

FUTURE READY DAIRY SYSTEMS

Investing in the most energy efficient irrigation system for the farm

THE FARM

Simon Bennett, “Forest Farm”
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Simon Bennett and his father, Gerald, run one of the largest family owned dairy operations in Tasmania. Their success is partially attributed to their foresight in being early adopters of irrigation to ensure they optimise year round production.

Then

Prior to the current system being installed (between 2002 and 2008), irrigation comprised a large Long Lateral System, installed in 1995. The original Long Lateral System covered around 221 ha (approx 546 acres), at the back of the property.



Much of the infrastructure of the existing Long Lateral System was utilised for the new Pivot System, including pumps and mainline. Additionally the current Long Lateral Systems providing the “fill in” between the Pivots is part of the original system.

Now

The current irrigation system comprises six fixed Centre Pivot irrigators covering a total of 270.18 ha. Additionally two Long Lateral Systems are utilised to “fill in” some areas between the Pivots, total Long Lateral Area is around 73.3 ha. Total all up irrigation area is approximately 343.5 ha. Sprinkler packages consist of Nelson R3000 rotators and Senniger I-Wob sprinklers. All Centre Pivots have been configured to apply 8mm per 24 hours.

SIMON'S TIPS FOR IRRIGATION UPGRADES

- ◆ **Seek independent advice up front and ask your irrigation adviser to be involved in job tendering**
- ◆ **Constantly reassess your needs and what suits your farm and available labour**
- ◆ **Upfront investment in system design has avoided dramatic increases in running costs**

BUSINESS SNAPSHOT

- ◆ **1460 cows, 200 calves on farm, all other young stock off the farm**
- ◆ **Spring calving**
- ◆ **56 unit rotary, approximately 20 years old.**
- ◆ **560 ha of effective farm area**
- ◆ **Approx 400 ha irrigated**
- ◆ **Annual rainfall: 950 mm**
- ◆ **Water supply is from on farm dams**
- ◆ **Approx 350 kg of grain fed per cow and around 300kg of veg waste per cow**
- ◆ **Pasture is rye and clover**



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COMMENTS ON THE IRRIGATION SYSTEM

Simon and Gerald have worked closely with irrigation consultants James Curran and Chris Thompson to design their system. James Curran reviewed the system from an energy efficiency perspective in December 2010 .

How efficient is the current system?

Pump efficiencies for the Centre Pivot systems are all excellent i.e. 78 to 83.5%. Pump efficiencies for the long Lateral Systems are also very good, i.e. 75% or greater. The costs for the Long Lateral pumping is very close to the Centre Pivot costs. This is a reflection of the conversion of the systems. In general the remaining Long Lateral systems are only running a fraction of the sprinklers they were originally designed to run, therefore friction losses in the mainlines are very low (much lower than would generally be designed for), hence the very low costs per ML.

A significant amount of time was invested in determining the layout of the new Pivot System and the pipe and pump system design. The main challenge was to utilise as much of the existing infrastructure, particularly mainline and pumps (in order to keep capital investment to a minimum), while at the same time ensuring no sacrifices were made to operational and energy efficiency. Additionally minimal disturbance to the existing underground pipe network was a key goal.

The Pivot systems have been designed for low losses throughout, resulting in a relatively low total head requirement, which is very good from an energy efficiency perspective.

What opportunities are there to improve system efficiencies?

The fluctuation in dam water level does have an impact on system pressure and overall pumping cost. In this instance, the system has been designed to allow for full pressure even when the dam is very low. The installation of VSDs on each pump unit could result in an energy saving. However in this instance it would be very unlikely to prove viable from a cost recovery perspective, especially as the pumps were already in place.

The sprinkler packages of the most recent Pivots have been equipped with 25 psi Nelson Rotators. Other sprinklers on the market are available that operate at lower pressure. i.e. 10 psi.

A reduction of say 15 psi would result in a saving of around \$2.50 per ML in this instance, and the use of lower sprinkler pressure was a key consideration at the design stage.

However the higher sprinkler pressure was nominated in order to ensure the wetter diameter of the sprinkler package could be as great as practical, in order to reduce the application intensity of the systems. In general the aim was to insure that field or soil application uniformity was as high as possible, as was actual sprinkler uniformity.



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DETAILS OF THE IRRIGATION SYSTEM

Current Pivot System Basic Description

	Final Layout					
	Pivot 1	Pivot 2	Pivot 3	Six Centre Pivot Irrigators. Pivot 4	Pivot 5	Pivot 6
Effective Area Irrigated	55.07 Hectares	64.32 Hectares	54.72 Hectares	59.45 Hectares	54.72 Hectares	41.35 Hectares
System Flow Rate	51.0 l/s	59.0 l/s	51.0 l/s	56.0 l/s	51.0 l/s	39.0 l/s
Design Application Rate	8 mm per day	8 mm per day	8 mm per day	8 mm per day	8 mm per day	8 mm per day
Instantaneous Application rate	72 mm per hr	78 mm per hr	52 mm per hr	56 mm per hr	52 mm per hr	44 mm per hr
Pump duty	51 l/s @ 64 mtrs	59 l/s @ 46 mtrs	51 l/s @ 84 mtrs	56 l/s @ 56 mtrs	51 l/s @ 52 mtrs	39 l/s @ 52 mtrs
Pump Unit Selected	SX 125x100-200 (228) c/w 55kw Motor	KSB E100/20 (195mm) c/2 45 kW Motor	Existing Line "B" pump, Mega 80-250 c/w 75 kW Motor	New Mega 80-200 c/w 45 kW Motor	Existing Line "A" Motor, with new Mega 100-200 c/w 75 kW Motor. Running both Pivot 2 and 4	Existing Line "A" Motor, with new Mega 100-200 c/w 75 kW Motor. Running both Pivot 2 and 4
Pump Efficiency at Duty	80%	79%	78%	83.5%	82.5%	82.5%
kW/h at meter	43.98	37.03	59.59	40.49	34.65	26.50
Total kW/hr per Season	79741.7	67144.1	108037.2	73403.2	62826.8	48044.0
Tariff 73/74 costs						
Cost per Season	\$10,951.64	\$9,221.50	\$14,837.70	\$10,081.11	\$8,628.56	\$6,598.31
Cost per ML	\$32.90	\$23.95	\$44.58	\$27.58	\$25.92	\$25.92
Contract Supply Costs (Estimated)						
Cost per Season	\$6,037.59	\$5,083.77	\$8,179.96	\$5,557.67	\$4,756.89	\$3,637.62
Cost per ML	\$18.14	\$13.20	\$24.57	\$15.21	\$14.29	\$14.29

Current Lateral System

Basic Description

	Existing Long Lateral Areas System Between Dam & Pivot 3	System Between Pivot 2 & 4 and East Boundary and area adjacent to Dairy
Effective Area Irrigated	33.28 Hectares	40.00 Hectares
System Flow Rate	41.0 l/s	46.0 l/s
Pump duty	Main 41 l/s @ 64 mtrs, Boost for line "B" 23 l/s @ 30 mtrs Existing Line "C" pump, Mega 80-200 c/w 55 kW Motor as main pump, and a SX 80x65-160(173) c/w 11kW 2 pole motor as the boost	46 l/s @ 55 mtrs Ex Line "D" pump, Mega 100-200 c/w 55 kW Motor.
Pump Unit Selected		
Pump Efficiency at Duty	78% & 75%	75.0%
kW/h at meter	46.18	36.37
Total kW/hr per Season	65788.5	51802.3
ML per Season	210.3	235.9
Tariff 73/74 costs		
Cost per Season	\$7,095.55	\$5,587.09
Cost per ML	\$33.75	\$23.68
Contract Supply Costs (Estimated)		
Cost per Season	\$5,357.06	\$4,218.19
Cost per ML	\$25.48	\$17.88



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