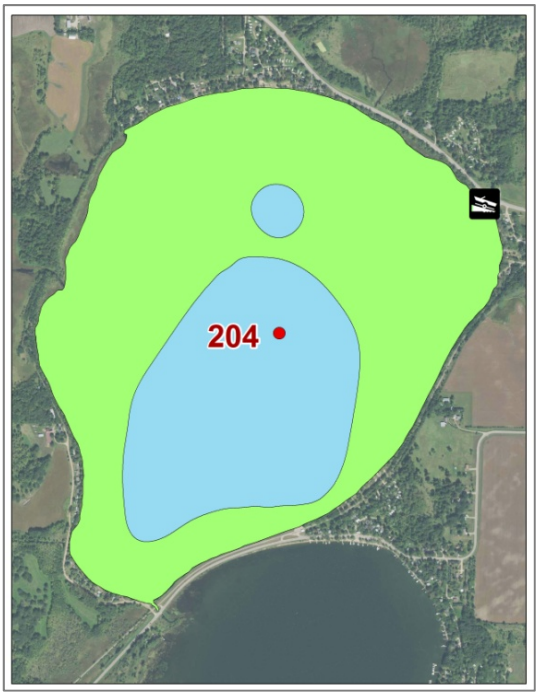
Villard Lake

Pope County

Summary

Villard Lake is a shallow eutrophic lake. Algae concentration results (chlorophyll a) show that the lake experiences algae blooms every summer. Trend analysis shows evidence of a declining trend in transparency and an increase in algae concentration. These trends indicate declining water quality. Villard Lake has a good amount of historical water quality monitoring data, which makes a lake evaluation like this possible. Monitoring should continue to enable future water quality analyses.



Lake Vitals

MN Lake ID:	61-0067-00
Ecoregion:	North Central Hardwood Forest
Major Watershed:	Chippewa River
Surface area (acres):	544.4
Littoral area (acres):	373.7
% Littoral area:	68.7%
Max depth:	15(ft) 4.6(m)
Aquatic Invasive Species:	None

Water Quality Characteristics

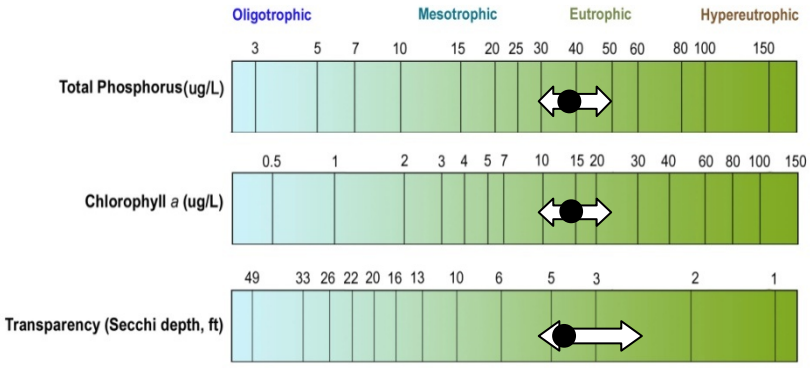
Years monitored: 1993 - 2016

Parameters	Historical	2016
Total Phosphorus Mean (ug/L):	43.2	39.6
Total Phosphorus Min (ug/L):	20	32
Total Phosphorus Max (ug/L):	138	52
Number of Observations:	133	5
Chlorophyll-a Mean (ug/L):	17.0	15.5
Chlorophyll-a Min (ug/L):	1	10.7
Chlorophyll-a Max (ug/L):	54	25.8
Number of Observations:	109	5
Secchi Depth Mean (ft):	6.5	4.0
Secchi Depth Min (ft):	2	2.5
Secchi Depth Max (ft):	16	5
Number of Observations:	328	4

Trophic State Index

Trophic State: Eutrophic (56)

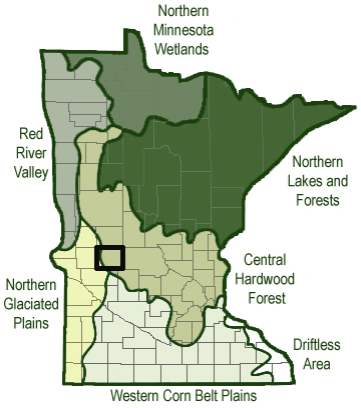
The figure below shows the minimum and maximum values with the arrows and the mean with the black dot (site 201).



Ecoregion Comparisons

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

Ecoregion:	North Central Hardwood Forest
Total Phosphorus:	Within Expected Range
Chlorophyll-a:	Within Expected Range
Secchi Depth:	Within Expected Range



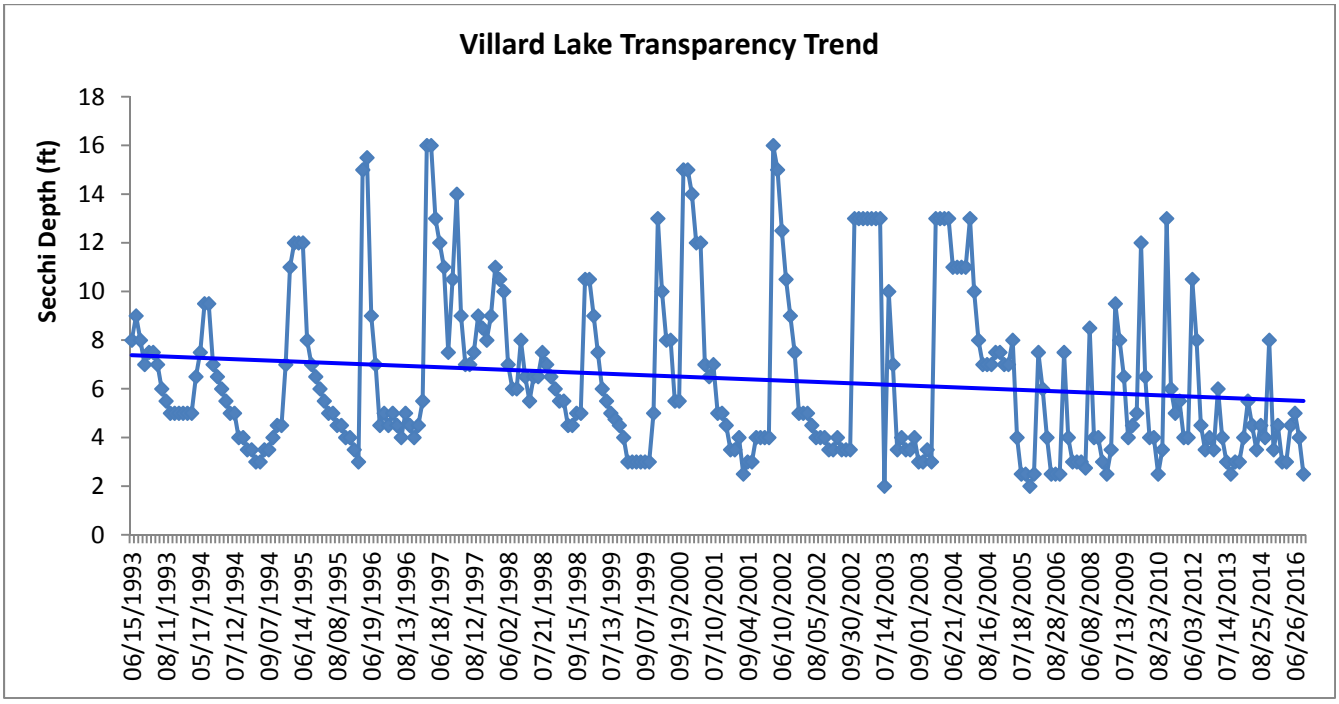
Trend Analysis Report

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.

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

Table 1. Trend analysis for Villard Lake.

Lake Site	Parameter	Date Range	Trend
204	Transparency	1993-2016	Decreasing (99.9%)
204	Total Phosphorus	1994-2016	No Trend
204	Chlorophyll-a	1996-2002, 2004-2011, 2013-2016	Increasing (95%)



Villard Lake shows evidence of declining water quality trends. The algae concentration (chlorophyll a) is increasing and the transparency is decreasing. This makes sense because when there are more algae in the water the transparency (clarity) is poorer. Monitoring should continue so that this trend can be tracked in future years.