines, which once were tightly secured by native vegetation. Lake level can be controlled to a certain degree by the village of Wauconda. Fluctuations in lake levels may also contribute to undercutting and inconsistent shoreline protection. Additionally, some shoreline areas may be more easily restored than others. An example of restored shoreline can be seen in the image below (Image 5-2). Current shoreline conditions are shown at the end of this Appendix.

Image 5-1: Example of severely degraded shoreline. (Source: Clemson University Extension Services)

Image 5-2: Example of well-maintained native shoreline (photo source: Illinois-Indiana Sea Grant)

Current Shoreline Conditions

Only the Peninsula Channel, Washington Channel and what is now the Circle Channel existed prior to 1939. Kimball Channel and Berger Channel were created between 1946 and 1961. Circle Channel was altered to have its circular design during that same timeline. The shorelines of these manmade channels are highly susceptible to erosion and degradation compared to that of a natural shoreline. The only area throughout the main body of Bangs Lake which has experienced shoreline migration is between Berger and Washington Channels. The original channel design is visible from the most recent aerial. While erosion is evident, the current "slope" and vegetative state dictates this area is only visibly experiencing "moderate" erosion at this time. Original channel design is shown at the end of this Appendix.

There are only a few sections of the lake shoreline, along Peninsula Channel and the northernmost point of Circle Channel, where severe erosion and undercutting is occurring. The remainder of the lake is either experiencing moderate or limited erosion issues. Areas experiencing moderate erosion vary drastically in composition. In many cases, seawalls or rip-rap (generally interlocking stone) are no longer in functional condition, resulting in sediment deposition in the lake. Metal seawalls are experiencing high levels of corrosion (example shown in Photo-5-1), while rip-rap is generally slipping further into the lake, away from the shoreline it was installed to protect.

Photo 5-1: Example of corroding/compromised seawall on Bangs Lake.

Many degraded natural areas are also experiencing moderate erosion, as they have become overrun with invasive terrestrial plant species. 4.5 miles (23,760 feet) of the shoreline are experiencing either severe or moderate erosion issues. Areas which are experiencing limited erosion issues generally have recently installed/maintained seawalls and rip-rap, as well as manicured recreational beaches. This does not indicate seawalls, rip-rap or manicured beaches are the best way to manage shoreline erosion. Instead, proper shoreline maintenance, whether through rip-rap, seawall or native buffer, helps control erosion along the Bangs Lake shoreline (Images 5-3 through 5-6). Some Best Management Practices for shorelines have been outlined in the *9-Lakes Plan*. These are some of the more extensive, and often costly projects which could be undertaken, while a handful of smaller scale projects also exist within the area (i.e. tributary restoration, bioswale creation, etc.).

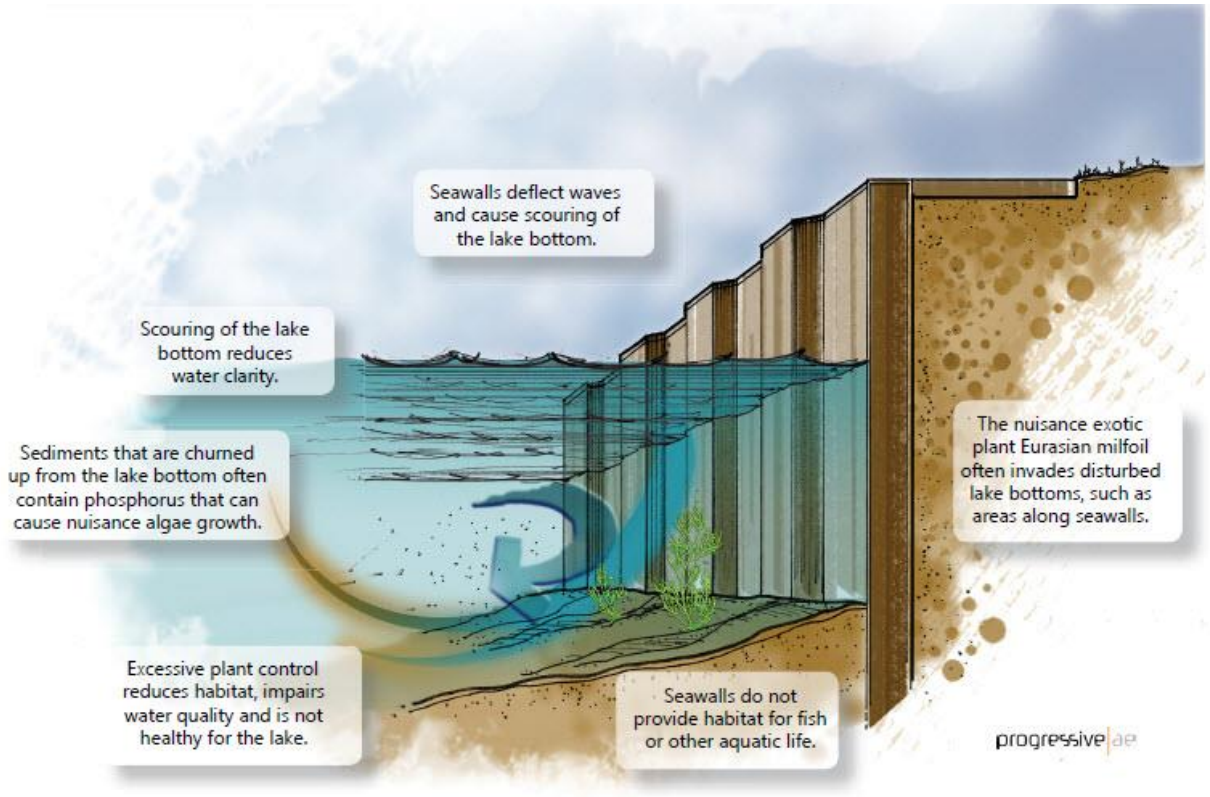


Image 5-3: Example of wave action impacts on seawall (source: Michigan Natural Shoreline Partnership)

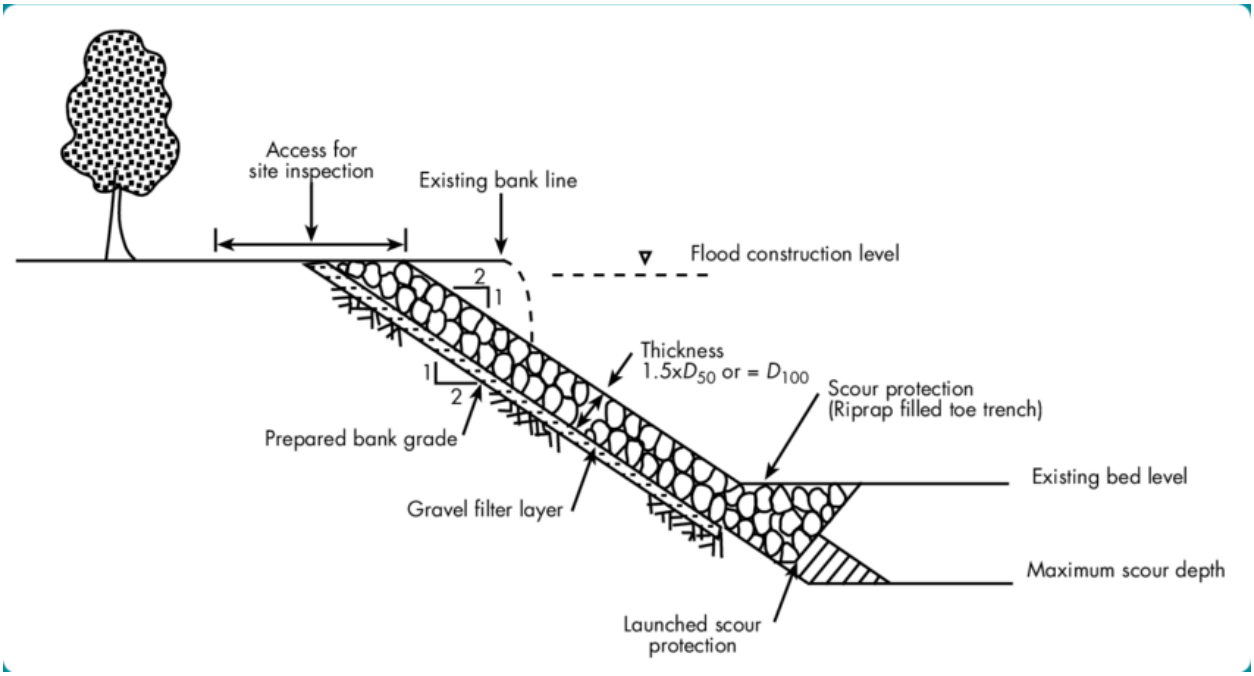


Image 5-4: Example of shoreline protected by rip-rap (source: Shrestha, Arun & GC, Ezee & Adhikary, Rajendra & Rai, Sundar. (2012). Resource Manual on Flash Flood Risk Management, Module 3: Structural Measures).

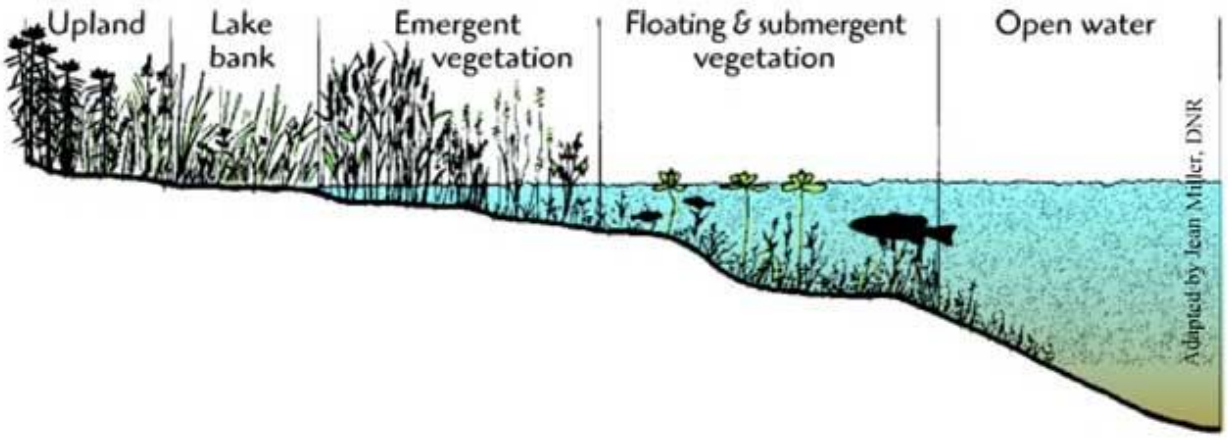


Image 5-5: Cross section of shoreline protected by native plant communities (Source: Mater Property Owners Association, Wonder Lake, IL).

Image 5-6: Example of flanking damage to adjacent shorelines (Photo source: Michigan Natural Shorelines Partnership)

Methods of Shoreline Control

Wave energy can scour the lake bottom of beneficial vegetation. Seawalls reflect wave energy and eat away at the wall base and can cause wave flanking damage to adjacent properties. Rip-rap can protect from erosion by armoring the land. The uneven surface of riprap helps to break up wave energy but does little to provide structure for fish. Native buffers planted on a gradual slope prevent most wave-based erosion, depending on wave height and species composition.

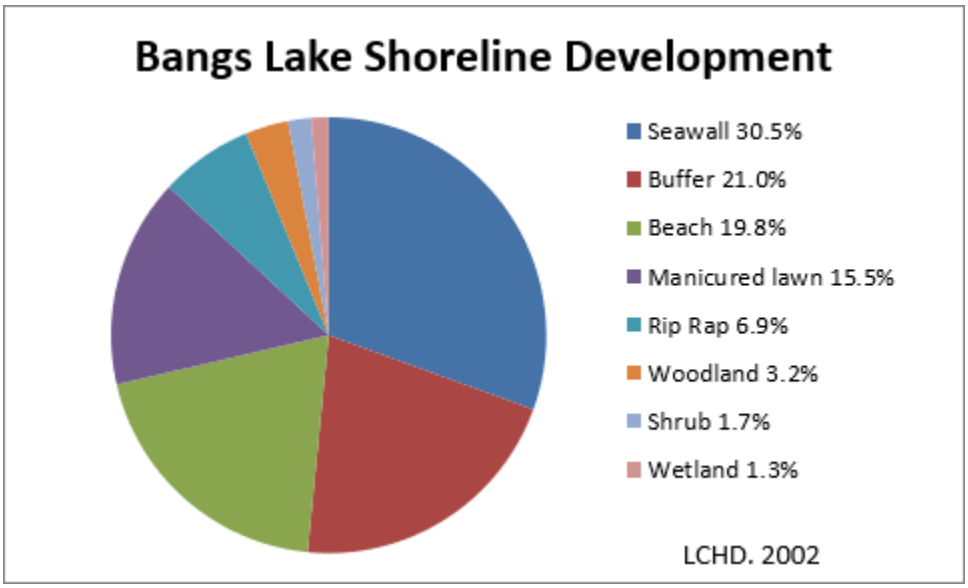


Figure 5-4: Shoreline development and conditions at Bangs Lake.

LCHD compiled the above shoreline chart in 2002 (Figure 5-4). While the use has changed in small ways over the last 21 years, this chart continues to be highly accurate and reflective of current shoreline composition.

Additional maps regarding surrounding soil characteristics and types can be found at the end of this Appendix.

Lake Use and Recreation

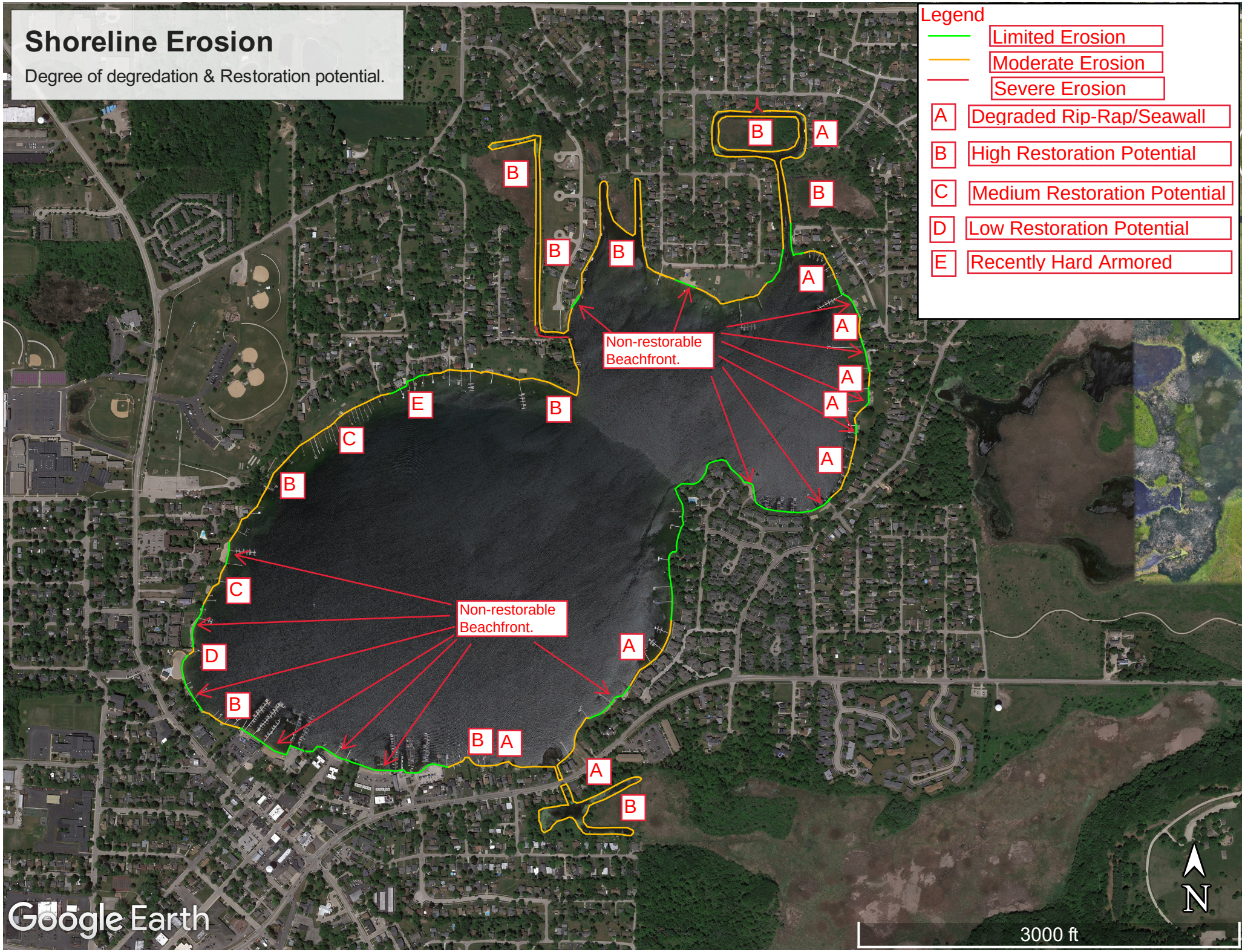
Erosion is driven by many forces; human activities can exacerbate such effects. Watersports are one of the primary recreational activities on Bangs Lake, including Paddleboarding, Water Skiing, Jet Skiing, Fishing, Sailing, Pontoons, Swimming and more. Many of the wake regulations prevent a greater magnitude of shoreline erosion from some of these activities. Wakeboarding is a relatively newer activity, with boats designed to increase wake size for a person towed behind the boat. Boats which are designed like this create wakes that are more intense in size, which is beneficial for the rider, but very detrimental to the shoreline. In larger bodies of water, wakes will die down before reaching shorelines. While Bangs Lake is considered a larger lake, it is not of a size where wave

inertia is depleted before reaching shore, resulting in more intense wave-based erosion along any exposed perimeter. Wave-based erosion will be discussed further in Appendix 9.

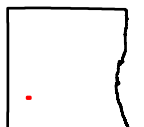
A recent study performed by the University of Minnesota concluded that:

“When researchers compared the wake waves of the four boats during their most typical mode of operations, the data indicated that wakesurf boats require distances greater than 500 feet from the shoreline/docks and other boats (or the distance of a little less than 1.5 football fields) to decrease their wake wave characteristics to levels similar to the non-wakesurf boats.” (https://twin-cities.umn.edu/news-events/university-minnesota-researchers-study-waves-created-recreational-boats)

While this information indicates that wakeboarding is a larger issue, the impacts of other recreational boats should not be discounted, especially on a “smaller” body of water such as Bangs Lake.


Shoreline Erosion
Degree of degredation & Restoration potential.
Legend
Limited Erosion
Moderate Erosion
Severe Erosion
A Degraded Rip-Rap/Seawall
B High Restoration Potential
C Medium Restoration Potential
D Low Restoration Potential
E Recently Hard Armored
Non-restorable Beachfront.
Non-restorable Beachfront.
Google Earth
3000 ft
N

Current Channel Topography



Lake County, Illinois

LakeCounty

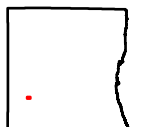
Map Printed on 7/14/2023

N

Tax Parcel
Information

Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

Original Channel Design



Lake County, Illinois

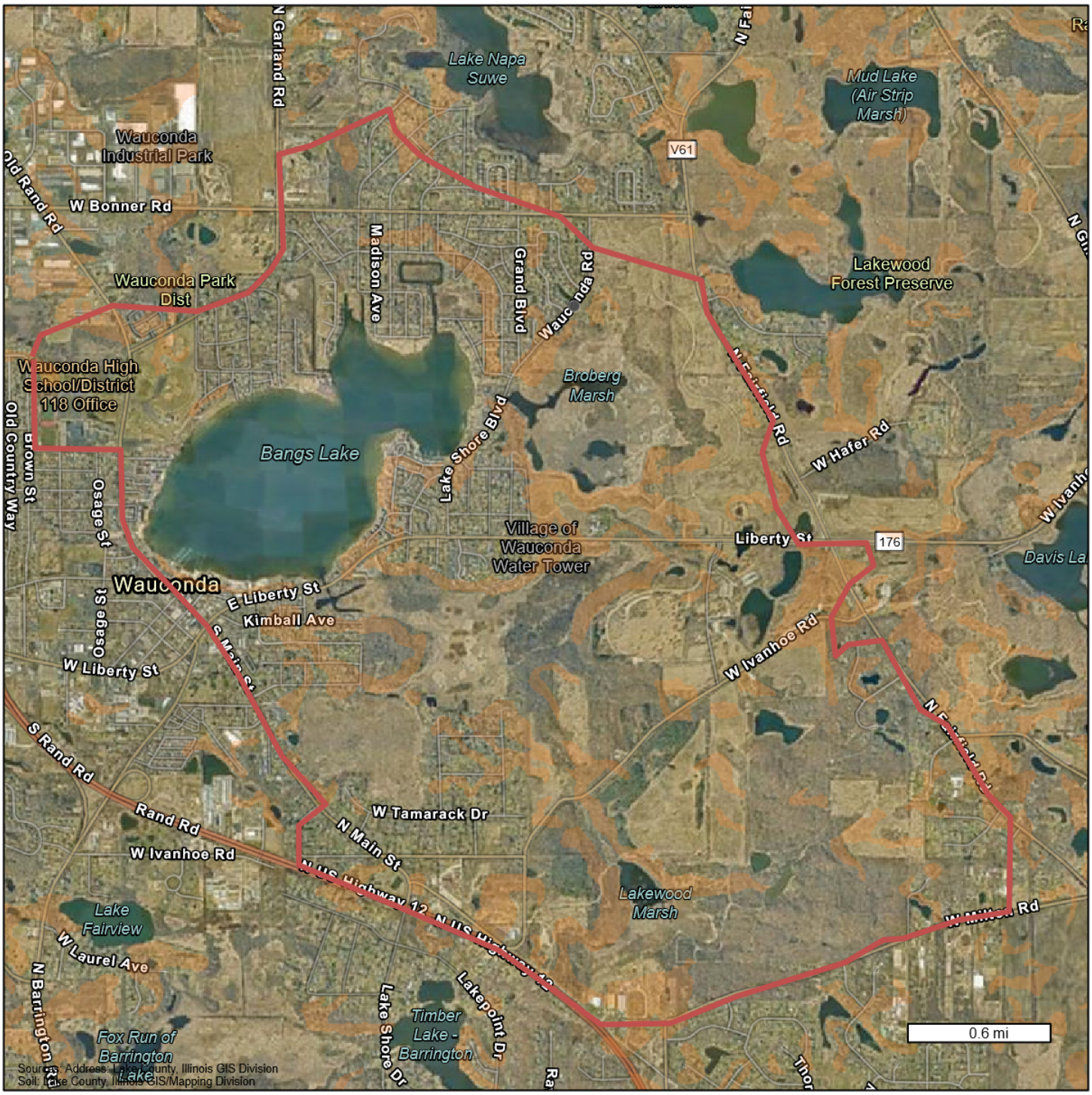
LakeCounty

Map Printed on 7/14/2023

N

Tax Parcel
Information

Highly Erodible Soils



Lake County, Illinois

LakeCounty

Map Printed on 7/3/2023

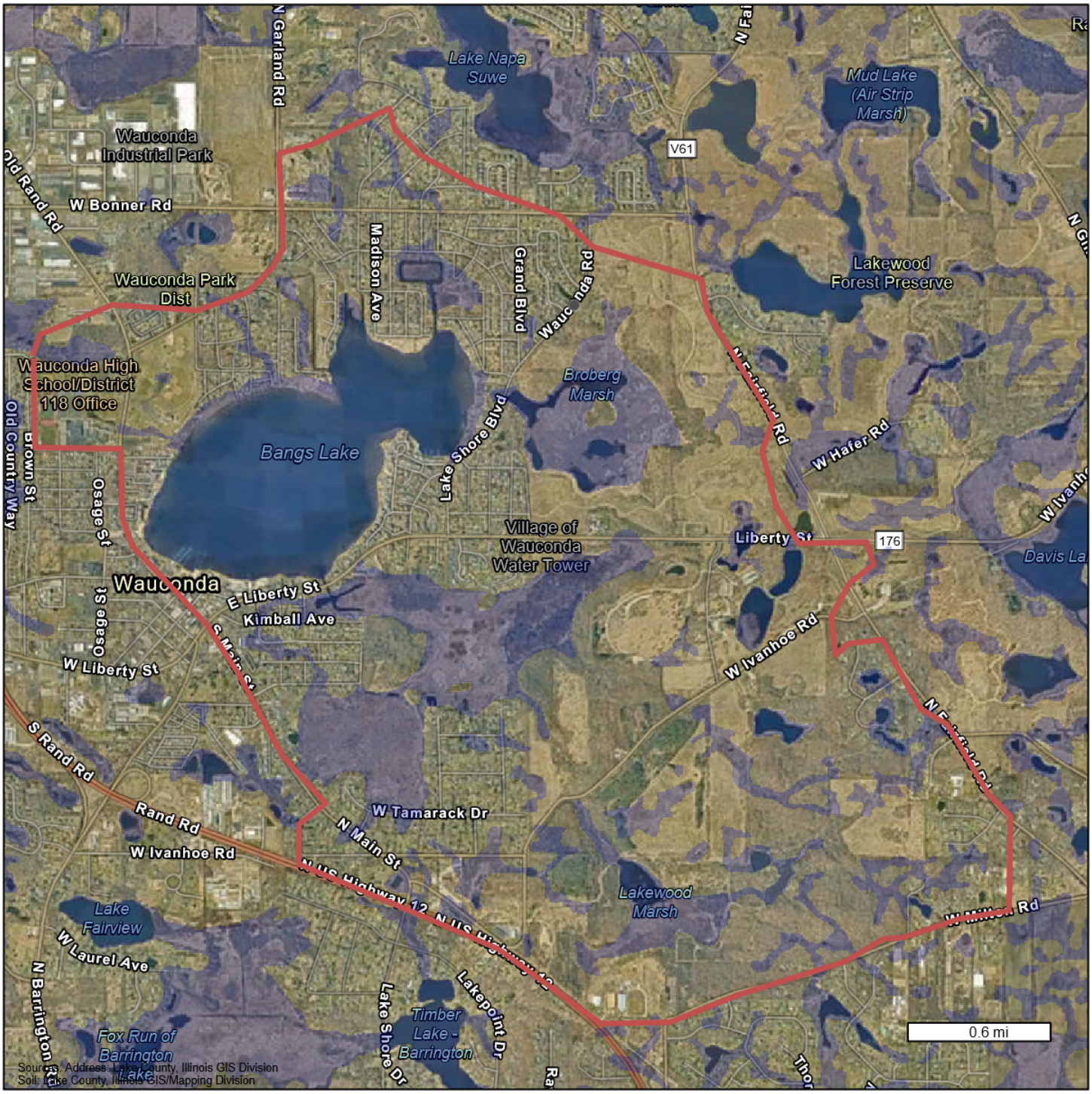
N

Override 1

Highly Erodible Soils

Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

Hydric soils



Override 1

Hydric Soils

Lake County, Illinois

LakeCounty

Map Printed on 7/3/2023

N

Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

Erosion Photo Log

Photo #1: Corroding seawall in circle channel.

Photo #2: Much of the shoreline is beachfront. These areas are generally maintained for erosion by shoreline property owners. Areas like this could improve by incorporating native landscaping in portions of the beach, while maintaining recreation potential.

Photo #3: Example of aging rip-rap installation.

Photo #4: Severe undercutting near the mouth of peninsula channel.

Erosion Photo Log

Photo #5: Aging shoreline and degraded natural areas.

Photo #6: Overgrown invaded shoreline on park district property. This offers limited erosion control, and impacts the ability to enjoy the lake, as it is not visible from the walking path.

Photo #7: Areas with invasive dominance (cattail) should be naturalized, offering better erosion control along the shoreline.

Photo #8: Combination of beachfront and aging rip-rap.

Erosion Photo Log

Photo #9: Areas with invasive dominance (Phragmites and woodies) should be naturalized, offering better erosion control along the shoreline.

Photo #10: More areas with aging shoreline control techniques. Often experiencing moderate erosion. Landscape species near the shore should be appropriate natives to enhance erosion control.

Photo #11: Island in circle channel. Experiencing moderate erosion along the entire perimeter.

Photo #12: Degrading seawall, unmanaged natural areas.

Erosion Photo Log

Photo #13: Newly installed timber shoreline control. If maintained routinely, can be effective means of control in areas with limited options.

Photo #14: Degraded shoreline control, unmanaged vegetation, offering little shoreline protection.

Photo #15: Older rip-rap now offering limited shoreline protection.

Photo #16: Less erosion in the “natural areas” however invasive species are dominating, reducing overall erosion control and pollutant reduction.

APPENDIX 6. Sediment

Appendix 6- Sediment

Most of the main body of Bangs Lake is absent of sediment issues, as the majority consists of a sandy bottom indicative of a glacial lake. Sediment issues do exist within the assorted channels.

ILM staff launched a canoe on April 14th and 18th, 2023, to conduct transects through the channels and take sediment thickness measurements at 215 points. The sediment was probed with a measuring device graduated in tenths of a foot. Each location had two measurements recorded. One was the depth to the top of the sediment (water depth), and the second was the total depth to firm substrate below the sediment (water depth + sediment thickness = total depth).

Sediment thickness was calculated by subtracting the water depth from the total depth. Locations were mapped in the field with a Trimble GeoXH Geoexplorer 6000 series receiver with sub-meter accuracy. The maps were created in ArcGIS ArcMap 10. Sediment volume was calculated by measuring the area of each contour and multiplying by the average depth between the contour lines (Tabe 6-1). This data typically varies from the average of the data points in the appendix.

Channel Results:

Sediment probing at Bangs Lake Channels 4/14 & 4/18/23		Berger	Circle	Kimball	Peninsula	Washington
Bathymetric Results	Size of Channel (acres)	0.9	5.1	3.1	2.6	0.6
	Average water depth (ft.)*	3.1	2.7	1.3	2.0	2.3
	Maximum water depth (ft.)	6.9	5.0	3.0	5.5	5.1
	Channel volume (acre-ft.)*	2.7	13.6	4.0	5.3	1.3
Sediment Results	Average sediment thickness (ft.)*	1.4	1.8	1.9	1.2	1.3
	Maximum sediment thickness (ft.)	5.3	4.7	5.4	5.0	4.1
	Sediment volume (CY)**	1,950	15,100	9,375	4,990	1,175
Total Depth Results (sediment + water)	Average total depth (ft.)*	4.9	4.5	3.4	3.4	4.0
	Maximum total depth (ft.)	10.8	8.5	8.4	9.9	7.9
	Total volume (acre-ft.)*	4.2	22.8	10.5	8.9	2.2
	Percent full of sediment	29%	41%	55%	35%	33%
Number of Data Points		24	76	45	50	20

* Based on average depth multiplied by area determined from ArcMap10.

**Wet sediment volume, which is typically 20-60% water. Dried material has a smaller volume.

Table 6-1: Current sediment volumes.

Sediment Removal:

Typically, sediment removal is recommended when:

- The area is > 30% full of sediment.
- The hydrology of the area is impacted.
- Sediment occurs near the surface.
- Nutrient rich sediment is causing heavy algae and/or aquatic plant growth.

Each channel meets one or two of these criteria. Probed sediment in each channel was very mucky indicating high organic/nutrient content.

Nutrients which feed aquatic plants and algae can occur from sediment or from runoff. The processes through which nutrients are released from sediment are complex and dependent on various environmental factors. For example, low dissolved oxygen levels alter biotic processes, leading to increased rates of nutrient release from the sediment into the water. Under certain conditions, even low levels of sediment nutrients can lead to increases in nuisance algae growth. While dredging these channels is the fastest, most complete way to decrease nutrients in the sediment that fuel algae growth, reducing sediment volume alone is not a guarantee of a reduction of nuisance algae and plant growth. Sediment, total and water depth maps can be found for these channels at the end of this Appendix.

Lab Results

Sediment samples were also collected on August 28th to determine total phosphorus and % organic material (Table 6-2 and Figure 6-1). It is important to note that these sediment samples were discrete grab samples and unlike water samples, may not represent the sediment for the entire channel.

The analytical results confirmed the field observations, with the sediment ranging from 10.6 – 17.6% solids. This means approximately 90 – 82% of the weight was water. Therefore, when dried, dredged sediment would condense substantially in volume. This % solids is also referred to as the Inorganic:Organic ratio.

Sediment Analysis	Low	Normal	High	Highly Elevated	Bangs Lake	Berger Channel	Circle Channel	Kimball Channel	Peninsula Channel	Washington Channel
Phosphorus, total (mg/kg)	< 394	394 – 1,115	1,115 - 2179	> 2,179	810	220	280	310	430	2,400
% Solids					10.6	13.3	12.1	16.0	17.6	12.5

Table 6-2: Values are compared to Illinois lake sediment (Source: Mitzelfelt, Jeffery. Sediment Classification for Illinois Inland Lakes. 1996. Illinois Environmental Protection Agency).

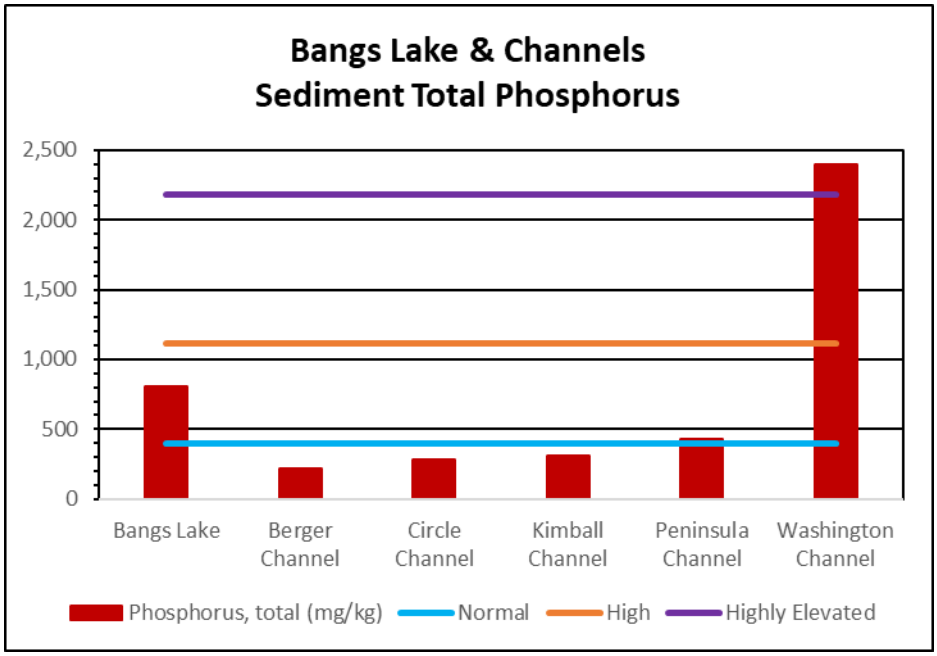
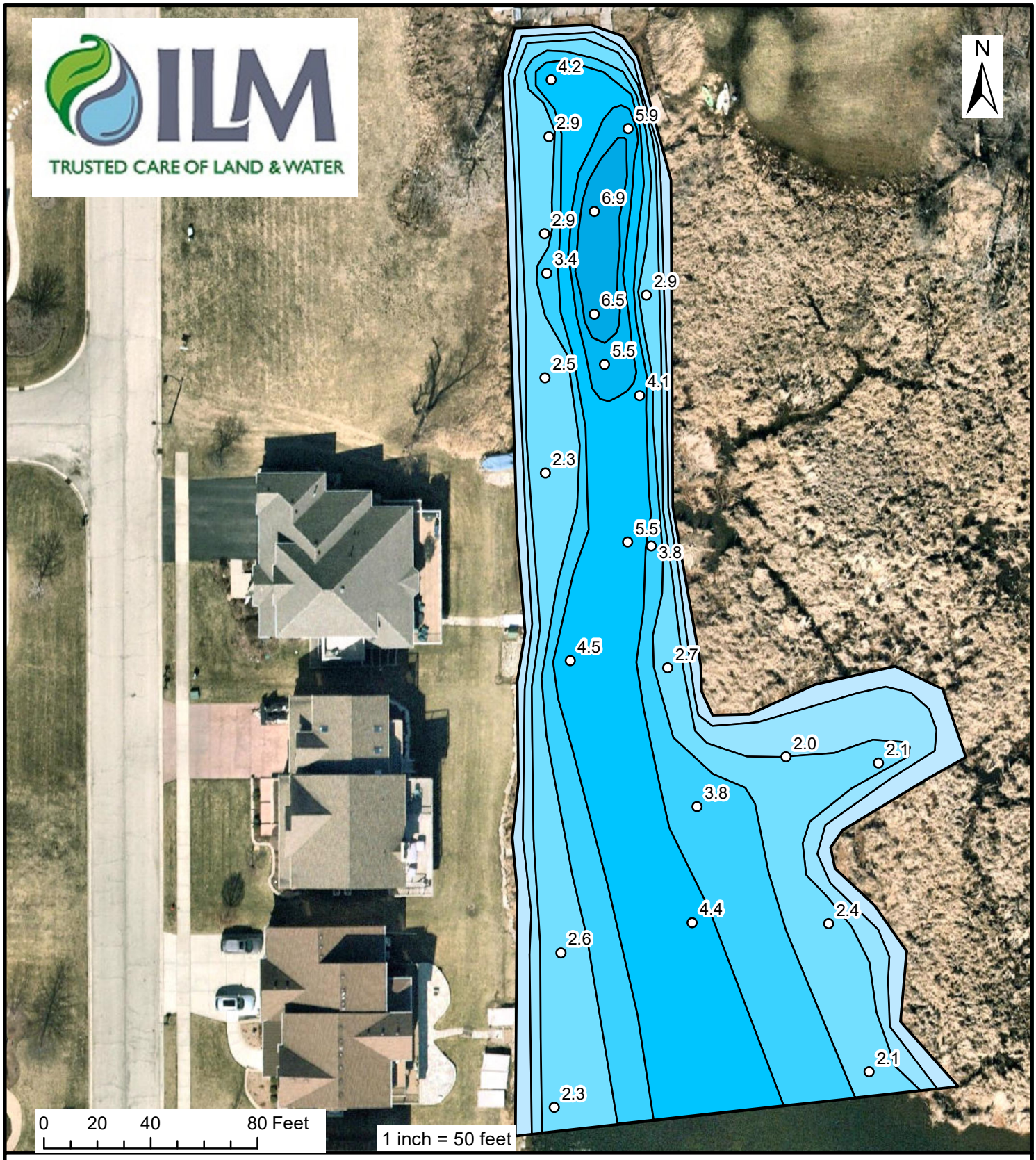


Figure 6-1: Total phosphorus in the sediment. The Washington Channel was highly elevated. This may be due to the large snail population that occurred at the testing area.

Sediment thickness was not measured throughout Bangs Lake. The lake-bottom consists mostly of sand along the perimeter. Some sediment has settled in the deeper areas in a relatively thin layer. This was determined during the vegetation survey, utilizing a rake toss to gauge resistance from muck/sediment.

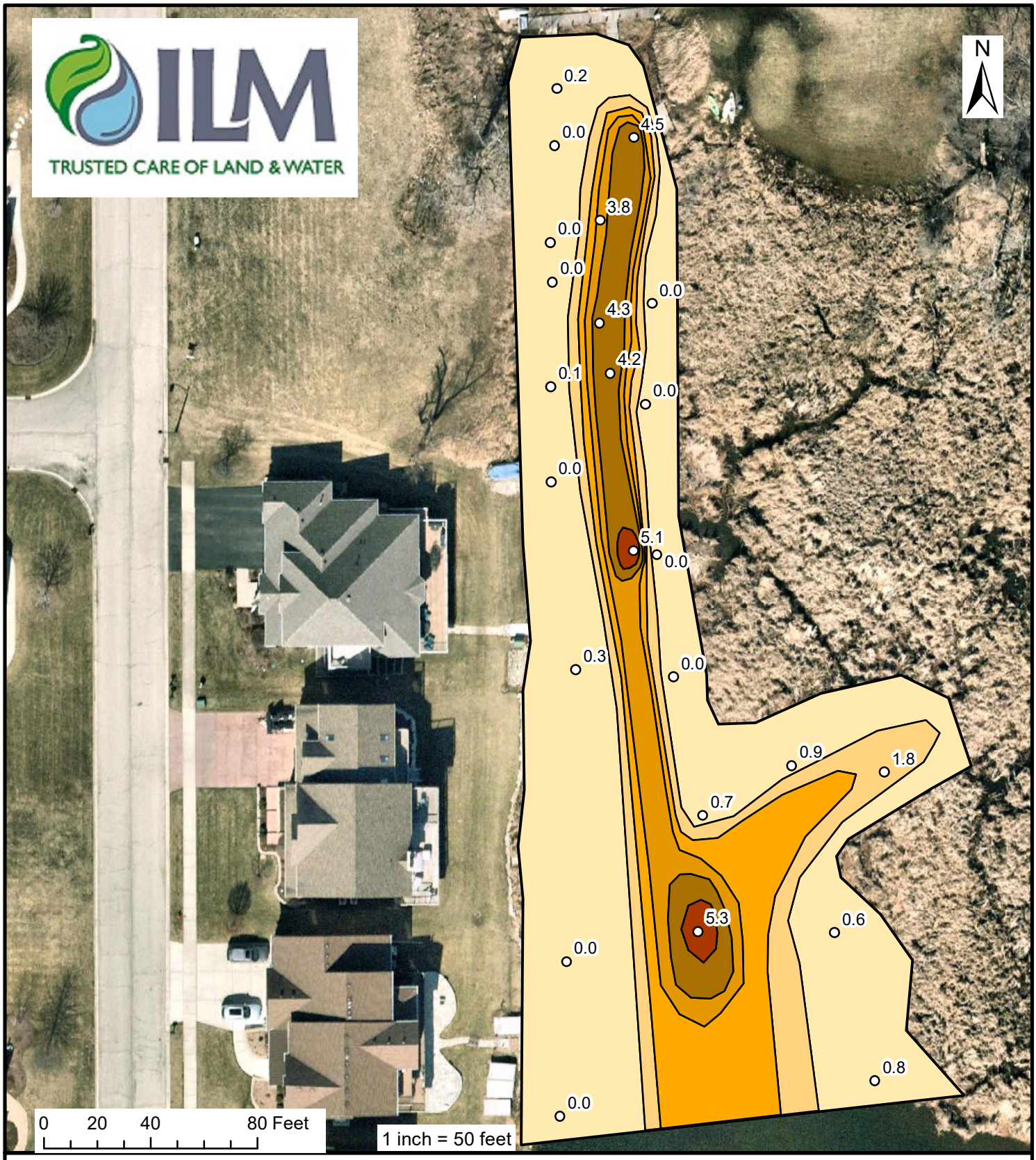


Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4 - 5 Foot
- 5 - 6 Foot
- 6 - 7 Foot

Bathymetric Map
Bangs Lake Berger Channel
April 14, 2023

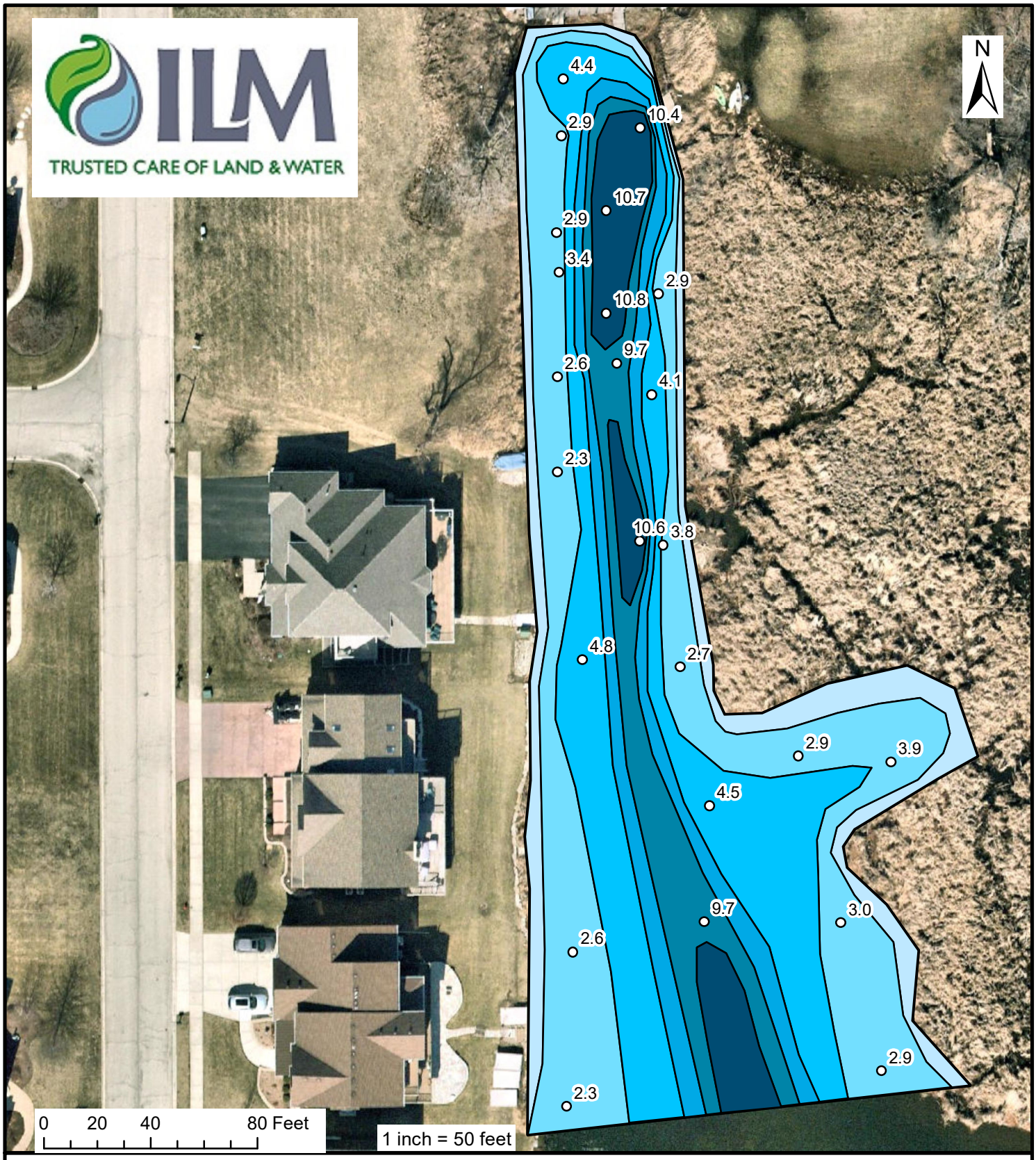
Not to be used for navigational purposes



Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4 - 5 Foot
- 5 + Foot

Sediment Thickness Map
Bangs Lake Berger Channel
April 14, 2023

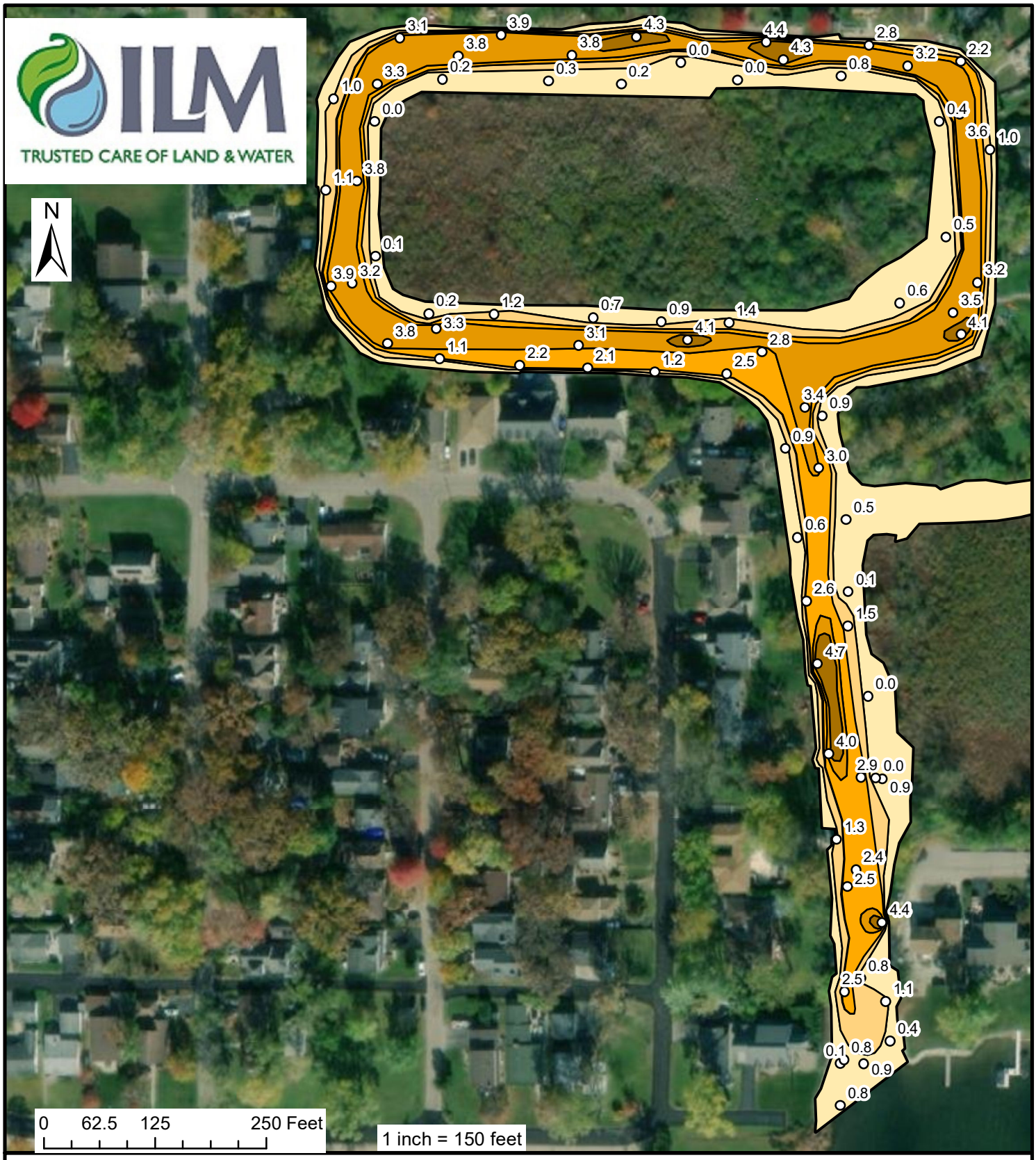


Legend

- Sample Point
- Shoreline
- 0 - 2 Foot
- 2 - 4 Foot
- 4 - 6 Foot
- 6 - 8 Foot
- 8 - 10 Foot
- 10+ Foot

Total Depth (Sediment + Water) Map
Bangs Lake Berger Channel
April 14, 2023

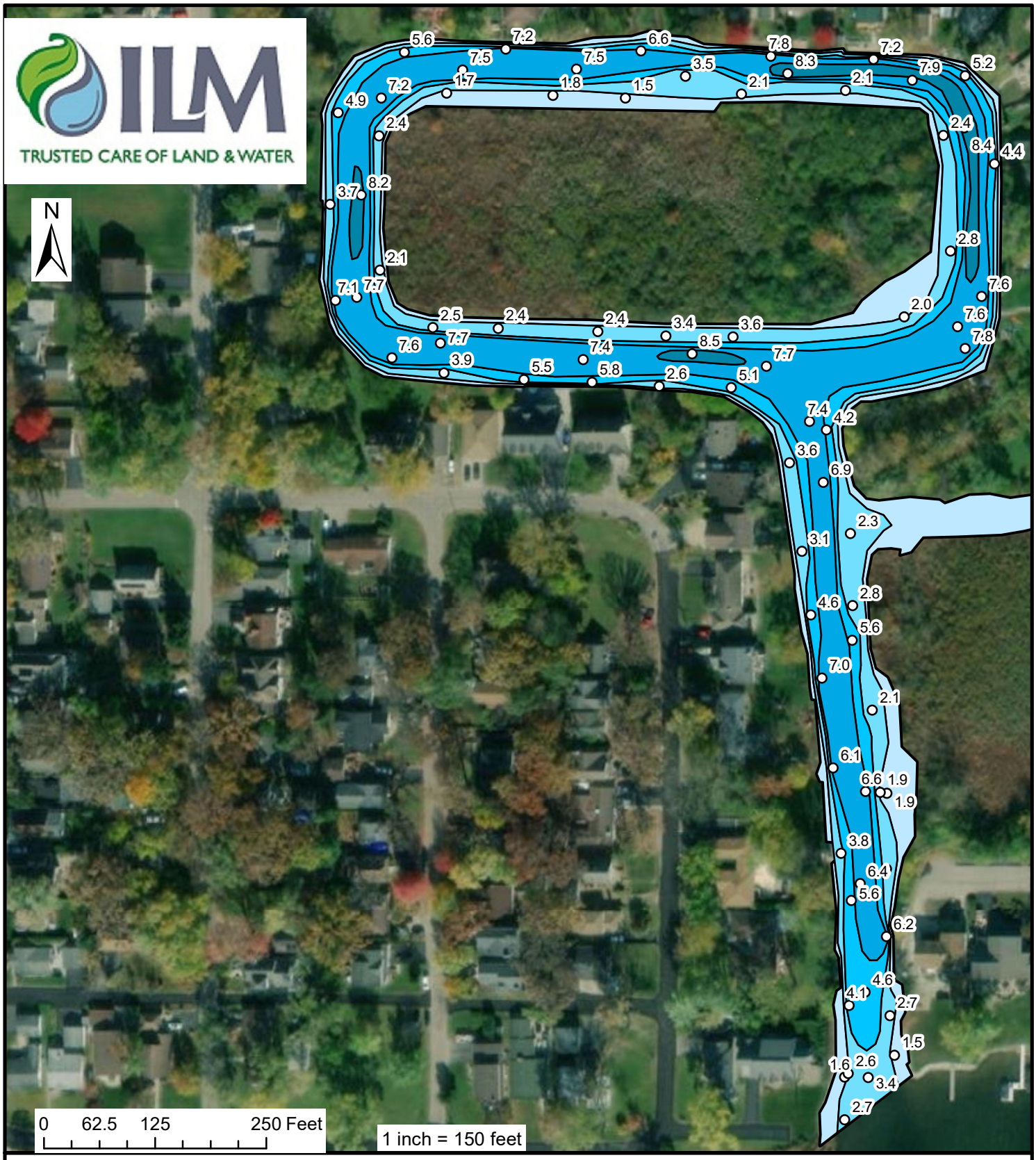
Not to be used for navigational purposes



Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4+ Foot

Sediment Thickness Map
Bangs Lake Circle Channel
April 14, 2023



Legend

- Sample Point
- Shoreline
- 0 - 2 Foot
- 2 - 4 Foot
- 4 - 6 Foot
- 6 - 8 Foot
- 8+ Foot

Total Depth (Water + Sediment) Map
Bangs Lake Circle Channel
April 14, 2023

Not to be used for navigational purposes

Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot

Bathymetric Map
Bangs Lake Kimball Channel
April 18, 2023

Not to be used for navigational purposes

Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4 - 5 Foot
- 5+ Feet

Sediment Map
Bangs Lake Kimball Channel
April 18, 2023

Legend

- Sample Point
- Shoreline
- 0 - 2 Foot
- 2 - 4 Foot
- 4 - 6 Foot
- 6 - 8 Foot
- 8+ Foot

Total Depth (Water + Sediment) Map
Bangs Lake Kimball Channel
April 18, 2023

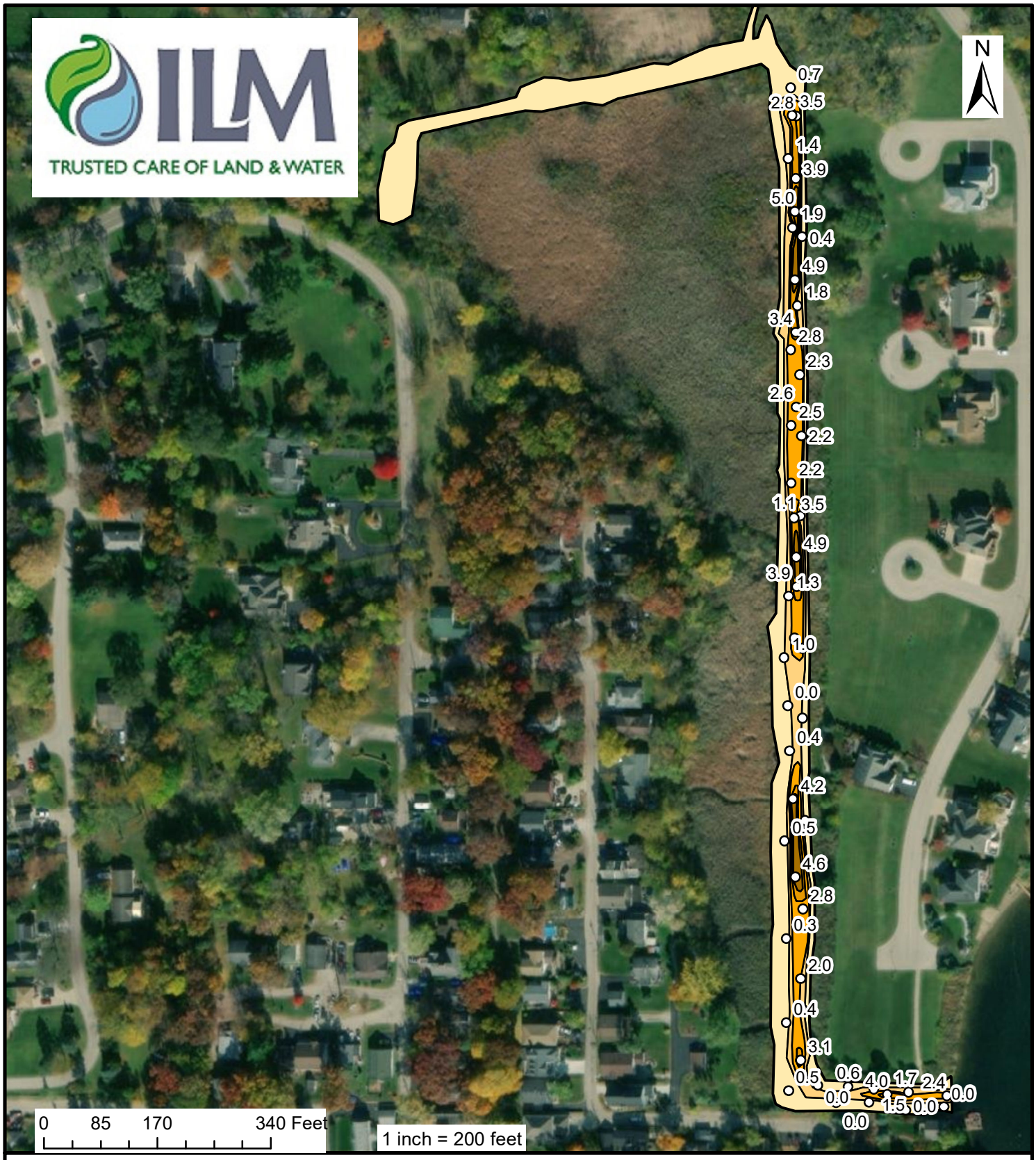
Not to be used for navigational purposes

Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4 - 5 Foot
- 5 - 6 Foot

Bathymetric Map
Bangs Lake Peninsula Channel
April 14, 2023

Not to be used for navigational purposes



Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4+ Foot

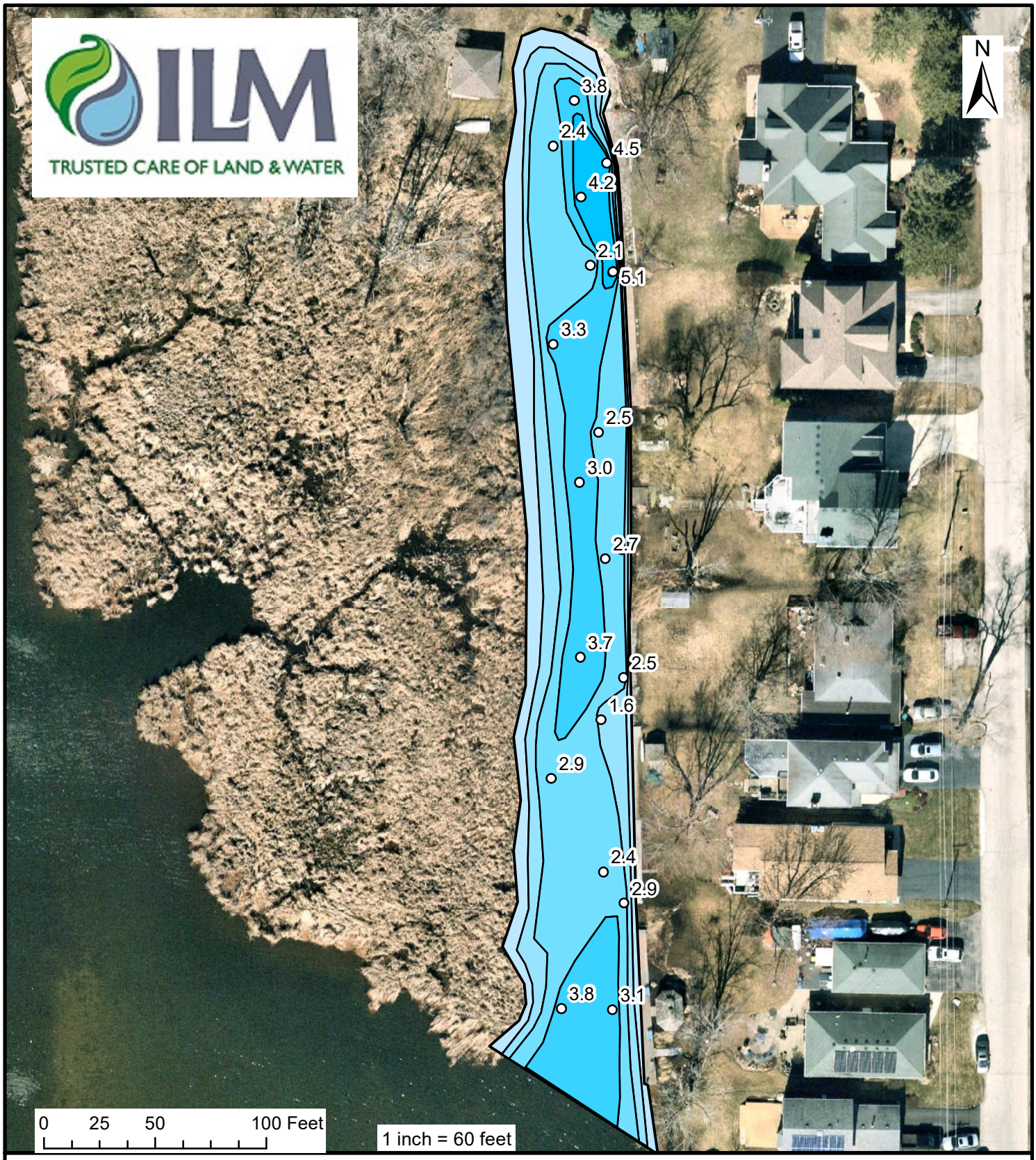
Sediment Thickness Map
Bangs Lake Peninsula Channel
April 14, 2023

Legend

- Sample Point
- Shoreline
- 0 - 2 Foot
- 2 - 4 Foot
- 4 - 6 Foot
- 6 - 8 Foot
- 8+ Foot

Total Depth (Water + Sediment) Map
Bangs Lake Peninsula Channel
April 14, 2023

Not to be used for navigational purposes



Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4 - 5 Foot
- 5 - 6 Foot

Bathymetric Map
Bangs Lake Washington Channel
April 14, 2023

Not to be used for navigational purposes

Legend

- Sample Point
- Shoreline
- 0 - 1 Foot
- 1 - 2 Foot
- 2 - 3 Foot
- 3 - 4 Foot
- 4+ Foot

Sediment Thickness Map
Bangs Lake Washington Channel
April 14, 2023

Legend

- Sample Point
- Shoreline
- 0 - 2 Foot
- 2 - 4 Foot
- 4 - 6 Foot
- 6+ Foot

Total Depth (Water + Sediment) Map
Bangs Lake Washington Channel
April 14, 2023

Not to be used for navigational purposes

Sediment Photo Log

Photo #1: Tributary along the eastern side of circle channel. Overgrown and invaded.

Photo #2: Heavily degraded inlet north of circle channel. Restoration of this area is highly suggested.

Photo #3: Property for sale along previous photo. Procuring such property and creating more wetland in this area could reduce sediment and pollutant loading more than just a basic restoration plan.

Photo #4: Swale leading to the northwest corner of circle channel. Has native and non-native vegetation present, but is currently being mowed.

Sediment Photo Log

Photo #5: Construction area on the same property from photo 4. There is a dewatering pipe set up to dewater the construction site without the constraint of the silt fence. The intention of the silt fence is to collect sediment before it enters the lake. This drainage prevents that from occurring.

Photo #6: Property just south of photo 5. A conveyance system exists within the invasive vegetation, carrying water into circle channel.

Photo #7: Tributary along the southwestern section of circle channel. Overgrown and degraded.

Photo #8: Where the tributary from photo 7 enters circle channel.

Sediment Photo Log

Photo #9: Culvert draining stormwater into the wetland between Washington and Berger channel.

Photo #10: Swale from culvert in photo 9. Overgrown and invaded.

Photo #11: Swale located on or partially on park district property near the community center.

Photo #12: Investments have been made into this property to build and maintain this structure, however the vegetation has been unmanaged, and blocks a view of the lake. This offers little ecological or aesthetic value.

Sediment Photo Log

Photo #13: Bangs Lake sediment from 27 feet deep consisted of dark brown silt.

Photo #14: Berger Channel sediment consisted of peaty soil.

Photo #15: Circle Channel sediment was black silt with marl, which are tiny white shells.

Photo #16: Kimball Channel sediment was dark brown muck. Sample collected north of Rt. 176 bridge.

Sediment Photo Log

Photo #17: Peninsula Channel consisted of black muck.

Photo #18: Washington Channel consisted of brown peaty sediment. Large snails accumulated on the Ekman dredge.

Photo #19: Snails that were found on the Ekman Dredge in Washington Channel. These appear to be Chinese mystery snails.

APPENDIX 7. Aquatic Vegetation

Appendix 7- Aquatic Vegetation

Aquatic Plants

Aquatic plants provide habitat for fish, stabilize the lake bottom and provide enhanced water quality and clarity. Fish use the plants to seek refuge from predator fish, to lay eggs, and to forage for food. Small fish eat macroinvertebrates and algae, which proliferate in areas with aquatic plants.

Water clarity and depth are the main limiting factors for aquatic plants. Plants can grow to a depth of approximately twice the secchi depth, which has varied between 7 and 14 feet in Bangs Lake. The presence of zebra mussels has allowed increased water clarity and for the aquatic plants to expand to deeper water.

Aquatic plant surveys have been conducted as part of the Lake County Health Department's routine monitoring and a listing of the number of species present occurs in Table 7-1. More species generally indicate higher biological diversity and potentially better lake quality. The plant species are entered into a database that measures the quality of the species. Rare species are ranked high and less desirable species are ranked low. The Floristic Quality Inventory (FQI) is listed for both native and nonnative species (w/adventives). An FQI of 20 or greater is considered a high-quality area.

Year	# of plant species	FQI (Floristic Quality Inventory)		Ranking out of Lake County Lakes (FQI)
		FQI (w/adventives)	FQI (natives)	
2023	16	19.0	21.1	NA
2014	19	26.2	27.8	#9
2013	17	26.0	29.6	#5
2012	24	33.8	34.6	#3
2011	15	25.2	26.9	#12
2010	18	29.8	32.0	#8
2009	20	29.5	31.0	#6
2008	14	25.7	27.4	#10
2007	17	24.5	26.2	#14
2006	13	26.4	28.0	#10
2005	10	21.2	23.7	#25
2002	17	27.9	28.9	#4
1998	24	26.9	NA	NA

Table 7-1: Floristic Quality Inventory for Bangs Lake (LCHD 1998-2014, ILM 2023 June). The Lake County average FQI (natives) is 14.9 in 2021 (2021 Island Lake Summary Report -LCHD).

The aquatic plant species matters. Curly leaf pond weed (CLPW) and Eurasian Water Milfoil (EWM) are the most problematic species present within the lake as they are very prevalent and are non-native and aggressive. Areas which tend to see the least water movement have higher presence of

duckweed and wolffia. These species, while native, disrupt the fishery and aesthetics of the channels and recreation in some areas. Some undesirable species may also pose a hazard to swimmers.

Figure 7-1 identifies the aquatic plants found by the LCHD in 2012. The C value is the Conservation of Conservatism, which rates each species found from 0 – 10, with 0 as undesirable and 10 being rare. Note that most of the species found have a high C value, indicating that they are not commonly found. Figure 7-1 also includes the 2023 plant survey FQI conducted collaboratively by ILM Environments and LCHD.

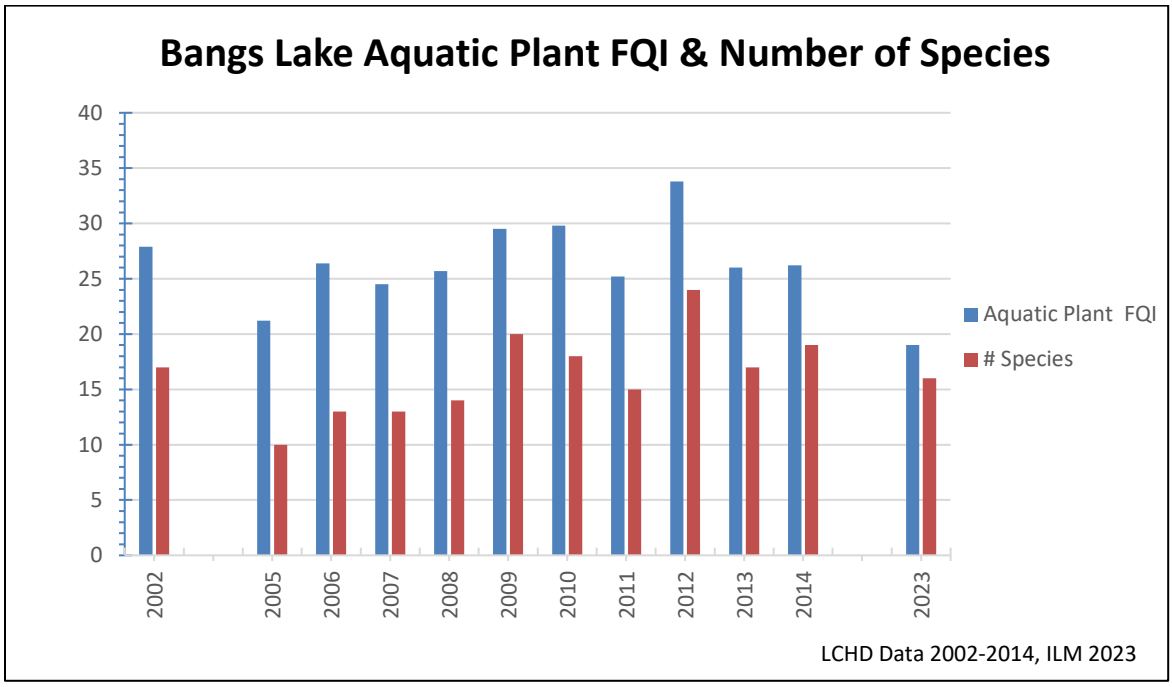


Figure 7-1: Floristic Quality Inventory for Bangs Lake and species total (LCHD 2002-2014, ILM 2023 June). Note the trending FQI is moving to a less diverse state, indicating the lake aquatic vegetation ecosystem is less healthy than it has been in the past.

Aquatic Plant Management

Since the 1980's, the Village of Wauconda has operated a plant harvester which clears the epilimnion (upper water layer) of aquatic vegetation for boat and recreational traffic. This is effective for these two goals. Unfortunately, EWM will spread through fragmentation, rendering mechanical control ecologically ineffective and likely detrimental to the lake ecosystem if all cut fragments are not collected. Control of CLPW is likely ecologically effective to a small degree; however, this species often has fully mature seeds by the time the harvester is utilized. Additionally, much of the plant remains intact below the surface, and continues to proliferate. It was noted in our visits this summer that shorelines, and entire sections of beachfront, contained remnants of plant material

which was cut but not effectively collected by the harvester. Lakefront stakeholders have been very vocal regarding the uncollected aquatic plants reaching shoreline as a result of harvesting efforts.

Harvesters are commonly utilized on lakes in Illinois, some with threatened & endangered (T&E) fish species as is the case with Bangs Lake. IDNR has required these other lake entities to develop a conservation plan to run the harvester, through an incidental take permit. This plan lays out how damage to T&E species will be minimized as a result of the harvesting process. Bangs Lake would need to develop such a plan and set aside finances for continuous monitoring, if operating the harvester is to be used as a lake management activity. A conservation plan was created for Bang's Lake in 2012, however the finances for requisite monitoring were not available. A permit for the current harvesting program was not issued.

Separately, individual landowners/entities perform targeted chemical treatments of invasive and nuisance aquatic species through a private contractor. As is evident in densities and composition, these treatments have reduced invasive/undesirable species near the shore and promoted conservative (high-quality) native growth. These native plants improve lake navigation, the fishery, and enhance water quality. Under current conditions, herbicide applications have been the most effective means in shifting the lake to a higher ecological state.

ILM performed a plant survey on June 5th – June 7th, 2023, sampling a total of 100 points. Aquatic herbicide management had not yet taken place for 2023. A minimum of two rake tosses were performed at each sampling location throughout the lake, until vegetation was no longer present. This vegetated zone was almost always relevant to water depth. As water depths reached 14 feet or greater, very limited aquatic plant growth was observed, although some CLPW was found at almost 20 feet. Bathymetric Data was gathered manually, through a depth finder, Biosonics visual software, and from public data. A Bathymetric Map can be viewed at the end of this Appendix. Data was also collected visually, as water clarity offered more insight at each location. Densities were assessed based upon plant density on the rake as it was retrieved, as well as visually (i.e. one toss starboard could be very dense, and the port side could be sparse). Toss locations, densities, and dominant species can be observed in Figures found at the end of this Appendix. A list of plants observed during this time is included in Table 7-2. Additional quantitative analysis can be observed in Table 7-3.

Species Name (NWPL/Mohlenbrock)	Species(Synonym)	Common Name
Ceratophyllum demersum	Ceratophyllum demersum	Coon's-Tail
Elodea canadensis	Elodea canadensis	Canadian Waterweed
Heteranthera dubia	Heteranthera dubia	Grass-Leaf Mud-Plantain
Lemna aequinoctialis	LEMNA AEQUINOCTIALIS	Lesser Duckweed
Myriophyllum spicatum	MYRIOPHYLLUM SPICATUM	Eurasian Water-Milfoil
Myriophyllum verticillatum	Myriophyllum verticillatum pectinatum	Whorled Water-Milfoil
Nymphaea odorata	Nymphaea tuberosa	American White Water-Lily
Potamogeton amplifolius	Potamogeton amplifolius	Large-Leaf Pondweed
Potamogeton crispus	POTAMOGETON CRISPUS	Curly Pondweed
Potamogeton foliosus	Potamogeton foliosus	Leafy Pondweed
Potamogeton gramineus	Potamogeton gramineus	Grassy Pondweed
Potamogeton pusillus	Potamogeton pusillus	Small Pondweed
Potamogeton zosteriformis	Potamogeton zosteriformis	Flat-Stem Pondweed
Stuckenia pectinata	Potamogeton pectinatus	Sago False Pondweed
Vallisneria americana	Vallisneria americana	American Eel-Grass
Wolffia borealis	Wolffia borealis	Northern Watermeal

Table 7-2: Species observed in early June.

*Highlighted text indicated nuisance or undesirable species.

MEAN C (NATIVE SPECIES)	5.85
MEAN C (ALL SPECIES)	4.75
MEAN C (NATIVE TREES)	n/a
MEAN C (NATIVE SHRUBS)	n/a
MEAN C (NATIVE HERBACEOUS)	5.85
FQAI (NATIVE SPECIES)	21.08
FQAI (ALL SPECIES)	19.00

Table 7-3: Quantitative results of aquatic vegetation in early June.

Qualitative Analysis of Aquatic Plant Communities

Bangs Lake has a diverse aquatic plant community. We observed a trend where shoreline property often exhibited limited growth of EWM and CLPW. Beyond these zones, many of which are frequently managed with aquatic herbicides, a dense mat of EWM and CLPW exists, creating multiple lake use issues. This is the zone where the harvester is most active. As depths increase, vegetative coverage is reduced significantly. More fish activity and vegetative diversity was observed outside of this dense zone of EWM and CLPW. One of the best ways to measure ecological enhancements is to assess coverage reductions of undesirable aquatic plants. Reductions in unwanted nuisance vegetation has not been achieved. See figure 7-2.

Bangs Lake was also surveyed for plants in the late summer of 2023 by LCHD. The timing of surveys by ILM Environments and LCHD were intentionally coordinated to gather as much comprehensive data as possible. Nitella, Illinois Pondweed, and Slender Naiad were observed by LCHD during their survey. These species were **NOT** observed by ILM during our survey. This was the expected result of seasonal surveys, with the goal of gathering a comprehensive data set. Early season species observed by ILM Environments and not by LCHD were provided to LCHD, along with additional plant data regarding densities and composition.

Early FQI results are indicative of a higher quality aquatic ecosystem. The overall quality of the Lake is determined by using a natural area index called the coefficient of conservatism (C-value) as described in Plants of the Chicago Region by Swink and Wilhelm (1994). Non-native species are not ranked. Low quality, “weedy” species are given a rank of 0 and species that only exist in intact native communities are ranked 10. An area of high natural quality would have a diverse population of plant species and the C value would average about 5. Bangs lake currently has a 5.85 mean C and would be considered a high-quality Lake in terms of aquatic vegetation. A mean C value of 3.5 or more is considered to have at least marginal natural area quality (Swink & Wilhelm, 1994). However, most areas in the Chicago area have been highly disturbed and the mean C value is usually around 2-3.

Dominance of a particular species is another way to determine the quality of an ecosystem. EWM was the most dominant species observed, with 40 instances where it was the dominant plant present. This was followed by Chara (*Chara vulgaris*). This species is not considered a nuisance and was dominant almost exclusively in shallow areas where other high quality aquatic species were also well distributed. Note that Chara is not listed on the aquatic plant list, as it is technically an algae, despite its vascular, plant-like structure. Chara is beneficial in most pond/lake systems and should only be controlled when it impacts recreation (very seldomly). CLPW was the third most dominant plant, with 29 instances of dominance. CLPW occupied the same general area (6-14 feet of depth) as the EWM, but more often was found in deeper waters. The turions (seeding structures) were fully mature during this visit. This is important to note, as control mechanisms should be in place before maturity is reached. Higher quality, desirable plants such as Eel Grass, Large Leaved Pondweed, and Variable Leaved Pondweed were all dominant (or co-dominant) in at least 2 locations. Water Star Grass and Small Pondweed were dominant in one sampling location.

Dominance of these species only occurred in areas where Chara coverage was lower, as their growth patterns are more sparse than Chara. ILM observed giant duckweed during a later visit for water quality. Comprehensive field data can be reviewed in Table 7-4.

Sample Point	Coverage	Dominant(s)	Plants Observed	Comments
1	Sparse	Eel Grass, EWM	Eel Grass, EWM, Algae, Chara, Curly Leaf, Coontail	
2	Very Dense	EWM	EWM, Eel Grass, Native Milfoil, Small Pondweed	
3	Dense	EWM, Chara	EWM, Chara, Curly Leaf, Water Star Grass	
4	Medium	EWM	EWM, Small Pondweed, Water Star Grass, Curly Leaf, Flatstem pondweed	
5	Medium	EWM	EWM, Curly Leaf	
6	Sparse	Curly Leaf	Curly Leaf, EWM	
7	Sparse	Curly Leaf	Curly Leaf	
8	Very Sparse	Curly Leaf	Curly Leaf	
9	Sparse	Curly Leaf	Curly Leaf, EWM	
10	Dense	EWM	EWM, Curly Leaf, Flat Stem Pondweed, Small Pondweed, Large Leaf Pondweed, Chara	
11	Very Sparse	Chara, Curly Leaf, EWM	Chara, Curly Leaf, EWM, Small pondweed, Large Leaf Pondweed	
12	Dense	EWM	EWM, Curly Leaf, Chara, Eel Grass, Small Pondweed	
13	Dense	Chara	Chara, EWM, Curly Leaf, Variable Leaf Pondweed, Eel Grass	
14	Medium	Eel Grass, Variable Leaf Pondweed	Eel Grass, Variable Leaf Pondweed, Large Leaf Pondweed, Chara, Curly Leaf, Flat Stem Pondweed	
15	Dense	Chara	Chara, EWM, Curly Leaf, Small Pondweed, Large Leaf Pondweed, Eel Grass, Flat Stem Pondweed	
16	Sparse	Chara	Chara, Algae, EWM, Curly Leaf, Eel Grass, Variable Leaf Pondweed	
17	Sparse	Chara	Chara, Eel Grass, Flat Stem Pondweed, Curly Leaf	
18	Medium	Chara	Chara, Curly Leaf, EWM, Eel Grass, Flat Stem Pondweed	
19	Sparse	Chara	Chara, Variable Leaf Pondweed	
21	Medium	EWM	EWM, Curly Leaf, Eel Grass	
22	Medium	Chara	Chara, Curly Leaf, Eel Grass, American Elodea	American Elodea was found floating, not rooted
23	Medium	Curly Leaf	Curly Leaf, EWM	
24	Dense	Curly Leaf	Curly Leaf, EWM, Small Pondweed, Eel Grass	
25	Very Dense	EWM	EWM, Flat Stem Pondweed, Curly Leaf	
26	Very Dense	EWM	EWM, Large Leaf Pondweed, Curly Leaf, Eel Grass, Flat Stem Pondweed, Chara	
27	Very Dense	Chara	Chara, EWM, Curly Leaf, Small Pondweed	
28	Very Sparse	Curly Leaf	Curly Leaf, EWM	

29	Dense	EWM	EWM, Curly Leaf, Chara, Flat Stem Pondweed, Eel Grass, Sago	
30	Sparse	Curly Leaf	Curly Leaf, Coontail, Chara	
31	Very Dense	EWM	EWM, Coontail	
32	Medium	Chara, EWM	Chara, EWM, Eel Grass, Variable Leaf Pondweed	
33	Sparse	Chara	Chara, EWM, Eel Grass, Variable Leaf Pondweed	
34	Dense	Chara	Chara, Eel Grass, Curly Leaf, EWM, Variable Leaf Pondweed, Leafy Pondweed	
35	Medium	EWM	EWM, Curly Leaf, Eel Grass, Large Leaf Pondweed, Chara, Variable Leaf Pondweed, Small Pondweed	
36	Very Sparse	Curly Leaf	Curly Leaf, EWM	
37	Very Dense	EWM	EWM, Curly Leaf	
38	Very Sparse	Curly Leaf	Curly Leaf, Spirogyra, Native Milfoil, EWM	
39	Sparse	Filamentous Algae, Eel Grass	Filamentous Algae, Eel Grass, Curly Leaf, Variable Leaf Pondweed, EWM	
40	Medium	Curly Leaf	Curly Leaf, Small Pondweed, EWM	
41	Medium	Curly Leaf	Curly Leaf, EWM, Chara	
42	Sparse	Chara	Chara, Variabe Leaf Pondweed, Eel Grass, EWM, Large Leaf Pondweed	
43	Medium	Curly Leaf	Curly Leaf, EWM	
44	Medium	Chara	Chara, Eel Grass, Variable Leaf Pondweed, Curly Leaf, EWM, Flat Stem Pondweed	
45	Sparse	Curly Leaf	Curly Leaf, EWM, Eel Grass	
46	Medium	Chara	Chara, Variable Leaf Pondweed	
47	Medium	Curly Leaf	Curly Leaf, Flat Stem Pondweed, Small Pondweed, Eel Grass	
48	Sparse	Chara	Chara, EWM, Curly Leaf, Variable Leaf Pondweed, Eel Grass, Large Leaf Pondweed	
49	Medium	Chara	Chara, Curly Leaf, Eel Grass, Variable Leaf Pondweed, Algae	
50	Dense	EWM	EWM, Chara, Eel Grass, Curly Leaf	
51	Very Sparse	Curly Leaf	Curly Leaf, EWM	
52	Medium	EWM	EWM, Curly Leaf	
53	Medium	Chara	Chara, EWM, Curly Leaf, Eel Grass, White Water Lily, Variable Leaf Pondweed	
54	Very Dense	EWM	EWM, Curly Leaf	Cut EWM has blown to shore and dominates the entire shoreline
55	Very Dense	Curly Leaf	Curly Leaf, EWM, Small Pondweed	
56	Medium	Curly Leaf	Curly Leaf, Chara, EWM	
57	Very Sparse	Chara	Chara, Variable Leaf Pondweed, Eel Grass	
58	Sparse	Chara	Chara, Large Leaf Pondweed, Variable Leaf Pondweed, EWM, Eel Grass, Curly Leaf, White Water Lily	
59	Sparse	Curly Leaf, Small Pondweed	Curly Leaf, Small Pondweed, EWM, Wolffia, Duckweed, Flat Stem Pondweed	

60	Dense	EWM	EWM, Wolffia, Flat Stem Pondweed, White Water Lily, Curly Leaf, Large Leaf Pondweed, Eel Grass, Small Pondweed, American Elodea	
61	Medium	Curly Leaf	Curly Leaf, EWM	
62	Sparse	Chara	Chara, Curly Leaf, EWM	
63	Medium	Chara	Chara, EWM, Curly Leaf, Variable Leaf Pondweed	
64	Medium	Curly Leaf	Curly Leaf, Chara, EWM	
65	Dense	EWM	EWM, Coontail, Curly Leaf	
66	Medium	Chara	Chara, EWM, Eel Grass, Variable Leaf Pondweed, Large Leaf Pondweed,	
67	Medium	EWM	EWM, Coontail, Curly Leaf, American Elodea, Duckweed, Wolffia, Small Pondweed	
68	Medium	EWM	EWM, Flat Stem Pondweed, Curly Leaf, Large Leaf Pondweed, Wolffia, American Elodea, Water Star Grass	
69	Dense	Chara	Chara, Water Star Grass, Curly Leaf, EWM, Coontail	
70	Dense	EWM	EWM, Curly Leaf. Large Leaf Pondweed, Chara, Water Star Grass	
71	Very Sparse	EWM	EWM, Curly Leaf, Large Leaf Pondweed	
72	Very Sparse	Curly Leaf	Curly Leaf, EWM	
73	Dense	EWM	EWM, Curly Leaf	
74	Sparse	Chara	Chara, Eel Grass, Curly Leaf, Water Star Grass, American Elodea	
75	Medium	Chara	Chara, Eel Grass, Variable Leaf Pondweed	
76	Dense	EWM	EWM, Curly Leaf, Chara	
77	Very Sparse	Curly Leaf	Curly Leaf, EWM	
78	Medium	Chara	Chara, Eel Grass, Variable Leaf Pondweed	
79	Dense	EWM	EWM, Curly Leaf, Water Star Grass	
80	Medium	Chara, Water Star Grass	Chara, Water Star Grass, Small Pondweed, Curly Leaf, EWM, Flat Stem Pondweed, Large Leaf Pondweed, Variable Leaf Pondweed	
81	Very Sparse	Chara	Chara, Variable Leaf Pondweed, Curly Leaf	
82	Sparse	Chara	Chara, Variable Leaf Pondweed	
83	Sparse	Curly Leaf	Curly Leaf, EWM	
84	Sparse	Chara	Chara, Eel Grass, Variable Leaf Pondweed, EWM, Curly Leaf, Small Pondweed	
85	Very Dense	EWM	EWM, Curly Leaf, Variable Leaf Pondweed, Small Pondweed	
86	Sparse	Curly Leaf	Curly Leaf, EWM, Eel Grass, Small Pondweed	
87	Very Sparse	EWM	EWM, Curly Leaf	
88	Medium	Curly Leaf	Curly Leaf, EWM, Large Leaf Pondweed, Variable Leaf Pondweed, Flat Stem Pondweed, Eel Grass, Water Star Grass	
89	Very Dense	EWM	EWM	Cut Milfoil along entire shoreline, non-navigable in this area
90	Very Dense	EWM	EWM, Curly Leaf	
91	Very Dense	EWM	EWM, Curly Leaf, Large Leaf Pondweed	

92	Dense	EWM, Large Leaf Pondweed	EWM, Large Leaf Pondweed, Water Star Grass, American Elodea	
93	Medium	EWM	EWM, Curly Leaf, Water Star Grass	
94	Sparse	Curly Leaf	Curly Leaf, EWM	
95	Very Sparse	EWM	EWM, American Elodea	
96	Medium	Large Leaf Pondweed	Large Leaf Pondweed, EWM, Eel Grass, Curly Leaf	
97	Dense	EWM	EWM, Water Star Grass, Curly Leaf, Eel Grass, Large Leaf Pondweed, Chara	
98	Very Sparse	Curly Leaf	Curly Leaf, EWM	
99	Very Sparse	Curly Leaf	Curly Leaf, Eel Grass, EWM, Water Star Grass, Chara, Variable Leaf Pondweed	
100	Medium	Chara	Chara, Eel Grass, EWM, Variable Leaf Pondweed	

Table 7-4: Comprehensive field data at each point.

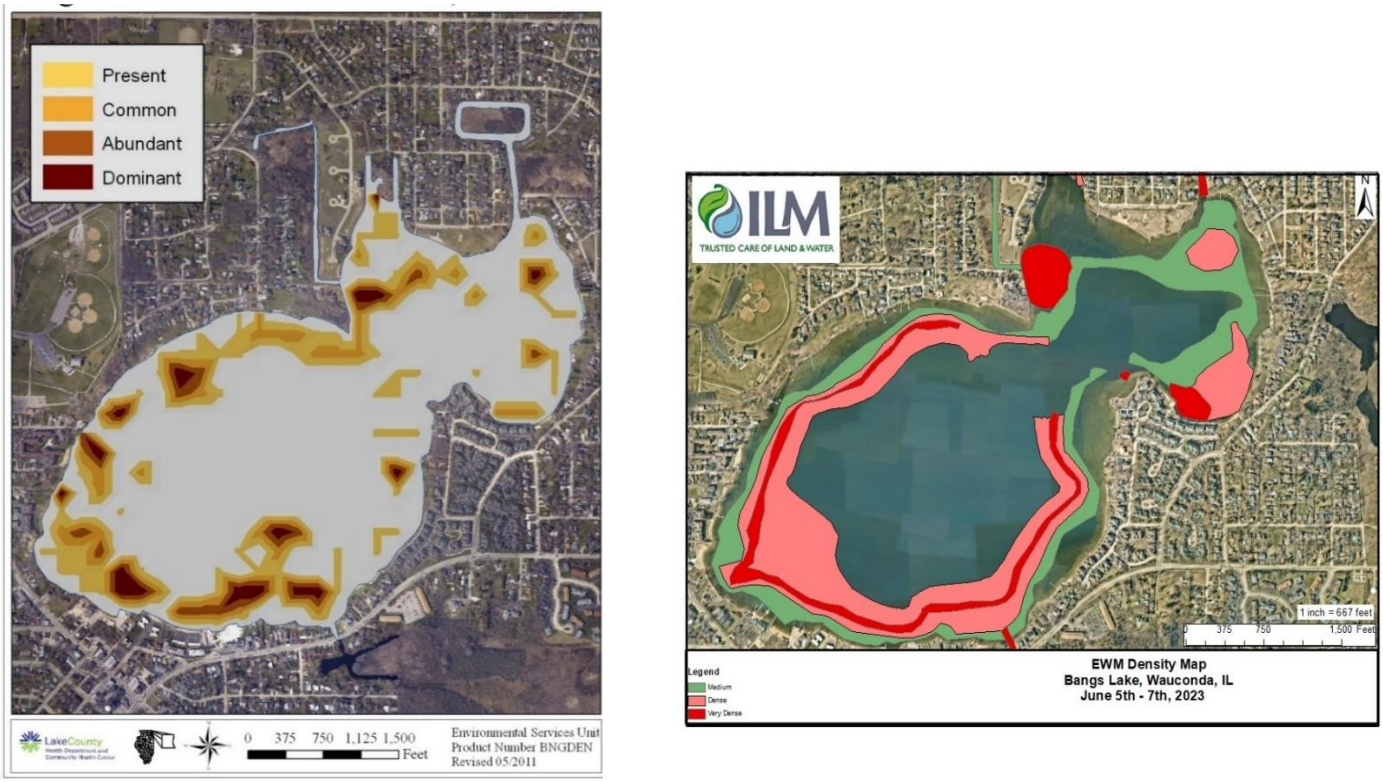


Figure 7-2: 2010 and 2023 EWM density maps. Compared to the 2023 map, it is obvious EWM has continued to proliferate despite management techniques. Spotty EWM populations in 2010 have become contiguous at certain depths in 2023.

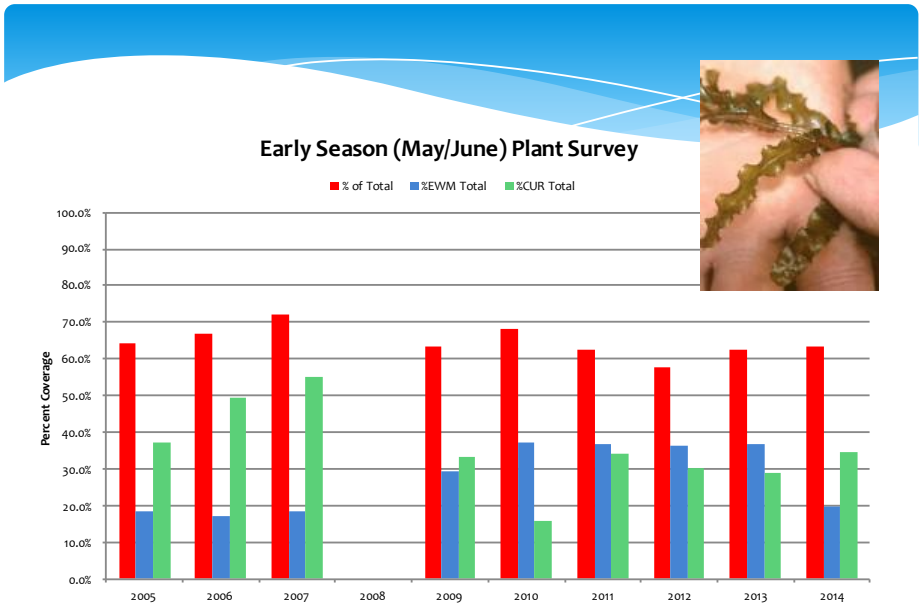


Image 7-1: Early season Milfoil and Curly leaf dominance on Bangs Lake 2005-2014.

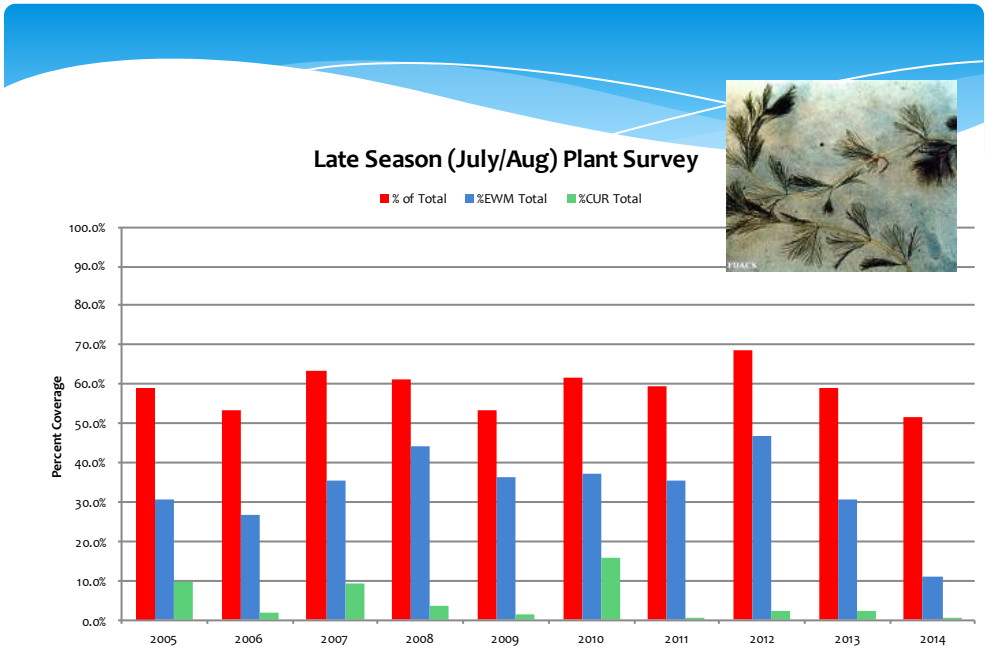


Image 7-2: Late season Milfoil and Curly leaf dominance on Bangs Lake 2005-2014.

This season's lake treatments occurred in June, later in the season than they should be performed. Regulatory requirements pertaining to threatened and endangered fish species require herbicide blackout dates. Applications took place during these blackout dates this year. The impacts to aquatic

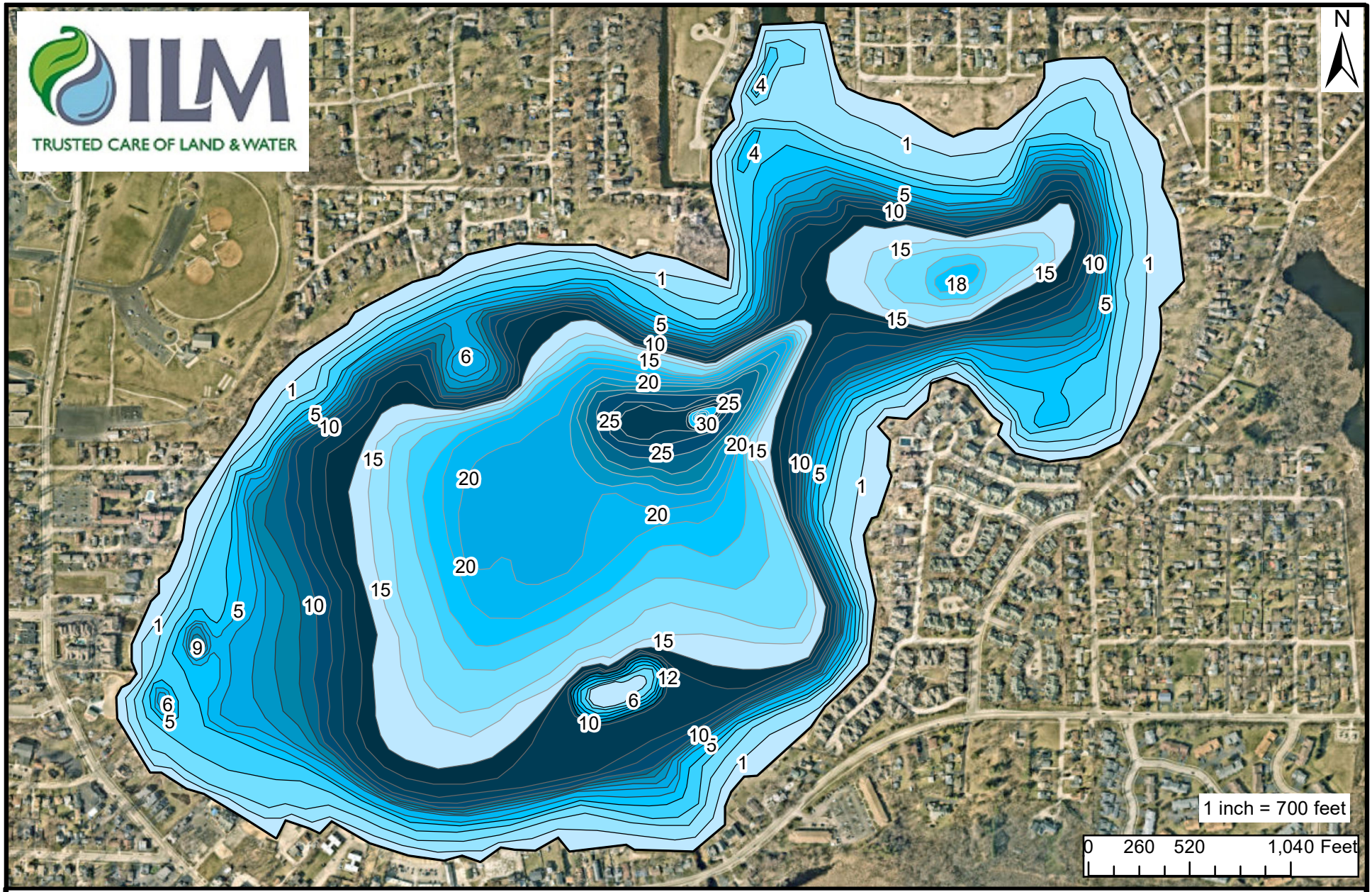
vegetation were notable in July, with significant die off of CLPW and EWM, as well as native species which are usually not present during early season applications. While reducing invasive coverage is encouraged, it is a process requiring caution to ensure the lake remains ecologically balanced. With the mass die off of aquatic vegetation, phosphorous loads in the water column increase. Dissolved oxygen levels are altered reducing success rates of fish eggs, and a large swath of fish habitat is removed, reducing the likelihood young fish reach reproductive maturity. During the final water quality visit of the year, a notable layer of blue-green algae was evident throughout the epilimnion. This is important for a few reasons:

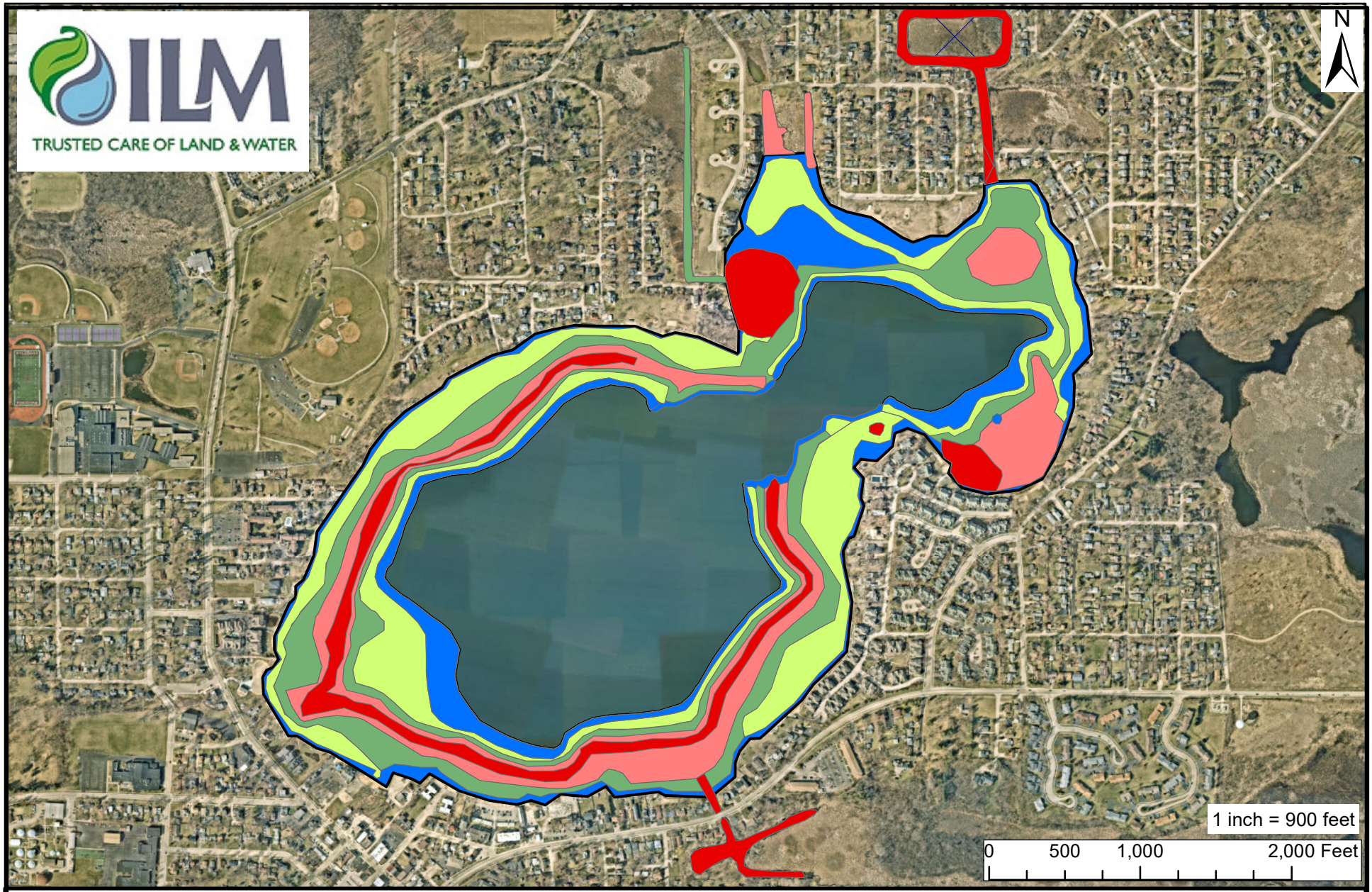
1.) This blue-green algae can produce a toxin which can impact humans and animals, especially in such concentrated numbers.

2.) When a lake transitions from a plant dominated lake, to algae dominated, it may not revert back to a plant dominated lake. This is unlikely because contact herbicides, not systemic, were applied this season.

Observations during the 2024 season will be essential when determining how the health of the lake is impacted by this season's herbicide applications, and the proper method to proceed.

Fauna (excluding fish) which were observed during vegetation survey visits included: Dragonflies, Scuds, Muskrats, Zebra mussels, Beaver, Great Blue Heron, Buffleheads, American Coots, Sandhill Cranes, Redheads, Eastern Kingfisher, Red Eared Sliders, Softshell Turtles.

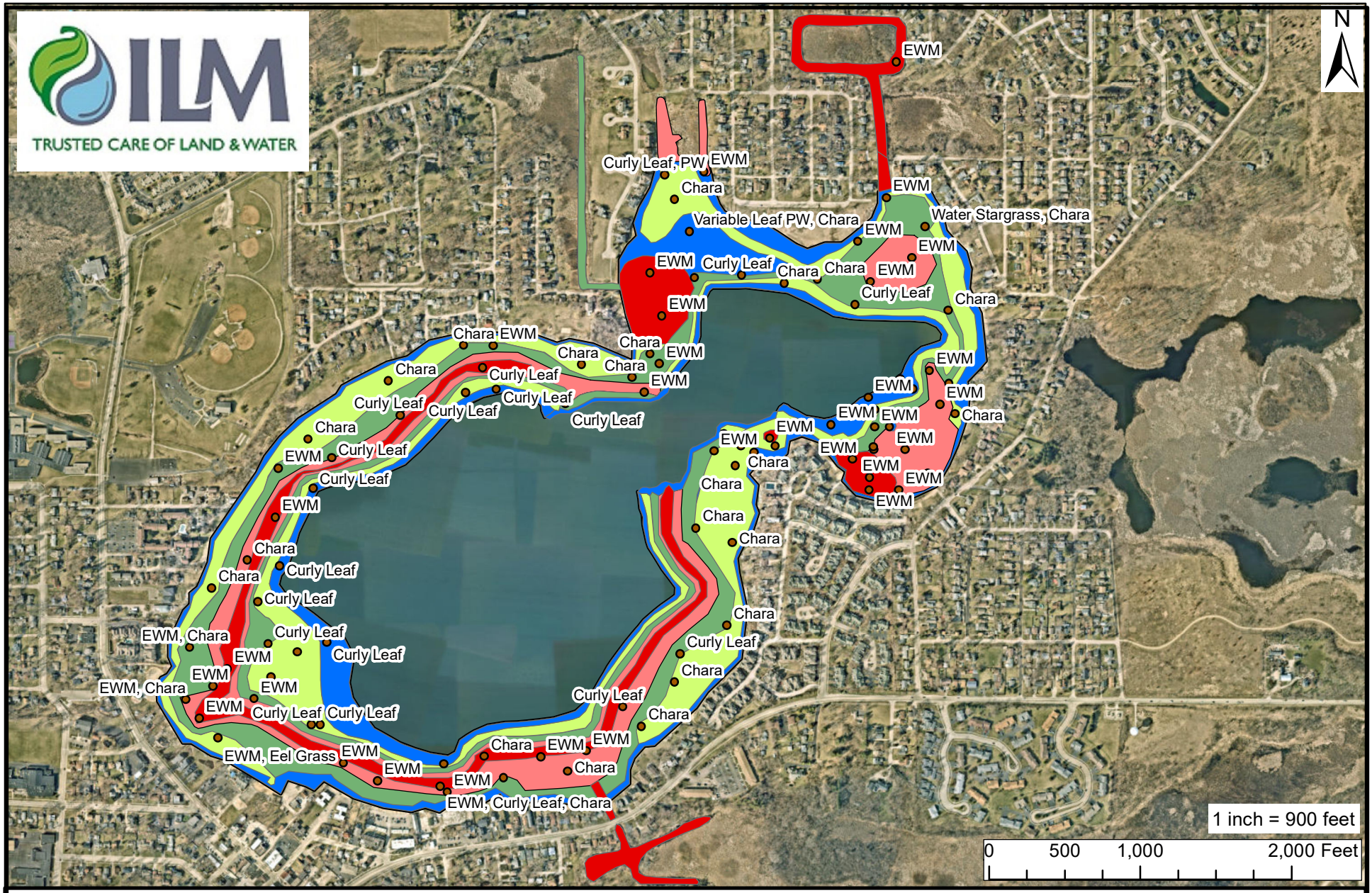

ILM
TRUSTED CARE OF LAND & WATER
N
1 inch = 700 feet
0 260 520 1,040 Feet
Legend
Bangs Lake Shoreline
0 - 1 Foot
1 - 2 Foot
2 - 3 Foot
3 - 4 Foot
4 - 5 Foot
5 - 6 Foot
6 - 7 Foot
7 - 8 Foot
8 - 9 Foot
9 - 10 Foot
10 - 11 Foot
11 - 12 Foot
12 - 13 Foot
13 - 14 Foot
14 - 15 Foot
15 - 16 Foot
16 - 17 Foot
17 - 18 Foot
18 - 19 Foot
19 - 20 Foot
20 - 21 Foot
21 - 22 Foot
22 - 23 Foot
23 - 24 Foot
24 - 25 Foot
25 - 26 Foot
26 - 27 Foot
27 - 28 Foot
28 - 29 Foot
29 - 30 Foot
30 - 31 Foot
31 - 32 Foot
Bathymetric Map
Bangs Lake, Wauconda, IL
June 2023



Legend

- Bangs Lake Shoreline
- Very Sparse
- Sparse
- Medium
- Dense
- Very Dense

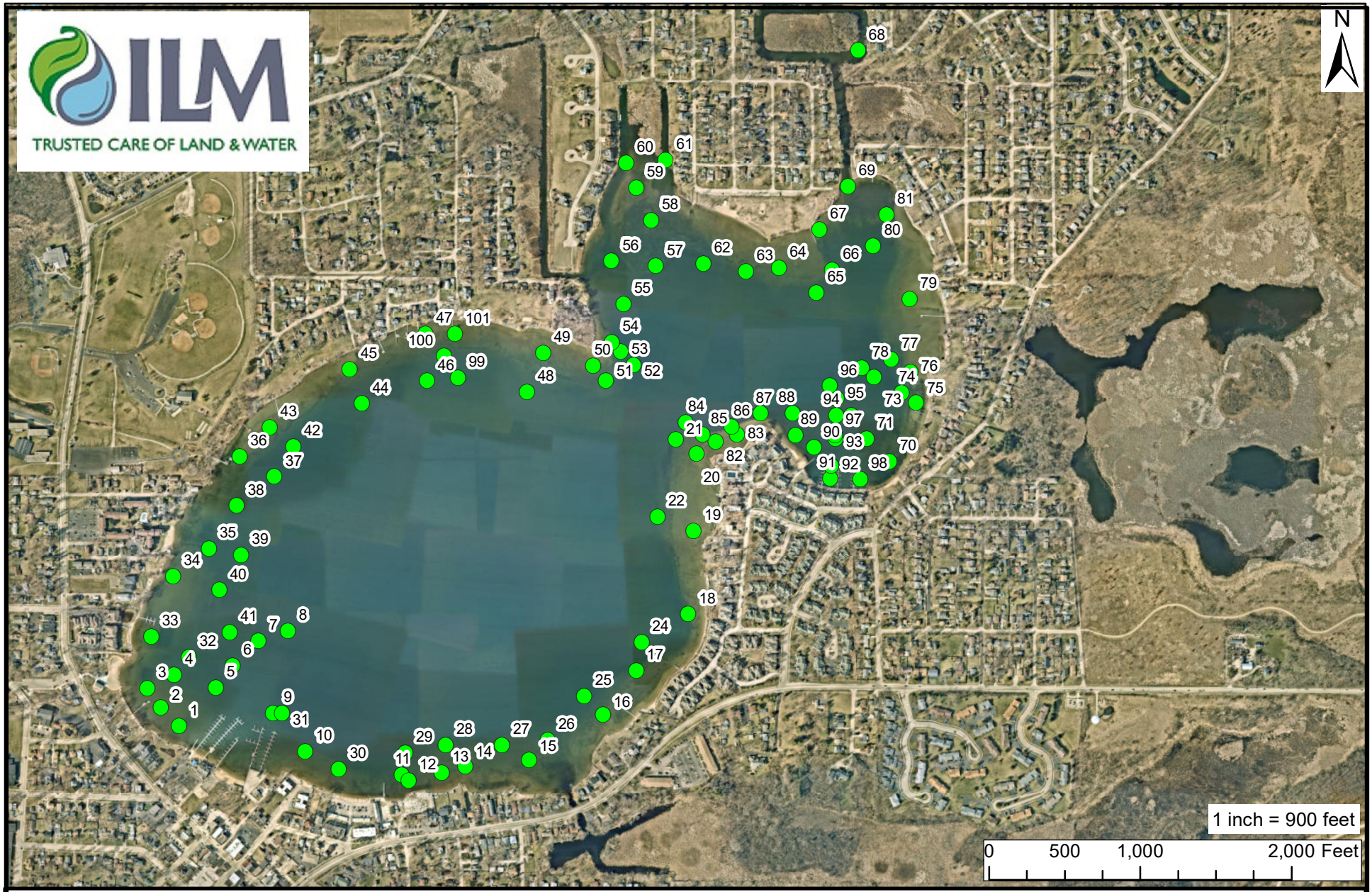
Plant Density Map
Bangs Lake, Wauconda, IL
June 5th - 7th, 2023



Legend

- Bangs Lake Shoreline
- Densities
- Very Sparse
- Sparse
- Medium
- Dense
- Very Dense

Plant Dominance Map
Bangs Lake, Wauconda, IL
June 5th - 7th, 2023



Plant Density Map
Bangs Lake, Wauconda, IL
June 5th - 7th, 2023

Aquatic Vegetation Photo Log

Photo #1: Cut Milfoil has accumulated along the Southeastern portion of the Northeast lobe.

Photo #2: Example of EWM and Curly leaf density.

Photo #3: Mature turions during the early June visit.

Photo #4: Dense Chara, with some high quality natives along the shoreline. These do not impact navigability while providing ecological value (fish habitat and water quality enhancements.

Aquatic Vegetation Photo Log

Photo #5: One of many examples of propellers densely covered in EWM and Curly leaf. This is during the harvesting season.

Photo #6: Wolffia and duckweed are around 100% coverage in circle channel.

Photo #7: Native aquatic vegetation along the shorelines.

Photo #8: Example of rake density. Throw was performed in deeper areas, dominated by Curly leaf.

Aquatic Vegetation Photo Log

Photo #9: Collection and analysis of plant data.

Photo #10: Collection and analysis of plant data.

Photo #11: Collection and analysis of plant data.

Photo #12: Collection and analysis of plant data.

Aquatic Vegetation Photo Log

Photo #13: Collection and analysis of plant data. Dense clusters of zebra mussels were observed clinging on to almost all plant life.

Photo #14: Collection and analysis of plant data.

Photo #15: Scuds, dragonflies, and other aquatic invertebrates were observed during the data collection.

Photo #16: Collection and analysis of plant data.

APPENDIX 8. Fisheries

Appendix 8- Fisheries

Fishing is one of the most popular recreational activities on Bangs Lake as reflected in the community survey.

The most recent fisheries survey was performed by Deuchler Environmental, Inc. in 2018 (Figure 8-1) and before that in 2015. Both studies used electrofishing and seining of selected shoreline areas. Some of the earlier studies did not utilize both methods depending on the purpose of the survey (game fish vs. threatened and endangered species). Considering the variability in data as a function of the different techniques coupled with the influence of stocking, establishing a trend in lake fishery health is not possible. To better determine fishery health moving forward, uniformity and standardization of surveying practices is essential.

The dominant fish species present in 2018 was bluegill at 16.4% and largemouth bass at 12.5% of the sample (includes seining). See Table 8-1 for more details on other fish species observed.

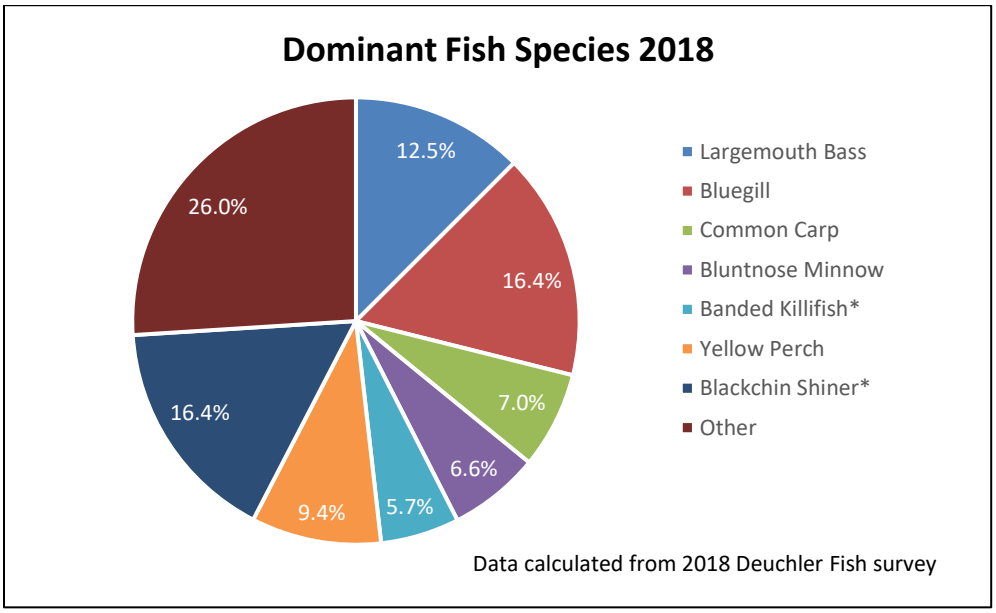


Figure 8-1: Data calculated from the 2018 Deuchler Environmental fish survey. Data summarizes all fish collected from both electrofishing and seining.

Bangs Lake Fisheries Survey Summary						
Common Name	Jul-18	Jun-15	Jul-09	May-07	Jul-02	**Scientific Name**
	Deuchler Env.	Deuchler Env.	E. A. Tech.	IDNR	SIU & Max McGraw	
	% of Total	% of Total	A/C/P & %**	% of Total	% of Total	
Bass, Largemouth	12.5%	28.2%	A	34.0%	1.3%	*Micropterus salmoides*
Bluegill	16.4%	22.1%	A	22.1%	11.2%	*Lepomis macrochirus*
Bowfin	1.1%	0.3%				*Amia calva*
Bullhead, Brown	2.3%	1.7%				*Ameiurus nebulosus*
Bullhead, Yellow	1.0%	1.7%	P	0.3%	0.2%	*Ameiurus natalis*
Carp, Common	7.0%	1.7%		1.9%		*Cyprinus carpio*
Chubsucker, Lake	4.1%	7.4%	P	1.9%		*Erimyzon sucetta*
Crappie, Black	3.6%	1.7%		1.3%		*Pomoxis nigromaculatus*
Darter, Iowa*	0.3%	1.3%	P		0.1%	*Etheostoma exile*
Darter, Johnny			P		0.1%	*Etheostoma nigrum*
Darter, Least			P			*Etheostoma microperca*
Gar, Longnose	0.2%			1.6%		*Lepisosteus osseus*
Grass Pickeral	0.2%	1.3%	p	0.8%	0.1%	*Esox americanus vermiculatus*
Killifish, Banded*	5.7%	0.7%	P	0.3%	3.4%	*Fundulus diaphanus*
Minnow, Bluntnose	6.6%	0.7%	C	5.4%	70.8%	*Pimephales notatus*
Northern Pike	0.2%	0.3%		1.3%		*Esox lucius*
Pearch, Yellow	9.4%	7.0%	C	6.2%		*Perca flavescens*
Shiner, Blackchin*	16.4%	3.0%	A	2.7%	0.6%	*Notropis heterodon*
Shiner, Blacknose*	2.1%	3.0%	C	0.3%	1.7%	*Notropis heterolepsis*
Shinner, Golden	0.3%	0.3%	C			*Notemigonus crysoleucas*
Shinner, Mimic					4.7%	*Notropus volucellus*
Shinner, Spotfin	3.6%	0.3%	C		5.6%	*Cyprinella spiloptera*
Silverside, Brook					0.1%	*Labidesthes sicculus*
Sunfish, Green	0.2%					*Lepomis cyanellus*
Sunfish, Pumpkinseed	3.4%	12.8%	C	15.4%		*Lepomis gibbosus*
Sunfish, Redear	0.3%				0.2%	*Lepomis microlophus*
Walleye				1.1%		*Stizostedion vitreum*
Warmouth	3.4%	4.4%		3.5%	0.2%	*Lepomis gulosus*
Number of species	23	20	16	17	15	
* Threatened and Endangered species						
**2009 P = present, C = Common, A = Abundant						

Table 8-1: Fish surveys at Bangs Lake.

Although the trend appears to show more diversity of fish in recent years, these surveys had different goals and the shoreline was not consistently seined for threatened and endangered species.

The 2018 Fish survey report stated that Bangs Lake has a diverse fish population with a good mix of both forage and predator species. The report noted that the Largemouth Bass population consisted of smaller mature fish compared to the 2015 data, but they felt that the size distribution and numbers represented a healthy population.

Recommendations included in the 2018 fish survey included:

- Continue the fish stocking program:
    - Do not stock Largemouth Bass – population was healthy in 2018.
    - Stock Walleye, Smallmouth Bass, Northern Pike, and Channel Catfish since these are desired fish for anglers. These species will not likely be self-sustaining because

reproductive habitat needs are not met by the existing ecosystem and will need to be frequently stocked.
    - Perform supplemental stocking of Yellow Perch, Black Crappie, and Redear Sunfish.
    - Recommendations regarding the number of fish to stock for each species are in the 2018 fish report.
- Adjust the fish creel limits, such as reducing the Bluegill limit from 25/day. This has been enacted and reduced to 10/day. Size limitations for Yellow Perch should be set to 8 inches with a daily limit of 10 to increase the number of mature fish.
- Maintain good aquatic plant diversity and control the non-native Eurasian Watermilfoil and Curly leaf Pondweed.
- Reduce runoff of nutrients entering the lake by creating buffer strips, limiting lawn fertilizer containing phosphorus, and use chloride alternatives for winter de-icing. Also, prevent soil runoff into the lake.
- Manage the Common Carp population. All carp that are caught should be removed. Signs should be posted.
- Perform a fish survey every three to five years to evaluate the fish stocking program.
- Provide additional fish habitat structures such as brush bundles, Christmas trees, and fish cribs to be applied in deeper water (up to 15 feet deep) so as not to create a navigational hazard.

Fish Stocking

Game fish stocking typically occurs annually at Bangs Lake (Table 8-2). The 2018 fish survey report stated specific species, amounts, and size ranges to install within a year or so after the report.

Fish Stocking History at Bangs Lake				from 2018 Deuchler Fish Survey Report				
	Walleye	Largemouth Bass	Smallmouth Bass	Northern Pike	Black Crappie	Channel Catfish	Redear Sunfish	Yellow Pearch
2022	3,000	0	0	0	0	0	0	0
2021	2,000	0	0	0	0	0	0	0
2020	No records found							
2019	No fish were stocked							
2018	No records found							
2017	0	2	0	200	750	200	300	200
2016	No fish were stocked							
2015	400	0	0	0	250	25	0	600
2014	0	0	500	0	0	0	0	0
2013	100	0	350	0	325	0	0	0
2012	680	100	200	205	700	0	0	0
2011	180	0	0	75	200	0	150	0
2010								
2009	0	0	0	0	0	1,300	0	0
2008	2,500	4	0	0	0	0	0	0
2007	No fish were stocked							
2006	No records found							
2005	No records found							
2004	1,760	300	0	0	0	0	0	0
2003	0	0	0	491	0	5,833	0	0
2002	4,555	0	0	0	0	0	0	0
2001	0	0	0	800	0	0	0	0
2000	3,447	740	0	0	0	1,250	0	0

Table 8-2: History of fish stocking at Bangs Lake.

Fishing Regulations

The goal of fishing regulations is to ensure Bangs Lake remains a sustainable fishery. Current fishing regulations (Table 8-3) for Bangs Lake can be found in detail on the Village of Wauconda website under the Police Department/Marine Patrol Unit in the Welcome to Bangs Lake in Wauconda (https://files4.1.revize.com/wauconda/Document_Center/Services/Department/Police/MarineUnitBrochure2021.pdf).

The fishing regulations were also found on a second link on the Marine Patrol website under the Recreation Regulations-Fishing and Fishing Shelters (https://files4.1.revize.com/wauconda/Document_Center/Services/Department/Police/Recreation%20Regulations%20Fishing-Shelters.pdf). These current regulations are challenging to find, as searching the Police Department is not the obvious choice for most anglers. Limitations such as these are often posted at all public boat launches and docks, emphasizing the need for adherence to these regulations in efforts to support a sustainable fishery.

Species	Size limit	Daily limit
Northern Pike	Minimum of 36 inches	1
Muskellunge & Tiger Muskies	Minimum of 36 inches	1
Bass (Large & Smallmouth)	none	Catch & release
Walleye	2	Between 14” to 16”
Bluegill, Sunfish, Pumpkinseed, and Perch	Minimum 6 inches	10
Black Crappie	Minimum of 10 inches	8

Table 8-3: Current fishing regulations for Bangs Lake as stated in the Village of Wauconda Recreation Regulations Fishing and Fishing Shelters.

Fisheries Concerns

There are several concerns regarding fish populations in Bangs Lake, which are described below.

Aquatic plants/herbicide usage

A healthy lake should have 20 – 40% of the lake bottom covered with native or beneficial aquatic plants to provide good habitat for the food chain which ultimately supports a healthy fishery. Aquatic plants clarify the water and provide dissolved oxygen needed for fish to survive and provide cover for young fish to reach breeding age.

- During ILM’s early June plant survey, approximately 60% of the lake contained aquatic plants and water clarity was at 9.3 ft. with little algae present. Dense mats of cut aquatic plants from the harvester operation occurred along portions of the shoreline.
- During the June 27th visit, many of the aquatic plants had died due to herbicide applications conducted a few weeks earlier. Water clarity was still at 9.3 feet, but some an undesirable species of blue-green algae (*Gloeotricia* sp. a cyanobacteria) colonies were observed suspended in the water.
- The July 25th visit noted limited areas of aquatic plant growth and a bloom of blue-green algae at the surface of the lake. Water clarity had decreased to 6.5 feet.

Bangs Lake, absent of herbicide treatments, has an overabundance of aquatic plants to support the diversity of current lake uses. However, herbicide treatments over large acreage when the plants are fully grown, can cause a significant drop of the dissolved oxygen and potentially cause a fish kill. Aggressive late chemical treatment causes a sudden loss of fish habitat.

- Lakes that are not dominated by aquatic plants, become dominated by algae, which was what was observed on July 25th. Although fish can survive in algae dominated lakes, the diversity decreases, and species shifts may occur to fewer sight-feeding fish.
- The 2018 fisheries survey mentions that controlling Eurasian watermilfoil and Curly leaf pondweed would help increase coverage by native plants and provide a better ecosystem for the fish. The good, diverse fishery at Bangs Lake is due to the good water clarity, which is due to the aquatic plant and Chara growth.

Threatened and Endangered Fish Species

Three threatened and endangered fish species occur in Bangs Lake (Table 8-4). These are the Blacknose Shiner, Blackchin Shiner, and Banded Kilifish (Images 8-1, 8-2, and 8-3), all which live in primarily shallow areas where aquatic vegetation thrives. These species require clear water and thick aquatic vegetation with good water quality. All threatened and endangered species have been routinely found during the surveys on Bangs Lake. It should be noted that the Iowa Darter was removed from the IDNR Threatened and Endangered Species List in November 2019

Herbicide applications should occur outside of protected fish spawning periods as required by the IDNR Division of Natural Heritage. Both the Blackchin Shiner and the Blacknose Shiner have similar spawning periods from June through August, while the Banded Killifish spawns from late spring to early summer. This would indicate that early spring (April) herbicide treatments would comply with these restrictions. The herbicide application in Bangs Lake in 2023 occurred in June.

Early season herbicide treatments would kill EWM and CLPW, both of which are present during this period. Native species start growing later in the spring/summer and are not likely to be affected by an early spring treatment. Also, colder water in the spring has a higher dissolved oxygen level, making the application least likely to cause a fish kill. The following Threatened and Endangered species play an important role in the fishery, as they are often a primary food source for larger predator fish popular with anglers.

		Species	Common name	Last documented in Illinois*	Status	Documented at Bangs Lake
1	Fish	Banded Killifish	*Fundulus diaphanus*	9/25/19	Threatened	2018
2	Fish	Blackchin Shiner	*Notropis heterodon*	5/12/21	Threatened	2018
3	Fish	Blacknose Shiner	*Notropis heterolepis*	5/12/21	Endangered	2018
4	Fish*	Iowa Darter	*Etheostoma exile*	NA	No longer listed	2018
5	Aquatic plant	Grass-leaved Pondweed/Variable-leaf Pondweed	*Potamogeton gramineus*	2013	Threatened	2023
6	Aquatic plant	White-stemmed Pondweed	*Potamogeton praelongus*	8/2012	Endangered	2012

Table 8-4: Threatened and Endangered species in Bangs Lake. From the Illinois Natural History Database, last updated May 2023

Of the threatened and endangered fish species occurring within Bangs Lake, the largest percentage was by the Blackchin Shiner from the 2018 fish survey (Figure 8-2).

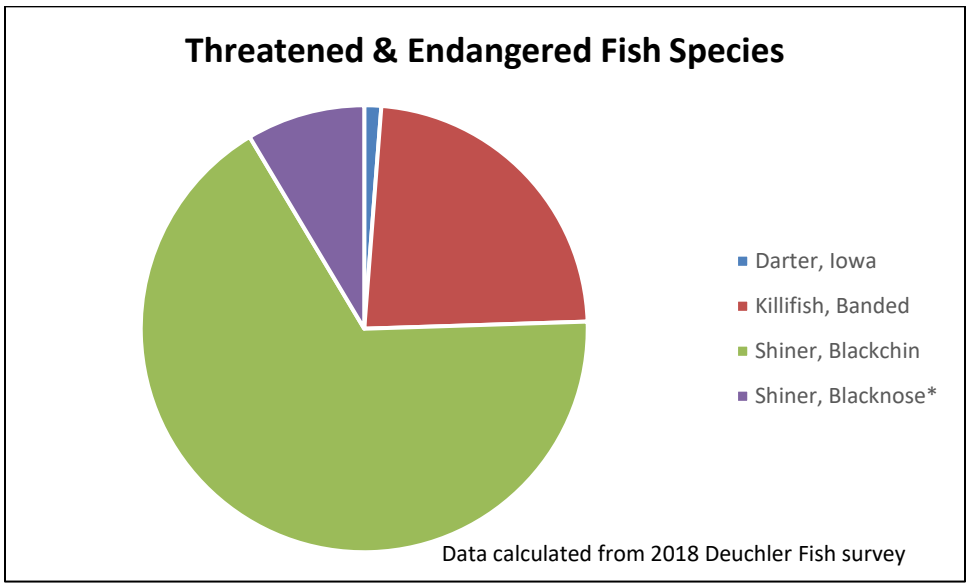


Figure 8-2: Threatened and endangered fish species dominance during 2018 fish survey by Deuchler Environmental.

Image 8-1: Blackchin Shiner. Approximately 2-3 inches in length. (Photo credit: Illinois Department of Natural Resources)

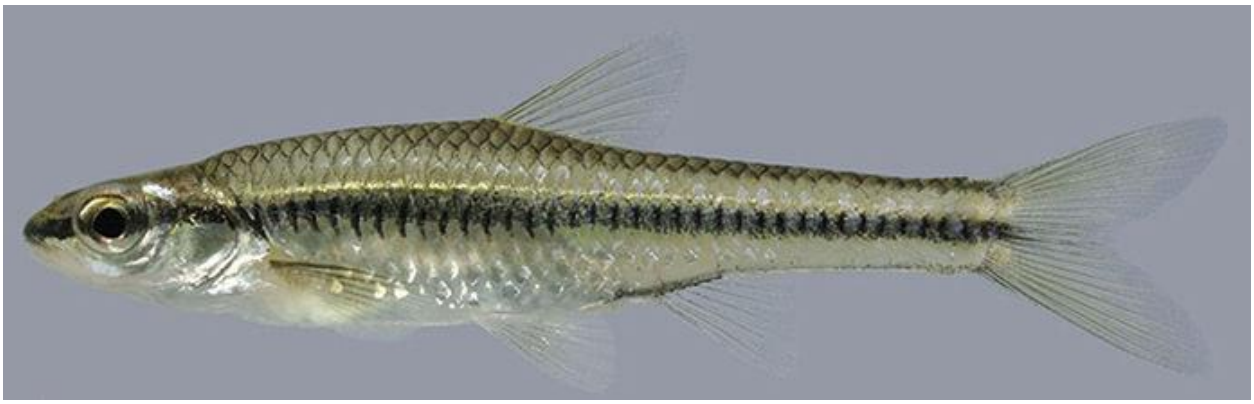


Image 8-2: Blacknose Shiner. Approximately 2-4 inches in length. (Photo credit: Illinois Department of Natural Resources)

Image 8-3: Banded killifish. Approximately 3 inches in length. (Photo credit: Illinois Department of Natural Resources)

Fish Advisory

The Illinois Department of Public Health has issued the following state-wide fish advisory:

> A statewide methylmercury advisory applies to all Illinois waters. IDPH recommends that women of childbearing age and children limit their consumption of predatory fish (bass, sauger, walleye, flathead catfish, gar, muskellunge, northern pike, trout, and salmon) to 1 meal per week, unless more restrictive advisories are in place (https://dph.illinois.gov/topics-services/environmental-health-protection/toxicology/fish-advisories/map.html).

As was mentioned in Appendix 3 – Water Quality, Bangs Lake is listed on the IEPA 303(d) list for methylmercury in the fish. Several species have been tested by both the IEPA and the IDNR and a fish consumption advisory has been in place since 2010 (Figure 8-3).

Bangs Lake

Bodies of Water

Bangs Lake

Lake County

Species and Meal Frequency

Black Crappie

All Sizes

1 meal/week for women of childbearing age and children

Contaminant: Methylmercury

Northern Pike

All Sizes

1 meal/week

1 meal/month for women of childbearing age and children

Contaminant: Methylmercury

Largemouth Bass

All Sizes

1 meal/week

1 meal/month for women of childbearing age and children

Contaminant: Methylmercury

Figure 8-3: Illinois Department of Public Health fish advisory for Bangs Lake

Fisheries Photo Log

Photo #1: Fishing is good for the Great Blue Heron.

Photo #2: Bluegill nests littered the shallows throughout Bangs Lake.

Photo #3: Fish were observed throughout the shallows favoring native vegetation.

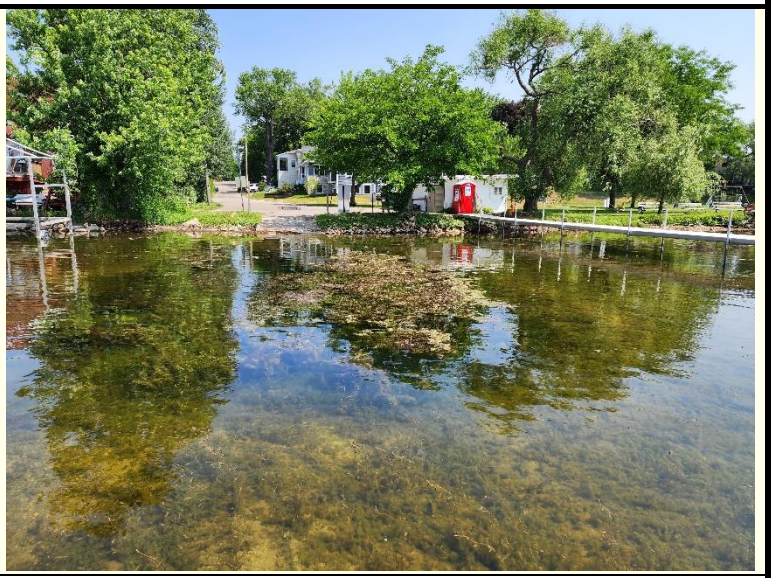


Photo #4: Fish were observed throughout the shallows favoring native vegetation.

APPENDIX 9. Community Actions and Behaviors

Appendix 9- Community Actions and Behaviors

Direct Human Impact

Practices and behaviors have a direct impact on the health of Bangs Lake. One of the key methods to improving overall quality of Bangs Lake is to enhance community outreach and influence behaviors relative to lake preservation through education. A better understanding of how stakeholders share a reciprocal relationship with Bangs Lake leads to behavior which results in the desired state of improved and sustained lake quality. This section will discuss some of the most detrimental activities and behaviors which adversely affect the lake.

Importation of Non-Native Species

Non-native species upset the ecological balance of an aquatic ecosystem and can substantially to the degradation of a lake. The 'Stop Aquatic Hitchhikers' program is a national effort to thwart the importation of non-native species (plants, fish, invertebrates, etc.) into waters where their presence can have a negative impact. There are many boat launches into Bangs Lake with little evidence of signage raising awareness to the program, and even less opportunity for boaters to implement the precautions and mitigative actions the program encourages. Example of a decontamination station near a lake is shown in Image 9-1.

Image 9-1: Example of a decontamination station near a lake (source: Utah Division of Wildlife Resources).

Many aquarium plants available at local pet stores are native to tropical regions where they have a place in the regional ecosystem. However, aquarium hobbyists often 'release' their pets into surface waters along with non-native plants, plant fragments, or seeds. This is thought to be how EWM became established in our region.

Bait shops often sell live bait (example Image 9-2)which is not native to the region where they are used. When bait is lost, or when an angler dumps unused bait into waters, these creatures can reproduce and disrupt the local ecosystem.

Image 9-2: Rusty Crawfish, example of escaped bait (Source: Seagrant Wisconsin)

Dumping

Stormwater systems which lead to Bangs Lake are generally unmarked. The washing or servicing of cars, patio furniture, trailers, grills etc. near these drains can transport nutrients and harmful chemicals into the lake. Example of no-dumping signage is shown below (Image 9-3).

Image 9-3: Example of no dumping signage (Source: USEPA Stormwater Best Management Practices Fact Sheet)

Lawn clippings, landscape waste, and/or leaves are sometimes blown or dumped directly into lakes left in areas that allow them to be washed into the lake. This adds to the nutrient load of the lake which leads to algae growth.

Waste generated from geese contains a very high concentration of bacteria and phosphorus. Discouraging activities such as feeding geese, washing goose feces into the water (Image 9-4), and maintaining shorelines that encourage goose presence can improve water quality.

Image 9-4: Example of goose abatement educational materials (Source: Elkhart Indiana Wildlife Coexistence Plan).

Litter

Littering is always an issue, as lakes are generally a local 'low point' and collect trash carried by water or wind. Trash was noted in several areas and was noted online by Wauconda residents. Other forms of indirect littering such as snagged fishing lines and hooks, can create human and wildlife hazards. Garbage which was disposed of on the roadside may also indirectly contaminate the lake, entering through assorted tributaries or storm sewers.

Watercraft

The horsepower used and types of watercrafts have evolved over the decades, and one of the most popular uses of the lake is boating. Research shows that waves created by ballast wake/ski boats are three times higher than similarly sized ski boats packing 10-25 times the wave energy. This energy has a damaging effect on most types of shorelines, wildlife habitat, and creates conditions for other watercraft (sailing, fishing, pontooning) that at least detract from the experience they were intended to create, and at most become detrimental to private and public property and a safety concern.

Watercraft Operation

While type of watercraft can be pointed to as a negative influence on lakes, many of the nuisances associated with them are a direct result of operation of the craft.

Image 9-5: Example of wake boat in action.

The speed at which the vessel is operated, how close to shore it travels, number of occupants, the operator's adherence to safe boating practices, and courtesies demonstrated (i.e. the volume of audio systems) all contribute to some degree to the effect it has on the ecology, wildlife, and lake experience of other users.

Image 9-6: Example of an overcrowded lake (Photo source: Lake of the Ozarks Lake Expo).

Access

Bangs Lake is a public lake, meaning there are no limitations (or enforcement of limitations) on its access via public points of entry such as beaches and boat launches(Figure 9-1). It is unclear whether there are limits on the number of docking spaces or moorings on Bangs Lake or if there are limits to the number of active boats allowed on the lake at one time. Lake overcrowding and conditions caused by overcrowding were frequent concerns voiced in the survey conducted this year.

Figure 9-1: Bangs Lake boat access points.

As a 300-acre lake, there is a calculable 'carrying capacity' of the lake that considers:

- Lake use characteristics (i.e. fishing, swimming, irrigation, sailing, etc.).
- Usable lake surface area (lake area minus buffer zones, shallows, marinas, etc.).
- Boating density standards (considers boating types and boating speeds).
- Lake use rate (the percentage of boats used during a certain time).

Currently, the carrying capacity and whether the current usage rate exceeds this is unknown.

Relating to lake use: aside from property taxes collected from owners whose property value is elevated because of Bangs Lake, the Village receives no income from lake users.

Research has indicated that HOA's grant access to residents. Access by friends and family is generally only allowed with residents of the HOA present.

Appendix 10 – Village of Wauconda:
2023 Bangs Lake Survey Results

Appendix 10 – Village of Wauconda: 2023 Bangs Lake Survey Results

Participation

Gathering community feedback is essential to understanding the needs, expectations and perceptions of stakeholders. This information improves project design, implementation and success when utilized effectively. 527 individuals participated in the Bangs Lake survey over a period of two months (June 1 – July 31, 2023). This is an approximate 3.8% participation rate (based on a residency of 14,000 people) which is considered a "good" survey response.

Demographics

Most participants live either on Bangs Lake (26%) or near Bangs Lake (51%). Only 6% of participants stated that they do not live in Wauconda. 52% of participants are between the ages of 41 and 64; 32% are over the age of 60. The remaining 16% of respondents are between the ages of 18 and 40. Most people who participated in the survey have lived in Wauconda for 21 years or more (44%) with 24% living in Wauconda between 11 and 20 years. This indicates that most respondents have lived in Wauconda long enough to observe changes over time. 62% of survey participants use the lake a few times each week and therefore have high engagement with Bangs Lake.

Health of Bangs Lake

When asked their impression of the overall health of Bangs Lake, most survey takers believe the lake is in decline. 44% responded that it is "okay but seems to be getting worse" and 14% feel the lake is "not good". 33% believe the lake "is good" and 5% indicated that the "lake is healthy and good the way it is".

Water quality and excessive aquatic plants and algae track as the top two concerns at 55% and 42% respectively. 48% of people expressed that they feel that water quality has declined at Bangs Lake.

Recreation and Fishing

People take advantage of many recreational opportunities centered around Bangs Lake. The top uses are (with multiple choices available):

Enjoying the views	84%
Swimming	64%
Motor boating	62%
Nature watching	53%
Canoeing/kayaking	53%
Fishing	46%

When asked about the quality of the fishing, 20% of respondents feel it has declined and 17% feel it has stayed the same. It should be noted that 40% of people who responded to this question stated

that they do not fish. For those that do fish, the biggest complaint is that hooks get tangled in plants (63% response), followed by fewer fish (42%) and smaller fish (31%).

Aquatic Plants

When asked which statement best describes the amount of aquatic plant growth present in Bangs Lake, 70% responded “dense and affects my use of the lake”. 81% of respondents feel that aquatic plant control is needed for Bangs Lake. Most survey takers are supportive of using EPA-approved herbicides to treat aggressive aquatic plants with 46% being highly supportive and 21% being somewhat supportive. Only 6% were unsupportive of this management method. Despite many negative write-in comments on using a mechanical harvester to control aggressive aquatic plants, 29% of respondents believe that the use of a mechanical harvester is helping to improve Bangs Lake. 22% disagree with this assumption and 28% are unsure. 12% of survey takers have no opinion on this subject.

Shorelines

Lakefront property owners were asked how they manage their shorelines. While “sandy beach” was not an option for selection, this was a popular response under the “other” write-in category that received 27% of responses. 24% indicated that their shorelines are mowed or weed-whacked to the water’s edge indicating that there is significant opportunity to improve shoreline stabilization and reduce nutrient runoff into the lake by planting native plant shoreline buffers. Most of the lakefront owners indicate that their shoreline is hardscaped by either seawall (25%) or riprap (18%) which provides no ecological habitat benefit but does help prevent the shoreline from eroding into the lake. Most survey takers were supportive of the use of native plants to prevent shoreline erosion with 52% believing native plants increase the beauty of a property, 34% responding that they help improve water quality, and 24% selecting that they believe native plants help to deter geese.

Fertilizers

An equal number of respondents use lawn fertilizers as do not (42% each) and 13% were unsure.

Importance of Bangs Lake

An overwhelming majority (98%) of survey takers feel that Bangs Lake is an extremely important or very important feature of Wauconda and 92% responded that managing Bangs Lake should be a high priority for the Village.

Education

Topics people are most learning more about are centered around lake heath and what they can do to help improve Bangs Lake. These topics and the percent of survey takers interested in these topics are:

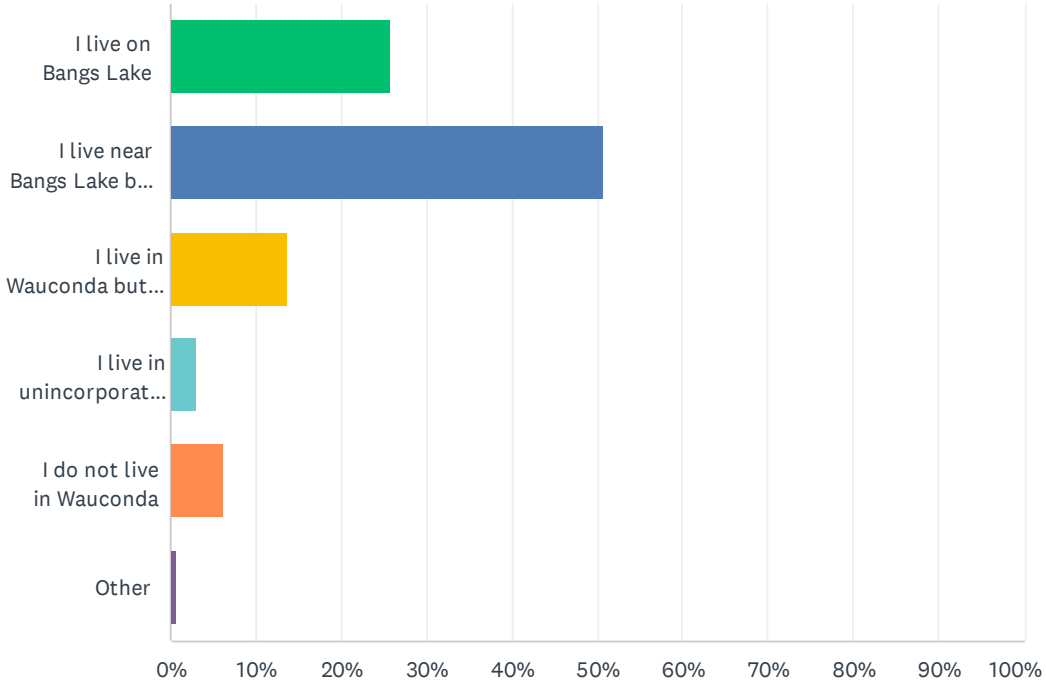
Ways that I can help improve the quality of Bangs Lake – 71%

Factors contributing to poor water quality – 69%

Understanding lake ecology and management – 60%

Q2 Where in Wauconda do you live (select one)?

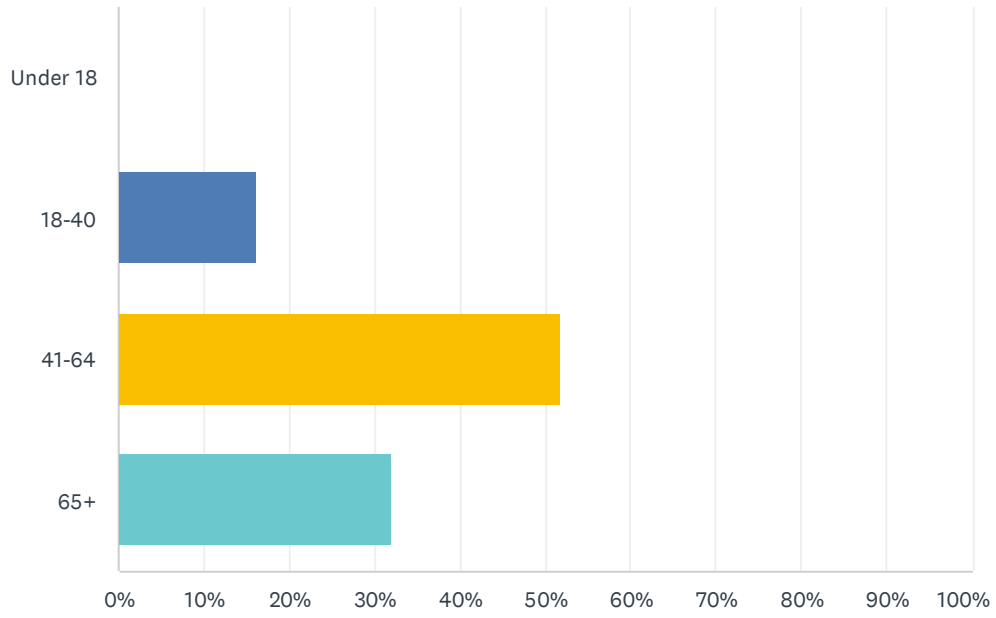
Answered: 527 Skipped: 0



ANSWER CHOICES	RESPONSES	
I live on Bangs Lake	25.81%	136
I live near Bangs Lake but not on the water	50.66%	267
I live in Wauconda but not near the lake	13.66%	72
I live in unincorporated Wauconda	3.04%	16
I do not live in Wauconda	6.26%	33
Other	0.57%	3
TOTAL		527

Q3 Which category includes your age (select one)?

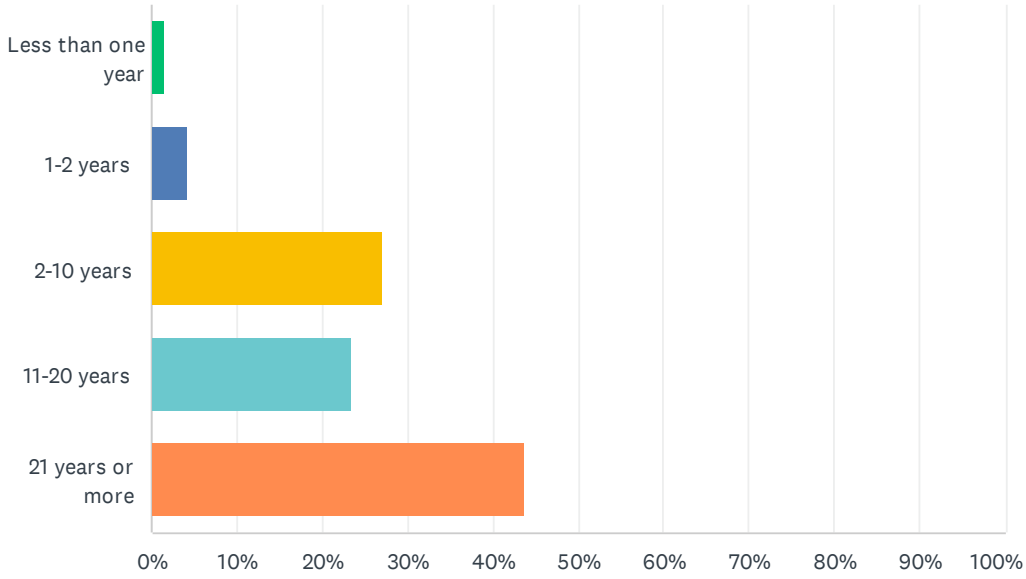
Answered: 523 Skipped: 4



ANSWER CHOICES	RESPONSES	
Under 18	0.00%	0
18-40	16.25%	85
41-64	51.82%	271
65+	31.93%	167
TOTAL		523

Q4 How long have you lived on, visited, or in some way used Bangs Lake (select one)?

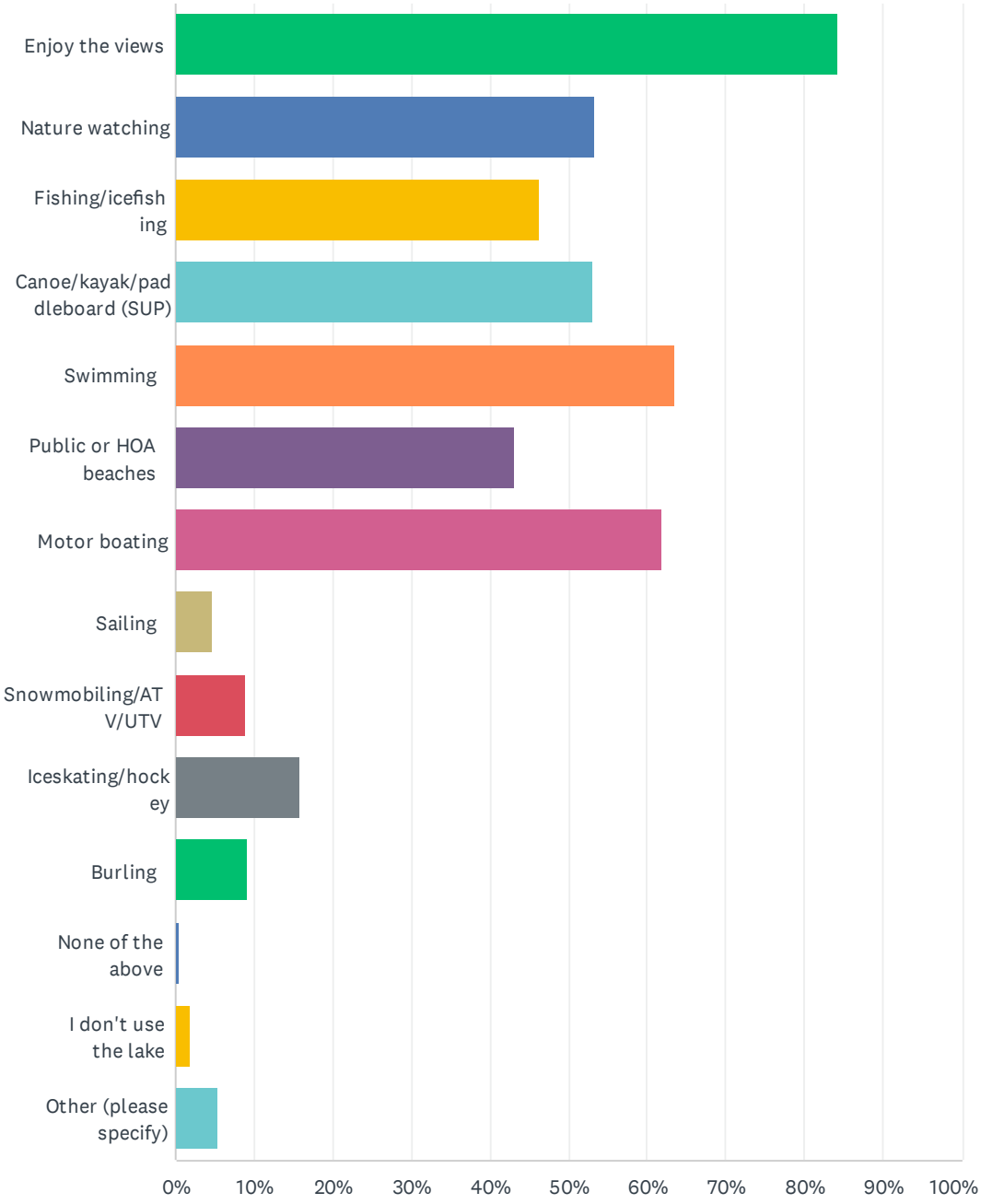
Answered: 527 Skipped: 0



ANSWER CHOICES	RESPONSES	
Less than one year	1.52%	8
1-2 years	4.17%	22
2-10 years	27.13%	143
11-20 years	23.53%	124
21 years or more	43.64%	230
TOTAL		527

Q5 How do you use Bangs Lake? Please check all that apply.

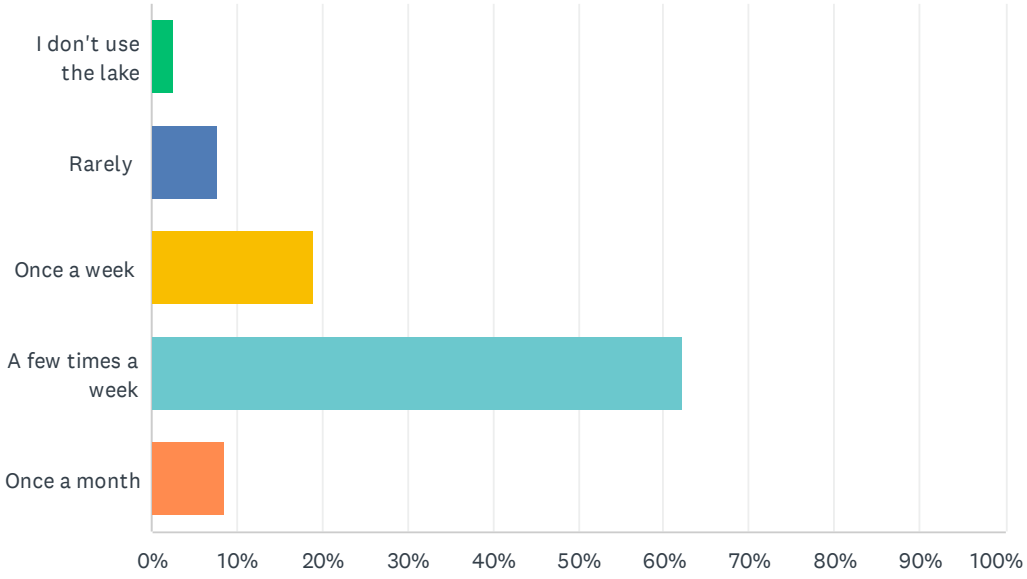
Answered: 527 Skipped: 0



ANSWER CHOICES	RESPONSES	
Enjoy the views	84.25%	444
Nature watching	53.32%	281
Fishing/icefishing	46.30%	244
Canoe/kayak/paddleboard (SUP)	53.13%	280
Swimming	63.57%	335
Public or HOA beaches	43.07%	227
Motor boating	61.86%	326
Sailing	4.74%	25
Snowmobiling/ATV/UTV	8.92%	47
Iceskating/hockey	15.75%	83
Burling	9.11%	48
None of the above	0.38%	2
I don't use the lake	1.90%	10
Other (please specify)	5.31%	28
Total Respondents: 527		

Q6 In general, how often do you engage with Bangs Lake (select one)?

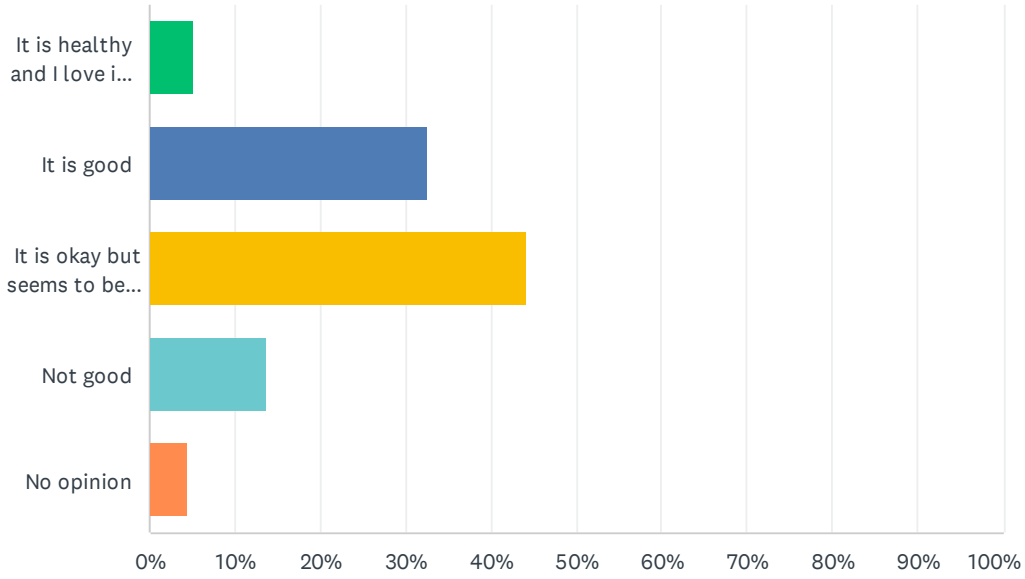
Answered: 525 Skipped: 2



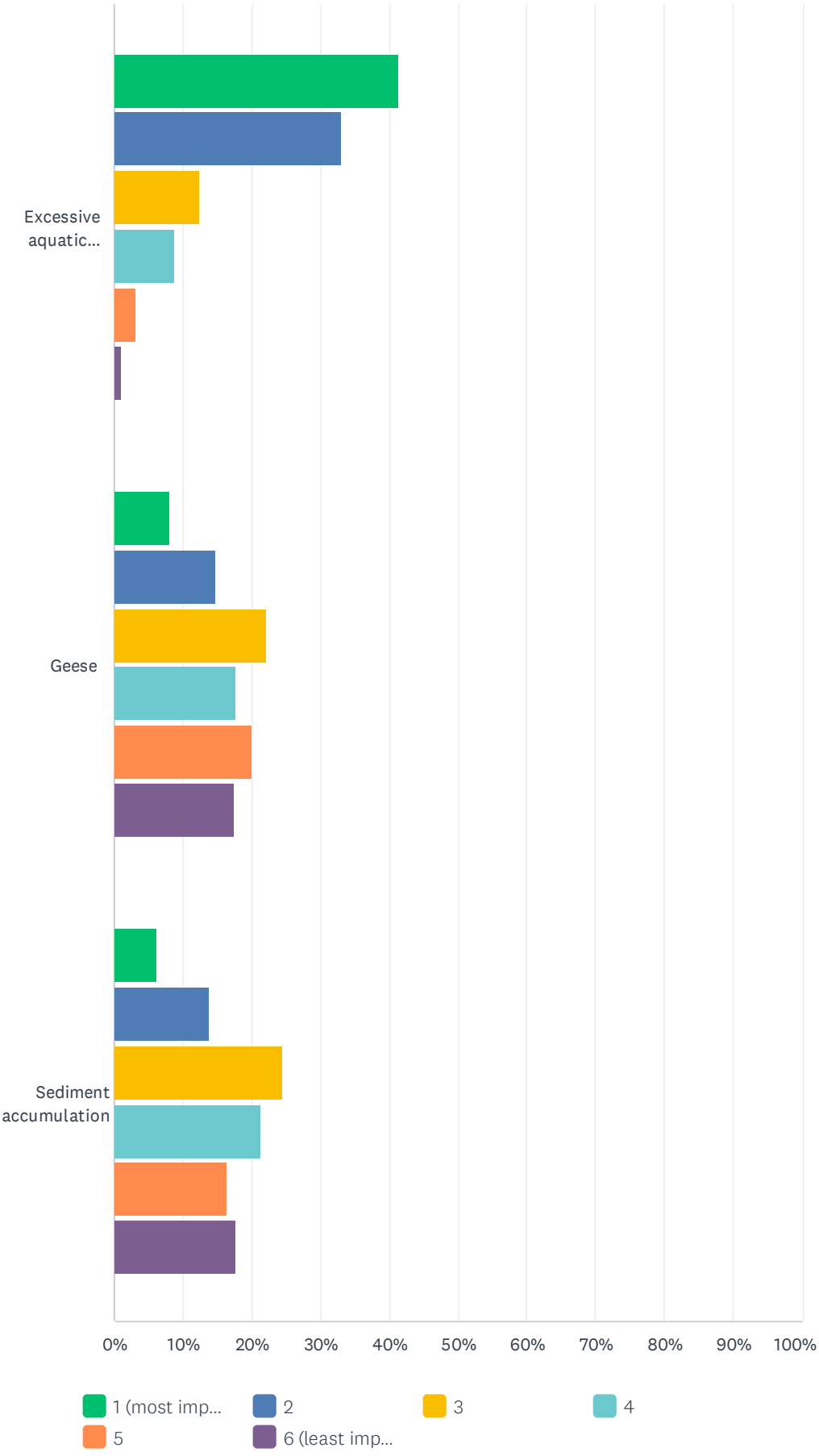
ANSWER CHOICES	RESPONSES	
I don't use the lake	2.48%	13
Rarely	7.62%	40
Once a week	19.05%	100
A few times a week	62.29%	327
Once a month	8.57%	45
TOTAL		525

Q7 What is your overall impression of the health of Bangs Lake (select one)?

Answered: 520 Skipped: 7



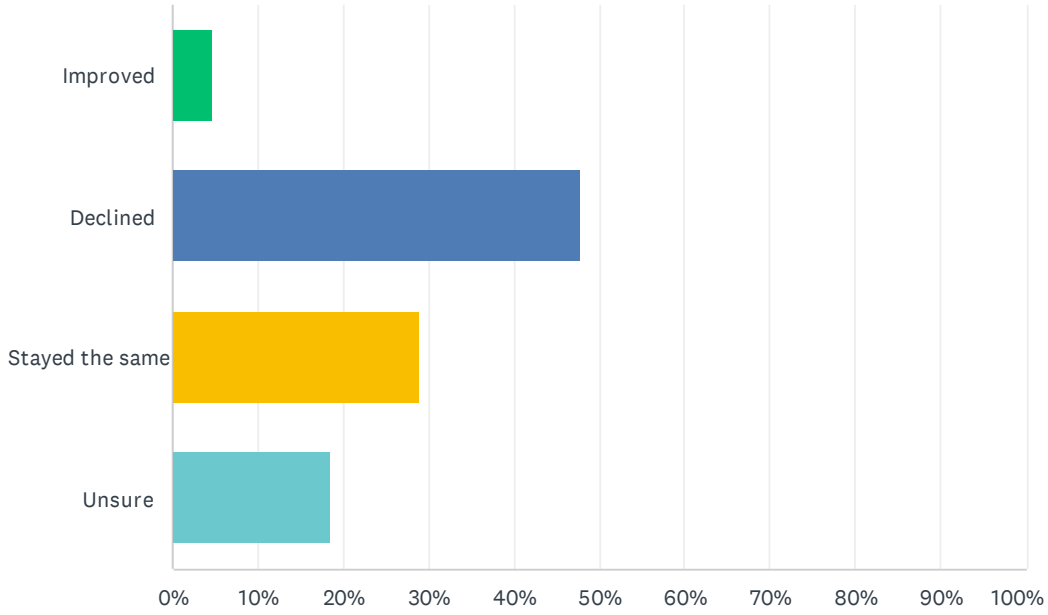
ANSWER CHOICES	RESPONSES	
It is healthy and I love it like it is	5.19%	27
It is good	32.69%	170
It is okay but seems to be getting worse every year	44.04%	229
Not good	13.65%	71
No opinion	4.42%	23
TOTAL		520


Excessive aquatic...
Geese
Sediment accumulation
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
1 (most imp...
2
3
4
5
6 (least imp...

	1 (MOST IMPORTANT)	2	3	4	5	6 (LEAST IMPORTANT)	TOTAL
Water quality	54.74% 231	20.62% 87	13.74% 58	6.87% 29	3.08% 13	0.95% 4	422
Flooding	2.71% 10	10.03% 37	13.01% 48	23.58% 87	23.31% 86	27.37% 101	369
Shoreline erosion	4.00% 16	16.50% 66	23.75% 95	23.50% 94	24.25% 97	8.00% 32	400
Excessive aquatic plants/algae	41.42% 193	33.05% 154	12.45% 58	8.80% 41	3.22% 15	1.07% 5	466
Geese	8.10% 34	14.76% 62	22.14% 93	17.62% 74	20.00% 84	17.38% 73	420
Sediment accumulation	6.19% 27	13.76% 60	24.54% 107	21.33% 93	16.51% 72	17.66% 77	436

Q9 In the time that you have used Bangs Lake, how would you say the water quality has changed (select one)?

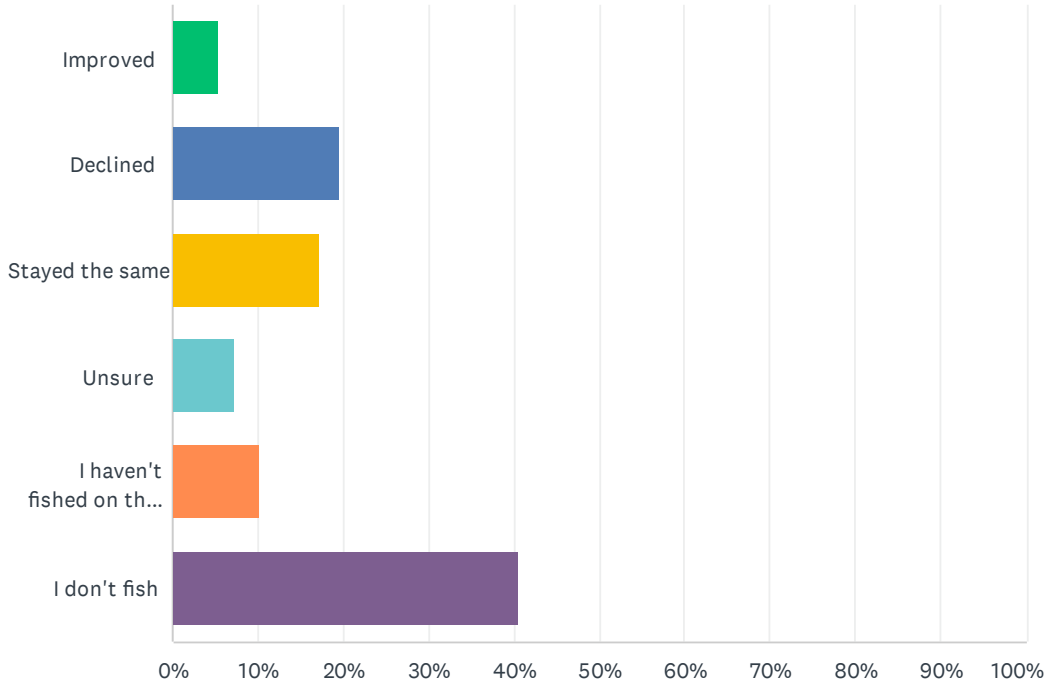
Answered: 525 Skipped: 2



ANSWER CHOICES	RESPONSES	
Improved	4.76%	25
Declined	47.81%	251
Stayed the same	28.95%	152
Unsure	18.48%	97
TOTAL		525

Q10 If you fish on Bangs Lake, how would you say the quality of fishing has changed (select one)?

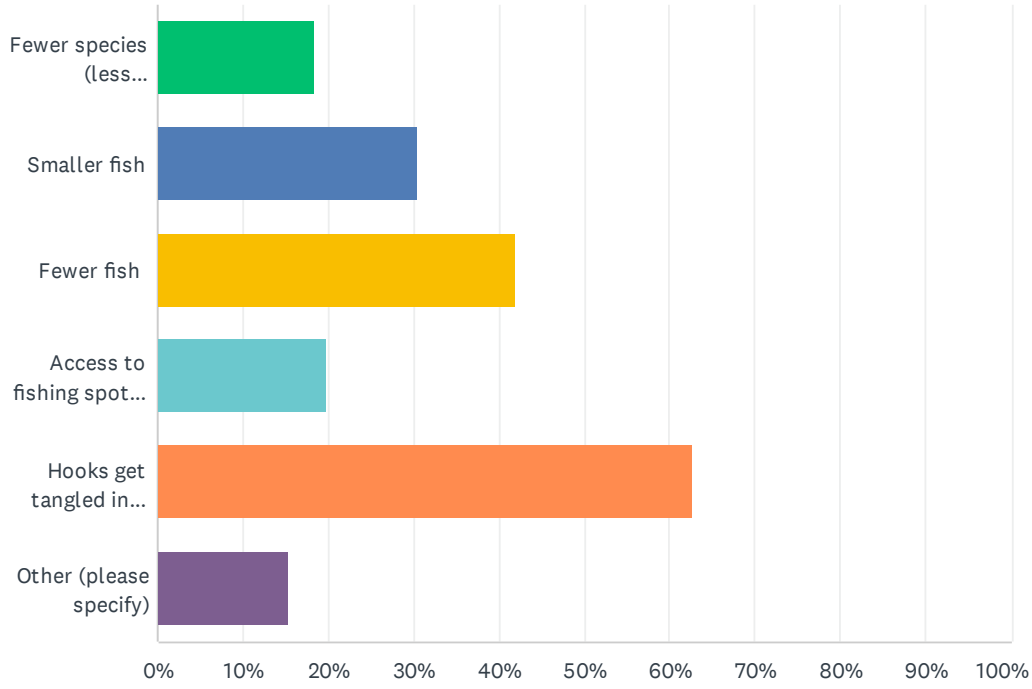
Answered: 516 Skipped: 11



ANSWER CHOICES	RESPONSES	
Improved	5.23%	27
Declined	19.57%	101
Stayed the same	17.25%	89
Unsure	7.17%	37
I haven't fished on the lake long enough to know	10.27%	53
I don't fish	40.50%	209
TOTAL		516

Q11 If you answered "fishing has declined", how has it declined (select all that apply)?

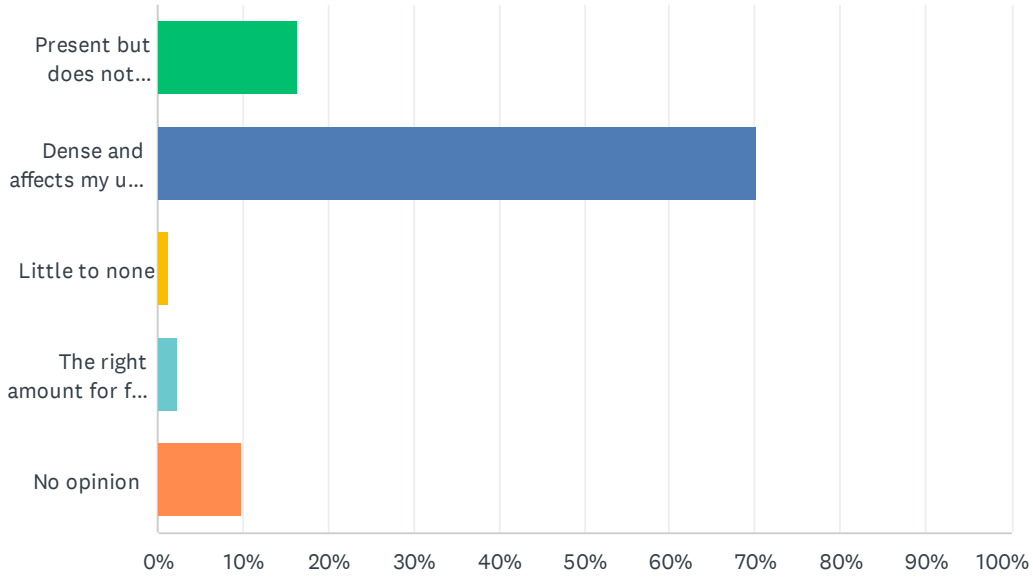
Answered: 131 Skipped: 396



ANSWER CHOICES	RESPONSES	
Fewer species (less diversity)	18.32%	24
Smaller fish	30.53%	40
Fewer fish	41.98%	55
Access to fishing spots has decreased	19.85%	26
Hooks get tangled in plants	62.60%	82
Other (please specify)	15.27%	20
Total Respondents: 131		

Q12 In your opinion, which statement best describes the amount of aquatic plant growth in Bangs Lake (select one)?

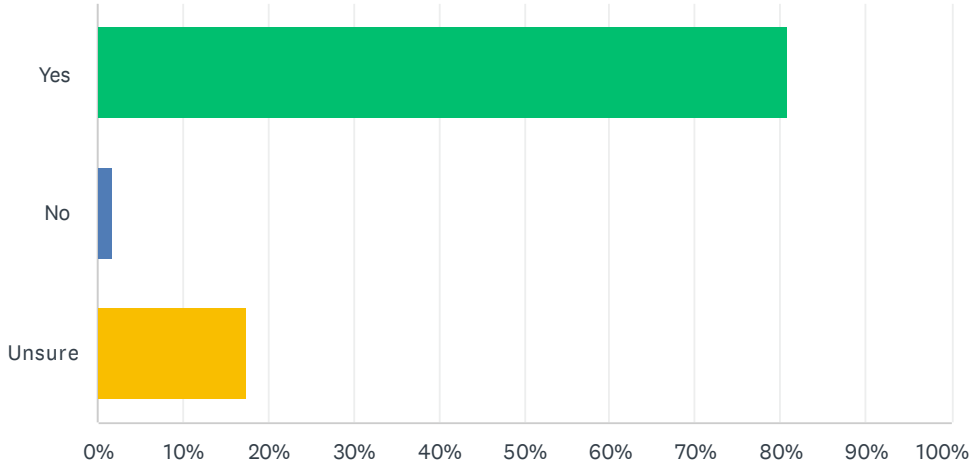
Answered: 520 Skipped: 7



ANSWER CHOICES	RESPONSES	
Present but does not substantially affect my use of the lake	16.35%	85
Dense and affects my use of the lake	70.19%	365
Little to none	1.35%	7
The right amount for fish and wildlife	2.31%	12
No opinion	9.81%	51
TOTAL		520

Q13 Do you believe aquatic plant control is needed for Bangs Lake?

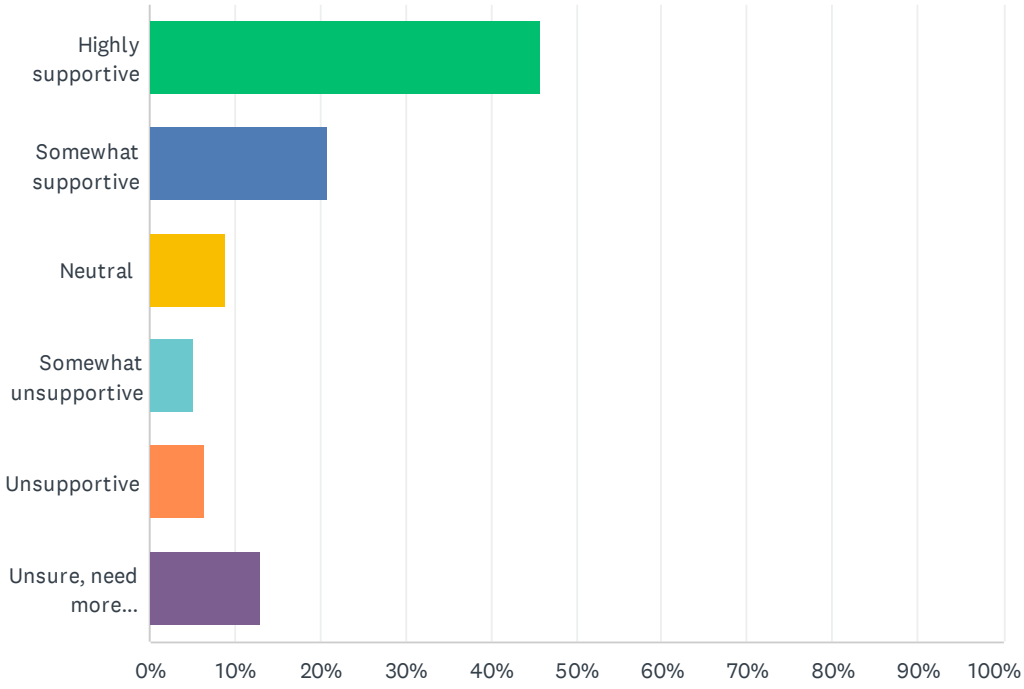
Answered: 524 Skipped: 3



ANSWER CHOICES	RESPONSES	
Yes	80.73%	423
No	1.72%	9
Unsure	17.56%	92
TOTAL		524

Q14 How supportive are you regarding using EPA approved herbicides to manage aquatic plants in Bangs Lake (select one)?

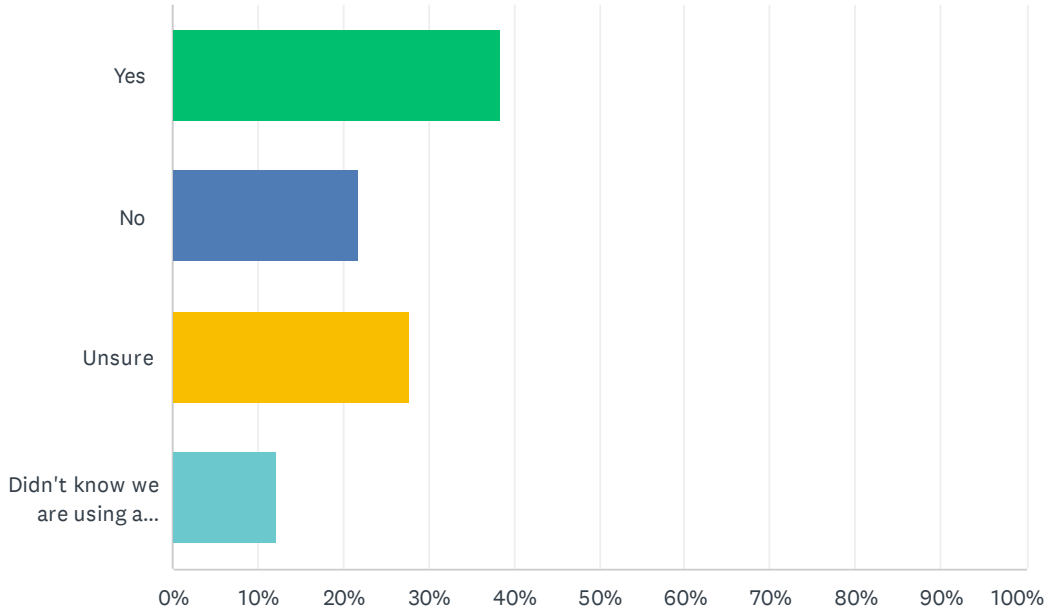
Answered: 517 Skipped: 10



ANSWER CHOICES	RESPONSES	
Highly supportive	45.84%	237
Somewhat supportive	20.89%	108
Neutral	8.90%	46
Somewhat unsupportive	5.03%	26
Unsupportive	6.38%	33
Unsure, need more information	12.96%	67
TOTAL		517

Q15 Do you think mechanical harvesting of aquatic plants is helping to improve Bangs Lake (select one)?

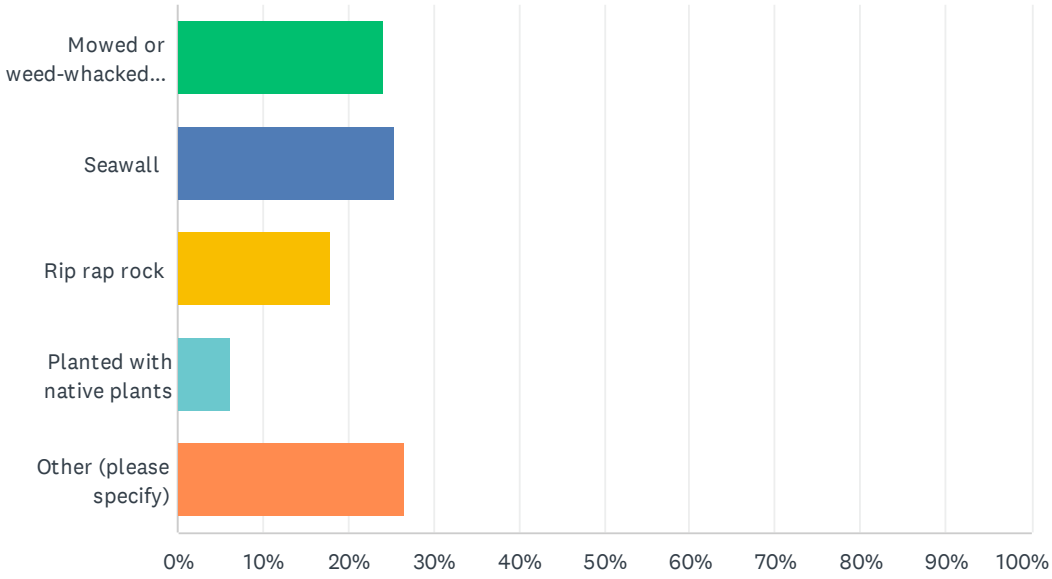
Answered: 525 Skipped: 2



ANSWER CHOICES	RESPONSES	
Yes	38.48%	202
No	21.71%	114
Unsure	27.62%	145
Didn't know we are using a harvester on Bangs Lake	12.19%	64
TOTAL		525

Q16 If you live on the lake or have HOA lakefront property, how do you currently manage your shoreline (select one)?

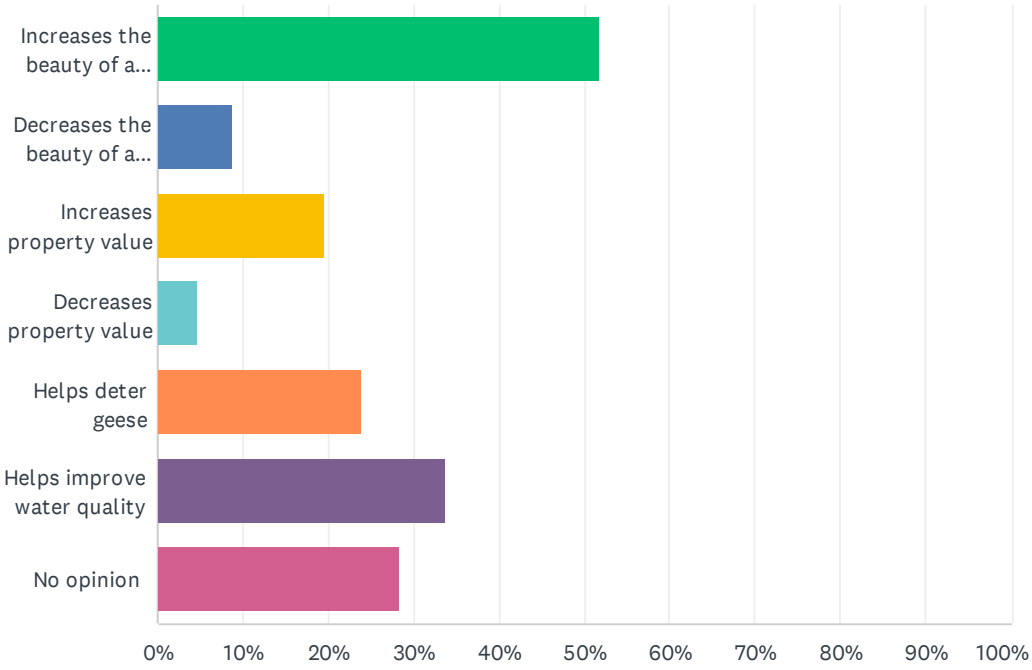
Answered: 229 Skipped: 298



ANSWER CHOICES	RESPONSES	
Mowed or weed-whacked to the water's edge	24.02%	55
Seawall	25.33%	58
Rip rap rock	17.90%	41
Planted with native plants	6.11%	14
Other (please specify)	26.64%	61
TOTAL		229

Q17 Regardless of where you live, what is your opinion about planting native plants to keep the shoreline from eroding (check all that apply)

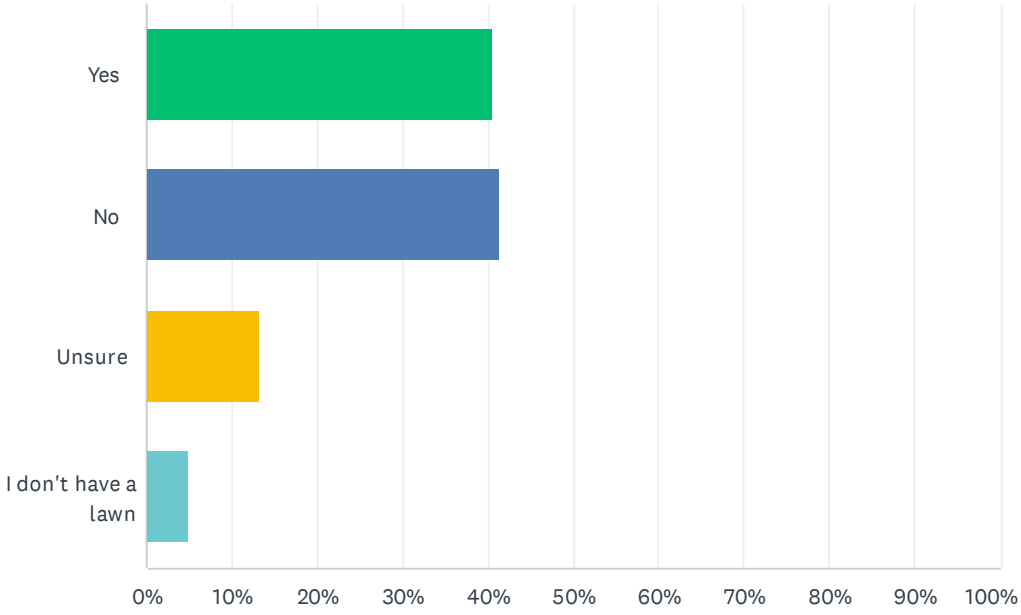
Answered: 516 Skipped: 11



ANSWER CHOICES	RESPONSES	
Increases the beauty of a property	51.74%	267
Decreases the beauty of a property	8.72%	45
Increases property value	19.57%	101
Decreases property value	4.65%	24
Helps deter geese	23.84%	123
Helps improve water quality	33.72%	174
No opinion	28.29%	146
Total Respondents: 516		

Q18 Do you or your lawn service use fertilizers (select one)

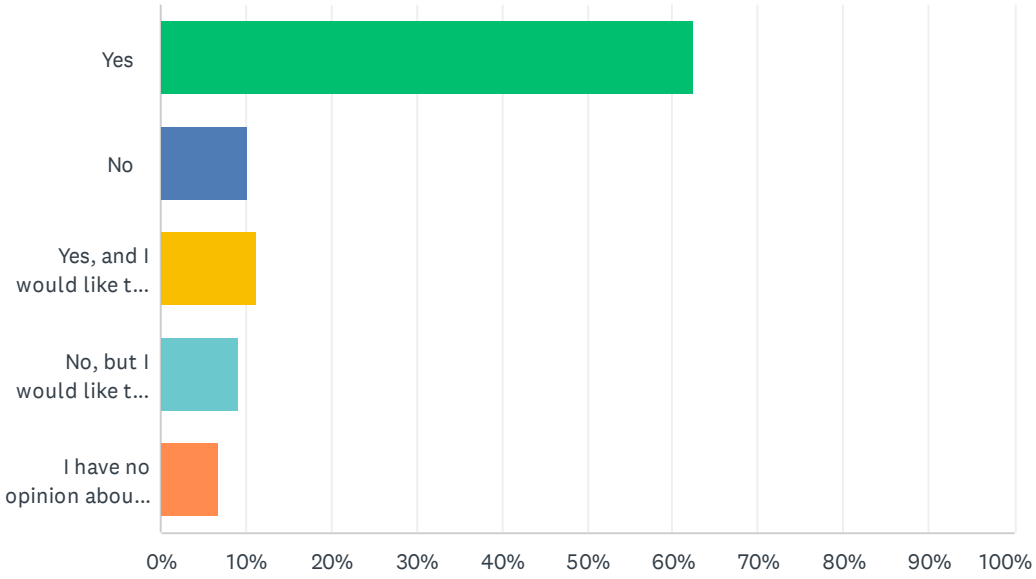
Answered: 507 Skipped: 20



ANSWER CHOICES	RESPONSES	
Yes	40.43%	205
No	41.42%	210
Unsure	13.21%	67
I don't have a lawn	4.93%	25
TOTAL		507

Q19 Are you aware of how lawn fertilizer, which also feeds lake plants and algae, can make it's way into Bangs Lake through drainage ditches or underground pipes even if you don't live on the lake (select one)?

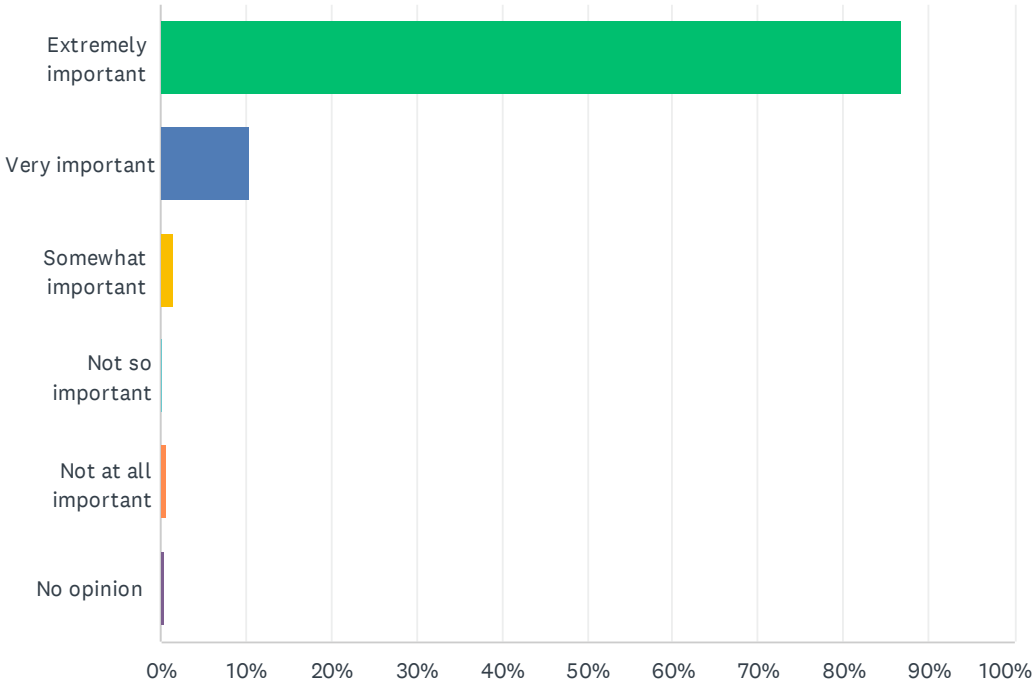
Answered: 515 Skipped: 12



ANSWER CHOICES	RESPONSES	
Yes	62.52%	322
No	10.29%	53
Yes, and I would like to learn more	11.26%	58
No, but I would like to learn	9.13%	47
I have no opinion about lawn fertilizers	6.80%	35
TOTAL		515

Q20 To what level do you perceive Bangs Lake as being an important feature of Wauconda (select one)?

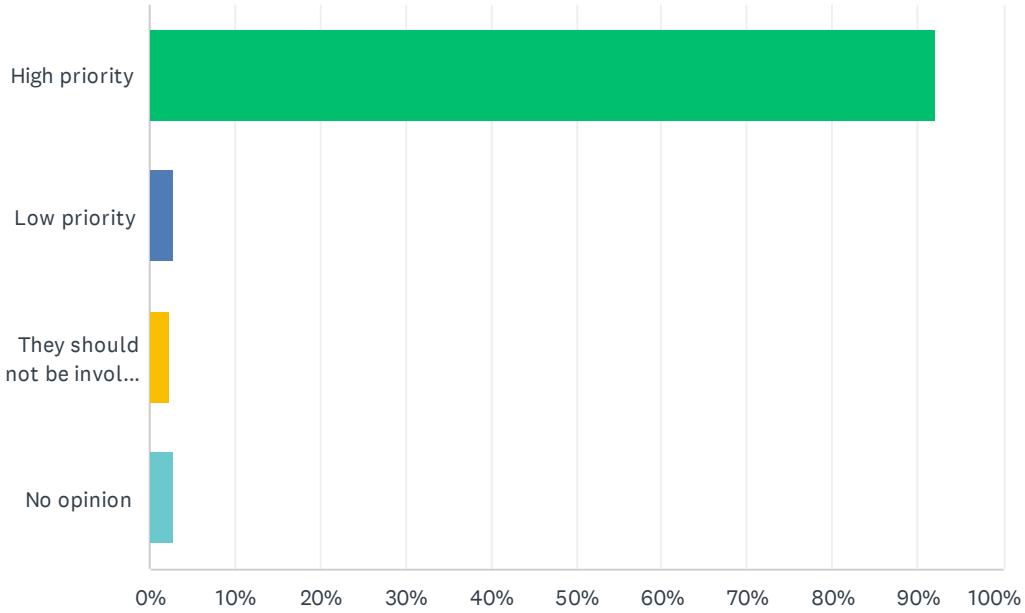
Answered: 523 Skipped: 4



ANSWER CHOICES	RESPONSES	
Extremely important	86.81%	454
Very important	10.52%	55
Somewhat important	1.53%	8
Not so important	0.19%	1
Not at all important	0.57%	3
No opinion	0.38%	2
TOTAL		523

Q21 How should managing Bangs Lake fit in with other Village priorities (select one)?

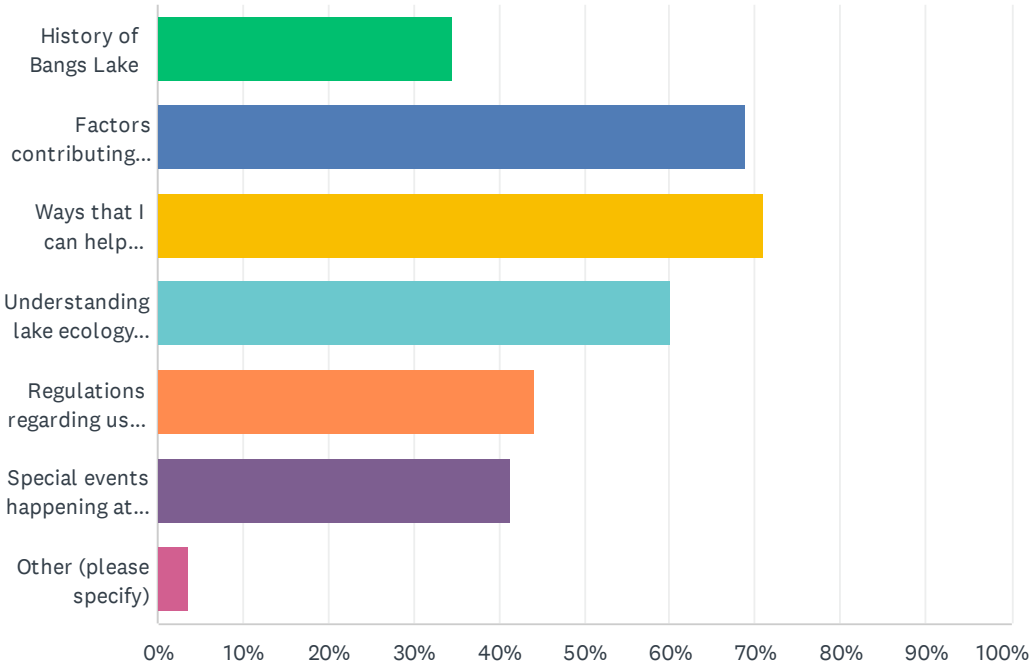
Answered: 523 Skipped: 4



ANSWER CHOICES	RESPONSES	
High priority	92.16%	482
Low priority	2.68%	14
They should not be involved in managing the lake	2.29%	12
No opinion	2.87%	15
TOTAL		523

Q22 Please select all of the topics you would like the Village to provide more education about (select all that apply):

Answered: 474 Skipped: 53



ANSWER CHOICES	RESPONSES	
History of Bangs Lake	34.60%	164
Factors contributing to poor water quality	68.78%	326
Ways that I can help improve the quality of Bangs Lake	71.10%	337
Understanding lake ecology and management	60.13%	285
Regulations regarding using Bangs Lake	44.09%	209
Special events happening at the lake	41.35%	196
Other (please specify)	3.59%	17
Total Respondents: 474		

What else should we know in regards to Bangs Lake?			
General			
	Jul 18 2023 04:45 PM	We moved to Wauconda because of Bangs Lake, and being able to enjoy the lake is very important to us. Thanks for giving the survey!	
	Jul 14 2023 08:10 AM	We have enjoyed the lake for almost 20 years, and I have always felt it has been extremely healthy!	
	Jul 13 2023 04:35 PM	It's an attraction	
	Jul 13 2023 02:34 PM	It is a beautiful feature to lake county and needs to be preserved and maintained while simultaneously respecting the wildlife and aquatic life	
	Jul 06 2023 12:17 PM	Our family is in love with this lake and we want it to be preserved as well as possible so we can all enjoy it forever.	
	Jun 26 2023 11:08 PM	It is very calming.	
	Jun 24 2023 09:25 AM	This lake is the reason we moved to Wauconda, and it's the reason that weâ€™ve remained in Wauconda. It's health, aesthetics, and usability are all of great importance to us, as with the jobs we have, we can live anywhere in this country. A topic that was not covered in the survey, and one that is of great importance, is policing of the lake. Our household strongly believes that policing is a necessity, and hopefully policing can continue to be accomplished with a strong community policing element, delivered by dedicated marine unit officers who become familiar with the individuals in the lake community. Also, the sworn officers have brought an element of professionalism and â€œbig picture policingâ€ to Bangs, while still keeping the users on our lake safe. A majority of our lake users are part of a small community, and all of this should be kept in mind as the most prominent marine unit officer has recently retired and will be replaced. The personalities, familiarity, and professionalism of the marine unit officers are a key element when it comes down to enjoying a day on the lake. It hasnâ€™t always been this way, but the last handful of years have been great. Hopefully it will continue.	

	Jun 19 2023 10:50 AM	I appreciate the Village taking the time to do the survey.
	Jun 24 2023 09:06 AM	It's a beautiful lake that people come for a good time! The lake should be one of the most important treasures of Wauconda.
	Jun 23 2023 11:56 PM	We have lived in Lakeview villa since 1952 kids from the city. It's a summer home. It's our 1st love thank you.
	Jun 23 2023 09:07 PM	Outrage grows so quickly. Years past weeds were worse. Clarke treatment has helped. But not everyone along the lake pays to have their perimeter done. More and more people expect the government to deal with all the problems but donâ€™t want taxes to go up. People cannot have everything.
	Jun 23 2023 07:52 PM	Thats why I bought the house hear.
	Jun 18 2023 11:16 AM	Love the lake. Wish the town would be built up more, sites, things to do, dining, etc. that can add to the entire community.
	Jun 09 2023 02:02 PM	Thanks for the survey and giving this topic the attention it deserves.
	Jun 07 2023 08:30 PM	Its a beautiful place to raise a family!! Itâ€™s a true blessing to have had Bangs Lake part of my life for the past 25 years!! Please continue to take care of it!
	Jun 07 2023 09:22 AM	The lake and its surroundings is what is going to help make Wauconda grow and be a place people want to come. Should be a main focus along with the business nearby
	Jun 06 2023 09:41 PM	Bangs lake is pretty much a private lake and should be paid for by the owners on the lake and any permits issued to people who use it. The citizens of wauconda shouldnt be paying for a lake used by only the few people who live on it.
	Jun 06 2023 08:51 PM	Its imperative to the property values in the community. Its really the main draw of people.
	Jun 06 2023 11:23 AM	Bangs Lake is a primary reason that Wauconda was established. It's a gem.

	Jun 06 2023 09:30 AM	It is the most important asset of Wauconda	
	Jun 06 2023 08:55 AM	The lake is why we live in Wauconda. If not for the lake we would probably move. I think the village does a good job of managing everything on the lake. You have fisherman, kayakers, boaters, skiers and we get along. I think the Marina police do a great job helping keep the lake and boating community safe. I love the activities on the lake like paddle board yoga and the triathlon. Love driving the boat to Lindy's for lunch. We love the lake, please do all you can to keep it in great condition and the water quality good.	
	Jun 06 2023 02:50 AM	The lake is the ONLY reason we moved to the area, if the lake doesnt improve we will move. Also, we need to fill the empty businesses in town its a shame they have sat empty for so long.	
	Jun 05 2023 10:54 PM	Protect our water	
	Jun 05 2023 10:35 PM	Is it safe for summer enjoyment please answer	
	Jun 05 2023 07:15 PM	Is Bangs Lake fed from underground springs or aquifers and if so where are those located ?	
	Jun 05 2023 02:30 PM	Wauconda is known for its lake. Keep it as an asset!	
	Jun 05 2023 11:59 AM	The lake is kind of gross, but I'm much more concerned about keeping small businesses alive in town.	
	Jun 05 2023 11:30 AM	Its a gem to residents	
	Jun 05 2023 09:30 AM	its a very small lake with a lot of traffic on it. Swimmers itch seems to be a problem. I will never use the lake. Much rather go to park district pool and pay non resident fees than use phils beach, as far as boating take a boat up to the chain.	
Aquatic Herbicide concerns			

	Jun 29 2023 06:26 PM	If chemicals are used by, (home owners, beach associations, and village) all applications should be the same product and not allowed to be poured in off random piers, and not be cancer causing. A puddle of chemicals for children to swim in is not acceptable.
	Jun 27 2023 10:17 AM	We should eliminate use of fertilizer anywhere near the late. Same with other products like Round Up. I live on the channel and house on both sides of me also on the channel use fertilizer and one neighbor is spraying roundup almost daily
	Jun 24 2023 09:27 PM	Stop using herbicides, it has killed almost all the native Aquatic plants, water clarity is diminished, aquatic life is greatly impacted. If you want a big swimming pool to put you boat in then keep killing it with herbicides and watch those bacteria counts rise. Donâ€™t blame it on the geese becuz if thereâ€™s no plant life they wonâ€™t feed here. Bacteria counts rise from all the decomposing plants the herbicides kill. Just watch how fast the clarity of water diminishes after the herbicides are used. Mechanical harvesting is best for the lake but has to be done on a consistent basis. A day and there is not enough. By keeping plants in the lake you keep the water oxygenated making clearer and healthier. Less algae blooms, fish healthier. All in all better for everyone and the environment. The harvester can keep up with the plants if itâ€™s used 4-5 days a week from mid May through mid Sept
	Jun 11 2023 01:54 PM	The aquatic harvester was out and chopped our HOA swim area recently and thinned out some aquatic vegetation. However, they still left some vegetation in the surrounding areas providing habitat and oxygen for a healthy fishery which is key to have a healthy ecosystem balance. I work in the ecological restoration industry and I do not think it is appropriate or necessary to treat Bangs Lakes for herbicides and algaecide treatments. The aquatic harvester is sufficient.
	Jun 07 2023 09:28 AM	Is there any way that we could have aerators at the north west end of Bangs Lake? The problem with herbicides is that it kills aquatic vegetation and the plants fall to the bottom, decompose and make more much in which more plants grow. I believe that what the weeds are so thick. I spend a lot of time taking seaweed off of my prop. Also, there used to be a sandbar at the north end. We'd see 40 boats anchored there five years ago. Now one or two boats anchored...not awesome. Thanks in advance for addressing this issue.
	Jun 05 2023 10:44 PM	Keep Bangs Lake clean, healthy and free from herbicides
	Jun 05 2023 08:34 PM	If Bangs Lake is going to be sprayed right before the opening of the beach, I think the public should know so they can make an informed decision about whether or not to go to the beach.

	Jun 05 2023 03:13 PM	Due to the future financial challenges the Village faces, we should be prioritizing core services. Iâ€™m not sure managing Bangs Lake would be considered a core service. Therefore budget spending should be planned based on revenues generated by sticker fees and not supplemented by the general fund. Not all residents use Bangs Lake.	
	Jun 05 2023 03:07 PM	WE MOVED TO WAUCONDA TO LIVE ON BANGS LAKE AND WE WANT IT PROTECTED AND IMPROVED	
Aquatic Weeds bad			
	Jun 25 2023 08:57 AM	The weeds seem to be the worst this year that I ever remember. The boats are getting bogged down with how dense the weed situation is. Bangs lake is an asset to this town and should be treated that way. Charge boats more to help maintain it. Make Lindyâ€™s and the park district help as they make substantial money off their boat slips. The lake should not be closed due to high water level. Kayaks should have no restrictions and they are using the lake at their own risk. Boat officer should be there all weekend not at 9am on weekdays. The officer should review the rules of the lake when safety check is done. The village should keep doing the 50% reimbursement for weed spraying. The weed harvester seems to make a small dent but also we notice a large amount of weeds on our shoreline after its near.	
	Jun 24 2023 08:08 AM	Needs more weed control and better quality of water	

	Jun 23 2023 11:13 PM	It does seem like the weeds are thicker than usual and there was a large blob floating Mr. Bergers home over the last few weeks that I'd never seen before.
	Jun 15 2023 08:35 PM	There is certain weeds that are better to keep than chop up. The milfoil gets out of control the last few years, on the 1st hot spells of the spring. It might be better to treat at that time, then after it is blooming out of control and spreads like a wildfire. Also the harvester might have a chance at keeping the weed edges under control in the depth range fish like to inhabit. (under 8 feet or so) and not just be recirculating the seeds that make more weeds at a little deeper depth. The millfoil weeds can grow to about 13 feet or more so it is a nuisance not just for fishing, but any activity.
	Jun 13 2023 10:13 PM	The aquatic growth seems to be the worst this year, than any year in the past since I moved on to Bangs Lake in 2019.
	Jun 08 2023 01:26 PM	its to beautiful a feature not to take care of it. The seaweed situation has to be addressed and taken care of it smells and ruins the simple pleasure of sitting and enjoying the view
	Jun 08 2023 08:31 AM	Please continue the cost sharing for herbicide application costs. The invasive milfoil & curl-leaf pondweed is horrible this year!
	Jun 07 2023 08:27 PM	Current conditions of the lake, including its plants and weeds make it nearly impossible to enjoy swimming for my family.
	Jun 07 2023 07:08 PM	The reason I moved to Wauconda is for Bangs Lake. I thoroughly enjoy taking my family out on my boat. My one complaint is the excessive weeds.
	Jun 07 2023 04:47 PM	Numbers of bass is good but overall size of bass is dropping. Weeds are good for fishing but the floating and emergent weeds are really really bad for boating to the point of being dangerous
	Jun 07 2023 03:26 PM	Weed/Algae infestation is a significant problem
	Jun 06 2023 09:54 PM	So much seaweed this year! Worst Ive ever seen at this time of year
	Jun 06 2023 12:18 PM	The aquatic weeds in the lake right now are the WORSE we've seen in boating there for 30 yrs! Everytime our boat leaves its slip at Bangs Lake Marina, our prop is immediately clogged with weeds, this has Never happened this bad in 30 yrs of

		having a boat slip at that Marina. Pls do weed eradication at the Marina boat slip areas ASAP!!!
	Jun 05 2023 10:37 PM	I believe that Bangs Lake is the 3rd cleanest lake in Illinois. The water is clean BUT the plant life is out of control this year. I have noticed more seaweed than usual on the shorelines and plant life seems to be taking over what use to be great swimming areas on the lake. There seems to be more bouys on the lake in recent years directing boats and that's great to see! The police patrol is friendly and courteous! (that's a side note) Question #21-If the village is not involved in managing the lake, who will be? Will there be a committee? #14-I answered somewhat supportive. What is the alternative to use and will it work with diminishing some of the over abundant plant growth? #9-the water quality still looks clean and clear. It's the over grown water foliage that is crazy!
	Jun 05 2023 07:00 PM	We love bangs, but the weeds this year really need to be addressed. Aso their are quite a few muskrats hanging around the boats.
	Jul 13 2023 02:29 PM	Too many weeds and boats getting too close to other boats. Water ski hours should be sunrise to sunset.
	Jun 27 2023 05:29 AM	The Algae plumes and seaweed are out of control this year. Let alone the zebra muscles.
	Jun 05 2023 05:43 PM	The weed problem this year is worse than ever and should be addressed. Taxes in Wauconda are very high so keeping it attractive both on the lake and off should be taken care of.
	Jun 05 2023 05:25 PM	The weeds are horrible.
	Jun 05 2023 04:21 PM	It's the crown jewel of our town and I love it. Weeds have been terrible this year but pretty bad each year. It affects the ability to swim and enjoy the water. Open to ways to help keep them in check. Thank you!
	Jun 05 2023 12:56 PM	Some people call it Weed Lake

	Jun 05 2023 12:23 PM	Those of us who live on the lake, especially the Main Street side, have seen a sharp increase in lake weeds coming ashore. In normal circumstances, I can handle the weeds but this year has been unprecedented in the amount of weeds coming ashore. In my 37 years here, I have never seen so much lakeweed coming ashore. So much so, Phils Beach has closed the deep water area with all the inflatables because of the weed problem. We need help from the village on this. The weed cutter has either been not collecting the weeds they cut, or there is some other factor I am not aware of, either way, it would be nice if the village could send the weed cutter over to our properties as they did with Phil's Beach and Lakepointe townhomes to collect the weeds they are not collecting during the mowing process. If you wish to speak with me (and I hope you do) my number is 847-845-0285. Thank you.	
	Jun 05 2023 12:14 PM	Please get rid of the massive amount of weed growth! Also, please have the harvester pick up cut weeds and not let float to shoreline off Bangs Lake. Thank you.	
	Jun 05 2023 11:55 AM	Something nee ds to be done to reduce seaweed and algae. Entire lake should be sprayed with seaweed killer. Weed cutting machine is a waste	
	Jun 05 2023 11:36 AM	This year the floating weeds are out of control. Its hard for boats in there slips to get out because the weeds are wrapped around out motors.	
	Jun 05 2023 10:38 AM	Way too much seaweed. We cant even use the beach	
	Jun 05 2023 10:29 AM	This year weeds are unbearable while kayaking, boating or wanting to walk into the water. Very unhappy with quality.	
	Jun 05 2023 09:39 AM	Lots of plant growth in the lake this year. When the Village cuts the growth it should also collect and dispose of. Continue aggressive responsible plant growth management.	
	Jun 05 2023 09:33 AM	Would consider re-upping Phils beach membership if the lake was not so full of seaweed.	
Boat Traffic/Overcrowding Concerns			

	Jun 25 2023 03:34 PM	Please keep in no wake till 10:00 am once powerboats start making wake other recreational activities become impossible. The no wake buoys only offer a slight â€œbufferâ€ and most times the power boats hug the buoy line anyway.	
	Jun 25 2023 10:49 AM	The lake is getting busier and busier each year with motorized boats on the lake. I think there should be a cap on the amount of stickers for access to the lake each year.	
	Jul 13 2023 09:55 PM	Way over crowded how fast do you have to go around in circles! Give kayaks and fishermen more room	
	Jun 24 2023 05:38 PM	Overpopulated with boats. Way to small of a lake for the number or boats out at a time. Takes the fun out of using the lake	
	Jun 06 2023 10:20 PM	Too many boats unsafe, its very dangerous out there with many inexperienced boaters, tubing and skiers are in danger in a small area. Need more patrol holding people responsible.	
	Jun 05 2023 08:37 PM	Too many fast boats	
	Jun 05 2023 07:28 PM	Boat traffic is out of control. The lake is constantly stirring from boat wakes, too much energy and nowhere to release it. It is not an acceptable boating lake with the traffic levels. The village must limit pubic use, this lake is the gem of the community - don't monetize it and ruin the lake because there is a belief that local businesses will benefit. This is erroding the quality of the lake and the experience for tax payers.	
	Jun 05 2023 05:23 PM	Boat traffic needs to be monitored more effectively. In general too much boat traffic.	
	Jun 05 2023 02:48 PM	The boat mooring is out of hand we have to many boats being moored to far out.	
Circle Channel/Island Channel Concerns			
	Jun 26 2023 08:19 AM	The circle channel is degrading rapidly and is in extreme need of dredging	

	Jun 25 2023 02:56 PM	The duckweed in the circle channel is horrible and getting worse each year. We would enjoy living on the channel much more is there wasn't the green scum on the water from May through October.
	Jun 24 2023 09:47 AM	Maintaining depth of the circle channel gives all boaters a unique quiet place to observe wildlife and a prime fishing area without the noise and wakes. Also, wakeboarding is destroying the shoreline, degrading the experience for other boaters and creates dangerous conditions for small craft like canoes and paddle boats.
	Jun 23 2023 09:57 PM	The circle channel is part of the lake and I pay taxes as if lake front. They need to clean the channel up for wildlife and boats
	Jun 23 2023 07:35 PM	The channel needs help it's starts to smell its gross water doesn't move
	Jun 06 2023 02:41 PM	The island channel is quickly becoming too shallow to navigate and extreme weeds on and below the surface need to be addressed before it canâ€™t be fixed.
	Jun 06 2023 08:53 AM	The weeds and growth are out of control. The channel is so shallow can hardly get in and out along with edges of the lake that we anchor at. The mouth of the channel is so shallow it's hard to get in and out and have to reverse the motor and take off weeds each time in and out. The entrance to the channel is only safe for one boat to go through due to the growth and depth of the water. Spoke to others in area and talked about history and it being dredged at the opening. Also spoke about how the channel used to be clear enough to jump and swim in. Now the whole spring and summer will be covered in algae. Sure is beautiful in the middle of the lake when the weed piles aren't going by, but also understand this year is different because of the lack of cold weather and ice. We do need to keep this attraction clean and beautiful. The whole reason we moved here was for the lake alone.
	Jun 06 2023 07:37 AM	Channels need help
	Jun 06 2023 03:14 AM	Back in the Chanel which is Northeast corner the alge is very bad. Starting to stink.
	Jun 06 2023 12:34 AM	Channels that flow into Bangs are silted in resulting in lower fish spawn habitat

	Jun 05 2023 05:05 PM	What can be done to prevent Circle Channel from further erosion? It is at times almost impossible to navigate due to very shallow waters	
	Jun 05 2023 12:58 PM	The circle channel is used by many boaters and it isnâ€™t fair that the residents in the channel are the ones who have to raise money to keep the channel navigable. It is part of the lake. Dredging needs to occur soon to sustain it. The village and bangs lake advisory committee need to ensure itâ€™s taken care of. Recently we have seen a rise in wildlife on our property that we have never seen before. (Muskrats, snapping turtles).	
Education Needed			
	Jun 27 2023 09:02 PM	Help inform people new to the area that are not conservation minded to help us maintain and improve the quality of the environment we share. Also a class or instruction in schools to educate our children on helping improve the health of our treasure we call Bangs Lake	
	Jun 24 2023 09:18 AM	need to educate people on kayaks and boats on how far to stay away from fisherman on the water and from docks. Lake is getting shallower with sediment and requires longer docks.	
	Jun 08 2023 10:05 AM	Being a boat owner using Bangs Lake I would like more information concerning lake water quality and evasive water plant management.	
	Jun 06 2023 04:32 PM	I am very happy with it, but would definitely like to see people educated so it can be sustained for wildlife and human enjoyment.	
	Jun 06 2023 04:25 PM	I would love for Musky to actually exist in the lake. I also would enjoy additional information how my family can help how to manage the lake. This could be clean up days, help counting fish, perhaps weed removal day, etc.	
Geese			
	Jun 06 2023 08:08 AM	Hate to say it, but the geese are terrible. Poop all over our lawn and at our neighborhood beach. I would never want to swim at the beaches. It just grosses me out. We boat and are only in the water way offshore. We absolutely love living on the channel, though, and love the lake. Weeds are the worst ever this year and not sure how difficult it will be to take the boat out. Havenâ€™t seen the harvester down the channel in years. Thank you for the survey!	
	Jun 05 2023 10:51 AM	Geese seem to be multiplying each year. Are there natual deterrents? Thanks	

Harvester Concerns			
	Jul 13 2023 04:50 PM	Mechanical harvesting has not been adeguate.	
	Jun 24 2023 06:45 AM	When the seaweed is cut by official cutter or passing boats, it all washes onto our shore, and it is heavy and stinking and A LOT of work to remove by ourselves	
	Jun 08 2023 09:00 AM	Mechanical harvesting simply cuts invasive seaweeds and the pieces that are not collected sink and propagate all over again. We absolutely need to continue to use EPS-approved herbicides. The Villages cost share program is a big help keeping invasives under control.	
	Jun 07 2023 02:51 PM	Harvesting milfoil actually makes it worse Cutting milfoil spreads the seeds I have lake property in Wisconsin and we only use chemicals to treat milfoil Not cutting allowed	
	Jun 25 2023 12:28 PM	The harvester seems to harvest willy nilly. Put the harvester on a schedule & publish the schedule. Have the harvester focus on areas that are 4-10' deep, or some criteria like that. Have some no harvest areas where weeds and critters can thrive, such as do not harvest from the buoys to 25' out. That will give a buffer zone. Recommend/or rent tools that homeowners can use to clear near-shore areas, such as https://products.bestreviews.com/best-lake-weed-roller	
	Jun 06 2023 08:08 PM	I feel that is essential to have a weed control plan for the lake. Unfortunately the weed cutter is not efficient. Home owners are buried in weeds left by the weed cutter. I am not sure if there is a more efficient cutter available but the old one thatâ€™s working on the weeds now does a horrible job. I know there are concerns about spraying however until we have a weed cutter that works to remove all the cut weeds we are simply adding to the weed growth. By developing a lake wide spraying problem to control the weed growth we could alleviate the problem. We have participated with the cost sharing as homeownersâ€¦ however there are many people that have boat slips on the lake that are not sharing the cost or the work involved with weed removal. Please consider getting advice from EPA on the safety of the sprays on the market. If there is a safe and effective treatment it would be better to treat the entire lake with the same product. There is real danger when individuals choose their own chemicals to treat their weeds. Thank you for trying to find a solution!	

	Jun 06 2023 05:03 PM	Im not sure the weedcutter we have is affective. I think there is better ways.	
	Jun 05 2023 05:12 PM	The mechanical cutter cuts but rarely picks up. It's difficult to kayak slugging throughout the floating cut grass. When the cutter doesn't pick up the wind pushes the grass onto our HOA property. We then have to rack it, pile it on our shoreline and then pay to have our lawn service pick it up. We pay taxes for the cutter but then have to pay again to have it removed. In my world that's ridiculous.	
	Jun 05 2023 01:51 PM	Need to get the weeds under control or boaters (money) will go elsewhere. The weed cutter is not being efficiently run - you should have an off load point at Mamons 1 beach and work that side of the lake exclusively in a given day - currently the weed cutter fills up and then takes a leisurely boat ride to the off load point - not efficient and just burns up tax dollars - you also need to start monitoring number if full loads removed from the lake and post that information daily - there are enough of us on the lake that can monitor that number as well. Also the full fledge police officer is overkill - in the past they were community members doing this role - bring back the cheaper community member option - in the absolute rare event of a problem on the water - the community member can radio a police officer to meet them at the dock. Also why have a police office at the lake at 7am on a Monday - complete waste of money. As the village seems strapped for cash - this would be your starting pointâ€¦.	
	Jun 05 2023 12:58 PM	While I know there is a mechanical weed harvester, I have rarely seen it in action. We weeds are out of control and essentially a danger to swimmers and boats. The number of swimmers itch reported is quite excessive as well. Philâ€™s beach was closed a significant amount of days last year due to poor water quality	
	Jun 05 2023 10:16 AM	Why the seaweed cutter isnt/doesn't seem to be collecting its clippings	
	Jun 05 2023 09:58 AM	Canâ€™t enjoy the lake. Out there daily dealing with weeds/harvest cuttings :(	
	Jun 05 2023 09:23 AM	I've lived on the lake for 40+ years and the seaweed has never been this bad. We get approximately 5 ft of weeds floating onto our shore daily. It takes half a day to rake the weeds up and we have nowhere to put the weeds The village needs to address this asap. It's really bad!	

Lake Access			
	Jul 18 2023 10:16 PM	The park district piers are in terrible condition	
	Jun 14 2023 03:20 PM	So much of Bangs Lake is privatized to individual homeowners, making it something very few people can access aside from via Park District means. If there were properties or land within reason to purchase or annex that would allow for more public access, I believe that would benefit everyone.	
	Jun 12 2023 08:43 PM	I wish there was a public pier to be able to dock the boat and shop/eat locally. Currently you can only dock and eat at Lindy's pier.	
	Jun 10 2023 08:29 AM	Most of the lake access is private, and Wauconda does not take great advantage of what we have. The Wauconda Park District Beach House is an absolute waste of prime lake front real estate that could be used for a development that would draw people to the lake like Lindy's. We need more lakefront dining/lounging area for people to have access to the spectacular views of the lake	
	Jun 07 2023 01:43 PM	Loading ramp at beach park is very shallow near end of pier making it very hard to get my boat in and out especially with low lake level. Weeds are so thick at the piers of beach park that lately it gets so tangled on my steering rudder that I can't turn my wheel.	
	Jun 06 2023 04:53 AM	More public access	
	Jun 05 2023 04:45 PM	Why park district doesn't care about weed in launch ramps	
	Jun 05 2023 04:36 PM	The handicap/fishing pier is a disgrace. It has needed painting and cleaning for years. Please take care of the areas that people use.	
	Jun 05 2023 11:20 AM	Last time we were in lake, had leaches. Maybe control that. Also better access to lake would be nice to non residents	
	Jun 05 2023 10:31 AM	Make public access more available	

	Jun 05 2023 11:01 AM	The new park district launch (Wauconda Boat) should have the same launch passes as the other launch near Middeltons. The launch pass should be good for both locations.	
	Jun 05 2023 09:53 AM	This survey didn't really address my questions or concerns about the lake. We like to say that the lake is an important part of Wauconda, but unless you live on the lake, there is really very limited ability to use or enjoy the lake. Very limited public access. It's a small lake, so I get it, but it really isn't a selling point for Wauconda given houses surround most of it. If there was the ability to open it up more, maybe could be used to attract people and businesses like in other cities or towns.	
Lake Management Concerns (muliple issues)			
	Jun 25 2023 07:18 PM	Take on the annual aquatic weed control financial and by directing the company doing the chemical treatment process to get them on task at the right time. Also to get the harvesting program in a supportive manner and to coordinate and assist the weed treatment process.	
	Jun 24 2023 12:46 PM	The lake needs someone to make sure boaters are not anchoring in the outside traffic pattern. And that everyone is operating safely. I donâ€™t think it necessarily needs to be a police officer. When yearly boat passes are given the rules should be reviewed with everyone. The lake should NEVER be closed. When the lake level is high people should be able to kayak and paddle board. People can swim and everyone does this at their own risk. Non motorized vessels can also participate in water activities at their own risk. Do not close the lake when water level is high.	
	Jun 24 2023 09:02 AM	I have friends that live on another lake that used enzymes to treat lake weeds and it worked great. Did not appear to negatively impact the fish or wildlife.	
	Jun 24 2023 08:58 AM	I live in LVVA and years ago the association would buy sand and drop it on the ice. When the ice melted the sand sunk to the bottom and there was now a soft bottom rather than sharp rocks and weeds.	
	Jun 10 2023 11:49 AM	Lived in the area my whole life. Forty plus years. The lake hasnt changed much- however the diversity of fish has somewhat. On the decline side. The weeds are necessary as long as theyre native. Although personally I remember the best years of fishing were heaviest in Eurasian milfoil. But I also understand its impacts on natural vegetation. I am thoroughly against the use of herbicides to control weeds. Some years (like last year) it was grossly over used- causing nearly 6 weeks of murky water and no cover for smaller fish- which depleted future generations of fish. It cant be all	

		about fishing I understand- however boaters (which I am) complain to much about weeds and algae- only to go back home to their well manicured and over fertilized lawns. There should be a healthy relationship between the two groups and the community at whole.
	Jun 09 2023 02:26 PM	Protect native aquatic plant species.
	Jun 08 2023 02:24 PM	I wish there was someway to keep the lake healthy without herbicides. I used to love to fish there. I dont anymore. Opening the lake up to everyone has made it crowded and dangerous in my opinion.
	Jun 08 2023 09:08 AM	Biggest issue is your use of aquatic chemicals has been poorly executed by poorly managed company just dumping diaquat and aquathol years past rather than broadcasting effectively. The optics were terrible. Runoff from storm sewers goes into the lake unchecked as there are no functional cisterns in the storm sewers. The lake also has too many rental slips for a lake this size that block water flow and lead to beach closures due to bacterial build up from goose shit and dog waste that no one seems capable of picking up and disposing of properly. Overall Iâ€™m tired of cleaning the beach of seaweed but I understand the decisions the town has made and feel they have let people see what it looks like if they lay off the chemicals in a year where aquatic weeds have thrived everywhere not just Wauconda.
	Jun 07 2023 04:48 PM	You need to spray the lake to kill the algae and not just harvest it. Also the fertilizer plays a big part in the growth of the Algae
	Jun 06 2023 04:05 PM	Its is a vital piece of wauconda and needs to be managed better!
	Jun 06 2023 03:54 PM	This year, I am hoping is just an unusual year because of our mild winter and lack of rain, the seaweed is out of control. Now that the weed eater has been out and about things seem to be improving. Would like to see a plan in place for utilizing the weed eater more consistently to help control the seaweed issue.
	Jun 06 2023 11:21 AM	An easier way to see if bangs lake is open and water quality. Also would like to know the water temperature daily.
	Jun 06 2023 08:23 AM	Too much seaweed which gets caught in the motor of boats causing damage. Erosion on the shoreline which is very unhealthy and makes it difficult to get into your kayak or use the beach. It smells so bad. Its just horrible!!!! Needs to be addressed. Should be high priority. Eating at Lindyâ€™s and smelling that horrific smell is just awful!!!

	Jun 06 2023 08:16 AM	Spend some money to fix problems on Lake
	Jun 05 2023 06:31 PM	We have seen the weed cutter 2 times! That needs to be done daily. Also the channels and bays need to be dredged. Flooding is a problem due to large homes being built in what was wetlands. Large homes are placing large rocks along shore line, which we were told, was not allowed. We were told that can not be any changes to the shoreline. This leads all people living in LVVA that money talks with this village!!
	Jun 05 2023 05:59 PM	Stop putting chemicals in our lake and let the lake level be higher than it is currently kept with the water outflow sysyem
	Jun 05 2023 11:14 AM	Get a metered water level monitor so we can check it. The Lake is the JEWEL of Wauconda. The bridge/channel over Liberty east of Docks always looks BAD. Iâ€™d support improvements to keep the algae from the Forest Preserve wetlands from entering the lake from that area. Also some algae/weed remediation there is needed.
	Jun 05 2023 09:38 AM	With the wind predominantly blowing from west to east, 90% of the time for the past 40 years we have been here, our HOA beach gets all the weeds that our residents have to rake up and pay to remove. The Village should go back to a once a week pick up of the weeds and not leave it to the residents to have to pay for. We also need stricter enforcement of the no wake after sunset rule, but not sure how to enforce that since the police boat is off the water at 7:00 PM. Can something be done about the geese? The beaches are full of geese excrements that is extremely unsafe for human health not to mention the droppings are everywhere and disgusting.
Park District Kudos		
	Jul 13 2023 05:18 PM	The park district does a WONDERFUL job Everyone I've had to deal with is very professional a polite. Mark is top notch a doing a fantastic job. NEVER had any problems with anyone associated to the park district. Marine units keep a tight but friendly atmosphere very professional. Thanks for asking my opinion.
Policing Concerns		
	Jul 15 2023 01:26 PM	Marine police unit should act only when needed. No need to bother easy going paddlers.

	Jul 14 2023 11:38 PM	Does not seem fiscally responsible to maintain two (2) Police Marine Patrol boats for one day (fire works). One boat is sufficient.	
	Jun 05 2023 09:48 PM	Having the lake patrolled by a police officer is unnecessary. The money used for this position could be used to maintain the lake. And when someone conducts the safety check on boats maybe a review of the rules of the lake. I frequently see misuse of the lake and feel that someone is going to get hurt. The lake should never be closed!!! People can use it at their own risk and paddle boarders, kayaks should be able to use even when lake level is high. The seaweed this year is the worst Iâ€™ve ever seen. The weed cutter spends hours trying to cut and then spends over an hour making its way across the lake to unload. If we want to maintain the lake the number of boats should be limited. Increase the cost of all the slips and make Lindyâ€™s, the park district and wauconda boat have to pay to maintain the lake as well.	
Rules			
	Jul 13 2023 05:45 PM	We need to extend the amount of time a boat can be moored on the lake	
	Jun 23 2023 08:32 PM	Teach the rules and proper etiquette of how to operate a watercraft. Do Not Park watercraft in â€œtravel laneâ€ for skiers/tubers to go around. Watercraftâ€™s that park in the travel lane make it difficult to operate safely.	
	Jun 19 2023 10:56 PM	Daily visitors should receive rules and regulations when launching I.e. speed limit, don't fish on private beaches,don't bang into the piers of property owners when fishing,travel counterclockwise,etc.	
	Jun 23 2023 11:58 PM	Close the lake to non residents. Outside vessels are routinely introducing invasive species to the lake at irreversible levels.	
	Jun 17 2023 07:51 AM	The current wake restriction is 10 - sunset. Sunset is difficult to perceive and changes. An easier to enforce restriction would be 10 - a specific time, such as 6:30 or 7:00. Many people get on the lake to enjoy the beautiful sunset. Restricting wakes would allow the viewing to be more enjoyable.	
	Jun 16 2023 10:00 AM	limit boats in certain times....make 1 day a week for fishing with no boating as fun driving ,limit jet skis certain times	

	Jun 30 2023 02:01 PM	If paying for use of the lake with canoes/kayaks, should be able to leave them at the beach year round like we used to be able to, it's a big hassle to have to remove them and bring them back every year. Otherwise the beach and lake are great!
	Jun 11 2023 09:24 AM	I think it's time to manage the number of slips on the lake, including cans for mooring boats and location of cans. It appears each HOA and business can have an unlimited number of slips, this should be regulated the same as the individual homes around the lake.
	Jun 09 2023 07:11 AM	The number of boats on Bangs Lake is becoming unsustainable. At some point the village will need to find ways to limit the number of slips at public/business marinas. Perhaps charging more for larger boats and wake setting boats will help to curb the chop on the lake on busy days. This could help with erosion as well.
	Jun 09 2023 05:59 AM	Bouys are too far out decreasing usable area
	Jun 08 2023 05:02 PM	Stop letting new home builders cut so many trees down on the lake front to build obnoxious home and condos. This may also contribute to extra runoff with the tree roots no longer soaking up lawn runoff including pesticides from lawn care. Plus the lake just looks better with more trees than condos.
	Jun 07 2023 09:11 PM	We should limit the amount of boats that use the lake. Too many for the size of the lake
	Jun 08 2023 07:22 AM	A rapidly increasing disregard for wake hours is problematic, and police presence is noticeably declining. People are at full throttle long before 10AM and almost flaunt it.
	Jun 07 2023 08:04 PM	We are concerned about organizations like the Barrington boat club offering non-residents boats to rent and use on Bangs. Often these boaters do not understand the value the lake has to our community, do not follow basic lake rules, and should be required to participate in training (perhaps a video before they could take the boat out?) Thank you for this opportunity to share concerns :)
	Jun 07 2023 06:55 PM	Creel limits e.g. catch and release only for bass, makes it illegal for those who like to keep some for dinner. It wasn't like that when we moved and purchased on the lake!
	Jun 07 2023 07:26 AM	Do what Lake Zurich did and dont allow wave runners. The lake is too small. Also no wake after 2 PM on Sunday in the summer just like Crystal Lake. Thanks!

	Jun 07 2023 07:09 AM	Limit non resident boaters. Limit boats until weed control is taken care of and until we get more rain	
	Jun 06 2023 04:30 PM	Weeds are currently terrible, and can damage boat motors. Also, why can't the no wake zone be changed to earlier in the day (like 8:00 AM) two to three days per week? Waterskiing at 10AM is no good because the wind/waves have already picked up.	
	Jun 06 2023 02:30 PM	There are way too many boats allowed on our lake. It should be restricted to residents only	
	Jun 06 2023 02:30 PM	Better control of lake front management ordinance. And geese control	
	Jun 06 2023 09:38 AM	Close the lake to non residents. Major contributor to Bangs decline is outside boats with unwashed hulls introducing invasive species to the lake.	
	Jun 06 2023 05:39 AM	Consider lifting the No wake earlier a few days a week for water sports. There should be an opportunity to take advantage of smooth water to ski or wakeboard.	
	Jun 05 2023 02:37 PM	Non-residents should be charged a much higher mooring fee at the marina and higher daily launch fees.	
	Jun 05 2023 02:17 PM	I am hearing more and more about residents paying for pool access in other communities because of the contaminated water and swimmers itch. If we cant keep the water clean enough for swimming and water sports, no one will want to visit our beaches. Lets make Bangs Lake the jewel she used to be.	
	Jun 05 2023 10:02 AM	I am happy to see importance being placed on this topic. I wonder about wake boats and if they should be limited (two at a time?). Iâ€™ve got to think they exacerbate erosion issues, among other things.	
	Jun 05 2023 09:41 AM	Please ban wake boats on Bangs Lake. Huge contributor to shore erosion and also makes boating pretty unpleasant for others on a small lake.	
Sediment Concerns			

	Jun 24 2023 12:19 PM	The spillway on Sheridan rd is contributing to sediment added to lake. It has not been maintained as promised by the village years ago	
	Jun 24 2023 02:02 AM	Channels need to be dredged. Channels need rip rap rock. Special assessment to tax bill to fix channels the right way.	
Shoreline Concerns			
	Jul 10 2023 06:12 AM	Don't plant native plants on shoreline. Look at park district boardwalk by fishing piers as an example of how it would end up. That area is all weeds, trees growing wild, garbage collects in it. The village will not maintain the shore line after the native plants are planted and shoreline will end up a bunch of weeds, trees and garbage. Please look at Toxic algae by blooms in lake. They develop by park district fishing piers and along shore line between the piers. The park district uses fertilizer which ends up in the lake, maybe that is why algae blooms develop in that area.	
	Jun 24 2023 07:59 AM	Shoreline erosion is a problem due to wakeboarding, channels are filled with sediment, invasive weeds need pulled at roots by divers, not harvested or sprayed	
	Jun 06 2023 07:13 AM	need easier permitting process to install seawalls to prevent erosion	
	Jun 05 2023 09:25 AM	I don't want the village to plant anything on my land.	
Water Levels Concerns			
	Jul 14 2023 11:50 AM	Water level control bars need to be raised and left alone for self-leveling management. The Public Works needs to keep the control bars up! The automatic raising & lowering doesnâ€™t work. This year, the control bars were low, draining the lake and we have a severe drought resulting in extremely low lake levels, which promotes dense weed growth. Itâ€™s time to rewrite the water level procedure to keep the control bars raised, welded in place and allow self-leveling, which permits water to flow past while maintaining higher water levels.	
	Jul 14 2023 11:36 AM	concerns with the Wauconda Public Works management approach with the lake level. the automatic control bars to raise/lower do not work. self-leveling principles were discussed years ago for effective management and need to be revisited to maintain the lake levels (especially in the case of drought). low water levels	

		contribute to the weed growth in the lake. maintaining higher water levels will resolve many issues.
	Jun 27 2023 02:30 PM	Please use foresight in managing the lake level. June, July and August are usually always very dry. We now have 2 inches of water at our seawall. If this keeps up our boat will be sitting on the lake bottom. We need more foresight in managing the lake level prior the summer dry season. The lake level can always be managed after rains if we are lucky enough to get them during these months. The number of boats on the lake has been ever increasing with boats dropping anchor closer and closer to private property and "Partying". Taxes keep going up, but quality of life is decreasing.
	Jun 24 2023 08:38 PM	No closing the lake when water level is high. Non motorized vessels should be allowed at all times. Itâ€™s a short season. We donâ€™t need a full time officer on the lake. They should be there on weekends when itâ€™s busy and stress safety. During boat registration tell people rules. Prevent people from anchoring in outside traffic pattern of lake.
	Jun 24 2023 12:37 AM	There needs to be a better monitoring system in place for managing the water level so flooding does not affect and ruin the lake front properties.
	Jun 12 2023 01:34 PM	Aside from the current drought, the seems to be kept below natural levels. The lake should be grated with bacteria and enzymes to help reduce muck.
	Jun 05 2023 04:25 PM	Prefer maintaining a higher water level throughout the year
	Jun 05 2023 02:05 PM	The lake level was lowered too much this year. In addition, the weeds are horrible.
Water Quality Concerns			
	Jun 24 2023 03:39 PM	Just want to be able to swim in the lake without having to deal with hi bacteria fears and ears hurting afterwards-needing to be cleaned out with swim ear. Thanks
	Jun 14 2023 06:12 AM	Alert Residence when water quality is poor for swimming. Avoiding swimmers itch..due to drought & geese droppings. Test the water & close the beaches.

	Jun 09 2023 03:35 PM	I worry about the water when people post things about the excessive plant growth or swimmer's itch - makes me question using the lake to kayak	
	Jun 06 2023 08:47 PM	We wish we could enjoy the beach/water in our neighborhood.	
	Jun 06 2023 03:15 PM	We love the lake and the park district beach! I think it gets interesting when the park district beach gets closed due to bacteria but Lindy's and other beaches stay open and its the same water.....seems strange.	
	Jun 06 2023 10:48 AM	In the over 40 years I have been coming to bangs lake & 29 Ive lived here, ve never seen the lake this bad.	
	Jun 06 2023 10:26 AM	I think residents should be given more information on swimmers itch, and how to deter the parasites in our local beaches.	
	Jun 06 2023 09:35 AM	It's not a "lake" - it's a dirty, disgusting septic pond.	
	Jun 06 2023 09:14 AM	I would love to swim in the lake with my children. I used to. I am very hesitant to do this as I keep hearing about people getting rashes after swimming in the water.	
	Jun 05 2023 10:40 PM	I live in liberty lakes. I would like to get a pass to Phils beach, but swimmers itch is a concern. If the water quality is bad, I will not be getting a pass for my 3 children. Swimmers itch is hard to handle and also takes weeks to get rid of. If you want us to use the beach, make the beach usable.	
	Jun 05 2023 12:41 PM	Testing for bacteria that causes swimmers itch should be done daily to inform families before swimming	
Zebra Mussels Bad			
	Jun 25 2023 11:02 AM	Got to do something about the zebra mussels. Used to be able to walk in the lake without water shoes, but now need them or Iâ€™ll get sliced by a zebra mussels.	
	Jun 25 2023 08:58 AM	Why are there so many clams in the lake. The shells make the sand sharp. When I started coming to the lake when I was 5 years old, there were no clams in the lake. How did this happen?	

	Jun 07 2023 07:10 AM	Seems to be an increase in mussels. Water quality has seemed extremely clear in early season, almost not natural, but fish seem to be less present in the last three seasons. Concerned with the overall impact of lake life with more recent vegetation and algae issues. Appreciate all your work looking into this.
	Jun 06 2023 01:37 PM	Are zebra mussels still an issue?
	Jun 05 2023 10:01 AM	Zebra mussels - I know there is very little that can be done to eliminate them, but I see them as a major threat to the recreational use of the lake (over seaweed). There has been good years and bad years for the the mussels, but when they are bad, they are everywhere. You can cut your foot on them growing on rocks. They cake up boat engines. What can be done? Circle channel - Over the decades, it is slowly filling in. It will eventually become unpassable unless something is done. Even if you don't live on the channel, I see it as a feature of the lake. It would be a shame if it were to be gone someday.

Q1 Valid email

Answered: 494 Skipped: 33

ANSWER CHOICES	RESPONSES	
Name	0.00%	0
Company	0.00%	0
Address	0.00%	0
Address 2	0.00%	0
City/Town	0.00%	0
State/Province	0.00%	0
ZIP/Postal Code	0.00%	0
Country	0.00%	0
Email Address	100.00%	494
Phone Number	0.00%	0

APPENDIX 11. Current Lake Management Costs

Appendix 11 – Current Lake Management Costs

Outlined below are the average annual lake-related costs that could be readily identified. This does not include any administrative staff time or use of Village or Park District trucks.

Cost analysis of lake management activities can be challenging. Some costs are direct, such as operation of the harvester, fish stocking or herbicide applications to control invasive and undesirable aquatic plants. Other costs, such as economic impacts from beach closures, individual projects by homeowners and shoreline maintenance are much more difficult to quantify.

	Estimated Costs
Total Current Costs	$252,700
Current Total Costs: Vegetation Harvesting	
Depreciated Cost of Harvester	$12,000
Operational Labor	$25,000
Maintenance/Repair (Parts)	$2,000
Maintenance/Repair (Labor)	$2,000
Insurance	$2,500
Shoreline Clean-Up	$118,500
Current Total Costs: Fish Stocking	
Fish Stocking	$3,200
Current Total Costs: Chemical Control of Aquatic Plants	
Lake Property Owners Costs	$17,500
Village Cost-share Program	$17,500
Current Total Costs: Policing/Enforcement	
Labor	$80,000
Boat (annualized)	$1,500
Operational Costs	$7,000
Maintenance	$5,000
Insurance	$2,500

*Highlighted costs are not assumed by the Village.

APPENDIX 12. Funding Sources

Appendix 12 – Funding Sources

Ensuring sustainable funding to manage Bang's Lake is crucial for its long-term health. Here are some strategies to help secure sustainable funding for lake management:

Fundraising Expertise:

Consider employing or collaborating with fundraisers with grant writing expertise who can identify funding opportunities and optimize revenue generation.

Dedicated Funding Mechanisms:

Special Tax Districts. Establish a special tax district dedicated to lake management. Property owners within the district pay an additional tax or fee to fund lake-related activities. This can provide a stable and predictable source of revenue.

User Fees. Implement or increase user fees for activities related to the lake, such as boat launch fees and fishing permits. These fees can be earmarked for lake management.

Membership or Subscription Models. Create a membership or subscription system where lake users pay an annual or monthly fee to access the lake and its amenities. This can help generate ongoing revenue.

Grants and Partnerships:

Seek Grant Funding. Explore state, federal, or local government grants that support environmental conservation and lake management initiatives. Private foundations are also a source for grant funding. A list of potential grant funding for Bangs Lake is shown in Table 1.

Nonprofit Partnerships. Collaborate with local or regional environmental nonprofits and conservation organizations. These entities may have access to grants, donations, and expertise that can support lake management.

Public-Private Partnerships. Work with private businesses or developers who have a vested interest in the lake's well-being. These partnerships can involve financial contributions or in-kind support.

Fundraising and Donations:

Community Fundraising. Organize community fundraising events, such as lake clean-up days, charity auctions, or benefit concerts, to raise funds for lake management.

Crowdfunding. Use online crowdfunding platforms to engage a broader audience and gather financial support from individuals and businesses.

Endowment Funds: Create an endowment fund dedicated to lake management. Funds from the endowment can be invested, and the interest or dividends generated can provide a steady income for lake management.

Regular Communication with Stakeholders:

Educate stakeholders. Educate stakeholders including property owners, local businesses, and the community, about the importance of sustainable funding for lake management. Building public support can lead to increased financial contributions.

Demonstrate Results. Regularly communicate the outcomes and successes of lake management efforts. Transparency and accountability can build trust among funding sources.

Create a Reserve Fund:

Set aside a portion of the budget as a reserve fund for unexpected expenses or emergencies.

Securing sustainable funding for lake management often requires a combination of strategies and a long-term commitment to financial planning. It's important to adapt your approach as circumstances change and to continually engage the community in supporting the lake's preservation and management efforts.

Table 1. Potential Grant Funding Sources for Bangs Lake.

Source	Grant	Due	Project Amount	Match	Purpose
ComEd	Green Regions	March 15th	Up to $20,000	50%/50%	Increasing the public's access to open space and encouraging their engagement with the project and creating active partnerships within the community
Illinois Department of Natural Resources (IDNR)	Illinois Habitat Fund	August 19th	$10,000 - $400,000	No match required	Funds to be used to preserve, protect, acquire and manage habitat for future generations.

Illinois Department of Natural Resources (IDNR)	Open Space Lands Acquisition and Development (OSLAD)	October 1st	Up to $1,725,000 for acquisition projects and $600,000 for development/renovation projects	50%/50% (100% for distressed communities)	Acquisition and development of public parks and open space
Illinois Department of Natural Resources (IDNR)	Land and Water Conservation Fund (LWCF) Grants	October 1st	No min/max	50%/50%	Buy land that will allow more public access to outdoor recreation opportunities close to home for residents.
Illinois Environmental Protection Agency (IEPA)	319 (h) Nonpoint Source Pollution Control	August 1st	$50,000-$450,000	60%/40%	Improved Water Quality by addressing non-point source pollution
Illinois Environmental Protection Agency (IEPA)	Green Infrastructure Grant Opportunity(GIGO)	21-Aug	$75,000 - $2.5 million	Minimum match 25% (15% for underserved communities)	Install stormwater management technique or practice employed with the primary goal to: preserve, restore, mimic or enhance natural hydrology
Lake County Stormwater Management Commission	Stormwater infrastructure Repair Fund (SIRF)	September 8th	$100,000	50%/50%	Resolve interjurisdictional drainage and flooding related problems (i.e., stormwater management system infrastructure needs) discovered through the Citizen Inquiry Response System and Flood Hazard Inventory process.
Lake County Stormwater Management Commission	WMB (Watershed Management Board) Cost Share Projects	September 8th	$20,000-$50,000	50%/50% Includes in-kind services	Projects that reduce flood damage, improve water quality and/or protect natural resources.

Lake County Stormwater Management Commission	WMAG (Watershed Management Assistance Grant)	Septemb er 8th	$12,000	!00% (no cost share)	Supports the management of local watershed partnerships and planning efforts that will help reduce flooding and improve water quality.
Midwest Glacial Lakes Partnership	Lake Conservation Grant	January 19th	$30,000-$100,000	50%-50%	Improve habitat for threatened fish species living in glacial lakes.
National Fish and Wildlife Foundation (NFWF) and the Wildlife Habitat Council (WHC)	5 Star and Urban Waters Restoration Grant	January 31st	$20,000-$50,000	50%-50%	Develop community capacity to sustain local natural resources through local partnerships focused on improving water quality, watersheds and the species and habitats they support.
National Fish and Wildlife Foundation (NFWF) and the Wildlife Habitat Council (WHC)	Monarch Butterfly and Pollinators Conservation Fund	Pre-proposal due early May. Proposal due July.	$50,000-$150,000	1:2 match (NFWF: Grantee)	Protect, conserve, and increase habitat for the monarch butterfly and other pollinators
Soil and Water Conservation District (SWCD) of McHenry and Lake Counties	Streambank Stabilization Restoration Program	Varies. Check with SWCD for details	Varies. Check with SWCD for details		Install vegetative, stone or other low-cost bio-engineering techniques for critically eroding streambank shorelines.

APPENDIX 13. Technical Data

Integrated Lakes Management Inc	Project: 2023 Sediment Testing		
110 Lebaron Street	Project Number: Bangs Lake	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	9/19/23 7:42	CB10424

Sample: Peninsula Channel

CB10424-05 (SO) Sampled: 08/28/23 13:30

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
% Solids	17.6		0.100	0.100	%	9/1/23 15:40	9/5/23 10:59	SBB	SM 2540-G 20ed	2
Metals										
Phosphorus, Total	0.043		0.0034	0.011	% dry	9/5/23 13:15	9/7/23 10:43	RAB	SW846 6010B	2

Sample: Kimball Channel

CB10424-06 (SO) Sampled: 08/28/23 14:20

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
% Solids	16.0		0.100	0.100	%	9/1/23 15:40	9/5/23 10:59	SBB	SM 2540-G 20ed	2
Metals										
Phosphorus, Total	0.031		0.0068	0.023	% dry	9/5/23 13:15	9/7/23 10:46	RAB	SW846 6010B	2

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Integrated Lakes Management Inc	Project: 2023 Surface Water Testing		
110 Lebaron Street	Project Number: Bangs Lake	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	9/7/23 12:19	CB10423

Sample Results

Sample: Bangs Surface

CB10423-01 (SW) Sampled: 08/28/23 11:15

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.034		0.0090	0.030	mg/L	8/31/23 15:52	9/6/23 10:30	AMR	4500-P F-1999	2

Sample: Bangs Deep

CB10423-02 (SW) Sampled: 08/28/23 11:15

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.098		0.0090	0.030	mg/L	8/31/23 15:52	9/6/23 10:31	AMR	4500-P F-1999	2

Sample: Circle Channel

CB10423-03 (SW) Sampled: 08/28/23 12:00

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.066		0.0090	0.030	mg/L	8/31/23 15:52	9/6/23 10:32	AMR	4500-P F-1999	2

Sample: Washington Channel

CB10423-04 (SW) Sampled: 08/28/23 12:40

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.060		0.0090	0.030	mg/L	8/31/23 15:52	9/6/23 10:33	AMR	4500-P F-1999	2

Sample: Berger Channel

CB10423-05 (SW) Sampled: 08/28/23 13:00

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.034		0.0090	0.030	mg/L	8/31/23 15:52	9/6/23 10:34	AMR	4500-P F-1999	2

Integrated Lakes Management Inc	Project: 2023 Surface Water Testing		
110 Lebaron Street	Project Number: Bangs Lake	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	9/7/23 12:19	CB10423

Sample: Peninsula Channel

CB10423-06 (SW) Sampled: 08/28/23 13:20

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.042		0.0090	0.030	mg/L	8/31/23 15:52	9/6/23 10:35	AMR	4500-P F-1999	2

Sample: Kimball Channel

CB10423-07 (SW) Sampled: 08/28/23 14:15

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.11		0.0090	0.030	mg/L	8/31/23 15:52	9/6/23 10:36	AMR	4500-P F-1999	2

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Integrated Lakes Management Inc	Project: 2023 Surface Water Testing		
110 Lebaron Street	Project Number: Bangs Lake (36 hour precip) 136616	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	8/23/23 10:04	CB09847

Sample Results

Sample: Kimball Inside

CB09847-01 (SW) Sampled: 08/16/23 10:50

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	10		0.036	0.12	mg/L	8/17/23 16:22	8/21/23 15:12	AMR	4500-P F-1999	2

Sample: Outflow

CB09847-02 (SW) Sampled: 08/16/23 10:35

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.17		0.0090	0.030	mg/L	8/17/23 16:22	8/21/23 14:08	AMR	4500-P F-1999	2

Sample: Circle

CB09847-03 (SW) Sampled: 08/16/23 09:35

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.31		0.0090	0.030	mg/L	8/17/23 16:22	8/21/23 14:09	AMR	4500-P F-1999	2

Sample: B/W

CB09847-04 (SW) Sampled: 08/16/23 09:20

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.027	J	0.0090	0.030	mg/L	8/17/23 16:22	8/21/23 14:12	AMR	4500-P F-1999	2

Sample: Bangs

CB09847-05 (SW) Sampled: 08/16/23 10:00

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.031		0.0090	0.030	mg/L	8/17/23 16:22	8/21/23 14:15	AMR	4500-P F-1999	2

Sample: Peninsula

CB09847-06 (SW) Sampled: 08/16/23 09:15

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Phosphorus, tot. as P	0.11		0.0090	0.030	mg/L	8/17/23 16:22	8/21/23 14:16	AMR	4500-P F-1999	2

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Integrated Lakes Management Inc	Project: 2023 Surface Water Testing		
110 Lebaron Street	Project Number: 7-25 Bangs	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	8/3/23 14:22	CB08538

Sample Results

Sample: 7-25 Bangs

CB08538-01 (SW) Sampled: 07/25/23 09:30

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Chlorophyll a, corrected	4.2				ug/L	7/27/23 12:33	7/28/23 12:30	SBB	10200 H-2001	2
Chlorophyll a, trichromatic	4.8				ug/L	7/27/23 12:33	7/28/23 12:30	SBB	10200 H-2001	2
Chlorophyll b, trichromatic	-0.15				ug/L	7/27/23 12:33	7/28/23 12:30	SBB	10200 H-2001	2
Chlorophyll c, trichromatic	0.27				ug/L	7/27/23 12:33	7/28/23 12:30	SBB	10200 H-2001	2
Pheophytin a	0.83				ug/L	7/27/23 12:33	7/28/23 12:30	SBB	10200 H-2001	2
Solids, tot. susp. (TSS)	4.9		1.4	1.4	mg/L	7/28/23 11:48	7/31/23 10:08	SBB	2540 D-1997	2
Nitrogen, Kjeldahl as N (unfiltered)	0.72		0.20	0.68	mg/L	7/28/23 13:46	7/31/23 9:59	WPV	EPA 351.2, Rev 2	2
Nitrogen, ammonia as N (unfiltered)	ND		0.039	0.13	mg/L	7/28/23 9:23	8/2/23 11:57	AMR	4500-NH3 G-1997	2
Nitrogen, NO2 + NO3 as N (unfiltered)	ND		0.052	0.17	mg/L	7/31/23 14:40	8/1/23 11:02	AMR	4500-NO3 F-2000	2
Phosphorus, tot. as P	0.023	J	0.0090	0.030	mg/L	7/26/23 16:33	7/31/23 10:36	AMR	4500-P F-1999	2
Phosphorus, dis. react. as P	0.0030	J	0.0030	0.010	mg/L	7/26/23 15:46	7/26/23 17:04	JDO	4500-P E-1999	2

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Integrated Lakes Management Inc	Project: 2023 Surface Water Testing		
110 Lebaron Street	Project Number: Bangs & Channels	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	7/17/23 12:39	CB07165

Sample Results

Sample: Circle Channel

CB07165-01 (SW) Sampled: 06/27/23 10:00

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Chlorophyll a, corrected	4.3				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll a, trichromatic	7.7				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll b, trichromatic	1.1				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll c, trichromatic	0.89				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Pheophytin a	5.4				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Solids, tot. susp. (TSS)	7.1		3.2	3.2	mg/L	6/30/23 12:11	7/3/23 11:40	SBB	2540 C-1997	2
Nitrogen, Kjeldahl as N (unfiltered)	1.5		0.20	0.68	mg/L	6/29/23 11:03	6/30/23 10:08	WPV	EPA 351.2, Rev 2	2
Nitrogen, ammonia as N (unfiltered)	ND		0.039	0.13	mg/L	6/30/23 15:22	7/5/23 14:38	AMR	4500-NH3 G-1997	2
Nitrogen, NO2 + NO3 as N (unfiltered)	ND		0.052	0.17	mg/L	7/6/23 9:28	7/6/23 18:23	JDO	4500-NO3 F-2000	2
Phosphorus, tot. as P	0.13		0.0090	0.030	mg/L	6/28/23 17:39	7/3/23 11:35	AMR	4500-P F-1999	2
Phosphorus, dis. react. as P	0.017	Filt	0.0030	0.010	mg/L	6/28/23 15:00	6/28/23 15:21	SBB	4500-P E-1999	2

Sample: Washington Channel

CB07165-02 (SW) Sampled: 06/27/23 10:30

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Chlorophyll a, corrected	9.8				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll a, trichromatic	16				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll b, trichromatic	1.5				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll c, trichromatic	1.3				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Pheophytin a	9.1				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Solids, tot. susp. (TSS)	11		1.7	1.7	mg/L	6/30/23 12:11	7/3/23 11:40	SBB	2540 C-1997	2
Nitrogen, Kjeldahl as N (unfiltered)	1.7		0.20	0.68	mg/L	6/29/23 11:03	6/30/23 10:10	WPV	EPA 351.2, Rev 2	2
Nitrogen, ammonia as N (unfiltered)	ND		0.039	0.13	mg/L	6/30/23 15:22	7/5/23 14:39	AMR	4500-NH3 G-1997	2
Nitrogen, NO2 + NO3 as N (unfiltered)	ND		0.052	0.17	mg/L	7/6/23 9:28	7/6/23 18:25	JDO	4500-NO3 F-2000	2
Phosphorus, tot. as P	0.18		0.0090	0.030	mg/L	6/28/23 17:39	7/3/23 11:36	AMR	4500-P F-1999	2
Phosphorus, dis. react. as P	0.033	Filt	0.0030	0.010	mg/L	6/28/23 15:00	6/28/23 15:21	SBB	4500-P E-1999	2

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Integrated Lakes Management Inc	Project: 2023 Surface Water Testing		
110 Lebaron Street	Project Number: Bangs & Channels	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	7/17/23 12:39	CB07165

Sample: Berger Channel

CB07165-03 (SW) Sampled: 06/27/23 11:00

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Chlorophyll a, corrected	1.6				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll a, trichromatic	2.7				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll b, trichromatic	0.19				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll c, trichromatic	0.32				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Pheophytin a	1.7				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Solids, tot. susp. (TSS)	3.5		1.4	1.4	mg/L	6/30/23 12:11	7/3/23 11:40	SBB	2540 C-1997	2
Nitrogen, Kjeldahl as N (unfiltered)	0.88		0.20	0.68	mg/L	6/29/23 11:03	6/30/23 10:11	WPV	EPA 351.2, Rev 2	2
Nitrogen, ammonia as N (unfiltered)	0.10	J	0.039	0.13	mg/L	6/30/23 15:22	7/5/23 14:41	AMR	4500-NH3 G-1997	2
Nitrogen, NO2 + NO3 as N (unfiltered)	ND		0.052	0.17	mg/L	7/6/23 9:28	7/6/23 18:27	JDO	4500-NO3 F-2000	2
Phosphorus, tot. as P	0.053		0.0090	0.030	mg/L	6/28/23 17:39	7/3/23 11:37	AMR	4500-P F-1999	2
Phosphorus, dis. react. as P	0.031	Filt	0.0030	0.010	mg/L	6/28/23 15:00	6/28/23 15:21	SBB	4500-P E-1999	2

Sample: Peninsula Channel

CB07165-04 (SW) Sampled: 06/27/23 11:15

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Chlorophyll a, corrected	3.9				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll a, trichromatic	5.1				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll b, trichromatic	0.26				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll c, trichromatic	0.47				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Pheophytin a	1.8				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Solids, tot. susp. (TSS)	5.0		2.5	2.5	mg/L	6/30/23 12:11	7/3/23 11:40	SBB	2540 C-1997	2
Nitrogen, Kjeldahl as N (unfiltered)	1.2		0.20	0.68	mg/L	6/29/23 11:03	6/30/23 10:13	WPV	EPA 351.2, Rev 2	2
Nitrogen, ammonia as N (unfiltered)	ND		0.039	0.13	mg/L	6/30/23 15:22	7/5/23 14:42	AMR	4500-NH3 G-1997	2
Nitrogen, NO2 + NO3 as N (unfiltered)	ND		0.052	0.17	mg/L	7/6/23 9:28	7/6/23 18:29	JDO	4500-NO3 F-2000	2
Phosphorus, tot. as P	0.11		0.0090	0.030	mg/L	6/28/23 17:39	7/3/23 11:38	AMR	4500-P F-1999	2
Phosphorus, dis. react. as P	0.034	Filt	0.0030	0.010	mg/L	6/28/23 15:00	6/28/23 15:21	SBB	4500-P E-1999	2

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Integrated Lakes Management Inc	Project: 2023 Surface Water Testing		
110 Lebaron Street	Project Number: Bangs & Channels	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	7/17/23 12:39	CB07165

Sample: Kimball Channel

CB07165-05 (SW) Sampled: 06/27/23 09:00

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Chlorophyll a, corrected	2.0				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll a, trichromatic	3.8				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll b, trichromatic	-1.9				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll c, trichromatic	-2.5				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Pheophytin a	2.4				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Solids, tot. susp. (TSS)	7.9		3.6	3.6	mg/L	6/30/23 12:11	7/3/23 11:40	SBB	2540 C-1997	2
Nitrogen, Kjeldahl as N (unfiltered)	1.9		0.20	0.68	mg/L	6/29/23 11:03	6/30/23 10:14	WPV	EPA 351.2, Rev 2	2
Nitrogen, ammonia as N (unfiltered)	ND		0.039	0.13	mg/L	6/30/23 15:22	7/5/23 14:44	AMR	4500-NH3 G-1997	2
Nitrogen, NO2 + NO3 as N (unfiltered)	ND		0.052	0.17	mg/L	7/6/23 9:28	7/6/23 18:30	JDO	4500-NO3 F-2000	2
Phosphorus, tot. as P	0.20		0.0090	0.030	mg/L	6/28/23 17:39	7/3/23 11:39	AMR	4500-P F-1999	2
Phosphorus, dis. react. as P	0.046	Filt	0.0030	0.010	mg/L	6/28/23 15:00	6/28/23 15:21	SBB	4500-P E-1999	2

Sample: Bangs Lake

CB07165-06 (SW) Sampled: 06/27/23 12:00

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Chlorophyll a, corrected	1.1				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll a, trichromatic	2.0				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll b, trichromatic	-0.062				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Chlorophyll c, trichromatic	0.21				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Pheophytin a	1.4				ug/L	6/29/23 11:18	6/30/23 11:45	WPV	10200 H-2001	
Solids, tot. susp. (TSS)	ND		1.6	1.6	mg/L	6/30/23 12:11	7/3/23 11:40	SBB	2540 C-1997	2
Nitrogen, Kjeldahl as N (unfiltered)	0.63	J, MS_H	0.20	0.68	mg/L	6/29/23 11:03	6/30/23 10:23	WPV	EPA 351.2, Rev 2	2
Nitrogen, ammonia as N (unfiltered)	ND		0.039	0.13	mg/L	6/30/23 15:22	7/5/23 14:46	AMR	4500-NH3 G-1997	2
Nitrogen, NO2 + NO3 as N (unfiltered)	ND		0.052	0.17	mg/L	7/6/23 9:28	7/6/23 18:32	JDO	4500-NO3 F-2000	2
Phosphorus, tot. as P	0.017	J	0.0090	0.030	mg/L	6/28/23 17:39	7/3/23 11:39	AMR	4500-P F-1999	2
Phosphorus, dis. react. as P	ND	Filt, HT5	0.0030	0.010	mg/L	7/13/23 14:14	7/13/23 14:47	AMR	4500-P E-1999	2

Zooplankton Analysis Report **Job #:** 203281

Client: Integrated Lakes Management **Date collected:** 05/30/23
Project: Bangs Lake **Report date:** 06/12/23
Station: 1
Depth: Epi

Method reference: American Public Health Association (APHA) 1995. Standard Methods for the Examination of Water and Wastewater, 19th Ed. Method 10200.G.

Order	Suborder	Species	Concentration (#/L)	Relative (%) abundance
		Immature Copepods (Nauplii and copepodids)	1,290.0	41.0
Ploima		*Polyarthra sp.*	1,140.0	36.2
Cyclopoida		*Mesocyclops edax*	360.0	11.4
Calanoida		*Skistodiaptomus oregonensis*	150.0	4.8
Diplostraca	Cladocera	*Daphnia galeata mendotae*	150.0	4.8
Diplostraca	Cladocera	*Bosmina longirostris (O.F. Müller)*	30.0	1.0
Ploima		*Keratella cochlearis (Gosse)*	30.0	1.0
			3,150.0	100.0

608-963-4365 info@watersci.com
Water's Edge Scientific LLC S2756A County T, Baraboo, WI 53913

Algal Analysis Report **Job #:** 203281

Client: Integrated Lakes Management **Date collected:** 5/30/2023
Project: Bangs Lake **Report date:** 6/12/2023
Station: 1
Depth: Epi
Method reference: American Public Health Association (APHA) 1995. Standard Methods for the Examination of Water and

Division	Class	Species	Concentration (cells/mL)	Relative (%) abundance
Ochrophyta	Chrysophyceae	*Ochromonas sp.*	420,000.0	89.8
Cyanobacteria	Cyanophyceae	*Microcystis sp.*	40,000.0	8.6
Bacillariophyta	Bacillariophyceae	*Asterionella formosa*	5,200.0	1.1
Bacillariophyta	Bacillariophyceae	*Fragilaria crotonensis*	2,000.0	0.4
Cyanobacteria	Cyanophyceae	*Microcystis wesenbergii*	200.0	0.0
Chlorophyta	Trebouxiophyceae	*Oocystis sp.*	150.0	0.0
Miozoa	Dinophyceae	*Ceratium hirundinella*	50.0	0.0
Chlorophyta	Chlorophyceae	*Desmodesmus bicaudatus*	50.0	0.0
Charophyta	Klebsormidiophyceae	*Elakatothrix sp.*	37.0	0.0
Charophyta	Zygnematophyceae	*Cosmarium sp.*	12.0	0.0
		Totals:	467,699.0	100.0

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Integrated Lakes Management Inc	Project: 2023 Surface Water Testing		
110 Lebaron Street	Project Number: 5-30 Bangs	**Reported:**	**Work Order:**
Waukegan, IL 60085	Project Manager: Sandy Kubillus	6/9/23 17:15	CB05695

Sample Results

Sample: 5 - 30 Bangs

CB05695-01 (SW) Sampled: 05/30/23 10:00

Analyte	Result	Qualifier	LOD	LOQ	Units	Date Prepared	Date Analyzed	Analyst	Method	Lab Cert Code
Wet Chemistry										
Chlorophyll a, corrected	0.32				ug/L	6/1/23 13:41	6/2/23 11:56	SBB	10200 H-2001	
Chlorophyll a, trichromatic	1.1				ug/L	6/1/23 13:41	6/2/23 11:56	SBB	10200 H-2001	
Chlorophyll b, trichromatic	0.013				ug/L	6/1/23 13:41	6/2/23 11:56	SBB	10200 H-2001	
Chlorophyll c, trichromatic	0.19				ug/L	6/1/23 13:41	6/2/23 11:56	SBB	10200 H-2001	
Pheophytin a	1.3				ug/L	6/1/23 13:41	6/2/23 11:56	SBB	10200 H-2001	
Solids, tot. susp. (TSS)	ND		1.8	1.8	mg/L	5/31/23 16:48	6/1/23 12:24	PJG	2540 C-1997	2
Nitrogen, Kjeldahl as N (unfiltered)	0.65	J	0.20	0.68	mg/L	6/5/23 14:04	6/6/23 12:30	WPV	EPA 351.2, Rev 2	2
Nitrogen, ammonia as N (unfiltered)	0.054	J	0.039	0.13	mg/L	6/2/23 11:34	6/6/23 11:45	AMR	4500-NH3 G-1997	2
Nitrogen, NO2 + NO3 as N (unfiltered)	ND		0.052	0.17	mg/L	6/7/23 7:04	6/7/23 14:06	AMR	4500-NO3 F-2000	2
Phosphorus, tot. as P	0.016	J	0.0090	0.030	mg/L	5/31/23 17:36	6/2/23 15:17	AMR	4500-P F-1999	2
Phosphorus, dis. react. as P	0.012		0.0030	0.010	mg/L	5/31/23 16:38	5/31/23 17:30	SBB	4500-P E-1999	2

Sonar*

An Effective Herbicide That Poses
Negligible Risk To Human Health
And The Environment

Sonar*

An effective herbicide that poses negligible risk to human health and the environment

Sonar is a highly effective aquatic herbicide used to selectively manage undesirable aquatic vegetation in freshwater ponds, lakes, reservoirs, rivers and canals. Sonar is absorbed through the leaves, shoots, and roots of susceptible plants, and destroys the plant by interfering with its ability to make and use food. As with any substance introduced into the environment, concerns arise about possible harmful effects on humans who may come into contact with it, and about its effects on wildlife and plants that we wish to protect and preserve. The following discussion, presented in a "Question and Answer" format, provides information regarding Sonar and evidence that Sonar presents negligible risk[1] to human health and the environment when applied according to its legally allowed uses and label directions.

Q1. What are the legally approved uses of Sonar?

A1. Sonar has been approved for use by the U.S. Environmental Protection Agency (USEPA) since 1986 for the management of aquatic vegetation in freshwater ponds, lakes, reservoirs, drainage canals, irrigation canals and rivers. Five different formulations have been approved for use—an aqueous suspension known as Sonar* A.S. (USEPA Registration Number 67690-4) and four pellet forms known as Sonar* SRP (USEPA Registration Number 67690-3), Sonar* PR Precision Release (USEPA Registration Number 67690-12), Sonar* Q Quick Release (USEPA Registration Number 67690-3) and SonarOne* (USEPA Registration Number 67690-45). There are no USEPA restrictions on the use of Sonar-treated water for swimming or fishing when used according to label directions. The Agency has approved Sonar's application in water used for drinking as long as residue levels do not exceed 0.15 parts per million (ppm) or 150 part per billion (ppb). For reference, one (1) ppm can be considered equivalent to roughly one second in 12 days or one foot in 200 miles, and (0.1) ppm can be considered approximately equal to one second in 120 days or one foot in 2,000 miles.

Sonar's USEPA-approved labeling states that in lakes and reservoirs that serve as drinking water sources, Sonar applications can be made up to within one-fourth mile (1,320 feet) of a potable water intake. For the control of Eurasian watermilfoil, curlyleaf pondweed and hydrilla where treatment concentrations are 0.01 to 0.02 ppm (10 to 20 ppb), this setback distance of one-fourth mile from a potable water intake is not required. Note that these effective treatment concentrations are well below the 0.15 ppm (150 ppb) allowable limit in water used for drinking.

Local public agencies may require permits for use of an herbicide in public waters. Therefore, the Sonar label states that the user must consult appropriate state or local water authorities before applying the herbicide.

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[1] Throughout this document, we use the phrases "negligible risk" or "no significant risk." We use these terms because it is beyond the capabilities of science to prove that a substance is absolutely safe, i.e., that the substance poses no risk whatsoever. Any substances, be it aspirin, table salt, caffeine, or household cleaning products, will cause adverse health effects at sufficiently high doses. Normal exposures to such substances in our daily lives, however, are well below those associated with adverse health effects. At some exposure, risks are so small that, for all practical purposes, no risk exists. We consider such risks to be negligible or insignificant.

Q2. How does a product such as Sonar gain approval for use? (How does it become registered?)

A2. Federal law requires that an aquatic herbicide be registered with the USEPA before it can be shipped or sold in the United States. To obtain registration, manufacturers are required to conduct numerous studies (i.e., over 120 studies depending upon the intended uses) and to submit a thorough and extensive data set to USEPA to demonstrate that, under its conditions of use, the product will not pose a significant risk to human health and the environment and that the herbicide is effective against the target weeds or plants.

Individual states can establish registration standards that are more strict than federal standards, but not less strict.

Q3. What types of information must be submitted to regulatory agencies before an herbicide is registered?

A3. To register a herbicide, the manufacturer must submit information that falls into the following categories: product chemistry (for example, solubility, volatility, flammability and impurities), environmental fate (for example, how the substance degrades in the environment), mammalian toxicology (studies in laboratory animals used to assess potential health risks to humans), and wildlife and aquatic (for example, bird and fish) toxicology. If there are any residues in the environment, their levels must be determined. A manufacturer also conducts studies of product performance (or efficacy as a herbicide).

Q4. Have all of the data required for registration of Sonar been submitted to regulatory agencies, and have those agencies found the data acceptable?

A4. The data required for registration of Sonar by the USEPA is complete and has been accepted by the USEPA and by all states.

Q5. What happens to Sonar when it is used according to approved labeling—that is, what is its environmental fate or what happens to Sonar once it is released or applied to the water?

A5. Tests under field conditions show that Sonar disappears from treated water in a matter of weeks or months, depending on a number of environmental factors such as sunlight, water temperature and depth. In lakes, reservoirs, rivers and canals where only a portion of the water body is treated, dilution reduces the level of Sonar relatively quickly following application.

Sonar does not persist in the environment. Its disappearance from aquatic environments is accomplished by several processes. First, the plants that are being treated absorb Sonar, thereby removing a portion of it from the water. Second, Sonar degrades or breaks down in the presence of sunlight by a process called “photo degradation.” Photo degradation is the primary process contributing to the loss of Sonar from water. Third, adsorption of Sonar to hydrosoil (sediments) also contributes to its loss from water. As Sonar is released from hydrosoil back into the water, it is photo degraded.

Study results indicate that Sonar has a low bioaccumulation potential and therefore is not a threat to the food chain. Specifically, studies have shown that Sonar does not accumulate in fish tissue to any significant degree. The relatively small amounts of Sonar that may be taken up by fish following application are eliminated as the

Sonar levels in water decline. In a study of crops irrigated with Sonar treated water, no residues of Sonar were found in any human food crops, and only very low levels were detected in certain forage crops. Consumption by livestock of Sonar-treated water and crops irrigated with Sonar-treated water was shown to result in negligible levels of Sonar in lean meat and milk. Sonar-treated water can be used immediately for watering livestock.

To ensure that residue levels of Sonar pose no significant risk, USEPA has established tolerances, or maximum legally allowable levels, in water, fish, and crops irrigated with Sonar-treated water, and other agricultural products (including eggs, milk, meat, and chicken). For example, the 0.15 ppm (150 ppb) concentration in water mentioned in the answer to Question #1 is the tolerance limit for water that is used for drinking. The recommended application rates of Sonar (detailed on the label) are established to ensure the product will do its job and that tolerance limits won't be exceeded.

Q6. How might people come into contact with Sonar after it is applied to an aquatic site?

A6. People could come into contact with Sonar by swimming in water bodies treated with the herbicide, by drinking water from treated lakes or reservoirs, by consuming game fish taken from treated waters, and by consuming meat, poultry, eggs or milk from livestock that were provided water from treated surface water sources.

Q7. Is it likely that people will be harmed because of those contacts?

A7. Extensive studies have demonstrated that contact with Sonar poses negligible health risks when the herbicide is used according to label instructions. The label for Sonar carries no restrictions for swimming or fishing in treated water or against drinking water treated with Sonar. Sonar does not build up in the body.

The conclusion that Sonar poses negligible health risks is evidenced by USEPA's toxicity rating for Sonar. The USEPA classifies herbicides according to their acute toxicity or potential adverse health effects and requires that a “signal word” indicating the relative toxicity of the herbicide be prominently displayed on the product label. Every herbicide carries such a signal word. The most acutely toxic herbicide category requires the signal word DANGER. However, if the product is especially toxic, the additional word POISON is displayed. Herbicides of moderate acute toxicity require the signal word WARNING. The least toxic products require the signal word CAUTION. Sonar labels display the word CAUTION, the USEPA's lowest acute toxicity rating category.

Q8. How do we know that humans are not likely to experience any harmful effects from Sonar's temporary presence in the environment?

A8. Companies that develop new herbicides are required to: 1) conduct extensive investigations of the toxicology of their product in laboratory animals; 2) characterize the ways by which people may contact the herbicide after it has been applied to an aquatic site; 3) determine the amount of exposure resulting from these possible contacts; and 4) demonstrate the fate of the herbicide in the environment. Before USEPA will register a herbicide, the Agency must establish with a high degree of certainty that an ample safety margin exists between the level to which people may be exposed and the level at which adverse effects have been observed in the toxicology studies.

Investigations of the toxicity of Sonar have been performed in laboratory animals under a variety of exposure conditions, including exposure to very high doses for short periods (acute studies), as well as repeated exposures to lower doses (which are still far in excess of any exposures that humans might actually receive) throughout the lifetime of the laboratory animals (chronic studies). Other special studies have been performed to evaluate the potential for Sonar to cause reproductive effects, cancer, and genetic damage. Study results indicate a low order of toxicity to mammalian species following acute exposures and repeat-dose exposures for up to a lifetime. In addition, repeated doses of Sonar did not result in the development of tumors, adverse effects on reproduction or on development of offspring, or genetic damage.

In characterizing the toxicity of a compound and its safety margin for exposures of humans and wildlife, toxicologists attempt to identify the maximum dose at which a chemical produces no toxicity. Another way of stating this is how much of the chemical can an organism be exposed to before it reaches a toxic level (recall from the footnote to the introduction on page 1 that all substances are toxic at some dose or level). This maximum non-toxic dose is usually established by studies in laboratory animals and is reported as the "no-observed-effect level" or NOEL. The dietary NOEL for Sonar (that is, the highest dose at which no adverse effects were observed in laboratory animals fed Sonar) is approximately 8 milligrams of Sonar per kilogram of body weight per day, abbreviated 8 mg/kg/day. This NOEL was derived from a study in rats that were fed Sonar in their regular diets every day for their entire two-year lifetime.

To put this NOEL into perspective, a 70-kg adult (about 150 pounds) would have to drink over 1,000 gallons of water containing the maximum legally allowable concentration of Sonar in potable water (0.15 ppm) daily for a significant portion of their lifetime to receive a dose equivalent to the 8 mg/kg/day NOEL. At most, adults drink about 2 quarts (one-half gallon) of water daily, which means that even if a person were drinking water with the maximum legally allowable concentration of Sonar, their margin of safety would still be at least 2,000. Similarly, a 20-kg child (about 40 pounds) would have to drink approximately 285 gallons of Sonar-treated water every day to receive a dose equivalent to the NOEL. Because children drink only about one quart of water daily, this provides a safety margin of greater than 1,000.

The above example calculation of safety margins is based on the assumption that potable water will contain levels of Sonar at its maximum allowable concentration of 0.15 ppm (150 ppb). In fact, the Sonar concentration achieved under typical applications is closer to 0.02 ppm (20 ppb), thereby providing a safety margin seven times greater. The point is that adults and children who drink water from potable water sources that have been treated with Sonar according to label instructions are at negligible risk.

Similarly, the levels of Sonar allowed in various food products pose negligible risk to human health. For example, even if Sonar were present at the maximum allowable limit of 0.05 ppm in meat, poultry, eggs, and milk, a 70-kg adult would have to consume almost 25,000 pounds of these foods daily (and again for a significant portion of a lifetime) to receive a dose equivalent to the dietary NOEL for Sonar. A child would have to consume over 7,000 pounds of these foods daily.

Because Sonar is used only intermittently in any one area, and because it disappears from the environment, there is virtually no way that anyone will be exposed continuously for a lifetime. Because the NOEL derives

from a study involving daily exposures for a lifetime, the actual safety margin for people is, in fact, much greater than is suggested by the above illustrative examples.

Q9. How complete is the toxicology information upon which this conclusion rests?

A9. All toxicity studies required by the USEPA to obtain registration approval for Sonar have been completed.

Q10. What about the people who apply Sonar—are they at risk?

A10. The Sonar label states that individuals who use Sonar should avoid breathing spray mist or contact with skin, eyes, or clothing; should wash thoroughly with soap and water after handling; and should wash exposed clothing before reuse. These precautions are the minimum recommendations for the application of any pesticide. If Sonar is used according to label instructions, exposures to the product should be minimal and use should pose negligible risks to applicators.

Sonar has been shown to be of low acute toxicity in laboratory animal studies (that is, toxicity from a high dose exposure for a short period of time). Therefore, any exposure to the product (even undiluted) that might occur during use is unlikely to lead to adverse effects as long as label instructions are followed. As discussed in Question #7, Sonar's label carries the signal word CAUTION that corresponds to the USEPA's lowest acute toxicity rating category.

Studies in laboratory animals show that the lethal dose from a single oral exposure of Sonar is greater than 10,000 mg/kg. To put this into perspective, an adult would have to drink over one million gallons of Sonar-treated water (at the 0.15 [150 ppb] ppm maximum allowable limit) to receive a dose of 10,000 mg/kg; a 20-kg child would have to drink approximately 350,000 gallons.

Because applicators are more likely to contact the undiluted material than the general population, questions about the toxicity of Sonar following direct skin contact have been raised. A laboratory study of the toxicity of an 80 percent solution of Sonar applied to rabbit skin (a standard model to predict effects in humans) suggests that Sonar is minimally toxic by this route. In this study, when Sonar was repeatedly applied to the skin of rabbits for 21 days (in the largest amounts that could be applied practically), there were no signs of toxicity and only slight skin irritation was observed. Further, the dermal administration of the 80 percent solution of Sonar did not induce sensitization in guinea pigs.

Q11. Has there been any investigation of the possible harmful effects of Sonar on fish, wildlife, pets and livestock?

A11. The toxicity of Sonar has been investigated in laboratory studies in birds (including the bobwhite quail and mallard duck), in the honey bee (as a representative insect) and in the earthworm (as a representative soil organism), in five different species of freshwater and marine fish, and in other aquatic animals. These studies have involved exposures to high concentrations for brief periods as well as exposures lasting as long as an entire lifetime, including during reproduction.

Extensive studies have also been performed to evaluate the effects of Sonar on various aquatic and terrestrial plants (both those considered undesirable aquatic weeds and those native plants that we wish to protect). Studies in laboratory animals designed primarily to assess potential health risk in humans are also relevant to the assessment of potential health effects in mammalian wildlife, livestock, and pets.

In addition, Sonar has been monitored in water, plants and fish during field trials. This provides firsthand information on residue levels in the environment following application of Sonar.

Q12. What do these investigations reveal?

A12. A combination of the toxicity studies and residue monitoring data reveals that Sonar poses negligible risks to aquatic animals including fish, wildlife, pets, and livestock when used according to label directions.

As was done with laboratory mammals, toxicity studies were conducted to establish a dietary no-observed effect level (NOEL) for birds. This maximum, non-toxic chronic dose is 1,000 ppm in the diet. One thousand (1,000) ppm is 2,500 times the highest average concentration of total residue found in fish (0.40 ppm), about 2,100 times the highest concentration found in aquatic plants (0.47 ppm), and about 11,500 times the highest average concentration of Sonar found in the water at field trial sites (0.087 ppm). Because the residue levels in these “bird food” items are so far below the NOEL, it can be concluded is that there are negligible risks to birds that might be exposed to Sonar in their diet following application of Sonar. The highest average Sonar concentration found in Sonar-treated water is below the lowest NOEL values for both short and long term exposures from freshwater and marine fish. Honeybees and earthworms are not particularly sensitive to Sonar. Sonar caused no deaths in honey bees when they were dusted directly with the herbicide, and earthworms were not affected when they were placed in soil containing more than100 ppm Sonar.

Extensive testing of Sonar in laboratory animals used to assess potential risks to human health indicates that a large safety margin exists for mammalian species in general. Thus, Sonar poses negligible risk to pets, livestock, and mammalian wildlife that might drink from water treated with Sonar.

Q13. Can Sonar be used in environmentally sensitive areas?

A13. Sonar has been used in a wide range of aquatic environments in the United States without incident since 1986. Florida canals and rivers are examples of environmentally sensitive areas that have been treated with Sonar. Some sites are habitats for the endangered Florida manatee. Although toxicity testing data for the manatee, or for other endangered species, cannot be collected directly, questions about whether Sonar treatment will pose any significant risk to the manatee can be answered with results of the mammalian toxicity studies.

The Florida manatee is an aquatic mammal that consumes up to 20% (one-fifth) of its body weight per day in aquatic plants. Treatment of canal water with Sonar according to label directions is expected to result in a maximum Sonar concentration of 0.15 ppm in the water and from 0.8 to 2.6 ppm in aquatic plants. Calculations show that it would be impossible for a manatee to ingest enough Sonar in its diet to cause any adverse effects, based on results of laboratory studies in other mammals. To reach the maximum non-toxic dose or NOEL for

sensitive mammalian species, a manatee would have to drink more than 40 times its body weight per day in treated water, or eat at least 3 to 10 times its body weight per day in aquatic plants. This calculation indicates that treatment with Sonar in manatee habitats—as one example of an environmentally sensitive area—will pose negligible risk. In fact, application to Florida canals and rivers has been approved by the U.S. Fish and Wildlife Service, Florida Department of Environmental Protection, and the Florida Game and Fresh Water Fish Commission.

Sonar has also been used in other environmentally sensitive areas such as Disney World, Ducks Unlimited MARSH projects, Sea World, state and federal parks, and numerous fish and waterfowl management areas.

Q14. What is it that makes Sonar an effective aquatic herbicide while being a compound of relatively low toxicity to humans?

A14. Sonar inhibits a plant's ability to make food. Specifically, Sonar inhibits carotenoid synthesis, a process specific only to plants. Carotenoids (yellow, orange and red pigments) are an important part of the plant's photosynthetic (food making) system. These pigments protect the plant's green pigments (called chlorophyll) from photo degradation or breakdown by sunlight. When carotenoid synthesis is inhibited, the chlorophyll is gradually destroyed by sunlight. As a plant's chlorophyll decreases, so does its capacity to produce carbohydrates (its food source) through photosynthesis. Without the ability to produce carbohydrates, the plant dies.

Humans do not have carotenoid pigments. Therefore, the property of Sonar that makes it an effective herbicide at low doses does not affect the human body.

Q15. Will Sonar have an adverse effect on water quality?

A15. Extensive testing of a wide range of water bodies has shown no significant changes in water quality after Sonar treatment. In fact, Sonar has a practical advantage over certain other aquatic herbicides in this area. Specifically, the dissolved oxygen content of the water does not change significantly following Sonar treatment because the relatively slow herbicidal activity of the product permits a gradual decay of the treated vegetation. Maintaining adequate dissolved oxygen levels are critical to fish and other aquatic animals, which require oxygen to survive. This contrasts with the changes in water quality that can arise from the application of certain other aquatic herbicides that are “fast-acting.” The sudden addition of large amounts of decaying plant matter to the water body can lead to decreased oxygen levels and result in a fish kill. To avoid depressions in dissolved oxygen content, label directions for certain “fast-acting” aquatic herbicides recommend that only portions of areas of dense weeds be treated at a time. Because Sonar does not have any substantial impact on dissolved oxygen, it is possible to treat an entire water body with Sonar at one time.

Q16. Is there any reason for concern about the inert ingredients used in Sonar?

A16. Inert ingredients are those components of the product that do not exhibit herbicidal activity; that is, the components other than Sonar. Water is the primary inert ingredient in Sonar A.S., making up approximately 45% of the formulation. The second largest (approximately 10%) inert is propylene glycol; a compound used in facial creams and other health and beauty products. Other inert ingredients are added to serve as wetters, dispersants, and thickeners in the formulation. Trace amounts of an antifoaming agent and a preservative are also added. The primary inert ingredient in the pelleted formulations is clay, which makes up approximately 89% of the formulation. Small amounts of a binder or coating solution are also added to reduce the dustiness of the pellets. None of the inert ingredients in Sonar formulations are on the USEPA's list of "Inerts of Toxicological Concern" or list of "Potentially Toxic Inerts/High Priority for Testing." Thus, there is no reason for concern about the inert ingredients used in Sonar.

Q17. Is it important to follow label directions for use and disposal of Sonar?

A17. Yes. It is a violation of federal law to use products, including Sonar, in a manner inconsistent with product labeling or to improperly dispose of excess products or rinsate. Although the results of extensive toxicity testing in the laboratory and in field trials indicate a low order of toxicity to non-target plants, animals, and people, Sonar, like all chemicals, will cause adverse effects at sufficiently high exposure levels. Failure to follow label directions for use and disposal of Sonar could result in environmental levels that exceeds the tolerances for Sonar established to be protective of human health and the health of pets, livestock and other wildlife. In addition, improper use of Sonar could result in unintended damage to non-target plants.

Q18. If Sonar is used in conformance with label directions, is there any reason to be concerned that Sonar will pose risk to human health or the environment?

A18. As discussed in the answers to the previous questions, results of laboratory and field studies and extensive use experience with Sonar in a wide range of water bodies strongly support the conclusion that Sonar will pose negligible risks to human health and the environment when used in conformance with label directions.

In summary, it can be said that Sonar has a favorable toxicological profile for humans. It has an overall low relative toxicity and it is not a carcinogen, mutagen or reproductive toxicant. Sonar also has a very good environmental profile for an aquatic product because of: 1) its low toxicity to non-target organisms; 2) its non-persistent behavior when applied to water bodies (i.e., it readily breaks down to carbon, hydrogen, oxygen, nitrogen and fluorine); and 3) its low bioaccumulation potential, which means it does not build up in the body or in the food chain.

APPENDIX 14. Monitoring

Appendix 14 – Monitoring

The purpose of having a monitoring program is to produce reliable data, over time, which indicates if the progress towards the outlined goals of 'improved water quality', 'less plant growth', and 'a better lake use experience' are being met. Reproducibility (i.e., the collection of data least likely to be skewed by influences outside of the parameters driving the current condition) is exceedingly important. It is imperative that the monitoring be done at the same location, at the same time of year, and as close to the same conditions (following three days of no precipitation for example) as possible.

Also considered in recommending these key monitoring programs is cost and ease of execution of each monitoring program. Ideally, a Lake Improvement Coordinator would be able to conduct the monitoring.

Aquatic Plants

The type and number (density, coverage) of aquatic plants currently present is considered a nuisance level. Steps will be taken to shift the plant population from many low quality plants (meaning those that spread quickly and do not support a healthy fishery) to fewer plants of a higher quality. The data presented in this report has established a baseline for which to monitor future trends and should continue annually. If the recommendation to implement a whole-lake herbicide treatment program is adopted, significant change in the plant population can be expected in the main lake. Adoption and implementation of the channel improvement program can expect to produce desired results, although much slower than what will be seen in the main lake body as the approach in the channels relies less on herbicides and more on shifting the ecological conditions within the channel. These plant monitoring programs (lake and channel) should be considered separate from each other.

Water Quality

For the main lake, scores of water quality parameters can be considered but all lead up to the formation of algae. The recommendation is for plankton tows (collection of measured amounts of water to determine the phytoplankton concentration) to be done consistently to get a measure of suspended algae, and to also collect turbidity readings (secchi depths). This monitoring should be done on calm waters (midweek mornings) under consistent weather conditions to produce the best results. For the channels, the suggested parameters would be total phosphorus (the nutrient leading to algae growth in the main lake) and dissolved oxygen. Over time, an inverse relationship should evolve between dissolved oxygen (increasing) and total phosphorus (decreasing) to indicate ecological improvement.

Fish

Fish are a key indicator for both lake health and for lake user satisfaction. To obtain the most usable data, a fish survey should be customized for the lake and channels which focuses on improvements of the fish reproduction within the lake. The more frequently this study is done, the more useful the data. Early on, this study may be done annually, and after ~3 years might revert to once every two years, and then possibly once every 4-5 years after that if the fishery is satisfactory.

Lake Use Satisfaction

The preceding measures are empirical, meaning that the 'result' is based on testing and defensible findings. The same does not hold true for 'Lake Use Satisfaction' which is subject to interpretation and potentially emotion. Monitoring the feelings or perceptions of lake users is very important, and a simple survey structured and administered carefully can maximize the reliability of the data. A survey should attempt to measure as many concerns of lake users as possible, covering as broad a range of issues as possible. These may include asking about their perception regarding: water quality, safety, access, costs, fishing experience, and their overall satisfaction with their lake experience.

Sediment Thickness

To determine the rate at which sediment thicknesses are changing, annual probing should be performed at the same time each year. A handful of representative points will be selected and probed. These locations will never change unless a sediment removal regimen is implemented. In this scenario, prioritization would be given to areas most recently targeted for such removal. The testing regimen remains the same in this scenario.

Shoreline Monitoring

Annual assessment of shoreline conditions allows for better community involvement and communication. Defining the "degree of degradation" (i.e. limited, moderate, severe) and calculating linear feet of those conditions will provide a rate at which the shorelines are degrading. As shorelines degrade, homeowners need to know the most effective and cost friendly shoreline management options available to improve lake ecology and property value. An early Spring or late Fall analysis of shoreline conditions should be conducted. Following up with property owners as part of this monitoring is essential in coordinating a community effort for shoreline enhancements.

APPENDIX 15. Lake Improvement Coordinator

Appendix 15 – Lake Improvement Coordinator

A powerful option that would consolidate recommendations and accelerate the timeline required to improve conditions of Bangs Lake is to create the new position of Lake Improvement Coordinator (LIC). The success of this position would be measured by the degree of improvement of Bangs Lake as related to the following goals:

- Improvement of water quality.
- Improvement of lake useability.
- Improvement of the lake experience.

Measurable outcomes would be tracked through a monitoring program created in-part by the LIC with results reported to the Village.

Achievement of these goals would be accomplished through a variety of activities and actions that including:

- Creation of a lake improvement monitoring program that measures progress toward the stated goals (based on quantifiable data/information).
- Timely actions and management of resources to accomplish above stated goals through:
    - Creation of work specifications.
    - Identify and engage service providers (internal or external).
    - Execute work yielding the best value for the Village.
- Identify and implement the most effective means to communicate vital information relating to lake improvement with stakeholders (newsletters, social media, signage, special/educational events, literature, etc.).
- Represent the Village with connected watershed groups and build necessary partnerships.
- Research sources of funding for watershed and lake improvement initiatives and pursue successfully (this may involve partnerships for the execution of some projects).
- Determine the Carrying Capacity of the lake and determine if limits need to be implemented to meet the stated goals.
- Have knowledge of the entire Bangs Lake watershed and be responsible for the control of detrimental inputs and/or enhancing the existing Best Management Practices (BMP's) resulting in the protection of the lake from counterproductive lake inputs.
- Understand shoreline protection options and be a ready resource for lake-front property owners to reduce shoreline erosion and create habitat intended to meet the stated goals.

Skills and Experience:

- Working knowledge of freshwater chemistry and biology.
- B.S. with 5-10 years of experience is preferred.
- Familiarity with laws relating to surface waters in Illinois.
- Excellent written and oral communication skills.

- Self-starter, ability to work unsupervised.
- Ability to recognize and seize opportunities as they present themselves to the advancement of the stated goals.
- Confident in their abilities (good leader and motivator) with the ability to work well with others to achieve the stated goals.

Depending on experience, this position can be expected to be successfully filled with an individual requiring a salary of approximately $85,000 plus traditional benefits.

APPENDIX 16. Options for Social Enhancements

Appendix 16 – Options for Social Enhancements

Community Lake Day:

- Set aside one day a year for community activities centered around the lake, focusing on its unique ecological importance (pointing out there are endangered and threatened fish and plants in the lake) and financial contributions to the community. To be successful, this should incorporate local vendors, fundraising activities, etc. to improve lake management funding. This event could also encourage local economic stimulation, as people will be active and engaged.

Signage:

- There is a limited amount of signage available to the public regarding fishing restrictions. This is especially important considering the 303d listing for mercury present in fish tissue, which should include a diagram of what portions of the fish are safe for consumption. Other signage should also include lake rules and regulations. Additionally, information on preventing swimmers itch should be installed at swimming beaches.

Educational topics:

- Hazards associated with illegal discharges and illicit disposal of waste (See something say something).
- Green infrastructure options such as bioswales, green roofs and rain gardens.
- What are common Household Hazardous Wastes and Mechanical wastes?
- What can and cannot be recycled (Recycling clarity)?
- Offer a boating safety class. This will encourage courteous lake behavior while informing the public about the importance of certain regulations and community safety which are in place for Bangs Lake.

Annual Tournaments:

- Similar to a “Community Lake Day”, annual tournaments bring people together and focus on the lake. Partnering with an outside entity, such as Bass Pro for a fishing tournament, would bring attention to the lake and its importance. Such events often encourage local economic stimulation.

Community Wide Competitions:

- Develop a lake slogan such as, “The Gem of Wauconda”. This can be chosen by the village or incorporated into a competition among the public with 3 top choices provided by Wauconda.

- Best lake photo competition, submitted to the Village (for vetting) online, to be voted on by the public. This continues to encourage public engagement while providing marketing photos to the Village. If successful, this can be expanded to one competition per season.
- Best lake painting competition, submitted to the Village (for vetting) in person, to be voted on by the public. This continues to encourage public engagement while providing marketing pieces to the Village. If successful, this can be expanded to one competition per season.

School Coordination:

- School plans could/should incorporate Bangs Lake into their curriculum since it ranks as a high quality lake in northern Illinois. A comprehensive local school program could be established when a learning plan begins discussing the environment and ecology topics. This program will have age appropriate (simple to complex) learning objectives developed for the class attending the lake and associated influences. Lake County Forest Preserve (LCFPD) will often collaborate free of charge on educational programs such as these.

Develop (or request from Lake County) Assorted Ecological Guides:

- An Ecological Guide should be developed for the following topics:
    - Lawn care
    - Shoreline protection guide (hardscape and/or native)
    - Goose waste management on docks
    - Ecological landscaping
    - Environmentally conscientious car washing techniques
    - Green infrastructure and resource reuse
    - Environmentally conscientious watercraft operation

Lake Importance Ecologically and Financially:

- QR Codes: Any major projects which are undertaken, or highly visible, should be highlighted as progress. A QR code should be placed near enhancement activities so people can find out more information about the goals of the project or donate if so inclined.

Develop a Team of Citizen Scientists:

- Engage some of the residents who are profoundly invested in quality lake management and ask for their input and assistance. These community members can be trusted to gather data, lead volunteer groups to conduct active management such as trash pick-up and more while reducing costs for the Village of Wauconda for some of these activities.
- Use these leaders to spread the importance of lake management through a grassroots network of community members, developing a coalition of like-minded community members.
- Regional Coordination: Funding and boots on the ground assistance is available for various lake/watershed projects. Opportunities are often missed due to lack of coordination.

Capturing these free or cost reduced programs can aid in implementation of a comprehensive lake management program by allocating resources provided by other agencies to Bangs Lake. Enhanced coordination with such agencies would better allow the Village to capture opportunities when they arise.

Private Shoreline Restoration Program:

- Implement a private shoreline restoration program that will allow homeowners to offset some costs associated with effective shoreline management. This program could be anything from a cost sharing program to a community enforced ordinance. If the latter were the case, an elaborate set of goals (composition) and requirements (management techniques) would need to be set forth.
- Lead by example. Naturalize high profile shorelines which have the highest restoration potential and utilize them as a showcase. Management cannot fall behind, or the public will continue to associate restored shorelines with poor aesthetics.
- Develop and implement a cost sharing program for channel bottom owners to have sediment removed. Prioritize finances on areas which impact lake use and satisfaction most significantly.
- Revise the Village Landscaping Ordinance to eliminate, or encourage, planting of different species (i.e. prohibit callery pear and other nuisance ornamentals, encourage natives with high aesthetic and ecological value). This should be done through consultation with an ecologist that understands the impacts of both specific ornamental species, as well as natives which fit the goals of landscaping.
- While there is a significant amount of beachfront along Bangs Lake, some areas are overgrown with vegetation. If a “Native Look” is not desired, there are various dune grass species which may provide ecological benefits while producing the desired aesthetic.

APPENDIX 17. Specifications for Whole Lake Systemic Herbicide Treatment

Appendix 17 – Specifications for Whole Lake Systemic Herbicide Treatment

Bangs Lake is a natural glacial lake located in the Village of Wauconda. This 306.1 acre lake has an average depth of 10.9 feet and a maximum depth of 32 feet. Eurasian/hybrid watermilfoil (EWM) and Curly-leaf pondweed (CLP) are non-native species which have been expanding within Bang's Lake. Both plants have formed dense mats at the water's surface inhibiting water recreation. Due to the clarity of the water, these plants have been observed in as much as 20 feet of water. They have also been overtaking habitat and outcompeting native aquatic plants, potentially lowering diversity while providing unsuitable shelter, food, and nesting habitat for native animals. CLP also has midsummer die-offs which have littered the shoreline with dead plants and increase nutrients levels within the lake. Both species are spread primarily through the movement of watercraft and water-related equipment. Recently, these plants have been controlled in a patchwork fashion by multiple contractors using multiple products and methods. The village is seeking bids for a systemic, unified approach to begin restoring the lake.

Scope

The goal of this treatment is to control Eurasian/hybrid watermilfoil and curly-leaf pondweed with a lake wide, low-dose Sonar AS herbicide treatment (active ingredient fluoridone). The goals of the treatment are to preserve habitat, maintain/improve biodiversity in the native plant community, and provide recreational opportunities for users.

- The contractor is responsible for all state and local permits.
- Treatment is to begin mid-March to minimize impact to native aquatic plants and minimize biomass die-off of target plants as a result of the application.
- Application is to be done using drop hoses to ensure that the product is delivered near the plant growth and to minimize photodegradation.
- Initial target concentration is 6 ppb with a goal of maintaining 2 ppb throughout 75 days.
- Contractor must provide the village or designee a full report which will include weather data (air temp, sky conditions, forecast) water body data (dissolved oxygen (profile), pH, water temperature (profile), application method, observations, and product amounts applied.
- Contractor shall provide the Village or designee with GPS tracking of where herbicide is applied.
- Signs shall be posted and maintained throughout the treatment at all public access points.
- FasTEST samples are to be collected from 2 locations on the lake each event. The contractor will provide GPS coordinates of FasTEST sample collection locations. Proposed schedule for FasTEST samples below:
    - 3 Days After Treatment (DAT) to check that concentration was achieved.
    - 14 DAT to check if concentration is holding.

    - 28 DAT to determine what will be needed for first bump treatment.
    - 42 DAT to check concentration after first bump treatment.
    - 56 DAT to check what will be needed for second bump treatment.
    - 70 DAT to check if concentration is holding.
- Results of each round of FasTEST are to be forwarded to the Village or designee upon receipt.
- Performance requirement is 95% control of target plants as determined by the Village or designee by June 12th, 2024.
- If performance standards are not met the Village will pay for the percentage of target plant controlled.