MEMORANDUM

TO:	Waitaki District Council	Job No.:	000442
ATTENTION:	Michael Goldingham	Date:	11 July 2019
FROM:	Melanie Stevenson	Page 1 of 7	
SUBJECT:	Ohau Water Supply Upgrade – Staged Option (Rev B)	Reference:	*MEMO 19-07-01 MKS 000442(Rev B)*

1.0 Introduction

This memorandum is in response to a request from the Waitaki District Council to provide comment and costs on a community (Task Force) designed option for upgrading the Ohau Village Water Supply. This memo is supplementary to the Ohau Alpine Village Water Supply Issues and Options Report [August 2018] and memorandums [dated 18th January 2019 and 21st May 2019].

The option (Option 9) is a staged option, initially utilising existing source with selective abstraction, using current storage and a new transportable WTP behind the village. The second stage would be the development of a new bore supply to augment or replace the existing surface water.

2.0 Description of Option 9

In summary, the suggested option from the Task Force was:

2.1 Stage 1: Option 9.1

Utilise existing source and tanks as raw water storage and install an actuated valve and turbidimeter at source, to allow for selective abstraction. This allows the source to be shut down when turbidity exceeds a set value. Water would then be treated with bag filtration, cartridge filtration and UV disinfection housed within a transportable shipping container. Treated water storage would be constructed adjacent the treatment plant with reticulation pumps to provide back up on-demand flow and fire flows when there is a drop in pressure in the reticulation. A generator would be required.

A location drawing for the proposed option is presented in Figure 2.1.

The proposed design is to run off the existing storage and provide gravity head to drive water through the filters and to the village. When the source water becomes dirty, the system will operate on the stored raw water and /or treated water storage until that runs out. This could take 2 to 4 days depending on demand.

It is unknown how long it takes for the source water to return to a low turbidity (about <2 NTU) that would be treatable by the proposed system.

When the source water clears up, the system will return to running off the source and through the raw water storage.

Works required are:

Source

- Turbidimeter (solar powered) to be installed at source.
- Actuated valve, at source, controlled by turbidimeter.
- Fencing around existing intake and water protection zone to protect area from any livestock – this area needs to be such that livestock cannot enter waterways in the 142 Ha water protection zone. Cut off drains may also be required to minimise any surface runoff into the protection zone.

Raw water storage

- Level transducer, solar power and RTU for control and monitoring

WTP

- New transformer and overhead power to site.
- Fencing around WTP to protect area from any livestock.
- New transportable containerised WTP with sound proofing and cladding with cartridge filtration and UV and allowance for chlorine.
- New tank farm located at water treatment site to provide fire and buffer storage.
- Generator provided for emergencies.

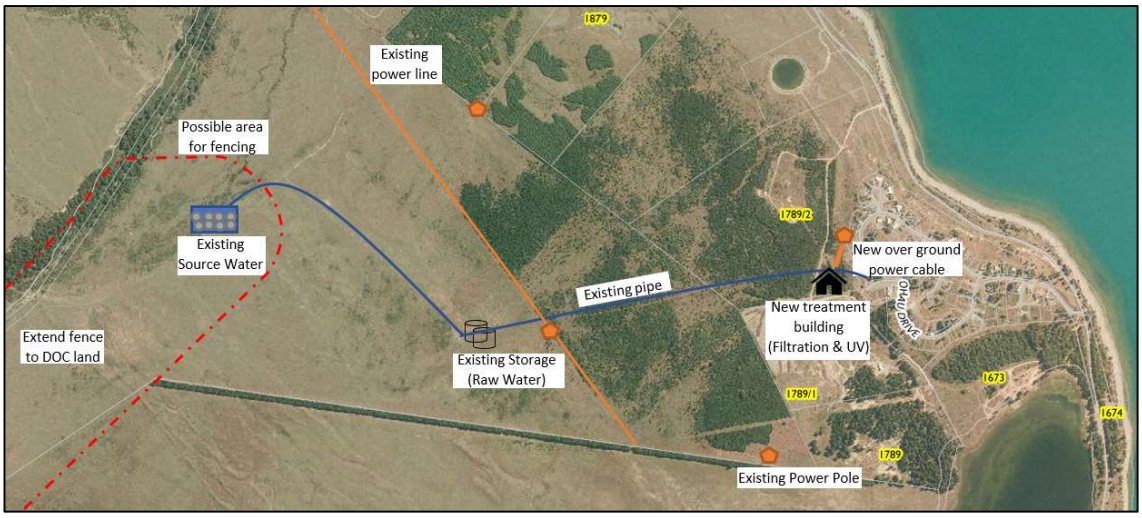

Figure 2.1: Schematic of Proposed Option 9.1

Process flow diagrams and detailed costs are attached in the appendices.

2.2 Stage 2: Option 9.2 (i) and 9.2 (ii)

Stage 2 is to develop a new water source, to meet future on-demand flows and improve quality of the water with a more consistent bore source. This stage is broken down into 2

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alternative versions based on whether water is available near the water treatment plant constructed in Stage 1.

- Option 9.2(i)– Subject to a test bore confirming adequate water supply, install 1 x new bore near the water treatment plant. The new bore is to augment the existing supply to meet higher demands and provide source water when the existing source is dirty.
- Option 9.2(ii) – If the test bore in 9.2(ii) confirms inadequate water then find a new source. Most likely this will be adjacent the lake. This second stage will then require the development of new bores by the lake, relocating WTP, treated water storage, reticulation pumps and generator to nearer bores. It is not cost effective to maintain the use of the existing source with this option due to separation of the two source water types and thus it is assumed that the existing source, falling main and raw water storage be abandoned.

2.2.1 Option 9.1 (i)

A location drawing for this proposed option is presented in Figure 2.2.

Works required are:

- New resource consent to take water
- Test drill and installation of 1 x new bore
- Actuated valve system for control of different source waters
- Fencing around bore
- Connection of bore to WTP

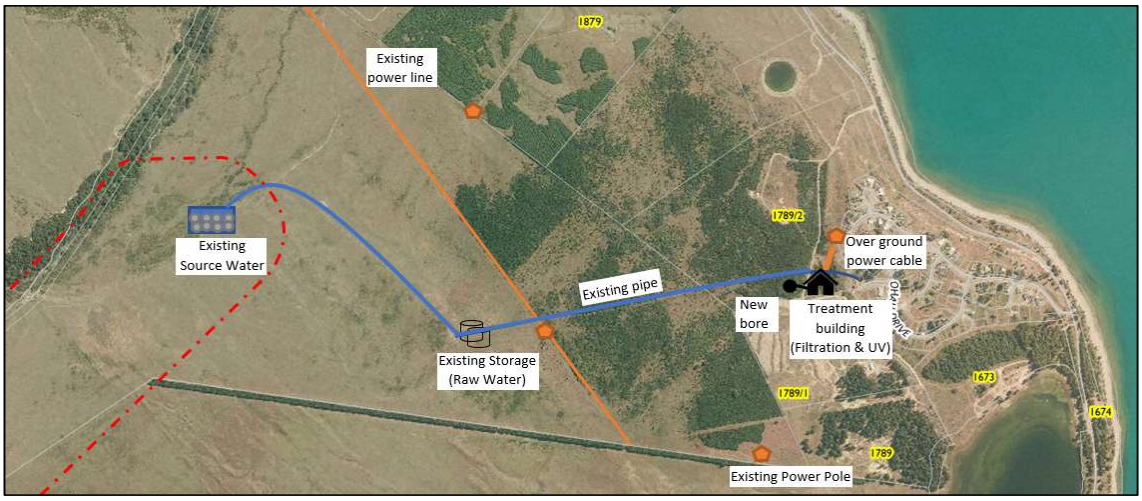

Figure 2.2: Schematic of Proposed Option 9.2(i)

Process flow diagrams and detailed costs are attached in the appendices.

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2.2.2 Option 9.2(ii)

A location drawing for this proposed option is presented in Figure 2.3.

Works required are:

- New resource consent to take water
- Test drill and installation of 2 x new bores
- Fencing around bores
- Connection of bore to WTP
- Relocation of WTP infrastructure to Lake Middleton Reserve
- New power connection
- Abandon existing source infrastructure

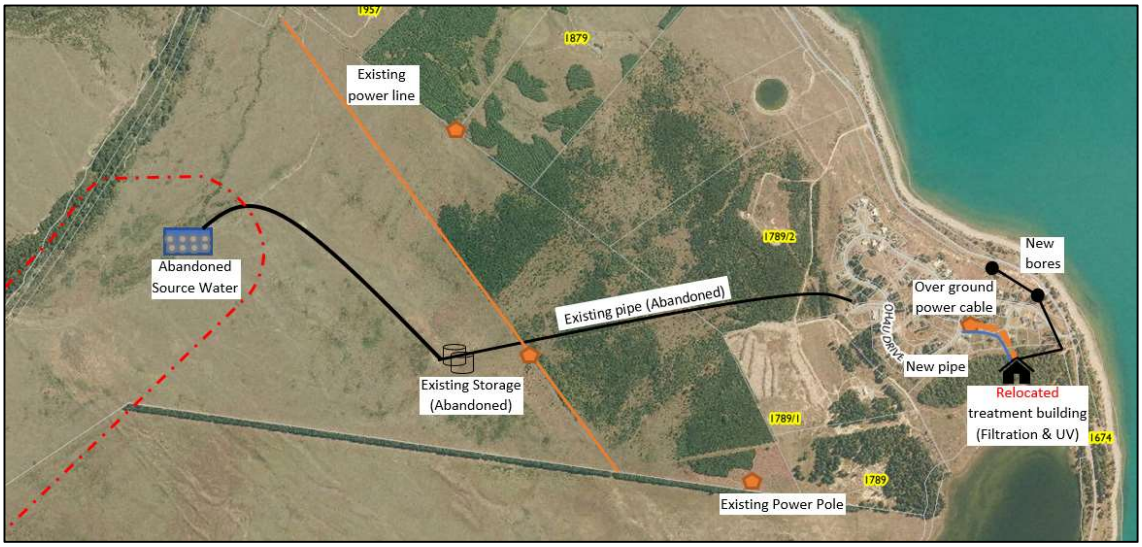

Figure 2.3: Schematic of Proposed Option 9.2(ii)

Process flow diagrams and detailed costs are attached in the appendices.

3.0 Cost Estimates for Option 9

Estimated costs for Option 9 scenarios are provided in the table below. More detailed costing is attached.

Please note that costs provided in this memorandum are for budgetary purposes and for comparison with other options presented in the previous report and memorandum.

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Table 3.1: Preliminary Cost Estimates for Staged Option 9 (without Chlorine)

Description	Stage One	Stage Two: New bore behind village		Stage Two: New bores on lakefront	
	On Demand	On Demand		On Demand	
	Option 9.1 a - OD	9.2(i) (add)	Total 9.2(i)	9.2(ii) (add)	Total 9.2(ii)
Source	132,000	120,750	252,800	213,000	345,000
Treatment	236,000	15,625	251,000	123,000	359,000
Reticulation	35,000	18,750	53,000	128,000	162,000
Storage	113,000	-	113000	19,000	131,000
Fire Protection	46,000	-	46,000	5,000	51,000
Generator	26,000	-	26000	5,000	31,000
P&G, Design and Contingency	235,000	82,750	317,000	197,000	431,000
Capital cost	**821,000**	**217,200**	**1,038,000**	**689,000**	**1,510,000**
Annual Cost	**45,000**		**43,000**		**37,000**
NPV 20 years at 8%	**1,262,000**		**1,466,500**[1]		**1,684,000**

4.0 Pros and Cons

Pros and Cons for this option are discussed below:

Pros

- The initial location of the WTP is close to the existing power supply.
- The cost of a modified shipping container is low compared with a bespoke and sympathetically designed WTP.
- Fire flows can be met through provision of adequate fire pump capacity and storage at the WTP.
- This option utilises the existing source which has support by Task Force community group.

Cons

- The landowners are not in favour of infrastructure or continued use of the water source located on their land. Therefore, upgrading and maintaining any part of the water supply on the land would be very difficult.
- The existing source is anecdotally subject to drought conditions and at higher risk of running out of water compared with sources near the lake. Water restrictions are more likely with Stage 1 of this option.
- The resource consent and probable yield of the existing source is for 2.2 L/sec and this option is only likely to be adequate to meet current demands and not a fully on-demand system (as preferred by the community).

[1] The NPV allows for a renewal of the existing consent at 2035 and replacement of the existing tanks after 10 years.

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- Selective abstraction requires construction works at the existing intake and continued operations resulting in added costs for communication and access. All work associated with the intake will be sunk costs if Option 9.2 (ii) is developed.
- Turbidity data collected from the existing supply indicates that the supply is subject to variability of quality. This is typical behaviour of a run of the river source. The treatment system as proposed is not suitable for treating high turbidity water. While there is back up storage, filters will block quickly and will not reduce turbidity enough to meet DWS, if exposed to dirty water.
- Having 'back up' treated water storage at the WTP introduces issues in that this water needs to be turned over regularly. Best practice is to turn water over every 24 hours to prevent it from becoming stagnant. To turn this water over would require either running this system or discharging to ground (which is wasteful).
- Maintaining the raw water storage and infrastructure takes away the opportunity to use the value of the depreciated assets for funding the upgrade. **The rates impact of this option is actually more expensive than most of the full upgrade options.**
- Option 9.2(i) proposes to retain the existing intake and storage.
    - The storage tanks will need replacement in the future as it is considered to be in poor condition. The NPV analysis assumes this will occur in 10 years time for option 9.2(i). This replacement is not included in the capital spend reported.
    - The raw water consent will need to be renewed in 2035. The NPV analysis assumes this will occur in 16 years time for option 9.2(i). This is not included in the capital spend reported.
- With a direct online system (raw water storage – treatment – consumer), the WTP would need to be sized for instantaneous peak flows (current peak flows up to 12 L/sec). If the treatment system is as proposed there will be potential pressure fluctuations in the network. To combat this, the treated water storage and pumps would need to switch on automatically with a drop in pressure. This adds complexities to the system and potential operational issues.
- There will be a drop in the normal operating pressures due to headloss through the filters (up to 240kPa). This could result in a reticulation pressure of 100kPa which is well below the Waitaki District Council Standards (250kPa for on-demand connections). This also requires the treated water storage and pumps to switch on automatically with a drop in pressure. This again adds complexities to the system and potential operational issues.
- There is no chlorine contact time when operating as a direct on-line system. If adding chlorine the system will need to pumped from the treated water storage.
- The Task Force have suggested that the WTP is constructed behind the village in a container. It is proposed that in the future, bores could be developed nearby. The feasibility of this option relies on water being found in this location. If an acceptable yield of water cannot be found at this location then the containerised WTP will need to be shifted. This will require significant re work including, new access, approvals,

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power supply and pipework. There is significant risk that costs will escalate for this option, making it one of more expensive options.

5.0 Comparison with other Options

Figure 5.1 below shows a summary of previous on-demand options presented Options have been ranked in order of increasing NPV cost. Results are presented for without chlorine only.

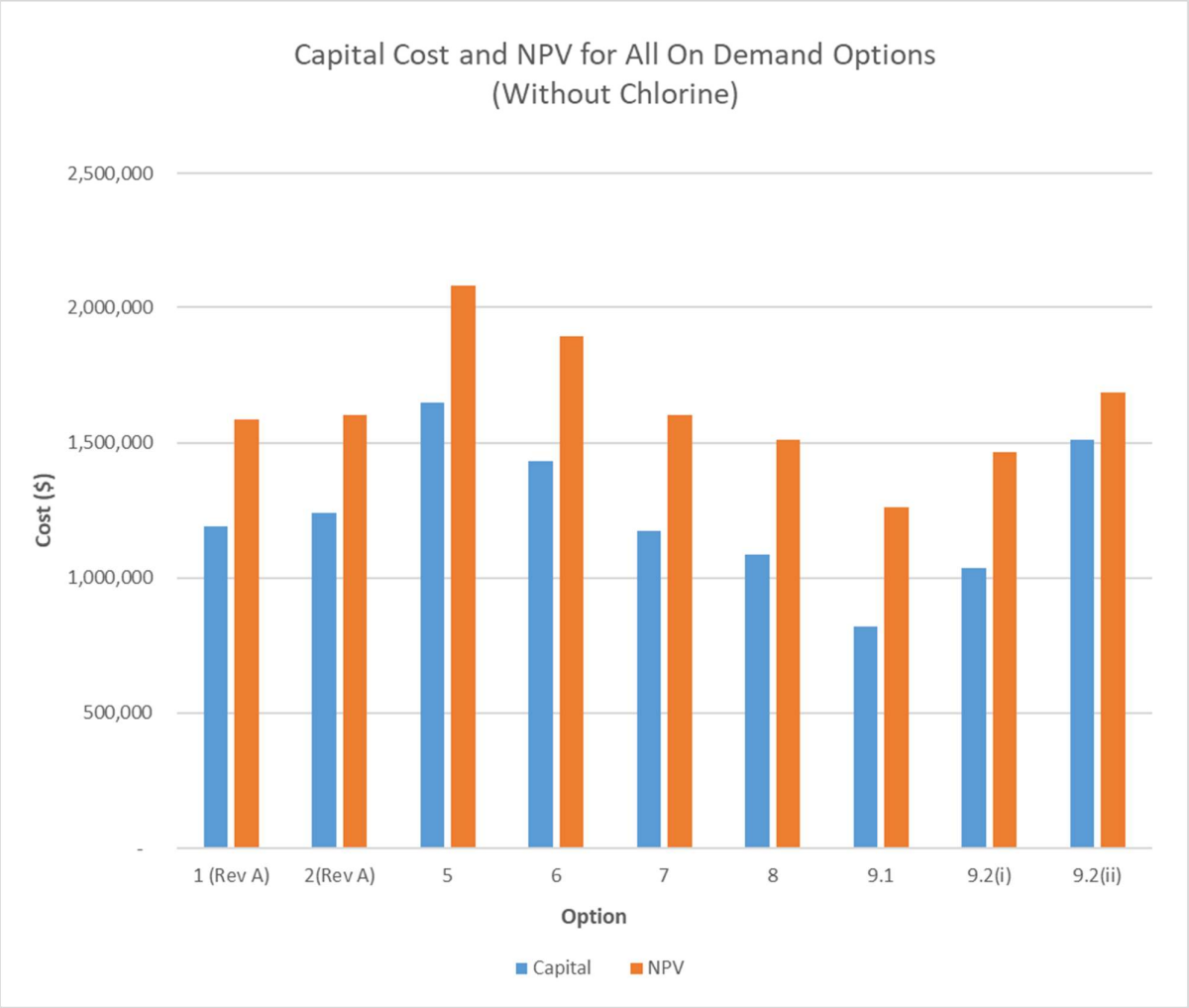

Figure 5.1: Graph showing all On-Demand options - Capital and NPV

It should be noted that depreciation costs have not been included in the operational costs and NPV analysis.

The impact on rates has been assessed and considers the depreciation effects of maintaining existing assets. A summary table and graph are presented below:

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Table 5.1 : Rates Impact

Option	Annual Rates ($) (estimate)
Option 1 (rev A)	1,166
Option 2 (rev A)	1,099
Option 5	1,601
Option 6	1,408
Option 7	1,185
Option 8	1,041
Option 9.1	1,155
Option 9.2i (revA)	1,313
Option 9ii	1,324

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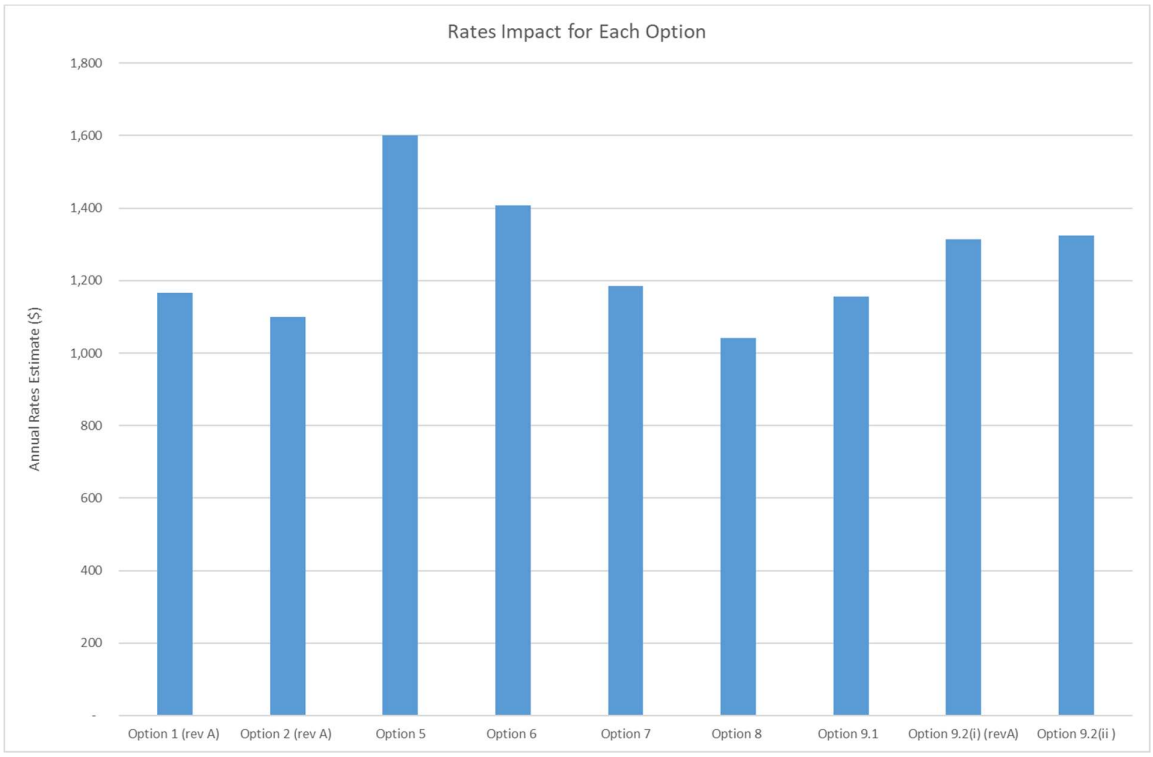

Figure 5.2: Rates Impact for each Option

Option 9 Stage 1(9.1) is the lowest cost option in terms of capital cost and NPV. This is due to the fact this is only the first stage. From a rating perspective, however, Option 9.1 is more costly to the Ohau residents than Options 2(Rev A) and Option 8. There are also a number of risks associated with Stage 1 which have been considered as part of a risk assessment workshop.

Costs for Option 9.2(i) is the lowest capital spend and NPV for a fully upgraded option. This is mostly due to the fact that only one bore has been allowed for as it is intended to augment the existing source only.

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Option 9.2(ii) has one of the highest capital and NPV of all of the options and is significantly higher than Option 2 (Rev A), which is essentially the same option other than it is fully upgraded from the start. This is due to the fact that there is a need to relocate equipment.

The rates for both 9.2(i) and 9.2 (ii) rank 6th equal out of 9. These final upgraded options would cost the ratepayers around $225/year more than Option 2 (Rev A).

APPENDIX 1
Process Flow Diagrams

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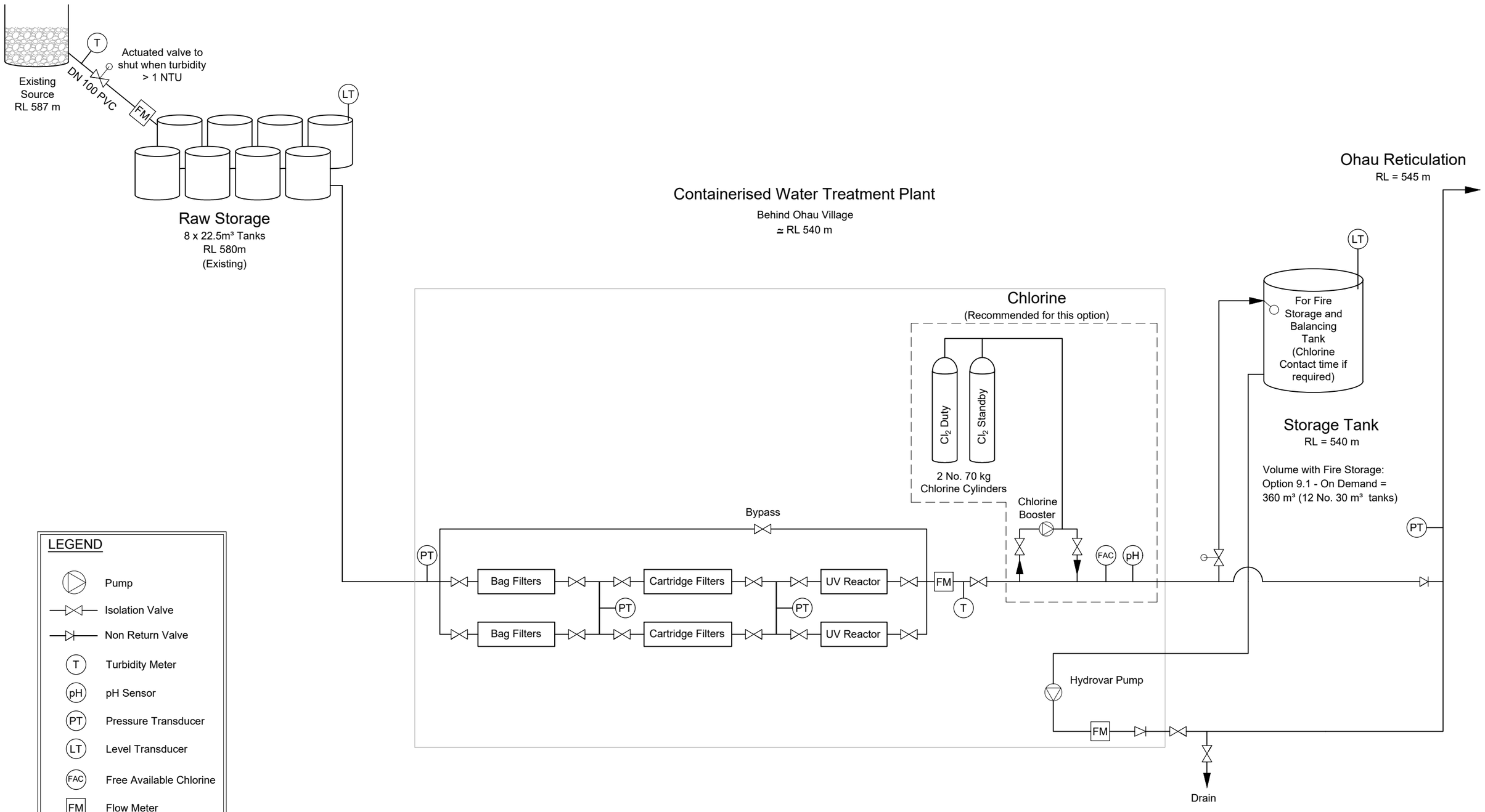

LEGEND

- Pump
- Isolation Valve
- Non Return Valve
- T — Turbidity Meter
- pH — pH Sensor
- PT — Pressure Transducer
- LT — Level Transducer
- FAC — Free Available Chlorine
- FM — Flow Meter
- Actuator Valve
- Three way Actuator Valve

Revision		App	Date
B	Selective abstraction at source	F.G.	
A	Draft	-	-

Surveyed	-	-
Designed	Task Force	June'19
Drawn	D.R.	June'19
Reviewed	-	-
Approved	-	-

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Client: Waitaki District Council — Te Kauniherā ā Rohe o Waitaki

Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram
Option 9.1 (Task Force Design)
Stage 1 - Existing Source
Selective Abstraction

Scale (A1 Original)		
NTS		
Issue		Draft
Project No	Sheet	Revision
000442	P09.1	B

Ohau Reticulation
RL = 545 m

Existing Source
RL 587 m

T

Actuated valve to shut when turbidity > 1 NTU

DN 100 PVC

FM

LT

Raw Storage
8 x 22.5m³ Tanks
RL 580m
(Existing)

For Fire Storage and Balancing Tank (Chlorine Contact time if required)

Storage Tank
RL = 540 m
To be located near lakefront if required

Volume with Fire Storage:
Option 9.2 - On Demand = 360 m³
(12 No. 30 m³ tanks)

Cl_2 Standby

2 No. 70 kg Chlorine Cylinders

Chlorine Booster

FAC

pH

PT

Bypass

Bag Filters

Bag Filters

Cartridge Filters

Cartridge Filters

UV Reactor

UV Reactor

Chlorine disinfection (if required)

New Bores

3 way Actuator Valve

AV

Hydrovar Pump set with or without option for Fireflow

Drain

P1

~25 m Deep Wells (TBC)

To be located behind village

Containerised Water Treatment Plant

Behind Ohau Village

~ RL 540 m

LEGEND

- Pump
- Isolation Valve
- Air Valve
- Non Return Valve
- Turbidity Meter
- pH Sensor
- Pressure Transducer
- Level Transducer
- Pressure Gauge
- Free Available Chlorine
- Flow Meter

Revision		App	Date
B	Continued use of existing source	M.S	12/07/19
A	Draft	M.S	June '19

Surveyed	-	-
Designed	F.G	June'19
Drawn	D.R & J.P	June'19
Reviewed	M.S	June'19
Approved	M.S	June'19

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Client: Waitaki DISTRICT COUNCIL
TE KAUNIHERA Ā ROHE O WAITAKI

Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram Option 9.2 (i) Stage 2 - Add Bores

Scale (A1 Original): NTS

Issue: Concept Design

Project No	Sheet	Revision
000442	P09.2	B

Ohau Reticulation
RL = 545 m

LT

For Fire Storage and Balancing Tank (Chlorine Contact time if required)

Storage Tank

RL = 540 m
To be located near lakefront if required

Volume with Fire Storage:
Option 9.2 - On Demand = 360 m³
(12 No. 30 m³ tanks)

PT

New Bores

Bypass

PT

Bag Filters

Cartridge Filters

UV Reactor

Bag Filters

Cartridge Filters

UV Reactor

PT

PT

FM

T

T

Cl_2 Standby

2 No. 70 kg
Chlorine Cylinders

Chlorine
Booster

FAC

pH

Chlorine disinfection
(if required)

FM

FM

AV

AV

P1

P2

2No. ~25 m Deep Wells
(TBC)

Adjacent to Lake Ohau

Hydrovar Pump
set with or without
option for Fireflow

FM

Drain

Containerised Water Treatment Plant

Lake Middleton Campground
~ RL 525 m

LEGEND

- Pump
- Isolation Valve
- Air Valve (AV)
- Non Return Valve
- Turbidity Meter (T)
- pH Sensor (pH)
- Pressure Transducer (PT)
- Level Transducer (LT)
- Pressure Gauge (P)
- Free Available Chlorine (FAC)
- Flow Meter (FM)

Revision		App	Date
A	Removal of Option 9.2 (i)	M.S	12/07/19

Surveyed	-	-
Designed	F.G	June '19
Drawn	D.R & J.P	June '19
Reviewed	M.S	June '19
Approved	M.S	June '19

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Client: Waitaki District Council — Te Kaunihera ā Rohe o Waitaki

Project Title: Ohau Alpine Village Water Supply

Sheet Title: Process Flow Diagram Option 9.2 (ii) Stage 2 - Add Bores Near Lake Middleton

Scale (A1 Original): NTS

Issue: Concept Design

Project No	Sheet	Revision
000442	P09.2	A

APPENDIX 2

Detailed Cost Estimates

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Option 9a OD- Selective Abstraction Existing Source then existing storage and new pumps - Current FLOW WTP & Storage behind Village with reticulation				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Additional Time to work with Landowner / public works act		1	$ 20,000	$ 20,000
ECAN Consent	consent to discharge to land	1	$ 10,000	$ 10,000
Improvements to intake - fencing	allowance	1	$ 20,000	$ 20,000
Raw water turbidimeter	Hach 1720E	1	$ 7,000	$ 7,000
Actuated valve to shut down when water above 1 NTU	Rotork	1	$ 15,000	$ 15,000
Flow meter	DN80 yokogawa mag flowmeter	2	$ 4,600	$ 9,200
Electrical, control and Telemetry (to provide data, alarms and shut down of Rotork)	RTU and aerial, pole, solar panel, battery and repeater	1	$ 25,000	$ 25,000
Installation and Construction		30%	$ 86,200	$ 25,860
SUBTOTAL Source				***$ 132,060***
Water Treatment				
Filtration, UV, Building, Civil				
Cartridge	1 HF40H304 (duty/standby) 1 um nominal - will treat up to 5 L/sec	2	$ 8,250	$ 16,500
Ultraviolet Disinfection	UV Pro 50 (up to 3.15 L/sec) Duty assist	2	$ 10,000	$ 20,000
UPS for UV	UPS - for management of brown outs 30min	1	$ 3,000	$ 3,000
Pressure Transducer	For monitoring pressure across cartridges	3	$ 500	$ 1,500
Turbiditmeter	For treated water	1	$ 7,000	$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
Pipes, valves and fittings	50 to 100 mm	1	$ 10,000	$ 10,000
Water Treatment Plant Building	40ft Containter (incl pad & modification - cedar cladding, insulation)	1	$ 30,000	$ 30,000
Fencing		1	$ 8,000	$ 8,000
Landscaping/Access	Landscaping/ Access Road	1	$ 10,000	$ 10,000
Tree Clearing	allowance	1	$ 10,000	$ 10,000
Telemetry	RTU and Aerial, programming etc	1	$ 10,000	$ 10,000
Electrical and Switchboard		1	$ 40,000	$ 40,000
Power Upgrade	power to new site - transformer on property- network Waitaki	1	$ 16,600	$ 16,600
	High voltage line to site - overhead power	20	$ 60	$ 1,200
Installation and Construction		25%	$ 188,400	$ 47,100
SUBTOTAL Treatment				***$ 235,500***
Reticulation				
Hydrovar Pump set (12 L/sec at 50m)	Lowara Twin Pac Dual 15SV06F055T5.5 KW	1	$ 11,000	$ 11,000
Flow meter	DN80 yokogawa mag flowmeter	1	$ 4,600	$ 4,600
WTP to Retic	DN150 PVC o	80	$ 150	$ 12,000
Installation and Construction		25%	$ 27,600	$ 6,900
SUBTOTAL Reticulation				***$ 34,500***
Storage				
Storage (operational and emergency)	30,000 L tanks with fittings (operational and emergency -287m3)	10	$ 6,000	$ 60,000
Telemetry (to talk to pumps and provide data, alarms)	RTU and aerial, pole, solar panel, battery and repeater	1	$ 15,000	$ 15,000
Pipework	Allowance for pipework	1	$ 15,000	$ 15,000
Installation and Construction		25%	$ 90,000	$ 22,500
SUBTOTAL Storage				***112,500***
Fire Protection				
Fire Tanks	30,000 L tanks with fittings	2	$ 6,000	$ 12,000
Additional Generator Cost	increase in size of generator for Fire pump	1	$ 6,000	$ 6,000
Fire Pump		*1*	$ 19,000	$ 19,000
Installation and Construction		25%	$ 37,000	$ 9,250
SUBTOTAL Fire Protection				***46,250***
Add- ons				
Generator	30 KVA generator	1	20,500	$ 20,500
Installation and Construction		25%	$ 20,500	$ 5,125
SUBTOTAL Generator				***25,625***
SUBTOTAL				**586,435**
Preliminary and General		10%		58,644
Design		20%		117,287
Contingency		10%		58,644
Total Estimated Capital Cost:			**-**	**821,000**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour **(5** hours monthly)	60	$ 180	10,800
Labour	per hour (weekly visits for 5 hours) plus additional 4 hours /monthly to address issues with land owner	308	$ 70	21,560
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2,015	$ 0.4	806
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unit)	1.0	$ 433	433
Cartridges	per cartridge (assume monthly)	12	$ 500	6,000
Electricity for Retic Pumps	kWhr (assumes4kw pump operating at 1.5 L/sec for 12 hours per day)	17,520	0.3	5,256
SUBTOTAL				***$ 44,854.92***
Total Estimated Annual Operational Costs				**$ 44,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 440,800**
NPV Capital plus Operating Costs				**$ 1,261,800**

Option 9.2(i)a OD- New bores upgrading Option 8 (WTP & Storage behind Village with reticulation pumps) - ON DEMAND FLOW				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Additional Time to work with Landowner / public works act	New land area/landowners	1	$ 20,000	$ 20,000
ECAN Consent	consent to take groundwater	1	$ 25,000	$ 25,000
Bores drilling and headworks		2	$ 40,000	$ 80,000
Bore Pumps	2.8 L/sec at up to 30m allowed for	2	$ 2,500	$ 5,000
VFD	VFD for pumps	2	$ 3,500	$ 7,000
Raw water turbidimeter	Included in Option 9.1	0	$ 7,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Electrical and Control	Included but requires upgrade	1	$ 5,000	$ 5,000
Installation and Construction		25%	$ 122,000	$ 30,500
SUBTOTAL Source				***$ 172,500***
Water Treatment				
Filtration, UV, Building, Civil				
Cartridge	Included in Option 9.1	0	$ 8,250	$ -
Ultraviolet Disinfection	Included in Option 9.1	0	$ 10,000	$ -
UPS for UV	Included in Option 9.1	0	$ 3,000	$ -
Pressure Transducer	Included in Option 9.1	0	$ 500	$ -
Turbiditmeter	Included in Option 9.1	0	$ 7,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Pipes, valves and fittings	Included in Option 9.1	0	$ 10,000	$ -
Water Treatment Plant Building	Included in Option 9.1	0	$ 30,000	$ -
Fencing	Included in Option 9.1 but requires upgrade	1	$ 2,500	$ 2,500
Landscaping/Access	Included in Option 9.1	0	$ 10,000	$ -
Tree Clearing	Included in Option 9.1 but requires upgrade	1	$ 5,000	$ 5,000
Telemetry	Included in Option 9.1	0	$ 10,000	$ -
Electrical and Switchboard	Included in Option 9.1 but requires upgrade	1	$ 5,000	$ 5,000
Power Upgrade	Included in Option 9.1	0	$ 16,600	$ -
	Included in Option 9.1	0	$ 60	$ -
Installation and Construction		25%	$ 12,500	$ 3,125
SUBTOTAL Treatment				***$ 15,625***
Reticulation				
Hydrovar Pump set (12 L/sec at 50m)	Included in Option 9.1	0	$ 11,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Bores to WTP	DN100 PVC/PE - 50m to each bore	100	$ 150	$ 15,000
WTP to Retic	Included in Option 9.1	0	$ 150	$ -
Installation and Construction		25%	$ 15,000	$ 3,750
SUBTOTAL Reticulation				***$ 18,750***
Storage				
Storage (operational and emergency)	Included in Option 9.1	0	$ 6,000	$ -
Pipework	Included in Option 9.1	0	$ 15,000	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Storage				***-***
Fire Protection				
Fire Tanks	Included in Option 9.1	0	$ 6,000	$ -
Additional Generator Cost	Included in Option 9.1	0	$ 6,000	$ -
Fire Pump	Included in Option 9.1	*0*	$ 19,000	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Fire Protection				***-***
Add- ons				
Generator	Included in Option 9.1	0	20,500	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Generator				***-***
SUBTOTAL				**206,875**
Preliminary and General		10%		20,688
Design		20%		41,375
Contingency		10%		20,688
Total Estimated Capital Cost:			**-**	**289,600**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour **(5** hours monthly)	60	$ 180	10,800
Labour	per hour (weekly visits for 5 hours) plus additional 4 hours /monthly to address issues with land owner	308	$ 70	21,560
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2,015	$ 0.4	806
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unit)	1.0	$ 433	433
Cartridges	per cartridge (assume quarterly)	4	$ 500	2,000
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2 L/sec)	5,069	$ 0.4	2,028
Electricity for Retic Pumps	kWhr (assumes4kw pump operating at 1.5 L/sec for 12 hours per day)	17,520	0.3	5,256
SUBTOTAL				***$ 42,882.70***
Total Estimated Annual Operational Costs				**$ 42,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 421,200**
NPV Capital plus Operating Costs				**$ 710,800**

Option 9.2(i)a OD- New bores upgrading Option 8 (WTP & Storage behind Village with reticulation pumps) - ON DEMAND FLOW				
Description	**Unit**	**Quantity**	**Rate**	**Cost**
Source Water				
Additional Time to work with Landowner / public works act	New land area/landowners	1	$ 20,000	$ 20,000
ECAN Consent	consent to take groundwater	1	$ 25,000	$ 25,000
Bores drilling and headworks		1	$ 40,000	$ 40,000
Bore Pumps	2.8 L/sec at up to 30m allowed for	1	$ 2,500	$ 2,500
VFD	VFD for pumps	1	$ 3,500	$ 3,500
Raw water turbidimeter	Included in Option 9.1	0	$ 7,000	$ -
Flow meter	New to measure bore flow	1	$ 4,600	$ 4,600
Electrical and Control	Included but requires upgrade	1	$ 5,000	$ 5,000
Installation and Construction		25%	$ 80,600	$ 20,150
SUBTOTAL Source				***$ 120,750***
Water Treatment				
Filtration, UV, Building, Civil				
Cartridge	Included in Option 9.1	0	$ 8,250	$ -
Ultraviolet Disinfection	Included in Option 9.1	0	$ 10,000	$ -
UPS for UV	Included in Option 9.1	0	$ 3,000	$ -
Pressure Transducer	Included in Option 9.1	0	$ 500	$ -
Turbiditmeter	Included in Option 9.1	0	$ 7,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Pipes, valves and fittings	Included in Option 9.1	0	$ 10,000	$ -
Water Treatment Plant Building	Included in Option 9.1	0	$ 30,000	$ -
Fencing	Included in Option 9.1 but requires upgrade	1	$ 2,500	$ 2,500
Landscaping/Access	Included in Option 9.1	0	$ 10,000	$ -
Tree Clearing	Included in Option 9.1 but requires upgrade	1	$ 5,000	$ 5,000
Telemetry	Included in Option 9.1	0	$ 10,000	$ -
Electrical and Switchboard	Included in Option 9.1 but requires upgrade	1	$ 5,000	$ 5,000
Power Upgrade	Included in Option 9.1	0	$ 16,600	$ -
	Included in Option 9.1	0	$ 60	$ -
Installation and Construction		25%	$ 12,500	$ 3,125
SUBTOTAL Treatment				***$ 15,625***
Reticulation				
Hydrovar Pump set (12 L/sec at 50m)	Included in Option 9.1	0	$ 11,000	$ -
Flow meter	Included in Option 9.1	0	$ 4,600	$ -
Bores to WTP	DN100 PVC/PE - 50m to each bore	100	$ 150	$ 15,000
WTP to Retic	Included in Option 9.1	0	$ 150	$ -
Installation and Construction		25%	$ 15,000	$ 3,750
SUBTOTAL Reticulation				***$ 18,750***
Storage				
Storage (operational and emergency)	Included in Option 9.1	0	$ 6,000	$ -
Pipework	Included in Option 9.1	0	$ 15,000	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Storage				**-**
Fire Protection				
Fire Tanks	Included in Option 9.1	0	$ 6,000	$ -
Additional Generator Cost	Included in Option 9.1	0	$ 6,000	$ -
Fire Pump	Included in Option 9.1	*0*	$ 19,000	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Fire Protection				**-**
Add- ons				
Generator	Included in Option 9.1	0	20,500	$ -
Installation and Construction		25%	$ -	$ -
SUBTOTAL Generator				**-**
SUBTOTAL				**155,125**
Preliminary and General		10%		15,513
Design		20%		31,025
Contingency		10%		15,513
Total Estimated Capital Cost:			**-**	**217,200**
Annual Operational Costs	*assumed average daily flow (m3/day)*	*50*		
Compliance and Management	per hour **(5** hours monthly)	60	$ 180	10,800
Labour	per hour (weekly visits for 5 hours) plus additional 4 hours /monthly to address issues with land owner	308	$ 70	21,560
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2,015	$ 0.4	806
Lamp Replacement	Assumes yearly reaplacement of 1 lamp (1 lamp per unit)	1.0	$ 433	433
Cartridges	per cartridge (assume quarterly)	4	$ 500	2,000
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2 L/sec)	5,069	$ 0.4	2,028
Electricity for Retic Pumps	kWhr (assumes4kw pump operating at 1.5 L/sec for 12 hours per day)	17,520	0.3	5,256
SUBTOTAL				***$ 42,882.70***
Total Estimated Annual Operational Costs				**$ 42,900**
NPV of Operating Costs (20 yr @ 8%)				**$ 421,200**
NPV Capital plus Operating Costs				**$ 638,400**