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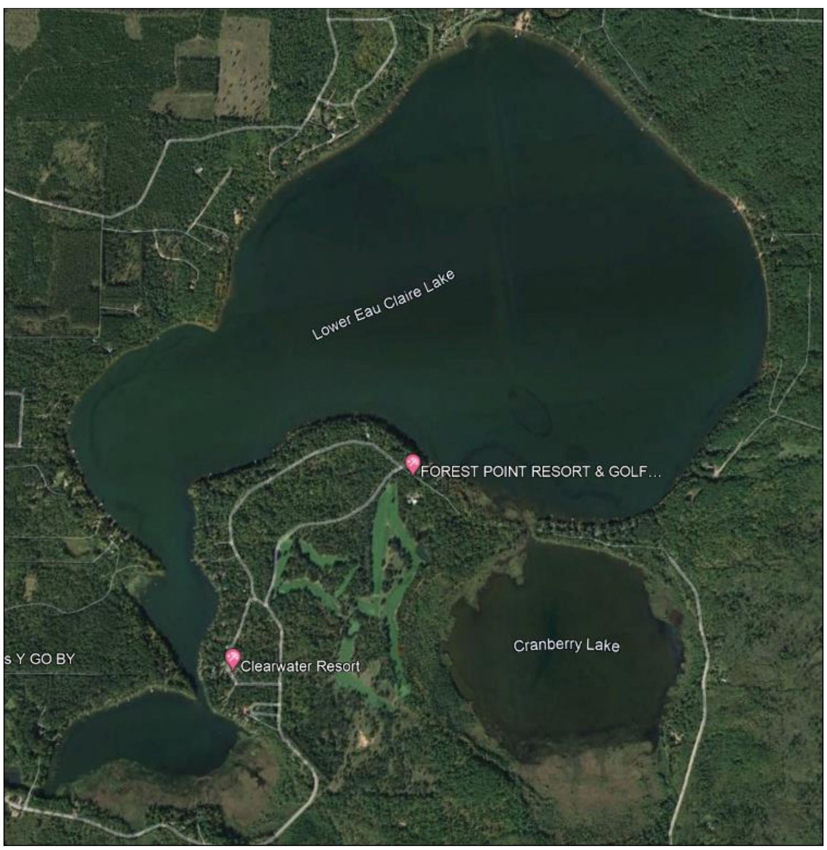
LOWER EAUCLAIRE LAKE, BAYFIELD COUNTY

2024-2028 Aquatic Plant Management Plan
WDNR WBIC: 2741600

Prepared by: Dave Blumer, Lake Educator
August 2023



Town of Barnes – Addendum 3

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1.0 Lake Characteristics

Lower Eau Claire Lake (LECL) is a 780-800 acre lake in the Eau Claire Chain of Lakes in the Towns of Barnes and Gordon in Bayfield and Douglas Counties. The Eau Claire Chain is comprised of the Upper Eau Claire, Middle Eau Claire, and Lower Eau Claire Lakes, as well as eight smaller connecting lakes for a total surface water area of 3,488 acres. LECL is accessible to the public via Mooney Dam Park and Boat Landing located at the dam on the southeast corner of the lake. Mooney Park also includes a popular public campground (Figure 1).

Fish include musky, panfish, largemouth bass, smallmouth bass, northern pike and walleye. The lake's water is moderately clear. Despite being outstanding resource water, LECL is listed as "impaired water" in the state by the WDNR because of higher than desired phosphorus levels.

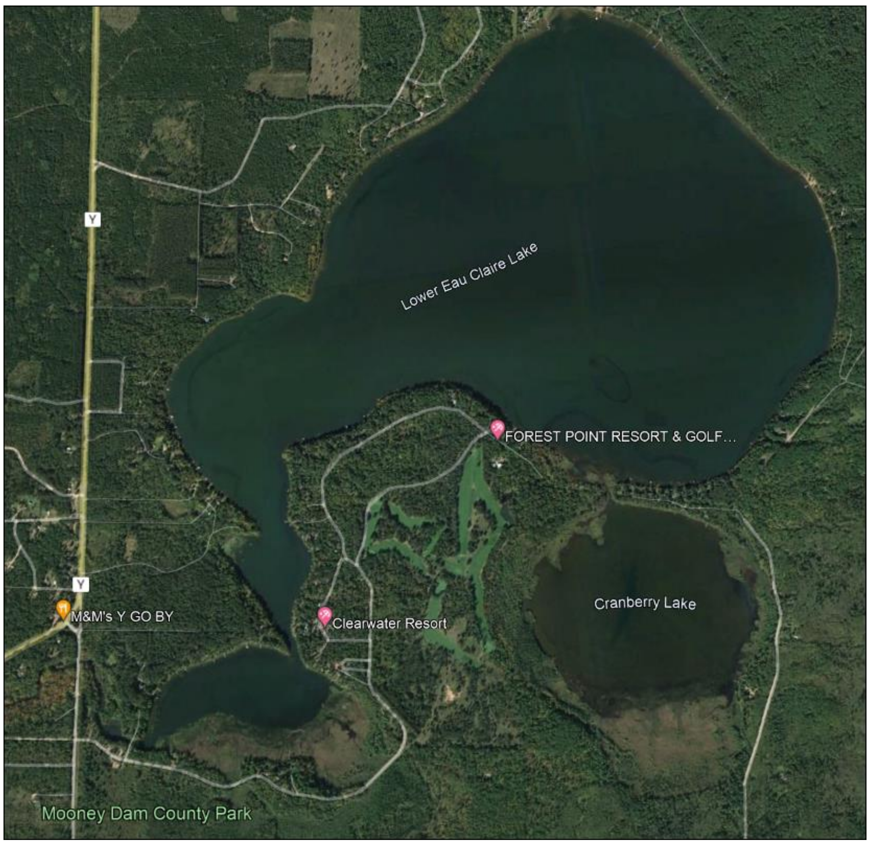

Figure 1: Lower Eau Claire Lake aerial photo and location map

LECL has a maximum depth of 42.5ft and an average depth of 20.3ft according to the most recent whole-lake, point-intercept (PI) aquatic plant survey completed in 2022. Depth soundings taken at LECL's 746 survey points revealed a wide open basin steeply sloping to deep water along the northeastern shore, and more gradually sloping from shallow water near the shore to deep water around the rest of the lake. A narrow channel moves from the main basin of the lake to the smaller, southwestern bay adjacent to the dam. Here the water is much shallower at only 16ft (Figure 2).

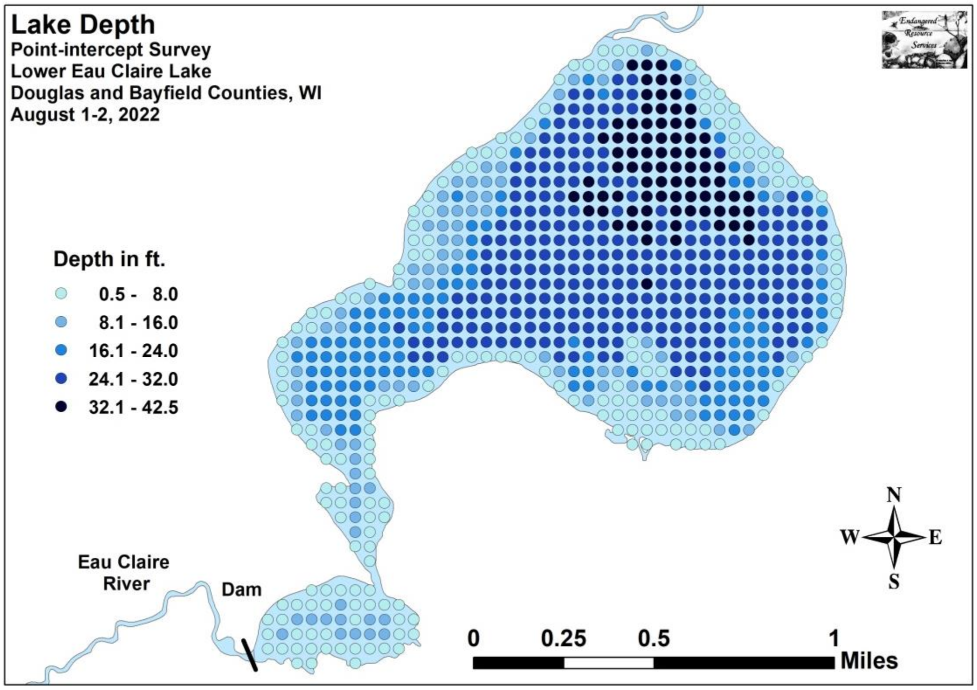

Figure 2: 2022 LECL depth

Of the points in the survey where the bottom could be determined, the main basin of the lake is predominately sand (>70%) with limited rock substrate (4.0%). The channel to the smaller northwest basin and that basin itself is where the majority of the muck bottom exists. It is in this area that CLP is found (Figure 3).

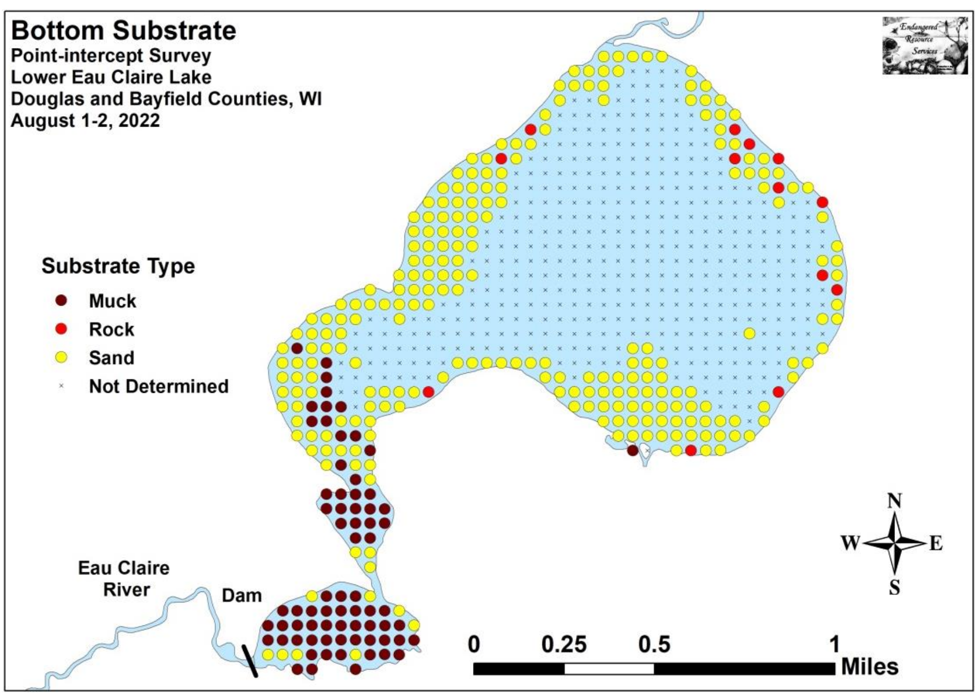

Figure 3: 2022 LECL substrate

2.0 Water Quality Data

The natural resources of the Upper, Middle, and Lower Eau Claire Lakes are a defining feature for the Town of Barnes. The Eau Claire Chain is comprised of the Upper Eau Claire, Middle Eau Claire, and Lower Eau Claire Lakes, as well as eight smaller connecting lakes for a total surface area of 3,488 acres of waters. These lakes are the headwaters of the Eau Claire River and are recognized as outstanding resource waters. These clear lakes are connected by streams with the Middle and Lower Lakes connected through a navigable channel controlled by a mechanical small boat lock.

Water quality appears to decline slightly moving downstream in this chain. Upper Eau Claire Lake (UECL) shows signs of oligotrophic characteristics while MECL and Lower Eau Claire Lake (LECL) show signs of increasing levels of fertility. Due to signs of deterioration in water quality, the Upper and Lower Lakes have been regularly monitored since 1986 through the WDNR's long term lake water quality monitoring program. MECL has been monitored by a self-help volunteer program since 1988.

The Citizen Lake Monitoring Network[1] (CLMN) is a water quality monitoring partnership between the WDNR, the Wisconsin Lakes Partnership, and over a 1,000 citizen volunteers statewide. The goals of the CLMN are to collect high quality data, to educate and empower volunteers, and to share this data and knowledge. Volunteers measure water clarity using the Secchi disk, as an indicator of water quality (based on clarity). They also comment on other parameters including lake level, water color, murkiness, and how they perceive the lake on any given monitoring date using a 1 to 5 scale with 1 being "great, fantastic" and 5 being "really bad". Volunteers may also collect chemistry data; collect temperature and dissolved oxygen data; and monitor for the first appearance of aquatic invasive species near boat landings, other access points, or along the shoreline. Volunteers on LECL have been collecting CLMN water quality data through the CLMN program since at least 1993. While a few years were missed in the late 1990's, consistent data exists between 2000 and 2022.

2.1 Secchi Readings of Water Clarity

From 1993 to 2022 the average annual Secchi disk reading of water clarity was about 16.3ft. The deepest Secchi disk reading of 39.0ft was taken in early June 2011. The worst or lowest Secchi disk reading of 2.75ft was taken in late September 2019. Based on all 282 Secchi disk readings of water clarity included in the WDNR SWIMS database from 1993 to 2022, there is a very slight, non-significant trend of better water clarity readings (Figure 4).

[1] For more information about the CLMN go to: https://dnr.wisconsin.gov/topic/lakes/clmn

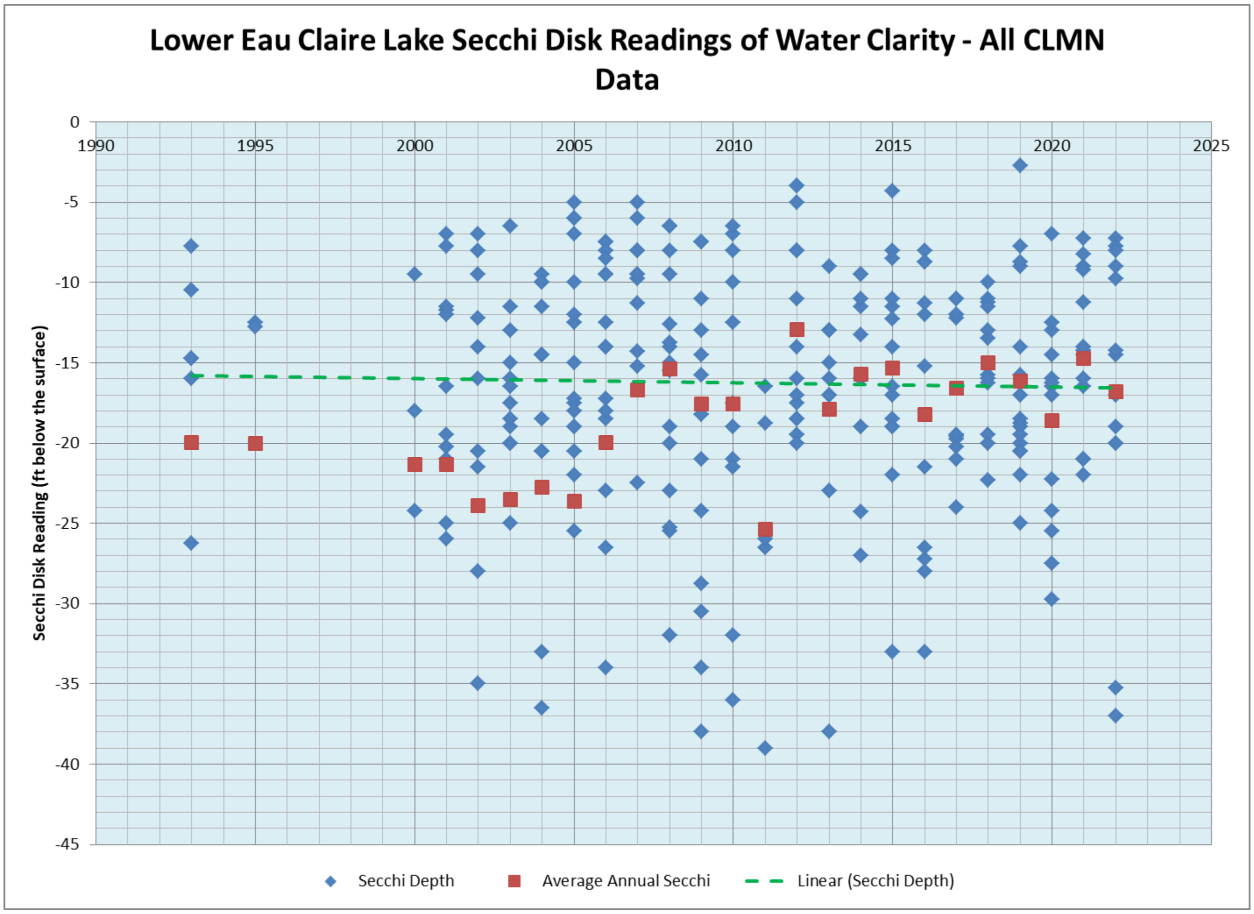

Figure 4: 1993 – 2022 Secchi depth readings, average annual readings, and trend line

Water clarity during the open water season in LECL follows the most common pattern for a stratified lake. In April, water clarity may be somewhat reduced by ice out and turnover and runoff into the lake during snowmelt. May and June present the best water clarity. Water clarity begins to worsen in July, with August and September being the worst due to warmer water and more available phosphorus supporting the growth of algae. By late October, water clarity begins to improve again as the water cools down again and algae die and sink to the bottom of the lake (Figure 5-top).

MECL follows a similar pattern except that Secchi readings do not improve as much in October (Figure 5-left). This could be due to greater phosphorous being added to the surface water during fall turnover. In UECL, water clarity is at its worst in the spring and again in the fall likely tied closely to spring and fall turnover, when water temperature is the same from the surface to the bottom of the lake (Figure 5-right).

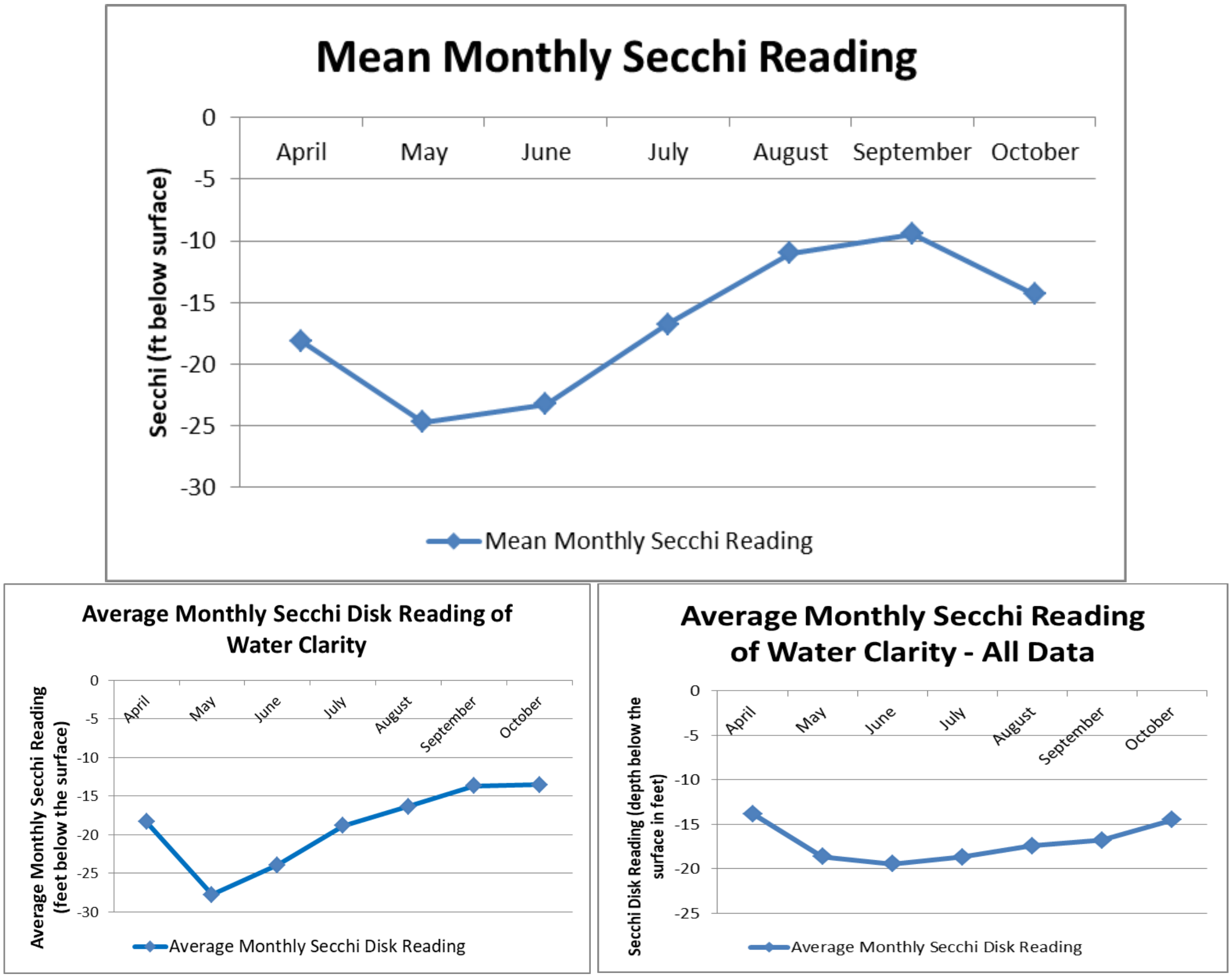

Figure 5: Average monthly Secchi depth readings Lower Eau Claire (top), Middle Eau Claire Lake (left); and Upper Eau Claire Lake (right)

2.2 Water Chemistry – TP and Chla

The "expanded" water quality monitoring level of the CLMN includes volunteers collecting Total Phosphorus (TP) and Chlorophyll-a (Chla) data along with Secchi disk readings of water clarity. TP and Chla have been collected by CLMN volunteers since 1989 with a gap from 1998 to 2002. TP concentrations appear to be less in the late 1990s, higher in the 2000s, and then dropping again in the 20-teens and early 2020s (Figure 6). A trend line for all data – 1993-2022 indicates a worsening trend with TP concentrations increasing (Figure 6). However, when looking at TP concentrations since 2003, that trend reverses and reflects decreasing concentrations (Figure 7). This is more in line with what Secchi disk readings of water clarity are reflecting.

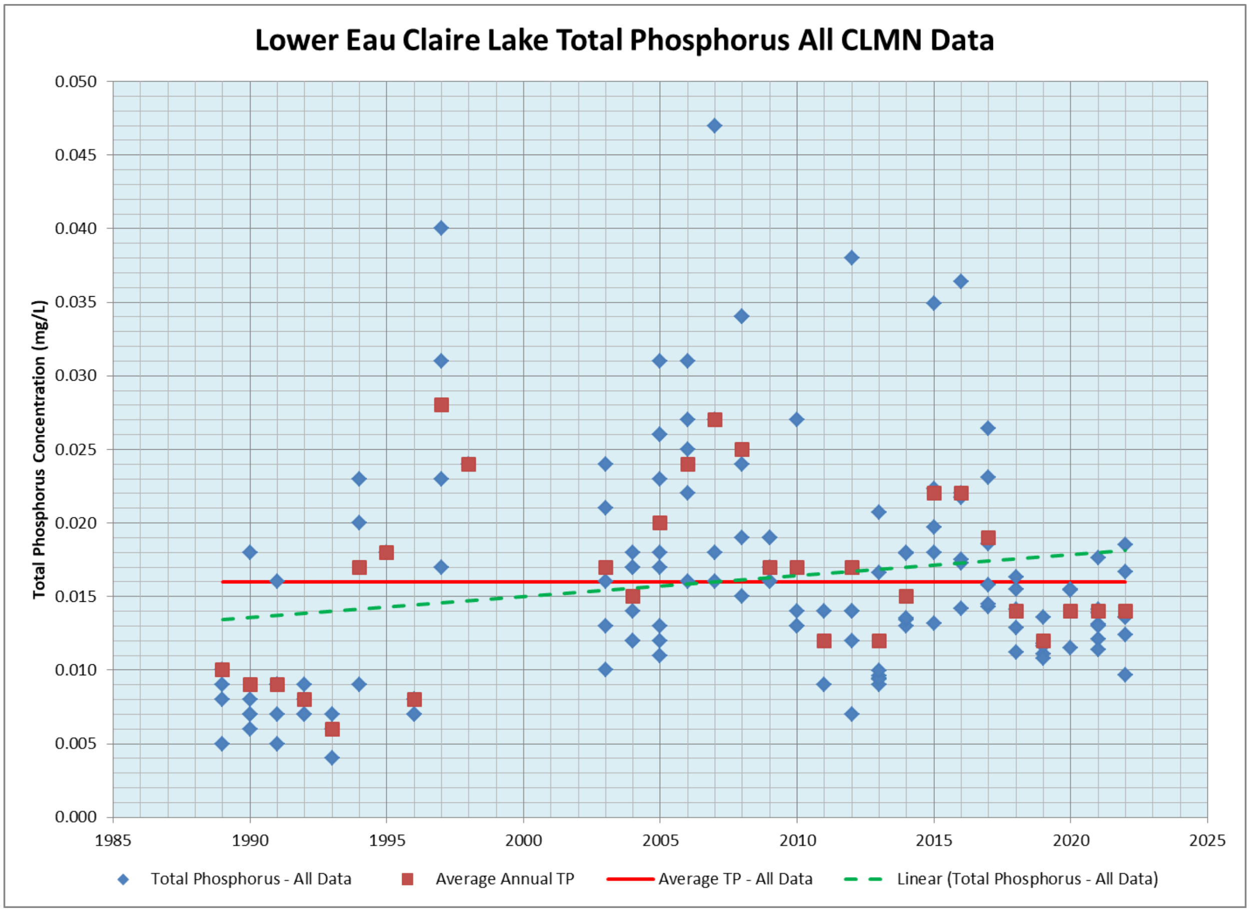

Figure 6: TP concentrations w/average annual TP and trend line

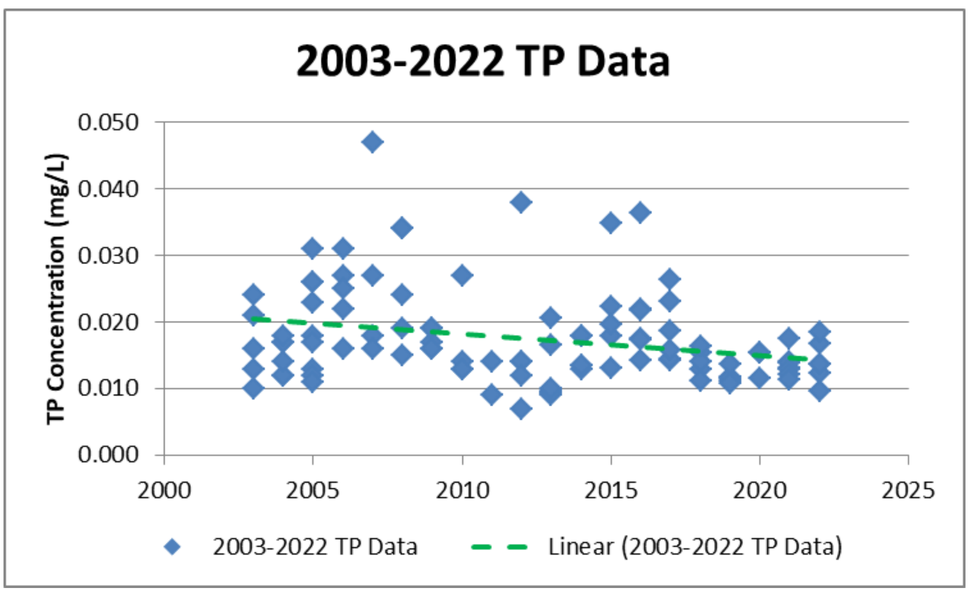

Figure 7: TP concentrations w/trend line (2003-2022)

Chlorophyll-a monitoring involves collecting water samples three times during the open water season. Chla is the pigment that makes all plants green. In a lake, Chla is used as a measurement of the amount of algae that is in the water. Chla data was been collected on LECL from 2003 to 2022. In each of those years, at least three Chla samples were collected (Figure 8). A trend line suggests that, like TP, the concentration over time has gone down, particularly in the late 20-teens and early 2020s.

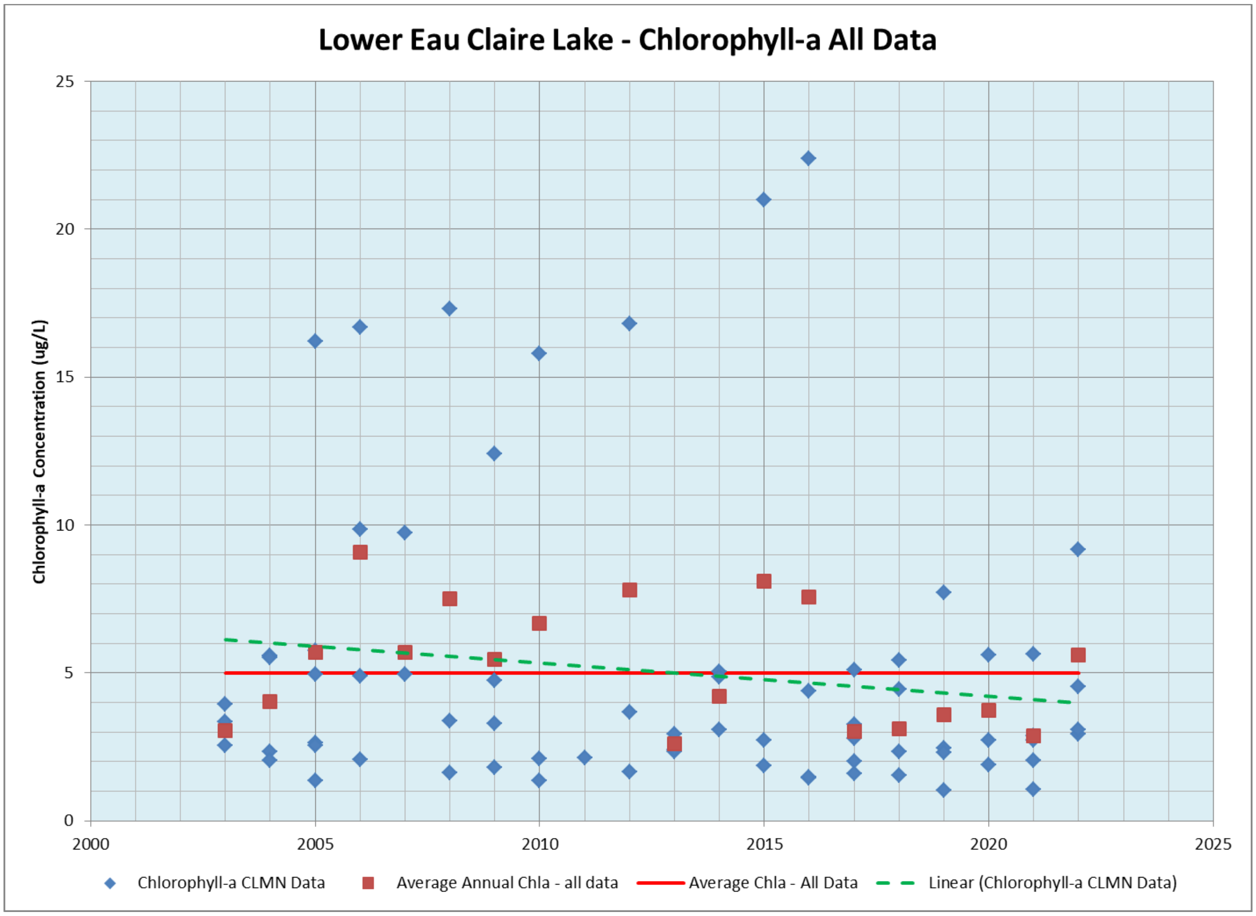

Figure 8: Chla concentrations with average annual Chla and trend line

2.3 Temperature and Dissolved Oxygen

Temperature and dissolved oxygen are important factors that influence aquatic organisms and nutrient availability in lakes. As temperature increases during the summer in deeper lakes, the colder water sinks to the bottom and the lake develops three distinct layers as shown in Figure 9. This process, called stratification, prevents mixing between the layers due to density differences which limits the transport of nutrients and dissolved oxygen between the upper and lower layers. In most lakes in Wisconsin that undergo stratification, the whole lake mixes in the spring and fall when the water temperature is between 53 and 66°F, a process called overturn. Overturn begins when the surface water temperatures become colder and therefore denser causing that water to sink or fall through the water column. Below about 39°F, water becomes less dense and begins to rise through the water column. Water at the freezing point is the least dense which is why ice floats and warmer water is near the bottom (called inverse stratification) throughout the winter.

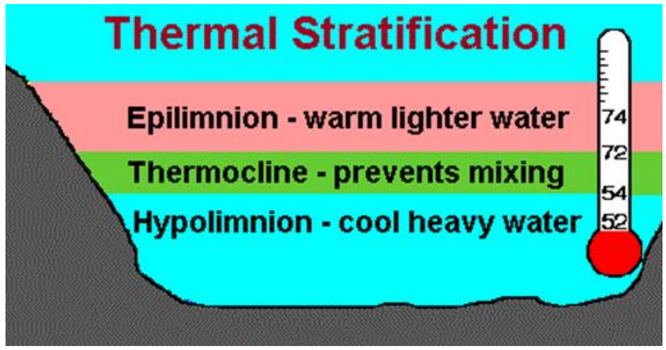

Figure 9: Summer thermal stratification

When a lake stratifies, dissolved oxygen (DO) levels in the bottom or hypolimnion portion of the lake may drop dramatically or disappear altogether. When this happens, nutrients normally trapped in the sediment can be released back into the water increasing the phosphorus available to grow more algae, degrading water quality further. If a deep lake stratifies and DO levels do not drop dramatically, that lake may support a two-story fishery – both cold water fish like cisco, trout and whitefish, as well as warm water fish like bass and walleye. The next section will discuss a two-story fishery in more detail.

Temperature and DO monitoring in the entire water column of LECL is part of the data that is collected annually. At 42ft deep and based on temperature and DO profiles taken in most of the months and years since 2003, LECL stratifies from about the middle of June through the middle of September. During that time, the thermocline becomes established between 25 and 35ft, with DO concentrations dropping below 1.0mg/L at around25ft. Enough DO is present for fish species (around 4.0mg/L) down to about 30ft in most summer sampling profiles.

The results of this data analysis corroborate what was observed in the second paragraph of Section 2.0. "Water quality appears to decline slightly moving downstream in this chain. UECL shows signs of oligotrophic characteristics while the Middle Eau Claire Lake (MECL) and Lower Eau Claire Lake (LECL) show signs of increasing levels of fertility." Hence there is a slight decline in water quality as a whole from Upper to Middle to Lower Eau Claire lakes.

2.4 Trophic State Index – Lake Productivity

Water clarity (based on Secchi disk readings), total phosphorus, and chlorophyll-a are parameters that can be used to determine the productivity or trophic status of a lake. The Carlson trophic state index (TSI) is a frequently used biomass-related index. The trophic state of a lake is defined as the total weight of living biological material (or biomass) in a lake at a specific location and time. Eutrophication is the movement of a lake's trophic state in the direction of more plant biomass. Eutrophic lakes tend to have abundant aquatic plant growth, high nutrient concentrations, and low water clarity due to algae blooms (Figure 10). Oligotrophic lakes, on the other end of the spectrum, are nutrient poor and have little plant and algae growth (Figure 10). Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms (Figure 10). Based on actual data (Secchi depth in feet and TP and Chla in ug/L), Figure 10 can be used to determine the productivity of a given lake. TP and Chla concentrations put LECL in the mesotrophic range, Secchi depth puts LECL in the oligotrophic range.

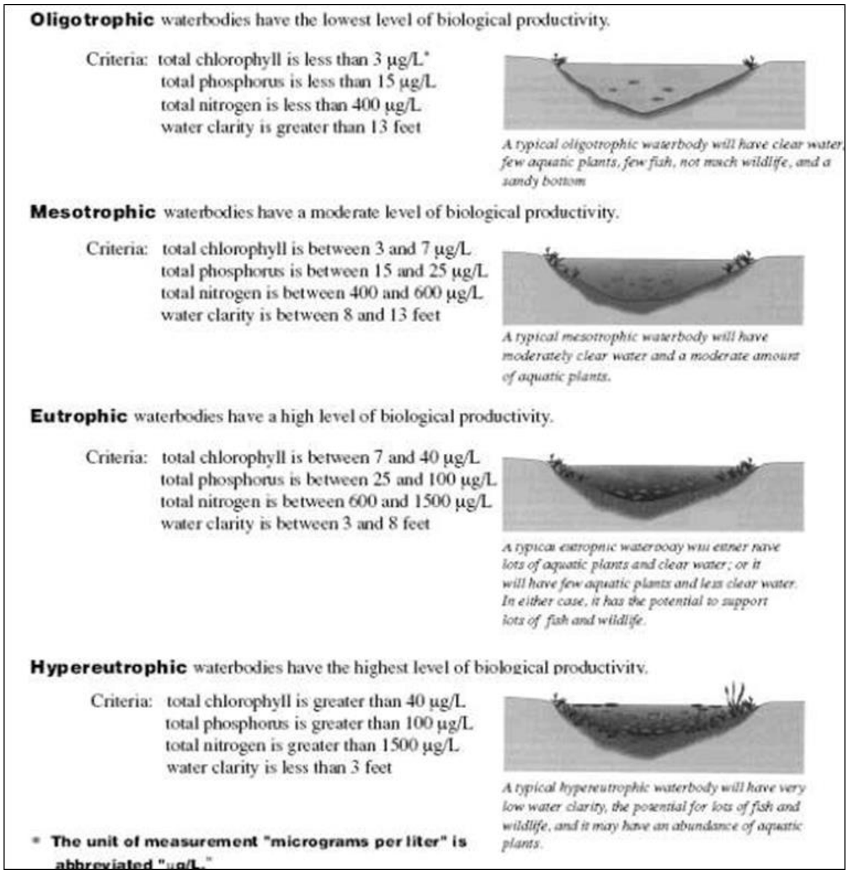

Figure 10: Trophic states in lakes

The TSI scale runs from "0" to "100". Generally, TSI values from 0-40 are considered oligotrophic, 40-50 are mesotrophic, 50-70 are eutrophic, and anything above 70 is considered hypereutrophic (Table 1).

Table 1: TSI Scale (Cedar Corporation, 2006)

Table 3-4: Trophic State Index (TSI)		
TSI Value	**Water Quality Attributes**	**Fisheries, Recreation or Example Lakes**
<30	**Oligotrophic:** Clear water, oxygen through the year in the hypolimnion. Water supply may be suitable unfiltered.	Salmonid fisheries dominate.
30-40	Hypolimnia of shallower lakes may become anoxic during the summer.	Salmonid fisheries in deep lakes only. Example: Lake Superior (WDNR)
40-50	**Mesotrophic:** Water moderately clear but increasing probability of anoxia in hypolimnion during summer. Possible iron, manganese, taste and odor problems may worsen in water supply. Water turbidity requires filtration.	Walleye may predominate and hypolimnetic anoxia results in loss of salimonoids.
50-60	**Eutrophic:** Lower boundary of classic eutrophy. Decreased transparency, anoxic hypolimnion during the summer, macrophyte problems evident, warm water fisheries dominant.	Bass may dominate.
60-70	Dominance of blue-green algae, algal scums probable, extensive macrophyte problems. Possible episodes of severe taste and odor from water supply. Anoxic hypolimnion, water-water fisheries.	Nuisance macrophytes, algal scums and low transparency may discourage swimming and boating.
70-80	**Hypereutrophic:** Light limited productivity, dense algal blooms and macrophyte beds.	Lake Menomin & Tainter Lake, Dunn County, WI (WDNR).
>80	Algal scums, few macrophytes, summer fishery kills.	Dominant rough fish.

The measurements of all three parameters (Secchi - feet, TP & Chla - µg/L) can be converted to values that fit in the TSI range of 0 to 100. By doing so, all three can be compared together to establish trends (Figure 11). The dark blue area of Figure 11 is considered oligotrophic; the light blue mesotrophic; and the green eutrophic. In the last 10 years or so, almost all values fall in the mesotrophic range on the chart. There is a period of time between 2003 and 2010 where the values for TP and Chla fell more consistently in the eutrophic range of the chart. Data from the last 10 years is more similar to the values in the 1990s again suggesting water quality is getting better, or at least going back to what it was.

TSI data can be used for more than just visualizing trends. Over time, several familiar patterns emerge from the data. Carlson and Havens (2005) discussed the patterns that frequently emerge when looking at long-term trend data and TSI values. Since TP and Chla monitoring began, TP has been consistently higher than Chla, which has been consistently higher than Secchi (Figure 11). This pattern suggests that zooplankton grazing has reduced the number of smaller particles, leaving larger particles. Biomass has been reduced below levels predicted from total phosphorus. From a water quality perspective, this pattern suggests that there might be good potential to control algae blooms (or prevent them from happening) with biomanipulation of the planktonic food web (e.g. increasing the biomass of large zooplankton (Carlson & Havens, 2005).

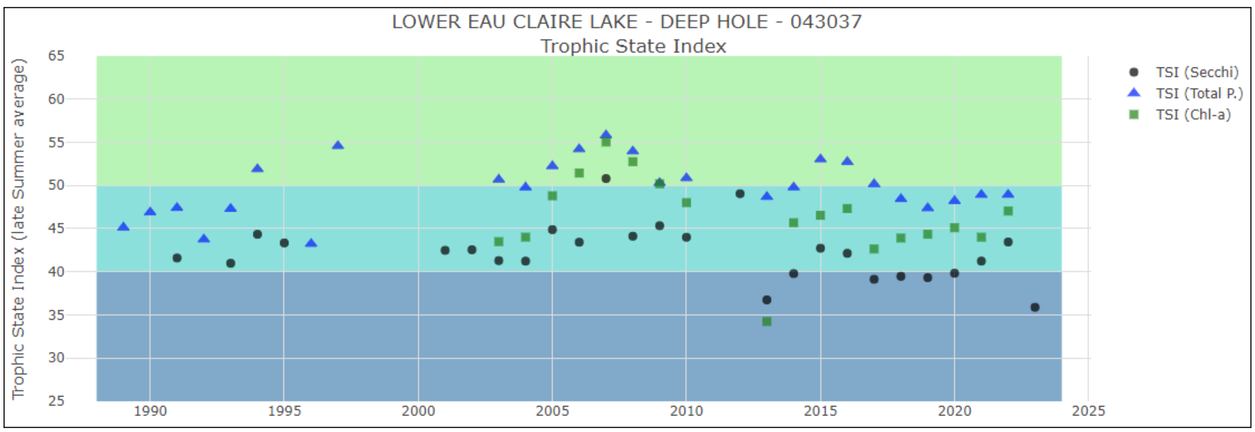

Figure 11: Yearly TSI values for Chla, Secchi (water clarity), and TP (CLMN)

3.0 Fisheries and Wildlife

As previously mentioned, LECL is considered an outstanding resource water by the WDNR. It is also listed as a Priority Navigable Water (PNW) for musky and walleye. Much of the data included in this section is from the last comprehensive fishery survey completed by the WDNR on LECL in 2008 (Toshner, 2010).

3.1 Fisheries

Lower Eau Claire Lake has a diverse fishery consisting of walleye, muskellunge, northern pike, largemouth bass, smallmouth bass, bluegill, pumpkinseed, rock bass, black crappie, yellow perch, warmouth, white sucker, yellow bullhead, creek chub, tadpole madtom, brook stickleback, johnny darter, Iowa darter, brook silverside, bluntnose minnow, common shiner, spottail shiner, mimic shiner, blackchin shiner, and golden shiner. Historic records indicate the presence of lake sturgeon and cisco, however recent surveys have not recorded the presence of these species. Rainbow trout were stocked in the mid-1980s to early 1990s but are no longer expected to be present in Lower Eau Claire Lake.

Historic fisheries management of Lower Eau Claire Lake has included surveys, stocking, and various length and bag regulations. Historic surveys for walleye occurred 6 in 1993 and 1995 utilizing Wisconsin Department of Natural Resources (WDNR) standardized treaty protocols (Hennessey 2002) and a survey in 1983 which utilized fyke nets for both mark and recapture periods for estimating population abundance. Additional walleye surveys estimating adult population were conducted by the Great Lakes Indian Fish and Wildlife Commission (GLFWC) in 1991 and 2001 using a different sampling protocol, i.e. electrofishing to both mark and recapture walleye. A historic panfish survey was conducted by WDNR in 1983. Basic fishery surveys utilizing a variety of gear types were conducted by WDNR in 1948, 1965 and 1971-1972. Fall electrofishing surveys were conducted annually to assess recruitment of walleye from 1985 to 2007, with the exception of 1989.

Lower Eau Claire Lake has a long stocking history and has been stocked with a number of fish species, including walleye, muskellunge, largemouth bass, bluegill and rainbow trout, since at least 1936 (Table 2). Nearly annual walleye and muskellunge stocking occurred from at least 1936 to 1971, when over 10,600,000 fry and over 208,900 small fingerling walleye were stocked and 246,500 fry and 5,400 fingerling muskellunge were stocked into Lower Eau Claire Lake. Since 1971, muskellunge have been stocked generally on an every other year basis. The only walleye stocking that has occurred since 1971 was in 1992 and 1993 when the Eau Claire Conservation Club cooperatively stocked fingerling walleye. Walleye stocking was discontinued after 1971 based on the appearance of good natural reproduction reported in the 1973 fishery survey report (Wistrom 1973). Muskellunge stocking which occurred nearly annually from 1939 to 1947 and then discontinued for unknown reasons was initiated again in 1984 due to a recommendation from a 1984 fishery survey report that called for an additional shallow water predator that would help control abundant slow growing panfish (Schram 1984). Since 2002, muskellunge stocking has occurred on an alternate basis at a rate of 0.5 fish/acre, with the exception of 2006 which had a stocking rate of 0.25/acre. Also, due to a recommendation from the 1984 fishery survey report rainbow trout were stocked in 1985, 1988 and 1991 but since survival was considered to be poor the stocking was discontinued after 1991

Recent management has focused on fishery surveys and woody habitat restoration. In addition, a critical habitat designation survey was begun in the summer of 2008. The objective of the 2007-2008 survey was to determine the status of the walleye and bass populations, along with sport and tribal use of these species. More specifically, we were interested in determining population abundance, growth, size structure and harvest of walleye and abundance and size structure of panfish.

In the 2007/08 Fisheries Report there are many fish management recommendations. The last one, however, is most pertinent to this APM Plan.

"Protection of inshore habitat is important for long-term health of fisheries. Schram (1984) recognized the importance of monitoring development to ensure that aquatic plants, spawning substrates and water quality were protected. Work with local residents, the Eau Claire Lakes Conservation Club, the Eau Claire Lake Property Owners Association and the WDNR lake grants program to create and adopt a lake management plan and aquatic plant management plan: 1) develop management objectives for fisheries including goals for densities and size structures for the various fish species found in the lake, 2) where the public is willing implement recommendations from the critical habitat designation process, 3) continue restoring woody habitat along conducive shorelines working with willing riparian landowners, 4) formally establish exotic species survey and control programs targeting satellite infestations, 5) provide educational and participation forum for environmentally sensitive shoreline living, 6) identify uses and user groups to facilitate all recreational uses on the lake, 7) continue water quality monitoring through the self help lake monitoring program. No amount of regulation or stocking practices will change the need for healthy aquatic environments. Although water quality remains high, habitat loss, declining shoreline aesthetics, and exotic introductions are warning signs of cultural disturbances that are degrading ecosystem health. Preserving and enhancing the ecosystem and vigilance for exotic species must continue and shoreline restoration projects in areas that are currently lacking buffers should be explored. Preventing the spread of exotics and enhancing habitat through restoration projects, as well as preserving the existing habitat will be far more beneficial than losing what is currently present and relying on stocking and artificial habitat improvements to maintain the fishery and ecosystem as a whole."

Table 2: WDNR stocking of musky, walleye, and rainbow trout

Stocking Year	Stocked Waterbody Name	Species	Age Class	Number Fish Stocked	Avg Fish Length(IN)
2021	LOWER EAU CLAIRE LAKE	WALLEYE	LARGE FINGERLING	8624	6.7
2019	LOWER EAU CLAIRE LAKE	WALLEYE	LARGE FINGERLING	7844	6.3
2017	LOWER EAU CLAIRE LAKE	WALLEYE	LARGE FINGERLING	7463	6.5
2015	LOWER EAU CLAIRE LAKE	WALLEYE	LARGE FINGERLING	7844	7.4
2010	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	LARGE FINGERLING	176	12.7
2006	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	LARGE FINGERLING	110	12.4
2004	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	LARGE FINGERLING	401	10.8
2002	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	LARGE FINGERLING	401	11.4
2000	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	LARGE FINGERLING	800	12.1
1998	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	LARGE FINGERLING	700	12.5
1997	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	LARGE FINGERLING	400	12.1
1996	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	FINGERLING	800	11.6
1993	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	FINGERLING	800	11.9
1992	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	FINGERLING	800	10
1992	LOWER EAU CLAIRE LAKE	WALLEYE	FINGERLING	11250	3.6
1991	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	FINGERLING	800	10
1991	LOWER EAU CLAIRE LAKE	RAINBOW TROUT	YEARLING	2500	9
1989	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	FINGERLING	400	11
1988	LOWER EAU CLAIRE LAKE	RAINBOW TROUT	YEARLING	2500	9
1985	LOWER EAU CLAIRE LAKE	RAINBOW TROUT	YEARLING	2500	9
1984	LOWER EAU CLAIRE LAKE	MUSKELLUNGE	FINGERLING	800	9.5

3.1.1 Two-Story Fishery

LECL is considered a "two-story" fishery by the WDNR, but in the 2021 revisions to the WDNR list of two-story fisheries, it is considered to only have marginal habitat. A two-story fishery is a lake capable of supporting warm-water species like bass and northern pike in its warm, “top story”, while at the same time, capable of supporting cold-water species like cisco or whitefish in its deeper, colder, well-oxygenated “lower story”. In Wisconsin there are only about 200 of these lakes. Recent WDNR documentation (Minahan, 2017) suggests that cisco need DO levels >6.0mg/L and water temperatures <73°F to survive in a lake. The survival of cold water fish species like cisco depends on conditions in and below the thermocline that allow them to move up in the water column as oxygen levels in the bottom of the lake decline, while at the same time staying in cold enough water to keep them alive (Figure 12).

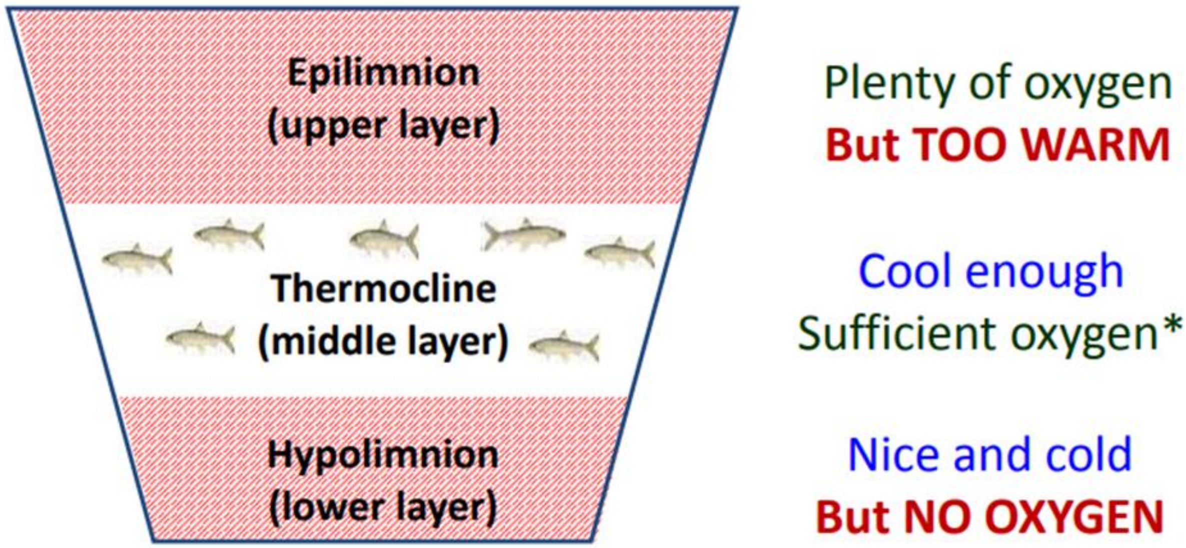

Figure 12: Lake stratification zones necessary to support a two-story fishery (Minahan, 2017)

Cold-water habitat in lakes is by its very nature fragile and imperiled. As organic matter dies and sinks, its decay uses up oxygen in deeper water. The amount of decay and the rate of oxygen loss depend upon how fertile the lake is. Imagine a first floor (lower story) where the floor and ceiling squeeze together for three or four months. Then a “normal” September brings surface cooling. Cisco and whitefish squeezed by low oxygen in the first floor now have an open stairway to the second floor (top story) because surface waters are now cool enough to meet their survival needs. If, however, summer hangs on well into September, a full month of squeeze is added and the proverbial stairs are blocked. The basement is plenty cold, but devoid of oxygen most of the time during the summer. The lower story can become devoid of oxygen as well, and if at the same time, the surface waters remain too warm, there is no escape. Under these conditions, the cold water fishery suffers. Longer summers and warmer temperatures brought on by climate change lead to even greater loss of oxygen in the “basement” and “first floor”.

3.2 Critical Habitat

Every body of water has areas of aquatic vegetation that offers critical or unique fish and wildlife habitat. Such areas can be identified by the WDNR and identified as Sensitive Areas (critical habitat) per Ch. NR 107. A sensitive areas survey was completed on LECL by the WDNR in 2013 Smith et al. (2013). Figure 13 shows the critical habitat areas in LECL identified by the WDNR in 2013. Aquatic habitat areas provide the basic needs (e.g. habitat, food, nesting areas) for waterfowl, fish, and wildlife. Tables 3 and 4 provide greater detail about each of the critical habitat areas identified on the lake. Disturbance to these areas should generally be avoided or minimized and chemical treatment is generally not allowed. Areas of rock and cobble substrate with little or no fine sediment are considered high quality walleye spawning habitat. No dredging, structures, or deposits should occur in these sensitive areas. Further details for each sensitive area can be found in the LECL Critical Habitat Designation Report Smith et al. (2013).

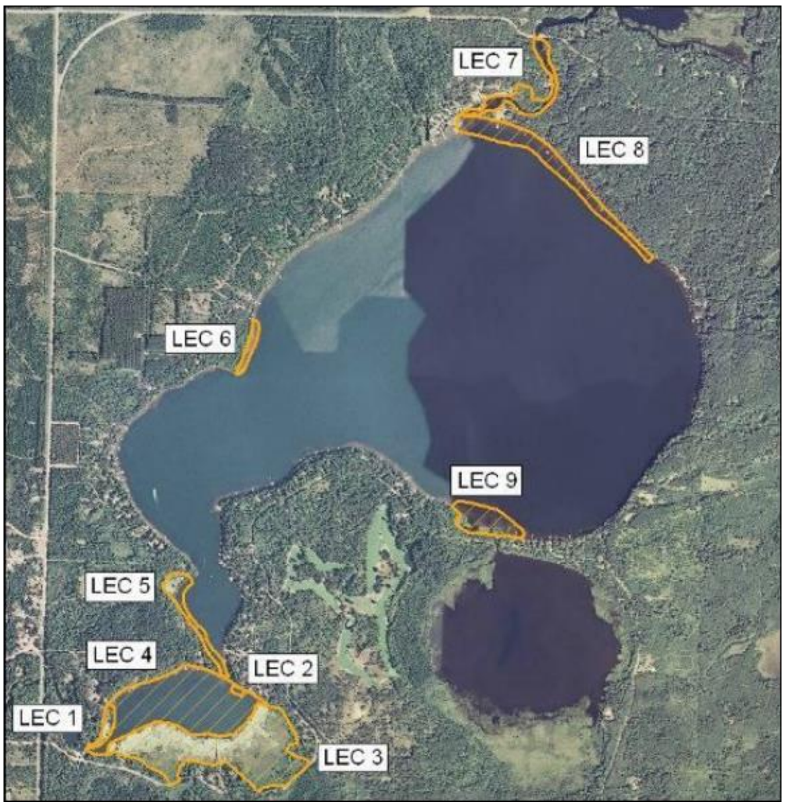

Figure 13: Lower Eau Claire Lake Critical Habitat Map (Smith et al. 2013)

Table 3: Lower Eau Claire Lake Critical Habitat Polygon Justifications

Critical Habitat Polygon ID	Acres	Justification	Justification	Justification	Justification	Justification	Justification	Classification
LEC 1	1.8	3	2	-	-	-	-	Sensitive Area
LEC 2	0.4	3	-	-	-	-	-	Sensitive Area
LEC 3	39.7	3	7	6	-	-	-	Sensitive Area
LEC 4	35.0	2	-	-	-	-	-	Sensitive Area
LEC 5	5.0	7	3	2	-	-	-	Sensitive Area
LEC 6	1.7	7	-	-	-	-	-	Public Rights Feature
LEC 7	7.4	8	11	7	2	3	6	Sensitive Area
LEC 8	14.1	8	7	-	-	-	-	Public Rights Feature
LEC 9	7.4	4	-	-	-	-	-	Sensitive Area

Table 4: Critical Habitat Justification Descriptions

Justifications	Justification Feature	Classification
1	Bio-diverse Submerged Aquatic Vegetation (SAV)	Sensitive Area
2	SAV Important to Fish and Wildlife Habitat	Sensitive Area
3	Emergent and Floating Leaf Vegetation	Sensitive Area
4	Rush Beds	Sensitive Area
5	Wild Rice Bed	Sensitive Area
6	Extensive Riparian Wetland	Sensitive Area
7	Woody Habitat	Public Rights Feature
8	Spawning Substrate	Public Rights Feature
9	Water Quality (springs, etc)	Public Rights Feature
10	Natural Scenic Beauty	Public Rights Feature
11	Navigational Thoroughfare	Public Rights Feature

3.2.1 Natural Heritage Inventory

The Natural Heritage Inventory (NHI) database contains recent and historic observations of rare species and plant communities. Each species has a state status including Special Concern (SC), Threatened (THR) or Endangered (END). On the county level (Bayfield/Douglas County), there are well over 100 communities, birds, plants, insects, fish, mammals, mussels, reptiles, and amphibians included in the NHI list. On a township level, the township and range that LECL is in lists only three – a lake community, a fish species (Least Darter), and the Bald Eagle.

Three invasive species have been officially verified within LECL: curly-leaf pondweed, Banded mystery snails, Rusty crayfish and purple loosestrife, yellow iris may also be present.

4.0 Aquatic Plant Surveys

While there is always some natural variation from year to year in the makeup of the aquatic plant community in a lake, human changes to a lake, including management of an invasive species like CLP, may have a more obvious impact to aquatic plants. Under active management, it is recommended by the WDNR that whole-lake, point-intercept, aquatic plant surveys be completed at least every five years. There has been only one such survey completed in LECL, in 2022 by Matt Berg of Endangered Resource Services (ERS). Only data from the 2022 survey is included in this document. There is no comparison of 2022 data to previous data.

Two years of CLP bed mapping survey work has been completed and is presented in this document.

4.1 2022 Early Season, Whole-lake, CLP Point-intercept Surveys

Information in the next several sections related to plant survey work completed in the lake, is taken in part from data collected and reports written by ERS but not published yet.

Using a standard formula that takes into account the shoreline shape and distance, islands, water clarity, depth, and total acreage, Jennifer Hauxwell (WDNR) generated the original 746-point sampling grid for Lower Eau Claire Lake. Using this grid, a density survey where CLP was sampled for at each point in and adjacent to the lake's littoral zone was completed in 2022. Each survey point was located using a handheld mapping GPS unit (Garmin 76CSx) and used a rake to sample an approximately 2.5ft section of the bottom. When found, CLP was assigned a rake fullness value of 1-3 as an estimation of abundance. Visual sightings of CLP within six feet of the sample point were also noted.

Following the establishment of the June 2022 littoral zone at approximately 14.0ft of water, survey results showed CLP was present in the rake at two sample points with one additional visual sighting. This extrapolated to 0.004% of the entire lake and 1.2% of the 242-point littoral zone having at least some CLP present. One point with CLP on the rake rated a density of 3 and the other a density of 1, for an average density of 2 on a 0-3 scale. All three points with CLP were located in that area of the lake with a muck bottom – the channel to the southwestern bay and the southwestern bay (Figure 14).

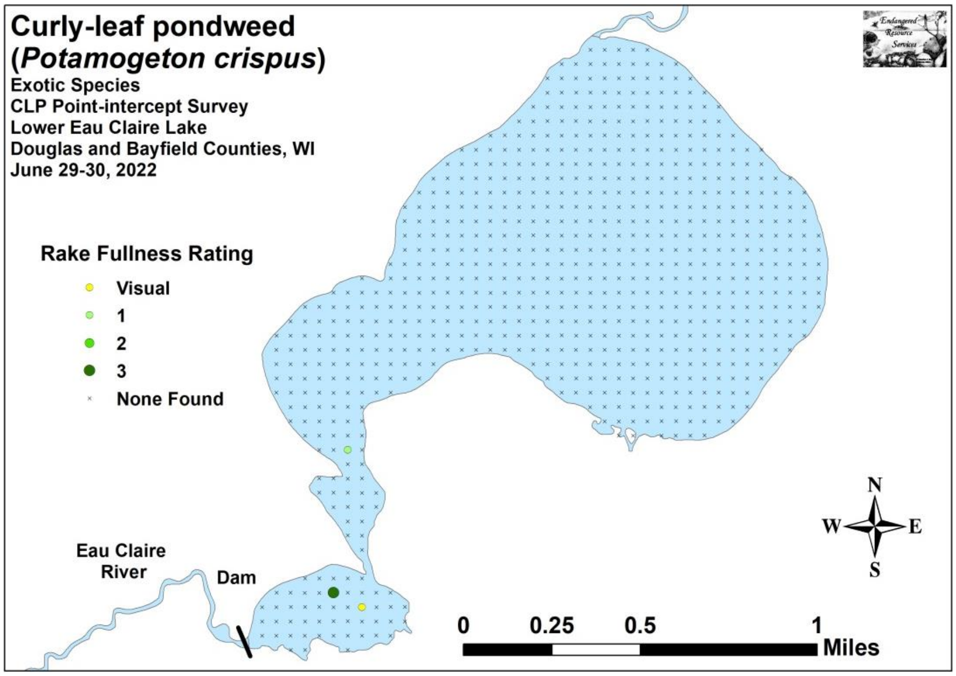

Figure 14: 2022 spring CLP density and distribution

4.2 2022 and 2023 CLP Bed Mapping

During a bed mapping survey, the lake's entire visible littoral zone is searched. By definition, a "bed" is determined to be any area where CLP was visually estimated to make up >50% of the area's plants, is generally continuous with clearly defined borders, and is canopied, or close enough to being canopied that it would likely interfere with boat traffic. After a bed is located, GPS coordinates are taken at regular intervals while motoring around the perimeter of the area. The GPS points are used to create maps with the acreage of each area. The rake density range and mean rake fullness of each area or bed mapped is also estimated. The maximum depth of the bed, whether it was canopied, and the impact it was likely to have on navigation (none – easily avoidable with a natural channel around or narrow enough to motor through/minor – one prop clear to get through or access open water/moderate – several prop clears needed to navigate through/severe – multiple prop clears and difficult to impossible to row through) is also recorded.

The first CLP bed mapping survey on LECL was completed in 2022. Bed mapping was repeated in 2023. During the 2022 six beds of CLP were mapped totaling 0.11 acres, way less than even a tenth of a percent of the entire surface area of the lake (Figure 15). In 2023, CLP had expanded in pretty much the same areas with 7 beds mapped (Figure 15). The total acreage has not been calculated yet, however, it is expected to be more than triple what was mapped in 2022. All of the beds were in the shallow southwestern bay adjacent to the dam.

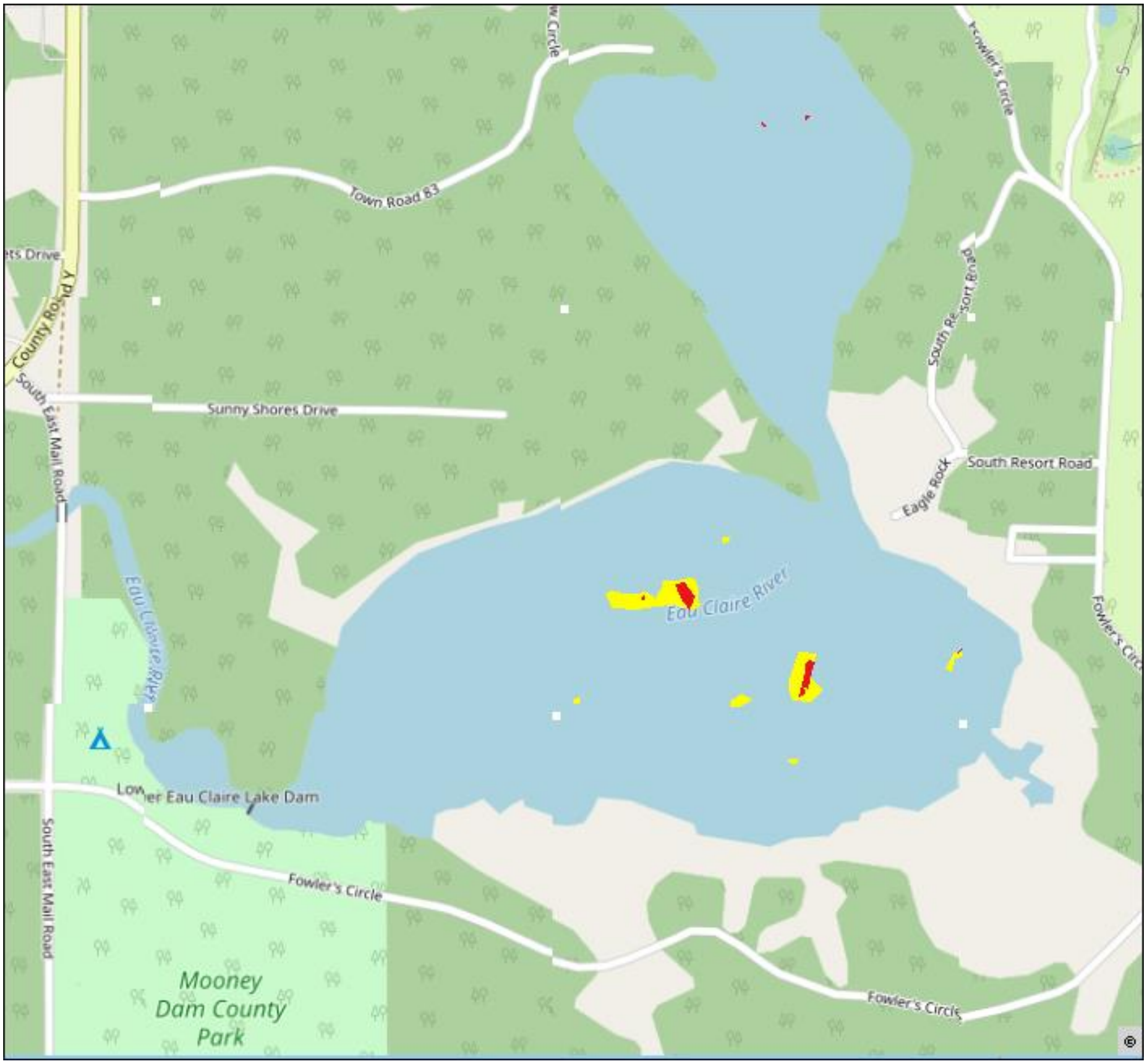

Figure 15: 2022 (red) and 2023 (yellow) CLP bed mapping results (ERS)

4.3 2022 Warm-water Whole-lake, Point-intercept Aquatic Plant Survey

During the August 2022 whole-lake, point-intercept survey, aquatic plants were found at 266 sites (35.7% of the whole lake and 84.7% of the 19.5ft littoral zone) (Table 5, Figure 16). Plant growth in 2022 was strongly skewed to deep water as the mean depth of 7.7ft was much greater than the median depth of 6.5ft (Table 5).

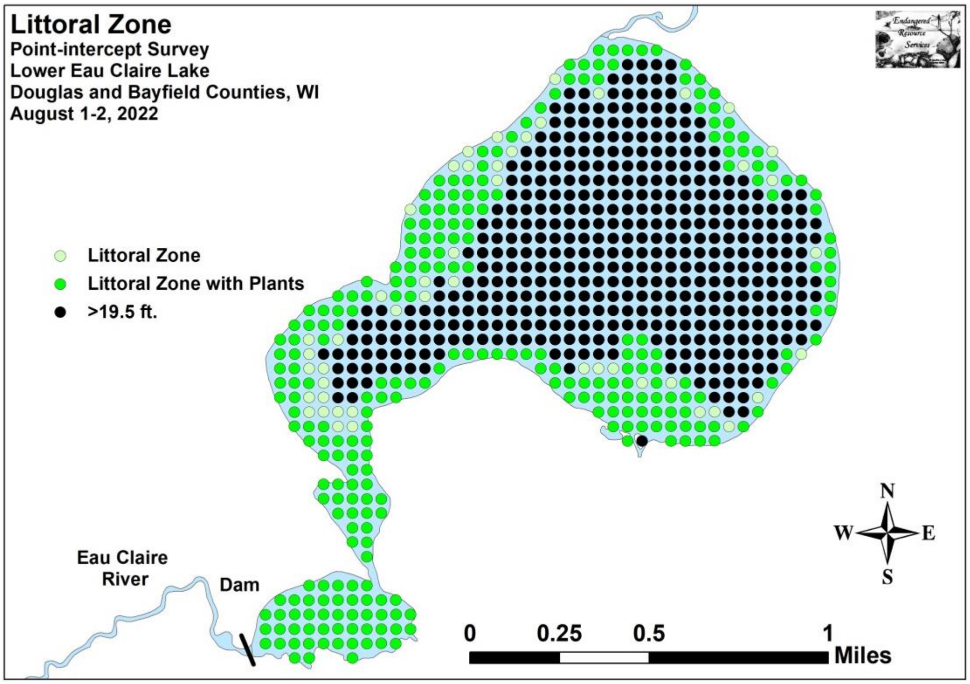

Figure 16: 2022 littoral zone

Plant diversity was exceptionally high in 2022 with a Simpson Index value of 0.95 (Table 5). Total species richness was also high with 66 species (including rake, visuals, and boat survey) found in and immediately adjacent to the lake in 2022. Mean native species richness at sites with native vegetation was 3.24 and density (rake fullness) was 1.87 on a scale from 0-3 (Table 5). The distribution of aquatic plants at each point and the density of vegetation at each point can be seen in Figures 17 & 18.

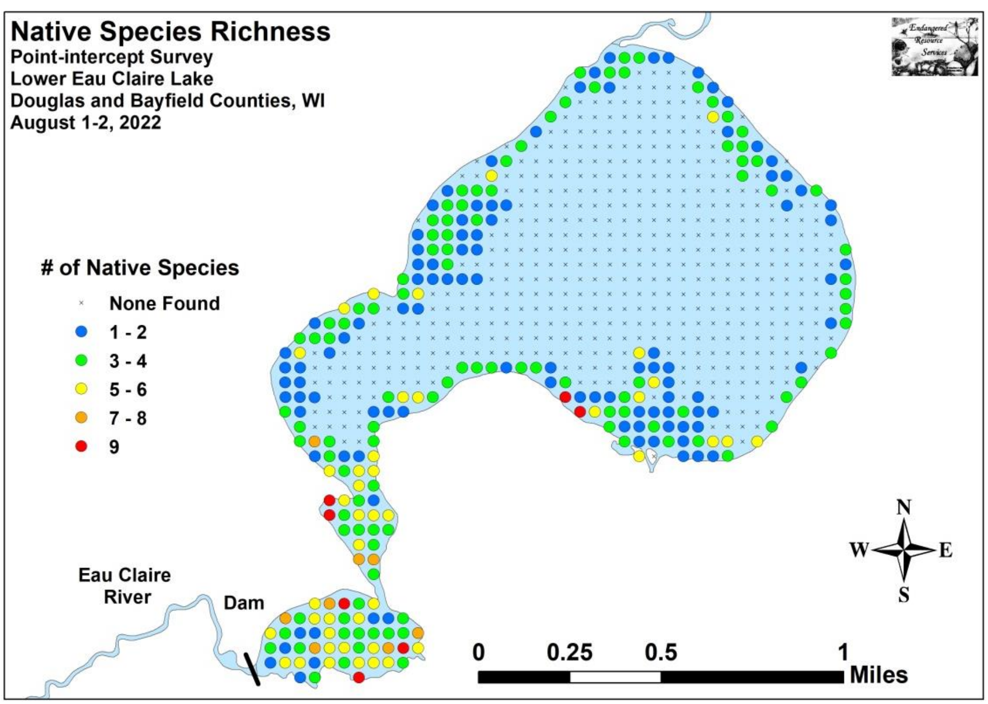

Figure 17: 2022 native species richness

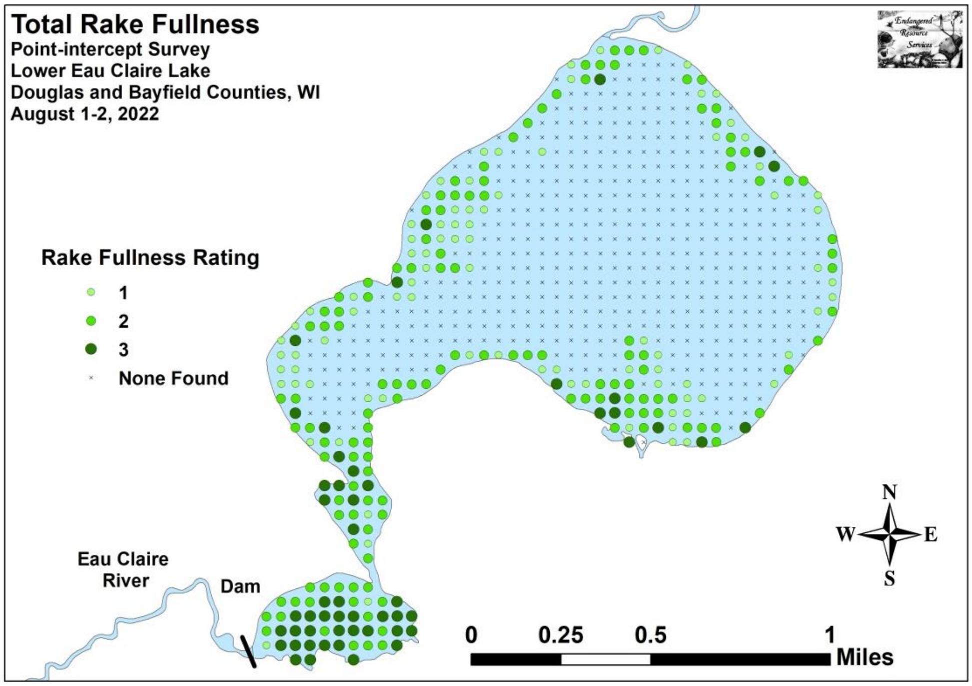

Figure 18: 2022 total rake fullness

Table 5: 2022 aquatic plant PI survey statistics

SUMMARY STATS: Lower Eau Claire Lake	2022
Total number of sites visited	746
Total number of sites with vegetation	266
Total number of sites shallower than maximum depth of plants	314
Frequency of occurrence at sites shallower than maximum depth of plants	84.71
Simpson Diversity Index	0.95
Maximum depth of plants (ft)**	19.50
Number of sites sampled using rake on Rope (R)	0
Number of sites sampled using rake on Pole (P)	321
Average number of all species per site (shallower than max depth)	2.75
Average number of all species per site (veg. sites only)	3.25
Average number of native species per site (shallower than max depth)	2.75
Average number of native species per site (veg. sites only)	3.24
Species Richness	49
Species Richness (including visuals)	55
Species Richness (including visuals and boat survey)	66
Mean depth of plants (ft)	7.71
Median depth of plants (ft)	6.50
Mean rake fullness (veg. sites only)	1.87

The three most common aquatic plant species in LECL are Northern watermilfoil, Muskgrass, and Slender naiad (Figure 19). Given that Northern watermilfoil (NWM) was the most common aquatic plant species, greater concern should be had for the introduction of EWM into LECL. EWM would likely flourish in the same areas that NWM currently grows (Figure 20). The next three most common plant species are Coontail, Wild celery, and Small pondweed (Figure 21). Ten more species were identified at more than 20 points each.

Figure 19: Northern watermilfoil, Muskgrass, and Slender naiad (ERS)

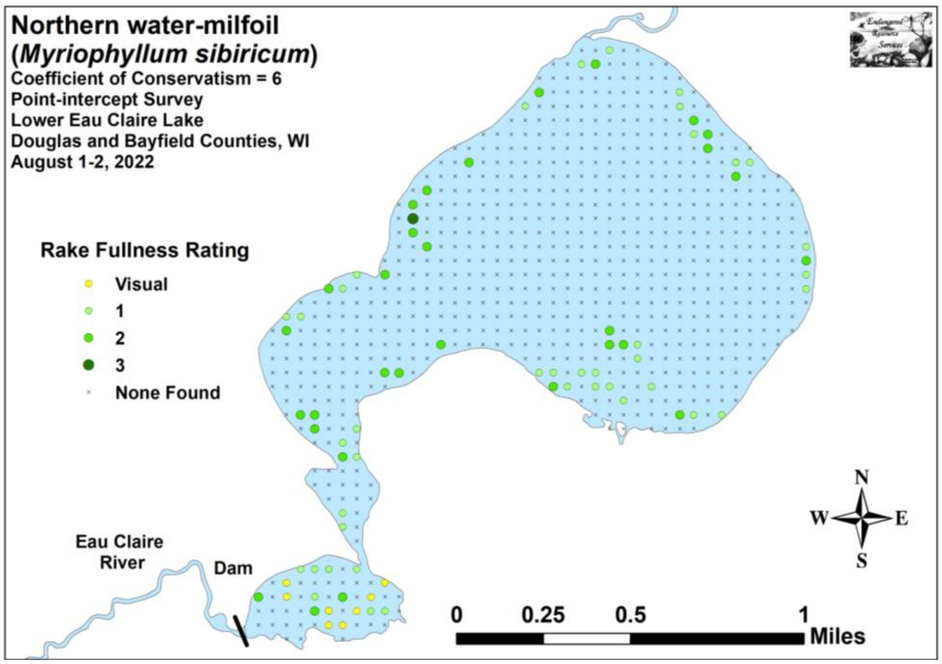

Figure 20: Northern watermilfoil distribution and density in LECL (ERS)

Figure 21: Coontail, Wild celery, and Small pondweed (ERS)

4.3.1 2022 Floristic Quality Index

The FQI 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. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, North Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Upper Eau Claire Lake is in the Northern Lakes and Forests Ecoregion.

Aquatic plant species are only included in calculating the FQI if they are identified on a rake. Visuals or plants identified during the boat survey are not included in the index and are excluded from FQI analysis. The 2022 point-intercept survey identified a total of 45 native index plants in the rake. They produced a mean Coefficient of Conservatism of 6.4 and a FQI of 43.2 (Table 6). Nine of the species identified were given Cs of 9 or 10 (one species had a C of 10) (Table 6). Nichols (1999) reported an average mean C for the Northern Lakes and Forest Region of 6.7 putting Lower Eau Claire Lake slightly below average for this part of the state. The FQI was, however, nearly double the median FQI of 24.3 for the Northern Lakes and Forest Region.

Table 6: 2022 FQI Calculations – Lower Eau Claire Lake

Species	Common Name	C
Bidens beckii	Water marigold	8
Brasenia schreberi	Watershield	6
Calla palustris	Wild calla	9
Carex comosa	Bottle brush sedge	5
Ceratophyllum demersum	Coontail	3
Chara sp.	Muskgrass	7
Dulichium arundinaceum	Three-way sedge	9
Elatine minima	Waterwort	9
Eleocharis acicularis	Needle spikerush	5
Eleocharis erythropoda	Bald spikerush	3
Eleocharis palustris	Creeping spikerush	6
Elodea canadensis	Common waterweed	3
Heteranthera dubia	Water star-grass	6
Isoetes echinospora	Spiny-spored quillwort	8
Lemna minor	Small duckweed	4
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern water-milfoil	6
Najas flexilis	Slender naiad	6
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton strictifolius	Stiff pondweed	8
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Sagittaria cristata	Crested arrowhead	9
Sagittaria graminea	Grass-leaved arrowhead	9
Schoenoplectus acutus	Hardstem bulrush	6
Schoenoplectus subterminalis	Water bulrush	9
Stuckenia pectinata	Sago pondweed	3
Typha angustifolia	Narrow-leaved cattail	1
Typha latifolia	Broad-leaved cattail	1
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia minor	Small bladderwort	10
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
N		45
mean C		6.4
FQI		43.2

4.3.2 Changes in Native Aquatic Plant Species

Because this is the first whole-lake, point-intercept survey completed by ERS, and the only data set to work with, there is no comparison of changes in native aquatic plant species.

4.4 Other Aquatic Invasive Species in Lower Eau Claire Lake

No evidence of EWM was found in LECL was found during the 2022 survey. However, in addition to CLP, stands of Hybrid cattail were identified (Figure 19). Native to southern but not northern Wisconsin, Narrow-leaved cattail and its hybrids with Broad-leaved cattail are becoming increasingly common in Bayfield and Douglas Counties where they also tend to be invasive. Besides having narrower leaves, the exotics can be told from our native cattails by having a relatively narrower and longer "hotdog-shaped" tan female cattail flower, whereas the native species tends to produce a fatter and shorter "bratwurst-shaped" dark chocolate colored female flower. Narrow-leaved cattail and its hybrids also have a male flower that is separated from the female flower by a thin green stem while the native Broad-leaved cattail has its male and female flowers connected.

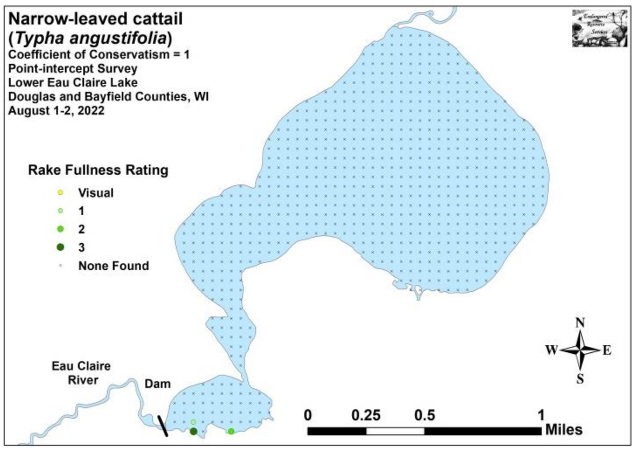

Figure 22: 2022 LECL hybrid cattail distribution (left) and example photo from UECL (right)

4.5 Wild Rice

Wild rice is an aquatic grass which grows in shallow water in lakes and slow flowing streams. This grass produces a seed which is a nutritious source of food for wildlife and people. The seed matures in August and September with the ripe seed dropping into the sediment, unless harvested by wildlife or people. It is a highly protected and valued natural resource in Wisconsin. Only Wisconsin residents may harvest wild rice in the state. According to the WDNR Surface Water Data Viewer, LECL is not wild rice water.

5.0 2022 and 2023 Curly-leaf Pondweed Management

In 2015, the Town of Barnes began the discussion of building a DASH (diver-assisted suction harvest) boat for use to remove CLP in the Eau Claire Lakes and EWM in Sand Bar and Tomahawk Lakes. The Barnes AIS Sucker (BAISS) boat was completed in 2016 and used for the first time in 2017. DASH involves scuba divers who swim along the bottom of the lake with a hydraulic suction tube and when an offending plant is found, it is dislodged by the diver and fed into the suction tube. Hydraulic suction brings the removed plant to the surface of the lake and deposits into a bag or bin on the boat (Figure 20).

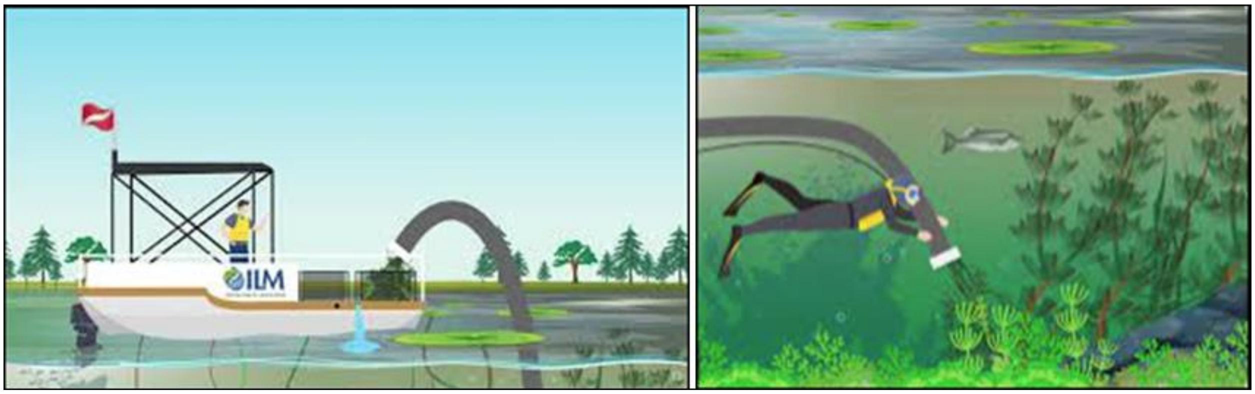

Figure 23: DASH boat and underwater operation (ILM Environments)
https://www.youtube.com/watch?v=YQmLMKzc1UM

While physical removal by volunteers continues in the lake to the current time, the BAISS boat and DASH is the main management action. No herbicide use has been proposed or implemented. Table 7 reflects the results of those management actions based on data mined from the Town of Barnes AIS Committee Minutes since 2014, and some of the volunteers involved in the process. In the Table, the term "bags" refers to the mesh bag or onion bag that is used to catch the aquatic vegetation that is removed from the bottom of the lake and fed into the suction tube.

When operating the BAISS boat having a volunteer driver, at least two volunteers to serves as deck hands assisting the divers and at least two paid divers is necessary. Hundreds of hours of volunteer and paid time have been expended by the Town of Barnes since 2017 operating the BAISS boat on Lower, Middle, and Upper Eau Claire Lakes.

CLP mapping of the lakes is a necessary pre-management action as it helps to minimize time wasted traveling around the lakes looking for CLP while on the BAISS boat. Hundreds of additional volunteers hours and paid consultant time has been expended doing mapping from 2014-2023.

In 2020, CLP was found in Shunenberg Lake and physically removed by volunteers. It was rediscovered in 2023.

Table 7: 2014-2023 CLP management actions in Lower, Middle, and Upper Eau Claire Lakes

2014 to 2023 Physical and DASH Removal of Curly-leaf Pondweed from Lower, Middle, and Upper Eau Claire Lakes										
Lake	**2014**		**2015**		**2016**		**2017**		**2018**	
	Method	**Result**	**Method**	**Result**	**Method**	**Result**	**Method**	**Result**	**Method**	**Result**
Lower	NA		NA		NA		NA		NA	
Middle	Physical	NR	Physical	NR	Physical	NR	DASH	48cuft	DASH	none
	Diver (ERS)	NR			Diver	NR				
Upper	Physical	NR	Physical	BR	Physical	NR	DASH	NR	DASH	NR

Lake	**2019**		**2020**		**2021**		**2022**		**2023**	
	Method	**Result**	**Method**	**Result**	**Method**	**Result**	**Method**	**Result**	**Method**	**Result**
Lower	NA		NA		NA		DASH	2 bags	DASH	?
Middle	DASH	none	DASH	10 bags	DASH	46.5 bags	DASH	25.5 bags	DASH	?
Upper	DASH	2 bags/day	DASH	21 bags	DASH	35.5 bags	DASH	57.25 bags	DASH	?
NA - Not Applicable		NR - No Report								

In both 2022 and 2023 the Town of Barnes BAISS boat has been used to remove CLP from LECL. In 2022, the removal was cut short due to the lateness of the season when it was identified. The CLP in LECL in 2022 was already setting turions and beginning to break-up when the BAISS personal were able to get to the lake. In 2023, the BAISS boat was put into service much earlier in LECL primarily due to the fact that very little CLP was found in MECL in 2023, enable the BAISS crew to skip it and go directly from UECL to LECL.

6.0 Management Discussion

In a Technical Review of the literature available discussing CLP, two WDNR researchers identified the following potential lake impacts as it relates to CLP (Mikulyuk & Nault, 2009).

Economic Impact

Monotypic stands of P. crispus can be quite a nuisance, presenting significant navigational difficulties to recreational users. P. crispus can also stimulate algal blooms which can decrease the aesthetic value of a waterbody. These factors have a significant impact on the recreational and real estate value of a waterbody, and may also have an impact on the tourism industry. Impacts are greatest in the species' introduced range, where it is considered a noxious weed.

Social Impact

P. crispus can be a substantial nuisance to recreational users by impeding navigation and tangling fishing line. This species can also reduce swimming access and stimulate unsightly, possibly toxic algal blooms. Its environmental effects can decrease the aesthetic value of a waterbody as well as affect property values and tourism.

Impact on Crops and Other Plants

Given this species' tendency to grow in monocultures with high productivity, it has been reported to cause decreases in biodiversity by outcompeting native plants. However, it should be noted that the impact of this species on the native plant community is disputed, with some authors concluding that the fact that the plant acts like a winter annual removes it from negatively impacting native species. In its native range it can be productive, but is not generally reported as a nuisance.

Impact on Habitat

Massive stands of P. crispus substantially alter a waterbody's internal loading, and can also reduce the fetch of a lake, sometimes inducing stratification in normally unstratified systems. In a comparative study that evaluated four related macrophyte species, P. crispus produced the highest shoot growth rate and biomass. It can grow in dense monotypic stands and affect habitat structure, which may have impacts on commercially and recreationally sought after fish species. P. crispus has been reported to decrease the amount of light reaching the sediment surface. However, the plant may have positive effects in extremely degraded systems. One study reports that planting of P. crispus in enclosures improved water transparency, decreased electric conductivity, increased pH, and was shown to have an inhibitory effect on green algae.

Impact on Biodiversity

Several sources report that P. crispus has a negative effect on macrophyte biodiversity and often outcompetes native plants. P. crispus is found at sites where P. ogdenii, a critically impaired species, exists. P. crispus likely competes with P. ogdenii and may be having a significant impact on it. In studies conducted in its native range of Poland, the variety of fungus species reported growing on dead fragments of P. crispus was greater in relation to other plant species.

6.1 CLP in Lower Eau Claire Lake

During the 2022 and 2023 bed mapping surveys, CLP was primarily located in the shallow, muck bottomed northwestern bay adjacent to the Mooney Park Dam. This same area of LECL has the greatest native aquatic plant diversity of the entire lake. Habitat for CLP is extremely limited in the rest of LECL allowing focus to be placed in this area. When first identified in 2022, CLP covered way less than 1/10 of a percent of the lake. In 2023, CLP still covered less than 1.0 of the lakes surface area, but had expanded three-fold from what it was in 2022. Whether this was simply due to better growing conditions in 2023, or because what was identified in 2022 truly expanded is a matter for speculation, but management actions that control the spread of CLP without negatively impacting native vegetation should be considered. In LECL and with the Town of Barnes this means mechanical harvesting (diver removal) using DASH.

The BAISS boat harvesting program appears to be keeping the CLP populations in check in both Middle and Upper Eau Claire lakes and as long the distribution of CLP does not expand rapidly these efforts will likely continue to be successful while simultaneously having minimal impact on all of the lakes rich and diverse native plant community. As long as running the harvester remains a viable management option, it will likely continue to be the most environmentally friendly method of controlling CLP. In the future, if suction harvesting is discontinued or if isn't possible to get to all of the CLP beds with the time available and the Town of Barnes and/or the Friends of the Eau Claire Lakes considers chemical control, it is strongly encouraged that a measured approach that is closely evaluated be taken.

6.2 CLP Management

A scenario-based approach to CLP management is recommended over the next five years. A scenario-based approach means that any amount of CLP may be managed in the lake; however, the management actions implemented will be dictated by the conditions that exist in the lake at any given time. Not all CLP needs to be removed from the lake, but efforts should be made to keep it from gaining more purchase in the lake. To do this, a combination of manual/physical removal, DASH, and chemical control methods are recommended for LECL. As such, the following monitoring and control activities have been outlined:

1) CLP will be monitored by volunteers and resource professionals every year.
    a. Pre-management surveys will be completed annually as soon as CLP begins to make an appearance in an effort to judge the severity of seasonal growth.
    b. Early summer CLP bedmapping will be completed annually in early to mid-June in an effort to track its expansion or decline.
2) Areas of CLP with sparse, isolated plants can and should be hand pulled or raked by volunteers in shallow water (≈ 5 feet) around docks and along shorelines.
    a. Can be completed at any time during the CLP growing season
    b. Does not require a WDNR permit.
3) Snorkel, rake, and/or scuba diver removal of CLP can and should take place in areas with isolated plants, small clumps, or small beds of plants where practical and if resources are available.
    a. Would likely be completed by the Friends of the Eau Claire Lakes and supported by the Town of Barnes
    b. Can be completed at any time during the CLP growing season
    c. Does not require a WDNR permit.
4) Diver-assisted Suction Harvest or DASH will likely be the most used management action in LECL. It has been and will continue to be used in place of or in combination with snorkel, rake, and/or scuba diver removal of CLP allowing larger areas of CLP to be managed without the use of herbicides.
    a. Would likely be completed by the Friends of the Eau Claire Lakes and supported by the Town of Barnes
    b. Can be completed at any time prior to when turions are set
    c. DASH requires a WDNR Mechanical Harvesting permit.

5) Application of aquatic herbicides can be used in any area under the following guidelines
    a. The Town of Barnes or Friends of the Eau Claire Lakes can show that other management methods have been tried.
    b. Conditions exist that are likely to make other management alternatives less effective
        i. Bed size and density of CLP in the area
        ii. Location of the area in relation to lake access and usability
        iii. Bottom substrate, water depth, and/or clarity are prohibitive
        iv. Limited or unavailable access to diver, or DASH services
        v. Limited financial resources
        vi. Less than a majority constituent support for a proposed management action.
    c. One-time herbicide application
        i. Proposed chemical treatment areas are at least 5.0 acres in size.
        ii. Liquid endothall (Aquathol K) is used at 1-3 ppm
        iii. Single or combined area treatments >10.0 acres will be considered large-scale
            1. Pre (prior year) and post (year of and/or year after) treatment aquatic plant surveys should be considered.
            2. Herbicide concentration testing should be considered
        iv. Single or combined area treatments >51.0 acres will be considered whole-lake
            1. Whole-lake herbicide concentration should be calculated based on the proposed application rate.
            2. Pre (prior year) and post (year of and/or year after) treatment aquatic plant surveys should be considered.
            3. Herbicide concentration testing should be considered
        v. Requires a WDNR Chemical Application permit
        vi. Herbicides must be applied by a licensed Applicator

Many of the management actions outlined for CLP would also be effective for the management of EWM should it be found in LECL over the next five years. A different herbicide would be used; likely ProcellaCOR or a liquid 2,4D-based herbicide. Annual management decisions for CLP (or EWM) will always be based on the level of infestation, current understanding of management alternatives, resources available, what is acceptable to the constituency, and what the WDNR will approve.

6.3 Management of Other AIS

At the present time, CLP is the only AIS plant that is actively managed in LECL. That said, other AIS plants including but not limited to EWM, purple loosestrife, and yellow iris should be monitored for on a regular basis and management actions taken when found. EWM would be managed similarly to CLP. Purple loosestrife could be physically removed, managed with aquatic herbicides, or in large areas, biological control beetles could be reared and released. Yellow iris would likely be managed with physical removal.

The lake should also be actively monitored for zebra mussels and spiny waterflea. For more information about these and other AIS review the more inclusive Aquatic Plant Management Plan for the Towns of Barnes, Gordon, and Highland in Bayfield and Douglas Counties of which this document is an addendum.

7.0 Aquatic Plant Management Goals

This Aquatic Plant Management Plan establishes the following goals for aquatic plant management in Lower Eau Claire Lake:

1) **CLP Management.** Maintain CLP at low levels through environmentally responsible management methods that will minimize the potential for negative impacts to the lake and native plant community in the future.

2) **AIS Education and Awareness.** Continue to educate property owners and lake users on aquatic invasive species through public outreach and education programs to help contain existing AIS in and around the lake and new AIS that could get introduced to the lake.

3) **Research and Monitoring.** Develop a better understanding of the lake and the factors affecting lake water quality through continued and expanded monitoring efforts.

4) **Adaptive Management.** Follow an adaptive management approach that measures and analyzes the effectiveness of control activities and modifies the management plan as necessary to meet goals and objectives.

7.1 Goal 1. CLP Management

The main goal of this APM Plan for LECL is to keep CLP from increasing its distribution and density in the lake. While the presence of CLP in the lake is not necessarily an indicator that the health of the lake and its aquatic plant community is deteriorating, in many lakes CLP can cause the following issues identified by the WDNR[2]:

- It can become dominant and invasive due to its tolerance for low light and low water temperatures.
- It may out compete other underwater plants and become dominant, which causes problems due to the formation of dense mats that interfere with recreational activities.
- It also causes an increase in phosphorus concentrations, causing an increase in algae blooms and a pile-up of dying plants along the shore.

At the present time, CLP is doing none of these things in LECL. The goal is to complete prevention management to keep it from doing so for as long as possible.

7.1.1 CLP Survey Work

Management of CLP will be updated regularly based on pre-management surveys and annual bed mapping surveys completed by either trained volunteers or resource professionals. Pre-management surveys should be completed as soon after ice out as possible to begin getting a perspective on how the given growing season will impact the amount of CLP in the lake. WDNR permitting either needs to wait to be completed until some perspective is gained from these surveys, or have the possibility of managing more CLP then expected built into it. This is easy with a mechanical harvesting permit, more difficult with a chemical application permit. Once pre-management surveys are completed management plans should be reviewed and modified if necessary. Annual CLP bed mapping surveys, completed at the height of CLP growth, will be used to quantify the extent of CLP in the lake in any given year. Generally

[2] https://dnr.wisconsin.gov/topic/Invasives/fact/CurlyLeafPondweed.html

speaking, greater amounts of CLP during a bed mapping survey will lead to more extensive management plans the following year.

Once these surveys are completed discussion pertaining to next season management will begin. Should it be determined that the application of aquatic herbicides will come into play in the following year, additional pre-treatment surveys of aquatic plants may be completed to document the present of native plants. Post-treatment surveys may be included in the year of treatment and/or in the year after treatment. Pre and post treatment surveys are not required by the WDNR unless the chemically treated areas cover 10 or more acres.

7.1.2 Herbicide Concentration Testing

At least in the first year covered in this APM Plan where aquatic herbicides are used in LECL it is highly recommended that herbicide concentration testing be done. Herbicide concentration testing helps determine if the amount of herbicide applied reached the expected concentrations, how fast it dissipates, and if it is transported to other parts of the lake that were not intended for treatment. If a chemical treatment is not very effective, concentration testing can help determine why.

7.2 Goal 2. AIS Education and Awareness

Aquatic invasive species can be transported via a number of vectors, but most invasions are associated with human activity. Maintaining signs and continuing watercraft inspection at the public boat landing should be done to educate lake users about what they can do to prevent the spread of AIS.

Early detection and rapid response efforts increase the likelihood that a new aquatic invasive species will be addressed successfully while the population is still localized and levels are not beyond that which can be contained and eradicated. Once an aquatic invasive species becomes widely established in a lake, complete eradication becomes extremely difficult, so attempting to partially mitigate negative impacts becomes the goal. The costs of early detection and rapid response efforts are typically far less than those of long-term invasive species management programs needed when an AIS becomes established.

It is recommended that the Town of Barnes and Friends of the Eau Claire Lakes continue to implement a proactive and consistent AIS monitoring program. At least three times during the open water season, trained volunteers should patrol the shoreline and littoral zone looking for EWM and other species like purple loosestrife, Japanese knotweed, giant reed grass, and zebra mussels. Free support for this kind of monitoring program is provided as part of the UW-Extension Lakes/WDNR CLMN AIS Monitoring Program. Any monitoring data collected should be recorded annually and submitted to the WDNR SWIMS database.

Providing education, outreach opportunities, and materials to the lake community will improve general knowledge and likely increase participation in lake protection and restoration activities. It is further recommended that the Town of Barnes and Friends of the Eau Claire Lakes continue to cultivate an awareness of the problems associated with AIS and enough community knowledge about certain species to aid in detection, planning, and implementation of management alternatives within their lake community. It is also recommended that the Town of Barnes and Friends of the Eau Claire Lakes continue to strive to foster greater understanding and appreciation of the entire aquatic ecosystem including the important role plants, animals, and people play in that system.

Understanding how their activities impact the aquatic plants and water quality of the lakes is crucial in fostering a responsible community of lakeshore property owners. To accomplish this, the Town of

Barnes and Friends of the Eau Claire Lakes should distribute, or redistribute informational materials and provide educational opportunities on aquatic invasive species and other factors that affect the lakes. At least one annual activity (picnic at the lake, public workshop, guest speakers, etc.) should be sponsored and promoted by the Town of Barnes and Friends of the Eau Claire Lakes that is focused on AIS. Results of water quality monitoring should be shared with the lake community at the annual meeting, or another event, to promote a greater understanding of the lake ecosystem and potentially increase participation in planning and management.

7.3 Goal 3. Research and Monitoring

Long-term data can be used to identify the factors leading to changes in water quality. Such factors include aquatic plant management activities, changes in the watershed land use, and the response of the lakes to environmental changes. The CLMN Water Quality Monitoring Program supports volunteer water quality monitors across the state following a clearly defined schedule. LECL has been a part of this program for many years and should continue its involvement.

The intensity/success of water quality monitoring efforts should be evaluated at least every three years. The background information and trends provided by these data are invaluable for current and future lake and aquatic plant management planning.

To monitor any changes in the plant community, it is recommended that whole-lake point intercept aquatic plant surveys be completed at three to five-year intervals. This will allow managers to adjust the APM Plan as needed in response to how the plant community changes as a result of management and natural factors. The next whole-lake point-intercept survey should be planned for 2027 with an update of this plan completed in 2028.

The Town of Barnes and Friends of the Eau Claire Lakes should continue to support efforts to improve/restore native shoreland around the lake that lead to healthier habitat and less polluted runoff from properties immediately adjacent to the lake. These efforts should continue and can be supported by the Wisconsin Healthy Lakes and Rivers Initiative. In addition, the Town of Barnes and Friends of the Eau Claire Lakes should continue to work with the Bayfield County Soil and Water Conservation Department to address runoff concerns in the greater watershed.

7.4 Goal 4. Adaptive Management

This APM Plan is a working document guiding management actions on LECL for the next five years. This plan will follow a scenario-based, adaptive management approach by adjusting actions as the results of management and data obtained deem fit following IPM strategy. This plan is therefore a living document, progressively evolving and improving to meet environmental, social, and economic goals, to increase scientific knowledge, and to foster good relations among stakeholders. Annual and end of project assessment reports are necessary to monitor progress and justify changes to the management strategy, with or without state grant funding. Project reporting will meet the requirements of all stakeholders, gain proper approval, allow for timely reimbursement of expenses, and provide the appropriate data for continued management success. Success will be measured by the efficiency and ease in which these actions are completed.

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