

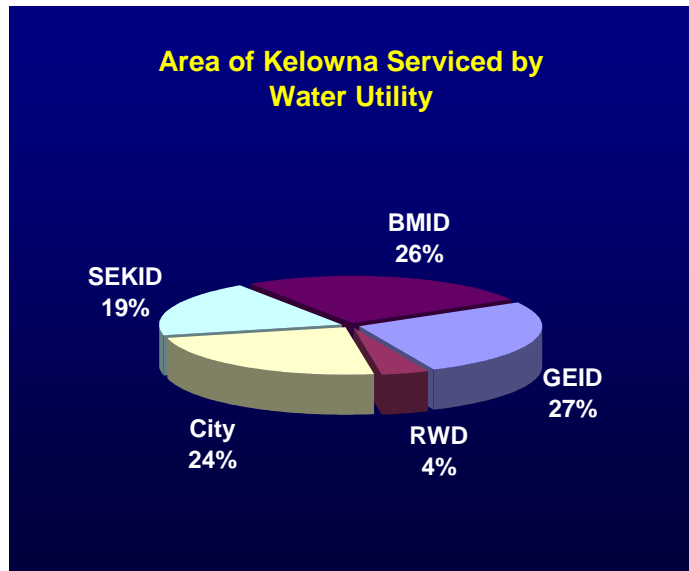
Drinking Water Quality

Why is it Important?

Water management issues center on the recognition that water is a precious resource relied upon by both people and nature. Okanagan Lake is the primary source of water for most activities in the valley.

The City water utility supplies approximately 53,000 people with drinking water from Okanagan Lake. Water is pumped from six pumphouses at five locations, with the two pumps at Poplar Point supplying the largest percentage of water used. Other water utilities supply the rest of the city's population from other sources; those sources include groundwater, watercourses, and upper watershed reservoirs.

To ensure water safety, the City of Kelowna water utility regularly tests the drinking water supplied to its residents. Water supplied by the city water utility complies with both the Provincial Safe Drinking Water Regulations and Federal Health Guidelines.



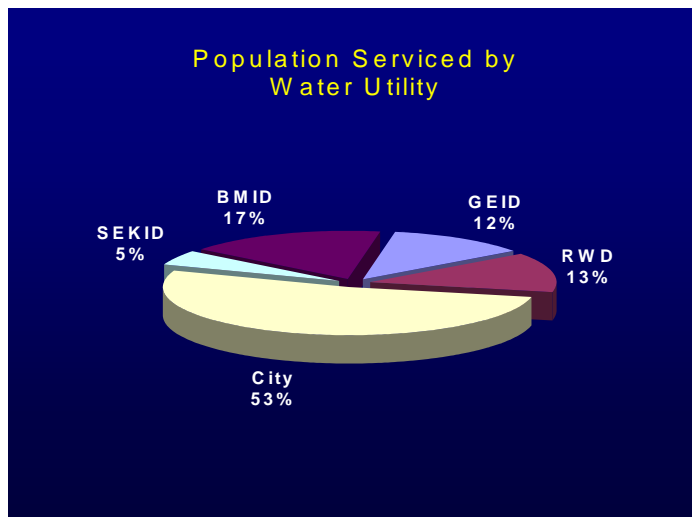
What is Being Done?

Drinking Water Monitoring

In 1991, the City implemented a drinking water quality program for its service area. This ensures the city complies with provincial and federal drinking water regulations and guidelines.

Provincial Safe Drinking Water Regulations:

The focus of the program is to comply with the *Safe Drinking Water Regulation* amendment of the *Health Act*. This regulation requires that potable water be monitored monthly from one site per 1,000 capita (Health Act, 1992).



Water analysis includes: Total Coliform and E. Coli bacteria, free chlorine, total chlorine, taste, odour, UV-absorbency, colour, temperature and turbidity. City employees collect and analyze samples from over 60 locations on the distribution system. The number of sample sites varies according to seasonal operations of the water system; however, the minimum number of sites required for Kelowna's water system is 50.

Federal Health Guidelines:

Federal Health Guidelines for potable water state..."In general, drinking water should be sampled semi-annually for all chemical substances for which maximum acceptable concentrations have been set. If particular substances are consistently absent from a water supply, the frequency may be reduced, subject to the approval of the control agency." The guidelines also state; "If there is a reason to believe

the presence of certain substances in a water supply, these substances should be sampled more frequently to ensure that their concentrations are below the acceptable limits."

Drinking water sample sites include all 6 of the pumphouse intakes, as well as, reservoirs, booster stations, and selected sites within the distribution system.

Nutrient and Physical/Chemical Analysis

Treated drinking water is examined for a variety of parameters. Nutrient analysis, conducted once per year for potable water, includes total nitrogen, total phosphorus, ammonia, nitrate, and nitrite. Ammonia analysis is performed daily, as a water quality indicator. General water chemistry includes free and total chlorine, taste, odour, colour, temperature, turbidity, hardness, pH, and UV-absorbency.

In addition to the general water chemistry and nutrient tests, the City also sends drinking water samples to private certified labs to test:

- ◆ Dissolved and heavy metals
- ◆ Trihalomethanes (THM) - a suspected cancer-causing substance that can form in chlorinated water where significant amounts of organic material are present
- ◆ Pesticides and herbicides

Microbiological Sampling

Daily microbiological testing occurs at the primary pumphouses on both raw and treated water.

WHAT IS CRYPTOSPORIDIUM?

Cryptosporidium is an infectious, hardy **ooocyst** that causes Cryptosporidiosis—an illness characterised by diarrhoea and cramping. A **cyst** is a protective, dormant structure formed by some microorganisms called protozoa. The **ooocyst** is the sexual stage of many protozoa, especially Sporozoa (Butler & Mayfield, 1996).



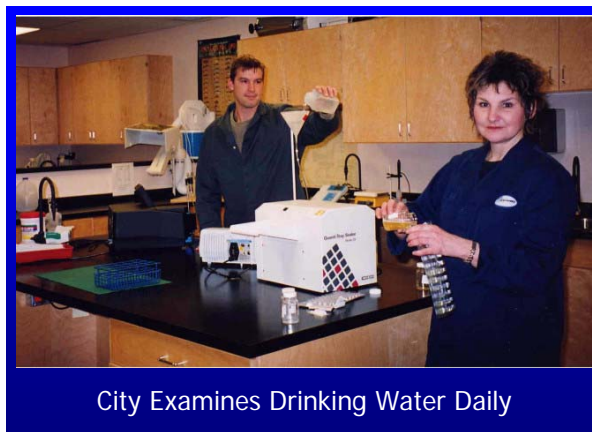
Cryptosporidium parvum

The results help to determine the amount of chlorine necessary for adequate disinfection. Microbiological testing is also performed monthly in the reservoirs; the response procedure for positive results includes disinfection and/or flushing of the affected reservoir(s). Disinfection and flushing of the affected reservoirs has proven effective in responding to water quality fluctuations before they become a problem.

Sample Collection

On-line monitoring equipment installed at the Poplar Point, Eldorado, Cedar Creek and most recently, the Swick Road pumphouses provides continuous raw water data for turbidity, pH, and temperature.

City employees collect additional samples from raw and treated water. Analysis includes tests on raw lines and on the treated lines daily. This data compares the online monitoring equipment with lab results to insure that disinfection has occurred. City staff adjusts the frequency of sampling to reflect seasonal operation changes.



City Examines Drinking Water Daily

Water Quality Deviation Response Procedure

The Kelowna Joint Water Committee (KJWC), in co-operation with the Okanagan Simikameen Health Region (OSHR), has developed a *Water Quality Response Guide* for adoption by all water purveyors in the City of Kelowna. This guide includes response and communication plans used by all water purveyors when water quality results deviate from the acceptable levels defined by the OSHR. Each of the water purveyors will employ specific response procedures to varying degrees of water quality degradation.

For more information about the City of Kelowna's Water Division, the Water Utility, or the *Operations Water Quality Deviation Response Procedure*, call the Wastewater Treatment Facility at (250)-862-5510.

See the [Drinking Water Quantity](#) section for detailed information regarding total volume pumped and typical household consumption.

Results and Trends

Physical and Chemical

General physical and chemical results for water quality parameters are listed in the [City of Kelowna Drinking Water Quality—Physical & Chemical Parameters](#).

The yearly averages for treated water chemistry tests met the Canadian Drinking Water Guidelines except for turbidity in 1991. Turbidity has since improved due to increased maintenance, reservoir cleaning, disinfecting, flushing of water mains, and installation of a new intake at Cedar Creek.

Temperature

Seasonal changes to temperature in the water column can affect lake behaviour and influence water quality. Warm water is less dense than cold water and warm water will rise above the colder layers. This effect can lead to the establishment of a seasonal '[thermocline](#),' which acts as an impediment to the exchange of water from top to bottom. In other words, mixing throughout the water column is reduced, currents may become restricted to the layers above and below the thermocline, and water quality may be adversely affected by the lack of turbulent exchange.

WHAT IS A THERMOCLINE?

Thermocline is a rapid change in the temperature of water as you move from the surface to deeper levels within a body of water.

The [Raw Water Temperature](#) chart shows the results from monitoring six raw-water sampling lines and compares deep and shallow intakes over a three-year period. Each of the sites is represented by a monthly average of approximately 6500 data points per site per month obtained by the on-line monitoring system. The data establishes two clear trends in temperature behaviour:

1. Seasonal temperature changes affect water temperatures.
2. Deeper water intakes experience less seasonal change in water temperature.

Continued on-line monitoring will provide further information of the lakes seasonal mixing and annual trends.

[Treated Water Temperature](#) understandably varies with the changes in seasonal ambient temperatures. Four complete years of data collection now offers us a clear picture of this seasonal phenomenon and the temperature of distribution systems water continues to remain below the Federal Health Guideline. Water samples are collected from scattered sites throughout the distribution system by City staff, including various kitchen taps, hydrants, pump stations, and reservoirs. The number of sample sites collected varies according to seasonal operation of the water system but the minimum number of sites is fifty(50).

Turbidity

Turbidity of water is an effective determinant of the condition and productivity of a water system. Suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble coloured organic compounds, and plankton or other microscopic organisms can cause turbidity in water.

Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through a water sample.

Measuring turbidity is based on a comparison of the intensity of light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions; the higher the intensity of scattered light, the higher the turbidity. The results are reported as *nephelometric turbidity units* or NTU.

The maximum acceptable concentration (MAC) for turbidity in water entering a distribution system is one (1) NTU, established based on health considerations. A less stringent value for turbidity in water entering a distribution system may be permitted if it is demonstrated that the system has a history of acceptable microbiological quality and that a higher turbidity value will not compromise disinfection. An aesthetic objective of five (5) NTU has been set for water at the point of consumption (Health Canada).

The [Raw Water Turbidity](#) chart shows the results from monitoring of six raw-water sampling lines and compares deep and shallow intakes over a three-year period. The raw water sample sites is represented by a monthly average of approximately 6500 data points per site per month obtained by the online monitoring system. The data establishes three clear trends in turbidity:

1. The water sources are consistently well below the Canadian maximum acceptable turbidity limit of 5.0 NTU for raw (untreated) water.
2. There is a seasonal increase in turbidity, likely resulting from spring run-off and increased productivity in the shallow zones during warmer seasons.
3. Deeper water intakes experience less seasonal change in water turbidity; likely due to the temperature stratification noted above.

On-line monitoring of the deep intake raw water turbidity no longer takes place. The City continues to monitor raw water to each of the pump stations and this information will continue to provide information of the lakes changes in turbidity. Seasonal mixing and other annual trends, such as, the apparent seasonal 'roll-over' of lake water during December through April may also continue.

[Treated Water Turbidity](#) varies slightly and demonstrates consistent compliance with the Federal Health Guideline. Water samples collected from numerous sites randomly scattered throughout the distribution system, including various kitchen taps, hydrants, pump stations, and reservoirs, provide a greater degree of statistical confidence. The number of sample sites collected varies according to seasonal operation of the water system but the minimum number is fifty sites (50).

Dissolved and Heavy Metals

Health Canada metals scans indicate that of those metals that were detectable were at a level far less than 5% of the Health Canada Guideline. Seven (7) of the seventeen (17) parameters were not detected at all.

Trihalomethanes

Chlorination of water may produce Trihalomethanes (THM). Normally, only four compounds are found in drinking water: chloroform, bromodichloromethane, dibromochloromethane, and bromoform. A stringent limit of 100 µg/L (parts per billion) for total THM in drinking water is set because of carcinogenicity in laboratory animals. This maximum contaminant level considers both the risk from a lifetime of exposure and the status of current technology to meet the standard without unreasonable cost. Consequently, the standard balances public health considerations with the feasibility of meeting the approval limit in public water systems. Trihalomethane scans indicate that the City of Kelowna's potable water is well below the limit of 100 parts per billion, set in the Federal Health Guidelines.

The 100-ppb limit for total THMs is a 12-month average value rather than from a single test; however, a running average of values obtained gives an indication of exposure over time. The 5-year running average THM is 57 ppb. [THM Charted Data](#)

YEAR 2002 - AVG. THM – 47 ppb

The year 2002 12-month average for the City of Kelowna water utility is 47 ppb, and continues to remain well below the 100-ppb limit. The City collects samples for analysis from selected sites throughout the distribution system. The sampling sites are representative of the concentrations for THM from the beginning of the distribution system to the end.

In March 2000, City staff improved the sampling procedure to give a more accurate representation of the THM concentration, and as a result, values have dropped significantly.

Pesticide Scans

None of the sixty-seven pesticide parameters monitored have been detected in any of the samples collected from Okanagan Lake in 2002. These results are consistent with data collected from previous years. Detailed numerical data are available in the monthly *City of Kelowna--Water Quality Reports*.

Note: Detectable limits range between 0.05 and 0.25 parts per billion.

Microbiological

• *Treated Water*

The Health Guidelines for treated waters sets limits for several microbiological parameters. For example:

- ◆ Cryptosporidium <30 oocysts per 100L and Giardia <3 cysts per 100 L
- ◆ Coliform bacteria limit is <10 CFU/100 ml and none of which should be fecal
- ◆ Fecal coliform bacteria limit is 0 CFU/100 ml

WHAT ARE COLIFORMS?

The term **total coliform** includes bacteria naturally found in soil and decaying vegetation, as well as fecal coliforms.

Fecal coliform refers exclusively to intestinal bacteria such as *E. coli*, and is used to indicate the probable presence of pathogens (disease causing organisms).

Analysis of the deep raw water intakes has been available since September 1999, with physical parameters showing improved water quality over the shallower intakes. Continued monitoring should indicate general trends for microbiological parameters and the effect of the lake's seasonal mixing.

The *Cryptosporidium parvum* and *Giardia lamblia* sampling is triggered by deviations in raw water turbidity at intake locations.

Analysis of treated water indicates that the City of Kelowna's potable water complies with the microbiological parameters set by the Health Guidelines.

• *Raw Water*

FACT:

The peak concentration of cryptosporidium was found in October 1996 at Okaview #1 with 33.5 oocysts/100 litres.

[Return to Drinking Water](#)

or

[Return to Environmental Indicators Home](#)