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TREGO LAKE, WASHBURN COUNTY

2022-26 AQUATIC PLANT MANAGEMENT PLAN

WDNR WBIC: 2712000

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TREGO LAKE DISTRICT
TREGO, WISCONSIN 54888

Distribution List

Trego Lake District

Wisconsin Department of Natural Resources

St. Croix Tribal Resources

National Park Service

Washburn County

Town of Trego

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PREPARED FOR THE TREGO LAKE DISTRICT

1.0 Executive Summary

Trego Lake, designated as "outstanding resource water" by the State of WI, is home to many species of birds, game fish, and a diverse aquatic plant community. Unfortunately, invasive curly-leaf pondweed *Potamogeton crispus* (CLP) and Eurasian watermilfoil *Myriophyllum spicatum* (EWM) are both established in Trego Lake, threatening its biodiversity, recreation, and overall health. CLP has been an issue in the lake since at least the early 1990's when the first Aquatic Plant Management (APM) Plan was developed. EWM was first discovered in the lake in July 2019 and was the impetus leading toward the development of a new APM Plan. Management of both species is necessary to protect this valuable resource and maintain its status as a high-quality waterbody. An integrated management approach that relies on a combination of manual removal (hand, rake, snorkel, scuba) and mechanical harvesting is recommended to continue for Trego Lake.

Formed in 1989, the Trego Lake District (TLD) in cooperation its partners including but not limited to the Great Lakes Fish and Wildlife Commission (GLIFWC), St. Croix Tribal Resources (SCTR), National Park Service (NPS), Washburn County (WC), Town of Trego, local business entities, and the general lake community, take an active role in managing the lake. Their mission is "To support and encourage the preservation of the natural beauty, peacefulness, safety, and recreational value of the shoreline and waters of Trego Lake, and to coordinate with the various public and private organizations involved in these efforts." Therefore, the primary goal of this plan is to protect Trego Lake's ecosystem and native plant community for the benefit of the general public and all lake users through management efforts that will control invasive aquatic plant species and maintain lake usability.

The main tasks included in this Plan are:

- Management of existing AIS through implementation of a mechanical harvesting program;
- Management of nuisance level native vegetation through implementation of a mechanical harvesting program;
- Education of property owners and lake users about aquatic invasive species – identification, monitoring, impacts on the lake, prevention, and control through public education, information, and outreach;
- Education and outreach to property owners and lake users on how they can reduce pollutant loading to the lake;
- Research and monitoring to develop a better understanding of the lake and the factors affecting it, and;
- Following an adaptive management approach based on Integrated Pest Management guidelines that will measure and analyze the effectiveness of control activities and modify the management plan as necessary to meet goals and objectives.

2.0 Aquatic Plant Management Summary

We recommend the continuation of manual and mechanical control methods to reduce the impact of CLP on the health of the overall plant community, navigation, and recreation; and to minimize future impacts of EWM in Trego Lake. The overall goal of this Aquatic Plant Management (APM) Plan is to protect this outstanding resource from degradation by maximizing prevention of new invasions and through containment and control of existing aquatic invasive species while maintaining recreational use of the lake.

This plan supports sustainable practices to protect, maintain and improve the native aquatic plant community, the fishery, and the recreational and aesthetic values of the lake. This plan is intended to be a living document that will be evaluated annually to determine if it is meeting stated goals and community expectations, and it can be revised if necessary. The TLD sponsored the development of this APM Plan aided by a WDNR Early Detection and Response grant awarded when EWM was first identified in the lake.

APM plans developed for northern Wisconsin lakes are evaluated according to Northern Region APM Strategy goals developed by the WDNR (Appendix A). APM plans and the associated management permits (chemical or harvesting) are reviewed by the WDNR. Additional review may be completed by the Voigt Intertribal Task Force (VITF) in cooperation with the Great Lakes Indian Fish and Wildlife Commission (GLIFWC). WDNR aquatic plant management planning guidelines, the Northern Region Aquatic Plant Management Strategy, and the goals of the TLD in conjunction with the current state of the lake formed the framework for the development of this APM Plan. This plan is designed to be implemented over the course of 5 years with goals and objectives to be met throughout that time frame (Appendix B).

3.0 Public Participation and Stakeholder Input

With the discovery of EWM in the lake in July 2019, it became necessary for the TLD to update their existing APM Plan, written by Barr Engineering (1994). The process of updating that Plan began in the fall of 2019 when TLD board members were asked to identify what they saw as future goals for the lake and lake use in light of the new discovery of EWM. The following goals were identified:

- Maintain and improve recreation, natural habitat, and scenic beauty;
- Ensure clean water, lake access and usability, and abundant fish for all lake users;
- Effective communication with the TLD constituency;
- Build and maintain partnerships with other stakeholders; and
- Effective management planning and implementation - AIS, nuisance native plants, water quality, & sediment build up.

From this, the TLD Board determined it was time to involve a consultant to guide them through the process of applying for grant funds to develop a management plan that would help meet these goals. After a presentation made by their chosen consultant during the October 10, 2019 Board Meeting a WDNR Early Detection and Response grant was submitted by the Trego Lake District. That grant was awarded in March 2020. A meeting with the TLD Board and its constituency was held on May 27, 2020 to introduce and discuss the project. Additional meetings were held in June and August of 2020, and in March, April, July and October 2021. A Stakeholders Meeting was held via ZOOM on October 5th, 2021. WDNR, SCTR, and WC were present. NPS was invited but unable to attend.

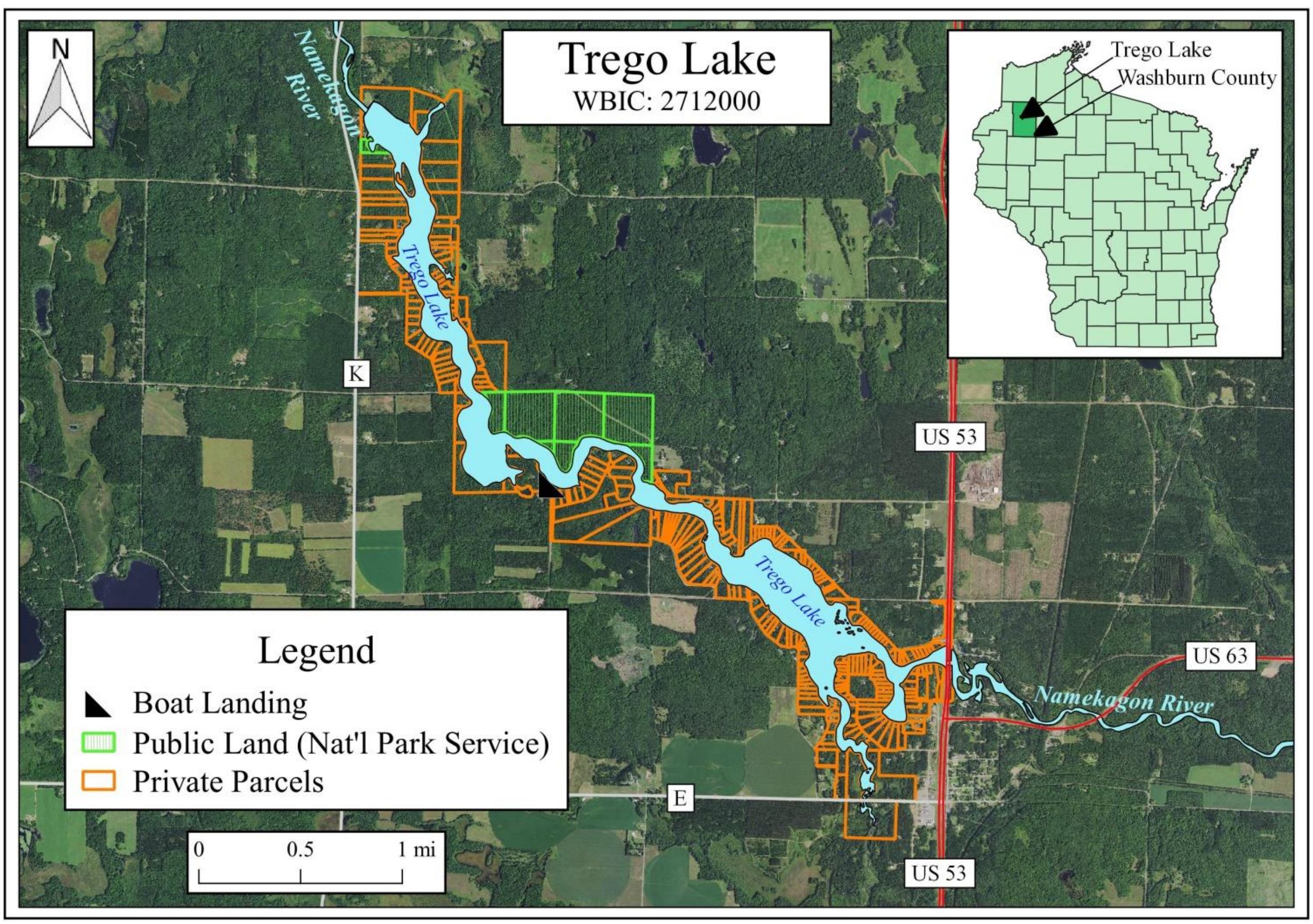
The completed APM Plan was put on the TLD and Consultant's webpage for review by interested parties. Notice was sent to all the primary stakeholders informing them of the posting. After a required comment period, the APM Plan was approved by the TLD and sent to the WDNR with an official request for approval.

4.0 Lake Information

Trego Lake (WBIC 2712000) is a 383 acre flowage created by the Trego Hydro Dam on the Namekagon River in central Washburn County, Wisconsin in the Town of Trego just north of Spooner, WI at the intersection of Hwy 53 and 63 (Figure 1). Potato Creek enters the lake from the south. It is approximately five miles long from Hwy 53 to the dam with a maximum depth of 36-feet and an average depth of 11-feet. While called a lake, it is officially a flowage with more riverine characteristics than lake characteristics. It is accessible from a public access about midway between the dam and Hwy 53 and from landings on the Namekagon River upstream.

Trego Lake is considered "outstanding resource water" by the WDNR. The Namekagon River both upstream and downstream of the lake itself is part of the St. Croix National Wild and Scenic Riverway. The upstream end of the lake is considered a Priority Navigable Waterway for musky. The entire body of Trego Lake and Potato Creek are considered wild rice waters.

The TLD is a local unit of government with responsibility for the protection and rehabilitation of Trego Lake. The TLD has authority to enter contracts, purchase equipment, apply for grants, levy taxes and accept donations. Its activities include: protection of fish, maintenance of water quality, marking navigation channels, control of aquatic plants and aquatic invasive species, and reduction of sedimentation buildup. The TLD consists of the Trego Flowage and lakeshore from the Hwy 53 bridge on the east to the Xcel Energy dam on the west. It is the second largest lake in Washburn County.



4.1 Watershed Land Cover

A watershed is an area of land from which water drains to a common surface water feature such as a stream, lake, or wetland. Trego Lake is within the Trego Lake-Namekagon River watershed (Figure 1). Land cover in the watershed is mostly forest with a mix of wetland, open water, and limited agriculture. A lake usually reflects how the land in its watershed is being used. Less human disturbance like home and business building, roadways, and agriculture within a lake's watershed generally means a healthier lake overall. Agricultural land, mowed lawns, and increased impervious (does not allow liquid to pass through) surfaces like roads and rooftops, cause more of the water falling on the land to "run off" into lakes, ponds, rivers and streams carrying dirt and other pollutants with it, rather than soaking into the ground where many pollutants are removed.

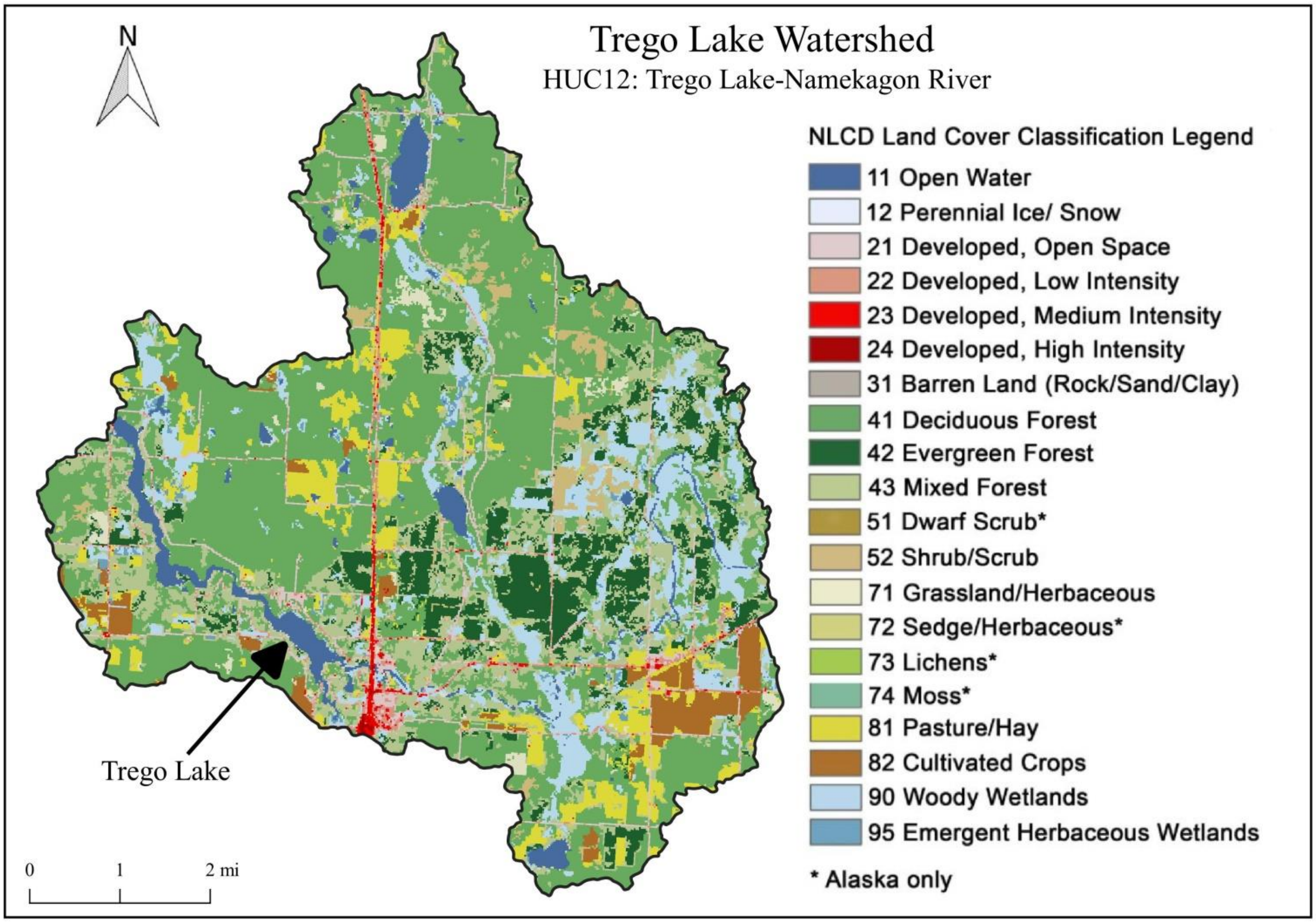


Figure 1: Trego Lake, Trego Lake-Namekagon River watershed land cover (NLCD, 2016)

4.2 Watershed Soils

The soil types found in a watershed help determine the capacity for runoff into a lake. Soils that have a high infiltration rate (can soak up lots of water) make the potential amount of runoff from the land very low. These soils are generally very sandy and allow water to pass through unimpeded. Conversely, soils that have a very low infiltration rate make the runoff potential fairly high. These soils are generally very dense with high amounts of organic material. Water moves slowly through these soils often resulting in standing water on flat surfaces and flowing water over sloped surfaces.

Soils in the Trego Lake watershed are mostly sandy in nature (Figure 2), minimizing overland runoff unless disturbed by human changes including lawns, driveways, roads, and rooftops.

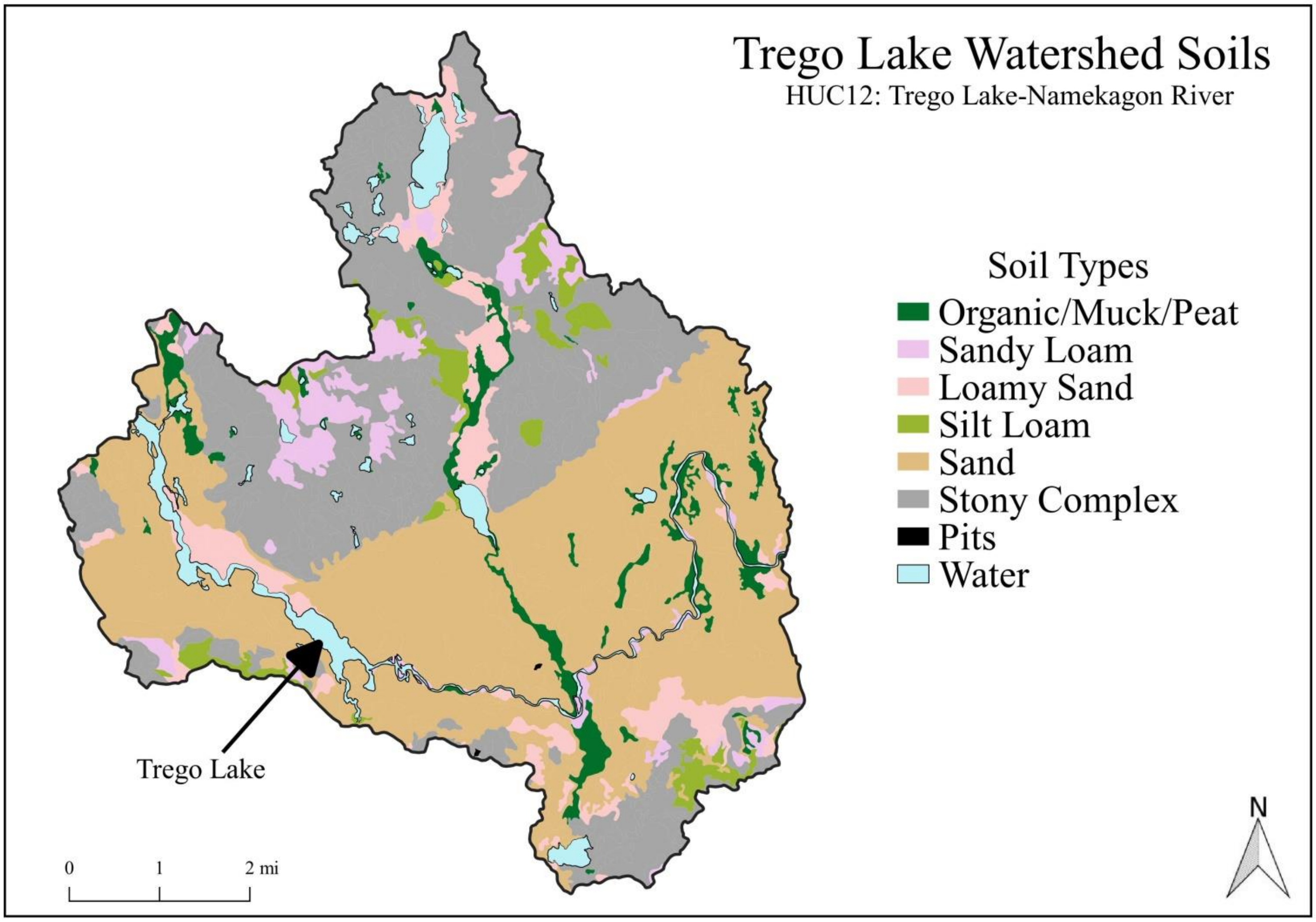


Figure 2: Soil types within the Trego Lake watershed

4.3 Water Quality

Water clarity and water chemistry are important indicators of water quality. Secchi disk readings of water clarity have been collected by Wisconsin Citizen Lake Monitoring Network (CLMN), formerly the Self-help Lake Monitoring Program, volunteers since 1987. The WDNR website indicates CLMN volunteers have collected consistent water quality data from 2003-2012, then sporadically thereafter. In the last full year of CLMN expanded volunteer monitoring (2012), the Deep Hole Near Dam site was sampled 16 different days. Parameters sampled included water clarity, temperature, total phosphorus, and chlorophyll.

The average summer (July-Aug) secchi disk reading in 2012 was 8.33 feet. The average for the Northwest Georegion was 8 feet. Typically the summer (July-Aug) water was reported as clear and brown. This suggests that the Secchi depth may have been mostly impacted by tannins, stain from decaying matter. Tannins are natural and not a result of pollution. Tannins can be distinguished from suspended sediment because the water, even though it's brown, it looks clear, like tea. Though tannins are not harmful per se, they are often not perceived as aesthetically pleasing as clear water. Tannins can also be important for decreasing light penetration into the water and decreasing algal growth.

Figure 3 shows the average total and summer (July-August) Secchi disk readings on Trego Lake between 2003 and 2012.

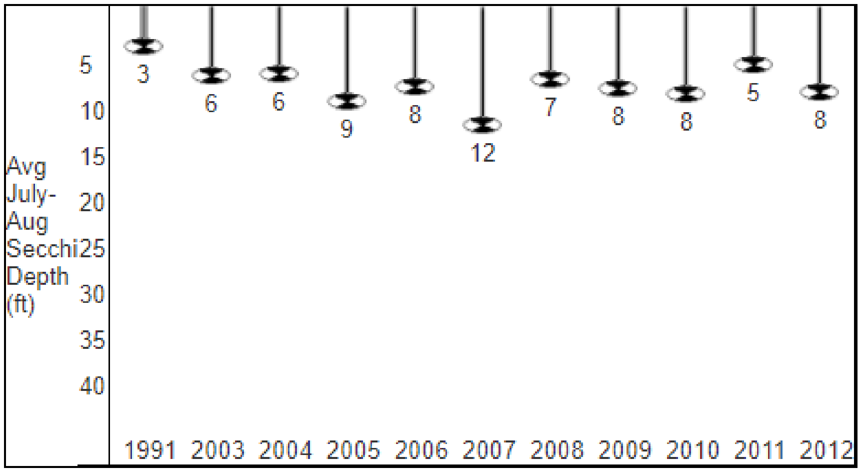


Figure 3: Average summer (July-August) Secchi disk readings at the Deep Hole Near Dam

The average summer chlorophyll in 2012 was 8.9μg/l, compared to a Northwest Georegion summer average of 26.4μg/l. The 2012 summer Total Phosphorus average was 25μg/l. Lakes that have more than 20 μg/l and impoundments that have more than 30 μg/l of total phosphorus may experience noticeable algae blooms.

The overall Trophic State Index (based on chlorophyll) for Trego Lake in 2012 was 51. The TSI suggests that Trego was eutrophic. This TSI usually suggests decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.

4.3.1 Trophic State Index

One of the most commonly used metrics of water quality is the trophic state of a lake. The trophic state is defined as the total load of biomass in a waterbody at any given time (Carlson & Simpson, 1996). To determine the trophic state of any given lake, the Tropic State Index (TSI) is generally used. This index uses the three main variables for water quality measurement in WI: Secchi depth (water clarity), total phosphorus (nutrients in the water), and chlorophyll concentration (the amount of algae in the water). TSI values are technically limitless, but when applied, they almost always fall between 0 and 100. To make sense of these values, they are broken into different trophic states. The four main trophic states are oligotrophic (TSI<40), mesotrophic (TSI 40-50), eutrophic (TSI 50-70), and hypereutrophic (TSI>70) (Figure 4). Oligotrophic lakes are usually very clear, clean lakes with low nutrient levels. Mesotrophic lakes are moderately clear with some nutrients and more plants present within the system. Eutrophic lakes have excess nutrients that support a great deal of algae growth, and may have a large aquatic plant community. Hypereutrophic lakes are typically very green with dense algae and limited plant growth.

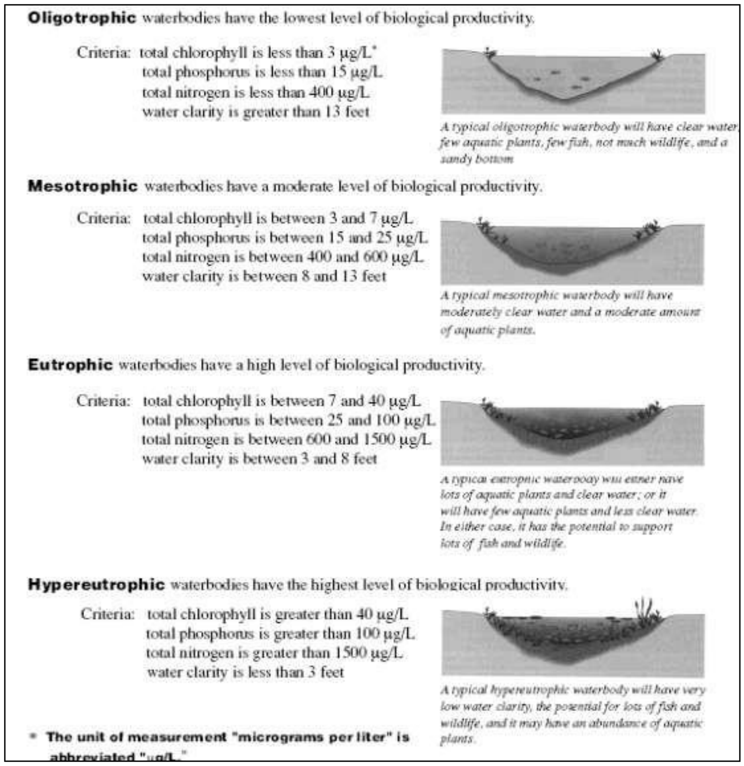


Figure 4: Trophic status in lakes

From 2003 to 2012, Trego Lake was listed as mesotrophic bordering on eutrophic in nature (Figure 5). Generally, the levels of chlorophyll within a lake are considered the most accurate indication of that lake's trophic status. However, with Trego Lake being a flowage with many riverine characteristics including quick movement of water through the system, algae may not as readily form before being carried through and out of the system.

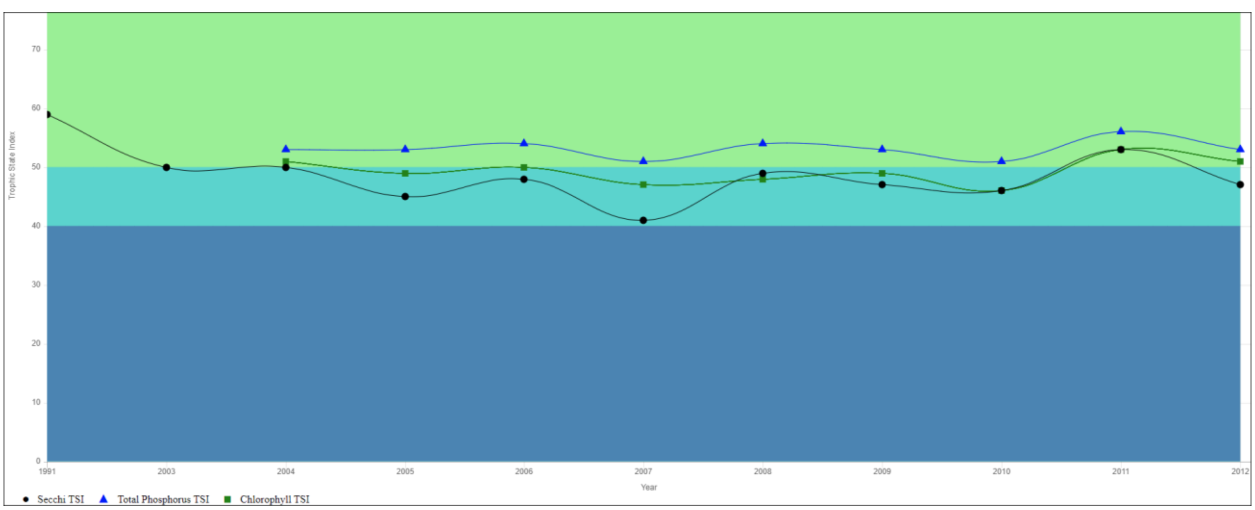


Figure 5: Average Summer (July-August) Trophic State Index for Trego Lake

4.3.2 Dissolved Oxygen

Dissolved oxygen is essential for the survival of most aquatic animals, just like atmospheric oxygen is essential for most terrestrial animals. Surface waters (also called the epilimnion) exchange oxygen with the atmosphere and are usually oxygen-rich. In deeper lakes, or smaller lakes that are generally sheltered from prevailing winds, the water in the lake stratifies (or separates) into distinct zones during the summer months, impacting water quality and affecting biota. These zones are the epilimnion (usually oxygen-rich surface waters), the thermocline (the layer separating the surface and bottom waters), and the hypolimnion (oxygen-depleted bottom waters). Drainage lakes, like Trego, typically do not stratify. This was confirmed through CLMN temperature profiling completed at the Deep Hole near the dam between 2003 and 2012. This means that the lake has sufficient oxygen to support life at all depths, and the lake is relatively uniform in temperature from top to bottom.

4.4 Fisheries and Wildlife

A fisheries survey was completed in 2019. According to WDNR Fisheries Biologist Craig Roberts, the Trego Lake fishery basically acts as a "complex riverine system" with lots of brushy habitat and vegetation. Walleye fry and fingerlings were stocked between 1979 and 2011. But in 2011, the WDNR fisheries biologist at that time cut stocking. According to Roberts, 2019 survey results continue to support that move saying that stocking is ineffective because current data indicates that

- Current catch of young walleye is comparable to years with stocking,
- Multiple year classes of natural walleye exist without stocking,
- Past surveys show poor stocking survival, and
- Fish leave the flowage (Trego Lake) to the river below.

According to 2019 fisheries survey results, smallmouth bass are the most abundant game fish. Largemouth bass are present, but rare. Northern pike and muskellunge are also present. Musky are stocked during even years but many of the stocked fish may get below the dam and support the downstream fishery. Stocking of lake sturgeon occurs during odd years and is primarily done as a restoration activity. Bluegills are the most abundant panfish.

Bald eagles, loons, and furbearers can be found on or near the lake on a regular basis. The Natural Heritage Inventory (Table 1) mostly lists animals including two mussel species, four fish species, two turtles, and a lizard. Wild rice is abundant in the system.

Table 1: Natural Heritage Inventory Report for T40N, R12W (last accessed 11-7-2021)

Scientific Name	Common Name	WI Status	Federal Status	Group
Acipenser fulvescens	Lake Sturgeon	SC/H		Fish~
Alasmidonta marginata	Elktoe	SC/P		Mussel~
Boechera missouriensis	Missouri Rock-cress	SC		Plant
Cyclonaias tuberculata	Purple Wartyback	END		Mussel~
Empidonax minimus	Least Flycatcher	SC/M		Bird
Emydoidea blandingii	Blanding's Turtle	SC/P	SOC	Turtle~
Etheostoma microperca	Least Darter	SC/N		Fish~
Glyptemys insculpta	Wood Turtle	THR	SOC	Turtle~
Moxostoma carinatum	River Redhorse	THR		Fish~
Northern dry-mesic forest	Northern Dry-mesic Forest	NA		Community
Northern hardwood swamp	Northern Hardwood Swamp	NA		Community~
Percina evides	Gilt Darter	THR		Fish~
Platanthera hookeri	Hooker's Orchid	SC		Plant
Plestiodon septentrionalis	Prairie Skink	SC/H		Lizard

4.5 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. Many of the values lake front 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 actually the hotbed of activity on a lake. 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. Many species 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 where they can grow by how deeply light can penetrate the water.

4.5.1 Threats To Shorelands

When a landowner develops a waterfront lot, many 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. Many of 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, send more 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 in a similar way can be enormous. A lake's response to stress depends on what condition the system is in 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.

4.5.2 Shoreland Preservation and Restoration

If a native buffer of shoreland plants exists on a given property, it can be preserved and care taken to minimize impacts when future lake property projects are contemplated. If a 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 bring many other values too. Some of these are aesthetic in nature, while others are essential to a healthy ecosystem. Healthy shorelines mean healthy fish populations, varied plant life, and the existence of the insects, invertebrates and amphibians which feed fish, birds and other creatures. Figure 6 shows the difference between a natural and unnatural shoreline adjacent to a lake home. More information about healthy shorelines can be found at the following website: https://healthylakeswi.com/ (last accessed 11-11-2021).

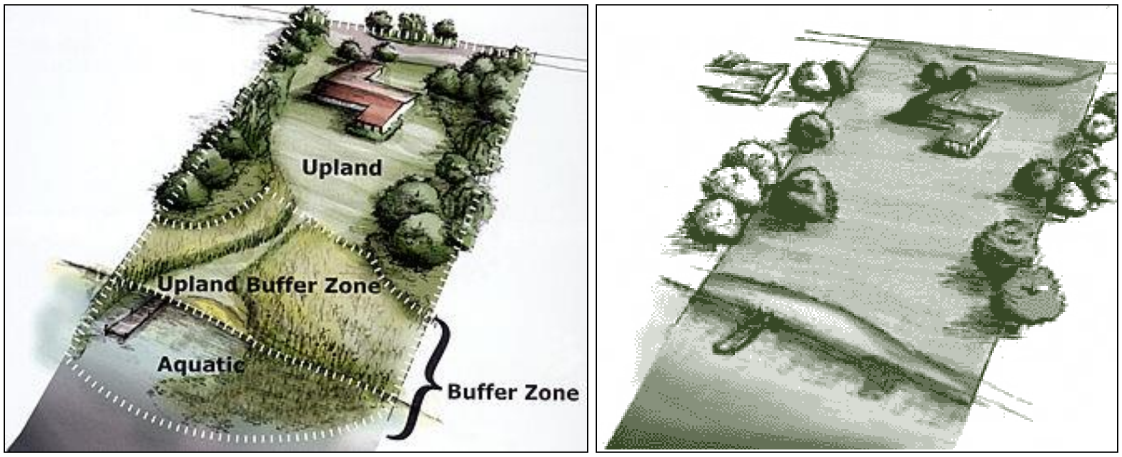


Figure 6: Healthy, AIS Resistant Shoreland (left) vs. Shoreland in Poor Condition

4.5.3 Septic System Contributions

Related to shoreland conditions is the status of private onsite waste treatment systems (POWTS) also known as septic systems. Malfunctioning systems may be adding pollutants to the lake. At present, no information has been collected related to the status of the POWTS around Trego Lake, but maintaining properly functioning systems is an important part of maintaining lake health.

4.6 Shoreland Habitat Assessment

One way to determine the health of the shoreland adjacent to Trego Lake is to complete a Shoreland Habitat Assessment. Using protocol developed by the WDNR, the survey is intended to provide management recommendations for individual property owners based on the evaluation of their property. The assessment involves photographing each parcel from the lake which is then matched to land use information collected from the riparian zone, defined as the strip of land, along the shore, from the high water level mark inland to 35 feet. The information collected includes ground cover (lawn, impervious surfaces, and native plants), the number of human structures in the riparian zone, and various other runoff concerns. This protocol also assesses the amount of coarse woody habitat (see next section) present in the lake however this is done on a whole lake level rather than for each individual parcel. Woody debris in the water provides habitat for fish, birds, and numerous other types of wildlife as well in addition to providing some protecting from bank erosion.

Completing a shoreland habitat assessment of Trego Lake would quantify the current level of development and make recommendations on how to improve the shoreland for the benefit of water quality, fish, and other fauna. In addition, it has been requested by the National Park Service as a part of the current hydro-dam relicensing process currently going on.

4.7 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 serves many functions within a lake ecosystem including erosion control, as a carbon source, and as a surface for algal growth which is an important food base for aquatic macro invertebrates. Presence of CWH has also been shown to prevent suspension of sediments, thereby improving water clarity. CWH serves as important refuge, foraging, and spawning habitat for fish, aquatic invertebrates, turtles, birds, and other animals. The amount of littoral CWH occurring naturally in lakes is related to characteristics of riparian forests and likelihood of toppling. However, humans have also had a large impact on amounts of littoral CWH present in lakes through time. During the 1800's the amount of CWH in northern lakes was increased beyond natural levels as a result of logging practices. But changes in the logging industry and forest composition along with increasing shoreline development have led to reductions in CWH present in many northern Wisconsin lakes over the last century.

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 have been well documented by researchers, making the loss of these habitats a critical concern.

Adding coarse woody habitat to a lake is relatively easy to do particularly when private landowners and lake associations are willing to partner with county, state, and federal agencies. Large-scale CWH projects, called "fishsticks", are currently being completed by lake associations and local governments with assistance from the WDNR (Figure 7).

Figure 7: Coarse woody habitat-Fishsticks projects

4.8 Healthy Lakes and Rivers Program

The WDNR supports a grant program specifically designed to provide funding for small projects that can help improve shoreland habitat and increase CWH in a lake. The grant program offers up to $1,000.00 per practice including native plantings, rain gardens, diversions, infiltration trenches, and fishsticks projects.

4.9 Dam Relicensing

The license (FERC No. 2711) held by Northern States Power Company – Wisconsin (NSPW) d/b/a Xcel Energy for the hydroelectric dam on the Namekagon River that forms Trego Lake expires as of November 30, 2025. The dam relicensing process has already begun with NSPW sending out a Preliminary Application Document (PAD) that provides the FERC and other entities with existing, relevant, and reasonably available information not already in the possession of NSPW, pertaining to the Project to help identify issues and related information needs, develop study requests and study plans, and prepare documents analyzing impacts. This document was sent to multiple stakeholders in the dam relicensing project including the TLD and NPS.

The NPS responded to the PAD with requests for several additional studies of Trego Lake to be completed before the dam license is renewed. These study requests included a Hydraulics, Sedimentation, and Channel Change Study; a Recreational Study; and a Shoreline Survey Study. All three of these requested studies would benefit current and future management planning for Trego Lake and are highly supported by the TLD.

One issue with the proposed dam relicensing is changing the current boundaries that make up Trego Lake. The proposal from NSPW removes a portion of lake surface area east of Hwy 53 reducing the size of the lake. This change would not impact the current taxing district area of the TLD, but it is still not supported by the TLD.

The TLD has been monitoring the dam relicensing process and provides updates to its membership, as they themselves learn more.

5.0 Native Aquatic Plant Surveys

In 2020, Endangered Resources Services, LLC completed a whole-lake, point-intercept (PI), aquatic plant survey on Trego Lake. Prior to 2020, the last official whole-lake point-intercept (PI) aquatic plant survey was completed in 2011 by the WDNR and volunteers from the TLD. Some key findings from the 2011 survey are listed below:

- The survey was completed in late June.
- Aquatic plants grow to a maximum depth of about 9 feet in Trego Lake.
- 55% of the lake's area is shallow enough to support aquatic plant growth (littoral zone)
- 270 sites were sampled in the area shallow enough to support aquatic plant growth
- 84% of these sites had aquatic plants present
- Thirty-nine species of aquatic plants were found
- Curly-leaf pondweed (*Potamogeton crispus*), an aquatic invasive species that has been present in Trego Lake for many years, was found at 12% of the sites sampled.
- Wild rice (*Zizania palustris*) was found at 17% of the sites sampled
- The three most commonly occurring aquatic plants were: coontail (*Ceratophyllum demersum*), 41% of sites; flat-stem pondweed (*Potamogeton zosteriformis*), 37% of sites; and common waterweed (*Elodea Canadensis*), 24% of sites.
- Two other non-native aquatic plants were found - narrow-leaved cattail (*Typha angustifolia*) and reed canary grass (*Phalaris arundinacea*).

Key findings from the 2020 survey are listed below:

- The survey was completed in late July.
- Aquatic plants grow to a maximum depth of 10-ft.
- 66% of the lake's area is shallow enough to support aquatic plant growth
- 325 sites were sampled in the area shallow enough to support aquatic plant growth
- 71% of these sites had aquatic plants
- 52 different plant species were found
- During a survey in mid-June curly-leaf pondweed was found at 24% of the sites in the littoral zone
- During a survey in mid-June, Eurasian watermilfoil (*Myriophyllum spicatum*) was found at 8% of the sites in the littoral zone
- Wild rice was found at 26% of the sites sampled within the littoral zone, and at 37% of the sites sampled with vegetation.
- The three most commonly occurring aquatic plants were: wild celery (*Vallisneria americana*), 43% of sites, coontail (*Ceratophyllum demersum*), 32% of sites; and flat-stem pondweed (*Potamogeton zosteriformis*), 29% of sites.
- Three other non-native aquatic plants were found – Eurasian watermilfoil, narrow-leaved cattail, and reed canary grass.

Summary statistics from both aquatic plant surveys are presented in Table 2. The total sites with vegetation are nearly identical. The number of different species identified is way up in 2020, but it is not known whether this is because Trego Lake is showing increased diversity or if it is because of the different surveyors used each year. Furthermore, during the 2011 survey, only points considered to be in the littoral zone were sampled. In the 2020, all points that were accessible were surveyed which could have increased the number of species identified.

Table 2: Aquatic plant survey statistics – 2011 (WDNR) and 2020 (ERS)

SUMMARY STATS:	2011	2020
Total number of sites visited	274	493
Total number of sites with vegetation	226	231
Total number of sites shallower than maximum depth of plants	270	325
Frequency of occurrence at sites shallower than maximum depth of plants	83.70	71.08
Simpson Diversity Index	0.90	0.92
Maximum depth of plants (ft)**	9.30	10.00
Number of sites sampled using rake on Rope (R)	0	0
Number of sites sampled using rake on Pole (P)	274	0
Average number of all species per site (shallower than max depth)	2.30	1.98
Average number of all species per site (veg. sites only)	2.75	2.79
Average number of native species per site (shallower than max depth)	2.19	1.94
Average number of native species per site (veg. sites only)	2.62	2.75
Species Richness	25	42
Species Richness (including visuals)	34	47
Species Richness (including visuals and boat survey)	41	52
Mean depth of plants (ft)	3.56	3.23
Median depth of plants (ft)	3.50	3.00
Mean rake fullness (veg. sites only)	1.54	2.05

5.1 Simpsons Diversity Index

Plant diversity was very high in 2011 with a Simpson Index value of 0.90. It was even higher in 2020 at 0.92. The Simpson's 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 Simpson's diversity index, the index value represents the probability that two individuals (randomly selected) will be different species. The index values range from 0 to 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.

5.2 Floristic Quality Index

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. Statistically speaking, the higher the index value, the healthier the lake's aquatic plant community is assumed to be.

In 2011, a total of 22 native index species were identified in the rake during the point-intercept survey. They produced a mean C of 6.4 and a FQI of 29.8. In 2020, a total of 35 native index plants were identified in the rake during the point-intercept survey. They produced a mean C of 5.8 and a FQI of 34.3. Neither survey identified any plants with a C-value of 10. In 2011, 6 species had a C-value of 8 or 9. In 2020, 10 species had a C-value of 8 or 9. Nichols (1999) reported an average mean C for the Northern Central Hardwood Forests Region of 5.6 identifying Trego Lake as slightly above average for this part of the state. The FQI was in both years was much higher than the median of 20.9 for the Northern Central Hardwood Forests Region (Nichols, 1999).

5.3 Littoral Zone, Species Richness, and Density

The total species richness in Trego Lake is quite high, with 52 species identified including on the rake and both boat and visual surveys in 2020. In 2011, there were 41 species identified. Mean total rake fullness increased in 2020 from

1.54 to 2.05. The littoral zone was slightly deeper in 2020, but the mean and median depth of plant growth was both down about a half foot in 2020. Despite the increase in native species richness from 2011 to 2020, the number of different species at each survey site pretty much stayed the same. Seven species showed significant declines from 2011 to 2020; however four species showed significant increase from 2011 to 2020, with at least 11 new species identified in 2020 (Figure 8).

The timing of these two surveys was different with the 2011 survey completed in late June and the 2020 survey completed in late July. In 2020, the plant surveyor looked at more points in the system. Two different plant surveyors completed the survey work. All of these factors, as well as changes in growing conditions in different years, likely contribute to the changes that were identified.

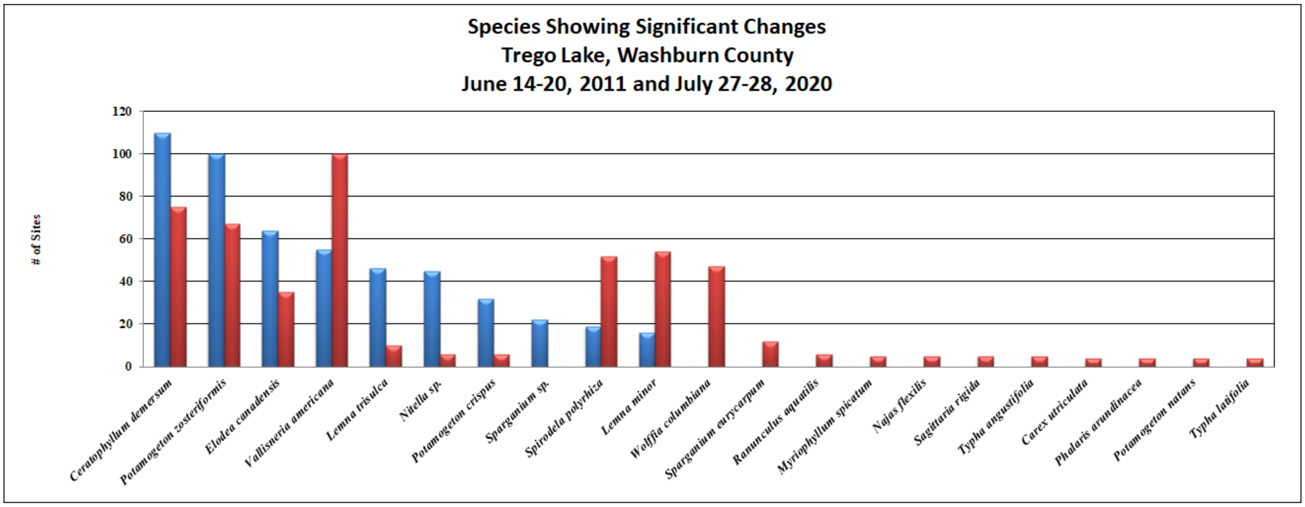


Figure 8: Species that showed significant changes between 2011 and 2020 (ERS)

The four most abundant plant species during the 2020 PI survey were Water celery (Figure 9), Coontail (Figure 10), Flat-stem pondweed (Figure 11), and Northern wild rice (Figure 12).

Figure 9: *Valisneria americana* (water celery) Present at 104/231 sites with vegetation

Figure 10: ***Ceratophyllum demersum*** **(Coontail) Present at 89/231 sites with vegetation**

Figure 11: ***Potamogeton zosteriformis*** **(Flat-stem pondweed) Present at 82/231 sites with vegetation**

Figure 12: ***Zizania palustris*** **(Northern wild rice) Present at 85/231 sites with vegetation**

Figure 13 shows the extent of the 2020 littoral zone and Figure 14 shows aquatic plant diversity at individual survey points. Figure 15 shows the density of vegetation at each point. From these figures, it is clear that the majority of aquatic plant related problems – aquatic invasive species and native species – are focused in the east basin and Potato Creek area of the lake.

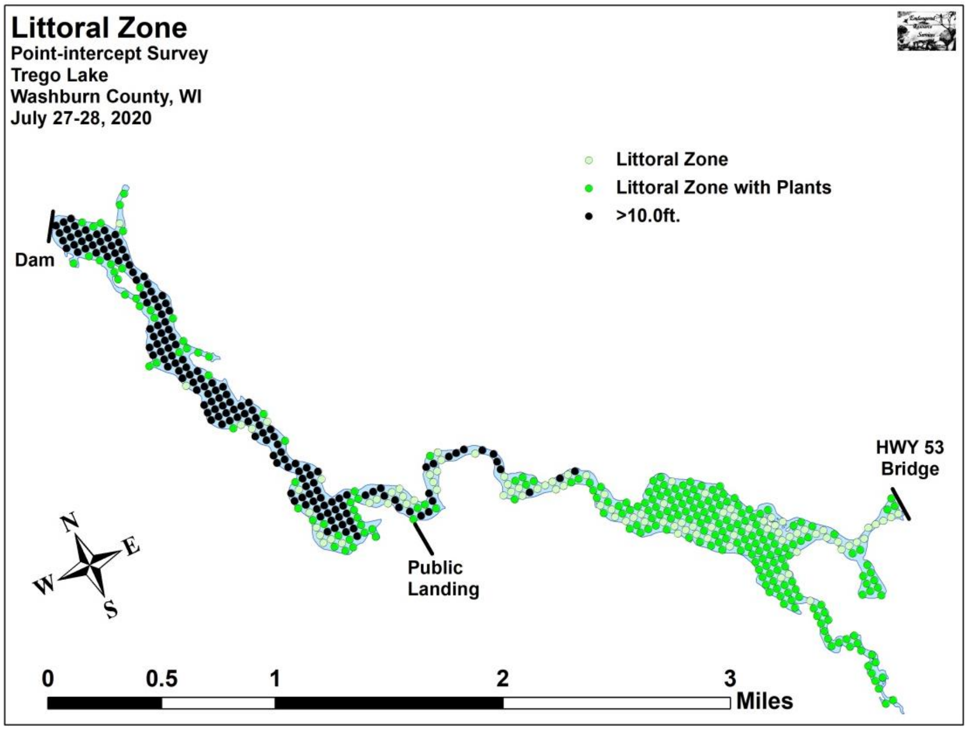


Figure 13: 2020 littoral zone (ERS)

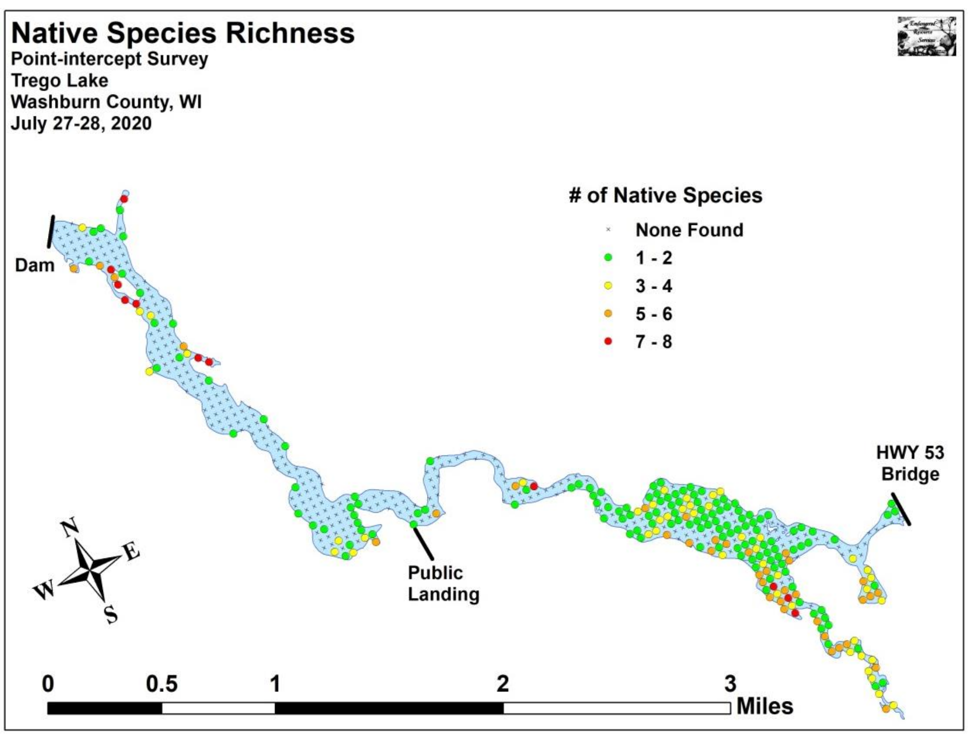


Figure 14: 2020 native species richness (ERS)

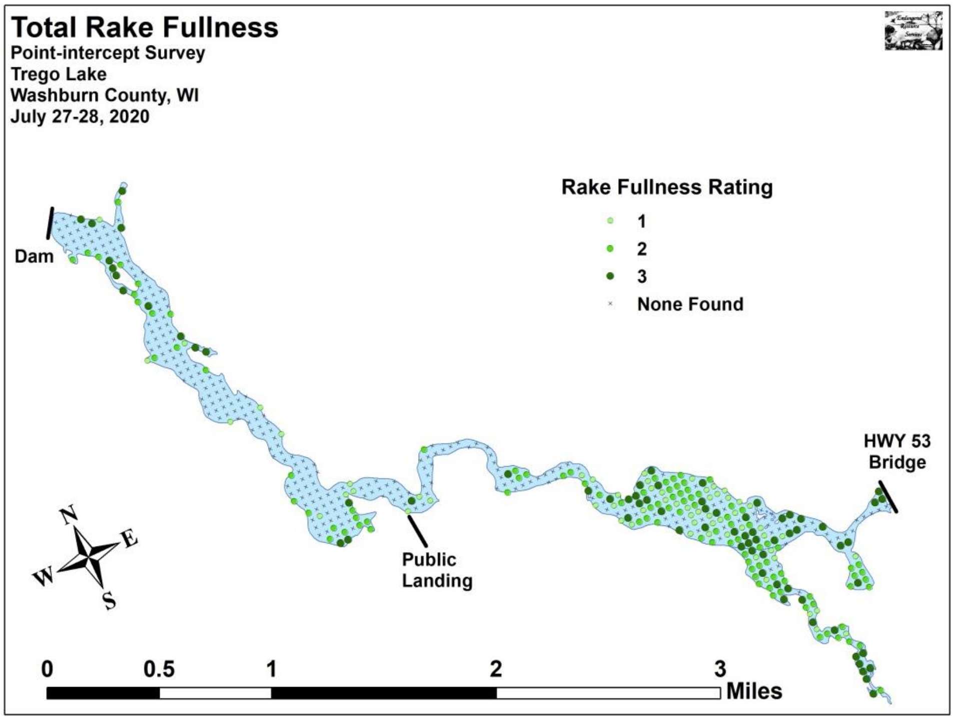


Figure 15: 2020 total rake fullness values (ERS)

5.4 Wild Rice

Wild rice is an annual aquatic grass that produces seed that is a nutritious source of food for wildlife and people (Figure 16). As a native food crop, it has a tremendous amount of cultural significance to the Wisconsin and Minnesota Native American Nations. Wild rice pulls large amounts of nutrients from the sediment in a single year and the stalks provide a place for filamentous algae and other small macrophytes to attach and grow. These small macrophytes pull phosphorous in its dissolved state directly from the water. Wild rice can benefit water quality, provide habitat for wildlife, and help minimize substrate re-suspension and shoreland erosion.

In Wisconsin, wild rice has historically ranged throughout the state. Declines in historic wild rice beds have occurred statewide due to many factors, including dams, pollution, large boat wakes, and invasive plant species. Renewed interest in the wild rice community has led to large-scale restoration efforts to reintroduce wild rice in Wisconsin's landscape. Extensive information is available on wild rice from GLIFWC and the WDNR.

In Wisconsin, wild rice is highly protected under DNR Rule NR 19.09 Wild Rice Conservation (Appendix C).

Figure 16: Wild rice

According to a 2010 report from the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) (David, 2010), significant beds of wild rice exist on Trego Lake/Flowage, and at least in 2010 they seemed to be expanding. Most of the rice is present in the primary inlets to the Flowage from the Namekagon River and Little Mackay/Potato Creeks on the east end of the Flowage. Figure 17 shows a photo from the plant surveyor going through wild rice in 2020. Figure 18 shows all the points in Trego Lake with wild rice during the 2020 PI survey. Figure 19 reflects an aerial photo of wild rice in Potato Creek and the east basin of Trego Lake from 2009.

Figure 17: Wild rice in the east basin of Trego Lake, July 2020 (ERS)

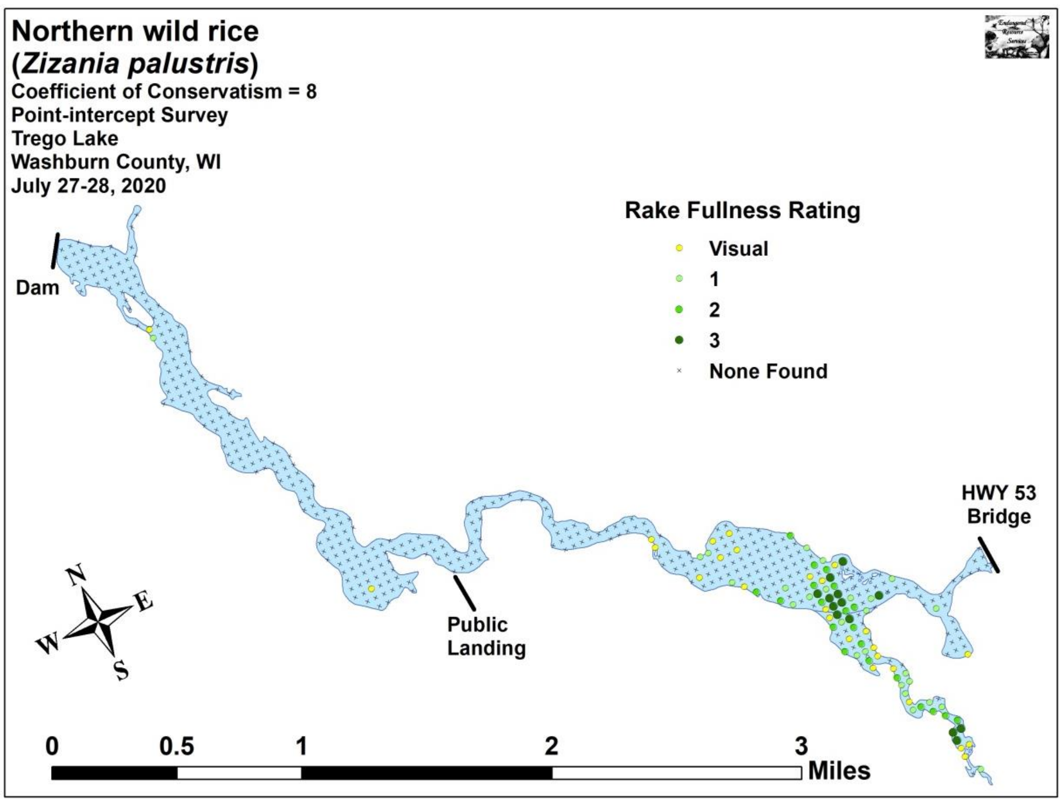


Figure 18: 2020 point-intercept survey results for wild rice (ERS)

Figure 19: Wild rice in Potato Creek and the east basin of Trego Lake in 2009 (GLIFWC)

As reported in the recently completed WDNR Strategic Analysis of Wild Rice Management in WI (WDNR, 2021), between 2005 through 2014 an average of 716 ricers harvested 59,000 pounds of wild rice a year, or 82 pounds per ricer each year. On an individual basis, Ojibwe tribal ricers harvest nearly twice as much as their non-tribal counterparts. According to data assembled by GLIFWC, the average tribal ricer harvested just over 130 pounds a year between 2005 and 2014. Since 2010, the total statewide off-reservation harvest has generally ranged between 40,000 and 80,000 pounds per year, with a high harvest of 118,000 pounds in 2009 followed by a low harvest of under 17,000 pounds in 2010.

Wild rice growth and abundance is impacted by many factors including changes in water level, water quality, competition from other native plants and invasive species, excessive herbivory (primarily by geese), disease, shoreland development, waterway recreation, and chemical herbicides. Many of these factors are being driven by changes in climate (WDNR, 2021). When present in a waterbody, any management that takes place in that waterbody is subject to review by the State and by Tribal Resources. Even physical removal is regulated.

6.0 Aquatic Invasive Species

Currently there are several invasive species within or around Trego Lake: curly-leaf pondweed (CLP), Eurasian and hybrid watermilfoil (EWM), Chinese mystery snails, and reed canary grass.

6.1 Curly-leaf Pondweed

Curly-leaf pondweed (CLP) is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia (Figure 20). The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. CLP is an annual with new plants growing from burr-like winter buds called turions (Figure 20) deposited on the lake bottom when the water is cool, even under the ice in winter. It is one of the first nuisance aquatic plants to emerge in the spring, growing rapidly as sunlight becomes more available. Dense mats of early growth vegetation often interfere with or out-compete native aquatic plant growth that begins a little later when water temperatures rise. At peak growth, mats of CLP at and just under the surface can interfere with aquatic recreation. CLP usually completes its annual life cycle in June depositing new turions on the bottom of the lake. By early July the plant dies, dropping to the bottom to decompose, releasing nutrients back into the water as it does so. Large-scale die-offs may result in a critical loss of dissolved oxygen. Floating mats of dead and dying CLP can inundate shallow water areas and foul shorelines and beaches. In the fall, when water temperature begins to cool, turions start to sprout again.

Figure 20: CLP Plants and Turions

6.1.1 CLP in Trego Lake

From as early as 1993, property owners and users of the lake have indicated nuisance and navigation issues caused by excessive growth of CLP in the spring and early summer of the year. The 1994 Aquatic Plant Management Plan mentions CLP but does not make any management recommendations for it. Finding EWM in the lake in 2019 was the main impetus behind developing this new plan, but the issues caused by EWM pale in comparison to those caused by CLP.

CLP mapping in 2020, identified more than 32-acres of dense growth CLP, with more than 30 of those acres in the east basin (Figure 21). Figure 22 reflects what 30-acres of dense growth surface matting looks like. From mid-May to the end of June, CLP dominated in 3 to 6-feet of water. Though not officially mapped in 2021, anecdotally, CLP was as bad as or worse than it was in 2020.

While the majority of CLP is located in the east basin and Potato Creek inlet, this is not the only place dense growth CLP is located. Further downstream, just before the narrow-most area of the lake and where the lake opens up again also supports dense growth CLP, just not as much. These areas, and areas even further downstream closer to the dam should be monitored on a regular basis to document nuisance aquatic plant growth.

This level of CLP interferes with early season navigation, shades out more beneficial native plants later in the season, and contributes nutrients to the lake when it dies and decays in early July.

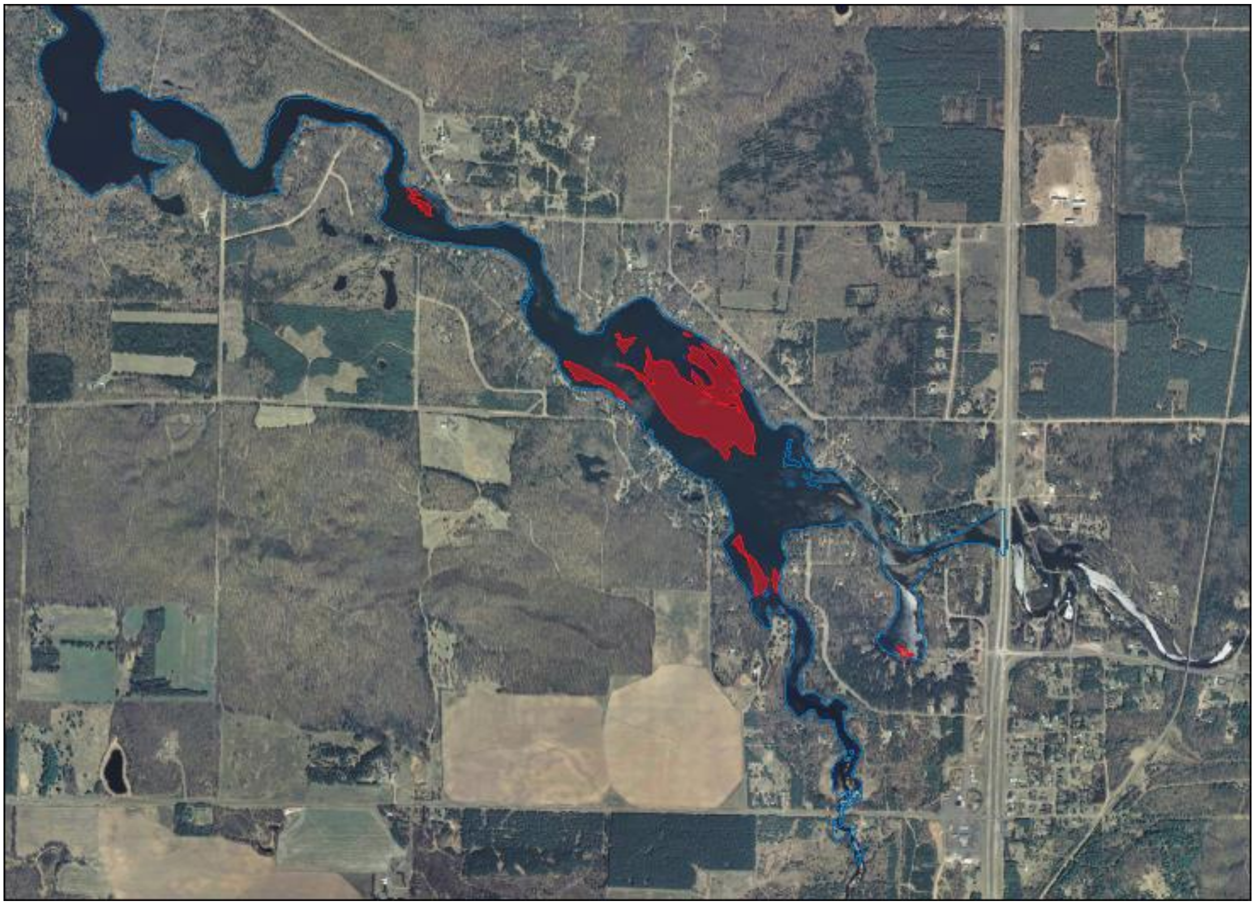


Figure 21: 2020 CLP bedmapping (ERS)

Figure 22: Dense 2020 CLP surface water mats in Trego Lake (ERS)

6.2 Eurasian Watermilfoil

EWM (Figure 23) is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. EWM has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets.

EWM grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes.

Unlike many other plants, EWM does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. EWM is readily dispersed by boats, motors, trailers, bilges, live wells, and bait buckets; and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, EWM is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of EWM provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of EWM also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. Cycling of nutrients from sediments to the water column by EWM may lead to deteriorating water quality and algae blooms in infested lakes.

Figure 23: EWM plant and a floating fragment with new roots

6.2.1 EWM in Trego Lake

EWM and hybrid EWM was first discovered in Trego Lake in 2019. This was not entirely a surprise given that upstream waters on the Namekagon River also have EWM. EWM was identified in Lake Hayward in 2011. Movement of fragments from Lake Hayward to Trego Lake is the mostly likely cause of the new introduction.

In order to determine the level of EWM infestation, a late-summer EWM bedmapping survey was completed by ERS in 2020. On August 25, 2020 more than 22 miles of boating transects were completed covering the entire visible littoral zone of the lake. During that survey, three low density beds of EWM covering 6.37 acres (1.66% of the lake's surface area) were documented (Figure 24). Outside of these areas, ten additional isolated plants were identified mostly in the same area as the beds, but with one isolated plant found near the public boat landing. Downstream from the boat landing, only a single fragment of EWM was found near the dam. All EWM was found in 3-5 feet of water and mixed with other, native plants. EWM bedmapping was not completed in 2021, but EWM was found in the areas identified in 2020 with a few new plants identified in that area known as Sunfish Bay (Figure 20).

In his 2020 EWM mapping report (Berg M. , 2020) the surveyor described the EWM in this way.

EWM currently occupies a small percentage of Trego Lake's surface area, but it is well established making eradication an unrealistic expectation. During our 2020 surveys, EWM seemed to be struggling to gain a foothold on the lake. Although it was widely distributed and we saw numerous floating fragments in the upstream "lake" region near the Namekagon Inlet, we noted that rooted plants were almost universally unhealthy. It may be that the lake's stained water is the main reason for this poor growth, or it could be that the low-nutrient sandy muck is suboptimal for EWM. Strong competition from canopied mats of Curly-leaf pondweed in the spring and dense native plant growth later in the summer might also be factors in EWM's limited coverage. Regardless if it's one of these factors, a combination of them, or something different entirely, EWM seemed to be unable to take advantage of the large patches of substrate left barren after CLP's early summer senescence. As it currently stands, EWM is more of a nuisance in the "lake" region than a true navigation impairment in the way that CLP is in the spring. Because of this, active management beyond the current harvesting program may be unnecessary.

Downstream from the "lake" region, the narrow littoral zone and sugar sand shorelines don't appear to offer EWM much habitat. Although we saw fragments in July as far downstream as the boat landing and in August just upstream from the dam, it seems likely most of these fragments are either going over the dam or dying in the depths.

Despite this, EWM will likely continue to slowly spread downstream and become more common in the few sheltered bays that exist. However, it seems equally unlikely that these plants will ever grow dense enough to cause significant navigation impairment for residents as the best habitat in these downstream areas occur along largely uninhabited shorelines. Because of this, continued monitoring with no active management is the most likely course of action in these areas – at least in the near future.

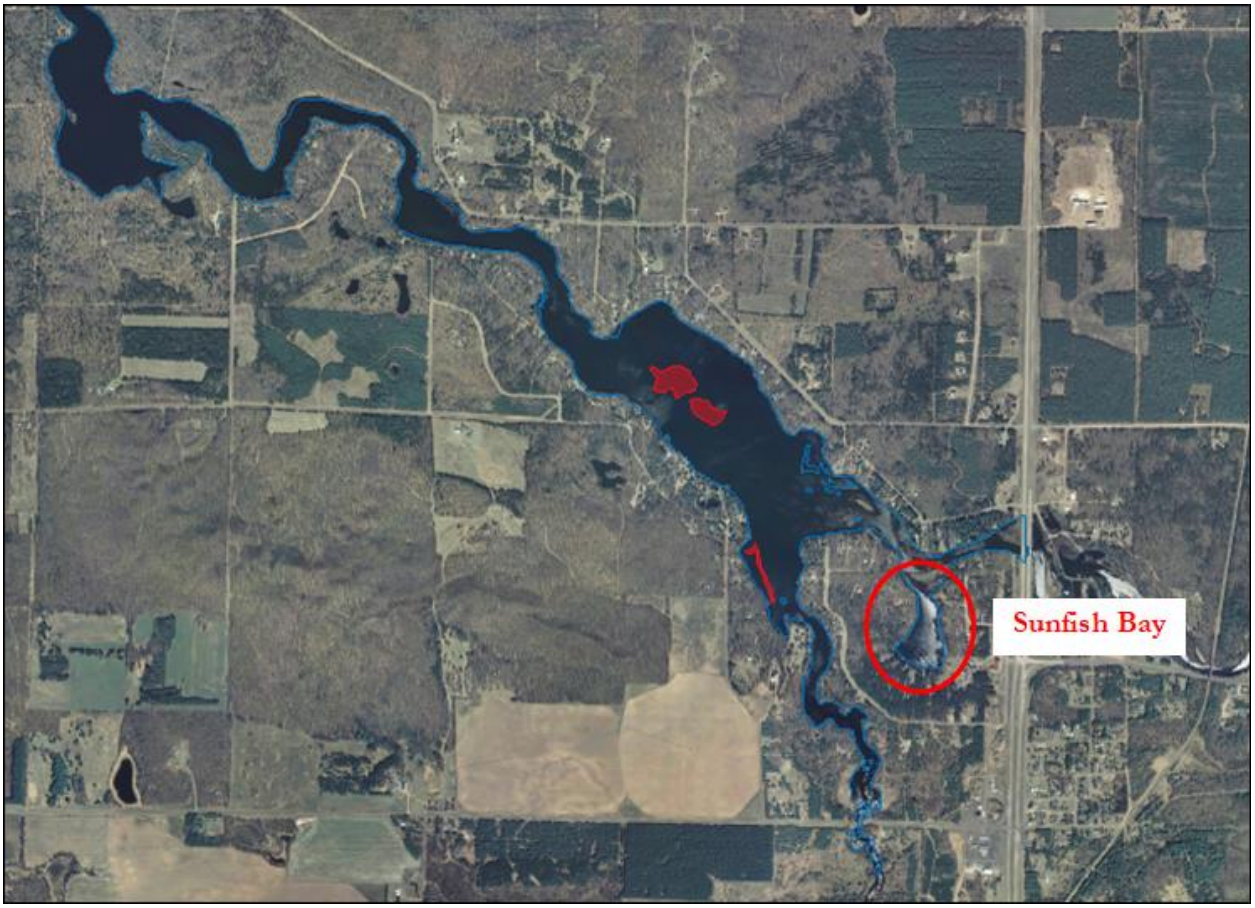


Figure 24: 2020 EWM beds in the east basin of Trego Lake

6.3 Purple Loosestrife

Purple loosestrife (Figure 25) is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers that vary from purple to magenta possess 5-6 petals aggregated into numerous long spikes, and bloom from August to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots can grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years.

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways.

By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Purple loosestrife is widespread in Washburn County including the area in and around Trego Lake.

Figure 25: Purple Loosestrife

6.4 Reed Canary Grass

Reed canary grass (Figure 26) is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The lead ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.

Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas.

Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring and then spreads laterally. Growth peaks in mid-June and declines in mid-August. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in just a few years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, and deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites.

Reed canary grass is located in a few locations along the shoreland of Trego Lake, but these have not become monotypic stands that impair the normal function of wetlands. While this should be monitored with other AIS, this is not considered an issue at this time.

Figure 26: Reed Canary Grass

6.5 Non-native Aquatic Invasive Animal Species

Currently, Chinese/Japanese mystery snails are the only non-native aquatic animal species found in Trego Lake. These were documented in 2007. There are several other non-vegetative, aquatic, invasive species that are in nearby lakes and streams, but have not been identified in Lower Turtle Lake. It is important for lake property owners and users to be knowledgeable of these species in order to identify them.

6.5.1 Chinese Mystery Snails

Chinese mystery snails and banded mystery snails (Figure 27) are non-native snails that have been found in a number of Wisconsin lakes. There is not a lot yet known about these species, however, it appears that they have a negative effect on native snail populations. The mystery snail's large size and hard operculum (a trap door cover which protects the soft flesh inside), and their thick hard shell make them less edible by predators and less susceptible to pesticides.

The female mystery snail gives birth to live crawling young. This may be an important factor in their spread as it only takes one impregnated snail to start a new population. Mystery snails thrive in silt and mud areas although they can be found in lesser numbers in areas with sand or rock substrates. They are found in lakes, ponds, irrigation ditches, and slower portions of streams and rivers. They are tolerant of pollution and often thrive in stagnant water areas. Mystery snails can be found in water depths of 1.5 to 15 feet. They tend to reach their maximum population densities around 3-6 feet of water depth. Mystery snails do not eat plants. Instead, they feed on detritus and in lesser amounts algae and phytoplankton. Thus removal of plants in the shoreline area will not reduce the abundance of mystery snails.

Lakes with high densities of mystery snails often see large die-offs of the snails. These die-offs are related to the lake's warming coupled with low oxygen (related to algal blooms). Mystery snails cannot tolerate low oxygen levels. High temperatures by themselves seem insufficient to kill the snails as the snails could move into deeper water.

Many lake residents are worried about mystery snails being carriers of the swimmer's itch parasite. In theory they are potential carriers, however, because they are an introduced species and did not evolve as part of the lake ecosystem, they are less likely to harbor the swimmer's itch parasites.

Figure 27: Chinese Mystery Snails (left) and Banded Mystery Snails (right)

6.5.2 Rusty Crayfish

Rusty crayfish have not been identified in Trego Lake.

Rusty crayfish (Figure 28) live in lakes, ponds and streams, preferring areas with rocks, logs and other debris in water bodies with clay, silt, sand or rocky bottoms. They typically inhabit permanent pools and fast moving streams of fresh, nutrient-rich water. Adults reach a maximum length of 4 inches. Males are larger than females upon maturity and both sexes have larger, heartier, claws than most native crayfish. Dark "rusty" spots are usually apparent on either side of the carapace, but are not always present in all populations. Claws are generally smooth, with grayish-green to reddish-brown coloration. Adults are opportunistic feeders, feeding upon aquatic plants, benthic invertebrates, detritus, juvenile fish and fish eggs.

Rusty crayfish reduce the amount and types of aquatic plants, invertebrate populations, and some fish populations--especially bluegill, smallmouth and largemouth bass, lake trout and walleye. They deprive native fish of their prey and cover and out-compete native crayfish. Rusty crayfish will also attack the feet of swimmers. On the positive side, rusty crayfish can be a food source for larger game fish and are commercially harvested for human consumption.

Rusty crayfish may be controlled by restoring predators like bass and sunfish populations. Preventing further introduction is important and may be accomplished by educating anglers, trappers, bait dealers and science teachers of their hazards. Use of chemical pesticides is an option, but does not target this species and will kill other aquatic organisms.

It is illegal to possess both live crayfish and angling equipment simultaneously on any inland Wisconsin water (except the Mississippi River). It is also illegal to release crayfish into a water of the state without a permit.

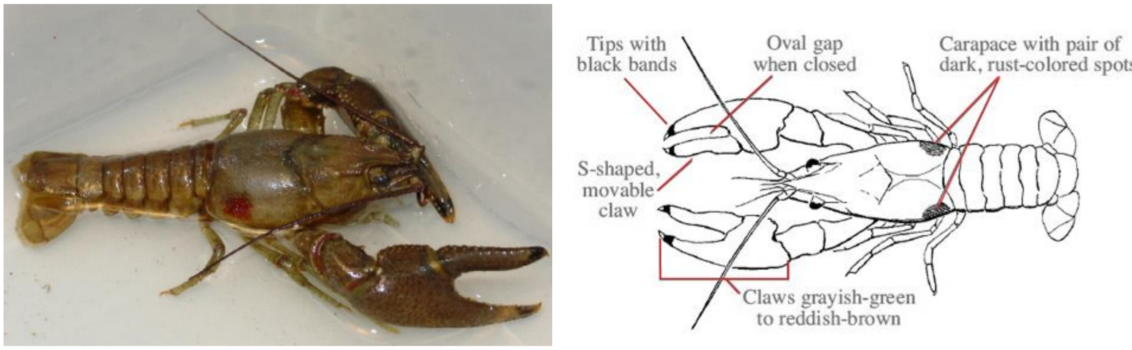


Figure 28: Rusty Crayfish and identifying characteristics

6.5.3 Zebra Mussels

Zebra mussels have not been identified in Trego Lake. The closest population is in Big and Middle Mckenzie lakes on the Burnett/Washburn County line just a few miles west of Trego Lake.

Zebra mussels (Figure 29) are an invasive species that have inhabited Wisconsin waters and are displacing native species, disrupting ecosystems, and affecting citizens' livelihoods and quality of life. They hamper boating, swimming, fishing, hunting, hiking, and other recreation, and take an economic toll on commercial, agricultural, forestry, and aquacultural resources. The zebra mussel is a tiny (1/8-inch to 2-inch) bottom-dwelling clam native to Europe and Asia. Zebra mussels were introduced into the Great Lakes in 1985 or 1986, and have been spreading throughout them since that time. They were most likely brought to North America as larvae in the ballast water of ships that traveled from fresh-water Eurasian ports to the Great Lakes.

Zebra mussels look like small clams with a yellowish or brownish D-shaped shell, usually with alternating dark- and light-colored stripes. They can be up to two inches long, but most are under an inch. Zebra mussels usually grow in clusters containing numerous individuals.

Figure 29: Zebra Mussels

6.6 AIS Prevention Strategy

The Trego Lake District supports watercraft inspection through the Clean Boats Clean Water program at the public boat landing. It also supports AIS monitoring efforts throughout the system. Several links are listed below that offer more information on aquatic invasive species in general, and how to prevent their introduction and spread in Trego Lake and to other lakes.

For general information on aquatic invasive species:
https://dnr.wi.gov/topic/invasives/species.asp?filterBy=Aquatic&filterVal=Y

Common regulated aquatic invasive species in WI:
https://dnr.wi.gov/topic/Invasives/documents/NR40Aquatics.pdf

Invasive Species Rule NR 40:
https://dnr.wisconsin.gov/topic/invasives/classification.html

Reporting invasive species:
https://dnr.wisconsin.gov/topic/Invasives/report.html

Preventing the spread of AIS:
https://dnr.wisconsin.gov/topic/Invasives/prevention.html

Eurasian watermilfoil fact sheet:
https://dnr.wisconsin.gov/topic/Invasives/fact/EurasianWatermilfoil.html

7.0 Past Management

7.1 Aquatic Plants

The last full aquatic plant management plan, developed in 1994 recommended aquatic plant harvesting primarily in the area referred to as the east basin or upstream third of the lake. The purpose of harvesting, as listed in the WDNR mechanical harvesting permits, is to "maintain navigation channels for common use." Access channels connecting shoreland residents to open water were predetermined and for the most part, have not changed in more than 20-years (Figure 30). These access lanes are generally 30-ft wide and all together cover approximately 1.7-acres. The TLD has an agreement with the Xcel Energy, the owner of the dam, whereby Xcel covers the cost of harvesting the predetermined navigation channels.

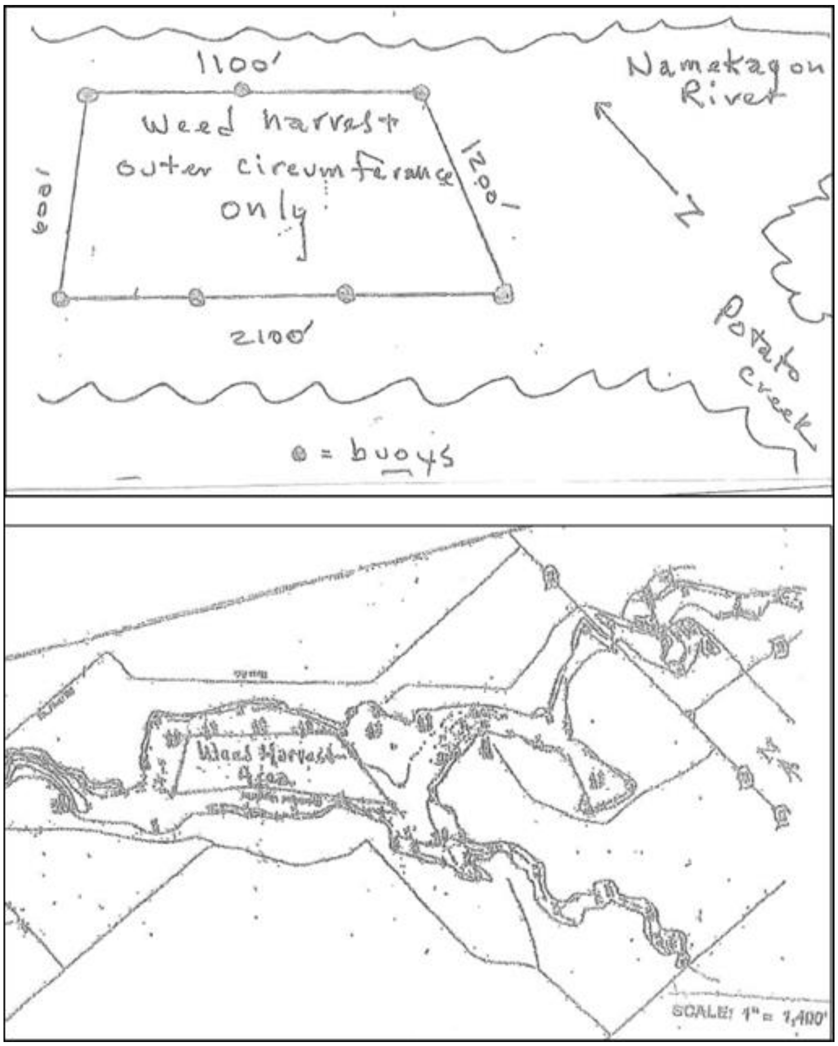


Figure 30: Navigation access lanes included with the last several WDNR mechanical harvesting permits (TLD)

GPS mapping in 2021 documented the current location of the buoys used to guide mechanical harvesting operations (Figure 31). Up until 2021, harvesting was completed in late July or August and generally only once a year. It was not done to provide any relief from CLP, only dense growth native vegetation. In 2021, harvesting of the access lanes was completed in mid-June to provide some navigation relief from CLP. Initially it was thought that harvesting might occur again in late July or August, but this was not needed in 2021.

Each year, the TLD provides a harvesting summary report to the WDNR. In 2019 and 2021, it was estimated that harvested vegetation totaled about 12 cubic yards of plant material each year. In 2021, due to the earlier harvest date, an estimated 66 cubic yards of plant material was removed, mostly CLP. Currently, harvested vegetation is taken to a dump site approximately a mile from the lake off County Hwy E near Trego.

Figure 31: 2021 location of navigation buoys (purple stars), and proposed harvesting lanes (yellow lines)

7.2 Dredging

While not directly a part of this plan, dredging within Trego Lake is relative to the conversation. Dredging in Trego Lake has been a hot topic of discussion since at least 1987. Ultimately it is the amount of deposited sediment that restricts access within the lake both directly (shallow water) and indirectly (providing a place for wild rice and other plants to grow). Managing sediment is outside of the realm of this APM Plan but is something that the TLD continues to study and wishes to address. At present, no dredging has been completed for the purpose of aquatic plant control. The following lists actions already taken by the TLD related to dredging.

- 2002 – Trego Lake District Sediment Committee created
- 2006 – Sediment Committee makes dredging recommendations
- 2009 – First planned dredging project – did not happen
- 2011 – Decision by TLD to continue moving forward with dredging planning using TLD funds
- 2012 – Reauthorization to complete a dredging project with donated funds
- 2014 – WDNR dredging permits are extended
- 2015 – Another resolution to move forward with a dredging project
- 2016 – Dredging project is finally completed
- 2020 – New dredging permit is requested, and the TLD purchases a Piranha mini suction dredge
- 2021 – Limited dredging for the purpose of deepening navigation channels was completed at several locations

For more information about past management actions both dredging and aquatic plant harvesting, go to Appendix D.

8.0 Need for Management

There are at least four major concerns related to the aquatic vegetation in Trego Lake – wild rice, curly-leaf pondweed, Eurasian watermilfoil, and dense growth native plants. While the entire Trego Lake system encompasses well over 300 acres of surface water, the majority of aquatic plant issues occur in the east basin and Potato Creek inlet which encompasses only about 165 acres or about half of the lake. The entire basin, the Potato Creek inlet included, is considered littoral zone, most of it supporting abundant plant growth. In this area, wild rice covers more than a third of what would otherwise be open water and needs to be protected. Dense growth curly-leaf pondweed in the spring and early summer covers more than 20% of the area. Eurasian watermilfoil is present covering about 4% of the area. Most of the EWM is in the same areas where CLP is growing. Finally, dense growth native aquatic vegetation takes over once CLP completes its life cycle in early July. It is also the area of Trego Lake with the most shoreland development. Adding to the issues, but not addressed in this plan, is sedimentation in the inlet area of the Namekagon River. Sedimentation is likely the main reason for all aquatic plant growth in this area, but is a much more difficult issue to address.

For the past 20-years the TLD has managed this area of the lake, primarily for the purpose of establishing navigation lanes to open water through dense vegetation (CLP, wild rice and other native plants) for the good of common use. Efforts include contracted harvesting to open the navigation lanes and some selective dredging completed by members of the TLD. Some level of physical removal is implemented by shoreland property owners.

Aquatic vegetation in the rest of Trego Lake is less of an issue with only a couple of areas with problems. Deeper water, a sandy shoreline, and a narrow littoral zone provides limited habitat for nuisance level aquatic plant growth.

Because of wild rice and substantial water movement through this area, the use of aquatic herbicides is not recommended. A combination of physical removal and mechanical harvesting are the best management options, but could be expanded from previous levels to provide more relief and control non-native invasive species. An expanded harvesting program could reduce CLP and EWM and provide more, much desired, access to and through open water without harming wild rice.

8.1 No Management

Regardless of the target plant species, native or non-native, sometimes no management is the best management option. Plant management activities can be disruptive to areas identified as critical habitat for fish and wildlife and should not be done unless it can occur without ecological impacts. This management alternative is not recommended for Trego Lake because current management actions have been less than satisfactory for both lake users and property owners. Aquatic invasive species are present and will likely continue to spread without management of some kind. As aquatic invasive species increase, so too will the negative impacts to native aquatic plants including wild rice caused by them.

9.0 Integrated Pest Management

Integrated Pest Management (IPM) is an ecosystem-based aquatic plant management strategy that focuses on long-term prevention and/or control of a species of concern. 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 32). In addition to monitoring and considering 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. Then, an IPM-based plan informed by current, comprehensive information on pest life cycles and the interactions among pests and the environment can be formed.

After monitoring and considering 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, data collected on the species and the waterbody will help groups select the most effective management methods and the best time to use them.

The most effective, long-term approach to managing a species of concern is to use a combination of methods. 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 on 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.

(Additional information on each method is outlined in the following section).

IPM is a process that combines informed methods and practices to provide long-term, economic pest control. A quality IPM program should adapt when new information pertaining to the target species is provided 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 an IPM program:

1. Identify and understand the species of concern
2. Prevent the spread and introduction of the species of concern
3. Continually monitor and assess the species' impacts on the waterbody
4. Prevent species of concern impacts
5. Set guidelines for when management action is needed

6. Use a combination of biological, cultural, physical/mechanical and chemical management tools
7. Assess the effects of target species' management
8. Change the management strategy when the outcomes of a control strategy create long-term impacts that outweigh the value of target species control.

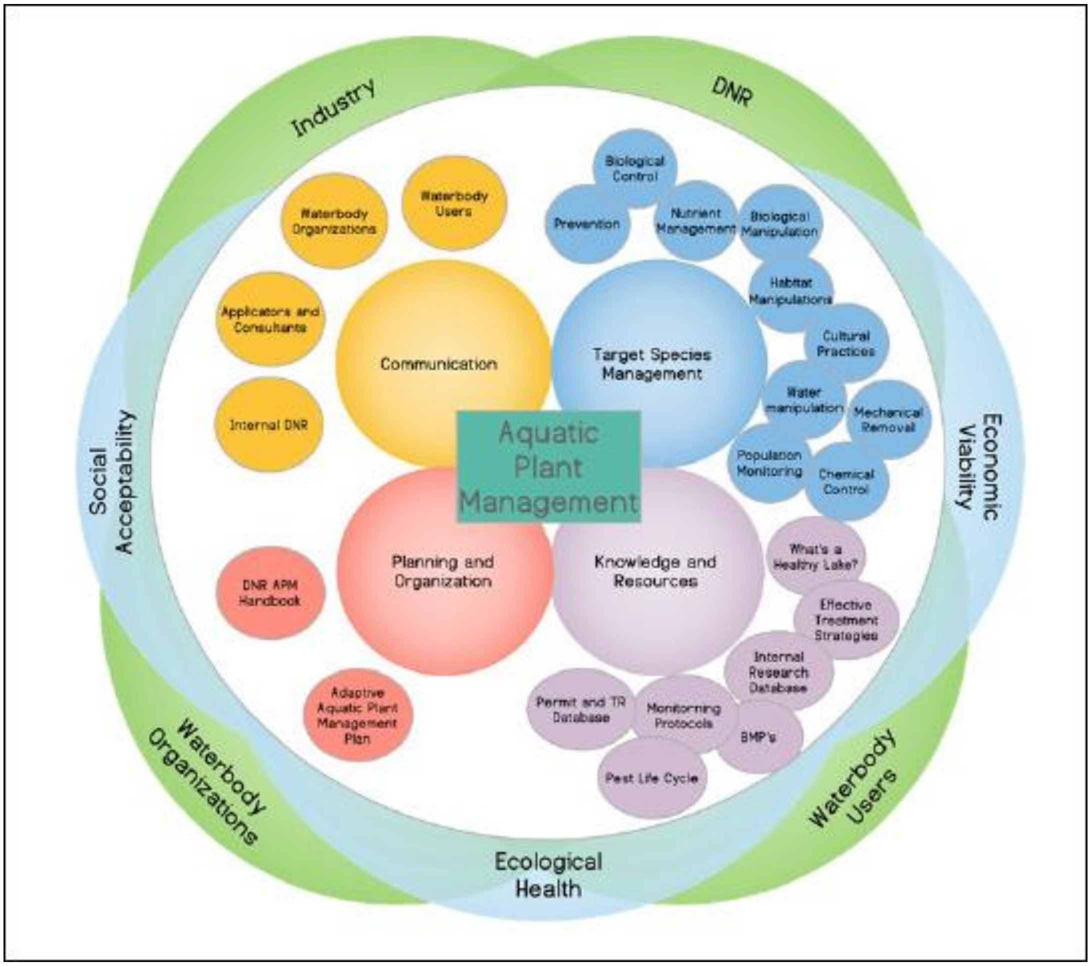


Figure 32: Wisconsin Department of Natural Resources: Wisconsin Waterbodies – Integrated Pest Management March 2020

9.1 Aquatic Plant Management Alternatives

Protecting native plants and limiting negative impacts caused by CLP and EWM is a primary focus of plant management in Trego Lake. A secondary focus is maintaining access to open water for property owners and other lake users. Generally, control methods for nuisance aquatic plants can be grouped into five categories:

- Physical control: hand-pulling, cutting, or raking
- Mechanical: Diver Aided Suction Harvest (DASH), large and small-scale mechanical harvesting
- Aquatic plant habitat manipulation: dredging, drawdowns, bottom barriers, and shading
- Biological control: the use of species that compete successfully with the nuisance species for resources
- Chemical control: use of herbicides

9.1.1 Physical/Manual Removal

Manual or physical removal of aquatic plants by means of a 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, boatlifts, swimrafts 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 33)
- Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 is unlimited if performed in a manner that does not harm the native aquatic plant community
- Removal of dislodged aquatic plants that drift on-shore 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)a are followed:

(1) Removal or destruction of wild rice.

(a) No person may remove or destroy by hand, mechanical or chemical means wild rice growing in navigable lakes unless the department has approved the removal or destruction under par. (b).

(b) In addition to harvest in accordance with s. 29.607, Stats., and subs. (2) to (8), the department may authorize by written approval the removal of wild rice growing in navigable lakes upon a finding that:

1. The wild rice resource in the navigable lake will not be substantially affected. The department may consider cumulative effects of an approval on such a lake under this paragraph; and

2. The removal or destruction is necessary to allow reasonable access to the lake by the riparian owner.

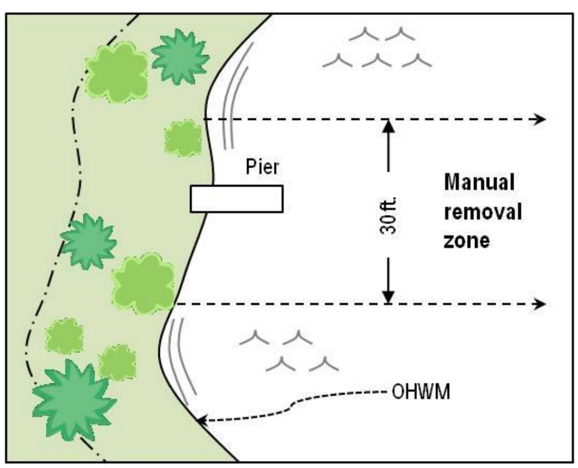


Figure 33: Aquatic vegetation manual removal zone

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 30-ft zone can extend, however clearing large swaths of aquatic plants not only disrupts lake habitats, it also creates open areas for non-native species to establish. Physical removal of aquatic plants requires a permit if the removal area is located 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.

9.1.2 Diver Assisted Suction Harvesting

Diver assisted suction harvesting or DASH, as it is often called, is a fairly recent aquatic plant removal technique. It is called "harvesting" rather than "dredging" because, although a specialized small-scale dredge is used, bottom sediment is not removed from the system. The operation involves hand-pulling of weeds from the lake bed and inserting them into an underwater vacuum system that sucks up plants and their root systems taking them to the surface. It requires water pumps on the surface (generally on a pontoon system) to move a large volume of water to maintain adequate suction of materials that the divers are processing. Only clean water goes through the pump. The material placed by the divers into the suction hose along with the water is deposited into mesh bags on the surface with the water leaving through the holes in the bag. The bags have a large enough 'mesh' size so that silts, clay, leaves and other plant material being collected do not immediately clog them and block water movement. If a fish or other living marine life is sucked into the suction hose it comes out the discharge unharmed and is returned to the body of water. According to Eichler et al. (1993) it can have some negative impacts to other nearby non-target plants if not done carefully, particularly those plants that are perennials and expand their populations by sub-sediment runners.

DASH removal is not recommended for CLP or EWM control on Trego Lake.

9.1.3 Mechanical Removal

Mechanical removal involves the use of devices not solely powered by human as a means to aid removal. This includes gas and electric motors, ATV's, boats, tractors, etc. Using these instruments to pull, cut, grind, or rotovate aquatic plants is illegal in Wisconsin without a permit. DASH is also considered mechanical removal. To implement mechanical removal of aquatic plants a Mechanical/Manual Aquatic Plant Control Application is required annually. The application is reviewed by the WDNR and other entities and a permit awarded if required criteria are met. Using repeated mechanical disturbance such as bottom rollers or sweepers can be effective at control in small areas, but in Wisconsin these devices are illegal and generally not permitted.

9.1.3.1 Large-Scale Mechanical Harvesting

Large-scale mechanical harvesting is commonly used for control of CLP, and in the absence of other alternatives or conditions that prevent other alternatives, can also be an effective way to reduce EWM biomass in a water body, particularly if the EWM is in the same area as the CLP being harvested. With harvesting of EWM, there is substantial risk of increasing fragmentation, so the risk of doing so should be weighed appropriately.

Aquatic plant harvesters are floating machines that cut and remove vegetation from the water. The size, and consequently the harvesting capabilities, of these machines vary greatly. As they move, harvesters cut a swath of aquatic plants that is 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, and the average lifetime of a mechanical harvester is 10 years.

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 build-up of organic material that normally occurs as a result of the decaying of this plant matter is reduced. Additionally, repeated treatments may result in thinner, more scattered growth.

Aside from the obvious effort and expense of harvesting aquatic plants, there are many environmentally-detrimental consequences to consider. 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. Shoreline erosion may therefore increase. 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 as a whole.

Much like mowing a lawn, harvesting must be conducted numerous times throughout the growing season. Although the harvester collects most of the plants that it cuts, some plant fragments inevitably persist in the water. This may allow the invasive plant species to propagate and colonize in new, previously unaffected areas of the lake. Harvesting may also result in re-suspension of contaminated sediments and the excess nutrients they contain.

Disposal sites are a key component when considering the mechanical harvesting of aquatic plants. The sites must be on shore and upland to make sure the plants and their reproductive structures don't make their way back into the lake or to other lakes. 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. The ideal time to harvest, in order to maximize the efficiency of the harvester, is just before the aquatic plants break the surface of the lake. For CLP, it should also be before the plants form turions (reproductive structures) to avoid spreading the turions within the lake. 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 from one body of water to another.

Contracted harvesting, or purchase and operation of a smaller mechanical harvester by the TLD remains a good alternative to the use of herbicides to maintain use of the lake and protect water quality and native plants.

9.1.3.2 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 (Figure 34) 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. Incidental plant disruption by normal boat traffic is not considered mechanical management and 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 illegal it can also re-suspend sediments, encourage aquatic invasive species growth, and cause ecological disruptions.

Figure 34: Aquatic Mower & Weedshear Weed Cutter (weedersdigest.com)

Small-scale harvesting could be used effectively to manage CLP and nuisance native vegetation in certain areas of Trego Lake. For a small investment to purchase a boat mounted type weed cutter and some volunteer time, the areas of greatest impact to navigation could be improved.

9.1.4 Dredging

Dredging is the removal of bottom sediment from a lake. Its success as an aquatic plant management strategy 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, 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. In Collins Lake, New York the biomass of curly-leaf pondweed remained significantly lower than pre-dredging levels 10-yrs after dredging according to Tobiessen et al. (1992). Dredging is very expensive, requires disposal of sediments, and has major environmental impacts. It is not a selective procedure so it can't be used to target any one particular species with great success except under extenuating circumstances. Dredging at any level must be permitted by the WDNR. It should not be performed for aquatic plant management alone. It is best used as a multipurpose lake remediation technique (Madsen, 2000).

With the exception of limited dredging to maintain adequate depth in frequently traveled boating lanes, dredging as a plant management action, is not a recommended Trego Lake.

9.1.5 Drawdown

Drawdown, like dredging, alters the plant environment, in this case 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 drawdown to control 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 actually benefit from a winter drawdown, as competition with other plants species may be reduced following a drawdown. This can aide certain native species like wild rice, but it could also result in CLP doing better in a lake.

In a literature review completed in 2017, (Carmignani & Roy, 2017) identify other negative impacts that can be caused by winter drawdowns. The dewatering, freezing, and increased erosion of exposed lakebeds drive changes in the littoral zone. Shoreline-specific physicochemical conditions such as littoral slope and shoreline exposure further induce modifications. Loss of fine sediment decreases nutrient availability over time, but desiccation may promote a temporary nutrient pulse upon re-inundation. Annual winter drawdowns can decrease taxonomic richness of macrophytes and benthic invertebrates and shift assemblage composition to favor taxa with r-selected life history strategies and with functional traits resistant to direct and indirect drawdown effects. Fish assemblages, though less directly affected by winter drawdowns (except where there is critically low dissolved oxygen), experience negative effects via indirect pathways like decreased food resources and spawning habitat.

While it is possible to complete a winter drawdown on Trego Lake, it is not a recommended management action. The 1994 Aquatic Plant Management Plan does a pretty job at explaining why. A drawdown is a whole-lake management approach and not appropriate when the whole lake is not impacted by aquatic plant issues. Past use of drawdowns have demonstrated that this technique only provides limited benefits as within 2 to 3 years aquatic plant growth returns to pre-drawdown levels. Past drawdowns have transferred sediment from the upstream portion of Trego Lake to the downstream portion of the lake. While there may have been some temporary increase in depth for boating upstream, shortly after refilling the areas were filled in again. Both CLP and EWM are growing in some of the deepest parts of the littoral zone requiring a substantial reduction in water level to impact the target species.

9.1.6 Bottom Barriers and Shading

Physical barriers, fabric or other, placed on the bottom of the lake to reduce plant growth may provide temporary relief, but also inhibits fish spawning, affects benthic invertebrates, and could cause anaerobic conditions which may release excess nutrients from the sediment. Gas build-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 turns 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 Trego Lake are not recommended.

9.1.7 Biological Control

Biological control involves using one plant, animal, or pathogen as a means to control a target species in the same environment. The goal of biological control is to weaken, reduce the spread, or eliminate the unwanted population so that native or more desirable populations can make a comeback. Care must be taken however, to insure 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 et al. (1988). None of these have currently been approved for use in Wisconsin.

9.1.7.1 Purple Loosestrife Bio-Control with Galerucella Beetles

Galerucella beetles are currently approved for the control of purple loosestrife in Wisconsin (Figure 35). The entire lifecycle of Galerucella beetles is dependent on purple loosestrife. In the spring, adults emerge from the leaf litter below old loosestrife plants. The adults then begin to feed on the plant for several days until they begin to reproduce. Females lay their eggs on loosestrife leaves and stems. When the larvae emerge from these eggs they begin feeding on the leaves and developing shoots. When water levels are high these larvae will burrow into the loosestrife stems to pupate into adult beetles. These new adults emerge and begin feeding on the loosestrife again (Sebolt, 1998). Galerucella beetles do not forage on any plants other than purple loosestrife. Because of this the populations, once established, are self-regulating. When the purple loosestrife population drops off, the beetle population also declines. When the loosestrife returns, the beetle numbers will usually increase. These beetles do not eradicate purple loosestrife entirely, but do help to reduce its dominance which will allow other native plants to recover.

Figure 35: Galerucella Beetle

Biological control is not recommended for CLP or EWM control, but could be used for control of purple loosestrife if large areas of the plant exist in or around Trego Lake. Washburn County already has a well-established purple loosestrife bio-control program.

9.1.8 Chemical Control

Aquatic herbicides are granules or liquid chemicals specifically formulated for use in water to kill plants or cease 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. Some individual states, including Wisconsin, also impose additional constraints on herbicide use.

The Wisconsin Department of Natural Resources 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 be used 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 means that, in most cases, the herbicide will be degraded by the time peak recreation on the water starts.

The WDNR encourages minimal herbicide use by requiring a strategic Aquatic Plant Management Plan for management projects over 10 acres or 10% of the water body or any projects receiving state grants. WDNR also requires consideration of alternative management strategies and integrated management strategies on permit applications and in developing an APM Plan, when funding invasive species prevention efforts, and by encouraging the use of best management practices when issuing a permit. The Department also supervises treatments, requires that adjacent landowners are notified of a treatment and are given an opportunity to request a public meeting if they want, requires that the water body is posted to notify the public of treatment and usage restrictions, and requires reporting after treatment occurs.

The advantages of using chemical herbicides for control of aquatic plant growth are the speed, ease and convenience of application, the relatively low cost, and the ability to somewhat selectively control particular plant types 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 aquatic invasive species 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. Early spring to 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 minimizing the impacts of de-oxygenation and contribution of organic matter to the sediments; fish spawning has ceased; and recreational use is generally low limiting human contact. The concentration and amount of herbicides can be reduced because colder water temperatures enhance the herbicidal effects. Selectivity of herbicides can be increased with careful selection of application rates and seasonal timing. Lake characteristics 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 other water uses in the treatment vicinity.

At the present time, the use of aquatic herbicides on any level to control CLP, EWM, and/or nuisance native vegetation in Trego Lake is not recommended. The two main reasons for this is the abundant wild rice present in the treatable areas, and the movement of water through the system.

10.0 Management Discussion

Through the course of this project, several meetings of the TLD and its constituency have been held. The purpose was to identify priorities related to the management of aquatic plants. Under the 1994 Plan and over the course of the last 25 years, the only aquatic plant management completed was harvesting of navigation and access channels as described in Section 7. Only twice during that time (2014 and 2018) was harvesting suspended due to minimal plant growth. Harvesting costs were covered by Xcel Energy (NSP) based on an agreement reached between Xcel and the TLD in 1997. In the original agreement, Xcel would cover the cost of harvesting up to two times per year, however, rarely has harvesting been done twice a year due in part to continued hesitation on the part of Xcel to pay for it. As a result, the timing of the harvesting shifted from once in the early summer and once in the mid-summer, to just one harvest mid to late summer.

10.1 CLP

Prior to the development of the 1994 Plan, the Trego Lake residents noted that nuisance growth of CLP during the spring and early summer inhibited recreational usage. Despite this, the 1994 Plan made no special reference to management of CLP, instead referring to all management as just "macrophyte management." Recommendations were made for harvesting of interconnected channels from residences to open water at least one and perhaps two times during the year; and hand raking by individual residents adjacent to their properties. There is some indication in the 1994 Plan that harvesting in the early summer with follow-up management later in the year was the best implementation approach.

10.2 EWM

Plant survey work completed in 2020 as a result of the need to update the existing APM Plan, highlighted the need for additional discussion related to plant management. Tasked at determining the distribution and impact of EWM, survey work instead documented CLP as the major issue impacting Trego Lake and the people who use it. EWM was present, and probably expanding, but it was doing so within the same area already dominated by CLP. Most of this area is outside of the access and navigation lanes kept open by the current harvesting program. 2020 mapping did lead to harvesting these lanes earlier in 2021 reversing the trend that had been established in previous years. However, the limited harvesting completed did little to address the distribution and density of CLP or the new infestation of EWM.

10.3 Dense Growth Native Vegetation

10.3.1 Wild Rice

Thick beds of wild rice during the late summer that restrict boat use were a concern back in 1994, and are still a concern today, except that most residents have accepted that any management specifically targeting the removal of wild rice is not allowable. During the 2011 and 2020 PI survey, 74 and 85 points respectively had wild rice present (Figure 36). In 2021, nearly 50 acres of wild rice were mapped in the east basin of Trego Lake (Figure 36). A majority of these acres were dense growth that prevented nearly all boating navigation except through river channels and approved harvesting lanes. Individual plants and small clumps of wild rice are scattered throughout Trego Lake.

10.3.2 Other Plants

Several other native plant species are dominant in the east basin and Potato Creek area of Trego Lake once CLP completes is life cycle. Larger, rooted plants including water celery and flat-stem pondweed, and coontail - a large suspended plant, form moderate to dense beds of vegetation in the mid to late summer throughout Trego Lake, but particularly in the east basin and Potato Creek inlet (Figure 37). The density of plants in these areas may appear worse than it is due to very abundant small floating plants including the duckweeds and watermeal that tend to get caught in the surface mats of the larger plant species (Figure 38). During mid to late summer harvesting it is these few plants that are removed most frequently and in abundance.

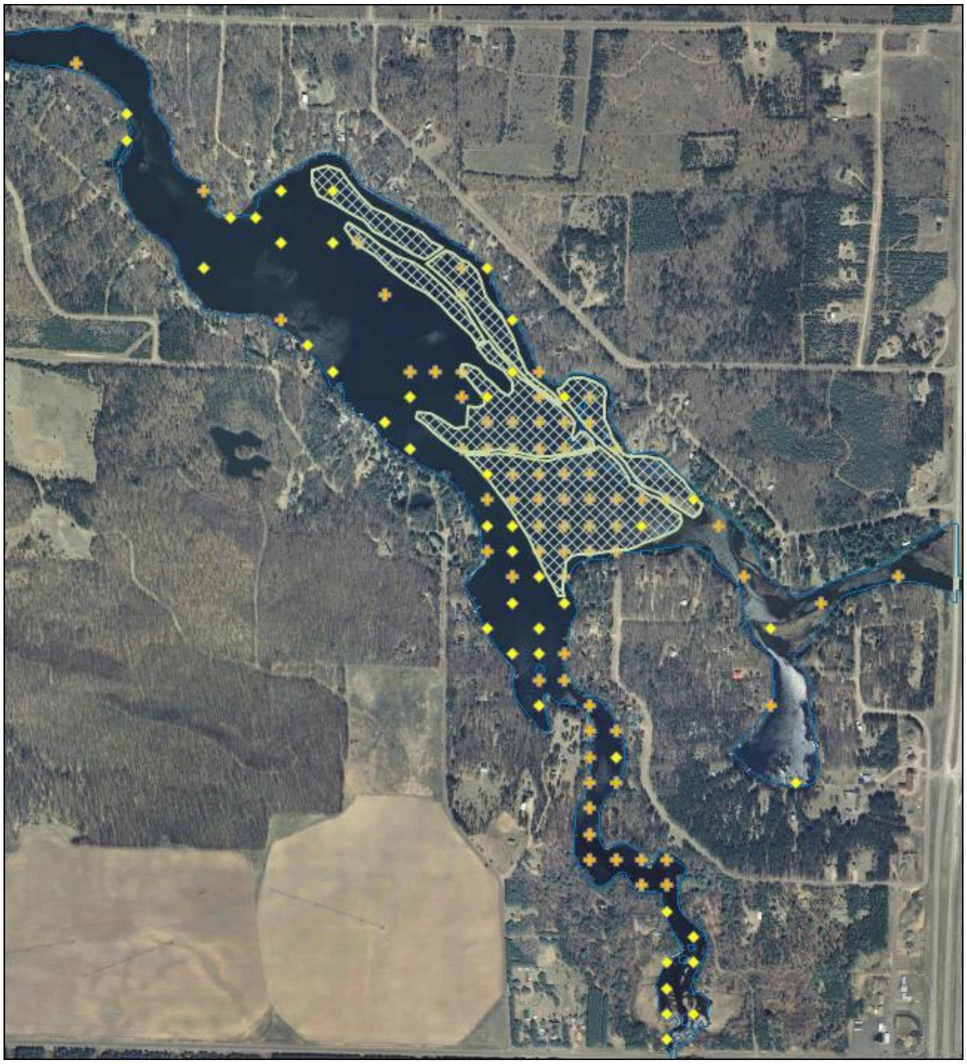


Figure 36: Wild rice in Trego Lake. Orange crosses (2011 WDNR PI), Yellow squares (2020 ERS PI), Green hash – 2021 bedmapping only in the east basin (LEAPS)

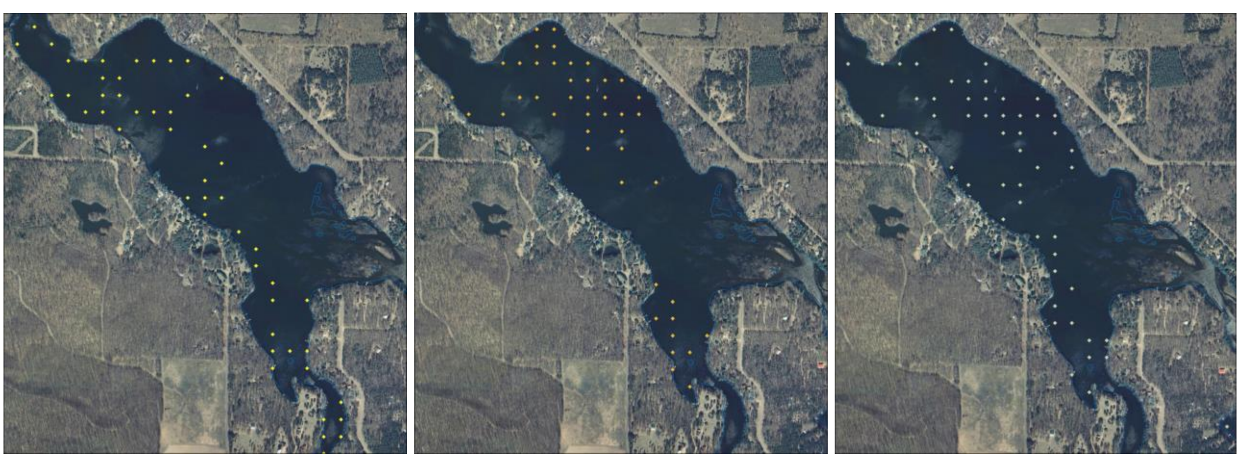


Figure 37: 2020 water celery distribution (left), coontail distribution (center), and flat-stem pondweed distribution (right)

Figure 38: *Lemna minor* (small duckweed) and *Wolfia Columbiana* (watermeal) (left), and *Spirodela polyrhiza* (large duckweed) (right) (ERS)

10.4 Changes to the Harvesting Plan

Until the discovery of EWM/HWM in 2019, few changes in the harvesting program were discussed. Instead, most of the concern was focused on navigation impairment as a result of sedimentation issues (see Section 7.2). Aquatic plant management that has taken place over the last 25 years has been based on opening up certain access and navigation lanes and what Xcel Energy would pay for per the 1997 agreement. All harvesting has been completed using contracted services.

10.4.1 Open Water (CLP, EWM, and Native Vegetation) Harvest

Given the recreational impairment and ecological harm caused by CLP particularly in the east basin and Potato Creek inlet, focusing more on its removal in the spring and early summer would be beneficial to the lake and lake users. In addition, most of the EWM in the system is located in the same areas as the CLP. CLP is located in water from 1.5 to 5.5 feet deep, but is most dense at about 3.75 feet. EWM is located in water from 3.5 to 5.5 feet deep, but is most dense at about 4.75 feet. Focusing early season management efforts on areas where both CLP and EWM are removed simultaneously reduces the impact of both. Late season nuisance native aquatic plant growth in areas without wild rice is most dense at depths between 3.5 and 6.5 feet. In areas deeper than this, native aquatic plant growth is limited. Designating an area within the east basin in the 4 to 6 foot range that can be harvested early in the season for CLP and EWM, and again later in the season (if needed) for native vegetation (and EWM) serves multiple purposes: 1) it removes CLP; 2) it removes EWM; and 3) it reduces navigation impairment caused by dense growth native vegetation. If the designated harvesting area is kept in water greater than 3.5 feet, almost all of the wild rice in the system will be unaffected.

In this plan, three areas within the east basin and Potato Creek inlet totaling about 23 acres have been designated as harvesting areas (Appendix E). All fall under the guidelines in the previous paragraph. While not all the CLP is included in the harvesting areas, all of the EWM is. With the harvested areas and deep water, the amount of open water in the east basin approaches 60 acres increasing recreational access.

10.4.2 Access and Navigation Lanes

Depending on which map that is used, the maximum length of the current access and navigation lanes harvested by the TLD each year is between 5,000 and 5,400 feet. WDNR permitting indicates that the access lanes will be harvested with 15 feet on either side of the marker buoys making the channels/lanes 30 feet wide. Using GPS and 2021 placement of the marker buoys, the total length harvested is 5,565 feet. This means that the total acreage currently included in the existing harvesting plan is between 3.44 and 3.83 acres. Of note though, harvesting is often not needed along the entire length between the buoys. The access and navigation lanes currently harvested do not include any area in the Potato Creek inlet or anywhere else in the lake, only the east basin.

In this plan the access and navigation lanes are extended within the east basin, and lanes are added in the Potato Creek inlet, Sunfish Bay, and in a couple other locations (Appendix E). The total distance of these new access and navigation lanes is 17,487 feet (3.3 miles) and at 30 feet wide would cover 12.0 acres. However, like the current access and navigation lanes, not all of these lanes would need to be harvested all the time. Some are kept open by the natural flow of water through the system, and some are on the edge of deep water and the previously proposed open water harvesting areas, so likely harvesting would not be needed.

10.4.3 Harvesting Totals and Estimated Costs (Owning versus Contracting Services)

Between these two new proposals, a maximum of 35 acres of Trego Lake, mostly in the east basin and Potato Creek inlet area could be harvested in any given year. It is a huge increase in what is currently completed and funded by Xcel Energy. In the following sections, an estimate of costs is made for both owning a harvester, and contracting harvesting services.

Costs per acre vary with numbers 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. However, using a report from Dane County, WI prepared by Koegel et al. (1974), and extrapolating their costs to current costs, an estimate of cost per acre of harvesting can be made when owning the equipment. Their calculations include paid operator cost, gas and lubrication, repair and maintenance and a mechanic to do the work, supervision of operators, storage and transportation, and the annual investment cost over 15 years. They estimated the cost of a mechanical harvester to be about $55,000.00. That value was upped to $255,000.00 in 2021. Their calculations estimated the cost in 1974 to be about $68.50/acre. When updating their numbers to 2021, the estimated cost is about $418.50/acre. If the TLD harvests 35 acres during the season, the cost is about $14,650.00. This number does not include the cost of any additional equipment like trailers or elevators or the cost of insurance.

For comparison purposes, the Rice Lake Protection and Rehabilitation District harvests up to 160 acres of CLP and another 60 acres of navigation lanes later in the season. They run three harvesters with 10-ft cutting heads. Their 2022 estimated annual budget to support its harvesting program is $130,000.00 and does include investment costs (as they just purchased a new harvester two years ago), the cost of other equipment, operating expenses, maintenance, insurance, and supporting consultant fees. At 220 acres, the cost is about $590.91/acre. At 35 acres, this would be a cost of $20,681.85 annually on Trego Lake.

In 2021, the TLD did request a bid for the purchase of an Eco-Harvester and a trailer to haul it. The total was $92,131.00. An Eco-harvester is a small mechanical harvester with only a 4-ft cutting/rolling head.

Local private harvesting contractors generally charge around $2,000 per day for harvesting services. There is one locally available contractor in NW Wisconsin. It is estimated that a large harvester (10-ft cutting head) can harvest about 0.78 acres per hour or 7.8 acres in a 10 hour day. It would take 4.5 days for a contractor to harvest 35 acres for a total of $9,000.00. If the harvesting was needed twice in the same year, the cost would be about $18,000.00 annually. The contractor used on Trego Lake in 2021 only has a harvester with a 5-ft cutting head. As such it would likely take twice as long to harvest 35 acres, so the cost could be as high as $18,000.00 for one time, and $36,000.00 for two. Actual contracted harvesting in 2021, took two full days to harvest what was likely about 3 acres of dense growth CLP. The contractor cost for this service was $4,800.00. Under this scenario, contracted harvesting could have a cost upwards of $48,000.00 for one time if all 35 acres were harvested.

Disposal sites are a key component when considering the mechanical harvesting of aquatic plants. The sites must be on shore and upland to make sure the plants and their reproductive structures don't make their way back into the lake or to other lakes. 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.

10.4.4 Benefits and Drawbacks

There are benefits and drawbacks for both contracted harvesting and purchasing a harvester outright. With contracted harvesting, the cost per acre can vary depending on vegetation density, distance between the area being harvesting and the off-loading site, and the distance to the designated disposal site. Another issue presented by contracting is that the timing of the harvesting is entirely dependent upon the contractor's schedule which can result in the vegetation being harvested after the optimal time. However there are many benefits to contracted harvesting, the biggest one being the reduced upfront costs associated with contracting. There is also no maintenance and storage costs, and there are reduced or no costs if less or no harvesting is completed in any given year.

Purchasing, on the surface, is the more expensive option due not only to the initial cost of purchase, but also insurance, storage, maintenance, and an operator's salary (unless volunteer operated). However, depending on the actual cost of the contractor and the efficiency in which the contractor can handle the harvesting project, purchasing may be less expensive overall. There are many benefits to purchasing as well. Purchasing a harvester eliminates the potential for new AIS to be introduced to the lake from the harvester, the cost per acre tends to go down the longer a harvester is operational, and these costs will not increase dramatically if the amount of vegetation being harvested increases. This also allows harvesting to be done during the best times as well as providing a way to maintain navigation channels throughout the summer. The biggest drawbacks to purchasing a harvester are the increased up-front cost and the annual costs associated with maintaining the harvester. Even during years with less harvesting, the maintenance, storage, and other miscellaneous costs will remain around the same as those costs would be during years that require large amounts of harvesting.

10.5 Operating a Mechanical Harvester on Trego Lake

While a majority of the proposed harvesting area is accessible with a harvester, there are a couple of areas that may not be. One such area is Sunfish Bay. Harvesting to open a navigation channel in Sunfish Bay is not the problem. It is getting the harvester into the bay in the first place. Shallow, rapidly moving water and sediment deposition may make it difficult or impossible to drive the harvester into the bay. It may be necessary to purchase a small, boat/pontoon mounted sickle blade cutter as described in Section 9.1.3.2 to cut vegetation in Sunfish Bay. At the same time, it would require additional effort to remove the cut vegetation from the lake by hand, as the cutter itself would not do that. The access lane that parallels the southern shore between the inlets of the Namekagon River and Potato Creek may also pose issues with appropriate depth. Limited, small-scale dredging to keep this access lane open may be all that is necessary. Several of the proposed access/navigation lanes follow natural river channels through the wild rice beds and will likely stay open on their own.

Harvesting operations are generally required to stay in at least 3-ft of water, so portions of some of the recommended access/navigation lanes may be restricted. This is particularly true the further into the Potato Creek inlet the harvester would go.

11.0 Wisconsin Department of Natural Resources Grant Programs

The WDNR Surface Water Grant Program can provide cost-sharing for aquatic plant management actions assuming they are being implemented under the guidelines of a WDNR approved Aquatic Plant Management Plan. Under the Aquatic Invasive Species (AIS) Population Control grant category, up to 75% of management and planning costs can be reimbursed. Through the Recreation and Boating Facilities grant program, the WDNR often will reimburse up to 35% of the cost to purchase aquatic plant harvesting equipment. Both of these grant programs require sponsor match and formal application for the funding. Funding awards are not a sure thing, as WDNR grants are a competitive program with way more funding requests each year than there is money to give.

For more information about WDNR Surface Water Grants go to: https://dnr.wisconsin.gov/aid/SurfaceWater.html.

For more information about Recreational Boating Facilities Grants go to: https://dnr.wisconsin.gov/aid/RBF.html.

12.0 Trego Lake Aquatic Plant Management Goals, Objectives, and Actions

There are nine general aquatic plant management goals for Trego Lake. Associated with the nine goals are 15 objectives and numerous actions to help meet the objectives. The goals, objectives, and actions are intended to act as a guide for the TLD to follow in at least the next five years to protect the health of the aquatic plant community and maintain/improve access and navigability for all lake users. All of the goals, objectives, and actions and additional management discussion are included in Appendix B.

- Protect, preserve, and enhance native aquatic plant communities including wild rice.
- Reduce the impact of AIS on the native plant community and on access and navigation.
- Improve access to open water through dense growth non-native and native aquatic vegetation for property owners and other lake users.
- Determine how best to implement the changes in the harvesting program laid out in this Plan.
- Minimize opportunities for new AIS to enter and become established in Trego Lake.
- Reduce pollutant loading into Trego Lake.
- Provide property owner and lake user education and awareness of issues impacting Trego Lake.
- Collect lake related data to enhance and support current and future lake management planning and implementation in Trego Lake.
- Implement this plan following Integrated Pest Management guidelines from the WDNR.

13.0 Implementation and Evaluation

This plan is intended to be a tool for use by the TLD to move forward with aquatic plant management actions that will maintain the health and diversity of Trego Lake and its aquatic plant community. 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 to ensure goals 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, other stakeholders, and/or TLD funds is highly recommended. An Implementation and Funding Matrix is provided in Appendix F.

14.0 Works Cited

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Appendix A

WDNR Northern Region Aquatic Plant Management Strategy

Appendix B

Trego Lake – Goals, Objectives, and Actions

Appendix C

WDNR Rule NR 19.09 Wild Rice Conservation

Appendix D

TLD Historical Management Document

Appendix E

2022-26 Harvesting Map

Appendix F

2022-26 APM Plan Implementation Matrix