Natural Resources
Adelaide and Mt Lofty Ranges

Farm water requirements

GUIDELINES FOR SMALL RURAL PROPERTIES

Government of South Australia

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1 INTRODUCTION

The rapid development of farm dams in the Mount Lofty Ranges and Eastern Hills has raised the question of sustainable water supplies in a number of catchments and sub-catchments. Agricultural production systems and delicate environmental ecosystems often compete for the same water supplies.

Drought and the effect of global warming will inevitably put further pressure on farm water supplies. Climate change projections by the CSIRO for the Adelaide and Mount Lofty Ranges region point to a reduction in rainfall and an increase in temperatures. Average annual rainfall may decrease by up to 10% by 2030, and as much as 30% by 2070, with the greatest decrease occurring in winter and spring (Suppiah et al 2006).

Properties that have access to reliable groundwater are fortunate, whereas those relying on farm dams will require more complex management of their water supplies. Average annual evaporation from farm dams can vary from 1,000mm in high rainfall areas to 2,000 metres in drier parts of the Eastern Hills. Figure 1 below shows the average annual pan evaporation across Australia. The challenge for landholders will be to ensure that adequate water supplies, of acceptable salinity, are provided for livestock. In addition, water for fire fighting purposes will need to be considered.

This booklet provides information on water requirements and quality issues. It takes into account the water intake of livestock varying greatly between species and between animals of the same species, depending on their environment, age, type of feed and production system.

In some situations landholders may find themselves facing a shortage of water for livestock. This booklet also highlights a range of other helpful tips on managing water resources.

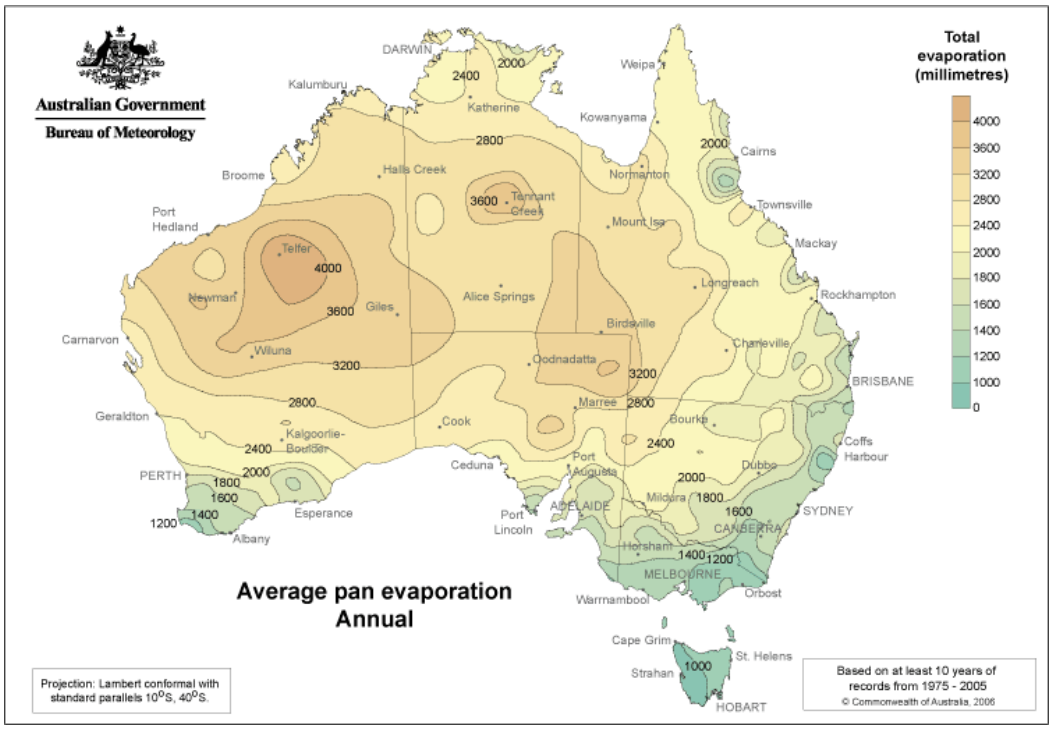


Figure 1. Average annual pan evaporation

2 LIVESTOCK WATER REQUIREMENTS

Water requirements of different classes of livestock vary considerably with water intake occurring through drinking and eating. Also as the body temperature of an animal increases, the demand for water increases as a result of water loss through sweating and panting in an effort to keep cool. Consequently, just like humans, animals need more water in hot weather or when being driven or actively worked.

In summer two thirds of a grazing animal's water requirements come directly from drinking water. In winter approximately 90% comes from pasture paddock feed. Therefore the type of feed ingested by stock will play an important part in how much water needs to be supplied from tanks and troughs.

The following examples show how different sheep feeds provide varying amounts of water with impacts on how much additional water is required.

(i) winter

- Sappy green feed (pasture) – no further water is required, however paddock water supplies are always recommended.

(ii) summer

- dry feed – water requirements are 2.5 to 3.0 times the weight of dry feed eaten
- salty feeds such as saltbush – up to 14 litres of water per day per sheep is required if animals are grazing pure saltbush
- lucerne hay – 9 litres of water per day per sheep is required.

Animal condition also plays an important part in how much water is required. For example, a lactating female requires 50% more water to produce milk than a dry animal. For dairy cows it takes 4 to 5 litres of water to produce 1 litre of milk. Theoretically a dairy cow in summer grazing on a grass/clover pasture will need to consume 80 litres of water per day for maintenance and a further 4 to 5 litres to produce a single litre of milk. Since dairy cows can produce up to 35 to 40 litres of milk per day, the total water requirements can be as high as 250 litres of water per day (1,750 litres per week).

When calculating livestock water requirements consideration must be given to:

- total livestock numbers
- number of watering points to be used at any one time
- peak needs of animals
- dry periods
- infrastructure failure.

LIVESTOCK WATER REQUIREMENTS

Table 1. Livestock daily water requirements
(Source: Department of Primary Industries 2007)

Type of livestock	Litres per head	
	Average daily consumption	Peak daily consumption
Sheep		
♦ Lactating ewes on dry feed	9	11.5
♦ Mature sheep on dry pastures	7	8.5
♦ Mature sheep on green pastures	3.5	4.5
♦ Fattening lambs on dry pasture	2.2	3
♦ Fattening lambs on green pasture	1.1	1.1
Cattle		
♦ Dairy cows in milk	70	250
♦ Dairy cows – dry	45	60
♦ Adult beef cattle	45	60
♦ Calves	22	30
Horses		
♦ Working	55	70
♦ Grazing	35	45
Pigs		
♦ Breeding sows	22	30
♦ Mature adult	11	15
Alpacas		
♦ Mature adult	5.5	7
♦ Lactating adult	10	12
Poultry (litres/100 birds)		
♦ Laying hens	32	40
♦ Non-laying hens	18	23
♦ Turkeys	55	70

Figure 2. Adult cattle can drink up to 60 litres of water per day

LIVESTOCK WATER REQUIREMENTS

Exercise 1: Calculating total livestock water requirements

In the table below record the type of livestock you are running (column A) and the number of these animals your property will hold at any one time (column B).

Record the peak daily consumption for each type of animal (column C).

Note: peak daily consumption is used to ensure a safe margin so that adequate water is always available for animals throughout the year irrespective of the type of production system in use.

Calculate the total daily water consumption (column D).

Add all the figures in column D and record at E. Multiply this figure by 365 to determine your annual water requirements and record at F.

Table 2. Livestock water requirement for your individual property

A. Type of livestock	**B. Livestock numbers**	**Litres / head**	
		C. Peak daily consumption	**D. Total daily water consumption**
Total **daily** water needs for property (total column D)			**E.**
Total **annual** water needs for property (multiply E by 365)			**F.**

The total water available should exceed the total annual requirements to allow for evaporation (and seepage) from dams and or other likely contingencies such as toxic algae. Upwards of 25% of water can be lost from dams due to evaporation. An additional amount should be allowed in most cases when considering livestock needs. This will depend upon a number of local conditions so landholders should seek professional advice from their local consultant.

3 DOMESTIC WATER REQUIREMENTS

The following estimates of domestic water usage were published by the Department for Environment and Aboriginal Affairs, and apply for the Adelaide region.

Table 3. Domestic water consumption litres / person / day

Activity	Consumption litres / head / day	
	Normal	With conservation
Shower	35	31
Bath	14	-
Toilet	35	32
Clothes washer	32	20
Dishwashing	18	12
Drinking/cooking	7	6
Car washing	3	3
Recreation (pools etc.)	3	-
Leaks	28	-
Total	**175**	**104**

Exercise 2: Calculating overall domestic use

(i) Estimating human consumption

Record the total number of people on the property who will be requiring water.

A. Total number of people = _____

Decide on an appropriate consumption rate (i.e. somewhere between 104 litres/head/day to 175 litres/head/day) depending on your circumstances, and record this figure at B.

B. Average consumption per person/day = _____ litres

Calculate the total water consumption for your property.

C. Total weekly consumption = A × B × 7 = _____ litres

D. Total annual consumption = C × 52 = _____litres

(ii) Estimating water use in the garden.

Under the *Natural Resources Management Act 2004* landholders are allowed to irrigate a domestic garden/orchard with a maximum area of 1 acre (i.e. 0.4 hectares).

DOMESTIC WATER REQUIREMENTS

As a comparison, approximate irrigation requirements (megalitres per hectare) for some crops in high rainfall areas are as follows:

Vines	0.8
Pastures	4.0
Lucerne	5.0
Potatoes	3.0 to 6.0
Peas	1.0 to 2.0
Apples	up to 5.0

Applying 20mm of water every 2 weeks for approximately 6 months will amount to approximately 1,000,000 litres (or 1 megalitre) per annum over 0.4 hectares.

Note: 1 hectare = 10,000m^2 = 2.5 acres

E. Record the estimated size of your garden (in hectares) = _____hectares

Estimate the water consumption for irrigating up to 0.4 hectares and record at F.

F. Total water used for garden = _____litres

Apart from agricultural enterprises and domestic use, water supplies are also required for fire fighting purposes. The South Australian Country Fire Service recommends storing 5,000 litres of water if using a fire pump and hoses, or 22,000 litres if a sprinkler system has been installed.

4 WATER SALINITY

The quantity of water is crucial to the survival of stock, as well as crops and pastures. In addition, the quality of water can have a major impact on plant and animal production. Extremely saline water can destroy crops and severely impact on the growth of stock.

The following table provides some benchmarks for salinity tolerances of crops and livestock.

Note: If establishing a farm business enterprise, landholders are advised to contact their local consultant or appropriate industry groups to obtain the most current benchmarks.

Table 4: Recommended upper salinity levels for a range of farm activities
(Source*:* Fontana 1995)

Usage	**Upper salinity (ppm or mg/L)**
Crops and pastures	
Field peas and beans	850
Clover	1,200
Corn, lucerne, millet, safflower, soybean	2,000
Phalaris, sorghum, sunflower	2,800
Fescue, perennial rye grass	3,200
Barley, wheat	3,700
Flowers and shrubs	
Violets	300
Aster, azalea, begonia, camellia, dahlia	700
Fuchsia, gladiolus, poinsettia, rose, zinnia	1,000
Chrysanthemum, oleander, stock	1,350
Fruit	
Loquat	300
Avocado, strawberry, walnut	700
Apple, almond, apricot, grapefruit, lemon, orange	1,000
Peach, pear, plum, olive, raspberry, fig, grape	1,350
Lawn grasses	
Fescue, ryegrass	1,200
Santa anna couch	5,000
Kikuyu	6,000
Vegetables	
French beans, peas	700
Capsicum, celery, lettuce	1,000
Broccoli, carrot, cauliflower, cucumber	1,350
Onion, potato, sweet corn, tomato	1,750
Asparagus, beetroot, cabbage, spinach	2,100

Table 4: continued

Usage	Upper salinity (ppm or mg/L)
Livestock	
Poultry	3,500
Pigs	4,000
Horses	7,000
Dairy cattle	6,000
Beef cattle	10,000
Sheep	13,000
Fish	
Rainbow trout	9,300
Brown trout	3,700
Human consumption	1,500
Sea water	30,000

Exercise 3: Determining salinity of farm water

Water samples can be tested for salinity levels. Use the salinity meter to measure the salinity of your samples and record below.

Sample A
Nature of sample (i.e. bore or dam water): _____

Salinity reading: _____us

Multiply this salinity reading by 0.64 to convert it to parts per million (ppm). Record at A.

A. Salinity level: _____ppm

Sample B
Nature of sample (i.e. bore or dam water): _____

Salinity reading: _____us

Multiply this salinity reading by 0.64 to convert it to parts per million (ppm). Record at B.

B. Salinity level: _____ppm

Sample C
Nature of sample (i.e. bore or dam water): _____

Salinity reading: _____us

Multiply this salinity reading by 0.64 to convert it to parts per million (ppm). Record at C.

WATER SALINITY

C. Salinity level: _____ppm

Knowing the purpose for which your water is being used, examine the values in Table 4 to determine if any of your samples are likely to create a problem. Record your findings below.

_____

_____

_____

_____

_____

Note: the figures in Table 4 represent upper salinity tolerances, so if sample values are close to these there may be a decline in production over time.

5 RETICULATED STOCK WATERING SYSTEM

Many properties still provide water for livestock by allowing animals to access dams directly. However dam walls and inlet areas can be badly degraded, and delicate ecosystems can be severely damaged.

Dams and watercourses should be fenced off and protected from livestock. This creates the need to pump water from these sites, store the water (usually in a header tank) and pipe it to troughs strategically placed in pasture paddocks. This system is referred to as a 'reticulated stock watering system'.

Header tanks are strategically placed on high ground to allow water to gravity feed through underground poly pipes to troughs in pasture paddocks. Determining the type and capacity of pump to move water from the dam to the tank will require the expertise of a qualified professional who is experienced with pumps. The volume of water being pumped over a certain distance, to a particular height will determine the capacity of pump required.

Careful planning is required to ensure that sufficient water is available in each paddock. The following factors should be considered:

- stocking rates
- existing and proposed water supplies
- paddock layout and future subdivision
- potential land degradation.

Landholders who have established an intensive rotational grazing system may have extremely high stock numbers in a particular paddock at any one time.

It is important to check the flow rate of any bores in use and also determine the capacity of each dam.

When determining the water requirements for each paddock always consider the peak daily consumption of animals.

Pipelines

Polyethylene pipes are generally used. These can be 25mm thick or 40mm thick. On most small properties 25mm pipe is adequate. These pipes need to be installed underground, usually 450mm to 600mm below the surface. Trenching equipment may need to be hired to complete the task.

Water troughs

Where possible, troughs should be placed centrally in paddocks on higher, drier ground, and adjacent to shade trees. Do not place a trough through a fence, where limited space is likely to create severe bare areas susceptible to erosion.

Water troughs come in many shapes and sizes. The older style concrete troughs are still used, but can crack in time and are generally too heavy to move around. Polyethylene troughs are light and can be shifted easily if creating temporary paddocks requiring a short-term water supply.

RETICULATED STOCK WATERING SYSTEM

Stock habits will influence decisions regarding the type and size of water troughs to be used. Livestock generally drink as individuals on small properties when paddock sizes are less than 10 hectares. On large properties when the distance from pasture to water is large (e.g. many hundreds of metres), animals will move as a group to 'herd drink' and therefore need larger troughs. They will often drink up to a third of their daily requirements in one hour.

Note: low inflow rates and 'herd drinking' will require large troughs.

The following troughs are ideal when herds are significant (e.g. 100 dairy cows) and groups of animals drink at any one time:

- 2.1 metre diameter, 2,000 litre capacity will provide space for 12 adult cattle
- 2.7 metre diameter, 3,000 litre capacity will provide space for 16 adult cattle.

Lower capacity troughs can be used for small herds or flocks.

A straight 4 metre trough (approximately 600 litres) with access both sides, is usually adequate for a mob of 300 sheep.

A herd of 50 beef cattle would require 1,000 litres of water if they all decided to drink a third of their daily intake at the same time. On small properties where individual drinking is common, a trough of between 500 litres to 1,000 litres should be adequate depending on the flow rate.

Flow rates

As well as considering the volume of water in the trough at any one time, which is available to stock, the rate at which it re-fills (i.e. flow rate) should also be known.

Normal design flow rate for livestock can be determined by dividing the total daily requirement of the herd or flock by 240 minutes. For example, a herd of 50 adult beef cattle will use 50 × 60L/day ÷ 240minutes = 12.5 litres per minute.

The 240 minutes is used as a benchmark and allows all animals to get their daily requirements in four hours. This is regarded as a minimum flow rate scenario.

On a dairy farm, likely flow rates would be between 20 and 30 litres per minute.

Storage tanks

It is important to always consider the maximum demand for water at any one time.

Even though you may have worked out the overall stocking rate for your property, additional stock may be required in times of high feed load, such as spring. Stock numbers could be three to four times that of autumn.

Large header tanks are generally favoured over smaller capacity tanks which only just supply livestock needs.

Storages should have the capacity to supply water for a minimum of:

- 5 days – for a windmill or solar driven system
- 3 days – for a gravity system using fuel or electric pumps.

RETICULATED STOCK WATERING SYSTEM

Many landholders prefer to have at least 7 days supply and also consider using two smaller header tanks rather than rely on a single large tank.

Example

Consider a 60 hectare property with 50 hectares of grazing land. Average rainfall is 700mm per annum. Carrying capacity is 50 adult cattle throughout the year. However, due to good spring pasture growth the property carries 125 adult cattle through this period.

Each animal requires 60 litres of water per day (i.e. peak consumption from Table 1).

Total water requirement is 125 cattle × 60 litres/day = 7,500 litres/day

Assume 3 days supply is required.

Total storage required is 7,500 litres × 3 days = 22,500 litres

An appropriate header tank for this situation would be 22,500 litres.

Exercise 4: Calculating the size of a header tank.

Calculate the total maximum daily water requirements for your property. At this stage you should account for any extra livestock which may be bought or agisted (refer to Exercise 1 for your initial results).

Record the total maximum daily water requirements for the whole of the property at A. below.

A. Total maximum daily water requirements _____litres

Calculate the volume of water which represents 3 days storage.

Multiply the value at A by 3 days and write the answer at B.

B. Volume of header tank =_____litres

6 ROOF RUNOFF

Collecting rainwater from houses and sheds provides good quality water for domestic use. However, if this water is being used for agricultural irrigation purposes (i.e. not a domestic garden of <1.0 acre), it is necessary to obtain an irrigation licence. Consult your local Natural Resources office for more information. There is also a limit of 1,500 kilolitres (1,500,000 litres) that can be collected as roof runoff and stored, but this is a considerable amount of water!

Note: for every millimetre (mm) of rain that falls on 1 square metre of surface, a volume of 1 litre can be collected.

Formula

$$\text{Potential estimated average annual capture (kilolitres)} = \frac{\text{roof area} \times \text{average annual rainfall (mm)}}{1{,}000}$$

Example:

A rectangular house with a length of 25 metres and a width of 20 metres will have a surface area of 25m × 20m = 500 square metres.

If the average annual rainfall is 700mm the total volume of water which could be collected each year is 500m^2 × 700 litres

= 350,000 litres

or 350 kilolitres.

Exercise 5: Calculating the maximum annual water capture off house and sheds

Record the average annual rainfall for this location _____mm

Identify a number of buildings to measure roof area and record below. Using the measuring wheel record the dimensions of the roof.

Table 5. Calculating roof runoff

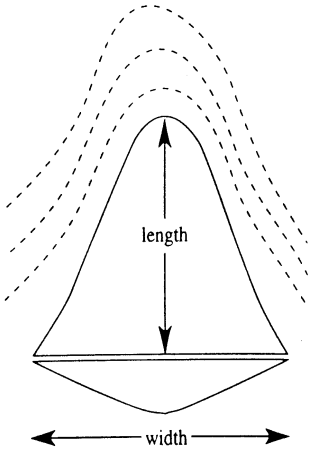
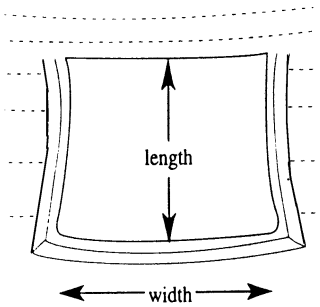
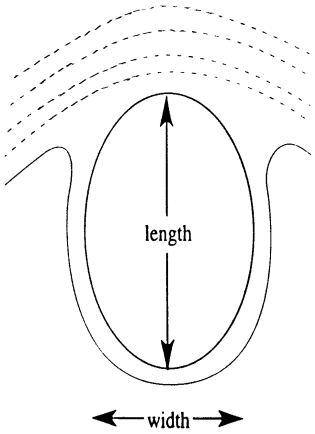
Building type	Measurements = length / width	Area (m^2)	Volume of water collected (mm)	Volume of water collected (KL)
Total volume collected				

7 FIELD ESTIMATION OF DAM VOLUME

A number of technical methods exist to accurately measure the volume of a dam. These rely on precise depth measurements across the floor and sides of the dam.

However, the following technique is regarded as a quick field estimation of dam capacity and has been used widely in this region when dam audits have been undertaken by authorities. Relatively small inaccuracies may occur as a result of silting of the dam over time or the slope on which it is constructed.

Dams vary in their general shape as shown below. You will need to decide on the general shape of the dam and use the appropriate formula for calculating surface area which applies to that shape.

TRIANGULAR	RECTANGULAR	ROUND
		
Triangular surface area = $\frac{\text{width x length}}{2}$	Rectangular surface area = width x length	Round surface area = 0.8 width x length

To estimate the volume of a dam, the following formula can be used:

Volume (megalitres) = surface area (m2) × depth (m) × 0.4 (slope factor) ÷ 1,000

Exercise 6: Estimating dam volume

First, estimate the dam volume on site. What do you think is the capacity of the dam being measured? _____ megalitres.

Measure the volume of the dam being observed and give your answer in megalitres.

Now calculate the following:

Step 1. Determine the shape of the dam (see above).

Step 2. Measure the dimensions of the dam at the top water level (in metres).

FIELD ESTIMATION OF DAM VOLUME

Width = _____ metres

Length = _____ metres

Step 3. Measure the maximum depth of the dam (in metres)

Depth = _____ metres

Step 4. Calculate the surface area (SA) of the dam (in square metres)

SA = _____ square metres

Step 5. Calculate the volume of the dam in cubic metres

Vol = 0.4 × SA (sq. metres) × Depth (metres)

= _____ cubic metres

Step 6. Convert this volume to megalitres by dividing the above volume by 1,000

Step. 7 Record your answer _____ megalitres (compare with your initial estimation).

How much water is available for livestock?

Seepage and evaporation will reduce the total volume of water available for livestock.

Seepage losses can vary substantially depending on the dam construction and the nature of the soil. Small amounts of water are lost from natural seepage. For this exercise we will assume a seepage value of 5%.

In this locality the annual pan evaporation rate is assumed to be 1000mm.

Record the dam volume at A in megalitres

A. Dam volume _____ megalitres

Convert this to litres by multiplying A by 1,000,000 litres

B. Dam volume _____ litres

To calculate the loss from seepage (5%), multiply B by 0.05. Record at C.

C. Seepage loss _____ litres

FIELD ESTIMATION OF DAM VOLUME

To calculate the loss of water through evaporation the following formula can be used:

Evaporation = surface area of the dam (full) in square metres × annual evaporation rate for the locality in mm.

D. Evaporation (litres) = _____square metres × 1,000mm

= _____litres

To calculate the total loss of water, the following formula can be used:

E. Total loss of water (litres) = C + D

= _____litres

F. Total water available for stock = B – E

= _____litres

8 CONVERSIONS

1 hectare = 10,000 square metres

1 hectare = 2.5 acres

10 inch rainfall = 250 mm rainfall

1 cubic metre = 1,000 litres

1 us/cm × 0.64 = 1 ppm

1 megalitre (ML) = 1,000,000 litres

1,000,000 litres = 1,000 m^3

1,000 litres = 1 kilolitre (KL)

9 REFERENCES AND BIBLIOGRAPHY

References

Department for Environment Heritage and Aboriginal Affairs 1999, *Rainwater tanks – their selection, use and maintenance*,, prepared by the Engineering & Water Supply Department in conjunction with the Department of Environment and Planning, Adelaide, South Australia.

Department of Primary Industries 2007, *Managing farm water supplies in drought,* Department of Primary Industries, Melbourne, Victoria, www.dpi.vic.gov.au.

Fontana, D 1995, *So you thought owning a small farm or property was easy?: property management planning for small farms and properties,* Department of Conservation and Natural Resources, Melbourne, Victoria

Suppiah, R, Preston, B, Whetton, PH, McInnes, KL, Jones, RN, Macadam, I, Bathols, J, Kirono, D 2006, *Climate change under enhanced greenhouse conditions in South Australia*, CSIRO Marine and Atmospheric Research, a consultancy report for the South Australian Government.

Bibliography

Adelaide and Mount Lofty Ranges Natural Resources Management Board 2010, *Roof runoff,* Discussion paper 9, Adelaide, South Australia, www.amlrnrm.sa.gov.au.

Bignell G 1999, *Stock water reticulation,* Water facts, Queensland Department of Natural Resources, Brisbane, Queensland.

Brown L 2006, *Livestock water system design*, Fact sheet, Ministry of Agriculture and Lands, British Columbia.

Country Fire Service 2009, *Fire fighting equipment,* Fact sheet, Government of South Australia, Adelaide, South Australia.

Cummings D 2002, *How much water do I need?*, Landcare note LC0066, Department of Sustainability and Environment, Melbourne, Victoria.

Dairy Extension Centre 2006, *Estimating stock water requirements for dairy cattle*, SW Victoria drought response, Department of Primary Industries, Victoria.

Dennis B 2007, *Livestock Water Supplies* Fact sheet 01/07, Primary Industries and Resources South Australia, Adelaide, South Australia.

McMurray D and Department for Water Land and Biodiversity Conservation 2004, *Farm dam volume estimations from simple geometric relationships, Mount Lofty Ranges and Clare regions*, Report 2004/48, Department of Water, Land and Biodiversity Conservation, Adelaide, South Australia.

10 APPENDICES

Appendix A: Case study

Water resources and requirements on a small property (Mount Barker)

Average annual rainfall: 772 mm
Property size: 11 acres (4.4 ha)

Livestock needs

Dry sheep equivalent (DSE) at Mt Barker	= 10/ha
Area of property that can be grazed	= 6 acres (2.4 ha)
Max stocking rate, (unimproved pasture)	= 6 DSE
Maximum livestock = 6 (DSE) × 2.4 (ha)	= 14.4 wethers
Water requirements on dry feed/sheep	= 3,600L per annum
Water requirements on green feed/sheep	= 2,700L per annum
14 animals on dry feed for 6 months	= 1800L × 14
	= 25,200L (4,200L per month)
14 animals on green feed for 6 months	= 1350L × 14
	= 18,900L (3,150L per month)
Total	**= 44,100L per year needed from dam**

Domestic requirements

Assume four people plus septic system	
180L per person per day × 4	= 720L per day
Total = 720L × 365	**= 262,800L per year needed from rainwater**

Garden/orchard requirements

Assume an area of 1500m^2 (0.15ha)	
Assume irrigation is for orchard/vineyard	= 1.5 megalitres per ha
1.5 megalitres per ha	= 1,500,000L per ha
0.15 × 1,500,000L	= 225,000L
Total	**= 225,000L per year needed from dam**

Total requirements

Domestic (rainfall)	= 262,800 litres
Orchard and livestock (dam)	= 225,000 + 44,100 = 269,100 litres
Total	**= 531,900 litres**

APPENDICES

Water resources

Dam size is 2.5 megalitres (2,500,000 litres).

Collection off roof areas (every mm of rain falling on each square metre produces 1 litre of water).

Months	mm	Collection (litres)		Requirements		
	Rainfall	House roof 22m×16m	Shed roof collection (litres) 15m×6m	Domestic (litres)	Livestock (14 sheep)	Garden / orchard < 1 acre / annum
J	27	9,504	2,430	21,900	4,200	
F	26	9,152	2,340	21,900	4,200	
M	32	11,264	2,880	21,900	4,200	
A	61	21,472	5,490	21,900	4,200	
M	90	31,680	8,100	21,900	3,150	
J	100	35,200	9,000	21,900	3,150	
J	106	37,312	9,540	21,900	3,150	
A	103	36,256	9,270	21,900	3,150	
S	85	29,920	7,650	21,900	3,150	
O	68	23,936	6,120	21,900	3,150	
N	40	14,080	3,600	21,900	4,200	
D	34	11,968	3,060	21,900	4,200	
Sub total	***772***	***271,744***	***69,480***	***262,800***	***44,100***	***225,000***
TOTALS	**772**	**341,224**		**531,900**		

Conclusion

The landholder can collect a total of 341,224 litres off roof areas and has 2.5 megalitres (2,500,000 litres) of dam water. Therefore ample water supplies available on the property to provide for all the stock, garden/orchard and domestic needs.

APPENDICES

Appendix B: Indicative costs for reticulated watering system

Round poly troughs	2.4m diameter (2,400 litres) 3.3m diameter (4,500 litres)	$940 $1,195
Rectangular poly trough	2.7m (450 litres) 3.7m (600 litres)	$485 $680
Polyethylene tank	10,000 litres 15,000 litres 22,500 litres	$2,000 $2,300 $2,600
Polypipe	25ml 40ml	$1/metre $1.40/metre
Polypipe fittings	25ml 40ml	$15 to $20ea $20 to $40ea

APPENDICES

Appendix C:
Cummings D 2002, *How much water do I need?*, Landcare note LC0066, Department of Sustainability and Environment, Melbourne, Victoria.

Appendix D:
Dennis B 2007, *Livestock Water Supplies* Fact sheet 01/07, Primary Industries and Resources South Australia, Adelaide, South Australia.

Appendix E:
Bignell G 1999, *Stock water reticulation,* Water facts, Queensland Department of Natural Resources, Brisbane, Queensland.

Natural Resources
Adelaide and Mt Lofty Ranges

Eastwood
205 Greenhill Rd
Eastwood SA 5063
T (08) 8273 9100
F (08) 8271 9585
E DEWNR.AMLR@sa.gov.au

Gawler
8 Adelaide Rd
Gawler South SA 5118
T (08) 8523 7700
F (08) 8523 7701
E gawler.office@sa.gov.au

Lobethal
1 Adelaide Lobethal Rd
Lobethal SA 5241
T (08) 8389 5900
F (08) 8389 5925
E lobethal.office@sa.gov.au

Willunga
5 Aldinga Rd
Willunga SA 5172
T (08) 8550 3400
F (08) 8550 3401
E willunga.office@sa.gov.au

www.amlrnrm.sa.gov.au

Government of South Australia