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Emerald Lakes Village, Oakland County *January 8th, 2018*

Sandshores Lake - Water Quality Report

The goal of this testing protocol was to monitor various water quality parameters of the lake, compare results to historical data, and identify any potential risks to the health of Sandshores Lake. Water samples were taken from the middle of the lake and tested for various parameters. Field tests and water samples were taken on July 19th, 2017. This report describes conditions at the times the samples were taken. The quality of the water was tested only to the parameters listed below.

Parameter	July 19th, 2017	Target Range
Temperature	79.4 ˚F	Less than 75 ˚F
Dissolved Oxygen	6.9 mg/L	4.0 – 12.0 mg/L
Total Phosphorus	100 ppb	0 – 100 ppb
Phosphate	40 ppb	0 – 100 ppb
Nitrate	352 ppb	0 – 1,000 ppb
Chlorophyll-α	2.8 ppb	0 – 7.3 ppb
Transparency	5.0 feet	More than 6.5 feet
pH	7.7	7.0 – 9.0 S.U.
Total Dissolved Solids	450 ppm	0 – 1,000 ppm
Conductivity	891 µS	0 – 1,500 µS
Alkalinity	127 ppm	0 – 250 ppm
Hardness	157 ppm	100 – 300 ppm
Total Salinity	450 ppm	0 – 500 ppm
Chloride	124 ppm	0 – 230 ppm
Trophic State Index – Total Phosphorus	71	Oligotrophic: 0 - 40 Mesotrophic: 40 – 50 Eutrophic: 50 – 70 Hypereutrophic: 70+
Trophic State Index – Chlorophyll-α	41	
Trophic State Index – Transparency	54	

Depth (ft.)	Temperature Profile(˚F)	Dissolved Oxygen Profile (mg/L)	Salinity Profile (ppm)
0	79.4	6.9	450
3	79.2	6.8	450
6	78.5	6.8	450
9	77.9	6.2	450
12	76.0	6.0	450

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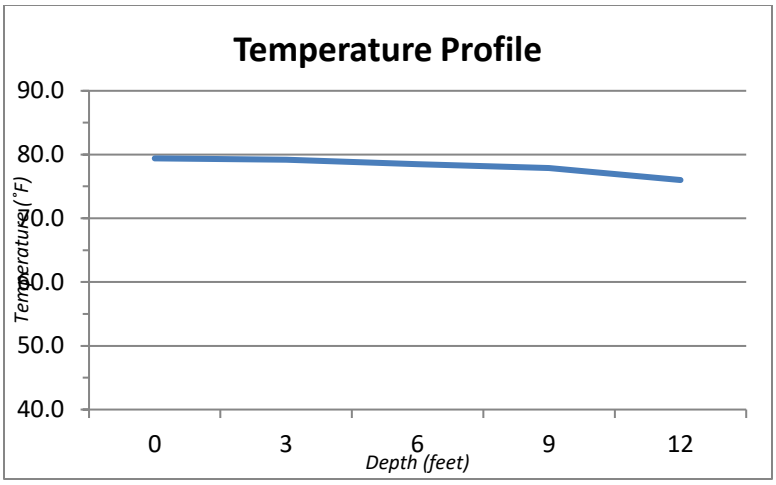

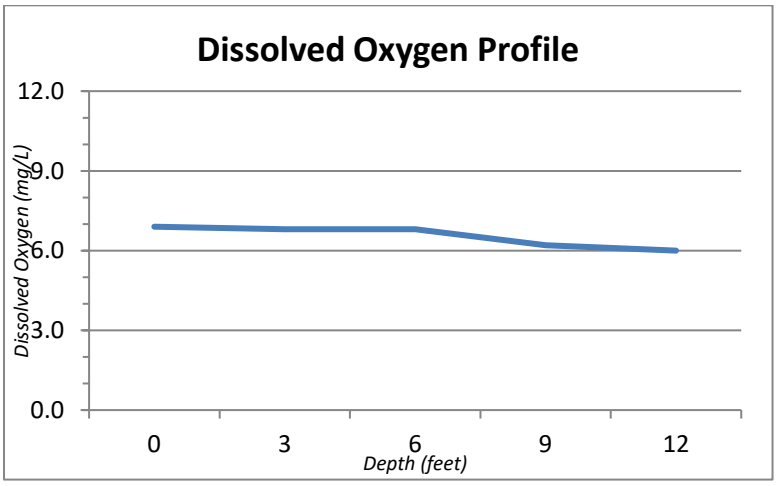

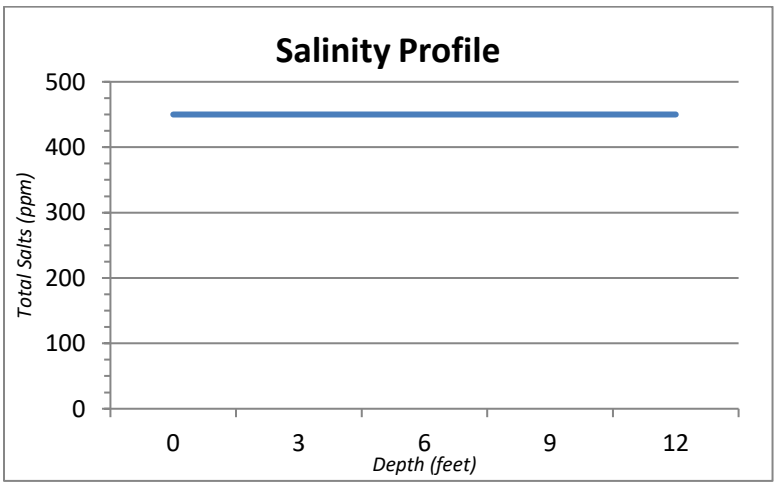

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Discussion

2017 air temperatures were above average with low precipitation. These factors increased the water temperature in Sandshores Lake. The warmer water was great for swimming, but it also couldn't hold as much oxygen as cold water. Despite the warmer temperature, the dissolved oxygen was abundant from surface to bottom. There was plenty of oxygen for a healthy ecosystem, including the fishes.

Phosphorus, phosphates, and nitrates were all within the target ranges. Keeping these nutrients low will help keep plants and algae from growing worse. To ensure more nutrients do not enter the lake, residents should examine their need for fertilizers, use a liquid fertilizer, and leave a buffer zone of unfertilized lawn along the lake edge.

Chlorophyll, which indicates plant production, was within its target range. The transparency of the lake was lower than the target range, but was hindered by the blue dye that LakePro adds throughout the summer.

Trophic State Indices are used to standardize water quality data as an aid to the comparison and categorization of lakes. The three most common indices are calculated using total phosphorus, chlorophyll, and transparency. Each index is unique and they should never be averaged. Rather, the relationship between these three indices can provide insight to the condition of the lake.

The TSI for phosphorus showed the lake as being highly productive, because of the amount of nutrients available in the water column. However, the TSI for chlorophyll showed the lake to have low productivity, based on the actual concentrations of chlorophyll. Furthermore, the TSI for transparency confirmed the lake was not as productive as the nutrients suggested. The transparency was slightly worse than the chlorophyll indicated, but this was most likely due to the blue dye added to the lake and the measurement is restricted by the depth of the lake.

To summarize, the lake was in very good condition regarding plant production, but has the potential to be worse because of the availability of nutrients. Without an aggressive management program, the algae and plant growth in the lake would most likely worsen. We saw this during our BioBase surveys before the two large herbicide treatments in 2017.

The water chemistry parameters were all within their target ranges. These results indicated there were no major issues with the water quality. Instead, the results showed that despite a highly developed watershed, Sandshores Lake remained in excellent condition in 2017.

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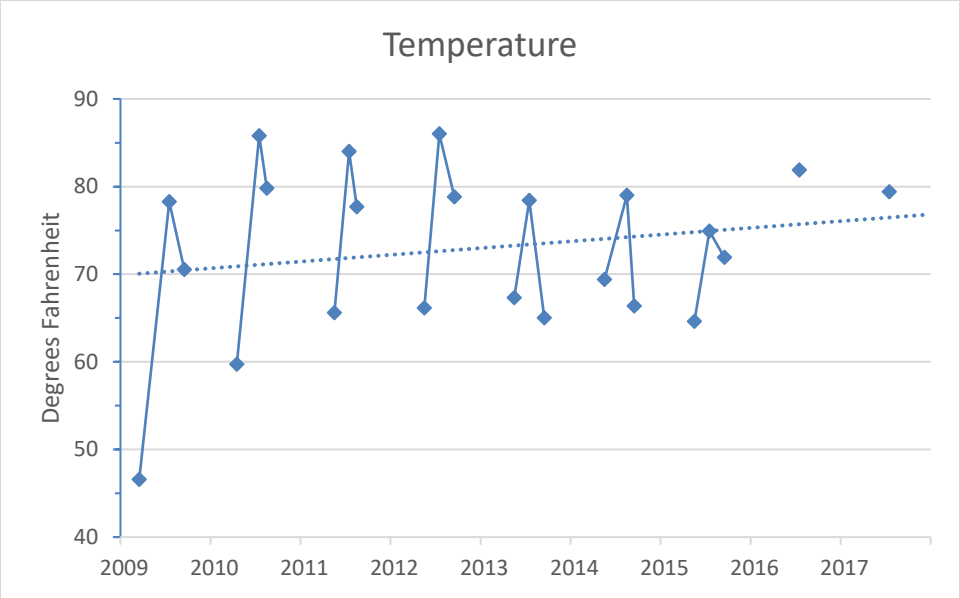
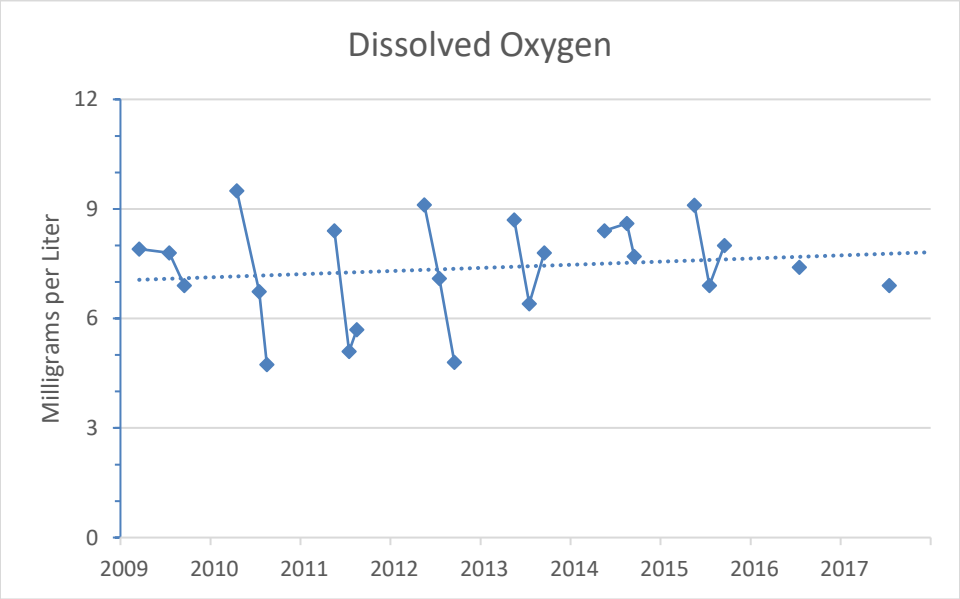
Long-Term Results

Last year, the water quality testing was reduced to a single testing event in the middle of summer. Over time, this change will affect the trends in the following graphs. For example, the water temperature is lower in spring and fall, so using only the summer water temperature will pull the trend upward faster than before.



The temperature increased slowly since our testing began in 2009. The main concern with warmer water is lower oxygen solubility, which decreases as temperature does up.



Despite the increasing temperatures (and decreasing solubility), the dissolved oxygen increased slightly over the testing history. This was a positive trend for the lake, showing that the ecosystem maintained enough oxygen to support the aquatic biota.

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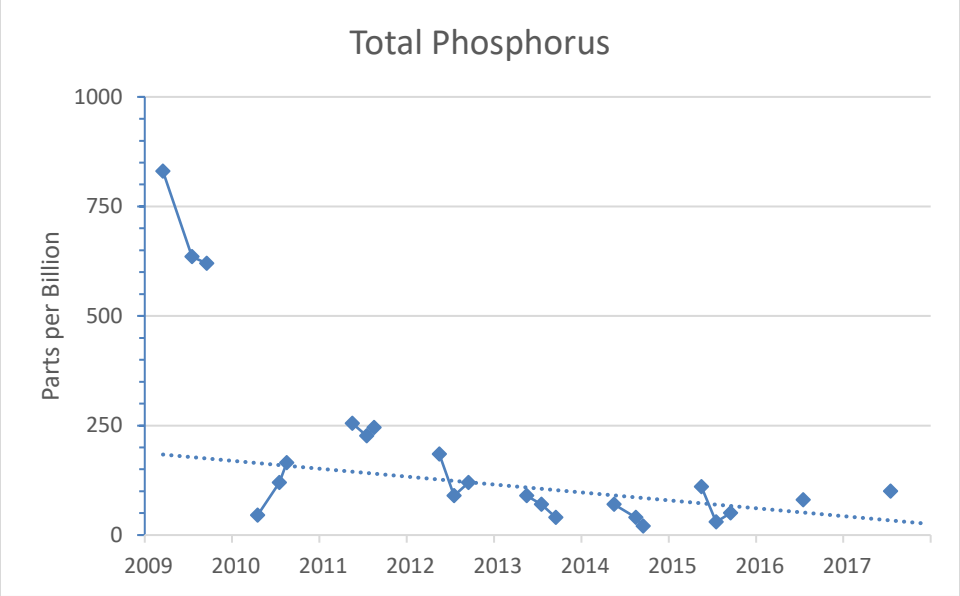
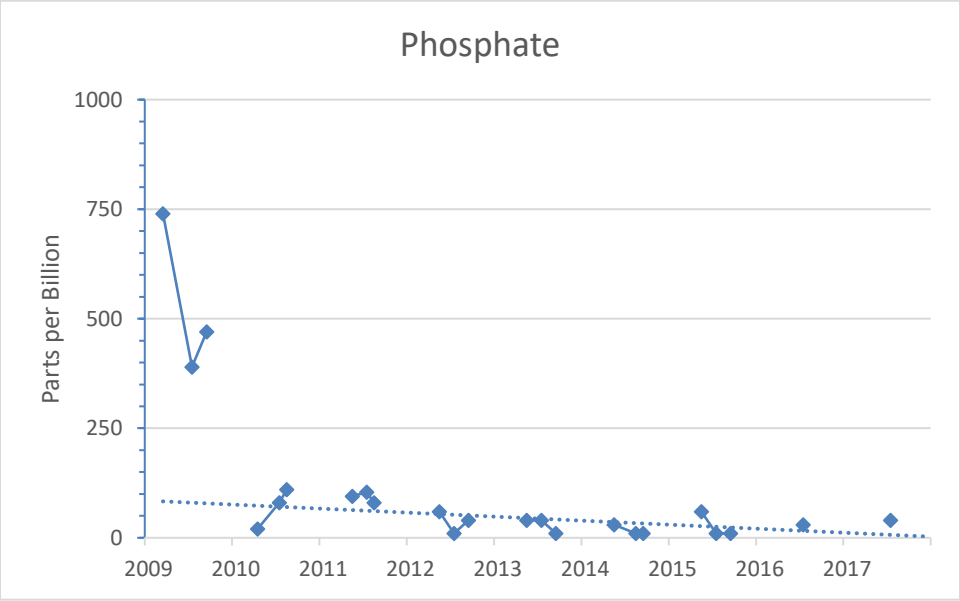


This summer, the total phosphorus concentration increased slightly from last year, but the long term trend remained downward. The state law banning phosphorus fertilizers, proper maintenance of catch basins and storm drains, and active plant management all helped decrease the phosphorus load of the lake.



Phosphate is the form of phosphorus that is usable to aquatic plants. The concentration of this nutrient showed the same pattern as the total phosphorus and approached minimal levels in the lake.

**The 2009 data for Total Phosphorus and Phosphate were excluded from the trendline to better show the long term changes since the major improvement in 2010.*

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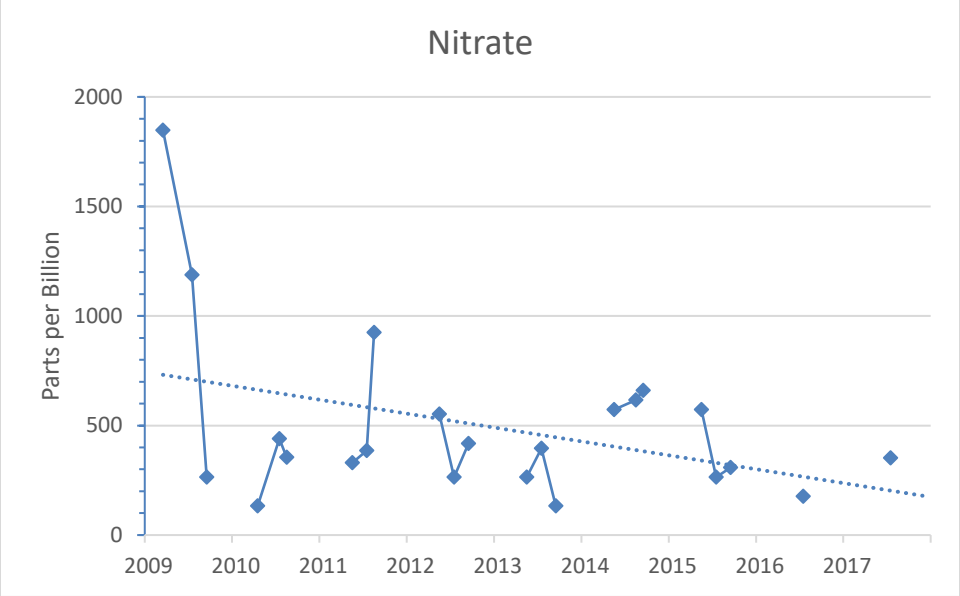
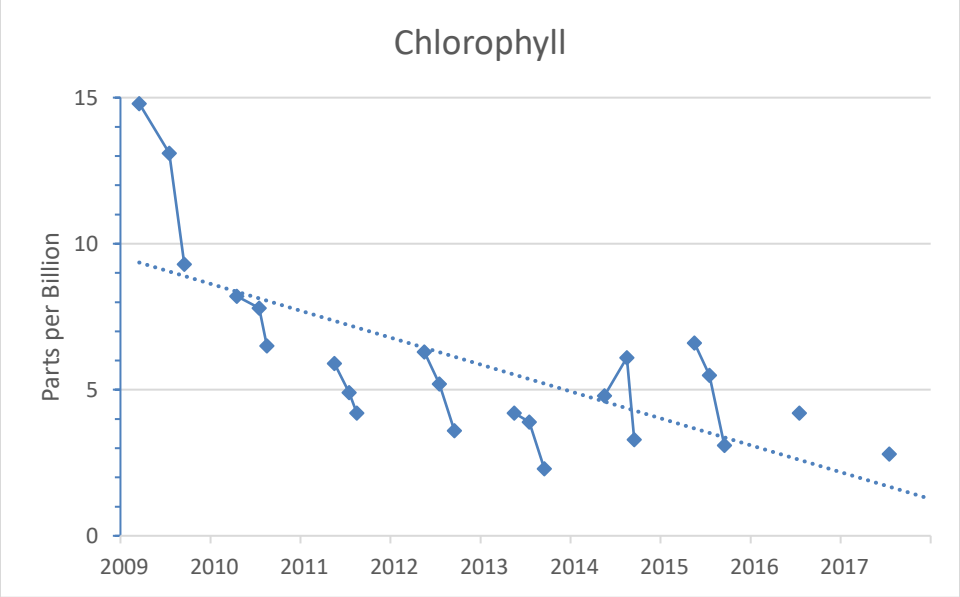


Nitrate is another vital nutrient for the growth of aquatic plants and the most abundant nutrient in lawn fertilizers. The long term trend is downward, despite a slight increase this past summer. It is important that all residents in the watershed responsibly fertilize to minimize the possibility of more nitrates reaching the lake.



Chlorophyll indicates the plant production in the lake. In Sandshores Lake, microscopic algae are the primary plants. This algae grows throughout the summer and is controlled by LakePro's algicide treatments, so the chlorophyll concentrations also depend on the testing date compared to the most recent algicide application. The concentration decreased over the testing history. We had a successful year treating the lake, the concentrations declined again this past year.

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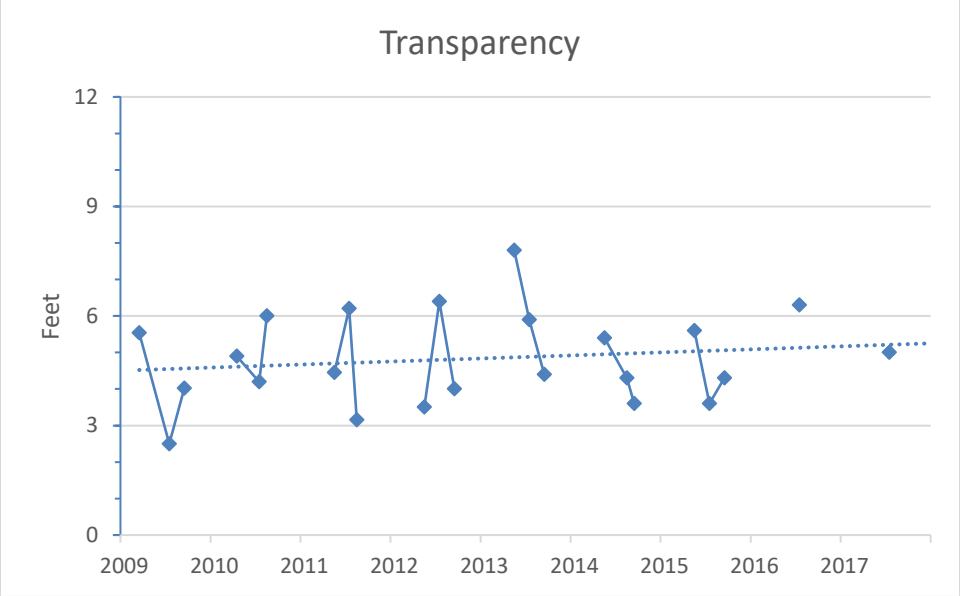
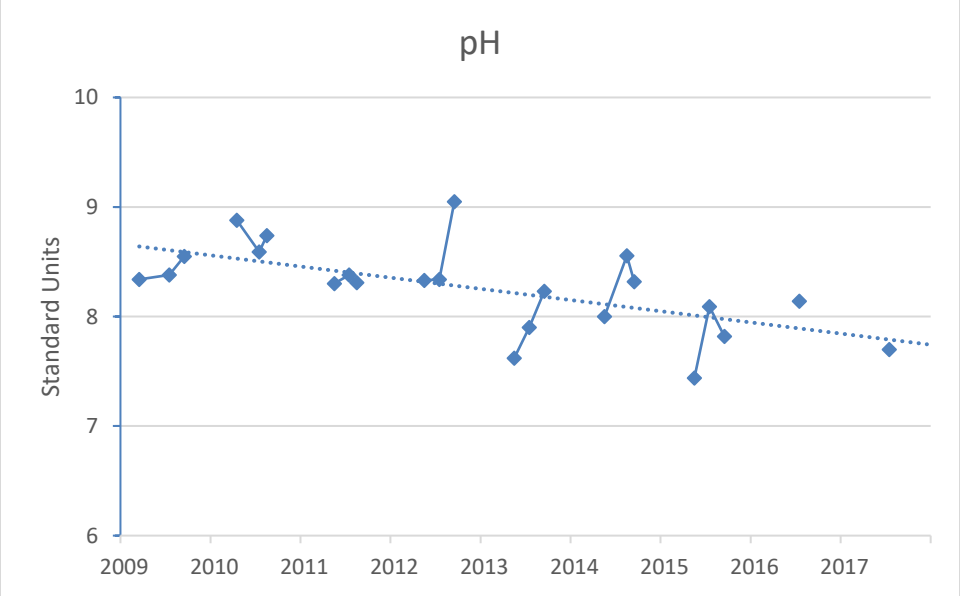


Transparency was affected by different factors including total dissolved solids, total suspended solids, algae growth, blue water dye, and rainfall. Overall, the transparency of the lake increased slightly over the testing history but showed some fluctuation, due to the addition of blue water dye as part of the lake management strategy.



The pH decreased over the testing history, but it stayed in the target range of 7 to 9. We will monitor this parameter for any further decrease and investigate if the pH drops below 7.

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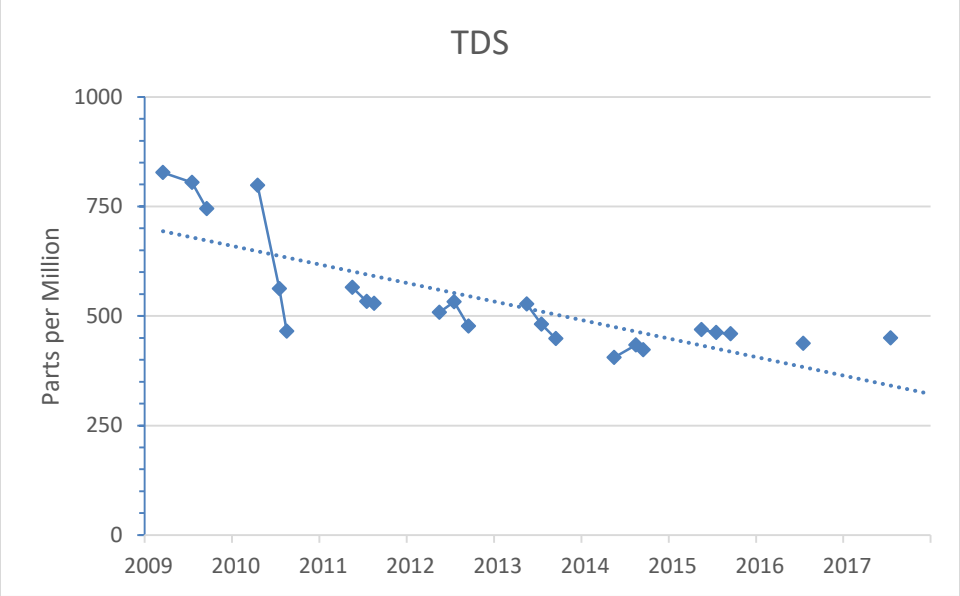
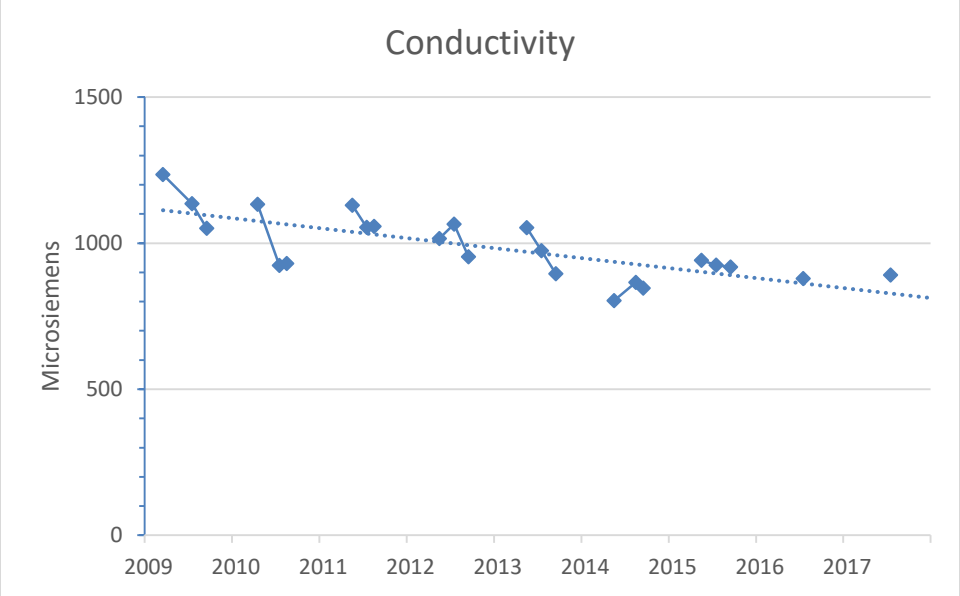


The Total Dissolved Solids fluctuated, but decreased overall since testing began. This was a positive trend for the lake and showed that excess molecules were flushed from the lake and are being prevented from reaching the lake. The trend is starting to flatten, showing the lake is reaching a stable level of dissolved solids.



Like the TDS, conductivity showed a decrease over the years of testing, with no major changes in the past four years.

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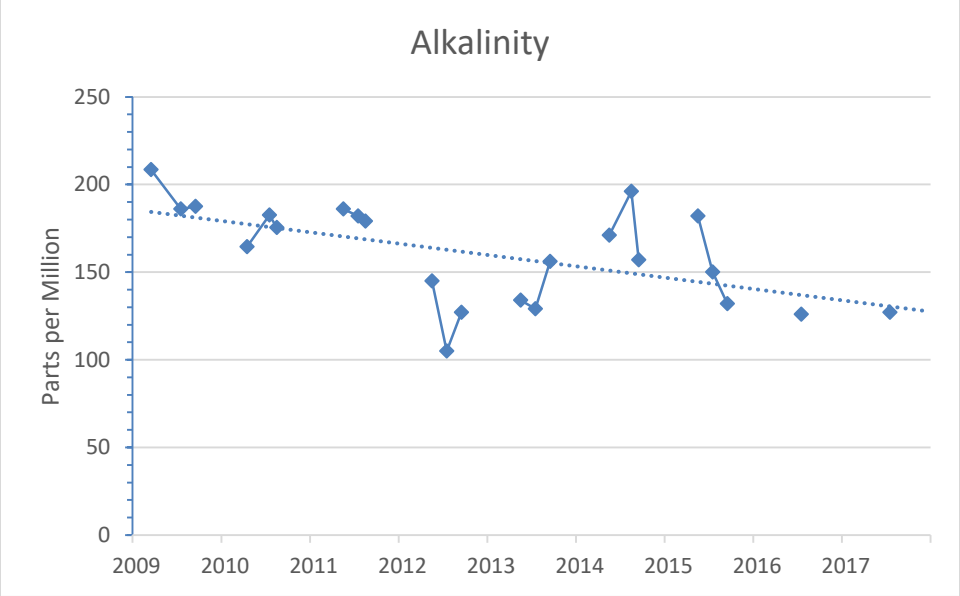
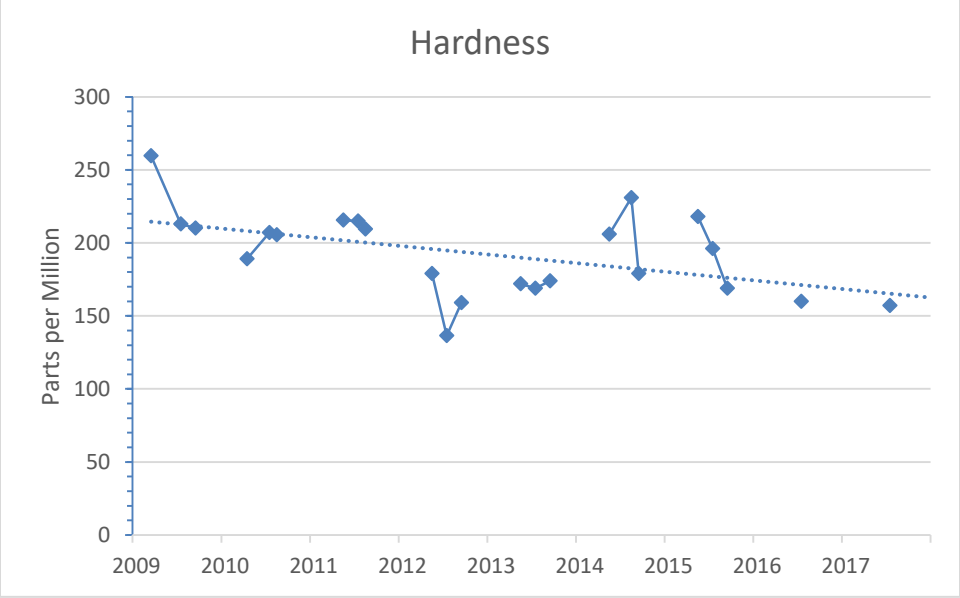


The alkalinity decreased slightly over the testing history, but remained near the middle of the target range. Alkalinity works as a buffer to stabilize the pH when foreign substances enter the lake, such as acidic rainwater.



While alkalinity measures the acid neutralizing capacity, mainly in the form of carbonate, hardness measures the polyvalent cations, such as calcium ions. Since one of the most commons salts in the water is Calcium Carbonate, hardness generally followed alkalinity.

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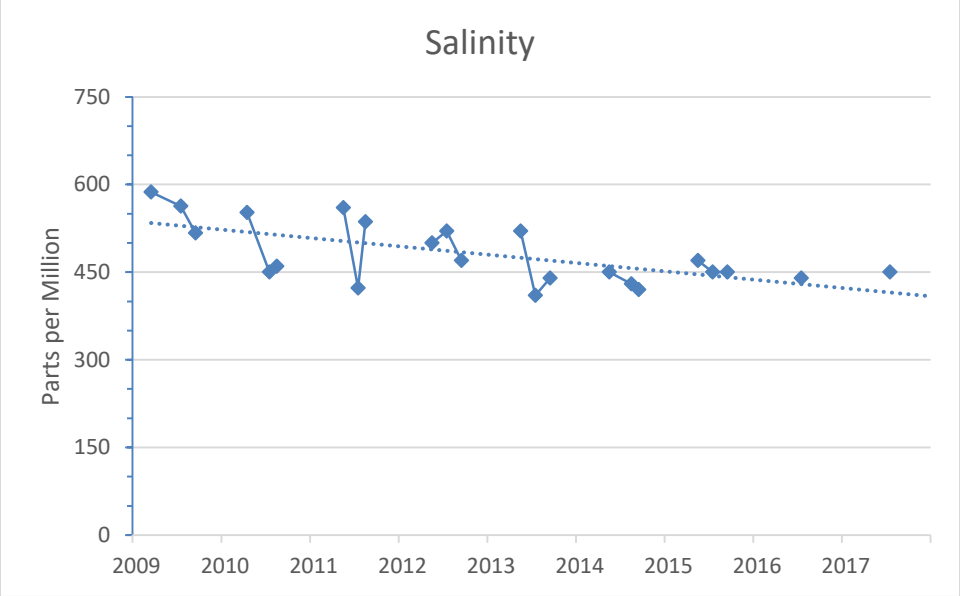
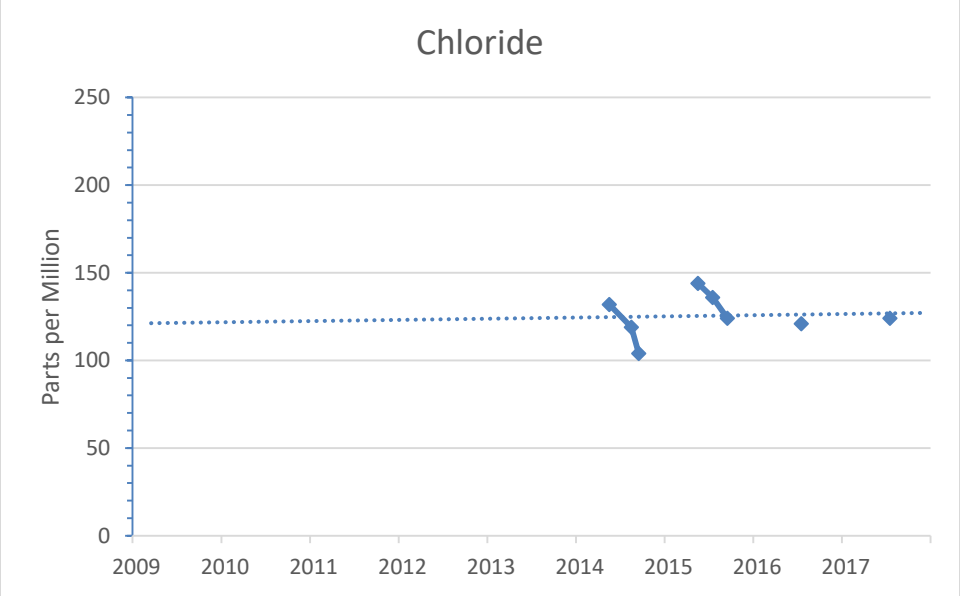


The salinity decreased since testing began, following the conductivity.



Chloride is the anion component of many different salts, the most common of which is Sodium Chloride. Some chloride will be present in ground and surface water, but elevated levels are indicators of pollution. One source of Chloride loading is road salt, which enters the lake in the spring as the snow and ice melts off the roads and drainage ditches. For that reason, Chloride is usually highest in the spring and decreases throughout the summer as it is flushed from the lake. Chloride increased slightly over the four years of testing, but remained within the target range.

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Summary & Conclusion

The water quality of Sandshores Lake was very good this summer. The only parameters not in the target range were temperature and transparency. The temperature was of little consequence, because the dissolved oxygen remained healthy. The transparency was not indicative the natural clarity, because LakePro adds blue water dye to shade the water.

The graphs and included trend lines above show that the overall water quality of the lake improved since testing began. The temperature has trended upward creating concerns about oxygen solubility. The temperature cannot be manipulated and, despite the increase, the dissolved oxygen actually increased over the same time.

The phosphorus, phosphate, and nitrate all showed long-term decreases, which was great for the lake. Corresponding to lower nutrients, the chlorophyll concentrations also decreased over the testing history. This allowed the transparency to increase over the course of our testing.

Finally, the water chemistry parameters were all within their target ranges. All the parameters showed long term decreases over the testing history, except for chloride. The Chloride showed a slight increase in the four years of testing, but remained within the target range.

Despite a highly developed watershed, Sandshores Lake is a valuable water resource with great water quality. There will always be areas that the quality of the water could improve, but Sandshores remains among the best that we test. Emerald Lakes Village should take pride in this lake and continue your hard work in improving it.

Completed and Certified by: _____ Date: January 8th, 2018

Peter Filpansick, B.S.
Aquatic Biologist