Water Analysis of Walton Lake and Earl Reservoir, NY

Monroe-Woodbury High School
AP Environmental Science Class
2018-19

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Acknowledgement

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Abstract

The Monroe-Woodbury AP Environmental Science Class continued working with the **Moodna Creek Watershed Intermunicipal Council** to research and determine water quality in and around Walton Lake and Earl Reservoir on April 11, 2019. The following tests were performed: soil fertility, dissolved oxygen, salinity, nitrate concentration, turbidity, phosphate concentration and total coliform test. All tests were within the normal range for both locations. The results for Walton Lake from 2019 were also compared to the results for Walton Lake from 2018.

Introduction

Walton Lake (WL) is located in Monroe, New York and is part of the **Moodna Creek Watershed**. It covers 117 acres and is 2.4 miles long, with a maximum depth of 68 feet and an average depth of 22 feet. Its elevation is 705 feet or 215 meters above sea level. The lake has residential neighborhoods and roads surrounding it, providing private access and a public launch site for electric motorized and non-trailered boats. Walton Lake is used for diving, swimming and fishing.

Earl Reservoir (ER) is located in Highland Mills New York and is part of the Moodna Creek Watershed. It is approximately 14 acres and is surrounded by residential neighborhoods. It is a private recreational park for the surrounding communities used for fishing, swimming, paddle boating, and has a sandy beach. It is also has tennis courts, basketball courts, fields and picnic areas.

On April 11, 2019 both locations were visited and water quality tests were conducted. Earl Reservoir was the first. Testing began around 8:30 am. It was cloudy and 42ºF. Walton Lake was second. Testing began at approximately 11:30am. It was sunny and 46ºF.

This year results of Walton Lake was then compared to the 2018 results of Walton Lake. The 2018 water testing on Walton Lake was at two locations. The April 18,2018 testing location was the DEC Walton Lake Fishing Access Site (DEC) and the May 21,2018 testing location was at 88 Osseo Park Road on Andrew Lawrence private dock (DOCK).

Section 1: Soil Analysis

The information was gathered through the Rapitest Digital 3-way analyzer to test the pH, temperature, and fertility of the soil. A soil's fertility is determined by the availability of nitrogen phosphorus and potassium along with other micronutrients to support plant growth such as boron, copper, iron, magnesium and sulfur. This meter looks at the combination of nitrogen, phosphorus and potassium. The ideal fertility rating should be between 3 - 7.

Figure 1a: *Soil Fertility and pH (ER 2019)*

Location	**Fertility**	**pH**	**Temperature** °C
Lake side	3	7	1
65 Feet Away	1	6.8	1.7
130 Feet Away	1	6.8	1.1

Figure 1b: *Soil Fertility and pH (WL 2019)*

Location	**Fertility**	**pH**	**Temperature** °C
Lake side	4	7	6.1
27 feet away from the lake	3	7	4.4
54 feet away from the lake	4	7	6.1

Earl Reservoir had a decrease in fertility further away from the lake's edge. Walton Lake had a higher fertility rate than Earl Reservoir. This could be due to the amount of sand at Earl Reservoir. The soil pH was within a normal range for both locations.

Figure 1c: *Soil Analysis (WL - DEC - 2018)*

Soil Tests	**Results**
pH	7.19
Temperature	1.4°C
Fertility	3.2

Figure 1d: *Soil Analysis (WL - DOCK - 2018)*

Soil Tests	Reading	
pH	*On Shore: 7.6	*Offshore: 6.7
Temperature	On Shore: 13.3	Offshore: 18.8
Fertility	On Shore: 0	Offshore: 1

There was not any significant change in fertility when comparing the 2018 and 2019 fertility reading at the DEC Lake Fishing Access Site.

Section 2: Water Analysis

Introduction: In this section, pH, temperature, and TDS of water was recorded in order to establish if the lake is a healthy ecosystem for surrounding organisms. The Hanna waterproof pH tester was utilized to conduct the readings by being placed in a cup of lake water. Acceptable levels in drinking water of TDS is less than 500 ppm. Salinity was also tested in 2019 in both locations.

Figure 2a: *Total Dissolved Solids, pH, and Salinity (2019)*

Location	TDS (Total Dissolved Solids)	pH	Salinity
Earl Reservoir	Dock 1: 81ppm Center Beach:79ppm Dock 2: 72ppm	Dock 1: 8.1 Center Beach: 8.3 Dock 2: 7.7	Dock 1: 0 Center Beach: 0 Dock 2: 0
Walton Lake	Site 1: 299ppm Site 2: 287ppm Raw: 285ppm	Site 1: 8.4 Site 2: 8.12 Raw: 7.8	Site 1: 0 Site 2: 0 Raw: 0

Both locations had TDS levels below 500 ppm and zero as a salinity reading.

Figure 2b: *Total Dissolved Solids and pH (WL - DEC - 2018*)

Water Tests	Reading
TDS	494 ppm
pH	7.29
Temperature	4.7℃

Figure 2c: *Total Dissolved Solids and pH (WL - Dock - 2018)*

Water Tests	Reading
TDS	627 ppm
pH	8.45
Temperature	19°C

The TDS level was better in 2019 than in 2018. This is most likely due to the difference in weather patterns. In 2018 the were storms prior to the days of testing for TDS.

Section 3: Dissolved Oxygen

Introduction: In this section, dissolved oxygen (DO) was measured. An azide modification of the Winkler method was used in order to do so. Dissolved oxygen is an important factor to water quality and aquatic life survival. If there is a lack of oxygen, aquatic life will be negatively affected. A concentration between 5-6 ppm of dissolved oxygen is considered to be sufficient for most species. A sample of water was taken and reagents were used to create a fixed sample. The solution was titrated to determine the concentration of dissolved oxygen in parts per million. The first sample was taken at the western corner of Walton Lake, a thermometer was used to calculate the temperature, and the altitude was 705 feet. The second sample was taken at Earl Reservoir, a thermometer was used to calculate the temperature, and the approximate altitude of the park is 843 feet.

Figure 3a: *Percent Saturation of Dissolved Oxygen (WL 2019)*

Water Temperature (℃)	4.4℃
% Saturation	65%
Oxygen (ppm)	9 ppm

The amount of dissolved oxygen was 9 ppm. From that, saturation was determined to be 65%. Because of this, it was concluded that the lake's dissolved oxygen levels are in a healthy range, considering the temperature and altitude.

Figure 3b: *Percent Saturation of Dissolved Oxygen (ER 2019*)

Water Temperature (℃)	3.3℃
% Saturation	50%
Oxygen (ppm)	7 ppm

The amount of dissolved oxygen was 7 ppm. From that, saturation was determined to be 50%. Because of this, it was concluded that the lake's dissolved oxygen levels are in a healthy range.

Figure 3c: *Percent Saturation of Dissolved Oxygen (WL - DEC - 2018)*

Water Temperature (℃)	6.6℃
% Saturation	40%
Oxygen (ppm)	5 ppm

The amount of dissolved oxygen was 5 ppm. From that, saturation was determined to be 40%. Because of this, it was concluded that the lake's dissolved oxygen levels are in a healthy range considering the temperature and altitude.

Figure 3d: *Percent Saturation of Dissolved Oxygen (WL - DOCK - 2018)*

Water Temperature (℃)	19℃
% Saturation	45%
Oxygen (ppm)	6 ppm

The amount of dissolved oxygen was 6 ppm. From that, saturation was determined to be 45%. Because of this, it was concluded that the lake's dissolved oxygen levels are in a healthy range considering the temperature and altitude.

The water at Walton Lake, this year, proved to have a higher Dissolved Oxygen content. Last year it was concluded that the water has a Dissolved Oxygen content of 5 ppm, and this year a content of 9 ppm. This data shows that there is a good quality of life for the aquatic animals. The Dissolved Oxygen content of the water at Earl Reservoir was found to be 7 ppm. This is slightly less than the Dissolved Oxygen content in Walton Lake, however still a healthy level. Due to influence factors such as water temperature and saturation, 7 ppm was concluded to be reasonable.

Section 4: Nitrates

Introduction: A Nitrate-Nitrogen Low Range Comparator Bar, Mixed Acid Reagent, and Nitrate Reducing Reagent was used to measure the low and high range concentration of Nitrate-Nitrogen in the water by sliding the Nitrogen-Nitrate Low Range Comparator into the Range Comparator Viewer and placing a test tube containing 10 mL of the sample water into the Low Range Comparator, and then a second tube with 5 mL of the sample water plus a Mixed Acid Reagent and 0.1 g of Nitrate Reducing Reagent, and comparing the sample water to a color standard.

Figure 4a: *Nitrate Analysis (ER 2019*)

Nitrate Tests (Low Range)	Reading
Off the Concrete Circle	0.0 ppm
Off the Dock	0.0 ppm

Figure 4b: *Nitrate Analysis (WL 2019)*

Nitrate Tests (Low Range)	Reading
Lake Water	0.0 ppm
Chester Water Plant Pre-Treated Water	0.0 ppm

The results of no nitrogen in both locations does not seem to be accurate. There could have been a malfunction with the equipment.

Figure 4c: *Nitrate Analysis (WL - DEC - 2018)*

Nitrate Tests	Reading
Low Range (0-1.0 ppm nitrate nitrogen)	0.0 - 0.2 ppm nitrate
High Range (0-10.0 ppm nitrate nitrogen)	0.0 - 0.2 ppm nitrate

Both high and low range samples were 0.2 ppm nitrate and we observed that both samples turned slightly purple. According to the test kit, they fall within an acceptable range.

Figure 4d: *Nitrate Analysis (WL - DOCK - 2018)*

Nitrate Tests	Reading
Low Range (0-1.0 ppm nitrate nitrogen)	0.0 - 0.2 ppm nitrate
High Range (0-10.0 ppm nitrate nitrogen)	0.0 - 0.2 ppm nitrate

The nitrate levels remained in the 0.0 - 0.2 ppm range. The lake still had an acceptable nitrate level.

Section 5: Turbidity

Introduction: The cloudiness or haziness of a fluid, caused by large numbers of individual particles. It is an important test for water quality. The test is important in finding particles unseen to the naked eye. The optimum turbidity for a lake is less than 20 JTU. Earl Reservoir and Walton Lake turbidity levels were tested. Water was first collected in a container separate from the turbidity tube. The water was then poured into the turbidity tube. The turbidity tube was then placed on top of a testing sheet, each of which has five circles on it, each split into four equal sections colored black and white. The black sections of each circle are shaded with different intensities. As each circles' black intensity is lowered the JTU (Jackson Turbidity Unit) increases by 20. The turbidity tube was then placed on the central circle set at 0 JTU. The shade of the circle under the test tube was then compared to the five circles on the sheet, whichever shaded circle the test tube's circle corresponds to wa the turbidity measure of the water. Three tests were performed at each location.

Figure 5a: *Turbidity (2019)*

Location	Test 1	Test 2	Test 3
Earl Reservoir	0 JTU	0 JTU	0 JTU
Walton Lake	0 JTU	0 JTU	0 JTU

The turbidity level was measured to be zero. Very clear water with little disturbance.

Figure 5b: *Turbidity (2018)*

Location	Result
Walton Lake - DEC	20 JTU
Walton Lake - DOCK	0 JTU

There was not a significant difference in Walton Lake from 2018 to 2019. The one reading of 20 JTU was most likely due to storms the day before increasing the sediments in the water. The roads that run along the lake create a source of runoff because the material they are made of is impermeable.

Section 6: Phosphate

Introduction: Both phosphorus and nitrogen are essential nutrients for the survival of both plant and animal life existing within an aquatic ecosystem. Due to the sensitivity of ecosystems to phosphorous, even a small change in levels can cause a multitude of issues including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals. Sources of phosphorus can be both naturally occurring and man made. These include soil and rocks, wastewater treatment plants, runoff from fertilized land, failed septic systems, runoff from manure storage facilities, disturbed land areas, water treatment, and chemical exposure. The tool that was used to test the phosphate was the LaMotte Low Range Phosphate Kit which included the Low Range Comparator which allows extremely faint color to be matched to color standards by viewing the reaction occuring. Phosphorus level of .01 ppm or higher can trigger algal blooms.

Figure 6a: *Phosphate Levels (ER 2019)*

Location	**Result**
Near Sandy Beach	0.0 ppm
Near Dock	0.1 ppm

Environmental observations during this test included overcast weather with no visible sun and a temperature of 37°F. The samples taken were both, on average, approximately three feet into each body of water, and read similar to each other with only a minor discrepancy despite their differing locations. This indicates a consistency throughout the reservoirs water of low phosphate levels, which is overall beneficial for the ecosystem. These readings may be due to the reservoirs isolated location, which is protected from excess agricultural runoff and other industrial pollutants.

Figure 6b: *Phosphate Levels (WL 2019)*

Location	**Result**
Near Boat Access Point	0.4 ppm
Near Dock	0.4 ppm

During this areas testing, observations were made that differed from the previous testing location. For example, while the weather was slightly warmer at 39°F with more sun exposure, the shores of the lake were littered with garbage. This may be in part due to its exposed location alongside a major road, near populated residential areas, which could increase the amount of phosphates present, attributing to the slightly higher reading of 0.4 ppm.

Figure 6b: *Phosphate (WL - DEC - 2018*)

Testing For	**Reading**
Phosphates	0.2 PPM

Figure 6c: *Phosphate (WL - DOCK - 2018)*

Testing For	**Reading**
Phosphates	0.1 PPM

The results showed a high phosphate level.

Both 2018 and 2019 showed high phosphate levels for Walton Lake. It is possible that there are high levels due to the lakes natural cycles, or residential runoffs. It is also possible, according to the EPA, the testing kit used was subjective due to matching colors and can lead to variable results especially in low phosphorus areas. The containers that are to be reused should also be acid washed to remove the absorbed phosphorus. If they are not, there could be inaccurate results.

Section 7: Total Coliform Test

Introduction: Coliform bacteria is found in fecal matter and can indicate sewage or fecal contamination in the water. The water at Walton Lake and Earl Reservoir was sampled using the LaMott Coliform Tablet (4890). This is just a positive or negative test result. In 2019 three tests were used at the Earl Reservoir, and two at Walton Lake. At Earl Reservoir two were performed at the beach, and one was performed at the dock.

Figure 7a: *Coliform Tablet Test (2019)*

Location	**Result**
Earl Reservoir	+
Walton lake	+

This is an expected results due to waterfowl present at the locations.

Figure 7b: *Coliform Tablet Test (2018)*

Location	**Result**
WL - DEC	+
WL - DOCK	+

There were a total of 7 test conducted at Walton Lake and all results were positive. This was expected due to waterfowl.

To determine if Coliform is beyond waterfowl, extensive testing would need to be conducted.

Section 8: Other Observations

Earl Reservoir: 2019

- Geese
- Dragonfly nymph
- Fish
- Mosquitoes
- Bald Eagle
- Salamander - red eft newt, adult aquatic stage

Walton Lake: 2019

- Crayfish
- Fish
- Snails

Walton Lake: (2018)

- Dragonfly nymphs
- Snails

Conclusion

Based on the preliminary findings Walton Lake appears to be a healthy lake for drinking and will maintain a stable ecosystem. Earl Reservoir is a healthy lake and will maintain a stable ecosystem and recreation activities. The pH, TDS, salinity, dissolved oxygen, nitrate levels, and coliform test was within a normal range. The turbidity was at the top end of optimal turbidity range. The phosphate level was high in Walton Lake in 2018 and 2019. It is something that should be looked into further.

Further Research

This research was the result of one day of testing in two different location. Although the findings supports healthy lake environments research should continue. The lakes could be tested at various times of year. More tests can be added in such as: alkalinity, total hardness and carbon dioxide levels. This would allow for a larger database to draw more accurate conclusions. Although it can be challenging to bring students to other safe access points in the Moodna Creek Watershed it would be wonderful if other locations can be added in so the students can create a map of the Watershed based on their testing. The AP Environmental Class hopes to continue with the research at Walton Lake and Earl Reservoir and expand this research to other locations in the Moodna Creek Watershed.

Sources Cited

http://www.cropnutrition.com/efu-soil-ph

https://www.fondriest.com/environmental-measurements/parameters/water-quality/turbidity-total-suspended-solids-water-clarity/

http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/soils/what-is-a-healthy-soil

https://www.accuweather.com/en/us/monroe-ny/10950/may-weather/339703

https://www.doh.wa.gov/Portals/1/Documents/Pubs/331-181.pdf

https://theberkey.com/.../what-is-the-acceptable-total-dissolved-solids-tds-level-in-drin...

https://archive.epa.gov/water/archive/web/html/vms56.html