# Farm Business Management Issues

## WISE **WATERING**
## **Irrigation Management Course**

These materials are part of the Wise Watering Irrigation Management Program, developed in part from the NSW Agriculture WaterWise on the farm education program and The Mallee Wells Irrigators manual.

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# *Introduction*

- The aim of the *Introduction to Irrigation Management* course is provide an understanding of an irrigation proposal as an investment.

This workshop aims to review a number of business management issues, particularly those that arise when changing or adding an enterprise, as occurs when irrigation is added to a farm business.

An irrigation proposal represents an investment, and needs to be assessed in the same way as any other business investment. The costs and returns from this investment can and should be compared with alternative investments, particularly the impact on profits and finance requirements. It is therefore important to consider:

- Why is it being undertaken?
- What are the alternatives?
- Will it be profitable over the long-term?
- Can it be funded?

A good way to review investment proposals is to consider Now?, Where? and How?.

- Now? – Where are we now?
- Where? – Where do we want to be?
- How? – How are we going to get there?

Investment in irrigation may represent one possible How? but it will not be the only one. But note that How? is the third question. We need to be clear about where we want to get to before thinking about how to get there. And we need to know where we are now as we may already be where we want to get to!

This module describes some tools to help answer these questions.

Examples of the investment analyses include the following assessments:

- Conversion from dryland to irrigated dairying.
- Diversification of a dryland grazing property to include irrigated poppies.
- Irrigating pasture with a centre pivot to fatten store lambs and cattle.
- Converting from a travelling irrigator to centre pivot system.

# *Learning outcomes*

When you have completed this workshop you will be able to:

- Undertake an assessment of a new irrigation enterprise.
- Conduct an investment analysis to determine profitability, showing the long-term impact on profit (over the “life” of the investment).
- Assess short-term financing requirements for a capital investment in irrigation infrastructure.

To achieve these outcomes, the workshop activities include:

- Theory session.
- Review of an example appropriate to your farming business.
- Discussion.

# *Now? - Where are we now?*

When assessing any change in your farming business it is important to be clear about your present position, so the impact of a change can be assessed. A useful framework for this is a review of the Strengths and Weaknesses, and Opportunities and Threats, and calculate some key indicators of the present performance (benchmarks).

## *SWOT analysis*

Strengths and weaknesses are characteristics of the business; they are mostly issues inside the farm gate. Opportunities and threats usually relate to outside influences, for example opportunities are usually driven by markets for a particular product. Threats inside the farm gate are generally manageable. While you can do little about the likelihood of threats in the wider environment you can take steps to reduce their impact.

### *Strengths*

What do you see as the strengths of your business. Consider the physical resources (land, water, plant & equipment, livestock, etc), the human resources (people, capacity and skills) and the financial resources.

### *Weaknesses*

Be fair and honest; what factors are weaker than you would like?

### *Opportunities*

**There are no opportunities without a customer and a market.**
So be sure there is a market for the produce from the proposed irrigation enterprise.

### *Threats*

There are threats both inside and outside the farm gate; those that are inside can be addressed and are likely to already be considered as potential weaknesses.

The more serious threats are outside the farm gate, for example interest rates, changes in world markets etc. While you are generally unable to affect these changes, or the likelihood of them occurring, there are often things that you can do to minimise their impacts, for example fixing interest rates on loans, taking out insurance and using forward sales contracts.

It is useful to assess the two components of business risks:

- The **likelihood** of the event actually occurring.
- The **consequences** of the event.

Where the likelihood of an event is high, and the consequences very significant, action to minimise potential losses is important. For example, droughts are certain to occur in the drier areas of Tasmania, and the consequences can be very substantial. The development of a drought preparedness plan is therefore recommended; this includes plans for the security of water and stock feed, stock reduction strategy etc.

Where the likelihood is very low, but the consequences very significant, for example the death of the business manager, the response could be to insure the life of the manager.

If the likelihood is low, and the consequences small, then why worry?

## *Benchmarks*

There are many systems for benchmarking farm businesses, and adhering to the KISS principle is useful. The following benchmarks are useful for the business as a whole, and are best used to monitor the business over a period of time to see whether the indicators are improving; if not then a weakness is exposed.

The indicators will vary between enterprises, but some general benchmarks are listed below.

### *Scale.*

The size of the business is important because larger enterprises and businesses are better able to recover fixed overhead costs. Examples of benchmarks that indicate scale are:

- Grazing properties; dry sheep equivalents per labour unit >7,500.

- Land value per family (depending on the business); aim for >$600,000.

## *Efficiency*

This is a measure of how well the resources are used. Benchmarking examples are:

- Machinery ratio (the value of plant and equipment relative to gross farm income); aim for a ratio <0.8 (higher on cropping farms and lower for grazing).

- Gross farm income per labour unit; aim for >$150,000.

- Operating costs (includes all variable and overhead costs, but excludes interest) as a percentage of gross farm income; aim for <60%.

- Return on assets managed; is the ration of EBIT (Earnings before interest and tax) over the total value of assets managed. This is highly variable and the interpretation depends strongly on personal requirements.

## *Debt servicing*

There are various ways of viewing this, including measures of equity etc. A convenient measure is;

- Interest as a percentage of gross farm income; aim for <15%

# *Where? - Where to we want to be?*

This is a key issue, and needs to be discussed with all members of the family or the management team.

There are a number of areas that to consider;

**Business issues:**

- Financial position; eg., level of equity or borrowings.
- Business size; eg., turnover, area, number of stock, labour pool.
- Enterprise mix; will influence labour and machinery requirements.
- Etc etc.

**Farm resources**

- Machinery
- Land and soil; sustainability considerations
- Etc etc

**Personal issues:**

- Balance of work and leisure.
- Family commitments and requirements.
- Where you live and where you work.
- Work preferences.
- Etc etc

Thinking about these issues will lead to a VISION, or a picture that represents where you want to be in the future. This leads to setting particular objectives. Remember, objectives need to be SMART.

**S**pecific
**M**easurable
**A**greed
**R**ealistic
**T**imed.

# *How? How to get where we want to be?*

Irrigation investment may be a diversification for the farming business, or it may allow expansion of existing irrigated enterprises. In either case, the management team needs to consider the options that could take the business in the desired direction; what are the alternative courses of action?

## *Alternatives*

List the alternatives that might help you get where you want to be.

## *Risks*

Change through diversification or enterprise expansion carries a suite of risks and costs (disincentives), particularly in the context of irrigation development. These risks and disincentives include;

- The security of the water resource; is the quantity and quality of the water at risk?
- The capital costs of the irrigation development, including the costs of water storages, irrigation equipment and additional plant (tractors and implements).
- Risks associated with growing new crops; lack of skills and experience results in increased chance of crop failure or low returns.
- Existing enterprises may be reduced in scale, with increased per unit production costs.
- Diversion of management emphasis from existing "proven" to the new enterprises, so that the performance of the existing enterprises suffers.
- The likelihood of long-term availability of markets for the output of the enterprises on which diversification is based.
- Risks to environmental sustainability; salinity and waterlogging are important issues in the lower rainfall areas of Tasmania.

Conduct a risk assessment, noting that it will have two parts;

**Describe** the risk, then describe the **response**.

For example, the response to reducing the risk of water availability may be to construct a dam with additional capacity.

Put simply, diversification is not risk free; it is not a recipe for increased profitability, even if increased profitability is a goal for the business.

There will be ways of managing these risks, some more so that others. But careful assessment of the risks and responses will help you decide whether irrigation is for you.

# *The Irrigation Development Plan*

Assuming an irrigation development has been selected as a means of getting the business where you want it to be, the next step is to create a Development Plan. This will incorporate these key areas;

- Resources assessment
- Irrigation plan
- Investment analysis

## *Business resources*

Key resources for an irrigation development are;

- Water
- Land and soils
- Plant and equipment
- Labour and expertise
- Finance and management

Review these key resources by asking and answering a number of questions.

### *Water resources*

Do you have a license for water? Is it large enough?
Could you purchase a license from others?
Can you purchase water from others?
Is storage of winter flows feasible? What will it cost? Can you get a permit for a storage?
Is groundwater a possibility.
Will water quality be an issue?

### *Land and soils*

Is your land of suitable capability for irrigation?
Is your topography suitable for irrigation?
Are the soils suitable? How intensively can they be cropped?
Will the soil structure sustain cropping operations?
Is drainage adequate?
Is soil salinity an issue?
Is sodicity an issue?

### *Plant and equipment*

Will the irrigation development and proposed enterprises require additional or different equipment?

Can the required equipment be hired when required?
Could contractors provide the necessary services?

### *Labour and expertise*

Do you have enough labour for the new or larger enterprises?
If not, will you need permanent, casual or seasonal labour? Is this available in the district?
Will you need to provide training for employees? If so, how will this be done?
Do you have the expertise to manage the new enterprises? Is expertise available from advisers, consultants etc?

### *Finance and management*

- What are the "**relevant**" costs of the investment? Relevant costs are the purchase costs of new equipment or the salvage values of traded equipment.
- How will you finance the project?
- Do you have contracts or markets for the produce?
- Do you have a sound management team?
- Do you have quality assurance systems?

Answers to these questions will form a basis for the business plan. Most farmers do these assessments automatically. But where the development is quite large, it can help to put the answers on paper, and invite other members of your management team to have input.

Involving others will not only help to find the best answers to these questions, it will also create "ownership" and commitment to the development.

## *The irrigation scheme*

This should address these critical issues;

- Water requirements; the volume required, where it will be sourced, the reliability of supply and a check that the water quality is satisfactory.

- The system design; particularly the type of watering system; for example sprinklers, travelling irrigator or centre pivot system. A key design factor is the daily evapo-transpiration demand that the system can satisfy (ie., mm per day that the system can apply, after allowing for system inefficiencies and for breakdowns).

- Capital costs; obtain several quotes from equipment suppliers.

- Sustainability; particularly in regard to soil structure and salinity.

## *Planning*

Planning usually involves discussing your requirements with several equipment suppliers. They will probably have different ideas about how best to meet your irrigation requirements. The picture can easily become confusing with a wide range of options.

To avoid a bewildering array of designs, try to be clear about the overall irrigation scheme, in terms of;

- The precise area of land that you want to irrigate; best shown on a map or aerial photograph.
- If cropping, the range of crops and their irrigation requirements, and the cropping rotation.
- Where the water source is located, and the expected quantity available.

Then ask the suppliers what equipment they can provide to meet this irrigation requirement.

A useful way of comparing designs is to ask each supplier to indicate the peak daily water demand that their system can deliver. For example, peak daily water use by vigorously growing crops in December is 6-8 mm in many districts.

To allow for down-time (breakdowns, time to move and set-up equipment, and very windy conditions when irrigation might be stopped), peak capacity should generally be at least 7-9 mm per day for field crops. This will ultimately be expressed in terms of the flow of water that is provided to the system (litres per second or gallons per minute).

## *Sustainability*

The threat of soil degradation, particularly the loss of soil structure due to cropping operations, and the development of soil salinity in the dryer areas of the State, should be assessed.

There are management practices that can be employed to assess and minimise these risks.

## *The investment analysis*

There are two components to the investment analysis:

- How will the investment impact on profitability; this requires assessment over the long term; over the "life" of the investment.

- What are the short-term financing implications.

### *Impact on profitability.*

**Partial budgeting** is a good way of estimating the contribution the investment will make to profits.

A partial budget is based on the **changes** that an investment will have on returns and costs. The changes are;

***Additional returns = extra income + costs saved***
***Additional costs = extra costs + income foregone***

The following method details the steps involved in determining the benefits and costs from an investment.

This example assumes a simple irrigation development based on building a dam to store winter runoff, with a diesel pumpset, aluminium pipes and travelling irrigator to water 15 hectares of poppies and 15 hectares of rye grass for seed.

Capital costs are;

| | |
|---|---|
| Irrigation dam, 80 ML capacity; | $35,000 |
| Pumpset | $12,000 |
| Aluminium pipes | $13,000 |
| Traveller | $30,000 |
| **TOTAL CAPITAL** | **$90,000** |

**Step 1.** Calculate the returns.

Extra income, ie., additional Gross Margin that the irrigation development will produce. The Gross Margin is calculated after allowing for the running costs of the irrigation equipment.

| | |
|---|---|
| Poppies, GM $1,700/ha | $25,500 |
| Grass seed, GM $440/ha | $6,600 |
| **TOTAL irrigated GM** | **$32,100** |

Costs saved; effectively none in this instance.

**Step 2.** Calculate the extra costs.

Variable costs are included in the Gross Margin, but there may be extra overhead costs. In most instances the added overhead costs will be small; assume overhead costs are increased at 10% of the Gross Margin.

| | |
|---|---|
| **Extra overhead costs** | **$3,200** |

Income foregone; represented by the Gross Margin that the irrigated land could otherwise have produced. Assume the alternative uses were barley (GM $250/ha) and grazing ($200/ha).

| | |
|---|---|
| Barley GM foregone (15 ha) | $3,750 |
| Grazing GM foregone (15 ha) | $3,000 |
| **TOTAL GM foregone** | **$6,750** |

**Step 3. Calculate the return on the investment, before financing costs.**

| | | |
|---|---|---|
| Income and costs saved | | $32,100 |
| LESS | | |
| Extra costs | $3,210 | |
| GM foregone | $6,750 | |
| | | $9,960 |
| **Earnings before interest & depreciation** | | **$22,140** |

**Step 4.** Allow for interest and depreciation on the capital investment.

Assume the dam has no depreciation, but the irrigation equipment depreciates to a salvage value of $13,000 after 10 years. Allow interest on the funds invested in the project at 10%.

| | |
|---|---|
| Depreciation, $90,000 depreciates to $48,000, over 10 years; | $4,200 pa |
| Interest on the average capital, $69,000 @ 10% | $6,900 pa |
| **TOTAL INTEREST & DEPRECIATION** | **$11,100** |

**Step 5.** Calculate the net gain from irrigating.

| | | |
|---|---|---|
| GM from the irrigation | $32,100 | |
| LESS | | |
| GM foregone | | $6,750 |
| Extra overhead costs | | $3,210 |
| Interest & depreciation | | $11,100 |
| **TOTAL EXTRA COSTS** | | **$21,060** |
| **Net gain from irrigating (profit)** | | **$11,040** |

This assessment shows the profit from the irrigation investment to be attractive.

It is worthwhile repeating this analysis with a range of more pessimistic assumptions, to calculate the level of profitability at lower yields and product prices.

## *Financing the investment*

The investment analysis will show whether the capital investment is expected to be profitable. But there may still be difficulties raising the cash and paying for the equipment.

Assume in the above example that the finance for the dam and the irrigation equipment is provided as a loan to be paid off over 4 years at an interest rate of 10%. If paid annually in arrears, there will be 4 payments of $28,392.

The **cash** position is therefore;

| | | |
|---|---|---|
| GM from the irrigation | $32,100 | |
| LESS | | |
| GM foregone | | $6,750 |
| Extra overhead costs | | $3,210 |
| Loan payment | | $28,392 |
| **TOTAL EXTRA COSTS** | | **$38,352** |
| **Net gain from irrigating** | **-$6,252** | |

In this example, the investment is profitable, but it produces a cash flow deficit for the first 4 years. After that time, the loan payments cease, and the investment produces a cash surplus of $22,140 per year. How will the business finance the loan payments during the first 4 years?

This example has been structured to demonstrate that although an investment may be profitable, it can create financing difficulties over the short term.

What could be done to reduce the short-term financial burden?

# *Examples of investment analyses*

The following examples are designed to illustrate the principles of various investment analyses. Remember the five steps;

Step 1. Calculate the extra returns; eg. the gross margin income and costs saved.

Step 2. Calculate the extra costs; added overhead costs and income foregone.

Step 3. Calculate the return on the investment before financing costs (ie., interest and depreciation).

Step 4. Subtract interest and depreciation.

Step 5. Calculate the net grain from the change.

The examples use hypothetical figures; the answers will vary greatly from one situation to another.

For example, the example of diversification of the dryland grazing property to include poppies irrigated with a centre pivot. This analysis shows the change to be very profitable based on an expected Gross Margin of $2,200/hectare.

This GM is relatively high. At a lower GM, say $1,500/hectare, the proposal is still profitable but has funding difficulties.

***So use these examples as models of the analysis process; do not apply the answers from these examples you your situation.***

# *A dryland grazing property diversifies into irrigated poppies with a towable centre pivot irrigator*

## *Background and resources*

The property is in the Midlands of Tasmania and has soils well suited to poppies. Contracts are available for 40 hectares of poppies. A cereal crop (dryland) will be drilled into the poppy stubble, and after harvest pasture will be drilled into the cereal stubble.

There is no evidence of salinity in the catchment and the proposed irrigation area, and the water quality is expected to be good.

The land to be irrigated would otherwise be used for dryland grazing with a Merino wool flock; the carrying capacity is 10 dse/ha, and the sheep produce a GM of $17.50/dse. The property presently crops some dryland cereals, and the incorporation of these into the irrigated area will not change the total area of cereals. Pasture is normally sown after the cereal crop, so the only change is to introduce irrigated poppies into the cropping rotation.

No additional labour will be required for the enterprise; cultivation and spraying will be done with existing equipment.

## *Irrigation plan*

The poppies will be irrigated with a towable centre pivot watering 2 circles each 20 hectares (250 metre pivot). Sowing times will be staggered to spread peak water requirements.

A good site is available for a gully dam to store approximately 120 ML of water, and the catchment is large enough to ensure that it will fill every year. The development will require about 100 ML, allowing 2.5 ML/hectare for irrigation plus about 20 ML for evaporation and distribution losses.

The dam is to be located at a good site (Storage:Excavation ratio of 10:1).

Estimated costs for the dam are:

| | |
|---|---|
| Earthworks | $30,000 |
| Outlet pipe etc | $5,000 |
| Engineering etc | $3,000 |
| **TOTAL** | **$38,000** |

Estimated costs for the irrigation equipment are:

| | |
|---|---|
| Pump & fittings | $10,000 |
| HEC connection | $10,000 |
| Mainline | $85,000 |
| Pivot | $75,000 |
| **TOTAL EQUIPMENT** | **$180,000** |

## *Investment analysis*

**Key assumptions:**

Crop GM $2,200/ha (yield say 1.25 t/ha @ $2500/t)

### Irrigation of poppies with a centre pivot

| Extra Crops Grown | Area | Water Used | | Gross Margin | |
|---|---|---|---|---|---|
| | | Per Ha | Total | Per Ha | Total |
| | (ha) | (ML/ha) | (ML) | ($/ha) | ($) |
| Poppies | 40 | 2.5 | 100 | $2,200 | $88,000 |
| **Total Irrigation Gross Margin** | | | 100 | | **$88,000** |
| **Less Gross Margin foregone** | | | | | |
| Grazing | 40 | | | $175 | |
| Total GM foregone | | | | | **-$7,000** |
| **Less Extra Wages/Overheads,** @ % of GM | | | 10% | | **-$8,800** |
| **MARGIN before Interest & Depreciation** | | | | | **$72,200** |

**Less Interest & depreciation**

| | New Cost | Depreciated (10yrs) |
|---|---|---|
| Dam | $38,000 | $38,000 |
| HEC connection | $10,000 | $8,000 |
| Pumpset | $10,000 | $4,000 |
| Mainlines | $75,000 | $40,000 |
| Centre pivot | $85,000 | $30,000 |
| Totals | $218,000 | $120,000 |

| | | |
|---|---|---|
| Interest on average capital | Interest rate: 10% | **-$16,900** |
| Average annual depreciation | | **-$9,800** |
| **PROFIT** | | **$45,500** |

**Financing,** assume funding by a loan at fixed interest over a contract period.

| | | |
|---|---|---|
| **MARGIN before Interest & Depreciation** | | **$72,200** |
| **LESS** | | |
| | Interest rate & duration (yrs) | |
| Loan payments | 10% 4 | **-$68,773** |
| **NET MARGIN AFTER LOAN PAYMENTS** | | **$3,427** |

This assessment shows the investment will produce a profit of $45,500 per year. In the first 4 years nearly all the profit will be required for the loan payments, leaving a cash surplus of $3,427 per year. In effect, the profits will pay for the capital investment in 4 years.

## *Risks*

An investment of this size needs an assessment of the risks. While the risks will vary from property to property, obvious risks are:

- Production risks that threaten yield; for example wet or dry weather, disease, insects etc. Is the water resource secure?
- Market risks; the availability of contracts may change in the future; prices may decline.
- Finance risks; the financial calculations assume fixed interest rates.
- Environmental risks; is the irrigation and cultivation program sustainable?
- Human risks; could the enterprise continue without your operational and management skills?

# *A dryland grazing property diversifies into irrigated pasture with a fixed centre pivot irrigator*

## *Background and resources*

The property is in the Derwent Valley and has soils well suited to irrigated pasture. Water is available by direct pumping from the Derwent River.

The soils drain reasonably well but the surface soil texture is too clayey in areas for cropping. Water lays in some depressions in winter, although the surface drainage will be improved by shallow surface drains.

The business proposes to install a fixed centre pivot irrigator capable of irrigating 60 hectares. The pasture will be used to fatten prime lambs and or store cattle bred on the property.

The land to be irrigated would otherwise be used for dryland grazing with a Merino wool flock, Cross bred lamb flock and beef cattle; the carrying capacity is 12 dse/ha, and an average GM of $18.00/dse is assumed for both the sheep and the cattle. Some lambs and cattle are sold as fat stock, and a proportion as stores.

This analysis assumes pasture production from April to September remains with the grazing enterprise. The loss by conversion to irrigation is estimated at 7 dse/ha averaged over the year (ie., grazing over the April September period is allowed at the equivalent of 5 dse/ha). The Gross Margin Foregone is therefore $126/ha (7 dse @ Gross Margin $18/dse).

A perennial pasture comprising varieties and species better suited to irrigation is sown and costed as part of the project capital cost (establishment cost $250/ha). Annual maintenance allows for fertiliser and pest/weed control.

No additional labour will be required for the enterprise.

## *Irrigation plan*

Water resources. The development will require about 300 ML, and an irrigation license has been obtained from the DPIWE.

The pivot site is located on a terrace about 15 metres above the river.

Estimated costs for the irrigation equipment are:

| | |
|---|---|
| Pasture establishment | $15,000 |
| Pump & fittings | $13,000 |
| HEC connection | $10,000 |
| Mainline, 750m 225mm | $22,000 |
| Pivot with genset | $140,000 |
| **TOTAL EQUIPMENT** | **$200,000** |

## *Investment analysis*

**Key assumptions:**

Lambs sold for $2.00/kg LW

Stocking rate averages 14 lambs/ha over the period October to March.

### Irrigation of pasture for store lambs with a centre pivot

| Lambs fattened | Area | Water Used | | Gross Margin | |
|---|---|---|---|---|---|
| | | Per Ha | Total | Per Ha | Total |
| | (ha) | (ML/ha) | (ML) | ($/ha) | ($) |
| Pasture/lambs | 60 | 5.0 | 300 | $859 | $51,548 |
| **Total Irrigation Gross Margin** | | | 300 | | **$51,548** |
| **Less Gross Margin foregone** | | | | | |
| Grazing | | 60 | Ha @ | $127 | **-$7,700** |
| **Less Extra Wages/Overheads,** @ % of GM | | | 5% | | **-$2,577** |
| **MARGIN before Interest & Depreciation** | | | | | **$41,270** |

| **Less Interest & depreciation** | | | |
|---|---|---|---|
| | New Cost | Depreciated (10yrs) | |
| Pasture sowing | $15,000 | $0 | |
| Pump & fittings | $13,000 | $6,000 | |
| HEC connection | $10,000 | $8,000 | |
| Mainline | $22,000 | $14,000 | |
| Pivot with genset | $140,000 | $60,000 | |
| Totals | $200,000 | $88,000 | |
| Interest on average capital | | Interest rate: 10% | **-$14,400** |
| Average annual depreciation | | | **-$11,200** |
| **PROFIT** | **$200,000** | | **$15,670** |

| **Financing,** assume funding by a loan at fixed interest over a contract period. | | | |
|---|---|---|---|
| **MARGIN before Interest & Depreciation** | | | **$41,270** |
| **LESS** | | | |
| | Interest rate & duration (yrs) | | |
| Loan payments | 10% | 4 | **-$63,094** |
| **NET MARGIN AFTER LOAN PAYMENTS** | | | **-$21,824** |

## *Risks*

The risks to pasture production are small; there will need to be attention to fertiliser applications to ensure the pasture response to irrigation is maximized.

The main risks are likely to be:

- Market risks; the price of fat stock has been extremely variable over the last 5 years, and currently at record levels.

- Environmental risks; the heavy and continuous irrigation may lead to waterlogging, soil salinity and soil compaction.

- Worm control in lambs will need to be carefully managed by grazing management and the use of capsules.

- It is likely that the area will need to be spelled after 10 years, perhaps earlier. Heavy soils in the Derwent Valley seem the benefit from a season without irrigation, to improve drainage through the soil profile.

# *A dryland dairying property expands with the aid of irrigation*

## *Background and resources*

The property is in Deloraine region of the state with land  well suited to irrigated pasture.  Water is available by direct pumping from a stream that passes through the property, with a lift of about 15 metres to the irrigated land.

The business presently carries 250 milkers and has a dairy with capacity for 350 cows.  Dry stock are reared on the property.

The business proposes to install a long lateral irrigation system to irrigate approximately 104 hectares.  Irrigation will generally be confined of the use of Off-Peak electricity.

Some additional labour will be required to move the sprinklers and milk the increased number of cows.

Income has been calculated at a price if $7.00/kg MF.

The existing perennial pasture comprises white clover and ryegrass, and resowing will not be required.  Irrigation is expected to increase pasture production from 7,000 kgDM/ha to 11,000.

## *Irrigation plan*

Water resources.  An irrigation license for a summer take of 500 ML has been obtained from the DPIWE.

Estimated costs for the irrigation equipment are $2,000/hectare, including pumping facilities, mainlines and sprinklers.

| | |
|---|---|
| **TOTAL EQUIPMENT** | **$205,000** |

*Investment analysis*

## Irrigation of pasture for dairy cattle

| **Extra MF produced** | | **Area** | **Water Used** | | |
|---|---|---|---|---|---|
| | | | **Per Ha** | **Total** | **Total** |
| | | (ha) | (ML/ha) | (ML) | ($) |
| Irrigated pasture | | 102 | 4.5 | 461 | |
| Added MF, kg: | 11,875 | | | | |
| MK price, $/kg: | $7.00 | | | | $83,125 |
| Added stock sales@ % of milk: | 10% | | | | $8,313 |
| **Total Irrigation Gross Income:** | | | | 461 | **$91,438** |
| **Less Variable & Overhead costs:** | | | | | |
| Variable costs @ % of Gross Income: | 10% | | | | -$9,144 |
| Pasture maintenance @ $/ha: | $60 | | | | -$6,143 |
| Irrigation costs (pumping, maintenance,labour) @ $/ML: | | | $50 | | -$23,038 |
| Wages & Overheads, @ % of Gross Income: | | | | 10% | -$9,144 |
| **MARGIN before Interest & Depreciation** | | | | | **$43,969** |
| **Less Interest & depreciation** | | | | | |
| | New Cost | Depreciated (10yrs) | | | |
| Irrigation equipment @ $2,000/ha | $204,778 | $125,000 | | | |
| Interest on average capital | | Interest rate: | 10% | | **-$16,489** |
| Average annual depreciation | | | | | **-$7,978** |
| **PROFIT** | | | | | **$19,503** |

| **Financing,** assume funding by a loan at fixed interest over a contract period. | | | |
|---|---|---|---|
| **MARGIN before Interest & Depreciation** | | | **$43,969** |
| **LESS** | | | |
| | Interest rate & duration (yrs) | | |
| Loan payments | 10% | 4 | **-$64,601** |
| **NET MARGIN AFTER LOAN PAYMENTS** | | | **-$20,632** |

This analysis shows the investment to be profitable (annual profit of $19,503) but creates a cash flow issues if funded over 4 years at 10%. If funds could be obtained at 8% over 6 years, then the cash flow breaks even over that period.

## *Risks*

The risks to pasture production are small; there will need to be attention to fertiliser applications to ensure the pasture response to irrigation is maximized.

The main risks are likely to be:

- Market risks; the price of milk has been extremely variable over the last 5 years, and is currently at record levels.
- Environmental risks are low; the risk of salinity as a consequence of irrigation is very low in this environment, and the well drained soils are not subject to waterlogging.

# *Converting from travelling irrigators for irrigating crops to a towable centre pivot.*

## *Background and resources*

Centre pivots offer a number of advantages relative to travelling irrigators; namely:

- Lower pumping costs.
- Higher water application efficiency.
- Better control of irrigation; more convenient to maintain soil moistures where crop production is maximized.
- Higher yields due to better water management.
- Lower labour requirement.

Given these advantages, growers are asking whether the added capital investment in changing is justified.

This analysis assumes a property located on gently undulating land on the northwest coast, and grows a range of vegetable and other crops. The cropping rotation varies, but for this assessment we have assumed and average Gross Margin of $2,000/hectare across all irrigated crops. Contrary to expectation, the benefit to a Centre Pivot may be reduced for higher value crops, because the production lost from the corners of square paddocks become more significant.

Note that a pivot can water about 78.5% of a square. With an end gun this can be increased to about 84%. Due to this, the investment analysis includes a loss of Gross Margin when comparing a pivot with a traveller.

It is assumed that irrigation with a centre pivot will increase yields by 10-15% and companies commonly quote 10-15%. A 10% yield increase will increase the Gross Margin by about 20%.

## *Irrigation plan.*

We have assumed the pivot will be towable, watering two 16 hectare circles. The paddocks were previously rectangular, and in total were 40 hectares in area. It is assumed the travellers will irrigate 39 hectares, and the pivot 32 ha.

The land missed by the centre pivot is to be used for shelter and no income is assumed.

It is assumed the farm manager is required to purchase all the irrigation equipment for this system, including pumps, mainlines and the in-paddock facilities.

The following capital investments are assumed.

- Traveller, $2,500/ha;  total for 39 ha is $97,500.
- Centre Pivot, $3,500/ha, 32 ha, $104,000.

The analysis would be different if the property already had travelling irrigators, and is considering upgrading to a centre pivot.  In this situation the relevant cost for the traveller is the salvage value of that equipment (includes the pump, mainlines and traveller), while the relevant capital cost for the pivot is the new price for that equipment.

## *Investment analysis*

The average Gross Margin from the crops irrigated with a traveller is $2,000/ha, with a 20% increase for crops irrigated with the pivot.

### Pumping costs

Travelling irrigators commonly operate with a pressure of 150 psi at the pump. In a similar situation, a pivot could operate at about 50 psi.  In the analysis the pump pressure is reduced by 100 psi.

Power costs when irrigating by both systems are based on a water requirement (in the soil) of 2 Ml/ha/year.  Applications of 70% and 90% are allowed for the traveller and pivot respectively.

### Labour costs

Assuming the pivot will be moved after applying 20 mm indicates 11 moves per circle, 22 in total.  Allowing 2 hours for a man and tractor per move at $35/hour  indicates a cost of $1,556 per year.

Allowing 6 runs per paddock, 2 paddocks and an average of 8 irrigations with the traveller, and 0.75 hours for man and traveller per move @ $35/hour, indicates a cost of $2,571.

### Capital costs

Capital costs are marginally higher for the Centre Pivot.

If the new system does not require a new pump and mainlines, so that the capital investment for the pivot system becomes much larger than the traveller, then the added depreciation and interest costs reduce the benefits of lower labour and pumping that pivots offer.

## Replacing travellers with centre pivot

| Gross Margin produced | | Traveller | Pivot | Benefit to Pivot |
|---|---|---|---|---|
| Area irrigated, ha | | 39 | 32 | |
| GM, $/ha | $2,000 | | | |
| Increased GM with Pivot | 20% | | | |
| **GM produced** | | **$78,000** | **$76,800** | **-$1,200** |
| | | | | |
| **Pumping costs** | | | | |
| Amount of water to apply, ML/ha | 2 | | | |
| Application efficiency | | 70% | 90% | |
| Amount to pump, ML/ha | | 2.9 | 2.2 | |
| Total ML | | 111.4 | 71.1 | |
| Total head, psi at pump | | 150 | 60 | |
| Electricity Tariff, % OP | | 61% | 61% | |
| Kwhr used in the season | | 50,648 | 12,929 | |
| **Electricity cost** | | **$4,565** | **$1,165** | **$3,400** |
| | | | | |
| **Labour** | | | | |
| Average application, mm | | 35 | 20 | |
| Number of applications | | 8 | 11 | |
| Number of moves/irrigation | | 12 | 2 | |
| Total moves | | 98 | 22 | |
| Hours/move | | 0.75 | 2.00 | |
| Total hours | | 73 | 44 | |
| Cost, $/hour man & tractor | $35 | | | |
| **Total labour cost** | | **$2,571** | **$1,556** | **$1,016** |
| | | | | |
| **BENEFIT TO CP before INTEREST & DEPRECIATION** | | | | **$3,216** |
| | | | | |
| **Less Interest & depreciation** | | Values | | |
| **Depreciation** | New Cost | Depreciated (10yrs) | | |
| Traveller system | $97,500 | $24,375 | | |
| Centre Pivot system | $104,000 | $31,200 | | |
| **Annual depreciation** | | $7,313 | $7,280 | **$33** |
| **Interest on average capital** | @ 10% | $6,094 | $6,760 | **-$666** |
| **BENEFIT TO CP AFTER INTEREST & DEPRECIATION** | | | | **2,582** |
| | | | | |
| **Financing,** assume funding by a loan at fixed interest over a contract period. | | | | |
| | | Interest rate & duration (yrs) | | |
| | | 10% | 4 | |
| **Loan payments** | | **$30,758** | **$32,809** | **-$2,051** |

## *Risks*

Centre Pivots have been used for several decades and are relatively robust, even on undulating terrain. Careful consideration will be necessary for undulating sites with steep banks, and a level of warranty should be sought from the supplier if the topography is a concern.

Where installations are completely new; ie., the area was previously not irrigated, then the slightly higher capital cost of a pivot is readily offset by savings of labour and pumping.

Where a pivot is replacing a traveller, then the total added capital cost becomes significant, as the pivot may require a new pump to suit the lower pressure.