Analysis of the Impact of Anthropogenic Factors on Northwood Lake: a Flood Controlled Reservoir

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Background

The Department of Environmental Science (DES) host the Volunteer Lake Assessment Program (VLAP) to collect water quality samples of lakes. Analysis of these samples has been performed to assess the water quality of Northwood Lake. Factors potentially negatively affecting the lake, such as the annual lake drawdown (Carmignani 2021) or the runoff of road salts in the winter (Novotny 2009), are focus points of this study. Historical trends were analyzed to determine the extent of anthropogenic effects on the lake and to determine appropriate management techniques.

Purpose

To better understand water quality issues and how various chemical parameters are changing the lake. Outside factors must be taken into consideration. Factors of interest are as follows:

❖ Road de-icing salts on surrounding roadways

Snowmelt washes salt into nearby bodies of water, which causes a steady increase in lake salinity (Likens et al. 2009) which is especially significant since Northwood Lake borders a major roadway, route 4.

❖ Homes with managed lawns & fertilizer runoff

The lake is surrounded by homes with managed, fertilized lawns. Rainwater washes fertilizer into lakes, which can increase chemical parameters such as E. coli and phosphorus (Whitman et al. 2006).

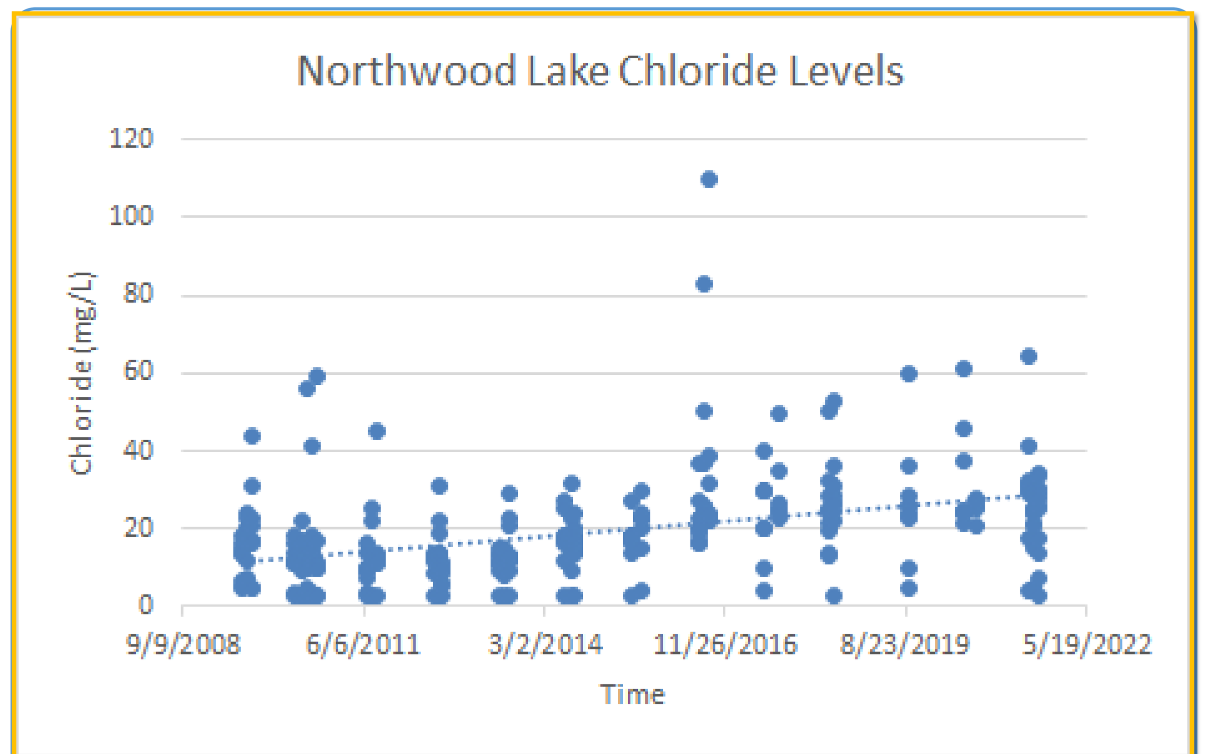

Figure 1: Graph of Chloride Concentrations

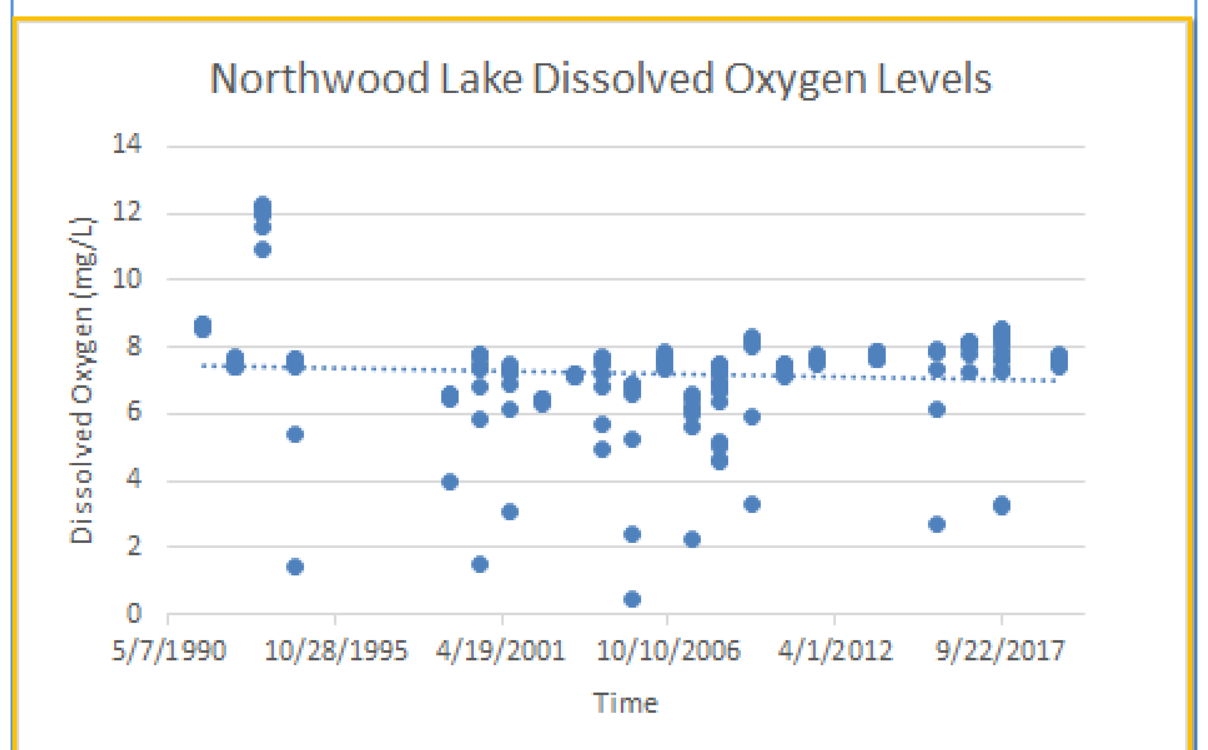

Figure 2: Graph of Dissolved Oxygen Measurements

Analysis

The average amount of chloride in the lake in 2009 was **16.5** mg/L, and in 2021 this average rose to **25.2** mg/L. The trendline in figure 1 illustrates this rise in average level. 10 years down the line, this average is expected to increase to **34** mg/L, and then to **42** mg/L 10 years after that. These values are not high enough to cause major issues, such as lake hypoxia or death and decrease of biodiversity (Bridgeman 2000).

Dissolved oxygen levels are optimal and remain relatively constant throughout the sampling period. Lakes that experience annual drawdowns often experience increased dissolved oxygen concentrations (Fox 1977), so there is little to no concern of this parameter decreasing to a concerning level. It is important that this parameter continues to be monitored as there will be issues if the average falls below 6.5 mg/L.

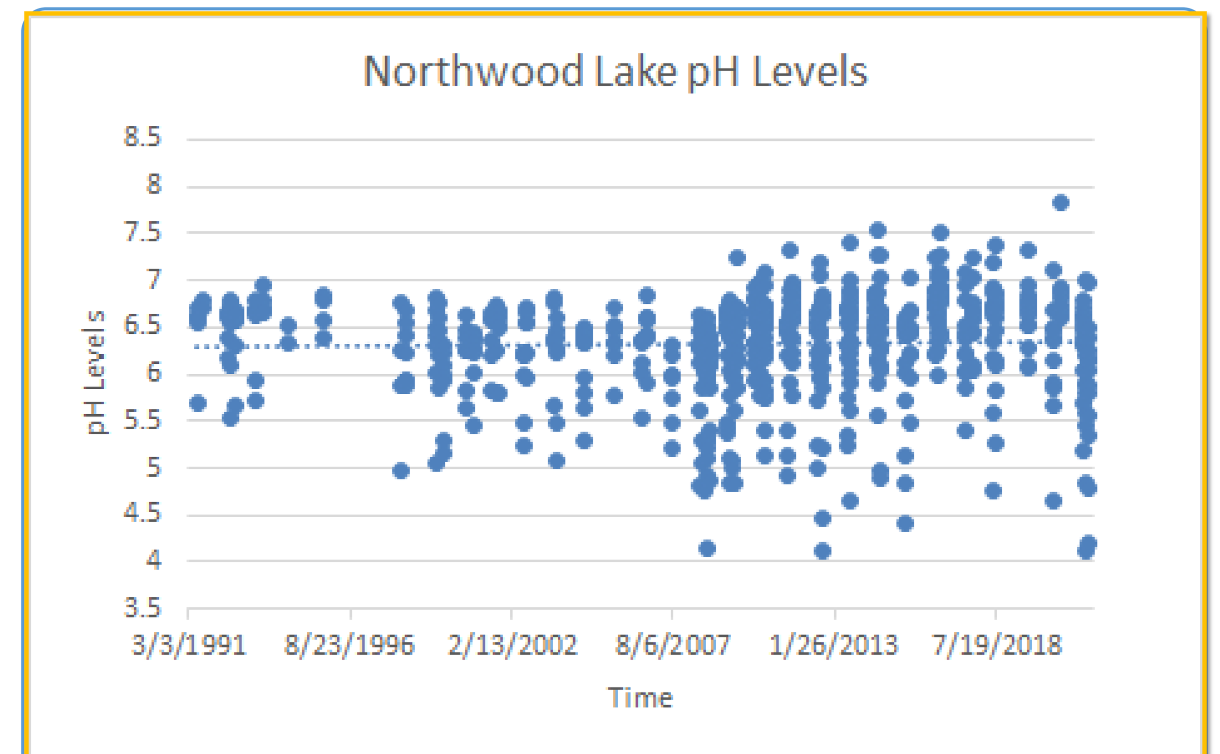

Figure 3: Graph of pH Levels

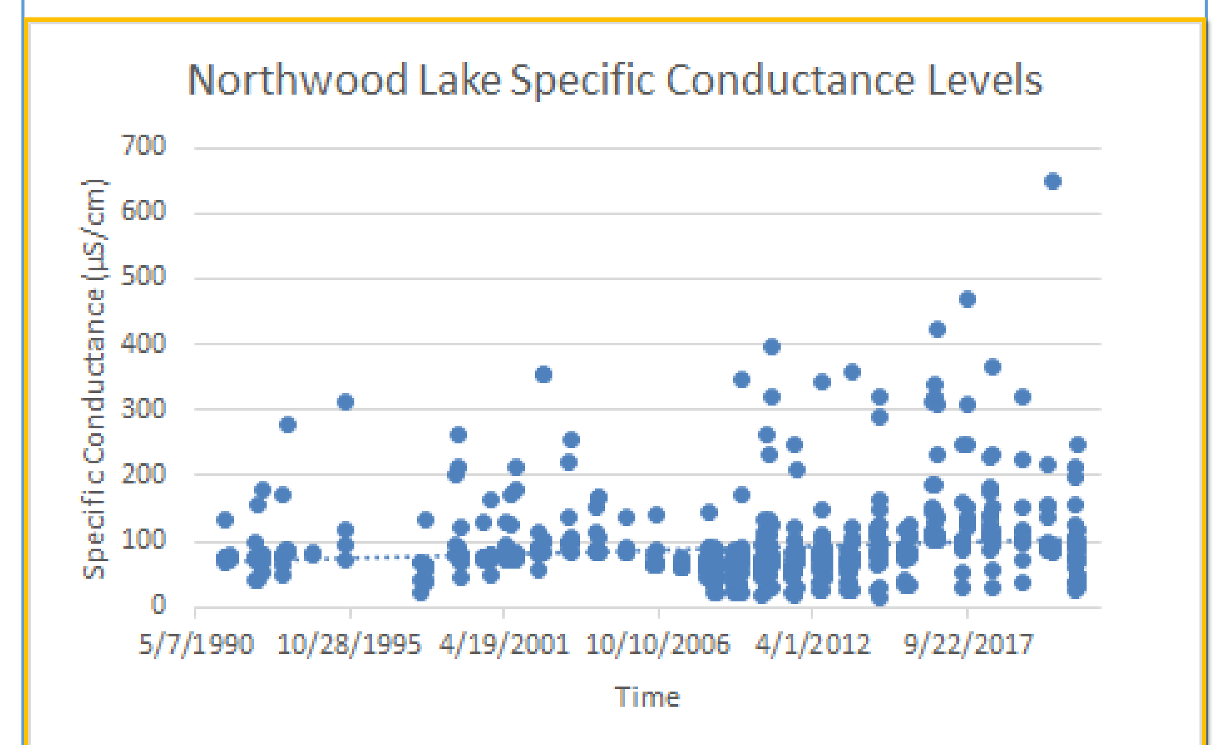

Figure 4: Graph of Specific Conductance Measurements

Analysis cont.

Figure 3 features each pH sample measurement taken from 1991 to 2021. This data features a constant trend averaging at **6.3**. This level is nearly optimal (EPA 2015) and predicted to remain this way for years to come. Slightly acidic lakes are not uncommon in the northeast portion of the United States, especially areas with granitic or siliceous bedrock such as Northwood Lake (Lyons 1997). Preventing leeching from occurring, as mentioned in the conclusions section, will help prevent the lake from becoming more acidic.

In figure 4, the average is currently **100** µs/cm, which is optimal. Increased conductivity indicates that other chemical parameters may be too high. For example, increased specific conductance is often caused by road salt runoff (Cockburn 2020) making conductivity useful in assessing overall water quality.

Measured Parameters

Northwood Lake Water Quality

Parameter	Average Amount
Alkalinity	2.9 mg/L
Chloride	29 mg/L
Dissolved Oxygen	7 mg/L
E. coli	250 MPN/100mL
pH	6.3
Phosphorus	0.0224 MG/L
Secchi	3.4 M
Specific Conductance	100 US/CM
Turbidity	1.34 NTU

Figure 5: Northwood Lake Measured Parameters

Conclusions

To ensure that water quality standards are met in the future, this data and lab report will be forwarded to the Northwood Lake Watershed Association (NWLA). Homeowners around the lake must manage their waste to prevent runoff. This includes picking up after pets and ensuring the functionality of septic systems. By doing so, the amount of fecal matter entering the lake can be reduced to prevent the growth of *E. coli* or cyanobacteria. The construction of rain gardens would also benefit the lake in the long term. Stormwater carries nutrients from other sources (such as *E. coli* trapped in forest soils or chloride from road salts) and deposits it in the lake. Rain gardens soak up these nutrients instead of letting them flow into the lake.

References

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