

# GROWER CASE STUDY

## “NORWOOD” MOREE

### IRRIGATION CONVERSION: Siphon to Bay and Rollover Bankless

Supported by CRDC

CASE STUDY AUGUST 2024

#### BACKGROUND

- Hugh and Sarah Ball, “Norwood” Moree, 2400
- Ben Kirkby, Farm Manager
- Irrigation area in this analysis: 102 Ha
- Farm irrigation area: 2,500 Ha
- Irrigation conversion: Siphon to Bay and Rollover Bankless
- Water Source: Gwydir River, Ground water

#### MOTIVATION

The main trigger for this development was the refurbishment of fields damaged by 2022 flooding. Rather than repair fields to business as usual, a shift towards a more efficient bankless irrigation system became the key focus. Water saving, less reliance on casual staff, and all-round productivity benefits were the main drivers of change.

#### OVERVIEW OF SYSTEM

##### » Before

The original design (damaged by flood) had been operating as a traditional siphon irrigation system and needed a re-brush and regrade. The previous siphon layout was characterised by a long row length of 1000m. Water use in these fields resulted in water logging in some rows while others ran through on time. The siphon system required 4-6 staff members for each water over a 12-hour change. The irrigation budget for these fields has typically been around 10 ML/Ha.

##### » After

Bankless design had been a consideration for some time at Norwood and other local irrigators were consulted to get a feel for management benefits and installation costs. Bay Bankless and Roll over bankless systems came out on top due to the control and efficiency of the design. Initial discussions with Jay Carrol, CAD Moree, resulted in a commitment to a new irrigation proposal that did not involve labour-intensive siphons resulting in a more simplified management and water savings. This involved cutting the current fields into smaller bays and using the existing land falls to stage the bays reducing the amount of soil that needed to be moved. An additional delivery channel was also installed.

The team collaborated closely with Jay, their engineer who took soil type and elevation surveys into account, this was worked into the design to ensure a uniform crop and to reduce yield variability as well as saving costs in the process. The development was then costed into an earthworks budget for the innovative design. Jay designed the systems to fit targeted fields while considering variables such as channel flow rates, desired watering times, and basic infrastructure that was simple to operate.



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## KEY CONSIDERATIONS

- A mix of Bay Bankless and Roll over Bankless was chosen ahead of other designs due to the revised field layout and run length, these designs provided the best fit and will make erosion and channel maintenance a lot easier to maintain over time.
- Aside from the more obvious benefits of water and labour savings, Norwood have found that there are marked improvements in productivity from machinery ground passes reducing the need to navigate rotobucks and allowing a shift towards 12 m machinery and 36 m sprayers. Efficiency improvements from machinery turns which could be 20 - 30% faster, when spread across an eventual, larger area will be an immense help.
- Implementing the earthworks design from CAD would require a substantial amount of capital to use a contractor on a turnkey basis. Given the scale of the conversion required across Norwood, the decision was made to purchase machinery for the bankless development which also enabled them to employ existing staff in-house. After the first fields, F13-14 were developed, the knowledge of the fields and their soil types helped the Norwood team better understand how to shift the soil more efficiently. Net of depreciation costs and including labour moving 94,000m<sup>3</sup> of earth, their approach has saved 38% of the total per hectare capital investment.
- With the addition of going to a tandem bucket setup for future works, the next stage of bankless conversion will be even more efficient. Owning this plant also gives the flexibility to contract for others in the area who see benefits in moving towards a more efficient bankless system or need their fields re-levelled. All the fields were deep ripped as well to help mitigate any compaction from the earthworks.

- Automation accessories are definitely a potential add-on for the new bankless system. 4G Connectivity is patchy, so strengthening the signal in some areas may be needed, although these issues are put aside for now. The main focus has been to get used to the manual controls and keep learning about the system limitations during the irrigation season.

## BENEFITS

### » Water Use Efficiency

The newly developed bankless design revealed a water saving of approximately 2.5 ML/Ha in a comparable season with minimal in-crop rain. The speed and efficiency of watering in much smaller bays than the original siphon layout with longer rows was noticeable. The bay bankless uses a lot less water to prime the system, as water can be easily reused in the following bay which has meant that a lift pump could be removed.

No other pumps have been upgraded and gravity drives the irrigation. The baseline siphon system had some rows taking longer to run through which needs to be taken into consideration. Therefore, on the amount of water saved during the development, not all can be attributed to the bankless layout.

### » Labour savings

The labour saved on the bankless design has meant for these fields, casual staff are no longer needed.

This has greatly simplified irrigation management and meant staff can move on to more productive tasks around the farm.



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## ANALYSIS OF COSTINGS

During the planning process, the Ball's ran an initial costings scenario using a turnkey earthworks contracting arrangement and an alternative scenario to purchase their own earthmoving equipment outright and use their permanent staff in the development.

The chart below shows the two different costing scenarios (less depreciation), which includes machinery O&M and farm labour at market value. These costs illustrate (Figure 1) a 38% discount on the overall outlay for the 1st stage of bankless development when compared with using contract services.

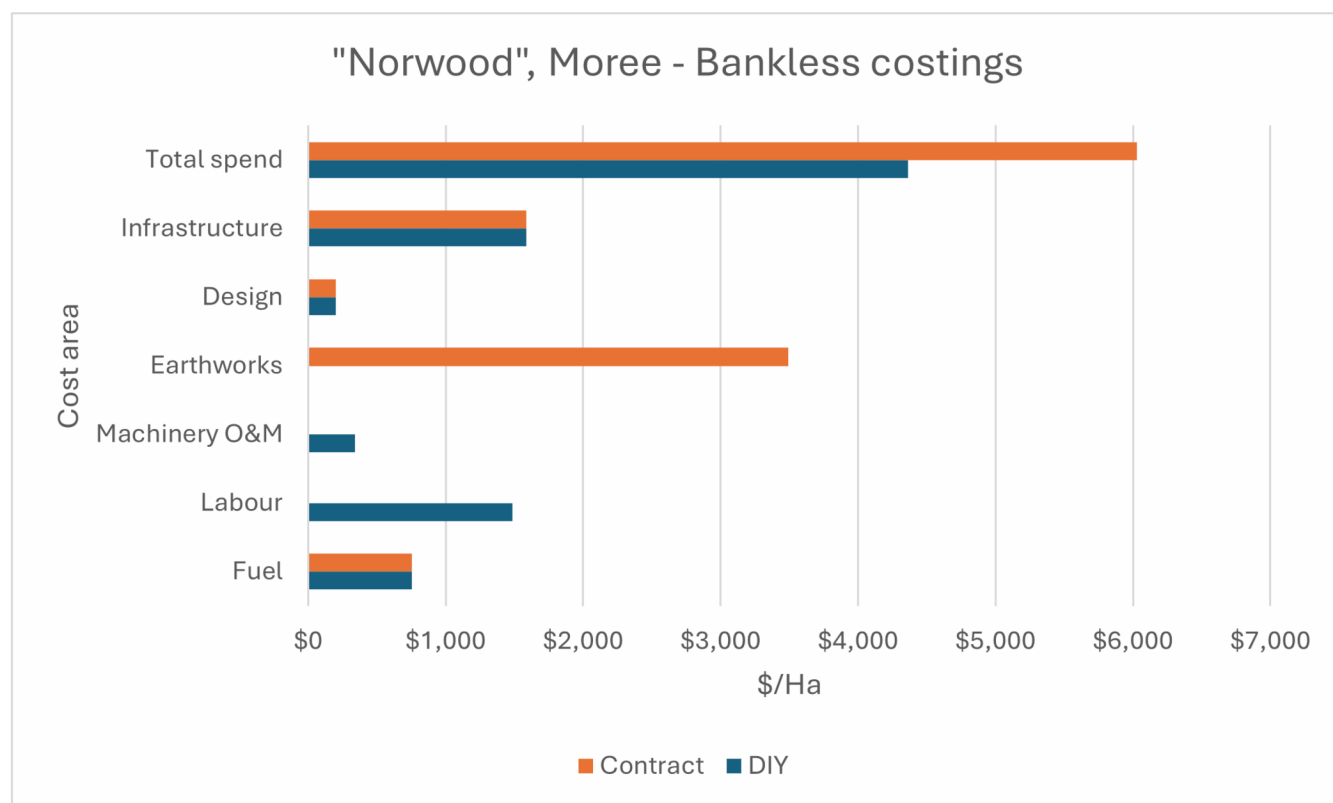


Figure 1 bankless costings at "Norwood", Moree



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## PROJECT ECONOMICS

There were benefits and costs associated with a system change from siphon/furrow irrigation to bankless at “Norwood.” The benefit categories included the avoidance of labour costs for the siphon irrigation, costs of excess water, and avoided energy costs from water savings.

Crop yields were assumed to have risen by 1% owing to better crop water management. The cost categories included all planning, equipment, and earthworks necessary to install the bankless system. There were no opportunity costs of foregone crops, with the works carried out during a planned crop fallow period during the summer prior to cotton planting. The crop rotation is irrigated cotton followed by wheat followed by fallow resulting in a one-in-two-year use of the bankless system in the fields in this analysis.

A Discounted Cash Flow (DCF) analysis was used to measure the Net Present Value of the system change over 20 years to better account for periods of drought and minimal water availability. A discount rate of 7% was used. The results of the analysis found a payback period of three irrigated cotton crops or six years. The change to bankless revealed an Internal Rate of Return of 21%. The benefits and costs are illustrated in Figure 2.

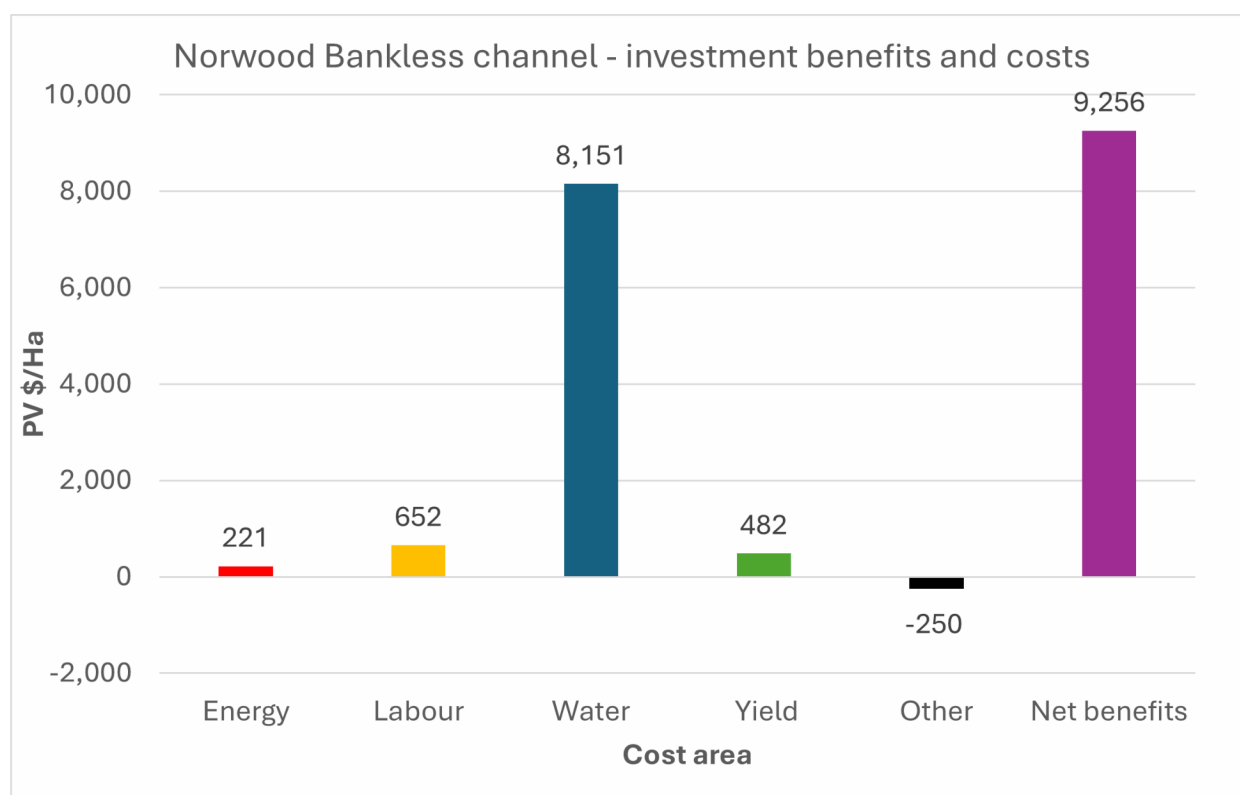


Figure 2 Present Value benefits and costs over 20 years on a bankless conversion at “Norwood”, Moree



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## REFLECTIONS

While the Ball's are generally pleased with the layout and system changes, irrigation manager, Ben Kirkby is conscious of the benefits of future planning for infrastructure that allows automation as an add-on.

Ben is working with Padmans and Jacobs Precast to work on a gate that can accommodate a bigger volume of water that can be used in both manual 'analogue' mode or converted to automation.

The addition of the new tandem bucket as an add-on also allows productivity benefits with one operator shifting far more cubic meters of earth than a single bucket. The costings of the next stages using the dual-bucket system should reduce \$/Ha conversion costs substantially.

As a staged approach across the entire 2,500 ha developed irrigation at "Norwood" the Ball's now have a taste of the system functionality with real numbers on the savings and productivity gains.

Field development from siphon to bankless is best done through the summer/autumn months before planting and the Ball's estimate is that they can develop another 200 ha's in the next stage.

**Images of irrigation conversion at "Norwood".**



For further information:

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