

Estimating Dairy Farm Water Requirements and Storages

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Estimating stock water needs and understanding what is currently in storage is fundamental to planning for the potentially difficult season ahead. Water requirements and supply can also vary across the milking area, turnout or leased areas therefore multiple water audits may be needed to reflect this.

How much water do I need?

Typical water uses include; stock, the dairy, evaporation, household and a contingency may also be needed for fire-fighting purposes. The following section provides some average figures to estimate on-farm water use. However, measuring your own use is the most accurate way of estimating your water requirements as water use varies considerably between farms.

Measuring your own water use

There are two methods that can be used to estimate your on-farm water uses this includes the storage volume method and the flow rate method.

Storage Volume Method

The storage volume method involves turning off the replenishment valve on a water tank that you know the volume of, and determining the volume of water used for a particular purpose. In the case of stock water it may also be necessary to time how long it takes for the tank to empty, as multiple tanks may be required per day.

Need a reminder on how to calculate the volume of a tank?

To calculate the volume of a tank:

$$\text{Volume of tank} = \pi \times r^2 \times h$$

Where π (pi) = 3.14

Where r = radius (half of the diameter in metres)

Where h = height (in metres)

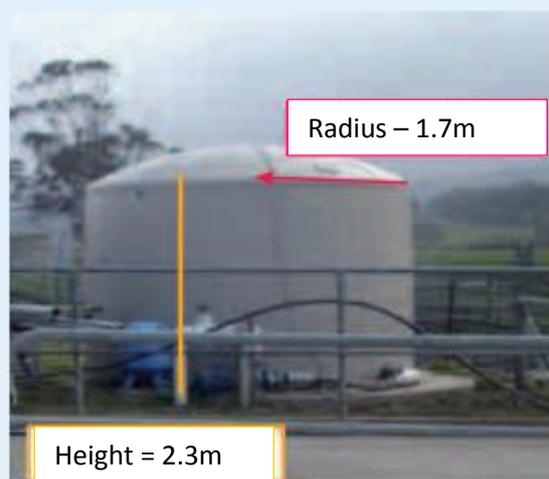
Then to convert volume (m^3) into litres (L)
multiply the answer by 1,000.

Example

Radius (r) = 1.7 Height (h) = 2.3

$$\text{Volume (m}^3\text{)} = 3.14 \times (1.7)^2 \times 2.3 = 20.87 \text{ m}^3$$

$$20.87 \times 1,000 = 20,870 \text{ L}$$



Flow Rate Method

The flow rate method can be applied for water used from a hose. A bucket or container of known volume is needed as the water is directed into this container, and the amount of time it takes to fill the container is recorded. This information, combined with an understanding of how long the particular hose is used per day, can estimate the total volume of water used each day.

A. Stock water

There are many factors that influence how much water animals require including; type of animal condition or physiological state of animal, diet, level of activity, quality of water on offer and environmental conditions. Table 1 provides some average figures that can be used to determine stock water requirements.

Table 1. Worksheet for determining stock water requirements on farm

Stock class	Average daily water requirement (litres)		Number		Daily total (litres/day)
Milking cow	110 – 200	X		=	
Replacement heifer	50	X		=	
Calves	25	X		=	
Bulls	80	X		=	
Dry cow	80-100	X		=	
			A. TOTAL STOCK REQ		

B. Dairy Shed Water

Dairy shed water use is extremely variable. The analysis of a dataset from 780 Victorian dairies is summarised in Table 2 below which shows the 75th percentile of water use. This means that 75% of dairies would use a daily volume of water below the figures shown. These figures can be used as a rough guide for water use. To measure your own water use please refer to the booklet - *Dairy shed water – how much do you use?*, as this will provide a more accurate estimation of your situation and insert your figures into Table 3.

Table 2. Predicted 75th percentile for dairy water use per day (l/day) by herd size and dairy type (DEPI 2009).

Dairy type ²	Herd size (milking cows)									
	50	100	200	300	400	500	600	700	800	900
Double-up	5642	6456	8465	11131	14654	19348 ¹				
Swingover	4921	6113	9444	14618	22663	25195 ¹				
Rotary		18358	21057	24142	27694	31790	36509 ¹	41957 ¹	48243 ¹	55502 ¹

Table 3. Worksheet for estimating dairy shed water use

Process water is used in	Water Source	Daily volume (litres/day)
Yard cleaning (inside the shed)		
Yard cleaning (outside the shed)		
Milk cooling		
Activities in the pit (trigger hoses etc.)		
Fixed cluster and platform sprays		
Milking machine and bulk tank/vat cleaning		
Other tasks (such as sprinklers on the yards for cooling cows)		
	B. TOTAL DAIRY USE	

Other uses of water

C. Evaporation and other losses

It is important to allow 3 to 5 mm/day to account for evaporation over summer (which can be calculated using Table 4). Storing water in one deeper dam rather than lots of shallower dams, can reduce the surface area exposed to evaporation and therefore reduce losses. A factor of 0.67 is also included in the calculation to account for the depth of the dam. Dams can also seep around 10% of their volume per year and leaking troughs and pipes can also contribute to unseen losses.

Table 4. Worksheet for estimating Dam evaporation

Dam Name	Average dam Length (m)		Average dam Width (m)		Daily evaporation (m) and depth factor		Conversion of m ³ to litres		Daily evaporative loss (litres)
		X		X	0.005 x 0.67	X	1000	=	
		X		X	0.005 x 0.67	X	1000	=	
		X		X	0.005 x 0.67	X	1000	=	
C. TOTAL EVAPORATIVE LOSS									

D. Fire-fighting

Fire-fighting requirements for water should also be considered as per your personal Bushfire Plan. For resources relating to bushfire preparation, refer to; www.cfa.vic.gov.au. Irrigators may also want to include their allowance for irrigating in this section.

Table 5. Worksheet for estimating fire-fighting requirement

Fire-fighting water strategy description	D. TOTAL FIRE-FIGHTING or irrigation allowance (litres needed in storage)

E. Household

Household water use can be estimated using a daily figure of 155 litre/day/person.

Table 6. Worksheet for estimating household water requirement

Number of household members		Daily allowance per person (litres/person/day)		E. TOTAL DAILY HOUSEHOLD WATER USE (LITRES/DAY)
	X	155	=	

F. Total farm water requirement

	F. Daily total water requirement (litres/day)
Add up the daily total for A+B+C =	

How much water do I have?

On farm water storages such as tanks and dams provide a buffer to provide water to the farm for periods when it doesn't rain in the absence of a reliable water supply. The look up tables below provide some basic estimations of dam volumes. An on-farm water calculator tool is available where you can alter the depth of the dam to establish the volume of water on-hand (see Resources at end of document).

Dam depth

To understand how much water you have on hand, you will need to know the depth of water in the dam. If you have a small boat, it may be possible to lower a weighted line over the side of the boat and measure the dam depth. An alternative is to use a fishing line with a sinker on the bottom and a float attached. The line is cast out repeatedly, with the float gradually adjusted until it's not quite floating on the surface. The distance between the float and the sinker will be the depth at that point in the dam.

G. Storage volume

Table 7. Worksheet for listing storage volumes on-farm

Dam or Tank Name	Total Volume of storage (litres)	Approximate volume of water on hand (litres)
G. Total volume of water (litres)*		
H. Water available on hand excluding fire-fighting contingency (G-D)		

*ML = mega litre = 1,000,000 litres

Table 8. Lookup table to estimate the volume of a rectangle or square dam (assumed batter slope of 1:2.5)

Width (m)	Length (m)				
	15m	20m	30m	40m	60m
15m (depth 3m)	0.23 ML	0.34 ML	0.56 ML	0.79 ML	1.24 ML
20m (depth 3m)	0.34 ML	0.53 ML	0.9 ML	1.28 ML	2.02 ML
40m (depth 4m)		1.3 ML	2.53 ML	3.73 ML	6.13 ML
60m (depth 4m)		2.13 ML	4.13 ML	6.13 ML	10.13 ML

Table 9. Lookup table to estimate the volume of a round dam (assumed batter slope of 1:2.5)

Radius (metres)	Depth (metres)	Volume (mega litres)
10m	2m	0.21 ML
20m	4m	1.67 ML
25m	4m	3.24 ML
30m	5m	5.63 ML

Table 10. Lookup table to estimate the volume of Gully dams

Dam surface area (m ²)	Depth (metres)	Volume (mega litres)
100m ²	2m	0.08 ML
500m ²	3m	0.6 ML
1000m ²	4m	1.6 ML
1500m ²	5m	3 ML
2000m ²	5m	4 ML
5000m ²	6m	12 ML

How long will it last?

Daily farm water requirement is F. _____ (litres/day) and in storage is H. _____ (litres)
 so $H \text{ (storage)} \div F \text{ (requirement)} = \text{_____ number of days of water available (where no rain falls).}$

Monthly water balance – worksheet to determine how long will the dam last without rainfall

A monthly water balance can also be used to assess the farm water situation and allows some more flexibility for seasonal variation, and can be updated as the season unfolds as a monitoring tool. To complete this worksheet you will need to multiply the daily average water use for each component by the number of days used per month and make seasonal adjustments.

Table 11. Worksheet for a monthly water balance

Water requirement/uses	Nov	Dec	Jan	Feb	March	April	Total
A. Stock drinking water							
B. Dairy Shed Water							
C. Evaporative loss from dams							
I. Total monthly water requirement (litres) (A+B+C)							
Storage volume (water on-hand) - Cumulative Total							

Table 12. Example worksheet for a monthly water balance for farm milking 300 cows and with a 10 ML dam with surface area of 4700m² and dairy use of 8840 l/day assuming no runoff and no rainfall onto dam surface.

Water requirement/uses	Nov	Dec	Jan	Feb	March	April	Total
Stock drinking water	1,350,000	1,800,000	1,800,000	1,680,000	1,395,000	1,350,000	9,375,000
Dairy Shed Water	265,200	274,040	274,040	247,520	274,040	265,200	1,600,040
Evaporative loss from dams	472,350	488,095	488,095	440,860	488,095	472,350	2,849,845
Total monthly water requirement (litres) (A+B+C)	2,087,550	2,562,135	2,562,135	2,368,380	2,157,135	2,087,550	13,824,885
Storage volume (water on-hand) - Cumulative Total	7,912,450	5,350,315	2,788,180	419,800	-1,737,335	-3,824,885	

Key Contacts and Resources

Southern Rural Water

Licensing of water such as digging dams, bore construction and sharing water between properties.

Web: www.srw.com.au

Phone: 1300 139 510

Groundwater Hub

Information and interactive maps relating to existing bores, aquifers and licensing. You can also download a copy of the Gippsland Groundwater Atlas from this web-site which provides and illustrated guide to the aquifers across Gippsland.

<http://gwhub.srw.com.au>

Emergency Water Supply points

Victoria has a networks of about 300 emergency water supply points which provide water for emergency stock and domestic purposes during severe dry seasonal conditions. Contact your local council, rural or urban water corporation about Emergency Water Supply points in your local area and to confirm the information on the below map.

Web: www.delwp.vic.gov.au/water/emergency-watersupply-points

Bore Drilling

A list of drilling contractors can be found on the Australian Drillers Association website.

Web: <http://www.adia.com.au>

Water Carting and irrigation suppliers

The yellow pages and/or a general internet search is one method for finding water carters and irrigation suppliers.

Web: www.yellowpages.com.au

On Farm Water Calculator Tool and farm water planning resources

Department of Economic Development, Jobs, Transport and Resources,

Web: <http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/water/farm-water-solutions/>

Phone: 56242218

Farm Water Quality Information Note

Farm Water Quality and Treatment – DPI NSW, 2014,

http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0013/164101/Farm-water-quality-and-treatment.pdf

On-farm Water Reticulation Planning Guide

GWM Water,

Web: <http://www.gwmwater.org.au/services/wimmera-mallee-pipeline/on-farm-water-reticulation-guide>

Dairy Australia

Saving Water in Dairies Resources

Web: <http://www.dairyaustralia.com.au/Environment-and-resources/Water/Saving-water.aspx>

Dairy Shed Water how much do you use? Booklet,

DEDJTR,

Web: http://agriculture.vic.gov.au/__data/assets/pdf_file/0007/197080/Dairy-shed-water.pdf