Water Facts

Manitoba
Water Stewardship

The Manitoba Water Services Board Box 22080 Brandon MB R7A 6Y9 (204) 726-6076

FARM WATER ANALYSIS

June 2003

Good quality water is an important economic and social asset for a farmstead. An adequate water supply will contribute to farmstead mechanization and an efficient household. (See Livestock and Water Quality).

Most households using private water supplies will be interested in two separate water quality analyses - bacterial and chemical. A bacterial analysis determines if the water is safe for human consumption while a chemical analysis is used to identify toxicity, determine elements responsible for taste and can assist in evaluating water conditioning requirements.

Bacterial Analysis

This analysis indicates if the water is safe to drink by measurement of the concentrations of coliform and E-coli bacteria.

Coliform bacteria are present in human and animal excrement. Although coliform bacteria are not usually harmful, they are used as an indicator of the sanitary condition of the well and may indicate the presence of pathogenic bacteria. Pathogenic, or disease-causing bacteria, can result in sickness such as typhoid or forms of dysentery. E-coli is the bacteria indicator used to determine if the water source is contaminated with fecal organisms.

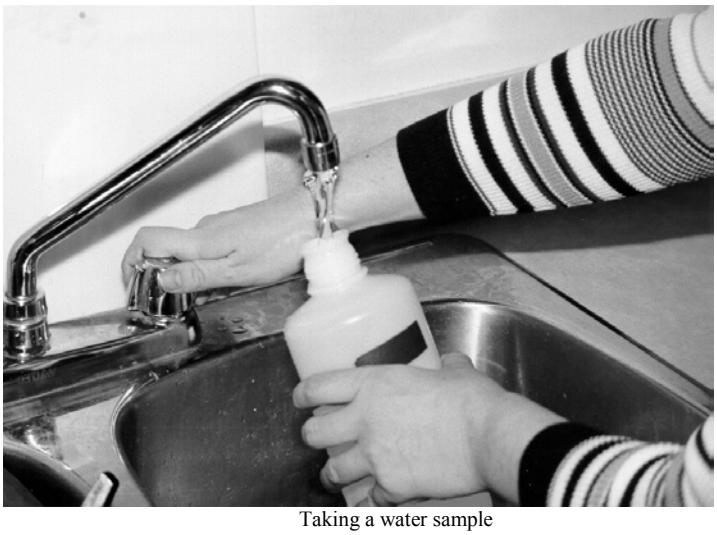
Bacterial analysis requires a special sterilized sample container, which is available from your local Public Health Inspector, The Manitoba Water Services Board office or directly from the laboratories. Follow the instructions included with the sample container for collecting and delivering the sample to the Lab.

The analysis report returned from the laboratory warns the household of any health hazards. The local Public Health Inspector or your Regional Farm Water Technologist can provide assistance in interpreting the results and make recommendations about any water source found unsafe for human consumption.

Chemical Analysis

Water quality is determined by chemical analysis. Once the analysis is completed, recommendations for any necessary water treatment can be made.

A chemical water analysis service is available from a number of laboratories in Manitoba for a nominal fee. A list of the major laboratories providing this service can be found on the back of this brochure. Some plumbing and water conditioning companies also provide chemical water analysis.



Taking a water sample

Water Sampling and Shipping

Water sampling is simple and straightforward. However, care must be taken in packaging and sending the sample to the laboratory. If water treatment equipment is currently in use, samples collected "before" and "after" the treatment can be analysed to determine treatment effectiveness. The following steps outline procedures for collecting and shipping a water sample for chemical analysis:

- Collect all samples from a tap in the water system normally in use.
- If the system has not been used for several days, the water should be run for one to two hours before the sample is taken. For taps used daily, run the water for five to ten minutes before taking the sample.
- Collect the sample in a clean, odor-free glass or in plastic container(s) two litres or larger in size.
- Rinse the containers two or three times with the water to be sampled.
- Immediately fill the container and cap it. If a plastic container(s) is used, compress the sides of the container before capping so that there is no air inside.
- Clearly label the sample bottle. (Masking tape and pen is an effective method).
- Enclose complete information including your name, address, water source (e.g. well, dugout, well water after softening, etc.), legal description of water source location (e.g. quarter section, township, range) and the date the sample was collected.

Keep the sample cool and forward it as soon as possible, along with prepayment, to the laboratory of your choice. Results of the chemical analysis, which indicate the concentration of the appropriate water quality characteristics, will be mailed or faxed to you.

Chemical Analysis Interpretation

Conductivity (in micromhos/cm) Conductivity is a measure of water's capacity to convey an electric current. It is related to the total concentration of ionized substances (salts) contained in the water. Filterable residue, commonly called total dissolved solids, can be estimated by multiplying conductivity by 0.7. The following table demonstrates water quality suitability for domestic use.

Conductivity	Farm Water Suitability for Domestic Use
0-1000	Good
1000-2000	Fair
2000-3000	Poor
3000+	Very Poor

pH The pH is a measure of the hydrogen ion concentration in water. A value of 7.0 indicates "neutral" water. Values less than 7.0 are progressively more acidic and may indicate corrosiveness. Values greater than 7.0 are progressively more alkaline and may indicate a tendency towards encrustation (scaling).

A pH value between 6.5 - 8.5 is acceptable with a maximum limit of 10.0.

When groundwater containing a large amount of dissolved carbon dioxide is pumped to the surface, any subsequent rise in temperature and/or reduction in pressure causes the carbon dioxide to release as a gas. A corresponding increase in pH results. For this reason it may be preferable to conduct further on-site tests when iron and/or manganese removal equipment is to be installed on water with a pH lower than 7.4.

Total Alkalinity (in mg/L as $CaCO_3$) Alkalinity is a measure of water's capacity to neutralize an acid. Total alkalinity is generally associated with the presence of carbonates, bicarbonates and hydroxides and some less significant constituents.

High alkalinity in water is undesirable because it causes excessive hardness and can result in high concentrations of sodium salts. Acceptable limits have been established to alleviate corrosive or encrusting properties and eliminate human health problems such as gastrointestinal (stomach) irritation.

Alkalinity less than 500 mg/L is generally considered acceptable. Water supplies with greater concentrations have been used.

If high alkalinity water is boiled over an extended time, deposits may appear or an unpleasant odor may result, depending upon the chemical reaction. Water with very low alkalinity corrodes pipes and plumbing.

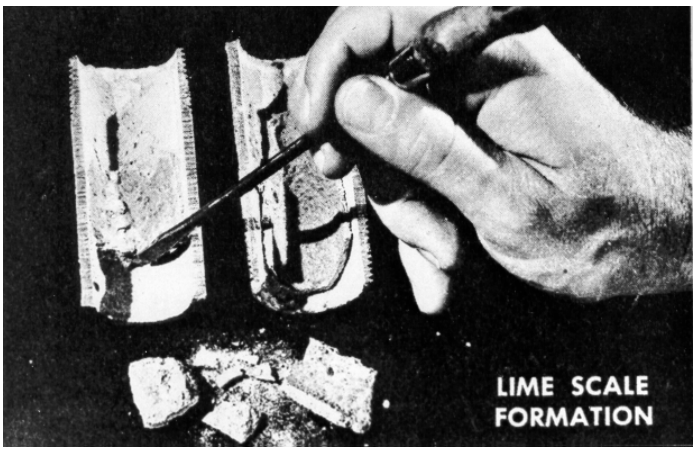
Calcium (in mg/L as Ca) Calcium (Ca) is the major mineral causing hardness in water. When groundwater saturated with dissolved carbon dioxide is pumped to the surface, any subsequent rise in temperature and/or reduction in pressure causes degassing of carbon dioxide and precipitation (settling) of calcium salts forming encrustation deposits.

Although water with much larger concentrations has been used with no apparent detrimental effects, 200 mg/L is a generally recognized maximum.

Magnesium (in mg/L as Mg) The second most common mineral causing hardness is magnesium (Mg). It tends to remain in solution after calcium has precipitated but can form part of the scale found on equipment after the water is heated.

Magnesium concentrations exceeding 150 mg/L may impart a "flat" taste to water. Magnesium in water is considered beneficial to human health.

Hardness (in mg/L as $CaCO_3$) Hardness is generally considered to be those chemicals in water requiring considerable amounts of soap to produce a foam of lather. They produce scales in hot-water pipes, heaters, boilers, and other units if temperature increases substantially.



Hardness in mg/L as $CaCO_3$	Rating	Hardness in Grains per U.S. Gallon
0-30	very soft	0-2
31-60	soft	2-4
61-120	moderately soft	4-7
121-180	hard	7-9
180+	very hard	9+

Zeolite Water Softeners (regenerated with salt) can be used to reduce the hardness of water (See Water Facts - Manganese Greensand Filters and Softeners). However, softened water has a higher sodium level and should not be used for watering plants or by persons on sodium-restricted diets.

Where hardness exceeds 1100 mg/L, softening is not economically feasible.

Manganese (in mg/L as Mn) Manganese (Mn) is a metallic cation similar to iron in chemical behaviour. It is frequently found in association with iron and normally occurs in the manganeous (Mn^{2+}) form. Upon exposure to air or chlorine, it is readily oxidized to a mangenic (Mn^{4+}) state which forms a black precipitate.

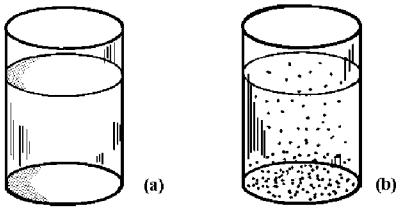
In excess of 0.05 mg/L, manganese usually causes black staining on fabrics and plumbing fixtures and imparts a bitter taste to water.

Iron (in mg/L as Fe) Iron (Fe) is a metallic reaction which causes reddish brown staining of clothes and plumbing fixtures. It also contributes to encrustation of pipes. Minute quantities of iron in calcium encrustation cause the deposits to become orange-red in color. Small amounts of manganese together with iron cause black stains and deposits. An excessive concentration of iron may promote bacterial activity in pipes and service mains.

Most iron found in well water is dissolved in the ferrous (Fe^{+2}) state, causing no serious problems. With exposure to air, ferrous ion oxidizes to the ferric (Fe^{+3}) state, forming a reddish-color precipitate which causes staining. Over a period of time, ferric iron will coat softener resin beads, reducing a zeolite softener's effectiveness.

Iron is not considered a health concern but the taste of water becomes objectionable when a concentration of 1 to 2 mg/L of iron is present. In excess of 0.3 mg/L iron will cause staining and should be removed.

In private wells, iron frequently indicates the presence of iron bacteria. To control this condition, shock chlorinate the water regularly (see Shock Chlorination for Iron Bacteria Control).



(a) Iron water, when first drawn, may be completely free of rust particles.
(b) When exposed to air, oxygen combines with iron to form small rust particles which settle to the bottom of the container.

Sodium (in mg/L of Na) A maximum acceptable level for sodium (Na) concentration in drinking water has not been established. Excess levels are detrimental to persons with heart ailments, circulatory diseases or on salt-restricted diets.

If a zeolite water softener is used, the concentration of sodium will increase.

If the sodium concentration is greater than 400 mg/L, contact your physician.

Fluoride (in mg/L as F) Concentrations in excess of 1.5 mg/L may cause dental fluorosis which in extreme cases may result in noticeable brown mottling or stains on tooth enamel.

Fluorides (F) occur naturally in most water supplies and a concentration of 1.0 mg/L is most desirable in drinking water supplies for the prevention of cavities.

Nitrate/Nitrite Nitrogen (in mg/L as N). Nitrate (NO_3) is the principal form of combined nitrogen found in natural waters. Nitrite (NO_2) is the transition stage between ammonia and nitrate under aerobic conditions or between nitrate and nitrogen gas under anaerobic conditions. Since nitrites are unstable when oxygen is present, all nitrites have usually been converted to nitrates by the time the samples reach the testing laboratory. Because of this, nitrites and nitrates are combined and reported as equivalents of nitrogen (N).

A large concentration of nitrate-nitrite nitrogen in drinking water may decrease the blood's oxygen - carrying capacity leading to methaemoglobinaemia (blue-babies) in infants. **To protect the public, a limit of less than 10 mg/L of nitrate/nitrite nitrogen has been established for drinking water.**

Since nitrates and nitrites are the result of decomposition of organic matter, large concentrations or sudden increases in recorded concentrations may indicate local pollution such as well cribbing failure, improper seals on wells or organic material seeping into the water supply.

Chloride (in mg/L as Cl) Chlorides (Cl) may increase water corrosiveness and are toxic to plants. **In excess of 250 mg/L they may cause unpleasant tastes in water or beverages prepared from the water.** There is no proof that chlorides cause health problems.

A sudden increase in the chloride concentration from one water analysis to another may indicate pollution of the water source and should be investigated.

Sulphate (in mg/L as SO_4) Sulphates (SO_4) in excess of 150 mg/L may cause noticeable tastes in water. Sulphate concentrations greater than 500 mg/L may be laxative to humans. Some individuals may develop tolerances to greater concentrations.

Water Treatment
If the chemical analysis reveals that water treatment is required and you have insufficient information for selecting equipment, you may contact The Manitoba Water Services Board.

Available Laboratories

Enviro.Test Laboratories
Manitoba Technology Centre Ltd.
745 Logan Avenue
Winnipeg, Manitoba
R3E 3L5
Phone: (204) 945-3705
Toll Free: 1-800-607-7555

Norwest Laboratories
1357 Dugald Road
Winnipeg, Manitoba
R2J 0H3
Phone: (204) 982-8630
Toll Free: 1-800-483-3448

(For further information regarding tests or analysis charges, please contact the laboratory.)

Regional Farm Water Technologists

Wes Friesen	Rob Sykes	Mursel Kluke
Dauphin	Brandon	Beausejour
(204) 622-2116	(204) 726-6078	(204) 268-6059

Prepared by: The Manitoba Water Services Board
Box 22080
2022 Currie Blvd.
Brandon, Manitoba
R7A 6Y9
Phone: (204) 726-6076

E-mail: farmwater@gov.mb.ca

Abbreviations

mg/L	=	milligrams per litre
ppm	=	parts per million
gpg (US)	=	grains per gallon U.S.
1 mg/L	=	1 ppm
17.1 mg/L	=	1 gpg (U.S.)