

# Water for livestock: interpreting water quality tests

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Dr Greg Curran, Senior Regional Animal Health Manager – Western Division  
Animal & Plant Biosecurity, Broken Hill

## Summary

When considering whether a water source is suitable for livestock, it is essential to test:

1. pH
2. Salinity, and
3. Chloride levels.

This Primefact also discusses:

1. Symptoms of salt poisoning
2. Additional water testing services
3. Salt in pasture and feed, and
4. Interpreting results from the water sampling kit.

NSW Department of Primary Industries offers a water quality testing service, 'Water Sampling Kit' for stock and domestic water uses, available from NSW DPI offices and testing is conducted at Wollongbar.

Other water quality measurements (hardness, calcium carbonate saturation index, total alkalinity and sodium absorption ratio) help assess use for household water and irrigation.

Turbidity is an indicator of how much solid matter (such as clay, silt, organic matter and micro-organisms) is suspended in the water. Suspended matter including blue-green algae, bacteria or chemical pollutants may significantly affect livestock.

## 1. pH

Water for domestic and stock use should be in the range 6.5 to 8.5.

- If the pH is highly acidic (less than 5.5), acidosis and reduced feed intake may occur.
- Highly alkaline water (over 9) may cause digestive upsets and diarrhoea, lower feed conversion efficiency and reduce intake of water and feed.

## 2. Salinity

Salinity is the sum of all mineral salts present in the water, including sodium, calcium, magnesium, chloride, sulfate and carbonate.

The effect of salinity on stock health and productivity depends on:

- The species, breed and age of the animals drinking the water;
- The feed the animals are consuming (water and mineral content);
- Ambient and water temperature;
- Humidity; and
- Which minerals are present in the water

Consider these factors when determining the suitability of a water source.

The measure of salinity is given as an electrical conductivity (EC) reading in microsiemens per centimetre ( $\mu\text{S}/\text{cm}$ ).

**Tables 1** and **2** may be used as a general guide for assessing water suitability for livestock.

General effects of saline water for all livestock are shown in **Table 1**.

**Table 2** shows the effects of different levels of salinity on each type of livestock.

### Notes to tables

\* Sheep on lush green feed may tolerate salinity up to an EC value of 20,300  $\mu\text{S}/\text{cm}$  without loss of condition or production.

\*\* The EC value is obtained by dividing the mg/L or ppm value given in the reference literature by 0.64 to give  $\mu\text{S}/\text{cm}$ . To convert salinity as mg/L or ppm to EC, multiply ppm by 0.64m/L

### 3. Chloride

Chloride has a number of functions in the body. These include the regulation of osmotic pressure and pH balance (along with sodium and potassium).

High chloride levels indicate a risk of salt toxicity.

In all animals, excess sodium chloride can result in dehydration, kidney failure, nervous system dysfunction and death. In ruminants, excessive chloride levels increase osmotic pressure in the rumen. This causes a decrease in microbial population and metabolic activity, reducing an animal's food intake.

The maximum acceptable levels of chloride in water for different livestock are:

- Dairy cattle: 1600 mg/L
- Beef cattle: 4000 mg/L
- Horses: 1200 mg/L
- Ewes and lambs: 2400 mg/L
- Adult dry sheep: 5600 mg/L

The tables and acceptable levels of chloride are intended as a general guide only.

**Table 1. Saline drinking water: general effects for livestock**

Salinity ** (EC in $\mu\text{S}/\text{cm}$ )	Effects/cautions for livestock
Less than 1600	Relatively low level of salinity. Should not present any serious burden to livestock.
1600 to 4700	Should be satisfactory but may cause temporary and mild diarrhoea in unaccustomed livestock. Should have no other effects on health or performance.
4700 to 7800	Can be used with reasonable safety for dairy and beef cattle, sheep, pigs and horses. For pregnant or lactating animals, or horses in work, avoid using water with salinity at higher levels in this range. Unacceptable for poultry.
10,900 to 15,600	Considerable risk in using water for pregnant or lactating stock, young animals or any animals subjected to heavy heat stress or water loss. Unacceptable for poultry. Unsuitable for pigs and horses. In general, should be avoided for se by livestock, although older livestock may subsist on these waters in conditions of low stress.
15,600 to 23,400	Risky. Cannot be used for stock other than adult, dry sheep (see <i>Table 2 below</i> ).
Around 30,000	Toxic: effects will vary depending on the type of salts present.

**Table 2. Effects of saline drinking water for various livestock types**

Livestock	No adverse effects on animals expected	Animals may have initial reluctance to drink or there may be some diarrhoea, but stock should adapt without loss of production	Loss of production and a decline in animal condition and health would be expected. Stock may tolerate these levels for short periods if introduced gradually.
	EC in $\mu\text{S}/\text{cm}$	EC in $\mu\text{S}/\text{cm}$	EC in $\mu\text{S}/\text{cm}$
Poultry	0 to 3100	3100 to 4700	4700 to 6300
Dairy cattle	0 to 3900	3900 to 6300	6300 to 10,900
Beef cattle	0 to 6300	6300 to 7800	7800 to 15,600
Horses	0 to 6300	6300 to 9400	9400 to 10,900
Pigs	0 to 6300	6300 to 9400	9400 to 12,500
Sheep	0 to 7800	7000 to 15,600	15,600 to 20,300*

## 4. Symptoms of salt poisoning

When saline water is used, livestock should be monitored for symptoms of salt poisoning. Symptoms of sodium chloride poisoning include:

- Appear unwell
- Lack of appetite & reluctant to drink
- Increased urination initially followed by small amounts of concentrated urine
- Nasal discharge
- Abdominal pain
- Lying down and nervous signs (such as star gazing, tremors, blindness, circling, walking backwards, head pressing, wobbly in the legs; knuckling at the fetlocks and convulsions)
- Death

Elements like potassium, magnesium, calcium and carbonate can cause other symptoms.

Within a population of animals, the individual animal's tolerance to salinity will vary.

**Important warnings:** If water causes diarrhoea or ill health, it should be analysed to determine the concentrations of specific ions.

If the salinity is high (around EC 4000  $\mu\text{S}/\text{cm}$ ) but chloride levels are normal, an ion analysis is advised to determine which salts are contributing to the high reading. The key anion test or standard test of 19 elements may be appropriate. Consult your adviser from NSW DPI.

**Table 3. Reference of chemical elements and their abbreviations**

Symbol	Element
Al	Aluminium**
As	Arsenic**
B	Boron
Ca	Calcium
Cd	Cadmium**
Co	Cobalt*
Cr	Chromium
Cu	Copper*
Fe	Iron*
K	Potassium*
Mg	Magnesium
Mn	Manganese*
Mo	Molybdenum*
Na	Sodium*
Ni	Nickel

Symbol	Element
P	Phosphorus
Pb	Lead**
S	Sulfur*
Zn	Zinc

\*\*Toxic at high levels

\*Occasionally toxic in certain situations

## 5. Additional water quality tests

You can request additional tests.

- Scan:** a test is available which measures 19 different elements in water. The elements measured in this tested are in the Table 3.
- Key anions test:** a test to measure key anions that may affect livestock health and productivity:
  - Chloride
  - Sulfate
  - Phosphate
  - Nitrite
- A test for nitrogen** (as ammonia and nitrate)

## 6. Salt in pasture and feed

As well as the quantity and types of salts in water, stock owners need to consider the quantity and types of salts their stock are taking in from pasture, particularly if pasture includes plants high in salts such as saltbush, bluebush and other chenopods. Salts from pasture plants will add to a risk of poisoning.

Summer heat greatly increases the quantity of water needed by livestock, especially on salty pastures. (See Primefact 326 Water requirements for sheep and cattle). If this water has high salt levels, the risk of poisoning increases. To assess how this applies to you, consult your advisor.

## 7. Interpreting results from the water sampling kit

For simplicity, temperature and other environmental stressors have not been included in these examples, but they do influence the tolerance of livestock to water salinity and need to be taken into consideration.

**Example 1: Bore water for lambing dorper ewes and heavily pregnant beef cattle**

Feed: pasture and supplementary silage

Analysis	Results	Interpretation
pH	7.1	Acceptable
EC	19,300 $\mu\text{S/cm}$	Very high. Risk for stock use. Would only consider use for dry, adult sheep in the short term. See Table 2. Unacceptable for pregnant and lactating animals. Use is NOT recommended.
Chloride	6489 mg/L	Very high. Exceeds maximum acceptable levels for sheep and cattle. Use is NOT recommended.
pH	6.9	Acceptable.
EC	13,300 $\mu\text{S/cm}$	Not suitable for young, growing animals. Older stock may tolerate this water for a short time if not under stress, but even then, loss in production and a decline in health may occur. As feed is dry and water intake will be increased, it will be advisable to dilute with less saline water for older stock. Not recommended for yearling cattle.
Chloride	4257 mg/L	Chloride level is just under the guide given for maximum acceptable. For older stock, this water could be used, with caution: the chloride level should be acceptable if it was diluted with less saline water.

**Example 2: Bore water for yearling beef cattle**

Feed: short, dry pasture &amp; cottonseed meal with wheat straw.

Analysis	Results	Interpretation
pH	7.1	Acceptable
EC	8200 $\mu\text{S/cm}$	Should be safe for both pigs and horses. They may be reluctant to drink it at first. It may cause gastrointestinal upsets initially. Would not expect any loss in production. See Table 2.
Chloride	2002 mg/L	Chloride level is acceptable for sheep. This level may be a problem for horses. Horses may refuse this water. There is a risk of metabolic disturbances and kidney problems if used long term.

## Further reading

For further information on salinity and livestock, see Primefact 326 *Water requirements for sheep and cattle*.

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## References

NRC, Nutrients and toxic substances in water for livestock and poultry, Washington DC: National Academy of Sciences, 1974.

Hungerford's Diseases in livestock, TG Hungerford, Sydney: McGraw-Hill, 1990.

Veterinary medicine: a textbook of the diseases of cattle, sheep, pigs, goats and horses, OM Radostits, DC Blood, CC Gay, London: Bailliere Tindall, 1994.

This Primefact used the following guidelines as a reference on water quality.

NATIONAL WATER QUALITY MANAGEMENT STRATEGY PAPER No. 4

Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1

The Guidelines (Chapters 1–7) October 2000

<http://www.environment.gov.au/system/files/resources/53cda9ea-7ec2-49d4-af29-d1dde09e96ef/files/nwqms-guidelines-4-vol1.pdf>

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