BC Lake Stewardship and Monitoring Program

Little Lac des Roches 2006-2014 & 2020-2022

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

The Importance of Little Lac des Roches & its Watershed

British Columbians want lakes to provide good water quality, aesthetics, and recreational opportunities. When these features are not apparent in recreational lakes, questions arise. People may begin to wonder if the water quality is getting worse, if the lake has been affected by land development, and what conditions will result from more development within the watershed.

The BC Lake Stewardship Society (BCLSS), in collaboration with the Ministry of Environment and Climate Change Strategy (ENV), has designed a program, entitled *The BC Lake Stewardship and Monitoring Program*, to address these concerns. With 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. Through regular status reports, the BCLSMP provides communities with recent monitoring results specific to their local lake and educational material on lake protection issues in general. This useful information can help communities play a more active role in the protection of the lake resource.

There are different levels of lake monitoring and assessment with increasing levels of complexity. More information on the levels of lake monitoring can be found on the BCLSS website Programs page. The appropriate level of monitoring for a particular lake depends on the funding, human resources available, and the specific issues being addressed. In some cases, data collected as part of a lower level program can point to the need for a more in-depth, higher level program. This report gives the 2020-2022 results of a Level I program for Little Lac des Roches and includes historical data from 2006-2014.

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.

Little Lac des Roches Watershed

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.

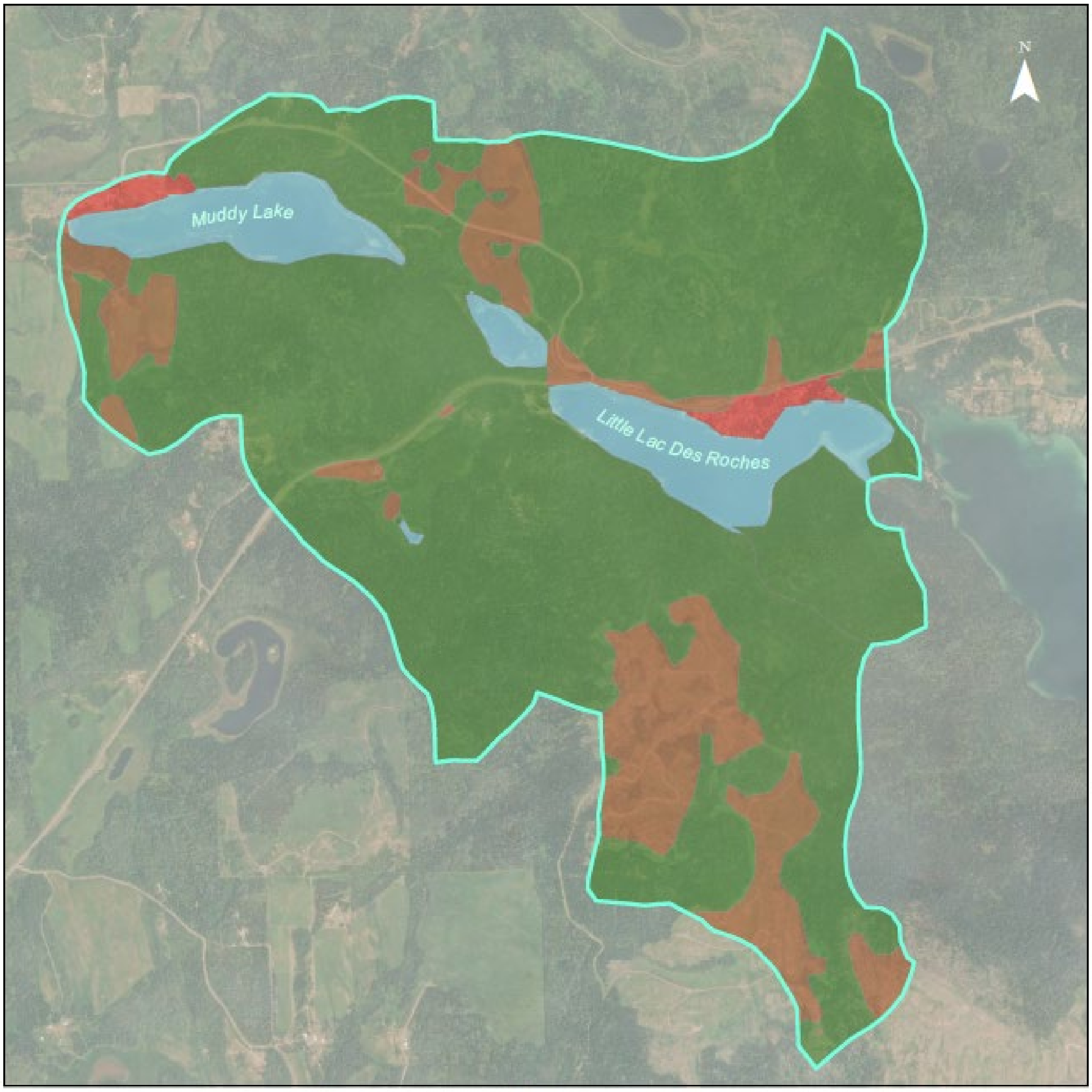
Human activities that impact water bodies range from small but widespread and numerous *non-point* sources throughout the watershed to large *point* sources of concentrated pollution (e.g., waste discharge outfalls, spills, etc.). Undisturbed watersheds have the ability to purify water and repair small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

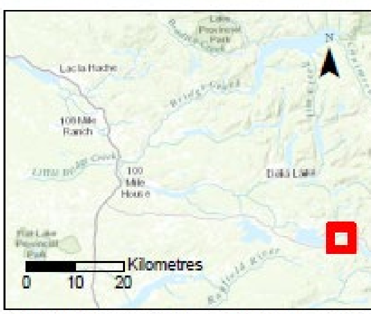
Little Lac des Roches has a perimeter of 3.7 km and lies at an elevation of 1129 m. There are limited bathymetric data on Little Lac des Roches, as its depths have never been formally surveyed. The maximum known depth is approximately 27 m (Sidney 2023, Pers. Comm.). Located 62 km southeast of 100 Mile House, Little Lac des Roches is surrounded by rolling hills and is connected to Lac des Roches through a small channel on the east end. There is a 20 km/h speed restriction on the lake. Land uses in the surrounding area include forestry, residential, and recreation. There are 14 full time residents that live along the shores of Little Lac des Roches, as well as the Lac des Roches Resort which operates year round (Atherton 2023, Pers. Comm.).

Aside from seasonal runoff, Little Lac des Roches has one small inlet from Muddy Lake, which flows mostly during snow melt and rain events, and one outlet flowing into Lac des Roches. Little Lac des Roches is fed mainly by springs. The lake has contained rainbow trout (*Oncorhynchus mykiss*), burbot (*Lota lota*), northern pikeminnow (*Ptychocheilus oregonensis*), red sided shiner (*Richardsonius balteatus*), fine scale sucker (*Catostomus catostomus*), large scale sucker (*Catostomus macrocheilus*), and peamouth chub (*Mylocheilus caurinus*) (BCLSS, 2009). The lake is stocked annually with rainbow trout (FIDQ, 2022).

The map on the following page shows the Little Lac des Roches watershed and its associated land use practices which include agriculture, range/grazing, oil and gas, forestry, recreation, and residential development. The watershed is approximately 285 km^2.

Little Lac des Roches Land Use Map





LEGEND	
8.40 km^2	Watershed Area
% of Watershed	Land Cover Type
9.4	Waterbody
0.0	Flooded Vegetation
74.8	Forested
1.5	Developed
14.3	Disturbed

BRITISH COLUMBIA

1:22,000

Kilometres
0 0.25 0.5

Map By: B.C. Ministry of Environment and Climate Change   Date Saved: 2023-04-14 12:02:25 PM   Coordinate System: NAD 1983 UTM Zone 10N Datum: Transverse Mercator
Land Cover credit: Sentinel-2 10m land cover time series of the world. Produced by Impact Observatory, Microsoft, and Esri. Orthophoto credit Esri basemaps

Non-Point Source Pollution and Little Lac des Roches

Point source pollution originates from municipal or industrial effluent outfalls. Other pollution sources exist over broader areas and may be hard to isolate as distinct effluents. These are referred to as non-point sources of pollution (NPS). Shoreline modification, urban stormwater runoff, onsite septic systems, agriculture, and forestry are common contributors to NPS pollution. One of the most detrimental effects of NPS pollution is phosphorus loading to water bodies. The amount of total phosphorus (TP) in a lake can be greatly influenced by human activities. If local soils and vegetation do not retain this phosphorus, it will enter watercourses where it will become available for algal production.

Agriculture

Agriculture including grains, livestock, and mixed farming, can alter water flow and increase sediment and chemical/bacterial/parasitic input into water bodies. Potential sources of nutrients (nitrogen & phosphorus) include chemical fertilizers and improperly situated winter feeding areas.

Forestry

Timber harvesting can include clear cutting, road building, and land disturbances, which alter water flow and potentially increase sediment and phosphorus inputs to water bodies.

Atmospheric Deposition

Gases and particulates released to the atmosphere from combustion sources such as motor vehicle emissions, slash burning, and industrial sources contain nitrogen, sulphur and metal compounds which eventually settle to the ground as dust or fall to the earth in rain and snow. These contaminants can fall directly into a waterbody, filter slowly into groundwater, or be washed into surface waters with runoff.

Onsite Septic Systems and Grey Water

Onsite septic systems effectively treat human wastewater and wash water (grey water) as long as they are properly located, designed, installed, and maintained. When these systems fail, they become significant sources of nutrients and pathogens. Poorly maintained pit privies, used for the disposal of human waste and grey water, can also be significant contributors.

Properly located and maintained septic tanks do not pose a threat to the environment, however, mismanaged or poorly located tanks can result in a health hazard and/or excessive nutrient loading to the lake. Excessive nutrients such as phosphorus can cause a variety of problems including increased plant growth and algal blooms.

Stormwater Runoff

Lawn and garden fertilizer, sediment eroded from modified shorelines or infill projects, oil and fuel leaks from vehicles, snowmobiles and boats, road salt, and litter can all be washed by rain and snowmelt from properties and streets into watercourses. Phosphorus and sediment are of greatest concern, providing nutrients and/or a rooting medium for aquatic plants and algae. Pavement prevents water infiltration to soils, collects hydrocarbon contaminants during dry weather and increases direct runoff of these contaminants to lakes during storm events.

Boating

Oil and fuel leaks are the main concerns of boat operation on small lakes. With larger boats, sewage and grey water discharges are issues. Other problems include the spread of aquatic plants and the dumping of litter. In shallow water operations, the churning up of bottom sediments and nutrients is a concern.

Little Lac des Roches Bathymetric Map

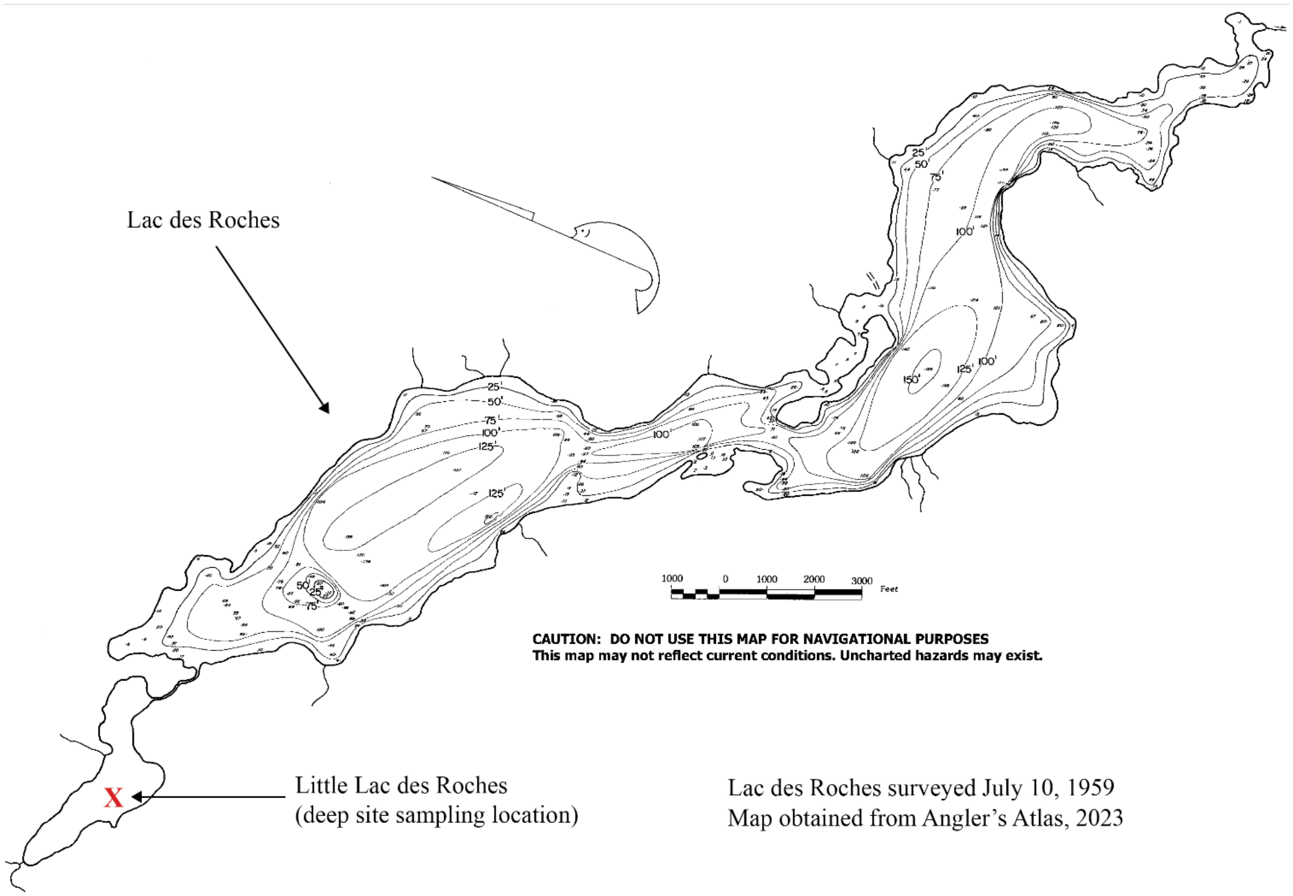


Figure 1: Lac des Roches bathymetric map (Angler's Atlas, 2023).

What's Going on Inside Little Lac des Roches

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 near the bottom. Because colder water is more dense, it resists mixing into the warmer, upper layer for much of the summer. When the warmer oxygen rich surface water distinctly separates from the cold oxygen poor water in the deeper parts of the lake, it is said to create a thermocline, a region of rapid temperature change between the two layers.

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. Because these types of lakes turn over twice per year, they are called dimictic lakes. These are the most common type of lake in BC.

Little Lac des Roches may be a meromictic lake, meaning it does not mix completely (BCLSS, 2022). More profile data is required to verify this classification.

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. Temperature stratification patterns are also very important to lake water quality. They determine much of the seasonal oxygen, phosphorus, and algal conditions. When abundant, algae can create problems for lake users.
The surface temperature summary below (**Figure 2**) shows the minimum, mean, and maximum surface temperature

readings recorded at the monitoring site in 2006-2014 and 2020-2022, as well as the number of readings each year (n).

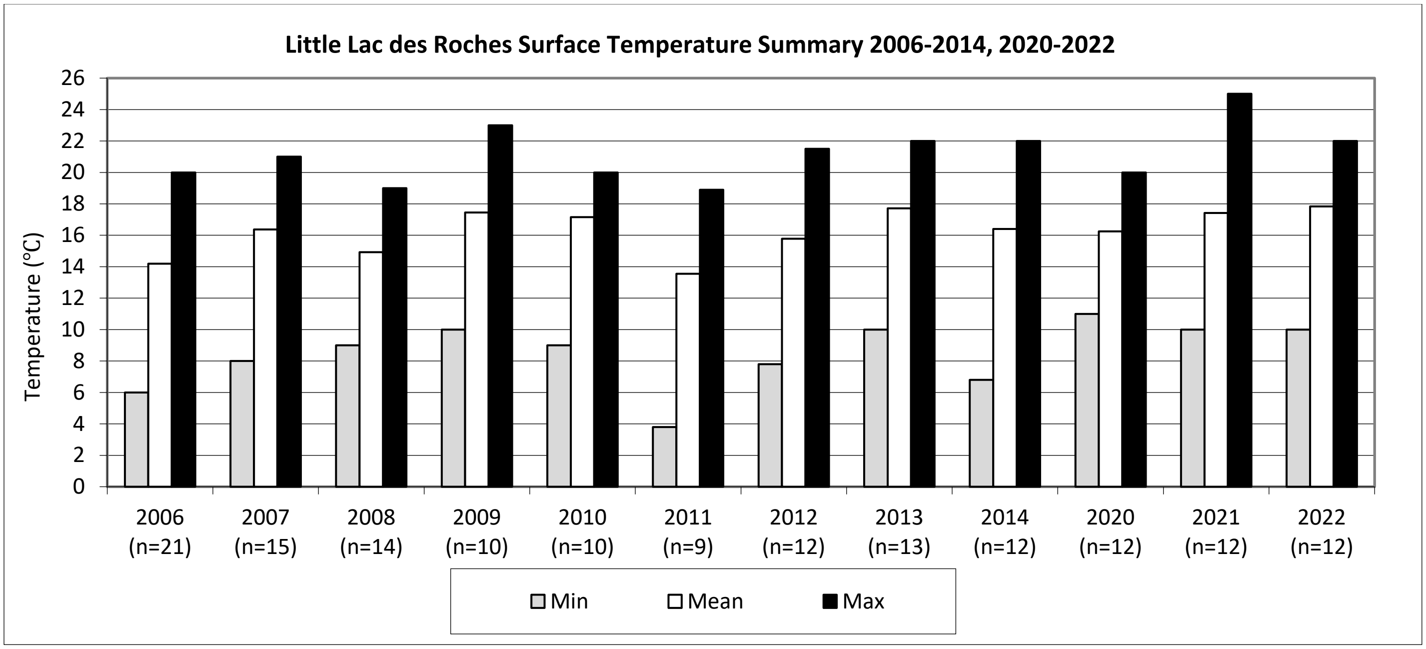


Figure 2: Little Lac des Roches Surface Temperature Summary 2006-2014 and 2020-2022.

The maximum surface temperature reading of the data collected was 25°C (Jun 30, 2021) and the minimum was 3.8°C (Nov 10, 2011). The average surface temperature reading of the data collected ranged from 13.6°C (2011) to 17.8°C (2022). The average surface temperature from 2006 to 2008 was 15.2°C and the average from 2020 to 2022 was 17.2°C. This may indicate that there is an increasing trend in water temperature. The high surface temperature reading in 2021 and the possible increasing temperature trend may have implications for fish and other aquatic life such as rainbow trout. Rainbow trout are an important species in this lake, and they have a preferred temperature range of 7°C to 18°C with an upper lethal temperature for adults of 27°C (DFO, 2020). Temperatures between 22 to 24°C are considered life threatening (DFO, 2020). It is important to study how temperature is distributed throughout the lake by taking profiles in order to better understand how their habitat may be affected by future heat wave events. **Figure 5** shows seasonal Secchi and surface temperature readings in 2022.

The timing of freeze-up and break-up of BC lakes is important information for climate change research. Little Lac des Roches volunteers collected ice data from 2005-2009. During that time, the lake froze over from the end of November to late April or early May. Ice on dates ranged from November 24, 2005, to December 15, 2008. Ice off dates ranged from April 27, 2006, to May 10, 2008.

Dissolved oxygen (DO) and temperature profiles were collected at the deep site of Little Lac des Roches on May 9, 2012, May 13, 2013, and May 7, 2014.

For 2012, the surface temperature was 8 degrees, for 2013 it was 14 degrees, and in 2014 it was about 7 degrees.
It appears that the basin had complete mixing down to about 6 metres in 2012, 5 metres in 2013, and 3 metres in 2014 with very limited mixing below these depths as evidenced by low dissolved oxygen below 5 metres.

The dissolved oxygen and temperature profiles are shown in **figures 3a, 3b, and 3c**.

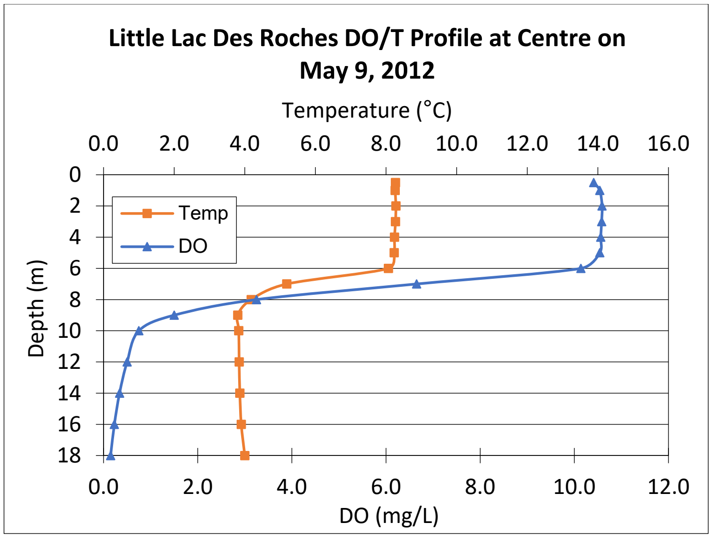


Figure 3a: Little Lac des Roches temperature and dissolved oxygen profile 2012.

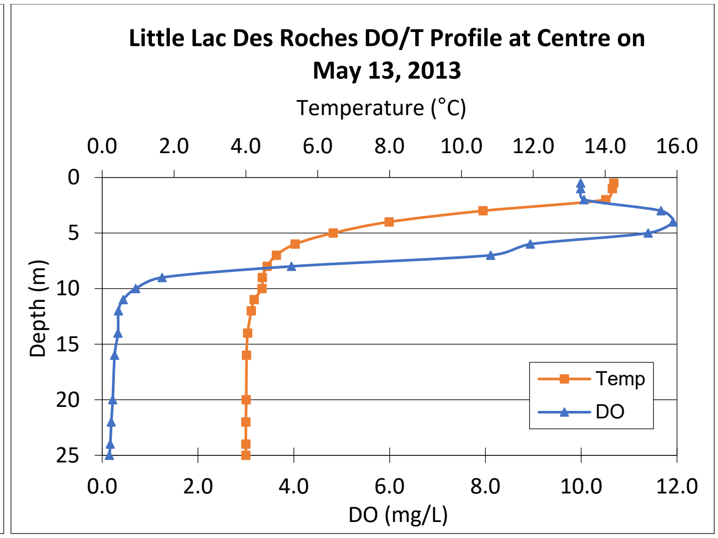


Figure 3b: Little Lac des Roches temperature and dissolved oxygen profile 2013.

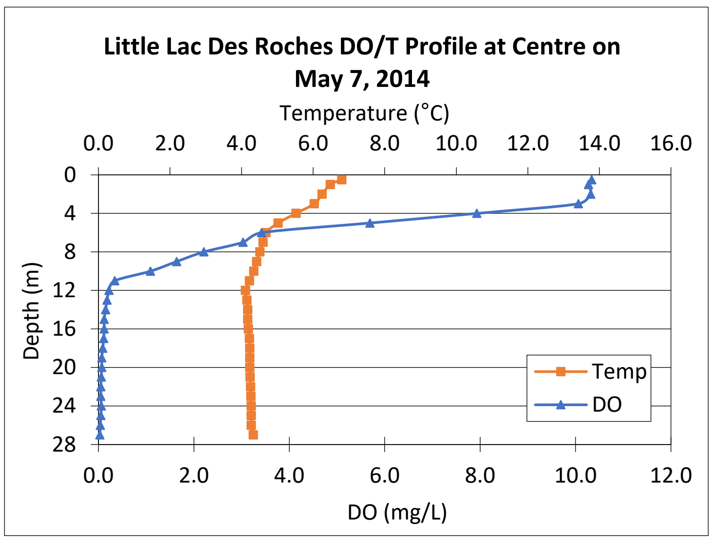


Figure 3c: Little Lac des Roches temperature and dissolved oxygen profile 2014.

Dissolved Oxygen

Dissolved oxygen (DO) is essential to aquatic life in lakes. Oxygen from the atmosphere dissolves and mixes into the water's surface and is also released from plants and algae during photosynthesis. Oxygen is consumed by respiration of animals and plants, including the decomposition of dead organisms by bacteria. A great deal can be learned about the health of a lake by studying oxygen patterns and levels.

Generally, lakes that are lower in nutrients and algae production will have sufficient DO to support life at all depths through the year. As lakes become more nutrient and algae rich there is increased plant and animal respiration and decay, resulting in more oxygen consumption. This is especially true near the bottom of the lake where dead organisms can accumulate, and oxygen is depleted more rapidly. Stratified lakes with low oxygen concentrations in the isolated bottom layer can impact the behaviours and locations of fish residing within the lake. Fish can become stressed when oxygen concentrations fall below 4 mg/L and begin to move up the water column to areas of the lake with higher DO (BC Ministry of Environment, 1997). Fish kills can occur when decomposing or respiring plants and algae use up the oxygen supply. In summer, this can happen on calm nights after an algal bloom, but most fish kills occur during late winter or at initial spring mixing.

Dissolved oxygen and temperature data were collected at the Deep Site of Little Lac des Roches on May 9, 2012, May 13, 2013, and May 7, 2014 as shown in **figures 3a, 3b, and 3c**.

The spring temperature and dissolved oxygen profile data indicates that the spring mixing in these three years was incomplete. Little Lac des Roches does not appear to mix completely to the bottom and the degree of mixing differs from year to year.

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 both floating algae (phytoplankton) and rooted plants (macrophytes). Algae are important to the overall ecology of a lake because they use nutrients to produce organic matter and are consumed by zooplankton, which in turn are food for other organisms, including fish. Macrophytes provide important habitat to many fish species and are the base of littoral zone (shallow water near shore) production.

In most BC lakes, phosphorus is the nutrient in shortest supply relative to need and thus limits the production of aquatic life. When in excess, phosphorus accelerates growth and may artificially age a lake. Total phosphorus in a lake can be greatly influenced by human activities.

Lakes with low levels of phosphorus usually support limited biological production and, thus, contain low concentrations of the photosynthetic pigment chlorophyll *a*, which is found in both algae and aquatic plants. These lakes are called *oligotrophic* and tend to have clear water and sufficient oxygen throughout the year to support fish and other aquatic organisms. *Mesotrophic* lakes have moderate levels of phosphorus and support greater biological production and therefore contain greater concentrations of chlorophyll *a*. Water clarity in mesotrophic lakes is moderate, but there is an increased probability of oxygen depletion in the deepest areas. *Eutrophic* lakes contain even greater concentrations of phosphorus and chlorophyll *a* and can experience extended periods of poor water clarity and low oxygen levels.

Mesotrophic and eutrophic lakes experience higher densities of macrophytes and algae. Surface accumulations or 'blooms' of algae may occur during the warmest months, particularly in eutrophic lakes, where lack of water transparency can significantly reduce recreational activities. Mesotrophic to slightly eutrophic lakes support productive fisheries, so are desirable for those seeking good fishing lakes. As a result of higher productivity, these lakes also tend to draw in wildlife and waterfowl in larger numbers.

The trophic status of a lake can be determined by looking at concentrations of different chemical and biological variables. One measure of productivity is water clarity. This can be assessed by using a Secchi disk, a 20 cm 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.

Figure 4 shows the minimum, average, and maximum Secchi depths recorded at the monitoring site in 2006-2014 and 2020-2022, as well as the number of readings each year (n). The minimum data requirements of 12 readings over the sampling season was not met for all years. Most years, the data was spread evenly throughout the season from May to September. In 2011, monitoring did not begin until the end of June.

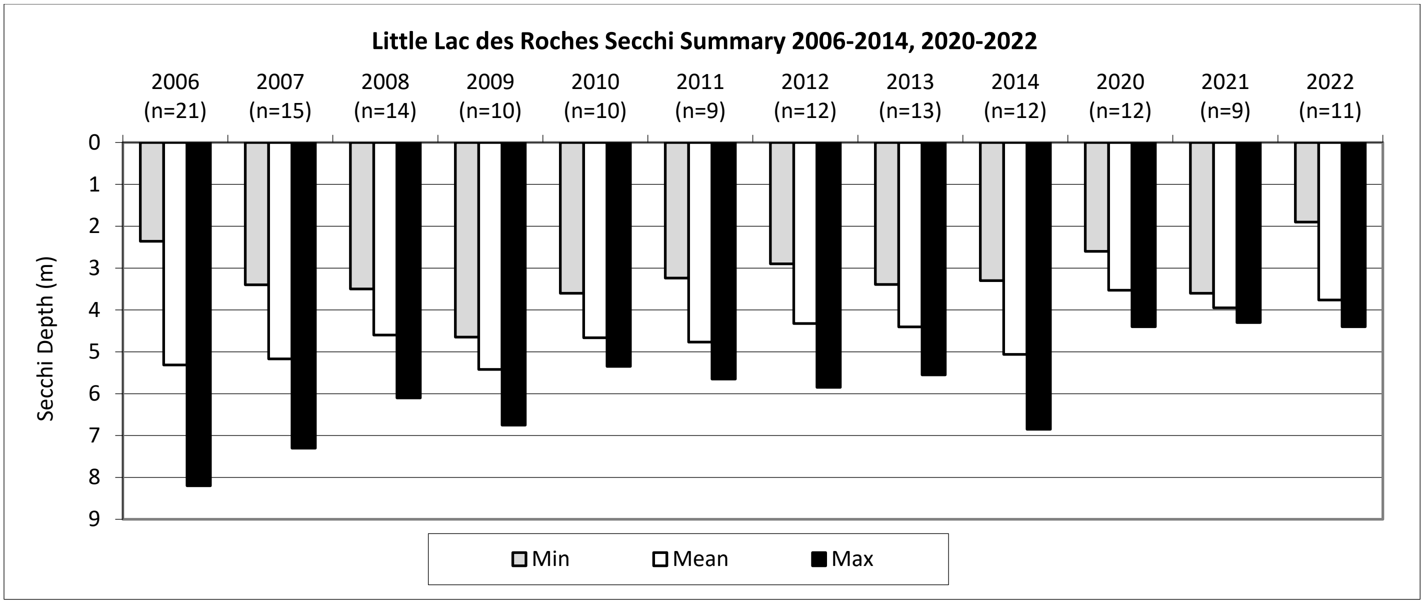


Figure 4: Little Lac des Roches Secchi Depth Summary 2006-2014 & 2020-2022.

Of the data collected, the maximum reading was 8.2 m (May 28, 2006) and the minimum was 1.9 m (May 23, 2022). In 2021 and 2022, there were several readings where the Secchi disk was visible resting on the lake bottom (Jul 21, Aug 3, Aug 13, 2021, and Aug 15, 2022). These readings were removed from the mean calculations and the count.

The average Secchi depth measurements ranged from 5.4 m (2009) to 3.5 m (2020). Based on these summer average Secchi values, Little Lac des Roches was exhibiting mesotrophic (3-6 m Secchi depth) conditions each year that it was monitored (Nordin, 1985). The average Secchi depth from 2006 to 2009 was 5.0 m and the average depth from 2020 to 2022 was 3.7 m. These results may indicate that there is a decreasing trend in water clarity. After performing a Mann Kendall trend analysis, it was confirmed that there is a decreasing trend in mean Secchi depth between 2006 and 2022. Nearby Bridge Lake also exhibited a consistent decreasing trend in Secchi depth between 1996 and 2001 indicating that there may be a common cause of decreasing water clarity in this region.

The graph below shows the seasonal Secchi and surface temperature data in 2022. The minimum data requirement of 12 readings was met for this year, however the Secchi disk was still visible resting on the lake bottom on August 15th so this depth was excluded from all calculations. The readings were spread evenly throughout the season.

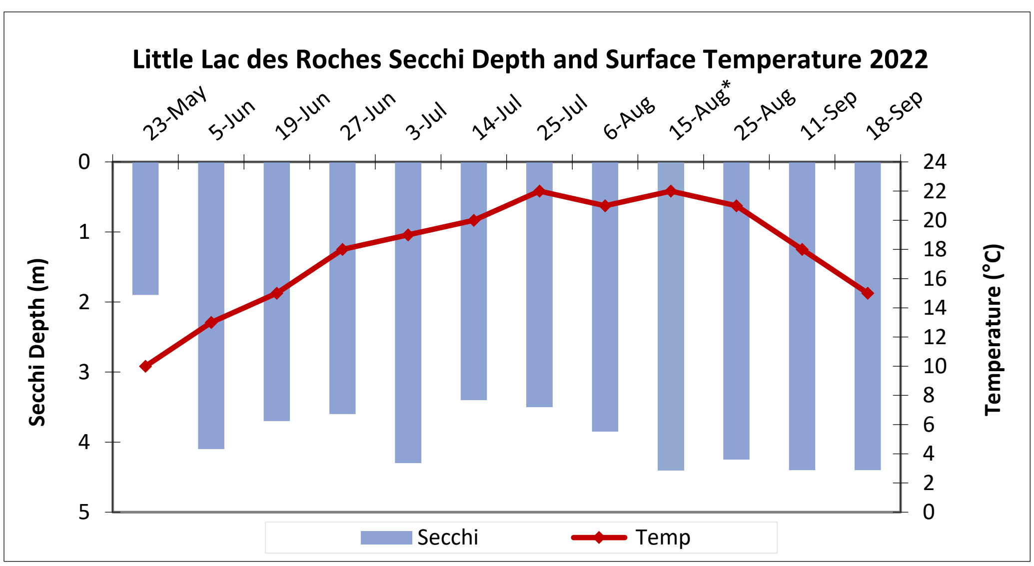


Figure 5: Little Lac des Roches Secchi depth and surface temperature measurements in 2022.

**Secchi disk still visible resting on lake bottom. Depth excluded from maximum, average, minimum, and trend calculations.*

Phosphorus

As mentioned previously, productivity can also be determined by measuring phosphorus levels. Phosphorus concentrations measured during spring overturn can be used to predict summer algal productivity. Productivity is dependent on the amount of nutrients (phosphorus and nitrogen) in a lake, which are essential for plant growth, including algae. Algae are important to the overall ecology of a lake because they are the food for zooplankton, which in turn are the 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, however, phosphorus accelerates growth and artificially ages a lake. Total phosphorus (TP) in a lake can be greatly influenced by human activities.

Lake sediments can themselves be a major source of ortho-phosphorus (OP), a form of total dissolved phosphorus (TDP). If deep-water oxygen becomes depleted (i.e., anoxic), a chemical shift occurs in bottom sediments. This shift causes sediment to release phosphorus to overlying waters. This *internal loading* of phosphorus can be natural but is often the result of phosphorus pollution. Lakes displaying internal loading have elevated algal levels and generally lack recreational appeal.

Figure 6 summarizes average spring Total Phosphorus (TP) and Total Dissolved Phosphorus (TDP) concentrations for Little Lac des Roches for 2012 to 2014. The variation is high between years and the relative contribution of TDP to TP has a wide range and is quite unusual. It is typically less variable for both indicators.

The TP concentrations range from 21 µg/L in 2012 to 9 µg/L in 2013 and 14 µg/L in 2014. The 2012 TP concentration is anomalous due to the large difference from TDP that year. TP can be affected by algae, particles, organic debris, and more. The TP data from 2013 and 2014 also indicates that the 2012 TP is unusually high. Despite this anomalous reading, it still falls within the range of mesotrophic conditions (10-30 µg/L) and is consistent with a Secchi depth averaging 3.5 to 5.4 m.

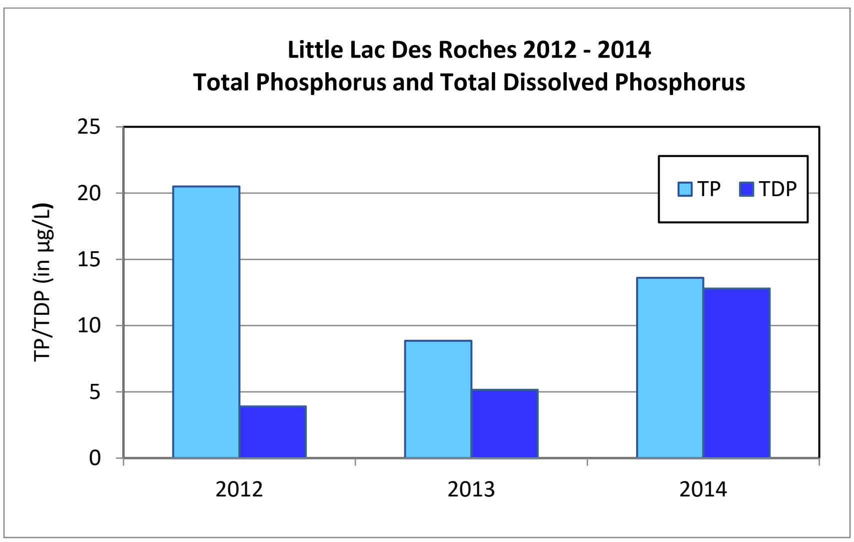


Figure 6: Little Lac des Roches TP and TDP concentrations 2012, 2013, and 2014.

Nitrogen

Nitrogen is the second most important nutrient involved in lake productivity. In BC lakes, nitrogen is rarely the limiting nutrient for algae growth (see phosphorus). In most lakes, the ratio of nitrogen to phosphorus is well over 15:1, meaning excess nitrogen is present. In lakes where the N:P is less than 5:1, nitrogen becomes limiting to algae growth and can have major impacts on the amount and species of algae present.

Nitrogen concentrations in Little Lac des Roches are also very variable at 567, 458, and 496 µg/L for 2012 to 2014, respectively. 2012 falls in the eutrophic range, and 2013 and 2014 fall within a mesotrophic range. However, additional samples would be required in order to determine trophic status using nitrogen. The N:P ratios ranged between 28:1 and 52:1 (by weight ratio) over this time period which means the lake is a strongly phosphorus limited system.

Figure 7 shows spring nitrogen values for Little Lac des Roches in 2012 to 2014.

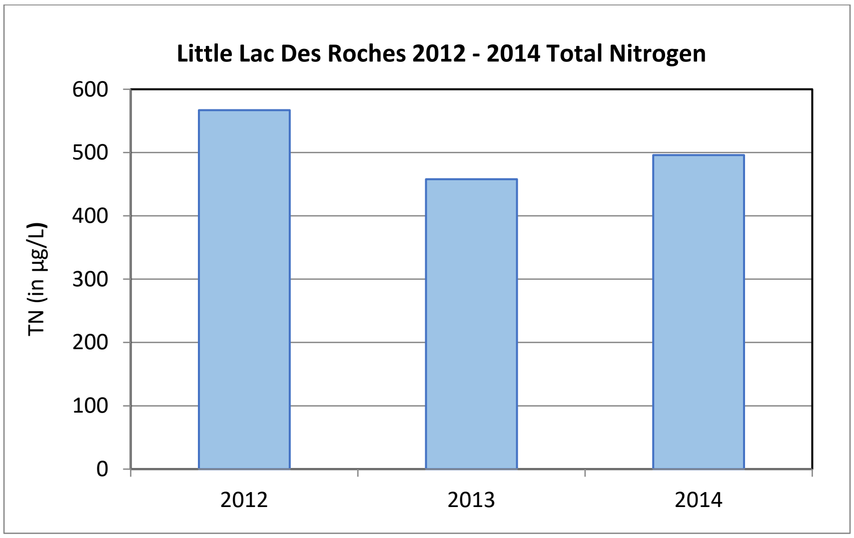


Figure 7: Little Lac des Roches TN concentrations 2012, 2013, and 2014.

Aquatic Plants

Aquatic plants are an essential part of a healthy lake. They play an important role in the lifecycle of aquatic insects, provide food and shelter from predators for young fish, and also provide food for waterfowl, beavers, and muskrats.

Factors that affect the type and amount of plants found in a lake include the level of nutrients (i.e., phosphorus), temperature, and introduction of invasive species.

Little Lac des Roches has not been surveyed for aquatic plants.

Aquatic plant species can spread between lakes via boaters. Be sure to check for and remove all organic material and mud from boats, trailers, and equipment (boots, waders, fishing gear). Drain onto land all items that can hold water (buckets, wells, bilge, and ballast) and dry all items before launching into another body of water (ISCBC, 2020).

Should Further Monitoring Be Done on Little Lac des Roches?

According to the Level I report from 2009, Secchi data indicated mesotrophic to slightly oligotrophic conditions using the range of 2-5 m for mesotrophic and >5 m for oligotrophic conditions. Using the classification method by Nordin (1985), the lake would have been classified as mesotrophic between 2006 and 2009. Seasonal Secchi depth data from 2006-2014 and 2020-2022, indicated mesotrophic conditions overall (Nordin, 1985). An excellent dataset of Secchi depth and temperature has been established by volunteers from 2006-2014 and 2020-2022. Statistical analysis of the Little Lac des Roches Secchi data indicates a decreasing trend in Secchi depth over the monitoring period which is consistent with the decreasing trend in water clarity observed at the nearby Bridge Lake.

Local volunteers could continue to record Secchi and surface temperature readings, with an emphasis on collecting a minimum of 12 evenly spaced readings between ice-off and ice-on. Future readings should be taken from the deepest point of the lake in order to compare to historical data. This volunteer collected data is important for long-term records and can help identify early warning signs should there be a deterioration in water quality from its current state. Due to the decreasing trend in clarity readings, Little Lac des Roches could benefit from additional water chemistry sampling and dissolved oxygen and temperature profiles. Late summer phosphorus sampling is important because it is an indication as to whether internal phosphorus loading is occurring. Regular dissolved oxygen and temperature profiles will also help to confirm whether the lake mixes fully or if it is meromictic and what the temperature patterns are in the hypolimnion, the isolated bottom layer of the lake. The BCLSS is able to provide assistance in finding funding opportunities for the purchase of new dissolved oxygen meters. Contact the BCLSS office for more information.

This volunteer collected data is important for long-term records and can help identify early warning signs should there be a deterioration in water quality from its current state. Local volunteer monitors are also encouraged to continue recording ice-on and ice-off dates for long-term climate change records.

The public now has the opportunity to contribute to tracking of algae bloom information for BC lakes on ENV's Algae Watch website: www.gov.bc.ca/algaewatch.

Tips to Keep Little Lac des Roches Healthy

Yard Maintenance, Landscaping & 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 lady bugs, as well as pests.
- Compost yard and kitchen waste and use it to boost your garden's health as an alternative to chemical fertilizers.

Agriculture

- Winter feeding of cattle should be a minimum of 30 m from a watercourse and located where no direct run off to streams and lake will occur.
- Install barrier fencing to prevent livestock from grazing on streambanks and lakeshore.
- Maintain or create a buffer zone of vegetation along a streambank, rivers or lakeshores.
- Ranchers are encouraged to have an Environmental Farm Plan for their operation (contact the Ministry of Agriculture).

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 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).
- Avoid planting trees or shrubs near the drain field because their roots can damage or plug the pipes.

Camping and Recreation

- Ensure black and grey water are contained and disposed of at a sanitation station.
- When washing yourself or your dishes, dip water out of the lake using a clean container and move 30 m away.
- Dispose of used water by throwing it over a large area away from your site, the sites of others, and flowing or standing water.
- Use phosphate-free, biodegradable soaps.
- If you pack it in, pack it out. Remove all garbage including biodegradable soaps.
- Ensure all vehicles are well maintained and tuned to prevent fuel leaks.

Auto Maintenance

- Use a drop cloth if you fix problems yourself.
- Recycle used motor oil, antifreeze, and batteries.
- Use phosphate-free biodegradable products to clean your car. Wash your car over gravel or grassy areas, but not over sewage systems.

Boating

- Do not throw trash overboard or use lakes or other waterbodies as toilets.
- Use biodegradable, phosphate-free cleaners instead of harmful chemicals.
- Conduct major maintenance chores on land.
- Use absorbent bilge pads to soak up minor leaks or spills.
- Clean, Drain, Dry. Clean off all organic material and mud from boat and equipment (boots, waders, fishing gear). Drain onto land all items that can hold water (buckets, wells, bilge, and ballast). Dry all items completely before launching into another body of water (ISCBC, 2020)
- 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 labeled with the owner's name, phone number, and confirmation that barrels have been properly emptied and washed.
- Untreated cedar is the best choice for dock construction. In some places, pressure-treated wood is banned for waterfront use because it can leach chemicals into the environment.
- Leading by example is often the best method of improving practices - help educate fellow boaters.

Who to Contact for More Information

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References

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