

Lake Washington

2007

Water Quality Assessment Report



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Water Quality Report

On May 25th, June 14th, July 9th, August 13th, and September 12th, 2007, Professional Lake Management, using a Hach Hydrolab Quanta water quality probe gathered and recorded water quality data from Lake Washington, Meeker County. The data collected came from five sites on the lake, shown in the map below.

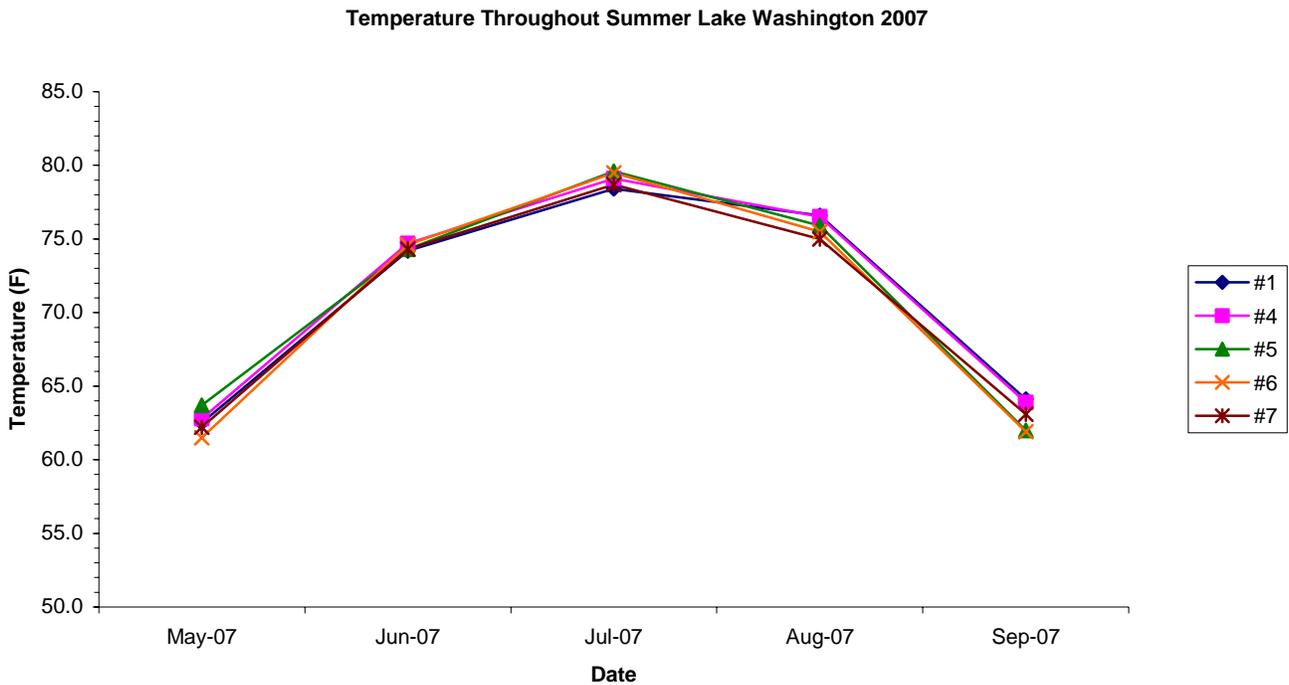


The following data was collected and will be further discussed throughout this report; temperature, dissolved oxygen (D.O.), conductivity, pH, total phosphorus (TP), chlorophyll-a (Chl-a), alkalinity, and trophic status index values (TSI). In addition to those, total suspended solids (TSS) and total dissolved solids (TDS) were taken in June. These parameters indicate in different ways, the current health of the lake as well as the future health of the lake.

Site	Temp (F)	D.O. (mg/L)	Conductivity (US/cm)	pH	Secchi (m)	TSI (S)	TP (Ug/L)	TSI (P)	Chl-a (Ug/L)	TSI (Ch)	TSS (mg/L)	TDS (mg/L)	AVG TSI
#1	62.5	7.68	396	8.58	1.75	51.9	22	48.7	3	41.4	N/A	N/A	47.3
#4	62.8	7.46	396	8.56	1.50	54.2	20	47.3	4	44.2	N/A	N/A	48.6
#5	63.7	8.03	396	8.61	1.83	51.3	30	53.2	1	30.6	N/A	N/A	45.0
#6	61.5	8.05	396	8.56	1.60	53.2	26	51.1	4	44.2	N/A	N/A	49.5
#7	62.2	7.94	397	8.59	1.83	51.3	23	49.4	1	30.6	N/A	N/A	43.8
#1	74.2	6.59	397	8.80	1.12	58.4	31	53.7	7	49.7	5	192	53.9
#4	74.7	6.78	399	8.85	1.01	59.9	26	51.1	9	52.2	N/A	N/A	54.4
#5	74.3	7.58	387	8.91	1.22	57.1	20	47.3	6	48.2	N/A	N/A	50.9
#6	74.6	8.05	387	8.97	1.12	58.4	18	45.8	7	49.7	N/A	N/A	51.3
#7	74.3	7.10	394	8.82	1.01	59.9	24	50.0	9	52.2	N/A	N/A	54.0
#1	78.4	7.71	382	8.26	0.86	62.1	22	48.7	12	55.0	N/A	N/A	55.3
#4	79.1	8.06	376	8.42	0.84	62.5	18	45.8	11	54.1	N/A	N/A	54.2
#5	79.6	7.79	374	8.34	0.81	63.0	32	54.1	13	55.8	N/A	N/A	57.6
#6	79.5	7.16	376	8.33	0.99	60.1	21	48.1	9	52.2	N/A	N/A	53.4
#7	78.7	8.91	375	8.43	0.81	63.0	35	55.4	13	55.8	N/A	N/A	58.0
#1	76.6	7.44	363	8.72	0.76	63.9	26	51.1	11	54.1	N/A	N/A	56.4
#4	76.5	8.10	360	8.89	0.69	65.4	26	51.1	17	58.4	N/A	N/A	58.3
#5	75.9	8.46	360	8.96	0.79	63.5	26	51.1	15	57.2	N/A	N/A	57.3
#6	75.5	8.44	357	8.92	0.46	71.3	29	52.7	17	58.4	N/A	N/A	60.8
#7	75.0	8.14	351	8.93	0.76	63.9	91	69.2	11	54.1	N/A	N/A	62.4
#1	64.1	8.35	359	9.16	0.56	68.4	33	54.6	11	54.1	N/A	N/A	59.0
#4	63.9	9.09	358	9.13	0.48	70.5	30	53.2	13	55.8	N/A	N/A	59.8
#5	62.0	9.03	359	9.22	0.71	64.9	31	53.7	13	55.8	N/A	N/A	58.1
#6	61.9	9.32	359	9.23	0.74	64.4	81	67.5	12	55.0	N/A	N/A	62.3
#7	63.1	9.16	359	9.17	0.71	64.9	30	53.2	9	52.2	N/A	N/A	56.8

Temperature

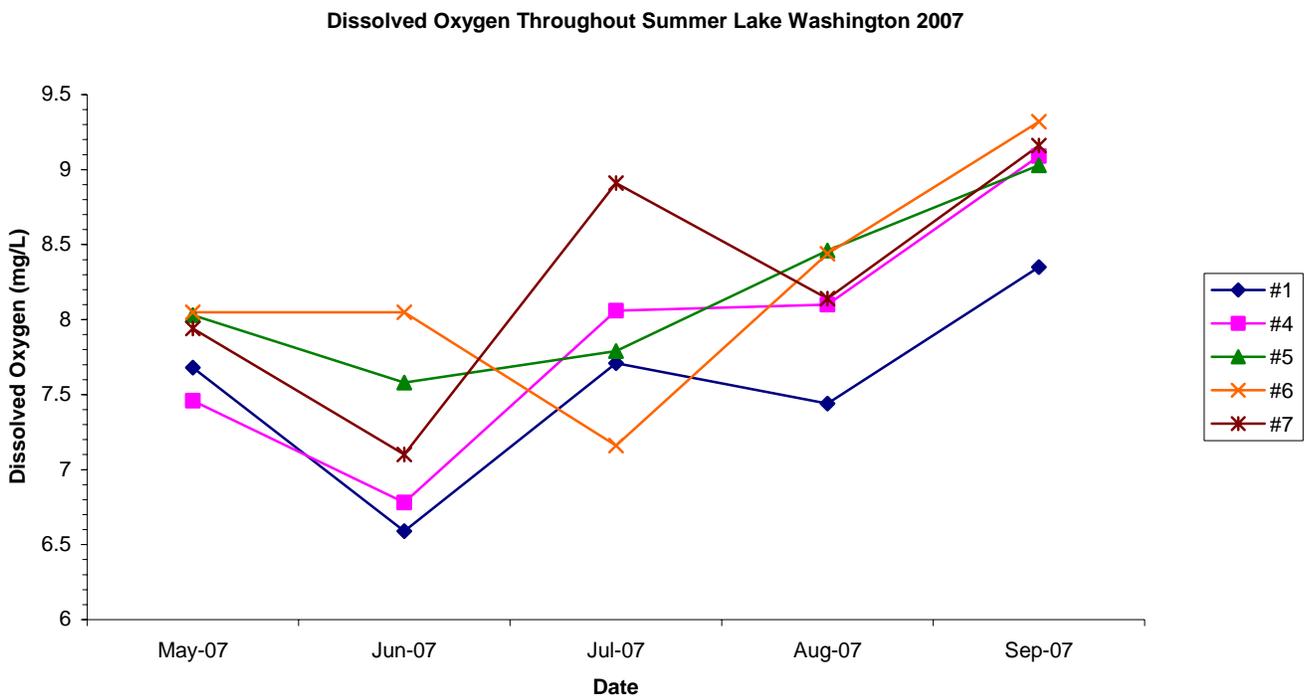
The temperature of a lake makes a big impact on the biological life in the lakes such as the fish, insects and the plants. Temperatures that become too warm may decrease the oxygen levels in the lake making survival of fish, insects and plants more difficult. Lakes actually have a variation of temperatures depending on the depth. The average temperatures, which can be seen in the chart below, are all in the correct range throughout the summer. There is very little variation between the sites.



Dissolved Oxygen

Dissolved Oxygen measures the amount of oxygen in the water. It is produced by the plants through photosynthesis and used by nearly all aquatic organisms for survival. Because

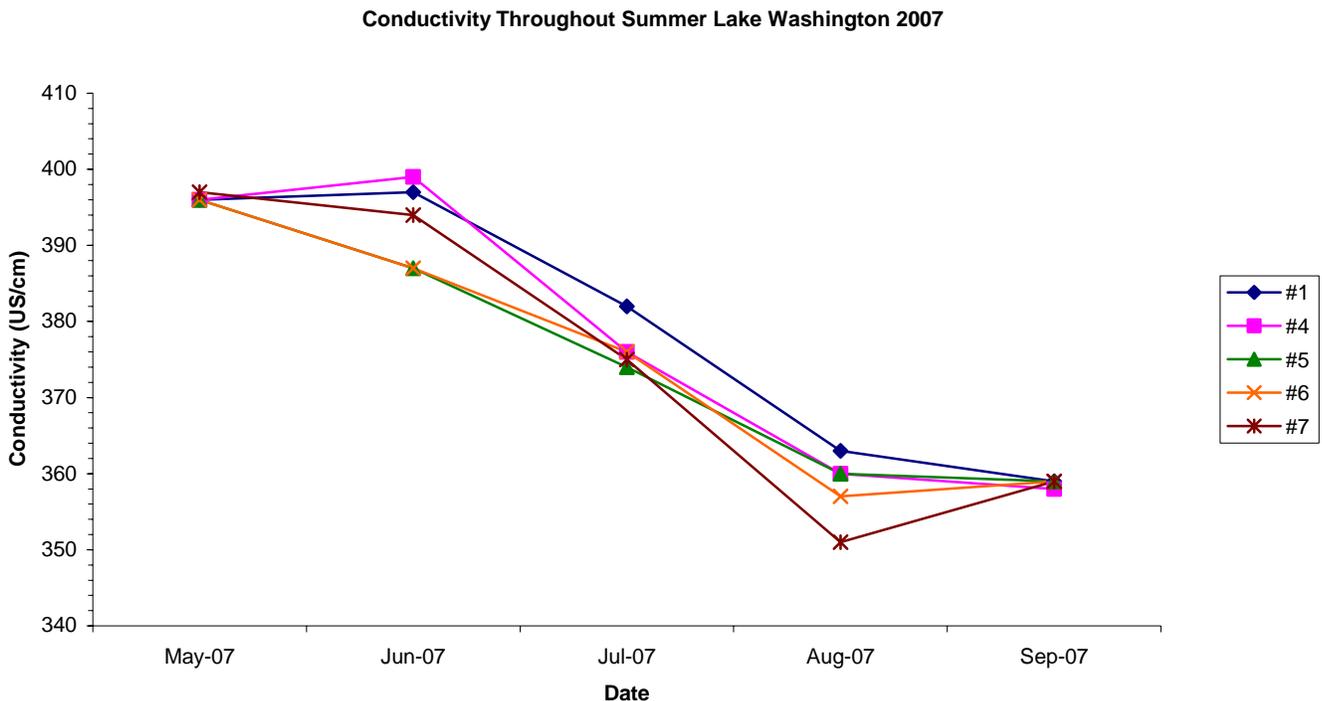
photosynthesis is dependent on sunlight, dissolved oxygen varies depending on the temperature the sunlight helps create as well. The higher the temperatures, the less gasses water can hold, which will produce less oxygen in the water. Oxygen can also be introduced to the water by the air and inflowing streams. Oxygen levels will also decrease with depth, as there is less sunlight to help generate photosynthesis. Dissolved Oxygen is measured in mg/L and must be at a level above three mg/L for aquatic organisms to survive. The oxygen levels in Lake Washington fall in healthy ranges. Because there is increased flow and shallow waters near site #7 it increased the most in July. By September, the flow seems to be increased in site #6 near the lake outlet.



Conductivity

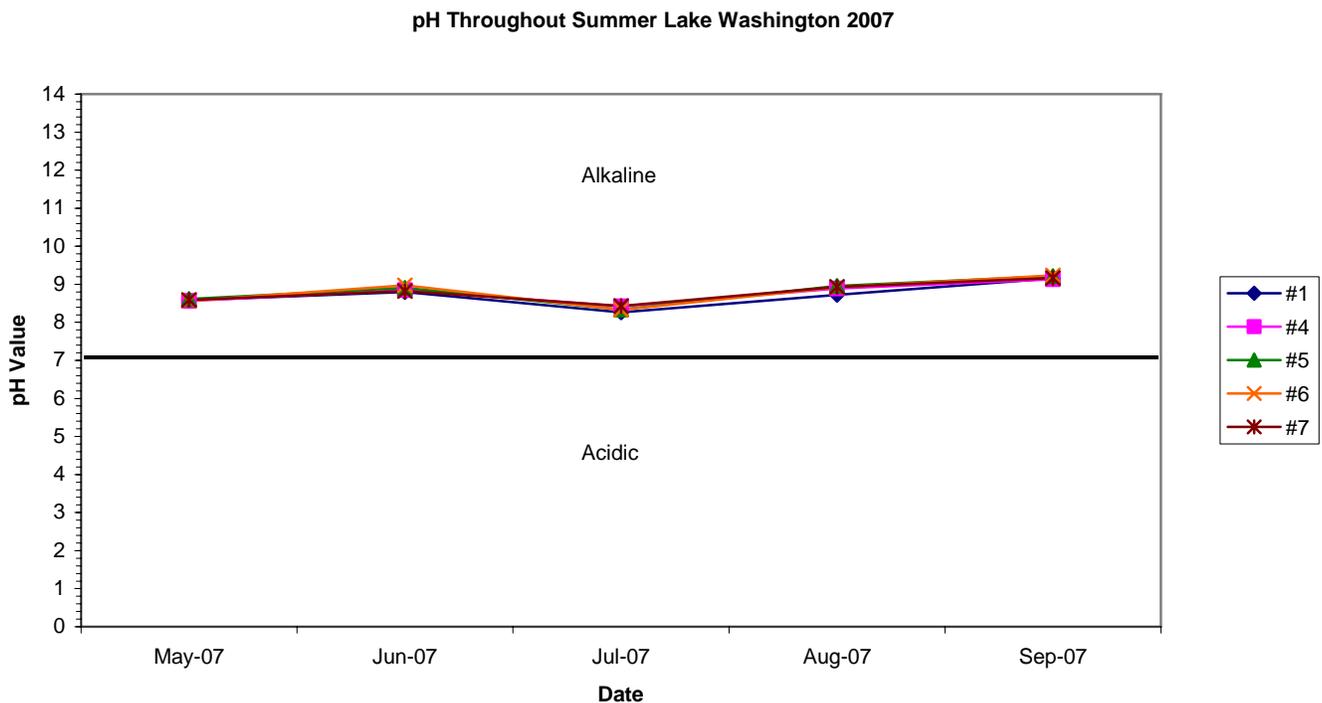
Electrical conductivity estimates the total amount of dissolved ions in the water and is controlled by things such as the rock composition of the lake, the size of the watershed relative to

the area of the lake, wastewater and runoff, and bacterial metabolism. The rock composition can add ions to the lake depending on the type of rock, for example a lake with a limestone basin will have a higher conductivity. A larger watershed can increase the amount of soils brought into a lake, which can increase the conductivity, as can wastewater and runoff. Bacterial metabolism, which is present in every lake, only becomes a problem when there is an overabundance of bacteria causing an increase in the carbon dioxide of a lake and in turn increasing the conductivity. The conductivity levels for the ecoregion in which Lake Washington falls (North Central Hardwood Forests Region) are usually between 300 and 400 $\mu\text{S}/\text{cm}$. Lake Washington falls in the normal range and indicate no associated problems. The levels decreased throughout the summer, likely due to less rainfall that would normally bring in more ions.



PH

The measurement of pH indicates a lake's acid level. Lower pH levels, usually below six, indicate more acidic waters and levels above nine indicate alkaline waters. Acidic waters can affect fish and fish spawning, possibly leading to a fish kill. The pH levels of Lake Washington as shown in the chart above are all above the neutral pH of seven, within the normal pH range, an alkaline range. June is a growing season for aquatic plants, which increases photosynthesis, decreasing the amount of carbon dioxide in the water and increasing the pH. This can explain why the pH levels went up slightly.

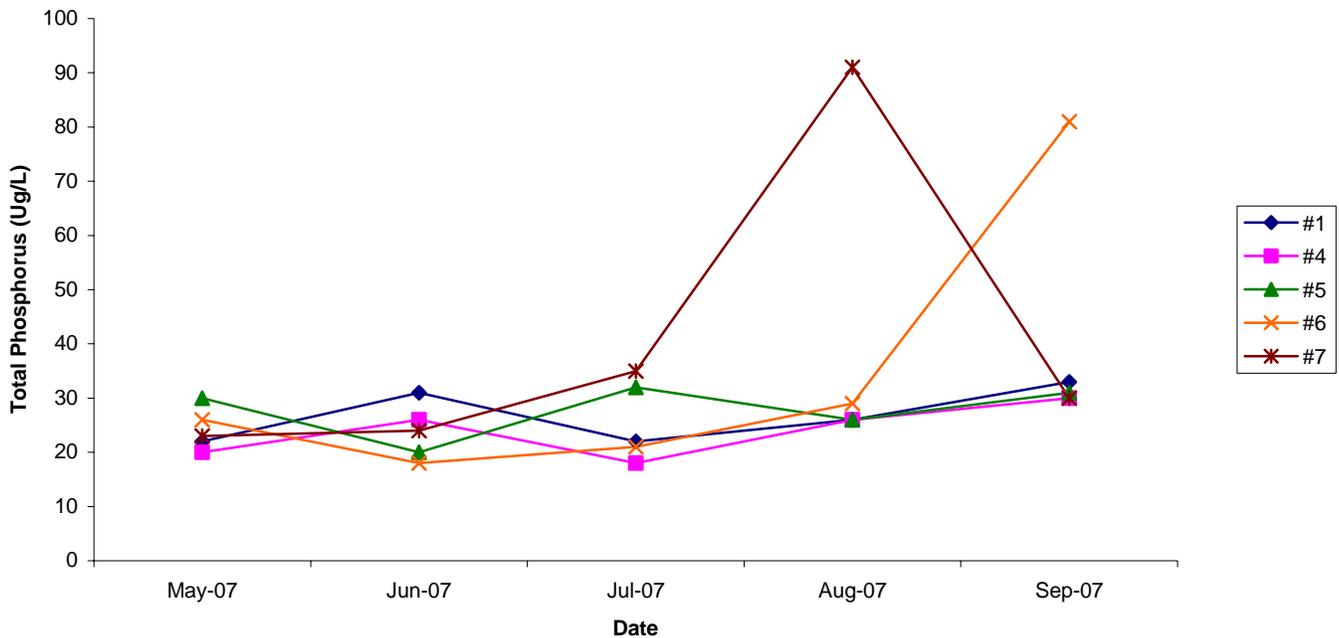


Total Phosphorus

Phosphorus promotes aquatic plant growth and comes from sources such as soil erosion, detergents, septic systems, runoff and animal waste. Average phosphorus levels for the

ecoregion of Lake Washington (North Central Hardwood Forests Region) according to the MPCA is 23 to 50 $\mu\text{g/L}$. The good water quality range should be between 20 and 30 $\mu\text{g/L}$. The lower the level, the better water quality. Lake Washington fell mostly within these ranges, except for site #7 in August and site #6 in September. Site #7 is an inlet from Lake Stella, and it appears that the inlet was bringing in higher levels of phosphorus in August. That phosphorus seems to have then traveled through the lake and had made it to the outlet at site #6 by September. Site #7 is also in an area known to have Eurasian watermilfoil, and as the milfoil begins to die down and decay, it releases a large amount of phosphorus, which may have also increased the levels. Phosphorus is also a good indicator for a lake's nutrient status or trophic state, which will be explained further in the TSI section of this report.

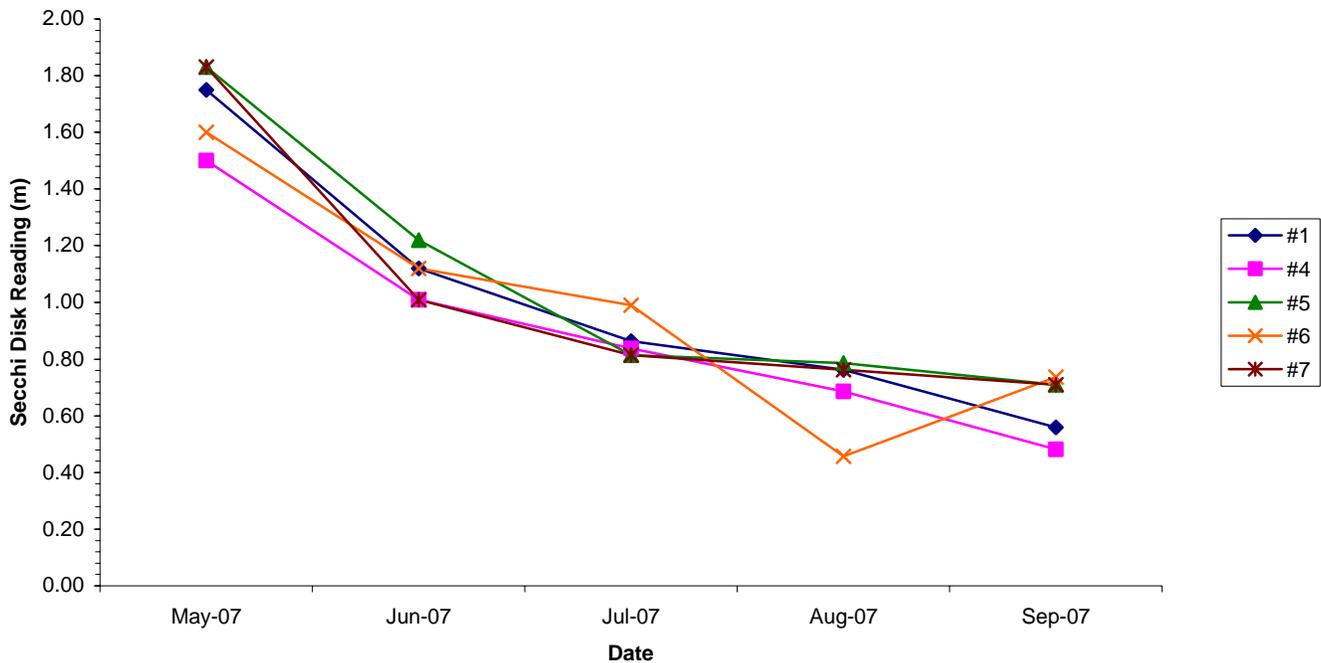
Total Phosphorus Throughout Summer Lake Washington 2007



Clarity

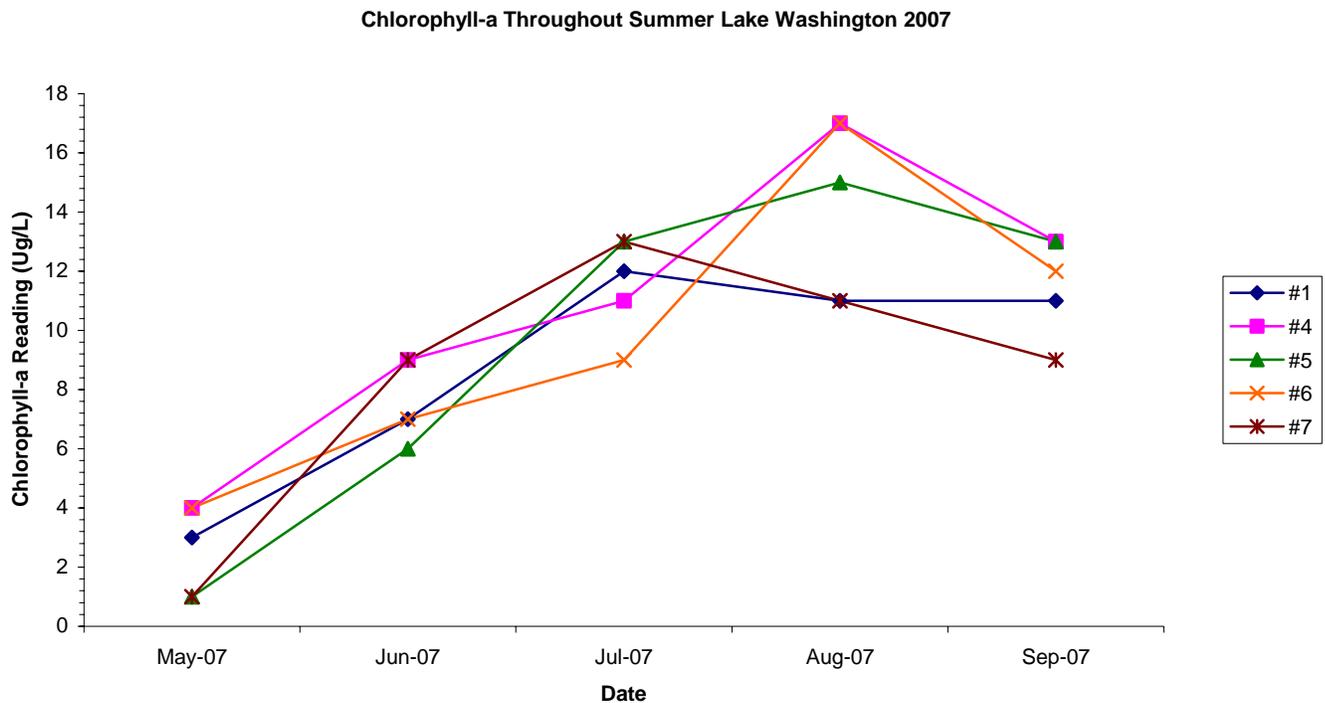
Clarity is determined using a secchi disk, to see how clear the water is or how far down from the surface the secchi disk can be seen. The average secchi disk readings for the North Central Hardwood Forests ecoregion are 1.5 meters to 3.2 meters. Lake Washington falls mostly below this level. May is the only month that the secchi disk readings fall in the North Central Hardwood Forests ecoregion levels, and they are at the lower end of that range. If water levels are low, this could contribute to the low clarity levels, because more sediment can be brought in and lower depths leave less room for deep secchi disk readings. Eurasian watermilfoil can also reduce clarity levels in lakes. Clarity can be used to indicate the trophic status of a lake as can total phosphorus, which will be explained in the TSI section of this report.

Clarity Throughout Summer Lake Washington 2007



Chlorophyll-a

Chlorophyll-a is the green pigment that is responsible for the conversion of sunlight into chemical energy during photosynthesis. The measurement of chlorophyll-a is best used for indicating the amount of algae in lakes. Higher readings of chlorophyll-a indicate more algae, which can indicate unhealthy waters. Lake Washington's chlorophyll-a readings range from one to 117 $\mu\text{g/L}$. Readings for the lake's ecoregion should be between five and 22. Lake Washington falls mostly in this range. Although within this range, the higher readings are bordering unhealthy waters. Lower water levels, excessive growth in the lake, and possible factors such as runoff likely attributed to the higher readings.



Total Suspended Solids

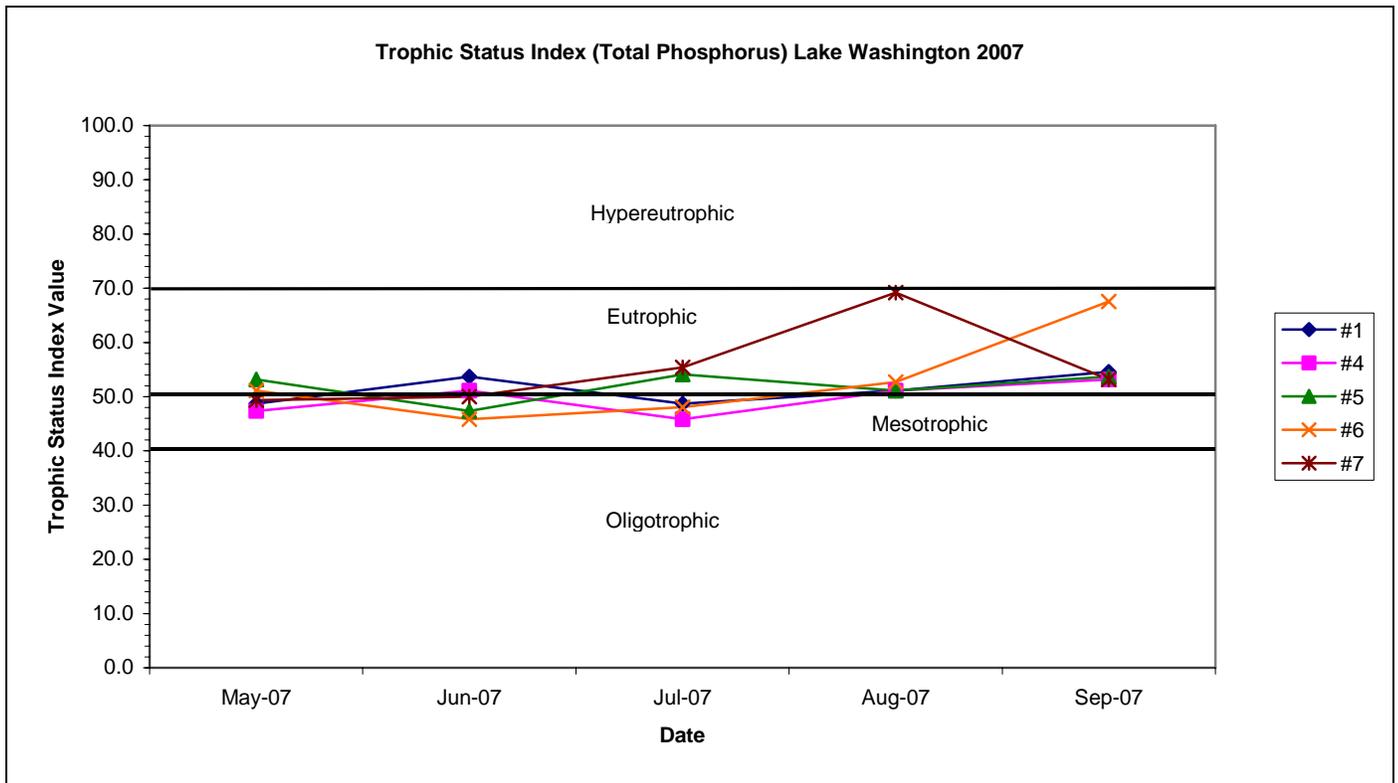
Suspended solids include soil, industrial waste, dead plant or animal material, live organisms, and sewage. Too many suspended solids can decrease water clarity, as well as light availability necessary for growth of aquatic plants, and harm fish and other aquatic organisms. Sediment can clog fish gills destroy aquatic habitats. High total suspended solids can also cause an increase in water temperature because the particles can trap heat from the sun. TSS readings can also indicate high levels of nutrients, bacteria, metals, and other chemicals, because these attach to sediment. For the North Central Hardwood Forests Region, TSS should be between two and six mg/L and Lake Washington falls in this range with a reading of five mg/L.

Total Dissolved Solids

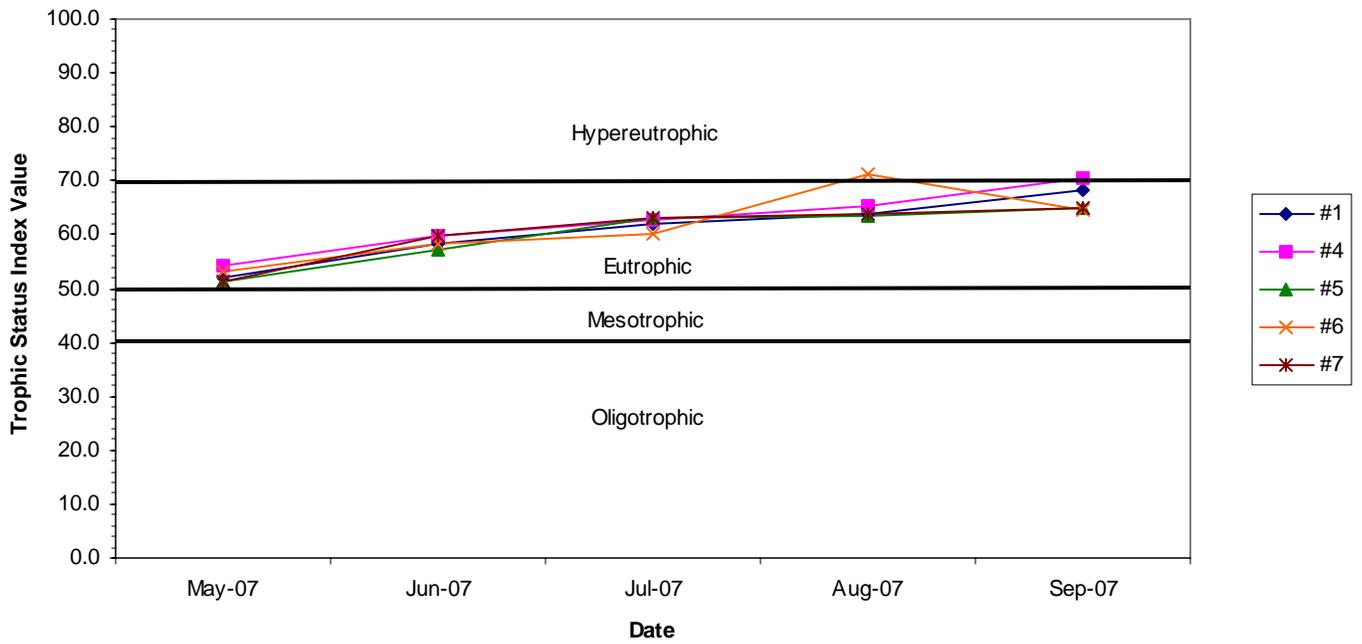
Total dissolved solids come from sources such as agricultural runoff, leaching of soil contamination and water pollution industrial or sewage treatment plants. The chemicals associated with TDS are calcium, phosphates, nitrates, sodium, potassium and chloride, which are found in nutrient and stormwater runoff, as well as runoff from roads where de-icing salts are applied. For human consumption, TDS readings would need to be below 500mg/L, however odor and appearance will usually prevent human consumption far below this level. Aquatic ecosystems such as lakes, can withstand a TDS reading up to 1000mg/L. Washington Lake had a reading of 192mg/L which doesn't indicate any associated problems.

Trophic Status Index

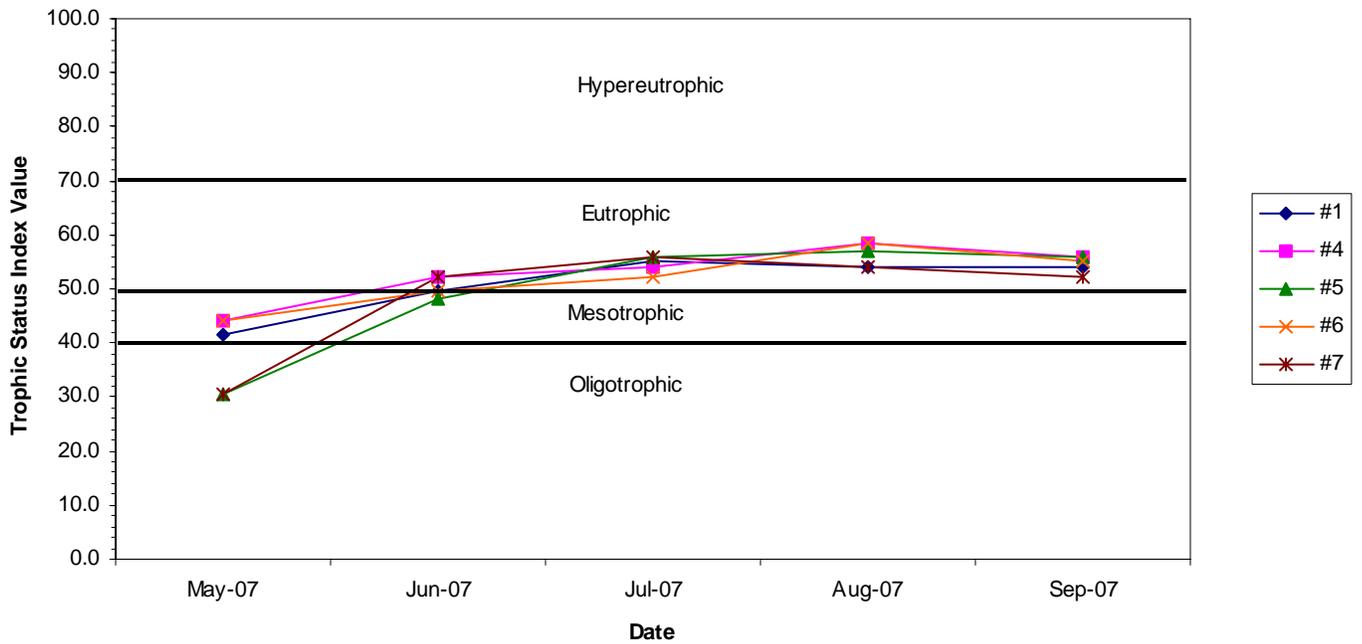
There are four trophic states, hypereutrophic, eutrophic, mesotrophic, and oligotrophic. Hypereutrophic lakes are extremely high in nutrients and unhealthy. Eutrophic lakes are high in nutrients and support a large amount of plants and animals, usually very weedy and susceptible to oxygen depletion and could lead to further problems. Mesotrophic lakes are in between the other two types, with good fisheries, productions and occasional algal blooms. Oligotrophic lakes are clear slightly low in nutrients and are capable of sustaining desirable fisheries of large game fish. The following graphs will show the trophic status index ranges Lake Washington fell into for 2007 using secchi disk readings, total phosphorus readings and chlorophyll-a readings.

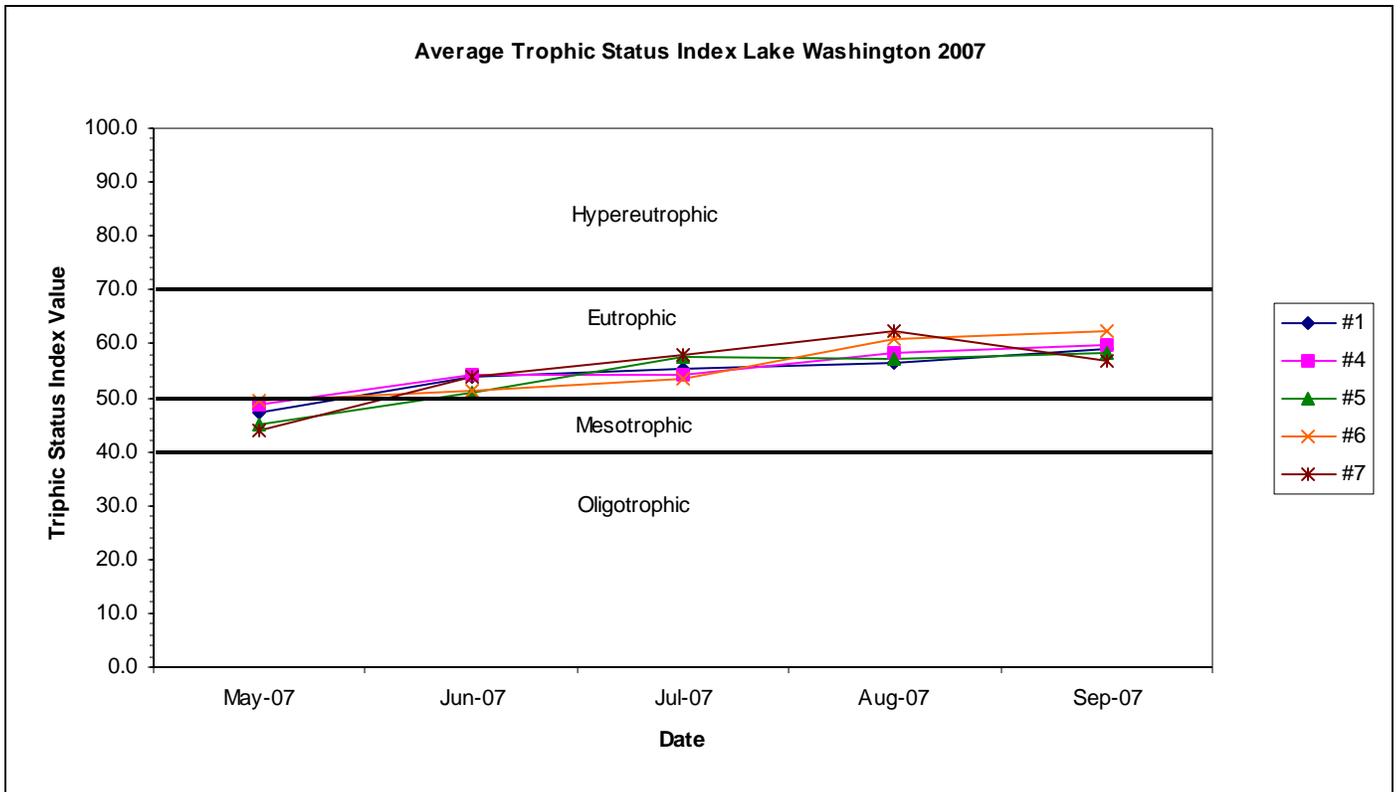


Trophic Status Index (Secchi) Lake Washington 2007



Trophic Status Index (Chlorophyll-a) Throughout Summer Lake Washington 2007





Conclusion

The parameters collected for Lake Washington indicate a slightly unhealthy lake. The parameters indicate the lake is in a eutrophic state putting it at risk. The risk however, could be a result of lack of rain, lower water levels and abundant plant growth. It may also be from human sources such as runoff. It is best to continue water quality monitoring to better evaluate the changes in the lake throughout the years.