

Hawkes Bay Regional Council

TANK Catchments

Lowland streams augmentation pre-feasibility
assessment of capital and operating expenditure for
the Tutaekuri, Ahurri, Ngaruroro, Karamu catchments



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Contributing Authors:

Mark Everest

Farm Management Consultant

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1. Introduction

This report has been prepared for Hawkes Bay Regional Council to assess the potential capital and operating expenditure required to augment pre-determined lowland streams as set by Grant Pechey, Monique Benson and Simon Harper for the TANK (Tutaekuri, Ahurri, Ngaruroro, Karamu) catchments.

The streams identified as requiring augmentation are: Irongate; Karamu; Karewera; Mangateretere; Ruapare, Awanui and Louisa.

This report is a desktop analysis from information provided by Hawkes Bay Regional Council and is intended to be a preliminary assessment of the economic requirements of undertaking stream augmentation.

The assessment includes capital expenditure estimates. It also includes an assessment for the time period 2015-2032 of annual maintenance and depreciation estimates and annual running charges estimates for the average and extreme seasons for each of the streams.

2. Summary

2.1. Capital Expenditure

Capital expenditure varied by stream but averaging approximately \$285,000 per stream, (approximately \$225,000 per augmentation site). The Karamu being the most expensive with the highest flow, but also three proposed augmentation sites (identified further on in this report as K1, K2, K3). If it were possible to have all the augmentation at one site the capital cost would halve as the amount of infrastructure required would be significantly less.

To get the flow range to an acceptable level, it was required at each site to have between two and three bores and pumps (the exception being Louisa with only one bore and pump). I have modelled the use pumps fitted with variable speed drives (VSD's), which allow the pump to speed up or slow down in order to pump the desired amount of water. VSD's, however, are only efficient to approximately 50% of pumping volume (ie they operate well between 50% and 100% of potential flow rate). As VSD's only operate well within a finite range, to have a wide operating range of augmentation pumping volumes (say between 15 and 120 litres per second), a range of different capacity pumps was required at each augmentation site.

It is possible to make the install cheaper by having only one well per augmentation site, with one pump fitted with a VSD, and an actuated gate or butterfly valve. This system would see the pump operate between say 50% and 100% of potential pump capacity, and under the 50% flow rate, the actuated valve would begin to close to "choke" back the pump to reduce flow rate further. Choking the pump is energy inefficient and only practical to approximately 25% of potential pump capacity, as once flow rates get too low, pumps can overheat as there is not enough water flow to keep them cool. This "choking" system would not likely meet irrigation NZ's design code of practice.

Variable speed drives are more expensive than soft starters to install, but they save energy over the longer term.

Some of the sites would be able to be operated with artesian water in some seasons, however the longer term analysis suggests that from time to time the bores would not be artesian and would require pumping of the water to operate. I expect you would need the pumps as the seasons when you would most want to augment streams would likely be the seasons when pump systems would be required to operate the augmentation well.

I expect that total capital expenditure will reach approximately \$2,000,000. This capital cost would provide the facilities to pump a peak 775 litres per second from all of the sites combined to the seven streams augmented. This is outlined in table 1 below.

Table 1: Estimated Capital Expenditure Required

CAPITAL EXPENDITURE REQUIRED							
Awanui	Irongate	Karamu	Karewarewa	Mangateretere	Louisa	Raupare	TOTAL
\$195,516	\$190,600	\$842,131	\$226,198	\$250,984	\$99,056	\$192,090	\$1,996,575

2.2. Operating Expenditure

Operating expenditure is made up of three key parts: electricity; depreciation; and maintenance. The depreciation is non-cash but still reflected in this analysis, the maintenance is required annually and the electricity is variable.

Operating expenditure is made up of three key parts: electricity; depreciation; and maintenance. The depreciation is non-cash but still reflected in this analysis as in time there will be a cost required to replace the infrastructure installed today. The maintenance is required annually irrespective of how many hours of use the pump and bore do, and therefore this cost is the same across all seasons. The electricity is variable made up by: fixed lines charges; and additional energy use charges paid for when pumps are used.

Because of the fixed costs of depreciation and maintenance (approximately \$104,000), in a year where a low level of augmentation is required (“min” row in table 2), there is still a significant operating expenditure required. The annual charges increase as more electricity is required to run the pumps. In the years when a high level of augmentation is required (“max” row in table 2), up to \$142,000 more than maintenance will need to be provisioned to operate the augmentation scheme. An outline of how operating charges may vary between years with high, mean and low levels of stream augmentation requirement is shown in table 2 below.

Table 2: Expected Annual Operating Expenditure Ranges

ANNUAL OPERATING EXPENDITURE								
	Awanui	Irongate	Karamu	Karewarewa	Mangateretere	Louisa	Raupare	TOTAL
Max	\$15,470	\$20,482	\$96,829	\$51,212	\$39,776	\$7,708	\$15,260	\$246,738
Min	\$11,596	\$7,544	\$44,053	\$13,934	\$16,905	\$6,810	\$10,123	\$110,964
Average	\$12,649	\$11,333	\$60,029	\$25,875	\$28,516	\$6,880	\$10,554	\$155,837

2.3. Considerations

I recommend looking closely at the feasibility of augmenting the Karamu stream at one (or even two) point(s) rather than three, as this will save significant capital cost and ongoing maintenance. As the three augmentation sites all require a staged increase in augmentation flow, a total of 9 bores are required. If these bores were consolidated to a common cluster, this could be reduced to 4 bores and pumps, saving considerably on capital cost and maintenance.

All of these augmentation sites have assumed that there is sufficient lines (electricity) capacity to run the required pumps. No provision has been made for lines upgrades if required.

There has been no provision for cost of land acquisition/compensation or cost of establishing legal easements if required.

3. Methodology

3.1. Capital Expenditure

Pump size was first calculated. This is based on the operational range of flows required to augment the streams and expected total head pressure (suction required + pressure head to deliver to the stream head 100m from the bore site).

In the instance of most streams, there are three bores and three pumps required to give HBRC the ability to accurately augment the streams to the required level. Multiple pumps and wells have been assumed as it is difficult to get two pump intakes down one well and multiple pumps on one intake manifold often cavitate. The pumps are expected to be a combination of soft start and variable speed drive pumps controlled by a programmable logic controller (PLC).

The cost of the bore was established by multiplying the bore depth (provided by HBRC) by a digging rate (derived from HBRC provided schedule of drilling quantities and Lincoln University Financial Budget Manual). The depth has been estimated using the average of surrounding wells as provided by HBRC from the "wellstor" data.

The cost of the pump station was then established using internal MRB database of install costs accompanied by Lincoln University Financial Budget Manual and discussions with irrigation plant suppliers.

Electricity supply is assumed to be 300 metres to the first site and 100m more to each subsequent site, with a multiple pump site utilising one transformer connection.

3.2. Operating Expenditure

Calculated as follows:

Energy:

- Calculated based on kilowatt hours used multiplied by known rate (as supplied by HBRC from a local Hawkes Bay farmer).
- Assuming 0.5bar of pressure loss in headworks, 0.1bar of pressure loss in PVC, 1.0bar pressure at delivery to stream head, system losses through suction and manifolds of 0.2bar.

Depreciation:

- Pump cost depreciated over 10 years.
- Switch gear depreciated over 25 years.
- Bore cost depreciated 50 years.
- Headworks and depreciated over 25 years.

Maintenance:

- Bore re-development every 10 years.
- Flow meter calibration every 3 years.
- Annual check and service fee by irrigation company.
- Data telemetry.
- Pump and switch gear 'maintenance' calculated at 2.5% of capital cost annually. Typically this is a large expense (for example a pump failure), that occurs ahead of scheduled plant replacement.

4. Results

4.1. Awanui

SUMMARY - Awanui					
pump capacity required					
Peak power required	25	kw			
Max flow rate	110	lps			
Min well water level	0.7	mbgl			
Production Year	Power use				
2015 -2016	6,652	KwH			
2016 -2017	7,030	KwH			
2017 -2018	3,158	KwH			
2018 -2019	14,115	KwH			
2019 -2020	6,132	KwH			
2020 -2021	964	KwH			
2021 -2022	4,058	KwH			
2022 -2023	6,218	KwH			
2023 -2024	1,360	KwH			
2024 -2025	4,472	KwH			
2025 -2026	6,659	KwH			
2026 -2027	3,738	KwH			
2027 -2028	1,089	KwH			
2028 -2029	1,073	KwH			
2029 -2030	4,304	KwH			
2030 -2031	5,102	KwH			
2031 -2032	8,620	KwH			
CAPEX - Infrastructure Capital					
	Bore 1	Bore 2	Bore 3	Bore 4	
Bore Depth	31m	31m	-	-	
Screen Length	5m	5m	-	-	
Bore Drilling	\$18,631	\$18,631	-	-	
Bore Development	\$3,576	\$3,576	-	-	
Bore Screening	\$6,229	\$6,229	-	-	
Consent and Mgmt	\$12,612	\$12,612	-	-	
Pump Capacity	80lps	30lps	-	-	
Pump Size	21kw	8kw	-	-	
Pump Cost	\$10,809	\$4,054	-	-	
Switchgear Type	VSD	VSD	-	-	
Switchgear Cost	\$10,535	\$3,951	-	-	
Headworks Cost	\$7,500	\$7,500	-	-	
Flowmeter Cost	\$2,600	\$2,600	-	-	
Flowmeter Calibratio	\$480	\$480	-	-	
Pump Shed	\$3,800	\$3,800	-	-	
Underground Pipe	\$5,000	\$5,000	-	-	
Underground Power	\$15,000	\$5,000	-	-	
Lines Connection	\$15,000				
Ancillary Costs	\$10,311				
TOTAL CAPEX	\$195,516				
OPEX - Annual Costs					
		Max	Min	Average	
Depreciation - Pumps			\$1,486		
Depreciation - Switchgear			\$579		
Depreciation - Bore			\$1,642		
Depreciation - Headworks			\$808		
Flowmeter calibration			\$320		
Telemetry Service			\$1,440		
Bore re-development			\$715		
Pump Maintenance			\$1,263		
Pump Service			\$3,000		
KwH used	14,115	964	4,985		
KwH cost	\$4,216	\$342	\$1,396		
TOTAL OPEX	\$15,470	\$11,596	\$12,649		

4.2. Irongate

SUMMARY - Irongate						
pump capacity required						
	Peak power required		24	kw		
	Max flow rate		75	lps		
	Min well water level		6.7	mbgl		
Production Year	Power use					
2015 -2016	2,380	KwH				
2016 -2017	21,194	KwH				
2017 -2018	17,191	KwH				
2018 -2019	0	KwH				
2019 -2020	16,569	KwH				
2020 -2021	128	KwH				
2021 -2022	18,069	KwH				
2022 -2023	5,826	KwH				
2023 -2024	18,961	KwH				
2024 -2025	18,638	KwH				
2025 -2026	21,989	KwH				
2026 -2027	579	KwH				
2027 -2028	408	KwH				
2028 -2029	0	KwH				
2029 -2030	45,620	KwH				
2030 -2031	19,775	KwH				
2031 -2032	28,734	KwH				
CAPEX - Infrastructure Capital						
			Bore 1	Bore 2	Bore 3	Bore 4
	Bore Depth		27m	27m	-	-
	Screen Length		5m	5m	-	-
	Bore Drilling		\$16,227	\$16,227	-	-
	Bore Development		\$3,576	\$3,576	-	-
	Bore Screening		\$6,229	\$6,229	-	-
	Consent and Mgmt		\$12,612	\$12,612	-	-
	Pump Capacity		50lps	30lps	-	-
	Pump Size		18kw	11kw	-	-
	Pump Cost		\$9,258	\$5,555	-	-
	Switchgear Type		VSD	VSD	-	-
	Switchgear Cost		\$9,024	\$5,414	-	-
	Headworks Cost		\$7,500	\$7,500	-	-
	Flowmeter Cost		\$2,600	\$2,600	-	-
	Flowmeter Calibration		\$480	\$480	-	-
	Pump Shed		\$3,800	\$3,800	-	-
	Underground Pipe		\$5,000	\$5,000	-	-
	Underground Power		\$15,000	\$5,000	-	-
	Lines Connection			\$15,000		
	Ancillary Costs			\$10,301		
	TOTAL CAPEX			\$190,600		
OPEX - Annual Costs						
				Max	Min	Average
	Depreciation - Pumps				\$555	
	Depreciation - Switchgear				\$217	
	Depreciation - Bore				\$773	
	Depreciation - Headworks				\$404	
	Flowmeter calibration				\$160	
	Telemetry Service				\$1,440	
	Bore re-development				\$358	
	Pump Maintenance				\$539	
	Pump Service				\$3,000	
	KwH used		45,620	0		13,886
	KwH cost		\$13,037	\$99		\$3,888
	TOTAL OPEX		\$20,482	\$7,544		\$11,333

4.3. Karamu

SUMMARY - Karamu K1					
pump capacity required					
	Peak power required	36 kw			
	Max flow rate	114 lps			
	Min well water level	4.1 mbgl			
Production Year	Power use				
2015 -2016	10,899 Kwh				
2016 -2017	28,237 Kwh				
2017 -2018	24,418 Kwh				
2018 -2019	0 Kwh				
2019 -2020	27,400 Kwh				
2020 -2021	253 Kwh				
2021 -2022	23,321 Kwh				
2022 -2023	9,487 Kwh				
2023 -2024	22,335 Kwh				
2024 -2025	22,024 Kwh				
2025 -2026	27,147 Kwh				
2026 -2027	2,826 Kwh				
2027 -2028	5,133 Kwh				
2028 -2029	4,252 Kwh				
2029 -2030	62,439 Kwh				
2030 -2031	22,281 Kwh				
2031 -2032	39,183 Kwh				
CAPEX - Infrastructure Capital					
		Bore 1	Bore 2	Bore 3	Bore 4
	Bore Depth	32m	32m	32m	-
	Screen Length	7m	7m	7m	-
	Bore Drilling	\$19,232	\$19,232	\$19,232	-
	Bore Development	\$3,576	\$3,576	\$3,576	-
	Bore Screening	\$8,363	\$8,363	\$8,363	-
	Consent and Mgmt	\$12,612	\$12,612	\$12,612	-
	Pump Capacity	30lps	40lps	50lps	-
	Pump Size	11kw	15kw	19kw	-
	Pump Cost	\$5,895	\$7,861	\$9,826	-
	Switchgear Type	VSD	VSD	Soft st	-
	Switchgear Cost	\$5,746	\$7,661	\$7,087	-
	Headworks Cost	\$7,500	\$7,500	\$7,500	-
	Flowmeter Cost	\$2,600	\$2,600	\$2,600	-
	Flowmeter Calibration	\$480	\$480	\$480	-
	Pump Shed	\$3,800	\$3,800	\$3,801	-
	Underground Pipe	\$5,000	\$5,000	\$5,000	-
	Underground Power	\$15,000	\$5,000	\$5,000	-
	Lines Connection	\$15,000			
	Ancillary Costs	\$14,222			
	TOTAL CAPEX	\$287,787			
OPEX - Annual Costs					
		Max	Min	Average	
	Depreciation - Pumps		\$2,358		
	Depreciation - Switchgear		\$820		
	Depreciation - Bore		\$2,627		
	Depreciation - Headworks		\$808		
	Flowmeter calibration		\$480		
	Telemetry Service		\$1,440		
	Bore re-development		\$1,073		
	Pump Maintenance		\$1,895		
	Pump Service		\$3,000		
	Kwh used	62,439	0	19,508	
	Kwh cost	\$17,902	\$315	\$5,637	
	TOTAL OPEX	\$32,403	\$14,816	\$20,138	

SUMMARY - Karamu K2					
pump capacity required					
	Peak power required	36 kw			
	Max flow rate	114 lps			
	Min well water level	4.3 mbgl			
Production Year	Power use				
2015 -2016	10,936 Kwh				
2016 -2017	28,304 Kwh				
2017 -2018	24,495 Kwh				
2018 -2019	0 Kwh				
2019 -2020	27,485 Kwh				
2020 -2021	253 Kwh				
2021 -2022	23,395 Kwh				
2022 -2023	9,502 Kwh				
2023 -2024	22,424 Kwh				
2024 -2025	22,097 Kwh				
2025 -2026	27,242 Kwh				
2026 -2027	2,830 Kwh				
2027 -2028	5,139 Kwh				
2028 -2029	4,280 Kwh				
2029 -2030	62,685 Kwh				
2030 -2031	22,368 Kwh				
2031 -2032	39,234 Kwh				
CAPEX - Infrastructure Capital					
		Bore 1	Bore 2	Bore 3	Bore 4
	Bore Depth	29m	29m	29m	-
	Screen Length	7m	7m	7m	-
	Bore Drilling	\$17,429	\$17,429	\$17,429	-
	Bore Development	\$3,576	\$3,576	\$3,576	-
	Bore Screening	\$8,363	\$8,363	\$8,363	-
	Consent and Mgmt	\$12,612	\$12,612	\$12,612	-
	Pump Capacity	30lps	40lps	50lps	-
	Pump Size	12kw	15kw	19kw	-
	Pump Cost	\$5,941	\$7,921	\$9,901	-
	Switchgear Type	VSD	VSD	Soft st	-
	Switchgear Cost	\$5,790	\$7,720	\$7,141	-
	Headworks Cost	\$7,500	\$7,500	\$7,500	-
	Flowmeter Cost	\$2,600	\$2,600	\$2,600	-
	Flowmeter Calibration	\$480	\$480	\$480	-
	Pump Shed	\$3,800	\$3,800	\$3,801	-
	Underground Pipe	\$5,000	\$5,000	\$5,000	-
	Underground Power	\$15,000	\$5,000	\$5,000	-
	Lines Connection	\$15,000			
	Ancillary Costs	\$14,255			
	TOTAL CAPEX	\$282,750			
OPEX - Annual Costs					
		Max	Min	Average	
	Depreciation - Pumps		\$2,376		
	Depreciation - Switchgear		\$826		
	Depreciation - Bore		\$2,519		
	Depreciation - Headworks		\$808		
	Flowmeter calibration		\$480		
	Telemetry Service		\$1,440		
	Bore re-development		\$1,073		
	Pump Maintenance		\$1,904		
	Pump Service		\$3,000		
	Kwh used	62,685	0	19,569	
	Kwh cost	\$17,975	\$317	\$5,655	
	TOTAL OPEX	\$32,400	\$14,743	\$20,081	

SUMMARY - Karamu K3					
pump capacity required					
	Peak power required	36	kw		
	Max flow rate	114	lps		
	Min well water level	4.2	mbgl		
Production Year	Power use				
2015 -2016	10,894	KwH			
2016 -2017	28,226	KwH			
2017 -2018	24,408	KwH			
2018 -2019	0	KwH			
2019 -2020	27,390	KwH			
2020 -2021	252	KwH			
2021 -2022	23,311	KwH			
2022 -2023	9,483	KwH			
2023 -2024	22,295	KwH			
2024 -2025	21,963	KwH			
2025 -2026	27,138	KwH			
2026 -2027	2,825	KwH			
2027 -2028	5,131	KwH			
2028 -2029	4,250	KwH			
2029 -2030	62,236	KwH			
2030 -2031	22,272	KwH			
2031 -2032	39,169	KwH			
CAPEX - Infrastructure Capital					
		Bore 1	Bore 2	Bore 3	Bore 4
Bore Depth		23m	23m	23m	-
Screen Length		7m	7m	7m	-
Bore Drilling		\$13,823	\$13,823	\$13,823	-
Bore Development		\$3,576	\$3,576	\$3,576	-
Bore Screening		\$8,363	\$8,363	\$8,363	-
Consent and Mgmt		\$12,612	\$12,612	\$12,612	-
Pump Capacity		30lps	40lps	50lps	-
Pump Size		12kw	15kw	19kw	-
Pump Cost		\$5,900	\$7,866	\$9,833	-
Switchgear Type		VSD	VSD	Soft st	-
Switchgear Cost		\$5,750	\$7,667	\$7,092	-
Headworks Cost		\$7,500	\$7,500	\$7,500	-
Flowmeter Cost		\$2,600	\$2,600	\$2,600	-
Flowmeter Calibration		\$480	\$480	\$480	-
Pump Shed		\$3,800	\$3,800	\$3,801	-
Underground Pipe		\$5,000	\$5,000	\$5,000	-
Underground Power		\$15,000	\$5,000	\$5,000	-
Lines Connection		\$15,000			
Ancillary Costs		\$14,225			
TOTAL CAPEX		\$271,594			
OPEX - Annual Costs					
		Max	Min	Average	
Depreciation - Pumps			\$2,360		
Depreciation - Switchgear			\$820		
Depreciation - Bore			\$2,302		
Depreciation - Headworks			\$808		
Flowmeter calibration			\$480		
Telemetry Service			\$1,440		
Bore re-development			\$1,073		
Pump Maintenance			\$1,896		
Pump Service			\$3,000		
KwH used		62,236	0	19,485	
KwH cost		\$17,846	\$315	\$5,631	
TOTAL OPEX		\$32,025	\$14,494	\$19,810	

4.4. Karewarewa

SUMMARY - Karewarewa						
pump capacity required						
	Peak power required		39 kw			
	Max flow rate		83 lps			
	Min well water level		17.6 mbgl			
Production Year	Power use					
2015 -2016	30,207	KwH				
2016 -2017	42,559	KwH				
2017 -2018	56,698	KwH				
2018 -2019	13,109	KwH				
2019 -2020	47,574	KwH				
2020 -2021	1,182	KwH				
2021 -2022	44,867	KwH				
2022 -2023	10,813	KwH				
2023 -2024	80,216	KwH				
2024 -2025	49,496	KwH				
2025 -2026	90,462	KwH				
2026 -2027	2,118	KwH				
2027 -2028	1,622	KwH				
2028 -2029	16,006	KwH				
2029 -2030	133,794	KwH				
2030 -2031	41,529	KwH				
2031 -2032	100,714	KwH				
CAPEX - Infrastructure Capital						
			Bore 1	Bore 2	Bore 3	Bore 4
	Bore Depth		35m	35m	-	-
	Screen Length		7m	7m	-	-
	Bore Drilling		\$21,035	\$21,035	-	-
	Bore Development		\$3,576	\$3,576	-	-
	Bore Screening		\$8,363	\$8,363	-	-
	Consent and Mgmt		\$12,612	\$12,612	-	-
	Pump Capacity		30lps	60lps	-	-
	Pump Size		16kw	32kw	-	-
	Pump Cost		\$8,270	\$16,540	-	-
	Switchgear Type		VSD	VSD	-	-
	Switchgear Cost		\$8,060	\$16,121	-	-
	Headworks Cost		\$7,500	\$7,500	-	-
	Flowmeter Cost		\$2,600	\$2,600	-	-
	Flowmeter Calibration		\$480	\$480	-	-
	Pump Shed		\$3,800	\$3,800	-	-
	Underground Pipe		\$5,000	\$5,000	-	-
	Underground Power		\$15,000	\$5,000	-	-
	Lines Connection			\$15,000		
	Ancillary Costs			\$12,275		
	TOTAL CAPEX			\$226,198		
OPEX - Annual Costs						
			Max	Min	Average	
	Depreciation - Pumps			\$2,481		
	Depreciation - Switchgear			\$967		
	Depreciation - Bore			\$1,823		
	Depreciation - Headworks			\$808		
	Flowmeter calibration			\$320		
	Telemetry Service			\$1,440		
	Bore re-development			\$715		
	Pump Maintenance			\$1,754		
	Pump Service			\$3,000		
	KwH used		133,794	1,182	44,880	
	KwH cost		\$37,904	\$625	\$12,567	
	TOTAL OPEX		\$51,212	\$13,934	\$25,875	

4.5. Louisa

SUMMARY - Louisa						
pump capacity required						
	Peak power required		4 kw			
	Max flow rate		12 lps			
	Min well water level		6.6 mbgl			
	Production Year		Power use			
	2015 -2016		215 Kwh			
	2016 -2017		16 Kwh			
	2017 -2018		16 Kwh			
	2018 -2019		0 Kwh			
	2019 -2020		16 Kwh			
	2020 -2021		0 Kwh			
	2021 -2022		0 Kwh			
	2022 -2023		0 Kwh			
	2023 -2024		137 Kwh			
	2024 -2025		0 Kwh			
	2025 -2026		0 Kwh			
	2026 -2027		0 Kwh			
	2027 -2028		0 Kwh			
	2028 -2029		0 Kwh			
	2029 -2030		3003 Kwh			
	2030 -2031		0 Kwh			
	2031 -2032		846 Kwh			
CAPEX - Infrastructure Capital						
			Bore 1	Bore 2	Bore 3	Bore 4
	Bore Depth		32m	-	-	-
	Screen Length		3m	-	-	-
	Bore Drilling		\$19,232	-	-	-
	Bore Development		\$1,788	-	-	-
	Bore Screening		\$4,095	-	-	-
	Consent and Mgmt		\$12,612	-	-	-
	Pump Capacity		15lps	-	-	-
	Pump Size		6kw	-	-	-
	Pump Cost		\$3,228	-	-	-
	Switchgear Type		VSD	-	-	-
	Switchgear Cost		\$3,146	-	-	-
	Headworks Cost		\$7,500	-	-	-
	Flowmeter Cost		\$2,600	-	-	-
	Flowmeter Calibration		\$480	-	-	-
	Pump Shed		\$3,800	-	-	-
	Underground Pipe		\$5,000	-	-	-
	Underground Power		\$15,000	-	-	-
	Lines Connection			\$15,000		
	Ancillary Costs			\$5,575		
	TOTAL CAPEX			\$99,056		
OPEX - Annual Costs						
			Max	Min	Average	
	Depreciation - Pumps			\$323		
	Depreciation - Switchgear			\$126		
	Depreciation - Bore			\$755		
	Depreciation - Headworks			\$404		
	Flowmeter calibration			\$160		
	Telemetry Service			\$1,440		
	Bore re-development			\$179		
	Pump Maintenance			\$424		
	Pump Service			\$3,000		
	Kwh used		3,003	0	250	
	Kwh cost		\$898	\$0	\$70	
	TOTAL OPEX		\$7,708	\$6,810	\$6,880	

4.6. Mangateretere

SUMMARY - Mangateretere					
pump capacity required					
Peak power required		34	kw		
Max flow rate		110	lps		
Min well water level		5.5	mbgl		
Production Year		Power use			
2015 -2016		56,506	KwH		
2016 -2017		59,809	KwH		
2017 -2018		53,487	KwH		
2018 -2019		11,762	KwH		
2019 -2020		53,377	KwH		
2020 -2021		26,585	KwH		
2021 -2022		58,742	KwH		
2022 -2023		57,985	KwH		
2023 -2024		64,828	KwH		
2024 -2025		78,788	KwH		
2025 -2026		69,825	KwH		
2026 -2027		34,825	KwH		
2027 -2028		31,335	KwH		
2028 -2029		44,354	KwH		
2029 -2030		93,130	KwH		
2030 -2031		54,699	KwH		
2031 -2032		62,089	KwH		
CAPEX - Infrastructure Capital					
		Bore 1	Bore 2	Bore 3	Bore 4
Bore Depth		18m	18m	18m	-
Screen Length		5m	5m	5m	-
Bore Drilling		\$10,818	\$10,818	\$10,818	-
Bore Development		\$3,576	\$3,576	\$3,576	-
Bore Screening		\$6,229	\$6,229	\$6,229	-
Consent and Mgmt		\$12,612	\$12,612	\$12,612	-
Pump Capacity		30lps	40lps	50lps	-
Pump Size		10kw	13kw	16kw	-
Pump Cost		\$4,986	\$6,648	\$8,311	-
Switchgear Type		VSD	VSD	VSD	-
Switchgear Cost		\$4,860	\$6,480	\$8,100	-
Headworks Cost		\$7,500	\$7,500	\$7,500	-
Flowmeter Cost		\$2,600	\$2,600	\$2,600	-
Flowmeter Calibration		\$480	\$480	\$480	-
Pump Shed		\$3,800	\$3,800	\$3,801	-
Underground Pipe		\$5,000	\$5,000	\$5,000	-
Underground Power		\$15,000	\$5,000	\$5,000	-
Lines Connection		\$15,000			
Ancillary Costs		\$13,753			
TOTAL CAPEX		\$250,984			
OPEX - Annual Costs					
			Max	Min	Average
Depreciation - Pumps				\$1,995	
Depreciation - Switchgear				\$778	
Depreciation - Bore				\$1,994	
Depreciation - Headworks				\$808	
Flowmeter calibration				\$480	
Telemetry Service				\$1,440	
Bore re-development				\$1,073	
Pump Maintenance				\$1,778	
Pump Service				\$3,000	
KwH used			93,130	11,762	53,654
KwH cost			\$26,431	\$3,559	\$15,171
TOTAL OPEX			\$39,776	\$16,905	\$28,516

4.7. Raupare

SUMMARY - Raupare					
pump capacity required					
	Peak power required	11	kw		
	Max flow rate	43	lps		
	Min well water level	2.1	mbgl		
Production Year	Power use				
2015 -2016	0	KwH			
2016 -2017	1,283	KwH			
2017 -2018	0	KwH			
2018 -2019	0	KwH			
2019 -2020	1,028	KwH			
2020 -2021	0	KwH			
2021 -2022	73	KwH			
2022 -2023	0	KwH			
2023 -2024	1,998	KwH			
2024 -2025	183	KwH			
2025 -2026	5,511	KwH			
2026 -2027	0	KwH			
2027 -2028	0	KwH			
2028 -2029	0	KwH			
2029 -2030	18,166	KwH			
2030 -2031	1,484	KwH			
2031 -2032	1,004	KwH			
CAPEX - Infrastructure Capital					
		Bore 1	Bore 2	Bore 3	Bore 4
	Bore Depth	37m	37m	-	-
	Screen Length	8m	8m	-	-
	Bore Drilling	\$22,237	\$22,237	-	-
	Bore Development	\$3,576	\$3,576	-	-
	Bore Screening	\$9,430	\$9,430	-	-
	Consent and Mgmt	\$12,612	\$12,612	-	-
	Pump Capacity	20lps	30lps	-	-
	Pump Size	5kw	8kw	-	-
	Pump Cost	\$2,807	\$4,211	-	-
	Switchgear Type	VSD	VSD	-	-
	Switchgear Cost	\$2,736	\$4,104	-	-
	Headworks Cost	\$7,500	\$7,500	-	-
	Flowmeter Cost	\$2,600	\$2,600	-	-
	Flowmeter Calibratio	\$480	\$480	-	-
	Pump Shed	\$3,800	\$3,800	-	-
	Underground Pipe	\$5,000	\$5,000	-	-
	Underground Power	\$15,000	\$5,000	-	-
	Lines Connection		\$15,000		
	Ancillary Costs		\$8,762		
	TOTAL CAPEX		\$192,090		
OPEX - Annual Costs					
			Max	Min	Average
	Depreciation - Pumps			\$702	
	Depreciation - Switchgear			\$274	
	Depreciation - Bore			\$1,914	
	Depreciation - Headworks			\$808	
	Flowmeter calibration			\$320	
	Telemetry Service			\$1,440	
	Bore re-development			\$715	
	Pump Maintenance			\$875	
	Pump Service			\$3,000	
	KwH used		18,166	0	1,808
	KwH cost		\$5,211	\$75	\$506
	TOTAL OPEX		\$15,260	\$10,123	\$10,554