# Examining Alkalinity of Water and Soil

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## Background

Farm lands and agricultural practices have a vital role in mitigating the harmful effects of Climate Change. The presence of organic content in soil effects soil structure, water quality and the nutrients in both media. Pasture management includes maintaining the soil nutrients to enable healthy plant growth, Pastures with an average pH of 6.6 is ideal for nutrient utilization to promote pasture growth and production (Mickel, 1994).

## Purpose of Study

The purpose of this study was to gain a better understanding about the relationship between alkalinity, soil quality and aquatic life.

## Variables

- Soil samples from three paddocks were chosen.
- Paddock 5 - closest to pond
- Paddock 6 - middle
- Paddock 8 - farthest from the pond west of P6

Two samples from each paddock were taken, and mixed together. Next the soil was filtered to remove organic matter, stones such that a fine soil mix remained. 50 ml of the soil was mixed with 250 ml of distilled water. The solution was stirred for 5 minutes. The soil solution was stored for 1 hour.

## Measures

### Rapitest Soil test

- The test uses a patented 4 chamber device called color comparators - one each for pH, Nitrogen, Phosphorus and Potash. The test involves comparing the color of the water tested to a color chart.
- **pH scale** - 7.5 Alkaline; 7.0 - neutral; 6.5 - slight acidic; 6.0 - acidic; 5.5 - acidic; 5.0 - very acidic; pH - very acid.
- **N Test -** N4- surplus; N3 - sufficient; N2- adequate; N1 - Deficient; No - Depleted.
- **P Test -** P4 - surplus; P3 - sufficient; P2 - adequate; P1 - deficient; P0 - depleted
- **K Test -** K4 - surplus; K3 - sufficient; K2 - adequate; K1 - deficient; K0 -depleted

**Water Quality test:** Water test strips that tested 16 items - Total alkalinity, pH, hardiness, Cyanuric acid, total chlorine, free chlorine, Bromine, Nitrate, Nitrite, Iron, Chromium, Lead, Copper, Mercury, Fluoride, and Carbonate root.

**Testing conditions:** Ambient temperature

**Plant Etymology**

Plants in the paddock are identified using Picture this(app).

## Experimental Method

**Materials Used:**

1. Hula hoop
2. Showel
3. Plastic bag to collect soil sample.
4. Soil samples(2 per paddock)
5. Measuring cup
6. Test strips
7. Comparator

**Phase 1 -**

1.Throw a hula-hoop in each paddock. Take a picture of the plants within the hula hoop. Next take a soil sample. Repeat in another area of the paddock.

**Prepare the soil sample for testing:**

Place soil samples into a clean container, sift the soil and remove organic matter and stones(small and large). To test pH, add soil to fill line and add distilled water to the to the water line. For Nitrogen, Potash and Phosphorus tests, add 250 ml to 50 ml of the soil, stir the mixture and let it stand for a minimum of 30 minutes.

**Testing:**

Select appropriate comparator for the test. Remove the cap, using the dropper provided fill the test and reference chambers to the fill mark with the solution from the soil sample. Remove appropriate colored capsules. Hold the capsule horizontally over the test chamber and pour the powder into the test chamber. Cap the comparator. Allow color to develop for 10 minutes. Compare the color of the solution in the test chamber to the color chart.

**Water Test:**

1. Fill the given test-tube with the water sample( soil mixture or pond water) using the given pipette.
2. Insert the 16 in 1 water testing strip into the test tube for 2 seconds and take it out.
3. Remove excess water and lay the strip horizontally for 30 seconds.
4. Using the color chart provided match the shade of the test strip to the appropriate color chart.

**Phase II**

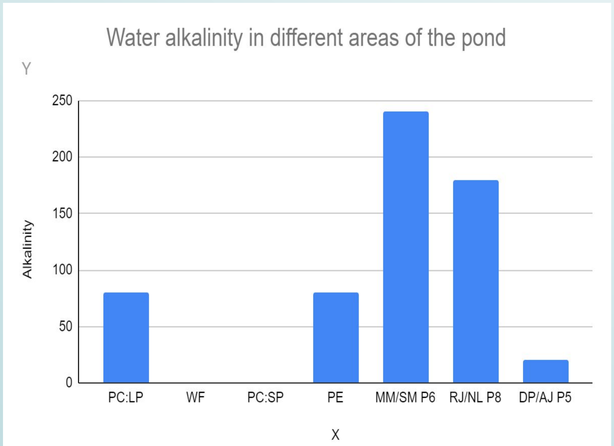
Take soil samples from the same paddocks after it rained(July 18th,22)and test for pH, Nitrogen, Phosphorus and Potassium.

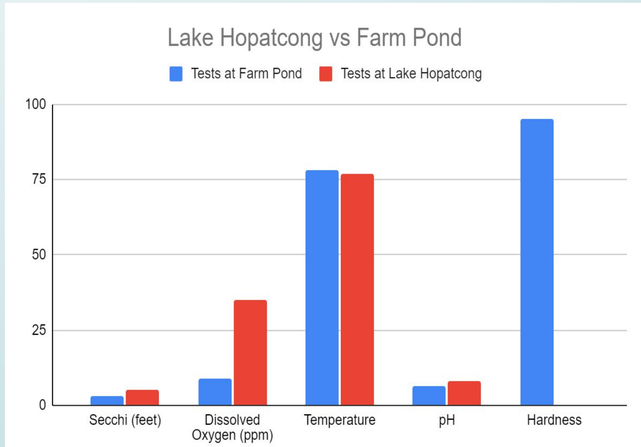
**Alkalinity Test:**

Alkalinity is the total concentration (as mg/l of CaCO3) of bases in the water, primarily bicarbonates, carbonates, and hydroxides. Adequate alkalinity is important for pond productivity and water chemistry. CaCO3 is the chemical composition for calcium carbonate and when measuring alkalinity one can just say mg/L.

## Results

In the center of the large pond, the level of alkalinity was 80 mg/L. In the waterfall, the level of alkalinity was 0 mg/L. In the center of the small pond, the level of alkalinity was 0 mg/L. On the edge of the pond, the level of alkalinity was 80 mg/L. In paddock 5, the level of alkalinity was 20 mg/L. In paddock 6, the level of alkalinity was 240 mg/L. In paddock 8, the level of alkalinity was 180 mg/L.




## Conclusion

The alkalinity levels in ponds and lakes are used to measure the health of the water body. Based on the correlation to alkalinity levels, the waterfall and the center of the small pond have an alkalinity value of 0 mg/L which is considered unhealthy. A good alkalinity level for aquatic life in spring fed ponds is 20 mg/L - 250 mg/L. Anything under 20 mg/L is not considered optimum for fish to live in. In the center of the large pond, the alkalinity level is 80 mg/L. This shows that the center of the large pond is moderately healthy. In the waterfall, the alkalinity level was 0 mg/L. This shows that the area of the waterfall is not optimum for aquatic life to live. In the center of the small pond, the alkalinity level was 0 mg/L. This also shows that the center of the small pond is not healthy for aquatic life to live. On the edge of the pond, the alkalinity level was 80 mg/L. This shows that the edge of the pond is quite healthy for aquatic life to live. In paddock 5, the alkalinity level was 20 mg/L. This shows that paddock 5 is unhealthy for plants as there is currently an alkaline deficiency. In paddock 6, the alkalinity level was 240 mg/L. This is very healthy for plants to be living here. In paddock 8, the alkalinity level was 180 mg/L. This is also very healthy for plants.

## Discussion

Based on a visual examination, the pond does not seem unhealthy. This observation makes us consider other factors besides alkalinity that affects the health of spring fed ponds. One important factor for water quality in spring fed ponds is Dissolved Oxygen (DO). Dissolved Oxygen is needed by fish and other aquatic organisms, and levels of DO will determine the ability of ponds and other water bodies to support aquatic life. Lake Management Services (LMS) had tested the spring fed pond at Fredon and their test showed that the DO was 9 ppm. A DO of 9-10 ppm is considered extremely healthy. If a pond has a DO of less than 2 ppm and more than 15 ppm most aquatic life (mainly fish) will die. Therefore the DO in the pond validates the visual examination of the pond and the healthy aquatic life. While alkalinity is a good measure, it does not correlate to aquatic life. On the other hand alkalinity is a very good measure for aquatic plants and plants on the shore. Currently the plants in the pond are the cattails, Eurasian milfoil, Sago pondweed, Curly leaf pondweed, Naiad, and Filamentous. These aquatic plants are thriving in this medium due to the alkalinity.

## References

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