

A Case Study Analysis of Cropping and Grazing Systems for Flinders River Agricultural Precinct Development Project



**A Department of Employment Economic Development and Innovation
(DEEDI) Report**

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Executive Summary

In late October, 2010, Business and Industry Services – North Region, DEEDI was approached to support the proposed Flinders River Agricultural Irrigation Precinct Development Project. The requested support involved undertaking economic modelling of potential irrigated cropping scenarios to indicate the potential cropping viability from flood harvesting along the Flinders River.

In collaboration with local producers, regional economic development organisation representatives, shire council representatives, and industry stakeholders, a series of irrigated cropping models were developed, concentrating on two key areas:

- 50 – 100 hectare fodder-based systems designed to complement existing cattle producing operations
- 200 – 500 hectare cropping operations

These examples concentrate on pivot/bore and furrow/ring tank based irrigation systems.

The models have been narrowed down to provide a series of succinct case study examples. Based on stakeholder input, grazing industry examples have been centred on using irrigated crops to fill the spring feed gap to target superior weight gains for final round weaner cattle.

The larger cropping operation modelling has been based on cotton growing, given this crop is currently of interest to local producers.

River system reliability has been recognised as a key factor and there is some contention as to an appropriate percentage on which to base economic modelling. Thus 65%, 75% and 85% examples have been included in the 500 ha cotton, furrow/ring tank model.

The models have been based off current crop gross margins; with a discounted cash flow approach adopted to include capital development costs and examine the modelled cropping operation over a 20 year timeframe. A conservative approach was taken to capital costs, with input from local producers and earth movers to capture an appropriate development base cost. Total costs per hectare and total costs per mega litre have been included for each case study. Management accounting (operating and net profit) and economic indicators (NPV, IRR and payback period) have been generated to provide a “reader-friendly” means to compare the viability of the various models.

The current analysis of this agricultural precinct does highlight significant potential investment and economic activity for the region. Example of the potential economic outcomes based on a small cotton industry of 3000ha would be;

- | | |
|--|----------------------|
| • Farm gate value approx | = \$16m/yr |
| • 7ML/ha @ 3000 ha | = 21,000 ML of water |
| • Capital investment required (\$8,500-9,500/ha) | = \$27m |
| • Direct employment 30 persons x 60K/year | = \$1.8m/yr |
| • Direct variable Input costs \$2000/ha | = \$6m/yr |
- Note (approx 3000ha is required for a cotton gin)

Glossary of terms

Mosaic farming -To develop precision and best practice farming principles of a cropping system within a “patch” of the agricultural landscape at a whole farm or catchment scale rather than the paddock level, so as to achieve and delivery both environmental and economic benefits.

Early weaning - Early weaning is weaning calves at a younger age, younger than normal practice. In Queensland, the normal range of weaning is 5-8 months though the range does extend either way by a couple of months in certain environments. The main purpose behind early weaning is the proactive management of breeding herds in times of feed scarcity or drought. During these times, late pregnancy and lactation (particularly 2-3 months post calving), can have a drastic effect on the body condition of cows, particularly first calf cows. This results in severe weight loss, low subsequent pregnancy, poor long term calf performance and possibly significant breeder deaths in extreme conditions.

Fodder – the consumption of cultivated forage plants by grazing animals, as a standing crop or as hay.

Silage – the harvesting of a fodder or forage crop and preserving through a process of burial in an air tight pit or wrapping in plastic to maintain the condition as valuable feed for later use.

Water harvesting - Water harvesting is seen as a diversion of water by gravity or lifting by pumping from the natural environment when wet season stream flows will be above an agreed threshold and into an on-farm storage for irrigation cropping use.

Ring tank – a constructed earthen-walled structure with suitable wall batter to hold water for surface storage on the farm. Water height when filled will be above ground level. Usually four sided square or rectangular.

Gross margin - The gross margin of a farm enterprise is the difference between gross income (total receipts which depend on yield and current prices) and its variable costs (those costs which vary in proportion to size of the enterprise)

Variable costs - Variable costs are those costs directly the result of an enterprise and changing with the level of production or size of the enterprise. eg. an increase in stock numbers causes a corresponding increase in associated costs.

Fixed costs - Overhead costs have to be met regardless of the size of the enterprise or level of production eg. bank interest on a loan is always payable no matter what or how much you produce in an enterprise.

Discounted cash flow - Used to determine the annual cost of production and the likely profitability of the enterprise. In any investment analysis, it is necessary to estimate likely future project cash inflows and outflows. A key feature of investment analysis is the process of discounting future cash flows to present values. Discounting procedures are used to evaluate the project profitability where the project life is more than one period. People generally prefer to receive a given amount of money now rather than receive the same amount in the future because money has an 'opportunity cost'.

Payback period - The time taken for a project to recover the initial investment. In a discounted cash flow, it is the time taken for the present value of project earnings to recover the initial investment.

Internal rate of return (IRR) - The discount rate at which the project has an NPV of zero. The IRR represents the maximum rate of interest that could be paid on all capital invested in the project. If all funds were borrowed and interest charged at the IRR, the borrower would break even (recover the capital invested in the project).

Net Present Value (NPV) - NPV is calculated as the difference between the Present Value (PV) of returns minus the PV of costs over the life of the project. A discount rate is used to calculate PV of these costs and returns for each year of the project's effective life. It relies on the principle of a specific sum of money being worth more today than in the future because having the money now can allow you to grow the amount into a larger sum possibly by alternative investment.

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Background

The Flinders River Agricultural Irrigation Precinct Development Project was created from a previous irrigation development strategy "O'Connell Creek Dam Proposal". This report is based within the confines of the Flinders Shire Council, Richmond Shire Council, McKinlay Shire Council & Mt Isa Townsville Economic Zone (MITEZ).

The project strategy aims to demonstrate the feasibility of irrigated agriculture on the Flinders River soils within a mosaic cropping context.

As discussed within the project brief, the key priorities are:

- Priority 1 – Set up relationships with Peak Body Industry Groups; develop a MOU and legal template
- Priority 2 – Prove up water availability and reliability
- Priority 3 – Consider soil type suitability for irrigation
- Priority 4 – Water storage capacities and locations
- Priority 5 – Regional features map for potential irrigation sites
- Priority 6 – Develop a legal agreement template, for various models for development

- Applicable to Priority 1 and Priority 6 - It would be highly desirable to compile a crop commodity profile and economic modelling for market comparative advantage, for domestic and export markets, to guide prospective industry partners and investors. The project proponents have requested DEEDI to assist in delivering economic modelling aspects of this project.
- It is recognized that this new innovative approach to irrigation development and regional development be used as a model with an aim to present the project at the 2011 Segra Conference.

Scope of the report

This report focuses on a mosaic irrigated agricultural system along the Flinders River from the Hughenden to Julia Creek districts.

To develop an economic model that would support a business case for the establishment of an agricultural precinct along the Flinders River.

Project Methodology

Interviews were conducted in the field with producers and major stakeholders to develop appropriate depth and scope of modelling. A collaborative approach was adopted to include key information in the models. Sub sequential visits were undertaken to present the findings.

The model is focused on two major aspects:

- Meeting the irrigation needs for the existing grazing industries and
- A fully developed irrigated farming system

To meet the brief, the economic model was constructed to:

- Provide an estimate of financial viability of such enterprises
- Provide an estimate of the total investment required to develop such opportunities
- Provide a financial model to review and evaluate individual strategies
- Replicate a range of irrigated cropping options within the region
- Provide case studies to aid the marketing of this precinct development

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Grazing Industry Case Studies for Flinders River Agricultural Precinct Development Project

The presented case studies are based on producer interviews, industry extension reckoning and core industry benchmarks.

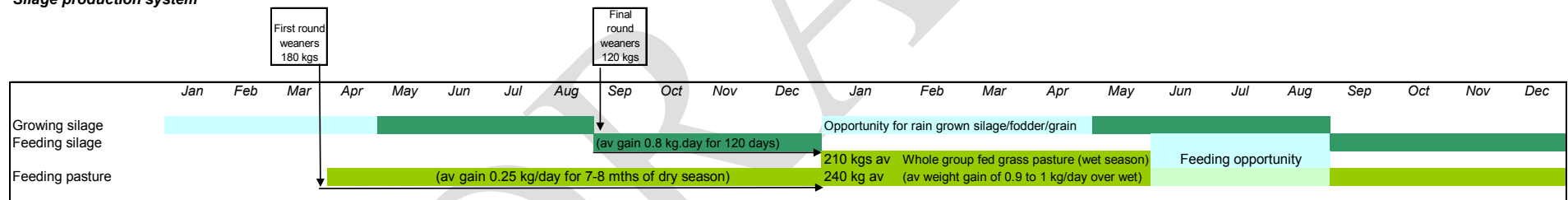
The Flinders River Ag Precinct has a number of potential irrigation system options. Those investigated within these case studies include river flow harvesting ring tank/furrow and pivot/bore systems where water is drawn from aquifers.

The intention of case studies one to four is to provide working examples of potential irrigation options within a grazing system. They included irrigation and equipment infrastructure that allows for a range of production options including drought feeding, finishing stock, grain and horticulture cropping. However time constraints and limitations within the brief have kept the range of examples discussed quiet narrow and highlights the need for further more detailed analysis.

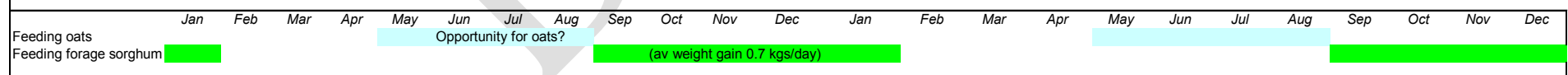
Local producers have identified a focus on early weaning which results in an under weight final round weaner group. They have also identified the fact that pasture quality is poor between September to December/January creating a feed gap. The following system captures the opportunity to accelerate the growth rate of these final round weaners to an average weight more comparative to first round weaners.

Figure 1 Silage Production System

Silage production system



Forage sorghum production system



Feeding window

Notes: Weaners smaller than 120 kgs may require feed supplements such as milk pellets, prior to starting on silage/forage ration
Assume bore location greater than 1km from river

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Case Study 1 – 50 hectare Silage Pivot/Bore Scenario

Given the model is based on numerous variables, changes to capital costs or other key variables (eg. input/output cattle prices) can dramatically change the results from a positive to a negative financial position. Therefore to more accurately model individual circumstance, further analysis should be carried out on a case-by-case basis.

System reliability has not been included as a variable given the small scale of the modelled operation. In a practical sense, seasonal risk would be managed by adjusting area under production according to water availability.

Assumptions used:

- Maize silage system based on 50 ha
- Silage storage system very basic pit or plastic lined facility
- Stock are fed in semi-permanent trough systems
- Maize silage crop grown using 400 ML (8ML/ha)

This case study has been based on a cattle marketing program involving:

- selling to southern finishers
- weaning at 120 kg, weaner production cost of \$1.20/kg included
- feeding for 120 days, average weight gain of 0.8kg/day
- feeding 9.7 kgs/day of maize silage (84%) and cotton seed (16%) ration. Other minor supplements included

Income:

- Turning off 1709 head finished from 50 ha of maize silage at \$1.70/kg

Variable costs:

- Based on Beef Gross Margin of \$68/head or \$2313/ha

Water allocation

- An arbitrary allocation to represent a base operational financial return to the Department of Environment Rural Management (DERM)

Fixed costs:

- Allocated portion of the enterprises existing fixed costs
- Wage allocation of one casual for 30 weeks

Capital costs:

- Reduced machinery costs to reflect smaller enterprise size and no silage making equipment (contractor used)
- Irrigation system
 - based on a single centre pivot with 30m bore
 - all new pipes, spans, seals, nozzles, pumps etc

Figure 2 Total irrigation capital cost: for 50 hectare Silage Pivot/Bore Scenario

Total costs per ha	\$ 4,800 /HA
Total costs per ML used	\$ 600 /ML

The case study of a 50 hectare silage system based on a furrow and ring tank scenario has not been included given the high initial capital costs suggest it may be unviable in a 20 year timeframe.

Table 1 Case Study 1 – 50 hectare Silage Pivot/Bore Scenario Summary

Summary

Total hectares under production (ha) =	50.00
Irrigation area	50.00
Pivot and bore	1.00
Furrow and ring tank	-
Lease option (\$/ha)	-
Water allocation (\$/ML)	20.00

Purchase land price (\$/ha) =	-
Discount rate (%) =	8%
Working capital (% of total capital)	10%
Maize Silage carrying capacity (AE/ha/yr) =	50.00
Cattle Production price (\$/kg)	\$ 1.20
Cattle Sale price (\$/kg)	\$ 1.70

Capital requirements	
Land	\$ -
Plant & equipment	\$ 182,350.00
Power (diesel gen)	\$ -
Fencing	\$ 2,400.00
Land development	\$ 286,437.76
Irrigation (water allocation purchase only)	\$ -
Housing	\$ -
Employee accommodation	\$ -
Machinery/storage sheds	\$ 10,000.00
Roads/headlands etc	\$ 15,000.00
Total Assets (land, improvements, water, machinery)	\$ 481,187.76
Total Capital Requirements	\$ 496,187.76
Project management/contingency	\$ 49,618.78
Total Capital Requirements, plus contingency	\$ 545,806.53

Income	
Income	\$ 624,240.00
Lease costs	
Variable costs	\$ 508,584.12
Fixed costs	\$ 27,328.40
Depreciation	
Operating profit (EBIT)	\$ 88,327.48
Interest on borrowings	\$ 19,847.51
Net Profit (Before Tax)	\$ 68,479.96

Notes
Assume all capital is borrowed therefore RoA and RoE give very different results

Discounted Cashflow Summary	
Discount rate	8%
NPV	261285
IRR	15%
Payback period (years)	9
<i>Maximum of 20 years presented</i>	

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Case Study 2a - 100 hectare Silage Pivot and Bore Scenario

Given the model is based on numerous variables, changes to capital costs or other key variables (eg. input/output cattle prices) can dramatically change the results from a positive to a negative financial position. Therefore to more accurately model individual circumstance, further analysis should be carried out on a case-by-case basis.

System reliability has not been included as a variable given the small scale of the operation. In a practical sense, seasonal risk would be managed by adjusting area under production according to water availability.

Assumptions used:

- maize silage system based on 100 ha
- silage storage system very basic pit or plastic lined facility
- stock are fed in semi-permanent trough system using second hand mixing wagon
- Maize silage crop grown using 800 ML (8ML/ha)

This case study has been based on a cattle marketing program involving:

- selling to southern finishers
- weaning at 120 kg, weaner production cost of \$1.20/kg included
- feeding for 120 days, average weight gain of 0.8 kg/day
- feeding 9.7 kgs/day of maize silage (84%) and cotton seed (16%) ration. Other minor supplements included

Income:

- turning off 3419 head finished from 100 ha of maize silage at \$1.70/kg

Variable costs:

- based on Beef Gross Margin of \$68/head or \$2316/ha

Water allocation

- An arbitrary allocation to represent a base operational financial return to DERM

Fixed costs:

- allocated portion of the enterprises existing fixed costs
- wage allocation of one casual for 30 weeks

Capital costs:

- machinery costs reflect silage making equipment is owned
- irrigation system
 - based on a single centre pivot with 30m bore
 - all new pipes, spans, seals, nozzles, pumps etc

Figure 3 Total irrigation capital cost: 100 hectare Silage Pivot and Bore Scenario

Total costs per ha	\$ 4,254 /HA
Total costs per ML used	\$ 532 /ML

Table 2 Case Study 2a-100 ha Silage Pivot and Bore Scenario Summary

Summary

Total hectares under production (ha)	100
Irrigation area (ha)	100
Pivot and bore	1
Furrow and ring tank	0

Lease option (\$/ha)	\$	-
Water allocation (\$/ML)	\$	20.00
Purchase land price (\$/ha) =	\$	-
Discount rate (%) =		8%
Working capital (% of total capital)		10%
Maize Silage carrying capacity (AE/ha/yr) =		
Area under production (ha)		100
Cattle Production price (\$/kg)	\$	1.20
Cattle Sale price (\$/kg)	\$	1.70

Capital requirements	
	(\$)
Land	\$ -
Plant & equipment	\$ 263,750.00
Power (diesel gen)	\$ -
Fencing	\$ 4,800.00
Land development	\$ 564,258.26
Irrigation (water allocation purchase only)	\$ -
Housing	\$ -
Employee accommodation	\$ -
Machinery/storage sheds	\$ -
	\$ -
Roads/headlands etc	\$ 15,000.00
Total Assets (land, improvements, water, machinery)	\$ 832,808.26
Total Capital Requirements	\$ 847,808.26
Project management/contingency	\$ 84,780.83
Total Capital Requirements, plus contingency	\$ 932,589.08

Income	
Income	\$ 1,248,847.20
Lease costs	\$ -
Variable costs	\$ 1,017,157.76
Fixed costs	\$ 30,078.40
Depreciation	\$ -
Operating profit (EBIT)	\$ 201,611.04
Interest on borrowings	\$ 33,912.33
Net Profit (Before Tax)	\$ 167,698.71

Discounted Cashflow Summary	
Discount rate	0.08
NPV	\$ 945,178.15
IRR	21%
Payback period (years)	7
Maximum of 20 years presented	

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Case Study 2b – 100 hectare Silage Furrow and Ring tank Scenario

Given the model is based on numerous variables, changes to capital costs or other key variables (eg. input/output cattle prices) can dramatically change the results from a positive to a negative financial position. Therefore to more accurately model individual circumstance, further analysis should be carried out on a case-by-case basis.

System reliability has not been included as a variable given the small scale of the operation. In a practical sense, seasonal risk would be managed by adjusting area under production according to water availability.

Assumptions used:

- maize silage system based on 100 ha
- assume the soil profile is full after wet season rain
- silage storage system very basic pit or plastic lined facility
- stock are fed in semi-permanent trough system using second hand mixing wagon
- Maize silage crop grown using 800 ML (8ML/ha)

This case study has been based off a cattle marketing program involving:

- selling to southern finishers
- weaning at 120 kg, weaner production cost of \$1.20/kg included
- feeding for 120 days, average weight gain of 0.8 kg/day
- feeding 9.7 kgs/day of maize silage (84%) and cotton seed (16%) ration. Other minor supplements included

Income:

- turning off 3419 head finished from 100 ha of maize silage at \$1.70/kg

Variable costs:

- based on Beef Gross Margin of \$68/head or \$2316/ha

Water allocation

- An arbitrary allocation to represent a base operational financial return to DERM

Fixed costs:

- allocated portion of the enterprises existing fixed costs
- wage allocation of one casual for 30 weeks

Capital costs:

- Machinery costs reflect silage making equipment is owned
- Irrigation system
 - based on furrow irrigation system with 400ML ring tank

Figure 4 Total irrigation capital cost 100 ha Silage Furrow and Ring tank Scenario

Total costs per ha	\$ 5,313 /HA
Total costs per ML used	\$ 2,657 /ML

Table 3 Case Study 2b–100 ha Silage Furrow and Ring tank Scenario Summary

Summary

Total hectares under production (ha) =		100
Irrigation area		100
Pivot and bore		0
Furrow and ring tank		1
Lease option (\$/ha)		
	\$	-
Water allocation (\$/ML)	\$	20.00
Purchase land price (\$/ha) =	\$	-
Discount rate (%) =		8%
Working capital (% of total capital)		10%
F.sorghum Hay price (\$/bale) =		
F.sorghum - no. cuts/year =		
F.sorghum yield (bales/ha/cut) =		
Oats carrying capacity (AE/ha/yr) =		
Cattle Production price (\$/kg)		
Cattle Sale price (\$/kg)		
Forage sorghum carrying capacity (AE/ha/yr) =		7.00
Cattle Production price (\$/kg)	\$	1.20
Cattle Sale price (\$/kg)	\$	1.70

Capital requirements		
Land	\$	-
Plant & equipment	\$	207,500.00
Power (diesel gen)	\$	-
Fencing	\$	4,800.00
Land development	\$	497,348.48
Irrigation (water allocation purchase only)	\$	-
Housing	\$	-
Employee accommodation	\$	-
Machinery/storage sheds	\$	10,000.00
Roads/headlands etc	\$	15,000.00
Total Assets (land, improvements, water, machinery)	\$	719,648.48
Total Capital Requirements	\$	734,648.48
Project management/contingency	\$	73,464.85
Total Capital Requirements, plus contingency	\$	808,113.33

Income		
Income		\$ 527,289.0
Lease costs	\$	-
Variable costs	\$	359,852.05
Fixed costs	\$	30,078.40
Depreciation	\$	-
Operating profit (EBIT)		\$ 137,358.55
Interest on borrowings	\$	29,385.9
Net Profit (Before Tax)		\$ 107,972.6

Assume all capital is borrowed therefore RoA and RoE give very different results

Discounted Cashflow Summary		
Discount rate		8.00%
NPV	\$	492,056.15
IRR		16.12%
Payback period (years)		9.00
<i>Maximum of 20 years presented</i>		

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Case Study 3a - 100 hectare Forage Sorghum Pivot and Bore Scenario

Given the model is based on numerous variables, changes to capital costs or other key variables (eg. input/output cattle prices) can dramatically change the results from a positive to a negative financial position. Therefore to more accurately model individual circumstance, further analysis should be carried out on a case-by-case basis.

System reliability has not been included as a variable given the small scale of the operation. In a practical sense, seasonal risk would be managed by adjusting area under production according to water availability.

Assumptions used:

- Based on 100ha of forage sorghum
- Crop grown and cattle grazed in paddock
- Forage crop grown using 200 MI (2MI/ha)

This case study has been based on a cattle marketing program involving:

- selling to southern finishers
- weaning at 120 kg, weaner production cost of \$1.20/kg included
- feeding for approximately 150 days, average weight gain of 0.6 kg/day

Income:

- Turning off 1485 head finished from 100ha of forage at \$1.70/kg

Variable costs:

- Based on Beef Gross Margin of \$113/head or \$1675/ha

Water allocation

- An arbitrary allocation to represent a base operational financial return to DERM

Fixed costs:

- Allocated portion of the enterprises existing fixed costs
- Wage allocation of one casual for 30 weeks

Capital costs:

- Machinery costs reflect silage making equipment is owned
- Irrigation system
 - based on a single centre pivot with 30m bore
 - all new pipes, spans, seals, nozzles, pumps etc

Figure 5 Total irrigation capital cost 100 ha Forage Sorghum Pivot and Bore Scenario

Total costs per ha	\$ 4,100.0 /HA
Total costs per ML used	\$ 2,050 /ML

Table 4 Case Study 3a- 100 ha Forage Sorghum Pivot and Bore Scenario Summary

Summary

Total hectares under production (ha) =		100
Irrigation area		100
Pivot and bore		1
Furrow and ring tank		0
Lease option (\$/ha)		
	\$	-
Water allocation (\$/ML)		20.00
Purchase land price (\$/ha) =	\$	-
Discount rate (%) =		8%
Working capital (% of total capital)		10%
Forage sorghum carrying capacity (AE/ha/yr) =		7.00
Cattle Production price (\$/kg)	\$	1.20
Cattle Sale price (\$/kg)	\$	1.70

Capital requirements		
Land	\$	-
Plant & equipment	\$	207,500.00
Power (diesel gen)	\$	-
Fencing	\$	4,800.00
Land development	\$	453,803.03
Irrigation (water allocation purchase only)	\$	-
Housing	\$	-
Employee accommodation	\$	-
Machinery/storage sheds	\$	10,000.00
Roads/headlands etc	\$	15,000.00
	\$	-
Total Assets (land, improvements, water, machinery)	\$	676,103.03
Total Capital Requirements	\$	691,103.03
Project management/contingency	\$	69,110.30
	\$	-
Total Capital Requirements, plus contingency	\$	760,213.33

Income		
Income		\$ 685,440.0
Lease costs	\$	-
Variable costs	\$	449,729.42
Fixed costs	\$	30,078.40
Depreciation	\$	-
Operating profit (EBIT)		\$ 205,632.18
Interest on borrowings	\$	27,644.1
Net Profit (Before Tax)		\$ 177,988.1

Assume all capital is borrowed therefore RoA and RoE give very different results

Discounted Cashflow Summary		
Discount rate		8.00%
NPV	\$	1,165,914.00
IRR		26.15%
Payback period (years)		5.00
<i>Maximum of 20 years presented</i>		

Case Study 3b - 100 hectare Forage Sorghum Furrow/Ring Tank Scenario

Given the model is based on numerous variables, changes to capital costs or other key variables (eg. input/output cattle prices) can dramatically change the results from a positive to a negative financial position. Therefore to more accurately model individual circumstance, further analysis should be carried out on a case-by-case basis.

System reliability has not been included as a variable given the small scale of the operation. In a practical sense, seasonal risk would be managed by adjusting area under production according to water availability.

Assumptions used:

- Based on 100ha of forage sorghum
- Crop grown and cattle grazed in paddock
- Forage crop grown using 200 MI (2MI/ha)

This case study has been based on a cattle marketing program involving:

- selling to southern finishers
- weaning at 120 kg, weaner production cost of \$1.20/kg included
- feeding for approximately 150 days, average weight gain of 0.6 kg/day

Income:

- Turning off 1485 head finished from 100ha of forage at \$1.70/kg

Variable costs:

- Based on Beef Gross Margin of \$113/head or \$1675/ha

Water allocation

- An arbitrary allocation to represent a base operational financial return to DERM

Fixed costs:

- Allocated portion of the enterprises existing fixed costs
- Wage allocation of one casual for 30 weeks

Capital costs:

- Machinery costs reflect silage making equipment is owned
- Irrigation system
 - Based on furrow irrigation system with 400ML ring tank to allow for evaporation.

Figure 6 Total irrigation capital cost 100 ha Forage Sorghum Furrow/Ring Tank Scenario

Total costs per ha	\$ 5,313 /HA
Total costs per ML used	\$ 2,657 /ML

The model is demonstrating the high capital costs in providing feed within September/January feed gap using a furrow/ring tank system

Table 5 Case Study 3b - 100 ha Forage Sorghum Furrow Scenario Summary

Summary

Total hectares under production (ha) =		100
Irrigation area		100
Pivot and bore		0
Furrow and ring tank		1
Lease option (\$/ha)		
	\$	-
Water allocation (\$/ML)	\$	20.00
Purchase land price (\$/ha) =	\$	-
Discount rate (%) =		8%
Working capital (% of total capital)		10%
Forage sorghum carrying capacity (AE/ha/yr) =		7.00
Cattle Production price (\$/kg)		1.20
Cattle Sale price (\$/kg)	\$	1.70

Capital requirements		
Land	\$	-
Plant & equipment	\$	207,500.00
Power (diesel gen)	\$	-
Fencing	\$	4,800.00
Land development	\$	501,803.03
Irrigation (water allocation purchase only)	\$	-
Housing	\$	-
Employee accommodation	\$	-
Machinery/storage sheds	\$	10,000.00
Roads/headlands etc	\$	15,000.00
Total Assets (land, improvements, water, machinery)	\$	724,103.03
Total Capital Requirements	\$	739,103.03
Project management/contingency	\$	73,910.30
Total Capital Requirements, plus contingency	\$	813,013.33

Income		
Income		\$ 685,440.0
Lease costs	\$	-
Variable costs	\$	449,729.42
Fixed costs	\$	30,078.40
Depreciation	\$	-
Operating profit (EBIT)		\$ 205,632.18
Interest on borrowings	\$	29,564.1
Net Profit (Before Tax)		\$ 176,068.1

Assume all capital is borrowed therefore RoA and RoE give very different results

Discounted Cashflow Summary		
Discount rate		8.00%
NPV	\$	1,126,314.00
IRR		24.75%
Payback period (years)		6.00
<i>Maximum of 20 years presented</i>		

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Cropping Industry Case Studies For Flinders River Ag Precinct Project

The presented case studies are based on producer interviews, industry extension reckoning and core industry benchmarks. Local intelligence suggested that a single cropping program would be appropriate given the environmental and climatic constraints of the region, and given there is little regional cropping experience. Therefore double cropping has not been included in this analysis however it may be a real option in some circumstances. Further production and economic analysis is required on this subject.

The Flinders River Ag Precinct has a number of potential irrigation system options. Those investigated within these case studies include ring tank/furrow and pivot/bore systems. Our single cropping based system suggested it was uneconomic to develop a ring tank/pivot combination due to the high capital infrastructure cost, and therefore this arrangement has not been included.

The model's intention is to provide working examples of potential irrigation options within a cropping system for a farming investor. It has been assumed that the farming investor has leased the production area and is investing to develop the farming block.

The irrigation and equipment infrastructure allows a range of production options including grain (sorghum, wheat, rice, maize), cotton, and horticulture cropping. However time constraints and limitations within the brief have kept this range of examples discussed quiet narrow, and highlight the need for further more detailed analysis.

Local producers have identified their focus on cotton production. The following system has been based on the DEEDI Burdekin cotton gross margin, with allowances made for notable differences. The Burdekin has now a 3 year history of cotton production with yields averaging between 6.5 and 8.5 bales/ha in 2010, despite experiencing several wet years. Given the Flinders River region is a far drier environment, it may potentially yield above these levels, however our case studies have been based off 8.5 bales/ha.

River system reliability has been recognised as a key variable. Three sub-scenarios have been developed to describe the viability of an off farm storage system, including 65%, 75% and 85% reliability.

Cotton production has been treated as a monoculture. Rotational and opportunity crops have not been included as the profitability of the cotton crop is the key economic driver.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Growing cotton	(overlap to allow for seasonality)											

Case Study 4 - 500 hectare Cotton Furrow Scenario

Given the model is based on numerous variables, changes to capital costs or other key variables (eg. input/output cattle prices) can dramatically change the results from a positive to a negative financial position. Therefore to more accurately model individual circumstance, further analysis should be carried out on a case-by-case basis.

This case study has been based off a cotton growing program involving:

- planting Genetically Modified cotton in December/January
- property owner leasing irrigation development to a sharefarmer
- a gross margin based off the Burdekin experience
- picking in May/June using contractors and new bale style pickers
- cotton transported to Emerald for ginning

Income:

- Have adopted a yield of 8.5 bales/hectare and a price of \$675/bale

Variable costs:

- Based on Burdekin Gross Margin of \$2400/ha
- Gross Margin reflects water use of 7 ML/ha given growing crop over wet season
- Freight costs of cotton bales to Emerald gin included within the analysis

Lease cost

- An arbitrary allocation to represent a base financial return to the land owner

Water allocation

- An arbitrary allocation to represent a base operational financial return to DERM

Fixed costs:

- Allocated portion of the enterprises existing fixed costs
- Wage allocation of 2 permanent employees (manager and experienced farm hand) and casuals employed at picking

Capital costs:

- Reduced machinery costs reflect contractors/leaser basis
- Irrigation system
 - based on furrow irrigation system with 3500ML ring tank

Figure 7 Total irrigation capital cost 500 hectare Cotton Furrow Scenario

Total set up costs per ha	\$ 8,524 /HA
Total set up costs per ML used	\$ 1,218 /ML

Note: due to the constraints of the brief no analysis has been developed on gravity water harvesting systems, however, It would be anticipated that gravity or a partial gravity water harvesting approach would delivery a favourable economic outcome.

Case Study 4a - 85% system reliability (cotton ring tank- furrow)

Table 6 Case Study 4a - 85% system reliability (cotton ring tank- furrow)

Summary Sheet

Type of Irrigation system	
Lease option (\$/ha)	Ring tank - Furrow \$ 250.00
Water allocation (\$/ML)	\$ 20.00
Purchase land price (\$/ha) =	\$ -
Discount rate (%) =	8%
Working capital (% of total capital)	10%
System Reliability (%) =	85%
Area under production (ha)	-
Fodder price (\$/bale) =	\$ 20.00
Fodder - no. cuts/year =	3
Fodder yield (bales/ha/cut) =	74
Area under production (ha)	500.0
Cotton price (\$/bale) =	675.0
Cotton yield (bales/ha) =	8.5
Sorghum (\$/t) =	\$ 300.00
Sorghum (t/ha) =	6.2

Capital requirements	
Land	\$ -
Plant & equipment	\$ 470,000.0
Power (diesel gen)	\$ -
Fencing	\$ 24,000.0
Land development	\$ 4,251,460.0
Irrigation (water allocation purchase only)	\$ -
Housing	\$ -
Employee accommodation	\$ -
Machinery/storage sheds	\$ 107,500.0
	\$ -
Roads/headlands etc	\$ 75,000.0
	\$ -
Total Assets (land, improvements, water, machinery)	\$ 4,852,960.0
Total Capital Requirements	\$ 4,927,960.0
Project management/contingency	\$ 492,796.0
	\$ -
Total Capital Requirements, plus contingency	\$ 5,420,756.0

Income	
Income	\$ 2,550,000.0
Lease costs	\$ 125,000.0
Variable costs	\$ 868,874.3
Fixed costs	\$ 211,174.3
Depreciation	\$ -
Operating profit (EBIT)	\$ 1,344,951.4
Interest on borrowings (assume 50% equity)	\$ 197,118.4
Net Profit (Before Tax)	\$ 1,147,833.0

Discounted Cashflow Summary	
Discount rate	8%
NPV	\$ 3,826,196
IRR	17%
Payback period (years)	8
<i>Maximum of 20 years presented</i>	

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Case Study 4b - 75% system reliability (cotton ring tank- furrow)

Table 7 Case Study 4b - 75% system reliability (cotton ring tank- furrow)

Summary Sheet

Type of Irrigation system	
Lease option (\$/ha)	Ring tank - Furrow \$ 250.00
Water allocation (\$/ML)	\$ 20.00
Purchase land price (\$/ha) =	\$ -
Discount rate (%) =	8%
Working capital (% of total capital)	10%
System Reliability (%) =	75%
Area under production (ha)	-
Fodder price (\$/bale) =	\$ 20.00
Fodder - no. cuts/year =	3
Fodder yield (bales/ha/cut) =	74
Area under production (ha)	500.0
Cotton price (\$/bale) =	675.0
Cotton yield (bales/ha) =	8.5
Sorghum (\$/t) =	\$ 300.00
Sorghum (t/ha) =	6.2

Capital requirements	
Land	\$ -
Plant & equipment	\$ 470,000.0
Power (diesel gen)	\$ -
Fencing	\$ 24,000.0
Land development	\$ 4,251,460.0
Irrigation (water allocation purchase only)	\$ -
Housing	\$ -
Employee accommodation	\$ -
Machinery/storage sheds	\$ 107,500.0
	\$ -
Roads/headlands etc	\$ 75,000.0
	\$ -
Total Assets (land, improvements, water, machinery)	\$ 4,852,960.0
Total Capital Requirements	\$ 4,927,960.0
Project management/contingency	\$ 492,796.0
	\$ -
Total Capital Requirements, plus contingency	\$ 5,420,756.0

Income	
Income	\$ 2,550,000.0
Lease costs	\$ 125,000.0
Variable costs	\$ 773,994.0
Fixed costs	\$ 211,174.3
Depreciation	\$ -
Operating profit (EBIT)	\$ 1,439,831.7
Interest on borrowings (assume 50% equity)	\$ 197,118.4
Net Profit (Before Tax)	\$ 1,242,713.3

Discounted Cashflow Summary	
Discount rate	8%
NPV	\$ 2,328,247
IRR	14%
Payback period (years)	11
<i>Maximum of 20 years presented</i>	

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Case Study 4c - 65% system reliability (cotton ring tank- furrow)

Table 8 Case Study 4c - 65% system reliability (cotton ring tank- furrow)

Summary Sheet

Type of Irrigation system	
Lease option (\$/ha)	Ring tank - Furrow \$ 250.00
Water allocation (\$/ML)	\$ 20.00
Purchase land price (\$/ha) =	\$ -
Discount rate (%) =	8%
Working capital (% of total capital)	10%
System Reliability (%) =	65%
Area under production (ha)	-
Fodder price (\$/bale) =	\$ 20.00
Fodder - no. cuts/year =	3
Fodder yield (bales/ha/cut) =	74
Area under production (ha)	500.0
Cotton price (\$/bale) =	675.0
Cotton yield (bales/ha) =	8.5
Sorghum (\$/t) =	\$ 300.00
Sorghum (t/ha) =	6.2

Capital requirements	
Land	\$ -
Plant & equipment	\$ 470,000.0
Power (diesel gen)	\$ -
Fencing	\$ 24,000.0
Land development	\$ 4,251,460.0
Irrigation (water allocation purchase only)	\$ -
Housing	\$ -
Employee accommodation	\$ -
Machinery/storage sheds	\$ 107,500.0
	\$ -
Roads/headlands etc	\$ 75,000.0
	\$ -
Total Assets (land, improvements, water, machinery)	\$ 4,852,960.0
Total Capital Requirements	\$ 4,927,960.0
Project management/contingency	\$ 492,796.0
	\$ -
Total Capital Requirements, plus contingency	\$ 5,420,756.0

Income	
Income	\$ 2,550,000.0
Lease costs	\$ 125,000.0
Variable costs	\$ 679,113.7
Fixed costs	\$ 211,174.3
Depreciation	\$ -
Operating profit (EBIT)	\$ 1,534,712.0
Interest on borrowings (assume 50% equity)	\$ 197,118.4
Net Profit (Before Tax)	\$ 1,337,593.6

Discounted Cashflow Summary	
Discount rate	8%
NPV	\$ 830,298
IRR	10%
Payback period (years)	15
<i>Maximum of 20 years presented</i>	

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Case Study 5 - 200 hectare Cotton Centre Pivot Scenario

Given the model is based on numerous variables, changes to capital costs or other key variables (eg. input/output cattle prices) can dramatically change the results from a positive to a negative financial position. Therefore to more accurately model individual circumstance, further analysis should be carried out on a case-by-case basis.

River system reliability has been set at 75% reliability

The assumption is that bore water is pump within a 1Km radius of the Flinders river which results in the same terms and conditions of the current water management policy

This case study has been based off a cotton growing program involving:

- planting Genetically Modified cotton in December/January
- property owner leasing irrigation development to a sharefarmer
- a gross margin based off the Burdekin experience
- picking in May/June using contractors and new bale style pickers
- freight costs of cotton bales to Emerald gin included within the analysis

Income:

- Have adopted a 9.5 bales/hectare with improved water efficiency from a centre pivot system and \$675/bale

Lease cost

- An arbitrary allocation to represent a base financial return to the land owner

Variable costs:

Based on Burdekin Gross Margin of \$2400/ha

- Gross Margin reflects water use of 7ML/ha Freight costs of cotton bales to

Water allocation

- An arbitrary allocation to represent a base operational financial return to DERM

Fixed costs:

- Allocated portion of the enterprises existing fixed costs
- Wage allocation of 1 permanent employees and three casuals employed at picking and with general farm duties

Capital costs:

- Reduced machinery costs reflect contractors/lease basis
- Three smaller 65ha centre pivot irrigation systems have been allocated within the analysis as to ensure constant watered soil profile

Figure 8 Total irrigation capital cost: 200 hectare Cotton Centre Pivot Scenario

Total irrigation costs per ha	\$ 4,030 /HA
Total costs per ML used	\$ 574 /ML

Table 9 Case Study 5 - 200 hectare Cotton Centre Pivot Scenario

Summary sheet

Type of Irrigation system		Bore - Centre Pivot
Lease option (\$/ha)	\$	250.0
Water allocation (\$/ML)	\$	20.0
Purchase land price (\$/ha) =	\$	-
Discount rate (%) =		8%
Working capital (% of total capital) =		10%
System Reliability (%) =		75%
Cropping system		
Crop area (ha) =		200.00
Cotton price (\$/bale) =	\$	675.0
Cotton yield (bales/ha) =		9.50

Capital requirements	
Land	\$ -
Plant & equipment	\$ 470,000.0
Power (diesel gen)	\$ -
Fencing	\$ 9,600.0
Land development	\$ 877,060.0
Irrigation (water allocation purchase only)	\$ -
Housing	\$ -
Employee accommodation	\$ -
Machinery/storage sheds	\$ 107,500.0
Roads/headlands etc	\$ 45,000.0
Total Assets (land, improvements, water, machinery)	\$ 1,464,160.0
Total Capital Requirements	\$ 1,509,160.0
Project management/contingency	\$ 150,916.0
Total Capital Requirements, plus contingency	\$ 1,660,076.0

Income	
Income	\$ 1,154,250.0
Lease costs	\$ 50,000.0
Variable costs	\$ 309,554.1
Fixed costs	\$ 203,560.6
Depreciation	\$ -
Operating profit (EBIT)	\$ 591,135.3
Interest on borrowings (assume 50% equity)	\$ 60,366.4
Net Profit (Before Tax)	\$ 530,768.9

Discounted Cashflow Summary	
Discount rate	8%
NPV	\$ 1,034,513.7
IRR	16%
Payback period (years)	8
<i>Maximum of 20 years presented</i>	

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Further considerations

The analysis suggests that capital development costs remain the key to long term profitability. The model takes a conservative approach to capital budgeting.

However, profitability is impacted by production variables as follows:

Cattle Industry (fodder systems)

<i>Enhance Profitability of model</i>	<i>Reduce profitability of model</i>
➤ Double crop	➤ Decrease crop frequency
➤ Increase crop yields	➤ Decrease crop yields
➤ Increase cattle weight gains	➤ Decrease cattle weight gains
➤ Increase cattle prices	➤ Decrease cattle prices
➤ Decrease weaner production costs	➤ Increase weaner production costs
➤ Decrease crop production costs	➤ Increase crop production costs

Enhanced profitability examples:

- an increase of 0.1kg/day weight gain can improve payback period by 2 years
- a decrease of \$0.1/kg in weaner production cost can improve payback period by 1 year

Cotton Industry

<i>Enhance Profitability of model</i>	<i>Reduce profitability of model</i>
➤ Double cropping	➤ Decrease cropping frequency
➤ Increase crop yields	➤ Decrease crop yields
➤ Increase crop prices	➤ Decrease crop prices
➤ Decrease crop production costs	➤ Increase crop production costs
➤ Increased water reliability	➤ Decreased water reliability
➤ Optimising capital infrastructure	➤ Over capitalisation
➤ Water harvesting by gravity or semi gravity means	➤ Extended pumping time by limited pumping constraints/conditions

Enhanced profitability examples:

- an increase of 0.5 bale/ha yield gain can improve payback period by 1 years
- an increase of \$50/bale can improve payback period by 1 years
- the construction of a cotton gin in the region will have a significant impact on the payback period of 3 years (Model 500ha at 85% water reliability)

Conclusion

Our involvement in the Flinders River Agricultural Irrigation Precinct Development Project was fundamentally to provide case studies to aid the marketing of this precinct development. Our brief extended to include providing economic modelling to replicate a range of irrigated cropping options, to review and evaluate individual strategies, and to estimate total investment requirements and financial viability of such enterprises. As such gross margin based, discounted cash flow economic models were developed to achieve these ends.

Many variables impact on the viability of irrigated cropping enterprises. Changes in prices, yields, production costs, weight gains, water reliability etc. all affect future cash flows. One of the key impacts on economic viability is the large capital inputs required to develop an irrigation block. Within the constraints of this modelling, a conservative approach was adopted to capital infrastructure development and associated costs.

The analysis of the beef system highlighted that with this sort of capital investment comes significant production system changes. Analysing the capital investment involved in moving from an extensive grazing system to an irrigation-based supplementary fodder system, is only a part of the whole management picture. Further and more detailed production management analysis needs to be carried out to capture these market opportunities.

Producers may find that their individual circumstances and needs differ significantly from those used in the modelling. Consequently we strongly recommend that individuals work through their own situation using a similar economic analysis, but tailoring it to suit their own circumstances.

As identified throughout the case studies, there is much need for further analysis of the proposed cropping systems, both production and economic based, at a regional and individual producer level.

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