



BC Lake Stewardship and Monitoring Program

Alpha Lake 2005 - 2007

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



The Importance of Alpha 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 BC 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 Alpha 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.

Alpha Lake is located within the boundaries of the Resort Municipality of Whistler in the Coast Mountains. The lake has a surface area of 15.18 ha, perimeter of 2.87 km and lies at an elevation of 632 m. The average depth of Alpha Lake is 4.3 m, and the deepest point is 11.6 m. The lake contains rainbow trout and kokanee. Two populations of rainbow trout inhabit the lake, the native population that spawns in Jordan Creek, and the sterile rainbow trout that are stocked in Alpha Lake annually.

Jordan Creek flows into Alpha Lake from Nita Lake. Flowing out of Alpha Lake is Millar Creek, which flows through an extensive wetland system and eventually enters the Cheakamus River. During development of the Whistler area much of Alpha Lake was filled in, reducing it to half its original size and depth by an ambitious developer who hoped to completely fill it in. It was also once used for log storage. As a result of both of these impacts, the lake bottom contains a large amount of sediment and organic debris. Today, the lake is bound along the northern edge by the CN railway. There are four houses on the lakefront and two 25 unit condominium complexes in the vicinity of Alpha Lake (Rebellato, 2005). 1

What's Going on Inside Alpha Lake?

Temperature

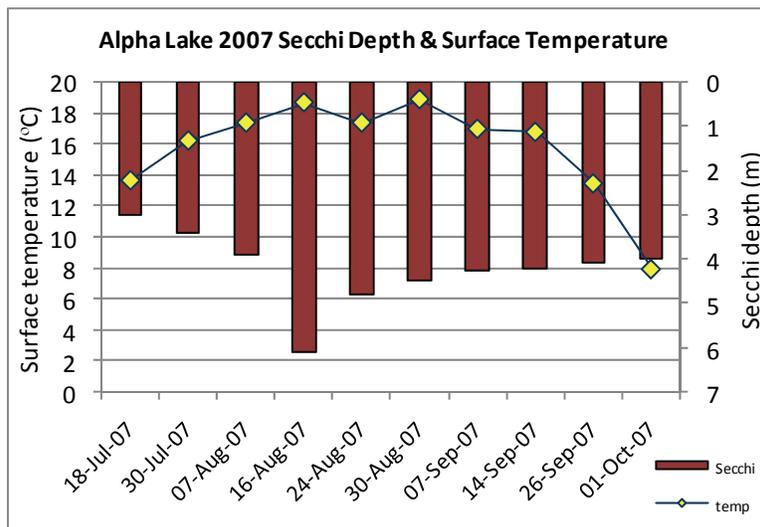
Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes form layers (stratify), with the coldest water at the bottom. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these 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. Alpha Lake is classified as 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. If possible, local residents should record and report the dates when Alpha 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 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 at the deep site on Alpha Lake from 2005 to 2007. The adjacent graph illustrates the 2007 Secchi and temperature data for Alpha Lake. The maximum surface temperature was 18.9°C (Aug 30th) and the minimum surface temperature was 8.0°C (Oct 1st). The maximum surface temperatures measured in 2005 and 2006 were 21.6°C (Aug 15th) and 21.5°C (July 23rd) respectively. Minimum surface temperatures were 15.1°C (July 7th) and 9.8°C (May 22nd) in 2005 and 2006, respectively. In 2007, BC MoE used a temperature logger to record surface temperature every three hours from July through November. The data showed that the surface temperature reached a peak of 21.76 °C on August 6th and a low of 4°C during on November 18th.



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 disk, an 8 inch diameter black and white disk that measures the depth of light penetration.

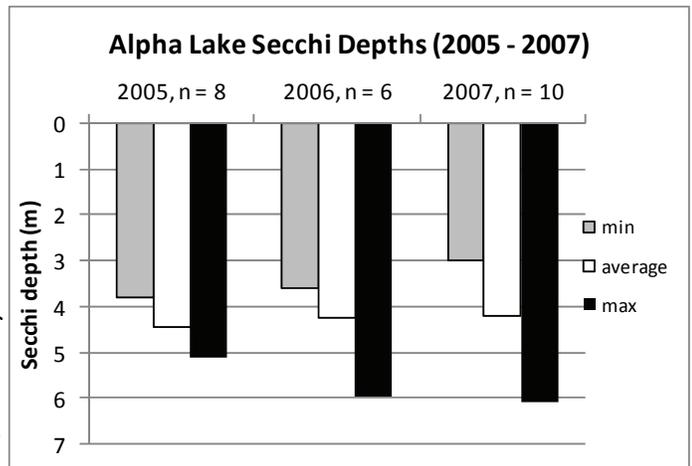
Natural variation and trends in Secchi depth and temperature not only occur between years, but also throughout one season. In general, as temperatures increase during the summer months, Secchi depth decreases. As the temperature of the lake increases, so do some species of algae. Due to the increase in algae, the water clarity can decrease. This general trend is not apparent in the 2007 data (above graph). Continued monitoring of the lake, with a minimum of 12 readings taken on a regular basis throughout the sampling season, will provide a better interpretation of data.

The graph on the following page illustrates the minimum, mean and maximum Secchi readings from 2005 to 2007, as well as the number of readings for year (n). The maximum reading for all sampling years, 6.1 m, occurred on August 16th, 2007. The lowest Secchi depth measured was 3 m on July 18th, 2007. The average Secchi readings for Alpha Lake were 4.47 m in 2005, 4.25 m in 2006, and 4.23 m in 2007. Based on these Secchi values, Alpha Lake was exhibiting mesotrophic to slightly oligotrophic conditions, however the shallow depth of the lake may make it susceptible to re-suspension of bottom sediments which may be leading to lower Secchi readings at times. Preliminary data from sampling by BC MoE indicates that total phosphorus for Alpha Lake is

in the oligotrophic range (4 - 7 µg/L).

Though Secchi depth and surface temperature measurements were taken in all three years, sampling did not start until later in the 2005 season (8 samples taken) and was conducted over a shorter time frame and with less frequently in 2006 (6 samples taken). Fewer samples over a shorter duration in 2005 and 2006 may explain the higher minimum, average and maximum values for 2007 as compared to the other sampling years. Despite this, the data shows a clear consistency in readings.

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 Alpha Lake is unknown.



Land Use and Pollution Sources

Land use activities at Alpha Lake include logging activity on private forest lands and development of lakeshore property. Concern regarding riparian and shoreline habitats have been expressed as a result of these land uses.

Local residents are encouraged to ensure that their land use activities are following good environmental practices. It is particularly important that pet owners pick up their pets' waste as this can lead to bacterial contamination of lake water. Further information on keeping Alpha Lake healthy can be found on the following page.

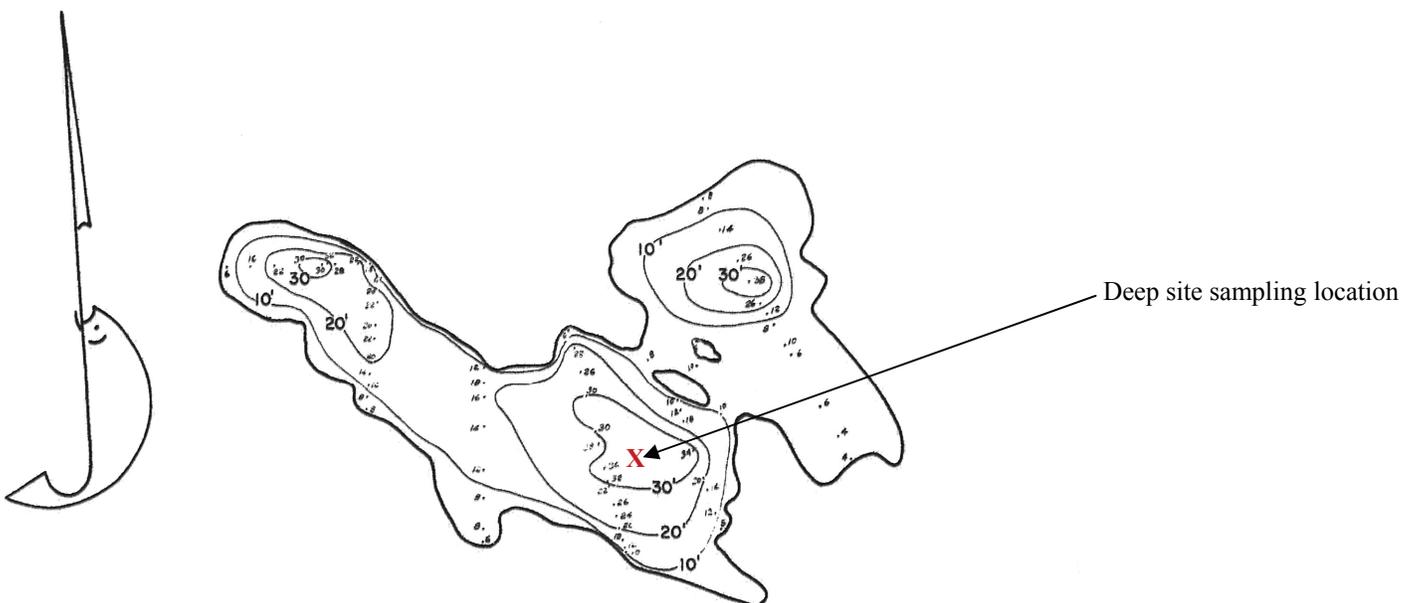
Should Further Monitoring be Done on Alpha Lake?

The data collected on Alpha Lake from 2005 to 2007 indicates that the water quality has remained relatively stable over the sampling years. Based on the three years of Secchi measurements, keeping in mind that the lake is shallow and prone to re-suspension of bottom sediments, it appears that Alpha Lake is oligotrophic. It is important that an adequate number of Secchi and surface temperature readings are collected during a sampling season. It is also important that all residents and land developers within the watershed are advised to continue to practice good land management so that nutrient migration to the lake and its tributaries are minimized.

If volunteers are willing to continue monitoring Alpha Lake, a minimum of twelve Secchi and surface temperature readings taken weekly or bi-weekly during the spring and summer are required to provide an adequate baseline for future comparison. Long-term collection of Secchi and surface temperature data could help identify early warning signs should there be a deterioration in water quality. If a declining trend in water quality is observed, monitoring for spring overturn water chemistry should be initiated.

Temperature data is also valuable for climate change studies. As well, freeze-up and break-up of ice should be recorded for climate change studies. An Ice-On/Ice-Off data form can be downloaded from the BCLSS website. The BC MoE is currently collecting water chemistry data including phosphorus, nitrogen, bacteria, and metals, in order to set site-specific Water Quality Objectives for Alpha Lake.

Alpha Lake Bathymetric Map



Tips to Keep Alpha Lake Healthy

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.
- When visiting Alpha Lake Park, be sure to use the park responsibly and pick up after your pets (as pet wastes can lead to bacterial contamination of lake waters).

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.
- 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 blue or pink closed-cell extruded polystyrene billets 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

2nd Floor - 10470 152nd Street
Surrey, BC V3R 0Y3
Phone: 604.582.5200
Fax: 604.930.7119

Resort Municipality of Whistler

4325 Blackcomb Way,
Whistler BC, V0N 1B4
Phone: 604.935.8323

The BC Lake Stewardship Society

203 - 1889 Springfield Rd.
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

References

Rebellato, B. 2005. Personal communication - written summary of four Whistler lakes sent by email. Fish and Wildlife Technician Resort, Municipality of Whistler. August 31, 2005.

FISS. 2005. Fisheries Inventory Summary System [online database]. Accessed August 30, 2005. <http://srmapps.gov.bc.ca/apps/fidq/>

Acknowledgements

Volunteer Monitoring by:

Bruce Dangerfield

Data Compiling by:

Kristi Carter

Brochure Produced by:

Kristi Carter

BC Lake Stewardship Society

Technical Review by:

Jennifer Bull (Ministry of Environment - Lower Mainland)

Photo Credit:

Resort Municipality of Whistler

Bathymetric Map:

Fish Wizard (www.fishwizard.com)