BC Lake Stewardship and Monitoring Program

Caverhill Lake (2004 & 2005)

A partnership between the BC Lake Stewardship Society (BCLSS) and the Ministry of Environment

The Importance of Caverhill Lake & its Watershed

British Columbians want lakes to provide good water quality, aesthetics, and recreational opportunities. When these features are not apparent in our local lakes, people begin to wonder why. Concerns often include whether the water quality is getting worse, if the lake has been impacted by land development or other human activities, and what conditions will result from more development within the watershed.

The BC Lake Stewardship Society (BCLSS), in collaboration with the Ministry of Environment, has designed a program, entitled *The BC Lake Stewardship and Monitoring Program*, to address these concerns. Through regular water sample collections, we can come to understand a lake's current water quality, identify the preferred uses for a given lake, and monitor water quality changes resulting from land development within the lake's watershed. There are different levels of lake monitoring and assessment. The level appropriate for a particular lake depends on the funding and human resources available. In some cases, data collected as part of a Level I or II program can point to the need for a more in-depth Level III program. This report gives the results of a Level I program for Caverhill Lake for the first year of monitoring.

The BCLSS can provide communities with both lake-specific monitoring results and educational materials on general lake protection issues. This useful information can help communities play a more active role in the protection of the lake resource. Finally, this program allows government to use its limited resources efficiently with the help of local volunteers and BCLSS. Thanks to the efforts of 3 dedicated volunteers at Caverhill Lake, frequent water clarity (Secchi disk) and temperature readings were taken from the lake beginning in May and continuing until mid October for 2004 and 2005.

A **watershed** is defined as the entire area of land that moves the water it receives into a common waterbody. The term watershed is misused when describing only the land immediately around a waterbody or the waterbody itself. The true definition represents a much larger area than most people normally consider.

Watersheds are where much of the hydrologic cycle occurs and play a crucial role in the purification of water. Although no "new" water is ever made, it is continuously recycled as it moves through watersheds and other hydrologic compartments. The quality of the water resource is largely determined by a watershed's capacity to buffer impacts and absorb pollution.

Every component of a watershed (vegetation, soil, wildlife, etc.) has an important function in maintaining good water quality and a healthy aquatic environment. It is a common misconception that detrimental land use practices will not impact water quality if they are kept away from the area immediately surrounding a waterbody. Poor land use practices in a watershed can eventually impact the water quality of the downstream environment.

Caverhill Lake is located approximately 103 km northwest of Kamloops. The lake has a surface area of 542.1 ha and lies at an elevation of 1397 m. The average depth of Caverhill Lake is 14 m, while the deepest spot is 40.2 m. The lake contains kokanee and rainbow trout. Other than an old trappers cabin at north end, the only development on the lake is the Caverhill Lake Lodge. There is a public boat launch and dock on the lake. Cattle grazing & logging activities do occur in the watershed.

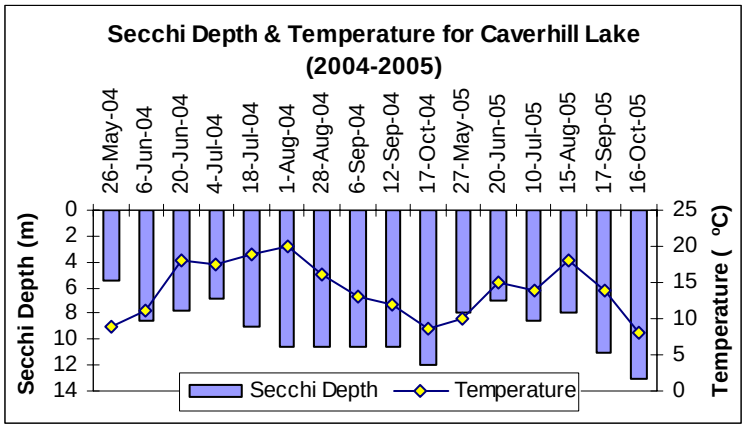
What's Going on Inside Caverhill Lake?

Temperature

Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes, such as Caverhill Lake, form layers (stratify), with the coldest water at the bottom. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these lakes usually mix from top to bottom (overturn) as wind energy overcomes the reduced temperature and density differences between surface and bottom waters. In the winter, lakes re-stratify under ice with the densest water (4°C) near the bottom. These lakes are called dimictic lakes because they turn over twice per year. They are the most common type of lake in British Columbia.

Coastal lakes in BC are more often termed warm monomictic lakes because they turn over once per year. These lakes have temperatures that do not fall below 4°C. Warm monomictic lakes generally do not freeze and circulate freely in the winter at or above 4°C, and stratify only in the summer.

Ice-on and ice-off dates for BC lakes are important data for climate change research. Local residents report that Caverhill Lake freezes every year. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes.



Surface temperature readings serve as an important indicator of the effects of climate change. By measuring surface temperature, we can record and compare readings from season to season and year to year. Surface temperature also helps to determine much of the seasonal oxygen, phosphorus, and algal conditions.

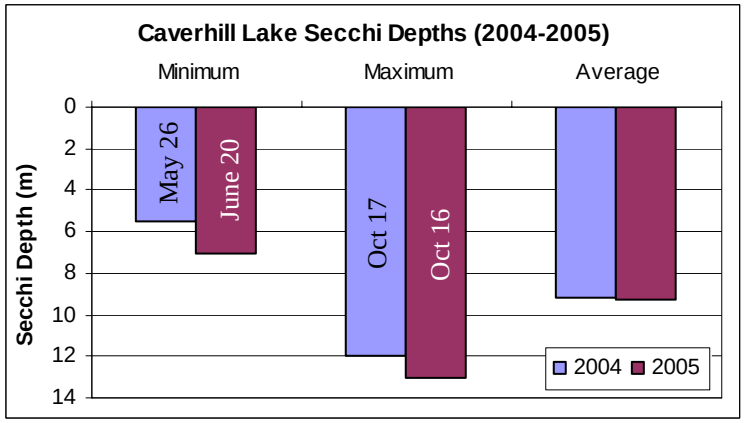
Temperature and Secchi depth were measured at one location on Caverhill Lake. The graph above illustrates the Caverhill Lake Secchi depth and temperature for 2004 and 2005. The maximum surface temperature was 20.0°C (August 1, 2004) and the minimum surface temperature was 8.5°C (October 16, 2005).

Trophic Status and Water Clarity

The term *trophic status* is used to describe a lake's level of productivity and depends on the amount of nutrients available for plant growth, including tiny floating algae called phytoplankton. Phytoplankton are important to the overall ecology of the lake because they are food for zooplankton, which in turn are food for other organisms, including fish. In most lakes, phosphorus is the nutrient in shortest supply and thus acts to limit the production of aquatic life. When in excess, phosphorus accelerates growth and may artificially age a lake. Total phosphorus (TP) in a lake can be greatly influenced by human activities.

One measure of productivity is water clarity. The more productive a lake, the higher the algal growth and, therefore, the less clear the water becomes. The clarity of the water can be evaluated by using a Secchi disk, a black and white disk that measures the depth of light penetration.

Natural variation and trends in Secchi depth and temperature not only occur between years, but also throughout one season. In general, as the temperature of the lake increases, so do some species of phytoplankton. Due to the increase in phytoplankton, the water clarity decreases. This trend is apparent in the above graph for early summer readings in both 2004 and 2005, until approximately July. In contrast, late summer data shows temperatures continuing to increase while Secchi depths also increase. Further monitoring of the lake will provide a better interpretation of data.



The adjacent graph displays the 2004 and 2005 average summer Secchi depths. The highest Secchi readings occurred in October for both 2004 and 2005 (12 m and 13 m, respectively) and the lowest reading occurred in May 2004 (5.5 m) and June 2005 (7 m). The average Secchi readings in 2004 and 2005 for Caverhill Lake were 9.2 m and 9.25 m, respectively. Two

summers of Secchi depth data provides only a *snapshot* of water quality within a lake. In order to get an overall idea of the health of an individual lake, the Secchi disk readings should be compared consistently over a number of years.

The flushing rate is another factor that affects water quality. The flushing rate is the rate of water replacement in a lake. The flushing rate depends on the amount of inflow and outflow of a lake. The higher the flushing rate, the more quickly excess nutrients can be removed from the system. Flushing rate data are not available for Caverhill Lake.

Land Use and Pollution Sources

Human activities that impact water bodies range from small, widespread and numerous *non-point* sources throughout the watershed to large *point* sources of concentrated pollution (e.g. outfalls, spills, etc.). Undisturbed watersheds have the ability to purify water and repair small amounts of damage from pollution and alteration. However, modifications to the landscape and increased levels of pollution impair this ability.

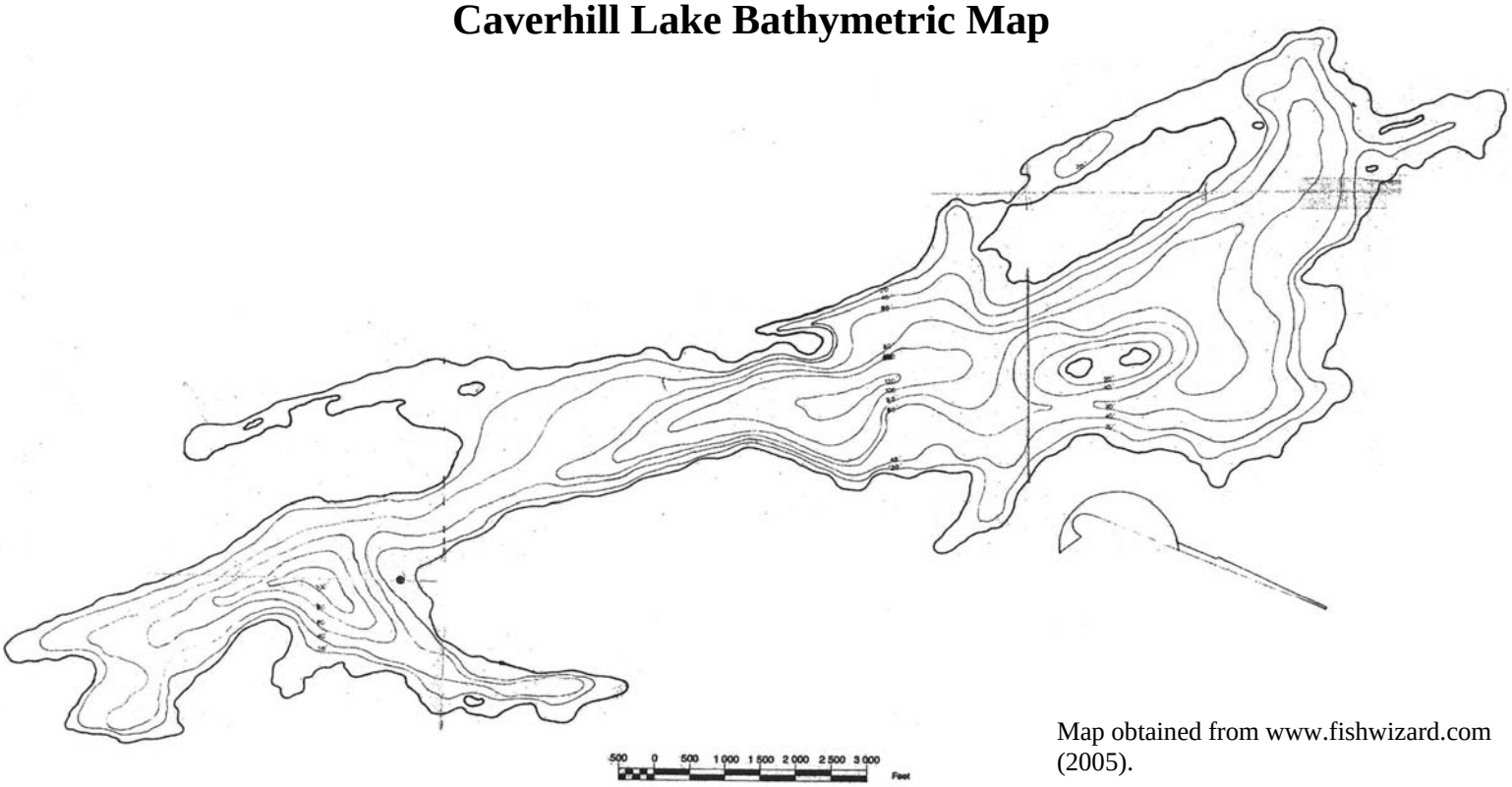
The Ministry of Environment believes the area immediately surrounding Caverhill Lake is likely to have the most influence on the lake's water quality. At this time, there are no obvious land use impacts on water quality in this area, however, a detailed survey has not been conducted. Lake users are encouraged to follow good environmental practices. Further information can be found on the following page.

Should Further Monitoring be Done on Caverhill Lake?

The Ministry of Environment recommends a minimum of three years of monitoring to establish a water quality baseline. This time frame is preferred because if data is collected for only one or two years, there is the risk of only sampling during atypical weather or other environmental conditions that would not reflect the true nature of the water. In other words, three years of data helps take into account annual changes in local climate. Therefore, three years of consistently collected data is beneficial.

Local volunteer monitors are encouraged to record ice-on and ice-off dates for long term climate change records. This information is important for climate change research. If these dates have been recorded in the past, please send the information to BCLSS so that it can be incorporated into climate change studies..

Caverhill Lake Bathymetric Map



Map obtained from www.fishwizard.com (2005).

Tips to Keep Caverhill Lake Healthy

Camping & Recreation

- Ensure black and grey water are contained and disposed of at a sanitation station.
- When washing yourself or your dishes, dip water out of the lake, using a clean container, and move 30 m away.
- Dispose of used water by throwing it over a large area, away from your site, the sites of others, or flowing or standing water.
- Use phosphate-free, biodegradable soaps.
- If you pack it in - pack it out. Remove all garbage, including biodegradable scraps.
- Ensure all vehicles are well maintained and tuned to prevent fuel leaks.

Agriculture

- Locate confined animal facilities away from waterbodies. Divert incoming water and treat outgoing effluent from these facilities.
- Limit the use of fertilizers and pesticides.
- Construct adequate manure storage facilities.
- Do not spread manure during wet weather, on frozen ground, in low-lying areas prone to flooding, within 3 m of ditches, 5 m of streams, 30 m of wells or on land where runoff is likely to occur.
- Install barrier fencing to prevent livestock from grazing on streambanks.
- If livestock cross streams, provide gravelled or hardened access points.
- Provide alternate watering systems, such as troughs, dugouts, or nose pumps for livestock.
- Maintain or create a buffer zone of vegetation along a streambank, river or lakeshore and avoid planting crops right up to the edge of a Waterbody.

Boating

- Do not throw trash overboard or use lakes or other water bodies as toilets.
- Use biodegradable, phosphate-free cleaners instead of harmful chemicals
- Conduct major maintenance chores on land.
- Keep motors well maintained and tuned to prevent fuel and lubricant leaks.
- Use absorbent bilge pads for minor leaks or spills.
- Recycle used lubricating oil and left over paints.
- Check for and remove all aquatic plant fragments from boats and trailers before entering or leaving a lake.
- Do not use metal drums in dock construction. They rust, sink and become unwanted debris. Use Styro foam or washed plastic barrel floats. All floats should be labelled with the owner's name, phone number and confirmation that barrels have been properly maintained.
- Fuel boats on shore rather than on the water.

Who to Contact for More Information

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Photo Credit:

Caverhill Lake Lodge (www.CaverhillLodge.com)