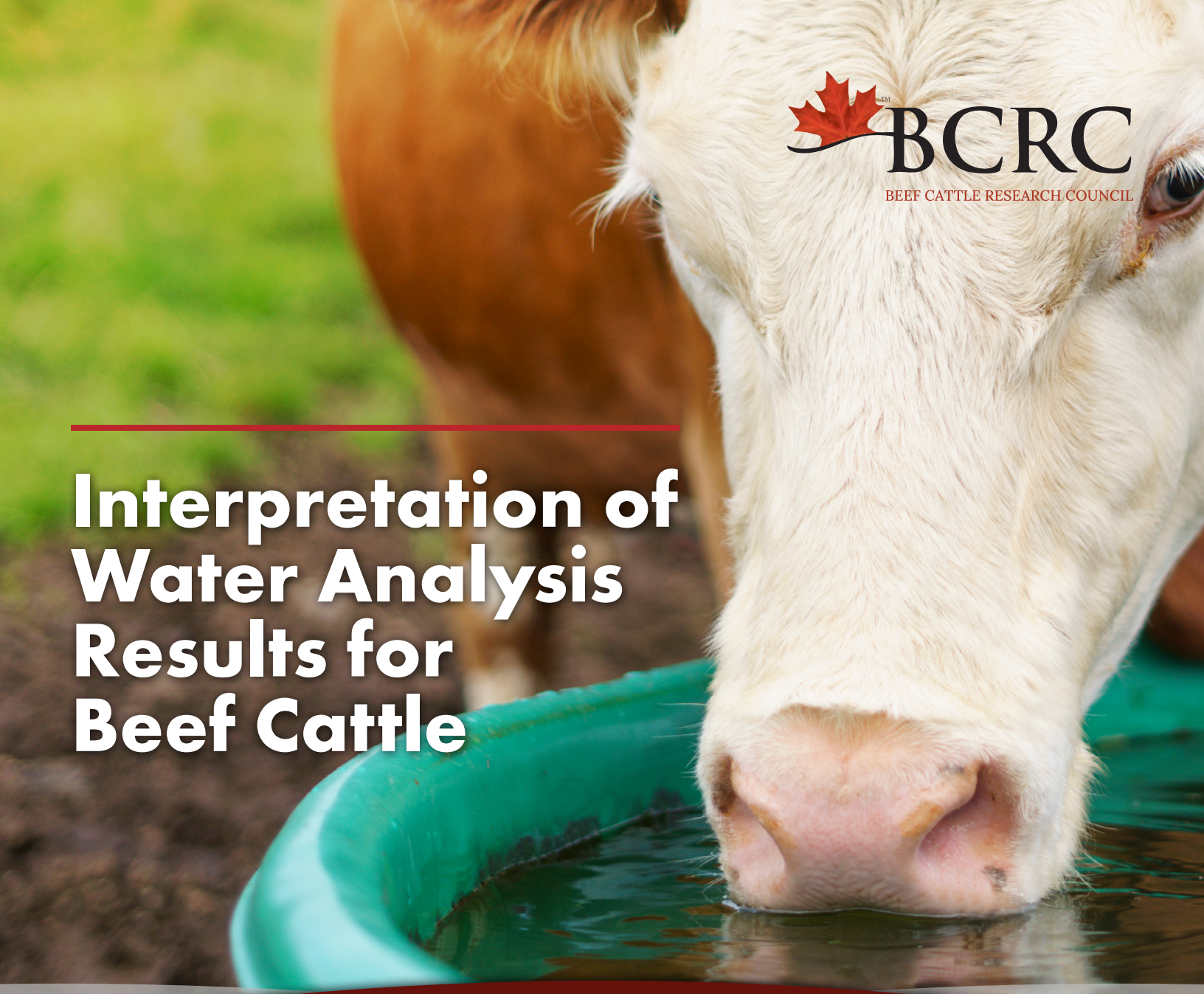

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Interpretation of Water Analysis Results for Beef Cattle

Cattle need high-quality water to maintain health, growth, lactation and reproduction. Water quality testing allows for the detection and management of issues before they negatively impact herd performance.

Water quality is influenced by multiple factors, including the type of rock or soil the water passes through, precipitation levels, groundwater recharge, runoff, evaporation, and adjacent land use. Handheld water meters can provide quick, on-site testing for conductivity and total dissolved solids (TDS). However, laboratory analysis remains the most reliable method for accurately measuring conductivity, TDS, and dissolved minerals such as sulphates.

Compounds in water can interact, sometimes enhancing the effects of one another. Cattle of different ages or stages of production—such as calves, adults, pregnant, or lactating animals—may react differently to the same amount of a compound. Due to these complexities, it is hard to recommend a single concentration that is safe in every situation. Therefore, it is recommend this resource is used cautiously.

Producers are encouraged to consult their veterinarian, nutritionist and provincial livestock specialists when interpreting water test results.

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NOTE

The water content levels in the following table assume that the feed provided to cattle does not exceed their mineral requirements. When evaluating the suitability of a water supply, the mineral content in the feed should also be considered.

Water quality value legend

Acceptable | Poor | Unsuitable

Item analyzed	Water content (mg/L or ppm)	Usefulness for Cattle	Considerations
Conductivity • Indirect measure for total dissolved solids		**All levels of conductivity* can be acceptable** * Refer to total dissolved solids (TDS) for details on specific water content levels	• Easily measured with handheld instruments • Contributors to conductivity will vary by region • When water quality is poor, handheld meters are more reliable for conductivity than TDS
Hardness • Measured as calcium carbonate ($CaCO_3$) equivalents	**<100 (soft)**	**All levels of hardness can be acceptable**	• Not a livestock water quality issue, but may cause scaling in water distribution systems
	101 - 2,000 (hard)	**All levels of hardness can be acceptable**	
pH • pH units range from 1 to 14: 7 is neutral, below 7 indicates acidic pH, above 7 indicates alkaline pH	**<5.5**	**Unsuitable**	• pH outside the acceptable range may cause digestive upset and reduced water and feed intake
	6.0 - 8.0	**Acceptable**	
	8.0 - 10	**Poor**	
	>10	**Unsuitable**	

Item analyzed	Water content (mg/L or ppm)	Usefulness for Cattle	Considerations
Total Dissolved Solids (TDS) • TDS measures all dissolved substances in water other than H_2O molecules • Used as an aggregate indicator of inorganic salts including calcium, magnesium, potassium, sodium, carbonates, nitrates, chlorides, and sulphates	**<1,000 - 3,000**	**Acceptable** 	• If > 3,000 recommendation for further analysis (e.g., sulphates, nitrates, sodium, magnesium, iron) • If > 5,000 recommendation to test for heavy metals (e.g., arsenic, cadmium, lead, chromium, copper, mercury, nickel) *Cattle have been productive at higher TDS levels, but field reports indicate production and health issues including polio at levels below 4,000 ppm
	3,001 - 5,000*	**Generally acceptable**  • May cause diarrhea and reduced performance, particularly in calves	
	5,000-10,000	**Poor**  • High levels can cause diarrhea, especially in lactating cows • Unsuitable for pregnant, lactating cattle or young animals • May negatively affect all animal classes	
	>10,000	**Unsuitable** 	
Nitrate (NO_3^-) • Nitrate levels assume no nitrate is present in the feed *See the bottom of the table for conversions	**0 – 132**	**Acceptable**  • Higher end of range generally safe in balanced diets with low nitrate feeds	• Check the unit and interpretations, as nitrate is often reported differently • Nitrates (NO_3^-) are more soluble in water than in feed, meaning cattle can consume higher amounts from drinking water, increasing the risk of nitrate toxicity. • Nitrates are often associated with coliform contamination (i.e. manure or fertilizer runoff) • Consult your nutritionist and/or veterinarian if nitrates are present in both feed and water
	133 – 220	**Poor**  • Prolonged exposure can be harmful, especially with high-nitrate feeds	
	>221	**Unsuitable**  • High risk of abortions and death, especially when combined with high nitrate feeds	

Item analyzed	Water content (mg/L or ppm)	Usefulness for Cattle	Considerations
Nitrite (NO_2^-) • Testing for nitrite levels is critical when nitrate is also present • Combined nitrate (NO_3^-) plus nitrite (NO_2^-) level should not exceed 100 mg/L *See the bottom of the table for conversions	**<10**	**Acceptable** • Recommended upper limit for cattle	
	11-23	**Poor**	
	>23	**Unsuitable** • High risk if nitrate levels in water or feed are also elevated	

Conversions for Nitrate
When measured as NO_3^- divide by **4.43** to obtain ppm nitrate nitrogen (NO_3-N)
When measured as NO_3-N multiply by **4.43** to obtain ppm nitrate (NO_3^-)
When measured as $NaNO_3$ multiply by **0.729** to obtain ppm nitrate (NO_3^-)
When measured as KNO_3 multiply by **0.613** to obtain ppm nitrate (NO_3^-)

***Conversion for Nitrite**
Nitrite nitrogen (NO_2-N) multiply by **3.29** to obtain nitrite (NO_2^-)

Values for Nitrate Nitrogen (NO_3-N) (alone)
0 - 30: Acceptable
30 - 49: Poor
>50: Unsuitable

Item analyzed	Water content (mg/L or ppm)	Usefulness for Cattle	Considerations
Sulphate (SO_4^-) • Cattle tolerance to sulphates in water depends on the sulphur content in the feed • Consider the combined effects of sulphate, sodium, chloride, and potassium	**<500**	**Acceptable**	• Sulphates are a common cause of poor water quality, particularly in the Southern Prairie region • There is evidence that the rumen microflora may adapt to sulphates, but management decisions should not rely on this • Sulphates bind with positively charged ions in the water such as sodium, calcium and magnesium
	501-1,000	**Acceptable** • May cause diarrhea or water refusal by animals not accustomed to it • Levels between 500-800 mg/L may affect calves, leading to trace mineral deficiencies which may result in reduced growth, fertility and immunity • Decreased performance in feedlot cattle • Recommended maximum = 1,000 mg/L in water if feed is high in sulphates or during high ambient temperatures	
	1,001 - 2,500	**Poor** • Acts as a laxative, reduces performance, and may cause sporadic cases of polio • High likelihood of trace mineral deficiencies, especially copper	
	>2,500	**Unsuitable** • High probability of polio, scours and reduced performance • Levels above 4,000mg/L pose a significant risk of polio and death	
*There is no clear scientific consensus on exact acceptable sulphate levels. These values serve as a reference. Producers should consult their advisors to interpret results in context.			
Potassium (K) • Potassium contributes to water alkalinity • Consider the combined effects of potassium and sodium	**<20**	**Acceptable**	
	21 to 300	**Acceptable** • But depends on alkalinity	

Item analyzed	Water Content (mg/L or ppm)	Usefulness for Cattle	Considerations
Sodium (Na) • Sodium, like potassium, contributes to water alkalinity, and therefore should be evaluated with potassium • Consider the combined effects of sodium, chloride, potassium, and sulphates	**<400**	**Acceptable**	• Sodium alone poses little risk but is a concern when combined with sulphates • High sodium in water may require adjustments to the amount of salt (NaCl) in the ration
	>400	**Acceptable** • Depends on alkalinity and pH	
Chloride (Cl) • Consider combined effects of chloride, sodium, and sulfates	**<15,000**	**Acceptable**	• Cattle tolerate relatively high chloride levels, but adverse effects are likely if associated with high sodium
Iron (Fe) • Iron in livestock water is generally a management concern (i.e. clogging water lines) rather than a toxicity issue	**<0.3**	**Acceptable**	• Levels >0.1 mg/L may cause iron to precipitate, clogging water lines
	>0.3	**Acceptable** • Water may taste bad but generally has minimal effect on water intake or productivity	
Factors with other important considerations			
Bacteria • Detects microbial contamination with pathogens associated with animal waste • Water counts of coliform bacteria or *E.coli* are most commonly used	**Bacteria Counts (CFU*/100 mL)** ***CFU = Colony Forming Units**	Livestock tolerance values are unknown; however, it is recommended to limit the amount of coliforms in cattle drinking water to **less than 100 coliforms/100 mL**	• Presence of *E.coli* in human drinking water usually triggers immediate action • Surface water is at a higher risk of contamination from direct cattle access, runoff, and human waste • Groundwater contamination can occur due to poorly sealed and located wells
Other trace minerals • Aluminum; arsenic; boron; cadmium; cobalt; copper; fluoride; lead; mercury; molybdenum; selenium; vanadium	**Varies**	• Testing for trace minerals adds additional costs, and is usually warranted only for specific issues or regional concerns • Producers should work closely with their advisors to determine whether trace mineral testing is necessary and how to interpret results	• Trace mineral concerns are often regional and may be influenced by geographical formations such as the Canadian Shield or Rocky Mountains foothills

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