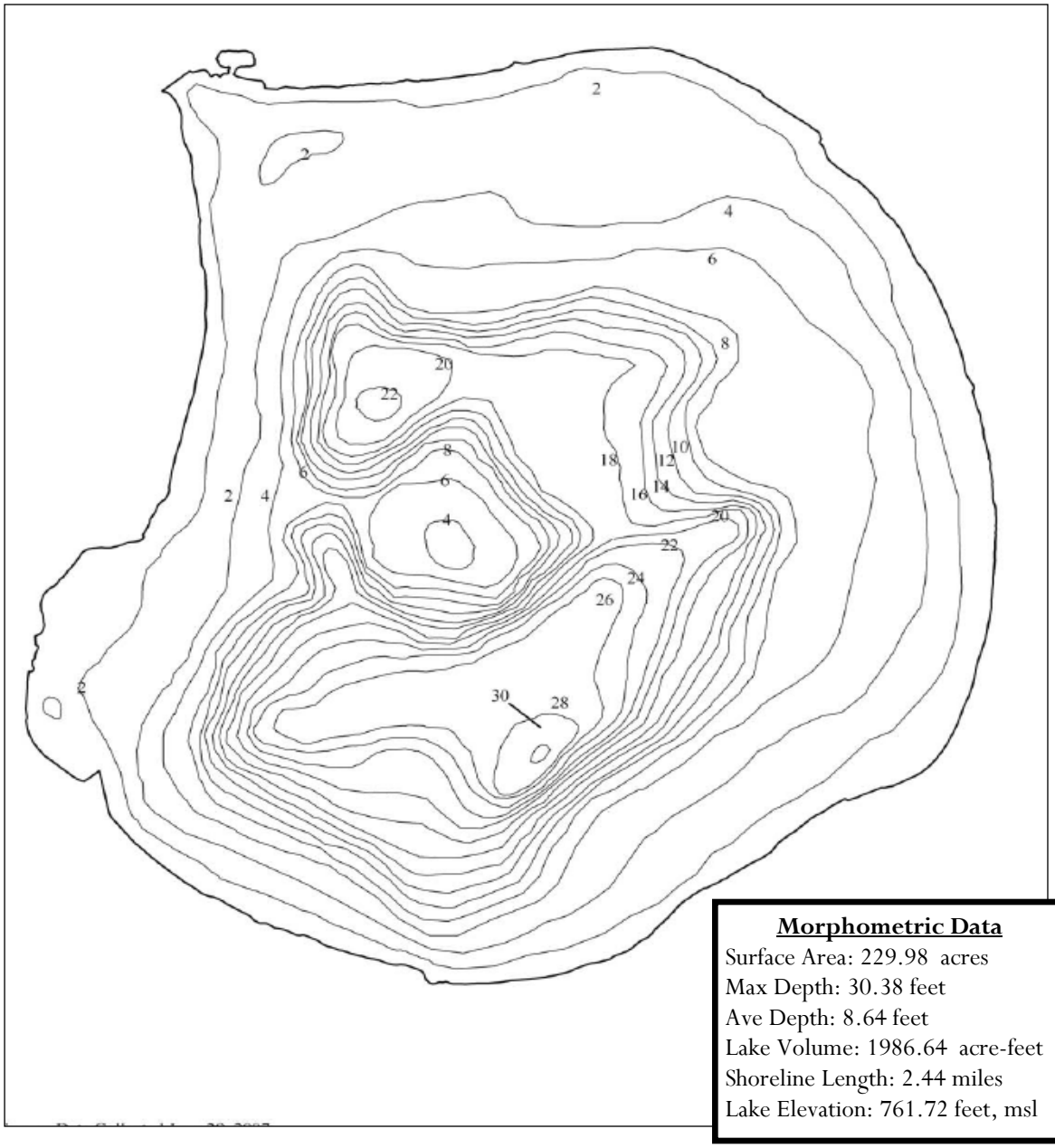
BATHYMETRIC MAPS

Bathymetric maps are also known as depth contour maps and display the shape and depth of a lake. They are valuable tools for lake managers because they provide information about the surface area and volume of the lake at certain depths. This information can then be used to determine the volume of lake that goes anoxic, how much of the lake bottom can be inhabited by plants, and is essential in the application of whole-lake herbicide treatments, harvesting activities and alum treatments of your lake. Other common uses for the map include sedimentation control, fish stocking, and habitat management.

Round Lake had a bathymetric survey conducted in 2007 by LCHD (Figure 9). The maximum depth was 30.38 ft. and average depth was 8.64 ft. Lake volume was estimated 1986.64 acre-feet. LCHD recommends updating bathymetric map every 10 years. For a complete list of the morphometric table for Round Lake refer to Appendix B.

Figure 9: *Round Lake Bathymetric Map, 2007*



Morphometric Data

Surface Area: 229.98 acres
Max Depth: 30.38 feet
Ave Depth: 8.64 feet
Lake Volume: 1986.64 acre-feet
Shoreline Length: 2.44 miles
Lake Elevation: 761.72 feet, msl

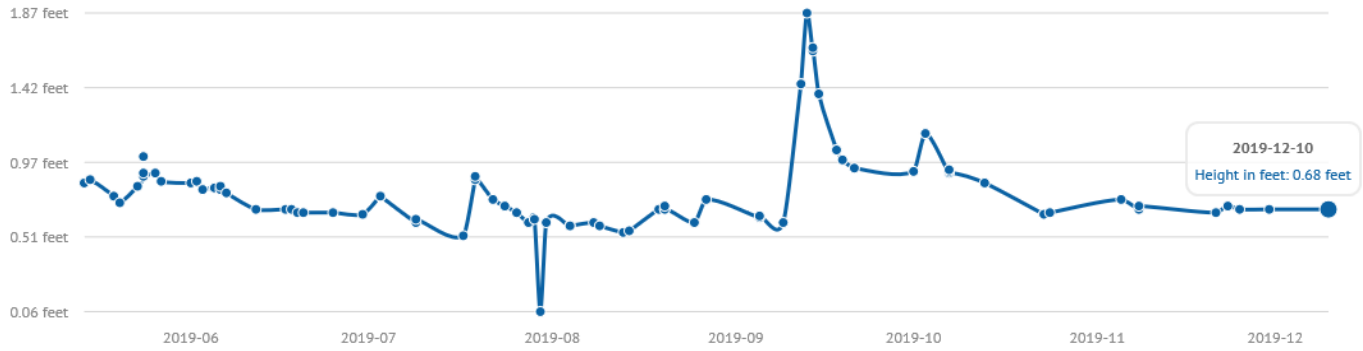
LAKE LEVEL

In 2019 a lake level Round was installed on Round Lake as part of the Lake Observations by Citizen Scientists & Satellites (LOCSS) project. This is a NASA-funded project in collaboration with a few universities including: Department of Geological Sciences at UNC-Chapel Hill, UNC Institute for the Environments Center for Public Engagement with Science, University of Washington Department of Civil and Environmental Engineering, and Tennessee Technological University Department of Computer Science.

The goal of the project is to investigate if lake volumes are affected most by precipitation, water table height, evaporation or other factors. It combines measurements by citizen scientists with measurements derived from satellite images to understand how the volume of water in a given lake is changing over time. The project has lakes established in Washington, North Caroline, Massachusetts, Illinois and even internationally—France and Bangladesh In 2021, NASA will launch a new satellite that will help monitor changes in water resources across the globe and the LOCSS citizen science data will help determine if this new NASA satellite can accurately monitor changes in water storage. For additional information check out www.locss.org.

Locally, the lake level will help understand lake fluctuations on Round Lake. Residents are encouraged to submit lake levels. It's as easy as texting the lake level to the number provided on the post! It's important that the RLCC encourages park visitors and lake users to submit readings so there can continue to be good water quality data. 2019 was another wet year, with numerous heavy rainfalls (Figure 10).

Figure 10: *2019 lake level readings on Round Lake*



SWIMMING BEACHES

There are 4 licensed swimming beaches on Round Lake which include: Round Lake Beach, Alpine Country Club, Bengson Park, and Ukranian Camp. They were sampled for the bacteria *Escherica coli (E.coli)* levels every two weeks, from mid May to the end of the August, by the LCHD-ES. While not all strains of *E.coli* are the same, certain strains can make humans sick if ingested in high enough concentrations. If water samples come back high for *E.Coli* (>235 E. Coli/100 ml), the management body for the swimming beach is notified and a sign is posted indicating the swim ban. *E.coli* is used as an indicator organism, meaning that high concentrations of *E.coli* might suggest the presence of harmful pathogens such as *Salmonella, Giardia,* etc.

There are many ways E.coli can end up in a swimming beach. Heavy rainfall and strong wind associated with storms can cause the water to become cloudy with sediment from the lake bottom. Stormwater from rain can also wash in other particles from lawns, streets, and buildings. This sediment and storm water may contain high concentrations of *E.coli*. Another source of *E.coli* contamination is the feces of gulls, geese, and other wildlife.

There were swim bans at Alpine Country Club (8/6/2019) and Round Lake Beach (7/8/2019 and 8/19/2019—8/21/2019) during the 2019 swim season. During swim bans and advisories, signs are posted.

HARMFUL ALGAL BLOOMS

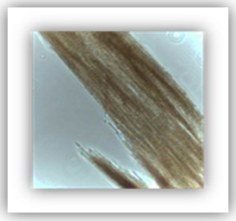
Algae are important to freshwater ecosystems and most species of algae are not harmful. Algae can grow quickly in water and are often associated with increased concentrations of nutrients such as nitrogen and phosphorus. Harmful algal blooms (HABs), also known as blue-green algae or cyanobacteria, are a type of algae that can bloom and produce toxins. They are called harmful algal blooms because exposure to these blooms can result in adverse health effects to human and animals. Certain environmental conditions such as elevated levels of nutrients, warmer temperatures, still water, and plentiful sunlight can promote the growth of cyanobacteria to higher densities. HABs tend to occur in late summer and early fall. Due to the potential presence of toxins, the IEPA and the LCHD have initiated a program to collect HABs from beaches and test for presence of microcystin, a common toxin produced by HABs.

It's important to report all HABs to the Lake County Health Department so they can further investigate the bloom. No major blooms were reported on Round Lake in 2019. If blooms are present its important to keep pets and children out of contact with water.

Example of common species of harmful algal blooms as observed under the microscope

Anabaena Sp.

Microcystis Sp.



Aphanizomenon Sp.

Example of Blue-Green Algae Bloom in Lake County

SHORELINE EROSION

Figure 12: *Example of erosion along Round Lake shoreline*

Erosion is the natural process of weathering and transport of solids (sediment, soil, rock and other particles) in the environment. In lakes, shorelines are impacted by waves and ice movement which displaces soil particles. Disturbed shorelines can also be caused by human activity such as replacing native plants with turfgrass. Increasing impervious pavement increases runoff and will accelerate erosion. Eroded materials cause turbidity, sedimentation, nutrients, and pollutants to enter a lake. Excess nutrients are the primary cause of algal blooms and increased aquatic plant growth and once in the lake, sediments, nutrients and pollutants are harder and more expensive to remove.

A shoreline erosion assessment was conducted on Round Lake in 2019 (Figure 11). The lake shoreline was evaluated for none, slight, moderate and severe erosion based on exposed soil and tree/plant roots, failing infrastructure and undercut banks. Based on the 2019 data, 64.1% of Round Lake shoreline is eroding. 14% of the shoreline is considered moderate erosion. Figures 12 represents typical erosion conditions on Round Lake. Many homeowners have created artificial shorelines to minimize erosion including riprap and seawalls.

Figure 11: *Shoreline Erosion Condition Round Lake, 2019*

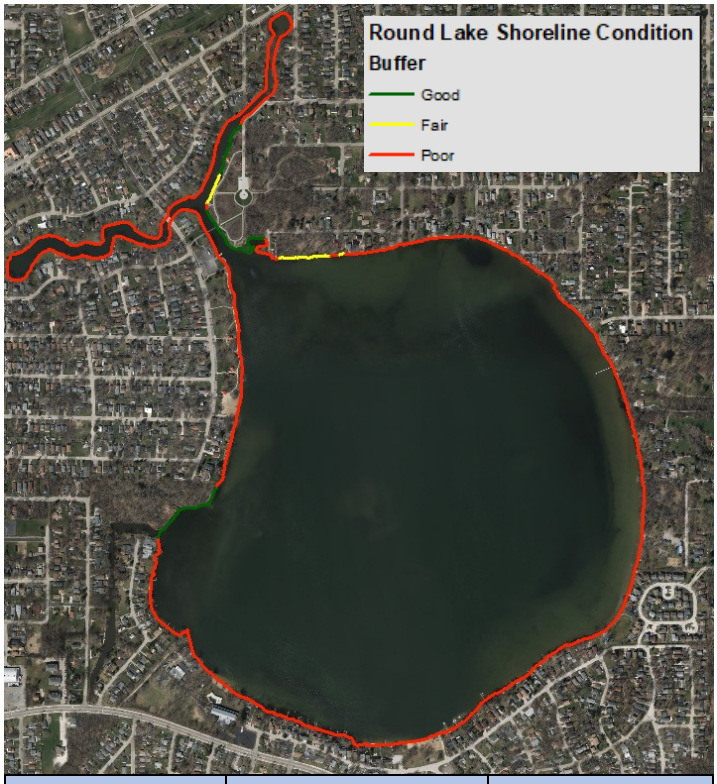
SHORELAND BUFFERS

A shoreland buffer helps stabilize the sediment near the lakes edge which prevents soil erosion. The buffer will also filter out pollutants and unwanted nutrients from entering the lake. Buffer strips should be at least 25 feet wide and can include native wildflowers, native grasses, and native wetland plants. Wider buffers may be needed for areas with a greater slope or additional runoff issues. Areas that are already severely or moderately eroding, a buffer strip of native plants may need to be bolstered for additional stability.

A shoreland buffer condition of Round Lake was assessed by looking at the land within 25 feet of the lake's edge on aerial images in ArcGIS. Shoreland buffer's were classified into three categories; poor, fair or good based on the amount of unmowed grasses, forbs, tree trunks and shrubs, and impervious surfaces within that 25 foot range. In 2019, Round Lake had 886% of the shoreline with poor buffer, 3.2% with fair buffer, and 8.8% with good buffer (Figure 14).

Round Lake could benefit from homeowners increasing buffer strip along their shorelines. Many homeowners have installed shoreline erosion mitigation (rip rap, sea walls) but keep mowed grass up to the edge of the lake. Figures 14 represent the typical buffer conditions around Round Lake, which is mowed turf grass up to the lakes edge. The Village of Round Lake has done a good job of installing buffers on the NE side of the channel on their park property. Buffers can be planted to fit personal preference in aesthetics choosing plants that bloom at different times, choosing specific height of plants, and colors.

Figure 13: *Shoreline Buffer Condition on Round Lake*

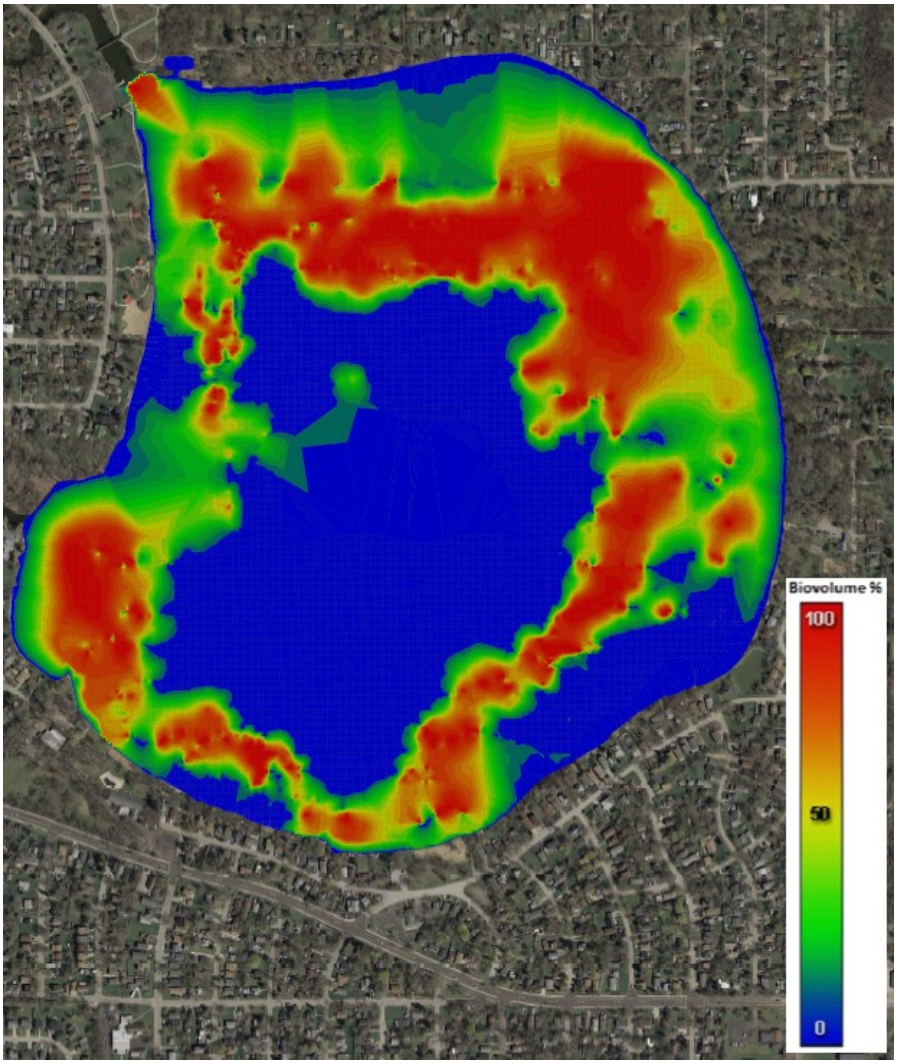


Buffer Condition	Shoreline Length	% of Total Shoreline
Good	1822.9	8.8%
Fair	659.7	3.2%
Poor	18138.6	88.0%
Total	20621.2	100.0%

Figure 14: (Left) no buffer, mowed grass up to edge (Right) Buffer along shoreline.

AQUATIC PLANTS

Figure 15: *Plant Biovolume Round Lake, August 2019*



Aquatic plants are a critical component of a lakes ecosystem as they compete against algae for nutrients, improve water quality and provide fish habitat. **Their presence is natural and normal in lakes.** An aquatic macrophyte survey was conducted on Round Lake in August 2019. Sampling sites were based on a grid system created by mapping software, with each site located 60 meters apart for a total of 266 sites. At each site, overall plant abundance was ranked and plant species were identified and ranked. In addition to the plant rake survey, the lake was mapped using Sonar and CIBiobase as more accurate measure for overall aquatic plant biovolume. Based on the aquatic plant rake survey, plants occurred at 184 of the 266 sites (69.4% total lake coverage) with plants found at depths up to 15 feet (Figure 15).

There were a total of 21 aquatic plant species and one macro-algae found in Round Lake. Eurasian Watermilfoil, an aquatic invasive species, was the most dominant species found at 63% of the sampling sites. The next most abundant plant was Coontail (42%) followed by Southern Naiad, Vallisneria, and Water Stargrass all at 17% of the sampling sites.

The number of plant species (diversity) is an increase since the 2009 sampling where only 13 plant species and Chara were observed . In 2009, Eurasian watermilfoil was still the most dominant plant species at 50.9% of the sampling sites followed by Illinois Pondweed at 22%. For a complete list of aquatic plant species and density found in Round Lake, refer to the aquatic plant table found in Appendix B.

Table 3: *Aquatic Plants in Highland Lake 2009 vs. 2019*

2009		2019	
American Pondweed	*Vallisneria*	*American Pondweed*	*Sago Pondweed*
Chara	*Water Stargrass*	*Brittle Naiad*	*Slender Naiad*
Coontail	*White Water Lily*	*Chara*	*Southern Naiad*
Curlyleaf Pondweed		*Coontail*	*Spatterdock*
Duckweed		*Curlyleaf Pondweed*	*Vallisneria*
Elodea		*Common Duckweed*	*Watermeal*
Eurasian Watermilfoil		*Elodea*	*Water Stargrass*
Flatstem Pondweed		*Eurasian Watermilfoil*	*White Water Lily*
Illinois Pondweed		*Flatstem Pondweed*	*Leafy Pondweed*
Sago Pondweed		*Giant Duckweed*	*Small Pondweed*
Slender Naiad		*Illinois Pondweed*	*Spiny Naiad*

AQUATIC PLANTS –DOMINANT PLANTS

The most dominant plants found in Round Lake were: Eurasian Watermilfoil (63%), Coontail (42%), Southern Naiad (17%), Vallisneria (17%) and Water Stargrass (17%). The diversity and extent of plant populations can be influenced by a variety of factors. Water clarity and depth are the major limiting factors in determining the maximum depth at which aquatic plants will grow. When the light level in the water column falls below 1% of surface light level, plants can no longer grow. The 1% surface light level is roughly at 2 times the average Secchi depth or can be measured with a photosynthetically active radiation (PAR) sensor. For Round Lake, the 1% light level based on average Secchi values was approximately would be approximately 26 feet , however, water clarity varied substantially from month to month which limits plant growth. Plants were found up to 15 feet in Round Lake. Submerged portions of all aquatic plants provide habitats for many micro and macro invertebrates.

Common Plants in Round Lake in 2019

Eurasian Watermilfoil
(*Myriophyllum spicatum)*

Description

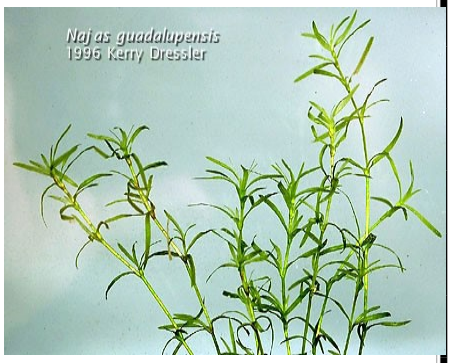
Invasive species with whorls leaves—typically 12-20 pairs of leaflets per leaf. The tip of the plant is usually red in summer. Eurasian watermilfoil often branches frequently near the surface and can form dense mats .

Coontail
(Ceratophyllum demersum)

Description

Coontail is a common aquatic plant. It is often heavily branches and is light green to brown. Leaves are whorled, and the tip of the plant is often very bushy.

Southern Naiad
(*Najas guadalupensis)*



Description

Southern naiad have leaves that are opposite or may appear loosely whorled. The leaf tip is blunt or abruptly acute and can be found in shallow to deep areas of the lake.

Vallisneria
(Vallisneria americana)

Description

Leaves are in basal form (all originating from base). Leaves have a wide stripe of large cells down the middle that are often appear shiny. Can be long and easily broken.

Water Stargrass
(Heteranthera dubia)

Description

Long, linear leaves with slightly flattened stems. Can have yellow flowers.

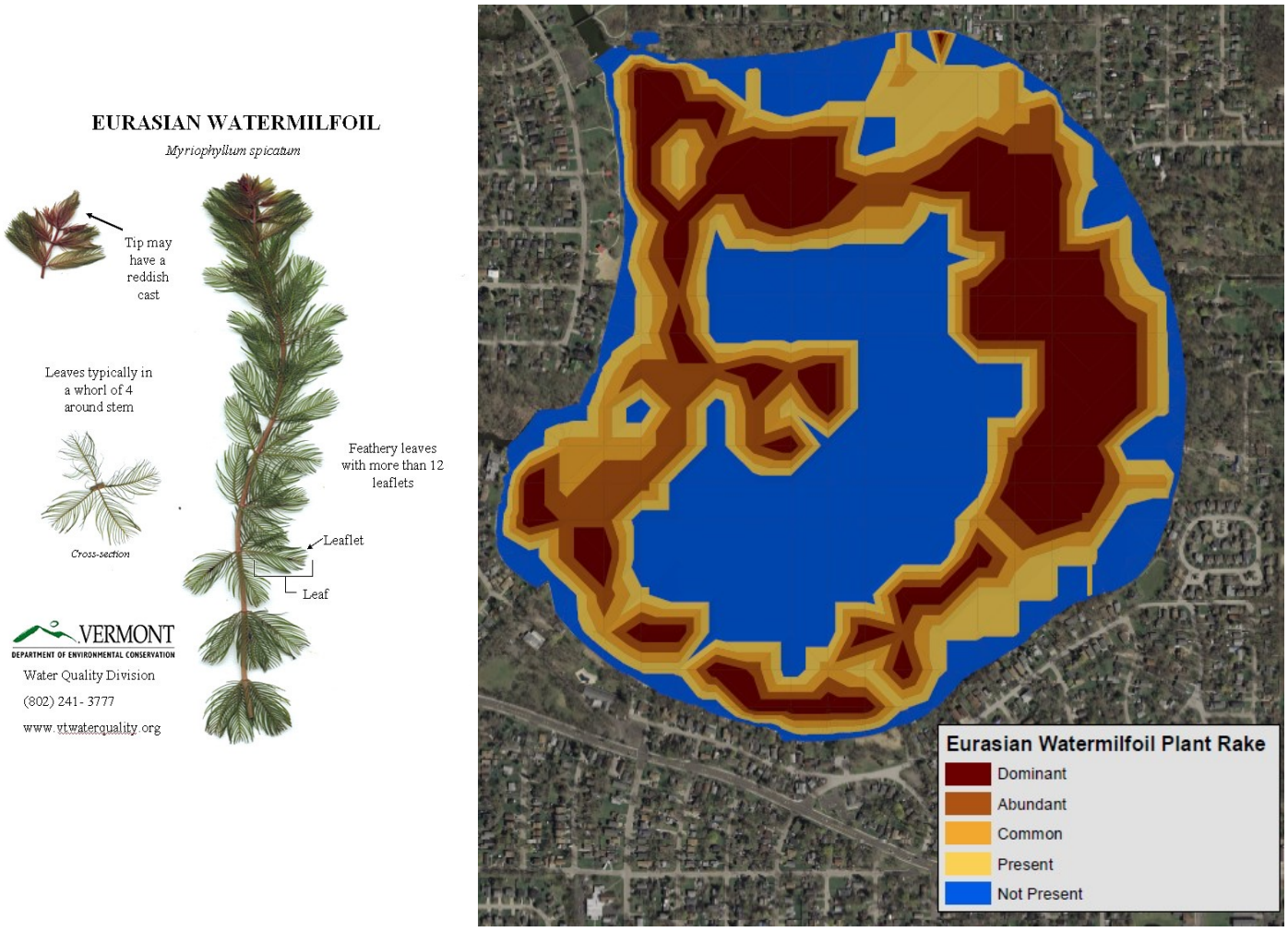
INVASIVE SPECIES: EURASIAN WATERMILFOIL

Eurasian Watermilfoil (EWM) is a feathery submerged aquatic plant that can quickly form thick mats in shallow areas of lakes and rivers in North America. These mats can interfere with swimming and entangle propellers, which hinders boating fishing, and waterfowl hunting. Matted milfoil can displace native aquatic plants, impacting fish and wildlife. Since it was discovered in North America in the 1940's, EWM has invaded nearly every US state and at least three Canadian Provinces. Milfoil spreads when plant pieces break off and float on water currents. It can cross land to new waters by clinging to sailboats, personal watercraft, powerboats, motors, trailers, and fishing gear.

Round Lake has previously has had high densities of EWM. In 2019, EWM was the most dominant plant on the lake and was found at 63% of the sampling sites! Figure 16 shows the map of EWM on Round Lake. In 2009, EWM was also the most dominant plant found at 50% of the sampling sites.

An aquatic plant management plan is critical to maintaining the health of the lake and a balanced aquatic plant community. The plan should be based on the management goals of the lake and involve usage issues, habitat maintenance/restoration, and limitations of the lake. The primary focus of the plan must include the control of exotic aquatic species including EWM and Curlyleaf Pondweed. Since Round Lake is a heavy boating lake, control of EWM could increase recreational access and also allow for the native plants to increase in diversity. It's important to note that treatment should be focused only on invasive species. Round Lake currently has high plant diversity and its important to keep aquatic plants and its diversity high on Round Lake. Follow up is critical to achieve long-term success. A good aquatic plant management plan considers both the short and long-term needs of the lake.

Figure 16: *2019 Plant Biovolume and presence of Eurasian Watermilfoil*



FLORISTIC QUALITY INDEX

Floristic Quality Index (FQI) is an assessment tool designed to evaluate the closeness the flora of an area is to that of undisturbed conditions . It can be used to (1) identity natural areas, (2) compare the quality of different sites, (3) monitor long term floristic trends and (4) monitor habitat restoration efforts. Each aquatic plant in a lake is assigned a value based on the species sensitivity. A high FQI number indicates that a large number of sensitive, high quality plants species are present in the lake. The average FQI for Lake County lakes from 2000-2019 was 14.0. Round Lake has an FQI of 24.3 ranking it 10/173 lakes in the county for FQI. If looking at the native plant FQI, Round has an FQI of 27.7 meaning Round has good native plant diversity and above average for Lake County. It is important to keep this high diversity and quality of plants in Round Lake as it will help keep the overall water quality of Round Lake above average.

LAKE COUNTY AVERAGE FQI = 14.0

ROUND LAKE FQI = 24.9

RANK =10/173

AQUATIC PLANTS SPECIES: 21

NATIVE PLANT SPECIES: 18

STOP THE SPREAD OF AQUATIC INVASIVE SPECIES

It's important to always keep an eye out for the spread of new invasive species. Since Round Lake has a public boat launch, its important to educate lake users on appropriately cleaning, draining, and drying their boats to prevent aquatic hitchhikers. There a few invasive species that have not yet been found in lakes in Illinois but residents and lake users should keep an eye out. Two of these invasive species include hydrilla and starry stonewort. Starry stonewort can resemble Chara, a common macro-algae found in many of our lakes. One of the key distinguishing features of starry stonewort is the white start shaped bulbil (Figure 17).

Figure 17: *Starry stonewort*

Hydrilla is an invasive species that is been found in many states, particularly the SE portion of the US. Hydrilla was recently found in a detention pond in Lake County, likely an aquarium release. It's important to keep an eye out for hydrilla. Hydrilla resembles another native plant elodea and another invasive species Brazilian elodea. Hydrilla has leaves in whorls of 4-8 with serrated (teeth) edges (Figure 18). Hydrilla can also form tubers which can distinguish it from Brazilian elodea.

Figure 18: *Hydrilla*

AQUATIC HERBICIDES & PLANT MANAGEMENT

Aquatic plants are essential for maintaining a balanced, healthy lake, but sometimes plants can create a nuisance for recreation, lake aesthetics, and invasive plant species can outcompete native plant species. Aquatic plant management is both controlling undesirable species while encouraging desirable species in important habitat areas.

Round Lake has seen improvements in the aquatic plant diversity and water quality and it's important to maintain this healthy ecosystem. Unfortunately, Eurasian Watermilfoil has also continued to expand on Round Lake and continues to the remain the most dominant plant. There are a number of ways for aquatic plant control and the main methods include: mechanical harvesting, manual harvesting, and herbicides. The most common control tool in aquatic plant management is the use of herbicides registered by the U.S. Environmental Protection Agency.

Table 4 briefly summarizes some pros and cons of the different aquatic plant management techniques. This is not a comprehensive list and should only be used as a guide to understanding different management options available.

Herbicide Terms You Should Know

Non-selective: A herbicide that controls many different types of plant species.

Selective: A herbicide that is effective at controlling some species but not the others

Contact: Herbicides that affect only the tissues that come into contact with.

Systemic: Herbicides that are translocated, or moved, throughout the plant.

Herbicide treatments are one of the many tools available to lake managers. Herbicide treatments can be an affective means of managing aquatic invasive plants, however, when used alone they provide a quick fix that does not address the source of the problem, high nutrient levels.

In 2019, RLLC did not apply herbicide on the lake, however, some homeowners and the Alpine Country Club have been applying herbicide to treat dense Eurasian Watermilfoil on their properties.

LCHD recommends chemical treatments to only treat invasive species and nuisance algae conditions. Native Pondweeds should remain to provide a the benefits of aquatic plants to the lake. It's beneficial for Round Lake to gather all interested stakeholders in creating an aquatic plant management plan to target critical areas of treatment. It's beneficial if private homeowners and RLLC coordinate treatment efforts which can save money by using same applicator and limiting the number of days the applicator has to come out to the lake and also makes applications more effective. RLLC can submit a request for proposal (RFP) to consultants for their management requests.

Table 4: *Methods for Aquatic Plant Management*

Management Options	Pros	Cons
Mechanical	Cost competitive	Undesirable plants may fragment, spread and colonize new areas
	Removes nutrients from the lake but may be minimal compared with other methods	Desirable plants such as pondweeds may be suppressed
	Removes organic material from the lake	Limited operation in shallow water and around docks and rafts
	May provide some selective control	Machine breakdowns can disrupt operations
Hand Harvesting	Low Cost, low environmental impact	Time intensive
	Excellent control in small areas	Not suitable for large areas
Herbicides	Costs are reasonable	introduction of pesticides
	Range of products and combinations available provides flexibility in management options	Algal blooms and fish kills are possible following large herbicide treatments (potential for misuse)
	Some products are highly selective for nuisance species	May contribute to the buildup of organic material
	Can provide complete control of plants for swimming beaches	Large treatments may encourage shifts in plant communities
		Water use restrictions may be need to be imposed
		Does not address the cause of cultural eutrophication