

BC Lake Stewardship and Monitoring Program

Heffley Lake 2005

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



The Importance of Heffley 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 Heffley 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.

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.



Heffley Lake is located approximately 44 km northeast of Kamloops, towards Sun Peaks Resort in the Thompson-Nicola region of BC. Heffley Lake was named after Adam Heffley, a local rancher who was a partner in the camel pack train business at the time of the Cariboo gold rush. The lake has a surface area of 222.1 ha and lies at an elevation of 944 m. The average depth of Heffley Lake is 11 m and the maximum depth is 23.5 m. The lake contains rainbow trout, which are stocked annually.

Heffley Lake has a high quality rainbow trout fishery, and is a popular recreational lake, likely due to its proximity to both Kamloops and Sun Peaks. It has been reported that the fish size is increasing over the past couple of years. There are approximately 100 residences on the north shoreline of Heffley Lake and about one third of those are year round residents. There are two fishing resorts at the east end of the lake in addition to a campsite and public access day use area. The south shore of Heffley Lake is undeveloped crown land. The lake is damned for irrigation purposes and the water level can fluctuate by up to a couple of metres.

What's Going on Inside Heffley Lake?

Temperature

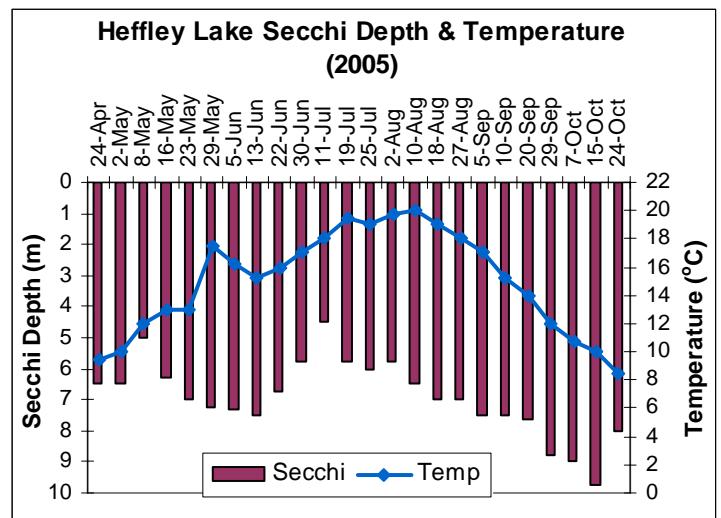
Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes, such as Heffley Lake, form layers (stratify), with the coldest water at the bottom. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In 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 Heffley Lake freezes every year. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes. There are historic ice-on and ice-off dates for Heffley Lake, dating back to 1973. In analyzing these dates, it shows that the ice-on date usually occurs in early December and ice-off is usually in mid-April. Preliminary analysis also suggests that the duration of ice cover is decreasing for Heffley Lake.

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 Heffley Lake. The graph above illustrates the Heffley Lake Secchi depth and temperature for 2005. The maximum surface temperature was 19.75 °C (August 2nd) and the minimum surface temperature was 8.5 °C (October 24th).

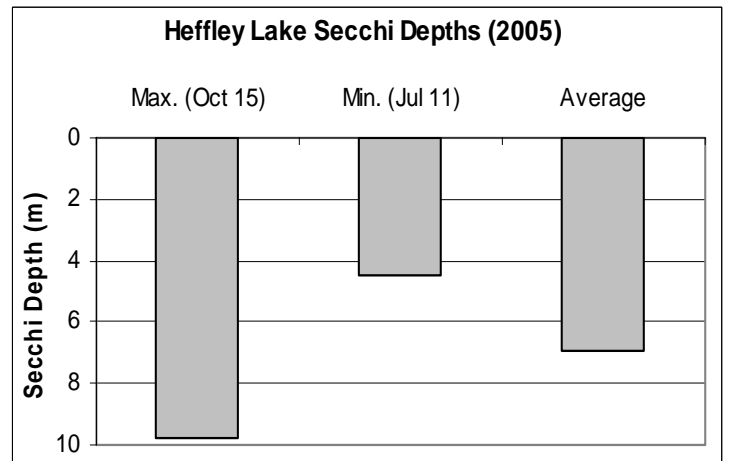


Trophic Status and Water Clarity

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. Algae 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. A common occurrence for many lakes is that as temperature increases during the summer months, the Secchi depth decreases. As the temperature of the lake increases, so do some species of algae. Due to an increase in algae abundance, the water clarity can decrease. This can be seen in the data for Heffley Lake with decreasing Secchi depth to a minimum on July 11th and then increasing Secchi depth through the fall. Further monitoring of the lake will provide a better interpretation of data.



The lower graph illustrates that the highest Secchi reading occurred in October (9.75 m) and the lowest reading occurred in

July (4.5 m). The average Secchi reading for Heffley Lake was 6.94 m. A single summer of Secchi depth 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. The dam on Heffley Lake has likely influenced the flushing rate, although detailed flushing rate information is not available at this time.

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.

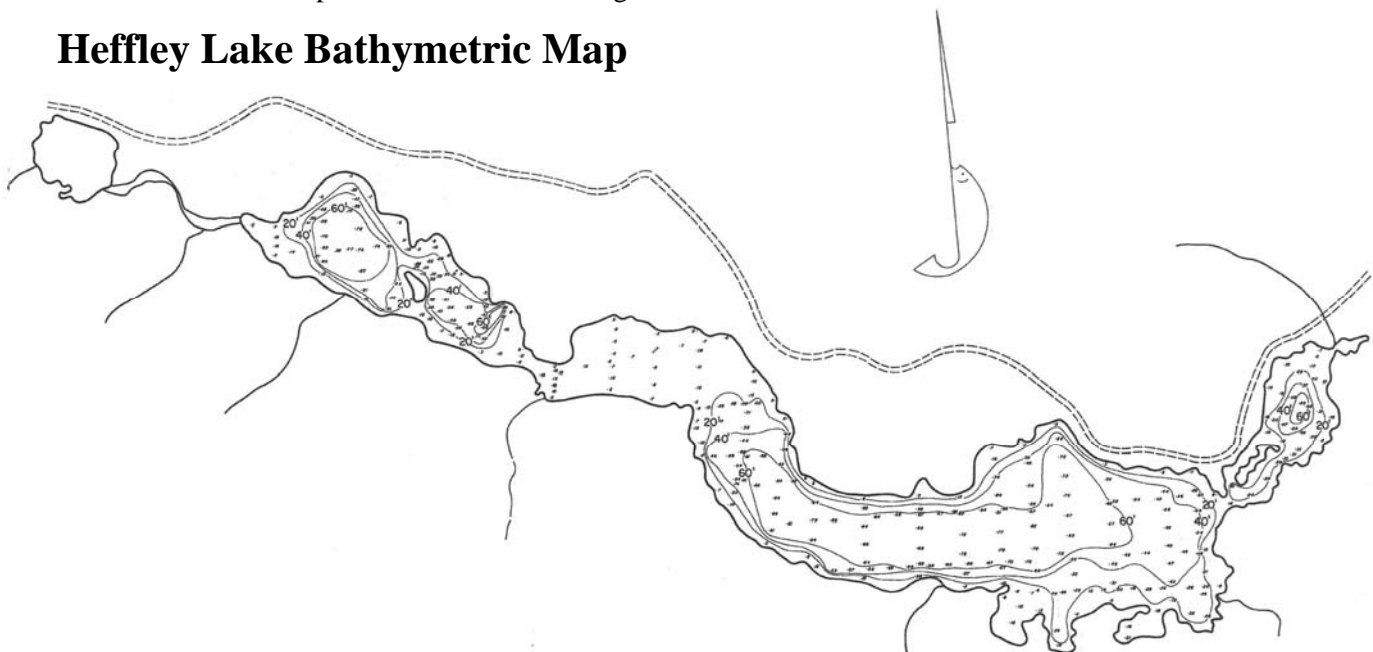
The Ministry of Environment believes the area immediately surrounding Heffley Lake is likely to have the most influence on the lake's water quality. There are activities in the upper watershed area that could have an impact on Heffley Lake, such as logging, livestock grazing and recreation. Flourometric studies conducted by Ministry of Environment found no indication of effluent flows into Heffley Lake from lakeshore systems at this time. To ensure that effluent does not flow into Heffley Lake, local residents are encouraged to ensure their septic systems are up to standard and that their land use activities are following good environmental practices. Further information can be found on the following page.

Should Further Monitoring be Done on Heffley 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. In consultation with the Heffley Lake Community Association, the Ministry of Environment is increasing the level of monitoring for Heffley Lake to a Level 2 commencing in spring of 2006.

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..

Heffley Lake Bathymetric Map



Map obtained from Fish Wizard (www.fishwizard.com)

Tips to Keep Heffley Lake Healthy

Onsite Sewage Systems

- Inspect your system yearly, and have the septic tank pumped every 2 to 5 years by a septic service company. Regular pumping is cheaper than having to rebuild a drain-field.
- Use phosphate-free soaps and detergents.
- Do not put toxic chemicals (paints, varnishes, thinners, waste oils, photographic solutions, or pesticides) down the drain because they can kill the bacteria at work in your onsite sewage system and can contaminate water-bodies.
- Conserve water: run the washing machine and dishwasher only when full and use only low-flow shower-heads and toilets.

Yard Maintenance, Landscaping and Gardening

- Minimize the disturbance of shoreline areas by maintaining natural vegetation cover.
- Minimize high-maintenance grassed areas.
- Replant lakeside grassed areas with native vegetation. Do not import fine fill.
- Use paving stones instead of pavement.
- Stop or limit the use of fertilizers and pesticides.
- Do not use fertilizers in areas where the potential for water contamination is high, such as sandy soils, steep slopes, or compacted soils.
- Do not apply fertilizers or pesticides before or during rain due to the likelihood of runoff.
- Hand pull weeds rather than using herbicides.
- Use natural insecticides such as diatomaceous earth. Prune infested vegetation and use natural predators to keep pests in check. Pesticides can kill beneficial and desirable insects, such as ladybugs, as well as pests.
- Compost yard and kitchen waste and use it to boost your garden's health as an alternative to chemical fertilizers.

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 Styrofoam 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

Who to Contact for More Information

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