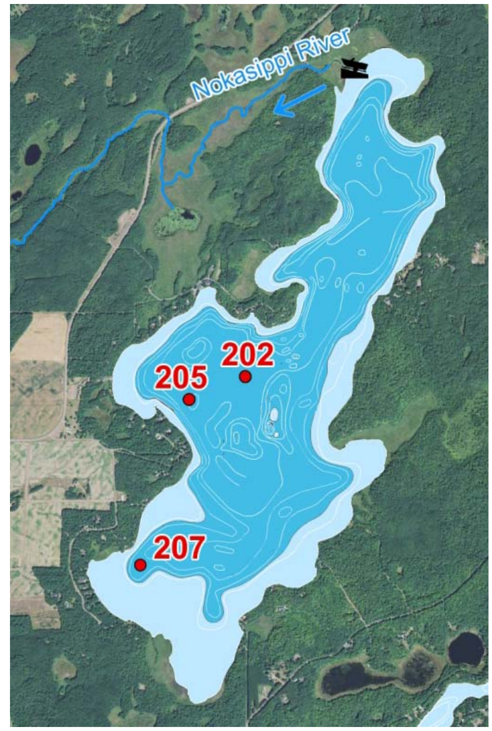
Clearwater Lake Crow Wing County

Summary

Clearwater Lake is a moderately deep mesotrophic lake. There are no detectable trends in water clarity over the past 30 years. This means that the lake is stable, with no indications of declining water quality. Because the lake has a small watershed, the land practices around the lake are likely the largest contributor of nutrients to the lake. To best protect the lake in the future, homeowners should manage stormwater runoff by installing vegetative shoreline buffers and rain gardens, minimize the addition of impervious surface, use silt fences to prevent runoff during construction projects, and properly maintain septic systems.



Lake Vitals

MN Lake ID:	18-0038-00
Ecoregion:	Northern Lakes and Forest
Surface area (acres):	907
Littoral area (acres):	338
% Littoral area:	37%
Max depth (feet):	54
Aquatic Invasive Species:	Eurasian watermilfoil

Water Quality Characteristics

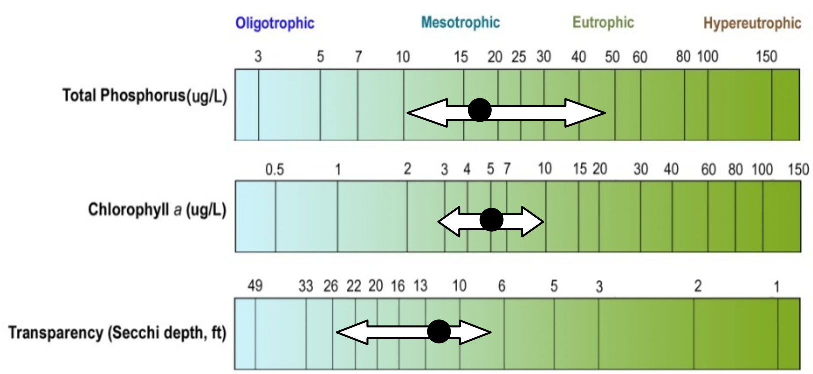
Years monitored: 1985 – 2016, site 202

Parameters	Historical	2016
Total Phosphorus Mean (ug/L):	16.6	21.0
Total Phosphorus Min (ug/L):	11.0	13
Total Phosphorus Max (ug/L):	45.0	45
Number of Observations:	16	4
Chlorophyll-a Mean (ug/L):	5.3	6.0
Chlorophyll-a Min (ug/L):	3.0	3.1
Chlorophyll-a Max (ug/L):	10.0	7.5
Number of Observations:	16	4
Secchi Depth Mean (ft):	12.8	
Secchi Depth Min (ft):	8.0	
Secchi Depth Max (ft):	23.0	
Number of Observations:	250	

Trophic State Index

Trophic State: Mesotrophic (44)

The figure below shows the minimum and maximum values with the arrows and the mean with the black dot.



Ecoregion Comparisons

(Primary site only. Comparisons are based on interquartile range, 25th - 75th percentile, for ecoregion reference lakes)

Ecoregion:	Northern Lakes and Forests
Total Phosphorus:	Within the ecoregion range
Chlorophyll-a:	Within the ecoregion range
Secchi Depth:	Within the ecoregion range

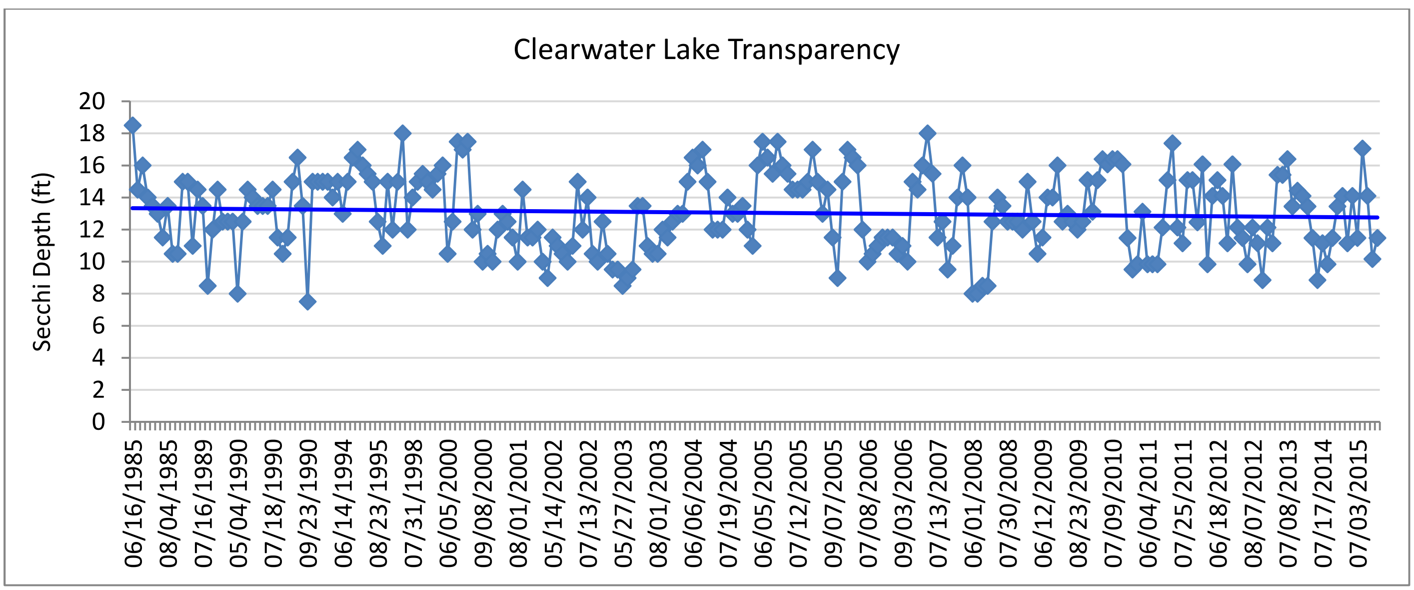
Trend Analysis Report

In assessing water quality, agencies and other lake data users want to know if the amount of algae has been changing over time. Scientists test hypotheses using statistics, and the hypothesis used in a trend analysis is that no trend exists. In other words, we begin with the assumption that there is no trend. We collect data and use statistics to determine the probability of collecting our data if this hypothesis of no trend is indeed true. The output from a statistical test is called the probability value (or p-value for short) of collecting data given the hypothesis of no trend is true. The smaller this probability value, the more likely the null hypothesis of no trend can be rejected. The MPCA has set the acceptable p-value to be less than 10%. In other words, if $p < 0.10$ we reject the hypothesis of no trend and accept that a trend likely exists. Another way to think of this is to say that there is in reality an existing trend, there is a 90% chance we would have collected the data we collected and that a 10% chance that the trend is a random result of the data. For detecting trends, a minimum of 8-10 years of data with four or more readings per season are recommended by the MPCA. Where data does not cover at least eight years or where there are only few samples within a year, trends can be misidentified because there can be different wet years and dry years, water levels, weather, and etc., that affect the water quality naturally.

Clearwater Lake had enough data to perform a trend analysis for transparency (Table 1). The data was analyzed using the Mann Kendall Trend Analysis.

Table 1. Trend analysis for Clearwater Lake.

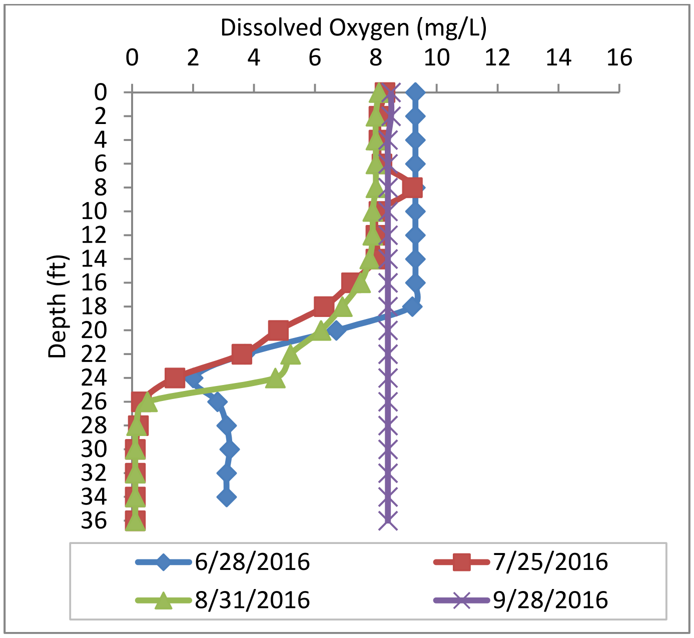
Lake Site	Parameter	Date Range	Trend
202	Total phosphorus	2007-2008, 2016	Insufficient data
202	Chlorophyll a	2007-2008, 2016	Insufficient data
205	Secchi depth	1985, 1989-1990, 1993-2015	No trend

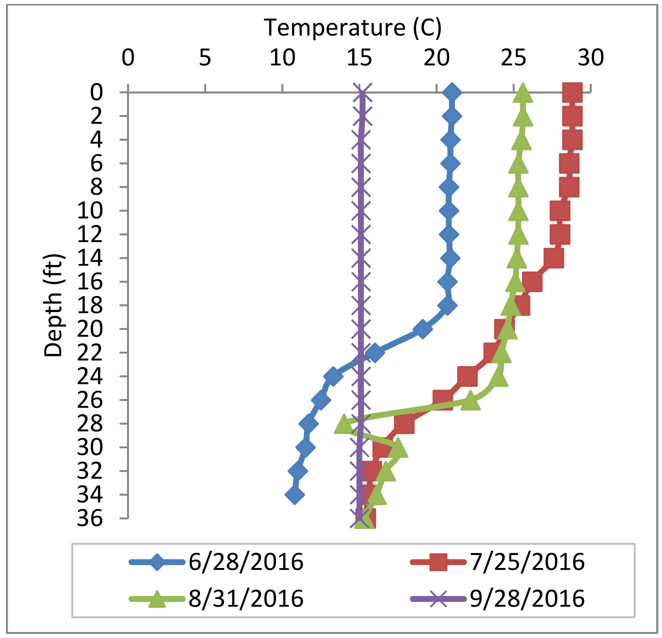


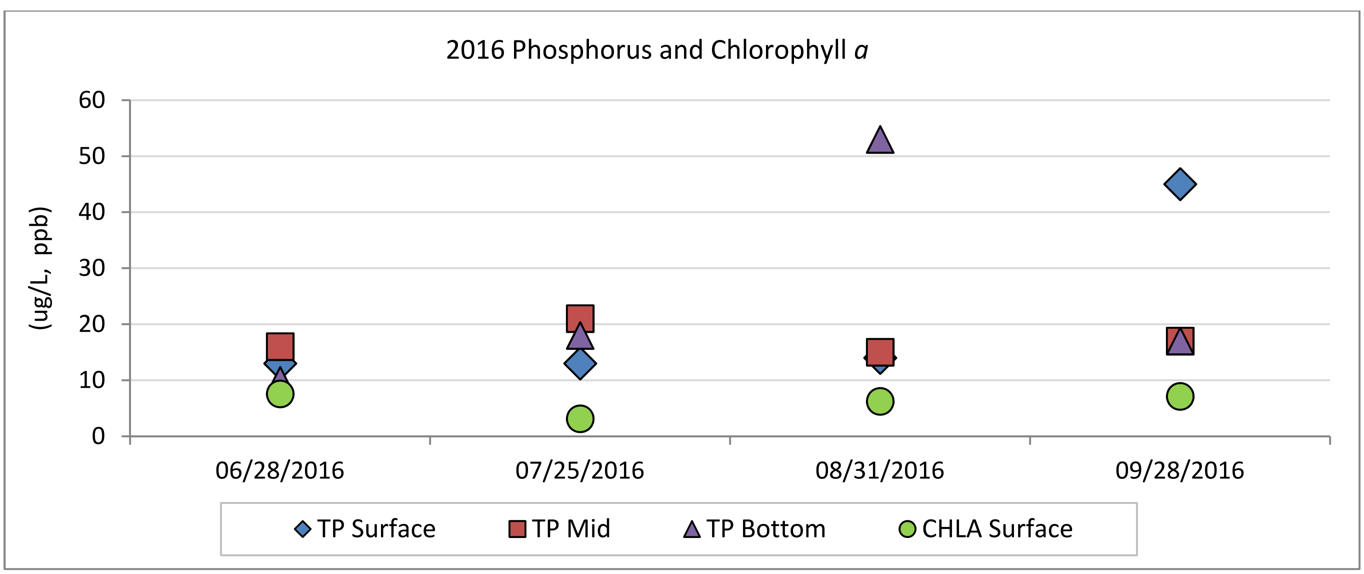
Clearwater Lake shows no evidence of a transparency trend over the past 30 years. Overall, these trend results show that the water quality in Clearwater Lake is stable, with no indication of decline. Transparency monitoring should continue so that this trend can be tracked in future years.

2016 Monitoring

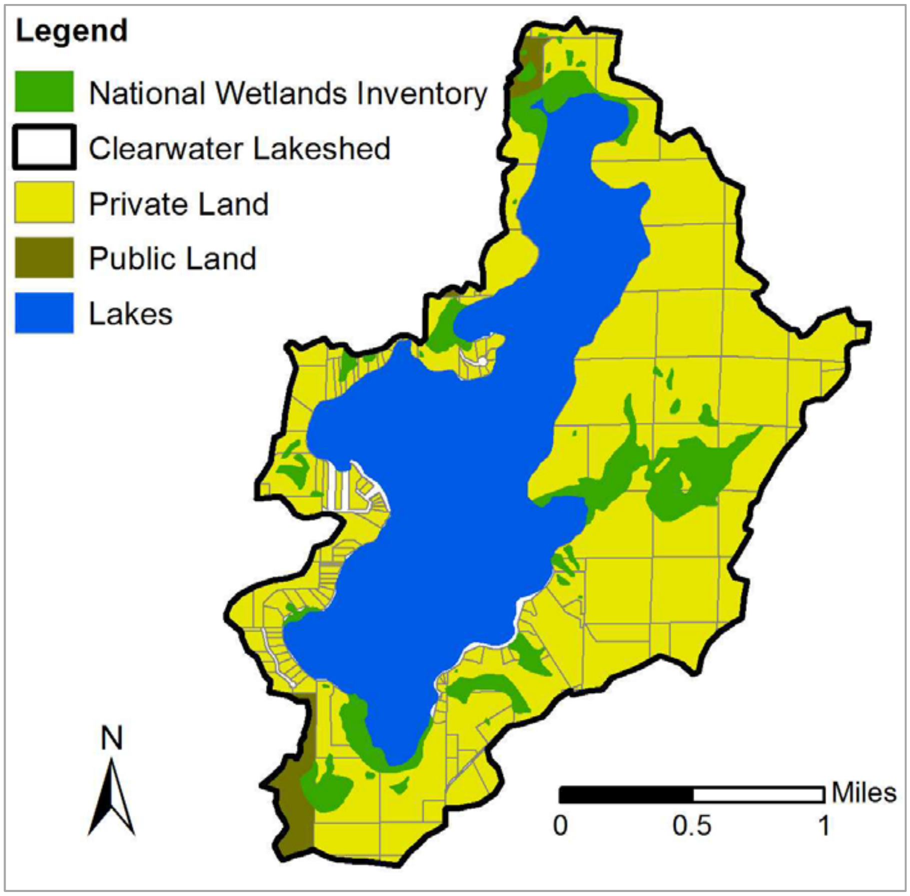
In 2016, water samples and dissolved oxygen profiles were collected in Clearwater Lake. The results show a very typical pattern for a northern Minnesota mesotrophic lake. The lake was stratified in the summer months, and the thermocline was around 18-20 feet deep. In July and August, the hypolimnion (water above the deep part of the bottom of the lake) was anoxic (no oxygen present). In August, there was some phosphorus release from the lake sediment (internal loading), and in late September that phosphorus had mixed up to the surface of the lake. The chlorophyll a results in September do not show an algae bloom from the higher phosphorus concentration. This could be because the water was relatively cool (15 C, 59 F) and not favorable to green algae. Comparison analyses of chlorophyll a levels with observed algae blooms shows that a minor algae bloom is perceived when the chlorophyll a concentration is around 10 ug/L, and chlorophyll a levels were below 10 ug/L on all sample dates in 2016.







Conclusions



Overall, Clearwater Lake has excellent water quality that has been stable for the past 30 years. The lake should be managed for protection of the current water quality.

Clearwater Lake has the advantage of a very small watershed. The lake does not have any major inlets, which means that it is probably groundwater fed. This means that the main potential impacts to the lake are from land practices directly around the shoreline.

The priority impact to Clearwater Lake would be the expansion of residential housing development along the lakeshore. The conversion of small lake cabins to year-round family homes increases the impervious surface and runoff from the lake lots. Much of the private land around the lake has been developed in the first tier on the western shore, but not the eastern and northern shore (see map to the right). There is a great potential for protecting this land with conservation easements and aquatic management areas (AMAs). Conservation easements can be set up easily and with little cost with help from organizations such as the Board of Soil and Water Resources and the Minnesota Land Trust. AMAs can be set up through the local DNR fisheries office.

The current lakeshore homeowners can lessen their negative impact on water quality by installing or maintaining the existing trees on their properties. Forested uplands contribute significantly less phosphorus (lbs/acre/year) than developed land cover. Forested uplands can be managed with Forest Stewardship Planning. In addition, filter strips or native vegetative buffers, and rain gardens could be installed to decrease or slow the runoff reaching the water's edge. Septic systems should be pumped and inspected regularly.

Native aquatic plants stabilize the lake's sediments and tie up phosphorus in their tissues. When aquatic plants are uprooted from shallow areas, the lake bottom is disturbed, and the phosphorus in the water column gets used by algae instead of plants. This contributes to "greener" water and more algae blooms. Protecting native aquatic plant beds will ensure a healthy lake and healthy fishery. If a swimming area is necessary in front of people's docks, clear only a small area of plants. Clearing a whole 100 foot frontage is not necessary and can contribute to additional algae blooms.