



2015 MONITORING SUMMARY

Grand Lake, Ploof's Creek South, Johannes Creek

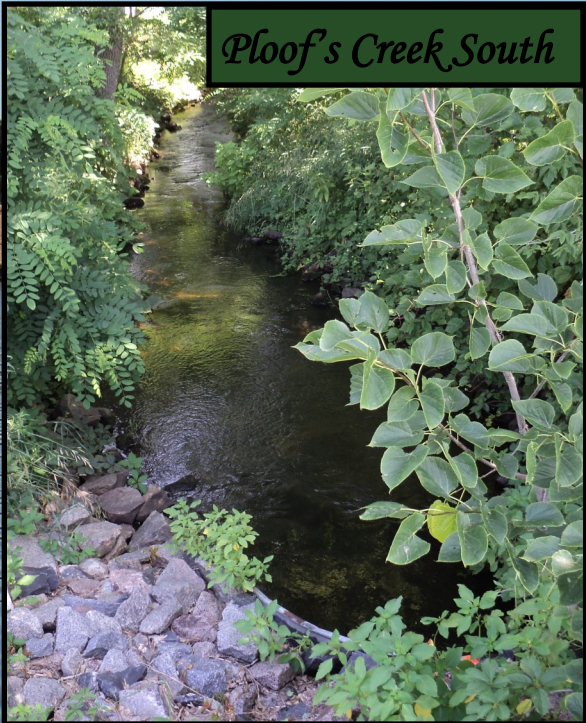
Introduction

Since the 2012 monitoring season, the Grand Lake Improvement District (Grand LID) and the Sauk River Watershed District (SRWD) have worked together to implement a monitoring plan designed to evaluate the water quality of Ploof's Creek, Johannes Creek, and Grand Lake. Knowing the water quality of these bodies of water will assist the Grand LID with their goal of improving the water quality of Grand Lake through best management practice (BMP) project implementation.

"We would like to measure our creeks to determine if we should help fund projects along the creeks with the ultimate goal of improving Grand Lake's water quality."

- Scott Palmer - Grand LID President

Ploof's Creek South



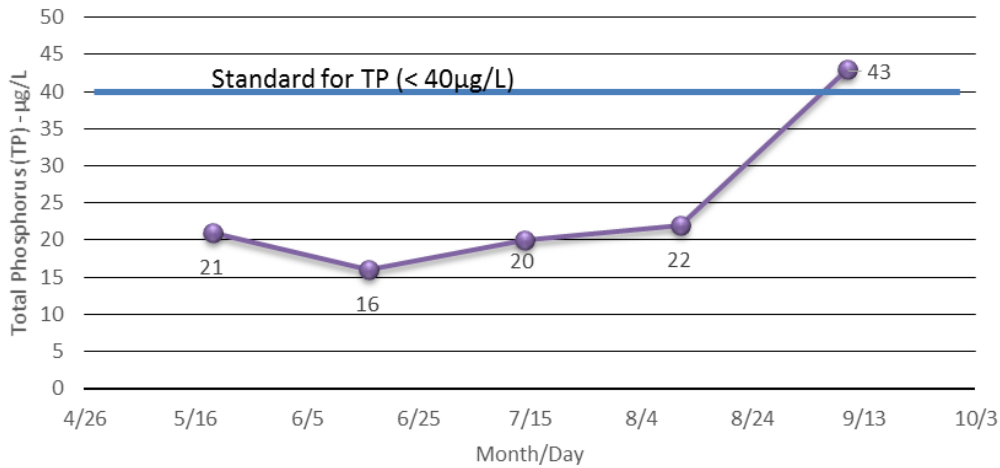
Johannes Creek



"It is the vision of the Sauk River Watershed District to protect and enhance our natural resources by increasing public awareness and involvement....The District will be wise stewards of our natural resources and will work alongside our partners to leave the water quality better for future generations."

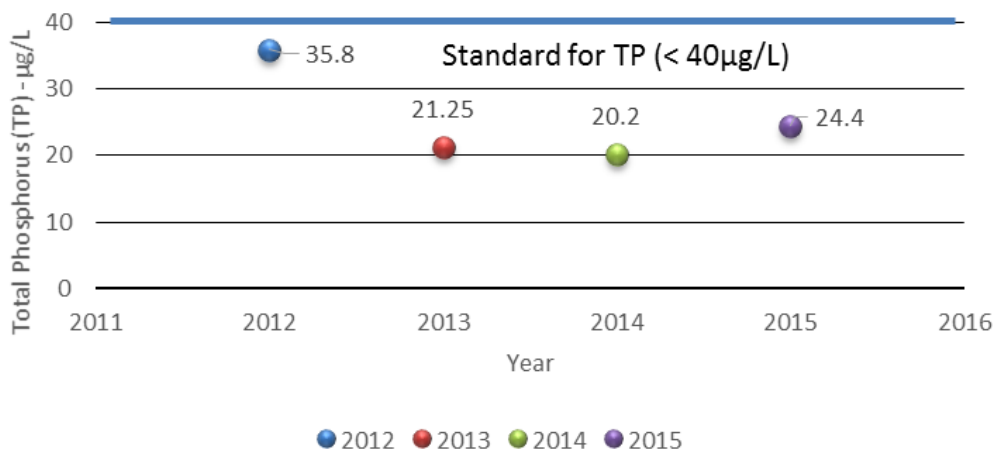
Grand Lake (Deep Point)

Total Phosphorus - Grand Lake - 2015



Total Phosphorus (µg/L) Grand Lake	May	June	July	August	September
2012	20	26	30	37	66
2013	NA	18	19	20	28
2014	22	16	16	25	22
2015	21	16	20	22	43

Total Phosphorus - Grand Lake Yearly Averages



Total Phosphorus (TP)

Total phosphorus is made up of both organic and inorganic (ortho-phosphorus) materials. It can be found suspended in the water or in the bottom materials of the lake. The MPCA's ecoregion standard level for phosphorus in deep lakes (max depth greater than 15 feet) is 40 µg/L.

The figure to the upper left shows that four out of five TP samples taken in Grand Lake in 2015 are below the standard.

The table to the left and the figure below it display the TP results from the last four monitoring seasons, where only two out of nineteen samples exceed the standard. Both samples that exceed the standard were taken in the month of September - one in 2012 and one in 2015.

The yearly averages for Total Phosphorus, displayed in the graph to the lower left, are all below the standard.

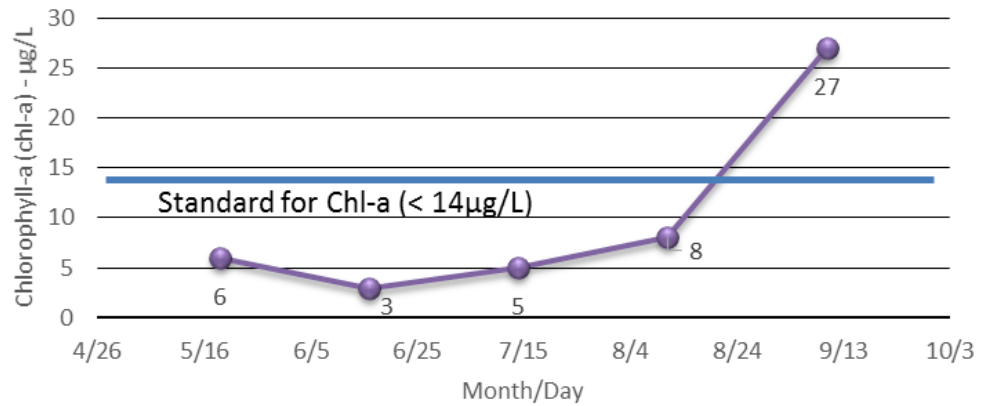
Chlorophyll A (Chl-a)

Chlorophyll A samples are used to measure the amount of algae in the water. Algae grows as the water warms and the amount of growth is dependent on the amount of phosphorus available. Other environmental factors such as wind and water temperature can impact the amount of algae growth as well.

The ecoregion standard for Chlorophyll A is 14 µg/L (micrograms/liter). As shown in the figure to the upper right, four of the five Chlorophyll A samples taken in Grand Lake in 2015 were within the ecoregion standard. The table to the right and chart below show the results for the last four monitoring seasons, with three samples exceeding the standard, two in 2012 and one in 2015.

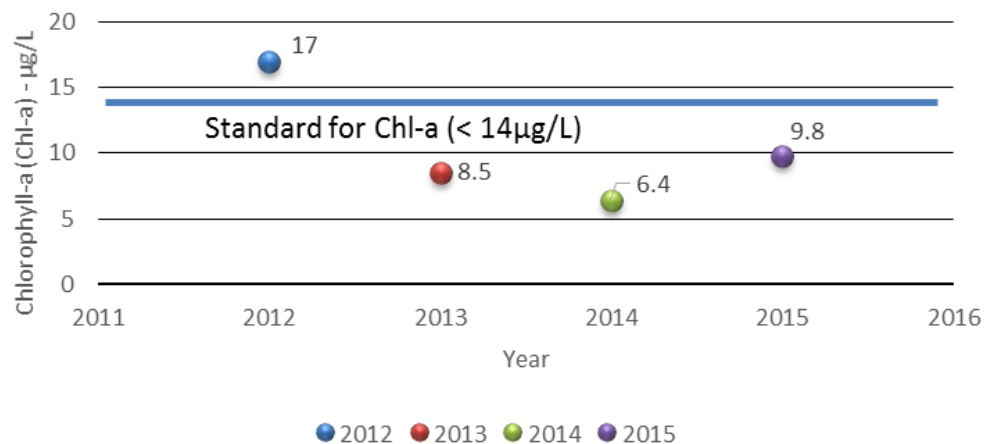
The yearly averages for Chlorophyll-a, displayed in the graph to the lower right, are below the standard with the exception of the average from 2012.

Chlorophyll-a - Grand Lake - 2015



Chlorophyll A (µg/L) Grand Lake	May	June	July	August	September
2012	3	9	8	28	37
2013	NA	10	5	11	8
2014	4	3	4	9	12
2015	6	3	5	8	27

Chlorophyll-a - Grand Lake Yearly Averages



Secchi Disk

Water clarity is measured using a transparency disk (secchi disk) that is lowered into the water on the shaded side of the boat until it can no longer be seen. Clarity is measured every time the lake is sampled. This data, along with phosphorus and chlorophyll a data, is used to assess the water quality of a lake.

The ecoregion standard for secchi disk readings is greater than 1.4 meters (which is equal to about 4.6 feet). The figure to the lower right shows the secchi disk readings collected in Grand Lake during the 2015 monitoring season. Of the five readings, only one did not meet the standard.

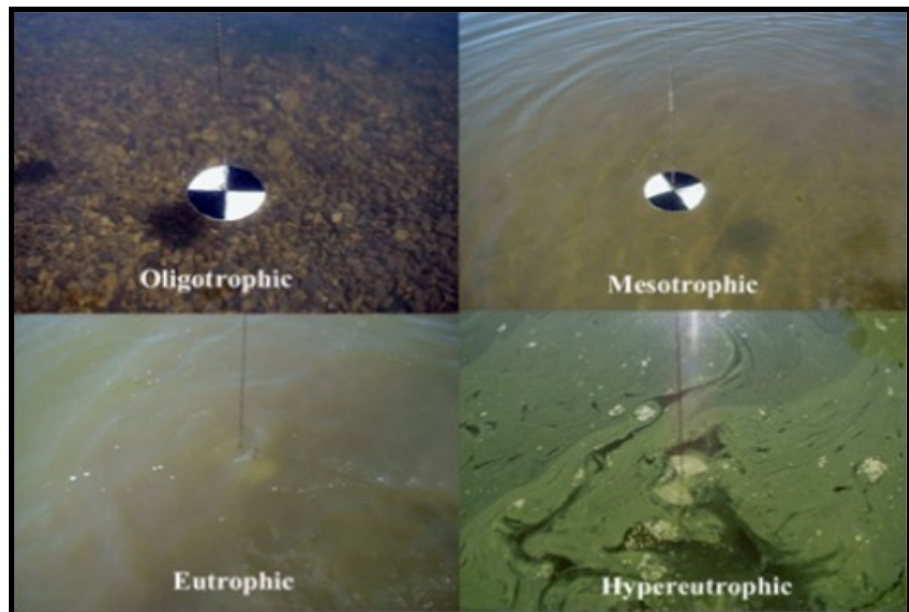
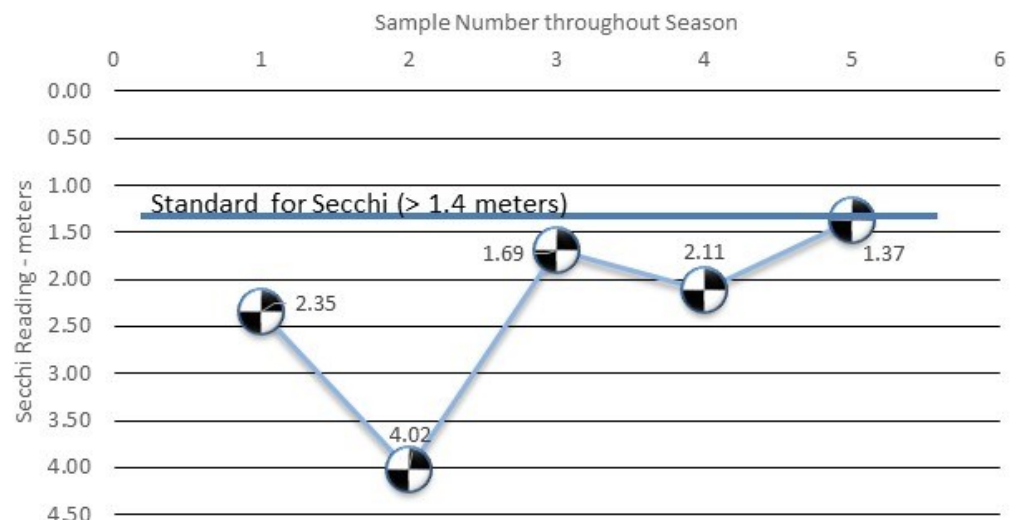


Photo Courtesy of the Minnesota Pollution Control Agency (MPCA)

The above photo provides examples of what the four main lake classifications (according to Carlson's Trophic Status Index/TSI) would look like during a secchi disk reading. Phosphorus samples, chlorophyll-a samples, and clarity/secchi disk readings are used to determine the TSI for a lake.

The four stages of lake classification are oligotrophic (clean, clear), mesotrophic (temporary algal and aquatic plant problems), eutrophic (persistent algal blooms and aquatic plant problems), and hypereutrophic (extreme nuisance algal blooms and aquatic plant problems).

Secchi Disk - Grand Lake - 2015

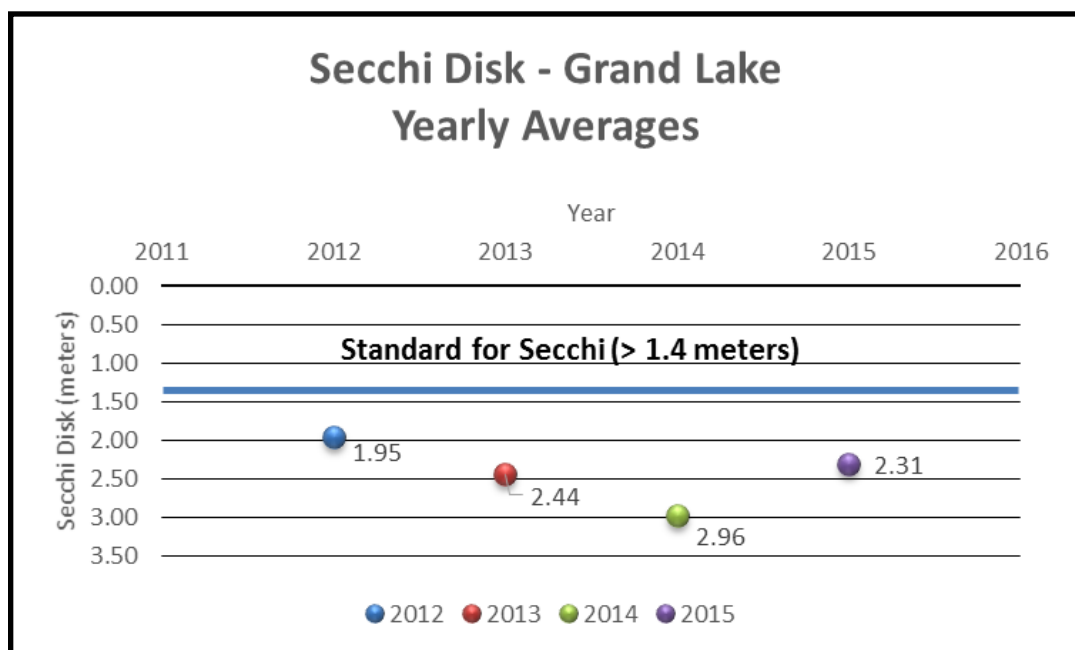


Secchi Disk (meters) Grand Lake	May	June	July	August	September
2012	4.57	1.07	1.68	1.22	1.22
2013	NA	3.96	2.06	1.91	1.83
2014	3.51	3.43	3.28	2.47	2.13
2015	2.35	4.02	1.69	2.11	1.37

The table above shows the monthly secchi disk readings from the last four monitoring seasons. The scatterplot below shows the yearly averages of the secchi disk readings.

Of the nineteen readings taken over the last four years, only four did not meet the standard. Three of those readings were taken in 2012 and one was taken in September of 2015.

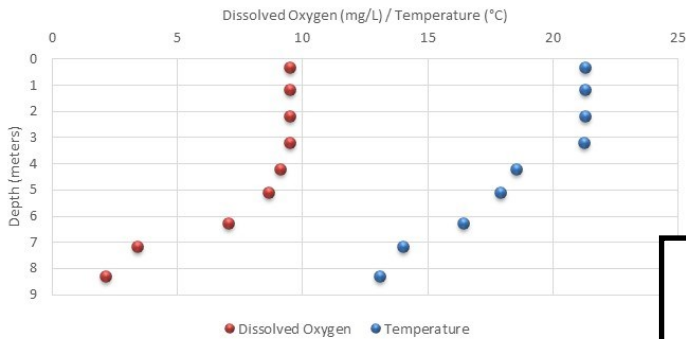
The yearly averages all met the standard.



Dissolved Oxygen and Temperature Grand Lake

Dissolved oxygen is the amount of oxygen dissolved in the water that is readily available for fish and other aquatic organisms. Temperature can directly influence the amount of dissolved oxygen present.

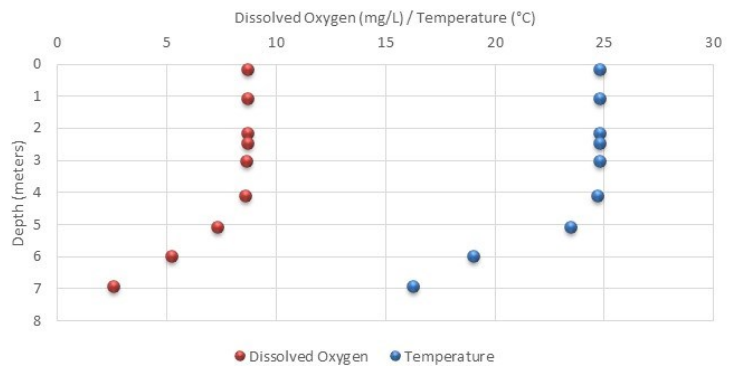
**Temperature and Dissolved Oxygen
June 16th, 2015 - Grand Lake**



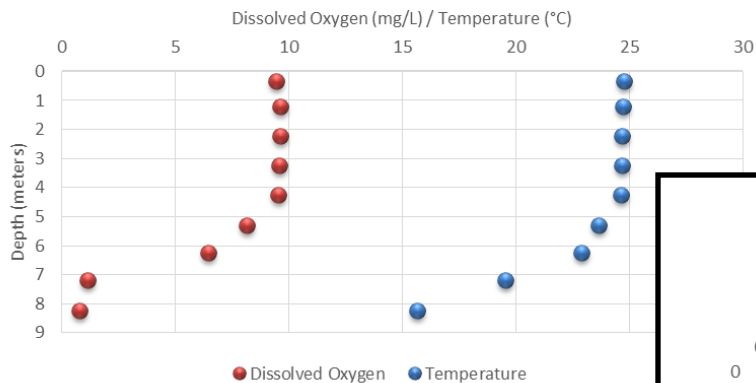
Dissolved oxygen and temperature profile readings are taken during each sampling event. Readings are taken every meter (approximately 3 feet) throughout the water column.

During the May 2015 sampling event, there was a connection error with the equipment and no data could be collected.

**Temperature and Dissolved Oxygen
July 14th, 2015 - Grand Lake**

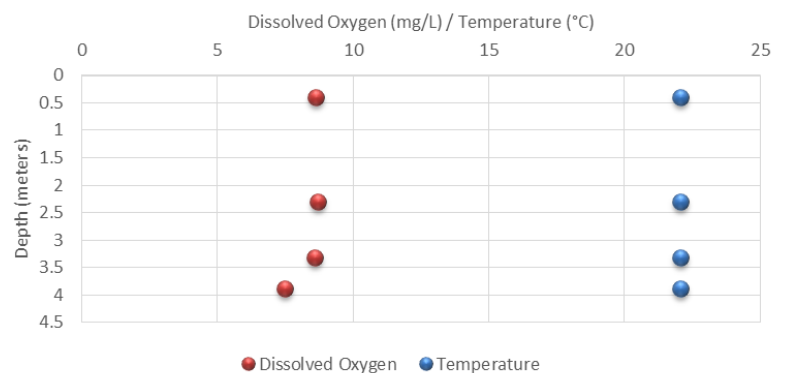


**Temperature and Dissolved Oxygen
August 11th, 2015 - Grand Lake**



The September profile is noticeably shallower than the previous months. Due to the wind during that sampling event, staff and volunteer boat driver were unable to keep the boat in place which made the profile data collection difficult.

**Temperature and Dissolved Oxygen
September 10th, 2015**



Shoreland Buffer Zone Option for Water Quality Protection

In 2012, the SRWD conducted a shoreline assessment of Grand Lake. Recommendations for protecting the water quality of Grand Lake were included in the final report, and could be expanded upon if requested.

One recommendation included in the report is to restore the manicured lakeshores into buffer zones with native vegetation. Creating a restored buffer zone provides several benefits such as offering a buffer between the affects of human activity and the lake, enhancing the amount and quality of habitat for both aquatic and terrestrial organisms, and stabilize the shorelines to decrease the amount of erosion occurring.

The final report on the shoreline assessment conducted in 2012, as well as additional documentation and recommendations from this project, are available upon request through the Sauk River Watershed District.

Summary of Grand Lake

Zebra Mussel Veliger Sampling

During the 2015 monitoring season, zebra mussel veliger sampling was also conducted. Three samples were collected throughout the season, all of which resulted in a negative presence of zebra mussel veligers.

A zebra mussel veliger is the microscopic, larval stage of a zebra mussel. Due to their microscopic nature, they would not be visible to the naked eye meaning a microscope would be necessary for identification.

Zebra mussel veliger samples were collected approximately 100 feet from the public access in a minimum of 10-15 feet of water.



Photos Courtesy of MN DNR Website

Summary of Grand Lake

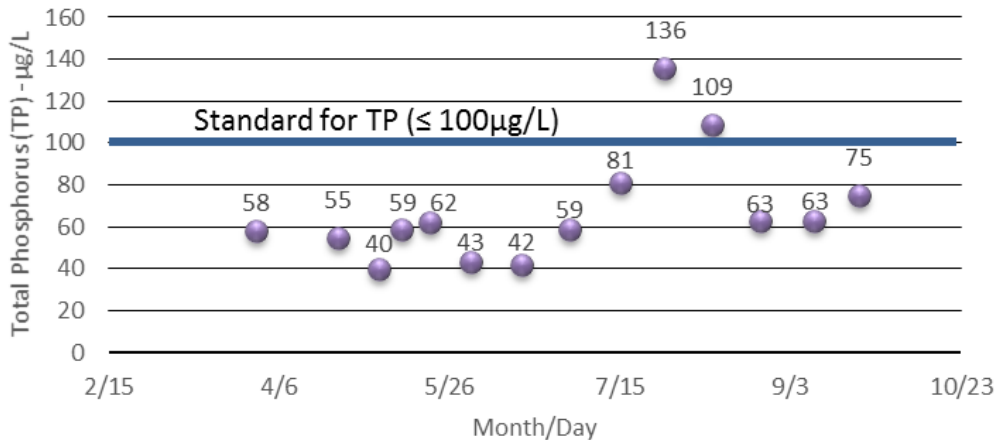
Based on the data that was collected by the Sauk River Watershed District during the 2015 monitoring season, Grand Lake is meeting the standards for the parameters tested, with the exception of the September sampling event.

Looking at the data collected over the last four monitoring seasons, the lake has good water quality overall, with the occasional sample exceeding standards. The lake is considered suitable for swimming/wading, with low algae levels and good water clarity during the open water season.

Additional data regarding fish population and water quality may be accessed through the Minnesota Pollution Control Agency (MPCA) or the Department of Natural Resources (DNR) websites, using the lake identification number which is 73-0055-00.

Ploof's Creek South

Total Phosphorus - Ploof's Creek South 2015

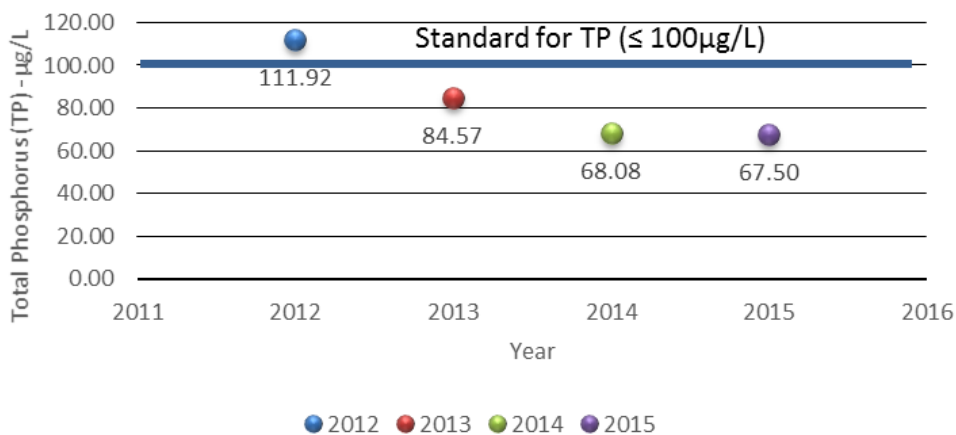


Total Phosphorus (TP)

The eutrophication standard for total phosphorus in streams within the North Central Hardwood Forest Ecoregion (NCHF) is $\leq 100\mu\text{g/L}$.

As shown in the figure to the left, only two of fourteen samples collected in 2015 exceeded the TP standard.

Total Phosphorus - Ploof's Creek South Yearly Averages



The figure to the left shows the yearly averages for total phosphorus samples collected on Ploof's Creek South from 2012 through 2015.

The majority of the phosphorus samples collected from Ploof's Creek South have been below the standard of $100\mu\text{g/L}$. Most of the samples that exceeded the standard were collected towards the end of the monitoring season.

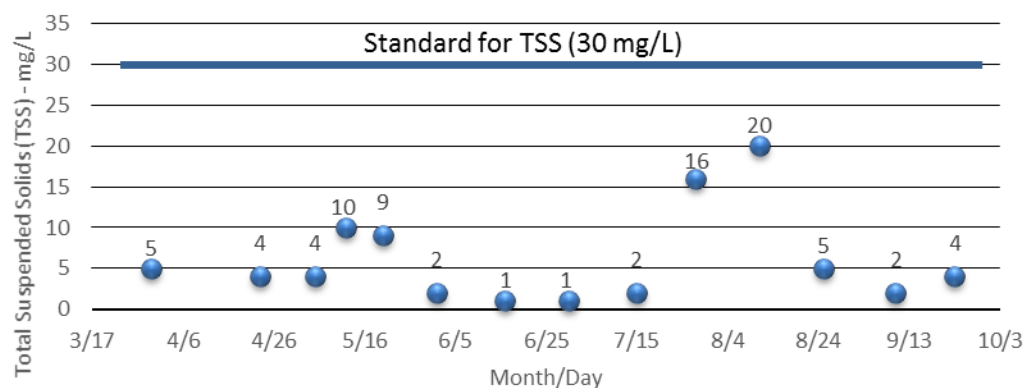
All of the yearly averages, (shown in the graph to the left) with the exception of 2012, meet the standard.

Total Suspended Solids (TSS)

The North Central Hardwood Forest Ecoregion standard for total suspended solids is 30mg/L.

As shown in the figure on the right, the samples collected from Ploof's Creek South in 2015 are all below the standard for total suspended solids.

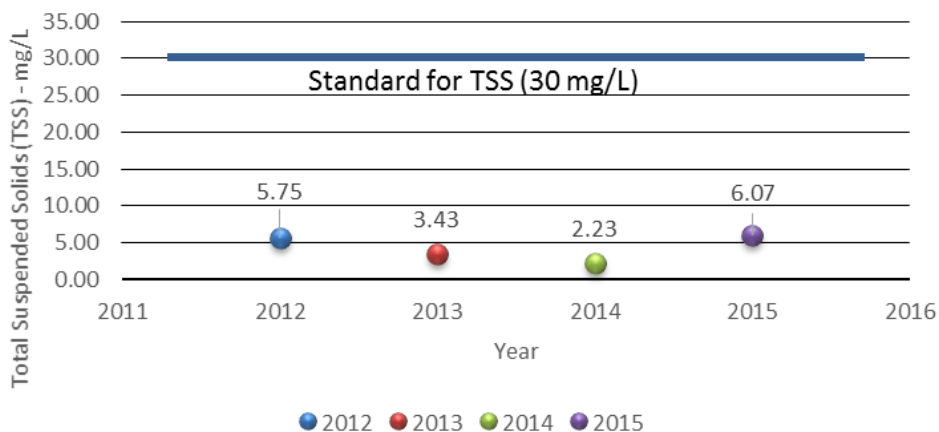
Total Suspended Solids - Ploof's Creek South 2015



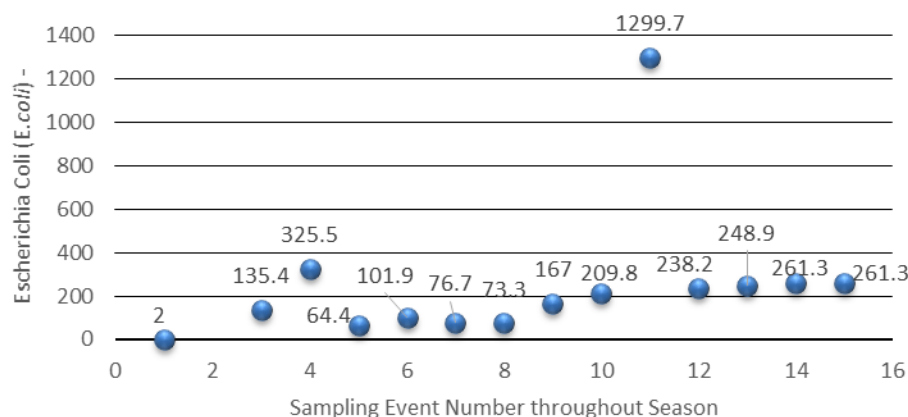
The figure to the right shows the yearly averages for total suspended solids samples collected from Ploof's Creek South from 2012 through 2015.

The standard for total suspended solids is 30mg/L, which all of the yearly averages were well below.

Total Suspended Solids - Ploof's Creek South Yearly Averages

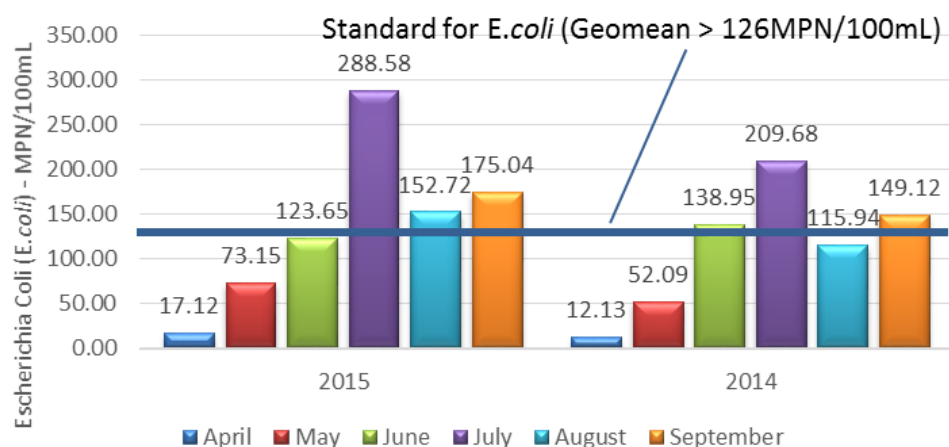


Escherichia Coli - Ploof's Creek South - 2015



The figure below shows the *E.coli* geomeans (geometric means) of the samples collected at Ploof's Creek South over the last four years. Of the six months that sampling occurs, three of them exceed the standard. This indicates that an *E.coli* impairment is likely in Ploof's Creek. However, since this is such a flashy parameter, there is a second standard that is looked at. That standard pertains to 10% of individual samples exceeding 1,260 MPN/100mL, which would imply that illness could occur upon exposure. Since Ploof's Creek does not have 10% of its samples exceeding this standard, the likelihood of getting sick from a one time exposure are minimal.

Escherichia Coli Geomeans - Ploof's Creek South - 2012-2015



Escherichia Coli (E.Coli)

E.coli is a bacteria found in surface waters that can be toxic to humans. It is found in human and animal waste and contaminates surface waters through direct surface runoff during rain events, snow melt, leaking septic systems, and manure spills. Due to the variety of ways it can contaminate surface waters, it is considered a "flashy" parameter and a large number of data points must be present to draw accurate conclusions regarding the data.

To establish a geometric mean for *E.coli* data (which is the standard process for evaluating the data) 5 samples need to be collected over a 30 day (one month) time frame (these samples can be collected over multiple years). If the geometric mean of those samples is greater than 126 MPN/100mL, or if 10% of the samples are greater than 1260 MPN/100mL then the site would not meet the North Central Hardwood Forest Ecoregion standard.

Using the *E.coli* samples collected from Ploof's Creek South from 2012-2015, there were sufficient data points to calculate geometric means for April, May, June, July, August, and September. As shown in the figure to the left, three of the six geomeans met the standard of 126 MPN/100mL.

Ploof's Creek South Data Summary

Of the data that was collected on Ploof's Creek South during the 2015 monitoring season, the majority of the results met the North Central Hardwood Forest Ecoregion standard.

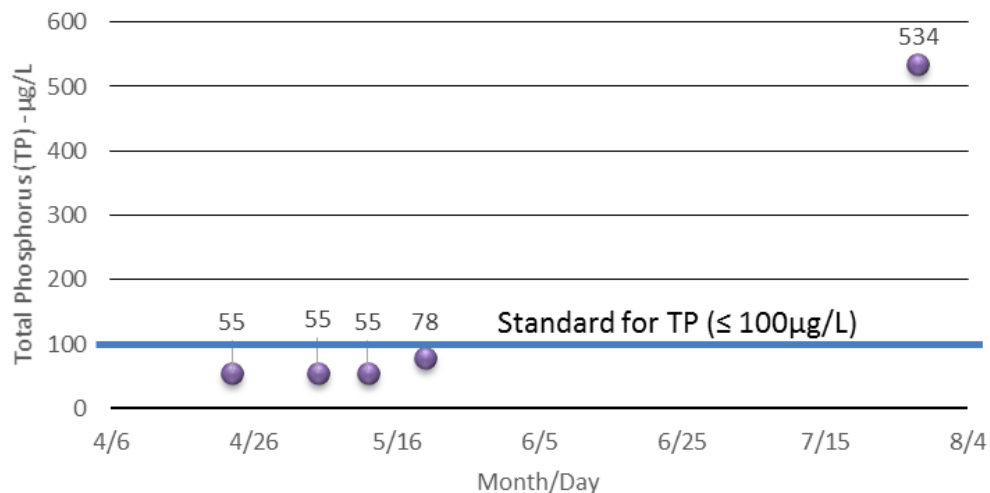
The parameter raising the most concern for Ploof's Creek South is *E.coli*, with three out of six monthly geometric means exceeding the standard. Additionally, five out of the six monthly geometric means increased from 2014 to 2015.

The Sauk River Watershed District's Monitoring Coordinator has contacted the Minnesota Pollution Control Agency (MPCA) regarding these data results and will be following their process for reporting this data moving forward. Additional information on the process will be provided to the Grand LID as it becomes available.



Johannes Creek

Total Phosphorus - Johannes Creek - 2015

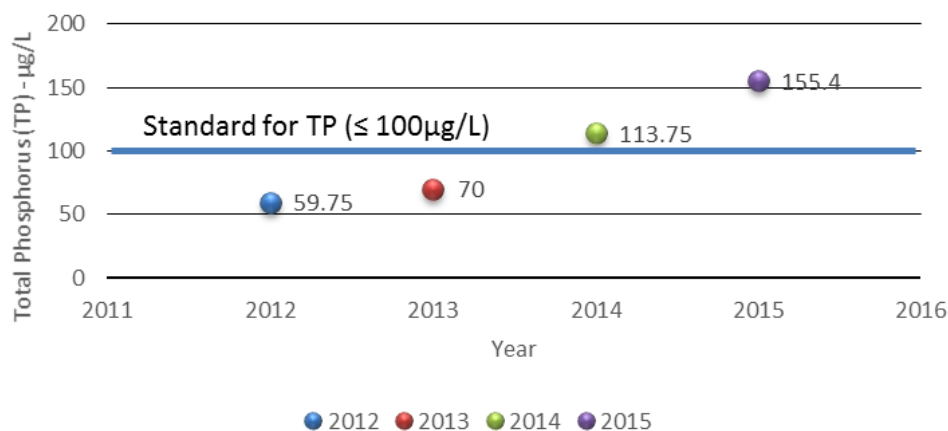


Total Phosphorus (TP)

The eutrophication standard for total phosphorus in streams within the North Central Hardwood Forest Ecoregion is $\leq 100\mu\text{g/L}$.

As shown in the figure to the left, four out of five samples collected on Johannes Creek during the 2015 monitoring season met the standard.

Total Phosphorus - Johannes Creek Yearly Averages



The figure to the left shows the yearly averages for total phosphorus samples collected on Johannes Creek from 2012 through 2015.

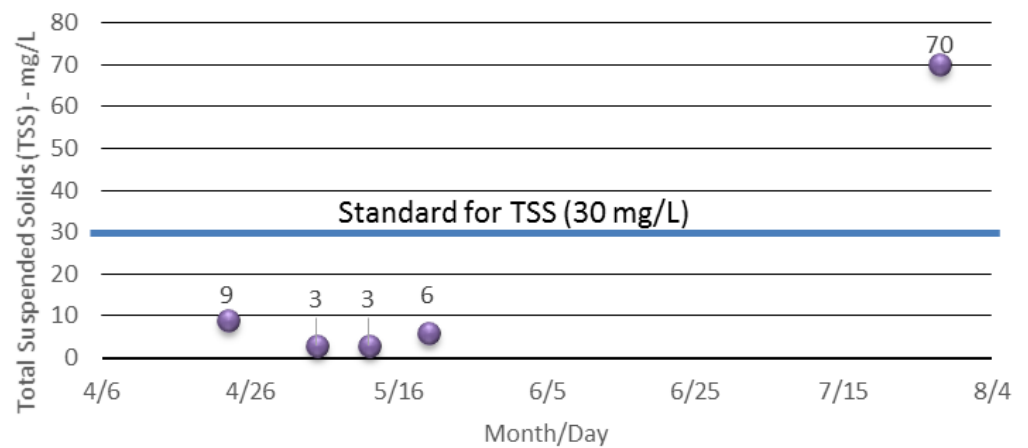
Although the majority of the samples that have been collected on Johannes Creek have been below the TP standard of $100\mu\text{g/L}$, the yearly averages for 2014 and 2015 exceed the standard. 2014 had several individual sampling events that exceeded the standard whereas 2015 had one extremely high sample.

Total Suspended Solids (TSS)

The North Central Hardwood Forest Ecoregion standard for total suspended solids is 30mg/L.

As shown in the figure on the right, four of the five samples collected from Johannes Creek in 2015 are below the standard for total suspended solids.

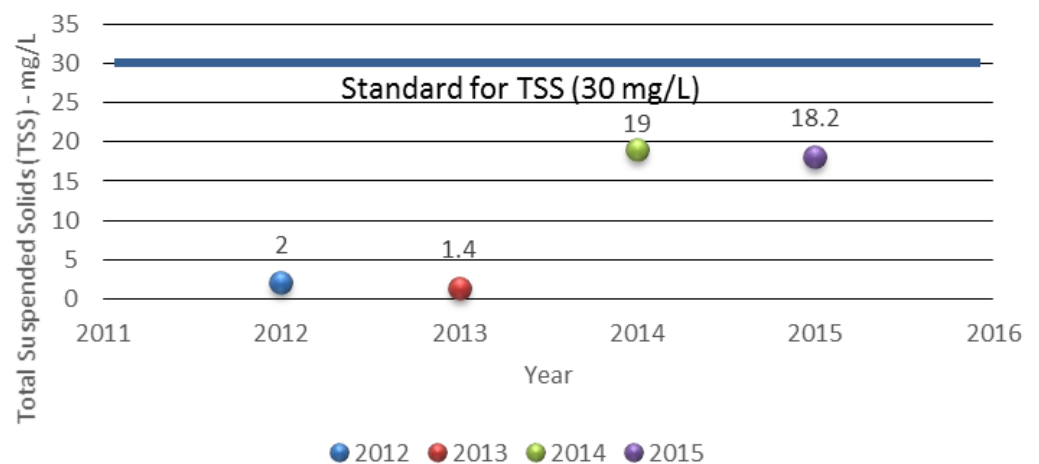
Total Suspended Solids - Johannes Creek 2015



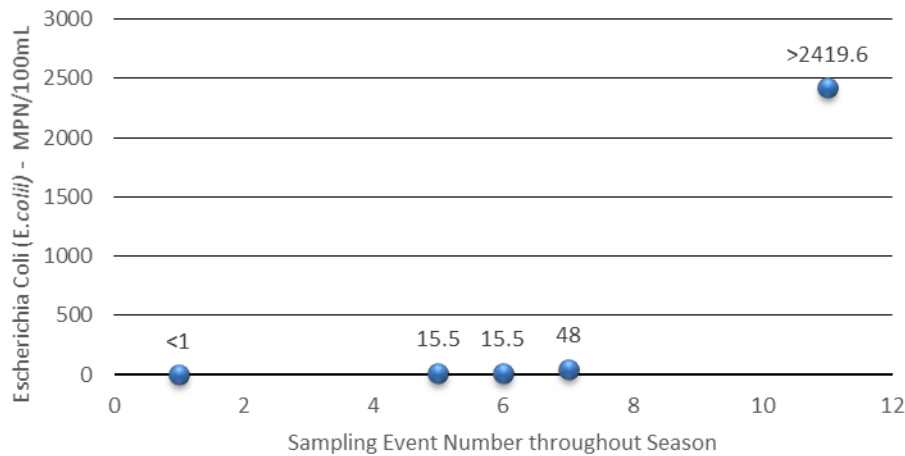
The figure to the right shows the yearly averages for total suspended solids samples collected on Johannes Creek from 2012 through 2015.

The standard for total suspended solids is 30mg/L, which all of the yearly averages fell below.

Total Suspended Solids - Johannes Creek Yearly Averages

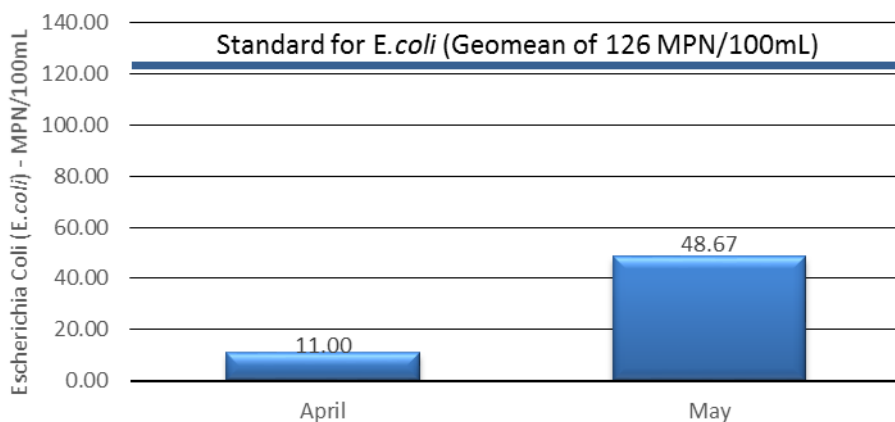


Escherichia Coli - Johannes Creek - 2015



The figure below shows the *E. coli* geomeans (geometric means) of the samples collected from Johannes Creek over the last four years. Only two of the months had sufficient data points to calculate geometric means. Looking at the 2015 data, four of the five samples had small amounts of *E. coli*, while the fifth sample of the season exceeded the upper detection limit of the lab equipment with a result of >2419.6 MPN/100mL. Due to the small number of samples collected, having one sample exceed 1260MPN/100mL is greater than 10% of the samples, which puts Johannes Creek in violation of that particular *E. coli* standard.

Escherichia Coli Geomeans Johannes Creek - 2012-2015



Escherichia Coli (*E. coli*)

E. coli is a bacteria found in surface waters that can be toxic to humans. It is found in human and animal waste and contaminates surface waters through direct surface runoff during rain events, snow melt, leaking septic systems, and manure spills. Due to the variety of ways it can contaminate surface waters, it is considered a "flashy" parameter and a large number of data points must be present to draw accurate conclusions regarding the data.

To establish a geometric mean for *E. coli* data (which is the standard process for evaluating the data) 5 samples need to be collected over a 30 day (one month) time frame (these samples can be collected over multiple years). If the geometric mean of those samples is greater than 126 MPN/100mL, or if 10% of the samples are greater than 1260 MPN/100mL then the site would not meet state standards.

Using the *E. coli* samples collected from Johannes Creek from 2012-2015, there were sufficient data points to calculate geometric means for the months of April and May. As shown in the figure to the left, both of these geomeans fell below the geomean standard of 126 MPN/100mL.

Johannes Creek Data Summary

Of the data that was collected on Johannes Creek during the 2015 monitoring season, the majority of the results met the North Central Hardwood Forest Ecoregion standard. However, due to stagnant water in the creek during the majority of the monitoring season, only five samples were collected. Of the five samples, one of them exceeded the standards for all three parameters (total phosphorus, total suspended solids, and *E.coli*).

The parameter raising the most concern for Johannes Creek is *E.coli*. While there were only enough data points to calculate geomeans for two months out of the six to seven month sampling season, and both geomeans met the standard, there was a single *E.coli* sample that exceeded the second component to the standard. The second component to the *E.coli* standard states that a maximum of 10% of the samples may exceed individual results of 1260 MPN/100mL.

The Sauk River Watershed District's Monitoring Coordinator has contacted the Minnesota Pollution Control Agency (MPCA) regarding these data results and will be following their process for reporting this data moving forward. Additional information on the process will be provided to the Grand LID as it becomes available.



Summary of 2015 Monitoring Data

Of the water chemistry data that was collected at the Ploof's Creek South, Johannes Creek, and Grand Lake Deep monitoring sites in 2015, the majority of it fell within the standards. This dataset indicates that these three sites have good water quality overall, however, the *E.coli* data results from Ploof's Creek South and Johannes Creek have raised some concerns.

The Sauk River Watershed District staff is working with the Minnesota Pollution Control Agency regarding the aforementioned *E.coli* sampling result concerns. Information will be passed on to the Grand LID as it becomes available. Any questions or concerns should be directed to Sarah Jo, the Monitoring Coordinator at the Sauk River Watershed District.

Contact Us

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IMPORTANT REMINDERS

THE DATA AND RECOMMENDATIONS INCLUDED IN THIS REPORT ARE BASED ON THE DATA COLLECTED FROM 2012-2015. SAMPLES WERE COLLECTED AND DATA WAS REVIEWED BY THE SAUK RIVER WATERSHED DISTRICT. IT IS IMPORTANT TO REMEMBER THAT THIS DATASET IS NOT A COMPLETE PICTURE OF ALL CONDITIONS.

PLEASE CONTACT SARAH JO, MONITORING COORDINATOR AT THE SAUK RIVER WATERSHED DISTRICT WITH ANY QUESTIONS OR CONCERNS REGARDING THE INFORMATION PRESENTED IN THIS REPORT.

AS PREVIOUSLY MENTIONED, SARAH JO WILL BE FOLLOWING UP WITH THE GRAND LID REGARDING THE *E.COLI* SAMPLE RESULTS ON PLOOF'S CREEK SOUTH AND JOHANNES CREEK.