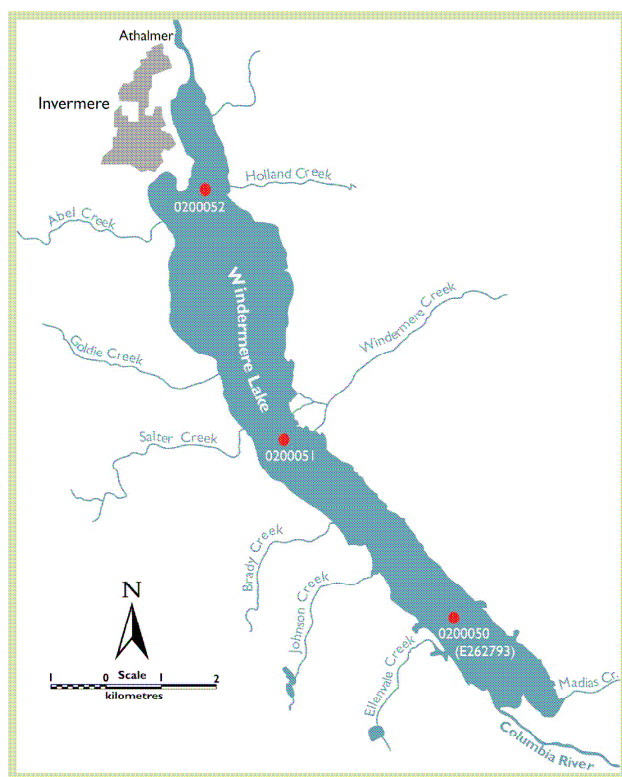


Lake Windermere 2011 Water Quality Monitoring Results

Locations of Water Quality Samples

In 2011 Lake Windermere Ambassadors' volunteers and staff sampled lake water at three locations established by the Ministry of Environment and sampled over the previous 5 years by the Lake Windermere Project. The sites cover the north and south end and center of the lake.



Sampling Sites = Red Dots

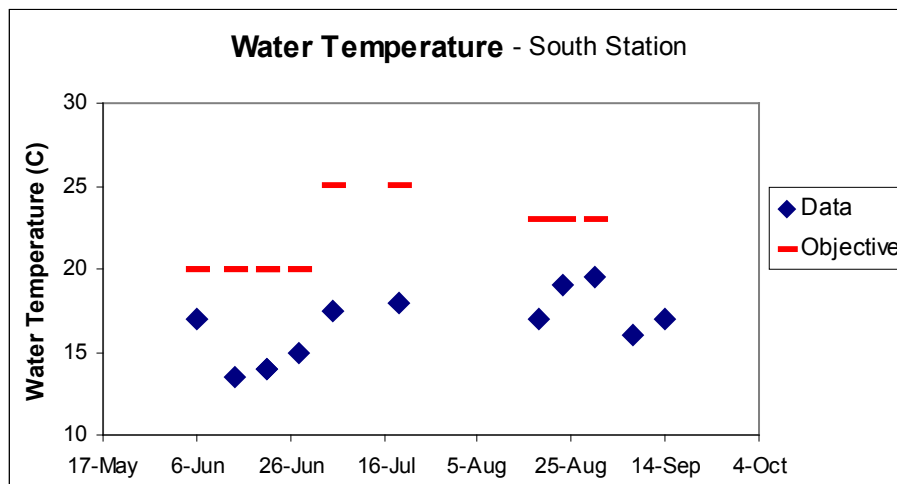
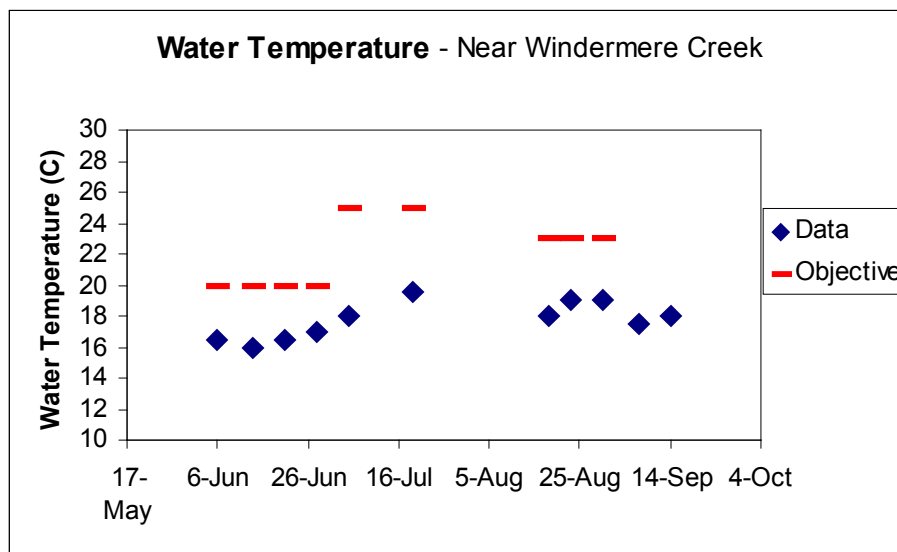
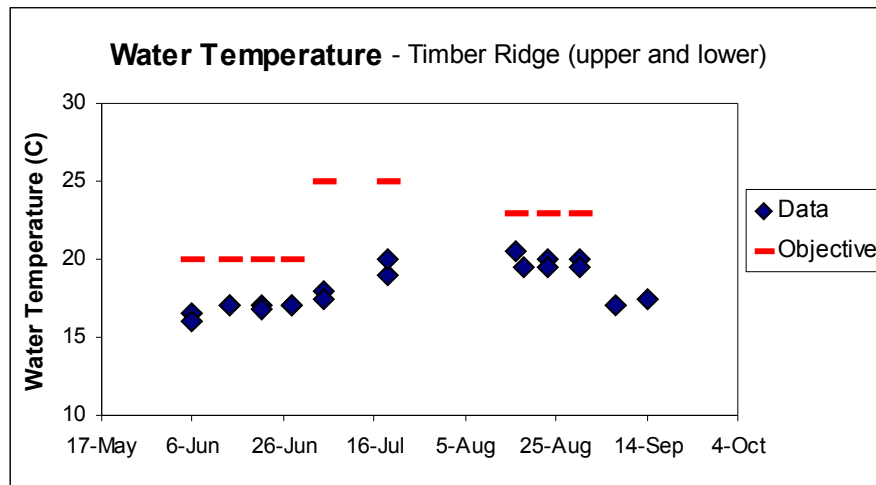
Temperature

Overview

Water temperature is important to the quality of drinking water, and is of critical importance to aquatic life. Lower temperatures are generally more desirable for both uses. The Ministry of Environment determined how warm the lake can get during the summer before problems start to occur – those temperatures are the water quality *objectives* for temperature.

Results

In the summer of 2011, temperature at all three water monitoring stations were below the maximum recommended temperature, and therefore the lake met water quality objectives.



Dissolved Oxygen



Overview

Dissolved oxygen is a measure of the amount of oxygen dissolved in water. Fish and other aquatic life need oxygen. The Ministry of Environment determined levels of oxygen necessary to protect aquatic life in Lake Windermere (water quality objectives).

How much oxygen is enough? The Ministry of Environment determined that oxygen should never drop to or below 5 milligrams per liter (instantaneous minimum), and the average of five samples taken over 30 days should be at or above 8 milligrams per liter (mg/L).

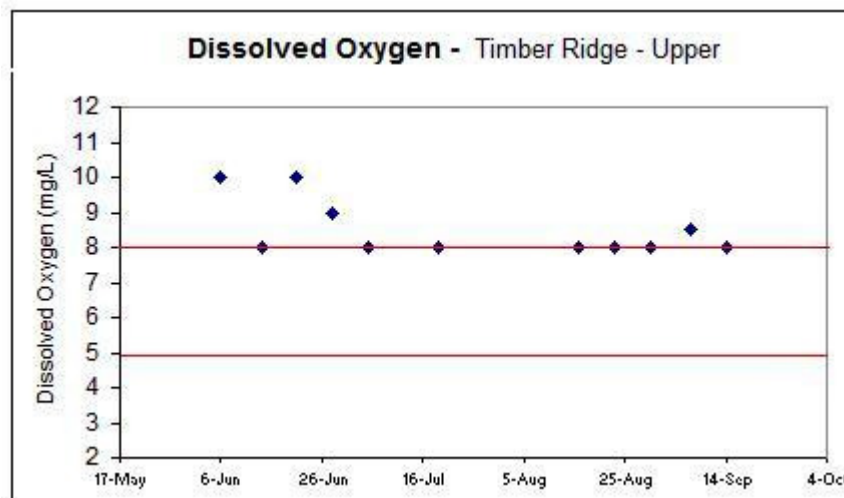
Results

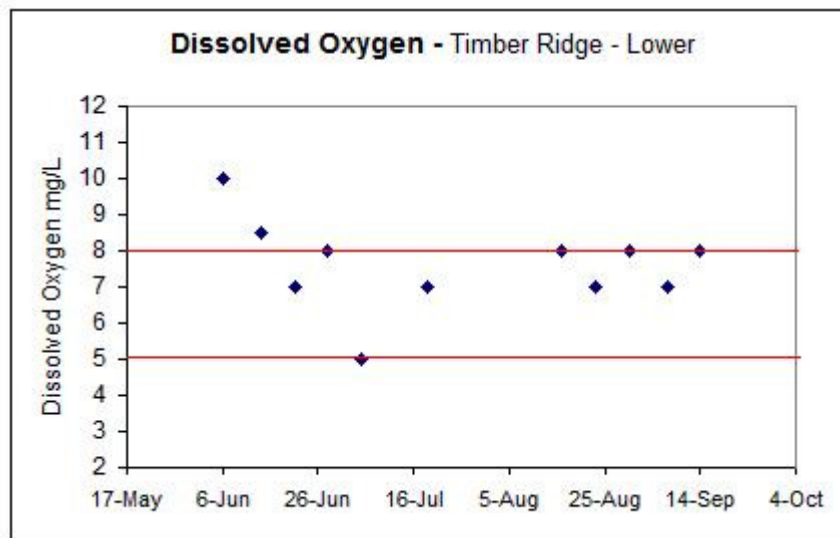
Timber Ridge

At the Timber Ridge station on the north end of the lake, mean oxygen levels at the lake surface were always at or above the objective to protect aquatic life (8 mg/L). The instantaneous minimum oxygen level (5 mg/L) was not detected during the sampling period.

One meter above the lake bottom, however, there was less oxygen. The mean oxygen levels were below the objective to protect aquatic life, and the instantaneous minimum oxygen level was detected once during the sampling period.

Given that there was sufficient oxygen near the surface during this time period, it is not likely that the lower oxygen levels down low were a threat to aquatic life. Nonetheless, historic water quality data show higher oxygen levels at this site (7 -14 mg/L), so further monitoring of this site should be undertaken to determine if a trend towards lower oxygen is occurring in this section of the lake.





Windermere and South Station

There was plenty of oxygen at both of these sites. Dissolved oxygen levels at the Windermere and South stations were above the recommended 8 mg/L objective to protect aquatic life. The instantaneous minimum oxygen level (5 mg/L) was not detected during the sampling period.

Turbidity

Overview

Turbidity is a measure of the light scattered by particles suspended in water, and indicates the cloudiness or clarity of the water. When waters are highly turbid, drinking water quality is impaired, light cannot penetrate to reach aquatic plants- which reduces photosynthesis, and fish become stressed. Since aquatic life in Lake Windermere have adapted to seasonal flushes of sediment into the lake, how much turbidity should be in the water (water quality objective) depends on time of year.



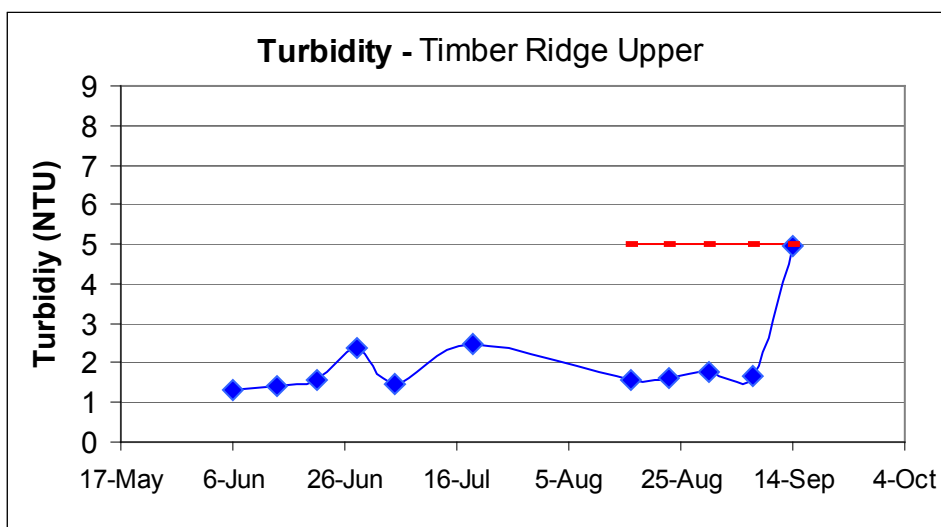
During spring runoff (May 1 – August 15), in what is known as “turbid flow”, the 95th percentile of turbidity measurements taken in five days over a 30-day period should not exceed 5 NTU (turbidity units). During “clear flow” (August 16 – April 30), the maximum turbidity at any time should be less than or equal to 5 NTU. Additionally, the objectives for “clear flow” state that the average of 5 samples over 30 days should not exceed 1 NTU.

Results

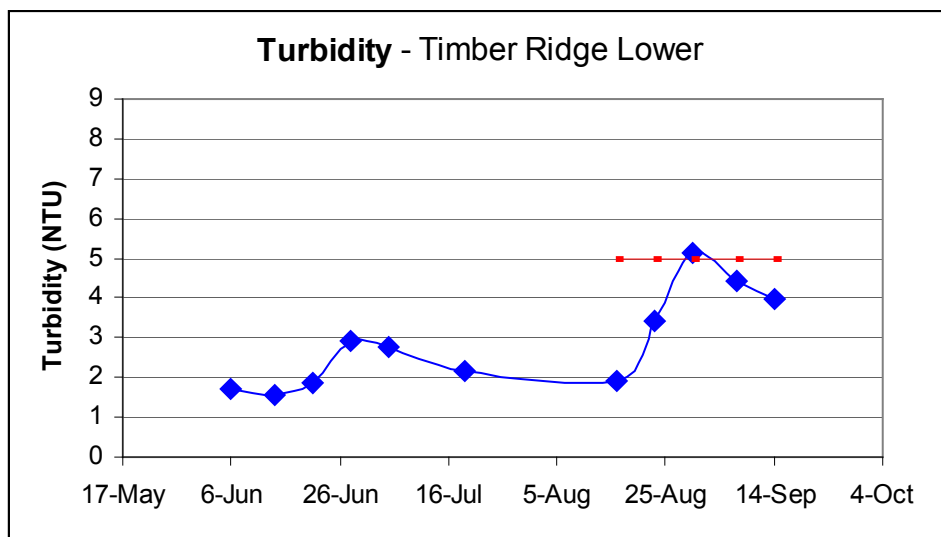
In 2011, the turbid flow objective was exceeded at the Windermere Creek station and the South station. Field observations and information about a landslide in Windermere Creek substantiate this finding for the station near Windermere Creek. Field notes from the south station documented turbid inflow from the Columbia River during this time.

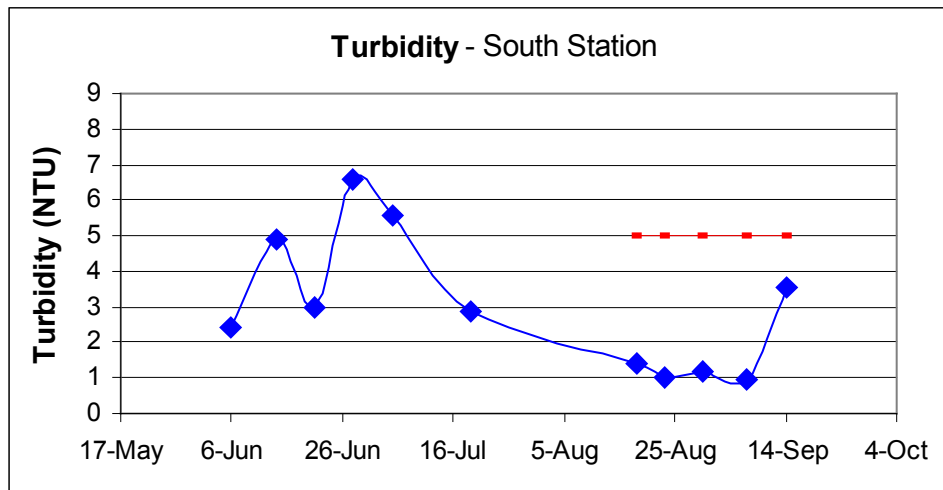
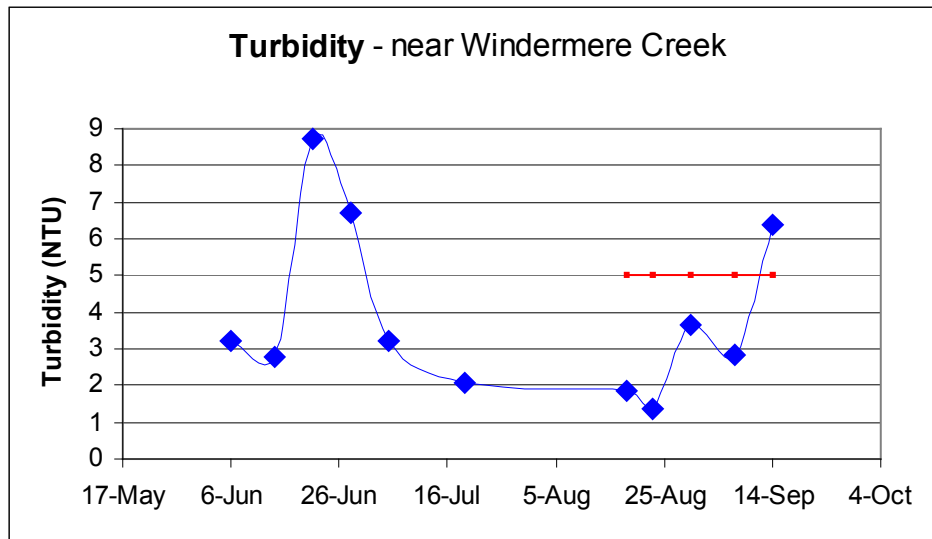
In 2011, the clear flow objective of 5 NTU maximum was exceeded once at the north site where the sample was taken 1 meter above the lake bottom (station = Timber Ridge Lower). Field notes from that day indicate that surface conditions were choppy and the distance to the bottom could not accurately be gauged. Thus, it is possible that the sample was taken very close to the lake bottom.

The clear flow objective for average turbidity over 30 days exceeded the recommended 1 NTU at all stations, indicating that conditions in 2011 were more turbid than both historically (1970s and 1980s) and recently (2006-2009).



Note: lines added to ease interpretation only – no continuous data were taken.
Red line indicates the “clear flow” objective.





Phosphorus

Overview

Phosphorus is a nutrient that is usually found in limited quantities in natural lakes. In high quantities it leads to algal blooms. Unnatural inputs of phosphorus into lakes are one of the main contributors to deterioration in lake health. The Ministry of Environment determined that the most total phosphorus that should be present in Lake Windermere (objective) is a concentration of 0.01 milligrams per liter.

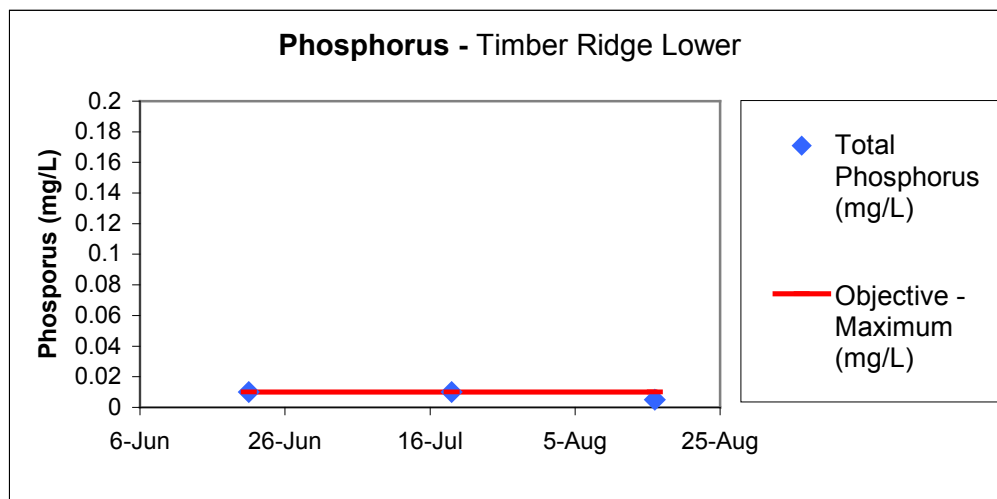
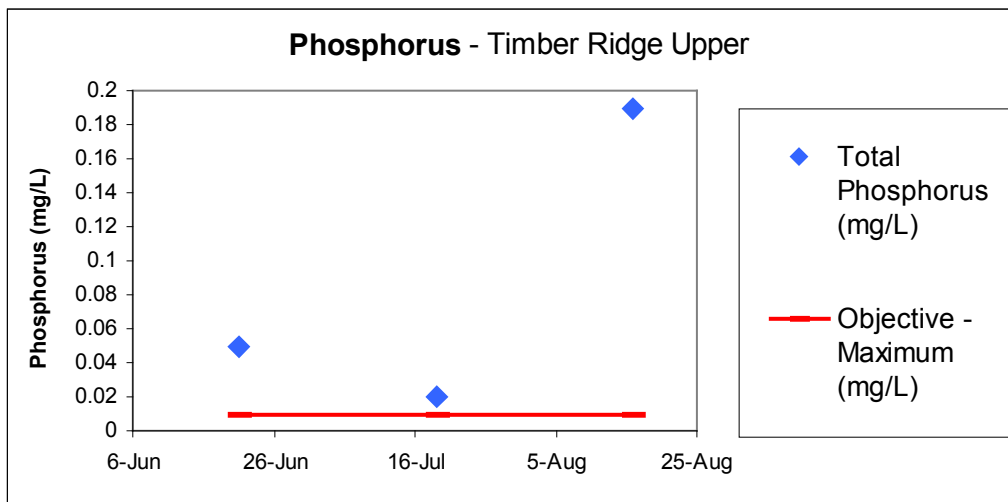


Results

The measured phosphorus concentration at the Timber Ridge station (average of phosphorus near the lake surface and near the bottom) was found to be higher than the recommended level during all three sampling events. In August it was 10 times higher than the recommended levels. The type of phosphorus present gives some insight into what might have been occurring at that

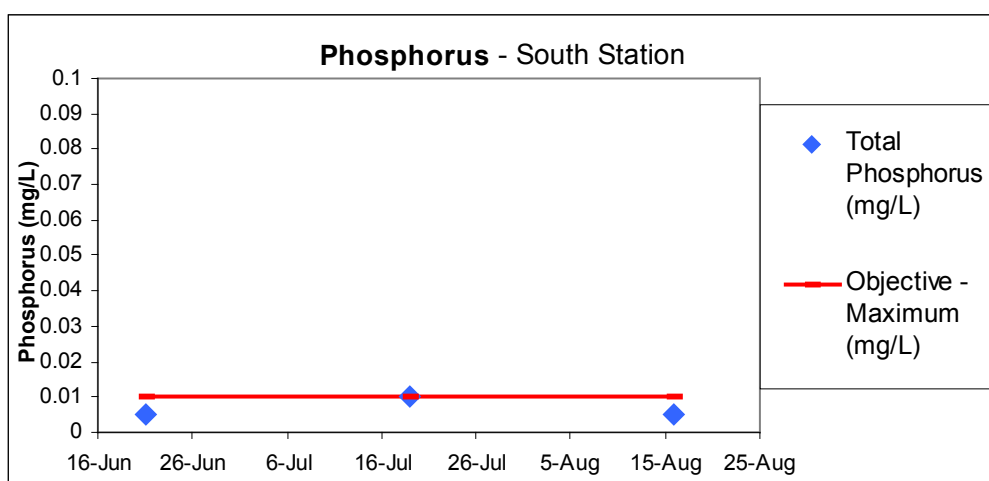
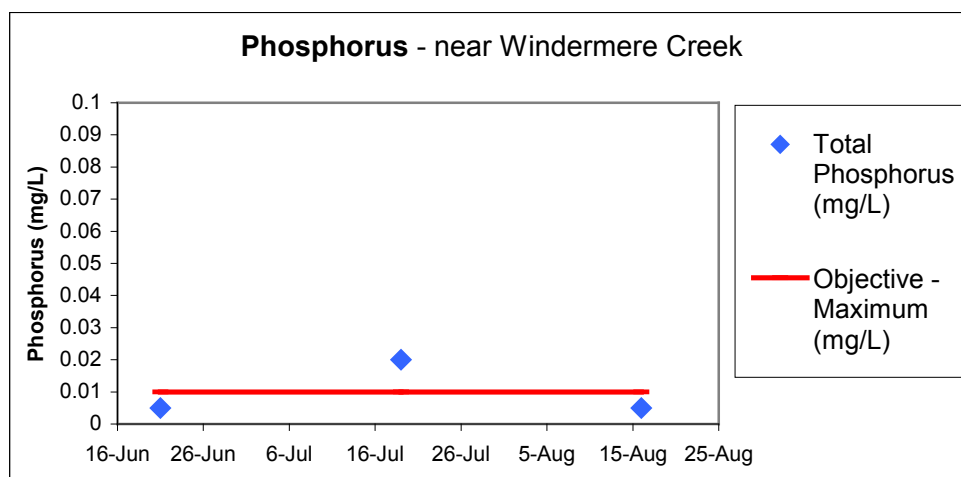
time. Since total phosphorus (typically bound to sediments) was much higher than dissolved phosphorus in that sample, the results may indicate the presence of particulates in the sample. Ministry of Environment scientists suggest that since Lake Windermere is a “riverine” system (a widening of the Columbia River) and there is more flow through it than in typical lakes, the mixing of nutrients, especially when they are bound to sediment, may be highly variable.

Compared to historic data, the 2011 Timber Ridge results appear to be an exception to the conditions typical of Lake Windermere. Nonetheless, the high results indicate that future monitoring at this site is warranted in order to determine if there might be an increase in phosphorus occurring.



Phosphorus concentration near Windermere Creek was higher than the objective in July. All of the phosphorus detected that day was in the dissolved form.

At the South station, phosphorus was always at or below the recommended level.



Nitrate

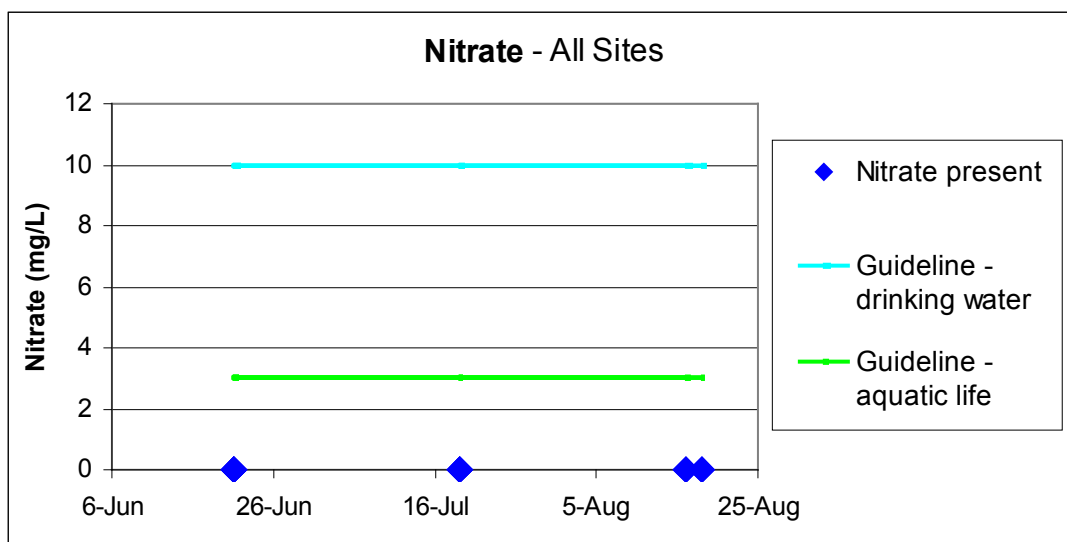
Overview

Nitrogen is a nutrient in aquatic ecosystems, but can be harmful to aquatic life when present in high quantities. Nitrate is an inorganic form of nitrogen that is a favorable form for use by algae.

The Ministry of Environment did not develop a water quality objective for Lake Windermere. However, Provincially, the water quality guideline for nitrate in source drinking waters is 10 mg/L. For protection of freshwater aquatic life, the 30-day average concentration should not exceed 3.0 mg/L, and nitrate concentrations should not exceed 31.3 mg/L at any time.

Results

Total nitrogen and nitrate levels were consistently well below guidelines at all sites throughout the monitoring season. These results are consistent with historic data.



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Erin Hillary and Fiona Devlin testing the water – June 2011