BC Lake Stewardship and Monitoring Program

White Lake 2009 - 2011

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

The Importance of White 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 2009 - 2011 results of a Level I program for White 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.

White Lake is located approximately 10 km northeast of the Trans Canada Highway from Balmoral (west of Salmon Arm). Balmoral, White Lake, Tappen, Sorrento and Salmon Arm are the communities closest to the lake. (BC Parks, 2013) The lake has a perimeter of 13.2 km and lies at an elevation of 470 m. Its surface area is 567 hectares, its maximum depth is 40.2 m, and its mean depth is 23.5 m (FISS, 2013).

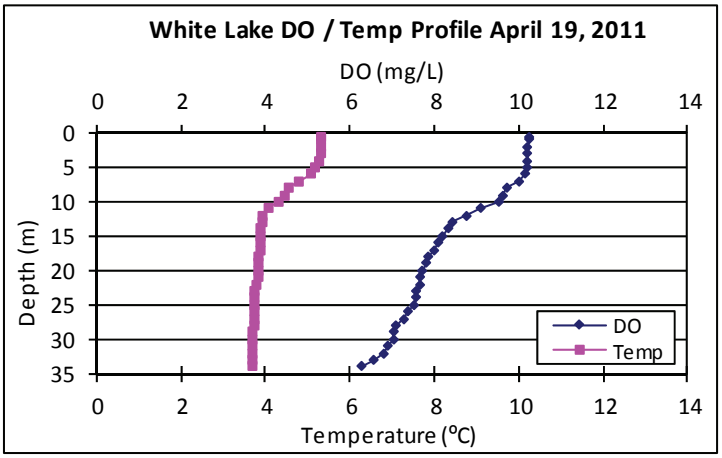
White Lake has a reputation for exceptional rainbow trout fishing and is home to the intermountain-Rocky Mountain population of the Western Painted Turtle (BC Parks, 2013). The Painted Turtle is the only native freshwater turtle in BC. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designates Painted Turtle populations as threatened (blue listed) in the interior of BC. In consideration of preserving Painted Turtle populations, please be vigilant when driving on nearby roads during the breeding season (May/June), keep pets on a leash, use the designated boat launch for lake access, camp in designated spots only, do not touch or move the turtles, and do no disturb shoreline habitat. (Frogwatch, 2013)

White Lake has two inflows and one outflow. The inflows are Cedar Creek, located at the east end of the lake, and Parri Creek, located halfway between the east and west ends of the lake on the north side. The outflow, White Creek, flows into Little White Lake at the west end of White Lake. (Turner 2013, Pers. Comm.). The lake contains kokanee, rainbow trout, longnose sucker, northern pikeminnow, largescale sucker, lake chub, peamouth chub, and goldfish (Munro, 2013). In the past 5 years the lake has been stocked with rainbow trout annually (Munro, 2013).

What's Going on Inside White Lake?

Temperature

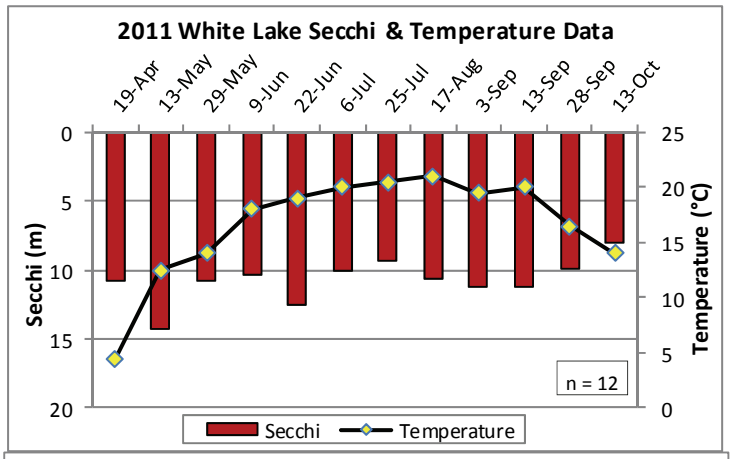
Lakes show a variety of annual temperature patterns based on their location and depth. Most interior lakes form layers (stratify), with the coldest water at the bottom. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these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



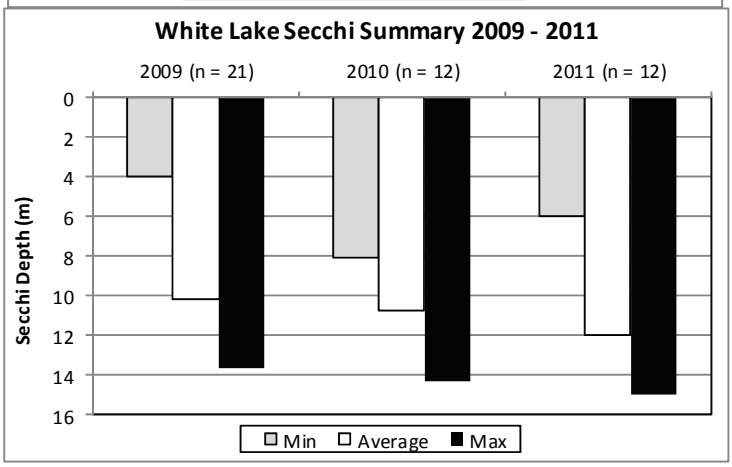
Ice-on and ice-off dates for BC lakes are important data for climate change research. By comparing these dates to climate change trends, we can examine how global warming is affecting our lakes. Volunteers have been collecting ice-on/ice-off data for White Lake, since 2009. The data shows that the lake typically freezes over in Dec or Jan and the ice comes off the lake in Mar or Apr each year.

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.

Two dissolved oxygen (DO) and temperature (T) profiles were collected at the Deep site (see p. 3 for sample site location) on White Lake on May 9/09 and Apr 19/11. The data from Apr 19/11 (depicted in the above right graph) show the lake likely did not completely mix, with DO values ranging from 10.2 mg/L (surface) to 6.3 mg/L (34 m depth) and T values ranging from 5.3°C (surface) to 3.7°C (34 m depth). The DO/T data from May 9/09 show the lake was stratified on that sample date with T data ranging from 9.3°C (surface) to 3.8°C (37m depth) and DO data ranging from 10.6 mg/L (surface) to 2.0 mg/L (37 m depth).



Temperature and Secchi depth (water clarity) were measured at the deep site on White Lake from 2009-2011. Secchi and temperature readings met or exceeded the minimum data requirements for all sampling years. The adjacent graph shows the 2011 Secchi and temperature data for White Lake, as well as the number of readings (n). The maximum surface temperature was 21.0°C (Aug 17) and the minimum surface temperature was 4.5°C (Apr 19). The maximum surface temperatures measured in 2009 & 2010 were 24.5°C (Jul 29) & 23.0°C (Jul 28), respectively. Minimum surface temperatures were 9.0°C (May 5) & 10.5°C (Nov 3) in 2009 & 2010, 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 could lead to nuisance algal blooms and decreased water clarity. 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 not apparent in the White Lake data.

The graph on the previous page shows the minimum, average and maximum Secchi readings from 2009 to 2011. The maximum reading for all sampling years was 15.0 m and occurred on Jun 9/11. The lowest Secchi depth measured over the 3 year sampling period was 4.0

m, on Nov 3/09. The average Secchi values ranged between 10.2 m (2009) and 11.9 m (2011) throughout the 3 years sampled. Based on the average summer Secchi values for 2009 - 2011, White Lake was exhibiting oligotrophic (>6 m) conditions (Nordin, 1985). Data show that White Lake has remained stable throughout the sampling years.

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 White Lake is estimated to be 20 years (Grace 2014, Pers. Comm.).

White Lake is a marl lake (Sidney 2014, Pers. Comm.). Typically marl lakes show a visible shift from dark blue/green to extreme turquoise colour during periods of warmer temperatures. Tiny particles remain suspended in the water, refracting light and causing the lake to turn a light aquamarine (lake whitening). Another quality of a marl lake is high calcium concentrations in the sediment especially in the shallower areas. These sediments are often lighter in colour due to the increased amount limestone (calcium carbonate). Since phosphate precipitates with calcium, marl lakes generally have low phosphorus levels and good water clarity.

Land Use and Pollution Sources

Land use in the White Lake watershed is predominantly agricultural, residential, and recreational (Turner, 2013). The lake is surrounded by private residences, a private campground, a fishing resort, and forested park land. A small lake called Little White Lake is located at the west end of the lake. White Lake Provincial Park is located on the northeastern and southeastern shores of White Lake and has some limited facilities for camping and boat launching, including two pit toilets, one boat launch and a picnic shelter. Due to extensive shoreline damage, boat launching is permitted at the boat launch only. The lake is popular for fly fishing and trolling in the summer and ice fishing in the winter and is one of the top three angling lakes in the province in terms of angler days (BC Parks, 2013).

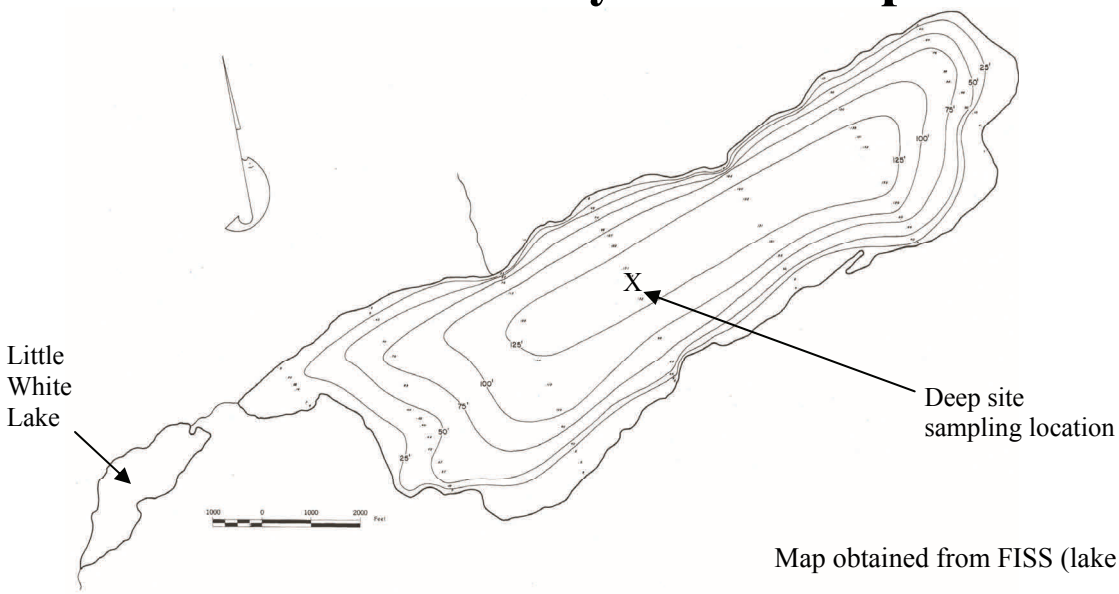
Local residents and recreational users who visit White Lake are encouraged to ensure they are following good environmental practices and that their boats and equipment are properly maintained. Further information on keeping White Lake healthy can be found on the following page.

Should Further Monitoring be Done on White Lake?

Based on average summer Secchi data, White Lake was exhibiting oligotrophic conditions throughout the sampling period. The data collected on White Lake indicate that the water quality has remained stable, therefore further monitoring is not necessary at this time. However, if volunteers are willing to continue monitoring at a Level 1 (minimum of 12 evenly spaced Secchi and surface temperature readings from ice-off through ice-on), the data would be valuable in identifying early warning signs should there be a deterioration in water quality.

Long-term collection of temperature and ice-on/ice-off data is also valuable for monitoring climate change over time. If volunteers are willing, continued collection of ice-on and -off dates will be valuable for long-term climate change studies. All residents, recreational users 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.

White Lake Bathymetric Map



Map obtained from FISS (lake surveyed 1959)

Who to Contact for More Information

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Tips to Keep White Lake Healthy

Onsite Sewage Systems (campers & RVs at campsites)

- Inspect your system yearly and have the septic tank pumped every 2-5 years by a septic service company. Regular pumping is less expensive than having to rebuild a drainage field.
- Use phosphate-free soaps and detergents.
- Be responsible and dispose of RV wastewater at designated RV dumping sites. Do not dump grey water tank at the lakeshore.
- Do not put toxic chemicals or harmful cleaners down the drain, as they can contaminate waterbodies.
- Conserve water: run the washing machine and dishwasher only when full and use only low-flow showerheads 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. If you have to use them, 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.
- Pick up after your pets, as pet waste can lead to bacterial contamination of lake water.

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 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.
- Leading by example is often the best method of improving practices - help educate fellow boaters.

Agriculture

- Locate confined animal facilities away from waterbodies and divert incoming water and treat outgoing effluent from these facilities.
- Winter feeding of cattle should be a minimum of 30 m from a watercourse and located where no direct run off to streams and lakes will occur.
- 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 and lakeshore.
- If livestock cross streams, provide graveled 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.

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Brochure Produced by:
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Photo Credits:
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