

# ALBERTA LAKES

## Surface Water Quality Monitoring Programs

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### Why Sample Lakes?

Lakes and reservoirs are important ecosystems within the major river basins of Alberta. They provide clean water and habitat for a complex variety of aquatic life, from microscopic plankton to fish and wildlife. Lakes are also important to humans for diverse uses such as supplies for drinking water, agriculture and industry, and recreation and aesthetic value.

The water quality of lakes is influenced by numerous factors, including the climate, geology, soils and vegetation cover, along with human activities within the lake watershed.



Lake watershed showing natural features & diverse human activities

Monitoring of surface water quality and aquatic life in lakes is essential to understand current conditions and lake type, as well as changes in natural processes and the influences of human activities. This knowledge is used to determine the ecological health of lakes and to develop sound, science-based plans and tools for watershed management.

The need for lake monitoring and watershed planning and management tools is increasing due to pressures of population growth, land development and recreation, climate change, and the formation of numerous lake stewardship groups.

### Lake Monitoring History & Goals

Alberta lakes occur in a broad diversity of ecoregions from the nutrient poor Rocky Mountains to more enriched boreal, parkland and grassland ecoregions. An important natural source of nutrients to most Alberta lakes is glacial till which covers most of province. However, the clearing of land and development of agriculture since European settlement has resulted in increased nutrient inputs to lakes.

Beginning in the mid-1900s, the sampling of Alberta lakes was primarily to establish inventories on fisheries and water resources. More systematic and standardised monitoring of lakes by Alberta Environment began in the early 1980s. This included intensive short-term studies and longer term monitoring.

The general goals of these monitoring programs are to:

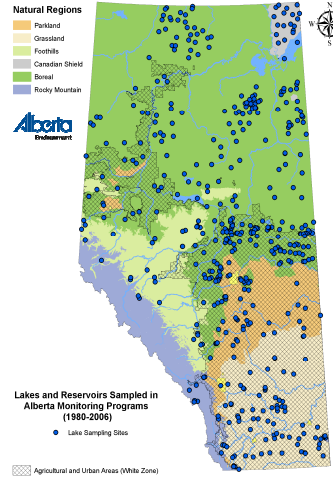
- establish the characteristics and current conditions of Alberta lakes,
- determine the sources of nutrients and nutrient budgets for specific lakes, and
- identify long-term trends in water quality of select lakes.

Much of this monitoring established the importance of nutrients in Alberta lakes, and that lake sediment is a major source of the nutrients to the water column. Nutrients in turn, cause algal blooms primarily due to cyanobacteria (often called "blue-green algae"), some of which produce toxins. These blooms can lead to aesthetic issues as the blooms die off and decompose, and may pose health concerns for humans, livestock, pets and wildlife.

### Scope of Monitoring Programs

Since the early 1980s, the total number of provincial lakes and reservoirs sampled has generally increased, although there are gaps in the spatial coverage for some ecoregions.

In addition, there are often gaps in the frequency of sampling from year to year. These gaps in the data can limit analysis of patterns and long-term trends in the provincial database of lake water quality.



Lakes & reservoirs sampled in one or more years as part of the Alberta Monitoring Programs (1980-2006)

Lakes and Reservoirs Sampled in Alberta Monitoring Programs (1980-2006)

### Elements of Lake Monitoring Programs

Water samples of the euphotic zone are usually taken at 10 sites throughout the lake. These samples are combined into a composite sample for the lake. The euphotic zone is the upper portion of the water column with enough light for the growth of rooted plants and floating algae.



Sampling zooplankton using a specialised net to obtain a sample of the water column

Additional *in situ* measurements are taken at the deepest area of the lake basin(s). Temperature, dissolved oxygen, conductivity and pH are measured at these (profile) sites using an electronic meter at a specific depth interval (usually 1 m). This will determine the existence of physical and chemical stratification of the water column. Stratification, if present, can influence water quality (eg, release of nutrients from sediments) and suitability of the water column for various types of aquatic life.

Depending on specific needs/issues, other water quality variables such as cyanobacteria toxins, trace metals, contaminants such as pesticides, and bacteria may also be sampled.

Sampling frequency is usually monthly during the open-water period (e.g., May to October). Sampling in mid/late winter is done for a small number of lakes.

The composite sample for a lake is analysed for alkalinity, hardness, major ions, nutrients and measures of the microscopic phytoplankton community (e.g., algae, chlorophyll-a and cyanobacteria). Zooplankton, or microscopic animals (e.g., water fleas and freshwater shrimp), are also sampled using a net at one or more sites.



Measuring select water quality variables at a profile site using an electronic meter

### Monitoring Partnerships

The overall provincial coverage and success of lake monitoring by Alberta Environment has been greatly enhanced by support to several partnerships provided by the Department, beginning in the 1970s.

These partnerships include:

- University of Alberta researchers, in the early 1980s, to collect data and compile information on lake water quality, ecology and watersheds for 100 lakes throughout the province. This led to the publication of the "Atlas of Alberta Lakes";
- Tourism, Parks and Recreation to collect long-term water quality data on lakes in provincial parks;
- Alberta Lake Management Society (ALMS) to collect data on lakes of interest to the ALMS membership;
- Numerous studies with individual lake/watershed stewardship groups to evaluate current conditions and develop nutrient budgets. Examples of such studies include Wabamun, Baptiste, Pine, Lac Ste Anne and Lake Isle; and
- Regional Aquatics Monitoring Program (RAMP), an industry, government and stakeholder group in north-eastern Alberta. This long-term program includes the collection of data on the sensitivity of lakes to acidifying emissions.



### Longer Term Needs

A variety of longer-term needs and planned actions include:

- Continue to support and expand existing monitoring networks, when possible;
- Encourage the formation of more partnerships (eg, lake stewardship groups);
- Analyse the existing provincial lake database (1980 to present) to better understand Alberta lakes and to assist with the development of lake watershed plans and management tools. For example, determine long-term trends in nutrients, algae and salinity, and evaluate broad patterns in surface water quality relative to lake basin and watershed characteristics;
- Review existing knowledge on Alberta lakes and lake science to develop management and mitigation strategies; and
- Develop provincial capacity to support planning and management activities. For example, develop water quality and ecological models to better manage lakes.

### Sources of Lake Data & Information

**Alberta Environment – Water Information Centre:** access to water quality data and on-line reports for lakes in the Alberta Environment, Water Data System (WDS). <http://www.environment.alberta.ca/2013.html>

**Alberta Environment – Surface Water Quality Information:** access to background on surface water quality programs, issues, partnerships and available information/reports including lakes and reservoirs. <http://www3.gov.ab.ca/env/water/SWQ/index.cfm>

**Alberta Environment Information Centre:** access to technical reports on lakes and reservoirs. <http://environment.gov.ab.ca/info/home.asp>

**Atlas of Alberta Lakes:** access to the complete publication including comprehensive information on 100 lakes. <http://alberta-lakes.sunsite.ualberta.ca/>

**Alberta Lakes Management Society (ALMS):** includes information on ALMS and reports on lakes of interest to the membership. <http://www.alms.ca/>

**Regional Aquatics Monitoring Program (RAMP):** includes information on RAMP activities and reports which include lakes in north-east Alberta - <http://www.ramp-alberta.org/>