CHAPTER 5
Water during a drought

This chapter outlines stock water requirements, problems that may occur and options for managing water resources on farm.

Key messages

- **Do water budgets early, based on your experience with water supplies, how much water you have available and how much your stock will need.**
- **Have a water plan that includes the worst case scenarios.**
- **Evaporation rates can be very high over dry summers and small dams are inefficient water storages.**
- **Consider water reticulation systems and transfer requirements between storages, particularly for containment areas.**
- **The major threat to water quality during drought is high levels of salt, although algae and animal manure can foul water following heavy summer rains or strong winds.**
- **Water can be tested for salinity and other minerals, to check suitability for various classes of stock and for toxicity of algal blooms.**

One of the main limitations of feeding animals through a drought is the availability of good-quality drinking water. Whether stock are in containment areas or in the paddock, water is essential for animal survival and performance. Poor water quality is a common cause of under-performing animals.

If your main water storage and supply is from dams, stock can get stuck in the mud trying to access the depleted pool of water left. This may require limiting access to some dams before they run out of water.

Will you have enough water?

Knowing your property and how water supplies perform in times of drought is essential information for the planning phase. Calculating the total water available and the total required by stock will tell you how many stock and of what class you can carry through a dry period.

If all stock water is supplied by dams, list all the dams by paddock and calculate the water available in each one. Add these quantities together to give you the total water available on your farm. Using this figure and the total water required by stock, based on Table 5.1, determine how many animals you can carry through.

Animal requirements

The amount of water an animal requires will depend on a number of factors including:

- the class of animal (a lactating ewe will require significantly more water than a weaner)
- the temperature and season (sheep consume more water in summer and during warmer weather)
- the feed on offer (stock will drink more on dry feed such as grains, hay and dead pasture than on feeds with higher water content)
- the quality of the water (water with higher salt levels will increase consumption).

Table 5.1 provides a guide to the average and summer daily requirements of most classes of sheep as well as beef cattle and horses.

Table 5.1: Stock water requirements litres/animal/day.

Stock type	Consumption (litres/animal/day)	
	Summer	**Average daily**
Sheep		
Weaners	6	4
Adult dry sheep	10	6
Ewes with lambs	14	10
Beef Cattle		
Weaner (250–300 kg)	70	Up to 55
Adult Dry stock	112	Up to 80
Horses (grazing)	49	35

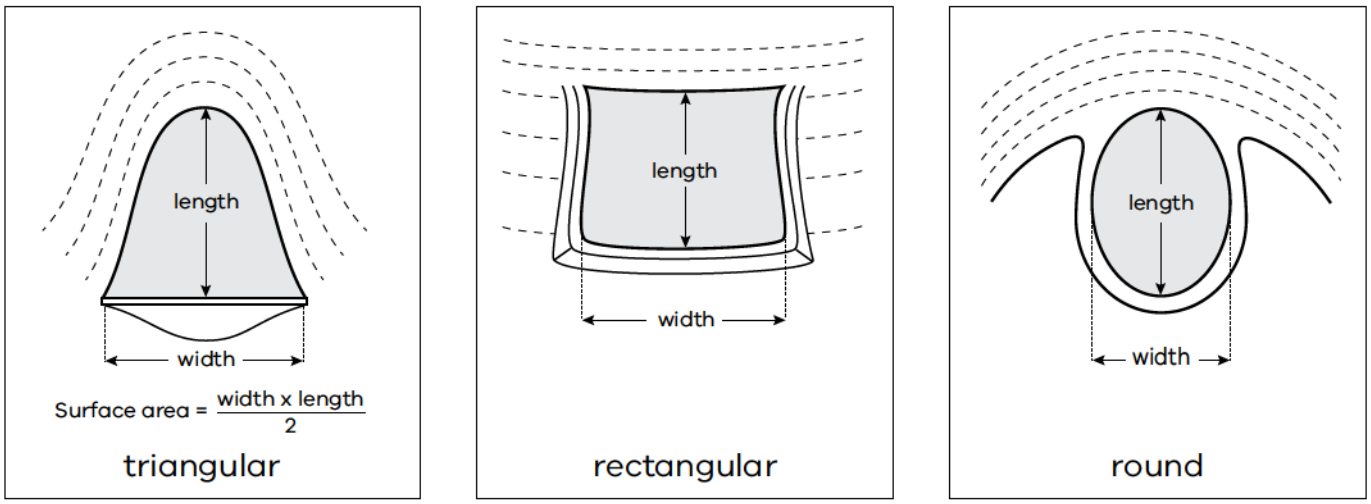
For more information on water requirements for sheep and other livestock types refer to 'Managing farm water supplies' agriculture.vic.gov.au/__data/assets/pdf_file/0003/319386/2016-DEDJTR-Farm-Water-Supplies-A5-web.pdf

How to calculate how much dam water you have

Step 1

Calculate the surface area of the dam. For both rectangular and round dams, surface area can be estimated by multiplying the length by the width of the dam. Example: 40 m wide x 20 m long = 800 m^2. For triangular-shaped dams, surface area can be estimated by (width x length) ÷ 2.

Picture source – www.water.nsw.gov.au/__data/assets/pdf_file/0010/547237/licensing_rights_harvest_dams_what_size_are_your_existing_dams.pdf



Step 2

Use the following formula to calculate the volume of the dam in cubic metres.

Volume (m^3) = 0.4 x Surface area x Depth

The 0.4 conversion factor takes into account the slope of the sides of the water storage.

Example: Volume = 0.4 x 800 m^2 x 5 m = 1,600 m^3

To convert this to megalitres (ML) divide by 1,000 = 1.6 ML

Step 3

Allow for evaporation and seepage.

Evaporation can be one of the biggest losses from farm dams, especially small or shallow dams. For example, average annual evaporation figures for farm dams based on Ballarat evaporation data are:

- a small farm dam 3 m deep would lose around 60%
- a small to medium-sized dam 4 m deep would lose around 43%
- a medium dam 5 m deep would lose around 37%
- a large dam 7 m deep would lose around 27%

In the hotter northern parts of the state, these figures could be higher. Although these are annual estimates, most evaporation will occur between October and April.

Allowance for loss from seepage into the water table may also need to be taken into account. Variation between dams can be significant, and daily seepage losses between 1 mm and 8 mm depth per day have been measured. Experience will guide you as to which dams cannot be relied on to hold water for long and it may be worthwhile to graze paddocks with unreliable water storage early. Regular monitoring or prior knowledge of a dam's capacity to hold water is necessary to accurately estimate how long your dam water will last. More depth may need to be taken off to account for this seepage.

Example: 1.6 ML dam less 37% in evaporation (not including seepage) as 592,000 litres (0.59 ML) lost= 1,008,000 litres (1 ML) available.

Step 4

Use Table 5.1 to calculate the daily requirements of all animals that rely on the dam/s for their drinking water.

Example: 2,000 dry sheep consuming 10 litres a day will consume 20,000 litres/day (Table 5.1 using the summer average daily rate).Divide the total dam capacity by the daily water usage: 1,008,000 litres/20,000 litres = 50 days of water available, noting that water quality may be very poor once the dam levels are low.

An online farm water calculator can be used to calculate stock water requirements and water available on farm. See www.agriculture.vic.gov.au/watercalculator

Water quality

Stock do best on water that is fresh, cool and clean. Water should be low in salt, low in organic matter (<20 mg/litre Dissolved Organic Carbon (DOC)), low in suspended clay (<200 Nephelometric Turbidity Unit (NTU)) and free of other toxic substances, such as blue green algae. Avoid using water that looks or smells bad. Water should be tested if there is any question of its suitability for stock. The major threat to water quality during drought is high levels of salt, although algae and animal manure can foul water following heavy summer rains or strong winds.

Water quality can affect plant growth, livestock health, soil quality, farm equipment and infrastructure. The quality of water will vary, depending on the season and weather conditions and storage source, particularly from dams. Evaporation increases the concentration of salts while a flush of water dilutes salts but may increase sediment, fertilisers and manure or nutrient runoff. Monitor sources regularly and more frequently in summer or in periods of prolonged moisture stress.

Salt content

Salinity is a major water quality issue in areas where accumulated salts are mobilised in the landscape and make their way into waterways and dams. Salinity refers to all the mineral salts present in the water including sodium, calcium, magnesium, chloride, sulphate and carbonate. Evaporation of water sources increases the concentrations of the salts and the problems associated with them. During a drought year, low water levels can double salt concentrations over the summer.

Young sheep have difficulty thriving on water supplies with higher than 5,000 ppm salt while adult stock can handle up to 14,000 ppm, especially once they get used to it. However, levels of above 10,000 ppm need to be treated with caution. Table 5.2 lists salt levels in drinking water that can be tolerated by sheep and cattle. In general, the salt content of water should not exceed 10,000 ppm.

Table 5.2: Salinity tolerance levels for stock water.

Type of Livestock		EC (µS/cm)	Mg/L (ppm)
Beef cattle	Production decline begins*	6,250	4,000
	*Maximum level***	*15,600*	*10,000*
Lactating ewes and weaners	Production decline begins*	6,000	3,800
	*Maximum level***	*10,000*	*6,400*
Dry mature sheep	Production decline begins*	9,300	6,000
	*Maximum level***	*21,800*	*14,000*

** Production decline begins = upper limit salt concentration for healthy growth.*
*** Maximum = maximum salt concentration that may be safe for limited periods.*

Table 5.3 outlines the **upper limit** tolerances for a range of elements across all stock types and classes. Some tolerance levels will be lower for sheep, particularly young sheep, such as magnesium, which should not exceed 400 ppm (mg/L) for young sheep or 600 ppm (mg/L) for adult sheep.

Table 5.3: Water quality stock tolerance levels.

Element	Rainwater	Upper limit	Effect
Calcium	40 mg/L	>1,000 mg/L	Phosphorous deficiency
Magnesium	0-19 mg/L	>1,000 mg/L*	Scouring and diarrhoea
Nitrate	10 mg/L 1 mg/L	>1,500 mg/L nitrate, >30 mg/L nitrite	Vomiting, convulsions, death
Sulfate	250 mg/L	>1,000-2,000 mg/L	Diarrhoea
Aluminium	0.05-0.2 mg/L	5 mg/L	Phosphorous deficiency
Arsenic		0.5 mg/L	Diarrhoea, anaemia, poor coordination
Copper	1 mg/L	0.5 mg/L	Liver damage and jaundice, Copper accumulation in the liver
Fluoride	1 mg/L	>2 mg/L	Tooth damage and bone lesions
Iron	0.3 mg/L	Low toxicity	
Lead (notifiable disease)*	0.015 mg/L	0.1 mg/L	Reduced coordination, blindness, going off feed
Molybdenum (related to copper)		0.15 mg/L	Scouring and loss of condition. Infertility, skeletal disorders, testicular damage.
pH	6.5-8.5	>9 <5	Other minerals become available, such as copper and aluminium
Total Dissolved Solids	500 mg/L	Variable generally >5,000 mg/L	Poor production, diarrhoea, higher mortality rates

The upper limits of mineral and metal levels described will vary due to specific geology weathering and acid conditions, in conjunction with high salinity levels or specific management. If feed contains the particular minerals then the limits are lower (Guidelines from the ANZECC 2000).

** Notifiable disease – seek advice from DEDJTR Animal Health*

Pollution

During the 1982–1983 and 2015–16 droughts, many dams in northern Victoria were severely polluted by manure and dried vegetation blowing from bare paddocks. The water turned black and gave off a putrid smell and stock stopped drinking.

Keeping ground cover on paddocks adjacent to dams will help to avoid soil and contaminants entering dams. Fencing off major water storages and reticulating water will improve water quality and stock performance. If paddocks that have significant dam storages do become very bare, sediment traps around the inflow area can reduce sediments entering dams when rain falls, or on the windward side to prevent sediment blowing in. Sediment traps can be made from shade cloth or straw bales to capture vegetation and manure before it runs into dams. A video and information note about building a sediment fence is at agriculture.vic.gov.au/agriculture/farm-management/managing-dams.

Figure 5.1: Sediment fence built to protect dam from debris and pollution after fire.

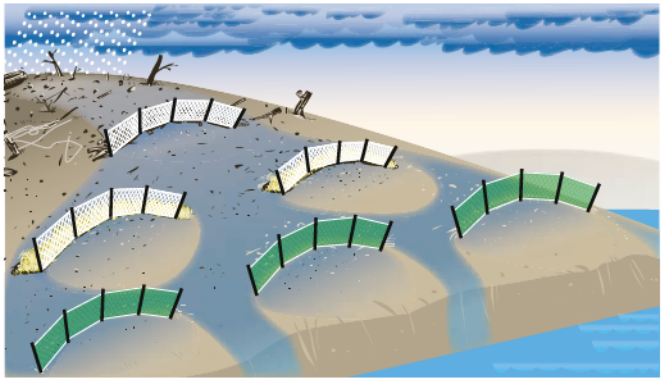


Figure 5.2: Diagram illustrating how sediment fences work to reduce sediment entering dams.

Once material is in the dam, aeration of the water is necessary to improve its condition and make it more acceptable to stock. This is best done by pumping to a tank and reticulating to a trough. If aerated water is returned to the dam, the organisms growing on the organic material will quickly use all the oxygen again.

Algal blooms

Algal blooms are common over summer months when water temperatures rise as dams become shallow and the levels of phosphorus and nitrogen in the water build up.

Most algal blooms are not toxic. Some blue-green algae, however, produce toxins that can have serious health implications for humans, animals and birds drinking or coming in contact with the water. It can kill animals within a few hours of ingestion.

Blue-green algae forms a scum that looks like green acrylic paint and leaves sky blue marks on rocks or plants around the edge of the dam.

If you suspect you have a blue-green algal bloom:

- isolate all stock from the dam or water supply
- collect a sample for testing by a water laboratory (use gloves, don't allow the water to come in contact with skin)
- contact a veterinarian if animals show symptoms of poisoning (loss of appetite, breathing difficulties, muscle twitches, weakness, scours, photosensitisation – any white areas of skin become swollen and reddish)
- contact Agriculture Victoria for further advice on controlling the algal bloom; see agriculture.vic.gov.au/agriculture/farm-management/blue-green-algae-issues/managing-blue-green-algae-in-farm-water-supplies for further information.

The best way to be certain about the quality of your water is to have it tested. The following laboratories test water, but there may be additional laboratories. The National Association of Testing Authorities (NATA) is the authority that provides independent assurance of technical competence through a network of best practice industry experts.

SGS

(NATA accredited)

10/585 Blackburn Road, Notting Hill, Victoria, 3168

(03) 9574 3200

Irrigation and stock water analysis available (salinity (EC), calcium, magnesium, sodium, iron, total oxidised nitrogen, pH, chloride, total hardness and other chemistry). Blue-green algae testing is also available at an additional cost.

Microbiological testing for human consumption is available in Shepparton (03) 5821 1708 and Mitcham (03) 9874 1988.

Water Quality Laboratory

(NATA accredited)

Deakin University, Warrnambool

(03) 5563 3481

wql-info@deakin.edu.au

Water testing service - Water chemistry (NATA accredited) and blue-green algae (not NATA accredited).

ALS Water Resources Group

(NATA accredited)

22 Dalmore Drive, Caribbean Business Park, Scoresby

(03) 8756 8000

melbournewrg@alsglobal.com

(Regional laboratories in Wangaratta, Bendigo, Traralgon and Geelong – basic water testing only)

Domestic, stock and irrigation packages available (includes: pH, electrical conductivity, turbidity, calcium, potassium, magnesium, hardness, sodium, iron, manganese, nitrate, chloride, sodium absorption ration) and blue-green algae.

Southern Scientific Services

(not NATA accredited)

33 Port Fairy Road, PO Box 234, Hamilton

(03) 5571 9666

ssspllltd@optusnet.com.au

Water testing service – Water chemistry and blue-green algae.

Ecosse

(not NATA accredited)

77 Curtis Street, Ballarat

(03) 5331 4677

Basic test includes salinity, hardness, pH and iron. Provides an indication only; more detailed testing may be required depending on initial results.

Options to reduce water requirements

If your water budget is indicating that you will not have enough water to carry all stock through, you may need to consider selling some or using agistment options if available.

Consider stock containment in purpose-built yards that eliminate the need for stock to wander large paddocks in search of feed, and may provide more efficient options for providing and monitoring water quantity and quality.

Minimise evaporation

To conserve water and maintain good water quality, one large deep dam is more efficient than numerous shallow dams. Depending on dam location, etc, it may be advantageous to pump the contents of a number of smaller dams into a single dam to minimise evaporative loss.

Reticulate from dams rather than allowing animals direct access. Reticulating water avoids pugging and bogging problems and allows a more efficient use of the water. Reticulation systems must be simple, reliable and have sufficient storage capacity and flow to meet peak demands. Schemes should include troughs and storage tanks. Reticulation systems should also consider water transfer and pumping requirements and emergency contingency plans in case of failure.

Where possible, site troughs, tanks and pipes to suit future needs. For example, in or near yards or smaller paddocks. Also consider the minimisation of energy requirements for pumping and transferring water. Gravity-fed systems to troughs can provide cheap and efficient distribution of water from a higher water storage point. They also work when the power goes out or you have a fire and power will not be restored for weeks.

Actions to address a water shortage

Cart water

Carting water is extremely labour intensive. For valuable stock, it may be a valid option but otherwise it is best regarded as a last resort.

Check the quality of the water supply available for carting. Many streams and bores are quite salty.

It is not feasible to put carted water into earthen dams due to seepage and evaporation so use tanks and reticulate to troughs.

Sink bores

Investigate likely water yields and likely water quality before drilling emergency bores. Consult your Water Authority if you are considering constructing a bore as you will need a licence. For more information and to apply for a licence visit mywater.waterregister.vic.gov.au

Dig new dams

Do not dig a new dam when soil moisture is low. Only build earth dams when soil is moist enough for maximum compaction. A permit is required to dig a new dam on a waterway. Seek advice and permission before construction from your Catchment Management Authority.

Dam design, siting and construction can be a complex and important part of dry time survival. Getting this correct is not a matter of luck but using the right people for the right job. When seasonal conditions improve build up a contingency plan for the next dry period. Aim to drought-proof your property and its enterprises. Do not get caught by the next dry period.

Farmer tips from past droughts

- Have a water plan and undertake a water audit, taking into consideration the worst case scenario. Calculate stock water requirements and water available using the online farm water calculator www.agriculture.vic.gov.au/watercalculator
- Assess reliability of all your water sources. A dam that fails five or more years out of 10 is not reliable.
- Have a large, fenced catchment dam on your property and reticulate from this to troughs.
- Spend money and set up your reticulation system properly from the start but do it in stages.
- Prepare early and ensure you have all permits in place well before summer.
- Plant trees strategically to reduce evaporation from dams.

Further information

- Farm Water Solutions (Package): www.agriculture.vic.gov.au/farmwater
- Dams: agriculture.vic.gov.au/agriculture/farm-management/managing-dams/how-long-will-my-dam-water-last
- Organic pollution in farm dams: agriculture.vic.gov.au/agriculture/farm-management/managing-dams/organic-pollution-in-farm-dams
- Farm Water Calculator: www.agriculture.vic.gov.au/watercalculator
- Water quality: agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/water/farm-water-solutions/technical-resources/managing-farm-water-supplies-in-drought
- Water supply for stock containment areas: agriculture.vic.gov.au/agriculture/farm-management/managing-dams/water-supply-for-stock-containment-areas
- Anzecc, Armcanz. 'Australian and New Zealand guidelines for fresh and marine water quality'. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra (2000): Section 9.3 pp 1-32.

  www.agriculture.gov.au/SiteCollectionDocuments/water/nwqms-guidelines-4-vol3.pdf