



BC Lake Stewardship and Monitoring Program

Gun Lake 2005 - 2008

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



The Importance of Gun 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 (MoE), 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 2005 - 2007 results of a Level I program for Gun Lake.

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 4 dedicated volunteers at Gun Lake, frequent water clarity (Secchi disc) readings were taken from the lake beginning in July and continuing until late September, from 1999 to 2005. Volunteers began monitoring surface temperature late in the summer of 2004 and throughout 2005, 2006 and 2007.

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.

Gun Lake was first used in the 1930's for recreation by residents of the nearby gold mining towns of Pioneer and Bralorne. The mining companies horse logged the area surrounding the lake fairly extensively to provide timber for the mines. Some of the long time residents recall the practice of sinking garbage in the middle of the lake during these early days. While this may be somewhat unsettling, it does serve as a nice example of what a long way we've come since then.

Gun Lake (also known as Big Gun Lake) is located approximately 100 km west of Lillooet on the eastern side of the Coast Mountains. The lake has a surface area of 535 ha, perimeter of 15.4 km and lies at an elevation of 883 m. The average depth of Gun Lake is 49.4 m, while the deepest spot is 103 m. The lake contains bull trout, dolly varden, kokanee, rainbow trout and reidside shiner. In the past five years, the lake has been stocked with rainbow trout every year. The lake has limited recreational development. There are approximately 260 residentially zoned properties, 3 commercially zoned properties and 30 year round residents. There has also been some recent



What's Going on Inside Gun Lake?

Temperature

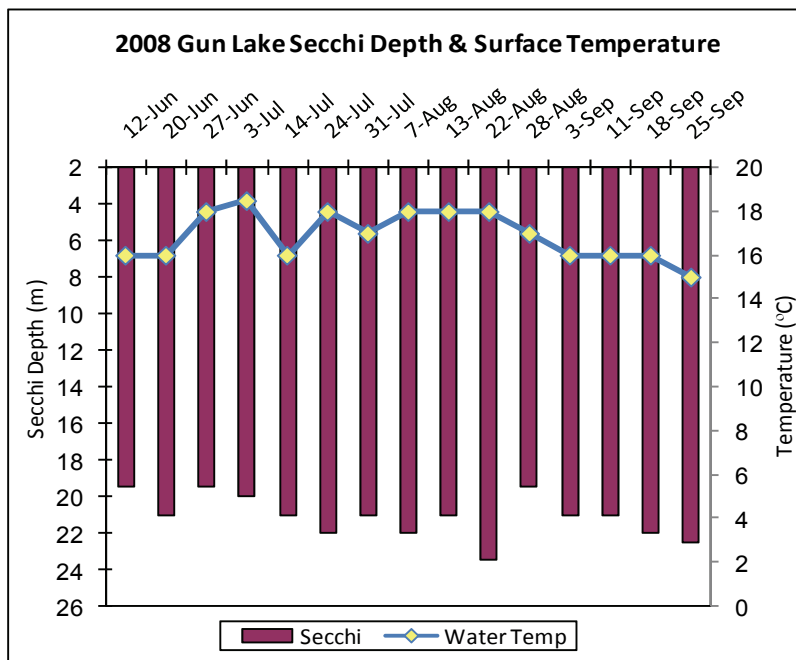
Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes, such as Gun Lake, form layers (stratify), with the coldest water at the bottom. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In spring 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. Gun Lake is a dimictic lake.

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. Since 2004, local residents have been reporting the date(s) that Gun Lake freezes each year to the BCLSS. 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 Gun Lake. The adjacent graph illustrates the Gun Lake Secchi depth and temperature for 2008. The maximum surface temperature was 18.5°C (July 3rd) and the minimum surface temperature was 15.0°C (September 25th).



Trophic Status and Water Clarity

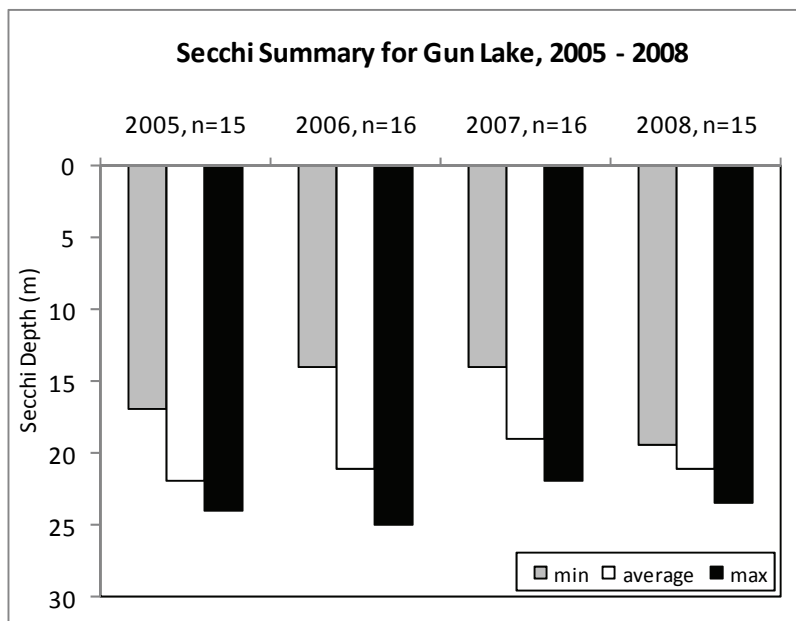
The term *trophic status* is used to describe a lake's level of productivity and depends on the amount of nutrients available for plant growth, including tiny floating algae called phytoplankton. Algae are important to the overall ecology of the lake because they are food for zooplankton, which in turn 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.

Phosphorous sampling was conducted on Gun Lake in the early 1990's and again in 2001 & 2002. The average TP value for Gun Lake is 0.325 ug/L indicating a low productivity, or oligotrophic, lake.

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. The above graph illustrates that the highest Secchi reading for 2007 occurred on August 22nd (23.5 m) and the lowest reading occurred on June 12th, June 22nd, and August 28th (19.5 m). The average summer Secchi reading for Gun Lake in 2007 was 21.1 m, well above the 5 m level for oligotrophic lakes.

Gun Lake has been participating in the annual Secchi Dip-In



(originally called the Great North American Secchi Disc Dip-In) since 1999 and has consistently had readings that are among the deepest Secchi depths. The lower graph on the previous page shows the average annual summer Secchi depths for 2005 - 2008. Secchi data exists for years prior to 2005, however less than the minimum of twelve readings were taken in those years, so that data has not been included here. The shallowest average summer Secchi reading was 19.1 m (2007), the deepest average reading was in 2005 (22.0 m) and the average for all years is 20.8 m.

The flushing rate, a measure of time that inflow replaces the lake water volume, is another factor that affects water quality. It is important because the longer the retention time, the less the lake has the ability to assimilate additional nutrients, and is more likely to avoid unnatural eutrophication. Based on limited data the flushing rate of Gun Lake is estimated to be 52.4 years. This long flushing rate indicates that Gun Lake has a low ability to assimilate nutrients, and therefore may be more sensitive to human impact. The longer the flushing rate, the less quickly excess nutrients can be removed from the system.

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 Gun Lake is likely to have the most influence on the lake's water quality. The main concerns identified by Ministry staff are the potential impacts from logging activities and septic system failures (due to highly permeable soils in the area that may not provide much treatment for septic effluent). Local residents are encouraged to ensure their septic systems are up to standard and that their land use activities follow good environmental practices. Further information can be found on the following page.

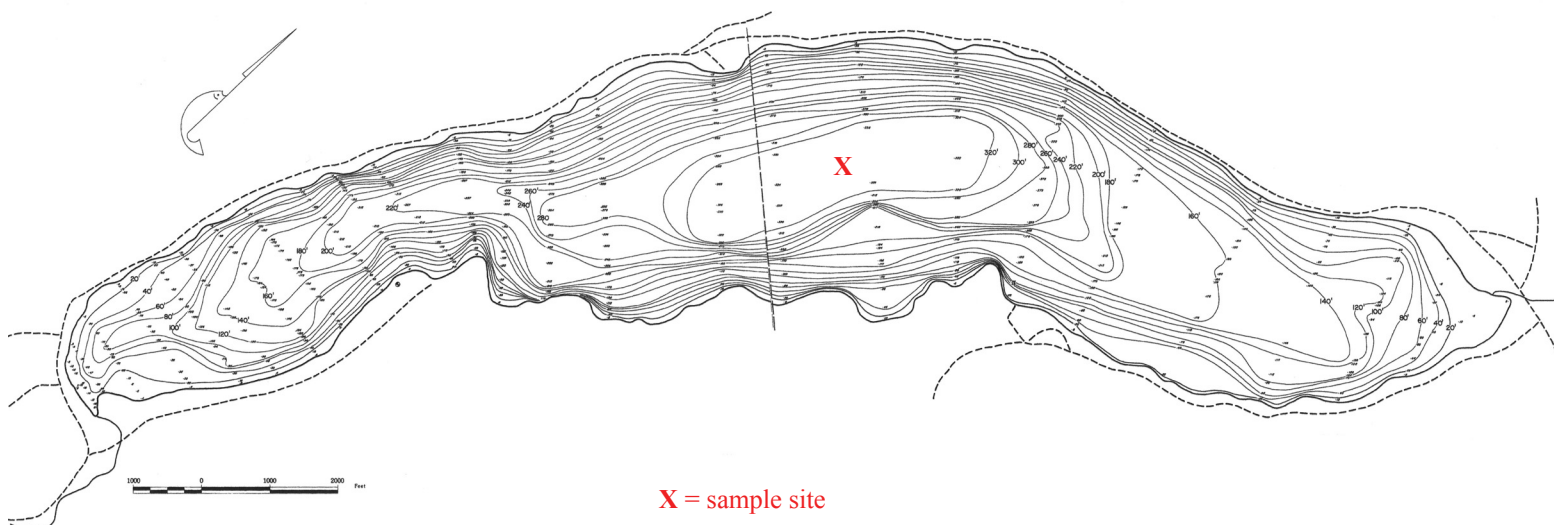
Should Further Monitoring Be Done on Gun Lake?

The data collected on Gun Lake from 2005 to 2008 indicates that the water quality has remained stable over the sampling years. Secchi readings over the four sampling years and phosphorus data collected in the early '90s and in 2001 & 2002 give the lake an oligotrophic classification. Local volunteer monitors are continuing to monitor Secchi depth and surface temperature which will provide valuable long term records and help identify early warning signs should there be a deterioration in water quality. Additionally, BC MoE will begin a three-year overturn water chemistry sampling program (level 2) in 2009 to confirm the trophic status of Gun Lake.

Local volunteer monitors are encouraged to continue recording ice-on and ice-off dates for long term climate change records. If these dates have been records prior to 2004, please send the information to the BCLSS office so that it can be incorporated into climate change studies.

All residents and land developers within the watershed are advised to continue to practice good land use management techniques so that nutrient or sediment addition to the lake and its tributaries is minimized.

Gun Lake Bathymetric Map



Tips to Keep Gun 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

Ministry of Environment

1259 Dalhousie Drive
Kamloops, BC V2C 5Z5
Phone: 250.371.6200
Fax: 250.828.4000

Gun Lake Ratepayers Association:

Contact: Irene Calbick
(winter) (summer)
7521 Waverly Ave. General Delivery
Burnaby, BC V5J 4A9 Gold Bridge, BC V0K 1P0

The BC Lake Stewardship Society

203 - 1889 Springfield Road
Kelowna, BC V1Y 5V5

Phone: 250.717.1212
Toll Free: 1.877.BC LAKES
Fax: 250.717.1226

Email: info@bclss.org
Website: www.bclss.org

Acknowledgements

Volunteer Monitoring by:

Irene Calbick, Budd McStay, John Rose & Terry Thiessen

Data Compiled by:

Kristi Carter (BC Lake Stewardship Society)

Brochure Produced by:

Kristi Carter
BC Lake Stewardship Society

Technical Review by:

Marge Sidney (MoE)

Photo Credit:

Irene Calbick

Bathymetric Map:

Fish Wizard (www.fishwizard.com)