BC Lake Stewardship and Monitoring Program

Slocan Lake 2007 - 2010

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

BRITISH COLUMBIA
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The Importance of Slocan 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 2007 - 2010 results of a Level I program for Slocan 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 the 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.

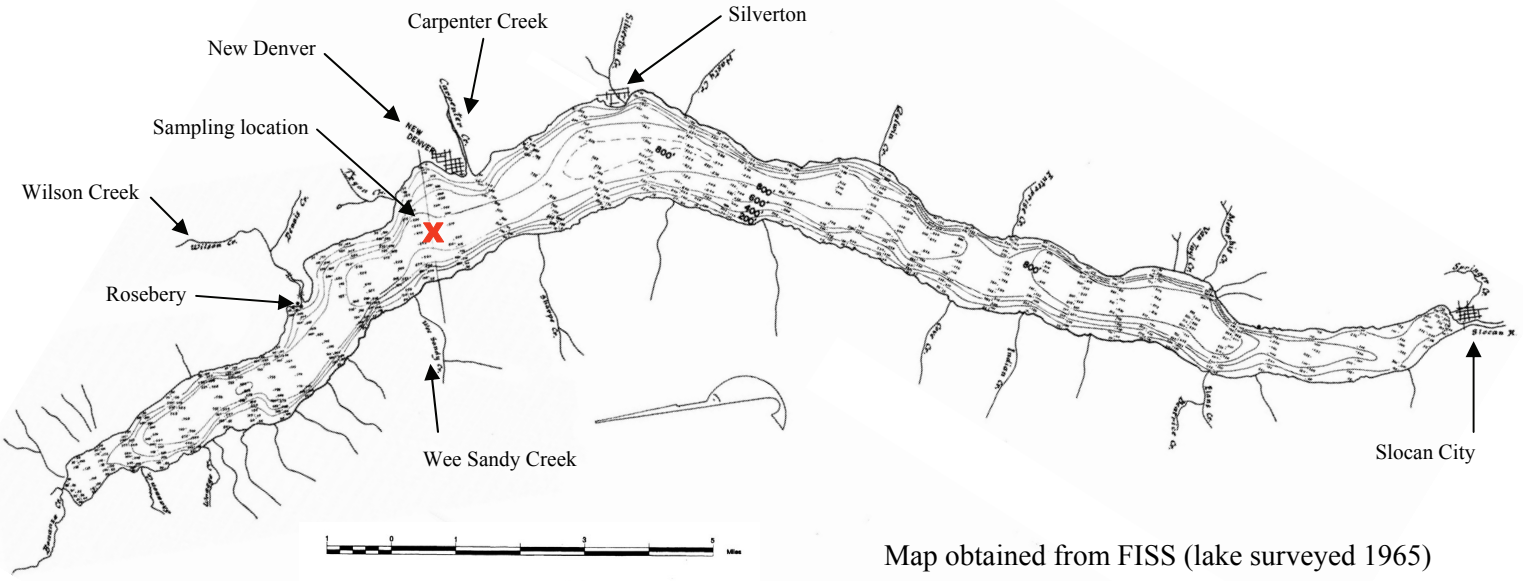
Every component of a watershed (vegetation, soil, wildlife, etc.) has an important function in maintaining good water quality and a healthy aquatic environment. It is a common misconception that detrimental land use practices will not impact water quality if they are kept away from the area immediately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

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

Slocan Lake has a surface area of 69.29 km^2, a perimeter of 84.1 km and lies at an elevation of 535 m. The average depth of the lake is 171 m, while the deepest spot is 298 m (from Slocan Lake bathymetric map accessed on FISS, 2010). The east side of the lake is bordered by Hwy 6, while the west side of the lake is bordered by Valhalla Provincial Park. There are many relatively small streams that flow into Slocan Lake, with the main inflow being Wilson Creek, north of New Denver at Rosebury (Roulston 2010, Pers. Comm.). The Slocan River flows out of the south end of Slocan Lake at Slocan City before flowing into the Kootenay River and eventually entering the Columbia River system.

Brook trout, bull trout, cutthroat trout, dace, burbot, kokanee, lake chub, largescale sucker, mountain whitefish, northern pikeminnow (formerly n. squawfish), peamouth chub, rainbow trout, redside shiner, sculpin (general), westslope (Yellowstone) cutthroat trout and white sturgeon are present in Slocan Lake. Slocan Lake has been stocked periodically since 1911 with several species of fish, including cutthroat trout, rainbow trout and kokanee, however the lake has not been stocked since 2002. (FISS, 2010)

Slocan Lake Bathymetric Map



Map obtained from FISS (lake surveyed 1965)

What's Going on Inside Slocan Lake?

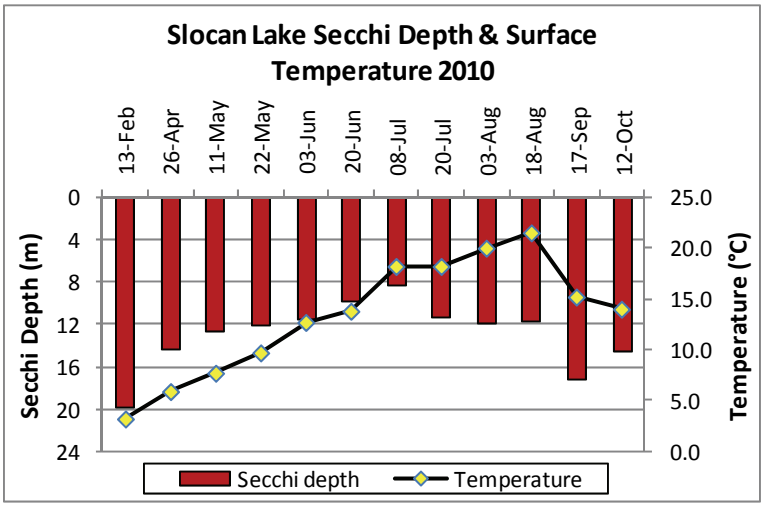
Temperature

Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes 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. Slocan Lake is classified as a warm monomictic 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. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes. Volunteers report that Slocan Lake does not freeze.

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



Temperature and Secchi depth (water clarity) were measured just north of the town of New Denver at the Deep Site, located mid way between Carpenter and Wee Sandy Creeks from 2007 to 2010. The adjacent graph illustrates the 2010 Secchi and temperature data from the New Denver site on Slocan Lake. The maximum surface temperature was 21.5°C (Aug. 18th) and the minimum surface temperature was 3.2°C (Feb. 13th). The maximum surface water temperatures measured in 2007, 2008 and 2009 were 21.0°C (Aug. 27th), 19.0°C (July 28th and Aug. 13th), and 20.8°C (Aug. 5th), respectively. Minimum surface temperatures were 5.5°C (April 23rd), 5.5°C (Feb. 16th) and 2.7°C (Feb. 21st), in 2007, 2008 and 2009, respectively.

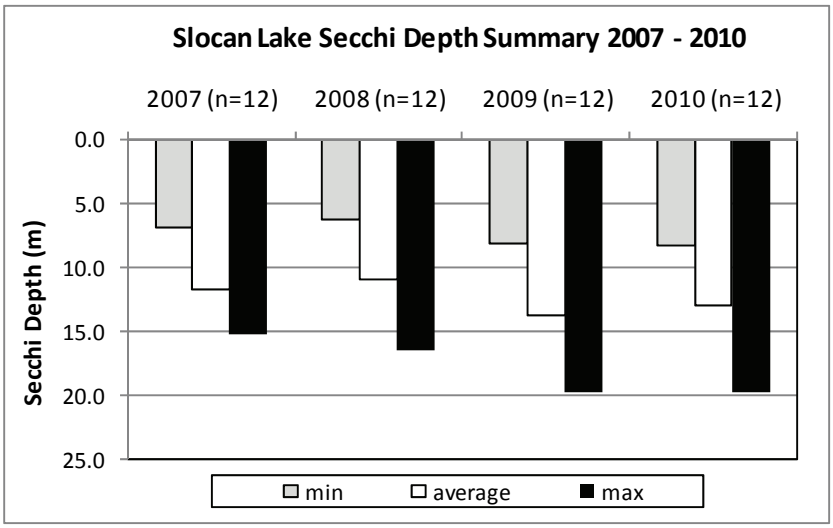
Trophic Status and Water Clarity

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.

Lakes of low productivity are referred to as ***oligotrophic***, meaning they are typically clear water lakes with low nutrient levels, sparse plant life and low fish production. Lakes of high productivity are ***eutrophic***. They have abundant plant life because of higher nutrient levels. Lakes with an intermediate productivity are called ***mesotrophic*** and generally combine the qualities of oligotrophic and eutrophic lakes.

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 disc, a 20 cm diameter black and white disc 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 temperatures increase during the summer months, Secchi depth decreases. As the temperature of the lake increases, so do some species of algae. Due to the increase in algae, the water clarity can decrease. This general trend is apparent in Slocan Lake during all the sampling years (see graph on page 2).

The graph above illustrates the minimum, average and maximum Secchi readings from 2007 to 2010 at the New Denver Deep Site, as well as the number of readings for each year (n). The maximum reading for all sampling years, 19.8 m, occurred on February 13th 2010. The lowest Secchi depth measured was 6.2 m on May 28th, 2008. The average Secchi readings for Slocan Lake were 11.7 m (2007), 10.9 m (2008) and 13.7 m (2009) and 13.0 m (2010).

Each year of data collected met the minimum data requirement of 12 evenly spaced readings from spring overturn through the fall, resulting in a representative data set. The average Secchi readings have remained stable between 2007 and 2010. Based on the graph above, Slocan Lake exhibited oligotrophic conditions throughout the entire sampling period (Nordin, 1985).

The flushing rate, another factor that affects water quality, is the rate of water replacement in a lake and 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 flushing rate for Slocan Lake is approximately 7 years, as compared to neighbouring Kootenay and Arrow lakes which are approximately 1.3 years (Hirst, 1991, as cited in Sebastian *et al.*, 2002). However, Andrusak (2006) states that 60% of the Slocan Lake's surface water is replaced during the summer months.

Some local fisherman would like to see a lake fertilization program on Slocan Lake, similar to Arrow Lakes and Kootenay Lake (Roulston 2010, Pers. Comm.), however the Slocan Lake Stewardship Society (SLSS) has indicated that a number of local residents have reservations about lake fertilization. The Ministries of Environment and Natural Resource Operations presently do not plan to move forward with a lake fertilization program until both community consensus and funding are clearly available (Burrows 2011, Pers. Comm.).

Land Use and Pollution Sources

There is relatively little development on Slocan Lake, with a small number of cottages and limited logging and mining activities. There are several small communities that exist along Slocan Lake, including Slocan City, Silverton, New Denver and Rosebery, none of which have municipal wastewater treatment facilities, but rather rely solely on septic systems. There are also two lakeside campgrounds, located in Silverton and New Denver. Until 2008, Slocan Lake was used for transporting logs from a log dump located in Rosebery, just north of New Denver, down to Slocan City at the south end of the 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. Recreational users of the lake are also encouraged to ensure their boats and equipment are properly maintained. Further information on keeping Slocan Lake healthy can be found on the following page.

Should Further Monitoring Be Done on Slocan Lake?

The data collected by BCLSS volunteers on Slocan Lake from 2007 to 2010 indicate that the water quality has remained relatively stable over the sampling years. Based on data collected at the New Denver Deep Site, Slocan Lake exhibited oligotrophic conditions. The SLSS and Galena Environmental Ltd. have also undertaken more in depth water quality and coliform sampling, including a 2008 baseline study, as well as a 2010 follow up study (Johnson 2010, Pers. Comm.). Combined, these data will provide a baseline for future comparison. All residents and land developers within the watershed are advised to continue to practice good land management.

Due to 4 years of consistent Secchi data collection, further Secchi and surface temperature monitoring is not necessary at this time. However if volunteers are willing to continue collecting Secchi and surface temperature data, it could help identify early warning signs should there be a deterioration in water quality.

Tips to Keep Slocan Lake Healthy

Yard Maintenance, Landscaping and Gardening

- Minimize the disturbance of shoreline areas by maintaining natural vegetation cover.
- Minimize high-maintenance grassed areas.
- Reduce your use of fertilizers and pesticides.
- 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.
- 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, as water contamination from runoff may occur. Use compost to fertilize gardens instead of commercial fertilizers, and hand pull weeds if necessary.

Boating and Recreation

- Do not throw trash overboard or use lakes or other water bodies as toilets.
- Use biodegradable, phosphate-free cleaners instead of harmful chemicals when cleaning your boat.
- Check for and remove all aquatic plant fragments from boats and trailers before entering or leaving a lake.
- Keep motors well maintained and tuned to prevent fuel and lubricant leaks.
- Conduct major maintenance chores on land.
- Use absorbent bilge pads to soak up minor oil and fuel leaks or spills.
- Recycle used lubricating oil and left over paints.
- Leading by example is often the best method of improving practices—help educate fellow boaters.

Onsite Sewage Systems

- Make sure that your system meets local requirements before installing, repairing, or upgrading an onsite sewage system.
- 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 drainfield.
- 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 waterbodies.
- Conserve water: run the washing machine and dishwasher only when full and use only low-flow showerheads and toilets.
- Use biodegradable household cleaners instead of bleach or other hazardous products (which will kill the good bacteria in your system).
- Don't overwater the drainfield or allow roof or perimeter drains to run onto the drainfield.
- Avoid using septic tank 'starters' or similar products. Allow bacteria to act on their own.

Who to Contact for More Information

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Bathymetric Map:
Fisheries Information Summary System (FISS)