

Requirements for Potable Water in Northern Health

As a **water supplier** under the *BC Drinking Water Protection Act*, you have an obligation to supply **potable** water to your clients at all times. Potable water must be (1) **safe** and (2) **fit** for domestic purposes without additional treatment. Before you begin to consider potability, make sure you understand your water source and water quality parameters. All surface water sources (streams, lakes, springs) require disinfection. Ground water sources (wells) also require disinfection if they are at risk of containing pathogens. Properly constructed deep wells in confined aquifers may not require disinfection. An analysis of **bacteriological and chemical parameters** is required for all water sources serving potable water systems.

Safe Water

There are two elements to water safety. First, safe water must be free of microbial **pathogens** – bacteria, viruses or protozoa that cause illness. We cannot easily test for all the different pathogenic organisms that could possibly occur. Instead, we test for **indicator bacteria** – *E. coli* and total coliforms, to indicate the level of pathogen risk that might be present in water. *E. coli* is the most common bacteria in human and animal excrement, and indicates fecal contamination of the water, which is a serious health hazard because most waterborne disease is transmitted along the fecal-oral exposure route. Total coliforms do not indicate fecal contamination, so they are a less serious health threat, but they show that a pathway exists for fecal contaminants to get into the water. It is unacceptable for *any E. coli* or total coliforms to be detected in drinking water. Laboratories usually report these tests as colony-forming units (CFU) per 100 mL. The only acceptable result is no bacterial colonies, usually stated as <1 CFU or L1 CFU. Sometimes a different lab procedure is used, and the acceptable bacterial result is reported as <1.1 MPN (most probable number).

Second, safe water must not have an unacceptable amount (concentration) of **toxic** chemicals. Toxicity itself has two aspects – acute and chronic. **Acute toxicity** refers to adverse health effects that occur quickly, in a timespan of minutes to hours, essentially poisoning. Acute toxicity is seldom a concern in drinking water provision (exception: nitrate/nitrite). **Chronic toxicity** occurs over a period of years. Some chemicals (eg, pesticides) exert chronic toxicity only when they *bioaccumulate* in your body over a lifetime. Others (eg, arsenic) exert a low level of chronic toxicity at all times and do not bioaccumulate. The maximum acceptable concentration (MAC) of each toxic chemical is suggested by Health Canada under the *Guidelines for Canadian Drinking Water Quality*. **Table 1** below lists the chemicals routinely assessed by Northern Health for water safety.

Northern Health considers water to be **safe** for human consumption if it meets these two criteria:

- <1 cfu or MPN for indicator bacteria
- no exceedance of MACs for toxic chemicals

The second element of potability under the *Drinking Water Protection Act* is fitness for domestic purposes without additional treatment.

Water Fit for Domestic Purposes

Domestic purposes comprise: human consumption, food preparation, sanitation, and household purposes. Fitness is not defined in legislation, so there is an element of subjectivity in determining when water is fit or unfit for domestic purposes. Northern Health considers the *aesthetic objectives* (AOs) in the *Guidelines for Canadian Drinking Water Quality*. AOs relate to factors that affect consumer

acceptability, primarily **taste, odour, and appearance**, but also include operational factors such as staining of laundry and fixtures and scaling on hot water appliances. Because these aesthetic factors do not pose a health threat, Northern Health uses flexibility in assessing water sources that have aesthetic exceedances only. There is no hard and fast rule, but if the concentration of a particular chemical is less than double the AO, we will usually consider the water fit. At the other end of the scale, if the concentration of a chemical is more than ten times the AO, we will usually consider the water unfit. **Table 2** lists chemicals routinely assessed by Northern Health for fitness for domestic purposes.

Northern Health considers water to be **fit** for domestic purposes without further treatment if it has no unreasonable exceedance of aesthetic or operational guidance criteria for the intended water uses (**Table 2**) and Northern Health is confident that the water will be acceptable to users. Treatment may or may not be required, depending on discussions between the water supplier, the Environmental Health Officer (EHO) and the Public Health Engineer (PHE).

Treatment to achieve potability

In many cases, small water systems can achieve potability with commercial treatment devices:

Filtration: sediment filters, sand filters, activated carbon, 1-micron absolute (cysts)

Conditioning: aeration, softening, greensand (iron, manganese), anion exchange (tannins)

Disinfection: chlorination (bacteria, viruses), UV (bacteria, viruses, cysts).

Consult an experienced water system designer or professional engineer for design advice. Northern Health cannot recommend specific firms, so search the phone book or internet under "water treatment". In selecting a designer, avoid firms that carry only one line of equipment – one size does not usually fit all. Consider too your expected need for tech support through construction and commissioning stages, and on-going service during operations and maintenance. More complex treatment also usually requires additional operator training. Refer to the Design Guidelines for surface and groundwater sources on the [PHE website](#) for more information.

Non-potable water

For small water systems serving fewer than 500 users, it is possible for a water supplier to apply for permission to deliver **non-potable** water in two distinct cases:

- (a) If each customer has a point-of-entry (POE) or point-of-use (POU) water treatment system operated under supervision of the water supplier.
- (b) If water is not and cannot be used for human consumption or food preparation purposes.

The process for evaluating water potability and treatment requirements is summarised in **Figure 1** below. In all cases, the EHO and PHE have discretion under the *Drinking Water Protection Act* and *Drinking Water Protection Regulation* to vary the procedure on a case-by-case basis to ensure a safe and reasonable outcome.

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Figure 1. Flowchart for assessing the provision of potable water in Northern Health.

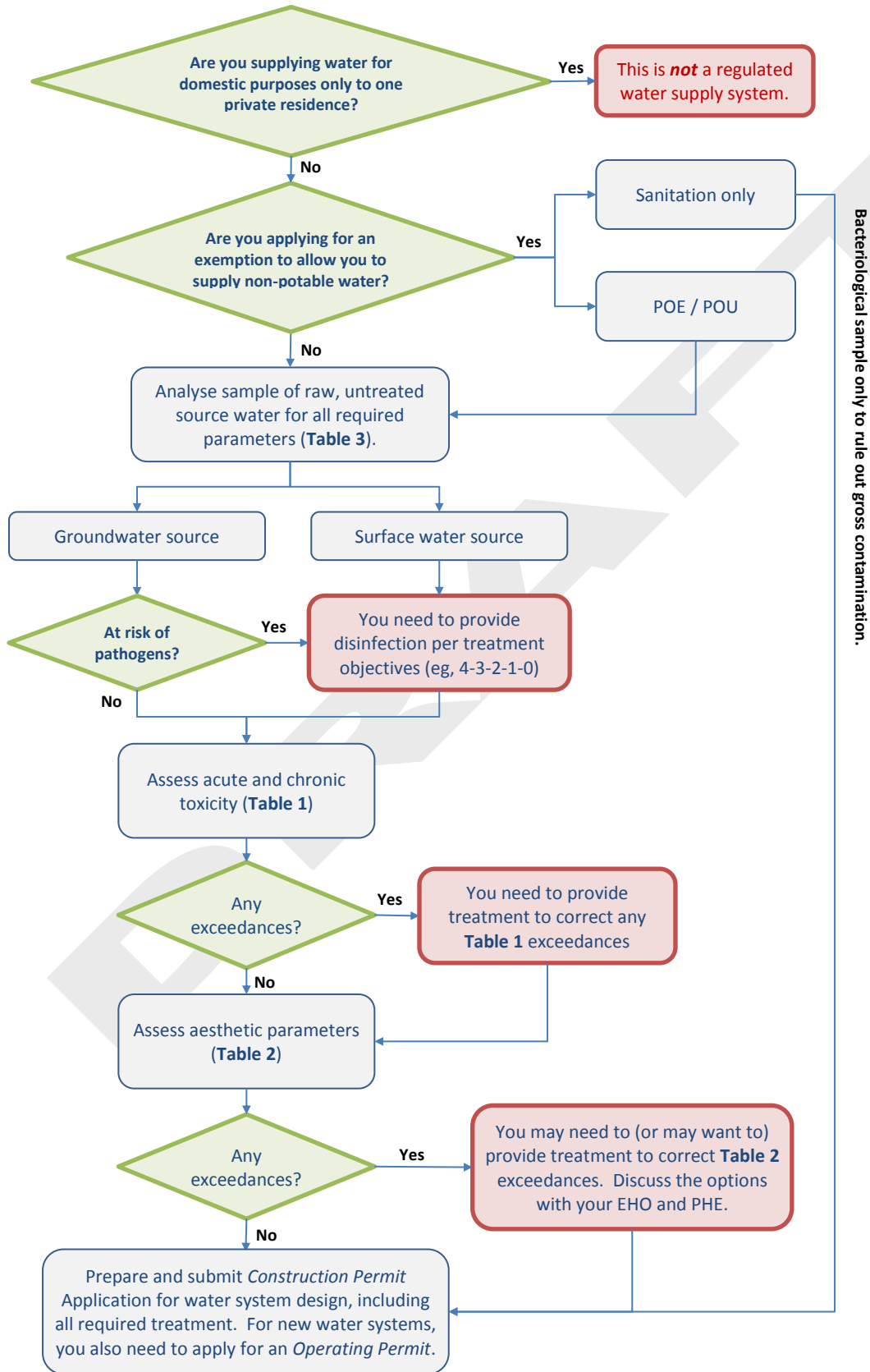


Table 1. Health-based Water Quality Parameters

Parameter	Units	Maximum Acceptable Concentration (MAC)	Comment
Turbidity	NTU	1, 5 *	Interference with disinfection.
Fluoride	mg/L	1.5	Moderate dental fluorosis (based on cosmetic effect, not health)
Nitrate (as N)	mg/L	10	Methaemoglobinaemia (blue baby syndrome) in infants less than 3 months old (short term). Classified as possible carcinogen.
Nitrite (as N)	mg/L	1	
Antimony	mg/L	0.006	Microscopic changes in organs (thymus, kidney, liver, spleen, thyroid)
Arsenic	mg/L	0.01	Cancer (lung, bladder, liver, skin) (human carcinogen). Skin, vascular and neurological effects (numbness and tingling of extremities).
Barium	mg/L	1	Increases in blood pressure, cardiovascular disease.
Boron	mg/L	5	Reproductive effects (testicular atrophy, spermatogenesis).
Cadmium	mg/L	0.005	Kidney damage and softening of bone.
Chromium	mg/L	0.05	Enlarged liver, irritation of the skin, respiratory and GI tracts from Cr (VI).
Lead	mg/L	0.01	Biochemical and neurobehavioural effects in children under 6. Anaemia, central nervous system effects; probable carcinogen.
Manganese	mg/L	0.5 **	possible* neurological effects (intellectual development).
Selenium	mg/L	0.01	Essential nutritional element. Hair loss and weakened nails.
Uranium	mg/L	0.02	Kidney effects (lesions); may be rapidly reversible after exposure ceases.

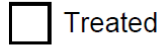
* 1 for surface water and GARP sources; 5 for low risk groundwater sources.

** Health Canada suggests 0.5 mg/L as a *Health-Based Screening Level*, which has not undergone the same scrutiny as a MAC.

Table 2. Fitness-based Water Quality Parameters

Parameter	Units	Objective	Usually Acceptable	Usually Unacceptable	Comment
Aesthetic Parameters					
Odour	—	none	inoffensive	offensive	consumer acceptance
Colour	TCU	15	30	100	interference with disinfection, acceptance
Dissolved Solids (TDS)	mg/L	500	1000	2000	aka salinity – taste
Chloride	mg/L	250	500	see TDS	taste
Sulphate	mg/L	500	1000	see TDS	laxative effect
Hardness	mg/L	250	500	see TDS	scaling, taste
Copper	mg/L	0.5	1	5	taste
Iron	mg/L	0.3	1	3	taste, staining
Manganese	mg/L	0.05	0.2	0.5	taste, staining, neurological
Phosphorus	mg/L	0.1	0.2	1	regrowth
Sodium	mg/L	200	400	800	taste, hypertension
Zinc	mg/L	5	10	50	taste
Treatment Parameters					
pH	—	7.0 to 10.5	6.5 to 10.5	<6.5 or >10.5	influences disinfection and DBPs, scaling
Langelier Index	—	-2 to +2	-3 to +3	-4 to +4	aggressiveness, scaling
Ammonia	mg/L	1.5	3	15	chlorinated by-products, sewage influence
Organic Nitrogen	mg/L	0.5	2	5	chlorinated by-products, odour
TOC	mg/L	2.5	5	15	chlorinated by-products, odour

Table 3. Core Water Quality Parameters



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Table 1. Required Water Quality Parameters

Core Parameters	Guideline	General Comments
<input checked="" type="checkbox"/> E. Coli	[none detected]	1. The sampler must make arrangements for receiving and shipping of chemical/physical sample bottles and coolers with an accredited private lab. <i>Northern Health</i> may accept bacteriological samples only. 2. Analysis of additional parameters may be required based on the results of the initial analysis and on potential impact by nearby sources of contamination. The required parameters should be confirmed with <i>Northern Health</i> before sampling. 3. The analytical detection limit must be <i>less than 10% of the Guideline for Canadian Drinking Water Quality</i> where applicable. Other analyses must provide sufficient information to reasonably assess the water suitability for domestic use and to determine what, if any, treatment might be needed. Analyses must be conducted in accordance with the methods prescribed in <i>Standard Methods</i> (latest edition). 4. Analyses should be for total or closely equivalent concentrations, to represent potential quality problems. 5. A copy of all analytical results must be sent to the <i>Northern Health</i> Officer responsible for the water system.
<input checked="" type="checkbox"/> Total Coliforms	[none detected]	
<input checked="" type="checkbox"/> HPC ⁽¹⁾	[~ 100-500 CFU/mL]	
<hr/>		
<input checked="" type="checkbox"/> Alkalinity	[~ 30-500 mg/L]	
<input checked="" type="checkbox"/> Chloride	[250 mg/L]	
<input checked="" type="checkbox"/> Colour	[15 TCU]	
<input checked="" type="checkbox"/> Electrical Conductivity	[~ 800 µS/cm]	
<input checked="" type="checkbox"/> Fluoride	[1.5 mg/L]	
<input checked="" type="checkbox"/> Hardness	[~ 250 mg/L]	
<input checked="" type="checkbox"/> Langelier Saturation Index	[~ -2 to +2]	
<input checked="" type="checkbox"/> Metals Scan	[varies] ⁽²⁾	
<input checked="" type="checkbox"/> Nitrogen species: ⁽³⁾		
<input checked="" type="checkbox"/> Ammonia - N	[~ 1.5 mg/L]	
<input checked="" type="checkbox"/> Organic N	[~ 0.15 mg/L]	
<input checked="" type="checkbox"/> Nitrate - N	[10 mg/L]	
<input checked="" type="checkbox"/> Nitrite - N	[1 mg/L]	
<input checked="" type="checkbox"/> pH	[6.5 – 8.5]	
<input checked="" type="checkbox"/> Sulphate	[500 mg/L]	
<input checked="" type="checkbox"/> Total Dissolved Solids (TDS)	[~ 500 mg/L]	
<input checked="" type="checkbox"/> Total Organic Carbon (TOC)	[2.5 mg/L]	
<input checked="" type="checkbox"/> Turbidity	[~ 1 NTU]	
<input checked="" type="checkbox"/> Odour	[describe]	
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
May require ...	Guideline	(1) May be omitted if bacterial growth is not found during Total Coliform test – lab to note " <i>Other bacterial growth not present</i> ". (2) <i>Total metals</i> required. <i>Dissolved metals</i> optional, but recommended if turbidity is elevated. Scan to include both high and low level metals: Aluminum (if coagulant used), Antimony (0.006) , Arsenic (0.010) , Barium (1) , Boron (5) , Cadmium (0.005) , Calcium (~ 100), Chromium (0.050) , Copper (1), Iron (0.300), Lead (0.010) , Magnesium (~ 30), Manganese (0.050; 0.500), Phosphorus (~ 0.100), Potassium (~ 400), Selenium (0.010) , Sodium (20-200; 1000), Zinc (5), Uranium (0.020) [expand scan if zone is mineralised to include Mercury (0.001)]. (3) Required for source water characterisation. If all are < 1 mg/L as N, later samples may be analysed for Total N only. (4) Required if <u>UV disinfection</u> is being considered as part of the water treatment process. The test must be conducted on a RAW, UNFILTERED water sample. [Modified version of <i>Standard Method</i> 5910B where the sample is not filtered or pH adjusted.] (5) Required if <u>chlorination</u> is used or proposed and <u>TOC>2.5 mg/L</u> . For new sources, specify " DBP formation potential ". Different DBPs are required for chlorine dioxide or ozone disinfection. (6) Required for TOC>2.5 mg/L and/or Colour>15 TCU. (7) Required if <u>bacterial regrowth</u> is suspected in well or distribution piping. Contact laboratory for sampling procedure. (8) Required if unsatisfactory <u>odour</u> is suspected. Analyse on site or preserve sample. Contact laboratory for sampling procedure. (9) Required if <u>hydrocarbon/gasoline</u> type contamination is suspected. Contact laboratory for sampling procedure. Colours: red → health parameter, violet → aesthetic, black → treatment options
<input type="checkbox"/> UV Transmittance (UVT) ⁽⁴⁾	[~ 80%]	
<input type="checkbox"/> Disinfection By-Products (DBPs)⁽⁵⁾		
<input type="checkbox"/> THMs	[0.100 mg/L]	
<input type="checkbox"/> HAAs	[0.080 mg/L]	
<input type="checkbox"/> Bromide	[0.050 mg/L]	
<input type="checkbox"/> Tannins & Lignin ⁽⁶⁾	[~ 0.400 mg/L]	
<input type="checkbox"/> Iron & Sulphate Bacteria ⁽⁷⁾	[presence]	
<input type="checkbox"/> Sulphide ⁽⁸⁾	[0.050 mg/L]	
<input type="checkbox"/> Hydrocarbons⁽⁹⁾		
<input type="checkbox"/> Benzene	[0.005 mg/L]	
<input type="checkbox"/> Toluene	[0.024 mg/L]	
<input type="checkbox"/> Ethylbenzene	[0.002 mg/L]	
<input type="checkbox"/> Xylenes	[0.300 mg/L]	