FACT SHEET

Managing hard water

Source: AgCommunicators

Hard water is very common in many parts of South Australia including the Eyre Peninsula.

Water hardness is a measure of the dissolved calcium, magnesium, carbonate, bicarbonate and sometimes sulphate ions in a water sample. Most of these minerals are very common in South Australia's geology, with the result that they are dissolved at significant levels in the local groundwater.

Hard water has the potential to cause costly issues in farming, including by causing calcium scale deposits in water infrastructure and adversely affecting the performance of spray compounds that are used in productive cropping.

Measuring hardness

Hardness is generally determined by calculation from the calcium and magnesium concentrations and expressed as total hardness in calcium carbonate equivalents – either in mg/L or parts per million (ppm), e.g. $CaCO_3$ mg/L. Bicarbonates may not be included in some standard water tests. Check the test parameters and specify a bicarbonate test if necessary.

Typical water hardness classifications are shown in Table 1.

Table 1. Water hardness classification.

CLASSIFICATION	$CaCO_3$ (ppm or mg/L)
Soft	0 – 50
Moderately soft	50 – 75
Slightly hard	75 – 150
Hard	150 – 300
Very hard	> 300

Source: NSW DPIRD Water quality for chemical spraying, 2012

Why hardness should be tested

Hard water is not usually considered to be adverse for livestock, but it can cause problems in water infrastructure, as the dissolved salts will calcify into hard scale that can reduce flow rates and cause threaded joints to seize.

The ions that cause hardness are more of a problem in spraying water. The positive ions will readily bind with negatively charged ions in weakly acidic ions in herbicides like glyphosate (Figure 1), as well as amine formulations of 2,4-D, clopyralid and diflufenican. Bicarbonates can also affect the efficacy of herbicides such as Group 3 'dims' (e.g. clethodim) and 2,4-D amine at levels as low as 175 ppm. (Source: Sprayers 101 https://sprayers101.com/ph-hardness/)

Hard water can also affect the performance of surfactants, emulsifiers and wetting agents, while precipitates and calcium deposits can inhibit or block pre-filters and nozzles, bind threaded joints and cause accelerated wear in the spray rig.

Excessively hard water can even cause some chemical active ingredients to precipitate out of solution as salts. Check the chemical label or manufacturer's recommendations for details of acceptable water hardness, ideally in calcium carbonate equivalents, and compare this to the hardness of the on-farm water source as measured in recent testing.

How to soften hard water

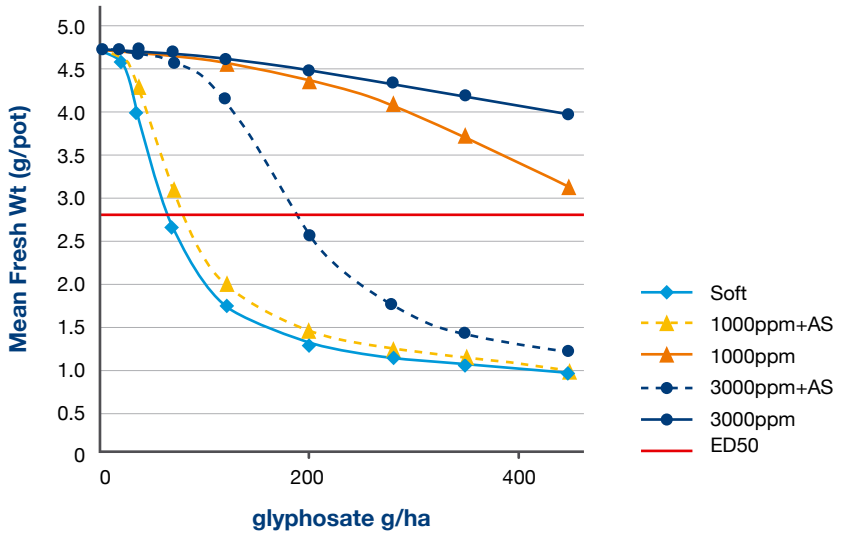
Very hard water may need to be 'softened' before it is used for spraying – especially in the case of amine herbicides such as glyphosate.

There are several water softening options, including various chelates, ammonium sulphate and washing soda (sodium carbonate). Most detergents also contain ingredients that will soften water. However, some softeners may not be compatible with water that is also high in dissolved iron, as is common in EP groundwater.

Always check the herbicide label for specific advice on compatible softening agents and the mixing order.

Also note that the active constituent in any agricultural adjuvant product, including water softeners, must have been approved by APVMA.

Figure 1 Effect of hard water, application rate and ammonium sulphate (AS) addition on the efficacy of glyphosate 450 SL on annual ryegrass. ED50 allows the treatments to be compared when they have reduced the maximum fresh weight of annual ryegrass by 50%



Source: https://eurekaag.com.au/glyphosate-effect-hard-water/

Source: EP Landscape Board

Water testing

As water quality is critical to agricultural performance and productivity, water sources should be tested regularly.

Water for spraying and irrigation should ideally be checked for at least salinity, pH and hardness before mixing, particularly where quality is variable.

Simple DIY test strips and kits are available for testing water hardness on-farm. These can be purchased from most hardware or farm suppliers, or online.

Electronic hardness meters are also available, and these will often give a more specific value reading than a strip or kit. If the salinity of a critical water source is highly variable, a continuous metering unit can be used for ongoing monitoring. Some manufacturers offer multipurpose meters that will measure hardness, salinity, pH and more.

However, the best test results will be achieved by submitting water samples to a laboratory for more sophisticated testing across a range of parameters. The results of these tests can be used to benchmark water quality for each source and to calibrate the results of at-home tests for more frequent monitoring.

For more information on testing options, sampling methods and water quality parameters, refer to our Water Testing fact sheet via the Further resources section below.

Shandying water

One of the simplest ways to manage water quality issues is by mixing the 'problem' water with fresh water captured from a clean source – such as rainwater runoff from infrastructure roofing or a lined catchment.

Often called 'shandying', this blending can help to moderate water quality issues including hardness.

However, while the salinity of shandied water is usually quite predictable, outcomes for other key properties such as hardness, pH, and dissolved minerals can depend on the nature of the two waters and their sources. Therefore, a detailed knowledge of both water sources, derived from testing, is essential to manage the shandying ratios and achieve a suitable result for the intended use.

The blended water sample should be re-tested to confirm that its hardness and other key parameters are all within target levels. If necessary, conduct small scale tests to establish the optimum blending ratio for the available water sources.

For more detailed steps on shandying water, refer to our Salinity fact sheet via the Further resources section below.

Managing other water quality issues

The colour and smell of water can provide important clues to its quality. Additionally, reduced flow rates may indicate blockages in farm water infrastructure, potentially caused by poor water quality. The cause of these should be addressed along with the impact.

For more information on specific water quality issues and how to manage them, refer to the other fact sheets in our Water Quality fact sheet series:

- **Salinity**
- **pH, dissolved iron**
- **Cloudiness, turbidity and algae**
- **Water testing**

Source: SA Water

Further resources

Additional EP Farm Water Security information and fact sheets
pir.sa.gov.au/sardi/projects/eyre-peninsula-farm-water-security-project

EP Landscape Board
landscape.sa.gov.au/ep/water

Water testing fact sheet, EP Landscape Board
cdn.environment.sa.gov.au/landscape/docs/ep/Water-Testing-fact-Feb2022.pdf

EP Water Security Response Plan, SA Water
sawater.com.au/__data/assets/pdf_file/0004/1017625/EP_Water-Security-Response-Plan.pdf

Water affecting activities resources and policy guide, EP Landscape Board
landscape.sa.gov.au/ep/water/water-affecting-activities

Handy links to local councils on the EP, Eyre Peninsula Local Government Association
eplga.com.au/about/councils

*Australian Water Quality Centre (AWQC)*Water testing available from independent business unit within SA Water
awqc.com.au

GRDC Spray Water Quality Fact Sheet (October 2019)
grdc.com.au/resources-and-publications/all-publications/publications/2019/spray-water-quality

Flocculants and water testing instructions, Water Quality Solutions
stage.waterqualitysolutions.com.au/how-to-clear-muddy-water/#:~:text=What%20is%20flocculation%3F,particles%20together%20and%20binds%20them

Measuring the turbitiy of water supplies
wedc-knowledge.lboro.ac.uk/resources/booklets/G031-Measuring-turbidity-in-water-supplies-online.pdf

A quick way of measuring the turbidity of water
wedc-knowledge.lboro.ac.uk/resources/posters/P023_A_quick_way_of_measuring_turbidity.pdf

Glyphosate and the Effect of Hard Water
eurekaag.com.au/glyphosate-effect-hard-water/

About EP Farm Water Security

EP Farm Water Security is a project to promote better capture, storage and management of water on EP farms. It is led by Primary Industries and Regions SA (PIRSA), with project partners SA Water, the Eyre Peninsula Landscape Board, AWI Extension SA, SA Department for Environment and Water and AgCommunicators.

Agriculture is the dominant force in Eyre Peninsula land use and economic activity. It is also the largest user of mains water, accounting for up to 40 percent of local SA Water supply. By acting now to enhance water capture, storage and infrastructure, farmers have the power to underwrite their own water security, save money and reduce their reliance on mains water.

References

ANZG (2023). Livestock drinking water guidelines (currently in draft form). https://www.waterquality.gov.au/sites/default/files/documents/livestock-drinking-water-guidelines-draft.pdf

ANZECC & ARMCANZ (2000) Water quality guidelines. https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf

Acknowledgements

NSW DPIRD *Water quality for chemical spraying*, 2012 (https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/433691/Water-quality-for-chemical-spraying.pdf)

Sprayers 101 (https://sprayers101.com/ph-hardness/)

Decision checklist:

- ☐ Consult with experts to assess the water test parameters needed.
- ☐ Identify a suitable water testing laboratory and confirm the test package covers all required results.
- ☐ Prepare sampling supplies, including containers labels, courier arrangements, etc.
- ☐ Identify suitable sampling locations.
- ☐ Plan for any other requirements, such as running a new bore pump for three hours before sampling.
- ☐ Ensure samples will be dispatched for testing promptly after collection.
- ☐ Regularly check and monitor water quality to ensure it is safe and fit for purpose, especially prior to using for crop spraying or watering livestock.
- ☐ Make sure your water quality tests check for salt, chemical and bio-contaminants such as bacteria and algae.

Legal considerations

On-farm construction activities designed to access water resources are subject to State Government legal requirements in South Australia. These requirements are designed to protect the water resources, other water users and the natural environment.

The legal requirements are affected by factors such as the location, size and type of the works, for example:

- Large dams and large, highly visible water harvesting structures (e.g. sheeted catchments) may be subject to the need for development approval via your local Council, under the state's planning regulations.
- A permit is required from the Eyre Peninsula Landscape Board for a range of water affecting activities that may impact on watercourses, including the construction or modification of small to medium sized dams in watercourses in some catchments across southern Eyre Peninsula.
- A permit is required from the Department for Environment and Water (DEW) to construct or modify a groundwater well or to discharge water into a well. A licensed well driller must carry out or supervise the drilling or modifications.

Landholders should seek information from their local Council, Landscape Board and DEW when in the early planning stage of their proposal, so that the activity can be located and designed to meet legal requirements and to streamline any approvals process that applies.

For more information, see the Resources and further reading section.