Farm Water Audit Workbook

Farm Water Management Planning



Know your numbers.
Know your needs.
Know the gap.

Have a plan.

Australian Government
Department of Agriculture, Fisheries and Forestry

Future Drought Fund

SOUTHERN NSW Innovation Hub
SUSTAINABLE AGRICULTURE, LANDSCAPES AND COMMUNITIES

NSW GOVERNMENT

Holbrook Landcare Network

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The following activities were adapted from material from the following agencies:

- *Sapphire Irrigation Consulting, Peter Smith.*
- *NSW Department of Primary Industries (NSW DPI).*
- *NSW Department of Water and Energy (DWE).*
- *Department of Agriculture (Government of Western Australia).*
- *Department of Water (Government of Western Australia).*

The Farm Water Audit Process.

Conducting a Farm Water Audit is a valuable process to highlight your current farm water situation. By conducting an audit, farmers can know how much water is required on their property, identify weaknesses in their farm water systems and maximise opportunities to increase water security on-farm, increase water quality for livestock and enhance their natural environments.

The Farm Water Audit consists of five parts.

Part 1 – Quantifying Farm Water Requirements (stock, domestic and general). Steps 1A, 1B, 1C and 1D.
Part 2 –Estimating Tank and Storage Capacity. Steps 2A, 2B, 2C, 2D, and 2E.
Part 3 – Calculating Losses. Steps 3A, 3B, and 3C.
Part 4 – How long will water last? Step 4.
Part 5 – Checking Supply Flow Rate and Trough Capacity. Step 5.

The Farm Water Audit process is an important component of your overall Farm Water Management Plan.

How to use this workbook:

This workbook is a resource that has been designed to support farmers in conducting their farm water audit process. It is best used in conjunction with the NSW DPI Farm Water AgGuide (2012).

This workbook consists of two sections.

Section 1: An example farm water scenario (p. 4 – 14) which demonstrates the farm water audit process The provided example scenario will be used during face-to-face or online Audit workshops. All required reference tables are on p. 14-15.

Section 2: Your Farm Water Audit. This workbook contains space for you to substitute your farm water data into the document and conduct an audit process specific to your property and drought/dry time plan.

Putting context around your Farm Water Audit – Your drought or dry time strategy.

Water on-farm is not an infinite resource. When our water systems feel the most stress (and when we often we are the most stressed) is during periods of dry or drought conditions. As farmers we are required to make decisions to ensure that our businesses make it out other side and we often have trigger point in our businesses which indicate when these decisions must be made.

Such decisions may include deciding whether to sell, feed or agist livestock, what class of livestock to retain and how many, whether to purchase or sell fodder and how to manage cashflow most effectively during tougher conditions.

We consider this as our drought plan or strategy.

For this workbook conducting your Farm Water Audit based on your drought/dry time plan or strategy will effectively assist you in determining whether you have enough water to support your current plan. It will also identify areas for improvement to increase water security during these periods.

Scan the QR code or visit the link below to download a copy of the Local Land Services Drought Plan template.

https://www.lls.nsw.gov.au/__data/assets/pdf_file/0008/1151099/Drought-plan-template-20230831.-web.pdf]

Data tips for your Farm Water Audit

Here are some tips on what data you should have on hand to help you complete your Farm Water Audit.

- Reflect on your drought/dry time plan. Know what stock classes you are retaining and how many.
- Identify your most secure dams which are most reliable during a dry period. You may know this off the top of your head, but if not, you can check out old satellite imagery using google earth to visually assess which dams were dry or contained water.
- Consider water that may be used during emergencies such as a bushfire.

Section 1: Example Scenario

The example scenario for this workbook is a **cattle** property located at **Holbrook, NSW,** currently with its drought plan/strategy already in effect, i.e., they've destocked to core livestock numbers.

- Total size 209 Ha.
- 4 adult residents.
- 0.2 Ha Garden/lawn area.
- Consists of three dams,
    - Dam 1 – Square [W] 30m x [L] 30m x [D] 4m.
    - Dam 2 – Rectangle [W] 25m x [L] 20m x [D] 2m.
    - Dam 3 – Square [W] 35m x [L] 35m x [D] 4m.
- House Tank – Diameter 3m, height 3.2m.
- 31 Ha sown to oats.
- 100 head dry cows.

The example scenario is working off the assumption that we want to know how many days of water we would have for summer, **October to March, approximately 181 Days.**

For all of Section 1, refer to the example provided above.

Useful conversions:

- 1 m^3 = 1000 L
- 1000 m^3 = 1 Megalitre (ML) = 1 000 000 L
- 1 ML =
    - 1 000 kilolitres (kL)
    - 1 000 cubic metres (m^3)

The Farm Water Audit Lunch Litre Webinar Series – Access the recordings and we'll step you through the whole process!

Through the Farm Water Management Planning Project, we ran a series on online webinars stepping farmers through how to conduct your farm water audit based on this example scenario. So, if you ever get stuck or need a hand you can scan the QR code below or visit the link and access all three recordings!

Part 1. Quantifying Farm Water Requirements

1A. Livestock Requirements

How much water do the livestock use during summer?

(Refer to Farm Water AgGuide Appendix 3, Table 27, p. 125)

Total daily water requirement (L) = daily requirement per head (L) x number of stock x No. Days

Table 1

Livestock Type	Number of Head	Daily Water Requirement (L)	No. Days	Total Water Required (L)

1B. Garden Water Requirements

How much water does the garden use in summer?

(Refer to Farm Water AgGuide Table 11, p. 16)

Range 10 000 – 30 000 L/Ha/Day
High Rain: 2 ML/Ha/Year
Low Rain: 8 ML/Ha/Year

Total water required for summer (L) = Garden Area (Ha) x Daily Water Requirement (L) x No. Days in Summer

Table 2

Garden Area (Ha)	Daily Water Requirement (L)	No. Days in Summer	Total Water Required for Summer (L)

1C. Household Water Requirements

How much water does the household use in summer?

(Refer to Farm Water AgGuide Tables 11 & 12, p. 16)

Total water required for summer (L) = daily requirement (L) x No. Days in Summer

Table 3

	Daily Water Requirement (L)	No. Days in Summer	Total Water Required for Summer (L)
No. Residents			
Toilet			
Evaporative Air Con			
Total			

1D. General Farm Needs

(Refer to Farm Water AgGuide Table 17, p.24)

Spraying – First application requires 100L/Ha, second application requires 70L/Ha.

Table 4

	Application Rate (L/Ha)	Crop Area (Ha)	Total water Required per Application(L)
Spray 1			
Spray 2			
Total			

Firefighting – 10 000 L/Ha home yard.

Table 5S

	Recommended Storage Rate (L/Ha)	Home Yard Area (Ha)	Total Water to Store (L)

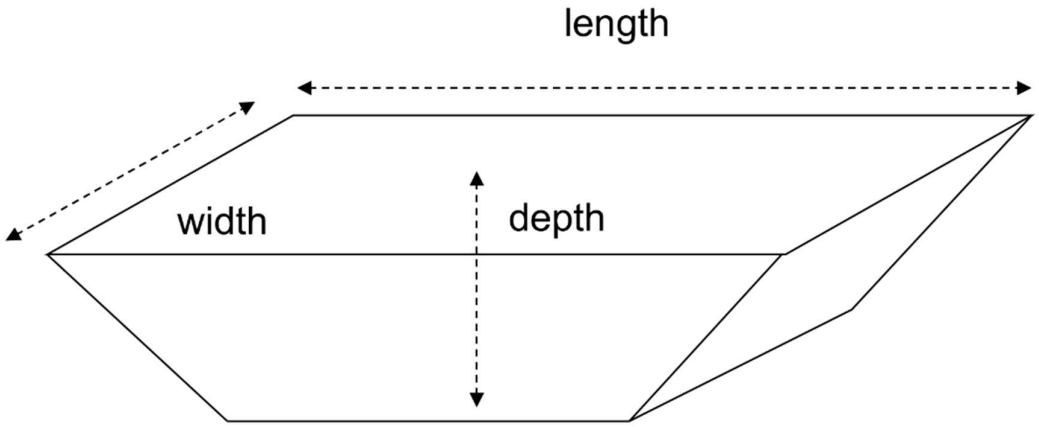
Part 2. Estimating Dam and Tank Capacity

(Refer to Farm Water AgGuide Appendix 5, p. 131)

2A. Rectangular Dam

Calculate the volume of a rectangular dam.

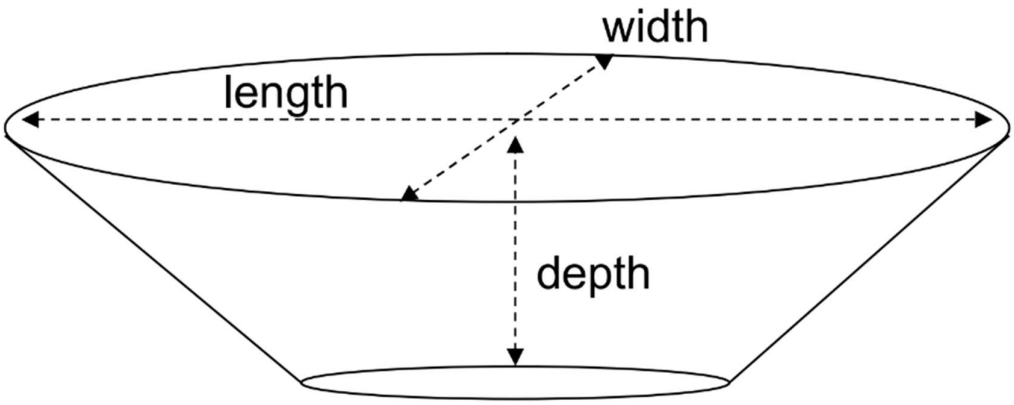
- Surface area (m^2) = Width x Length
- Volume (m^3) = 0.4 x Surface Area x Depth



2B. Circular Dam

Calculate the capacity of the round dam.

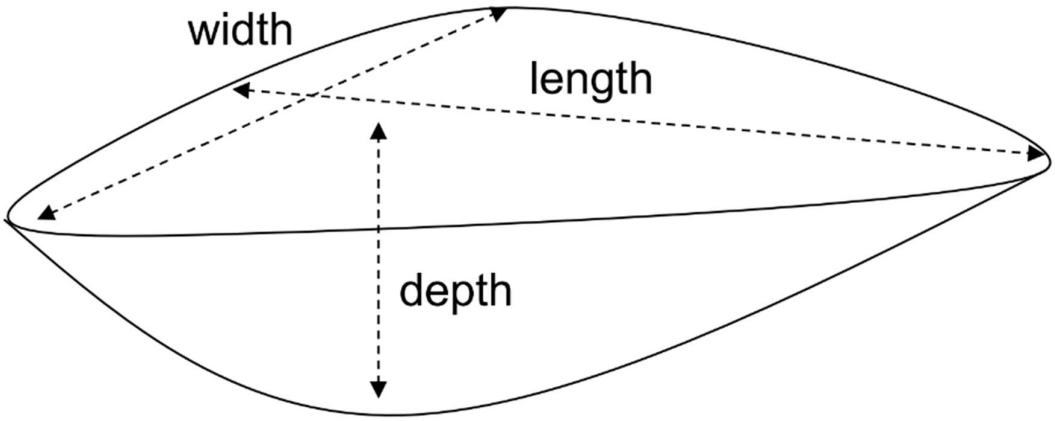
- Surface area (m^2) = 0.8 x Width x Length
- Volume (m^3) = 0.4 x Surface Area x Depth



2C. Triangular Dam

Calculate the capacity of the triangular dam.

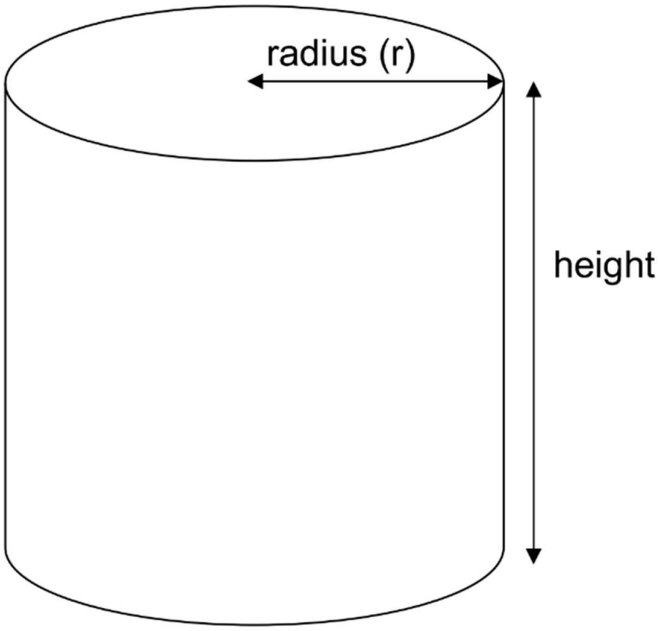
- Surface area (m^2) = (Width x Length) ÷ 2
- Volume (m^3) = 0.4 x Surface Area x Depth



2D. Estimating Tank Capacity

Calculate the capacity of the tanks.

- Measure the radius of the top of the tank and the height of the tank.
- Surface area (m^2) = π x r^2
- Volume = (m^3) = π x r^2 x Height



2E. Total water storage capacity of existing dams and tanks

Table 6

Dam/Tank Name	Width (m)	Length (m)	Depth (m)	Surface Area (m^2)	Approx. Volume (m^3)	Water Storage Capacity (ML)
Square Dam 1						
Rectangle Dam 2						
Square Dam 3						
House Tank						
Total Storage						

Food for thought…

When estimating dam and tank capacity during your farm water audit consider your drought/dry time plan. List all storages (dams and tanks) which you know are reliable (e.g., retain some water or hold water the longest) during this period. You don't need to estimate the capacity of every single dam on the property. There are two steps you can do.

Step 1. Calculate the maximum capacity of all listed dams. Imagine all storages are full and based your calculation on the depth of the full dam or storage.
Step 2. Calculate the current volume of all listed dams. This means you need to measure the physical depth of the dam or tank from where the current water level is. This step allows you to calculate what water you currently have on hand and to assist decision making.

How to make and use a DamDeep Measuring Tool.

Farm dams are often difficult to determine their depth without waiting for them to be dry and in some cases may be unsafe or time consuming to measure.

Scan the QR code or visit the link to check out a quick video on how to make and measure your dam using the DamDeep Measuring Tool from Agriculture Victoria

https://www.youtube.com/watch?v=Kp21tB5hPj8&t=3s

2F. Calculating Harvestable Rights [Optional]

What are Harvestable Rights?

In NSW landholders have Harvestable Rights. This allows landholders to "capture and store a portion of the rainfall runoff from their landholding in one or more harvestable rights dams without a water access licence, water supply work approval or water use approval" (Water NSW, 2023).

Where can a Harvestable Rights dam be located?

A harvestable rights dam is a dam that is located on a non-permanent minor stream, hillside, or gully. A harvestable rights dam cannot be within 40-metres of a third order or higher order stream, or within 3 kilometres of a wetland of international importance (Water NSW, 2023).

How is my Harvestable Right calculated?

Each landholding has its own harvestable right dam capacity, which is determined by where the landholding is located.

Coastal draining catchments and central in-land draining catchments allow landholders to capture up to 10% of the average annual regional rainfall runoff and used for any purpose (Water NSW, 2023).

In the Western Division all rainfall can be captured and used for any purpose (Water NSW, 2023).

Scan the QR code or click the link below to view the map of the NSW Harvestable Rights areas and for more information.

https://water.dpie.nsw.gov.au/our-work/licensing-and-trade/basic-landholder-rights/harvestable-rights

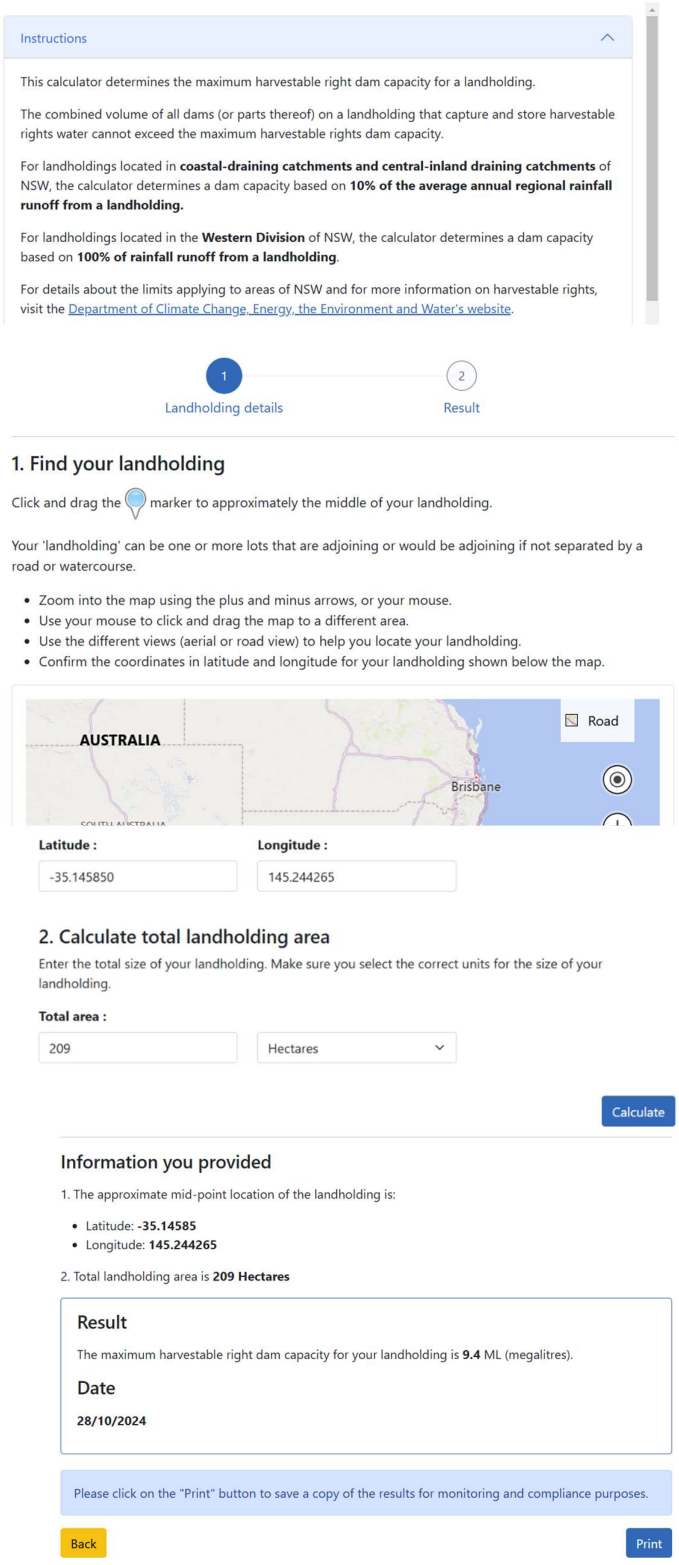
You can use Water NSW's Maximum Harvestable Right's Calculator to determine your maximum harvestable right dam capacity for your property.

Scan the QR code or click the link below to access the Maximum Harvestable Rights Calculator.

https://www.waternsw.com.au/customer-services/water-licensing/maximum-harvestable-rights-calculator

Maximum Harvestable Rights Calculator

This page demonstrates what the Maximum Harvestable Rights Calculator looks like.



Part 3: Quantifying Losses from Dams.

3A. Evaporation Loss

Determine the daily evaporation loss from a dam.

Estimated average evaporation (mm) for **Holbrook** (Example Scenario location).

(Average evaporation 2000-2023 from Queensland Government SILO)

Holbrook	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Evaporation (mm)	249	191	156	87	47	31	33	50	81	130	174	225	1454

- From the table above, determine the summer evaporation (mm)

Average evaporation (daily) = (Jan + Feb + March + Oct + Nov + Dec) ÷ 181 days

In Table 7 below, calculate the summer evaporation loss in L using this formula:

Evaporation loss (L) = Surface area (m^2) ***x average daily evaporation (mm) x no. days (summer period)***

3B. Seepage Loss

Estimate seepage loss from the dams over the season.

(Note: Seepage loss will depend on the material on which a dam is located and built and the quality of construction. Maximum acceptable loss is 5mm/day – if your losses are above this the dam needs attention).

Assume seepage rate of 1mm per day for this activity.

In Table 7 below, calculate the summer seepage loss in litres using this formula:

Seepage Loss (L) = Surface Area (m^2) ***x seepage (mm/day) x no. days (summer period)***

Table 7

Dam Name	Surface Area (m^2)	Season Evaporation (mm)	Season Evaporation Loss (L)	Season Seepage (mm)	Season Seepage Loss (L)
Square Dam 1					
Rectangle Dam 2					
Square Dam 3					

Total:					

3C. Residual or 'dead' water

Sometimes a portion of water in a dam cannot be retrieved. This is referred to as residual or 'dead' water.

In table 8, estimate the residual water in the dams.

Table 8

Dam Name	Total Volume (m^3)	Residual Water (%)	Residual Water (m^3)	Residual Water (L)
Square Dam 1				
Rectangle Dam 2				
Square Dam 3				
Total:				

Part 4: How Long Will the Water Last?

Based on the previous sections of the workbook, use Table's 9 and 10 to calculate how long the water will last on the example farm during the dry season.

Table 9

No. of Days in Season		A
Water Usage During Season	**Litres (L)**	
Livestock		
Garden		
Household		
General farm needs		
Other		
Total summer usage		B
Daily summer water consumption: (B÷A)		C

Table 10

Total Storage Capacity (L)		D
Less evaporation losses		E
Less residual water		F
Less estimated seepage losses		G
Available Water: (H = D – E – F – G)		H
Days water will last: (H ÷ C)		

Part 5: Checking Supply Flow Rate and Trough Capacity

Water must be supplied at least at the rate of stock and domestic usage. This sets the minimum flow rate that the pump and pipework must deliver.

(Refer to Farm Water AgGuide Table 21, p. 96)

What peak flow rate from the water supply is required to keep up with stock water demand and how much trough capacity is needed?

Table 11

Stock Type	**No. Head of Stock**	**Inflow (L/min/head)**	**Flow Rate Required (L/min)**	**Volume (L/Head)**	**Trough Capacity Required (L)**
	A	B	A x B	C	A x C
Dry Cows					
Total:					

This completes the example farm water audit exercise.

Useful Tables from the Farm Water AgGuide

Farm Water AgGuide Appendix 3, Table 27, p. 125	
Stock Type	**Consumption Per Head per Day (L)**
Sheep Weaners	 2 – 4
Adult Dry Sheep - Grassland - Saltbush	 2 – 6 4 – 12
Ewes with Lambs	4 – 10
Cattle Lactating Cows - Grassland - Saltbush	 40 – 100 70 – 140
Young Stock	25 – 50
Dry Stock (400kg)	35 – 80
Horses	40 - 50

Farm Water AgGuide Table 11, p. 16					
Number of People	1	2	3	4	6
Litres per day (household)	180	250	320	340	380
1000 Litres/Year	65.7	91.25	116.8	124.1	138.7
Gardens	10 000 – 30 000 L/Ha/Day				

Farm Water AgGuide Tables 12, p. 16		
	Average residential use	
Appliance	**L/House/Day**	**L/Person/Day**
Bath and Shower	171	51
Washing Machine	139	42
*Toilet	112	33
Tap	83	24
Other	18	5
Total	523	155
**One Flush toilet systems use more than dual flush systems.*		

Farm Water AgGuide Table 17, p.24		
Activity	**Daily Consumption**	**Annual Consumption**
Sheep dips	1.4L per sheep up to two weeks off shears	1400L per 1000 sheep
Spray	4.5L per sheep 2 months off shears	4500L per 1000 Sheep
Plunge	6.5 to 13L per sheep 2 to 6 weeks of shears.	6500 – 13 000L per 1000 Sheep
Dust Wetting * Sheep Yards Cattle Yards	100L per 10 m^2	800L per 10 m^2
Pesticide Spraying: cereal crops or canola	50 – 150L per Ha per Application	
Spray Tank Cleanout (2 rinses)	400 per 1000L of tank	
Fire fighting		Recommended that each farm has at least 10,000L supply for property protection.**
Buildings	1200L per 10 m^2	
Grass	72L per m^2	
Storages	40 000L for House	
**Based on impulse sprinkler with 17L/min output, 6m spray radius, running for one hour.* ***NSW Rural Fire Service Recommendation.*		

Section 2: Your Farm Water Aduit

Following the steps demonstrated in Section 1, apply your own drought/dry time plan/strategy to the farm water audit process using the following tables.

If editing in word you may need to add rows as necessary.

1A. Livestock Requirements

Table 1

Livestock Type	Number of Head	Daily Water Requirement (L)	No. Days	Total Water Required (L)
Total Livestock Requirements (L):				

1B. Garden Water Requirements

Table 2

Garden Area (Ha)	Daily Water Requirement (L)	No. Days in Summer	Total Water Required for Summer (L)
Total Water Required (L)			

1C. Household Water Requirements

Table 3

	Daily Water Requirement (L)	No. Days in Summer	Total Water Required for Summer (L)
No. Residents			
Toilet			
Evaporative Air Con			
Total			

1D. General Farm Needs

Table 4

Application	Application Rate (L/Ha)	Crop Area (Ha)	Total water Required per Application(L)
Total			

2E. Total water storage capacity of existing dams and tanks

Table 6

Dam/Tank Name	Width (m)	Length (m)	Depth (m)	Surface Area (m^2)	Approx. Volume (m^3)	Water Storage Capacity (ML)
Total Storage						

2F. Calculating Harvestable Rights [Optional]

Use Water NSW's Maximum Harvestable Rights Calculator to determine the maximum harvestable right available for your property and record the volume in the table below.

Landholding Name	Latitude & Longitude	Landholding Area (Ha)	Maximum Harvestable Right (ML)

3A. Evaporation Loss

Estimated average evaporation (mm) for …_____

Evaporation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Evap
Holbrook	249	191	156	87	47	31	33	50	81	130	174	225	1454

Note: You might like to find monthly evaporation data for your region using the Bureau of Meteorology Website.

3B. Seepage Loss

Table 7

Dam Name	Surface Area (m^2)	Season Evaporation (mm)	Season Evaporation Loss (L)	Season Seepage (mm)	Season Seepage Loss (L)
Total:					

3C. Residual or 'dead' water

Table 8

Dam Name	Total Volume (m^3)	Residual Water (%)	Residual Water (m^3)	Residual Water (L)
Total:				

4. How long will the water last?

Table 9

No. of Days in Season		A
Water Usage During Season	**Litres (L)**	
Livestock		
Garden		
Household		
General farm needs		
Other		
Total summer usage		B
Daily summer water consumption: (B÷A)		C

Table 10

Total Storage Capacity (L)		D
Less evaporation losses		E
Less residual water		F
Less estimated seepage losses		G
Available Water: (H = D – E – F – G)		H
Days water will last: (H ÷ C)		

5. Checking Supply Flow Rate and Trough Capacity

Table 11

Stock Type	**No. Head of Stock**	**Inflow (L/min/head)**	**Flow Rate Required (L/min)**	**Volume (L/Head)**	**Trough Capacity Required (L)**
	A	B	A x B	C	A x C
Dry Cows					
Total:					

Additional Resources

AUS Dams Interactive Map

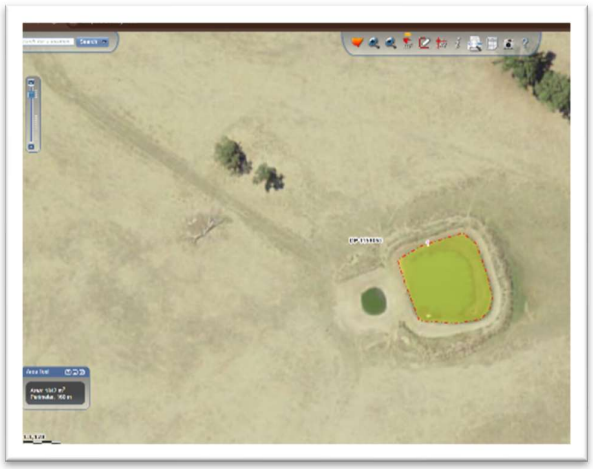
Link: http://ausdams.org/

Tips: An interesting tool to look at but shouldn't be taken as accurate. This does not replace ground truthing your own property and water storages.

Six Maps (NSW Government Spatial Services

Link: https://maps.six.nsw.gov.au/

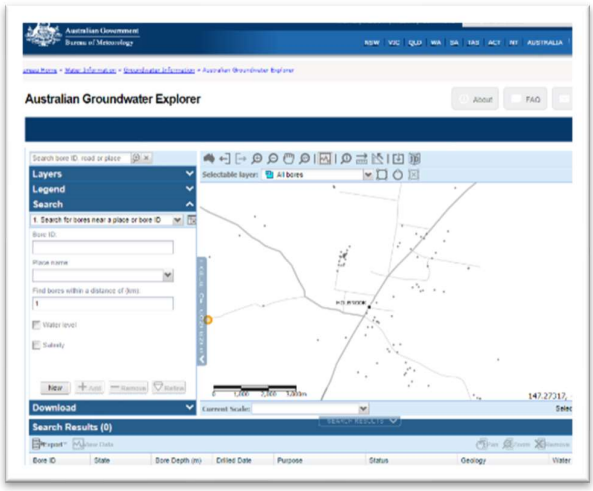
Tips: Can search for properties based on Address and Lot and DP numbers. Can be used to calculate surface areas of dams. Google Earth is also a good tool with similar capabilities but cannot search by Lot & DP.



Australian Ground Water Explorer

Link: http://www.bom.gov.au/water/groundwater/explorer/map.shtml

Tips: Initially is a lot to look at. This allows you to navigate around the region and click on bores local to your area and check features such as depth of bore holes.



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