

MEMORANDUM

TO:	Waitaki District Council	Job No.:	000442
ATTENTION:	Michael Goldingham	Date:	18 th January 2019
FROM:	Melanie Stevenson	Page 1 of 16	
SUBJECT:	Ohau Water Supply Upgrade – Further Options (DRAFT)	Reference:	<i>MEMO 19-01-16 Mks 000442</i>

1.0 Introduction

This memorandum is in response to a request from the Waitaki District Council to provide comment and costs on additional options for upgrading the Ohau Water Supply. These options have been requested by some of the property owners in Ohau Village. It should be noted that while these options were considered during preliminary investigations, they were discounted early on due to issues of expected costs and land access.

This memorandum also provides comment on other concerns, including:

- the effect of chlorine on polybutylene pipe and hot water cylinders
- the Local Govt Act and undertaking construction works on private land

2.0 Options

Subsequent to the Ohau Community meeting held on 3rd January 2019, there has been a request to provide costs of options that utilise the existing water source and maintain a gravity supply of water to Ohau Village.

Three options have been identified (in addition to those provided in the Ohau Alpine Village Water Supply Issues and Options Report [August 2018]). These are:

- Option 3 - Utilise existing source and treat with microfiltration (membrane) and new storage (with and without chlorine)
- Option 4 – Utilise existing source with selective abstraction, add raw water storage and treat water with bag and cartridge filtration followed by ultraviolet disinfection (with and without chlorine) and new treated water storage
- Option 5 – New bores located near existing intake, treat water with cartridge filtration and ultraviolet disinfection, and add new storage (with and without chlorine).

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

2.1 Option 3: Utilise existing source and treat with microfiltration (membrane) and new storage (with and without chlorine)

2.1.1 Description

This option is for the utilisation of the existing source water, a new membrane treatment plant and new storage. The water treatment plant and storage would be located near the existing storage tanks to ensure adequate gravity pressure above Ohau Village as shown in Figure 2.1.

This option can only be constructed for restricted flow conditions due to the limited quantity of water available from the existing source, unless the intake is upgraded and new consents are obtained.

Works required are:

- Upgrade access road to provide all weather access to new plant
- New transformer and power line to site
- Construction of a waste system to handle backwash water from membrane and chemical waste from plant. A backwash pond, CIP holding tank and neutralisation system will be required. At this stage we have allowed for a pond for settling out sludge with the supernatant to go to ground. This would require resource consent.
- Fencing around intake – the area of water supply protection zone could likely be reduce to the level of treatment in place.
- Fencing around WTP site
- New storage tanks to store treated water – to replace existing storage that is in poor condition

The membrane system can be containerised with the chlorine disinfection installed in a small concrete shed.

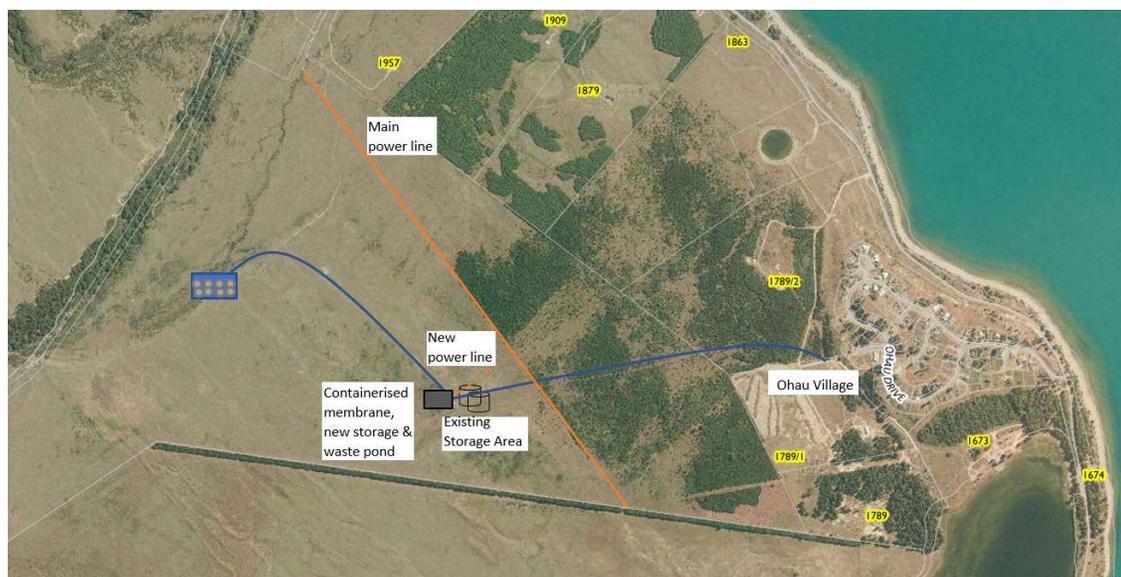


Figure 2.1: Schematic of Proposed Option 3

2.1.2 Cost Estimate

Estimated costs for Option 3 scenarios are provided in the table below. More detailed costing is attached.

Table 2.1: Preliminary Cost Estimates for Option 3, with and without Chlorine Disinfection, for Restricted Flows only.

Description	Existing source, membrane treatment, new storage at WTP	Existing source, membrane and CHLORINE treatment, new storage at WTP
	Restricted	Restricted
	Option 3 a - R	Option 3 b - R
Source	145,600	145,600
Treatment	659,360	729,660
Reticulation	-	-
Storage	87,880	87,880
Fire Protection	11,700	11,700
Generator	-	-
P&G, Design and Contingency	361,800	389,900
Capital cost	1,266,400	1,364,800
Annual Cost	53,200	53,400
NPV 20 years at 8%	1,788,700	1,889,100

2.1.3 Pros and Cons

Pros and Cons for Option 3 are:

Pros

- Elevated storage provides a fire supply during power outage without the need for a generator (if properties are on a restricted supply the benefits of elevated storage cannot be taken advantage of).
- The WTP cannot be seen from the village.
- The treatment process is robust and can treat water of variable quality.
- The likely water protection zone and associated fencing requirements can be reduced due to the level of treatment.
- The membrane system can be containerised so is relatively simple to construct. Adding chlorine later is relatively simple with the installation of a standard concrete water shed.

Cons

- This is a change to infrastructure on private land and will require landowner permissions, and likely compensation to the owner. The owners are not in favour of infrastructure on their land and with alternative options available, approval to proceed with this option is likely to end in legal action, with unknown and possibly significant costs and delays.

- The WTP and storage is on a remote site so there will be additional operational cost with travel time to site and ensuring adequate notice is given.
- Membrane processes are complex and require chemical cleaning. Backwash water and chemical cleaning water needs to be disposed of.
- The existing source is subject to drought conditions and can run out of water.
- The resource consent and probable yield of the existing source is for 2.2 L/sec and this option is only available for restricted flows. If the yield is to increase, it is likely that a new intake would need to be constructed at additional cost and a new consent. This has not been allowed for in the cost estimate above.

2.2 Option 4: Utilise existing source with selective abstraction, add raw water storage and treat water with cartridge filtration and Ultraviolet Disinfection (with and without chlorine)

2.2.1 Description

This option is for the utilisation of the existing source water and installing a large raw water reservoir to allow for selective abstraction. An actuated valve and turbidimeter would allow the supply to be shut down when turbidity exceeded a set turbidity of 1 or 2 NTU. Treatment will then be based around a bag filter, cartridge filtration and ultraviolet disinfection. The water treatment plant and storage would be located near the existing storage tanks to ensure adequate gravity pressure above Ohau Village as shown in Figure 2.2.

This option can only be constructed for restricted flow conditions due to the limited quantity of water available from the existing source, unless the intake is upgraded and new consents are obtained.

Online turbidity monitoring of the raw water should be performed to assess whether this option is viable.

Works required are:

- New 1,200m³ raw water storage tank (steel tank with liner allowed for)
- Upgrade access road to provide all weather access to new plant
- New transformer and power line to site
- Fencing around 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.
- New storage tanks to store treated water – to replace existing storage that is in poor condition
- New WTP with bag and cartridge filtration and UV with allowance for chlorine.
- Fencing around WTP site

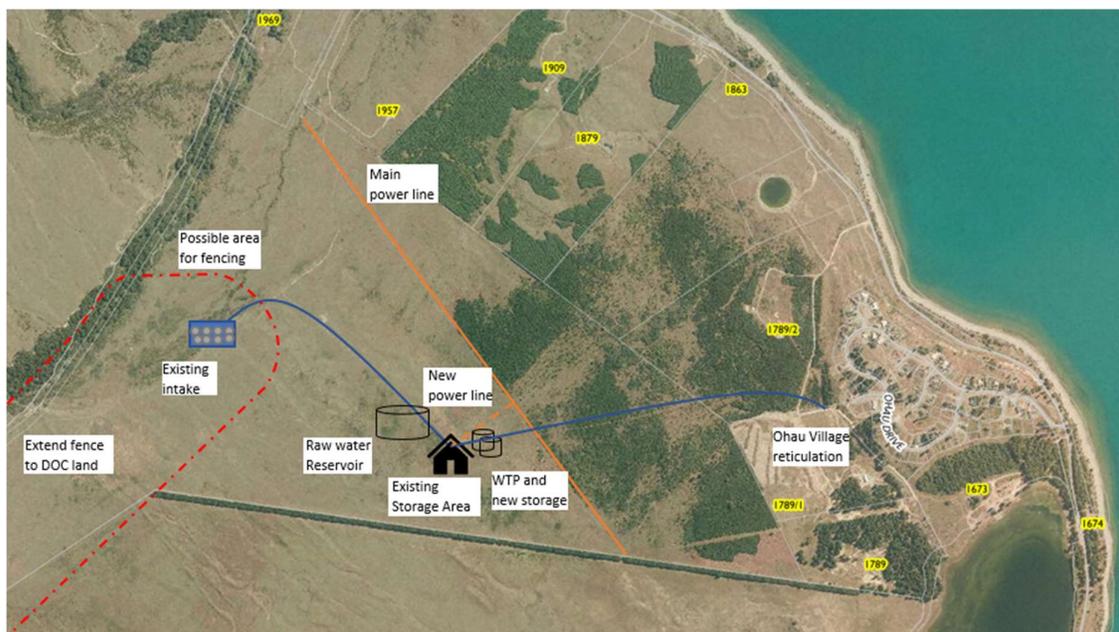


Figure 2.2: Schematic of proposed Option 4

2.2.2 Cost Estimate

Estimated costs for Option 4 scenarios are provided in the table below. More detailed costing is attached.

Table 2.2: Preliminary Cost Estimates for Option 4, with and without Chlorine Disinfection, for Restricted Flows only.

Description	Existing source, selective abstraction, treatment (bag, cartridge, UV), new storage at WTP	Existing source, selective abstraction, treatment (bag, cartridge, UV & CHLORINE), new storage at WTP
	Restricted	Restricted
	Option 4 a - R	Option 4 b - R
Source	217,100	217,100
Treatment	707,694	764,958
Reticulation	-	-
Storage	87,880	87,880
Fire Protection	11,700	11,700
Generator	-	-
P&G, Design and Contingency	409,700	432,700
Capital cost	1,434,100	1,514,300
Annual Cost	46,600	46,700
NPV 20 years at 8%	1,891,600	1,972,800

2.2.3 Pros and Cons

Pros and Cons for Option 4 are:

Pros

- Elevated storage provides a fire supply during power outage without the need for a generator (if properties are on a restricted supply the benefits of elevated storage cannot be taken advantage of).
- The WTP cannot be seen from the village.
- Raw water storage available for drought or intake maintenance

Cons

- This is a change to infrastructure on private land and will require landowner permissions, and likely compensation to the owner. The owners are not in favour of infrastructure on their land and with alternative options available, approval to proceed with this option is likely to end in legal action, with unknown and possibly significant costs and delays.
- The WTP and storage is on a remote site so there will be additional operational cost with travel time to site and ensuring adequate notice is given.
- During times of extended heavy rainfall/snow melt, the raw water storage may not be adequate to cover the extent of the event. This may result in dirty water entering the treatment process and blocking the filters.
- A large catchment area will need to be fenced off to prevent livestock entering protection zone (if the owner wants to utilise the land for this purpose).
- The existing source is subject to drought conditions and can run out of water.
- The resource consent and probable yield of the existing source is for 2.2 L/sec and this option is only available for restricted flows. If the yield is to increase, it is likely that a new intake would need to be constructed at additional cost and a new consent. This has not been allowed for in the cost estimate above.

2.3 Option 5: New bore supply near existing source with cartridge filtration and Ultraviolet Disinfection (with and without chlorine)

2.3.1 Description

This option is for the development of new bores near the existing source water, and a new WTP and new storage at the current intake as shown in Figure 2.3. To provide adequate fire flow, the pipeline from the new storage tanks to the location of the existing storage tanks would need to be upgraded to a DN150.

This option can be constructed for restricted and on-demand flow conditions provided there is adequate yield from the new bores.

Works required are:

- New bores near existing intake
- Upgrade access road to provide all weather access to new bores and plant

- New transformer and power line to site
- Fencing around intake to protect area from any livestock – this area needs to be confirmed based on advice from a Hydrogeologist but is may be up to 1km upstream of bore.
- New WTP with cartridge filtration and UV and allowance for chlorine.
- Fencing around WTP site.
- New storage tanks to store treated water – to replace existing storage that is in poor condition
- Upgrade 750m of DN100 to DN150 supply pipe from existing intake to existing storage. This is to allow adequate fire flow.

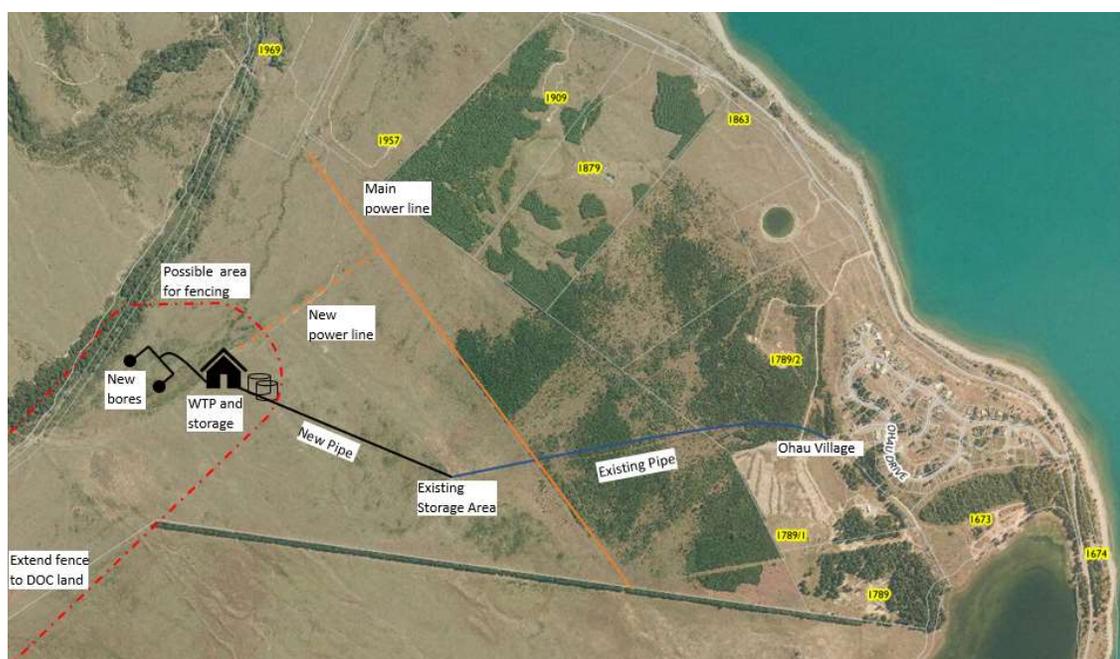


Figure 2.3: Schematic of proposed option 5

2.3.2 Cost Estimate

Estimated costs for Option 5 scenarios are provided in the table below. More detailed costing is attached.

Table 2.3: Preliminary Cost Estimates for Option 5, with and without Chlorine Disinfection, for Restricted and On-demand Flows.

Description	Bore at creek, treatment (cartridge, UV), new storage located at source		Bore at creek, treatment (cartridge, UV & CHLORINE), new storage located at source	
	Restricted	On Demand	Restricted	On Demand
	Option 5 a - R	Option 5 a - OD	Option 5 b - R	Option 5 b - OD
Source	341,120.00	342,160	341,120	342,160
Treatment	490,334	500,760	547,598	558,024
Reticulation	-	-	-	-
Storage	94,380	137,280	94,380	137,280
Fire Protection	153,900	196,560	153,900	196,560
Generator	-	-	-	-
P&G, Design and Contingency	431,900	470,700	454,800	493,600
Capital cost	1,511,600	1,647,500	1,591,800	1,727,600
Annual Cost	43,500	43,500	43,700	43,700
NPV 20 years at 8%	1,938,700	2,074,600	2,020,800	2,156,600

2.3.3 Pros and Cons

Pros and Cons for Option 5 are:

Pros

- Elevated storage provides supply during power outage without the need for a generator.
- The WTP cannot be seen from the village.
- Water yield is likely to be more than existing supply so can provide protection against drought and meet on-demand flow scenarios if the community requires.
- Bore supply is often cleaner and more consistent resulting in less complex treatment systems.

Cons

- This is a change to infrastructure on private land and will require landowner permissions, and likely compensation to the owner. The owners are not in favour of infrastructure on their land and with alternative options available, approval to proceed with this option is likely to end in legal action, with unknown and possibly significant costs and delays.
- The WTP and storage is on a remote site so there will be additional operational cost with travel time to site and ensuring adequate notice is given.

- A large catchment area will need to be fenced off to prevent livestock entering protection zone (if the owner want to utilise the land for this purpose).
- During times of extended heavy rainfall/snow melt, the bores may suffer from elevated turbidity which may result in dirty water entering the treatment process and blocking the filters.

2.4 Other Cost Information

2.4.1 Power Upgrade Cost

Cost estimates for supplying power to a new site were obtained from Network Waitaki. For a Three phase 30kVApower supply to site the base costs are as follows:

For transformer on pole, capacity levy and fuse box = \$16,560
 Cost per meter from main power line (underground) = \$180/m
 Cost per meter from main line (overhead) = \$60/m

Any lines installed within private land would need to be underground.

The above data can be used an indication of costs for locating water treatment plants elsewhere.

2.4.2 Changing On-demand to Restricted Connections

There are estimated to be 34 properties with on-demand connections. These would need to be converted to a restricted connection requiring:

- Restrictor at manifold
- 3,000L PE tank
- Domestic pump
- Interconnecting pipework and electrical connection of pump.

A cost estimate for this work (if completed as one project) is:

Table 2.4: Preliminary Cost Estimates for Converting On-demand Connections to Restricted Connections

Item	Quantity	Cost	Total Cost
3000L tank	34	\$ 1,300	\$ 44,200
Pump 1L/s VFD	34	\$ 2,000	\$ 68,000
Plumbing	34	\$ 1,000	\$ 34,000
Electrical connection	34	\$ 1,200	\$ 40,800
Civil works misc.	25%	\$ 1,400	\$ 46,750
SUBTOTAL		\$ 6,900	\$ 233,750
P&G, Design & Contingency	40%	\$ 2,800	\$ 93,500
Total		\$ 9,700	\$ 327,250

Please note that these costs are in addition to all restricted options.

3.0 Summary of Options

For comparison, Table 3.1 and Figure 3.1 below summarises the various options presented in this memorandum and also in the Issues and Options Report, dated August 2018.

Table 3.1: Summary of All Options Presented with Corresponding Preliminary Cost Estimates

Option	Description	Option Code	Chlorine Disinfect	Flow Type	Cost		
					Capital	Operational	NPV
1	New bores and water treatment plant adjacent lake. Elevated storage in current location	1a-R	No	Restricted	919,900	38,200	1,294,900
		1a-OD	No	On-demand	1,045,700	38,200	1,420,700
		1b-R	Yes	Restricted	1,119,500	38,400	1,496,500
		1b-OD	Yes	On-demand	1,250,900	38,400	1,627,900
2	New bores, water treatment plant and storage with reticulation pumps adjacent lake	2a-R	No	Restricted	964,000	33,000	1,288,000
		2a-OD	No	On-demand	1,089,600	36,400	1,447,000
		2b-R	Yes	Restricted	1,044,800	33,200	1,370,800
		2b-OD	Yes	On-demand	1,172,800	36,500	1,531,200
3	Existing source, membrane filtration and storage at existing storage area	3a-R	No	Restricted	1,266,400	53,200	1,788,700
		3b-R	Yes	Restricted	1,364,800	53,200	1,889,100
4	Existing source with selective abstraction, water treatment plant and storage at existing storage area	4a-R	No	Restricted	1,434,100	46,600	1,891,600
		4b-R	Yes	Restricted	1,514,300	46,700	1,972,800
5	New bores, water treatment plant and storage at source	5a-R	No	Restricted	1,511,600	43,500	1,938,700
		5a-OD	No	On-demand	1,647,500	43,500	2,074,600
		5b-R	Yes	Restricted	1,591,800	43,700	2,020,800
		5b-OD	Yes	On-demand	1,727,600	43,700	2,156,600

Key
 R = Restricted Flow OD = On-demand Flow
 a = Without Chlorine Disinfection b = With Chlorine Disinfection

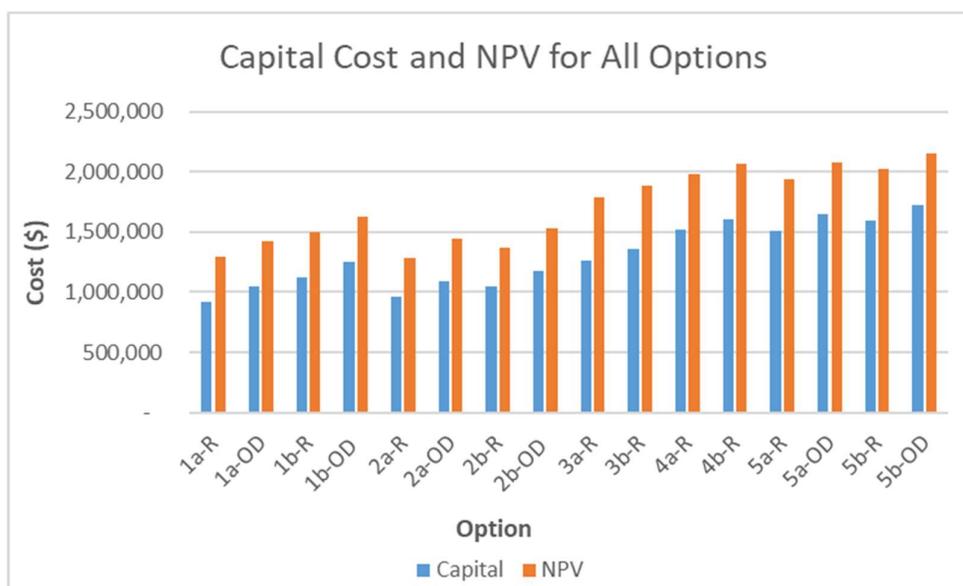


Figure 3.1: Graph Comparing Capital and NPV Costs for All Options Presented

As can be seen from the table and graph above Options 3,4 and 5 are more expensive than Option 1 and 2. Option 3, using the existing source with membrane treatment moderately cheaper than other options presented in this memorandum. This is because the membrane process will likely require less fencing around the intake, there is no need for extensive changes to pipework and building costs will be less as the membrane is containerised.

4.0 Other Relevant Information

This section below provides commentary on other issues that have been highlighted following community consultation:

4.1 Chlorine Effect on Polybutylene Pipes and Hot Water Cylinders

A property owner from the Ohau Village has raised concerns about the effect of chlorine on polybutylene pipes and on hot water cylinders.

A brief literature review has been undertaken and is summarised below:

Polybutylene - while scientific evidence is scarce, it is believed that oxidants in the public water supplies, such as chlorine, react with the polybutylene piping and fittings causing them to scale and flake and become brittle. Polybutylene piping is not suitable for swimming pool piping systems, or where more than 2 ppm of chlorine (free residual) will be routinely encountered. A good summary can be found here:

<http://www.okvalleyinspector.ca/reports/polyb.pdf>

As a general comment, there are a significant number of homes in metropolitan areas of New Zealand with polybutylene pipes who are exposed to chlorinated supplies and failure of these pipes is not a problem. We spoke with a Dunedin plumber who said failure of these pipes is mostly attributed to poor installation rather than scaling and becoming brittle.

Copper Hot Water Cylinders

Adding chlorine to drinking water will increase the corrosion of copper and iron in the system, however, provided the pH of the water is between 7.0 and 8, and the free chlorine is less than about 2 mg l⁻¹ only minor corrosion of copper will occur. Ref:

<https://www.sciencedirect.com/science/article/abs/pii/S0043135482900938>

The existing source has a pH averaging 6.8 and is already considered corrosive. A ground water source near Lake Ohau is likely to be similar to this however it is recommended that testing of the lake water is completed. pH control could be added to the water supply system by dosing soda ash, or using an akdolit filter if required. This can be addressed during detailed design.

4.2 Installing New Infrastructure on Private land

The existing intake, storage and connecting pipework is on private land and there is an easement in place.

Although we have not sighted the wording of the easement, any significant changes to the infrastructure will require disruption to the land, permission from the landowner and changes to the easement to incorporate the extent and purpose of the new infrastructure. It is known that the landowners do not want the new water infrastructure on their land so the Council would likely need to initiate procedures using the Local Government Act 2002 and the Public Works Act, which allow for public works to be carried out on private land.

Key Extracts from the Acts are detailed below:

4.2.1 Public Works Act

Section 197: Minister may construct and maintain water supply works

- 1) The Minister is hereby empowered to investigate, design, construct, maintain, or control any water supply works which are proposed to be constructed, or which have been constructed wholly or partly, out of money appropriated by Parliament for the purpose, as part of an irrigation scheme.
- 2) The Minister has, in respect of water supply works to which subsection (1) applies, **all the powers, rights, duties, and authorities conferred, in respect of water supply works, upon a territorial authority under the Local Government Act 2002**; except that in any case where a resolution is required it may be made by the Minister in writing under his or her hand and published in the Gazette.

4.2.2 Local Government Act

Construction of works

Section 181 Construction of works on private land

- 1) A local authority may construct works on or under private land or under a building on private land that it considers necessary for—
 - (a) the supply by territorial authorities of water by means of reticulated systems:
- 2) A local authority or a territorial authority, as the case may be, must not exercise the power in subsection (1) or subsection (2) unless it has—
 - (a) **the prior written consent of the owner of the land to the construction of the work; or**
 - (b) **complied with the requirements of Schedule 12.**
- 3) A local authority may enter the land to inspect, alter, renew, repair, or clean any work constructed under this section or under the corresponding provision of a former Act.
- 4) The power in subsection (4) must not be exercised without first giving reasonable notice of the intention to enter the land to the owner and occupier (if any).
- 5) This section applies subject to the Public Works Act 1981 as to compensation for injurious affection to land.

Schedule 12

Conditions of constructing or undertaking works on private land without the owner's consent

Section 181(3)(b)

- 1) For the purposes of section 181(3)(b), the requirements are as follows:
 - a) a description of the works, accompanied by a plan (in the case of any works to be constructed), showing how they affect any land or building, must be deposited for public inspection at a place within the district in which the works are to be undertaken:
 - b) the territorial authority must give notice in writing of the intention to construct the works (referring to a plan and description of the works and where the plan and description can be viewed)—
 - i. to the occupier of the land or building unless there is no occupier
 - ii. or, after all reasonable steps have been taken, the occupier cannot be found; and to the owner if known:
 - c) however, if there is a change of occupier, it is not necessary to give notice to however any subsequent occupier before the work is done:
 - d) if, within 1 month after the notice is given, the occupier or owner serves on the territorial authority a written objection to the proposed works, the territorial authority must—
 - i. appoint a day for hearing the objection; and
 - ii. give to the objector reasonable notice of the day, time, and place of hearing so as to enable the objector to attend the hearing:
 - e) the territorial authority must hold a meeting on the day appointed, and may, after hearing any person making any objection, if present, determine—
 - i. to abandon the works proposed; or
 - ii. to proceed with the works proposed, with or without any alterations that the territorial authority thinks fit.

- 2) **A person who is aggrieved by a determination of the territorial authority under clause 1(e) to proceed with the works proposed (with or without alterations) may appeal to the District Court against the determination within 14 days after the date of the determination.**

- 3) Pending the decision of the court on the appeal, the territorial authority must not proceed with the works.

- 4) On the hearing of the appeal, the court, whose decision is final, may confirm or amend or set aside the determination of the territorial authority.

4.2.3 Summary Comment

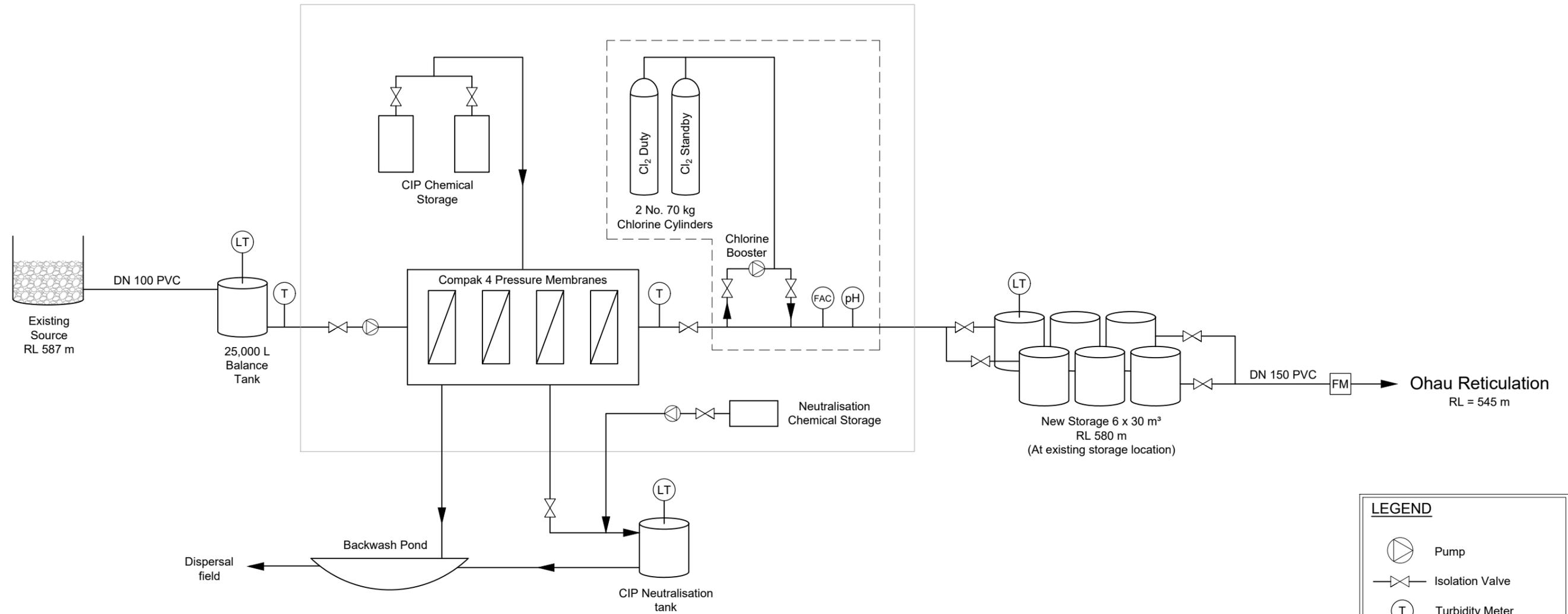
While the Local Govt Act and Public Works Act provide the Council with the ability to undertake public works in private land, there are procedures in place for appeal from the land owner and the final decision ends with the Minister, under the Public Works Act. With

alternative and more cost effective options available to Council, there is a likelihood that the works would not be allowed to proceed.

APPENDIX 1
Process Flow Diagrams

Water Treatment Plant/Container

At Existing storage location
RL 580 m



LEGEND	
	Pump
	Isolation Valve
	Turbidity Meter
	pH Sensor
	Pressure Transducer
	Level Transducer
	Free Available Chlorine
	Flow Meter

Revision	App	Date	Approved	MS	Jan '19
A	Concept Design	MS 17/01/19	Reviewed	MS	Jan '19
			Designed	FG	Jan '19
			Drawn	JP	Jan '19
			Reviewed	MS	Jan '19
			Approved	MS	Jan '19

Level 2, Burns House, 10 George Street PO Box 5240, Dunedin 9058 T: 03 929 1263 E: office@fluentsolutions.co.nz

Client

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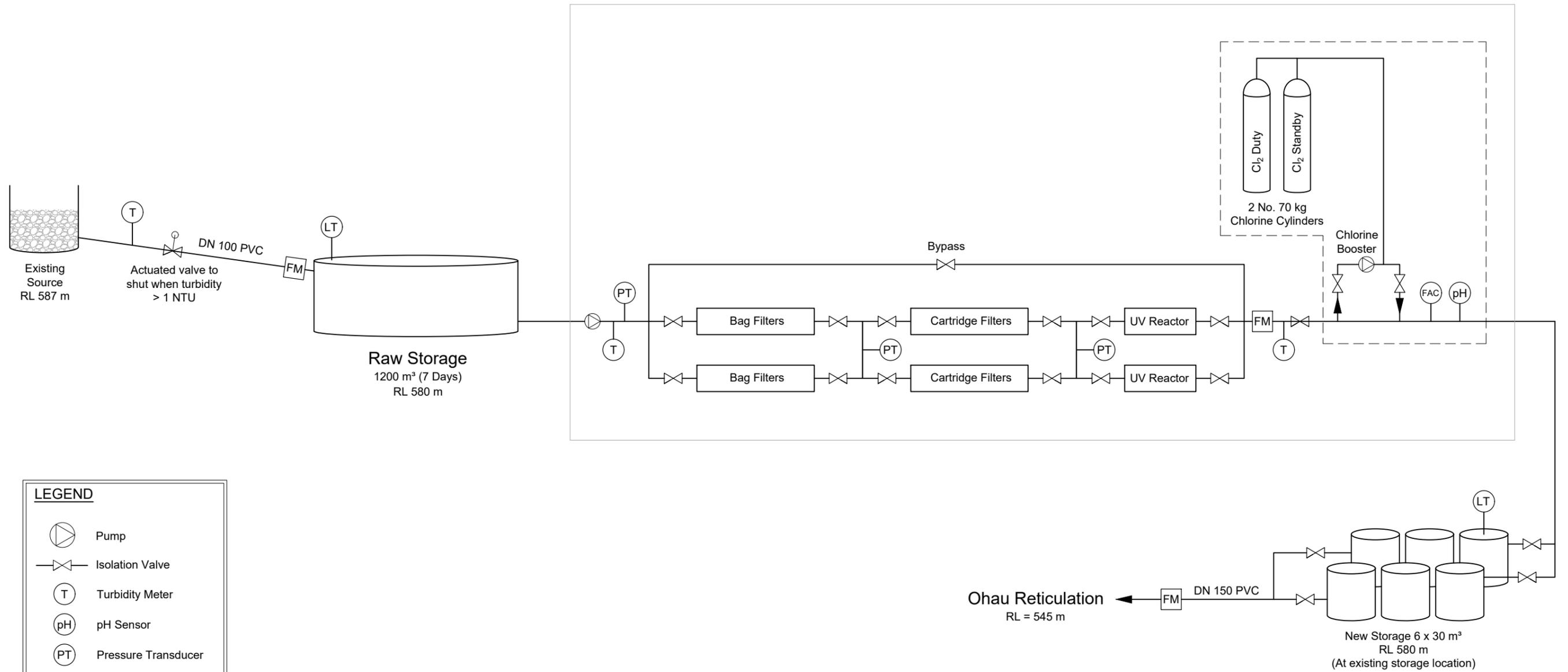
Project Title
Ohau Alpine Village Water Supply

Sheet Title
Process Flow Diagram Option 3 Existing Source With Membrane Treatment

Scale (A1 Original)	NTS	
Issue	Concept Design	
Project No	Sheet	Revision
000442	P03	A

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Water Treatment Plant
At existing storage tank area
RL 580 m



LEGEND	
	Pump
	Isolation Valve
	Turbidity Meter
	pH Sensor
	Pressure Transducer
	Level Transducer
	Free Available Chlorine
	Flow Meter
	Actuator Valve

Revision	App	Date	Approved	MS	Jan '19
A	Concept Design	MS 17/01/19	Designed	FG	Jan '19
			Drawn	JP	Jan '19
			Reviewed	MS	Jan '19
			Approved	MS	Jan '19

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Fluent SOLUTIONS

Level 2, Burns House, 10 George Street
PO Box 5240, Dunedin 9058
T: 03 929 1263
E: office@fluentsolutions.co.nz

Client

Waitaki
DISTRICT COUNCIL
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Project Title

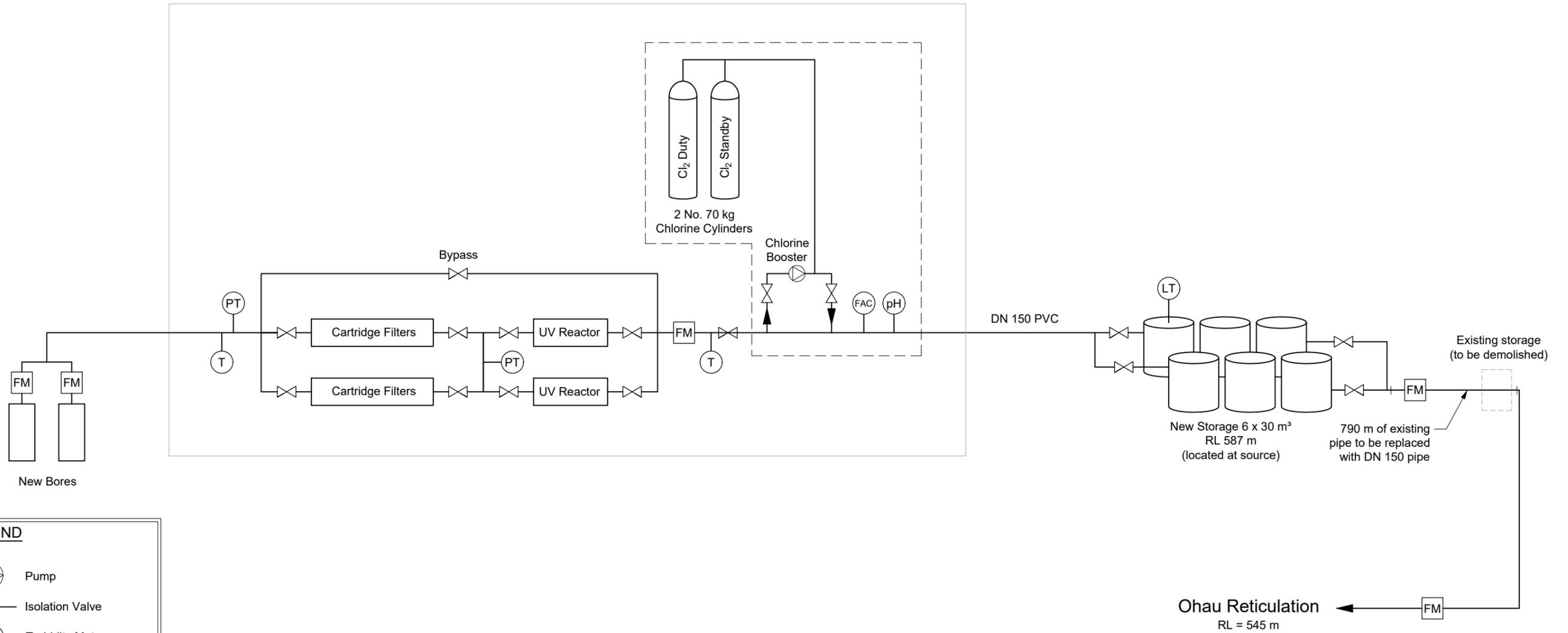
Ohau Alpine Village Water Supply

Sheet Title

Process Flow Diagram Option 4 Existing Source Selective Abstraction

Scale (A1 Original)	NTS	
Issue	Concept Design	
Project No	Sheet	Revision
000442	P04	A

Water Treatment Plant
 Located at source
 RL 587 m



LEGEND

	Pump
	Isolation Valve
	Turbidity Meter
	pH Sensor
	Pressure Transducer
	Level Transducer
	Free Available Chlorine
	Flow Meter
	Actuator Valve

Revision	App	Date	Approved	MS	Jan '19
A	Concept Design	MS 17/01/19	Surveyed -	Designed FG	Jan '19
			Drawn JP	Reviewed MS	Jan '19
			Approved MS		Jan '19

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Fluent SOLUTIONS

Level 2, Burns House, 10 George Street
 PO Box 5240, Dunedin 9058

T: 03 929 1263
 E: office@fluentsolutions.co.nz

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Project Title

Ohau Alpine Village
 Water Supply

Sheet Title

Process Flow Diagram
 Option 5
 New Bores near existing
 source - with WTP

Scale (A1 Original)	NTS	
Issue	Concept Design	
Project No	Sheet	Revision
000442	P05	A

APPENDIX 2
Detailed Cost Estimates

Option 3 a R - Existing source, membrane WTP and new storage at existing storage location - RESTRICTED FLOW				
Description	Unit	Quantity	Rate	Cost
Source Water				
Additional Time to work with Landowner /Local Government act		1	\$ 50,000	\$ 50,000
Compensation to Owner		1	\$ 50,000	\$ 50,000
Raw water turbidimeter	Hach 1720E	1	\$ 7,000	\$ 7,000
Improvements to intake - fencing	allowance	1	\$ 5,000	\$ 5,000
Installation and Construction		30%	\$ 112,000	\$ 33,600
SUBTOTAL				\$ 145,600
Water Treatment				
Membrane, Building, Civil				
Membrane Filtration package	CompPak 4	1	\$ 219,000	\$ 219,000
Backwash Pond Disposal	Disperse over land	1	\$ 15,000	\$ 15,000
Auxillary requirements for Containerised Membrane s	insulation, ancillary	1	\$ 10,000	\$ 10,000
CIP Holding tank and neutralisation	dosing to neutralise waste	1	\$ 15,000	\$ 15,000
Balance tank	1 x 25,000L tank (raw water)	1	\$ 6,000	\$ 6,000
Turbidimeter	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	\$ 20,000	\$ 20,000
Landscaping/fencing/Access	Landscaping/ Access Road	1	\$ 70,000	\$ 70,000
Telemetry	RTU and Aerial, programming etc	1	\$ 30,000	\$ 30,000
Electrical and Switchboard		1	\$ 40,000	\$ 40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$ 16,600	\$ 16,600
	High voltage line to site	300	\$ 180	\$ 54,000
Installation and Construction		30%	\$ 507,200	\$ 152,160
SUBTOTAL Treatment				\$ 659,360
Storage				
Replacement of existing tanks				
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600
New tanks	24 Hours emergency storage = 116m3	4.5	\$ 6,000	\$ 27,000
Pipework valving		1	\$ 10,000	\$ 10,000
Installation and Construction		30%	\$ 67,600	\$ 20,280
SUBTOTAL Storage				\$ 87,880
Fire Protection				
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000
Installation and Construction		30%	\$ 9,000	\$ 2,700
SUBTOTAL Fire Protection				\$ 11,700
Add-ons				
Generator	Not required for restricted flow - allow to bring in plug in generator			
SUBTOTAL				\$ 904,540
Preliminary and General		10%		90,454
Design		20%		180,908
Contingency		10%		90,454
Total Estimated Capital Cost:				\$ 1,266,400
Annual Operational Costs				
Compliance and Management	<i>assumed average daily flow (m3/day)</i> per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	50 66		11,880
Labour	per hour (weekly visits for 6 hours) plus additional 10 hours /monthly to address issues with land owner and membrane process - cleaning etc	432	70	30,240
Power	kWhr (assumes 2kw operating 24 hours per day)	17520.0	0.4	7,008
Membrane Replacement	assume 7 year replacement \$2875 for replacement (based on other pressure membranes)	1.0	1,642.9	1,600
Chemical Use	CIP / Neutralisation	1	2,000	2,000
Desludging		1	500	500
SUBTOTAL				\$ 53,200.00
Total Estimated Annual Operational Costs				\$ 53,200
NPV of Operating Costs (20 yr @ 8%)				\$ 522,300
NPV Capital plus Operating Costs				\$ 1,788,700

Option 3 a R - Existing source, membrane WTP and new storage at existing storage location - RESTRICTED FLOW				
Description	Unit	Quantity	Rate	Cost
Source Water				
Additional Time to work with Landowner /Local Government act		1	\$ 50,000	\$ 50,000
Compensation to Owner		1	\$ 50,000	\$ 50,000
Raw water turbidimeter	Hach 1720E	1	\$ 7,000	\$ 7,000
Improvements to intake - fencing	allowance	1	\$ 5,000	\$ 5,000
Installation and Construction		30%	\$ 112,000	\$ 33,600
SUBTOTAL				\$ 145,600
Water Treatment				
Membrane, Building, Civil				
Membrane Filtration package	ComPak 4	1	\$ 219,000	\$ 219,000
Backwash Pond Disposal	Disperse over land	1	\$ 15,000	\$ 15,000
Auxiliary requirements for Containerised Membrane s	insulation, ancillary	1	\$ 10,000	\$ 10,000
CIP Holding tank and neutralisation	dosing to neutralise waste	1	\$ 15,000	\$ 15,000
Balance tank	1 x 25,000L tank (raw water)	1	\$ 6,000	\$ 6,000
Turbidimeter	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	\$ 20,000	\$ 20,000
Landscaping/fencing/Access	Landscaping/ Access Road	1	\$ 70,000	\$ 70,000
Telemetry	RTU and Aerial, programming etc	1	\$ 30,000	\$ 30,000
Electrical and Switchboard		1	\$ 40,000	\$ 40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$ 16,600	\$ 16,600
	High voltage line to site	300	\$ 180	\$ 54,000
Installation and Construction		30%	\$ 507,200	\$ 152,160
SUBTOTAL				\$ 659,360
Chlorine Disinfection, Contact Time				
Chlorine Gas Dosing	Gas Cylinders and Dosing	1	\$ 30,749	\$ 30,749
Carry water Pump	Carry water Pump	1	\$ 2,000	\$ 2,000
Chlorine Analyser	MFC with Depolox 5	1	\$ 11,300	\$ 11,300
Shed		1	\$ 10,000	\$ 10,000
Installation and Construction		30%	\$ 54,049	\$ 16,215
SUBTOTAL				\$ 70,300
SUBTOTAL Treatment				\$ 729,660
Storage				
<i>Replacement of existing tanks</i>				
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600
New tanks	24 Hours emergency storage = 116m3	4.5	\$ 6,000	\$ 27,000
Pipework valving		1	\$ 10,000	\$ 10,000
Installation and Construction		30%	\$ 67,600	\$ 20,280
SUBTOTAL Storage				\$ 87,880
Fire Protection				
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000
Installation and Construction		30%	\$ 9,000	\$ 2,700
SUBTOTAL Fire Protection				\$ 11,700
Add-ons				
Generator	Not required for restricted flow - allow to bring in plug in generator			
SUBTOTAL				\$ 974,840
Preliminary and General		10%		\$ 97,484
Design		20%		\$ 194,968
Contingency		10%		\$ 97,484
Total Estimated Capital Cost:				\$ 1,364,800
Annual Operational Costs				
Compliance and Management	<i>assumed average daily flow (m3/day)</i> per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land per hour (weekly visits for 6 hours) plus additional 10 hours /monthly to address issues with land owner and membrane process - cleaning etc	50 66		11,880
Labour		432	70	30,240
Power	kWhr (assumes 2kw operating 24 hours per day)	17520.0	0.4	7,008
Membrane Replacement	assume 7 year replacement \$2875 for replacement (based on other pressure membranes)	1.0	1,642.9	1,600
Chemical Use	CIP / Neutralisation	1	2,000	2,000
Chlorine Dosing	er kg (based on 70kg cylinder assume 1.5g/m	27.4	5	145
Desludging		1	500	500
SUBTOTAL				\$ 53,400.00
Total Estimated Annual Operational Costs				\$ 53,400
NPV of Operating Costs (20 yr @ 8%)				\$ 524,300
NPV Capital plus Operating Costs				\$ 1,889,100

Option 4 a R - New bores, WTP at source, storage at existing site - RESTRICTED FLOW				
Description	Unit	Quantity	Rate	Cost
Source Water				
Additional Time to work with Landowner / public works act		1	\$ 50,000	\$ 50,000
Landowner Compensation		1	\$ 50,000	\$ 50,000
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
Improvements to intake - fencing	allowance	1	\$ 20,000	\$ 20,000
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%	\$ 167,000	\$ 50,100
SUBTOTAL				\$ 217,100
Water Treatment				
Filtration, UV, Building, Civil				
1200 m3 RAW WATER STORAGE (7 days)	Steel Tank	1	\$ 220,000	\$ 220,000
Treatment pump	For overcoming headloss through cartridge and backwashing filter	1	\$ 5,000	\$ 5,000
Bag Filter	Bag filter	2	\$ 3,100	\$ 6,200
Cartridge	1 HF40H304 (duty/standby) 1 um nominal - will treat up to 5 L/sec	2	\$ 8,250	\$ 16,500
Ultraviolet Disinfection	UV Pro 30 (up to 1.89 L/sec) (Duty Assist)	2	\$ 5,990	\$ 11,980
UPS for UV	UPS - for management of brown outs 30min	1	\$ 3,000	\$ 3,000
Pressure Transducer	For monitoring pressure across cartridges/bags	3	\$ 500	\$ 1,500
Turbidimeter	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	\$ 20,000	\$ 20,000
Water Treatment Plant Building	Alpine style m2	12	\$ 4,000	\$ 48,000
Landscaping/Access	fencing/Landscaping/ Access Road	1	\$ 70,000	\$ 70,000
Telemetry	RTU and Aerial, programming etc	1	\$ 20,000	\$ 20,000
Electrical and Switchboard		1	\$ 40,000	\$ 40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$ 16,600	\$ 16,600
	High voltage line to site	300	\$ 180	\$ 54,000
Installation and Construction		30%	\$ 544,380	\$ 163,314
SUBTOTAL Treatment				\$ 707,694
Storage				
Replacement of existing tanks				
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600
New tanks	24 Hours emergency storage = 116m3	4.5	\$ 6,000	\$ 27,000
Pipework valving		1	\$ 10,000	\$ 10,000
Installation and Construction		30%	\$ 67,600	\$ 20,280
SUBTOTAL Storage				\$ 87,880
Fire Protection				
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000
Installation and Construction		30%	\$ 9,000	\$ 2,700
SUBTOTAL Fire Protection				\$ 11,700
Add-ons				
Generator	Not required for restricted flow - allow to bring in plug in generator			
SUBTOTAL				\$ 1,024,374
Preliminary and General		10%		102,437
Design		20%		204,875
Contingency		10%		102,437
Total Estimated Capital Cost:			-	1,434,100
Annual Operational Costs				
Compliance and Management	assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	50		
		66	\$ 180	\$ 11,880
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues with land owner and changing filters etc	384	\$ 70	\$ 26,880
UV Disinfection	KWhr (assumes 0.23 kw operating 24 hours per day)	2014.8	\$ 0	\$ 806
Lamp Replacement	Assumes yearly replacement of 1 lamp (1 lamp per unit)	1.0	\$ 433	\$ 433
Cartridges	per cartridge (assume montly)	12	\$ 500	\$ 6,000
	per bag	12	\$ 50	\$ 600
SUBTOTAL				\$ 46,598.92
Total Estimated Annual Operational Costs				\$ 46,600
NPV of Operating Costs (20 yr @ 8%)				\$ 457,500
NPV Capital plus Operating Costs				\$ 1,891,600

Option 4 a R - New bores, WTP at source, storage at existing site - RESTRICTED FLOW				
Description	Unit	Quantity	Rate	Cost
Source Water				
Additional Time to work with Landowner / public works act		1	\$ 50,000	\$ 50,000
Landowner Compensation		1	\$ 50,000	\$ 50,000
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
Improvements to intake - fencing	allowance	1	\$ 20,000	\$ 20,000
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%	\$ 167,000	\$ 50,100
SUBTOTAL				\$ 217,100
Water Treatment				
Filtration, UV, Building, Civil				
1200 m3 RAW WATER STORAGE (7 days)	Steel Tank	1	\$ 220,000	\$ 220,000
Treatment pump	For overcoming headloss through cartridge and backwashing filter	1	\$ 5,000	\$ 5,000
Bag Filter	Bag filter	2	\$ 3,100	\$ 6,200
Cartridge	1 HF40H304 (duty/standby) 1 um nominal - will treat up to 5 L/sec	2	\$ 8,250	\$ 16,500
Ultraviolet Disinfection	UV Pro 30 (up to 1.89 L/sec) (Duty Assist)	2	\$ 5,990	\$ 11,980
UPS for UV	UPS - for management of brown outs 30min	1	\$ 3,000	\$ 3,000
Pressure Transducer	For monitoring pressure across cartridges/bags	3	\$ 500	\$ 1,500
Turbidimeter	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	\$ 20,000	\$ 20,000
Water Treatment Plant Building	Alpine style m2	12	\$ 4,000	\$ 48,000
Landscaping/Access	fencing/Landscaping/ Access Road	1	\$ 70,000	\$ 70,000
Telemetry	RTU and Aerial, programming etc	1	\$ 20,000	\$ 20,000
Electrical and Switchboard		1	\$ 40,000	\$ 40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$ 16,600	\$ 16,600
	High voltage line to site	300	\$ 180	\$ 54,000
Installation and Construction		30%	\$ 544,380	\$ 163,314
SUBTOTAL				\$ 707,694
Chlorine Disinfection, Contact Time				
Chlorine Gas Dosing	Gas Cylinders and Dosing -	1	\$ 30,749	\$ 30,749
Carry water Pump	Carry water Pump	1	\$ 2,000	\$ 2,000
Chlorine Analyser	MFC with Depolox 5	1	\$ 11,300	\$ 11,300
Installation and Construction		30%	\$ 44,049	\$ 13,215
SUBTOTAL				\$ 57,264
SUBTOTAL Treatment				
				\$ 764,958
Storage				
Replacement of existing tanks				
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600
New tanks	24 Hours emergency storage = 116m3	4.5	\$ 6,000	\$ 27,000
Pipework valving		1	\$ 10,000	\$ 10,000
Installation and Construction		30%	\$ 67,600	\$ 20,280
SUBTOTAL Storage				\$ 87,880
Fire Protection				
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000
Installation and Construction		30%	\$ 9,000	\$ 2,700
SUBTOTAL Fire Protection				\$ 11,700
Add-ons				
Generator	Not required for restricted flow - allow to bring in plug in generator			
SUBTOTAL				\$ 1,081,638
Preliminary and General		10%		108,164
Design		20%		216,328
Contingency		10%		108,164
Total Estimated Capital Cost:				\$ 1,514,300
Annual Operational Costs				
Compliance and Management	assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues with land owner and changing filters etc	50		
Labour		66	180	11,880
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2014.8	0.4	806
Lamp Replacement	Assumes yearly replacement of 1 lamp (1 lamp per unit)	1.0	433.0	433
Cartridges	per cartridge (assume monthly) per bag	12	500	6,000
Chlorine Dosing	per kg (based on 70kg cylinder assume 1.5g/m	27.4	5	145
SUBTOTAL				\$ 46,744.01
Total Estimated Annual Operational Costs				\$ 46,700
NPV of Operating Costs (20 yr @ 8%)				\$ 458,500
NPV Capital plus Operating Costs				\$ 1,972,800

Description	Unit	Quantity	Rate	Cost
Source Water				
Additional Time to work with Landowner / public works act		1	\$ 50,000	\$ 50,000
Land owner compensation		1	\$ 50,000	\$ 50,000
Further investigation for ground water		1	\$ 15,000	\$ 15,000
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	Hach 1720E	1	\$ 7,000	\$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	2	\$ 4,600	\$ 9,200
Electrical and Control	level switches electrical cabinet, install	1	\$ 15,000	\$ 15,000
Installation and Construction		30%	\$ 263,200	\$ 78,960
SUBTOTAL Source				\$ 342,160
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
Turbidimeter	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	Alpine style m2	10	\$ 4,000	\$ 40,000
Landscaping/Access	Landscaping/ Access Road	1	\$ 70,000	\$ 70,000
Telemetry	RTU and Aerial, programming etc	1	\$ 30,000	\$ 30,000
Electrical and Switchboard		1	\$ 40,000	\$ 40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$ 16,600	\$ 16,600
	High voltage line to site	700	\$ 180	\$ 126,000
Installation and Construction		30%	\$ 385,200	\$ 115,560
SUBTOTAL Treatment				\$ 500,760
Storage				
Replacement of existing tanks				
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600
New tanks	24 Hours emergency storage, operational storage = 287m3	10	\$ 6,000	\$ 60,000
Pipework	Allowance for pipework	1	\$ 15,000	\$ 15,000
Installation and Construction		30%	\$ 105,600	\$ 31,680
SUBTOTAL Storage				137,280
Fire Protection				
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000
Upgrade main from intake to old storage location (to achieve fireflows)	DN150 PVC/PE	790	\$ 180	\$ 142,200
Installation and Construction		30%	\$ 151,200	\$ 45,360
SUBTOTAL Fire Protection				196,560
Add-ons				
Generator	allow to bring in plug in generator			\$ -
SUBTOTAL				1,176,760
Preliminary and General		10%		117,676
Design		20%		235,352
Contingency		10%		117,676
Total Estimated Capital Cost:			-	1,647,500
Annual Operational Costs				
Compliance and Management	assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	66	180	11,880
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues with land owner and changing filters etc	384	70	26,880
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2014.8	0.4	806
Lamp Replacement	Assumes yearly replacement of 1 lamp (1 lamp per unit)	1.0	433.0	433
Cartridges	per cartridge (assume quarterly)	3	500	1,500
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2 L/sec)	5,069	0.4	2,028
SUBTOTAL				\$ 43,526.70
Total Estimated Annual Operational Costs				\$ 43,500
NPV of Operating Costs (20 yr @ 8%)				\$ 427,100
NPV Capital plus Operating Costs				\$ 2,074,600

Option 5 a R - New bores, WTP at source, storage at source - RESTRICTED FLOW				
Description	Unit	Quantity	Rate	Cost
Source Water				
Additional Time to work with Landowner / public works act		1	\$ 50,000	\$ 50,000
Land owner compensation		1	\$ 50,000	\$ 50,000
Further investigation for ground water		1	\$ 15,000	\$ 15,000
ECAN Consent	consent to take groundwater	1	\$ 25,000	\$ 25,000
Bores drilling and headworks		2	\$ 40,000	\$ 80,000
Bore Pumps	1.3L/sec at up to 20m allowed for	2	\$ 2,100	\$ 4,200
VFD	VFD for pumps	2	\$ 3,500	\$ 7,000
Raw water turbidimeter	Hach 1720E	1	\$ 7,000	\$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	2	\$ 4,600	\$ 9,200
Electrical and Control	level switches electrical cabinet, install	1	\$ 15,000	\$ 15,000
Installation and Construction		30%	\$ 262,400	\$ 78,720
SUBTOTAL Source				\$ 341,120
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 30 (up to 1.89 L/sec) (Duty Assist)	2	\$ 5,990	\$ 11,980
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
Turbidimeter	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	Alpine style m2	10	\$ 4,000	\$ 40,000
Landscaping/Access	Landscaping/ Access Road	1	\$ 70,000	\$ 70,000
Telemetry	RTU and Aerial, programming etc	1	\$ 30,000	\$ 30,000
Electrical and Switchboard		1	\$ 40,000	\$ 40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$ 16,600	\$ 16,600
	High voltage line to site	700	\$ 180	\$ 126,000
Installation and Construction		30%	\$ 377,180	\$ 113,154
SUBTOTAL Treatment				\$ 490,334
Storage				
<i>Replacement of existing tanks</i>				
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600
New tanks	24 Hours emergency storage = 116m3	4.5	\$ 6,000	\$ 27,000
Pipework valving		1	\$ 15,000	\$ 15,000
Installation and Construction		30%	\$ 72,600	\$ 21,780
SUBTOTAL Storage				\$ 94,380
Fire Protection				
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000
Upgrade main from intake to old storage location (to achieve fireflows)	DN150 PVC/PE	790	\$ 180	\$ 142,200
Installation and Construction		30%	\$ 9,000	\$ 2,700
SUBTOTAL Fire Protection				\$ 153,900
Add-ons				
Generator	Not required for restricted flow - allow to bring in plug in generator			
SUBTOTAL				1,079,734
Preliminary and General		10%		107,973
Design		20%		215,947
Contingency		10%		107,973
Total Estimated Capital Cost:				1,511,600
Annual Operational Costs				
	<i>assumed average daily flow (m3/day)</i>	50		
Compliance and Management	per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	66	180	11,880
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues with land owner and changing filters etc	384	70	26,880
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2014.8	0.4	806
Lamp Replacement	Assumes yearly replacement of 1 lamp (1 lamp per unit)	1.0	433.0	433
Cartridges	per cartridge (assume quarterly)	3	500	1,500
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2L/sec)	5,069	0.4	2,028
SUBTOTAL				\$ 43,526.70
Total Estimated Annual Operational Costs				\$ 43,500
NPV of Operating Costs (20 yr @ 8%)				\$ 427,100
NPV Capital plus Operating Costs				\$ 1,938,700

Option 5 a OD- New bores, WTP, Storage in Existing Location - ON DEMAND FLOW				
Description	Unit	Quantity	Rate	Cost
Source Water				
Additional Time to work with Landowner / public works act		1	\$ 50,000	\$ 50,000
Land owner compensation		1	\$ 50,000	\$ 50,000
Further investigation for ground water		1	\$ 15,000	\$ 15,000
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	Hach 1720E	1	\$ 7,000	\$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	2	\$ 4,600	\$ 9,200
Electrical and Control	level switches electrical cabinet, install	1	\$ 15,000	\$ 15,000
Installation and Construction		30%	\$ 263,200	\$ 78,960
SUBTOTAL Source				\$ 342,160
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
Turbidimeter	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	Alpine style m2	10	\$ 4,000	\$ 40,000
Landscaping/Access	Landscaping/ Access Road	1	\$ 70,000	\$ 70,000
Telemetry	RTU and Aerial, programming etc	1	\$ 30,000	\$ 30,000
Electrical and Switchboard		1	\$ 40,000	\$ 40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$ 16,600	\$ 16,600
Installation and Construction	High voltage line to site	700	\$ 180	\$ 126,000
		30%	\$ 385,200	\$ 115,560
SUBTOTAL				\$ 500,760
Chlorine Disinfection, Contact Time				
Chlorine Gas Dosing	Gas Cylinders and Dosing	1	\$ 30,749	\$ 30,749
Carry water Pump	Carry water Pump	1	\$ 2,000	\$ 2,000
Chlorine Analyser	MFC with Depolox 5	1	\$ 11,300	\$ 11,300
Installation and Construction		30%	\$ 44,049	\$ 13,215
				\$ 57,264
SUBTOTAL Treatment				\$ 558,024
Storage				
Replacement of existing tanks				
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600
New tanks	24 Hours emergency storage, operational storage = 287m3	10	\$ 6,000	\$ 60,000
Pipework	Allowance for pipework	1	\$ 15,000	\$ 15,000
Installation and Construction		30%	\$ 105,600	\$ 31,680
SUBTOTAL Storage				137,280
Fire Protection				
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000
Upgrade main from intake to old storage location (to achieve fireflows)	DN150 PVC/PE	790	\$ 180	\$ 142,200
Installation and Construction		30%	\$ 151,200	\$ 45,360
SUBTOTAL				196,560
Add-ons				
Generator	allow to bring in plug in generator			\$ -
SUBTOTAL				1,234,024
Preliminary and General		10%		123,402
Design		20%		246,805
Contingency		10%		123,402
Total Estimated Capital Cost:				- 1,727,600
Annual Operational Costs				
Compliance and Management	assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	50		
		66	180	11,880
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues with land owner and changing filters etc	384	70	26,880
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	2014.8	0.4	806
Lamp Replacement	Assumes yearly replacement of 1 lamp (1 lamp per unit)	1.0	433.0	433
Cartridges	per cartridge (assume quarterly)	3	500	1,500
Chlorine Dosing	per kg (based on 70kg cylinder assume 1.5g/m3)	27.4	5	145
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2 L/sec)	5,069	0.4	2,028
SUBTOTAL				\$ 43,671.79
Total Estimated Annual Operational Costs				\$ 43,700
NPV of Operating Costs (20 yr @ 8%)				\$ 429,000
NPV Capital plus Operating Costs				\$ 2,156,600

Option 5 a R - New bores, WTP at source, storage at source - RESTRICTED FLOW				
Description	Unit	Quantity	Rate	Cost
Source Water				
Additional Time to work with Landowner / public works act		1	\$ 50,000	\$ 50,000
Land owner compensation		1	\$ 50,000	\$ 50,000
Further investigation for ground water		1	\$ 15,000	\$ 15,000
ECAN Consent	consent to take groundwater	1	\$ 25,000	\$ 25,000
Bores drilling and headworks		2	\$ 40,000	\$ 80,000
Bore Pumps	1.3L/sec at up to 20m allowed for	2	\$ 2,100	\$ 4,200
VFD	VFD for pumps	2	\$ 3,500	\$ 7,000
Raw water turbidimeter	Hach 1720E	1	\$ 7,000	\$ 7,000
Flow meter	DN80 yokogawa mag flowmeter	2	\$ 4,600	\$ 9,200
Electrical and Control	level switches electrical cabinet, install	1	\$ 15,000	\$ 15,000
Installation and Construction		30%	\$ 262,400	\$ 78,720
SUBTOTAL Source				\$ 341,120
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 30 (up to 1.89 L/sec) (Duty Assist)	2	\$ 5,990	\$ 11,980
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
Turbidimeter	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	Alpine style m2	10	\$ 4,000	\$ 40,000
Landscaping/Access	Landscaping/ Access Road	1	\$ 70,000	\$ 70,000
Telemetry	RTU and Aerial, programming etc.	1	\$ 30,000	\$ 30,000
Electrical and Switchboard		1	\$ 40,000	\$ 40,000
Power Upgrade	power to new site - transformer - network Waitaki	1	\$ 16,600	\$ 16,600
Installation and Construction	High voltage line to site	700	\$ 180	\$ 126,000
		30%	\$ 377,180	\$ 113,154
SUBTOTAL				\$ 490,334
Chlorine Disinfection, Contact Time				
Chlorine Gas Dosing	Gas Cylinders and Dosing	1	\$ 30,749	\$ 30,749
Carry water Pump	Carry water Pump	1	\$ 2,000	\$ 2,000
Chlorine Analyser	MFC with Depolox 5	1	\$ 11,300	\$ 11,300
Installation and Construction		30%	\$ 44,049	\$ 13,215
SUBTOTAL				\$ 57,264
SUBTOTAL Treatment				
				\$ 547,598
Storage				
Replacement of existing tanks				
Demolition of tanks	Demolition of existing tanks (20% replacement cost)	20%	\$ 130,000	\$ 26,000
New Flow meter	DN80 yokogawa mag flowmeter	1	\$ 4,600	\$ 4,600
New tanks	24 Hours emergency storage = 116m3	4.5	\$ 6,000	\$ 27,000
Pipework valving		1	\$ 15,000	\$ 15,000
Installation and Construction		30%	\$ 72,600	\$ 21,780
SUBTOTAL Storage				\$ 94,380
Fire Protection				
Fire Tanks	30,000 L tanks with fittings (45m3)	1.5	\$ 6,000	\$ 9,000
Upgrade main from intake to old storage location (to achieve fireflows)	DN150 PVC/PE	790	\$ 180	\$ 142,200
Installation and Construction		30%	\$ 9,000	\$ 2,700
SUBTOTAL				\$ 153,900
Add-ons				
Generator	Not required for restricted flow - allow to bring in plug in generator			
SUBTOTAL				1,136,998
Preliminary and General		10%		113,700
Design		20%		227,400
Contingency		10%		113,700
Total Estimated Capital Cost:				1,591,800
Annual Operational Costs				
Compliance and Management	assumed average daily flow (m3/day) per hour (5.5 hours monthly) extra 1.5 hours as infrastructure on private land	50		
Labour	per hour (weekly visits for 6 hours) plus additional 6 hours /monthly to address issues with land owner and changing filters etc	66	180	11,880
UV Disinfection	kWhr (assumes 0.23 kw operating 24 hours per day)	384	70	26,880
Lamp Replacement	Assumes yearly replacement of 1 lamp (1 lamp per unit)	2014.8	0.4	806
Cartridges	per cartridge (assume quarterly)	1.0	433.0	433
Chlorine Dosing	per kg (based on 70kg cylinder assume 1.5g/m	3	500	1,500
Electricity for Bore Pumps	kWhr (assumes 2kw pump operating at 2L/sec)	27.4	5	145
		5,069	0.4	2,028
SUBTOTAL				\$ 43,671.79
Total Estimated Annual Operational Costs				\$ 43,700
NPV of Operating Costs (20 yr @ 8%)				\$ 429,000
NPV Capital plus Operating Costs				\$ 2,020,800