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RICE LAKE, BARRON COUNTY

2026-30 AQUATIC PLANT MANAGEMENT PLAN
WDNR WBIC: 2103900

Prepared by: Dave Blumer, Lake Educator

August 2025

R I C E L A K E P R O T E C T I O N &
R E H A B I L I T A T I O N D I S T R I C T
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PREPARED FOR THE RICE LAKE PROTECTION & REHABILITATION DISTRICT

INTRODUCTION

Rice Lake (WBIC 2103900) in Barron County in northwestern Wisconsin (Figure 1) is an impoundment on the Red Cedar River. The water level is controlled by a dam operated by Barron County. The lake narrows at Sawyer Street (County Road C) Bridge creating two basins, each with its own distinct set of characteristics. The maximum depth of the larger part of the lake, locally referred to as the Central and North Basins, is 15 feet and receives inflow from two primary tributaries, the Red Cedar River and Bear Creek. The smaller South Basin has a maximum depth of 19 feet. Clearwater Bay extends from the east side of the South Basin and has some of the highest aquatic plant diversity anywhere in the lake.

The lake has established colonies of curly-leaf pondweed (CLP). In 2018, a small population of hybrid watermilfoil (Eurasian watermilfoil x northern watermilfoil) was found in Clearwater Bay and has since spread throughout the South Basin and has been detected in the larger Central and North Basins. Purple loosestrife, Chinese mystery snails, and rusty crayfish are also present. The Rice Lake, Lake Protection and Rehabilitation District (Lake District) has an active aquatic plant management program including mechanical harvesting and herbicide application to control CLP; and diver/DASH removal, herbicide application, and harvesting of hybrid watermilfoil (HWM). Mechanical harvesting is also used throughout the season to maintain navigation and recreation channels in the lake.

The City of Rice Lake is adjacent to the lake, and both are impacted by each other. The lakeshore is nearly fully developed. Downtown Rice Lake is along the west shore and a significant portion of the urban storm sewer from the city drains directly to the lake. Numerous public boat launch facilities exist around the lake, with the most frequently used launch facilities off Orchard Beach Lane and at the downtown launch site off Stein Street. Several private residences on the lakes are operated as vacation rental units. Tourists and locals use the lake for boating, fishing, waterfowl hunting, water skiing, winter sports (fishing, cross-country skiing, snowmobiling, and automotive ice racing), wildlife watching, and general recreation. The main attraction to Rice Lake is the fishing, including trophy muskellunge.

Numerous references will be made to various places in and around the body of water known as Rice Lake. Figure 2 provides a map and labels of many of these areas.

Rice Lake was listed as a Wisconsin 303(d) impaired water in 2012. Rice Lake was evaluated for phosphorus and algae every two years between 2012 and 2024. Chlorophyll-a values were too high as seen in algal blooms on the lake during the summer months. This lake is covered by a restoration plan: A Water Quality Strategy for the Land and Waters of the Red Cedar River Basin (expires 2026).[1]

[1] https://apps.dnr.wi.gov/water/impairedDetail.aspx?key=15977

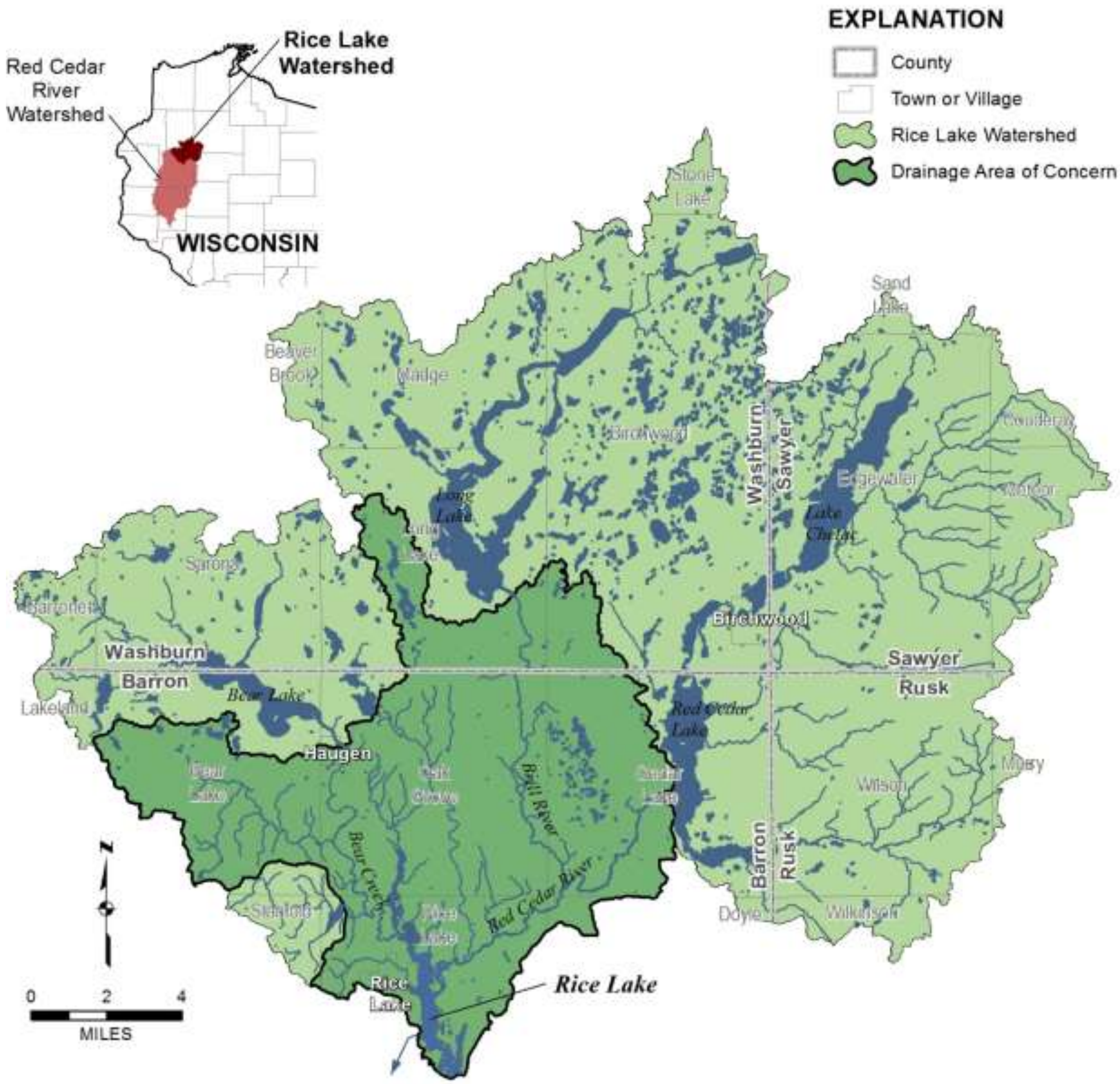


Figure 1: Location of Rice Lake and its watershed

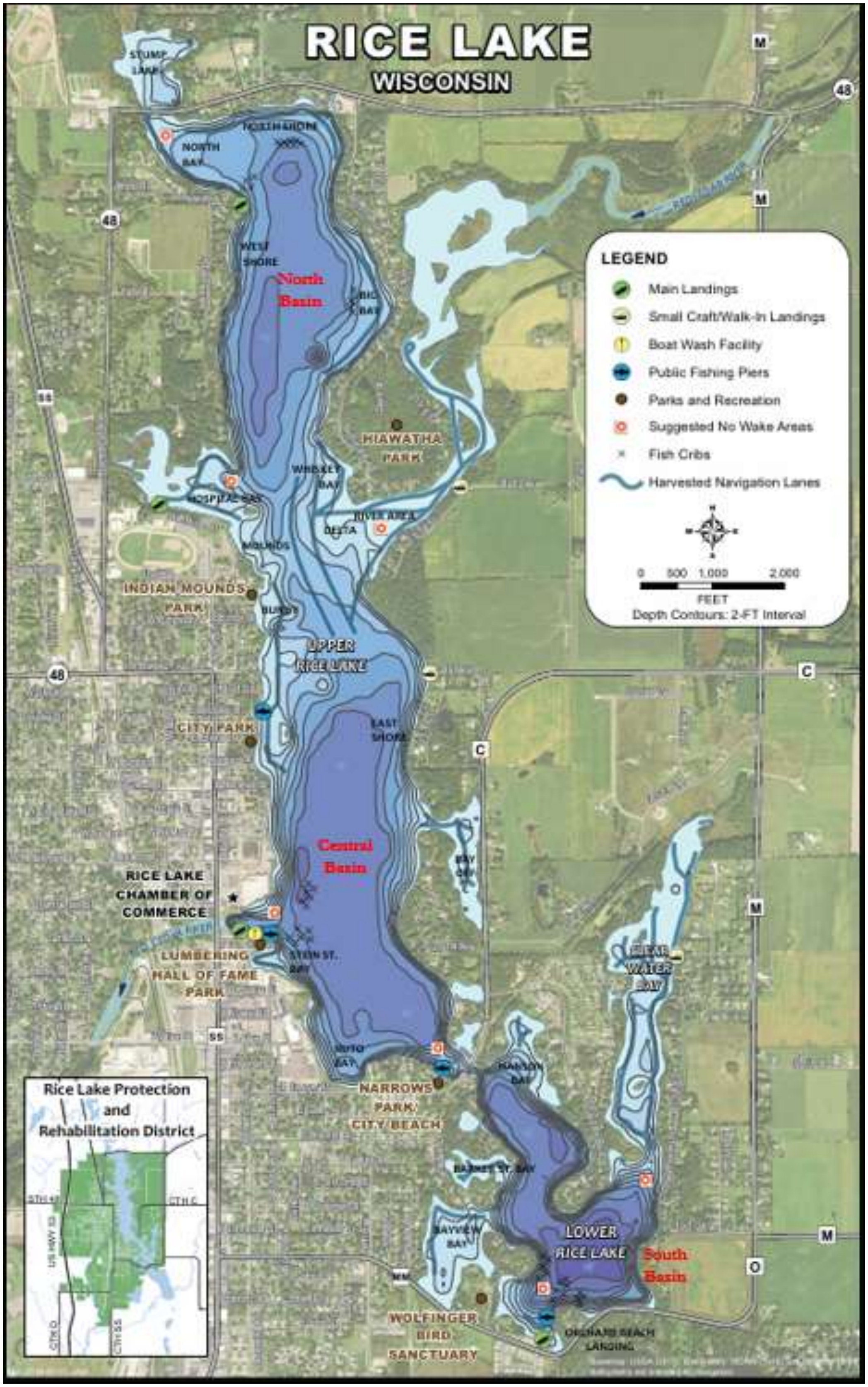


Figure 2: Rice Lake with places identified

PUBLIC PARTICIPATION AND STAKEHOLDER INPUT

The official end date of the existing APM Plan is the end of 2025 with the new APM Plan beginning implementation in 2026. Work on updating the existing APM Plan began in 2024 with a whole-lake point-intercept aquatic plant survey and continued in late 2024 and 2025. Preliminary objectives for management were presented during the October 2024 Annual Meeting with monthly updates related to the development of the new APM Plan given between October 2024 and April 2025. A draft of the new 2026-30 APM Plan was presented to the RLPRD Board during its May 2025 Board Meeting. A public input period followed with several past board members providing feedback on the new APM Plan. Additional data was added when the 2025 CLP and HWM management season was mostly complete. The final version of the 2026-30 APM Plan was presented to the Lake District during its August 2025 Board Meeting and posted on the Lake District webpage. A second 21-day public notice period began on August 21 and included several Facebook posts and notice in the Rice Lake Chronotype. No specific feedback was received.

During the August 2025 Board Meeting, management recommendations for 2026 and beyond were discussed with and then approved by the Board. A Determination of Eligibility was sent to the WDNR in late August 2025.

OVERALL MANAGEMENT GOAL

The Mission of the Rice Lake, Lake Protection and Rehabilitation District is to represent and protect the interests of the residents and property owners of the Town and City of Rice Lake. To this end, the Rice Lake, Lake Protection and Rehabilitation District seeks to protect the ecology of the lake, enhance the natural scenic beauty, control invasive species, and promote responsible boating, swimming, fishing, and recreational opportunities that beautiful Rice Lake offers all residents and visitors to our shores. That is the overall goal of this APM Plan.

WISCONSIN'S AQUATIC PLANT MANAGEMENT STRATEGY

There are many techniques for managing aquatic plants in Wisconsin. Often management may mean protecting desirable aquatic plants by selectively hand pulling the undesirable ones. Sometimes more intensive management may be needed such as using harvesting equipment, herbicides, or biological control agents. Because aquatic plants are recognized as a natural resource to be protected, managed, and used wisely, the development of long-term, integrated aquatic plant management strategies to identify important plant communities and manage nuisance aquatic plants in lakes, ponds or rivers is often required by the State of Wisconsin.

The Public Trust Doctrine is the driving force behind all management in Wisconsin lakes. Protecting and maintaining Wisconsin's lakes for all of Wisconsin's people are at the top of the list in determining what is done and where. The importance of a strong, diverse community of aquatic plants in a healthy lake ecosystem, the continuing concern over the spread of AIS, and the realization that sometimes what is implemented to control an AIS may be more detrimental to the lake's ecosystem than the AIS itself, strongly influences the management of aquatic plants in a lake.

LAKE CHARACTERISTICS

To make recommendations for aquatic plant and lake management, basic information about the water body of concern is necessary. A basic understanding of physical characteristics including size and depth, critical habitat, water quality, water level, fisheries and wildlife, wetlands and soils is needed to make appropriate recommendations for improvement.

PHYSICAL CHARACTERISTICS

Rice Lake has an estimated size ranging from 859 acres up to 940 acres. Bear Creek flows into the North Basin. The North Basin is separated from the Central Basin by the Red Cedar River delta that creates a "sand bar effect" across the lake east to west. The Red Cedar River channel flows through the Central Basin to the dam on the west side of the lake. The South Basin of the lake is separated from the North and Central Basins by the "narrows" created by the E. Sawyer St./Hwy. O bridge crosses and where a City Park and Beach exists. Clearwater Bay extends north off the east side of the South Basin. Most of the shoreline falls within the City of Rice Lake and is heavily developed (Figure 3). There are two small islands in the west-central portion of the North Basin which are maintained for public use.

Figure 3: Rice Lake City Limits (dotted line)

Based on summer of 2024 point-intercept (PI) survey results that sampled 793 points in the lake, most shoreline areas around the North and Central Basins slope sharply into 10ft+ creating a narrow littoral zone away from the numerous shallow side bays. In the irregular-shaped Soth Basin, these shoreline drop-offs are even more pronounced. The lake's substrate as 54.0% organic and sandy muck, 2.0% gravel and rock, and 44.0% pure sand. In the bays around the north basin and south basins, thin sandy muck typified most of the bottom, while the flat near the Red Cedar River Inlet and the margins of the southeast bays had generally thicker, more nutrient-rich organic muck. The deepwater areas of the basins themselves tended to be pure sand with scattered cobbles and gravel areas mixed in (Figure 4).

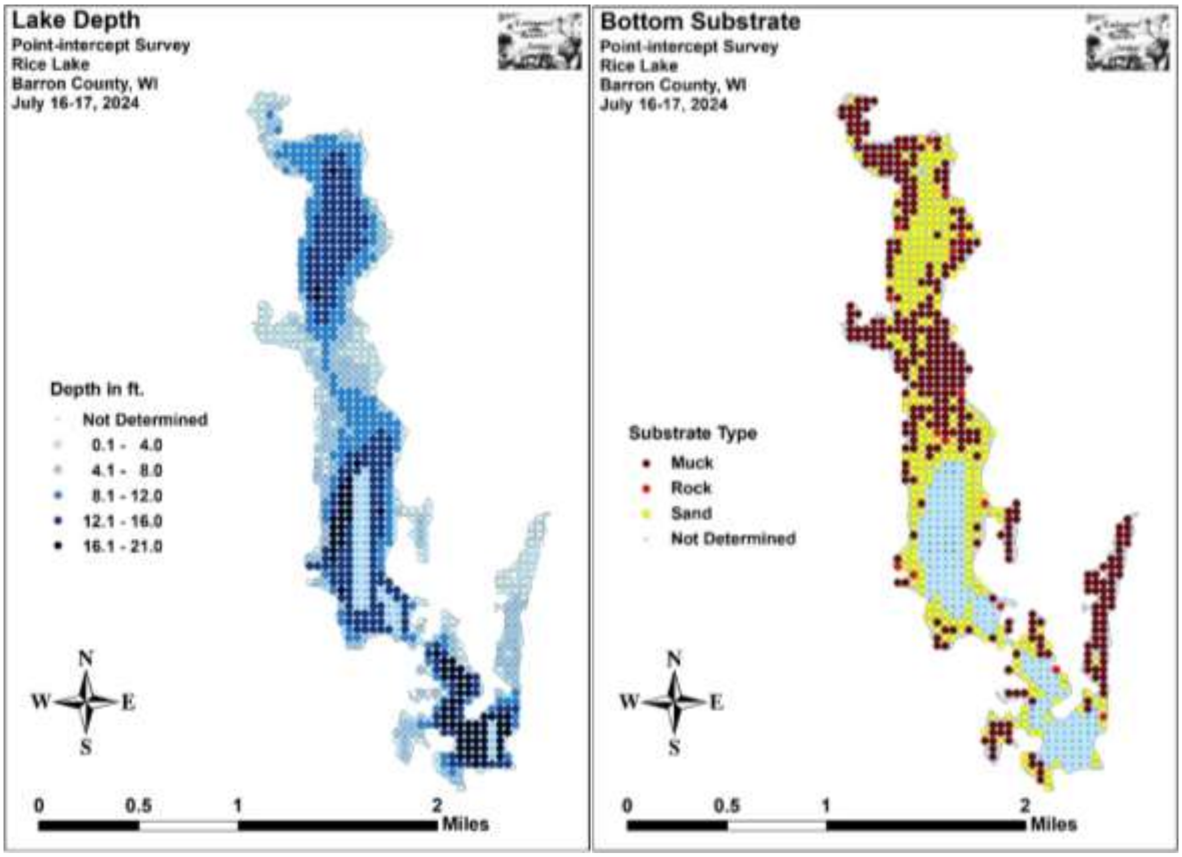


Figure 4: 2024 Rice Lake PI survey results – Depth and Substrate

During the summer of 2024, PI survey, the littoral zone (area of the lake that could support aquatic plant growth) covered approximately 68% of the surface area of the lake (Figure 5). Plants were documented growing to 13.0ft (down from 13.5ft in 2018). There were 333 points with vegetation (approximately 39.5% of the entire lake bottom and 61.8% of the littoral zone), a non-significant increase when compared to the 2018 survey when EIS biologists found plants growing at 306. Visual analysis of the 2018 and 2024 maps suggested plant growth was little changed outside of some expansion in the southeast bays (Figure 5).

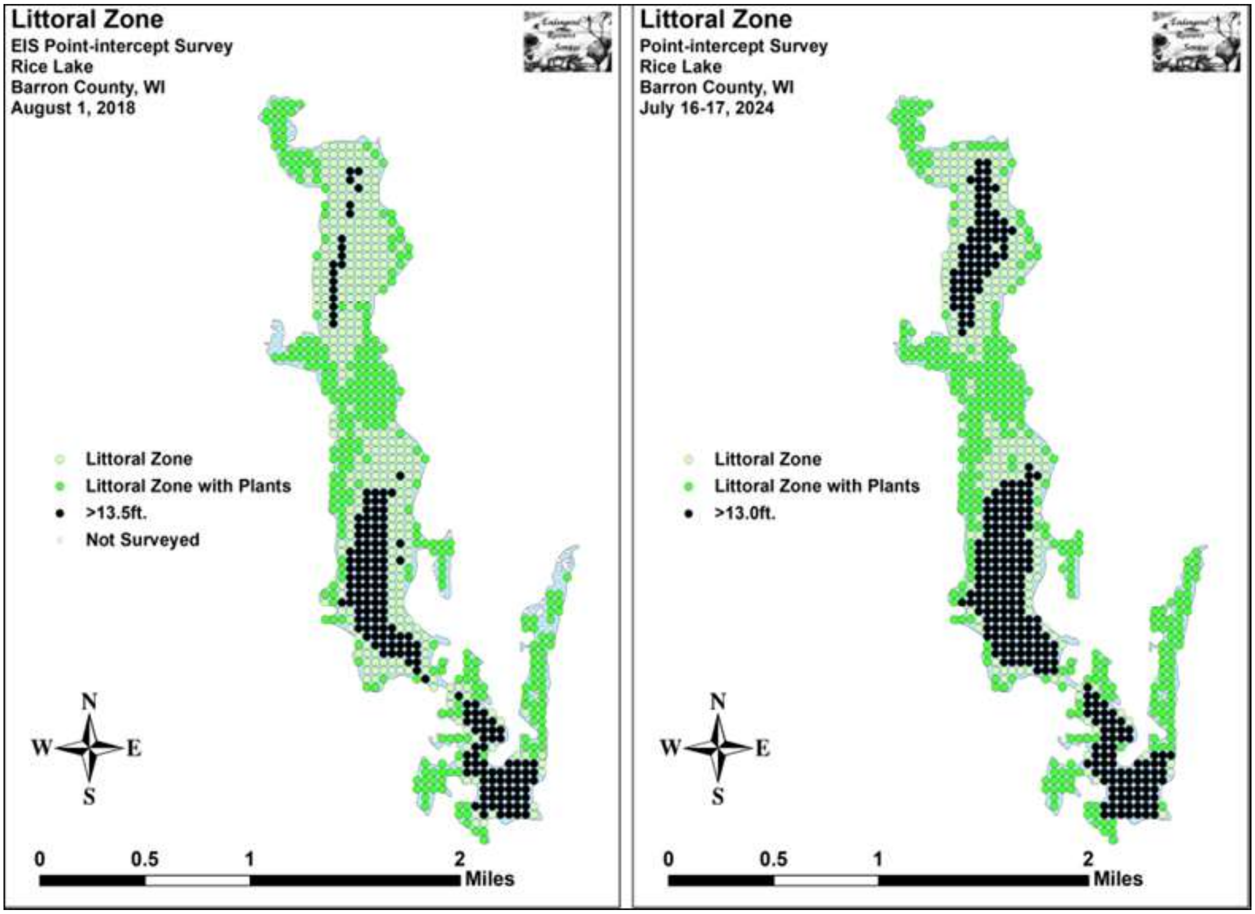


Figure 5: 2018 and 2024 Rice Lake PI survey results – Littoral Zone

CRITICAL HABITAT

Most lakes have areas of aquatic vegetation or other features that offer critical or unique aquatic plant, fish and/or wildlife habitat. Critical Habitat areas include important fish and wildlife habitat, natural shorelines, physical features important for water quality (for example, springs) and navigation thoroughfares. These areas, which can be located within or adjacent to the lake, are selected because they are particularly valuable to the ecosystem or would be significantly and negatively impacted by most human induced disturbances or development. Critical Habitat areas include both Sensitive Areas and Public Rights Features. Sensitive Areas offer critical or unique fish and wildlife habitat, are important for seasonal or life-stage requirements of various animals or offer water quality or erosion control benefits.

The WDNR designated eighteen Sensitive Areas in Rice Lake in 1997 (Figure 6). Management recommendations for these critical habitats include limiting macrophyte removal and littoral zone alterations and minimizing sediment and nutrient inputs from lawns and septic systems. The Sensitive Areas report also recommends that coarse woody structure be left in the lake, promoting shoreline buffer zones, enforcing zoning ordinances, implementing "slow-no-wake" zones for watercraft, and encourages the Lake District to acquire property near sensitive area sites for conservation purposes. In the last five years, the Lake District has acquired and protected land adjacent to the lake on the north end of Clearwater Bay, the north shore of the lake, and what is locally known as Boy Scout Island (Figure 6).

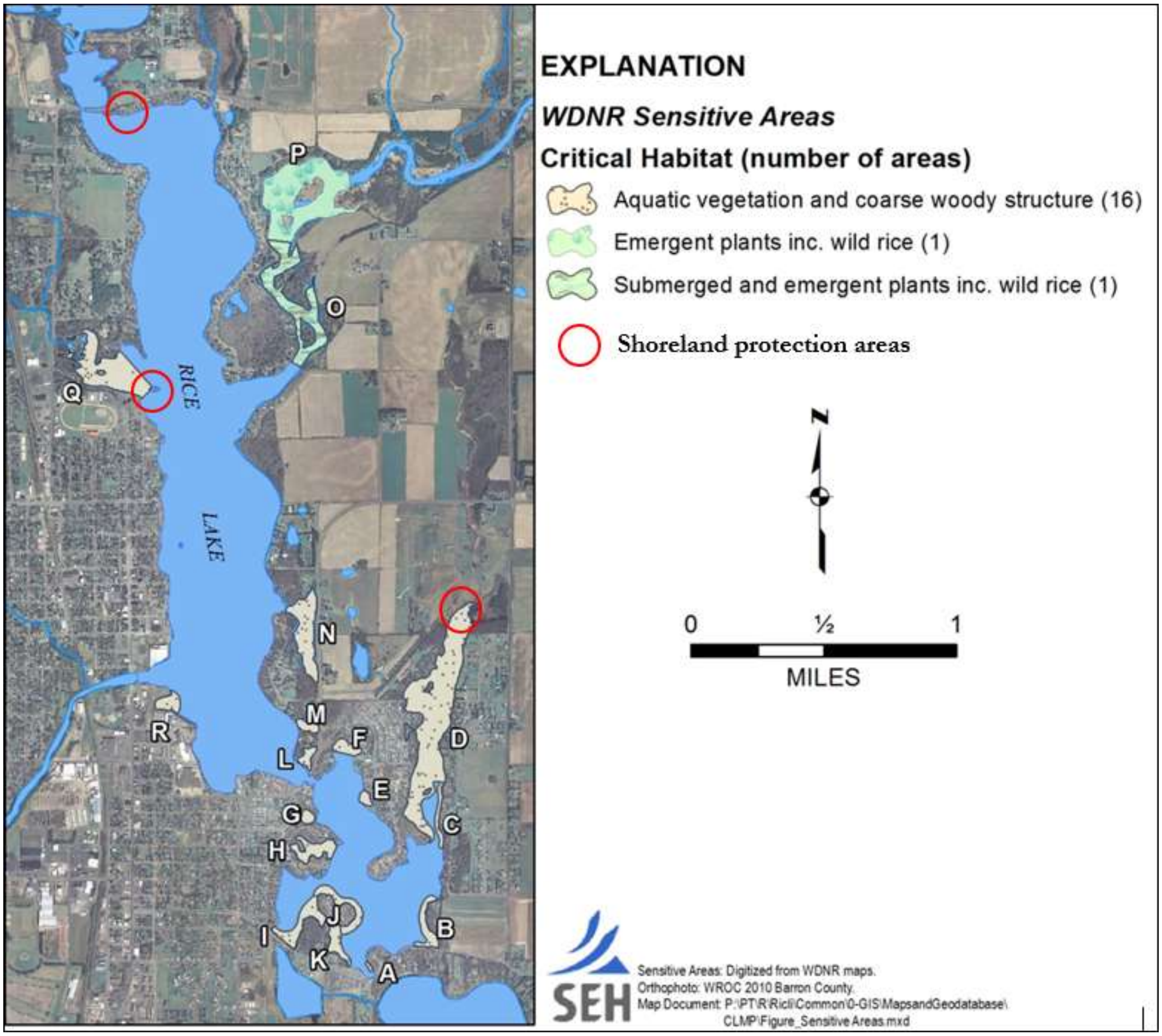


Figure 6: Sensitive Areas in Rice Lake

WATER QUALITY

Within Rice Lake, there are three different basins that are being monitored for water quality. The North Basin and the Central Basin make up the largest percentage of the lake and are impacted by large amounts of water coming into Rice Lake from Bear Creek to the north and the Red Cedar River to the east. The outlet of the lake to the Red Cedar River below the dam is also located in the central basin. Neither basin stratifies much if any time during the open water season due to their shallow nature and water moving through from the inlets to the outlet.

The South Basin is separated from the Central and North Basins by a narrow channel and bridge on Sawyer St/Hwy O. There is no inlet in the South Basin. It is fed primarily by groundwater and runoff from the land around it. The South Basin stratifies in mid to late June and remains stratified until sometime in September. Water moves from the South Basin into the Central Basin on its way to the outlet. The fact that the south basin stratifies and is separated from the other basins essentially makes it act as a separate lake. Water quality monitoring confirms this. The South Basin has better water clarity than the other basins through August, but then internal loading of phosphorus leads to more algal growth reducing clarity, occasionally worse than what is documented in the north and central basins at the same time.

Large storm events impact the North and Central Basins more than the South Basin. The Red Cedar River and Bear Creek bring in large amounts of sediment and other pollutants during these events reducing clarity. The good news is that during these events, the water passes through and over the dam more rapidly, often reducing residence time to only a few hours. Reduced residence time during these events rapidly flushes the North and Central Basins. The South Basin doesn't receive many flushing events so holds onto sediment and nutrients longer. Because of its "better" water quality, the South Basin also gets more recreational lake use (water skiing, tubing, jetskis, and wake boats) which stirs up additional sediment and nutrients.

Within Rice Lake, there are three main basins where water quality data is collected (Figure 7). North Basin data primarily consists of Secchi disk readings of water clarity. Central Basin data includes water clarity, total phosphorus, chlorophyll-a, and temperature/dissolved oxygen profiles. South Basin data has the most data of all three sites and consists of water clarity, total phosphorus, chlorophyll-a, and temperature/dissolved oxygen profiles.

Figure 7: Citizen Lake Monitoring Network Water Quality Monitoring Sites – Rice Lake

WATER CLARITY

Water clarity is a measurement of how deep sunlight can penetrate the waters of a lake. It can be measured in several ways, the most common being an 8" disk divided into four sections, two black and two white, lowered into the lake water from the surface by a rope marked in measurable increments (Figure 8). The water clarity reading is the point at which the Secchi disk, when lowered into the water, can no longer be seen from the surface of the lake. Water color (like dark water stained by tannins from nearby bogs and wetlands), particles suspended in the water column (like sediment or algae), and weather conditions (cloudy, windy, or sunlight) can impact how far a Secchi disk can be seen down in the water. Some lakes have Secchi disk readings of water clarity of just a few inches, while other lakes have conditions that allow the Secchi disk to be seen for dozens of feet before it disappears.

Figure 8: Black and white Secchi disk

TOTAL PHOSPHORUS AND CHLOROPHYLL-A

Phosphorus is a nutrient that promotes excessive aquatic plant and algae growth. In more than 80% of Wisconsin's lakes, phosphorus is the key nutrient affecting the number of algae and weed growth. Phosphorus originates from a variety of sources, many of which are related to human activities. Major sources include human and animal waste, soil erosion, detergents, septic systems and runoff from farmland or lawns. An analysis of phosphorus often includes both soluble reactive phosphorus and total phosphorus (TP). Soluble reactive phosphorus dissolves in the water and readily aids plant growth. Its concentration varies widely in most lakes over short periods of time as plants take it up and release it. TP is considered a better indicator of a lake's nutrient status because its levels remain more stable than soluble reactive phosphorus.

TP includes soluble phosphorus and the phosphorus in plant and animal fragments suspended in lake water. Ideally, soluble reactive phosphorus concentrations should be 10μg/l (micrograms per liter or parts per billion (ppm)) or less at spring turnover to prevent summer algae blooms. A concentration of TP below 30μg/l for impoundments and 20μg/l for lakes should be maintained to prevent nuisance algal blooms.

Phosphorus does not dissolve easily in water. It forms insoluble precipitates (particles) with calcium, iron, and aluminum. Iron is common in northern Wisconsin lakes but will only form sediment particles that store phosphorus if oxygen is also present in the water. When lakes lose oxygen in winter or when the deep water (hypolimnion) loses oxygen in summer, like the south basin of Rice Lake, iron and phosphorus again dissolve in water. Strong summer winds, lake use, or spring and fall turnover may mix iron and phosphorus with surface water enabling an algae bloom, the rapid and visible increase in algae growth that may turn the water green.

Shallow and windswept lakes, like the north and central basins of Rice Lake, stay mixed and do not experience oxygen depletion. But because they remain mixed, levels of phosphorus may be higher due to disturbed bottom sediments suspended in the water. Impoundments that remain mixed, like the north and central basins of Rice Lake generally have higher phosphorus levels than natural lakes. Deep stratified lakes, or portions of lakes that act like natural lakes, like the south basin, generally have the lowest levels.

Chlorophyll is a pigment found in all green plants, including phytoplankton. Phytoplankton are very small free-floating aquatic plants such as algae. Their abundance, as measured by the amount of chlorophyll-A (ChlA) in a water sample is commonly used to classify the trophic status of a lake, discuss in a later section of this plan.

Through the Citizen Lake Monitoring Network (CLMN) in WI, water chemistry volunteers measure total phosphorus levels, chlorophyll-A concentrations, and temperature & dissolved oxygen profiles from the top to the bottom of the lake. This type of monitoring is done four times per year and requires several hours of time during each monitoring event. Chemistry monitoring helps determine if nutrient pollution is occurring in a lake, or if seasonal fish die-offs may be a possibility due to low oxygen levels. Soluble phosphorus is not measured as a part of CLMN.

TROPHIC STATE INDEX

One method of classifying lakes is by lake productivity, or trophic status. The most used index of lake productivity is the Carlson's Trophic State Index (TSI), which is based on the near-surface concentrations of ChlA and TP, and on Secchi depth. The Carlson's TSI was modified in the early 1990s by the WDNR to create an index that better represents Wisconsin lakes, the Wisconsin TSI (WTSI). Oligotrophic lakes (clear, nutrient-poor) have WTSI values <40, mesotrophic lakes (moderate supply of nutrients, moderate clarity) have values between 40 and 50, and eutrophic lakes (productive, nutrient-rich lakes) have values >50. Hyper-eutrophic lakes have values >70. Higher WTSI values are often associated with poorer water quality. Figure 9 provides greater detail related to what conditions might exist in a lake in each of these trophic states.

TSI classification	TSI carlson
Ultraoligotrophic	<20
Oligotrophic	21-41
Mesotrophic	41-50
Eutrophic	51-60
Supereutrophic	
Hypereutrophic	>61
TSI, Trophic State Index	

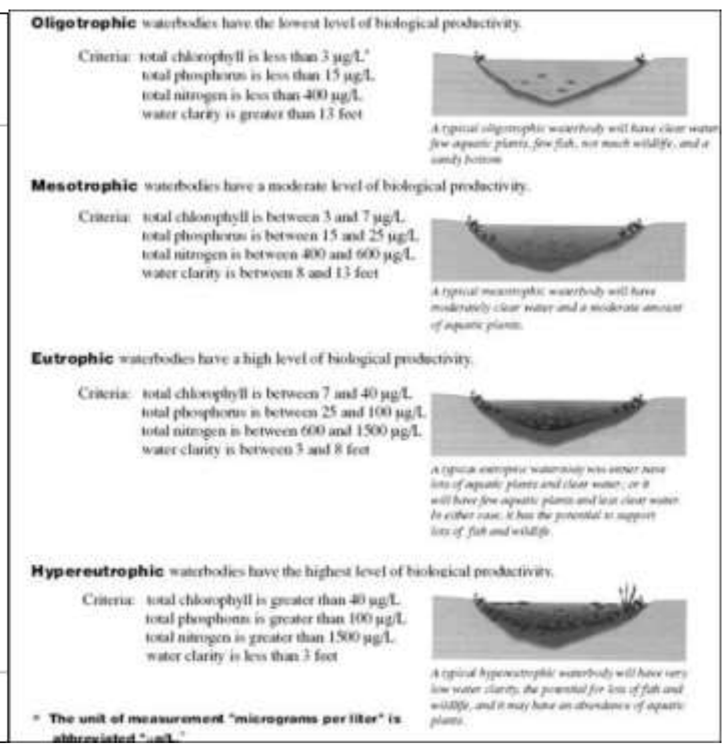


Figure 9: Trophic status in lakes

TEMPERATURE AND DISSOLVED OXYGEN

Temperature and dissolved oxygen are important factors that influence aquatic organisms and nutrient availability in lakes. As temperature increases during the summer in deeper lakes, the colder water sinks to the bottom, and the lake develops three distinct layers as shown in Figure 10. This process, called stratification, prevents mixing between the layers due to density differences which limits the transport of nutrients and dissolved oxygen between the upper and lower layers. In most lakes in Wisconsin that undergo stratification, the whole lake mixes in the spring and fall when the water temperature is between 53 and 66°F, a process called overturn. Overturn begins when the surface water temperatures become colder and therefore denser causing that water to sink or fall through the water column. Below about 39°F, colder water becomes less dense and begins to rise through the water column. Water at the freezing point is the least dense, which is why ice floats and warmer water is near the bottom (called inverse stratification) throughout the winter.

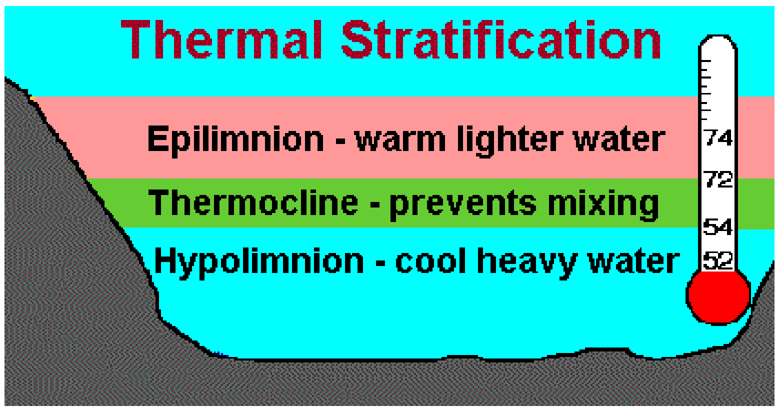


Figure 10: Summer thermal stratification

During the summer months, the upper warm layer, called the epilimnion, remains well oxygenated due to wind and wave action and photosynthesis. The middle layer, called the metalimnion or thermocline, is where changes in temperature and dissolved oxygen are greatest. This middle layer acts as a barrier that prevents warmer, oxygen rich waters in the upper layer from mixing with colder, deeper waters. It is common for dissolved oxygen levels to be depleted in the lower layer, called the hypolimnion, as there is no source of new oxygen, and the decomposition of organic matter consumes oxygen.

A dissolved oxygen level of 2mg/l or less, called hypoxia is an important criterion of sediment phosphorus release. When near-bottom dissolved oxygen is at 2mg/l or less the sediment-water interface is likely anoxic (no oxygen). This lack of oxygen causes the chemical bonds between phosphorus and the iron in the sediments to break which releases free phosphorus back into the water column. If the phosphorus released from sediments reaches the upper part of the lake through spring or fall overturn or when natural or human induced wave action mixes the lake, it can provide a significant internal source of phosphorus to fuel algae blooms.

NORTH BASIN

Water quality sampling in the North Basin consists of Secchi readings of water clarity during the summer months starting in 2008. According to the Wisconsin Waters Explorer[2] database that houses all the CLMN data collected by volunteers, there are no established trends in water clarity based on early and late summer readings (Figure 11). Overall, the tropic state of the North Basin seems worse after 2020 than it was before

[2] https://dnr-wisconsin.shinyapps.io/WaterExplorer/

2020 with TSI values hovering just above 60 indicating hypereutrophic conditions (Figure 12). Water clarity in the North Basin is slightly worse than average when compared to data collected from similar reservoirs (Figure 13).

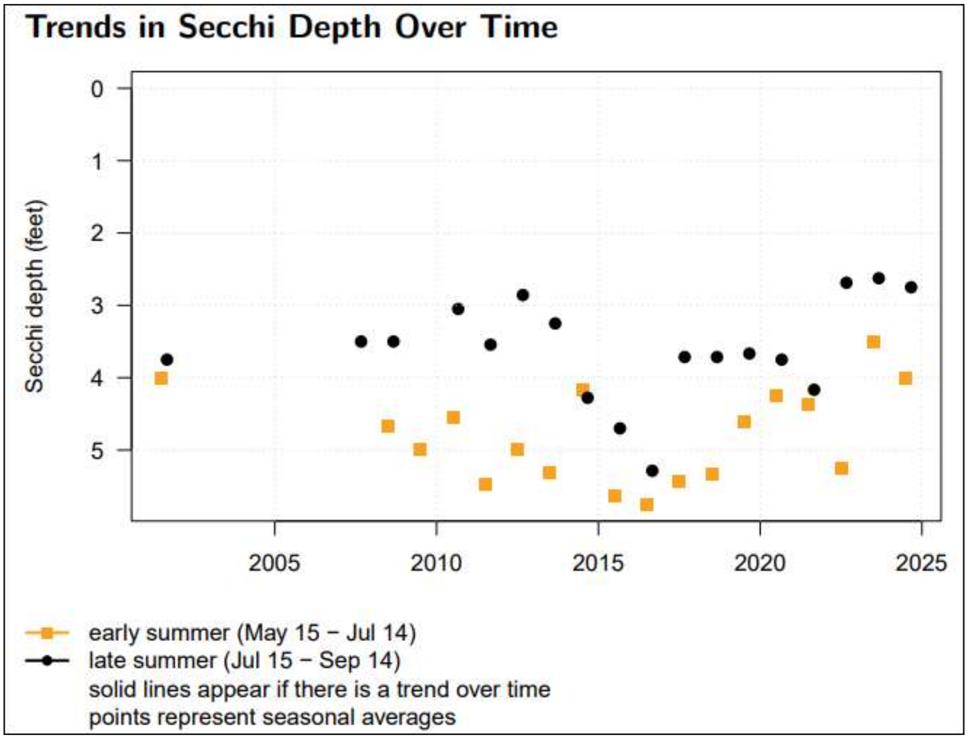


Figure 11: Rice Lake – North Basin water clarity data (WEx, 2024)

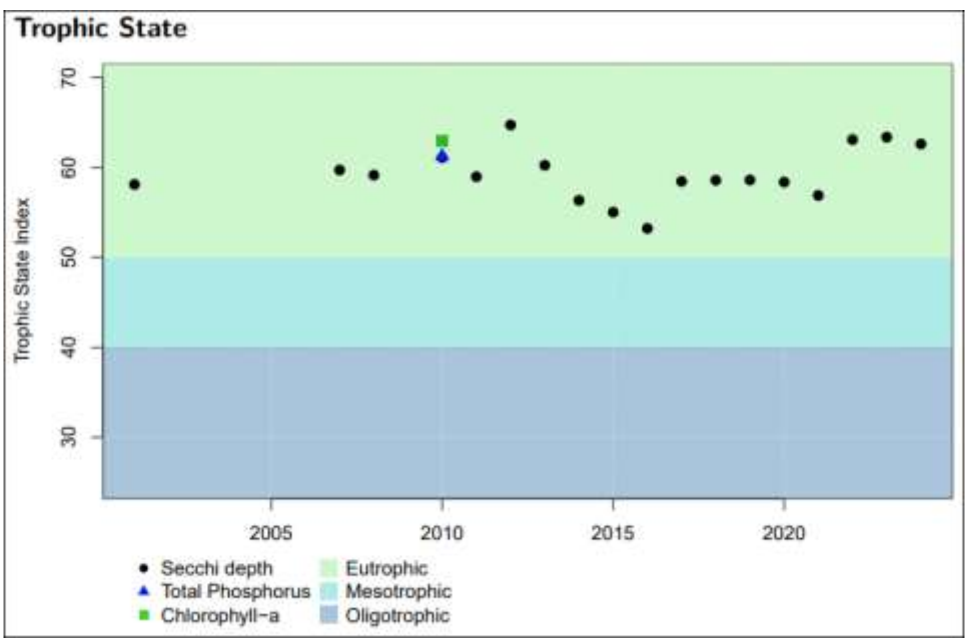


Figure 12: Trophic status – North Basin of Rice Lake (WEx, 2024)

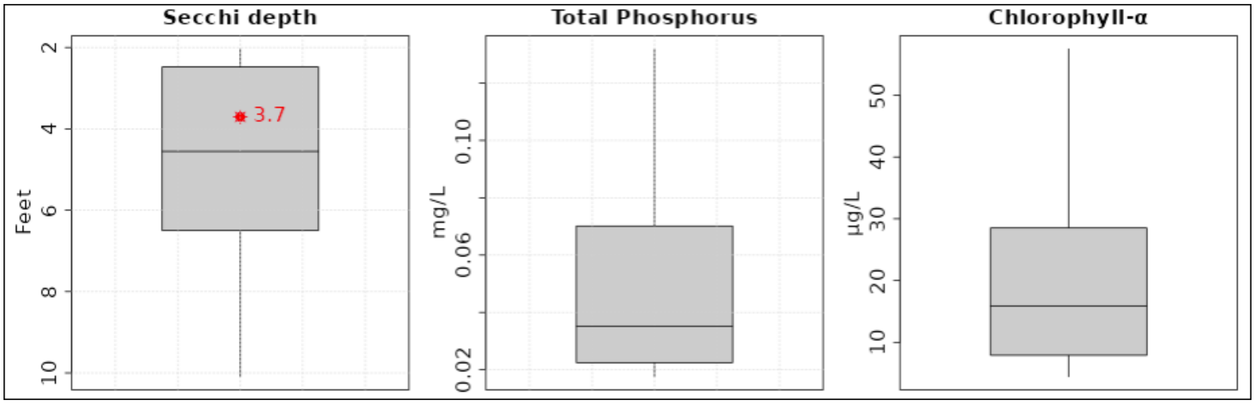


Figure 13: North Basin - Late summer trophic indicator averages (red) from the last 10 years compared to other RESERVOIR lakes (gray box and whiskers). If red dots are absent, not enough recent data exists to calculate an average. (WEx, 2024)

The North Basin of Rice Lake exhibits some tendency to stratify but temperature remains constant surface to bottom through the summer months (Figure14). If hypoxia occurs at all, it starts below about 13ft starting in August.

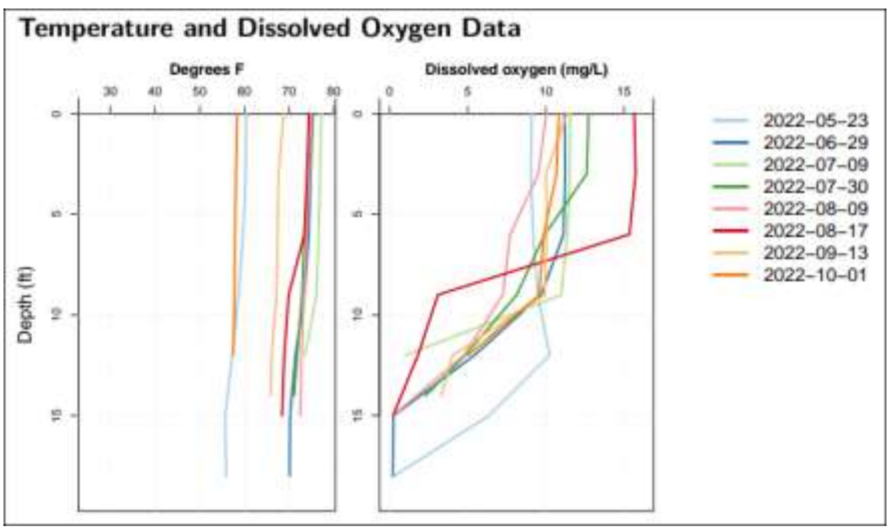


Figure 14: Representative North Basin temperature and dissolved oxygen profiles (WEx, 2024)

CENTRAL BASIN

Water quality sampling in the Central Basin consists of Secchi readings of water clarity, TP, and Chla during the summer months starting about 2008. According to the Wisconsin Waters Explorer database, there are no established trends for any of these parameters based on early and late summer readings (Figures 15-17). Overall, the tropic state of the Central Basin is steadily getting worse from about 2015 with TSI values hovering in the mid-50s in 2015 and reaching the mid-60s in 2024 indicating a steady climb into hypereutrophic conditions (Figure 18). Water clarity and TP in the Central Basin are slightly worse than average when compared to data collected from similar reservoirs (Figure 19). Chla values are way worse, outside of the generally established range of results from other reservoirs (Figure 19).

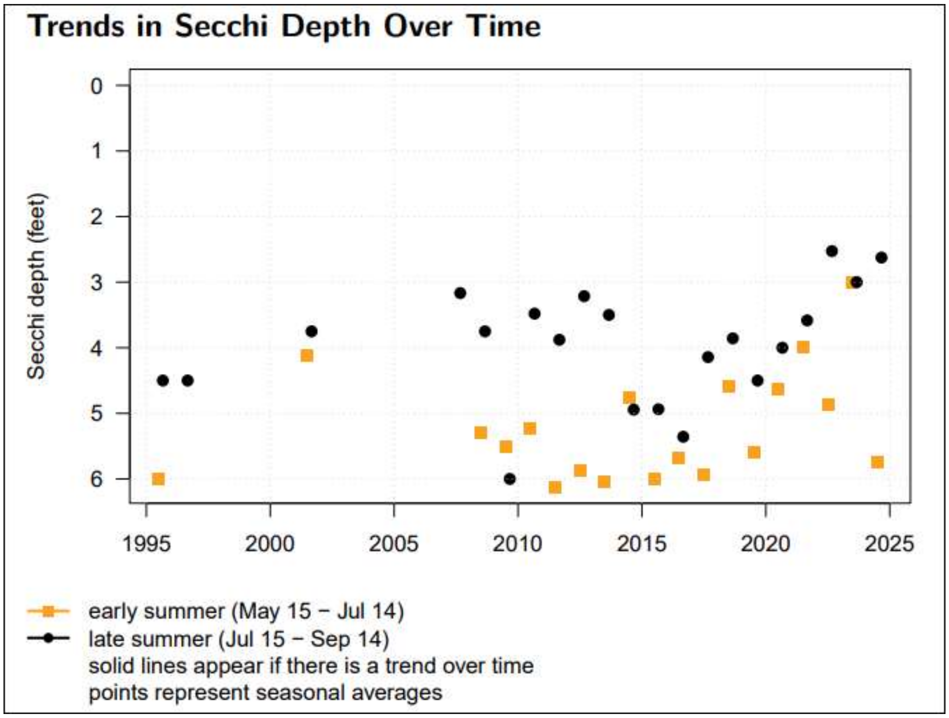


Figure 15: Central Basin Secchi (WEx, 2024)

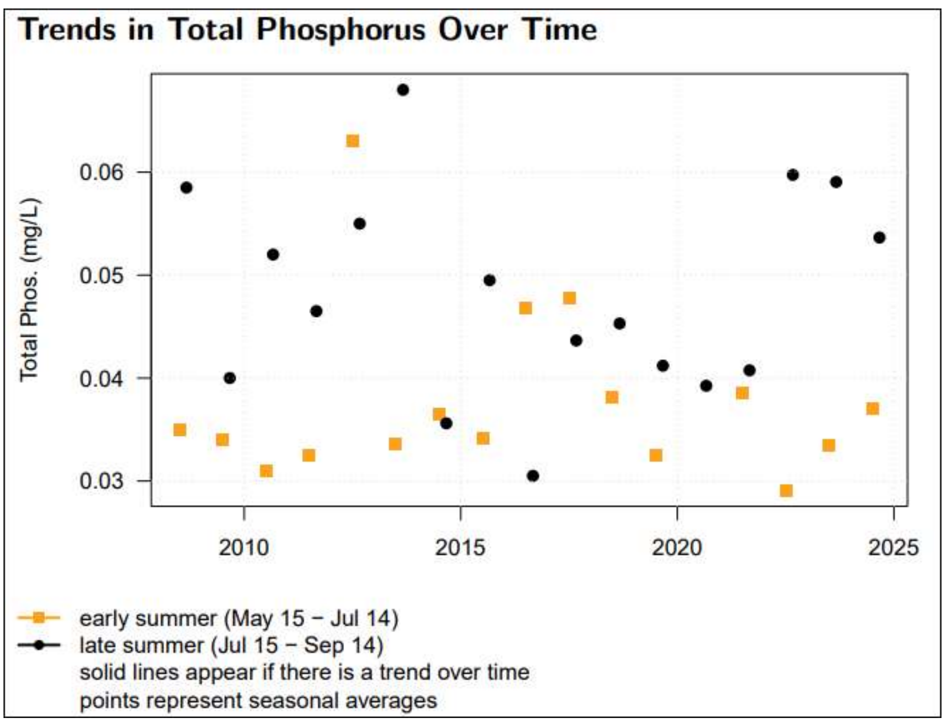


Figure 16: Central Basin Total Phosphorus (WEx, 2024)

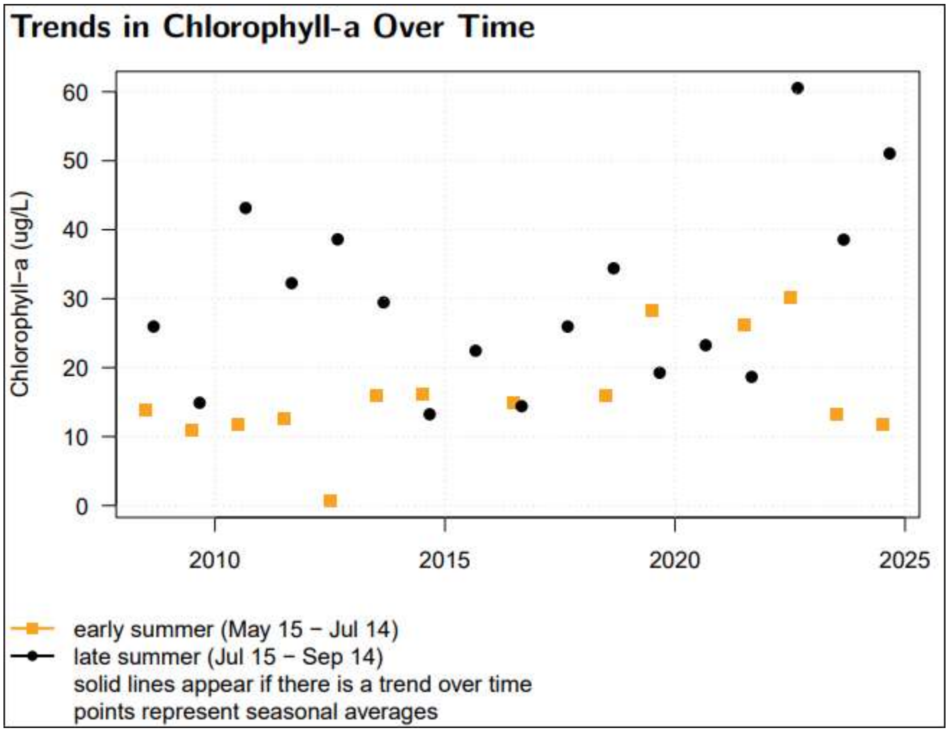


Figure 17: Central Basin Chlorophyll-a (WEx, 2024)

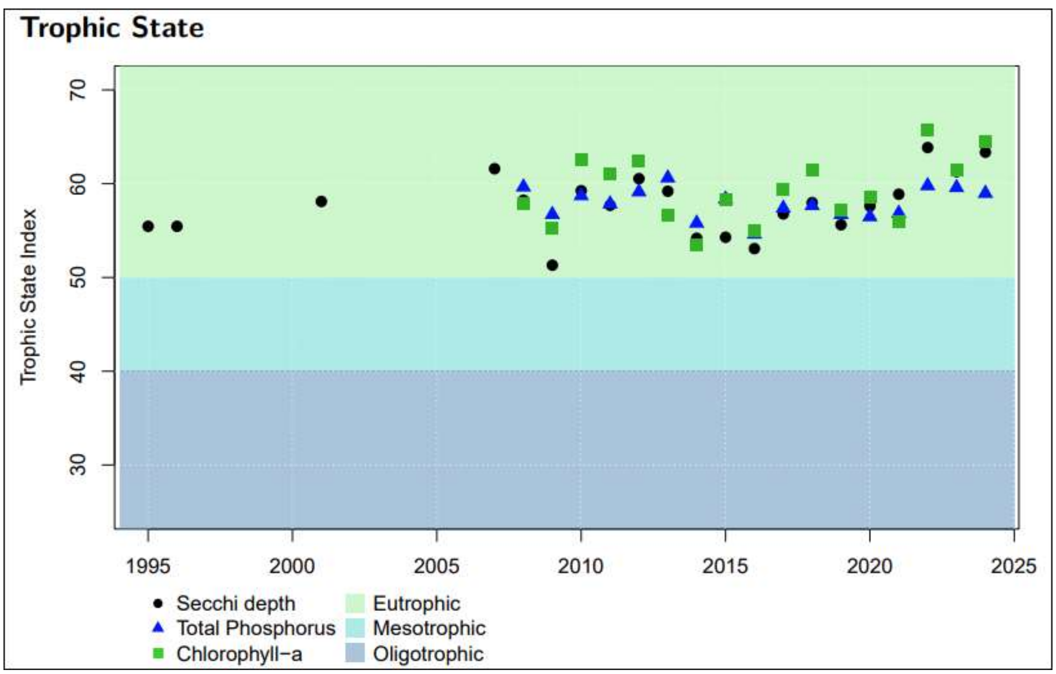


Figure 18: Central Basin Trophic Status (WEx, 2024)

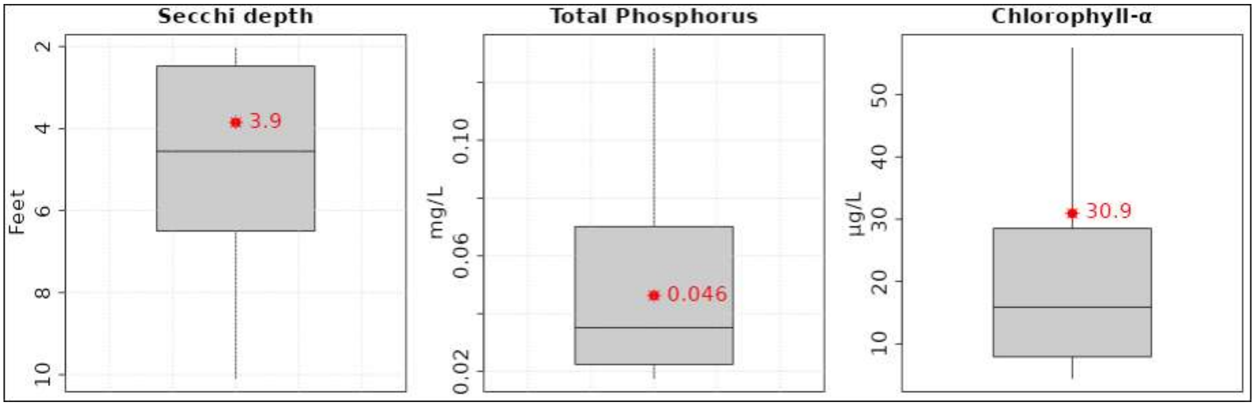


Figure 19: Central Basin compared to similar impounds (WEx, 2024)

The Central Basin remains more mixed throughout the season than either the North or the South Basin due to the flowthrough of the Red Cedar River. Hypoxia generally does not occur except at the water-sediment interface (Figure 20).

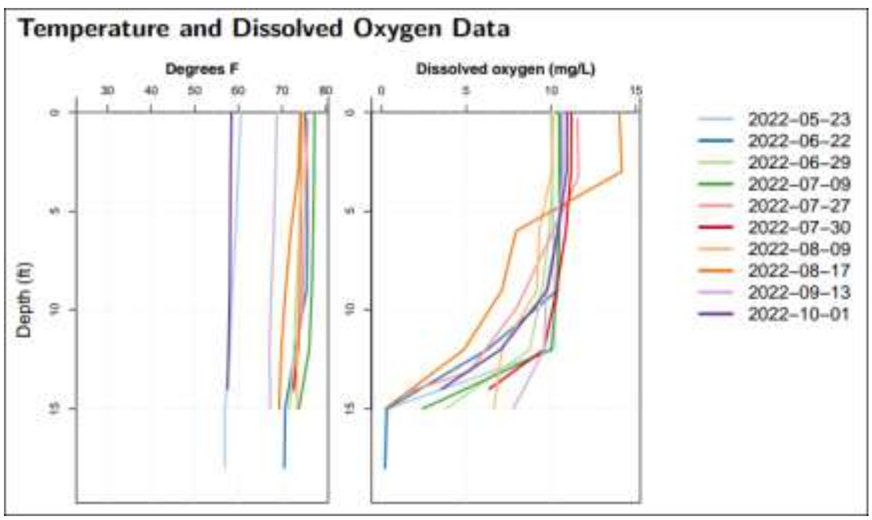


Figure 20: Representative Central Basin temperature and dissolved oxygen profiles (WEx, 2024)

SOUTH BASIN

Both the North and Central Basins are heavily influenced by water flowing into and out of the lake. As mentioned, the Red Cedar River and Bear Creek are major contributors to inflow with most of that water flowing all the way through and over the dam in the Central Basin. The South Basin has no inflow other than groundwater and surface runoff. The South Basin also stratifies in June, creating conditions of hypoxia at about 15ft and remaining so through late September.

Water clarity and Chla exhibit a worsening trend in the early summer (Figures 21&22). TP exhibits no trend (Figure 23). Overall, there appears to be a slight trend toward worsening water quality over the last 10 years (Figure 24). When compared to data from other reservoirs, water clarity and TP are slightly better than average with Chla being slightly worse (Figure 25). However, being separated from the North and Central Basins by the narrows, the South Basin does not have all the characteristics of a reservoir, it acts more like a seepage lake, without the flushing that a reservoir or drainage lake gets.

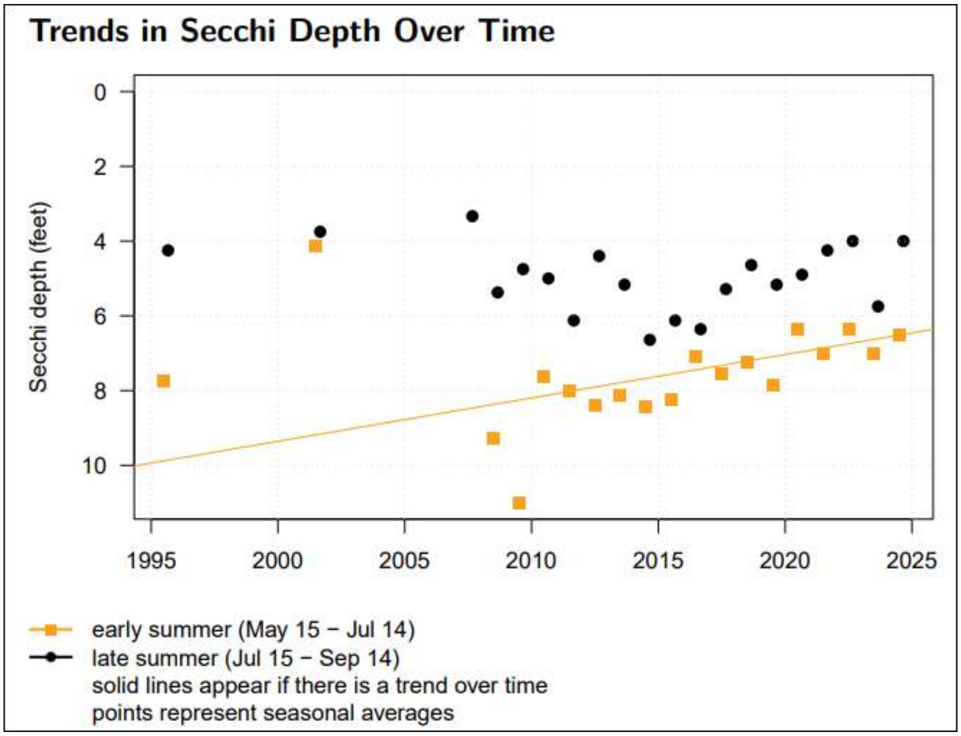


Figure 21: South Basin Secchi (WEx, 2024)

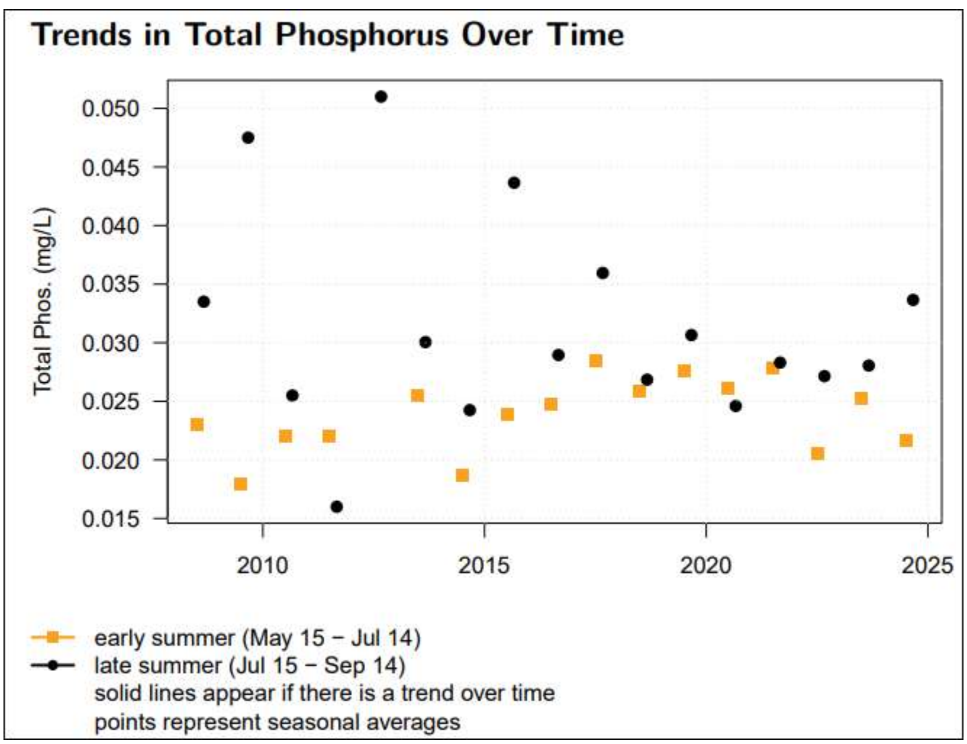


Figure 22: South Basin Total Phosphorus (WEx, 2024)

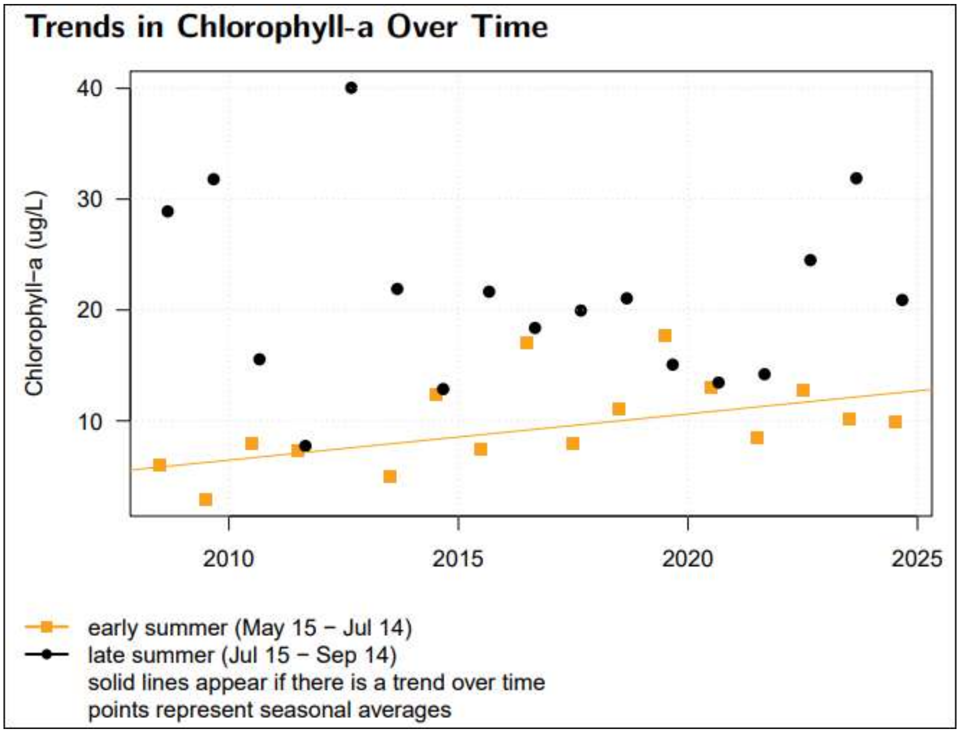


Figure 23: South Basin Chlorophyll-a (WEx, 2024)

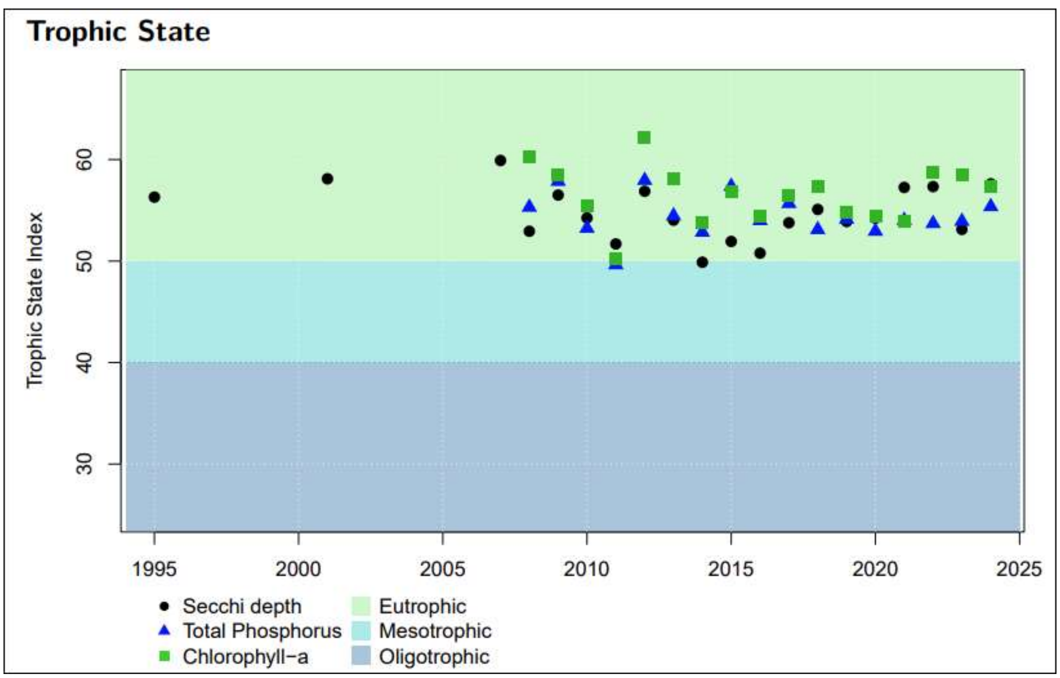


Figure 24: South Basin Trophic Status (WEx, 2024)

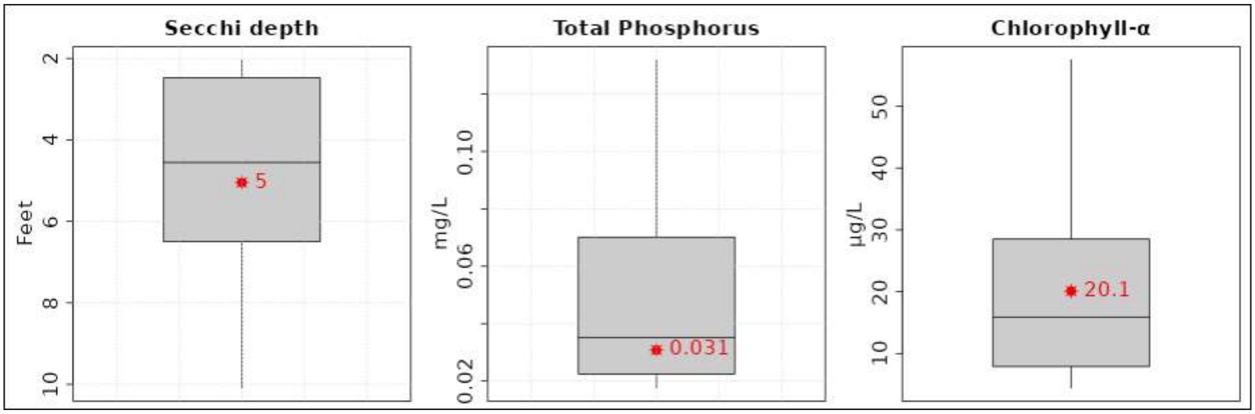


Figure 25: South Basin comparison to similar water bodies (WEx, 2024)

The South Basin stratifies around 12ft and remains through the warm water season. Hypoxia is most pronounced starting in June, running through September (Figure 26). The area below 15ft becomes devoid of oxygen sometime in July releasing TP into the hypolimnion. Mixing events caused by increased boater use and/or summer storms generate enough disturbance to break the thermocline and bring phosphorus from the hypolimnion to the surface where it supports the growth of algae. When the South Basin enters fall turnover, even more phosphorus is made available for algae growth. It is this phenomenon that causes the South Basin to have worse water quality in the late summer than either the North or Central Basins.

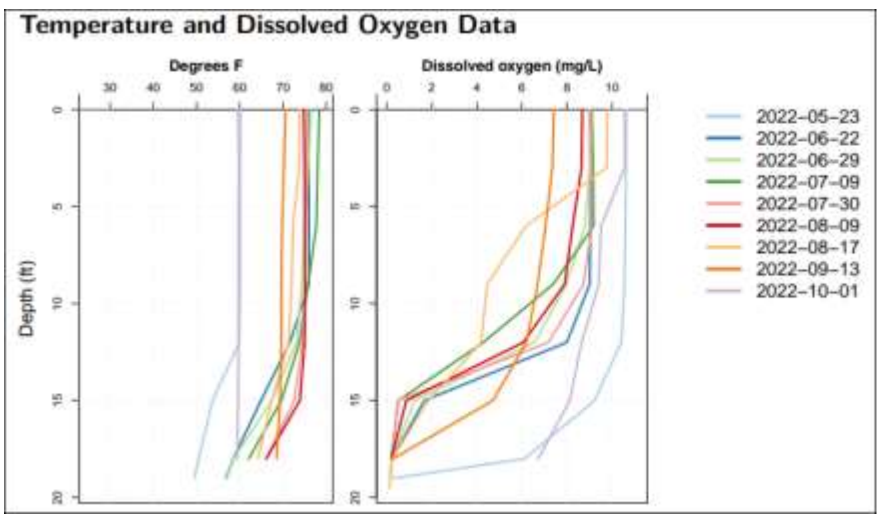


Figure 26: Representative South Basin temperature and dissolved oxygen profiles (WEx, 2024)

The total Rice Lake watershed is a large area which contains lakes that are managed by other lake organizations (Figure 27). The Rice Lake District focuses management efforts on the area of watershed that is not managed by other organizations (sub-watershed). Within the Rice Lake sub-watershed, agricultural land uses (row crops (corn & soybeans), dairy, pasture, hay, and vegetables like potatoes) dominate at 44.4%, followed by forests at 38.8%. Moderate development (4.7%) is focused primarily within the Rice Lake City Limits (Table 1). Agricultural land use is vastly greater in the Rice Lake sub-watershed than it is in any of the other three sub-watersheds.

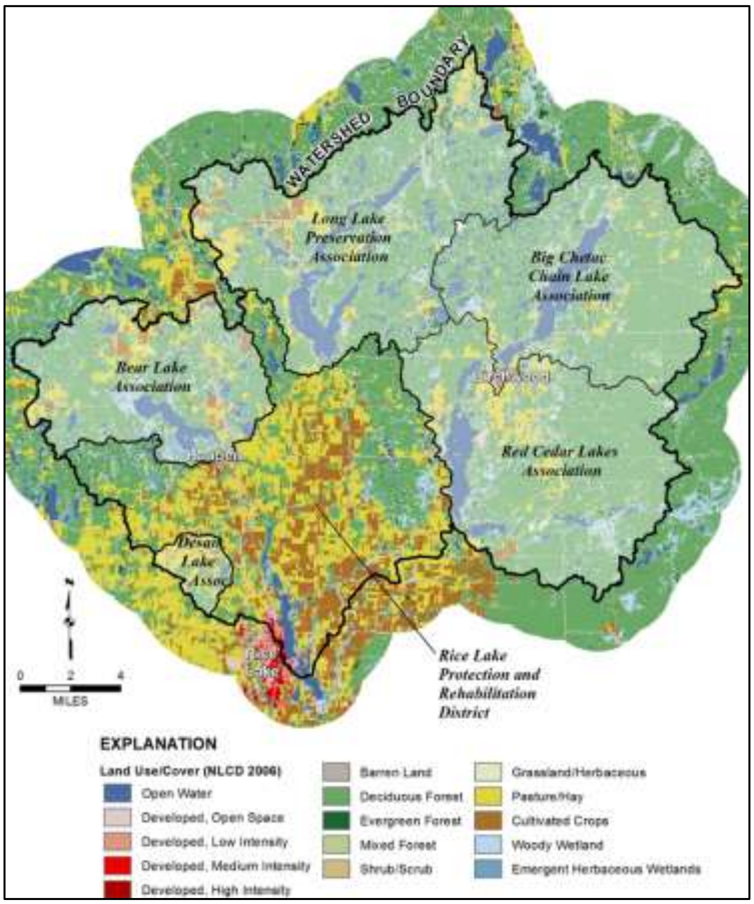


Figure 27: Land use within the Rice Lake Watershed

Table 1: Land use within the Rice Lake Immediate Drainage Watershed

Watershed Land Use	
Land Use	**% of Area**
Developed	4.7%
Agriculture	44.1%
Grassland	6.5%
Forest	38.8%
Open Water	2.7%
Wetland	2.5%
Other	0.7%

WETLANDS

A wetland is an area where water is near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions. Wetlands benefit the ecosystem surrounding Rice Lake with a higher floral diversity of native species supporting a greater variety of native plants, supporting regionally scarce plants and plant communities, providing fish and wildlife habitat for feeding, breeding, resting, nesting, escape cover, travel corridors, spawning grounds for fish, and nurseries for mammals and waterfowl.

Wetlands also provide flood protection within the landscape. Due to the dense vegetation and location within the landscape, wetlands are important for retaining stormwater from rain and melting snow moving towards surface waters and retaining floodwater from rising streams. This flood protection minimizes impacts on downstream areas. Wetlands provide water quality protection because wetland plants and soils have the capacity to store and filter pollutants ranging from pesticides to animal wastes.

Wetlands also provide shoreline protection to Rice Lake by acting as buffers between land and water. This is particularly true in the wetlands that line the Red Cedar River and Bear Creek as they enter the lake. Wetlands also provide groundwater recharge and discharge by allowing the surface water to move into and out of the groundwater system. The filtering capacity of wetland plants and substrates help protect groundwater quality. Wetlands can also stabilize and maintain stream flows, especially during dry months. Aesthetics, recreation, education, and science are also all services wetlands provide.

Within the immediate drainage basin of Rice Lake, approximately 6,000 acres or just fewer than 10% of the total area is comprised of wetlands. The largest concentrations of wetland areas are found in the far east of the drainage basin and the far west. However, the two largest sources of water coming into Rice Lake, Bear Creek and Red Cedar River) are lined with wetlands along their lengths (Figure 28).

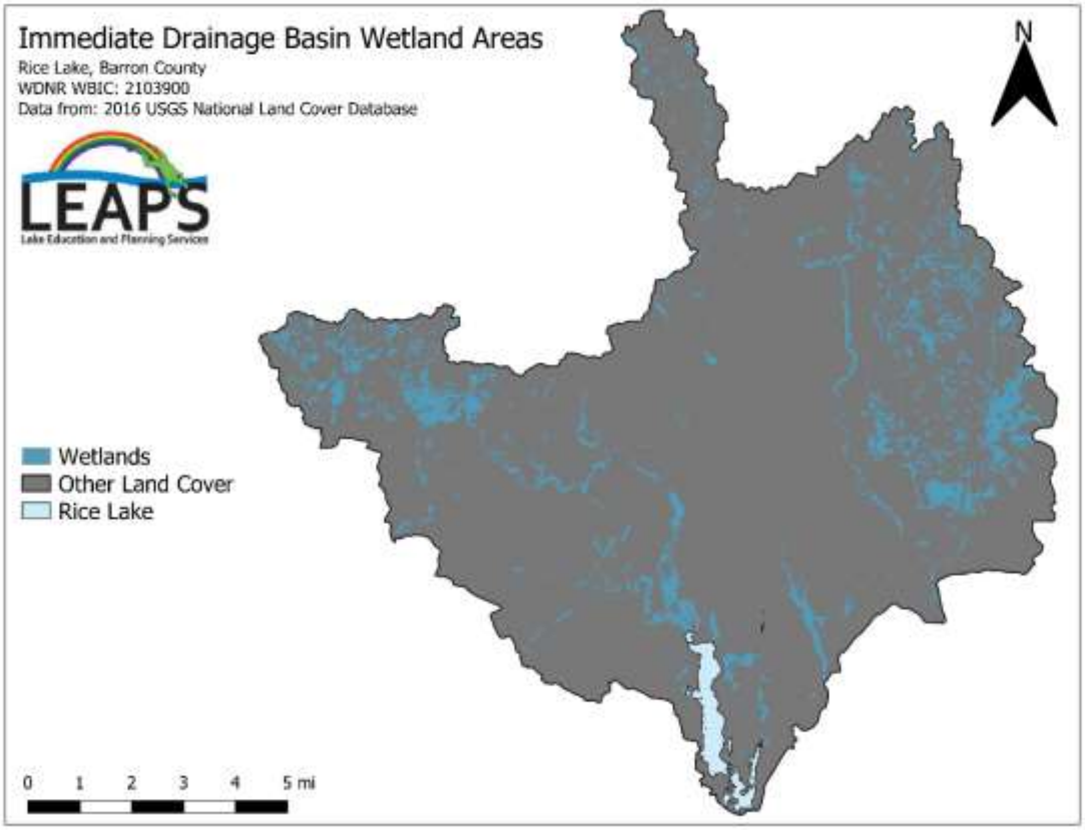


Figure 28: Wetland areas within the immediate Rice Lake drainage basin

COARSE WOODY HABITAT (WOLTER, 2012)

Coarse woody habitat (CWH) in lakes is classified as trees, limbs, branches, roots, and wood fragments at least 4 inches in diameter that enter a lake by natural (beaver activity, toppling from ice, wind, or wave scouring) or human means (logging, intentional habitat improvement, flooding following dam construction). CWH in the littoral or near-shore zone provides erosion control, acts as a surface for algal growth which is an important food base for aquatic macro invertebrates, prevents suspension of sediments improving water clarity, provides important refuge, foraging, and spawning habitat for fish, aquatic invertebrates, turtles, birds, and other animals.

CWH is often removed by shoreline residents to improve aesthetics or select recreational opportunities (swimming and boating). Jennings et al. (2003) found a negative relationship between lakeshore development and the amount of CWH in northern Wisconsin lakes. Similarly, Christensen et al. (1996) found a negative correlation between density of cabins and CWH present in Wisconsin and Michigan lakes. While it is difficult to make precise determinations of natural densities of CWH in lakes it is believed that the value is likely on the scale of hundreds of logs per mile. The positive impact of CWH on fish communities has been well documented by researchers, making the loss of these habitats a critical concern.

Fortunately, remediation of this habitat type is attainable on many waterbodies, particularly where private landowners and lake associations are willing to partner with county, state, and federal agencies. Large-scale CWH projects are currently being conducted by lake associations and local governments with assistance from the WDNR where hundreds of whole trees are added to the near-shore areas of lakes. For more information on this process visit: http://dnr.wi.gov/topic/fishing/outreach/fishsticks.html (last accessed on 1-4-2018). These types of projects are more formally called "tree drops" but are popularly called "fish sticks" (Figure 29).

Figure 29: Coarse woody habitat-Fishsticks projects

The woody habitat within Rice Lake has not been quantified but interested property owners are still able to install fish sticks projects in the lake adjacent to their property if they follow the proper channels for permitting and obtaining the trees.

SHORELANDS

How the shoreline of a lake is managed can have big impacts on the water quality and health of that lake. Natural shorelines prevent polluted runoff from entering lakes, help control flooding and erosion, provide fish and wildlife habitat, may make it harder for aquatic invasive species to establish themselves, muffle noise from watercraft, and preserve privacy and natural scenic beauty. Things that many lakefront property owners appreciate and enjoy about their properties - natural scenic beauty, tranquility, privacy, relaxation - are enhanced and preserved with good shoreland management. And healthy lakes with good water quality translate into healthy lake front property values.

Shorelands may look peaceful, but they are a hotbed of activity on a lake. At least 90% of all living things found in lakes - from fish to frogs, turtles, insects, birds, and other wildlife - are found along the shallow margins and shores. They rely on shorelands for all or part of their life cycles as a source for food, a place to sleep, cover from predators, and to raise their young. Shorelands and shallows are the spawning grounds for fish, nesting sites for birds, and where turtles lay their eggs. There can be as much as 500% more species diversity at the water's edge compared to adjoining uplands.

Lakes are buffered by shorelands that extend into and away from the lake. These shoreland buffers include shallow waters with submerged plants (like coontail and pondweeds), the water's edge where fallen trees and emergent plants like rushes might be found, and upward onto the land where different layers of plants (low ground cover, shrubs, trees) may lead to the lake. A lake's littoral zone is a term used to describe the shallow water area where aquatic plants can grow because sunlight can penetrate to the lake bottom. Shallow lakes might be composed entirely of a littoral zone. In deeper lakes, plants are limited to where they can grow by how deeply light can penetrate the water.

Shorelands are critical to a lake's health. Activities such replacing natural vegetation with lawns, clearing brush and trees, importing sand to make artificial beaches, and installing structures such as piers, can cause water quality decline and change what species can survive in the lake.

PROTECTING WATER QUALITY

Shoreland buffers slow down rain and snow melt (runoff). Runoff can add nutrients, sediments, and other pollutants into lakes, causing water quality to decline. Slowing down runoff will help water soak (infiltrate) into the ground. Water that soaks into the ground is less likely to damage lake quality and recharges groundwater that supplies water to many of Wisconsin's lakes. Slowing down runoff water also reduces flooding and stabilizes stream flows and lake levels.

Shoreland wetlands act like natural sponges trapping nutrients where nutrient-rich wetland sediments and soils support insects, frogs, and other small animals eaten by fish and wildlife.

Shoreland forests function as filters, retainers, and suppliers of nutrients and organic material to lakes. The tree canopy, young trees, shrubs, and forest understory all intercept precipitation, slowing runoff, and contributing to water infiltration by keeping the soil's organic surface layer well-aerated and moist. Forests also slow down water flowing overland, often capturing its sediment load before it can enter a lake or stream. In watersheds with a considerable proportion of forest cover, the erosive force of spring snow melts is reduced as snow in forests melts later than snow on open land and meltwater flowing into streams is more evenly distributed. Shoreland trees grow, mature, and eventually fall into lakes where they protect shorelines from erosion, and are an important source of nutrients, minerals, and wildlife habitat.

NATURAL SHORELANDS ROLE IN PREVENTING AQUATIC INVASIVE SPECIES

In addition to removing essential habitat for fish and wildlife, clearing native plants from shorelines and shallow waters can create opportunities for invasive species to take over. Like rototilling a home garden to prepare it for seeding, clearing shoreland plants exposes bare earth and removes the existing competition (the cleared shoreland plants) from the area. Nature fills a vacuum. While the same native shoreland plants may recover and reclaim their old space, invasive species possess "weedy" traits that enable them to quickly take advantage of disturbed areas and outcompete natives.

The act of weeding creates continual disturbance, which in turn benefits plants that behave like weeds. The modern-day practice of mowing lawns is an example of keeping an ecosystem in a constant state of disturbance to the benefit of invasive species like turf grass, dandelion, and clover, all native to Europe. Keeping shoreline intact is an effective way to minimize disturbance and minimize opportunities for invasive species to gain a foothold.

THREATS TO SHORELANDS

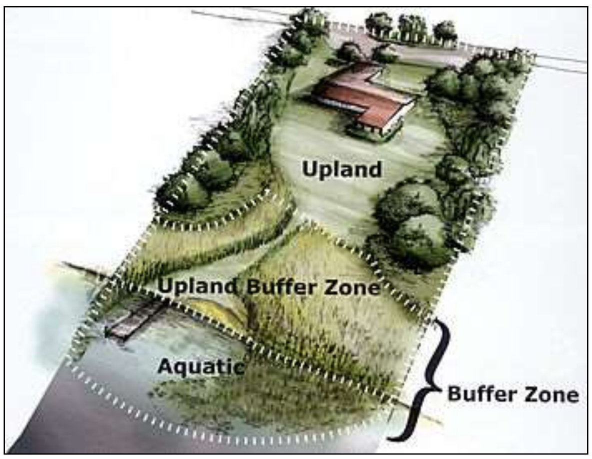
When a landowner develops a waterfront lot, changes may take place including the addition of driveways, houses, decks, garages, sheds, piers, rafts and other structures. Wells, septic systems, lawns, sandy beaches and more impact groundwater and shoreline too. These changes result in the compaction of soil and the removal of trees and native plants, as well as the addition of impervious (hard) surfaces, all of which alter the path that precipitation takes to the water.

Building too close to the water, removing shoreland plants, and covering too much of a lake shore lot with hard surfaces (such as roofs and driveways) can harm important habitat for fish and wildlife, increase nutrient and sediment runoff into the lake, and cause water quality decline.

Changing one waterfront lot in this fashion may not result in a measurable change in the quality of the lake or stream. But cumulative effects when several or many lots are developed can be enormous. A lake's response to stress depends on what condition the system is to begin with, but bit by bit, the cumulative effects of tens of thousands of waterfront property owners "cleaning up" their shorelines, are destroying the shorelands that protect their lakes. Increasing shoreline development and development throughout the lake's watershed can have undesired cumulative effects.

SHORELAND PRESERVATION AND RESTORATION

If a native buffer of shoreland plants exists on a given property, it can be preserved to minimize impacts when future lake property projects are contemplated. If the shoreline has been altered, it can be restored. Shoreline restoration involves recreating buffer zones of natural plants and trees. Not only do quality wild shorelines create higher property values, but they also improve the natural aesthetic making it better for healthy fish populations, varied plant life, and the existence of the insects, invertebrates and amphibians which feed fish, birds, and other creatures. Figure 30 shows the difference between a natural and unnatural shoreline adjacent to a lake home.



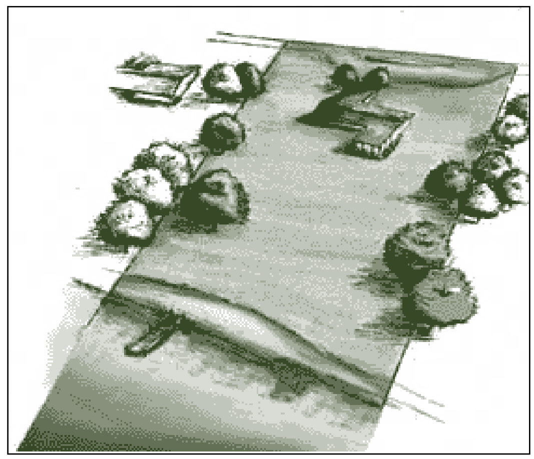


Figure 30: Healthy, AIS Resistant Shoreland (left) vs. Shoreland in Poor Condition

SHORELAND AND WATERSHED PROJECTS TO REDUCE THE NUTRIENT LOAD INTO RICE LAKE

The Lake District offers a program aimed at helping property owners to establish small buffer areas of native plants on their shoreline or upland rain gardens. Called the **R**ice Lake **R**unoff **R**eduction **P**rogram (R3P)[3], it provides project planning for free and up to 50% of project cost (not to exceed $1000.00) is reimbursed after project completion. Providing buffers of wildflowers, grasses, and a few trees between the lake and developed lots helps stabilize shorelines, slow stormwater runoff, and create homes for birds, butterflies, and other wildlife while adding natural beauty to the property. Rain gardens and other water diversions help keep pollutants and extra nutrients out of the lake by collecting runoff from roofs, driveways, and other hard-surfaced areas and letting it soak into the ground. The native plants used in these projects are indigenous to Wisconsin and thrive in our growing conditions and support local pollinating insects.

In addition to the R3P program, the Lake District has implemented multiple projects throughout the watershed aimed at reducing nutrient loading. Most of these projects were installed when the WI Dept. of Transportation had major runoff issues in the Bear Creek waterway and Rice Lake during its construction of a new interchange at Hwy 53 and Cty. V near Haugen, WI. A large sum of money was awarded to the Lake

[3] Reimbursement Program - Rice Lake Lake Protection District

District to implement projects that would mitigate issues caused by the construction site. The intent of the money was to use it for on-the-ground, shovel ready projects that would reduce future surface water runoff and sediment from entering waterways within the Rice Lake and Bear Lake watersheds. Several projects were proposed at the initial award. Some of those projects have been completed, others have been modified, and new projects have been proposed. The following projects were completed using this funding.

WASHBURN COUNTY BOAT LANDING ON BEAR LAKE

This project was one of the original projects proposed when the funding was made available. An unimproved landing on Bear Lake's northeast side was carrying a lot of gravel and road runoff into the lake. It was proposed to make improvements to this landing that would reduce the amount of sand and gravel entering the lake at this site. The project was completed, but unfortunately not to the satisfaction of the WDNR and others. As a result, additional planning was completed and additional modifications made to the site. Although now 100% complete and doing what it was supposed to do, the project cost nearly $10,000 more than was originally included when it was proposed.

TUSCOBIA CREEK HEADWATERS TROUT STREAM REHABILITATION

A trout stream that is the headwaters of Tuscobia Creek which feeds Tuscobia Lake and moving water into Bear Creek, Stump Lake, and Rice Lake was rehabilitated. This project cleaned out a fouled area of the stream, stabilized stream banks that were suffering major erosion, and removed cattle access to the stream (Figure 31).

Figure 31 – Mlejnek Tuscobia Creek Headwaters Project (Barron County, 2015)

MULLIN GRASSED WATERWAY – SUPERWASH

This project was in the northern portion of the watershed between 25th and 26th Street. It included a grassed waterway to be used for light pasturing of dairy cattle. To prevent significant damage to the grassed waterway, fencing was installed to control cattle movement on the site. Several conditions were placed on the pasturing area including the requirement that the farmer maintain it in good condition for a minimum of 10 years (Figure 32).

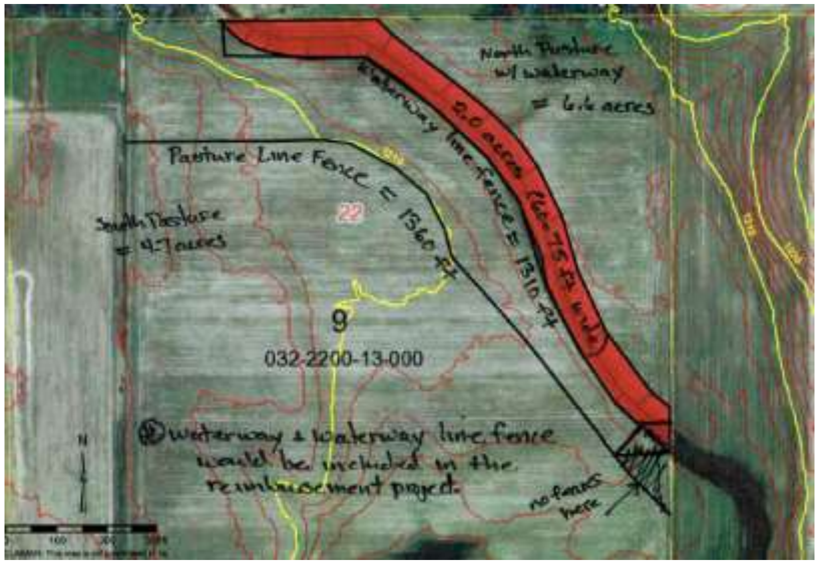


Figure 32 – Mullen Grassed Waterway Project (LEAPS, 2015)

HUMBIRD STREET GRIT CHAMBER

The City of Rice Lake redid a stretch of Humbird Street between Main Street and Lakeshore Drive in 2016. This project included the installation of a grit chamber at the lake side of the storm water sewer system. The actual grit chamber was paid for by the Lake District to the sum of $15,000.00. Design work and installation was completed by the City of Rice Lake. The Humbird St. project was already planned by the city, but it originally did not include a grit chamber. With the settlement money, the installation of a grit chamber was approved and added to the original project. This project was completed over the summer (Figure 33). The City of Rice Lake continues to maintain the grit chamber to this day.

Figure 33: Humbird Street Grit Chamber Installation

BARRON COUNTY FAIRGROUNDS STORMWATER RETENTION BASIN/RAIN GARDEN

The Barron County Fairgrounds in Rice Lake have been a source of sediment and nutrient loading into Rice Lake for years. While several projects have been completed including reshaping the clay harness racing track, installing grassed waterways and rock drainage basins, a rain garden had never been installed. In cooperation with the City of Rice Lake, Barron County Fair Board, and the Barron County Land and Water Conservation Department, the Lake District funded much of the cost to install a large catch basin/rain garden behind the large animal show barns on the northern edge of the Fairgrounds up above the lake (Figures 34 and 35). This project was completed in November 2017 under the direction of the Barron County Soil and Water Conservation Department. Since that time, both Barron County and the Lake District have maintained it, including redoing it a few years later when it stopped working the way it was originally supposed to.

Figure 34: Location of the rain garden installed at the Barron County Fairgrounds

Figure 35: Original construction of the rain garden at the Barron County Fairgrounds

Over the course of the next five years, the Lake District intends to continue support for its R3P program and work with the City of Rice Lake and Barron County to once again pursue sediment and nutrient loading reduction projects in the watershed and immediate shoreline around the lake. The City of Rice Lake will be redoing the entirety of Lakeshore Drive during this period, providing a great opportunity for the Lake District to help fund additions like the installation of grit chambers along the route.

AQUATIC PLANT SURVEYS

Using a standard formula that considers the shoreline shape and distance, islands, water clarity, depth, and total acreage, the Wisconsin Department of Natural Resources (WDNR) generated an 843-point sampling grid for Rice Lake that has been used for every PI survey since 2008 (Figure 36).

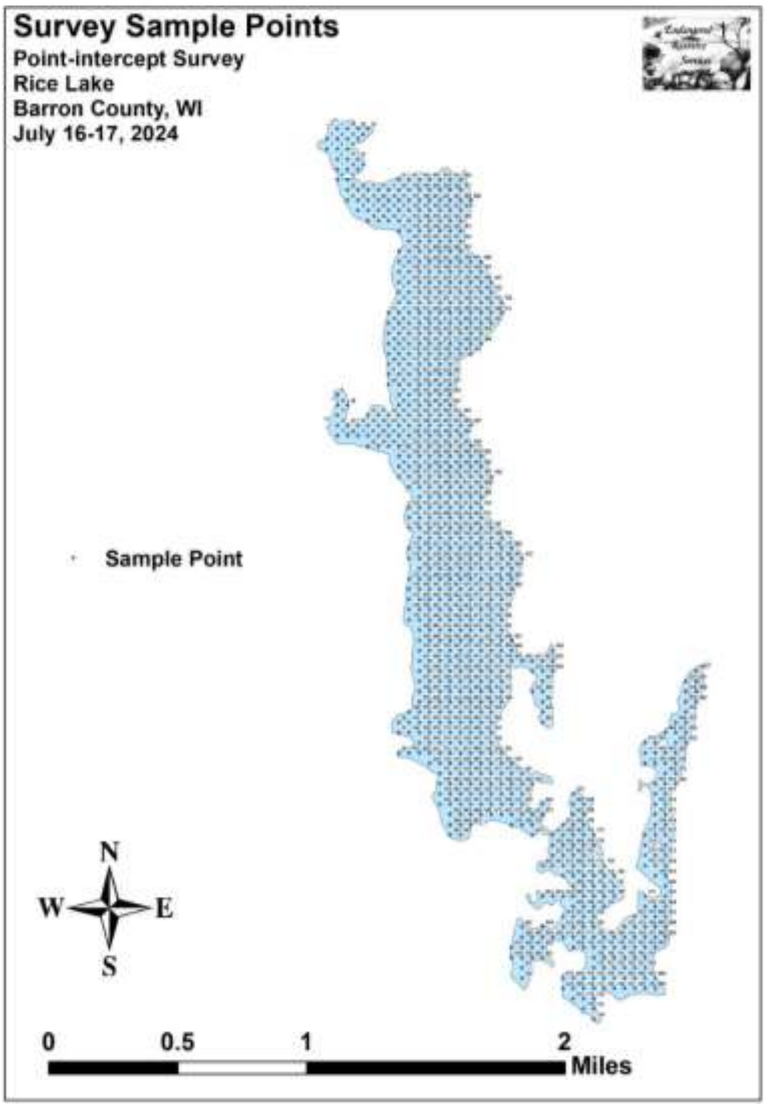


Figure 36: WDNR-generated PI survey grid of 843 points

Using these points, Ecological Integrity Service (EIS) completed warm-water PI surveys in 2008, 2013, and 2018. In 2024 Endangered Resource Services (ERS) completed both an early-season cold-water survey targeting curly-leaf pondweed (CLP) and hybrid watermilfoil (HWM), and a summer survey documenting all aquatic plants in the lake. These surveys provide the means to compare changes in the aquatic plant community over time. Changes are driven by lake conditions, weather conditions, and management implementation.

WARM-WATER FULL POINT-INTERCEPT MACROPHYTE SURVEYS

Warm-water point-intercept surveys were conducted in 2008, 2013, 2018, and 2024. Table 2 shows a comparison of summary statistics from all four surveys. The Lake District contracted with EIS to complete the first three surveys, and ERS to complete the 2024 survey. Aquatic plant survey data is taken from the 2024 Plant Survey Report provided by Endangered Resource Services (Berg M. , 2024).

Table 2: Comparison of Point-intercept Survey Statistics for 2008, 2013, 2018 (EIS), and 2024 (ERS)

SUMMARY STATS: Summer PI Surveys (EIS &ERS)	2008	2013	2018	2024
Total number of sites visited	677	788	689	793
Total number of sites with vegetation	368	342	306	333
Total number of sites shallower than maximum depth of plants	658	622	635	539
Frequency of occurrence at sites shallower than maximum depth of plants	55.9	55.0	48.19	61.78
Simpson Diversity Index	0.89	0.89	0.88	0.92
Maximum depth of plants (ft)**	13.2	14.1	13.50	13.00
Number of sites sampled using rake on Rope (R)	216			0
Number of sites sampled using rake on Pole (P)	410			659
Average number of all species per site (shallower than max depth)	1.97	1.71	1.33	2.52
Average number of all species per site (veg. sites only)	3.52	3.01	2.76	4.08
Average number of native species per site (shallower than max depth)	1.81	1.46	1.33	2.47
Average number of native species per site (veg. sites only)	3.42	2.86	2.76	3.99
Species Richness	41	41	42	51
Species Richness (including visuals)	55	48	46	53
Species Richness (including visuals and boat survey)		52	50	60
Mean depth of plants (ft)	5.4	4.9	4.2	5.1
Median depth of plants (ft)			3.9	5.0
Mean rake fullness (veg. sites only)		1.91	1.98	2.31

Total plant richness in Rice Lake is high with 51 species found in the rake in 2024, up from 42 in 2018 (Figure 37). Nearly all other statistics from the 2024 survey are "better" than any of the previous survey statistics. The differences may simply be due to a different aquatic plant surveyor completing the 2024 survey. A comment made by the 2024 aquatic plant surveyor stated that the improved statistics were due in part to their accessing shallow points with higher density via kayaks and waders. Visual analysis of the maps showed the highest richness occurred in the lake's shallow, muck-bottomed side bays, further supporting that notion (Figure 37). The only negative change is how deep of water aquatic plants were found. The 13.0ft in the 2024 survey is the lowest recorded of all four surveys. There is a documented worsening trend in early season water clarity in the South Basin that could be contributing to this limited depth of aquatic plant growth (See Water Quality Section).

The density (total rake fullness) of aquatic plants at each point was also higher, again likely due to the surveyor creating more access in the shallowest parts of the lake (Figure 38).

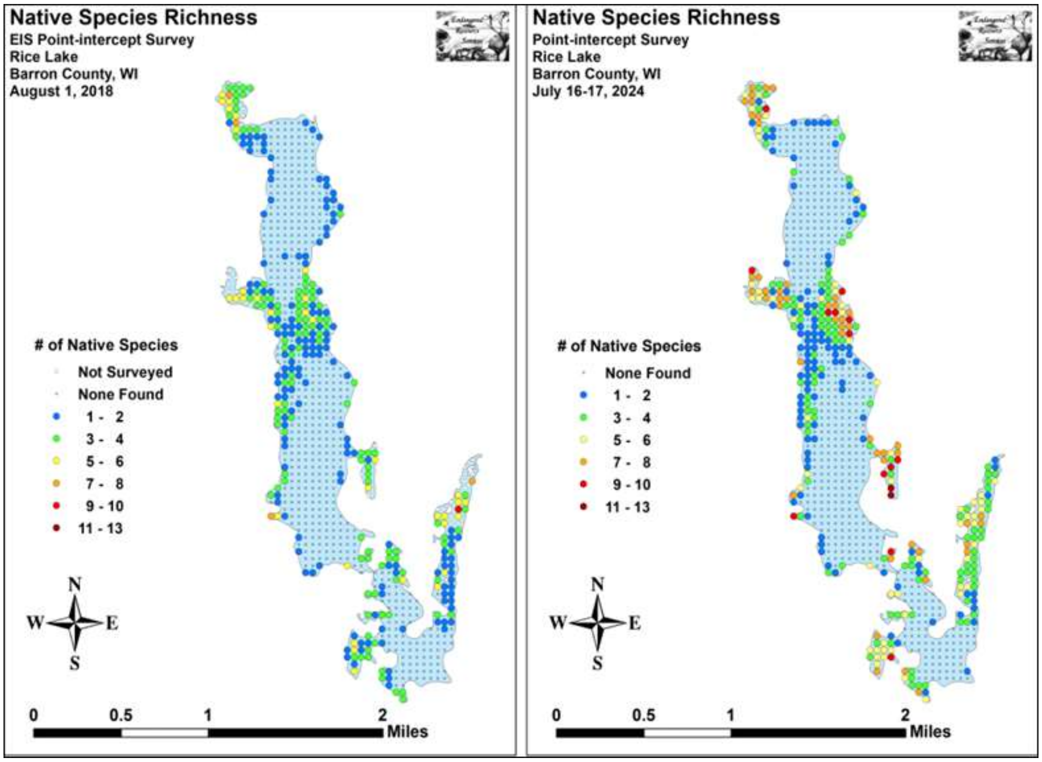


Figure 37: 2018 and 2024 Native Species Richness

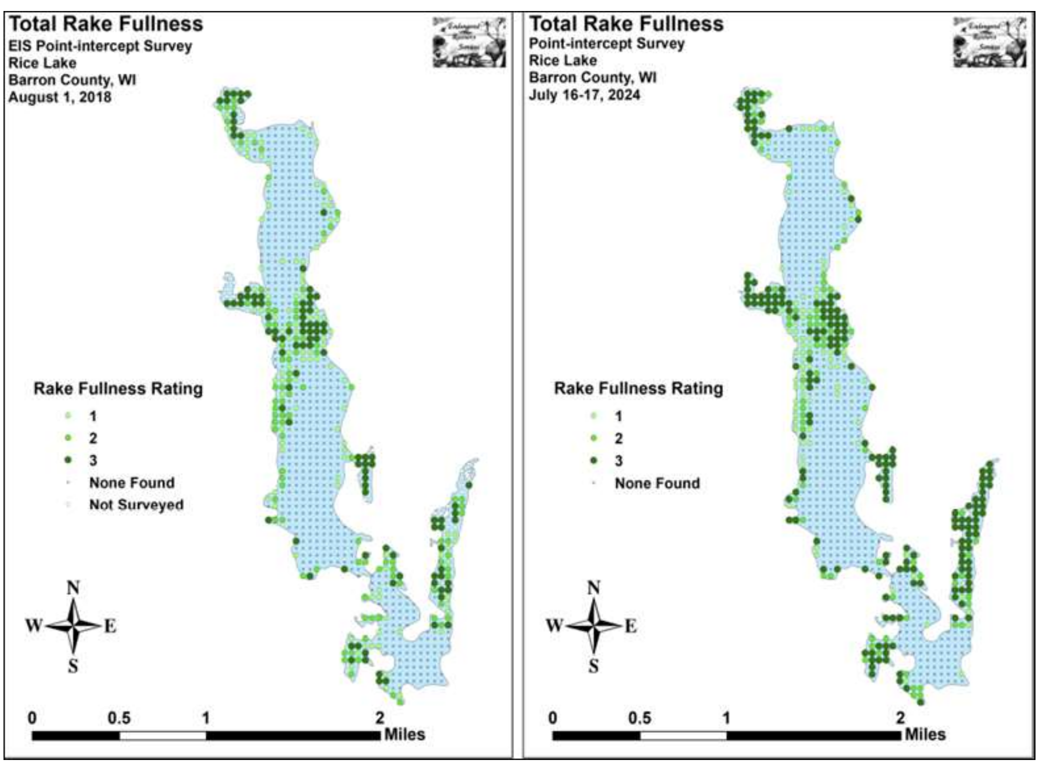


Figure 38: 2018 and 2024 Total Rake Fullness

Growth in 2024 was slightly skewed to deep water as the mean plant depth of 5.1ft was greater than the median depth of 5.0ft. Both values were approximately 1.0ft higher than in 2018 when the mean and median were 4.2ft and 3.9ft respectively (Figure 39).

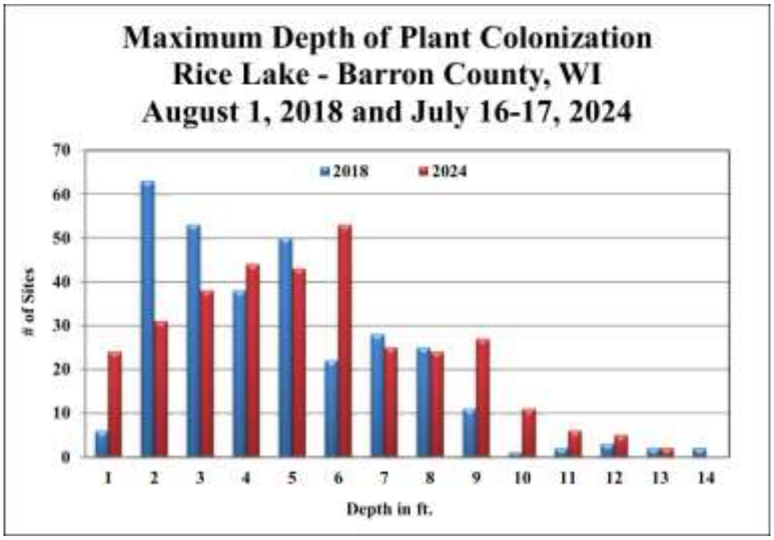


Figure 39: 2018 and 2024 Plant Colonization Depth Chart

SIMPSON'S DIVERSITY INDEX (SDI)

A diversity index allows the entire plant community at one location to be compared to the entire plant community at another location. It also allows the plant community at a single location to be compared over time thus allowing a measure of community degradation or restoration at that site. With the SDI, the index value represents the probability that two individual plants (randomly selected) will be different species. The index values range from 0 -1 where 0 indicates that all the plants sampled are the same species to 1 where none of the plants sampled are the same species. The greater the index value, the higher the diversity in a given location. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be more resistant to invasion by exotic species.

In the first two PI surveys, the SDI remained the same at 0.89, not real high, but decent. In 2018 the SDI was lower at 0.87. In 2024, the SDI increased to its highest recorded level at 0.92. Whether this is due to changing conditions in the aquatic plant community or simply due to a different surveyor is unknown. Regardless, it is good news for the lake.

FLORISTIC QUALITY INDEX (FQI)

This index measures the impact of human development on a lake's aquatic plants. The 124 species in the index are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and they often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each native index species found in the lake during the point-intercept survey and multiplying it by the square root of the total number of plant species (N) in the lake. Statistically speaking, the higher the index value, the healthier the lake's aquatic plant community is assumed to be. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, North Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Rice Lake is in the Northern Central Hardwood Forests Region.

The FQI and associated values from the 2024 survey are all higher than from previous surveys suggesting that the aquatic plant community in Rice Lake is healthier now than it has been since before 2008 (Table 3). In 2024, a total of 47 native index plants were identified in the rake during the point-intercept survey. The index plants found produced a mean C of 6.3 and a FQI of 43.5. Nichols (1999) reported an average mean C for the North Central Hardwood Forests Region of 5.6 and an average FQI of 20.6, putting Rice Lake well above average for this part of the state.

Table 3: Floristic Quality Index, Mean C, and # of Species for the four PI surveys completed on Rice Lake

	2008	2013	2018	2024
FQI	39.8	38.6	39.7	43.5
Mean C	6.1	6.2	6.1	6.3
# of Species	43	39	42	47

COMPARISON OF NATIVE MACROPHYTE SPECIES IN 2018 AND 2024

In August 2018, EIS biologists found Coontail, Wild celery, Flat-stem pondweed, and Common waterweed were the most common macrophyte species (Figure 40). They were present at 80.39%, 31.37%, 29.41%, and 15.03% of survey points with vegetation respectively, and, collectively, they accounted for 56.50% of the total relative frequency. Relative frequency shows a species' frequency relative to all other species. It is expressed as a percentage, and the total of all species' relative frequency will add up to 100%. Organizing species from highest to lowest relative frequency value gives an idea of which species are most important within the macrophyte community. White water lily (5.32%), Fern pondweed (4.14%), and Forked duckweed (4.02%) also had relative frequencies over 4.00%.

Figure 40: 2018 and 2024 most common species in Rice Lake

In 2024, Coontail, Flat-stem pondweed, Common waterweed, and Wild celery were again the most common macrophyte species (Figures 40 & 41). They were found at 72.97%, 43.54%, 37.54%, and 28.83% of sites with vegetation, and they captured 44.85% of the total relative frequency. Small pondweed (6.26%), White water lily (5.96%), Large duckweed (4.93%), Small duckweed (4.64%), Common watermeal (4.49%), and Fern pondweed (4.42%) also had relative frequencies over 4.00% (See the 2024 Summer PI Report from ERS for photos of these and other plants found in Rice Lake).

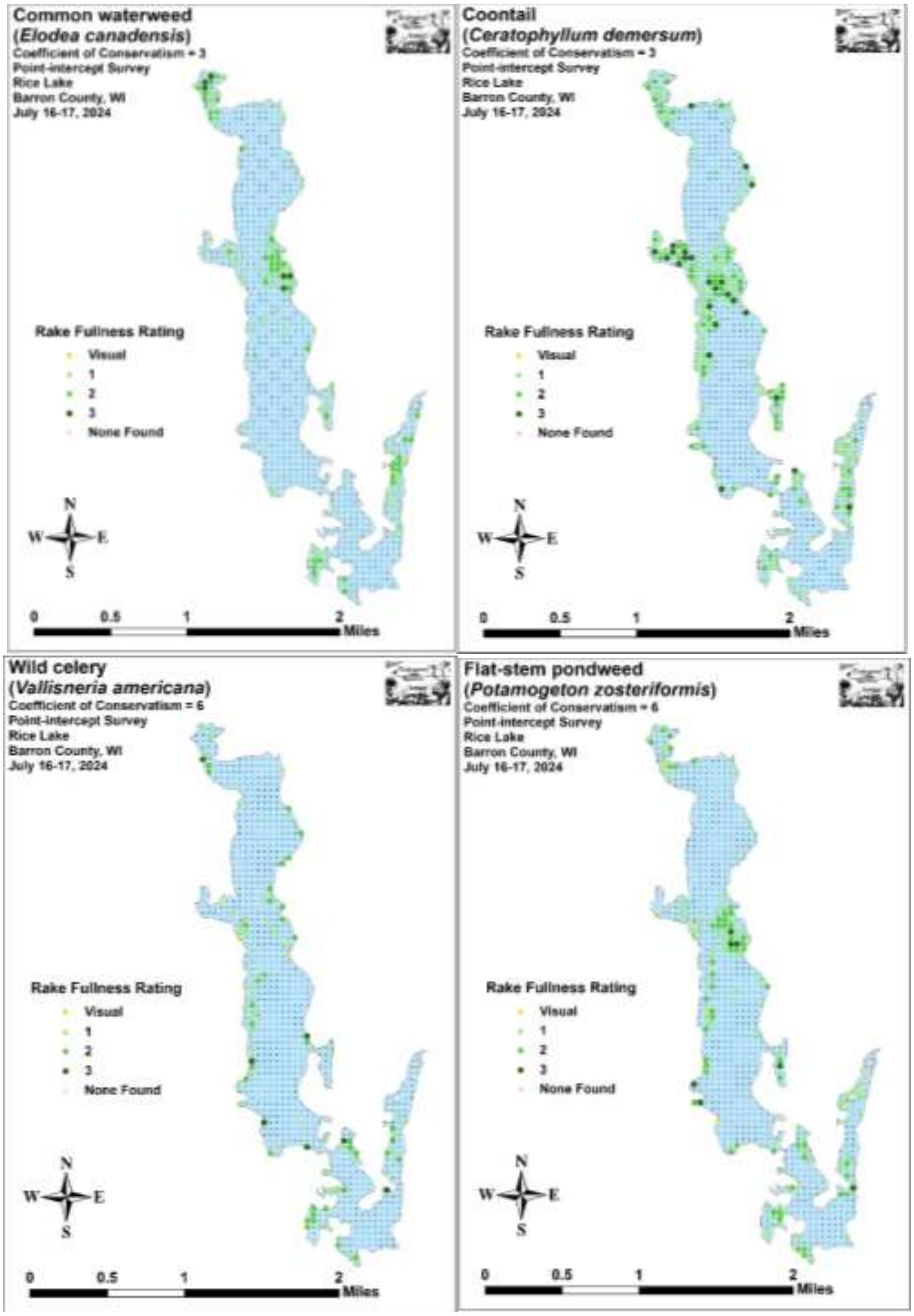


Figure 41: Distribution and density of the four most common aquatic plant species in Rice Lake

Lakewide, 21 species showed significant changes in distribution from 2018 to 2024. Slender waterweed suffered a highly significant decline (potentially due to differences in surveyors' opinion about this species identification); and Coontail saw a significant decline (potentially a statistical artifact due to the 2024 survey accessing more shallow water points that didn't contain Coontail). The other 19 species were all significant increases with Flat-stem pondweed, Common waterweed, filamentous algae, Large duckweed, Small duckweed, Common watermeal, Small pondweed, and Hybrid water-milfoil all enjoying highly significant increases; White water lily and White water crowfoot showing moderately significant increases; and Fern pondweed, Water star grass, Creeping bladderwort, Slender naiad, Common bur-reed, Watershield, Narrow leaved woolly sedge, Curly-leaf pondweed, and Slender riccia demonstrating significant expansions.

WILD RICE

Wild rice is an aquatic grass which grows in shallow water in lakes and slow flowing streams. This grass produces a seed which is a nutritious source of food for wildlife and people. The seed matures in August and September with the ripe seed dropping into the sediment, unless harvested by wildlife or people. It is a highly protected and valued natural resource in Wisconsin. Only Wisconsin residents may harvest wild rice in the state. According to the WDNR Surface Water Data Viewer, Rice Lake is not wild rice water; however, the section of the Red Cedar River as it enters Rice Lake is noted as having wild rice. In both the 2013 and the 2018 point-intercept surveys, wild rice was found in a very limited area near the Red Cedar River inlet.

In 2024, wild rice was limited to a few 100 goose-cropped blades in and adjacent to the Red Cedar River Inlet, and no areas even approached levels that would provide human harvest potential (Figure 42). The 2018 survey found rice in the rake at two points with a mean rake fullness of 1 and recorded it as a visual at a single point. In 2024, it was found in the rake at a single point which had a rake fullness of 1 with two additional visual sightings (Figure 43). Neither surveyor headed upstream in the Red Cedar River to check on wild rice.

Figure 42: 2024 Wild Rice near the Red Cedar River Inlet (Photo from ERS)

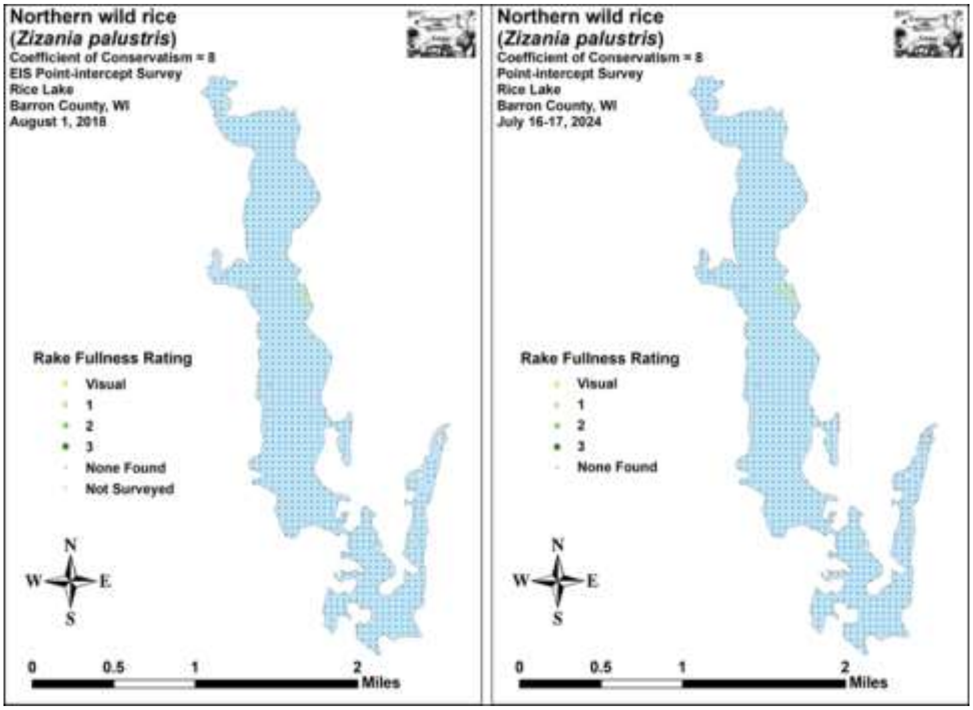


Figure 43: PI points with wild rice in the 2018 and 2024 surveys. Neither surveyor went upstream in Red Cedar River to identify wild rice

Wild rice flourished in 2020 with sizable beds along both sides of the river for at least a quarter mile upstream from the lake delta. The author of this Plan has been working on Rice Lake for better than 15 years and this is the first time he has seen wild rice with this amount of density. Photos of the rice were sent to Peter David, Manoomin Biologist with the Great Lakes Indian Fish and Wildlife Commission (Figure 44). His comment was "You rock my world! It does seem more abundant than my past impressions." This was the first time wild rice in this area produced some potential for harvest. Anecdotally though, one person who attempted harvest said that actual rice was spotty with much of it being consumed by wildlife.

WILD RICE IMPACTS ON AQUATIC PLANT MANAGEMENT

The presence of wild rice must be taken into consideration when planning aquatic plant control. The use of aquatic herbicides is highly discouraged in any area where rice is present. Mechanical harvesting must avoid incidental take of wild rice. Even physical removal of wild rice is technically illegal in WI. Aquatic plant management planning in Rice Lake considers locations where wild rice is known to have a presence. No use of aquatic herbicides is recommended in these areas, and limited harvesting is only done in the open channels of the river. It does not target any wild rice. This practice will continue for the foreseeable future to prevent plant management of any kind from damaging the wild rice populations.

Figure 44: August 13, 2020 Wild rice in the Red Cedar River just upstream of Rice Lake. Purple dots indicate all the places where sizable beds were located. Photos and Maps from LEAPS

AQUATIC INVASIVE SPECIES IN RICE LAKE

Several aquatic invasive species are present in Rice Lake. They include Curly-leaf pondweed (CLP), Hybrid watermilfoil (HWM), Yellow flag iris (YFI), Japanese knotweed (JK), Purple loosestrife (PL), Reed canary grass, non-native cattails, Rusty crayfish, and Chinese mystery snails. The most problematic of these invasive species are CLP, HWM, YI, JK, and PL. The others are present, but not a focus of any management actions in this plan. More information about the other AIS already in the lake and a few that are not can be found in Appendix E.

CURLY-LEAF PONDWEED

The 2024 early-season PI survey documented CLP at 263 points which approximated to 31.2% (268 acres) of the entire lake and 44.1% of the 14.0ft spring littoral zone (Figure 45). Where CLP was documented, 85 points had a rake fullness value of 3, another 85 points rated a 2, and the remaining 93 points were a 1 for a combined mean rake fullness of 1.97. CLP was also noted as a visual (not on the rake) at 32 other points. The 170 points with a rake fullness of a 2 or a 3 extrapolated to 20.2% (174 acres) of the entire lake having a significant infestation. CLP bed mapping completed by Lake District employees confirmed the locations of CLP with a total of about 255 acres mapped (Figure 45).

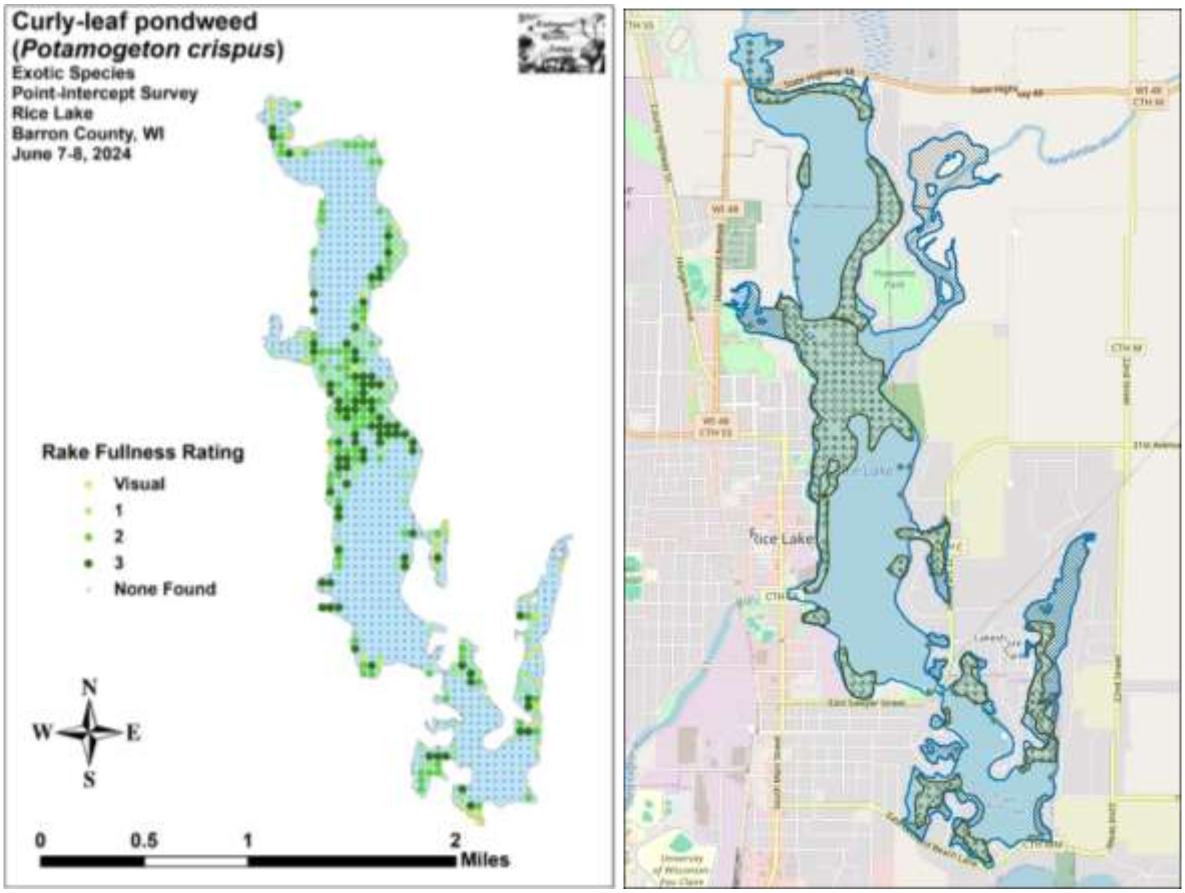


Figure 45: 2024 Early-season CLP distribution and density; Lake District CLP bed mapping (255 acres)

In 2009, EIS did the first formal bed mapping of CLP in Rice Lake. At that time, 33 areas with CLP were mapped totaling 200 acres (Figure 46). In 2013, CLP was again mapped, this time using a point-intercept grid (Figure 46). Mapping results suggested about 130 acres of CLP in 2013. CLP bedmapping done in both 2018 and 2019 showed less than 50 acres. Mapping from 2021 to 2023 showed the acreage of CLP increasing but still under 75 acres. Two mild winters (2022 and 2023) led to increases in CLP despite continued harvesting efforts and herbicide application in 2023. During the 2023/24 winter, little ice and even less snow created growing conditions for CLP that allowed well over 250 acres of CLP in 2024 Table 4. This significant increase in CLP was not just in Rice Lake. Nearly all lakes dealing with CLP in northern WI saw significant increases.

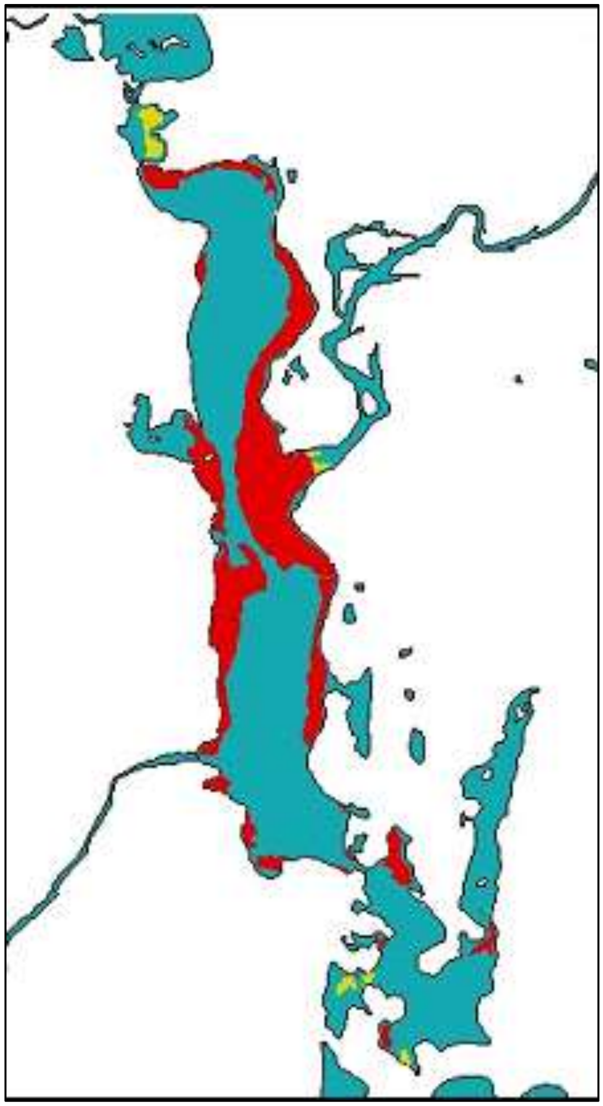


Figure 46: Extent of CLP in 2009

Table 4: CLP bed mapping since 2018

Year of Survey	# of Beds	Mean Bed Size (acres)	Central-North Basin	South Basin	Total Acres
2018	23	1.4	17.9	5.8	23.7
2019	27	1.3	29.0	5.6	34.6
2020	23	6.0			137.5
2021	18	7.5	124.5	10.0	134.5
2022	11	5.6	50.2	11.3	61.5
2023	15	4.9			73.4
2024	15	17.0	203.3	51.4	254.7

The Lake District has been managing CLP since the 1970s, primarily with the use of mechanical harvesters of which they currently own three. Prior to 2010, harvesting was not done following recommendations in an aquatic plant management plan. In 2010, the first APM Plan was completed. It recommended a combination of mechanical harvesting and the use of herbicide to control CLP. It also made recommendations as to the extent of removal and the best timing to do harvesting. Since 2010, and until 2024, the amount of CLP harvested or chemically treated had gone down.

HYBRID WATERMILFOIL

In June of 2018, hybrid watermilfoil (HWM) was discovered in Clearwater Bay in the south basin of Rice Lake (Figure 47). The Lake District took an aggressive, integrated approach to management which included rake removal, diver removal, and chemical control followed by multiple recon and mapping surveys with rake removal.

Figure 47: HWM in Rice Lake, June 2018. Photos from LEAPS

During the 2024 early-season PI survey, the amount of CLP and HWM was documented. Several areas with HWM were chemically treated prior to the early-season survey, and most surviving plants showed evidence of chemical burn – even when located outside the treatment areas. In total, just eight points had HWM (0.9% (7.7acres) of the entire lake) with six additional visual sightings (Figure 48). Although herbicide was not applied to areas within Clearwater Bay, herbicide drift obviously carried into the bay as most of the HWM that was previously mapped in the entry area of the bay was gone or chemically burned.

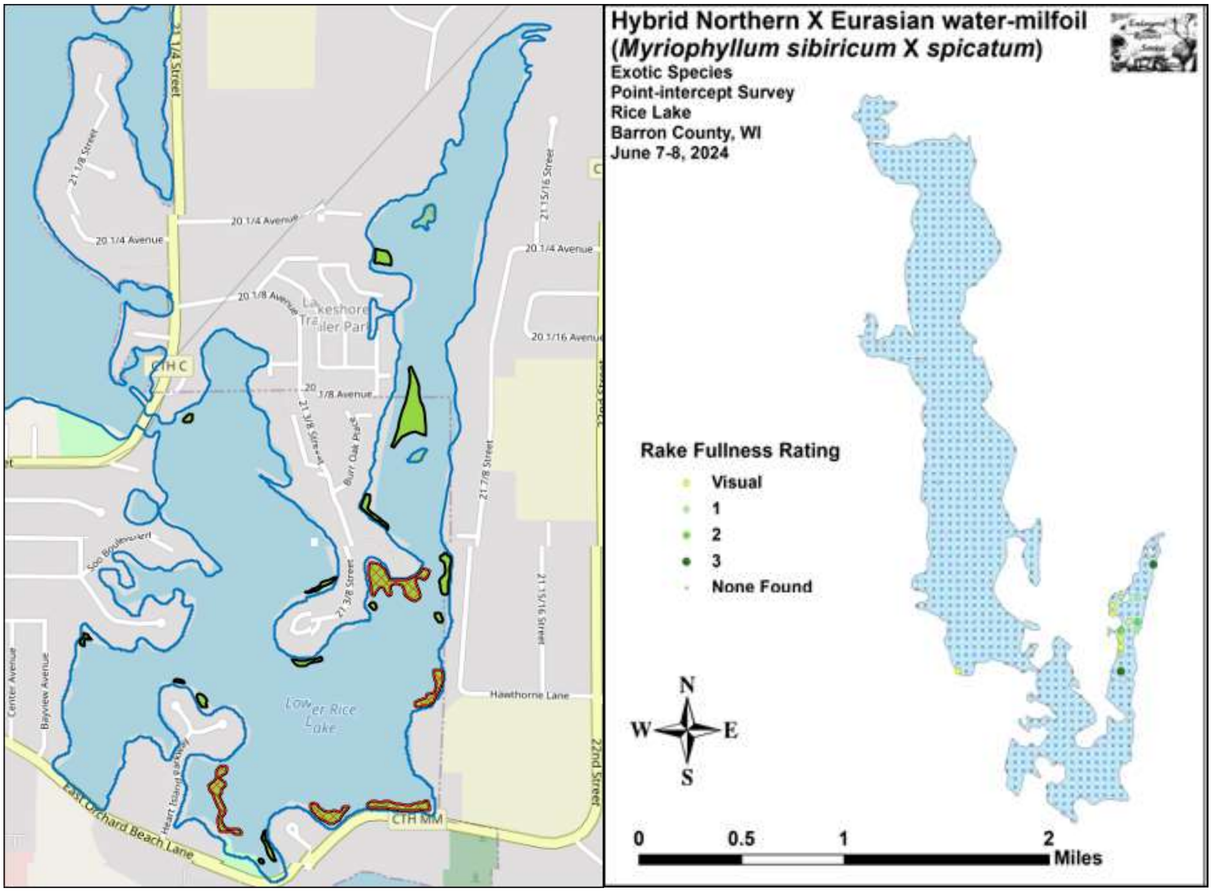


Figure 48: 2023 fall HWM mapping results (lime green), spring chemical treatment areas (red hash), and 2024 early-season PI survey results (right)

HWM was not found on the rake at any point during the 2018 survey. In 2024, it was found at 21 points (2.5% of the entire lake (21.5 acres) with seven additional visual sightings, despite implementation of management actions including physical removal, diver removal, and application of herbicides from 2018 through 2024 (Figure 49). Of the points identified with HWM, two were a rake fullness of 3, none rated a 2 (0.2% entire lake with a significant infestation) and the other 19 had a rake of 1 for a mean rake fullness of 1.19. Statistically, compared to 2018, this was a highly significant expansion in mean density, total distribution, and rake fullness 1; and a significant increase in visual sightings. It was also a significant increase in total distribution and a moderately significant increase in rake fullness 1 compared to the June 2024 survey.

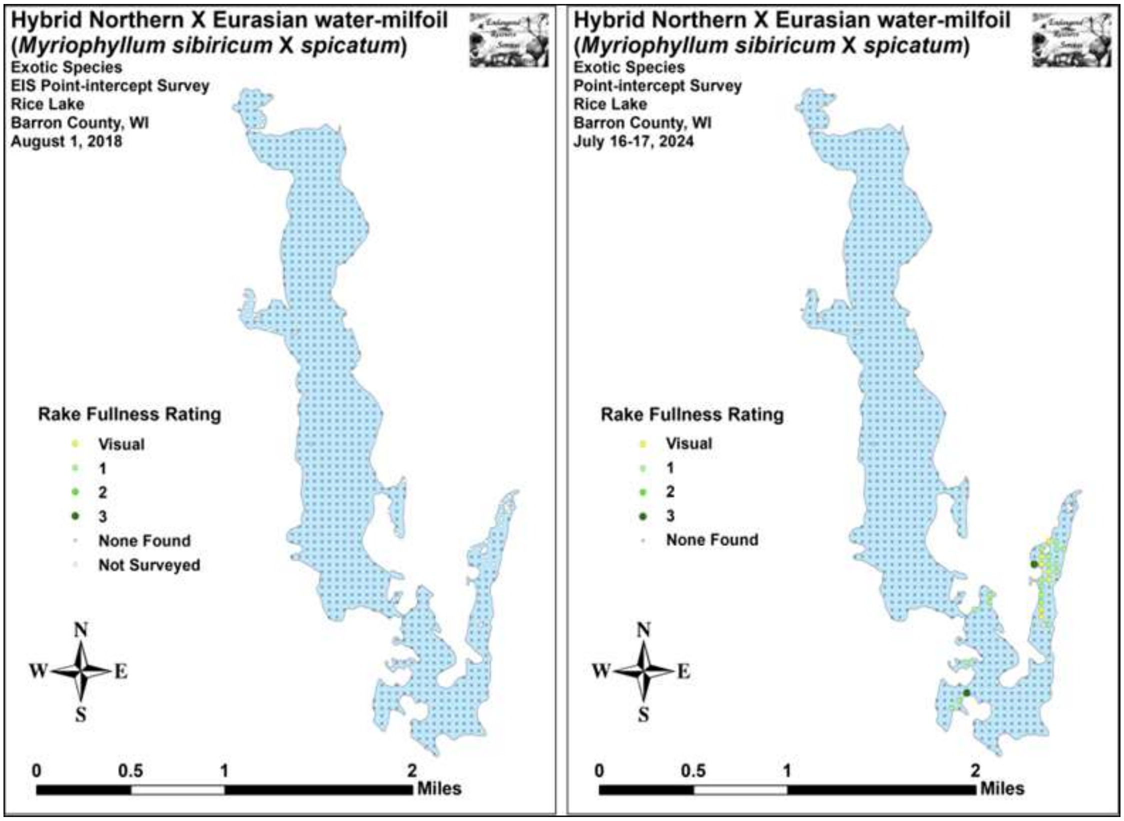


Figure 49: 2018 and 2024 summer HWM density and distribution

ERS was also contracted to complete a whole-lake, meandering, bed mapping survey looking for HWM throughout the lake. This survey was completed on September 1, 2024, covering 19.8 miles of transects throughout the lake's visible littoral zone. Ultimately, six HWM beds ranging in size from 0.10 acres (Bed 1) to 14.81 acres (Bed 5) were mapped (Figure 50). Each of these beds occurred in the southeast bays near the site of the original infestation. However, the discovery of six additional HWM plants scattered throughout the rest of the lake (Figure 50) suggests that it has broken out of this area and will continue to spread even though the aquatic plant surveyor rake-removed each of these isolated individuals. Collectively, the beds totaled 21.62 acres and covered 2.52% of the lake's surface area. HWM bed mapping in the fall of 2023 conservatively identified 8.88 acres (1.03%) of the lake's surface area (Figure 50).

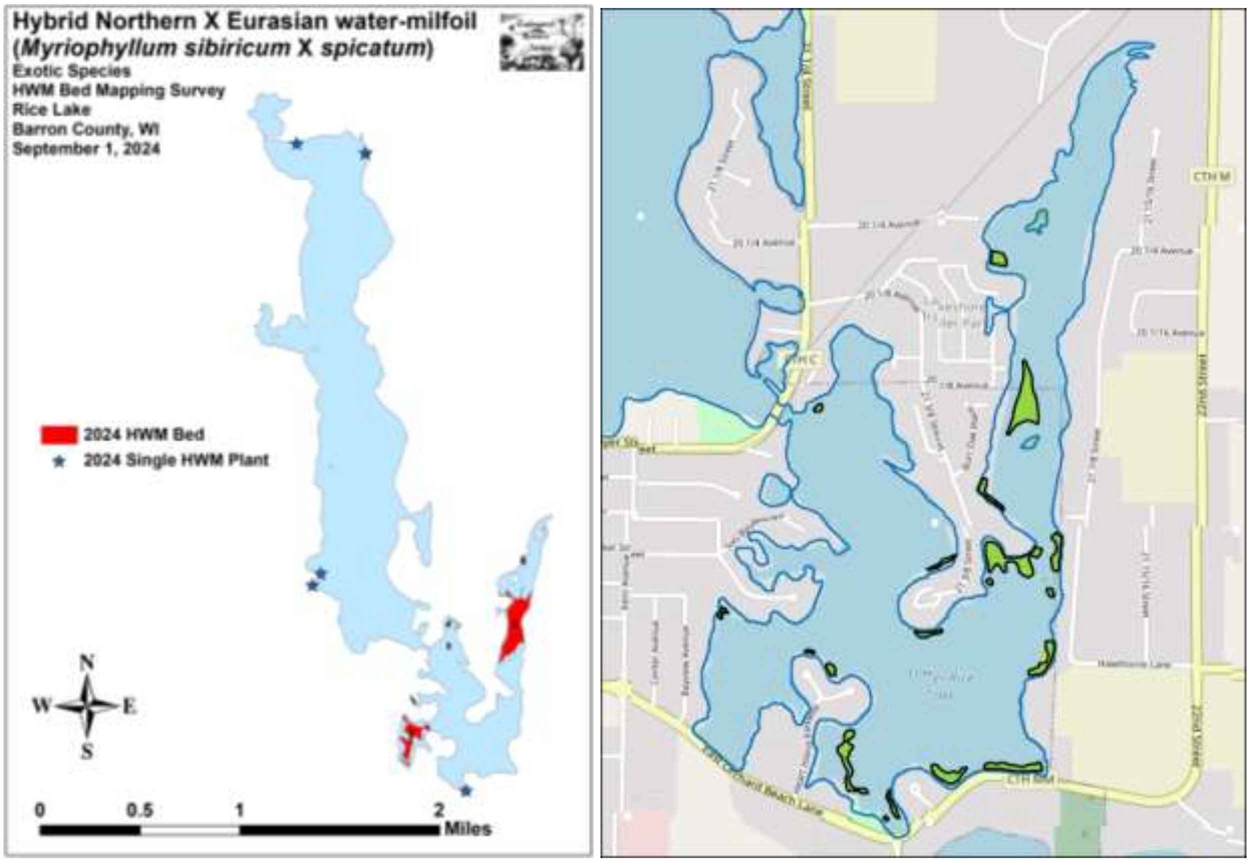


Figure 50: 2024 Fall HWM bed mapping results (left), and Fall 2023 bed mapping results (right)

Rice Lake provides habitat for several native milfoils Northern watermilfoil (*Myriophyllum sibiricum*), Whorled watermilfoil (*Myriophyllum verticillatum*), and Farwell's watermilfoil (*Myriophyllum farwellii*) (Figure 51). HWM is a cross between Northern watermilfoil (native) and Eurasian watermilfoil (non-native) (*Myriophyllum spicatum*) (Figure 52). Management of HWM in Rice Lake using what is generally considered appropriate is complicated by the Lake District's use of mechanical harvesters to remove CLP and nuisance native vegetation. The current integrated approach of herbicide treatments coupled with mechanical harvesting may be counterproductive as the harvester is clearly fragmenting plants and leading to HWM's spread and re-establishment in areas where herbicide treatments recently occurred. If harvesting continues in areas with HWM, these herbicide treatments may be a waste of resources. However, if the goal of lowering HWM levels supersedes mechanical harvesting of other vegetation, treating HWM chemically may remain a management option. Ultimately, the amount of HWM growth the Lake District is comfortable with will determine how much, if any, focused management occurs in the future.

Figure 51: Northern watermilfoil (left), Whorled watermilfoil (middle), Farwell's watermilfoil (right)

Figure 52: Northern watermilfoil (left), Hybrid watermilfoil (middle), Eurasian watermilfoil (right)

YELLOW FLAG IRIS

Yellow flag iris (Iris pseudacorus) is a "Restricted" plant species in WI according to the Invasive Species Rule (NR40) meaning that it is considered an invasive species that is already established in the state and cause or has the potential to cause significant environmental or economic harm or harm to human health. Yellow flag iris (Figure 53) can produce many seeds that float from the parent plant, or plants can spread vegetatively via rhizome fragments. Once established, it forms dense clumps or floating mats that can alter wildlife habitat and species diversity. All parts of this plant are poisonous, which results in lowered wildlife food sources in areas where it dominates. This species can escape water gardens and ponds and grow in controlled and natural environments. It can grow in wetlands, forests, bogs, swamps, marshes, lakes, streams and ponds. Dense areas of this plant may alter hydrology by trapping sediment.

Figure 53: Yellow Flag Iris

Identification

Yellow iris has broad, sword-shaped leaves that grow upright, tall and stiff. They are green with a slight blue-grey tint and are very difficult to distinguish from other ornamental or native iris species. Flowers are produced on a stem that can grow 3-4 feet tall among leaves that are usually as tall or taller. Its flowers are showy and variable in color from almost white to vibrant dark yellow. Flowers are 3-4 inches wide and bloom from April to June. Three upright petals are less showy than the larger three downward pointing sepals, which may have brown to purple-colored streaks. Seeds are produced in fruits that are 6-angled capsules, 2-4 inches long. Each fruit may have over 100 seeds that start pale before turning dark brown. Each seed has a hard outer casing with a small air space underneath, which allows the seeds to float. The plant has thick, fleshy, pink-colored rhizomes or roots that spread extensively in good conditions, forming thick mats that can float on the water's surface.

When not flowering, the yellow flag iris can be easily confused with the native blue flag iris (*Iris versicolor*) as well as other ornamental irises that are not invasive (Figure 50). The blue flag iris is usually more miniature and does not tend to form as dense clumps or floating mats. When not flowering or showing fruiting bodies, the yellow flag iris may be confused with other wetland plants such as cattails (*Typha* spp.) or sweet flag (*Acorus* spp.) species (Figure 54).

Figure 54: Blue Flag Iris (left), Cattails (middle), Sweet Flag (right)

In Rice Lake, a significant expansion of yellow iris has been noticed over the last several years, particularly in the South Basin. Survey work done in June 2024 specifically to map locations of yellow iris show the extent of the issue. Yellow iris was found at 325 points, mostly in the South Basin (Figure 55).

Small stands of yellow flag iris can be controlled through hand removal. Gloves should be used when handling this plant, as the sap can cause skin irritation in some people. Plants should be dug, taking care to remove as many rhizomes as possible. Plant parts should be disposed of responsibly, as rhizomes can resprout if left on the ground. The area should be monitored for regrowth from missed rhizomes. Some control may be obtained for plants in standing water by cutting all leaves and stems below the waterline. Covering plants with a heavily weighted tarp for several years can control small patches. Tarps should extend well beyond the edges of the patch. Removal of the seed pods will prevent seed dispersal but will not harm the plants (or prevent the spread of the rhizomes).

Yellow flag iris can also be controlled using specific herbicides. However, any herbicide applications applied to a body of water in Wisconsin will require a WDNR permit, and in most cases, must be applied by an appropriately licensed herbicide applicator. Cut-stem application or wicking/wiping may be the most effective use of herbicides on individual plants and small areas. When using herbicides, always read and follow label directions for rates, spraying conditions, personal protective equipment and grazing intervals. Do not spray when it is windy or raining, or when rain is forecast. Do not cut sprayed plants for at least 2 weeks after herbicide application.

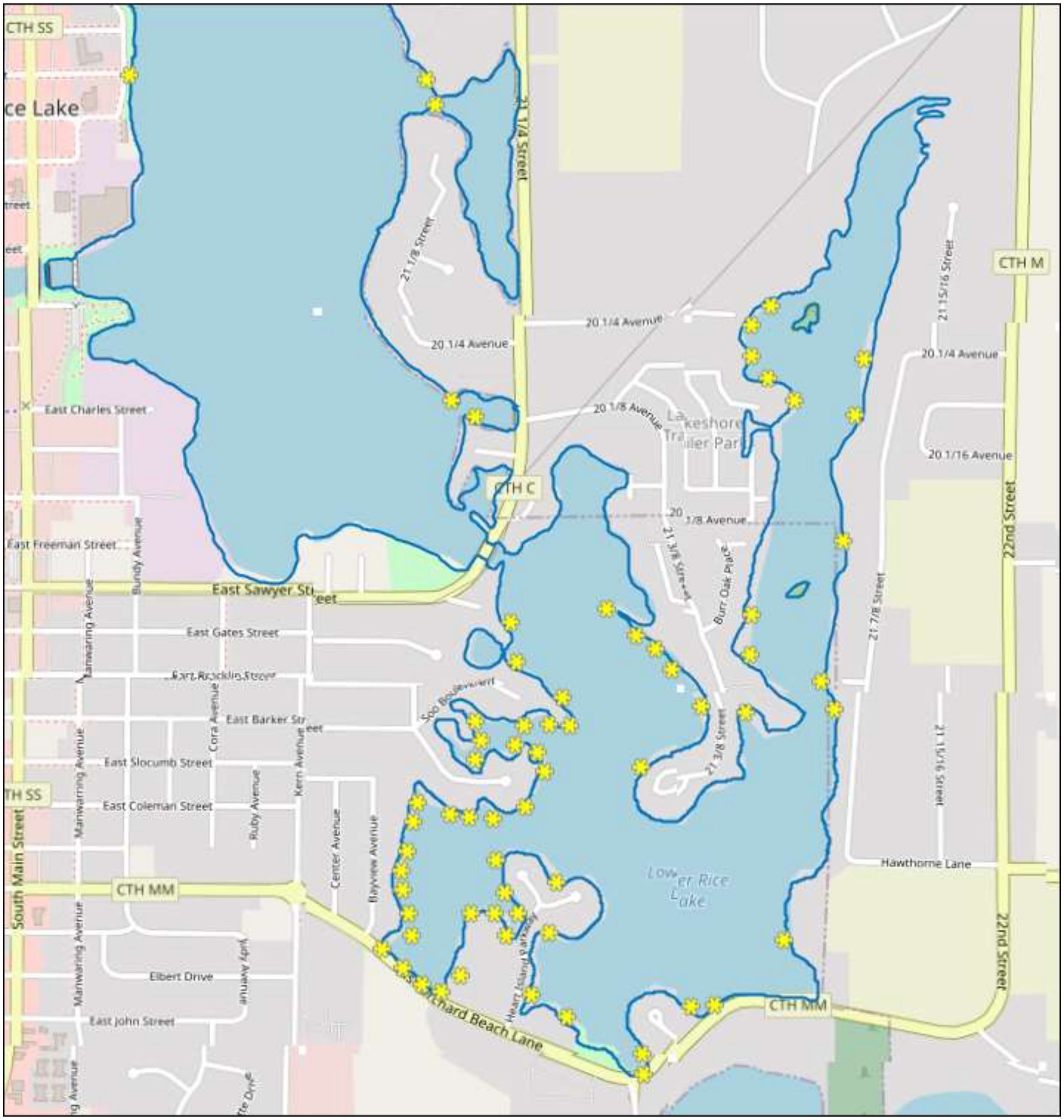


Figure 55: Locations where individual plants or beds of yellow iris were found, often extending dozens of feet along the shoreline

JAPANESE KNOTWEED

While completing the fall HWM survey, the aquatic plant surveyor also found three stands of Japanese knotweed (*Polygonum cuspidatum*) scattered around the lake (Figure 56). Japanese knotweed is an invasive, shrub-like perennial plant native to East Asia. It can grow up to 10ft tall, with green, bamboo-like stems and simple, alternating leaves that taper to a point. The plant spreads quickly, forming dense thickets that shade out native vegetation and degrade wildlife habitats. It is considered one of the world's worst invasive plants and is thought to exist on every continent except Antarctica.

The current infestation on the shores of Rice Lake is highly localized, and, with immediate action, eradication should be possible. It is strongly encouraged that the Lake District take action to eliminate this species from the lakeshore in 2025. Follow-up visits to make sure plants don't re-establish is also strongly encouraged.

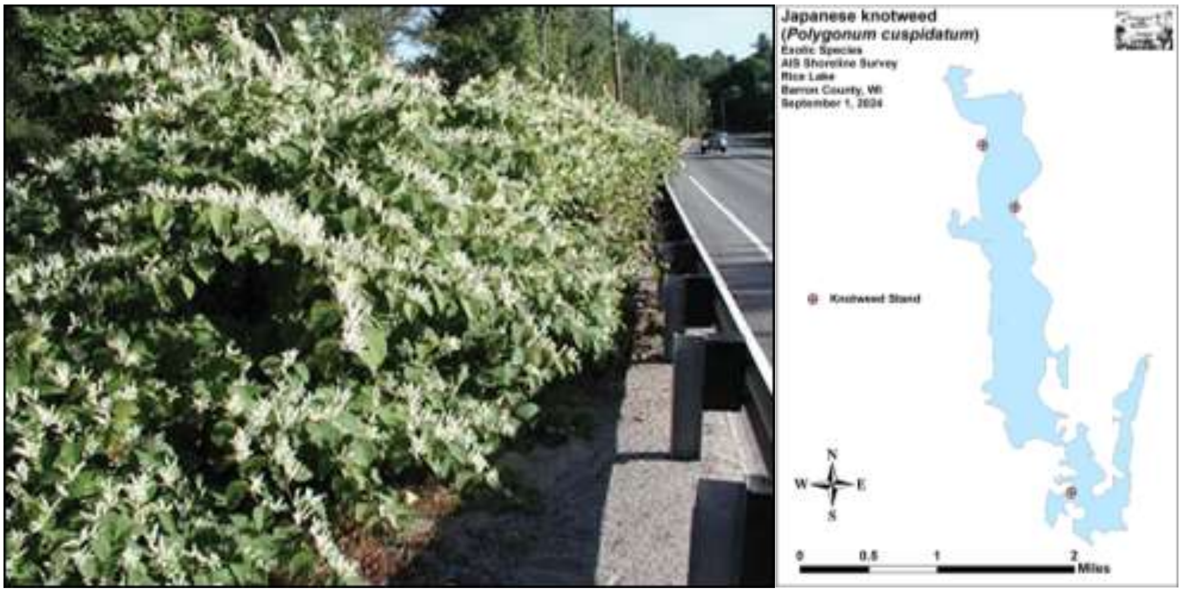


Figure 56: Japanese knotweed and its locations on the shores of Rice Lake

PAST MANAGEMENT

The Lake District currently owns three 10-ft mechanical harvesters, two of which are new within the last five years. Their primary management action for CLP and nuisance native aquatic plants is mechanical harvesting and they have been doing it since the late 1960's with the first harvester purchased by the City of Rice Lake.

1984 was the first year that the WDNR stated that they felt harvesting was the best way for excessive plant growth in Rice Lake to be dealt with. Around 1985, the City of Rice Lake turned the harvesting operation over to the Lake District, which was formed in 1977, as one of the first Lake Districts in WI. In 1985, the Lake District added a second harvester. These two harvesters were used until 1992, when a large indoor storage shed was built to house all the harvesters, a pontoon boat and a Lake District owned truck. In 1993, two new harvesters were purchased. In 1996, an elevator was purchased, and Jeff Smith was hired as the foreman in charge of the harvesting operation. Jeff held that position until 2019.

In 2006, the WDNR informed that Lake District that they would need an aquatic plant management plan if they were to continue harvest. Other conversations with the WDNR were had about what kind of study needed to be done to get a new APM Plan. In 2008, the Lake District contracted with a consultant to complete what was necessary to get a new APM Plan. CBCW inspection began on Rice Lake in 2008. Through 2008, the Lake District was struggling to find places to deposit harvested vegetation and began contracting with a local farmer for disposal. In 2009, management of CLP and native plants continued while the APM Plan was in development. 2009 was the first year in decades that herbicides were used on the lake along with harvesting. In 2010, the first official APM Plan was completed and guided plant management until 2014. Also in 2010, the Lake District hired its first Lake Educator and purchased 17 acres north of the lake near Brill to dispose of their harvested weeds.

Since 2010, there have been three APM Plans written for Rice Lake. The first covered 2010-15 and focused on harvesting CLP early and then limiting harvesting of native aquatic plants to pre-determined navigation and open-water access lanes rather than the generally "all plants should be gone" focus that dominated management prior to 2010. The 2010-15 APM Plan also added select and limited use of aquatic herbicides to control CLP along the west shore of the Central Basin.

The second APM Plan covered 2016-2019 and again focused on harvesting of CLP and pre-determined navigation and open-water access lanes but added new management recommendations in 2018 when hybrid watermilfoil was first found in Clearwater Bay in the South Basin.

The 2020-25 APM Plan continued to focus on management of CLP and nuisance level native aquatic vegetation but increased management planning and implementation for HWM.

The 2026-30 APM Plan will be the fourth APM Plan for Rice Lake.

Table 5 reflects management of CLP, HWM, and native aquatic vegetation in Rice Lake since about 1996. Harvesting before the 2010 APM Plan focused on clear-cutting all areas where dense aquatic vegetation grew. This included areas that did not receive much boat traffic or in some other way interfere with lake use. The delta where the Red Cedar River enters the lake and a similar area on the north end of the lake where water enters Rice Lake from Stump Lake under Hwy 48 were two areas that were continually clear-cut prior to 2010. Up to 2009, an average of 992 tons of vegetation was removed from the lake. After the 2010 APM Plan changed the approach to management, only an average of 467 tons has been harvested annually, and this number is higher simply due to the massive plant growth experienced in 2024 after a winter of little snow and little ice.

Table 5: CLP and nuisance and navigation harvesting records, CLP chemical treatments, and HWM chemical treatments 1996-2024

	1996-2024 CLP and Native Aquatic Plant Harvesting Totals (Tons of plant material)				Herbicide Treatments (acres)		
	CLP	**Nui&Nav**	**HWM**	Total	**CLP**	**HWM**	**Native**
1996	1008			1008			
1997	1104			1104			
1998	1432			1432			
1999	972			972			
2000	1122			1122			
2001	804			804			
2002	966			966			
2003	1128			1128			
2004	912			912			
2005	1056			1056			
2006	1008			1008			
2007	Missing Data			Missing Data			
2008	744			744			
2009	644			644	18.7		
2010	236	209		445	49.76		
2011	139	326		465	41.76		
2012	138	272		410	46.65		
2013	65	138		203	5.5		
2014	36	147		183			
2015	60	178		238	10.66		
2016	68	228		296	19.1		
2017	134	283		417	8.3		
2018	228			228		0.8	5.58
2019	89.5	245.5		335			
2020	1505			1505		3.97	
2021	490	390		880	21.07	7.71	
2022	149	276		425		4.45	
2023	176	524	5	705			
2024	755	705	65	1525		4.49	
2010 APM Plan Implementation							
2018 Hybrid water milfoil found in Clearwater Bay, harvesting curtailed							

Table 6 focuses on management of HWM since it was discovered in Clearwater Bay in 2018. Physical removal, diver removal, application of liquid 2,4D and ProcellaCOR, and mechanical harvesting have been used to control HWM. Despite all management efforts, HWM spread from Clearwater Bay into the South Basin, and for the first time last fall (2024) was found in several locations in the Central and North Basins of the lake. In this new APM Plan, management of HWM will continue with an integrated pest management approach that includes many different management actions, starting in 2025.

Table 6: HWM Management History 2018-2024

2018-2024 HWM Management History - Rice Lake					
Year	Location	Action	# of Beds	Total Acres	Status
2024	SB	ProcellaCOR	4	4.49	Completed
	CWB	24D	1	38.7	*Permit denied*
	SB/CWB	Harvesting			Completed
2023	SB/CWB	Free Diving			Completed
	SB	Scuba			Completed
	CWB	Harvesting			Completed
2022	SB/CWB	ProcellaCOR	5	4.45	Completed
	SB/CWB	Free Diving			Completed
	CWB	Harvesting			Completed
2021	CWB	24D	1	7.71	Completed
	CWB	Free Diving			Completed
2020	CWB	24D	3	3.97	Completed
	CWB	Free Diving			Completed
	CWB	Scuba			Completed
2019	CWB	24D	5	3.36	*Approved, but not implemented*
	CWB	Free Diving			Completed
2018	CWB	Aquastrtike	10	6.38	Completed
	CWB	Free Diving			Completed
	CWB	Scuba			Completed

2024 AND 2025 AQUATIC PLANT MANAGEMENT

Little snow, early ice out, and cool growing conditions that extended through the end of May in both 2024 and 205 created conditions that highly favored the growth of early season plants like CLP and HWM. CLP mapping in 2024 (see Figure 45) identified 255 acres of CLP, the highest total in more than a decade. CLP in 2025 was similar to what was mapped in 2024 keeping all three mechanical harvesters busy. HWM in Clearwater Bay and the South Basin continued to spread.

Management actions in 2024 included initial proposals to chemically treat HWM at 4 locations in the South Basin totaling 4.9-acres with ProcellaCOR, and a 39-acre area of Clearwater Bay with liquid 2,4D. The ProcellaCOR treatment was completed in the South Basin, but the larger Clearwater Bay treatment was not due to the permit application being denied. The ProcellaCOR application was very successful.

HWM mapping in the fall of 2024 and again in June of 2025 showed that the areas where ProcellaCOR was applied in 2024 remained mostly free of HWM (Figure 57). Unfortunately, in those areas that were not chemically treated in 2024, HWM remained and was generally denser. Mapping in June of 2025 also confirmed the presence and expansion of HWM in areas of the Central and North Basins identified in the Fall 2024 survey. June 2025 mapping identified two new beds of HWM, one in the southwest corner of the Central Basin in the area known as Nuto Bay and in the northeast corner of the North Basin (Figure 58).

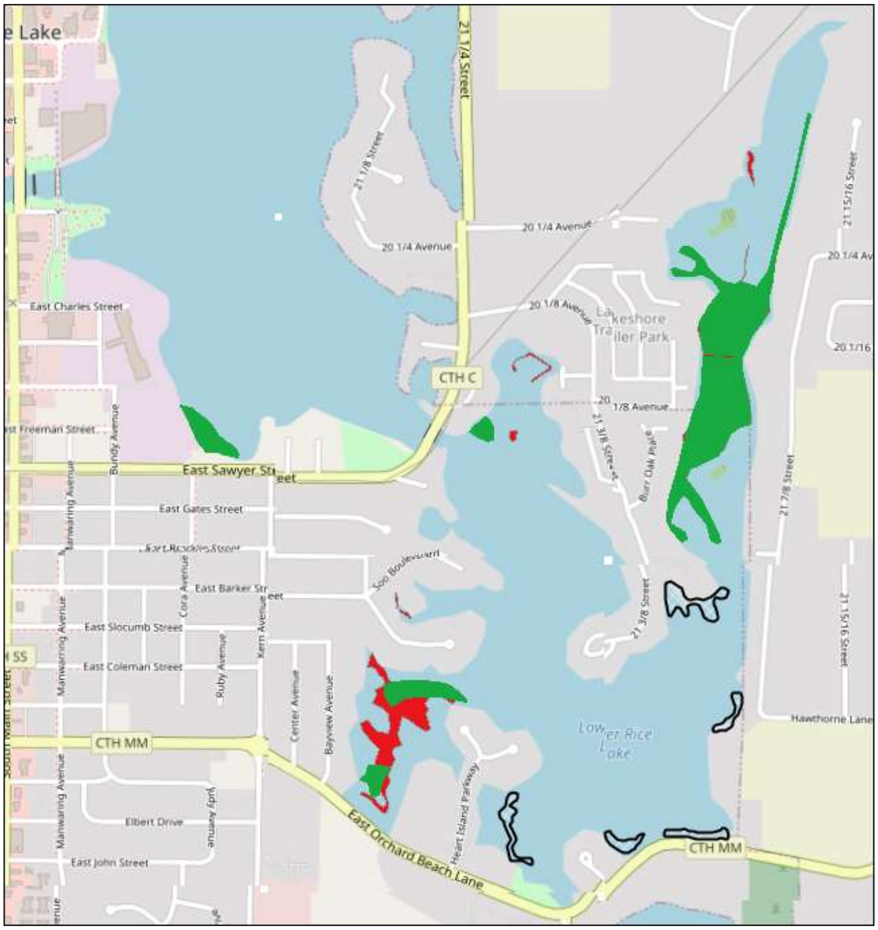


Figure 57: 2024 PCOR treatment areas (black outline), 2024 fall bedmapping results (red), June 2025 bedmapping results (green)

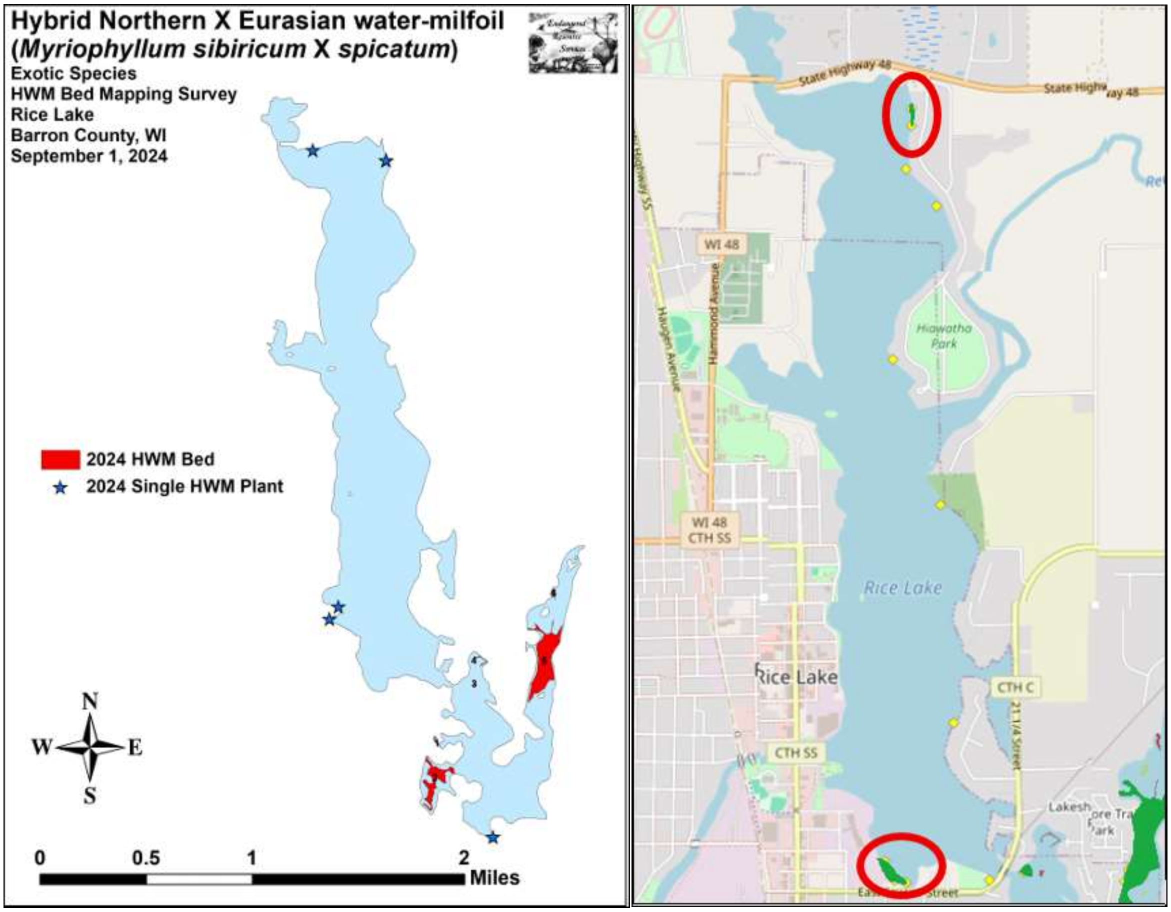


Figure 58: HWM in the Central and North Basins – Fall 2024 (left) and HWM beds (green) and individual plants (yellow points) in June 2025 (right)

Mechanical harvesting continued in 2025 to remove CLP throughout the lake, and HWM in those areas that were not chemically treated in 2024 (parts of the South Basin and in Clearwater Bay). Mechanical harvesting in the Nuto Bay area in 2025 was limited due to its isolation from more developed areas of the lake that required more harvesting to maintain access.

Following the yellow iris mapping completed in 2024, the Lake District implemented an herbicide application program to control yellow iris along Orchard Beach Dr and along the shores of the Wolfinger Bird Sanctuary owned by the City of Rice Lake in 2025. Less than an acre of total area with yellow iris was managed. Flowering in mid to late June was substantially less after treatment than it had been in 2024. The Lake District will pursue WDNR surface water grant funding to continue a multi-year education and awareness, management, and native plant restoration project for yellow iris beginning in 2026.

INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) is an ecosystem-based management strategy that focuses on long-term prevention and/or control of species of concern or their damage. IPM considers all the available control practices such as prevention, biological control, biomanipulation, nutrient management, habitat manipulation, substantial modification of cultural practices, pesticide application, water level manipulation, mechanical removal and population monitoring (Figure 59). Integrated pest management projects should be informed by current, comprehensive information on pest life cycles and the interactions among pests and the environment.

Groups should focus their efforts to keep the species of concern from becoming a problem by looking into the environmental factors that affect the species and its ability to thrive. Once groups understand the species of concern, they can create conditions that are either unfavorable or less beneficial for it.

Monitoring means checking the waterbody to identify what species are present, how many there are and what their impacts are on each other and on water use. Correctly identifying the species of concern and other species in the waterbody is key to knowing whether it is likely to become a problem and determining the best management strategy.

After monitoring and considering the information about the target species' life cycle and environmental factors, groups can decide whether the species' impacts can be tolerated or whether those impacts warrant control. If control is needed, the data collected on the species and the waterbody will also help groups select the most effective management methods and the best time to use them.

The most effective, long-term way to manage species of concern is by using a combination of methods that work better together than separately. Approaches for managing pests are often grouped in the following categories:

- **Assessment** – is the use of learning tools and protocols to determine a waterbodies' biological, chemical, physical and social properties and potential impacts. Examples include point-intercept (PI) surveys, water chemistry tests and boater usage surveys. This is the most important management strategy for every single waterbody.
- **Biological Control** – is the use of natural predators, parasites, pathogens and competitors to control target species and their impacts. An example would be beetles for purple loosestrife control.
- **Cultural controls** – are practices that reduce target species establishment, reproduction, dispersal, and survival. For example, a Clean Boats, Clean Waters program at boat launches can reduce the likelihood of the spread of species of concern.
- **Mechanical and physical controls** – can kill a target species directly, block them out, or make the environment unsuitable for it. Mechanical harvesting, hand pulling, and diver assisted suction harvesting are all examples.
- **Chemical control** – is the use of pesticides. In IPM, pesticides are used only when needed and in combination with other approaches for more effective, long-term control. Groups should use the most selective pesticide that will do the job and be the safest for other organisms and for air, soil, and water quality.

IPM isn't a single solution to problems caused by a species of concern. It's a process that combines common-sense methods and practices to provide long-term, economic pest control. Over time, a good IPM program should adapt whenever new information is provided on the target species or monitoring shows changes in control effectiveness, habitat composition and/or water quality.

While each situation is different, eight major components should be established in a group's IPM program:

1. Identifying and understanding the species of concern
2. Preventing the spread and introduction of the species of concern

3. Continually monitoring and assessing the species' impacts on the waterbody
4. Preventing species of concern impacts
5. Setting guidelines for when management action is needed
6. Using a combination of biological, cultural, physical/mechanical and chemical management tools
7. Assessing the effects of target species' management
8. Changing the management strategy when the outcomes of a control strategy create long-term impacts that outweigh the value of target species control.

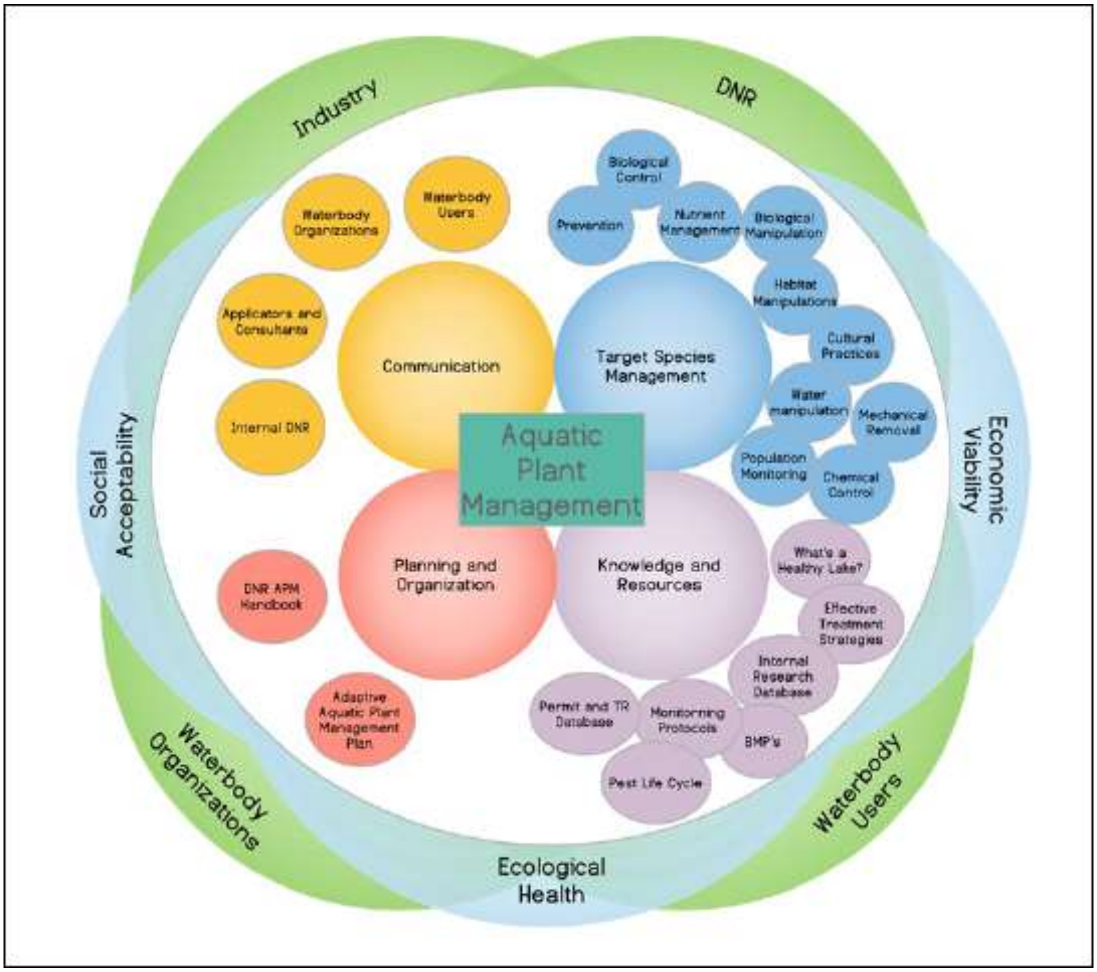


Figure 59: Wisconsin Department of Natural Resources: Wisconsin Waterbodies – Integrated Pest Management March 2020

MANAGEMENT ALTERNATIVES

Nuisance aquatic plants can be managed in a variety of ways in Wisconsin. The best management strategy will be different for each lake and depends on which nuisance species needs to be controlled, how widespread the problem is, and the other plants and wildlife in the lake. In many cases, an integrated approach to aquatic plant management that utilizes several control methods is necessary. The eradication of non-native aquatic invasive plant species such as EWM or CLP is generally not feasible but preventing them from becoming a more significant problem is an attainable goal. It is important to remember however, that regardless of the plant species targeted for control, sometimes no manipulation of the aquatic plant community is the best management option. Plant management activities can be disruptive to a lake ecosystem and should not be done unless it can be shown they will be beneficial and occur with minimal negative ecological impacts.

Management alternatives for nuisance aquatic plants can be grouped into four broad categories: manual and mechanical removal, chemical application, biological control, and physical habitat alteration. Manual and mechanical removal methods include digging, pulling, cutting, raking, harvesting, suction harvesting, and other means of removing the physical plant from the water. Chemical application is typified using herbicides that kill or impede the growth of the aquatic plant. Biological control methods include organisms that use the plant for a food source or parasitic organisms that use the plant as a host, killing or weakening it. Biological control may also include the use of species that compete successfully with the nuisance species for resources. Physical habitat alteration includes dredging, installing lake-bottom covers, manipulating light penetration, flooding, and drawdown. It may also include making changes to or in the watershed of a body of water to reduce nutrients going in.

Each of the above control categories is regulated by the WDNR and most activities require a permit from the WDNR to implement. Mechanical harvesting of aquatic plants and under certain circumstances, physical removal of aquatic plants, is regulated under Wisconsin Administrative Rule NR 109. The use of chemicals and biological controls are regulated under Administrative Rule NR 107. Certain habitat altering techniques like the installation of bottom covers and dredging require a Chapter 30/31 waterway protection permit. In addition, anytime wild rice is involved one or more of these permits will be required.

Informed decision-making on aquatic plant management implementation requires an understanding of plant management alternatives and how appropriate and acceptable each alternative is for a given lake. The following sections list scientifically recognized and approved alternatives for controlling aquatic vegetation.

NO MANAGEMENT

When evaluating the various management techniques, the assumption is erroneously made that doing nothing is environmentally neutral. In dealing with nonnative aquatic invasive species like CLP, the environmental consequences of doing nothing may be high, possibly even higher than any of the effects of management techniques. Unmanaged, these species can have severe negative effects on water quality, native plant distribution, abundance and diversity, and the abundance and diversity of aquatic insects and fish (Madsen, 1997). Nonindigenous aquatic plants are the problem, and the management techniques are the collective solution. Nonnative plants are a biological pollutant with a very long residence time and the potential to "biomagnify" in lakes, rivers, and wetlands (Madsen, 2000).

Foregoing any management of AIS in Rice Lake is not a recommended option. Despite many years of active management CLP still forms monoculture beds. HWM continues to spread throughout the South Basin and has now been found in the Central and North Basins. Yellow Iris has increased its visible distribution over the last five years, although there is no distribution data prior to 2023. Purple loosestrife and Japanese Knotweed are present, although their distribution is still limited. Forgoing management would only allow the current distribution and density of these invasive plants to increase causing greater negative impacts on the ecosystem, lake use, and water quality. Rusty Crayfish and Chinese Mystery Snails are present, but management actions remain limited and unproven, so will not be implemented over the next five years.

MANUAL REMOVAL BY DIGGING, RAKING, AND/OR HAND-PULLING

Manual or physical removal of aquatic plants by digging (hand-held shovel), hand-held rake or cutting implement, or by pulling the plants from the lake bottom by hand is allowed by the WDNR without a permit per NR 109.06 Waivers under the following conditions:

- Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured along the shoreline provided that any piers, boat lifts, swim rafts and other recreational and water use devices are located within that 30-foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method (Figure 60)
- Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 is performed in a manner that does not harm the native aquatic plant community
- Removal of dislodged aquatic plants that drift onshore and accumulate along the waterfront is completed.
- The area of removal is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1, or in an area known to contain threatened or endangered resources or floating bogs
- Removal does not interfere with the rights of other riparian owners
- If wild rice is involved, the procedures of s. NR 19.09 (1) are followed.

Any aquatic vegetation managed in this way must be removed from the lake and not left to drift away to other properties.

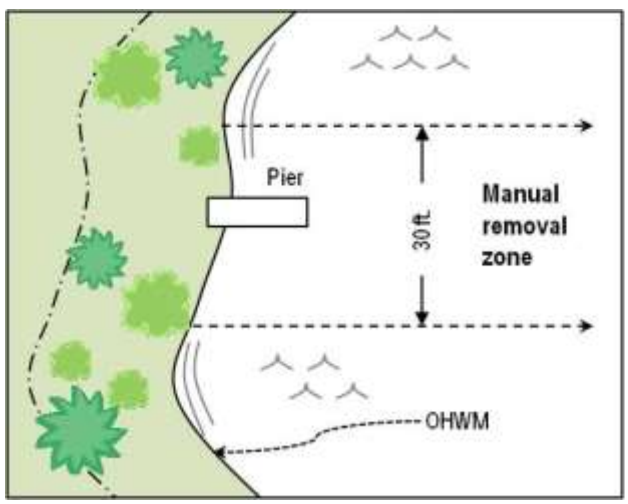


Figure 60: Aquatic vegetation manual removal zone

Although up to 30 feet of aquatic vegetation can be removed, removal should only be done to the extent necessary. There is no limit as to how far out into the lake the 30ft zone can extend, however clearing large swaths of aquatic plants not only disrupts lake habits, but it also creates open areas for non-native species to establish. Physical removal of aquatic plants requires a permit if the removal area is in a "sensitive" or critical habitat area previously designated by the WDNR. Manual or physical removal can be effective at controlling individual plants or small areas of plant growth. It limits disturbance to the lake bottom, is inexpensive, and can be practiced by many lake residents. In shallow, hard bottom areas of a lake, or where impacts to fish spawning habitat need to be minimized, this is the best form of control. If water clarity in a body of water is such that aquatic plants can be seen in deeper water, pulling aquatic invasive species while snorkeling or scuba diving is also allowable without a permit according to the conditions in NR 106.06(2) and can be effective at slowing the spread of a new aquatic invasive species infestation within a lake when done properly.

This method of control is part of the integrated management strategy being used to control AIS adjacent to and in Rice Lake. Hand pulling is a recommended management action for HWM and purple loosestrife. Digging may be incorporated to control yellow iris. Cutting may be incorporated to control Japanese Knotweed. The CLP within Rice Lake is far too dense and widespread to make hand pulling a viable method of control, so it is not recommended for CLP control. However, property owners around the lake should be encouraged to hand pull CLP near their property if they wish to.

FREE DIVING, SNORKELING, AND/OR SCUBA DIVER REMOVAL OF AIS

Larger physical removal projects involving free diving, snorkeling, or scuba divers can be effective at removing small areas of AIS. Free diving involves identifying AIS from a boat and then having a swimmer wearing goggles hold their breath while diving to the bottom to pull the plant and bring it to the surface where it is collected by a person in the boat. Long-handled nets are usually available to help pick up fragments dislodged by the free-diver. This method works best when AIS is mostly individual plants or small beds that are widespread, in clearer water, and in areas without other underwater obstructions. How deep a free diver goes depends on the swimmer, but 6-8ft is generally a good limit. Free diving is not without risks. One concern is shallow water blackout. Shallow water blackout occurs when a free diver loses consciousness due to a lack of oxygen. This can happen at any depth but is most common in shallow water. Shallow water blackout is extremely dangerous, as the free diver may drown before they are able to be rescued. As such, it is crucial that the person in the boat also acts as a spotter, keeping an eye on the diver to make sure they are safe. It is also important to have a free diver take their time and relax and rest between dives. Trying to do too much too fast increases the danger.

Snorkeling works best as a shallow water "inspect and remove" activity. Using a snorkel to breathe, a swimmer patrols shallow areas looking for AIS. When found, and if in shallow water, removal follows.

Scuba diving makes it possible to spend more time underwater looking for and then hand removing AIS. Often a scuba diver will carry a fine mesh bag along with them to put the plant material that they remove into to minimize the number of fragments that are dislodged or that simply break away from a pulled plant.

In all these methods, it is important for the diver to remove as much of the plant and the root from the bottom of the lake as possible. When targeting AIS, none of these methods require a permit to complete. Under water obstructions like stumps and other woody debris, and poor water clarity issues increase the danger of this form of removal and make it less effective. Inexperienced divers should have multiple precautions in place to help ensure the safety of the diving experience.

All three of these physical removal actions will be used to control HWM in Rice Lake. They are not recommended for CLP removal due to its extensive distribution and density.

MECHANIZED AQUATIC PLANT REMOVAL

Mechanical management involves the use of devices not solely powered by human means to aid in removal of aquatic plants. This includes gas and electric motors, ATV's, boats, tractors, backhoes, etc. Using these instruments to cut, dig, grind, pull, or rotovate aquatic plants is illegal in Wisconsin without a permit. To implement mechanical removal of aquatic plants a Mechanical/Manual Aquatic Plant Control Permit or other task-specific permit is required from the WDNR. Applications are reviewed by the WDNR, and other entities and a permit awarded if required criteria are met. All the following mechanical forms of aquatic plant management require WDNR permits.

DIVER ASSISTED SUCTION HARVESTING

Diver assisted suction harvesting or DASH, as it is often called, involves scuba divers who swim along the bottom of the lake with a hydraulic suction tube and when a target plant is found, it is dislodged by the diver and fed into the suction tube. Hydraulic suction brings the removed plant to the surface of the lake and deposits into a bag or bin on the boat (Figures 61 & 62). It is called "harvesting" rather than "dredging" because, although a specialized small-scale dredge is used, bottom sediment is not removed from the system. DASH increases the ability of a diver to remove offending vegetation from a larger area, faster. A DASH boat consists of a pontoon boat equipped with a water pump, catch basin, suction hose, and other apparatus (Figure 62). In addition, many DASH boat setups include an air compressor, hose, and regulator system on board that can support 1-3 divers without scuba tanks.

Like with other diver removal efforts, underwater obstructions and poor water clarity can make DASH less effective as a removal technique.

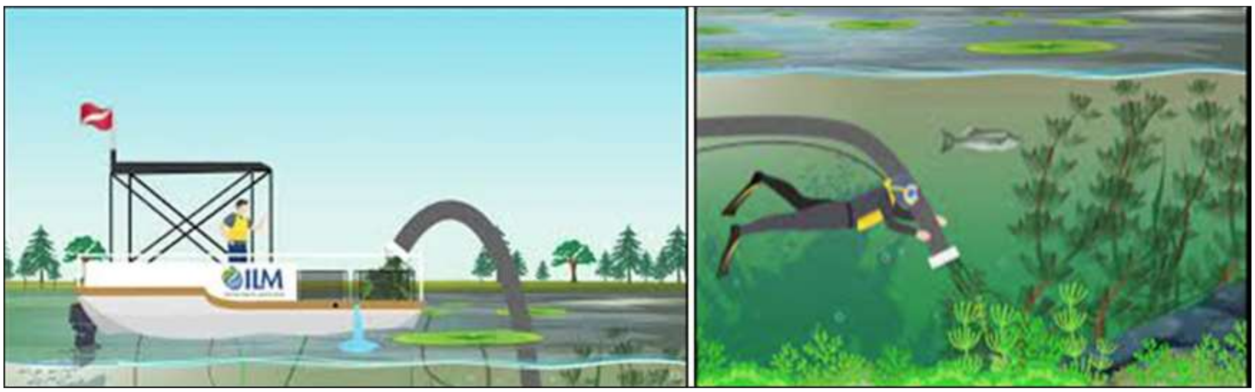


Figure 61: DASH boat and underwater operation (ILM Environments)[4]

Figure 62: DASH – Feeding EWM into the underwater Suction Hose (Marinette Co.); and a sample DASH Pontoon Boat (Beaver Dam Lake Management District)

Access to DASH services in northern WI is limited, with only one private company offering services in all northern WI. Contracted DASH services usually run in the $2,500.00 to $3,500.00 per day range with no guarantees on how much EWM can be removed in a day. The estimated costs to build a custom DASH boat range from $15,000.00 to $20,000.00.

[4] https://www.youtube.com/watch?v=YQmLMKzc1UM

DASH may work well in areas of Rice Lake where small, dense beds of HWM have been identified. It is less effective when used to remove individual and small clumps of plants spread out over a large area due to the time it takes to travel with the DASH boat to all these sites, or in large beds of HWM that quickly overwhelm removal efforts.

CONTINUED MECHANICAL DISTURBANCE TO CONTROL AQUATIC PLANTS

Mechanical disturbance devices such as bottom rollers, automated rakes or sweepers, and Aqua-Thrusters are not illegal in WI, but do require a WDNR Waterway and Wetland General or Individual Permit from the WDNR to legally place in a lake.[5]

Weed rollers are slow-moving pivot beams attached to a pier or wharf that slowly roll along a lake bottom, agitating lakebed material to prevent aquatic plant growth. Because these are submerged structures, they can potentially cause navigation concerns and can limit habitat availability for fish and aquatic life. For these reasons, rollers are not generally permitted in Wisconsin's waters. A miscellaneous structure individual permit is required if a riparian owner wishes to pursue a roller.[6]

A weed rake is a device that attaches to an existing structure such as a pier or piling, designed to mechanically remove aquatic plants by the movement of rake tines attached to a floating boom without grubbing, lifting, or rolling of the bottom sediments. A weed rake general permit is available for qualifying weed rake projects.[7] Projects that cannot meet the eligibility requirements of the general permit must apply for a miscellaneous structure individual permit.

Jetting is a process of forcefully shooting water toward the lakebed to dislodge sediment and/or plants. Aqua-Thrusters are a common site on many Wisconsin lakes and are an example of "jetting". The dislodged sediment typically moves from one area of a lake to another and can cause several environmental concerns including declining water clarity, nutrient release, destruction of fish and wildlife habitat, and increased sedimentation of neighboring properties or channels. Due to these potentially severe side effects, the jetting of sediment is classified as dredging and requires a DNR dredging-jetting aquatic plants permit.[8]

SMALL-SCALE MECHANICAL HARVESTING

There are a wide range of small-scale mechanical harvesting techniques, most of which involve the use of boat mounted rakes, scythes, and electric cutters. As with all mechanical harvesting, removing the cut plants is required. Commercial rakes and cutters range in prices from $200 for rakes to around $3000 for electric cutters with a wide range of sizes and capacities. Using a weed rake or cutter that is run by human power is allowed without a permit, but the use of any device that includes a motor, gas or electric, would require a permit. Dragging a bed spring or bar behind a boat, tractor, or any other motorized vehicle to remove vegetation is also illegal without a permit.

Although not truly considered mechanical management, incidental plant disruption by normal boat traffic is a legal method of management. Active use of an area is often one of the best ways for riparian owners to gain navigation relief near their docks. Most aquatic plants won't grow well in an area actively used for boating and swimming. It should be noted that purposefully navigating a boat to clear large areas is not only potentially

[5] https://dnr.wisconsin.gov/topic/Waterways/construction/intake_outfall.html
[6] https://dnr.wisconsin.gov/sites/default/files/topic/Waterways/checklist/IP/IndividualPermitAll.pdf
[7] https://apps.dnr.wi.gov/doclink/forms/3500-143.pdf
[8] https://apps.dnr.wi.gov/doclink/forms/3500-154.pdf

illegal, it can also re-suspend sediments, encourage aquatic invasive species growth, and cause ecological disruptions.

LARGE-SCALE MECHANICAL HARVESTING

Large-scale mechanical harvesting can be an effective way to reduce aquatic plant biomass in a water body. It is typically used to open channels through existing plant beds (native or non-native) to improve access for both human related activities like boating, and natural activities like fish distribution and mobility on lakes in maintenance mode.

Aquatic plant harvesters are floating machines that cut and remove vegetation from the water (Figure 63). The size and harvesting capabilities of these machines vary greatly. As they move, harvesters cut a swath of aquatic plants between 4 and 20 feet wide and can be up to 10 feet deep. The on-board storage capacity of a harvester ranges from 100 to 1,000 cubic feet (by volume) or 1 to 8 tons (by weight). Most harvesters can cut between 2 and 8 acres of aquatic vegetation per day. The expected average lifetime of a mechanical harvester is about 10 years with proper maintenance.

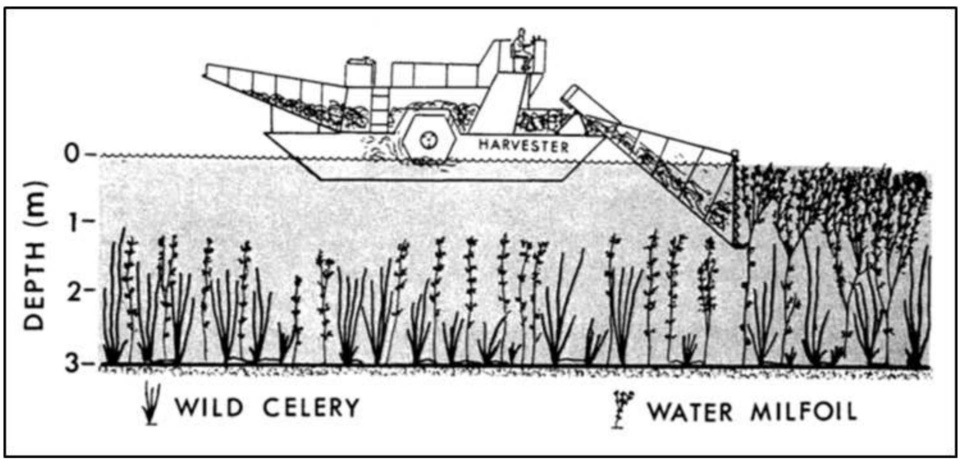


Figure 63: How a mechanical harvester works (Engle, 1987)

Mechanical harvesting of aquatic plants presents both positive and negative consequences to any lake. Its results—open water and accessible boat lanes—are immediate and can be enjoyed without the restrictions on lake use which follow herbicide treatments. In addition to the human use benefits, the clearing of thick aquatic plant beds may also increase the growth and survival of some fish. By eliminating the upper canopy, harvesting reduces the shading caused by aquatic plants. The nutrients stored in the plants are also removed from the lake, and the sedimentation that would normally occur because of the decaying plant matter is prevented. Additionally, repeated harvesting may result in thinner, more scattered growth.

Of negative consequence, the removal of aquatic species during harvesting is non-selective. Native and invasive species alike are removed from the target area. This loss of plants results in a subsequent loss of the functions they perform, including sediment stabilization and wave absorption. Other organisms such as fish, reptiles, and insects are often displaced or removed from the lake in the harvesting process. This may have adverse effects on these organisms' populations as well as the lake ecosystem. Harvesting activities in shallow water can re-suspend bottom sediments into the water column releasing nutrients and other accumulated compounds (Madsen J. , 2000). Even the best aquatic plant harvesters leave some cutting debris in the water to wash up on the shoreline or create loose mats of floating vegetation on the surface of the lake. This "missed" cut vegetation can potentially spread invasive plant species as it floats around the lake and establishes in new sites. Floating mats of "missed" cut vegetation can pile up on shorelines creating another level of nuisance that property owners may have to deal with

Disposal sites are a key component when considering the mechanical harvesting of aquatic plants. Dumping sites must be in an upland area to make sure the plants and their reproductive structures don't make their way back into the lake or to other water bodies. The number of available disposal sites and their distance from the targeted harvesting areas will determine the efficiency of the operation, in terms of time and cost.

Timing is also important. To maximize the efficiency of the harvester, the ideal time to harvest is just before the aquatic plants break the surface of the lake and prior to the formation of reproductive structures like flower/seeds and turions. If the harvesting work is contracted, the equipment should be inspected before and after it enters the lake. Since these machines travel from lake to lake, they may carry plant fragments with them and facilitate the spread of aquatic invasive species.

Mechanical harvesting is expensive. Costs per acre vary with the number of acres harvested, accessibility of disposal sites to the harvested areas, density and species of the harvested plants, and whether a private contractor or public entity does the work. Costs as low as $250 per acre have been reported. Private contractors generally charge $500 to $800 per acre or $2500 to $3500 per day. The purchase price of new harvesters ranges from $75,000 to $300,000. There are several harvester manufacturers in the United States (including at least two in Wisconsin) and some lake groups may choose to operate and purchase their own machinery rather than contracting for these services.

In the last several years, more companies have started offering contracted mechanical harvesting. Several companies are in the northern half of Wisconsin including TSB Lakefront Restoration and Diving (New Auburn, WI) and Aquatic Plant Management (Minocqua, WI). Several other companies exist in southeastern WI, the Twin Cities area, and northern Illinois.

The Lake District currently owns and operates three large-scale harvesters and uses them to control CLP populations in early summer, to control HWM all season, and to maintain navigation lanes throughout the rest of the season.

DREDGING

Dredging is the removal of bottom sediment from a lake. Its success is based on altering the target plant's environment. It is not usually performed solely for aquatic plant management but rather to restore lakes that have been filled in with sediment, have excess nutrients, inadequate pelagic and hypolimnetic zones, need deepening, or require removal of toxic substances (Peterson S. A., 1982). In shallow lakes with excess plant growth, dredging can make areas of the lake too deep for plant growth. It can also remove significant plant root structures, seeds, turions, rhizomes, tubers, etc. Dredging projects to remove material from lakebeds or streambeds can pose a risk to the aquatic environment. As such, permit authorization typically requires input from multiple WDNR programs. Dredging projects can be logistically challenging and expensive to implement. Projects may require contaminated sediment sampling, in-water sediment control practices, and dredge spoil disposal techniques.

While in general, dredging is not recommended for Rice Lake, there are a couple of places where at some point in the future limited dredging may be necessary. One area is in the navigation channel that follows the east shore of Clearwater Bay. Currently, aquatic harvesting operations occasionally remove bogs that float in or break free from the edge to block the navigation channel. There are also several smaller bays that have narrow access sites that may need dredging to maintain boating access in the future.

BOTTOM BARRIERS AND SHADING

Physical barriers, fabric or other, placed on the bottom of the lake to reduce plant growth may provide temporary relief from invasive aquatic plant species, but also inhibits fish spawning, affects benthic invertebrates, and could cause anaerobic conditions which may release excess nutrients from the sediment. Gas built up beneath these barriers can cause them to dislodge from the bottom; and sediment can build up on them allowing vegetation to re-establish. Bottom barriers are typically used for very small areas and provide only limited relief. Currently the WDNR does not permit this type of control.

Creating conditions in a lake that may serve to shade out aquatic plant growth has also been tried with mixed success. The general intention is to reduce light penetration in the water, which in turn limits the depth at which plants can grow. Typically, dyes have been added to a small water body to darken the water. Bottom barriers and attempts to further reduce light penetration in Rice Lake are not recommended.

DRAWDOWN

Drawdown, like dredging, alters the plant environment by removing water in a water body to a certain depth, exposing bottom sediments to seasonal changes including temperature and precipitation. A winter drawdown is a low cost and effective management tool for the long-term control of certain susceptible species of nuisance aquatic plants. A winter drawdown controls susceptible aquatic plants by dewatering a portion of the lake bottom over the winter and subsequently exposing vascular plants to the combined effect of freezing and desiccation (drying). The effectiveness of controlling plants hinges first on being able to draw the water down far enough to dewater the areas of most concern; and then on the combined effect of the freezing and drying. If freezing and dry conditions are not sustained for 4-6 weeks, the effectiveness of the drawdown may be reduced. Winter drawdowns are most effective for plants like EWM and lily pads that reproduce from rhizomes and vegetative runners under the sediment. They are much less effective for controlling plants that grow annually from seeds or turions like CLP and other pondweeds. In some cases, pondweed species may benefit from a winter drawdown, as competition with other plants species may be reduced following a drawdown. This can aid certain native species like wild rice, but it could also result in CLP doing better in a lake.

The severity of the winter weather can affect the results of a winter drawdown. A mild winter, especially one with persistent precipitation, may not provide the freezing and/or drying required for plant destruction. Conversely, a cold winter with lots of snow might also lead to disappointing results. Snow is an excellent insulator, so exposed bottom sediments that are constantly covered by snow may not experience the low temperatures required to kill overwintering structures. High levels of groundwater seepage may also reduce or negate the destructive effects on target species by keeping the area moist and unfrozen. Ideally, the sediments should be exposed for at least 6-8 weeks, with temperatures below freezing (0° C/ 32° F) for two weeks or more.[9]

Rice Lake is controlled by a dam near Stein Street, but a drawdown is not a recommended management action. Drawdowns can be used to control HWM, but HWM in Rice Lake is in deep water that would require at least a 7-9ft drawdown. A drawdown of this magnitude would drain much of the system.

BIOLOGICAL CONTROL

Biological control involves using one plant, animal, or pathogen to control a target species in the same environment. The goal of biological control is to weaken, reduce the spread, or eliminate the unwanted

[9] Read more at: https://haywood.ces.ncsu.edu/winter-drawdown-as-a-pond-management-tool/

population so that native or more desirable populations can make a comeback. Care must be taken, however, to ensure that the control species does not become as big a problem as the one that is being controlled. A special permit is required in Wisconsin before any biological control measure can be introduced into a new area.

Currently, there are no biological controls available for CLP. It was thought at one time that the introduction of plant eating carp could help control CLP and EWM. It has since been shown that these carp have a preference list for certain aquatic plants. CLP is very low on this preference list (Pine & Anderson, 1991). Use of "grass carp" as they are referred to in Wisconsin is illegal as there are many other environmental concerns including what happens once the target species is destroyed, removal of the carp from the system, impacts to other fish and aquatic plants, and preventing escapees into other lakes and rivers. Several pathogens or fungi are currently being researched that when introduced by themselves or in combination with herbicide application can effectively control CLP and lower the concentration of chemical used or the time of exposure necessary to kill the plant (Sorsa, Nordheim, & Andrews, 1988).

Biological controls do exist for EWM and purple loosestrife. The milfoil weevil (*Euhrychiopsis lecontei*) is a small, herbivorous aquatic beetle that is native to North America (Figure 64). It is a watermilfoil specialist, meaning that it feeds and develops only on plants in this genus. Its original host before the introduction of EWM was the native northern watermilfoil. The weevil completes all life stages fully submersed, feeding and developing on milfoil, and the larvae are stem miners. These characteristics make it unique, as specialist herbivores are very rare among aquatic insects (Newman, 2020). These characteristics are why the milfoil weevil has shown the most promise as a potential biocontrol agent for EWM and why it has been the subject of much research. Unfortunately, though these insects have been used in WI, the process of rearing and distributing them is very difficult and time consuming involving harvest of EWM from the lake the weevils are to be put in, setting up of rearing stations that consist of large water tanks and live EWM, tending and refreshing the tanks, collecting weevils in the field, and distributing them once they have propagated. This consultant is also not aware of any research that has been done to test the effectiveness of the weevils on hybrid watermilfoil.

To control purple loosestrife, the WDNR has been using four of its insect enemies, also from Europe, since 1994. Careful research has shown that all four control species depend only on loosestrife and do not threaten native plants. This is classic biocontrol, and it is likely the best long-term control for loosestrife, reducing the need for other more costly and disruptive controls, such as herbicides. Two beetle species (*Galerucella calmariensis* and *pusilla*) have proven extremely effective at control (Figure 64). Both species of beetles feed almost exclusively on leaves, shoots, and stems of purple loosestrife during all their life stages. Galerucella beetles monitored in the state and elsewhere have decreased the vigor, size and seed output of purple loosestrife, allowing native plants to survive and increase naturally by competing better against smaller loosestrife plants.

The length of time required for effective biocontrol of purple loosestrife in any wetland typically ranges from one to several years, depending on such factors as site size and loosestrife density. Though loosestrife elimination is rare, this process offers effective and environmentally sound control of the plant without herbicides. Furthermore, unlike EWM weevils, the process of rearing and releasing purple loosestrife beetles is a lot easier. However, both processes require permitting from the WDNR. The use of biological controls for EWM and purple loosestrife aims to reduce pest populations to tolerable levels but not eliminate it. Keeping a low density of the offending plant species is important to maintain control agent populations. Successful biocontrol of EWM and purple loosestrife will reduce their abundance, eliminate large areas, and will promote healthier native plant communities but will not eliminate them from the lake environment.

Figure 64: Milfoil weevil (left) and purple loosestrife beetle (right)

Artificially enhancing the population of EWM weevils in Rice Lake is not recommended, however, completing a study to determine if any weevils already exist would be interesting. Using beetles to control purple loosestrife will be considered if the population of purple loosestrife in and around Rice Lake increases past just a few plants that can be physically removed and/or treated with aquatic herbicides.

CHEMICAL CONTROL

Aquatic herbicides are granular or liquid chemicals specifically formulated for use in water to kill plants or retard plant growth. Herbicides approved for aquatic use by the U.S. Environmental Protection Agency are considered compatible with the aquatic environment when used according to label directions.

The WDNR evaluates the benefits of using a particular chemical at a specific site vs. the risk to non-target organisms, including threatened or endangered species, and may stop or limit treatments to protect them. The Department frequently places conditions on a permit to require that a minimal amount of herbicide is needed and to reduce potential non-target effects, in accordance with best management practices for the species being controlled. For example, certain herbicide treatments are required by permit conditions to be in spring because they are more effective, require less herbicide and reduce harm to native plant species. Spring treatments also mean that, in most cases, the herbicide will be degraded and gone by the time peak recreation on the water starts.

The advantages of using chemical herbicides for control of aquatic plant growth are the speed, ease and convenience of application, relatively low cost, and the ability to control plant types somewhat selectively with certain herbicides. Disadvantages of using chemical herbicides include possible toxicity to aquatic animals or humans, oxygen depletion after plants die and decompose which can cause fishkills, a risk of increased algal blooms as nutrients are released into the water by the decaying plants, adverse effects on desirable aquatic plants, loss of fish habitat and food sources, water use restrictions, and a need to repeat treatments due to existing seed/turion banks and plant fragments. Chemical herbicide use can also create conditions favorable for non-native AIS to outcompete native plants (for example, areas of stressed native plants or devoid of plants).

When properly applied, the possible negative impacts of chemical herbicide use can be minimized. Spring and early summer applications are preferred because exotic species are actively growing and many native plants are dormant, thus limiting the loss of desirable plant species. Plant biomass is relatively low during this time minimizing the impacts of de-oxygenation and contribution of organic matter to the sediments. If herbicide application is planned in areas where fish spawning occurs, it should wait until spawning has ceased. Recreational use by humans is also generally low during this timeframe, limiting human contact. In some cases, the concentration of herbicides can be reduced because colder water temperatures enhance the herbicidal effects. Plant selectivity can be influenced by the herbicide used, the concentration that is applied, and seasonal timing. Lake hydrodynamics must also be considered; steep drop-offs, inflowing waters, lake currents and wind can dilute chemical herbicides or increase herbicide drift and off-target injury. This is an especially important consideration when using herbicides near environmentally sensitive areas or where there may be conflicts with water uses in the treatment vicinity.

EFFICACY OF AQUATIC HERBICIDES

The efficacy of aquatic herbicides is dependent on both application concentration and exposure time. These factors are influenced by two separate but interconnected processes - dissipation and degradation. Dissipation is the physical movement of the active herbicide within the water column both vertically and horizontally. Dissipation rates are affected by wind, water flow, treated area size relative to untreated area size, and water depths. Degradation is the physical breakdown of herbicide into inert components. Depending on the herbicide utilized, degradation occurs over time either through microbial or photolytic (chemical reactions caused by sunlight exposure) processes.

Several emergent, wetland, or dry ground non-native plant species have been identified in Rice Lake including purple loosestrife, yellow iris, reed canary grass, Japanese knotweed, and common forget-me-nots. Over the last five years, yellow iris has increased its distribution and density along much of the shoreline of the lake and is the species of most concern. purple loosestrife and Japanese knotweed are present but not a major issue yet, although efforts should be made to control them before they become a bigger issue. Cut-stem dabbing and hand wicking are commonly used for small-scale, chemical control of yellow iris and purple loosestrife. Reed canary grass and aquatic forget-me-nots will likely not be managed.

CUT-STEM AND WICKING APPLICATION

Cut-stem dabbing (Figure 65) is carried out by cutting stems of target species within two to four inches of the ground followed by the application of herbicide to the cut surface. Treatment should occur immediately following cutting to ensure proper absorption of herbicide. A colored dye is usually added to the solution so that it is apparent as to where the herbicide has been applied.

Hand wicking (Figure 65) involves spraying an herbicide solution on an absorbent glove and carefully wiping the herbicide onto the surface of a leaf. It's important to wear an herbicide resistant glove beneath the absorbent glove, to protect skin from herbicide. This method is appropriate when controlling small populations of invasive species that are growing in a high-quality area, or when controlling invasive species in close proximity of endangered or threatened native species (https://muskegonlake.org/habitat-management-plan/invasive-species-control/, last accessed on August 6, 2020).

Figure 65: Herbicide application using "Cut-stem dabbing" (top) and "wicking" (bottom)

SMALL-SCALE HERBICIDE APPLICATION

Small-scale herbicide application involves treating areas less than 10 acres in size. Concern on the part of the WDNR regarding the use of small-scale herbicide applications to control CLP or EWM has been expressed for several years. The concerns are based on data that shows that small-scale applications of aquatic herbicides tend to dissipate rapidly and/or dilute quickly minimizing effective results. WDNR research has also shown that granular herbicides do not provide any greater contact time than liquid herbicides. As such, when using common herbicides like endothall for CLP control and 2,4D or triclopyr for EWM control, the WDNR recommends that individual treatment areas be at least 5 acres in size. The desired target species contact time for these herbicides is between 18 and 36 hours. Dissipation and dilution in small treatment areas makes this level of contact difficult to achieve. Smaller treatment areas are likely to be less effective and possibly denied by the WDNR when considering chemical permit applications and/or requests for grant funding.

ProcellaCOR, used more and more for the control of EWM, requires a much lower target species/herbicide contact time – down to only 2-4 hours. The effective bed size for the use of ProcellaCOR has not been defined by the WDNR.

Installation of a Limno-Barrier

Small-scale herbicide applications can be made more effective by installing a limno-barrier or curtain around a treatment area to help hold the applied herbicide in place longer. By doing so, the herbicide/target species contact time is increased. The curtain is generally a continuous sheet of plastic that extends from the surface to the bottom of the lake (Figure 66). The surface edge of the curtain is supported by floating devices. The bottom of the curtain is held in place by some form of weighting. The curtain or barrier, sometimes thousands of feet of it, is installed around the proposed treatment area holding the herbicide in place longer by preventing dilution and drifting away from the treated area (Figure 67).

Figure 66: Limno-curtain material on a roll before installation (photo from Marinette Co. LWCD)

Figure 67: Limno-curtain installed on Thunder Lake (photo from Marinette Co. LWCD)

In a limno-curtain trial completed in Thunder Lake, Marinette County in 2020, a curtain was installed around two small areas (0.9 and 2.9 acres) of dense growth EWM prior to chemical treatment. Liquid 2,4-D was applied at 4.0ppm inside the barrier. The barriers stayed in place until 48 hours after treatment. Herbicide concentration testing was completed within the treated areas to determine how long the herbicide stayed in place and at what concentration. Figure 68 reflects what happened to the herbicide that was applied.

Herbicide concentrations stayed relatively high for a longer period (48hrs). Once the curtain was removed, the herbicide dissipated rapidly.

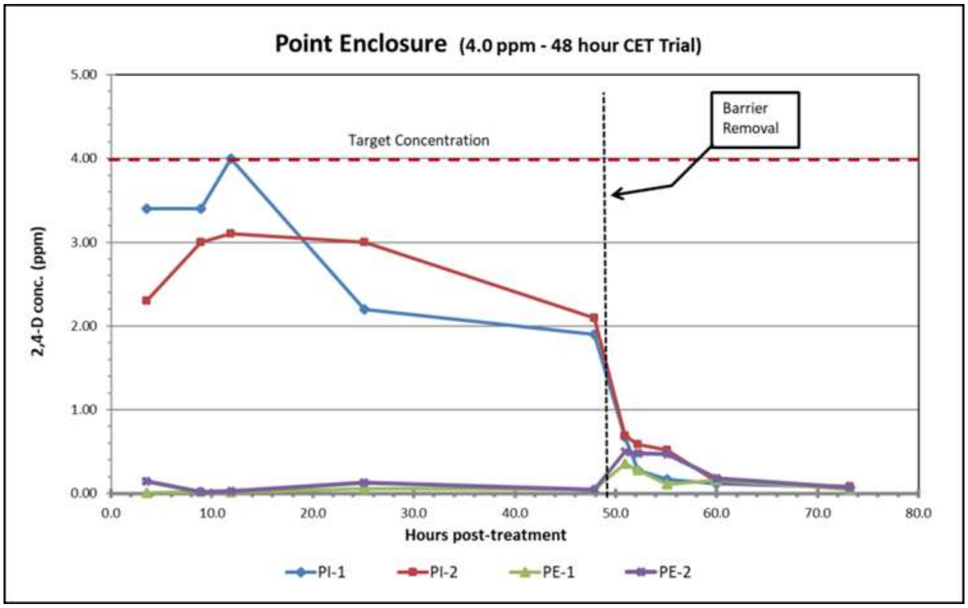


Figure 68: Herbicide concentration results from 2020 Thunder Lake limno-curtain trial (Marinette Co LWCD)

LARGE-SCALE HERBICIDE APPLICATION

Large-scale herbicide application involves treating areas more than 10 acres in size. Like small-scale applications, this is usually completed in the early season (April through May) for control of non-native invasive species like CLP or EWM while minimizing impacts on native species. It is generally accepted that with large-scale applications the likelihood of the herbicide staying in contact with the target plant for a longer time is greater. If the volume of water treated is more than 10% of the volume of the lake, or the treatment area is ≥160 acres, or 50% of the lake's littoral zone, effects can be expected at a whole-lake scale. Large-scale herbicide application can be extended in some lakes to include whole bay or even whole lake treatments. The size of the treatment area, the more contained the treatment area, and the depth of the water in the treatment area, are factors that impact how whole bay or whole lake treatments are implemented.

COMMON AQUATIC HERBICIDES

ProcellaCOR® (PCOR) is a relatively new systemic, selective herbicide that can be used to target EWM with limited impact to most native species. It is also very fast acting, making it an effective control measure on smaller beds that may be too large for DASH, especially ones in high boat traffic areas and/or deeper water. In addition, applications rates are measured in ounces, not gallons as is common with almost all other liquid herbicides. And while it is more expensive to use than 2,4-D equivalents, it has been shown to provide two or more years of control without re-application.

2,4-D and triclopyr are active ingredients in several selective herbicides including 2,4-D Amine 4®, Navigate®, DMA 4®, Renovate®, and Renovate Max G®. These herbicides stimulate plant cell growth causing them to rupture, but primarily in narrow-leaf plants like milfoil. These herbicides are considered selective as they have little to no effect on monocots in treated areas. ProcellaCOR, fluridone, 2,4-D, and triclopyr are all considered systemic. When applied to the treatment area, plants in the treatment area draw the herbicide in through the leaves, stems, and roots killing the whole plant.

Sonar®, whose active ingredient is fluridone, is a broad-spectrum herbicide that interferes with the necessary processes in a plant that creates the chlorophyll needed to turn sunlight into plant food through a process called photosynthesis. Sonar is generally applied during a whole-lake application and is expected to be in the lake at very low concentrations for weeks or months once applied.

Aquathol® whose active ingredient is endothall and Reward® whose active ingredient is diquat are considered broad spectrum contact herbicides. They destroy the outer cell membrane of a plant killing it very quickly. They are not selective and have the potential to kill all the plants in a treated area. As such, great care should be taken when using these products. Certain plant species like CLP begin growing very early in the spring, even under the ice, and are often the only growing plant present at that time. This is a good time to use contact herbicides like Aquathol, as few other plants would be impacted. Using these products later in the season, can kill all vegetation providing substantial relief from a variety of nuisance aquatic plants.

Glyphosate is a commonly used herbicide that is used in both aquatic and terrestrial sites. Glyphosate is a systemic herbicide (i.e., it moves throughout the plant tissue). It is a WSSA Group 9 herbicide, meaning that the mechanism of action is by inhibiting an important enzyme needed for multiple plant processes including growth. Following treatment, plants will gradually wilt, appear yellow, and decompose in approximately two to seven days. Glyphosate is only effective on plants that are actively growing above water. It will not be effective on submerged aquatic plants, nor will it control regrowth from seed. Unless the glyphosate product used includes a pre-mixed surfactant, chemical applicators must mix a surfactant approved for aquatic sites with glyphosate before application. A surfactant helps the herbicide "stick" to the plant surfaces and increases the rate of absorption.

INCIDENTAL IMPACTS OF AQUATIC HERBICIDES ON WILD RICE

Of great concern to Wisconsin's Tribal Resources and the WDNR is the potential impact of aquatic herbicides on wild rice.

Clay and Oelke (1990) evaluated applications of 2,4D amine salt for weed control in commercial rice populations. 2,4D rates as low as 1.1 kg/ha applied at the two-aerial-leaf growth stage severely injured wild rice plants, and higher rates significantly reduced grain yield.

Oelke and McClellan (1991) similarly observed that 2,4D rates ≥ 0.84 kg/ha applied to wild rice in the mid- to late-tillering growth stage significantly injured plants and reduced grain yields.

Miller (1994) studied the impacts of Fluridone and 2,4D on the floating leaf growth stage of southern wild rice. Fluridone applied to water at higher rates (i.e., ≥ 8 ppb) caused significant decreases in biomass, while lower rates (i.e., 2 and 4 ppb) did not impact biomass. 2,4D applied at rates as low as 0.4 ppm significantly reduced biomass weight by 24%, while higher rates (i.e., 0.8, 1.6, & 3.2 ppm) resulted in even greater biomass losses (67, 88, & 94%, respectively).

Nelson et al. (2003) examined the effects of diquat, endothall, fluridone, and 2,4D on the growth and survival of seedling, young, and mature northern wild rice. The degree of herbicide damage varies with growth stage. Younger stages of wild rice were more sensitive than later growth stage plants. Mature wild rice plants were not impacted by any of the products or rates tested. Wild rice was most sensitive to 2,4D, with rates as low as 1.0 parts per million (ppm) significantly inhibiting tiller, seed head, and biomass production. Biomass of wild rice was also reduced following exposure to endothall, diquat, and fluridone, however seed head and tiller production was not impacted. Results of this study suggest that wild rice is most resistant to herbicides applied to the water column when plants are mature or in the late flowering stages.

Madsen et al. (2008) investigated the sensitivity of seedling, young, and mature northern wild rice to liquid triclopyr. Concentrations were 0, 0.75, 1.5, and 2.5 ppm and plants were exposed to herbicide for 72 hours. Rice exposed to the highest concentration (2.5 ppm) exhibited reduced biomass and height regardless of growth stage. Declines in biomass, height, seed head density, and tiller formulation were not observed at lower concentrations (0.75 ppm), though seedlings appeared more sensitive to this exposure rate.

To date there have been no published studies on the impact of ProcellaCOR on wild rice.

FISH AND AQUATIC HERBICIDES

Any herbicide, if misapplied, can cause negative impacts to fish and many other living creatures in the water. The herbicides that have been approved for aquatic use have had extensive research done on them to determine what is considered a "safe" amount to apply. ProcellaCOR, 2,4-D, and triclopyr are the herbicides used in Rice Lake to control HWM. Endothall has been used to control CLP. An herbicide that combined endothall and diquat (Aquastrike®) was used in 2018, however, diquat is not recommended for use in Rice Lake at this time due to its impact on walleyes.

Diquat

According to Paul et al. (1994), a review of the toxicity literature for diquat indicates that it is highly toxic to some aquatic animals. Young walleyes are the most sensitive fish species tested.

PRE AND POST TREATMENT AQUATIC PLANT SURVEYING

When introducing new chemical treatments to lakes where the treatment size is greater than ten acres or greater than 10% of the lake littoral area and more than 150ft from shore, the WDNR requires pre and post chemical application aquatic plant surveying. The protocol for pre and post treatment survey is applicable for chemical treatment of CLP and EWM.

The WDNR protocol assumes that an Aquatic Plant Management Plan has identified specific goals for non-native invasive species and native plants species control. Such goals could include reducing coverage by a certain percent, reducing treatments to below large-scale application designations, and/or reducing density from one level to a lower level. A native plant goal might be to see no significant negative change in native plant diversity, distribution, or density. Results from pre and post treatment surveying are used to improve consistency in analysis and reporting, and in making the next season's management recommendations.

The number of pre and post treatment sampling points required is based on the size of the treatment area. Ten to twenty acres generally requires at least 100 sample points. Thirty to forty acres require at least 120 to 160 sampling points. Areas larger than 40 acres may require as many as 200 to 400 sampling points. Regardless of the number of points, each designated point is sampled by rake, recording depth, substrate type, and the identity and density of each plant pulled out, native or invasive.

In the year prior to an actual treatment, the area to be treated must have a mid-season/summer/warm water point intercept survey completed that identifies the target plant and other plant species that are present. A pre-treatment aquatic plant survey is done in the year the herbicide is to be applied, prior to application to confirm the presence and level of growth of the target species. A post-treatment survey should be scheduled when native plants are well established, generally mid-July through mid-August. For the post-treatment survey, repeat the PI for all species in the treatment polygons, as was done the previous summer. For whole-lake scale treatments, a full lake-wide PI survey should be conducted.

CHEMICAL CONCENTRATION TESTING

Chemical concentration testing is often done in conjunction with treatment to track the fate of the chemical herbicide used. Testing is completed to determine if target concentrations are met, to see if the chemical moved outside its expected zone, and to determine if the chemical breaks down in the system as expected. Monitoring sites are located both within and outside of the treatment area, particularly in areas that may be sensitive to the herbicide used, where chemical drift may have adverse impacts, where movement of water or some other characteristic may impact the effect of the chemical, and where there may be impacts to drinking and irrigation water. Water samples are collected prior to treatment and for a period of hours and/or days following chemical application.

Pre- and post-treatment aquatic plant surveys and testing for herbicide residuals are not required by the WDNR for small-scale treatments. Nor is an approved Aquatic Plant Management Plan if the organization sponsoring the application is not using grant funding to help defer the costs. Even though not required by the WDNR, participating in these activities is recommended as it helps to gain a better understanding of the impact and fate of the chemical used.

MANAGEMENT DISCUSSION

When the 2021-25 APM Plan was written, it had five main goals:

Goal 1: Maintain a level of aquatic plant growth (native and non-native) that supports a healthy lake system and multiple human uses of the lake system.

Goal 2: Reduce the threat and impact of AIS to and in Rice Lake.

Goal 3: Improve fish and wildlife habitat, reduce runoff, and minimize nutrient loading into Rice Lake.

Goal 4: Implement monitoring and evaluation that supports adaptive management of aquatic plants and water quality.

Goal 5: Assess the progress and results of this project annually and report to and involve other stakeholders in planning efforts.

At the core of these five goals was removing CLP from the lake, trying to minimize the spread of HWM in the lake, and continuing to maintain navigation and access to open water through the summer harvesting program. To do these three things, a combination of mechanical harvesting, application of aquatic herbicides, and physical removal was incorporated.

These same five goals guide this new 2026-30 APM Plan, but the existing core management actions have been modified, and active management of yellow iris has been added.

The CLP population in Rice Lake was and remains well-controlled by a combination of large-scale mechanical harvesting and limited herbicide application, although this may prove to be more difficult in the future due to more frequent weather conditions that create optimal growing conditions in the lake for CLP.

HWM management over the last 7 years has included physical removal (by hand and divers), large and small-scale herbicide application, and mechanical harvesting While there have been examples of successful HWM management with 2 or more years of control in the treated areas, most notably the 2024 treatment using

ProcellaCOR, HWM continues to spread in those areas not chemically treated in Clearwater Bay and the South Basin, and in the fall of 2024, was identified in several areas of the Central and North Basins. Follow-up survey work in the early summer of 2025 again showed effective control of HWM in treated areas. The continued spread of HWM is inevitable, so management needs to focus on minimizing its negative impact rather than preventing its spread. This should include targeted herbicide application to reduce the amount of HWM in areas where mechanical harvesting may simply cause HWM to spread more rapidly to other areas of the lake. Specifically, this includes any area in the South Basin other than Clearwater Bay, and new beds of HWM found in the Central and North Basins of the lake (Nuto Bay and the North Shore). In areas where HWM has already overtaken an area (Clearwater Bay) mechanical harvesting can keep navigation areas open.

In the last three years (2023-25), yellow iris has taken over a large portion of the shoreline particularly in the South Basin. Herbicide application in 2024 along the south shore of the South Basin greatly reduce the number of flowering plants in 2025 but it remains to be seen what the longer-term results will be going forward. A continued yellow iris management program that includes a public education and information program, additional herbicide application, physical removal, and most important - replacement of the yellow iris with native flowering plants - is recommended in this 5yr plan.

Keeping the constituency aware of and educated about how they can help reduce the impacts of AIS in and around the lake will continue. AIS education, outreach, and prevention through social media outlets, newsletters, and workshops will continue. Watercraft inspection at the public boat landings will continue with the goal of reducing AIS leaving the lake and keeping new AIS like zebra mussels out.

Specific objectives and actions associated with each goal can be viewed in Appendix A. Appendix A also comments on whether a specific objective was met during the last five-year period. An Implementation Matrix is provided as Appendix B. An annual timeline for implementation is covered in Appendix C.

The following sections discuss how the Lake District is going to move forward with aquatic plant management (native and non-native in the next five years (through 2030).

PHYSICAL REMOVAL – HAND, SHOVEL, RAKE, FREE DIVING, AND SCUBA DIVER REMOVAL

Physical removal is the first management action implemented when new locations with just a few HWM plants are found, particularly those in the Central and North Basins. Most effective is removal by free diving (without scuba gear) or diving (with scuba gear). Both management actions can be completed without WDNR permits. They work better than rake removal due to more complete removal of the rooted plant and less breakage.

Along the lakeshore, single plants or small clumps of yellow iris, purple loosestrife, or Japanese knotweed can be removed by pulling or digging. At a minimum, the flower heads of yellow iris and purple loosestrife can be removed. Care should be taken to wear gloves and long sleeves when removing yellow iris as it can be irritating to the skin.

Physical removal of CLP and large areas of HWM is not recommended. While larger areas of yellow iris could still be removed by physical means, adding cut-stem, dabbing, or swiping application of herbicide is recommended.

DIVER ASSISTED SUCTION HARVEST (DASH)

DASH will likely only be used for removal of HWM in areas that are too small for herbicide application and reach a point when free diving or scuba divers become less effective, like in deep water. With DASH, scuba divers still remove the plant, but instead of bringing it to the surface by hand, the pulled plant is fed into a suction tube and brought to the surface via hydraulic suction minimizing breakage and escaping fragments. DASH can be used in larger areas that may be sensitive to the application of herbicides or where mechanical harvesting may not be possible. DASH requires a WDNR Mechanical Harvesting permit. DASH is not recommended for CLP removal.

MECHANICAL HARVESTING

As previously mentioned, the Lake District owns three mechanical harvesters with 10ft cutting heads. Two of them were purchased in the last five years. Purchase of a third new harvester to replace one that was purchased in the 1990's is planned in the next 1-3 years. Mechanical harvesting remains the main aquatic plant management action used by the Lake District and generally has two main harvesting stages – 1) CLP removal and 2) nuisance and navigation relief.

In a normal year two of the three harvesters are launched in early May on the main body of the lake (North and Central Basins). The third is launched into the South Basin a little later. Mechanical harvesting is used to remove CLP from the North and Central Basins with most harvesting occurring in May and June. The areas most targeted for CLP removal in the North and Central Basins include the area between the Red Cedar River delta and Hospital Bay, North Shore, Big Bay, Stein St. Bay, East Shore, and Nuto Bay. Additional CLP harvesting occurs in the South Basin near the Orchard Beach boat landing, Hanson Bay, Bayview Bay, and in Clearwater Bay. Mechanical harvesting of CLP in South Basin and Clearwater Bay is somewhat problematic as that is also where the majority of HWM is located. Fortunately, the harvester that is placed in the South Basin is not used in the Central or North Basins. Harvesting is also used to remove floating debris/mats of dead and dying floating vegetation and rafts of break-away bogs that block navigation.

The second stage of harvesting begins in early July when pre-established navigation lanes are kept free of nuisance growth vegetation to improve access and lake use. Currently there are 9.92 miles of navigation lanes that vary between 20ft and 160ft (Figure 69). Total navigation lane harvesting accounts for a little more than 67 acres.

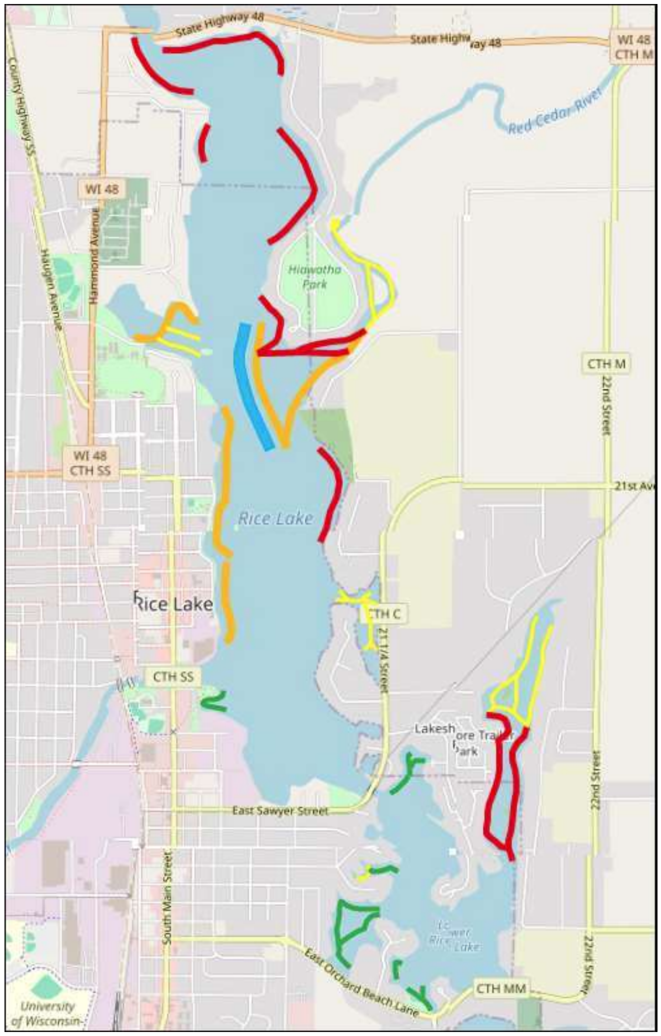


Figure 69: Navigation lanes in Rice Lake – Yellow-20ft, Green-40ft, Red-60ft, Orange-80ft, Blue-160ft

For the most part these lanes are parallel to shore or cut through dense aquatic plant beds in the delta of the Red Cedar River. Harvesting also keeps navigation channels open in Clearwater Bay and in several other smaller bays. Mechanical harvesting is effective at removing large areas of HWM as well, however it creates many fragments that can be spread to other parts of the lake. Mechanical harvesting requires a WDNR mechanical harvesting permit.

APPLICATION OF AQUATIC HERBICIDES

Several herbicides have been used for control of CLP in Rice Lake. The most used are liquid or granular herbicides with the active ingredient - endothall. Diquat based herbicides have also been used. Both are contact herbicides that will kill the vegetative plant parts if concentrations and contact time are high enough. Contact herbicides do not generally kill parts of the target plant that do not come in contact with the herbicide. In some cases, this may mean the root (buried in the sediment) is not entirely killed, which may allow regrowth from existing root structures. Contact herbicides like diquat and endothall are also not plant selective. Both can kill all plant material they come in contact with.

Several herbicides have been used to control HWM in Rice Lake. The most used are liquid herbicides with the active ingredients 2,4D or triclopyr. ProcellaCOR has also been used. All are considered systemic herbicides that are absorbed into the plant and dispersed throughout to kill the entire plant. All three of these herbicides can be somewhat selective in what they kill depending on time of application, the amount of herbicide applied, and the type of aquatic plant. Like broadleaf herbicides used to kill dandelions in a corn field, and grassy herbicides used to kill crab grasses in a soybean field, different aquatic herbicides impact different plants. Systemic herbicides like 2,4D, triclopyr, and ProcellaCOR are like herbicides used to kill crabgrass in a soybean field. Only the grasses are killed, not the broadleaves or in aquatic settings, pondweeds.

Glyphosate is another systemic herbicide, most often used for control of yellow iris, purple loosestrife, or Japanese knotweed. While still considered a systemic herbicide, it is not selective. It will kill whatever it comes in contact with so great care should be used when applying it. For plants like yellow iris, purple loosestrife or Japanese knotweed, glyphosate is most often applied using cut-stem or wiping/wicking methods. If used as a spray, the area treated should consist of all target species.

A WDNR chemical application permit is required for all herbicide applications in or near an aquatic setting. In most cases, a WDNR permit will not be approved if planning on using herbicides to control native aquatic vegetation.

LAKESHORE DRIVE AND SOUTH OF THE RED CEDAR RIVER INLET

Lakeshore Drive in downtown Rice Lake follows the western edge of the lake from Newton St. to Hwy 48 near the Barron County Fairgrounds (Figure 70). This stretch of Lakeshore Drive contains several parks and other interesting community and public attractions and is considered a celebration of the history of the area and of Rice Lake. Parks include Veteran's Memorial Park and City Band Shell, and Indian Mounds Park. Several iron sculptures commemorating the history or the area including Wooly-Mammoth (glacial times), Rusty-The Draft Horse (the logging era), and a third sculpture to serving as a tribute to the Native American communities that used to make their homes along the Red Cedar River and Rice Lake. A historic information sculpture commemorating what was called the Bayfield Trail (from Lake Superior through Rice Lake to points south traveled by Native Americans, Fur Traders, and Settlers is also in the works.

Nearly all the shoreland between Lakeshore Drive and the body of water known as Rice Lake is owned by the city and is frequented daily by community residents and travelers. There are several public fishing piers and a specialized kayak launching dock along this stretch of Lakeshore Drive. Lakeshore Drive is adjacent to Fireworks Island where 4th of July Fireworks is celebrated each year. Lakeshore Drive is also the focal point during the annul Rice Lake Aquafest Celebration in early June. During this event, activities have included a children's fishing contest, rubber duck race, and a waterski show that utilizes the lake front. Veteran's Memorial Park and Band Shell on Lakeshore Dr. are a focal point of Aquafest activities. There is also a summer "Music in the Park" scene that runs for several months. The Elks Lodge and Moose Club are also along Lakeshore Drive, as is the Heritage Manor Lakeside – a senior living community.

The water depth in this area of the lake ranges from 3 to 10 feet deep with bottom substrates of sand, gravel, and rock, covered with a thin layer of muck. The area supports abundant native plant growth when not overrun by CLP. Lake District harvesters work strenuously in this area throughout the season, but particularly during late May and early June with the goal of keeping the area in good shape for Aquafest and other summer events. While harvesting is effective, when the amount of CLP reaches higher density levels, it is difficult to maintain the area. When there is a lot of CLP, harvesting leaves abundant fragments that wash into shore and decay. About every 3-5 years, a limited herbicide treatment is applied to parts of the lake along Lakeshore Drive. This helps reduce the amount of harvesting needed during those years in-between herbicide application.

In more recent years, the area of the Rice Lake lakeshore on the eastern shore of the lake south of the Red Cedar River Inlet has become more problematic (Figure 70). Though not used as a public place of gathering, there is small watercraft/walk-on access point in this area off Zabel Road. It is expected that herbicide use in this area to control CLP would only be used every 5-10 years, and only the year after a survey has documented dense CLP growth.

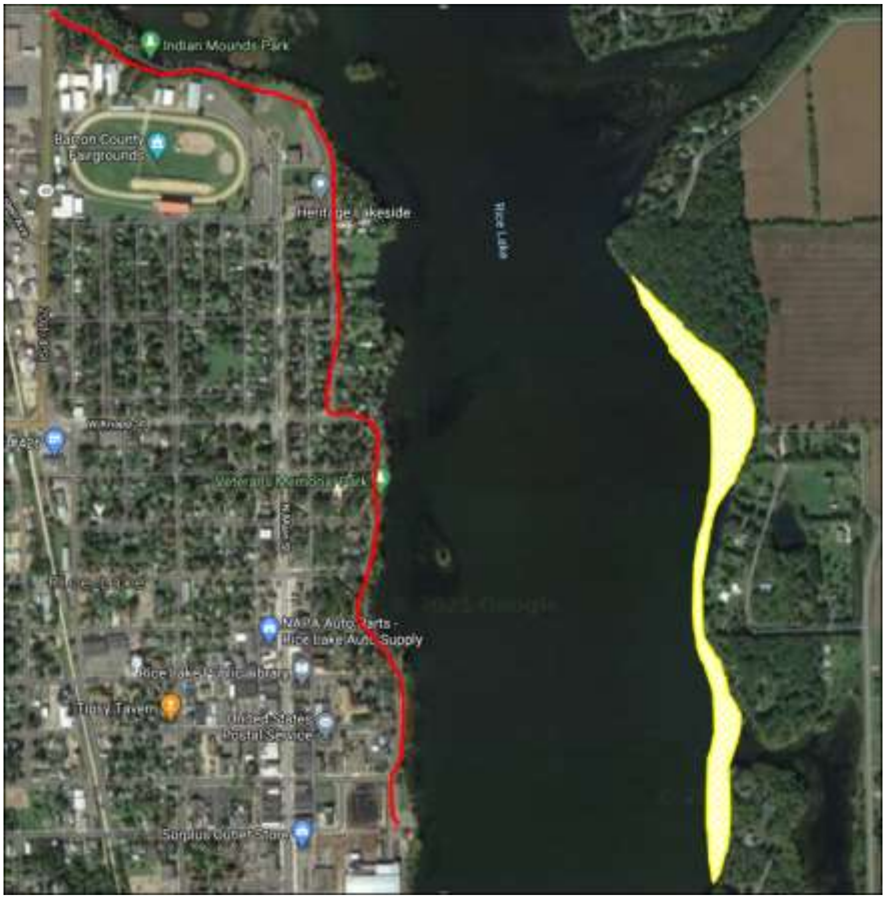


Figure 70: Lakeshore Drive (red line) and South of Red Cedar River Inlet (yellow)

AQUATIC PLANT SURVEYING

Rice Lake has a healthy and diverse native aquatic plant community. Aquatic plant survey work has shown that past management of non-native, invasive species and areas of dense growth native vegetation have caused little change in that community. There are three levels of aquatic plant surveying that will continue to be implemented to better assess and understand how management actions affect aquatic plants and the lake.

RECON AND MAPPING SURVEYS

Recon and mapping surveys within the littoral zone, also known as meandering, bedmapping surveys, look for specific plant species like CLP, HWM, and yellow iris and are important as they are generally the first indicator that there is something that does not belong. These surveys help find target plant species, document the location where target plants are found using GPS technology, and provide an opportunity to physically remove the target plant or make it a part of another management action. Annual bedmapping of CLP is considered a recon and mapping survey and serves to identify areas of concern for management in the following spring. AIS monitoring as a part of the CLMN AIS monitoring program is also an example of recon and mapping surveys. These are completed at least monthly during the open water season and look for

AIS including EWM/HWM, purple loosestrife, and yellow flag iris. The Lake District will complete recon and mapping surveys annually to help define management actions and impacts.

PRE- AND POST-TREATMENT POINT-INTERCEPT SURVEYS

Pre- and post-treatment, point-intercept surveys are more quantifiable and document short-term changes in areas that are chemically managed. These surveys consist of a set of points that can be surveyed multiple times, usually before and after a chemical treatment. Statistical information can be gathered from the data collected during one of these surveys. The WDNR only requires pre- and post-treatment, point-intercept aquatic plant surveying when greater than 10 acres of the littoral zone are proposed for treatment, or if a chemical treatment is grant funded. Should these conditions be met, pre- and post-treatment point-intercept surveys will be completed as a part of management. Harvesting operations generally do not require pre- and post-treatment point-intercept surveys.

WHOLE-LAKE, POINT-INTERCEPT, AQUATIC PLANT SURVEYS

Whole-lake, PI surveys are intended to track changes to the aquatic plant community over time. Typically, in a lake where management of aquatic plants (non-native or native) takes place, whole-lake surveys are recommended at least every five years using the same set of pre-designated points each time. The first time a whole-lake PI survey is completed, the results serve as a baseline for future comparisons. After the first survey, the results from any future surveys can be compared to the first survey for changes. If any changes are identified, it is then possible to analyze what might have caused the changes. While changes naturally occur in most lakes from one year to another, management actions can also be a reason for change.

Whole-lake PI surveys were completed in Rice Lake in 2008, 2015, 2018, and 2024. The 2018 point-intercept survey was completed early due to HWM.

COARSE WOODY HABITAT

Coarse woody habitat has never been formally quantified within Rice Lake. One recommendation in this plan is to complete a coarse woody habitat survey to help identify places along the shore where "fishsticks" or fish cribs could be installed to augment the fishery. The most appropriate shorelines for fishsticks installation are those with little or no development and that drop off into 6-12ft of water a short distance from shore. Figure 71 shows areas where conditions would be favorable for installation. Once locations have been identified, property owners can be approached to discuss installation. Funding up to $1,000.00 per fishsticks project is available through the Healthy Lakes and Rivers Initiative, but any grant request would have to be prepared by the Lake District.

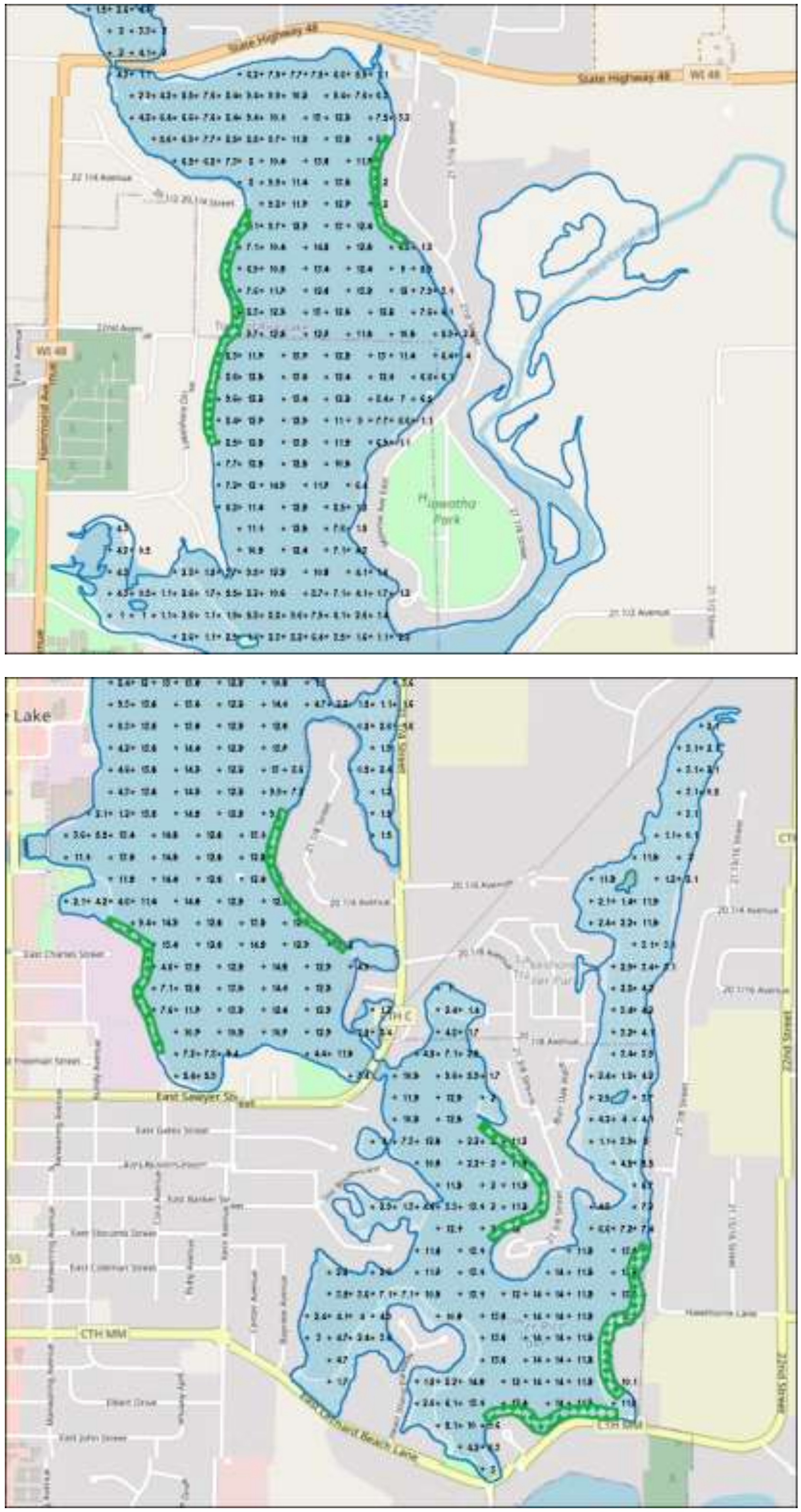


Figure 71: Potential “fishsticks” installation areas

AIS AWARENESS, EDUCATION, AND PREVENTION

Rice Lake currently has many different AIS including CLP, purple loosestrife, rusty crayfish, Japanese knotweed, yellow flag iris, Chinese mystery snails, and most recently – hybrid watermilfoil, a cross between native northern watermilfoil and non-native Eurasian watermilfoil. Zebra mussels and spiny waterflea have not been discovered in the lake. The presence of AIS has impacts on the lake, how it is managed, lake use, and healthy lake habitat. As a Lake District with taxing authority, nearly $100,000.00 annually is collected from upwards of 8,000 property owners with the primary function of managing AIS.

Preventing new AIS from entering the lake and keeping existing AIS from leaving the lake and expanding its abundance and density is a primary goal of this APM Plan. Rice Lake is one of 300 lakes on a WDNR list of lakes with high potential to be source waters for AIS going to other lakes, simply due to the amount of boating pressure it receives. The Lake District has been sponsoring a watercraft inspection program following Clean Boats, Clean Waters protocol. Each year they apply for $8,000.00 to support 400 or more hours of inspection at the two main boat landings off Stein Street and Orchard Beach Lane. In 2020, Arnolds Landing off Lakeshore Drive and 22-1/4 Ave., was improved with a new blacktop leading to a new ramp in the lake so it is expected that this landing will start seeing more use and will be added to the watercraft inspection list during this plan. Rice Lake has several other walk-in or small craft landings that are not monitored and receive limited use. In addition to watercraft inspection, AIS signage has been installed near these landings. That signage is inventoried nearly every year to determine if changes or improvements are needed.

The Lake District posts information about existing AIS in the lake and potential new invaders on their Facebook and webpage. At least one article is published in the Rice Lake Chronotype, the local newspaper, highlighting AIS. The status of AIS in the lake is one of the agenda items discussed monthly during regular board meetings and the annual constituency meeting each year. A newsletter is sent out with the notice for the annual meeting that includes information about AIS and AIS management in the lake.

SHORELAND AND WATERSHED IMPROVEMENT PROJECTS

The Lake District will continue to offer its R3P program and continue to work with the City, Town, and County to develop and implement larger water shed projects. While it is not expected that any more money will come from the Hwy 53 and V interchange, the WDNR does have funding for certain projects through its Healthy Lakes and Rivers Initiative.[10]

IMPLEMENTATION AND EVALUATION

This plan is intended to be a tool for use by the Lake District to move forward with aquatic plant management actions that will maintain the health and diversity of the aquatic plant community in Rice Lake. Management actions will also maintain lake access and aide navigation in areas of dense growth native vegetation. This plan is not intended to be a static document, but rather a living document that will be evaluated on an annual basis and updated as necessary following Integrated Pest Management Strategies that will ensure that the goals of this plan and community expectations are being met. This plan is also not intended to be put up on a shelf and ignored. Implementation of the actions in this plan through funding obtained from the WDNR and/or Lake District funds is highly recommended. An Implementation and Funding Matrix is provided in Appendix B. A Calendar of Actions is provided in Appendix C. A harvesting plan for CLP and native aquatic plants for navigational purposes is included in Appendix D.

[10] Healthy Lakes Program of WI. Let's Make Healthy Lakes Together!

WISCONSIN DEPARTMENT OF NATURAL RESOURCES GRANT PROGRAMS

The surface water grant program provides cost-sharing grants for surface water protection and restoration. Funding is available for education, ecological assessments, planning, implementation, and aquatic invasive species prevention and control. With many different projects eligible, grant funding may be available to support surface water management at any stage: from organization capacity development to project implementation.[11]

Counties, municipalities, natural resource agencies, tribal governing bodies, other local units of government, accredited colleges, universities, technical schools, lake districts and town sanitary districts are automatically eligible to apply for a Surface Water Grant.

Actions in this APM Plan that may be eligible for surface water grant application and funding are identified in the Implementation and Funding Matrix, Appendix B.

[11] Surface Water Grants | | Wisconsin DNR

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