

Dryland Rural Drainage

Financial Cost-Benefit Assessment Tool Guide



Cover image

Dryland rural drainage can improve productivity in the floodplain at Snowy River.

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it.

We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

DEECA is committed to genuinely partnering with Victorian Traditional Owners and Victoria's Aboriginal community to progress their aspirations.



Dryland Rural Drainage Financial Cost-Benefit Assessment Tool Guide version 2

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1. Introduction

1.1 Background

The Rural Drainage Assessment Tool (the 'tool') is a computer application (in the form of an Excel spreadsheet) that has been developed for use by landholders to make a preliminary assessment, at the local scale, of the economic viability of improving or maintaining existing drainage infrastructure. This document is a user guide that is designed to introduce the tool to landholders and to provide a step-by-step overview of how to use the tool and how to interpret the results it produces. The tool is available for download from <https://www.water.vic.gov.au/our-programs/victorian-rural-drainage-strategy>.

Important note: Undertaking drainage works may require landholders to gain approval from the relevant authorities. Appendix A provides a brief summary of the roles and responsibilities of landholders and other organisations in relation to rural drainage and how to go about seeking any relevant approvals.

1.2 The Rural Drainage Assessment Tool

The Rural Drainage Assessment Tool has been developed to enable individual landholders and groups of landholders to assess if renewing and maintaining on-farm drains is economically viable. The assessment involves the input of a range of enterprise data such as stocking rate, crop yield, and profitability and production costs, as well as scale and costs associated with proposed drainage refurbishment¹ works. The financial benefits associated with drainage are compared with the costs of generating these benefits through a user-friendly benefit:cost analysis.

It is designed for use primarily across beef, sheep, dairy and cropping enterprises, including properties where there is a mix of enterprises. Horticulture can be treated as cropping within the tool. It has also been configured to use across multiple properties, such as in situations where groups of landholders in an area wish to assess the economic viability of joint activity to improve drainage.

The tool is in the form of an Excel spreadsheet with the ability for the user to use default values (for example, in calculating input costs and gross margins) or to define new values where appropriate.

The tool is designed to be as simple as possible to provide an approximation of economic viability, as a first step towards determining if further investigation and detail is warranted. All outputs should be treated as indicative and should not be relied upon alone to make investment or management decisions. While there may be a range of benefits and costs associated with improving rural drainage, the tool focuses on the financial aspects that will be relevant to landholders. There are a range of other factors that will need to be considered alongside the direct financial impacts before determining whether drainage works are appropriate. These include:

- Environmental costs and benefits, including the purchase of environmental offsets
- Impacts of any drainage works
- Planning permits and other approvals for works (and associated costs in meeting these requirements)
- Tax implications of changes in revenues and costs.

Potential benefits for landholders of improving drainage:

- Reducing the extent, severity and duration of inundation after rainfall, resulting in:
 - Improved productivity and enterprise profitability
 - Increased efficiency of farm management (e.g. stock management, machinery movement).
- What might be the costs?
 - Direct financial costs associated with refurbishment¹ (i.e. returning degraded drains to good functioning condition)
 - Direct ongoing financial costs associated with maintaining drainage conditions
 - Cost/time inputs involved in coordinating drainage works with other landholders
 - Costs involved in obtaining environmental and other approvals.

While the tool has been developed for use by individual landholders and groups of landholders, it is also likely to be useful for farm advisors, consultants and farming systems groups working with landholders on rural drainage issues.

1 'Refurbishment' refers to structural earthworks, weed spraying and slashing/mowing, to return drains to a well-functioning condition

1.3 Guide to the User Manual

This User Manual has been designed to provide guidance in using the Rural Drainage Assessment Tool to undertake a preliminary assessment of the benefits and costs of refurbishing and maintaining drainage infrastructure on private land.

In addition to the background information provided above, this user manual includes:

- An overview of how the tool works
- A description of circumstances in which you might use the tool
- A summary of the key input data required to undertake an assessment
- Step-by-step instructions
- A series of worked examples
- Advice on how to interpret the results
- A glossary of terms.

1.3.1 When to use the tool

- You have drainage infrastructure on your property and are considering investing in refurbishment and/or maintenance works
- Your property is part of a community drainage scheme, across multiple properties, and you would like to collaborate with your neighbours to assess the economic viability of refurbishment and/or maintenance works.

The tool is not designed to assess publicly operated and managed drainage schemes or to assess the broader environmental benefits and costs associated with drainage.

1.3.2 Overview of the assessment process

Figure 1 provides an overview of the assessment process.

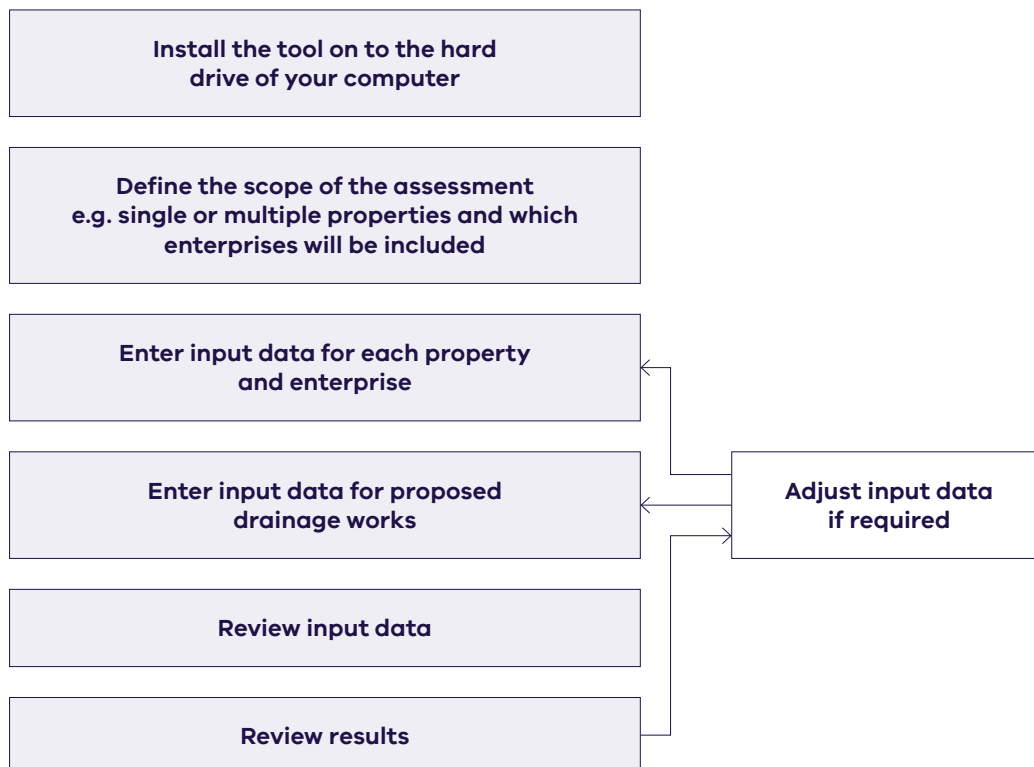


Figure 1: Overview of assessment process

2. User guide

2.1 Getting started (Step 1)

The tool is in the form of an Excel spreadsheet.

It is recommended that you make a copy of the file *rural-drainage-assessment-calculator.xlsm* to the hard drive of your computer, and into a folder where it can easily be located in the future.

When you open the file you will see the first worksheet, named Guidance (Figure 2 below). This worksheet provides an overview of the **four key steps** you need work through to undertake a new assessment.

Step 1:
To start a new assessment **click here** to clear all sheets – this removes previous input data

Step 2:
Select the main enterprise involving drainage on the property (e.g. cropping) – **click here** to open the relevant worksheet. See Section 2 for guidance on entering user data.
Note: for properties with more than one enterprise each relevant worksheet should be filled out

Step 3:
Click here to go to the Drainage worksheet where you enter input data on the drainage features of the property

Step 4:
Enables you to review a summary of the input data and results

Figure 2: Guidance worksheet


Notes:

1. Before you begin a new assessment you should save the previous assessment with a unique file name and then reopen the original spreadsheet file and 'clear all sheets' to begin a new assessment.
Tip: Once you have completed an assessment save it with a new file name.
2. Step 2 (Enterprise inputs) and Step 3 (Drainage inputs) require you to enter data into the cells only. Relevant white cells will then be populated automatically.
3. Step 4 (Summary worksheet) provides an overview of the data you have entered, together with key calculations and results. If you wish to alter any input data, return to the relevant enterprise worksheet or the drainage worksheet.

2.2 Entering enterprise input data (Step 2)

The tool has been designed to undertake drainage assessments for four different types of enterprises: beef, dairy, sheep and cropping. A mix of enterprises on each property can also be assessed by entering information for each production type under the appropriate property number. For example, if Property 1 produces both crops and beef, then information should be entered in the 'Property 1' column in both the 'cropping' and 'beef' worksheets.

Each enterprise worksheet has the same basic structure, with a set of specific questions relevant to that enterprise. The questions relate to factors about the current operation, such as stock numbers, income and costs and then ask you to consider how these factors might alter with improved drainage.

Think carefully about each question and then enter your response into the corresponding  cell for Property 1.

Note that when you enter user data, 'default values' will be generated in subsequent cells. These values are automatically calculated from the 'General Inputs and Assumptions' worksheet. Further information on these inputs and assumptions is provided in Section 2.5 (Figure 9). If you wish you can override the default value with values that are more reflective of your enterprise operations. Note that the assessment is only concerned with changes in operating revenues and operating costs (and hence operating profits), which are then compared against the cost of drainage works. Other potential benefits and costs are not considered (such as environmental impacts, changes in land values, lifestyle benefit, and all other factors mentioned in Section 1.2). Each enterprise worksheet has a set of three buttons at the bottom of the worksheet:

- Go to 'Summary' sheet – click this button if you wish to review the relevant summary information that has been compiled for the assessment to that stage.
- Return to the 'Guidance' sheet – click this button if you wish to check the guidance information. The values you have entered will be retained.
- Clear this sheet – click this button if you wish to delete the values you have entered for this enterprise. Note that you will need to enter new values to proceed with the assessment.

The tool has been designed for use across multiple properties – for example, by a group of landholders wishing to take a collaborative assessment of the viability of renewing and maintaining a drainage network at a landscape or community scale. Further guidance on multiple property assessments is provided in Example 3.

Specific guidance for each of the four enterprise worksheets is provided on the following pages.

2.2.1 Beef

Figure 3 below describes the inputs required for assessing the beef enterprise on an individual property.

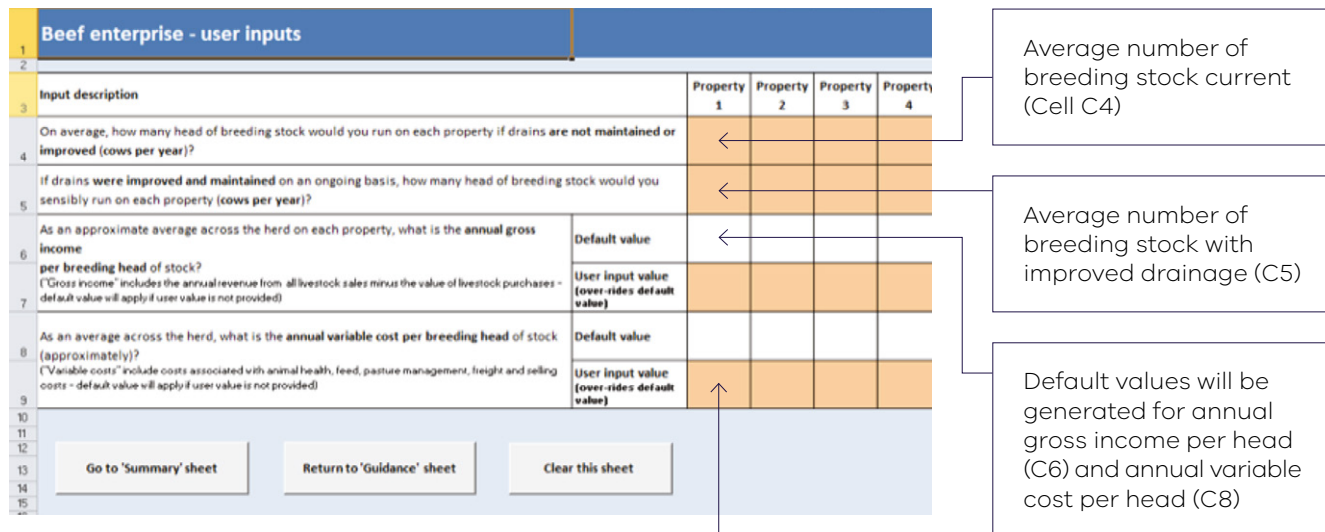


Figure 3: Beef enterprise worksheet

Notes:

- 'Gross income' includes the annual revenue from all livestock sales minus the value of livestock purchases.
- 'Variable costs' include costs associated with animal health, feed, pasture management, freight and selling costs.
- The difference between gross income and variable costs will generate the average gross margin per head – see Cell H8 in 'Summary' worksheet.
- Review the assumptions used to generate the default values for annual gross income and annual variable costs in 'General Inputs and assumptions' worksheet. Return to the 'Beef' worksheet and adjust these values if required.

2.2.2 Dairy

Figure 4 below describes the inputs required for assessing the dairy enterprise on an individual property.

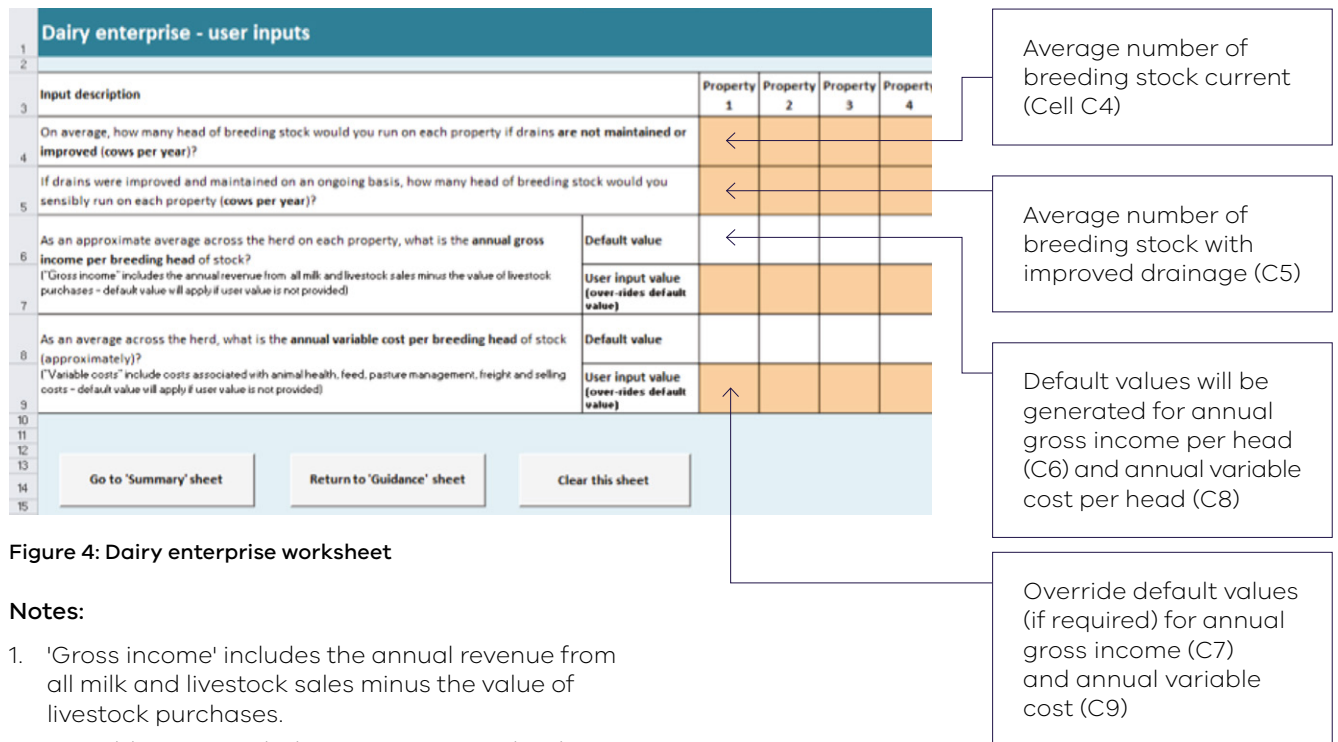


Figure 4: Dairy enterprise worksheet

Notes:

- 'Gross income' includes the annual revenue from all milk and livestock sales minus the value of livestock purchases.
- 'Variable costs' include costs associated with animal health, feed, pasture management, freight and selling costs.
- The difference between gross income and variable costs will generate the average gross margin per head – see Cell H11 in 'Summary' worksheet.
- Review the assumptions used to generate the default values for annual gross income and annual variable costs in 'General Inputs and assumptions' worksheet. Return to the 'Dairy' worksheet and adjust these values if required.

2.2.3 Sheep

Figure 5 below describes the inputs required for assessing the sheep enterprise on an individual property.

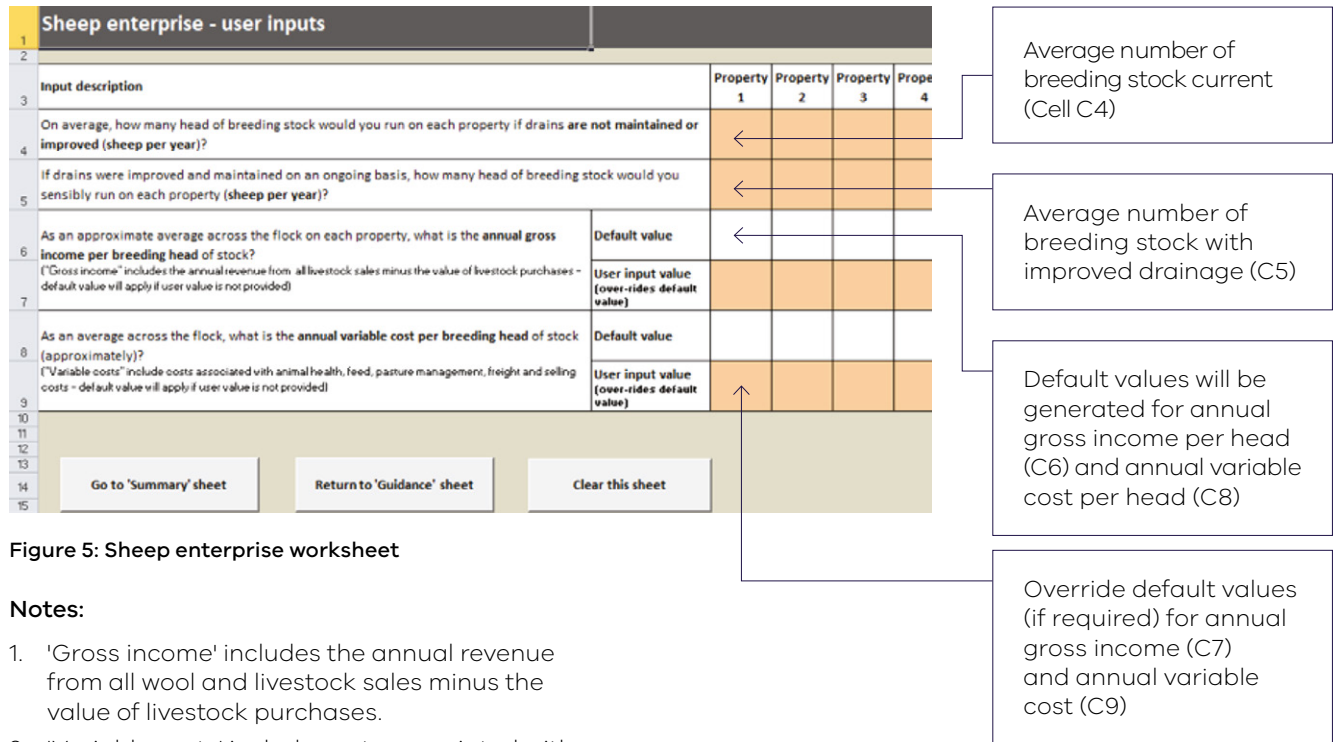


Figure 5: Sheep enterprise worksheet

Notes:

- 'Gross income' includes the annual revenue from all wool and livestock sales minus the value of livestock purchases.
- 'Variable costs' include costs associated with animal health, feed, pasture management, freight and selling costs.
- The difference between gross income and variable costs will generate the average gross margin per head – see Cell H14 in 'Summary' worksheet.
- Review the assumptions used to generate the default values for annual gross income and annual variable costs in 'General Inputs and assumptions' worksheet. Return to the 'Sheep' worksheet and adjust these values if required.

2.2.4 Cropping

Figure 6 below describes the inputs required for assessing the cropping enterprise on an individual property.

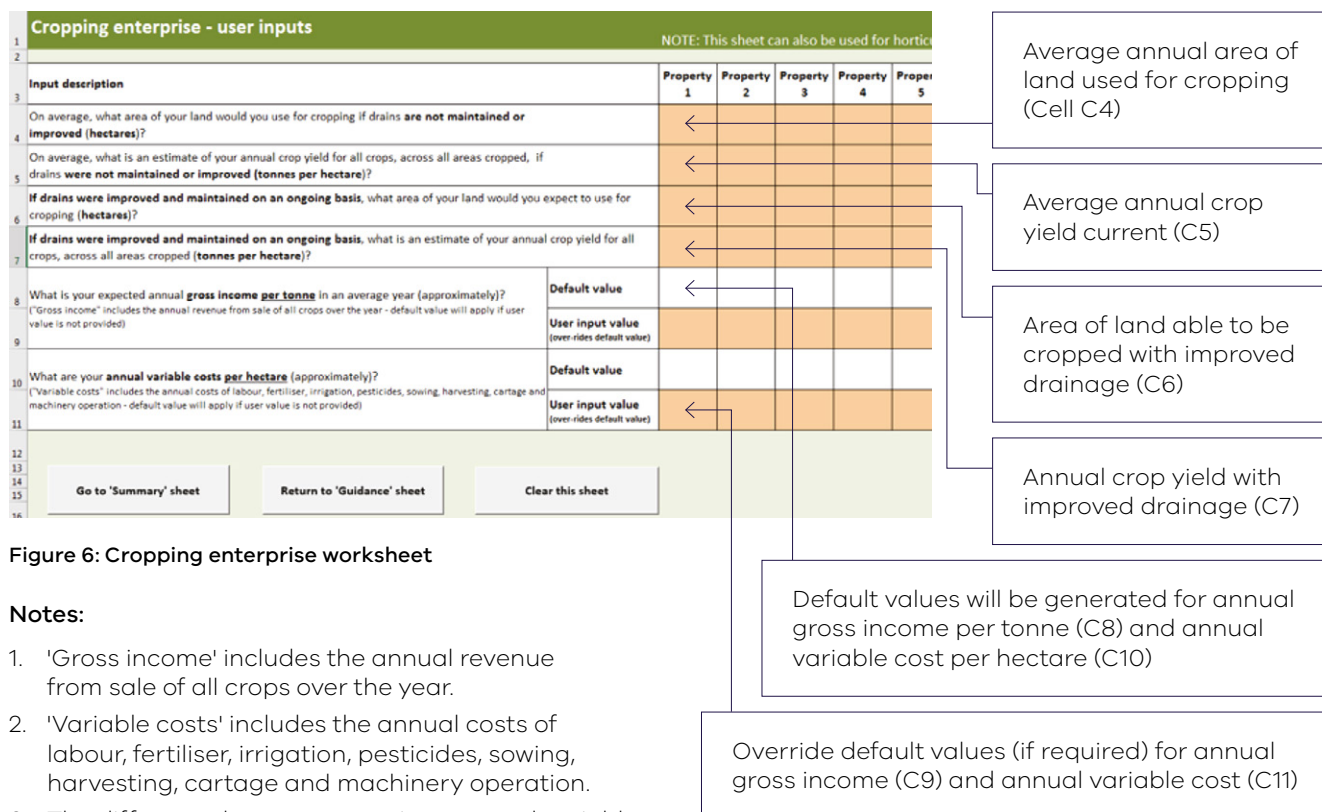


Figure 6: Cropping enterprise worksheet

Notes:

- 'Gross income' includes the annual revenue from sale of all crops over the year.
- 'Variable costs' includes the annual costs of labour, fertiliser, irrigation, pesticides, sowing, harvesting, cartage and machinery operation.
- The difference between gross income and variable costs will generate the average gross margin per hectare – see Cell H17 in 'Summary' worksheet.
- Review the assumptions used to generate the default values for annual gross income and annual variable costs in 'General Inputs and assumptions' worksheet. Note that the default values are based on dryland wheat (assumed price \$220/tonne) and will therefore need to be adjusted for other crops. Return to the 'Cropping' worksheet and adjust these values if required. Because the tool is at a whole farm scale, if you have a mix of crop types then you need to consider the average yield weighted across the farm (for example if you have 200 ha of wheat that yields 2.5 t/ha and 100 ha of canola that yields 1 t/ha then the area cropped is 300 ha and the average yield is $(2.5 \times 200 + 1 \times 100) / 300 = 1.67$ t/ha). The average price would need to be calculated based on the relative prices of wheat and canola.
- This sheet can equally be used for horticulture, however 'user input values' will need to be entered when estimating gross income per tonne and annual variable costs per hectare.

2.3 Entering drainage input data (Step 3)

Figure 7 below describes the inputs required for assessing the drainage requirements on an individual property.

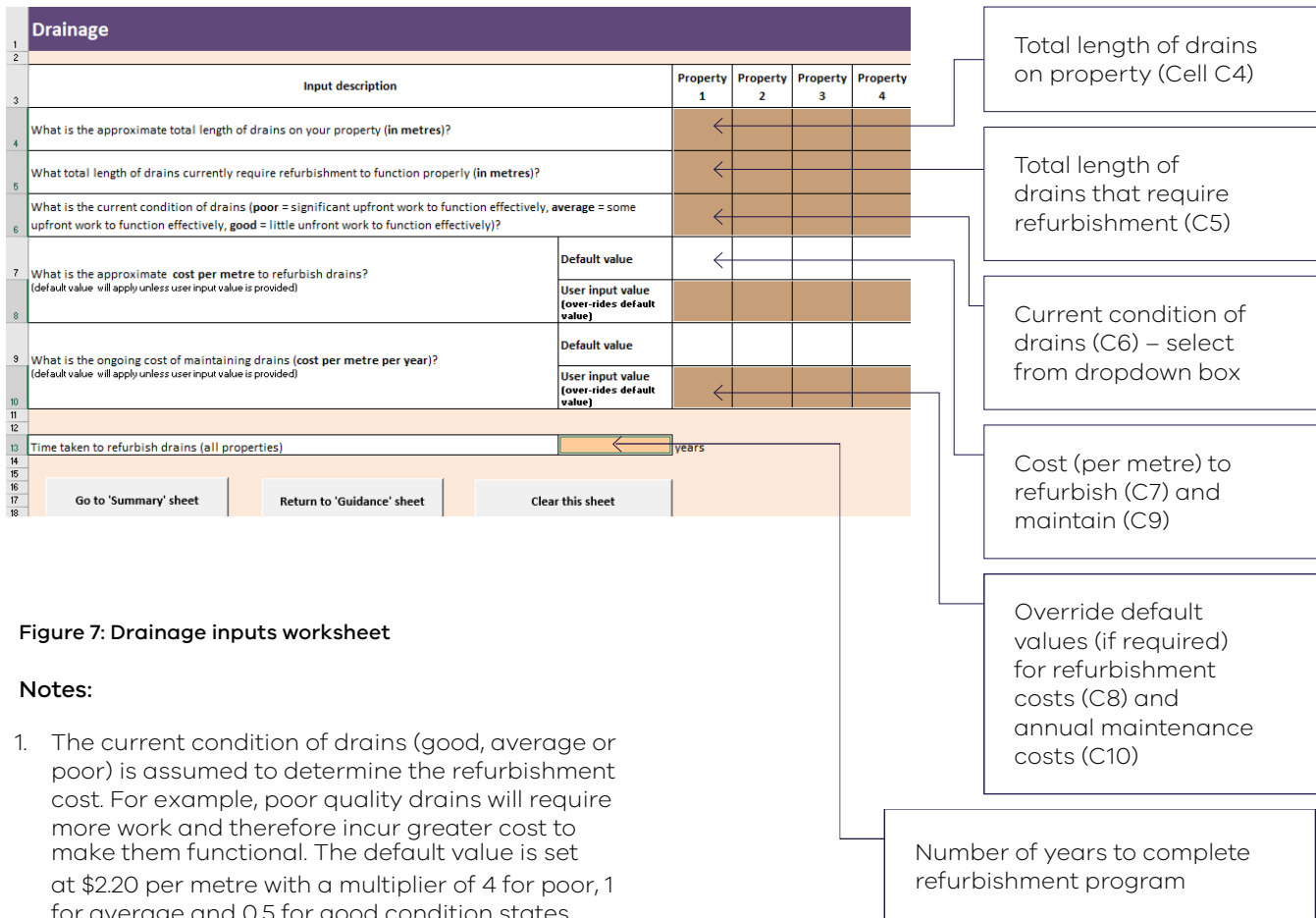


Figure 7: Drainage inputs worksheet

Notes:

1. The current condition of drains (good, average or poor) is assumed to determine the refurbishment cost. For example, poor quality drains will require more work and therefore incur greater cost to make them functional. The default value is set at \$2.20 per metre with a multiplier of 4 for poor, 1 for average and 0.5 for good condition states. These can be varied as required using the 'user input value' cells. Note that drainage costs can vary widely and so it is important to think carefully about whether you want to stick with the default value or enter your own estimate.
2. The time taken to refurbish all drains will affect the calculation of benefits and costs.
3. The costs of any additional works required that are not within the boundaries of the properties being assessed should be estimated, and the costs incorporated into the costs of the properties being assessed.

2.4 Summary worksheet (Step 4 – see next page)

The 'Summary' worksheet is automatically populated from the input data provided in the relevant enterprise worksheets and the drainage worksheet. Figure 8 provides an overview of the information that is provided in the summary assessment.

Notes:

1. It is not possible to adjust or change values in this worksheet. Return to the specific enterprise or drainage worksheet by clicking on the relevant button to the left of the summary of inputs table.
2. For assessments involving multiple properties, specific input data should be provided for each property and enterprise combination. Worked example 3 provides guidance for such an assessment. Up to 10 properties can be combined if required.
3. The graphs (annual benefits and costs of drainage and cumulative benefits and costs of drainage) provide a visual representation of how the benefits and costs vary through time, noting that the time frame for the analysis is 25 years.
4. The Benefit: Cost Ratio (BCR) will provide a general indication of the economic viability of the proposed drainage improvements. A BCR of 2 indicates that the benefits are double the costs over a 25 year time frame and that improvement works appear to be worth investing in. A BCR of 0.5 would indicate that the costs are double the benefits and therefore that investment is not justifiable on economic terms.

Click here to return to the enterprise input worksheet

Summary of input data and automated calculations (e.g. enterprise gross margins and drainage costs)

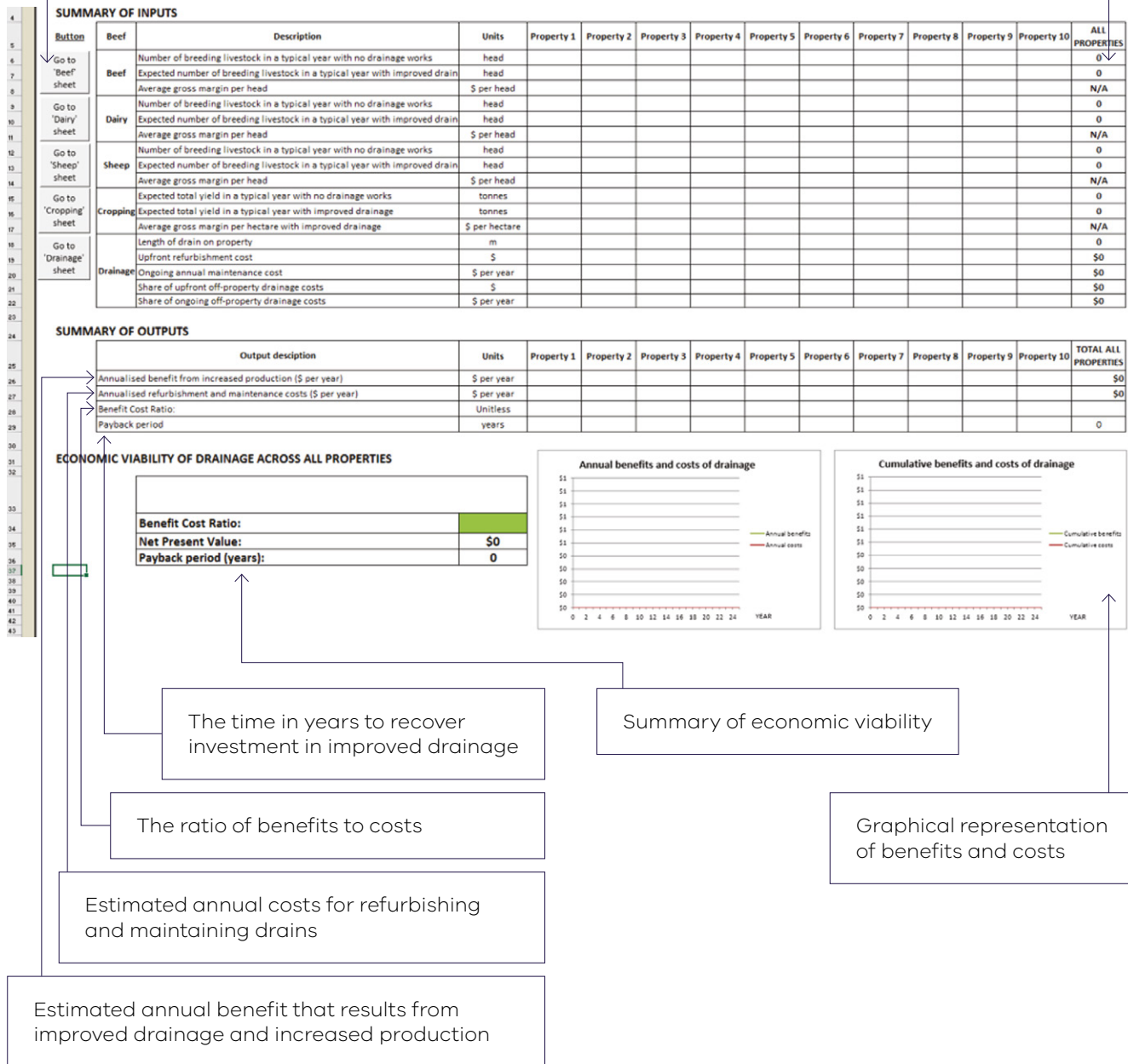


Figure 8: Summary worksheet

Users should be aware of the impacts of external market and environmental factors that may affect revenues and costs, and therefore the financial outputs presented in this summary sheet. Testing these outputs across a range of potential prices and costs in the input sheets will help inform decisions about investing in drainage works. Other factors not covered by the tool, such as those discussed in Section 1.2, should also be considered in this process.

2.5 Inputs and assumptions

Apart from user defined inputs, there are a series of general inputs and assumptions used to populate the tool. These are described in the 'General Inputs and Assumptions' worksheet (Figure 9).

1 General inputs and assumptions																
2																
3																
4	Required rate of return on capital	10% per annum														
5	Evaluation period	25 years														
6	Ramp up period to achieve full benefit of drain refurbishment	5 years														
7																
8																
9	Default production values:															
10	Production type	Gross income per unit	Variable costs per unit	Gross margin per unit												
11	Beef (\$ per breeding unit)	\$1,000	\$400	\$600												
12	Dairy (\$ per breeding unit)	\$2,800	\$1,024	\$1,776												
13	Sheep (\$ per breeding unit)	\$120	\$60	\$60												
14	Cropping income (\$ per tonne)	\$220	not used	not used												
15	Cropping cost (\$ per hectare)	not used	\$1,250	not used												
16																
17	Drainage costs	\$ per m														
18	Refurbishment of existing drains (\$ per metre)	2.2														
19	Maintenance (\$ per metre)	0.41														
20	Refurbishment multiplier (condition)	Poor	4													
21		Average	1													
22		Good	0.5													
23																
24																
25																
26																
<table border="1"> <thead> <tr> <th>Comment</th> <th>Info sources</th> </tr> </thead> <tbody> <tr> <td>Variable depending on operation. Should be reflective of enterprise owner's hurdle rate (not social discount rate)</td> <td></td> </tr> <tr> <td>breeding over a few years once carrying capacity has increased</td> <td></td> </tr> </tbody> </table>					Comment	Info sources	Variable depending on operation. Should be reflective of enterprise owner's hurdle rate (not social discount rate)		breeding over a few years once carrying capacity has increased							
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Figure 9: General inputs and assumptions worksheet

This worksheet has three components:

1. Economic and financial parameters
2. Default production values
3. Drainage cost assumptions.

Each component includes some brief explanatory notes, together with relevant information sources.

The default production values and drainage costs in this worksheet cannot be altered, but where applicable they can be overridden in specific worksheets (using the 'user input value' cells). For example, you can adjust the values for gross income and variable costs for specific enterprises they apply to your context.

2.6 Worked examples

2.6.1 Example 1: Mixed beef and cropping enterprise using default input values

This section describes a worked example for a hypothetical mixed farm, with both beef and cropping enterprises. In this example the default input values have been used for estimation of benefits and costs.

Beef enterprise - user inputs					
Input description	Property 1	Property 2	Property 3	Property 4	
On average, how many head of breeding stock would you run on each property if drains are not maintained or improved (cows per year)?	200				
If drains were improved and maintained on an ongoing basis, how many head of breeding stock would you sensibly run on each property (cows per year)?	205				
As an approximate average across the herd on each property, what is the annual gross income per breeding head of stock? <small>("Gross income" includes the annual revenue from all livestock sales minus the value of livestock purchases - default value will apply if user value is not provided)</small>	Default value	\$1,000			
	User input value (over-rides default value)				
As an average across the herd, what is the annual variable cost per breeding head of stock (approximately)? <small>("Variable costs" includes costs associated with animal health, feed, pasture management, freight and selling costs - default value will apply if user value is not provided)</small>	Default value	\$400			
	User input value (over-rides default value)				

Figure 10: Beef enterprise inputs

- Number of breeding stock without improved drainage (200) and with improved drainage (205)
- Default value for gross income per head (\$1,000) and annual variable cost per head (\$400) is generated and accepted

Cropping enterprise - user inputs					
Input description	Property 1	Property 2	Property 3	Property 4	
On average, what area of your land would you use for cropping if drains are not maintained or improved (hectares)?	200				
On average, what is an estimate of your annual crop yield for all crops, across all areas cropped, if drains were not maintained or improved (tonnes per hectare)?	8				
If drains were improved and maintained on an ongoing basis, what area of your land would you expect to use for cropping (hectares)?	210				
If drains were improved and maintained on an ongoing basis, what is an estimate of your annual crop yield for all crops, across all areas cropped (tonnes per hectare)?	8.5				
What is your expected annual gross income per tonne in an average year (approximately)? <small>("Gross income" includes the annual revenue from sale of all crops over the year - default value will apply if user value is not provided)</small>	Default value	\$220			
	User input value (over-rides default value)				
What are your annual variable costs per hectare (approximately)? <small>("Variable costs" includes the annual costs of labour, fertiliser, irrigation, pesticides, sowing, harvesting, cartage and machinery operation - default value will apply if user value is not provided)</small>	Default value	\$1,250			
	User input value (over-rides default value)				

Figure 11: Cropping enterprise inputs

- Current area of cropping is 200 ha and current annual yield is 8 t/ha without improved drainage. This is estimated to change to 210 ha and 8.5 t/ha with improved drainage
- Default value for gross income per tonne (\$220) and annual variable cost per hectare (\$1,250) is generated and accepted

Drainage				
Input description	Property 1	Property 2	Property 3	Property 4
What is the approximate total length of drains on your property (in metres)?	2000			
What total length of drains currently require refurbishment to function properly (in metres)?	1000			
What is the current condition of drains (poor = significant upfront work to function effectively, average = some upfront work to function effectively, good = little upfront work to function effectively)?	average			
What is the approximate cost per metre to refurbish drains? (default value will apply unless user input value is provided)	Default value	\$2.20		
	User input value (over-rides default value)			
What is the ongoing cost of maintaining drains (cost per metre per year)? (default value will apply unless user input value is provided)	Default value	\$0.41		
	User input value (over-rides default value)			
Time taken to refurbish drains (all properties)	2 years			

Go to 'Summary' sheet
Return to 'Guidance' sheet
Clear this sheet

- Current length of drains is 2,000 m, and 1,000 m (50%) require refurbishment. These drains are in average condition.
- Default values for refurbishment cost (\$2.20/m) and maintenance cost (\$0.41/m) are accepted
- It is estimated that the refurbishment program will take two years

Figure 12: Drainage inputs

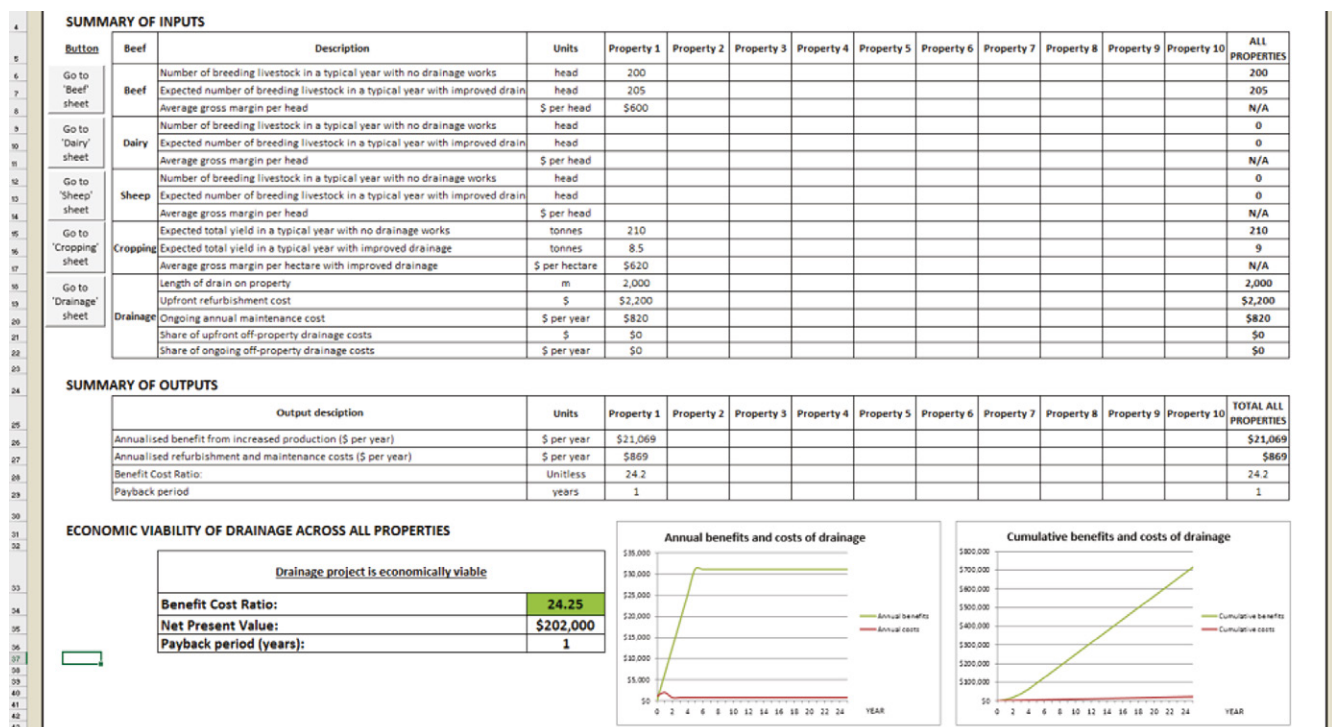


Figure 13: Summary of inputs and results

- The annualised benefits from increased production are \$21,069/year
- The annualised refurbishment and maintenance costs are \$869/year
- The benefits are estimated to exceed the costs by ~ 30 times (BCR of 24.25) with a payback period of one year
- The proposed program appears highly economically viable

2.6.2 Example 2: Dairy enterprise with user defined input values

This section describes a worked example for a hypothetical dairy farm of 400 hectares. In this example the default data has been overridden for both enterprise inputs and drainage inputs.

Dairy enterprise - user inputs				
Input description	Property 1	Property 2	Property 3	Property 4
On average, how many head of breeding stock would you run on each property if drains are not maintained or improved (cows per year)?	150			
If drains were improved and maintained on an ongoing basis, how many head of breeding stock would you sensibly run on each property (cows per year)?	155			
As an approximate average across the herd on each property, what is the annual gross income per breeding head of stock? <small>("Gross income" includes the annual revenue from all milk and livestock sales minus the value of livestock purchases - default value will apply if user value is not provided)</small>	Default value	\$2,800		
	User input value (over-rides default value)	2600		
As an average across the herd, what is the annual variable cost per breeding head of stock (approximately)? <small>("Variable costs" include costs associated with animal health, feed, pasture management, freight and selling costs - default value will apply if user value is not provided)</small>	Default value	\$1,024		
	User input value (over-rides default value)	1060		

Figure 14: Dairy enterprise inputs

- Number of breeding stock without improved drainage (150) and with improved drainage (155)
- Input values for gross income per head (\$2,600) and annual variable cost per head (\$1,060) has been used to override default values which were seen to be overestimating income and underestimating costs

Drainage				
Input description	Property 1	Property 2	Property 3	Property 4
What is the approximate total length of drains on your property (in metres)?	3000			
What total length of drains currently require refurbishment to function properly (in metres)?	2500			
What is the current condition of drains (poor = significant upfront work to function effectively, average = some upfront work to function effectively, good = little upfront work to function effectively)?	poor			
What is the approximate cost per metre to refurbish drains? <small>(default value will apply unless user input value is provided)</small>	Default value	\$8.80		
	User input value (over-rides default value)	\$10.00		
What is the ongoing cost of maintaining drains (cost per metre per year)? <small>(default value will apply unless user input value is provided)</small>	Default value	\$0.41		
	User input value (over-rides default value)	\$2.00		
Time taken to refurbish drains (all properties)	2 years			

Figure 15: Drainage inputs

- Current length of drains is 3,000 m, and 2,500 m (~80%) require refurbishment. These drains are in poor condition.
- Input values for refurbishment cost (\$10/m) and maintenance cost (\$2/m) have been used to override default values
- It is estimated that the refurbishment program will take two years

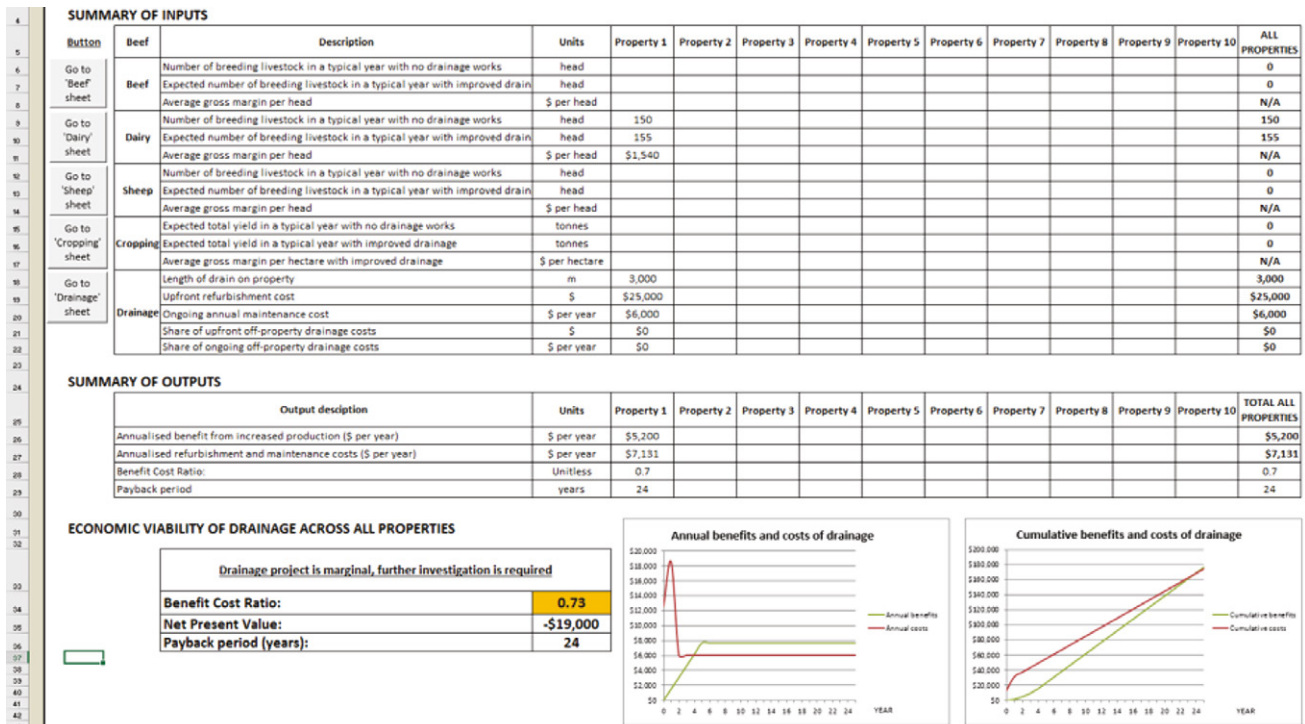


Figure 16: Summary of input data and results

- The annualised benefits from increased production are \$5,200/year
- The annualised refurbishment and maintenance costs are \$7,235/year
- The benefits are estimated to be slightly less than the costs (BCR of 0.73)
- The proposed program appears to not be economically viable

2.6.3 Example 3: Multiple properties with a mix of enterprises and user defined input values

This section describes a worked example showing an assessment for multiple properties (three) where there is a mix of enterprises (two beef and one dairy). User defined values have been used as inputs.

Beef enterprise - user inputs				
Input description	Property 1	Property 2	Property 3	Property 4
On average, how many head of breeding stock would you run on each property if drains are not maintained or improved (cows per year)?	100	0	50	
If drains were improved and maintained on an ongoing basis, how many head of breeding stock would you sensibly run on each property (cows per year)?	105	0	60	
As an approximate average across the herd on each property, what is the annual gross income per breeding head of stock? <small>(*Gross income* includes the annual revenue from all livestock sales minus the value of livestock purchases - default value will apply if user value is not provided)</small>	Default value	\$1,000		\$1,000
	User input value (over-rides default value)	800		800
As an average across the herd, what is the annual variable cost per breeding head of stock (approximately)? <small>(*Variable costs* include costs associated with animal health, feed, pasture management, freight and selling costs - default value will apply if user value is not provided)</small>	Default value	\$400		\$400
	User input value (over-rides default value)	390		390

Figure 17: Beef enterprise inputs

- Two of the three properties are beef. Number of breeding stock without improved drainage (100 on Property One and 50 on Property Three) and with improved drainage this increases (105 on Property One and 60 on Property Three)
- Default value for gross income and annual variable costs has been overridden

Dairy enterprise - user inputs				
Input description	Property 1	Property 2	Property 3	Property 4
On average, how many head of breeding stock would you run on each property if drains are not maintained or improved (cows per year)?	0	200	0	
If drains were improved and maintained on an ongoing basis, how many head of breeding stock would you sensibly run on each property (cows per year)?	0	210	0	
As an approximate average across the herd on each property, what is the annual gross income per breeding head of stock? <small>(*Gross income* includes the annual revenue from all milk and livestock sales minus the value of livestock purchases - default value will apply if user value is not provided)</small>	Default value		\$2,800	
	User input value (over-rides default value)		2600	
As an average across the herd, what is the annual variable cost per breeding head of stock (approximately)? <small>(*Variable costs* include costs associated with animal health, feed, pasture management, freight and selling costs - default value will apply if user value is not provided)</small>	Default value		\$1,024	
	User input value (over-rides default value)		1200	

Figure 18: Dairy enterprise inputs

- Property Two is dairy – number of breeding stock without improved drainage (200) and with improved drainage (210)
- Input values for gross income per head (\$2,600) and annual variable cost per head (\$1,200) has been used to override default values that were seen to be overestimating income and underestimating costs

Drainage					
Input description		Property 1	Property 2	Property 3	Property 4
What is the approximate total length of drains on your property (in metres)?		1000	1000	2000	
What total length of drains currently require refurbishment to function properly (in metres)?		300	800	1500	
What is the current condition of drains (poor = significant upfront work to function effectively, average = some upfront work to function effectively, good = little upfront work to function effectively)?		poor	poor	average	
7	What is the approximate cost per metre to refurbish drains? (default value will apply unless user input value is provided)	Default value	\$8.80	\$8.80	\$2.20
		User input value (over-rides default value)	\$5.00	\$10.00	\$5.00
9	What is the ongoing cost of maintaining drains (cost per metre per year)? (default value will apply unless user input value is provided)	Default value	\$0.41	\$0.41	\$0.41
		User input value (over-rides default value)	\$1.00	\$2.00	\$1.00
Time taken to refurbish drains (all properties)		2 years			

Figure 19: Drainage input data

- Current length of drains is 4,000 m over the three properties, and 2,600 m (~65%) require refurbishment. These drains are in poor or average condition
- Input values for refurbishment cost and maintenance cost vary across properties and user values have been defined
- It is estimated that the refurbishment program will take two years

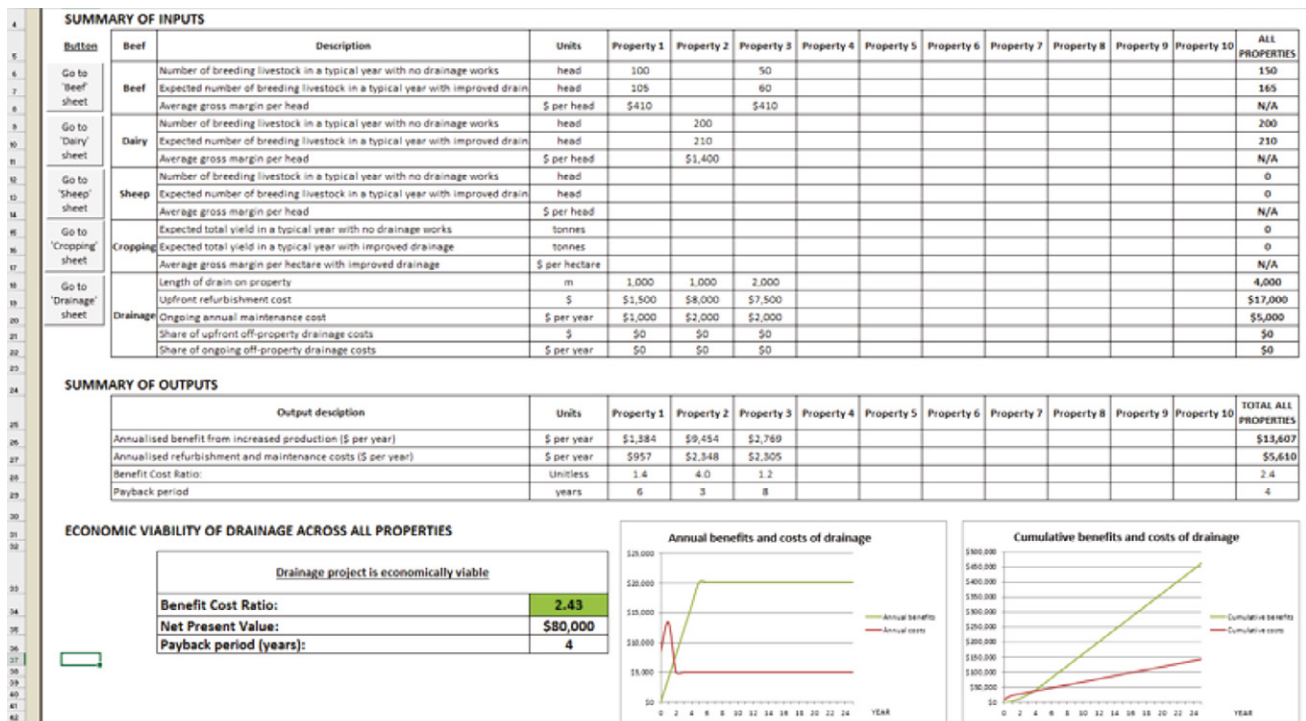


Figure 20: Summary of inputs and results

- The annualised benefits from increased production are \$13,607/year in total across all properties
- The annualised refurbishment and maintenance costs are \$5,610/year in total
- The benefits are estimated to be outweighing the costs (BCR of 2.43)
- The proposed program appears to be economically viable

Appendix A. Additional information

Future changes in dryland agricultural production and in land use, both of which are largely driven by market demand for agricultural commodities, may affect the benefits derived from rural drains. The potential for reducing the effects of inundation of agricultural land is heavily dependent on the condition and subsequent performance of existing drainage infrastructure.

Climate change and climate variability

The effects of future climate change are predicted to be significant for Victorian agriculture. These changes are likely to affect productivity and costs associated with different agricultural enterprises, together with the characteristics and function of drainage schemes.

In general, climate change is expected to produce hotter and drier conditions, which would tend to decrease the average annual impacts of inundation. Although drier conditions are expected, the intensity of some extreme rainfall events may increase. The benefits of well-maintained drains would be most evident following these events. The overall net effect of climate change on the cost-benefit equation for maintaining rural drains is thus uncertain and may not be evident in the short term.

Furthermore, the local effects of climate change are difficult to predict with any certainty, and therefore the benefits and costs of improving drainage systems are perhaps best explored through a range of scenarios which can then inform landholder decision making.

Table 1 describes the predicted implications for temperature change, rainfall, evapotranspiration and runoff for three scenarios (DELWP, 2016) that have been generated from a set of global climate models. More detailed information is available in this report at a river basin scale; however, the general pattern is similar to the state wide data shown here.

There is considerable uncertainty around these climatic factors, and landholders should take this uncertainty into consideration when assessing the cost effectiveness of drainage interventions. Landholders should consider how changes in temperature, rainfall and runoff may affect their farming operations (stocking rates, areas cropped, yields, prices and costs of inputs) in the future. These factors will change the effectiveness of drainage and its impact on enterprise profitability. The best approach would be to develop scenarios around changes in these inputs, and then assess how they would respond in terms of their operations. They should then consider how improved drainage may alter these operational decisions under these scenarios.

The design and ease-of-use of the Rural Drainage Assessment Tool makes it suitable for scenario analysis, such as exploring the implications of various climate change scenarios for the economic viability of investing in drainage improvement.

To use the tool in this way we would recommend the following steps:

1. Select a climate change scenario you would like to explore, using Table 1 as a guide
2. Create a new assessment in the Rural Drainage Assessment Tool
3. Complete the assessment giving consideration to what you think the estimated impact of the climate change scenario will be on your operations (and hence the respective input values). For example:
 - Under the medium climate change scenario, what effect would the predicted change in temperature, rainfall, potential evapotranspiration and runoff have on:
 - i. The carrying capacity and/or yield of your enterprise 'with' and 'without' improved drainage
 - ii. Income and costs
 - iii. The proportion of drains that would require refurbishment and the future condition of the drainage network on the property.
4. Compare the results of this assessment with the previous baseline assessment (without 'climate change').

Table 1: Predicted impacts²

Climate change scenario	Temperature change		Rainfall		Potential evapotranspiration (PET)		Runoff	
	2040	2065	2040	2065	2040	2065	2040	2065
Low			+2.4%	+2.7%			8.7%	+1.5%
Medium	+1.30°C	+2.30°C	-3.6%	-4.7%	-4.5%	-7.4%	-8.5%	-15.9%
High			-10.4%	-19.4%			-24.7%	-43.8%

² Data not available for temperature change and PET for low and high scenarios

Approvals and other factors to consider

Currently, individual landholders may need to apply to a range of agencies to obtain the necessary approvals to drain water from their land. A number of these approvals have costs associated with them and will need to be considered when planning for works.

The existing requirements can include: permission from local council for earthworks that relate to the management of dryland rural drainage; approval to undertake works on a waterway from catchment management authorities and permission to remove native vegetation or undertake works on Crown land from the Department of Energy, Environment and Climate Action.

Extra effort may be required to demonstrate that works will be undertaken in an environmentally sensitive way where drainage works could affect:

- Ramsar wetlands
- Flagship waterway sites
- Wetlands and waterways by:
 - Changes in watering regimes
 - Impact on ecological values (this would also apply to a cumulative effect on ecological values), including:
 - Native vegetation (trees, shrubs and grasses)
 - Aquatic and/or terrestrial fauna
 - Aquatic and/or terrestrial habitat
 - Water quality and/or quantity.

Where a greater level of effort is required to consider environmental approval applications, approvals may still be granted. But more detailed investigation may be necessary to ensure potential impacts from drainage works have been considered, avoided or minimised. The Australian Government *Environment Protection and Biodiversity Conservation Act 1999* identifies heritage items of national significance and provides protection mechanisms for these items. If an action is proposed that significantly affects a nationally listed heritage item, approval is required from the Australian Government – in addition to state and local approvals.

Landholders also have an obligation to protect cultural heritage and cultural landscapes during land management activities under the *Aboriginal Heritage Act 2006*. Landholders are responsible for reporting the discovery of Aboriginal cultural heritage and for not causing harm (without the appropriate authorisation under the *Aboriginal Heritage Act 2006*). An approved Cultural Heritage Management Plan or cultural heritage permit may be required in such places while undertaking dryland rural drainage works, including maintenance. Your council can advise on which group you need to talk to regarding cultural heritage in your area.

For more information on the approvals that may be required for your rural drainage works, refer to the *Dryland Rural Drainage Resource Kit for Landholders Version 3.0*.

In addition to the costs of meeting regulatory, legislative and planning obligations, there are other costs that landholders may need to consider. These include potential costs associated with planning, design, procurement and coordination of drainage works.

References

Hope, P, Timbal, B, Hendon, H, Ekström, M, Potter, N. 2017. A synthesis of findings from the Victorian Climate Initiative (VicCI). Bureau of Meteorology, 56pp, Australia. Available by download at <http://www.bom.gov.au/research/projects/vicci/>

Changes in climate conditions will affect the way rural drainage needs to be managed into the future. The Bureau of Meteorology recently released a synthesis of findings from the Victorian Climate Initiative. Because of the uncertainty about when and the extent to which reductions in rainfall and streamflow may occur, a scenario-based approach to planning is recommended.

Specific guidance for the water sector was developed in 2020 by the Department of Energy, Environment and Climate Action to help the sector plan for and adapt to a range of climate scenarios. The Guidelines for Assessing the Impacts of Climate Change on Water Availability in Victoria apply a risk-based framework that considers the vulnerability of supply systems to climate variability and climate change.

<https://www.water.vic.gov.au/our-programs/climate-change-and-victorias-water-sector/delivering-water-in-a-changing-climate/water-availability-climate-change-guidelines>

The Victorian Government has partnered with CSIRO to help Victorian communities prepare for climate change by providing authoritative and up-to-date information. Victorian Climate Projections 2019 has produced regional reports to help you understand how the climate will change in your region.

<https://www.climatechange.vic.gov.au/victorias-changing-climate>

Glossary of terms

Annualised benefit: The equivalent yearly value of a project's total projected benefits over its lifetime.

Annualised cost: The equivalent yearly value of a project's total projected costs over its lifetime.

Annual gross income: The value of gross annual income from all sources (before deductions e.g. income tax).

Benefit: Cost Ratio: A benefit:cost ratio (BCR) is an indicator, used in cost-benefit analysis, which summarises the overall value for money of a project or proposal. All benefits and costs are expressed in discounted present values.

Gross margin: Refers to the total income derived from an enterprise less the variable costs incurred in the enterprise. This is usually expressed as a value per head of stock or per hectare of crop.

Macros: A macro is a piece of programming code that runs in the Excel computer program and helps automate routine tasks. The Rural Drainage Assessment Tool contains a number of macros that need to be enabled for the tool to work.

Net Present Value (NPV): The net present value (NPV) or net present worth (NPW) is a measurement of economic profit calculated by subtracting the present values (PV) of cash outflows (including initial cost) from the present values of cash inflows over a period of time.

Payback period: Payback period is the time in which the initial cash outflow of investment is expected to be recovered from the cash inflows generated by the investment.

Refurbishment: In the context of rural drainage this refers to cases where an existing drain requires major works to restore its original function and effectiveness.

Rural drainage: The works and functions related to the collection, and timely removal, of excess water generated by high rainfall to support agriculture production. It involves enhancing the hydraulic capacity of drainage lines and soils, and increasing the rate at which water will flow off (or through) and away from land, to support increased agricultural production in dryland areas.

Variable costs: Expenses that vary in direct proportion to the quantity of output (e.g. number of animals in the enterprise, area of crop established).

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