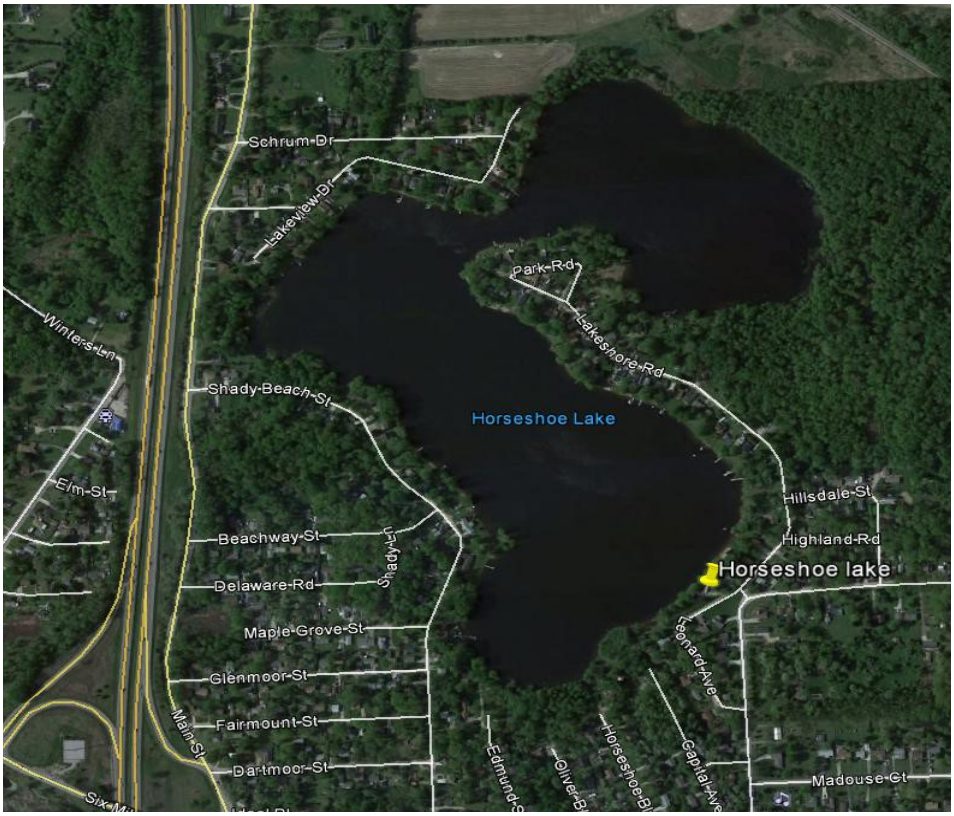
Horseshoe Lake Report



Summer 2018

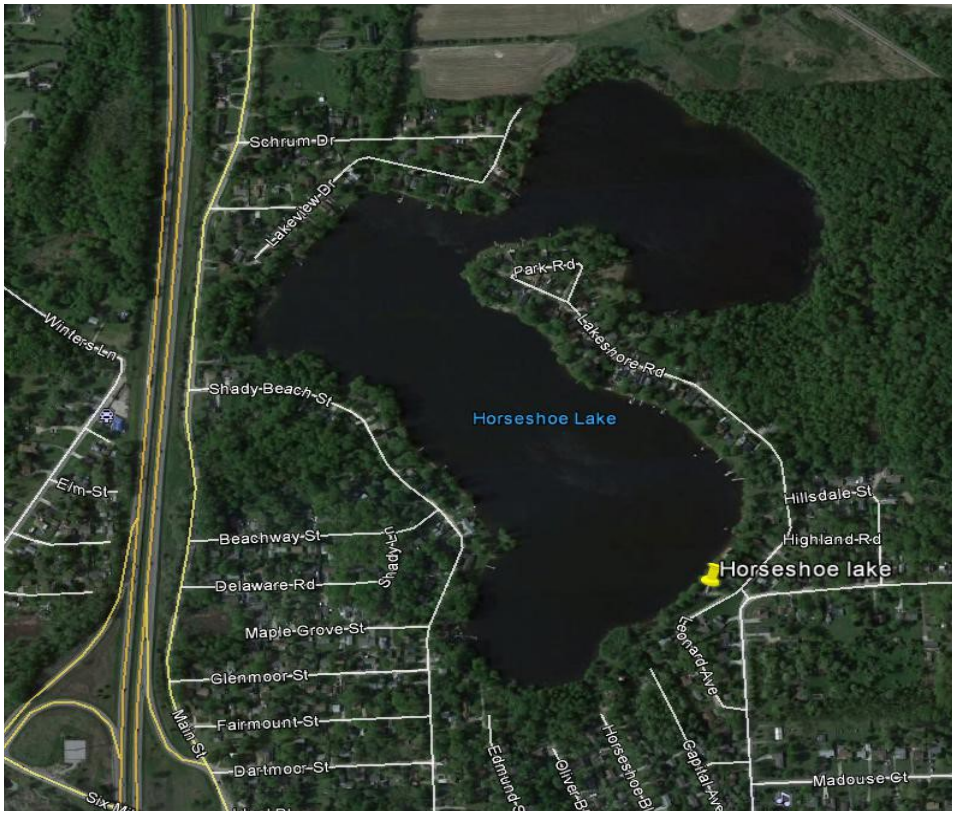
Produced by: Aqua weed Control

414 Hadley St. Holly MI 48442

www.aquaweed.com

Background Information

Horseshoe Lake



- Size: 91 S/A
- Max Depth: 29.4 ft
- Primary Uses: A developed lake with homes around 80% of the waterbody. The lake supports water activities such as boating and fishing.

Site map for Horseshoe Lake

Site Selection: The sites were selected to create a representation of the whole lake by sampling across the whole waterbody. The Spring samples were collected on May 3rd, 2018 and the Fall samples were collected on September 11th, 2018

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	Site 1	Site 2	Site 3
Phosphorous results **Target Range:** **0-100 ppb**	Spring: <0.6 ppb Fall: 755 ppb	Spring: 0.37 ppb Fall: 426 ppb	Spring:0.09 ppb Fall: 530 ppb
Nitrogen Results **Target Range:** **0-50 ppm**	Spring: <.05 ppm Fall: <.05 ppm	Spring:<.05 ppm Fall:<.05 ppm	Spring:<.05 ppm Fall: <.05 ppm

Total Phosphorus: Phosphorus is an essential nutrient for plant growth. However, concentrations exceeding 100 ppb can impair the water and result in nuisance vegetation growth. In water, phosphorus is present in three forms. Total phosphorous tests for all three forms, including inorganic, bio-available and organic, bound molecules. The Environmental Protection Agency recommends that the amount of phosphate does not exceed 0.25 mg/L in lakes and reservoirs. The EPA also states that surface waters that are maintained at .01 to .03 mg/l of total phosphorus tend to remain uncontaminated by algal blooms

Nitrogen / Nitrate: Nitrogen is the nutrient applied in the largest quantities for lawn and garden care and crop production. In addition to fertilizer, nitrogen occurs naturally in the soil in organic forms from decaying plant and animal residues. In the soil, bacteria convert various forms of nitrogen to nitrate, a nitrogen/oxygen ion (NO_3-). This is desirable as the majority of the nitrogen used by plants is absorbed in the nitrate. The amount of nitrogen/ nitrate in a healthy waterbody is around 3 mg/L. Anything less than 50 mg/L is considered acceptable. When the amount of nitrogen/ nitrate increases above 50 mg/L is when problems can start to occur. Plants and algae growing in lakes remove nitrates from the water column by taking them in and using them to grow. Also, bacterial denitrification readily occurs in the summer months, this where nitrates are converted to nitrogen gas by bacteria.

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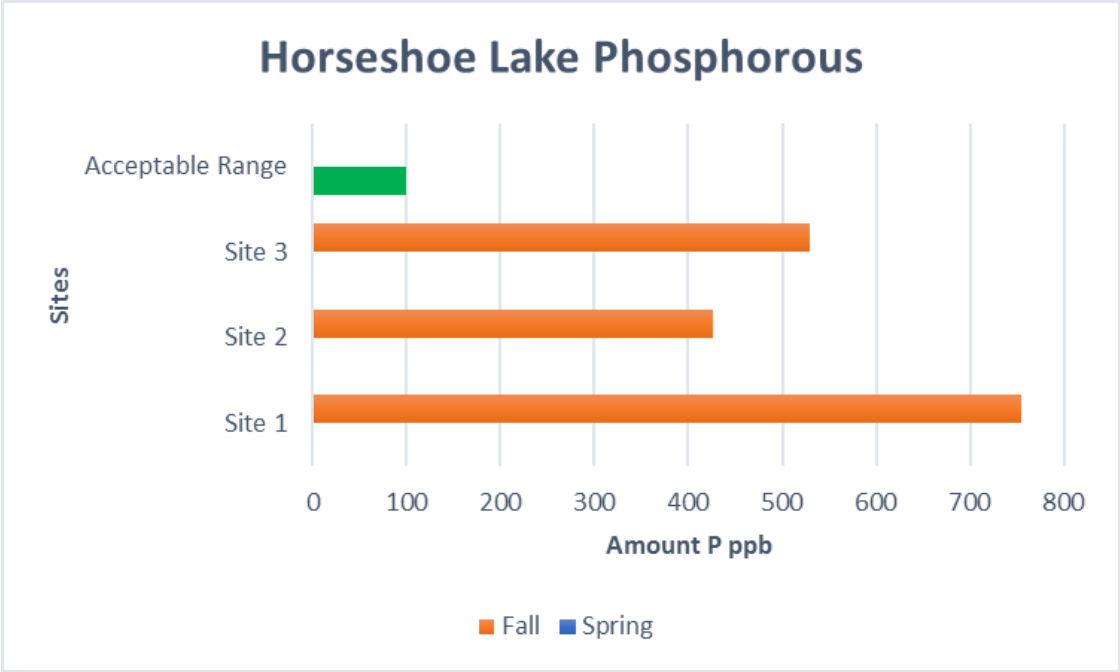

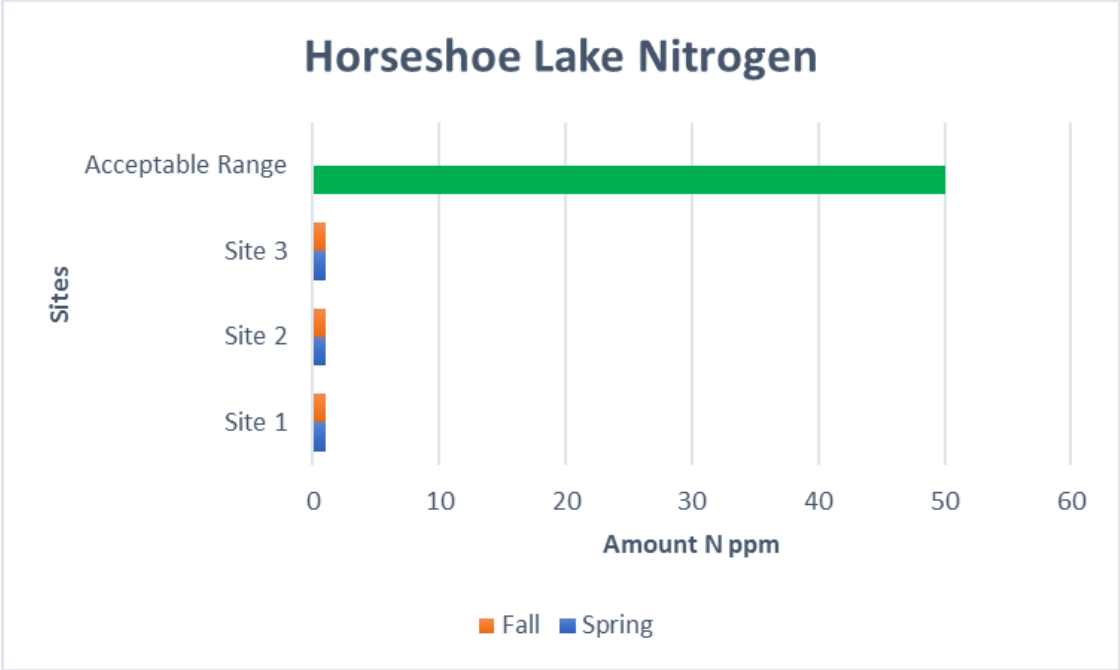

	Site 1	Site 2	Site 3
Chlorophyll α results **Target Range:** **1-140 mg/m^3**	Spring: 1.5 mg/m^3 Fall: 8.52 mg/m^3	Spring: 0.449 mg/m^3 Fall: 4.10 mg/m^3	Spring: 0.961 mg/m^3 Fall: 4.17 mg/m^3
Total Dissolved Solids Results **Target Range:** **0-1,000 ppm**	Spring: 418.5 ppm Fall: 403.9 ppm	Spring: 397.4 ppm Fall: 404.5 ppm	Spring: 384.9 ppm Fall: 402.6 ppm

Chlorophyll α: Is the pigment in the plants that makes it green, but more importantly allows the plant to photosynthesize. Chlorophyll α is tested to create a measurement of projected biomass and photosynthesis rate of algae and plants within the waterbody. This measurement translates to a trophic state of the lake, or how active the lake is to produce algae and plants. There are four trophic states: Oligotrophic (< 3 ppb, very inactive), Mesotrophic (3.1-15 ppb, moderately active), Eutrophic (15.1-60 ppb, very active) and Hyper Eutrophic (> 60.1 ppb, extremely active). Many lakes and ponds in urbanized areas are Eutrophic to Hyper Eutrophic, meaning there is continuous production of algae and plants due to constant to excessive nutrient loading. A pond or lake that is Mesotrophic is generally desired and considered healthy.

Total Dissolved Solids: The measurement of the combined content of all inorganic and organic substances contained in a waterbody. The principal constituents are usually the cations calcium, magnesium, sodium and potassium and the anions carbonate, bicarbonate, chloride, sulfate and, particularly in groundwater, nitrate Pure water will contain no dissolved solids. Storm water run-off is the primary source of dissolved solids. Drinking water must have reading below 500 ppm. Reading of up to 1,000 ppm are generally considered safe for plants and other aquatic organ-isms.

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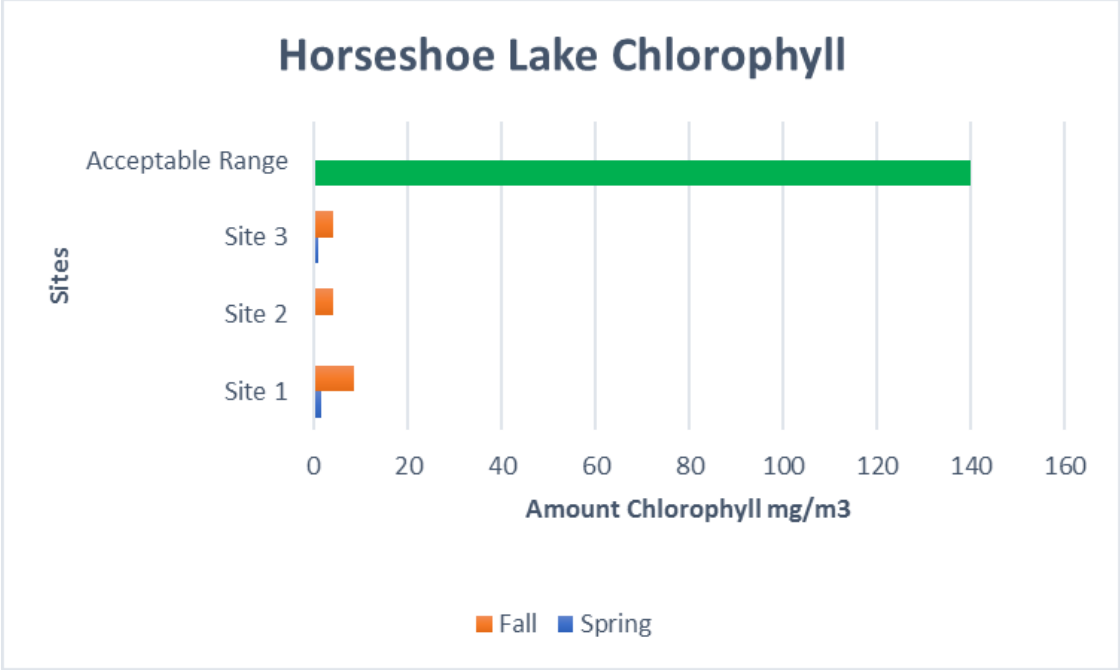
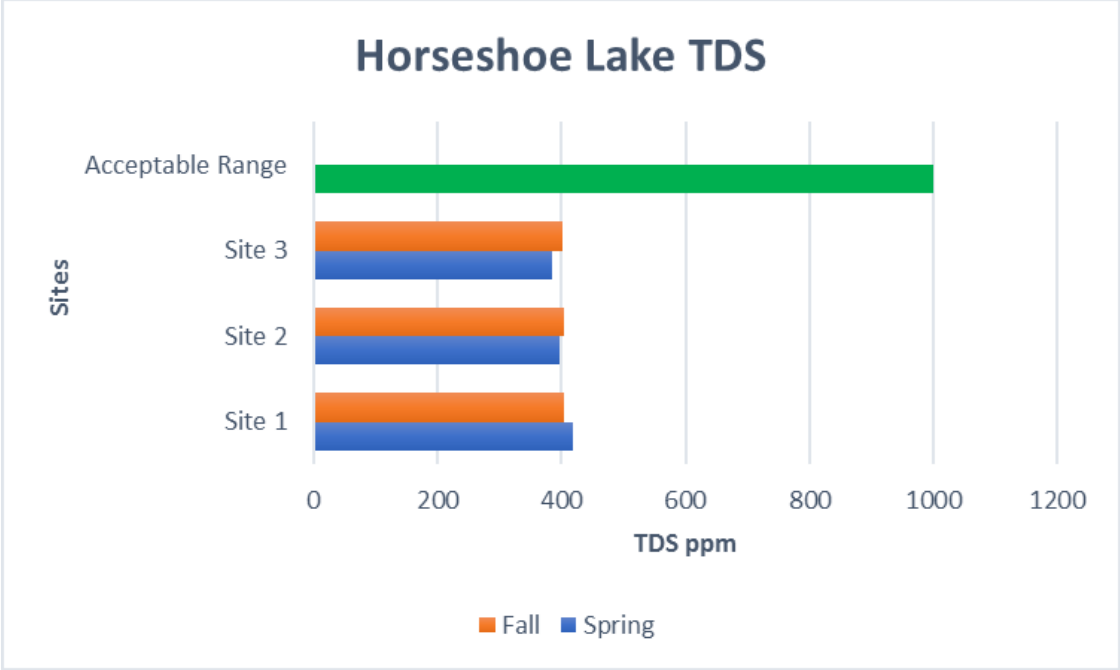


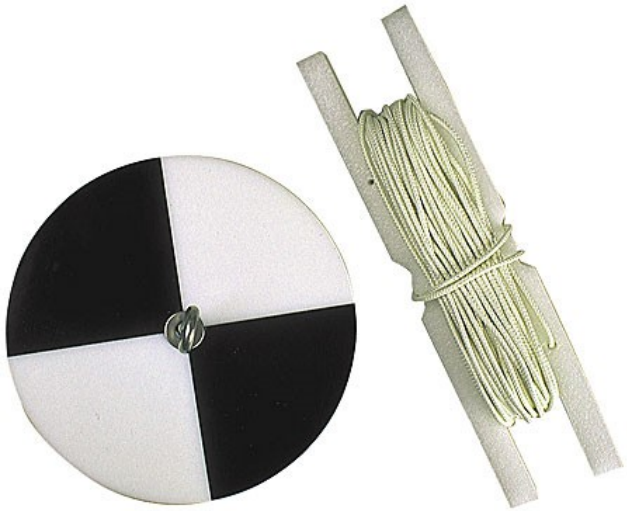


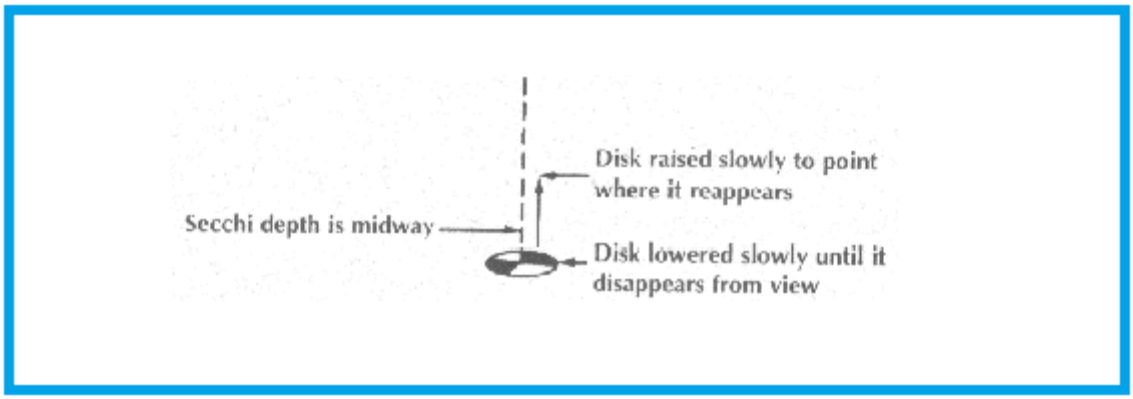
Secchi Disk

Is a simple tool that is used to determine the water clarity. This is accomplished by lowering the Secchi disk into the water until it disappears from sight and then is raised back until it reappears and the distance is averaged to determine the amount of water that can be seen through. This creates an absolute determination of the water clarity.

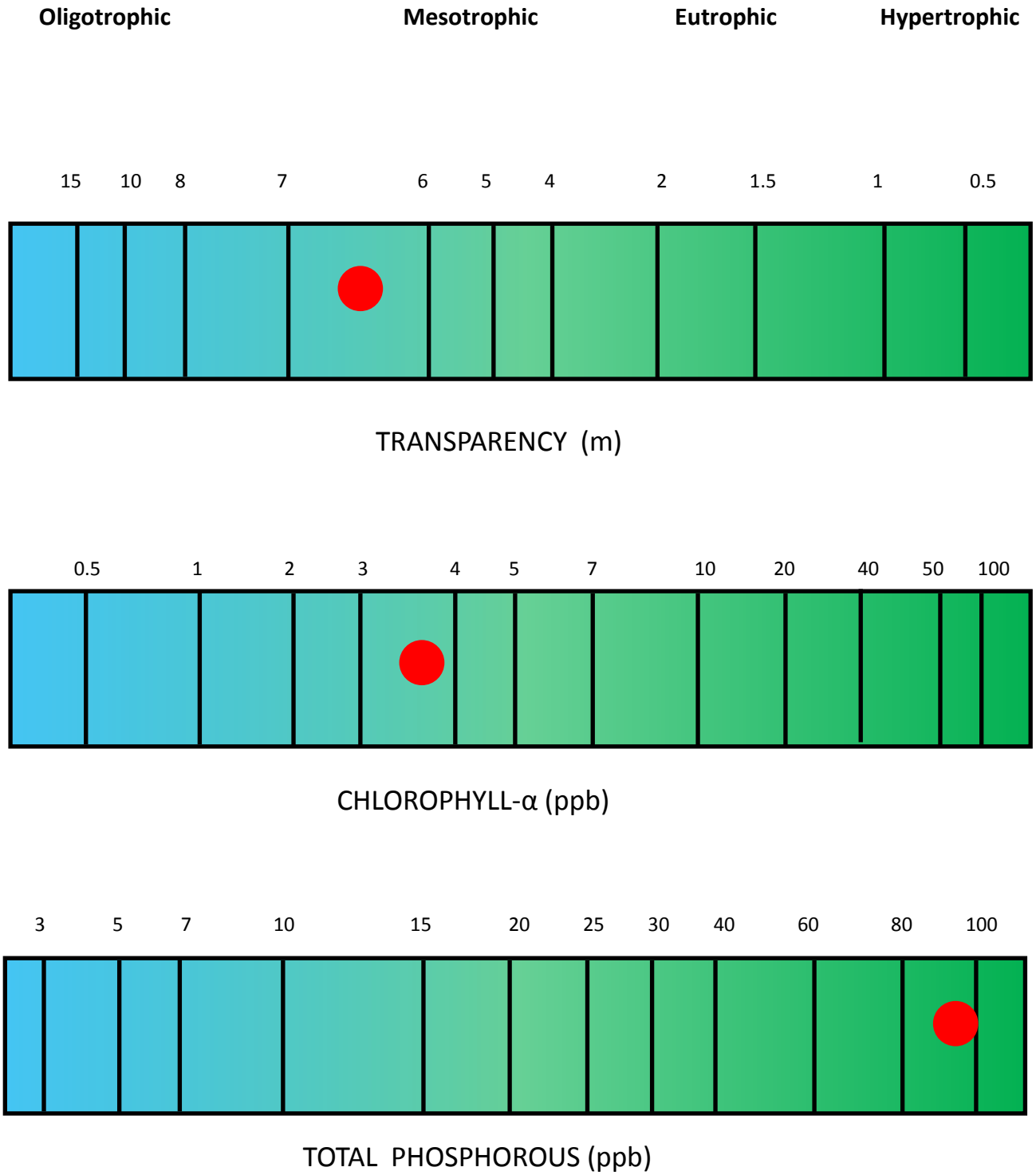
This measurement is important because it gives a tangible number on the water clearness of the lake. Having multiple readings from year to year is beneficial in looking at how the lake is adjusting year to year. The turbidity of the water is influenced by many factors the more common ones are: run off from residents yards, lots of boat traffic or a high turnover rate, and the amount of free floating particulates in the water.

Secchi Disk Date	Reading in Feet
5/13/18	6 Feet 11 Inches
9/11/18	6 Feet 1 Inch





Eutrophic State



Eutrophic State

When looking at a waterbody, the physical appearance can be useful in the indication of the overall health of the lake or pond. The clarity of water along with any growth of algae can point to the tropic level of the water body, the tropic level being the total weight of the biomass in the waterbody. Biomass is generally described as algae, but aquatic weeds can also be a part of this. Water bodies have various amounts of growth, which depend on the available nutrients within the water. The main nutrients that contribute to increase growth is phosphorus and nitrogen, abundant amounts of these nutrients lead to more growth in the water. Phosphorus and nitrogen are naturally occurring in all waterbodies, but humans can increase the amount of available nutrients in the water through a process called cultural eutrophication. This process occurs through activity in the water, increased erosion of ground debris into the water, and physical alteration of the water's edge. As the process occurs it raises the waterbodies tropic level.

There are three common tropic levels that most of Michigan waterbodies fall into: oligotrophic, mesotrophic, and eutrophic. These levels are determined by the amount of chlorophyll α in the water, the amount of total phosphorous and the Secchi Disk reading. The various levels indicate the amount of plant activity in the water; oligotrophic is little activity, mesotrophic is moderate activity, and eutrophic is a lot of activity. The amount of activity is related back to the amount of available nutrients in the water. This is why some waterbodies experience more growth than other waterbodies, even if they are in the same area. The waterbodies tropic level is derived from the baseline nutrient level and the amount of nutrients that enter the waterbody.

Based on the data collected this season it appears that Horseshoe lake falls into the mesotrophic state. The amount phosphorous was high in the fall, but there was reasons to explain that unusual high numbers

Temperature and Dissolved Oxygen

The temperature and dissolved oxygen profile of the lake were also taken. These reading were taken over the deepest spot on the lake. The data shows a steep drop in the 12 to 15 feet range indicating the likely position of the thermocline. During the summer, warm water, which is less dense, will sit on top of colder, denser deeper water, with a thermocline separating them. The warm layer is called the epilimnion and the cold layer is called the hypolimnion. Since warm water is exposed to the sun during the day, a stable system exists, and very little mixing of warm water and cold water occurs, particularly in calm weather. One result of this stability is that as the summer wears on, there is less and less oxygen below the thermocline, as the water below the thermocline never circulates to the surface, and organisms in the water deplete the available oxygen. As winter approaches, the temperature of the surface water will drop as nighttime cooling dominates heat transfer. A point is reached where the density of the cooling surface water becomes greater than the density of the deep water, and overturning begins as the dense surface water moves down under the influence of gravity, this process is called turnover.

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