Lake County, Illinois

2014 Summary Report Channel Lake

Prepared by the

LAKE COUNTY HEALTH DEPARTMENT

Population Health-Ecological Services

Lake Catherine (right) and Channel Lake (left) 2010 Aerial Photo.

Channel Lake is one of the 13 lakes sampled in the Fox Chain 'O' Lakes during 2014 by the LCHD-ES. It is a glacial lake whose maximum depth is 36 feet and whose surface area is 371.0 acres. The water elevation is influenced by the McHenry Dam which was built in 1939. Lake Catherine is hydrologicaly connected to Channel Lake, however this was not always the case as there was once a gravel bar that separated the two. Most of that bar is now eroded away and both lakes form one large footprint. Boaters are still observed anchored at the remaining sandbar on the eastern shoreline, swimming and recreating. Catherine and Channel lakes are both located at the bottom of their watershed, and are the deepest of the lakes in the Fox Chain 'O' Lakes. Like Catherine, Channel Lake is in the Trevor Creek Watershed which flows from Wisconsin and is part of the Fox River Watershed. Channel Lake receives waters from Peat Lake, Center Lake and Camp Lake located in Kenosha County Wisconsin. The effluent of these lakes meander through large wetland complexes before entering into Channel Lake on its north end. There are also several small tributaries and stormwater drainage outfalls entering the lake. Data supplied by the Lake County

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SUMMARY (CONTINUED)

Lake Facts:

Major Watershed: Fox River

Sub-Watershed: Fox River

Location: T43N, R9E, Section 11

Surface Area: 164.7 acres

Shoreline Length: 6.24 miles

Maximum Depth: 39.00 ft.

Average Depth: 16.7 ft.

Lake Volume: 2881.90 acre-ft

Watershed Area: 12,581.67 acres (WI and IL)

Lake Type: Glacial

Management Entity:

Fox Waterway Agency

State of Illinois

Homeowners Associations (various)

Current Uses: fishing, swimming, boating, aesthetics

Access: Private although there are public launches on other lakes of Fox Chain 'O' Lakes.

Mapping Services Division and Southeastern Wisconsin Regional Planning Commission estimate the Trevor Creek watershed to be approximately 12,581.67 acres; agriculture, single family and wetlands are the dominant land uses. However single family and transportation contribute the greatest percentage runoff into Channel Lake at 38.8% and 24.9% respectively.

Channel lake is well known by anglers, and has two public boat launches allowing access to the public. There are other private, public launches on the Fox Chain 'O' Lakes, as well as two public launches located in Chain 'O'Lakes and Oak Point State Parks.

In 2014, the LCHD-ES sampled the lakes for the water quality parameters discussed in this report. Once a month water chemistry samples were collected at the deep hole of the lake at 3 feet from the surface (epilimnion) and lake bottom (hypolimnion) by use of a Van Dorn sampler. A multi-parameter sonde was used to collect depth profile data. Additionally, a Secchi disc was lowered into the water column to measure the water clarity of the lake. Other environmental data was recorded including air temperature, water elevation and any observations of wildlife in the area.

The water clarity has significantly decreased in Channel Lake since 2002. The 2014 average Secchi depth was 2.8 feet, this is a decrease of 140% from the average Secchi depth in 2002 of 6.75 feet. The cause of the decrease is unknown however, VLMP data supports that there was a significant change in water clarity that occurred between 2011 and 2012, and again between 2012 and 2013. The average Secchi depth in 2014 ranked Channel Lake number 89 out of the 158 lakes whose water clarity has been measured since 2000 and it was close to the median Secchi depth for lakes measured between 2000 and 2014 of 2.95 feet.

Like many of the lakes in our county, Channel Lake is impaired for phosphorus based upon the Illinois Environmental Protection Agency's (IEPA) phosphorus standard for general use of ≥ 0.05 mg/L TP for lakes with a surface area greater than 20 acres. It only takes one exceedance of the standard per season to be considered impaired. The average TP concentration during 2014 was 0.068 mg/L. This is well below the 2014 median TP concentration for all Fox Chain 'O' Lakes of 0.126 mg/L and is equivalent to the 2014 county median TP concentration for lakes in the county whose TP concentration has been recorded since 2000. Channel ranked 77 out of 173 lakes in the county sampled for TP since 2000.

A aquatic vegetation survey using the point intercept method was conducted in April on Channel Lake. In order to accomplish this a randomized grid was placed over the footprint of the lake using ARCGIS 10.2 and points falling within the footprint were sampled by lowering a rake at each grid point and applyimg a score in order to estimate the cover of aquatic vegetation at that point. Aquatic vegetation colonized 25.9% of the points sampled with an average cover of 31.19%. This was above the average cover of aquatic vegetation found at all points sampled on the Fox Chain 'O' Lakes. Dominant species in the lake were Coontail, White Water Lily and Star Duckweed. A floristic quality assessment was conducted on the 11 aquatic plant species found in Channel Lake in 2014 resulting in an FQI score of 18.7. Floristic quality assessements are used to identify natural areas, for site comparisons, monitoring of restoration projects and long term monitoring of sites. Channel Lake ranked 56th out of 170 lakes in the county scored for FQI and was above the median score of 15.2 (Appendix A, Table 8).

SUMMARY (CONTINUED)

There are three licensed beaches on Channel Lake: Turtle Beach, Bluffs Lodge Subdivision and Lake Shore Park. In 2014, none of the beaches had swim bans due to elevated E-coli colonies (235 colonies/mL). However, Turtle Beach and Lake Shore Park have historically had swim bans. The cause of the swim bans at Turtle Beach could be due to either waterfowl or stormwater as there is an outlfall adjacent to the beach. Bans at Lake Shore Park are waterfowl related.

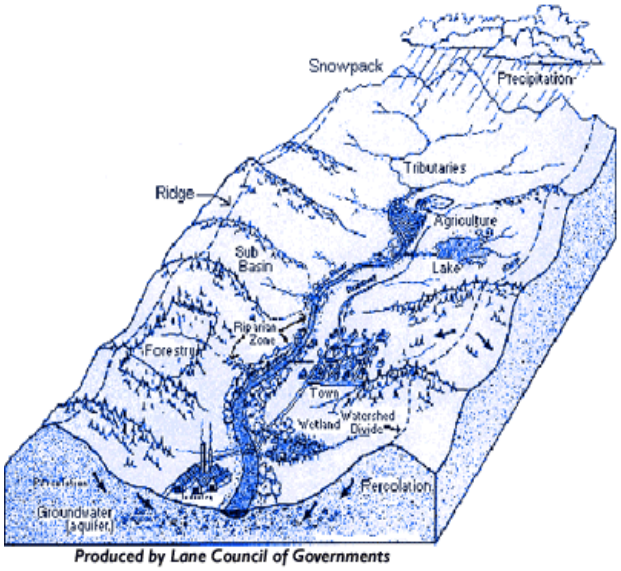
On May 31, 2013, the LCHD-ES was informed of a blue green algal bloom at Lake Shore Park beach. This was not a routine sample day. The beach was sampled for both E-coli and the HAB. The HAB was tested for presence of microcystin, a toxin that is produced by Microcystis spp., which is a species of blue green algae, the level was above 10 ppb. The beach manager was contacted and they decided to close the beach until the bloom subsided, additionally the E-coli concentration was above the 235 colonies/mL threshold and a swim ban was issued. The sample was sent to an independent lab for ELISA enzyme linked immunoabsorbant assay and was reported to have toxins above the no contact limit defined by the World Health Organization of 20 ppb.

WATERSHED

A general definition of a watershed is an area of land defined by two or more high ridges, however they are usually much more complex than that due to the engineering of drainage areas to more efficiently remove stormwater from the landscape which can make boundaries hard to decifer at times.

Both Channel Lake and Lake Catherine are part of the Trevor Creek subwatershed which is approximately 12,581.67 acres (SEWRPC and Lake County Mapping Division). According to the land use data, the subwatershed was dominated by Agricultural (42.5%), Single Family (15.5%) and Wetlands (15.1%). The main tributary into Channel comes from a different source than that of Catherine. Waters flowing from Peat Lake, Camp Lake and Center Lake in Kenosha County find there way to Channel Lake by way of a ditch system. It is estimated that the total percent runoff coming from the Trevor Creek watershed is from Single Family and Transportation representing 36.5% and 26.7% respectively (Appendix A, Table 1).

LCHD-ES recommends that the stakeholders within the watershed become educated on practices that can help reduce phosphorus loading into the Fox Chain 'O' Lakes as they are all impaired for phosphorus. Practices such as nutrient management plans for the agricultural community. Homeowners in the watershed ensuring their septic systems are maintained and eroding shorelines are repaired. Winter maintenance crews should develop winter road maintenance plans and incorporate practices into their program that will alleviate chlorides from entering into Channel Lake as well as the entire Fox Chain 'O' Lakes system.



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WATER CLARITY

Water clarity is important as it allows light to penetrate into the water column. This light is used by the primary producers (plants and phytoplankton) in the water. Water clarity is measured by lowering a Secchi disk into the water until it can no longer be seen by the naked eye. The resulting depth is recorded.

The average Secchi depth of 2.80 feet measured in Channel Lake during 2014 was slightly below the county median of 2.95 feet for lakes measured between 2000 and 2014 for water clarity (Figure 1; Appendix A, Table 2). Water clarity in the lake ranged from a Secchi depth of 1.3 feet in September to 6.9 feet in June. All of the lakes in the Fox Chain 'O' Lakes experienced decreased water clarity since 2002, however none suffered as much as that of Channel and Catherine lakes (Figure 2).

The water clarity in Channel Lake decreased 140% since 2002 when the average Secchi depth was 6.7 feet compared to the 2014 average Secchi depth. Lake Catherine also experienced similar declines in water clarity, indicating that some event happened between the two dates that caused significant declines in water clarity for both lakes. VLMP data collected since 2011 suggests that a something occurred between 2011 and 2012; and again from 2012 to 2013, that accounted for the decline in water clarity. Declines of 108.6% and 60.1%, were measured between monitoring years, 2012-13 and 2013-14, respectively (Figure 4; Appendix A, Figure 4).

Many factors can influence water clarity, weather patterns, aquatic plants, algal blooms, sediments and nutrient loading as well as recreational boating can affect water clarity.

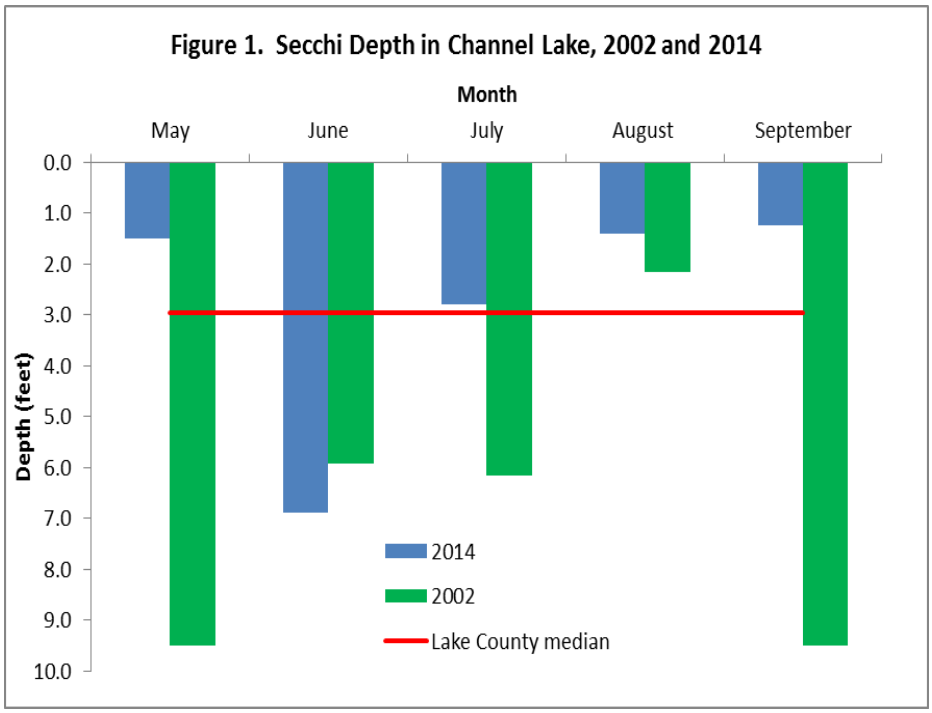


Figure 2. Water clarity of Channel Lake, 2002 versus 2014.

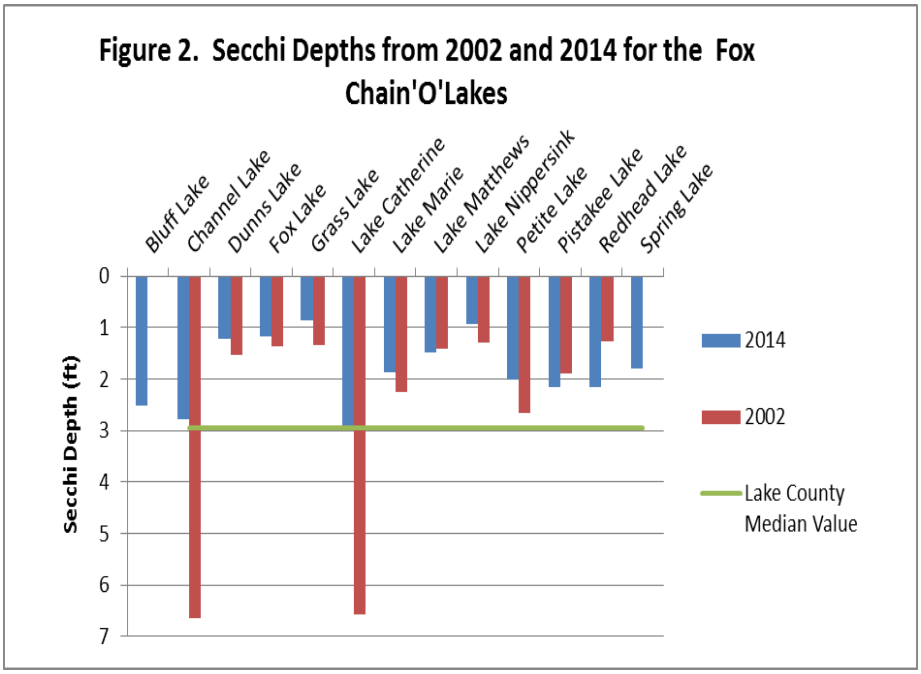
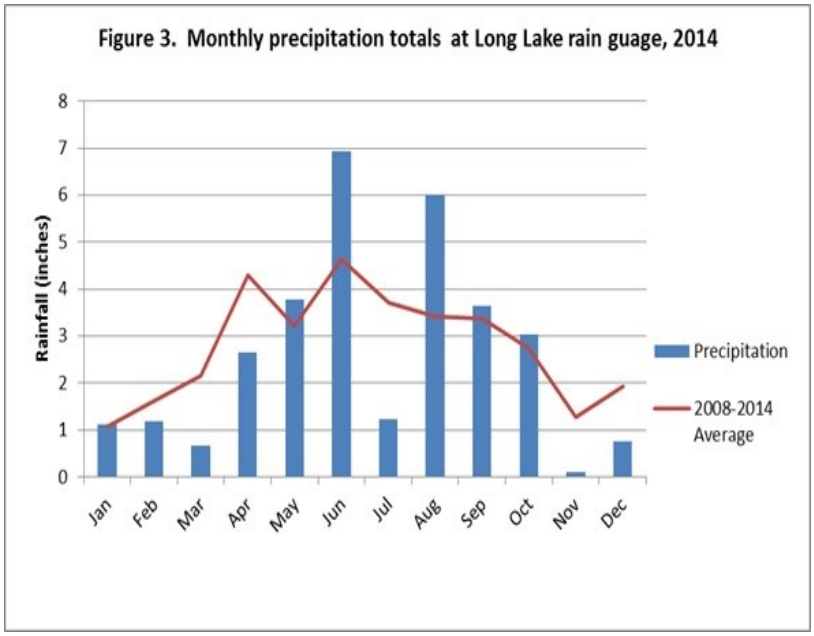


Figure 3. Secchi depths from 2002 and 2014 for all lakes' on the Fox Chain. Note the significant decreases in water clarity for Channel and Catherine lakes.

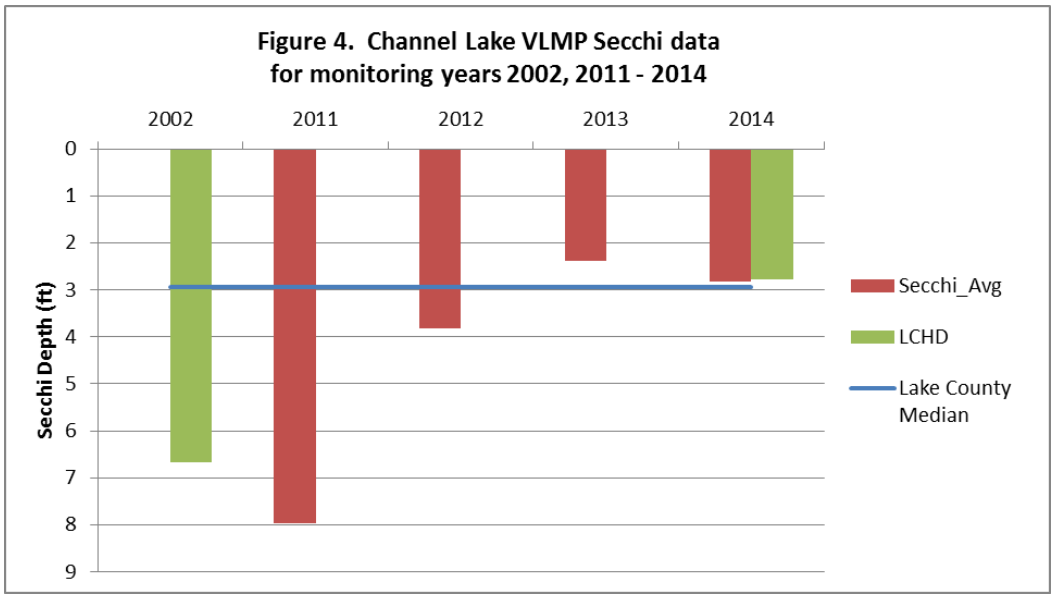
Water Clarity (Continued)

In 2014, a planktonic algal bloom was observed in September, which impacted the water clarity and resulted n a Secchi depth reading of 1.3 feet. Algal blooms are usually a result of aquatic vegetation lacking in lakes as well as is an indication of excess nutrients.

Storm events can also impair water clarity. According to the Long Lake rain gauge (Lake County Stormwater Commission), May precipitation measurements accumulated to a total of 3.77 inches of rainfall, which is comparable to the average May precipitation measurement of 3.21 inches. In June, precipitation was well above the 12 year average of 4.64 in., with a total of 6.93 inches recorded at Long Lake however for thetwo weeks prior to our June 2014 sampling event cumulatively only 1.01 inches of rain that fell in the region. This could explain the increase in Secchi depth in June and the subsequent decrease in Secchi depth between June (6.9 ft.) and July (2.8 ft.). Above average precipitation also occurred in August which likely deposited stormwaters into Channel Lake, and increased algae in the lake causing decreased water clarity for the remainder of the monitoring season.



Volunteer Lake Monitoring Program



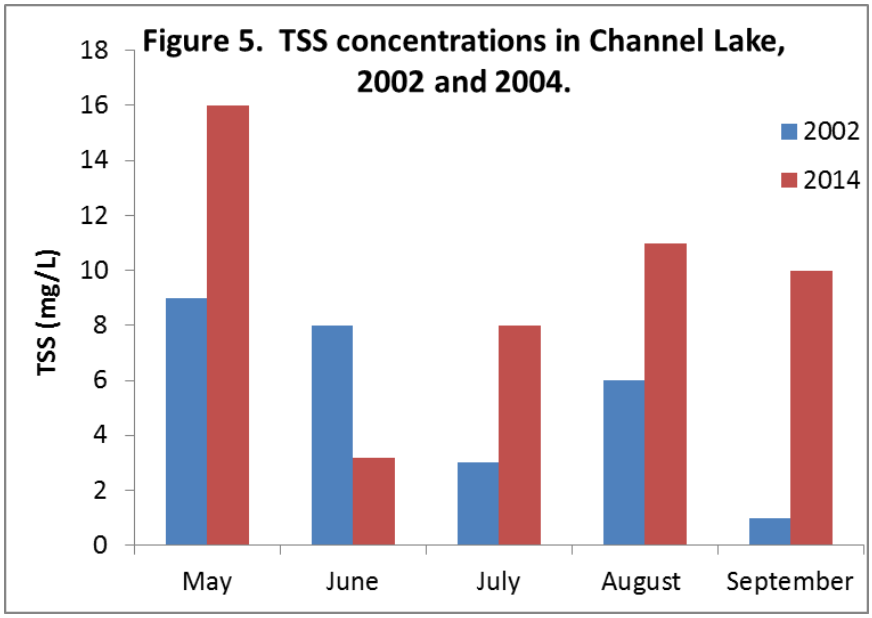
VOLUNTEER LAKE MONITORING PROGRAM (CONTINUED)

The Volunteer Lake Monitoring Program was established in 1981 to assist in gathering water quality information on Illinois lakes and to provide an educational program for citizens interested in lake water quality. The primary measurement taken by all volunteers in the program is Secchi disk (water clarity). Other observations such as algal blooms, vegetation, water color, and wildlife, plus any observations that the VLMP feels noteworthy are recorded. The sampling season is May through October. Two visits a month are required under the program.

Data presented in Figure 4 arejust one example on how invaluable VLMP data is in assisting lake managers in rapidly identifying and correcting problems impacting their lake. VLMP data additionally provides a continuous dataset to agencies when the lake is not actively being monitored under their programs. Jim Lubkeman, President of Channel Lake Shores subdivision has agreed to be the VLMP on Channel Lake beginning 2015. Thank Jim, for his help!

VLMP Secchi disk data displayed in Figure 4 are of the average Secchi disk measurements across all 3 VLMP sites on Channel Lake for years 2011—2014. This data indicates that the water clarity in Channel Lake decreased by 52% between 2011 through 2012; and again from 2012 to 2013. The data indicates that water clarity improved in the lake between the 2002 monitoring by LCHD and the beginning of the VLMP sampling in 2011. This increase in water clarity was likely due to the explosion of zebra mussels in the northern lakes between the two sampling periods. The water clarity improved slightly from 2013 to 2014 and were similar to the results from the LCHD 2014 monitoring season.

TOTAL SUSPENDED SOLIDS



Total Suspended Solids (Continued)

Total suspended solids (TSS) are comprised of volatile (organic) materials and nonvolatile (inorganic) materials within the water column. Total suspended solids reduce water clarity and can impact both flora and fauna when prevalent. Examples of volatile solids are algae, plankton and plant material as well as small macroinvertebrates. Non-volatile solids are sediments. TSS concentrations are inversely correlated to water clarity, hence when TSS concentrations are elevated, water clarity is diminished.

In 2014, TSS concentrations in Channel Lake ranged from 3.2 mg/L in June to 16.0 mg/L in May (Figure 5; Appendix A, Table 3). The 2014 average TSS concentration of 9.6 mg/L was greater than the median TSS concentration of 8.2 mg/L for lakes in the county measured for TSS since 2000. 2002 TSS concentrations averaged 5.4 mg/L, with concentrations ranging from 1.0 mg/L to 9.0 mg/L.

In 2014, Total volatile solids (TVS) ranged from 102 mg/L in September to 126 mg/L in June. The average TVS concentration measured in the epilimnion in 2014 was 119 mg/L., this is less than the county median concentration of 121 mg/L for county lakes measured for TVS since 2000. In 2002, TVS concentrations ranged from 1 mg/L to 4 mg/L. The large differences between TVS concentrations in 2014 and 2002 are likely due to analytical differences used at different labs and are not comparable.

In 2014, non-volatile suspended solids (NVSS) in the form of sediments ranged from 9.05 mg/L in May to 1.11 mg/L in June. Non volatile solids were elevated throughout the entire water column in May with concentrations in the hypolimnion of 9.33 mg/L. Elevated NVSS is likely due to spring rains flushing the system and waters remaining well mixed.

Activities in the watershed likely contributed to the increases in the TSS concentrations in Channel Lake, however, recreational boating, low coverage of aquatic vegetation and eutrophication likely played a role in the algal blooms observed in September, as there were biologically available nutrients (SRP, NO^3, NO^{-2} and NH_3) in the waters of the epilimnion during both August (SRP) and September (NH_3).

LCHD-ES recommends outreach occur to residents, businesses and the agriculture community on best management practices that they can incorporate into their daily lives that can reduce sediments from entering into waters that eventually discharge into Channel Lake. Practices such as remediating eroding shorelines by incorporating native plantings with hardscaping should be encouraged. Those who live near the water should be reminded to maintain septics in order to prevent seepage of additional nutrients and sewage into Channel Lake and other areas around the Fox Chain 'O' Lakes. Additionally, Channel Lake residents should promote a long term aquatic plant management plan on the Fox Chain 'O' Lakes to allow for expansion of vegetation in sensitive areas as aquatic vegetation can filter sediments and other pollutants out of the water column as well as provide competition to algae.

Sediments

Sedimentation naturally occurs in our environment, however, human activities can increase the amount of sediment that ends up in our streams and subsequently our lakes. Sediments are usually fine grained sands, silts and clays that can cover up the coarser bottom sediments and the spaces between rocks and cobbles that provide habitat for aquatic life.

In the Midwest region, sediments entering into our lakes and stream through erosion are laden with phosphorus and is a major source of eutrophication of surface waters. Sediments also reduce water clarity and the amount of light penetrating into the water which impacts the ability of plant to photosynthesize, and plant propagules (seeds) to reestablish. Subsequently reducing the amount of habitat for fish and macro-invertebrates. Sediment particles bury and suffocate fish eggs and gravel nests and absorb warmth from the sun resulting in increased water temperatures. This can cause problems with dissolved oxygen and cause stress to fish.

The Fox Waterway Agency (FWA) provides the service of removing sediments deposited from the Fox River and other tributaries to the lakes within the Fox Chain 'O' Lakes. The sediment load coming from all tributaries has been calculated to be steady at approximately 100,000 yds^3/year. Of that sediment, 12%, or approximately 12,000 yds^3/year enter the Fox Chain 'O' Lakes through Lake Catherine from Trevor Creek.

The FWA frequently tests the dredged soils and results from a 2005 sampling by conducted by Hey and Associates shows that sediment concentrations for most parameters (total phosphorus as P, Arsenic, Cadmium, Chromium, copper, Lead, Manganese, Nickel, Zinc, and Mercury) fall within the "Low" or "Normal" classification based on the IEPA's Illinois Lake Sediment Classification, therefore sediments are recyclable. Sediment guidelines from MacDonald et al (2000) support these findings as the concentrations measured in the sediments in 2005 are considered clean to marginally polluted and no affects on a majority of the sediment dwelling organisms are expected.

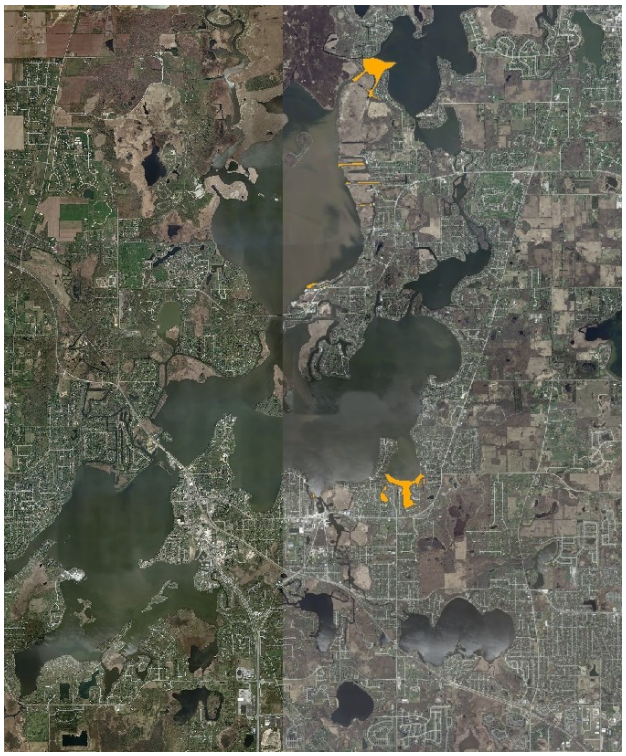


Figure 7. Location of dredging activities on the Fox Chain 'O' Lakes, 2014.

Figure 8. Fox Waterway Agency dredging a channel in Lake Marie, 2014.

Sediments (Continued)

Table 1. Most of the pollutants sampled in dredging sediments by Hey and Associates compared to IEPA and Macdonald Sediment Classifications

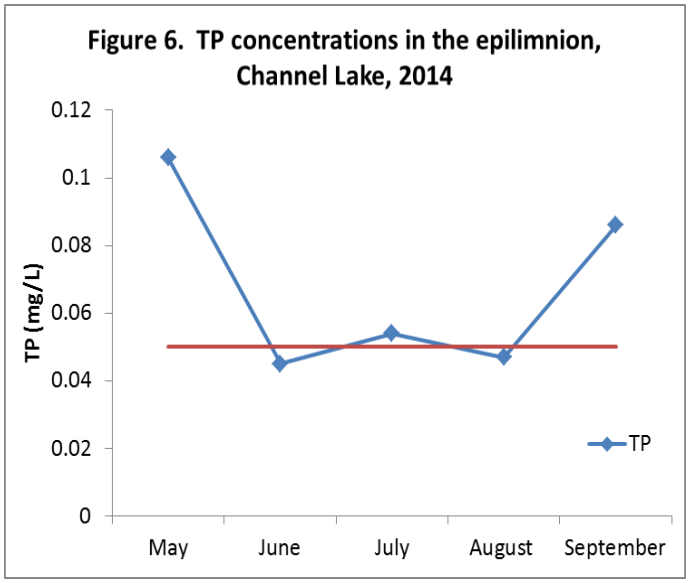
Metal	Value (Hey & Associates)	IEPA Illinois Lake Sediment Classification	MacDonald et al. Sediment Guidelines
Arsenic	12 mg/kg	Normal (4.1 to <14)	Below ERL
Cadmium	<0.5 mg/kg	Normal (<5)	Below LEL
Chromium	20 mg/kg	Normal (13 to <27)	Below LEL
Copper	14 mg/kg	Low (<16.7)	Below LEL
Lead	18 mg/kg	Normal (14 to <59)	Below LEL
Mercury	0.11 mg/kg	Normal (<0.15)	Below LEL
Nickel	14 mg/kg	Low (<14.3)	Below LEL
Zinc	51 mg/kg	Low (<59)	Below LEL

ERL: Effect range-low: represents the chemical concentration below which adverse effects would be rarely observed

LEL: Sediments are considered to be clean to marginally polluted. No effects on the majority of sediment dwelling organisms are expected below this concentration

Nutrients

Phosphorus and nitrogen are essential, naturally occurring nutrients needed for plant growth; however, in excess they can impair water quality in lakes. Phosphorus is usually the nutrient responsible for water quality problems in lakes. Phosphorus can come from both internal and external sources, and in general is the easiest of the limiting nutrients to manipulate due to the ability of some plants and algal species to fix nitrogen. High phosphorus levels can lead to excessive algae and aquatic plant growth which can harm aquatic life and impair recreational use. Additionally, it can reduce water clarity, and deplete oxygen levels. External sources are those that occur within the watershed, however, in deep lakes such as Channel, anoxic bottom sediments can be a contributing factor as they release phosphorus into the waters of the hypolimnion. In fall, the nutrient laden waters from the hypolimnion mix with those of the epilimnion causing spikes in TP (Figure 6). Eroding shorelines, Carp and propellers from recreational water craft can also be a cause of increased nutrients.



NUTRIENTS

Like many of the lakes within Lake County, Channel Lake is impaired for total phosphorus (TP) under the Illinois Environmental Protection Agency (IEPA) standard. A lake is considered impaired if TP concentrations in lakes ≥20 acres are above 0.05 mg/L at anytime during the growing season. Epilimnetic TP concentrations in 2014 ranged from 0.044 mg/L in August to 0.110 mg/L occurring in May (Appendix A, Table 3). TP concentrations in the hypolimnion were higher. The average TP concentration in Channel Lake was 0.068 mg/L, during the monitoring season (May—Sept) and was equivalent to the median TP concentration of lakes within the county during the period of 2000—2014.

As indicated in Figure 9, the epilimnetic TP concentrations in 2002 were not considered impaired with a maximum concentration of 0.049 mg/L (Figure7; Appendix A, Table 3) . In 2014 most of the TP concentrations were well above the maximum TP concentration measured in 2002.

A ratio between total nitrogen and total phosphorus (TN:TP) is a tool utilized to determine which nutrient is limiting plant or algal growth. Ratios of less than 10:1 indicate a system limited by nitrogen, while lakes with ratios greater than 20:1 are limited by phosphorus. The TN:TP ratio calculated for Channel Lake in 2014 was 25, therefore phosphorus was the limiting nutrient. This means that any additional phosphorus into the epilimnetic waters could cause nuisance plant or algal growth. In May , the TSIp score was 16, therefore neither nutrient was limiting the growth of plants or algae at that time. The monthly TSIp score remained above 20 for the remainder of the 2014 monitoring season.

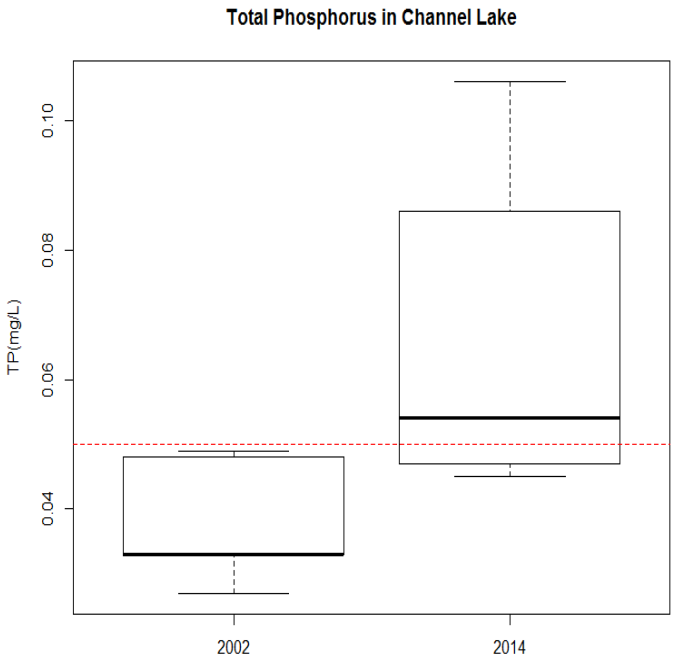
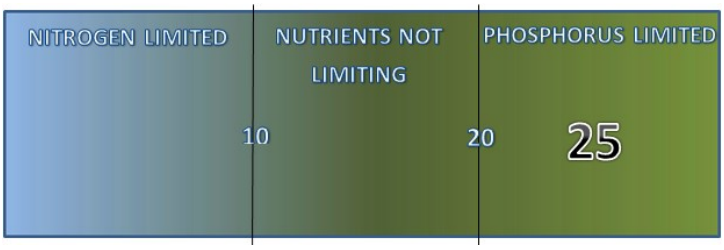


Figure 7. Comparison of TP concentrations in Channel Lake rom 2002 and 2014. Red dashed line is represented of IEPA standard (0.05 mg/L).



Trophic State Indeces

OLIGOTROPHIC:

Lakes are generally clear, deep and free of weeds or large algae blooms. Though beautiful, they are low in nutrients and do not support large fish populations.

MESOTROPHIC:

Lakes lie between the oligotrophic and eutrophic stages. Devoid of oxygen in late summer, their hypolimnions limit cold water fish and cause phosphorus cycling from sediments.

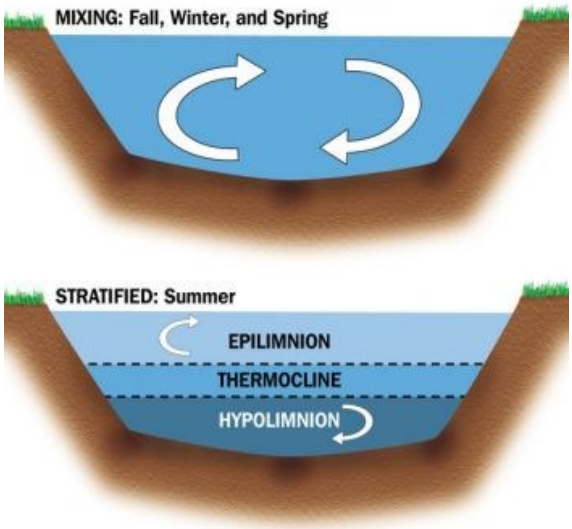
EUTROPHIC:

Lakes are high in nutrients, they are usually either weedy or subject to frequent algae blooms, or both. Eutrophic lakes often support large fish populations, but are also susceptible to oxygen depletion.

A Trophic State Index (TSI) based on phosphorus (TSIp) is commonly used to classify and compare lake productivity levels (trophic states). Excessive phosphorus entering a lake can accelerate the rate of eutrophication. Eutrophication is a natural aging process where nutrients eventually increase resulting in productive lakes. Lakes start out with clear water and few aquatic plants and over time become more enriched with nutrients and vegetation, until the lake becomes a wetland. This process normally takes thousands of years, however, human activities that supply lakes with additional phosphorus speed up the eutrophication process significantly. The TSIp index classifies the lake into one of four categories: oligotrophic (nutrient -poor, biologically unproductive) mesotrophic (intermediate nutrient availability and biological productivity), eutrophic (nutrient-rich, highly productive), or hypereutrophic (extremely nutrient-rich, productive). In 2014 Channel Lake was considered eutrophic with a TSIp score of 64.91. The TP phosphorus concentrations measured in Channel Lake ranked it 77 of 173 lakes in the county whose TP concentrations have been ranked since 2000 (Appendix A, Table 5).

Stratification

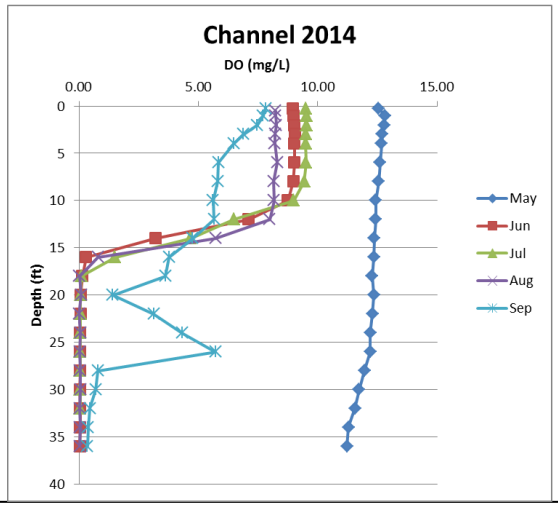
Thermal stratification occurs when the lake separates into an upper layer (epilimnion) and a lower layer (hypolimnion). Thermal stratification usually takes place in deep lakes where the wind and water currents are not strong enough to continually mix warmer waters with the cooler bottom waters and waters of the hypolimnion eventually experience anoxic conditions (where dissolved oxygen concentration fall <1 mg/L). Conditions in the hypolimnion during stratification can have profound effects on water quality, as most pollutants become concentrated as DO is depleted in the hypolimnion.

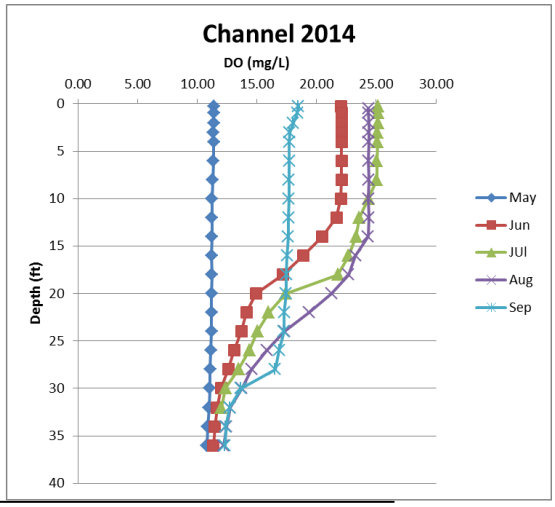


DO and temperature profiles are a good visual of stratification taking place in a lake. The profiles collected at the deep hole of Channel Lake are presented below. A multi-parameter sonde was used to record data. Measurements were recorded at every foot from the surface to 4 ft below the surface and every foot thereafter until the lake bottom

STRATIFICATION

was reached. The temperature and DO measurements are used to determine the depth of relative thermal resistance or where in the water column that lake stratification has set up (Appendix A, Table 6). In 2014, Channel Lake stratified between 12 feet and 16 feet during June through August.





DISSOLVED OXYGEN

Dissolved Oxygen (DO) is essential for the survival of fish and invertebrates in a lake and influences many different biological and chemical processes in lakes (Indiana Department of Environmental Management, 2011).

Fish become stressed as DO concentrations fall below 5 mg/L and as DO concentrations become anoxic or fish are no longer present. Anoxic conditions did occur in Channel Lake in 2014, as expected in deep lakes, however, concerns do arise in the summer when strong thermal stratification develops near the surface of the lake where water temperatures are prohibitive for most fish species. In 2014, Channel Lake became anoxic at 16 ft in June and August and 18 ft in July. The fisheries biologist from the IDNR suggests that as long as anoxic conditions do not expand above 14', there is a sufficient volume of oxygenated water for fish to utilize. However, in a year of extreme drought like what was experienced in 2012, the expansion of anoxic zones higher into the water column due to low water levels can become problematic.

Concerns arise when %DO saturation levels becomes supersaturated (>100%). DO is considered saturated when the %DO is 100%, or is equivalent to the ambient oxygen concentration, it becomes supersaturated due to algae and plants producing oxygen more rapidly than it can escape into the atmosphere. Although rare, excess DO can cause "gas bubble disease", this is where oxygen bubbles or emboli block the flow of blood in the blood vessels of fish. Channel Lake exhibited supersaturated % DO throughout the entire water column in May and between 6 to 8 feet during June through August.

While most water quality parameter concentrations increase in the hypolimnion, DO tends to get used up by detrivores in the bottom sediments causing anoxic conditions both in the water and bottom sediments. As DO concentrations approach 2 mg/L near the lake bottom, bottom sediments become anoxic, this allows for phosphorus to release from sediments. As indicated in Figures (8 and 9) above, Channel Lake stratified from June through September. By September the average TP concentration in the hypolimnion of Channel Lake was 1.16 mg/L setting up a conditions conducive for fall algal blooms.

Algae

Algal blooms have historically occurred on Channel Lake during our monitoring years and planktonic blooms were again noted in Channel Lake during 2014. Algae, like plants utilize dissolved phosphorus and nitrogen for their growth and can have balanced populations or they can become imbalanced and a bloom can occur, usually because of excess nutrients. Shifts in populations from a balanced population to one dominated by blue green algal species can also occur. In 2013, Channel Lake experienced a blue green algal bloom on one of it's beaches, Lake Shore Park Beach. The beach is routinely monitored as part of our beach monitoring program. However, the bloom occurred outside of the regular schedule. The beach manager was contacted and the beach was closed until the bloom subsided.

Recently, increased awareness in Harmful Algal Blooms (HABs) has initiated an effort to track such blooms in lakes within Lake County as well as statewide. In 2013, the LCHD-ES chose a subset of beaches that would routinely be sampled for HABs. Lake Shore Beach on Channel Lake was selected to as one of those beaches. A water sample is collected during E-coli sampling of the beach. If a blue-green algal bloom is present at the time of sampling, an Abraxis test is performed on a subsample to determine if toxins are present. Otherwise the sample is sent to an independent laboratory to have ELISA (enzyme-linked immunosorbent assay) testing performed. If the results of Abraxis test indicated that toxins are present at >10 ppb, the beach manager is advised of the results. Regardless of presence of a blue green bloom, the sample taken is sent out for ELISA testing.

In May, 2013, a blue-green algal bloom was reported to be present at Lake Shore Beach, the LCHD-ES collected a sample . The sample tested positive for toxins at a concentration of ≥10 ppb; the beach manager was contacted and advised to close the beach until the bloom subsided, the results of ELISA indicated that the toxin level was above the recommended level for no contact at ≥20 ppb by the World Health Organization (WHO).

Stakeholders of Channel Lake should make sure that they are servicing their septic systems and are incorporating best management practices designed to reduce nutrients from entering surface waters. This will help to alleviate some of the algal blooms observed on Channel Lake in the future.

CHLORIDES/CONDUCTIVITY

Conductivity measures the amount of ions in water, the more ions or salts in the water the higher its conductivity. It can be used to estimate both total dissolved solids ($R^2 = 0.96$) and chloride concentrations due to a strong correlation ($R^2 = 0.94$) between these parameters. Sources of chlorides are road salts (40% chloride) which are used in winter deicing programs by both public and private maintenance crews and water softener systems. The USEPA has determined that 230 mg/L of chloride is the critical concentration in which adverse impacts to aquatic ecosystems are possible if the critical concentration is maintained for prolonged periods. Although certain species can be impacted at much lower concentrations. It only takes 1 teaspoon of salt (chloride) to pollute 5 gallons of water (230 mg/L).

Recent trends show increasing chloride concentrations in surface and ground waters in the County. The chloride ion does not bind to soils or sediments so once in the water they remain there indefinitely, unless the water is diluted or treated by a reverse osmosis system, which is a very costly and not very practical for most surface water applications.

In 2014, the average chloride concentration in Channel Lake was 90 mg/L with concentrations ranging from 81.0 mg/L to 95.0 mg/L. Chloride was not a parameter tested for in 2002. Conductivity which was measured in 2002 was used to estimate chloride concentrations and it is estimated that the average chloride concentration was 85 mg/L, representing a slight increase (5.9%) since 2002.

Although chloride concentrations were not highly elevated in 2014, single family and transportation were estimated to be the two highest contributors of total percent runoff, and therefore homeowners and those winter road maintenance crews should minimize their salt usage. Many residences in the Fox Chain 'O' Lakes remain on septic. If they are using a water softener, there is no removal of chloride from the waste water as it percolates through the soils and eventually into the lake. Shifts in algal populations to blue green algae and native plant communities to non-native invasive plant communities can occur, these both can have management consequences related to them. Additionally, saltwater is more dense than freshwater and therefore can get trapped in bottom waters eventually changing the volume of water mixed in the lake which can affect the entire lake ecosystem.

The LCHD-ES and Lake County Stormwater Management Commission (LCSMC) have been holding annual training sessions targeting deicing maintenance personnel for both public and private entities. Since 2010 we have provided training to approximately 468 winter maintenance personnel on the recommended application rates for applying deicers while still maintaining safe passageways. Almost all deicing products contain chloride so it is important to read and follow product labels for proper application. For instance, at a pavement temperature of 30° F, rock salt will efficiently melt ice; however at 10°F it is ineffective and therefore another product would be required to melt ice. Check with your HOA to see what is required of private companies hired to deice roads in your subdivisions. Support changes in deicing policies proposed by the local township in their

EPavement Temp. °F	One Pound of Salt (NaCl) melts	Melt Times
30	46.3 lbs of ice	5 min.
25	14.4 lbs of ice	10 min.
20	8.6 lbs of ice	20 min.
15	6.3 lbs of ice	1 hour
10	Dry salt is ineffective and will blow away before it melts anything	

Aquatic Plants

Aquatic plants are a critical component in lakes as they contribute to the uptake of available nutrients such as phosphorus from the water column making it unavailable for use by algae, filter sediments and other pollutants from the water, and stabilize bottom substrates. They also provide habitat for nesting and nursery for fish and other aquatic organisms. At times, nuisance growth has been encountered by lake managers due to invasive species and eutrophication. Good data allows lake managers to be more efficient and environmentally sound when managing lake vegetation.

In April, 2014, an aquatic vegetation survey was conducted on Channel using the point survey method. In order to accomplish this a randomized 60-meter grid was overlaid on an aerial photo of Channel Lake using ARCGIS10. A total of 413 points fell within the lake footprint. Above the 12 ft depth, which is the average depth that plants are likely to be detected given a 3—5 ft. Secchi depth, every point was sampled regardless of whether plants were detected or not, if plants dropped out of the littoral zone after 12 ft. depth, points lying at greater depths were not sampled. To sample the vegetation, a rake was lowered into the water and then scored from 1—5 (Appendix A, Table 7). Each species was scored from a modified scale. The scales were then converted to a percentage value using the midpoint of a percentage range which was associated with each score. The midpoint was used to establish species cover. A total of 227 points were sampled and species cover, relative cover, frequency, relative frequency and relative importance were quantified using a modified Braun-Blanquet scale (Mueller-Dombois, Ellenberg, 2002) Appendix A, Table 7 presents the estimated cover, frequency and relative importance for each species detected in the April, 2014 survey. A ranking of relative importance determined dominant species in the lake.

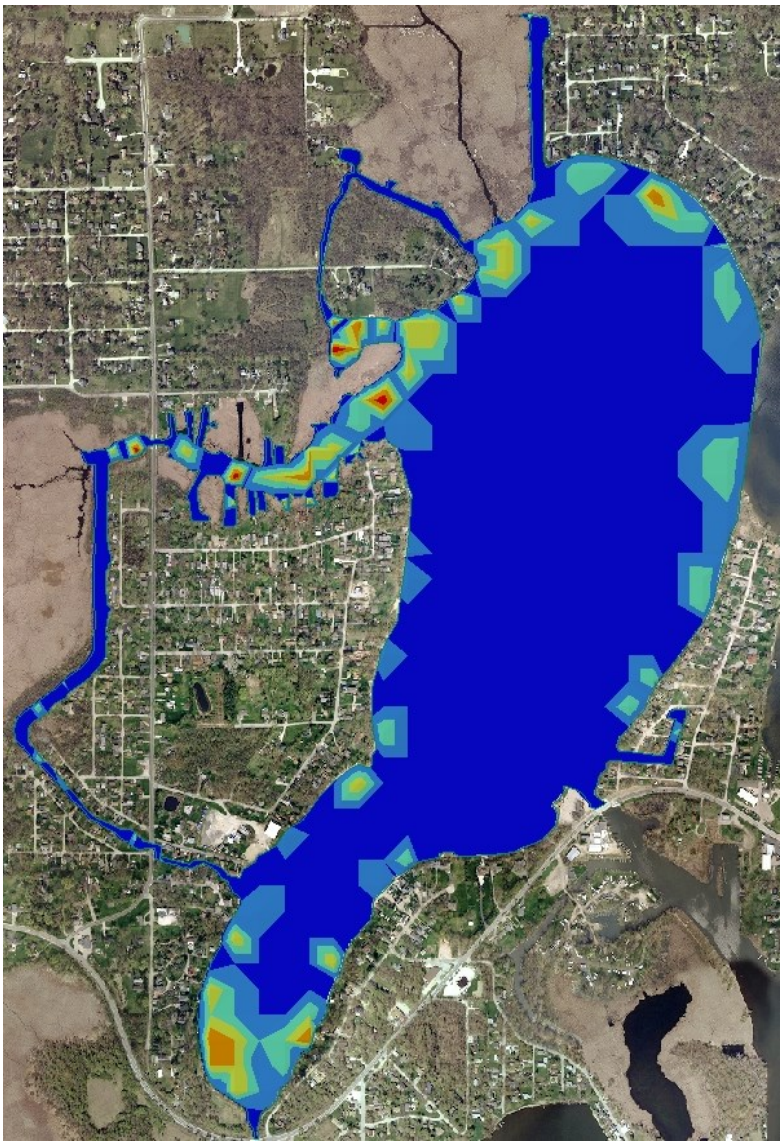


Figure 10. Status of vegetation in Channel Lake, July, 2014.

In 2014, vegetation was found at 46.7% of the 227 points sampled in the lake with an estimated cover of 31.2%. Ten plant species and Chara, a macro-algae were detected. Three floating plants were co-dominant; Coontail, White Water Lily and Star Duckweed. Coontail, is a native submerged aquatic species, and is tolerant of low light conditions. Due to the early sampling that took place in Channel Lake,

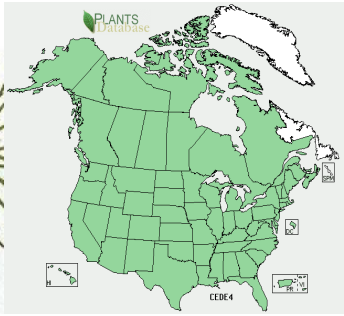
Aquatic Plants (Continued)

some species may have not emerged due to cool water temperatures. In May, the water temperature in Channel Lake averaged 11.2°C (52.16°F). Many native aquatic plants do not begin to actively grow until water temperatures reach 59°F. Figure 10 is a map displaying areas of vegetation in Channel Lake based upon the April survey (Appendix A, Figure 6).

A floristic quality assessment was performed using the aquatic plant species found in Channel Lake generating a floristic quality index (FQI) of 18.8. A floristic quality assessment is commonly used in four applications; identification of natural areas, comparisons among sites, long term monitoring and monitoring of habitat restoration. Although there is no record of residents or associations managing the aquatic vegetation in Channel Lake the FQI can be a tool to lake managers or home owner associations (HOA's) to determine if activities in the watershed might be having an impact on the plant community and to keep a long term record of the dynamics of the aquatic vegetation. Due to the sampling of the vegetation occurring in April, it is likely that later in the season there were more species present and the FQI would have been higher. The LCHD-ES is recommending that Channel Lake adopt a long term aquatic plant management plan that is developed by all stakeholders of the lake (lake associations, citizens, townships, park districts etc.). The plan would provide a template that describes the goals of aquatic plant management in Channel Lake and defines objectives to help attain those goals. If a plan is not developed it is recommended that the native plant community be increased in areas where plants can colonize, if chemical treatments are used to control invasive species, they should occur when water temperatures are cooler in order to retard the microbial breakdown of chemical as well as to ensure that chemicals have minimal if any impact to native plant populations. Other considerations are whether plants are monocots or dicots; Curlyleaf Pondweed (monocot) and Eurasian Watermilfoil (Dicot) were both present in the April survey; Therefore the strategy might differ for targeting one species over the other or if you were to target both.

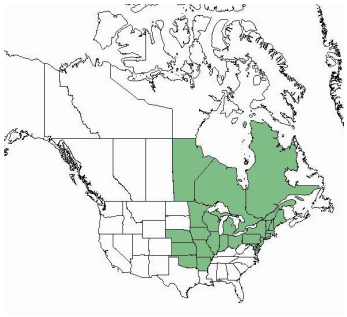
Coontail (dicot)

Coontail (*Cerataphyllum demeserum*) is a widespread native in and around the United States and Canada. It is identified by its forked whorl of leaves which extends the length of the stem. Early in the season, plants can be confused with Chara, a macroalgae.



White Water Lily (Monocot)

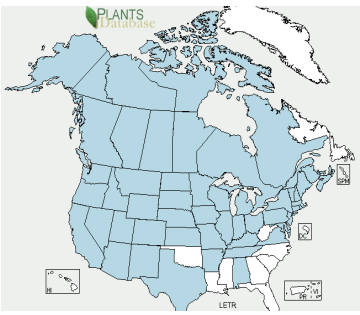
White Water Lily (Nymphaeae tuberosa odorata) is a widespread native in and around the United States and Canada. It is identified by its floating round leaf with a slit from near the center of the leaf to the leaf edge. The leaf stalk is round in cross section. It has a showy white composite flower that sits on the surface of the water. It can be confused with Spatterdock and American Lotus.



Aquatic Plants (Continued)

Star Duckweed (monocot)

Star Duckweed (Lemna trisulca) is a widespread native aquatic plant. Star Duckweed is usually forming large mats under the water surface, this is unlike Giant or Common Duckweed which float upon the water surface.



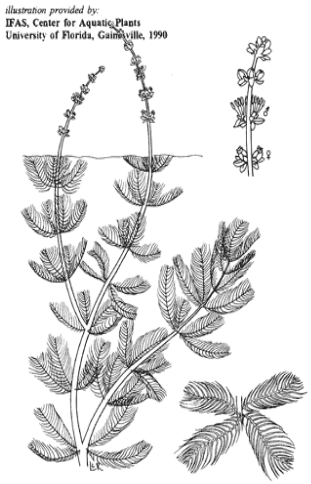
Invasive species—Eurasian Watermilfoil

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

Results from the April survey found that EWM was present at 5.29% of the points sampled with an average cover of 1.09%. The cover of EWM was likely underestimated due to the early sampling date and cool water temperatures. EWM has been found to be rapidly growing at water temperatures approaching 59°F. As mentioned earlier, the average water temperature at the deep hole was 52.15°F during our May sample event. So it is likely that temperatures were even cooler during April.

There is no record of herbicide treatments occurring in Channel Lake. Recently a hybrid milfoil (a cross between Eurasian Watermilfoil and the native Northern Watermilfoil) has been encountered on many lakes in the region who have conducted genetic testing on plants collected from Eurasian watermilfoil populations. The hybrid milfoil has proven to be less sensitive than either parental species to certain herbicides. Therefore, it is important to know whether the hybrid is present or to occasionally switch chemicals used to treat EWM to reduce the chance of chemical sensitivity being reduced in the future.

Illustration of Eurasian Watermilfoil



Invasive Species—Eurasian Watermilfoil (Continued)

Eurasian watermilfoil was not a dominant member of the aquatic vegetation in Channel Lake in April 2014.

Common Name	Average Cover	Frequency	Importance
EWM	1.09	5.29	7.99

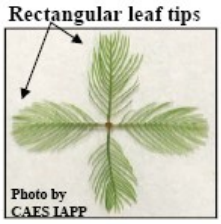
Myriophyllum spicatum Exotic*

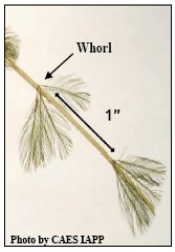
Common Names:
Eurasian watermilfoil

Origin: Exotic
Europe and Asia. Found throughout lake county and Illinois

Importance:
This invasive plant spreads rapidly, crowding out native species, clogging waterways, and blocking sunlight and oxygen from underlying waters.

Look alikes:
Northern watermilfoil; Hybrid Milfoil Which has fewer than 12 leaflet pairs per leaf, and generally has stouter stems.





Key Features:

Stem: Long, often abundantly branced stems form a reddish or olive-green surface mat in summer.

Leaf: Leaves are rectangular with ≥12 pairs of leaflets per leaf and are dissected giving a feathery appearance, arranged in a whorl, whorls are 1 inch apart.

Flower: Small pinkish male flowers that occur on reddish spikes, female flowers lack petals and sepals and 4 lobed pistil.

Illustration of Curlyleaf Pondweed

Invasive Species—Curlyleaf Pondweed

Curlyleaf Pondweed (*Potamogeton crispus;* CLP) is a non-native invasive pondweed. Like our native pondweeds it is a perennial monocot. This has management consequences as our native pondweeds and other of our native plant species are equally sensitive to herbicides that are effective in controlling this plant. CLP however, does have a life history that differs from our native pondweeds. The vegetative part of the plant dies back completely in early summer and only seeds and turions over-summer. The turions (which are the main source of reproduction in CLP) sprout in fall, and are rapidly able to elongate in spring after ice melts as temperatures reach 5°C. Vigorous growth of CLP occurs as most of our native plants are just beginning to emerge, senescing by late June and early July after turion production giving it a competitive advantage. Algal blooms have been associated with larges stands of senescing or dying plants of CLP, as nutrients used by the plant for growth are released into the water upon its death.

Curlyleaf Pondweed is identifiable by its entire leaves with prominent mid-vein and curly toothed edge which alternate along the stem of the plant.

Invasive Species—Curlyleaf Pondweed (Continued)

Potamogeton crispus *Exotic**

Common Names:
Curlyleaf Pondweed

Origin: EXOTIC
Europe and Asia. Found throughout lake county and Illinois

Importance:
Early growth of CLP negatively impacts both the establishment and distribution of native macrophytes.

Look alikes:
Illinois Pondweed (*Potamogeton illinoensis*)
Richardson's Pondweed

KEY FEATURES:

LEAF: ALTERNATE, ENTIRE WITH PROMINENT MIDVIEN , STALKLESS, CURLY TOOTHED EDGE, OBLONG, NO FLOATING LEAVES, STIPULES FUSED AT BASE

PLANT: CAPABLE OF GROWING OVER WINTER EMERGING EARLY SPRING BEFORE MOST SPECIES, COMPLETES CYCLE BEFORE MID-JULY, STEMS SLIGHTLY FLAT, SLENDER RHIZOMES

FLOWER: SMALL GREEN BROWN FLOWERS ON CURVED SPIKE ABOVE WATER;

LOOK ALIKES: RICHARDSON'S PONDWEED

Aquatic Plant Management

For full details of Part 895 see:

http://www.ilga.gov/commission/jcar/admincode/017/01700895sections.html

Herbicide application is a tool utilized by home owner associations, individual residents and lake managers to control aquatic plants in lakes of the Fox Chain 'O' Lakes. Targeted species are usually non-native invasive species; however our records indicate that there has been some treatments over the years, targeting native species. In 2014, there was no record of any herbicide applications occurring in Channel Lake.

By Administrative Code, applying herbicides on Channel Lake or any other lake in the Fox Chain 'O' Lakes requires a permit by the Illinois Department of Natural Resources (IDNR) In order to obtain the permit an application needs to be filed with the IDNR requesting a permit for pesticide application, the application can be filled out by the applicant or their representative (which is usually the pesticide consultant). It should minimally document the location and area of treatment. The targeted species, pesticide and application rate as well as an estimated time when pesticide will be applied. The application can be obtained at the Fox Waterway Agency or its website (http://www.foxwaterway.state.il.us/). The IDNR has 45 days to issue or deny the permit. The Fox Waterway agency has the right to review all applications and can recommend denial of a permit if it feels that it could cause harm to the environment. Chemicals should only be used if they are labelled and registered with the Illinois Environmental Protection Agency. More information is available at the link to Part 895 of the Administrative Code which covers management of aquatic plants on the Fox Chain 'O' Lakes.

A NPDES permit is required before applying pesticides over or near waters of the state. A notice of intent to apply pesticides needs to be filed with the state and can be found its website (http://www.epa.state.il.us/water/permits/pesticide/forms/noi.pdf). There is a 14 day public notice period and additional information may be requested so plan ahead. Either the homeowner or its representative can apply for the permit. Once issued the permit is good for 5 years. If your treatments exceed 80 acres annually additional reporting is required. Additional documentation is required in the cases where adverse affects due to a spill or overdosing occur.

The LCHD is encouraging homeowner associations and individuals and agencies to formulate a long-term Aquatic Plant Management Plan (APMP) for the Fox Chain 'O' Lakes that can be used as a template by any entity or homeowner applying pesticides into the lake. Developing the plan should consider all stakeholders that utilize the lake. The plan should describe all methods of control and select the best management tool to address problems identified and explain why it was chosen. The plan should consider timing of pesticide application, targeted species, and pesticide selection. Distributing information on pesticides that are approved for aquatic use should be included so that the person(s) responsible for lake management decisions are knowledgeable about the pesticides being applied to the lake and any risks associated with those chemicals. This allows them to formulate a clear concise Request for Proposal (RFP) that addresses the key considerations, sets reasonable goals and the objectives for achieving those goals. The APMP should also require monitoring of the lake vegetation to ensure that the goals are being met. This would allow for modifying strategies if goals defined in the APMP are not met.

Zebra Mussels

Zebra Mussel

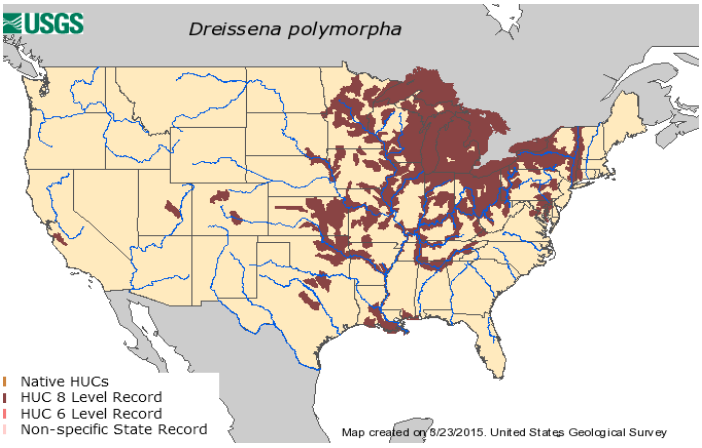
Zebra Mussels were not detected by LCHD-ES in Lake Catherine during 2014 surveys.

In the late 1990's, the presence of zebra mussels (Dreissena polymorpha) was confirmed in the Fox Chain O Lakes. These mussels are believed to have been spread to this country in the mid 1980's by cargo ships from Europe that discharged their ballast water into the Great Lakes. The mussels spread throughout the Great Lakes and by 1991 had made their way into the Illinois and Mississippi Rivers. Currently, 32 inland lakes in the county are known to be infested with the zebra mussel, but this number could be much higher, since the zebra mussel can go unnoticed.

The zebra mussel's reproductive cycle allows for rapid expansion of the population. A mature female can produce up to 40,000 eggs in a cycle and up to one million in a season. They can live as long as five years and have an average life span of about 3.5 years. Adults are typically about the size of a thumbnail but can grow as large as 2 inches in diameter. Colonies can reach densities of 30,000 - 70,000 mussels per square meter. Due to their quick life cycle and explosive growth rate, zebra mussels can quickly edge out native mussel species. Negative impacts on native bivalve populations include interference with feeding, habitat, growth, movement and reproduction.

The impact that mussels have on fish populations is not fully understood. However, zebra mussels feed on phyto-plankton (algae), which is also a major food source for planktivorous fish, such as minnows, shad and young of the year bluegill. These fish, in turn, are a food source for piscivorus fish (fish eating fish), such as largemouth bass and northern pike.

Zebra mussels clogging water intake pipes have caused economic hardships for power plants, public water supplies, and industrial facilities. Boats stored on the water offer suitable areas for zebra mussels to start a colony. They can eventually affect cooling and exhaust systems on boats and create



Key Features:

The zebra mussel is a small shellfish named for the striped pattern of its shell. Color patterns can vary to the point of having only dark or light colored shells and no stripes. It is typically found attached to objects, surfaces, or other mussels by threads extending from underneath the shells. Although similar in appearance to the quagga mussel (*Dreissena bugensis*), the two species can be easily distinguished. When placed on a surface zebra mussels are stable on their flattened underside while quagga mussels, lacking a flat underside, will fall over. See Mackie and Chlosser (1996) for a key to adult dreissenids

Zebra Mussels (continued)

extra drag causing lower fuel economy. Studies on the transport of the zebra mussel have shown that they can be found in any area of a boat that holds water, including the engine cooling system, bilge water, and bait buckets used in fishing. Researchers found that many of the mussel larvae were being transported via aquatic plants that were taken from one lake to another on boats and trailers. Therefore, it is important that all boats and trailers entering or leaving the Fox Chain O' Lakes are inspected for aquatic plants and all water from the bilge and motors are drained.

Recently, an experimental biocide called Zequanox has shown to be effective against zebra mussels and it is not toxic to humans, native bivalves, and fish. In-lake tests show that it reached 97.1% mortality on zebra mussels within 14 days of treatment . Zequanox is a non-chemical solution made from dead cells of a naturally occurring microbe (Psuedomonas flourescens). It is highly selective to zebra and quagga mussels and has low toxicity (Marrone Bio Innovasions). Currently winter drawdowns have exposed the zebra mussels along the shorelines, however prevention is the best defest against any invasive species spread. The Great Lakes Sea Grant Network provides the following tips to prevent the spread of zebra mussels:

Always inspect your boat and boat trailer carefully before transporting. Studies have shown that transport via aquatic plant fragments is one of the major contributors to the spread of zebra mussels.

Drain all bilge waters, live wells, bait buckets and engine compartments before entering another lake. Make sure water is not trapped in your trailer. Never transport water from one lake to another.

Flush clean water (tap) through the cooling system of your motor to rinse out any larvae.

Full grown zebra mussels can be easily seen but cling stubbornly to surfaces. Boats that have been in the water for long periods of time should be carefully inspected. Carefully scrape the hull (or trailer), or use a high pressure spray (250 psi) to dislodge them. Or leave your boat out of the water for at least 5 days, preferably up to two weeks. The mussels will die and drop off.

In their earlier stages, attached zebra mussels may not be easily seen. Pass your hand across the boat's bottom - if it feels grainy, it's probably covered with mussels. Don't take a chance; clean them off by scraping or blasting.

Dispose of the mussels in a trash barrel or other garbage container. Don't leave them on the shore where they could be swept back into the lake or foul the area.

BEACHES

Fish Species in Lake Catherine and Channel Lake, 2013.

- Black Crappie
- Blue Gill
- Bluntnose minnow
- Bowfin
- Brown Bullhead
- Brook Silverside
- Carp
- Channel Catfish
- Emerald Shiner
- Fresh Water Drum
- Golden Shiner
- Green Sunfish
- Gizzard Shad
- Johnny Darter
- Large Mouth Bass
- Log Perch
- Muskellunge
- Northern Pike
- Pumpkinseed
- Spottail Shiner
- Quillback
- Walleye
- Warmouth
- White Bass
- Yellow Bullhead
- Yellow Perch
- Yellow Bass

Channel Lake has 3 licensed beaches along its shore; Turtle Beach, Bluffs Lodges Subdivision Beach and Lake Shore Park Beach. Licensed beaches are sampled bi-weekly for E-coli during the beach season, Memorial Day through Labor Day. If E-coli colonies are ≥ 235 colonies/100 mL, a swim ban is issued. Since 2004, Turtle Beach has had 8 swim bans; none have occurred at Bluffs Lodges Subdivision Beach, and 12 have occurred at Lake Shore Park Beach, most occurring between 2009 and 2010. The record does not show a ban placed on Lake Shore Park Beach in May, 2013 as it occurred before the swim season and was detected during a response to a harmful algal bloom that was taking place at the beach.

Since 2013, Lake Shore Park Beach was selected for routine sampling of blue-green algae as part of a pilot program developed by the LCHD and IEPA. Samples collected are sent out to an independent laboratory for enzyme-linked immunosorbent assay (ELISA). If a bloom is present an Abraxis test is run to test for presence of toxin. If present at concentrations above 10 ppb, the beach manager is contacted and it recommended that the beach close until the bloom subsides. In 2013, the results of ELISA were well below the recommended level by the World Health Organization for no contact (≥20 ug/L).

FISH

The Illinois Department of Natural Resources continuously monitors the fish populations in the Fox Chain 'O' Lakes through biennial fish surveys. They normally catch between 35—40 fish species during these surveys. In 2013, the IDNR conducted their biennial survey on the Fox Chain 'O' Lakes. During this survey they sampled Lake Catherine and Channel Lake and found 27 species of fish. Bluegill was the most abundant fish caught (354 individuals), however, Muskellunge (3) and Carp (7) were the fish having the greatest average weight, 8.4 lbs. and 7.6 lbs., respectively.

The Fox Chain 'O' Lakes is annually stocked with 243,000 2"walleye fingerlings, 2 million walleye fry, and at least 2000 muskie fingerlings. Sixty-five thousand 4" to 6" largemouth bass fingerlings are stocked every other year. Natural reproduction maintains all other species.

FISHING REGULATIONS – Includes the Fox River from the Illinois State line to the Algonquin Dam.
Trot line fishing is permitted.

Species	Daily Creel Limit	Minimum Length Limit
Largemouth Bass and	6	**14"**
Smallmouth Bass (No more than 3 fish can be smallmouth bass, smallmouth must be released immediately between April 1 to June 15, no possession)		
Walleye	4	**14" to 18"** (18" to 24" protected slot limit, no possession) **only 1 fish can be >24"**
Muskie	1	48"
Northern Pike	3	24"

(see current Illinois Fishing Information booklet or IFISHILLINOIS website http://www.ifishillinois.org/ for specific details).

LakeCounty
Health Department and
Community Health Center

ENVIRONMENTAL SERVICES

Senior Biologist: Mike Adam

madam@lakecountyil.gov

Population Health Services
500 W. Winchester Road
Libertyville, Illinois 60048-1331

Phone: 847-377-8030
Fax: 847-984-5622

For more information visit us at:

http://www.lakecountyil.gov/Health/want/BeachLakeInfo.htm

Protecting the quality of our lakes is an increasing concern of Lake County residents. Each lake is a valuable resource that must be properly managed if it is to be enjoyed by future generations. To assist with this endeavor, Population Health Environmental Services provides technical expertise essential to the management and protection of Lake County surface waters.

Environmental Service's goal is to monitor the quality of the county's surface water in order to:

- Maintain or improve water quality and alleviate nuisance conditions
- Promote healthy and safe lake conditions
- Protect and improve ecological diversity

Services provided are either of a technical or educational nature and are provided by a professional staff of scientists to government agencies (county, township and municipal), lake property owners' associations and private individuals on all bodies of water within Lake County.

RECOMMENDATIONS

LCHD-ES recommends the following actions for improving the water quality and overall health of Channel Lake:

- Develop an aquatic plant management plan that can be used as a template for lake managers, homeowners and other entities charged with aquatic plant management on Channel Lake.
- Encourage groups within the Trevor Creek watershed to incorporate best management practices to reduce the nutrient load (especially phosphorus) into Channel Lake and the Fox Chain 'O' Lakes.
- The IEPA has prioritized the funding of projects through 319 grant funds for the Fox River Watershed. Channel Lake is part of that watershed. It is recommended that a work group be formed that can identify potential projects to include in a proposal. The LCHD-ES is willing to provide guidance for producing the application proposal and implementation of any projects funded. The workgroup should include partner volunteers from the entire Fox Chain 'O' Lakes to strengthen the proposal. At least one of the partners should be an entity that has legal status to receive funds from the State of Illinois; including state and local governmental units, non-for profit organizations, citizen and environmental groups, individuals and businesses. They are funding projects identified under approved watershed plans, (Sequiot Creek). Applications are due in Springfield on August 1, 2015. Contact the LCHD at (847) 377-8030 for more information.

STOP AQUATIC HITCHHIKERS!™

Prevent the transport of nuisance species.
Clean all recreational equipment.
www.ProtectYourWaters.net

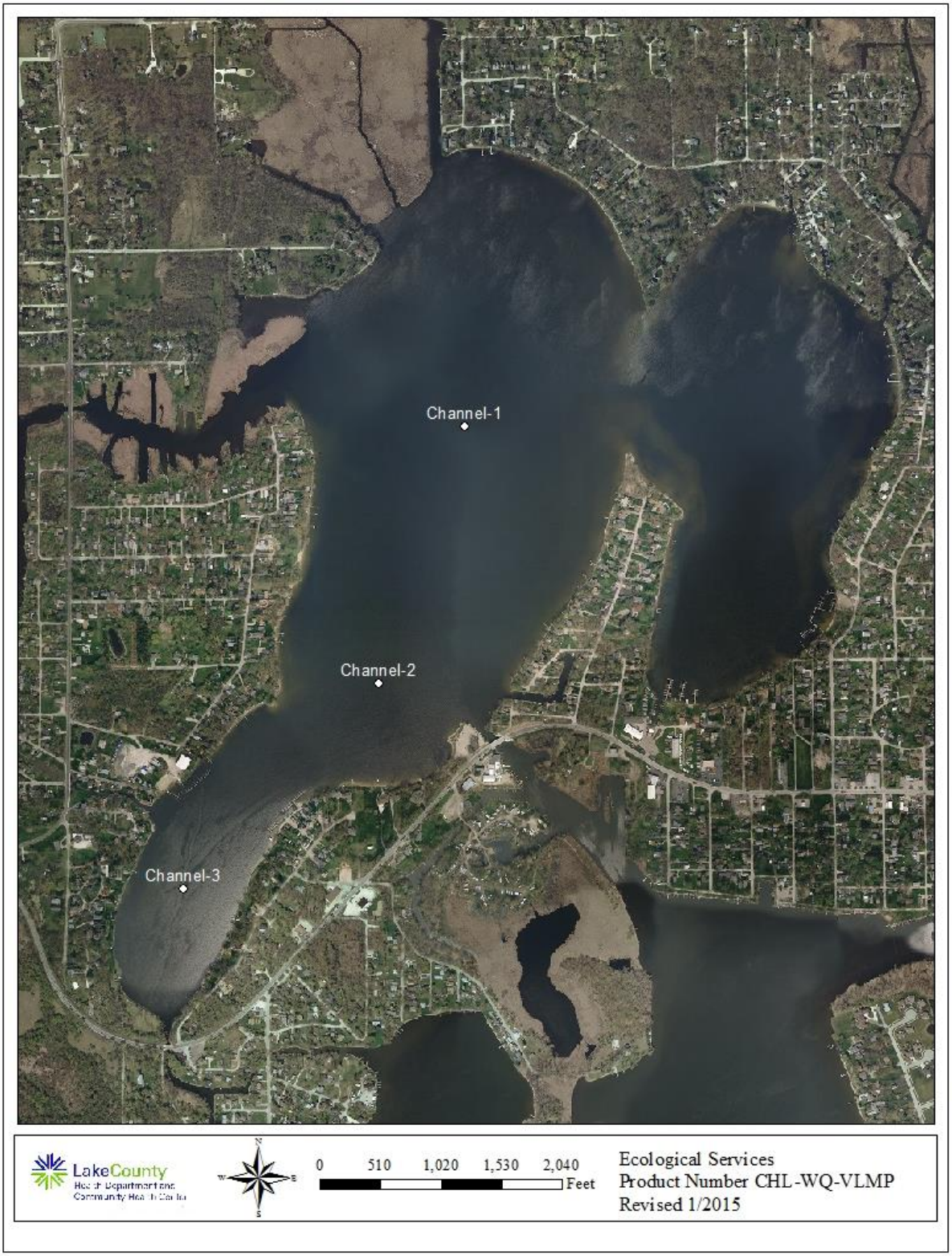
When you leave a body of water:

- Remove any visible mud, plants, fish or animals before transporting equipment.
- Eliminate water from equipment before transporting.
- Clean and dry anything that comes into contact with water (boats, trailers, equipment, clothing, dogs, etc.).
- Never release plants, fish or animals into a body of water unless they came out of that body of water.

APPENDIX A

FIGURES AND TABLES
CHANNEL LAKE
2014

Figure 1. LCHD water quality sampling points – Channel Lake, 2014.



.

Table 1. Approximate land uses and retention time for Channel Lake. (Lake County Mapping Services and SEWRPC data)

Land Use	Acreage	% of Total
Agricultural	4588.33	36.5%
Disturbed Land	48.34	0.4%
Forest and Grassland	832.73	6.6%
Government and Institutional	95.22	0.8%
Industrial	50.06	0.4%
Multi Family	26.95	0.2%
Public and Private Open Space	400.49	3.2%
Retail/Commercial	105.38	0.8%
Single Family	2260.50	18.0%
Transportation	870.90	6.9%
Utility and Waste Facilities	0.00	0.0%
Water	1500.81	11.9%
Wetlands	1801.97	14.3%
Total Acres	**12581.68**	**100.0%**

Land Use	Acreage	Runoff Coeff.	Estimated Runoff, acft.	% Total of Estimated Runoff
Agricultural	4588.33	0.05	630.9	13.1%
Disturbed Land	48.34	0.05	6.6	0.1%
Forest and Grassland	832.73	0.05	114.5	2.4%
Government and Institutional	95.22	0.50	130.9	2.7%
Industrial	50.06	0.50	37.1	0.8%
Multi Family	26.95	0.50	165.2	3.4%
Public and Private Open Space	400.49	0.15	165.2	3.4%
Retail/Commercial	105.38	0.85	246.3	5.1%
Single Family	2260.50	0.30	1864.9	38.8%
Transportation	870.90	0.50	1197.5	24.9%
Utility and Waste Facilities	0.00	0.30	0.0	0.0%
Water	1500.81	0.00	0.0	0.0%
Wetlands	1801.97	0.05	247.8	5.2%
TOTAL	**12581.68**		**4806.9**	100.0%

Lake volume	**4895.00**	**acre-feet**
Retention Time (years)= lake volume/runoff	**1.02**	**years**
	371.69	**days**

.

Figure 2. Land Use and Watershed for Channel Lake (Lake County Mapping Services and SEWRPC data).

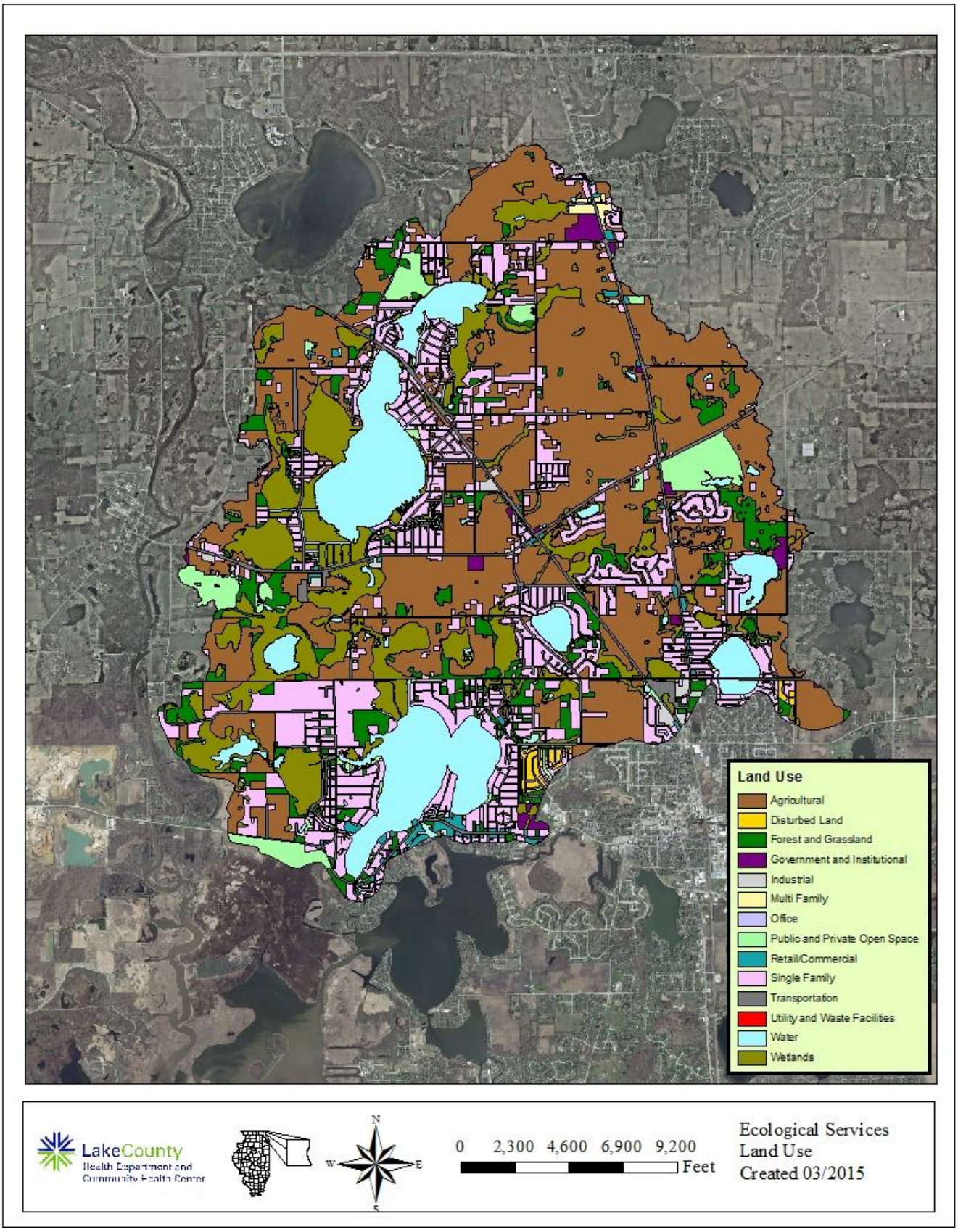


Table 2. 2000 - 2014 Water Quality Parameters, Statistics Summary.

	ALKoxic <=3ft00-2014	
Average	163	
Median	161	
Minimum	65	IMC
Maximum	330	Flint Lake
STD	39	
n =	870	

	ALKanoxic 2000-2014	
Average	197	
Median	189	
Minimum	103	Heron Pond
Maximum	470	Lake Marie
STD	46	
n =	231	

	Condoxic <=3ft00-2014	
Average	0.8699	
Median	0.7900	
Minimum	0.2260	Schreiber Lake
Maximum	6.8920	IMC
STD	0.5210	
n =	868	

	Condanoxic 2000-2014	
Average	1.0183	
Median	0.8320	
Minimum	0.3210	Lake Kathyrn, Schreiber Lake
Maximum	7.4080	IMC
STD	0.8073	
n =	233	

	NO3-N, Nitrate+Nitrite,oxic <=3ft00-2014	
Average	0.145	
Median	<0.05	*ND
Minimum	<0.05	*ND
Maximum	9.670	S. Churchill Lake
STD	0.533	
n =	870	

76.1% of samples < detection limit of 0.05 mg/L
Statistics assume ND=0.049 mg/L
Beginning in 2006, Nitrate+Nitrite was measured.

	NH3-Nanoxic 2000-2014	
Average	1.875	
Median	0.978	
Minimum	<0.1	*ND
Maximum	18.400	Taylor Lake
STD	2.412	
n =	233	

21.8% of samples < detection limit of 0.1 mg/L
Statistics assume ND=0.09 mg/L

	pHoxic <=3ft00-2014	
Average	8.34	
Median	8.33	
Minimum	5.24	Red Wing Slough
Maximum	10.50	Antioch Lake
STD	0.47	
n =	868	

	pHanoxic 2000-2014	
Average	7.28	
Median	7.24	
Minimum	5.80	Third Lake
Maximum	9.16	White Lake
STD	0.45	
n =	233	

	All Secchi 2000-2014	
Average	4.21	
Median	2.95	
Minimum	0.18	McDonald 2/Ozaukee/Rollins 2
Maximum	29.23	Bangs Lake
STD	3.60	
n =	787	

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Table 2. 2000 - 2014 Water Quality Parameters, Statistics Summary (continued.

	TKNoxic <=3ft00-2014	
Average	1.516	
Median	1.200	
Minimum	<0.1	*ND
Maximum	41.200	Almond Marsh
STD	1.690	
n =	870	

*ND = 1.0% Non-detects from 5 different lakes

	TKNanoxic 2000-2014	
Average	3.149	
Median	2.270	
Minimum	<0.5	*ND
Maximum	21.000	Taylor Lake
STD	2.584	
n =	233	

	TPoxic <=3ft00-2014	
Average	0.113	
Median	0.068	
Minimum	<0.01	*ND
Maximum	7.270	Almond Marsh
STD	0.274	
n =	869	

*ND = 1.8% Non-detects from 6 different lakes

	TPanoxic 2000-2014	
Average	0.357	
Median	0.176	
Minimum	0.012	Independence Grove, W. Loon
Maximum	3.800	Taylor Lake
STD	0.461	
n =	233	

	TSSall <=3ft00-2014	
Average	15.9	
Median	8.2	
Minimum	<1	*ND
Maximum	220.0	Rollins 2
STD	22.3	
n =	875	

*ND = 1.5% Non-detects from 9 different lakes

	TVSoxic <=3ft00-2014	
Average	125.1	
Median	121.0	
Minimum	34.0	Pulaski Pond
Maximum	1090.0	Almond Marsh
STD	49.3	
n =	870	

	TDSoxic <=3ft00-2004	
Average	470	
Median	454	
Minimum	150	Lake Kathryn, White
Maximum	1340	IMC
STD	169	
n =	745	

No 2002 IEPA Chain Lakes.

	CLanoxic 2000-2014	
Average	193	
Median	124	
Minimum	3.5	Schreiber Lake
Maximum	2390	IMC
STD	298	
n =	194	

	CLoxic 2000-2014	
Average	174	
Median	139	
Minimum	2.7	Schreiber Lake
Maximum	2760	IMC
STD	191	
n =	802	

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Anoxic conditions are defined <=1 mg/l D.O.
pH Units are equal to the -Log of [H] ion activity
Conductivity units are in MilliSiemens/cm
Secchi Disk depth units are in feet
All others are in mg/L

Minimums and maximums are based on data from all lakes from 2000-2014 (n=3516).

Average, median and STD are based on data from the most recent water quality sampling year for each lake.

LCHD Environmental Services ~ 12/10/2014

Table 3. Water Quality Data Summary for Channel Lake, 2014.

2014	Epilimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
May	3	187	1.73	<0.100	<0.05	0.106	<0.005	92.5	370	16.0	441	125	1.5	0.642	8.79	12.71
June	3	187	1.15	<0.100	<0.05	0.045	<0.005	94.8	378	3.2	422	126	6.9	0.6579	8.48	9.04
July	3	173	1.20	<0.100	<0.05	0.054	<0.005	81.0	374	8.0	398	110	2.8	0.6488	8.41	9.5
August	3	181	1.46	<0.100	<0.05	0.047	0.008	90.2	362	11.0	419	133	1.4	0.6259	8.57	8.22
September	3	174	1.78	0.199	<0.05	0.086	<0.005	90.4	361	10.0	385	102	1.3	0.6240	7.90	9.27
	Average	180	1.46	<0.199[k]	<0.05	0.068	<0.008	89.8	369	9.6	413	119	2.8	0.6397	8.43	9.75

2002	Epilimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-**	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
9-May	1	280	2.24	0.070	0.2	0.033	0.013	87.3	371	9	NR	3	9.5	0.6425	8.26	9.45
12-Jun	1	205	1.09	0.010	0.22	0.027	0.011	81.9	362	8	NR	3	5.9	0.6249	8.45	9.42
17-Jul	1	245	1.20	<0.100	<0.05	0.048	0.006	78.6	356	3	NR	3	6.2	0.6141	8.49	8.43
14-Aug	1	185	<0.10	<0.100	<0.05	0.033	0.005	79.6	358	6	NR	4	2.2	0.6176	8.54	7.13
2-Oct	1	240	<0.10	0.240	0.03	0.049	0.006	95.1	383	1	NR	1	9.5	0.6682	8.04	7.39
	Average	231	<1.51[k]	<0.107[k]	<0.15[k]	0.038	<0.008	84.5	366	5.4	NR	3	6.7	0.6335	8.36	8.36

Glossary

ALK = Alkalinity, mg/L $CaCO_3$
TKN = Total Kjeldahl nitrogen, mg/L
NH_3-N = Ammonia nitrogen, mg/L
NO_2+NO_3-N = Nitrate + Nitrite nitrogen, mg/L
NO_3-N = Nitrate + Nitrite nitrogen, mg/L
TP = Total phosphorus, mg/L
SRP = Soluble reactive phosphorus, mg/L
Cl^- = Chloride, mg/L

TDS = Total dissolved solids, mg/L
TSS = Total suspended solids, mg/L
TS = Total solids, mg/L
TVS = Total volatile solids, mg/L
SECCHI = Secchi disk depth, ft.
COND = Conductivity, milliSiemens/cm
DO = Dissolved oxygen, mg/L

k = Denotes that the actual value is known to be less than the value presented.
NA= Not applicable
* = Prior to 2006 only Nitrate - nitrogen was analyzed
**=Estimated based on Conductivity
NR = no measurement taken
ND = data not available

Table 3. Water Quality Data Summary for Channel Lake, 2014.

2014	Hypolimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
6-May	33	183	1.77	<0.100	<0.05	0.110	<0.005	93.8	371	17.0	437	120	NA	0.6437	8.71	11.43
10-Jun	33	226	6.38	5.190	<0.05	0.771	0.716	94.0	404	6.0	445	115	NA	0.7095	7.18	0.05
8-Jul	30	229	5.14	4.700	<0.05	0.618	0.604	97.3	433	5.4	444	117	NA	0.7661	7.16	0.05
12-Aug	34	261	8.37	7.390	<0.05	0.982	0.965	97.4	429	3.6	462	127	NA	0.7586	6.99	0.05
16-Sep	33	278	10.30	9.440	<0.05	1.160	1.070	94.4	457	6.4	439	93	NA	0.8140	6.65	0.43
	Average	235	6.39	6.680	<0.05	0.728	0.839	95.4	419	7.7	445	114	NA	0.7384	7.34	2.40

2002	Hypolimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-**	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
9-May	33	265	1.47	0.44	0.16	0.089	0.060	89.1	374	7.0	NR	3	NA	0.6484	7.74	4.55
12-Jun	33	205	2.80	0.85	0.04	0.199	0.180	96.3	385	8.0	NR	2	NA	0.6721	7.48	0.12
17-Jul	33	300	4.09	2.2	<0.05	0.477	0.445	103.1	396	3.0	NR	3	NA	0.6941	7.15	0.09
14-Aug	35	285	<0.10	2.3	<0.05	0.428	0.358	107.2	403	3.0	NR	2	NA	0.7075	7.08	0.05
2-Oct	33	290	<0.10	5.6	<0.05	0.884	0.840	127.1	436	5.0	NR	5	NA	0.7727	6.86	0.01
	Average	269	2.79	2.278	<0.10	0.415	0.377	104.6	399	5.2	NR	3	NA	0.6989	7.262	0.964

Figure 3. Channel Lake 2002 and 2014 Secchi Depths.

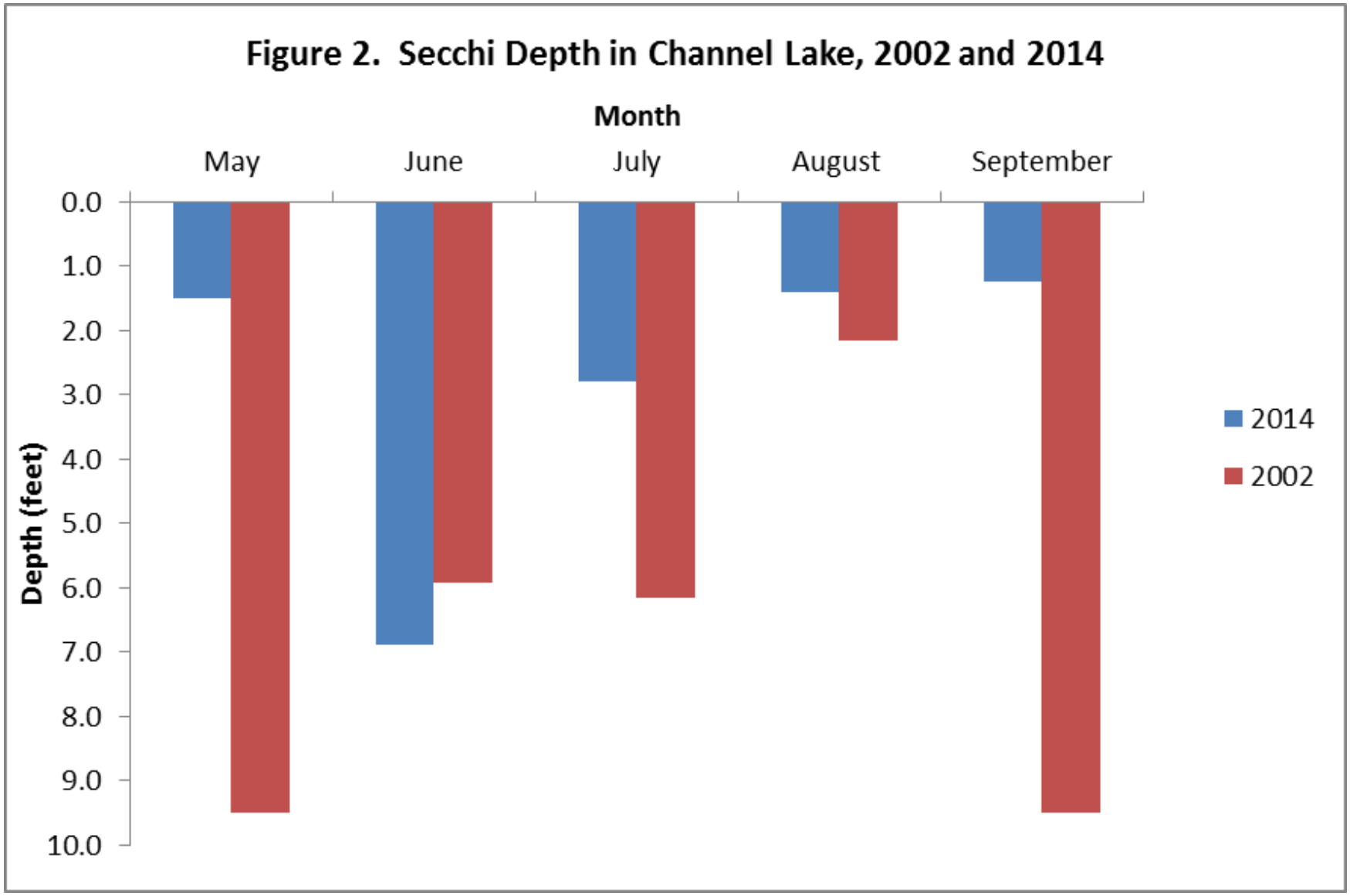

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
1	Windward Lake	14.28	38.79
2	Lake Carina	13.21	39.92
3	Cedar Lake	12.55	41.00
4	Druce Lake	12.25	41.00
5	Pulaski Pond	11.69	41.68
6	West Loon Lake	11.55	41.85
7	Independence Grove	11.50	41.92
8	Sterling Lake	11.35	42.10
9	Lake Zurich	10.40	43.37
10	Third Lake	9.76	44.00
11	Davis Lake	9.65	44.44
12	Harvey Lake	9.47	44.72
13	Little Silver Lake	9.42	44.79
14	Old School Lake	9.40	44.82
15	Lake Kathryn	9.39	44.84
16	Dugdale Lake	9.22	45.10
17	Dog Training Pond	9.04	45.39
18	Banana Pond	8.85	45.69
19	Deep Lake	8.83	45.72
20	Stone Quarry Lake	8.81	45.76
21	Lake of the Hollow	8.74	45.87
22	Cross Lake	8.18	46.83
23	Ames Pit	8.14	46.90
24	Bangs Lake	8.02	47.00
25	Briarcrest Pond	8.00	47.15
26	Sand Lake	7.48	48.12
27	Sand Pond (IDNR)	7.42	48.23
28	Timber Lake (North)	7.37	48.33
29	Lake Miltmore	7.35	48.37
30	Lake Leo	7.31	48.45
31	Schreiber Lake	7.25	48.57
32	Nielsen Pond	7.23	48.61
33	Honey Lake	7.17	48.73
34	Lake Minear	7.13	48.81
35	Round Lake	7.01	49.05
36	Highland Lake	6.97	49.14
37	Lake Helen	6.43	50.30
38	Sun Lake	6.33	50.52
39	Lake Barrington	6.12	51.00
40	Cranberry Lake	5.94	51.00
41	Lake Fairfield	5.89	51.56
42	Gages Lake	5.45	52.68
43	Wooster Lake	5.33	47.00
44	Owens Lake	5.30	53.08
45	Valley Lake	5.05	53.78
46	McGreal Lake	5.04	53.81
47	Old Oak Lake	4.85	54.36
48	Waterford Lake	4.70	54.82
49	Lake Linden	4.60	55.13

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
50	Peterson Pond	4.51	55.41
51	Timber Lake (South)	4.46	56.00
52	Crooked Lake	4.39	55.79
53	Mary Lee Lake	4.35	55.93
54	Butler Lake	4.35	55.93
55	Crooked Lake	4.28	56.17
56	Deer Lake	4.20	56.45
57	Seven Acre Lake	4.18	56.51
58	Lambs Farm Lake	4.17	56.54
59	Grays Lake	4.08	56.86
60	Lake Naomi	4.05	56.96
61	White Lake	3.96	57.29
62	Hook Lake	3.95	57.32
63	Turner Lake	3.92	57.43
64	North Tower Lake	3.89	60.00
65	Leisure Lake	3.85	57.69
66	Salem Lake	3.77	58.00
67	Lake Fariview	3.75	58.00
68	Countryside Glen Lake	3.64	58.50
69	Taylor Lake	3.52	58.99
70	Hastings Lake	3.52	58.99
71	Duck Lake	3.49	59.11
72	Fish Lake	3.47	59.19
73	Bishop Lake	3.47	59.19
74	Lake Lakeland Estates	3.41	59.00
75	Lake Holloway	3.40	59.49
76	Stockholm Lake	3.38	59.57
77	East Loon Lake	3.30	59.92
78	Bresen Lake	3.28	60.00
79	Summerhill Estates Lake	3.27	60.05
80	Lucky Lake	3.22	60.27
81	Diamond Lake	3.17	60.50
82	Liberty Lake	3.16	60.54
83	International Mining and Chemical Lake	3.08	60.91
84	Long Lake	3.05	61.00
85	Lake Christa	3.01	61.24
86	Lucy Lake	2.99	61.34
87	Lake Catherine	2.90	62.00
88	St. Mary's Lake	2.79	62.34
89	Channel Lake	2.77	62.00
90	Werhane Lake	2.71	62.76
91	East Meadow Lake	2.61	63.30
92	Buffalo Creek Reservoir 1	2.60	64.00
93	Countryside Lake	2.58	63.00
94	Kemper Lake 1	2.56	63.58
95	Bluff Lake	2.51	64.00
96	Broberg Marsh	2.50	63.92
97	Antioch Lake	2.48	64.03
98	Little Bear Lake	2.38	64.63

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
99	Island Lake	2.32	65.00
100	Tower Lake	2.31	56.00
101	Buffalo Creek Reservoir 2	2.30	67.00
102	Woodland Lake	2.28	65.00
103	Rivershire Pond 2	2.23	65.57
104	Lake Charles	2.20	65.76
105	College Trail Lake	2.18	65.89
106	Loch Lomond	2.17	65.96
107	Redhead Lake	2.16	65.00
108	Pistakee Lake	2.15	66.00
109	Echo Lake	2.11	66.36
110	Eagle Lake (S1)	2.10	66.43
111	West Meadow Lake	2.07	66.64
112	Forest Lake	2.04	66.85
113	Grand Ave Marsh	2.03	66.92
114	Columbus Park Lake	2.03	66.92
115	Grassy Lake	2.00	67.14
116	Petite Lake	2.00	67.00
117	Sylvan Lake	1.98	67.28
118	Bittersweet Golf Course #13	1.98	67.28
119	Fischer Lake	1.96	67.43
120	Spring Lake	1.78	69.00
121	Kemper Lake 2	1.77	68.90
122	Fourth Lake	1.77	68.90
123	Nippersink Lake	1.73	69.23
124	Deer Lake Meadow Lake	1.73	69.23
125	Lake Louise	1.68	69.65
126	Willow Lake	1.63	70.09
127	Slough Lake	1.63	70.09
128	Rasmussen Lake	1.62	70.17
129	Lake Farmington	1.62	70.17
130	Half Day Pit	1.60	70.35
131	Lake Marie	1.56	68.00
132	Longview Meadow Lake	1.51	71.19
133	Lake Matthews	1.48	72.00
134	Big Bear Lake	1.32	73.13
135	Fox Lake	1.28	74.00
136	Dunn's Lake	1.22	74.00
137	Lake Eleanor	1.16	74.99
138	McDonald Lake 1	1.13	75.37
139	Lake Napa Suwe	1.06	105.00
140	Rollins Savannah 1	1.05	76.43
141	Osprey Lake	1.03	76.70
142	Manning's Slough	1.00	77.13
143	Rollins Savannah 2	0.95	77.87
144	Dog Bone Lake	0.94	78.02
145	Redwing Marsh	0.88	78.97
146	Flint Lake Outlet	0.83	79.82
147	Slocum Lake	0.81	80.00

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
148	Fairfield Marsh	0.81	80.17
149	Oak Hills Lake	0.79	80.53
150	Grass Lake	0.78	77.00
151	Lake Nippersink	0.77	81.00
152	South Churchill Lake	0.73	81.67
153	Lake Forest Pond	0.71	82.07
154	ADID 127	0.66	83.12
155	North Churchill Lake	0.61	84.26
156	Hidden Lake	0.56	85.54
157	Ozaukee Lake	0.51	86.84
158	McDonald Lake 2	0.50	87.12

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
1	Lake Carina	0.0100	37.35
2	Sterling Lake	0.0100	37.35
3	Cedar Lake	0.0130	41.14
4	Independence Grove	0.0130	41.14
5	Lake Zurich	0.0135	41.68
6	Druce Lake	0.0140	42.00
7	Windward Lake	0.0160	44.13
8	Sand Pond (IDNR)	0.0165	44.57
9	West Loon	0.0170	45.00
10	Pulaski Pond	0.0180	45.83
11	Banana Pond	0.0200	47.35
12	Gages Lake	0.0200	47.35
13	Lake Kathryn	0.0200	47.35
14	Lake Minear	0.0200	47.35
15	Highland Lake	0.0202	47.49
16	Lake Miltmore	0.0210	48.00
17	Timber Lake (North)	0.0210	48.05
18	Cross Lake	0.0220	48.72
19	Dog Training Pond	0.0220	48.72
20	Sun Lake	0.0220	48.72
21	Deep Lake	0.0230	49.36
22	Lake of the Hollow	0.0230	49.36
23	Round Lake	0.0230	49.36
24	Stone Quarry Lake	0.0230	49.36
25	Little Silver Lake	0.0250	50.57
26	Bangs Lake	0.0260	51.13
27	Lake Leo	0.0260	51.13
28	Cranberry Lake	0.0270	51.68
29	Dugdale Lake	0.0270	51.68
30	Peterson Pond	0.0270	51.68
31	Fourth Lake	0.0360	53.00
32	Lambs Farm Lake	0.0310	53.67
33	Old School Lake	0.0310	53.67
34	Grays Lake	0.0310	54.00
35	Harvey Lake	0.0320	54.50
36	Hendrick Lake	0.0340	55.00
37	Honey Lake	0.0340	55.00
38	Sand Lake	0.0380	56.00
39	Third Lake	0.0384	56.00
40	Sullivan Lake	0.0370	56.22
41	Ames Pit	0.0390	56.98
42	Diamond Lake	0.0390	56.98
43	East Loon	0.0400	57.34
44	Schreiber Lake	0.0400	57.34
45	Waterford Lake	0.0400	57.34
46	Hook Lake	0.0410	57.70
47	Nielsen Pond	0.0450	59.04
48	Seven Acre Lake	0.0460	59.36
49	Turner Lake	0.0460	59.36
50	Willow Lake	0.0460	59.36
51	East Meadow Lake	0.0480	59.97
52	Lucky Lake	0.0480	59.97
53	Old Oak Lake	0.0490	60.27

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
54	College Trail Lake	0.0500	60.56
55	Hastings Lake	0.0520	61.13
56	Butler Lake	0.0530	61.40
57	West Meadow Lake	0.0530	61.40
58	Wooster Lake	0.0530	61.40
59	Lucy Lake	0.0550	61.94
60	Lake Linden	0.0570	62.45
61	Lake Christa	0.0580	62.70
62	Owens Lake	0.0580	62.70
63	Briarcrest Pond	0.0580	63.00
64	Lake Barrington	0.0600	63.10
65	Redhead Lake	0.0608	63.20
66	Lake Lakeland Estates	0.0620	63.66
67	Lake Naomi	0.0620	63.66
68	Lake Tranquility (S1)	0.0620	63.66
69	Lake Catherine	0.0620	63.76
70	Liberty Lake	0.0630	63.89
71	North Tower Lake	0.0630	63.89
72	Werhane Lake	0.0630	63.89
73	Countryside Glen Lake	0.0640	64.12
74	Davis Lake	0.0650	64.34
75	Leisure Lake	0.0650	64.34
76	St. Mary's Lake	0.0670	64.78
77	Channel Lake	0.0680	64.91
78	Buffalo Creek Reservoir 1	0.0680	65.00
79	Mary Lee Lake	0.0680	65.00
80	Little Bear Lake	0.0680	65.00
81	Timber Lake (South)	0.0720	65.82
82	Lake Helen	0.0720	65.82
83	Grandwood Park Lake	0.0720	65.82
84	Crooked Lake	0.0710	66.00
85	ADID 203	0.0730	66.02
86	Broberg Marsh	0.0780	66.97
87	Redwing Slough	0.0822	67.73
88	Tower Lake	0.0830	67.87
89	Countryside Lake	0.0800	68.00
90	Lake Nippersink	0.0800	68.00
91	Woodland Lake	0.0800	68.00
92	Lake Fairview	0.0890	68.00
93	Potomac Lake	0.0850	68.21
94	White Lake	0.0862	68.42
95	Grand Ave Marsh	0.0870	68.55
96	North Churchill Lake	0.0870	68.55
97	McDonald Lake 1	0.0880	68.71
98	Pistakee Lake	0.0880	68.71
99	Rivershire Pond 2	0.0900	69.04
100	South Churchill Lake	0.0900	69.04
101	McGreal Lake	0.0910	69.20
102	Lake Charles	0.0930	69.40
103	Deer Lake	0.0940	69.66
104	Eagle Lake (S1)	0.0950	69.82
105	International Mine and Chemical Lake	0.0950	69.82
106	Valley Lake	0.0950	69.82

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
107	Buffalo Creek Reservoir 2	0.0960	69.97
108	Fish Lake	0.0960	69.97
109	Lochanora Lake	0.0960	69.97
110	Big Bear Lake	0.0960	69.97
111	Fox Lake	0.1000	70.52
112	Nippersink Lake - LCFP	0.1000	70.56
113	Sylvan Lake	0.1000	70.56
114	Petite Lake	0.1020	70.84
115	Longview Meadow Lake	0.1020	70.84
116	Lake Marie	0.1030	71.00
117	Dunn's Lake	0.1070	71.53
118	Lake Forest Pond	0.1070	71.53
119	Long Lake	0.1070	71.53
120	Grass Lake	0.1090	71.77
121	Spring Lake	0.1100	71.93
122	Kemper 2	0.1100	71.93
123	Bittersweet Golf Course #13	0.1100	71.93
124	Bluff Lake	0.1120	72.00
125	Middlefork Savannah Outlet 1	0.1120	72.00
126	Osprey Lake	0.1110	72.06
127	Bresen Lake	0.1130	72.32
128	Round Lake Marsh North	0.1130	72.32
129	Deer Lake Meadow Lake	0.1160	72.70
130	Lake Matthews	0.1180	72.94
131	Taylor Lake	0.1180	72.94
132	Island Lake	0.1210	73.00
133	Columbus Park Lake	0.1230	73.54
134	Echo Lake	0.1250	73.77
135	Lake Holloway	0.1320	74.56
136	Antioch Lake	0.1450	75.91
137	Lakewood Marsh	0.1510	76.50
138	Pond-A-Rudy	0.1510	76.50
139	Forest Lake	0.1540	76.78
140	Slocum Lake	0.1500	77.00
141	Middlefork Savannah Outlet 2	0.1590	77.00
142	Grassy Lake	0.1610	77.42
143	Salem Lake	0.1650	77.78
144	Half Day Pit	0.1690	78.12
145	Lake Eleanor	0.1810	79.11
146	Lake Farmington	0.1850	79.43
147	Lake Louise	0.1850	79.43
148	ADID 127	0.1890	79.74
149	Lake Napa Suwe	0.1940	80.00
150	Patski Pond	0.1970	80.33
151	Dog Bone Lake	0.1990	80.48
152	Summerhill Estates Lake	0.1990	80.48
153	Redwing Marsh	0.2070	81.05
154	Stockholm Lake	0.2082	81.13
155	Bishop Lake	0.2160	81.66
156	Ozaukee Lake	0.2200	81.93
157	Kemper 1	0.2220	82.08
158	Hidden Lake	0.2240	82.19
159	McDonald Lake 2	0.2250	82.28

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
160	Fischer Lake	0.2280	82.44
161	Oak Hills Lake	0.2790	85.35
162	Loch Lomond	0.2950	86.16
163	Heron Pond	0.2990	86.35
164	Rollins Savannah 1	0.3070	87.00
165	Fairfield Marsh	0.3260	87.60
166	ADID 182	0.3280	87.69
167	Slough Lake	0.3860	90.03
168	Manning's Slough	0.3820	90.22
169	Rasmussen Lake	0.4860	93.36
170	Albert Lake, Site II, outflow	0.4950	93.67
171	Flint Lake Outlet	0.5000	93.76
172	Rollins Savannah 2	0.5870	96.00
173	Almond Marsh	1.9510	113.00

Table 6. Multiparameter data for Channel Lake, 2014.

Channel Lake Multi-parameter 2014

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
5/6/2014	0.25	0.31	11.39	12.56	114.8	0.6424	9.05	3755	Surface	100%
5/6/2014	1	1.07	11.38	12.82	117.1	0.6421	8.80	3690	Surface	100%
5/6/2014	2	1.97	11.38	12.78	116.8	0.6420	8.79	159	0.22	4%
5/6/2014	3	3.01	11.36	12.71	116.1	0.6420	8.79	66	1.26	2%
5/6/2014	4	4.00	11.38	12.67	115.8	0.6420	8.80	335	2.25	9%
5/6/2014	6	6.05	11.34	12.62	115.2	0.6420	8.79	28	4.3	1%
5/6/2014	8	8.02	11.30	12.56	114.6	0.6421	8.79	15	6.27	0%
5/6/2014	10	10.02	11.24	12.43	113.3	0.6426	8.78	4	8.27	0%
5/6/2014	12	12.13	11.24	12.44	113.3	0.6425	8.78	2	10.38	0%
5/6/2014	14	14.05	11.24	12.37	112.7	0.6427	8.78	1	12.3	0%
5/6/2014	16	16.03	11.21	12.35	112.4	0.6427	8.77	1	14.28	0%
5/6/2014	18	18.05	11.22	12.28	111.8	0.6423	8.78	1	16.3	0%
5/6/2014	20	19.98	11.21	12.35	112.4	0.6427	8.78	0	18.23	0%
5/6/2014	22	22.41	11.19	12.30	112.0	0.6420	8.79	0	20.66	0%
5/6/2014	24	23.95	11.19	12.20	111.0	0.6428	8.78	0	22.2	0.0%
5/6/2014	26	26.07	11.14	12.21	110.9	0.6432	8.76	1	24.32	0.0%
5/6/2014	28	27.99	11.09	11.96	108.6	0.6436	8.74	1	26.24	0.0%
5/6/2014	30	30.02	11.06	11.73	106.4	0.6439	8.73	1	28.27	0.0%
5/6/2014	32	32.12	10.99	11.56	104.7	0.6439	8.71	1	30.37	0.0%
5/6/2014	34	34.08	10.87	11.29	102.0	0.6435	8.70	1	32.33	0.0%
5/6/2014	36	36.03	10.82	11.23	101.4	0.6420	8.70	1		

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
6/10/2014	0.25	0.27	22.08	8.97	103.0	0.6577	8.49	846	Surface	100%
6/10/2014	1	1.05	22.09	9.00	103.3	0.6576	8.49	706	Surface	100%
6/10/2014	2	2.05	22.10	9.01	103.5	0.6578	8.48	231	0.3	33%
6/10/2014	3	3.03	22.10	9.04	103.8	0.6579	8.48	116	1.28	16%
6/10/2014	4	3.97	22.10	9.03	103.7	0.6575	8.47	90	2.22	13%
6/10/2014	6	6.00	22.10	9.02	103.5	0.6575	8.47	56	4.25	8%
6/10/2014	8	8.02	22.10	8.98	103.1	0.6578	8.46	31	6.27	4%
6/10/2014	10	10.02	22.05	8.75	100.3	0.6577	8.43	18	8.27	3%
6/10/2014	12	11.99	21.67	7.11	80.9	0.6590	8.29	10	10.24	1%
6/10/2014	14	13.95	20.48	3.19	35.5	0.6613	7.91	7	12.2	1%
6/10/2014	16	16.00	18.87	0.29	3.0	0.6658	7.74	4	14.25	1%
6/10/2014	18	18.03	17.17	0.14	1.4	0.6672	7.74	3	16.28	0%
6/10/2014	20	20.01	14.92	0.06	0.6	0.6711	7.66	2	18.26	0%
6/10/2014	22	22.02	14.13	0.06	0.6	0.6705	7.64	2	20.27	0%
6/10/2014	24	23.96	13.69	0.05	0.5	0.6722	7.61	1	22.21	0%
6/10/2014	26	25.99	13.08	0.05	0.5	0.6773	7.52	1	24.24	0%
6/10/2014	28	27.98	12.59	0.05	0.5	0.6816	7.42	1	26.23	0%
6/10/2014	30	30.02	12.00	0.04	0.4	0.6952	7.28	1	28.27	0%
6/10/2014	32	31.99	11.65	0.05	0.5	0.7072	7.20	1	30.24	0%
6/10/2014	34	34.03	11.47	0.05	0.4	0.7118	7.15	0	32.28	0%
6/10/2014	36	35.99	11.36	0.04	0.4	0.7175	7.13	1	34.24	0%

Table 6. Multiparameter data for Channel Lake, 2014.

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
70814	0.25	0.52	25.14	9.49	116.9	0.6486	8.42	4986	Surface	100%
70814	1	1.06	25.15	9.52	117.2	0.6488	8.42	3883	Surface	100%
70814	2	1.91	25.13	9.54	117.4	0.6495	8.42	408	0.16	11%
70814	3	2.97	25.12	9.50	116.9	0.6488	8.41	822	1.22	21%
70814	4	4.03	25.10	9.49	116.7	0.6490	8.42	601	2.28	15%
70814	6	5.93	25.06	9.51	116.8	0.6498	8.41	218	4.18	6%
70814	8	7.95	25.06	9.44	116.1	0.6500	8.41	91	6.2	2%
70814	10	10.02	24.35	9.00	109.2	0.6529	8.19	38	8.27	1%
70814	12	11.97	23.60	6.49	77.6	0.6524	7.96	12	10.22	0%
70814	14	13.97	23.30	4.67	55.6	0.6544	7.84	3	12.22	0%
70814	16	16.00	22.68	1.51	17.7	0.6555	7.64	1	14.25	0%
70814	18	17.89	21.80	0.10	1.2	0.6654	7.60	0	16.14	0%
70814	20	20.10	17.42	0.06	0.7	0.7122	7.50	0	18.35	0%
70814	22	21.93	15.97	0.06	0.6	0.7218	7.45	0	20.18	0%
70814	24	24.05	15.05	0.05	0.5	0.7290	7.40	0	22.3	0%
70814	26	26.03	14.37	0.05	0.5	0.7327	7.37	1	24.28	0%
70814	28	28.01	13.46	0.05	0.5	0.7443	7.28	0	26.26	0%
70814	30	30.02	12.36	0.05	0.4	0.7661	7.16	1	28.27	0%
70814	32	31.99	12.01	0.05	0.4	0.7774	7.11	1	30.24	0%
									-1.75	0%

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
8/12/2014	0.5	0.37	24.36	8.23	101.5	0.6264	8.57	1010	Surface	100%
8/12/2014	1	1.03	24.35	8.24	101.7	0.6260	8.57	887	Surface	100%
8/12/2014	2	2.03	24.37	8.26	102.0	0.6262	8.57	332	0.28	37%
8/12/2014	3	3.06	24.38	8.22	101.4	0.6259	8.57	97	1.31	11%
8/12/2014	4	3.98	24.38	8.21	101.3	0.6260	8.57	63	2.23	7%
8/12/2014	6	6.01	24.36	8.31	102.5	0.6260	8.57	12	4.26	1%
8/12/2014	8	7.97	24.38	8.16	100.7	0.6257	8.56	4	6.22	0%
8/12/2014	10	10.08	24.36	8.17	100.8	0.6253	8.57	1	8.33	0%
8/12/2014	12	11.96	24.37	7.99	98.5	0.6265	8.55	1	10.21	0%
8/12/2014	14	13.99	24.32	5.72	70.6	0.6264	8.42	1	12.24	0%
8/12/2014	16	15.96	23.25	0.80	9.7	0.6399	7.88	0	14.21	0%
8/12/2014	18	18.02	22.68	0.02	0.3	0.6433	7.74	1	16.27	0%
8/12/2014	20	19.96	21.23	0.09	1.0	0.6506	7.60	1	18.21	0%
8/12/2014	22	22.02	19.36	0.00	0.0	0.6669	7.44	0	20.27	0%
8/12/2014	24	23.98	17.30	0.06	0.7	0.6846	7.30	1	22.23	0%
8/12/2014	26	26.04	15.83	0.04	0.4	0.6964	7.25	1	24.29	0%
8/12/2014	28	28.15	14.56	0.05	0.5	0.7083	7.19	1	26.4	0%
8/12/2014	30	29.81	13.74	0.07	0.7	0.7205	7.12	1	28.06	0%
8/12/2014	32	31.96	12.75	0.04	0.4	0.7489	7.02	1	30.21	0%
8/12/2014	34	34.16	12.44	0.05	0.5	0.7586	6.99	1	32.41	0%
8/12/2014	36	36.01	12.22	0.04	0.3	0.7684	6.96	0		

Table 6. Multiparameter data for Channel Lake, 2014.

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	BGA	Depth of Light Meter feet	% Light Transmission Average
9/16/2014	0.25	0.25	18.49	7.82	83.5	0.6220	8.05	47324	Surface	100%
9/16/2014	1	1.00	18.39	7.72	82.1	0.6230	8.02	54220	Surface	100%
9/16/2014	2	2.00	18.06	7.48	79.0	0.6230	7.94	59653	0.25	110%
9/16/2014	3	3.00	17.76	6.90	72.2	0.6240	7.90	61532	1.25	113%
9/16/2014	4	4.00	17.73	6.49	67.2	0.6240	7.89	58927	2.25	109%
9/16/2014	6	6.00	17.70	5.85	61.4	0.6240	7.84	58516	4.25	108%
9/16/2014	8	8.00	17.69	5.81	61.1	0.6240	7.82	60004	6.25	111%
9/16/2014	10	10.00	17.67	5.62	59.0	0.6240	7.82	58840	8.25	109%
9/16/2014	12	12.00	17.65	5.66	59.5	0.6240	7.83	57986	10.25	107%
9/16/2014	14	14.00	17.61	4.77	49.8	0.6260	7.76	55190	12.25	102%
9/16/2014	16	16.00	17.54	3.77	38.8	0.6300	7.66	56385	14.25	104%
9/16/2014	18	18.00	17.47	3.62	37.9	0.6310	7.64	55629	16.25	103%
9/16/2014	20	20.00	17.43	1.41	14.9	0.6370	7.46	43662	18.25	81%
9/16/2014	22	22.00	17.29	3.14	34.2	0.6300	7.57	56744	20.25	105%
9/16/2014	24	24.00	17.27	4.33	45.5	0.6270	7.64	55759	22.25	103%
9/16/2014	26	26.00	16.87	5.72	59.3	0.6220	7.75	57126	24.25	105.4%
9/16/2014	28	28.00	16.52	0.80	8.5	0.6710	7.18	21026	26.25	38.78%
9/16/2014	30	30.00	13.67	0.70	6.5	0.7830	6.82	12820	28.25	23.6%
9/16/2014	32	32.00	12.73	0.46	4.3	0.8060	6.69	12046	30.25	22.2%
9/16/2014	34	34.00	12.39	0.39	3.7	0.8210	6.61	15796	32.25	29.1%
9/16/2014	36	36.00	12.32	0.36	3.2	0.8270	6.55	23072	34.25	42.6%

Figure 4. Channel Lake VLMP Secchi Data 2002, 2011 – 2014.

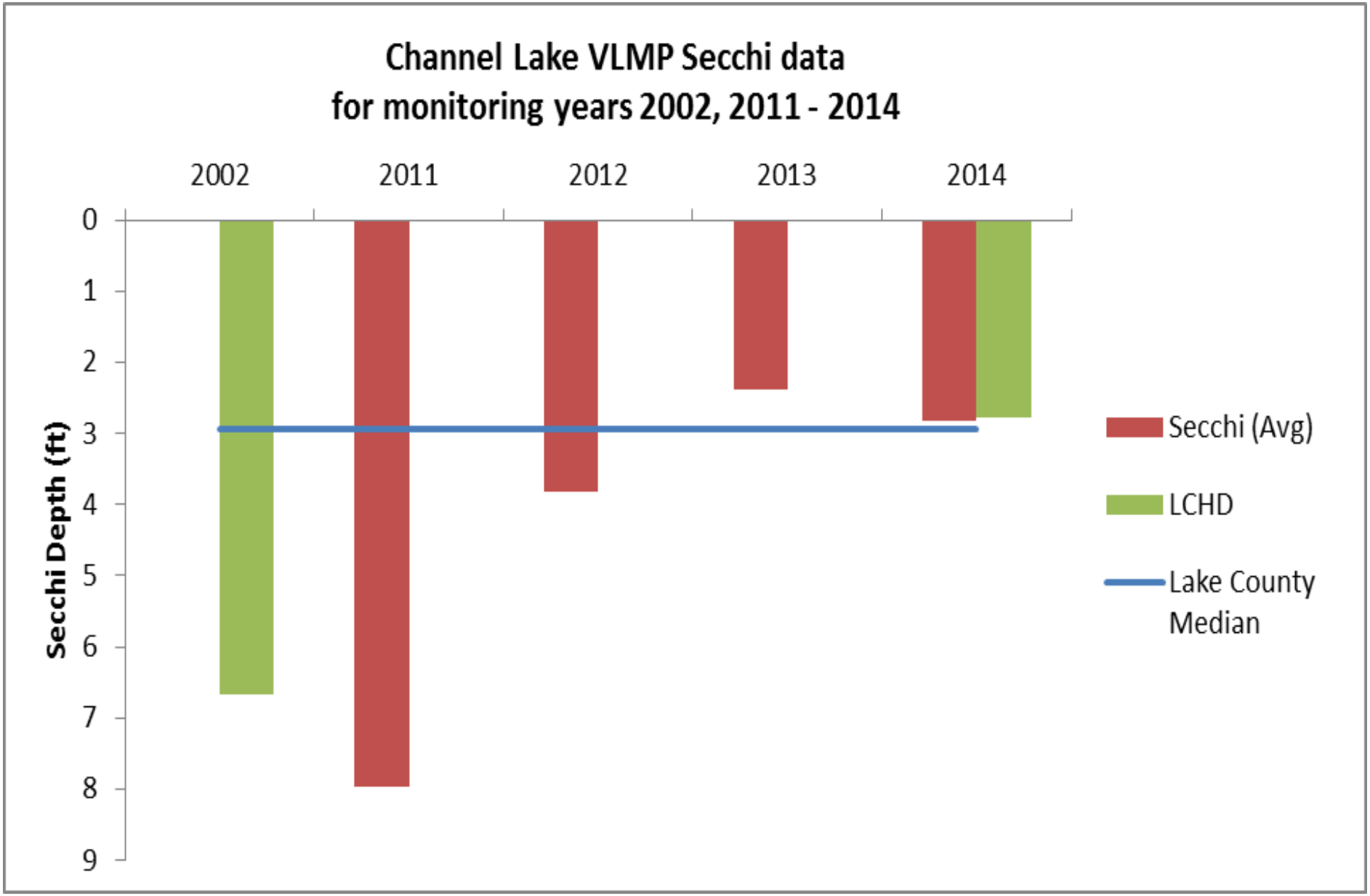

Figure 5. Monthly TP Concentrations measured in Channel Lake in 2002 and 2014 compared to Illinois EPA General Use Standard.

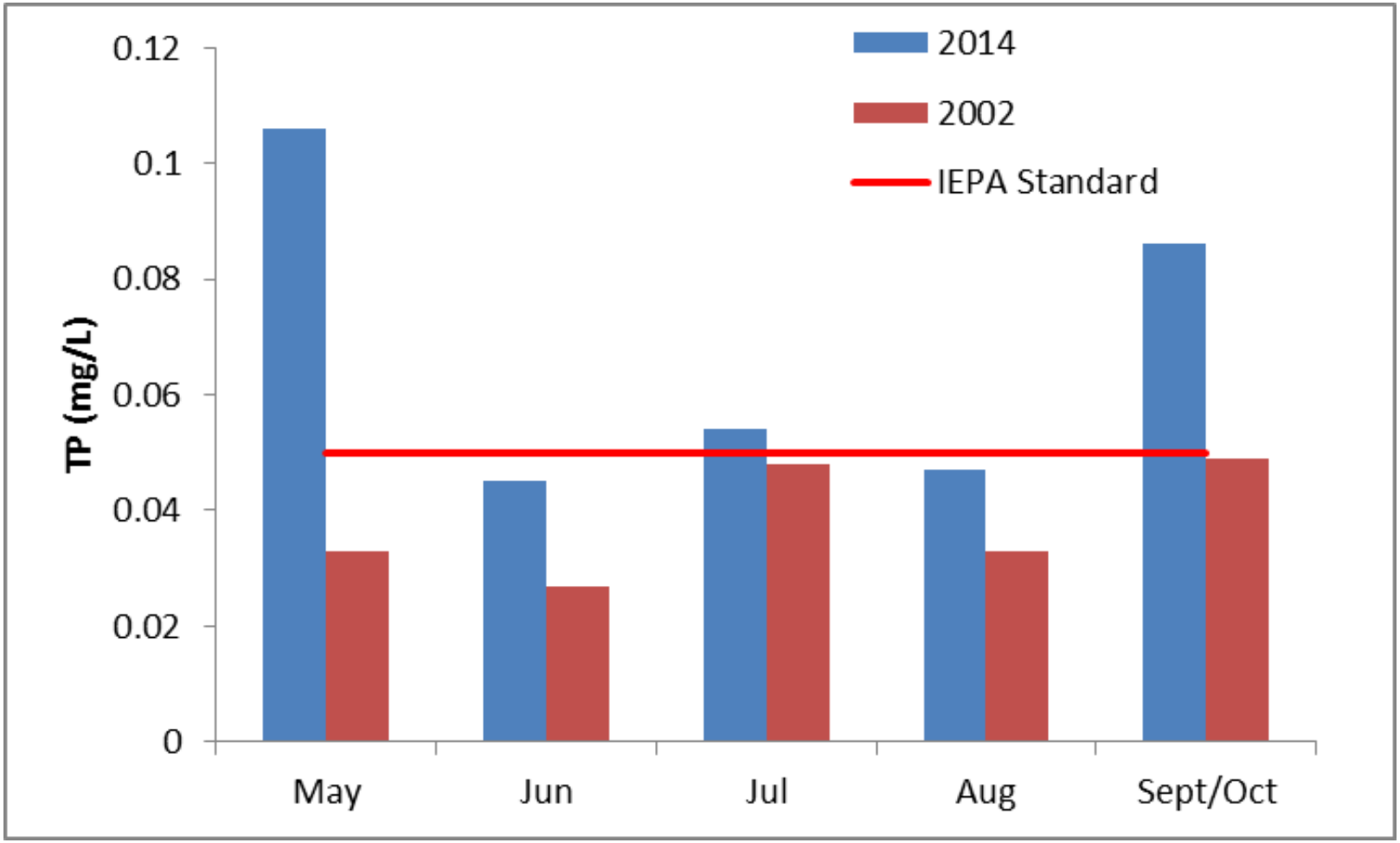

Table 7. Estimated Species Cover, Frequency, and Relative Importance per species for Lake Catherine, 2014.

Common Name	Scientific Name	Average Cover	Frequency	Relative Importance
Coontail	***Ceratophyllum demersum***	13.10	36.56	72.96
White Water Lily	***Nymphaea odorata***	4.04	11.45	22.64
Star Duckweed	***Lemna trisulca***	3.56	12.78	22.24
Common Duckweed	***Lemna minor***	2.98	12.78	20.39
Water Meal	***Wolffia spp.***	1.74	10.57	14.53
Curlyleaf Pondweed	***Potamogeton crispus***	1.61	7.93	11.86
Flat-stemmed Pondweed	***Potamogeton zosteriformis***	1.32	7.93	10.94
Sago Pondweed	***Stuckenia pectinata***	0.74	7.49	8.70
Eurasian Watermilfoil	***Myriophyllum spicatum***	1.09	5.29	7.99
Common Bladderwort	***Utricularia vulgaris***	0.76	3.96	5.79
Chara (macroalgae)	***Chara spp.***	0.26	1.32	1.97
	Total Average Cover	**31.19**		

Cover Abundance Scale	
Scale	Estimated Cover
0	No Plants
1	1%-10%
2	11% - 40%
3	41% - 60%
4	61% - 90%
5	≥ 91%

Figure 6. Estimated abundance and location of submersed aquatic vegetation found in Channel Lake, 2014.

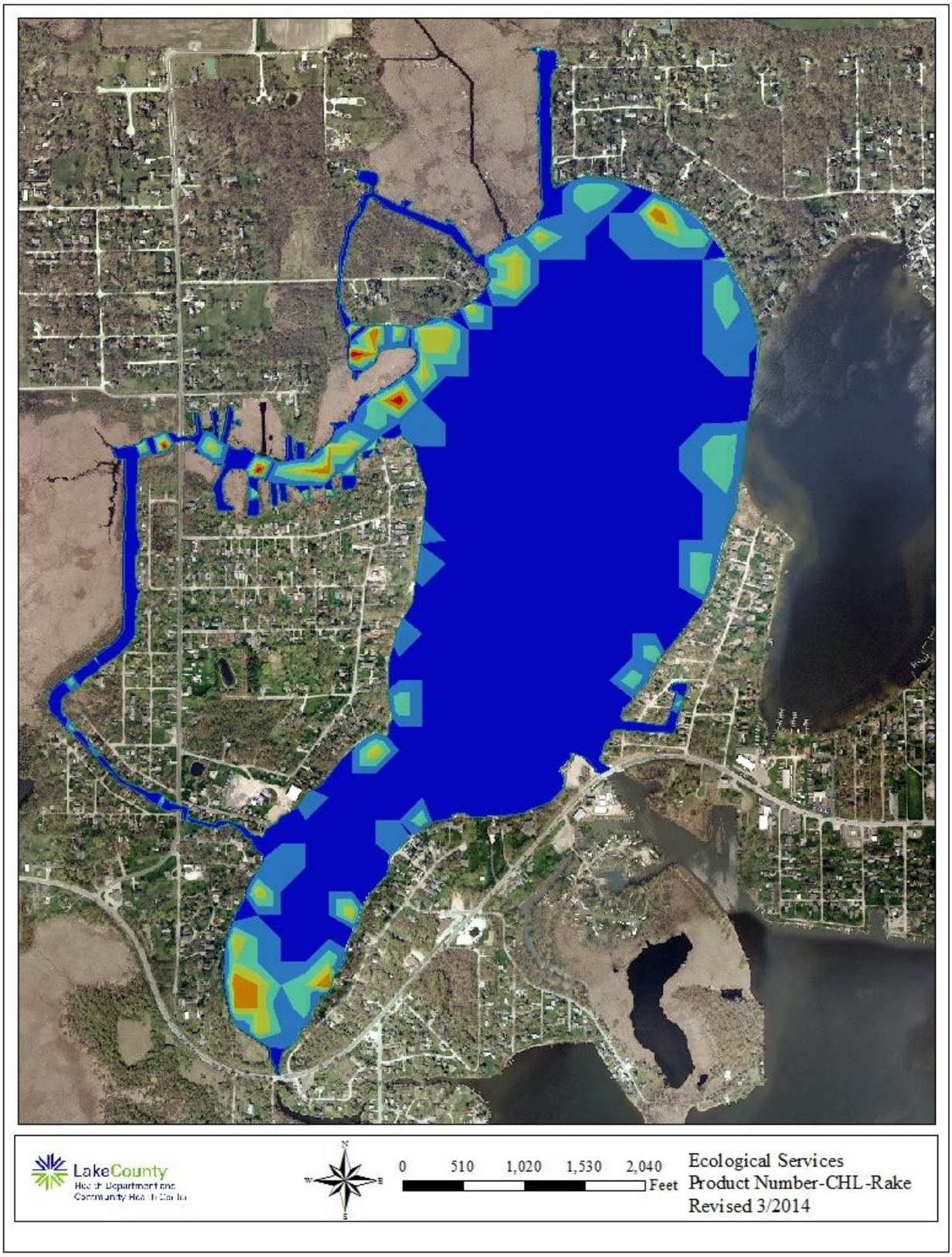

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
1	Cedar Lake	37.4	38.9
2	East Loon Lake	34.7	36.1
3	Cranberry Lake	29.7	29.7
4	Deep Lake	29.7	31.2
5	Little Silver Lake	29.6	31.6
6	Round Lake Marsh North	29.1	29.9
7	West Loon Lake	27.1	29.5
8	Sullivan Lake	26.9	28.5
9	Bangs Lake	26.2	27.8
10	Third Lake	25.1	22.5
11	Fourth Lake	24.7	27.1
12	Independence Grove	24.6	27.5
13	Sterling Lake	24.5	26.9
14	Sun Lake	24.3	26.1
15	Lake Zurich	24.3	27.1
16	Redwing Slough	24.0	25.8
17	Schreiber Lake	23.9	24.8
18	Lakewood Marsh	23.8	24.7
19	Deer Lake	23.5	24.4
20	Round Lake	23.5	25.9
21	Pistakee Lake	23.5	25.2
22	Lake Marie	23.5	25.2
23	Honey Lake	23.3	25.1
24	Lake of the Hollow	23.0	24.8
25	Cross Lake	22.4	24.2
26	Nippersink Lake (Fox Chain)	22.4	23.2
27	Countryside Glen Lake	21.9	22.8
28	Grass Lake	21.5	22.2
29	Davis Lake	21.4	21.4
30	Butler Lake	21.4	23.1
31	Lake Barrington	21.2	21.2
32	Duck Lake	21.1	22.9
33	Timber Lake (North)	20.9	23.4
34	Lake Catherine	20.8	21.8
35	ADID 203	20.5	20.5
36	Broberg Marsh	20.5	21.4
37	McGreal Lake	20.2	22.1
38	Fox Lake	20.2	21.2
39	Lake Kathryn	19.6	20.7
40	Fish Lake	19.3	21.2
41	Druce Lake	19.1	21.8
42	Turner Lake	18.6	21.2
43	Wooster Lake	18.5	20.2
44	Salem Lake	18.5	20.2
45	Lake Helen	18.0	18.0
46	Old Oak Lake	18.0	19.1
47	Potomac Lake	17.8	17.8
48	Redhead Lake	17.7	18.7
49	Long Lake	17.7	15.8
50	Hendrick Lake	17.7	17.7
51	Rollins Savannah 2	17.7	17.7
52	Grandwood Park Lake	17.2	19.0
53	Seven Acre Lake	17.0	15.5
54	Lake Miltmore	16.8	18.7
55	Petite Lake	16.8	18.7
56	Channel Lake	16.8	18.7
57	McDonald Lake 1	16.7	17.7
58	Highland Lake	16.7	18.9

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
59	Bresen Lake	16.6	17.8
60	Almond Marsh	16.3	17.3
61	Owens Lake	16.3	17.3
62	Windward Lake	16.3	17.6
63	Grays Lake	16.1	16.1
64	White Lake	16.0	17.0
65	Dunn's Lake	15.9	17.0
66	Dog Bone Lake	15.7	15.7
67	Osprey Lake	15.5	17.3
68	Heron Pond	15.1	15.1
69	North Churchill Lake	15.0	15.0
70	Hastings Lake	15.0	17.0
71	Lake Tranquility (S1)	15.0	17.0
72	Forest Lake	14.8	15.9
73	Dog Training Pond	14.7	15.9
74	Grand Ave Marsh	14.3	16.3
75	Nippersink Lake	14.3	16.3
76	Taylor Lake	14.3	16.3
77	Manning's Slough	14.1	16.3
78	Tower Lake	14.0	14.0
79	Dugdale Lake	14.0	15.1
80	Eagle Lake (S1)	14.0	15.1
81	Crooked Lake	14.0	16.0
82	Spring Lake	14.0	15.2
83	Lake Matthews	13.9	15.5
84	Longview Meadow Lake	13.9	13.9
85	Bishop Lake	13.4	15.0
86	Ames Pit	13.4	15.5
87	Mary Lee Lake	13.1	15.1
88	Old School Lake	13.1	15.1
89	Summerhill Estates Lake	12.7	13.9
90	Buffalo Creek Reservoir 1	12.5	11.4
91	Buffalo Creek Reservoir 2	12.5	11.4
92	McDonald Lake 2	12.5	12.5
93	Rollins Savannah 1	12.5	12.5
94	Stone Quarry Lake	12.5	12.5
95	Kemper Lake 1	12.2	13.4
96	Pond-A-Rudy	12.1	12.1
97	Stockholm Lake	12.1	13.5
98	Lake Carina	12.1	14.3
99	Lake Leo	12.1	14.3
100	Lambs Farm Lake	12.1	14.3
101	Grassy Lake	12.0	12.0
102	Flint Lake Outlet	11.8	13.0
103	Albert Lake	11.5	10.3
104	Rivershire Pond 2	11.5	13.3
105	Antioch Lake	11.3	13.4
106	Hook Lake	11.3	13.4
107	Briarcrest Pond	11.2	12.5
108	Lake Naomi	11.2	12.5
109	Pulaski Pond	11.2	12.5
110	Lake Napa Suwe	11.0	11.0
111	Redwing Marsh	11.0	11.0
112	West Meadow Lake	11.0	11.0
113	Lake Minear	11.0	13.9
114	Nielsen Pond	10.7	12.0
116	Sylvan Lake	10.6	10.6
117	Gages Lake	10.2	12.5

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
118	College Trail Lake	10.0	10.0
119	Valley Lake	9.9	9.9
120	Werhane Lake	9.8	12.0
121	Loch Lomond	9.4	12.1
122	Columbus Park Lake	9.2	9.2
123	Lake Lakeland Estates	9.2	9.2
124	Waterford Lake	9.2	9.2
125	Bluff Lake	9.1	11.0
126	Lake Fairfield	9.0	10.4
127	Lake Louise	9.0	10.4
128	Fischer Lake	9.0	11.0
129	Lake Fairview	8.5	6.9
130	Timber Lake (South)	8.5	6.9
131	East Meadow Lake	8.5	8.5
132	South Churchill Lake	8.5	8.5
133	Kemper Lake 2	8.5	9.8
134	Lake Christa	8.5	9.8
135	Lake Farmington	8.5	9.8
136	Lucy Lake	8.5	9.8
137	Bittersweet Golf Course #13	8.1	8.1
138	Lake Linden	8.0	8.0
139	Sand Lake	8.0	10.4
140	Countryside Lake	7.7	11.5
141	Fairfield Marsh	7.5	8.7
142	Lake Eleanor	7.5	8.7
143	Banana Pond	7.5	9.2
144	Slocum Lake	7.1	5.8
145	Lucky Lake	7.0	7.0
146	North Tower Lake	7.0	7.0
147	Lake Forest Pond	6.9	8.5
148	Ozaukee Lake	6.7	8.7
149	Leisure Lake	6.4	9.0
150	Peterson Pond	6.0	8.5
151	Little Bear Lake	5.8	7.5
152	Deer Lake Meadow Lake	5.2	6.4
153	ADID 127	5.0	5.0
154	Island Lake	5.0	5.0
155	Liberty Lake	5.0	5.0
156	Oak Hills Lake	5.0	5.0
157	Slough Lake	5.0	5.0
158	International Mining and Chemical Lake	5.0	7.1
159	Diamond Lake	3.7	5.5
160	Lake Charles	3.7	5.5
161	Big Bear Lake	3.5	5.0
162	Sand Pond (IDNR)	3.5	5.0
163	Harvey Lake	3.3	5.0
164	Half Day Pit	2.9	5.0
165	Lochanora Lake	2.5	5.0
166	Echo Lake	0.0	0.0
167	Hidden Lake	0.0	0.0
168	St. Mary's Lake	0.0	0.0
169	Willow Lake	0.0	0.0
170	Woodland Lake	0.0	0.0
	Mean	**14.1**	**15.2**
	Median	**13.4**	**15.0**