

GORE AND MATAURA WWTPS RESOURCE CONSENT RENEWAL

Gore and Mataura WwTP Options
Assessment

Gore District Council



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1.0 INTRODUCTION

Gore District Council (GDC) are currently in the process of renewing the discharge consents for the Gore and Mataura Wastewater Treatment Plants (WwTPs).

In preparation for the resource consent application, an extensive options evaluation process has been undertaken to arrive at the Best Practicable Option (BPO) to provide wastewater services for the community.

As an initial step in this process a wide range of potential options was collated in the long list. These were narrowed down to the short list based on a qualitative evaluation process.

The short list options were evaluated in further detail, using a Multi-Criteria Analysis (MCA) assessment. The intent of the MCA was to provide a holistic evaluation of the options that addresses the environmental, cultural, social and economic needs of the community. From this evaluation process, the proposed BPO was derived.

This report presents a detailed account of the options evaluation process that was used to arrive at the proposed BPO.

2.0 GORE WASTEWATER SCHEME

2.1 GORE WWTP

The Gore WwTP treats both domestic wastewater from the Gore Township and industrial trade waste. Trade waste is received from two meat works, Silver Ferns Farms and Blue Skies Meat Works (Formerly Clover Meat Works), and a dairy factory Mataura Valley Milk in the area.

The main treatment process at the plant consists of screening followed by two oxidation ponds in series.

During low flow conditions in the Mataura River (less than 60 m³/sec), additional treatment is provided by an Actiflo clarifier, followed by UV disinfection. The UV unit is a new addition to the treatment process and is due to be commissioned in mid-2020.

Trade waste from Mataura Valley Milk is treated through a dedicated treatment facility, commonly known as the “Industrial Hub”. The treated effluent from the Industrial Hub is discharged to Pond 2 for further polishing.

A schematic of the treatment process at the plant is shown in Figure 1.

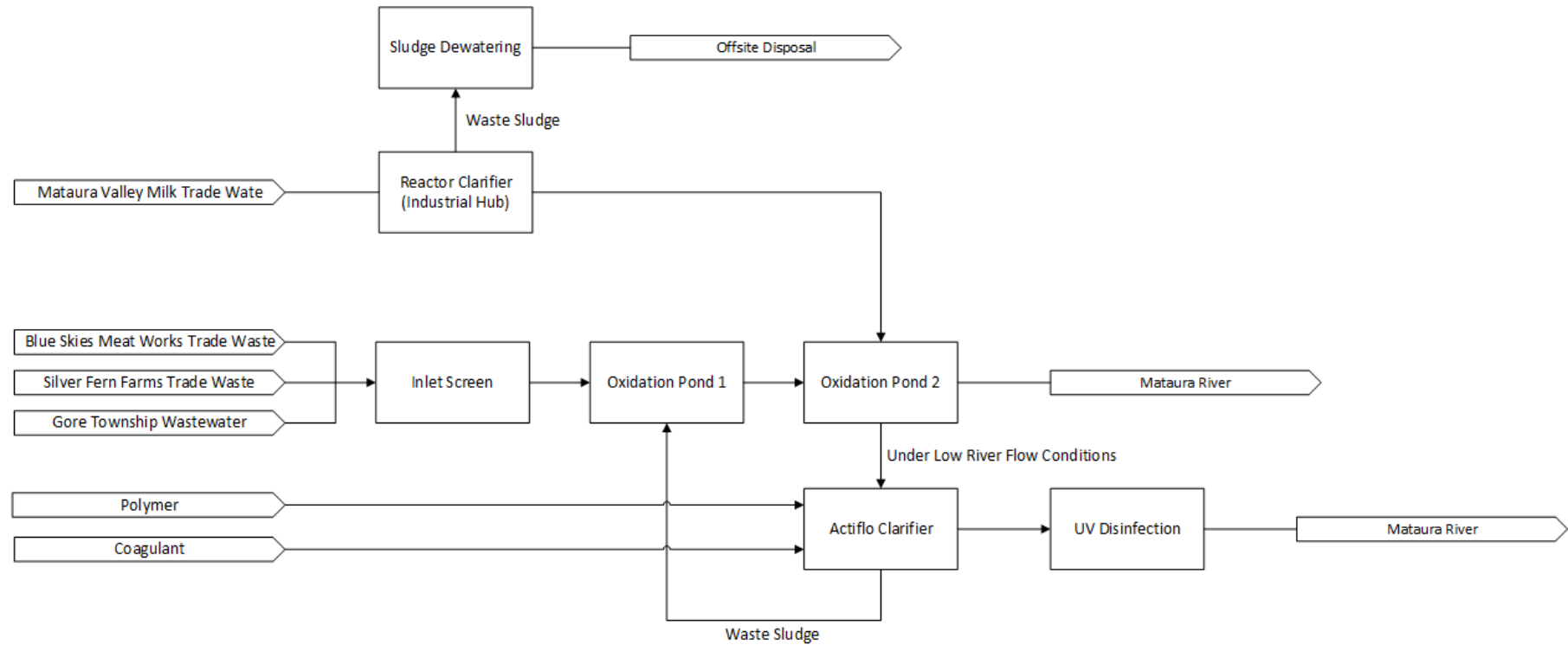


FIGURE 1: GORE WWTP TREATMENT PROCESS

2.2 GORE FUTURE FLOWS AND LOADS

The future flows and loads to the plant have been estimated to establish a design basis for the upgrade options for the Gore WwTP. The assumptions that have been made to estimate the future domestic and industrial flows and loads are discussed in the sections below.

2.2.1 GORE DOMESTIC FLOW AND LOADS

POPULATION GROWTH

The current population for the Gore Township has been based on the 2013 census. population. Growth estimate have been based on the targets set out in the Southland Regional Development Strategy Action Plan.

The Action Plan aims to increase the Southland population by 10,000 people by 2025. Based on this, it has been assumed that the Gore population will increase by 15% by 2030, with a further 20% increase by 2050. The current and future Gore populations have been summarised in Table 1.

TABLE 1: GORE TOWNSHIP CURRENT AND FUTURE POPULATIONS			
	2013	2030	2050
Population	7,350	8,453	10,143

DOMESTIC FLOWS AND LOADS

The current wastewater production rates observed at the plant are 550 and 800 L/p/d for average dry weather and average daily flows respectively. These figures are significantly higher than typical values observed in New Zealand. It is assumed that the planned future inflow and infiltration remedial works will reduce the domestic wastewater production rate from 800 to 500 L/p/d¹ over the next 30 years.

The future domestic wastewater flows have been estimated by applying the following wastewater production rates to the estimated populations for 2030 and 2050 stated in Table 1. The future flows up until 2030 have been estimated based on a wastewater production rate of 650 L/p/d. The 2050 flows have been estimated using an average production rate of 500 L/p/d based on the assumption that significant gains to the inflow and infiltration programme will be made in the next 30 years.

The future domestic loads have been based on the influent quality currently observed at the plant.

2.2.2 GORE INDUSTRIAL FLOWS AND LOADS

The Gore WwTP currently receives trade waste from Silver Ferns Farms (SFF), Blue Skies Meat (BSM) and Mataura Valley Milk (MVM). The industrial development in the area is assumed to be governed by the allocated flows in the existing trade waste agreements. The growth assumptions¹ made for each of the sources are discussed below.

SSF

The current flows and loads from SSF presented in Table 2, represent the 90th percentile values observed in the current influent. It has been assumed that the future flows to the plant will remain the same as what is currently observed. Future loading has been

¹ Teleconference on 20th March 2019 with GDC and revised assumption confirmation (email 29th April)

based on the 90th percentile limits stated in the existing trade waste agreement, for the purpose of biological treatment design.

BSM

The future BSM flow and loads have been based on the limit stated in the existing trade water agreement. For parameters that are not included in the trade waste agreement the future loading has been based on the current influent quality observed at the plant.

MVM

The loading from MVM presented in Table 2, reflects the treated effluent from the Industrial Hub to give an indication of the influent loading that the rest of the plant will experience. The current flow to the plant represents the average influent flow to the plant measured from September 2018 – November 2018. GDC have advised that they anticipate an increase in the trade waste discharges from MVM. The future flows from MVM are assumed to be double what is currently stated in the existing trade waste agreement.

Both the current and future cBOD₅ and TN loading have been estimated based on the effluent quality targets stated in the Industrial Design report. For parameters where no target has been stated (TSS and TP), the loading has been estimated using the effluent quality data presented in the “2018_2019 Wastewater Monitoring Information_2” supplied by GDC.

The additional loads from MVM will require the construction of a second reactor clarifier. It is assumed that MVM will provide the necessary funding for this upgrade.

FUTURE INDUSTRIAL ALLOWANCE

An additional allowance of 500 m³/day has been made for future industries in the area after 2030. Future loading has been estimated based on the following concentrations, which are similar to domestic wastewater:

- cBOD₅ – 300 g/m³;
- TSS – 300 g/m³;
- TN – 60 g/m³;
- TP – 10 g/m³.

2.2.3 GORE WWTP DESIGN FLOWS AND LOADS

The design flows and loads that have been estimated based on the assumptions stated in Sections 2.2.1 and 2.2.2 are summarised in Table 2 below.

TABLE 2: ESTIMATED DESIGN FLOWS AND LOADS

SOURCE	FLOWS (m ³ /d)			cBOD ₅ LOADS (kg/d)			TSS LOADS (kg/d)			TN LOADS (kg/d)			TP LOADS (kg/d)		
	CURRENT	2030	2050	CURRENT	2030	2050	CURRENT	2030	2050	CURRENT	2030	2050	CURRENT	2030	2050
Domestic Wastewater	5,879	5,495	5,072	819	942	1,130	790	908	1,090	203	233	280	39	45	54
SFF	786	800	800	1,205	1,320	1,320	1,268	1,500	1,500	87	100	100	11	30	30
BSM	69	20	20	46	36	36	41	6.0	6.0	8.0	3.5	3.5	0.9	0.4	0.4
Pre-Treated Effluent from Industrial Hub	1,120*	2,400	2,400	45	96	96	17	36	36	12	26	26	1.2	2.6	2.6
Future Industrial Allowance	0	0	500	0	0	150	0	0	150	0	0	30	0	0	5
Total	7,854	8,714	8,792	2,160	2,394	2,732	2,116	2,450	2,782	310	363	440	52	78	92

Note: * MVM has only been discharging to the WwTP from September 2018 onwards.

As seen from Table 2, the wastewater quantity is predicted to increase by 12% by 2050, due to both population and industrial growth. The reduction in domestic wastewater flows between 2030 and 2050 is a result of future inflow and infiltration programme by GDC.

3.0 MATAURA WASTEWATER SCHEME

3.1 MATAURA WWTP

The Mataura WwTP treats both domestic wastewater from the Mataura Township and industrial trade waste from Slink Skins Ltd and Tulloch Transport. The wastewater from ablution facilities at Alliance Meat Works and Dongwha Patinna MDF is also discharged to the Mataura WwTP.

The treatment process at the plant consists of an oxidation pond, fitted with an internal partition or baffle. The oxidation pond is followed by six wetland cells that operate in parallel. Effluent from the wetland cells is discharged to the Mataura River. The discharge flow rate is measured using a v-notch weir. A schematic of the treatment process of the plant is shown in Figure 2.

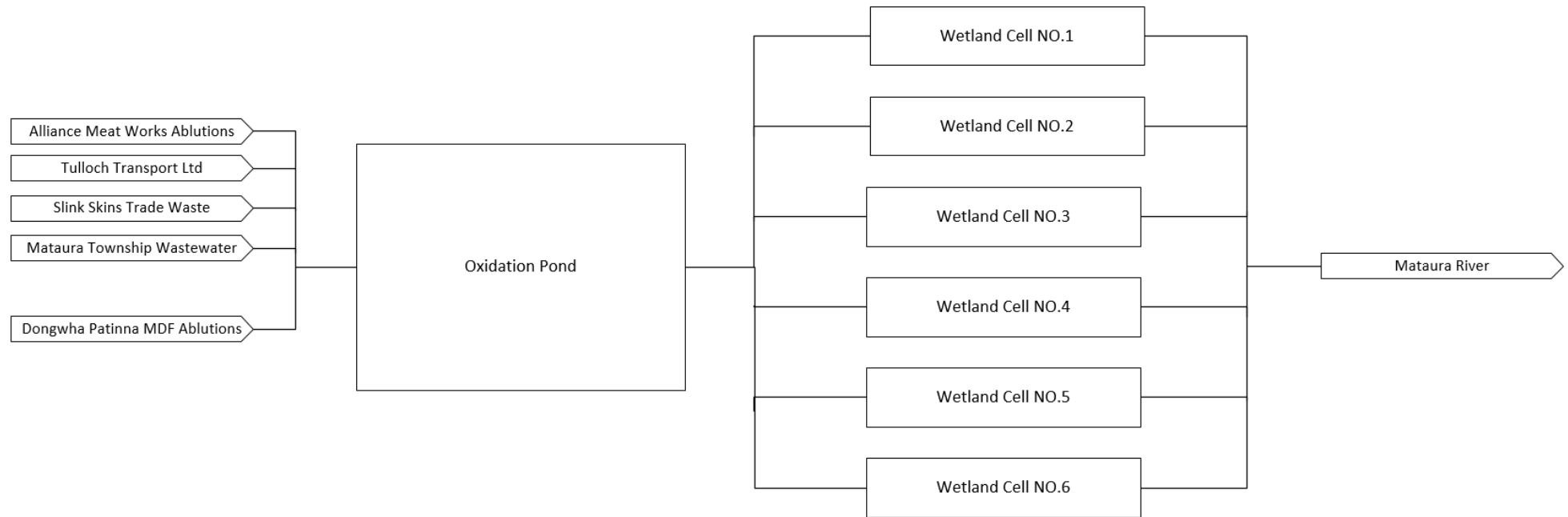


FIGURE 2: MATAURA WWTP PROCESS

3.2 MATAURA GROWTH

3.2.1 MATAURA POPULATION GROWTH

The future population has been estimated based on the population growth targets for set out in the Southland Regional Development Strategy Action Plan. Based on these targets it has been assumed that the population will increase by 15% by 2030, with a further 20% increase by 2050.

These growth rates have been applied to the 2013 census population to obtain an estimate of the future Mataura Township population. The future population estimates are presented in Table 3.

TABLE 3: MATAURA TOWNSHIP CURRENT AND FUTURE POPULATIONS			
	2013	2030	2050
Population	1,509	1,735	2,082

3.2.2 MATAURA INDUSTRIAL GROWTH

The Mataura WwTP treats trade waste from Slink Skins Ltd and Tulloch Transport. Wastewater from the ablution facilities of Alliance Meat Works and Dongwha Patinna MDF is also treated at the Mataura WwTP.

Based on discussion with GDC, it is assumed that influent flows from these sources will not increase.

3.3 MATAURA WWTP FUTURE WASTEWATER FLOWS AND LOADS

No influent flow or quality data is available for the Mataura WwTP. Future influent flows have been estimated based on an assumed wastewater production rate of 430 L/p/d. This has been calculated using the 2013 census population and effluent flows measured at the plant.

Influent loading has been estimated using typical per capita domestic loads observed in New Zealand. To account for the additional loads from trade waste sources, a conservative approach has been adopted in assuming the per capita load rates. The assumed rates are stated in Table 4.

TABLE 4: ESTIMATED CONTAMINANT LOADS		
PARAMETER	TYPICAL RATE PER CAPITA (g/p/d)	ASSUMED PER CAPITA FOR THIS STUDY (g/p/d)
cBOD ₅	60-80	80
TSS	60-90	90
TN	12-15	15
TP	2.0-3.0	3.0

The future influent flows and loads estimated on the above assumptions are presented in Table 5 below.

TABLE 5: 2050 ESTIMATED AVERAGE FLOWS AND LOADS

SOURCE	FLOWS (m ³ /d)		cBOD ₅ (kg/d)		TSS (kg/d)		TN (kg/d)		TP (kg/d)	
	CURRENT	2050	CURRENT	2050	CURRENT	2050	CURRENT	2050	CURRENT	2050
Mataura WwTP Combined Influent	650	895	121	167	121	187	27	31	4.5	6.0

4.0 LONG LIST OPTIONS

The long list options for the Gore and Mataura WwTPs have been developed based on the following three approaches for the long-term provision of wastewater services for the Gore and Mataura communities:

1. Improvements to the existing treatment systems with discharge to the Mataura River;
2. Upgrades to a mechanical treatment plant for high nutrient removal, with discharge to the Mataura River;
3. Discharge to land.

A number of treatment upgrades options are possible under each of the three approaches. The long list options evaluation process has been used to select the most viable option under each approach to be taken forward to the short list.

4.1 GORE WWTP LONG LIST OPTIONS

The expected effluent quality for the long list options that have been considered for the Gore WwTP are summarised in Table 6 below.

The “Current Plant” column in the table shows the average effluent concentration currently observed at the plant when the Actiflo is in operation. The loads for this scenario have been calculated using the current flow presented in Table 2 above. This column has been included to provide comparative loadings against the various long list options. This differs from the “Do Nothing” column which reflects the expected effluent concentrations and loads for the scenario where no upgrades are implemented at the plant and the influent flows increase to the estimated 2050 flow.

Future anticipated loads that greatly exceed the current loading have been highlighted. This is an indication that these options may have limited environmental acceptability. Further ecological work is required to determine what effects the estimated future loading will have on the discharge. This assessment may take into account the combined effect of the loading from both plants. It is possible that the preferred solution for one of the plants will offset the loading from the other plant.

TABLE 6: GORE WWTP LONG LIST OPTIONS EXPECTED EFFLUENT QUALITY

OPTION	CURRENT PLANT (WITH ACTIFLO IN OPERATION)		DO NOTHING		ADDITIONAL ACTIFLO AND UV ⁴		TERTIARY TREATMENT UPGRADE ⁵		GORE WWTP MECHANICAL BNR PLANT ⁵	
PARAMETER	AVERAGE CONC. ² . (g/m ³)	AVERAGE LOAD ³ (kg/d)	AVERAGE CONC. (g/m ³)	AVERAGE 2050 LOAD (kg/d)	AVERAGE CONC. (g/m ³)	AVERAGE 2050 LOAD (kg/d)	AVERAGE CONC. (g/m ³)	AVERAGE 2050 LOAD (kg/d)	AVERAGE CONC. (g/m ³)	AVERAGE 2050 LOAD (kg/d)
TSS	26	204	30	264	15	132	<3.0	26	<5.0	44
cBOD ₅	14	110	20	176	15	132	<10	88	<5.0	44
TN	20	157	40	352	30	264	30	264	10-20 ⁶	88-176
Nitrate	4.0	31	10	88	10	88	10	88	7.0-12 ⁶	62-149
Ammonia	16	126	30	264	20	176	20	176	<3.0	26
TP	0.9	7.1	2.0	18	1.0	8.8	1.0	8.8	1.0-3.0 ⁶	8.8-26 ⁶
DRP	0.2	1.6	1.0	8.8	0.15	1.3	0.15	1.3	0.15-2.0 ⁶	1.3-17 ⁶
E.coli ¹	1,450	-	1,500	-	500	-	<10	-	<50	-

Notes:¹ Unit is MPN/100ml

² Current effluent concentration taken from compliance monitoring data and the “Gore Wastewater Sampling Information” spreadsheet of Actiflo effluent over the period from 2014-2018 for periods when the Actiflo was in operation. Note the industrial hub was not commissioned at during this period.

³ Loads calculated based on current flow as stated in Table 2 above.

⁴ Expected effluent quality also applies to the discharge through wetland option and land disposal options with the same treatment process. Concentrations and load are an indication of the effluent as it leaves the treatment plant and does not take into account any additional treatment that may result from the land disposal.

⁵ Expected effluent quality also applies to land disposal options with the same treatment process. Concentrations and load are an indication of the effluent as it leaves the treatment plant and does not take into account any additional treatment that may result from the land disposal.

⁶ Higher effluent nitrogen and phosphorus concentrations and loads are assumed to be acceptable for land disposal options.

4.1.1 IMPROVEMENT TO EXISTING TREATMENT SYSTEM -DISCHARGE TO MATAURA RIVER

Figure 3 summarises the upgrade options that have been considered to improve the existing treatment system at the Gore WwTP. Further details on each of the treatment options is provided below.

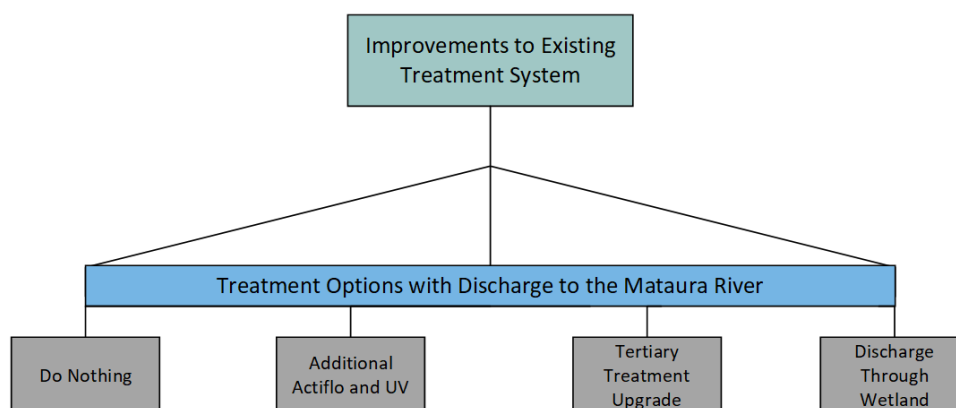


FIGURE 3: GORE WWTP IMPROVEMENTS TO EXISTING SYSTEM

4.1.1.1 - DO NOTHING

Under this the option no changes will be made to the Gore WwTP. The treatment process will remain the same as what is presented in Figure 1.

No capacity upgrades will be done to account for additional influent flows. As seen in Table 6, the contaminant mass loads in the final effluent are likely to increase significantly, thus this option has not been carried forward for further consideration.

4.1.1.2 - ADDITIONAL ACTIFLO AND UV

Currently the Actiflo and UV are operated during low river flows. For this option the outlet from oxidation pond 2 will be discontinued and all the flow from the WwTP will be treated through the Actiflo and UV irrespective of the river conditions.

This system will also include sand traps to capture the sand spill over from the Actiflo. GDC are in the process of installing sand traps, these would be incorporated into the upgraded system.

The capacity of the existing Actiflo was previously believed to be 7,500 m³/d. It is now thought to be closer to 5,000 m³/d. To cope with the additional flows to the plant, it has been assumed that two new Actiflo units will be installed for this option. The existing Actiflo would be mothballed.

Capacity upgrades to oxidation ponds will also be required. This will involve installing additional aerators in oxidation pond 1, as well as baffle curtains in both the ponds. It has been assumed that the existing inlet screens will be used as part of this option.

A schematic of this option is shown in Figure 4.

The requirements for this option are summarised below:

- Installation of additional aerators in oxidation pond 1;
- Installation of baffle curtains in oxidation ponds 1 and 2;

- Installation of two new Actiflo units;
- Installation of additional sand traps;
- Installation of a second UV.

This option will also include a provision for periodic pond de-sludging as part of the ongoing operation and maintenance (O&M) regime.

Expected effluent quality for this option is presented in Table 6.

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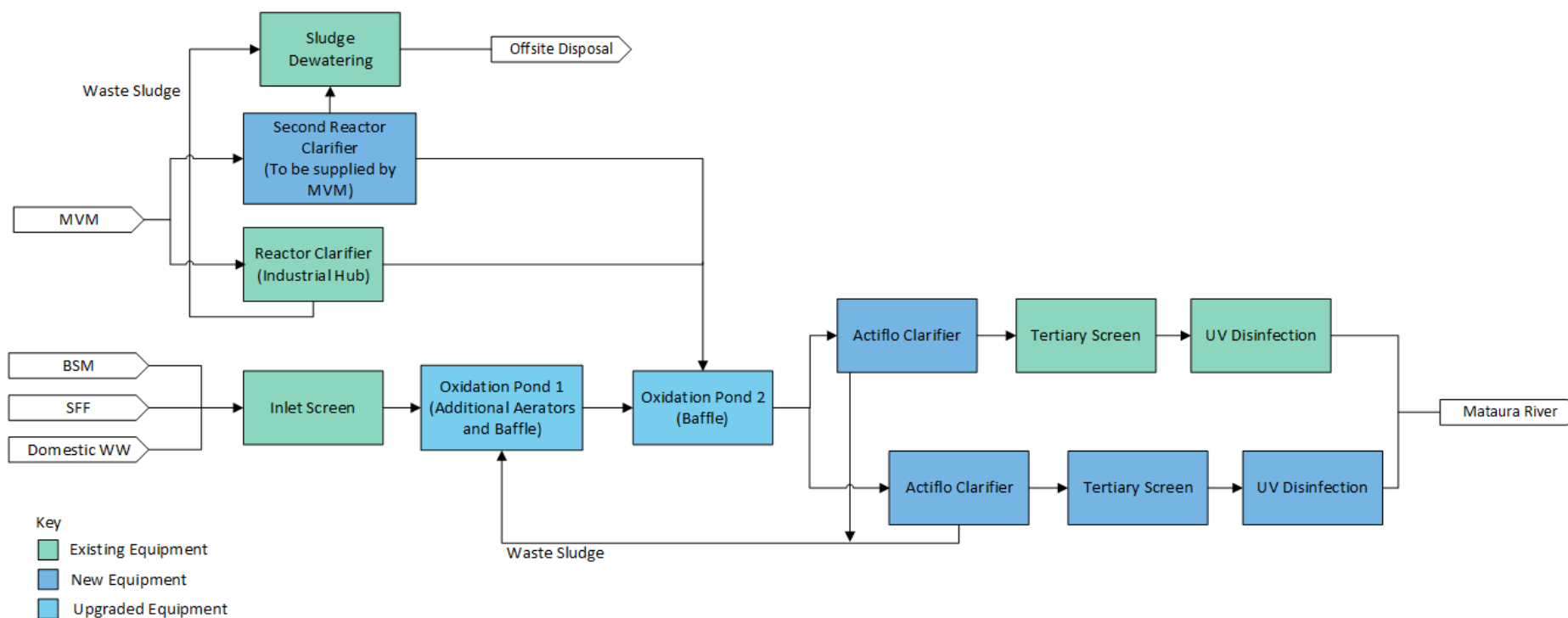


FIGURE 4: ADDITIONAL ACTIFLO AND UV

4.1.1.3 - TERTIARY TREATMENT UPGRADES

For this option, the Actiflo and UV treatment process will be replaced with an ultra-filtration system. This system will include coagulant dosing upstream of the membranes to substitute phosphorus removal that is currently provided by the Actiflo. This would require the installation of a coagulant dosing system and a membrane plant to treat the effluent from oxidation pond 2. This option may also require the installation of clarifiers to prevent the membranes from fouling as a result of excess algae. Capacity upgrades to the oxidation ponds will also be required to cope with the increased BOD loading. This will include additional aerators in oxidation pond 1 and baffle curtains in both ponds. It has been assumed that the existing inlet screens will be used as part of this option. A schematic of this option is shown in Figure 5.

The requirements for this option are summarised below:

- Installation of additional aerators in oxidation pond 1;
- Installation of new baffle curtains in oxidation ponds 1 and 2;
- Installation of a coagulant dosing system;
- Installation of clarifiers (may be required);
- Installation of a new membrane plant including associated pre-screening, chemical storage and dosing equipment;
- Installation of a new membrane building;
- Decommissioning of existing Actiflo and UV.

This option will also include a provision for periodic pond de-sludging as part of the ongoing operation and maintenance (O&M) regime.

The expected effluent quality for this option is presented in Table 6.

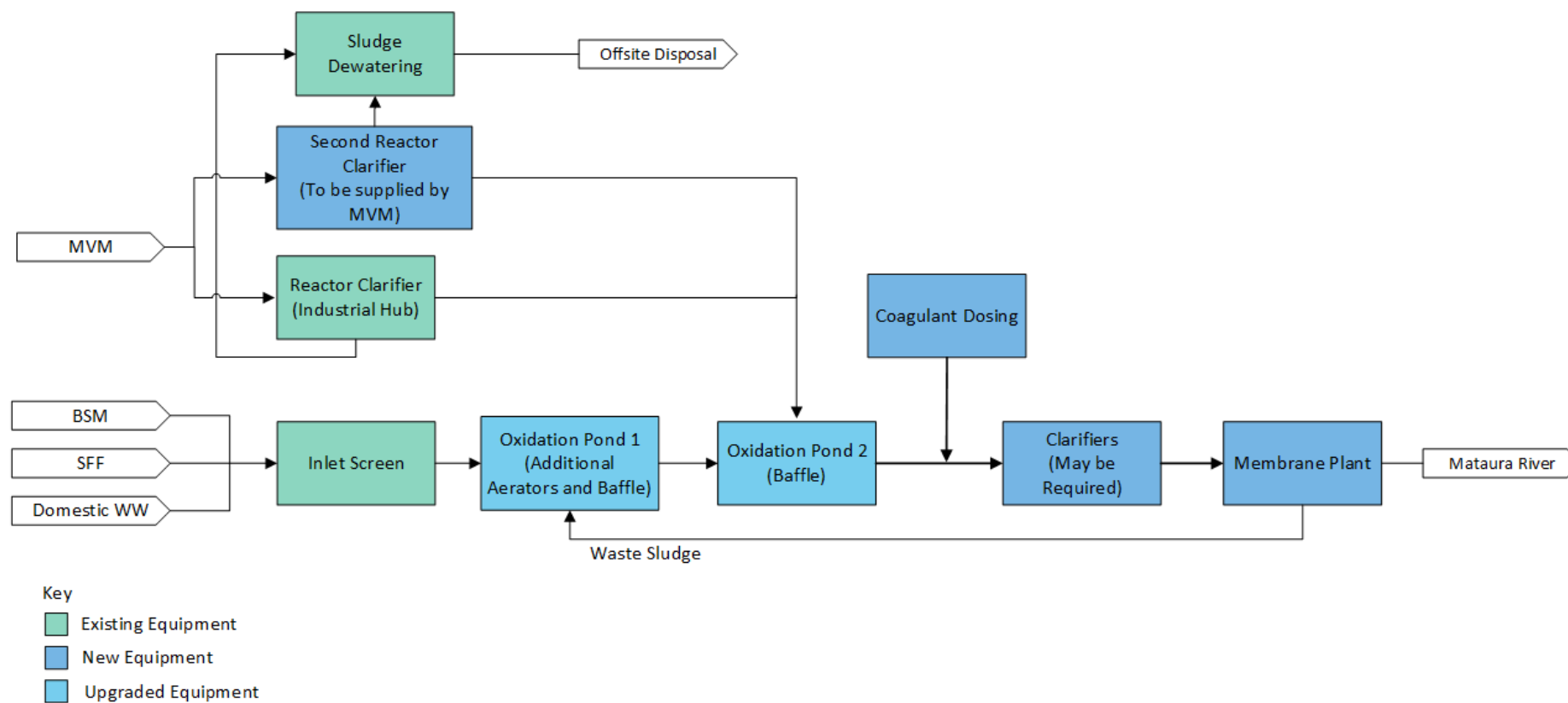


FIGURE 5: GORE WWTP TERTIARY TREATMENT UPGRADE

4.1.1.4 – DISCHARGE THROUGH WETLAND

This option will involve similar upgrades as described in Section 4.1.1.2, with the addition of a habitat wetland. Following UV treatment, the treated effluent would pass through a constructed habitat wetland before being discharged to the Mataura River. For this option it has been assumed that a portion of oxidation pond 2 will be re-purposed as a constructed wetland.

The wetland is intended to add to the aesthetic and cultural value of the treatment scheme and is unlikely to improve the effluent quality. A schematic of this option is shown in Figure 6.

The requirements for this option are summarised below:

- Installation of additional aerators in oxidation pond 1;
- Installation of baffle curtains in oxidation ponds 1 and 2;
- Installation of two new Actiflo units;
- Installation of a second sand trap;
- Installation of a second UV;
- Installation of a partition in oxidation pond 2;
- Construction of a new artificial wetland.

The consent compliance of this option will be at the UV outlet, refer to Table 6 for the expected effluent quality.

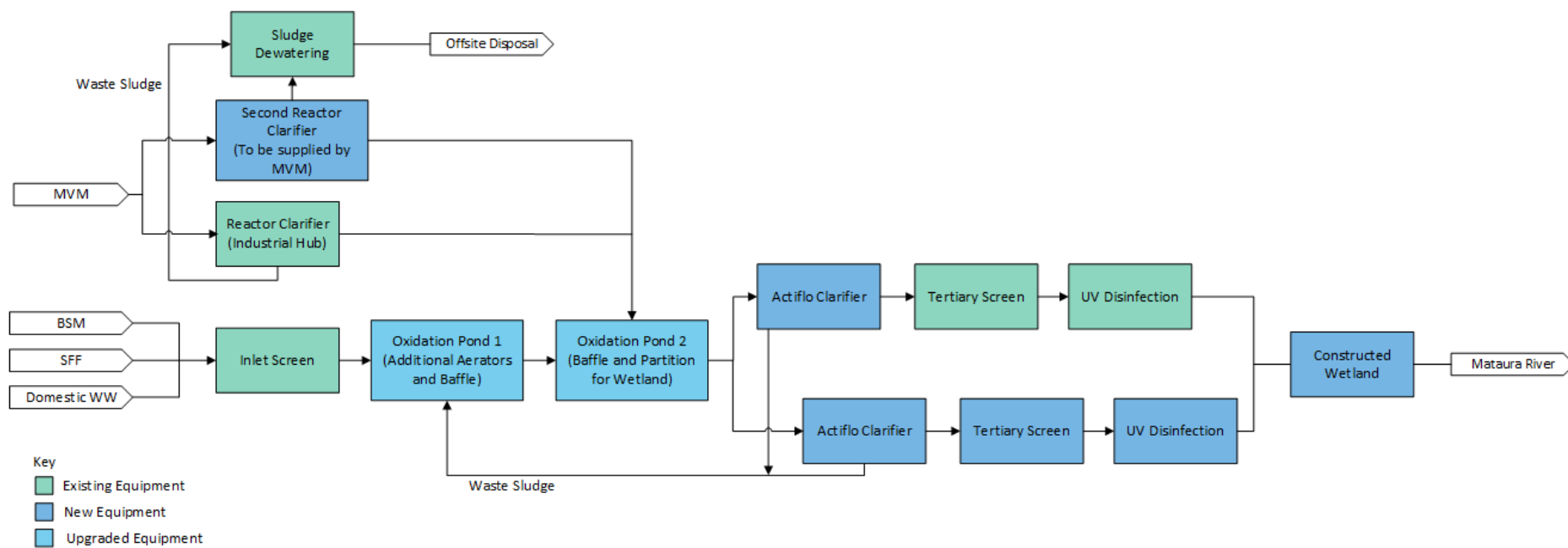


FIGURE 6: GORE WWTP DISCHARGE THROUGH HABITAT WETLAND

4.1.2 MECHANICAL TREATMENT PLANT – DISCHARGE TO MATAURA RIVER

4.1.2.1 – GORE WWTP MECHANICAL BNR PLANT

For this option the existing pond system would be replaced by a biological nutrient removal (BNR) plant. This would require the installation of activated sludge reactors, followed by either membrane filtration or clarifiers and UV disinfection. Tertiary filters such as cloth-media filters be required if membrane filtration is not selected. Oxidation pond 1 will be retained for flow balancing. Oxidation pond 2 will be decommissioned.

This system will generate more sludge than what is currently produced at the plant. A new solids handling system will be required to dewater the sludge from the BNR process. Alternatively, part of pond 1 could be partitioned and converted into a sludge storage pond, to defer capital expenditure related to sludge dewatering equipment. It has been assumed that the existing inlet screens will be used as part of this option. A schematic of this treatment option is shown in Figure 7.

The requirements for this option are summarised below:

- Ground preparation and raising of area next to the existing Industrial Hub for the installation of the new BNR plant and sludge handling system;
- Installation of a new grit removal system;
- Installation of new activated sludge reactors;
- Installation of new clarifiers or membranes;
- Installation of new tertiary filters and UV, not required if membranes are used;
- Installation of sludge handling plant for sludge thickening and dewatering, or partitioning of pond 1 for sludge storage;
- Decommission oxidation pond 2;
- Decommissioning of existing Actiflo and UV (note: UV could be reused in the new scheme).

The expected effluent quality for this option is presented in Table 6.

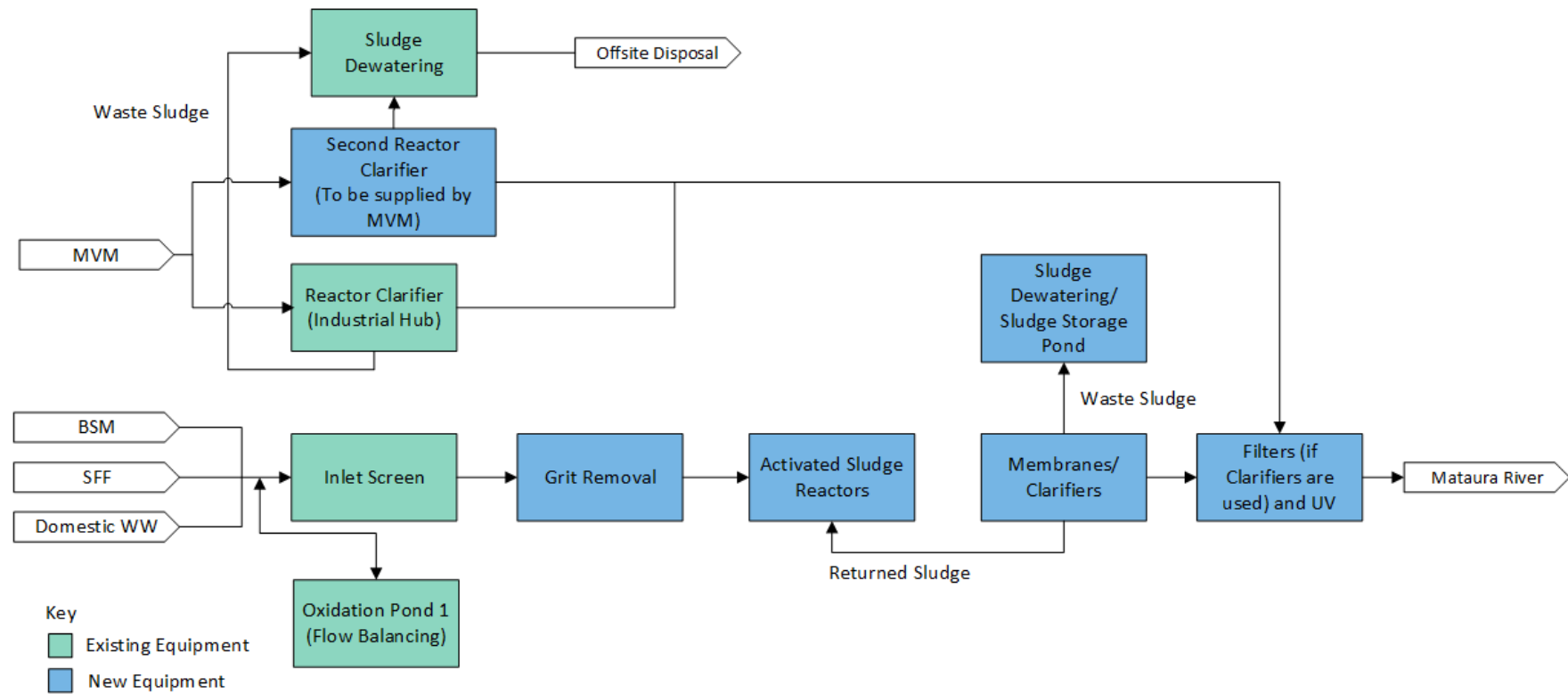


FIGURE 7: GORE WWTP MECHANICAL BNR PLANT

4.1.3 DISCHARGE TO LAND

The treatment options considered for land disposal are summarised in Figure 8. Further details on each of the treatment options are provided below.

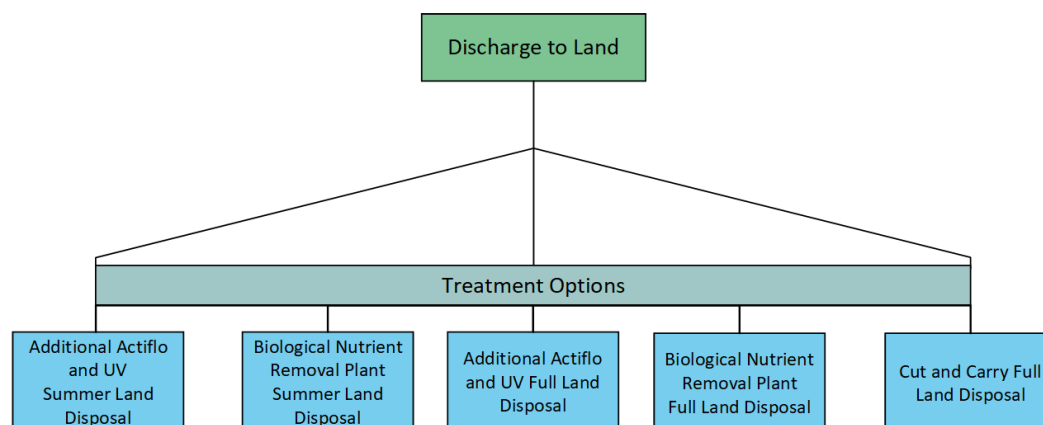


FIGURE 8: GORE WWTP LONG LIST TREATMENT OPTIONS DISCHARGE TO LAND

4.1.3.1 –ADDITIONAL ACTIFLO AND UV

For this option the treatment system will be upgraded as described in Section 4.1.1.2. The effluent from the treatment plant would be irrigated to land using central pivot irrigators. This could either be done all year round for full land disposal or only in the summer months for partial land disposal. The required land area for these two scenarios is summarised in Table 7.

	SUMMER LAND DISPOSAL	FULL LAND DISPOSAL
Required Land Area Excluding Buffer (ha)	321	642
Required Land Area Including 25% Buffer (ha)	401	802
Hydraulic Loading Rate (mm/d)	2.7	1.4

The land area requirements have been estimated by applying a maximum loading rate of 150 kg-TN/ha.y to the expected effluent TN effluent concentration (30 g/m³) and the future 2050 flow. The hydraulic loading rates that correspond to these land areas have also been included in the table. The maximum TN loading rate has been taken from regional plan rule 50² relating to discharge of dairy effluent to land. A schematic of this option is shown in Figure 9.

The requirements for this option are summarised below:

- Capacity upgrades to the WwTP will be required to handle the increased flows and loads, as described in Section 4.1.1.2.
- Pipeline and pump stations to the land disposal site;

² Environment Southland Regional Plan for Southland April 2010 – Rule 50

- Acquisition of land disposal area;
- Installation of irrigation system.

The expected effluent quality for this option is presented in Table 6. The concentrations and loads presented in the table represent the effluent quality as it leaves the treatment plant.

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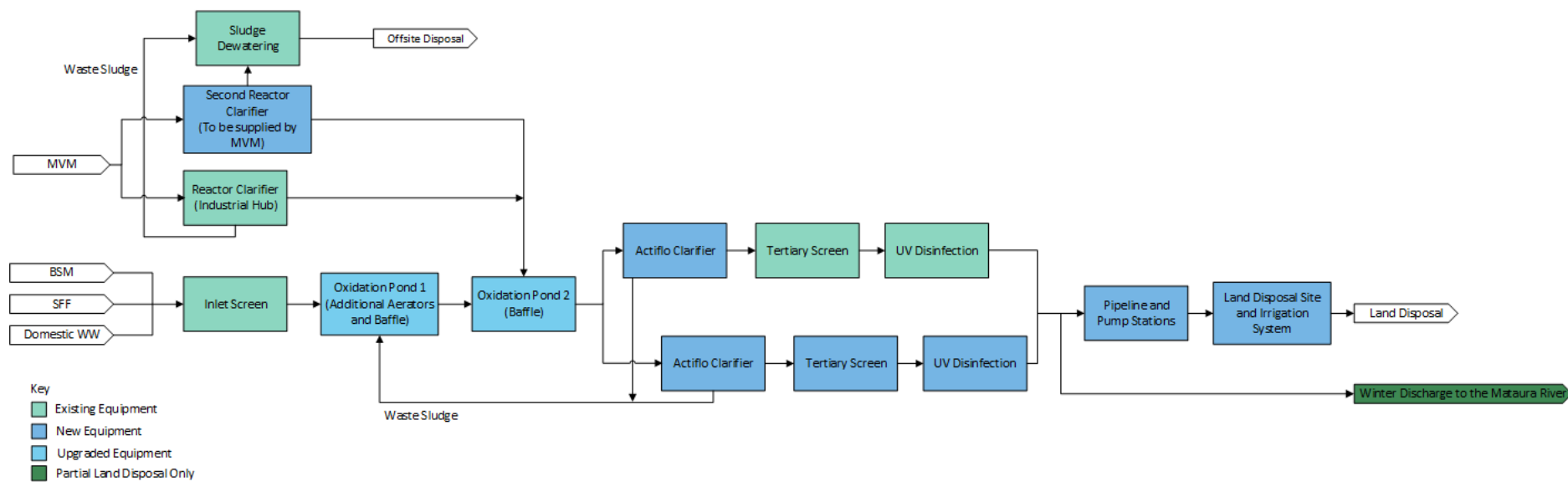


FIGURE 9: GORE WWTP ADDITIONAL ACTIFLO AND UV

4.1.3.2 – GORE WWTP BNR PLANT

This treatment option will focus on reducing the TN concentration in the treated effluent. This will reduce the land area required for effluent disposal based on the maximum discharge of 150 kg-TN/ha.y.

The reduction in TN will be achieved by installing a new BNR plant, with associated sludge processing facilities, as described in Section 4.1.2.1. The new plant will be designed to achieve a TN concentration of 20 g/m³ in the final effluent.

The effluent from the treatment plant will be irrigated using central pivot irrigators. This could either be done all year round for full land disposal or only in the summer months for partial land disposal. The required land area for these two scenarios is summarised in Table 8. Similar to Section 4.1.3.1, the land area estimates, and corresponding hydraulic loading rates have been based on the predicted 2050 flows. A schematic of this option is shown in Figure 10.

TABLE 8: GORE WWTP MECHANICAL BNR PLANT LAND DISPOSAL OPTIONS		
	SUMMER LAND DISPOSAL	FULL LAND DISPOSAL
Required Land Area Excluding Buffer (ha)	214	428
Required Land Area Including 25% Buffer (ha)	267	535
Hydraulic Loading Rate (mm/d)	4.1	2.1

The requirements for this option are summarised below:

- Construct a larger BNR plant similar to option discussed in Section 4.1.2.1;
- Pipeline and pump stations to the land disposal site.
- Acquisition of land disposal area;
- Installation of irrigation system.

The expected effluent quality for this option is presented in Table 6. The concentrations and loads presented in the table represent the effluent quality as it leaves the treatment plant.

FIGURE 10: GORE WWTP BNR

4.1.3.3 - GORE WWTP CUT AND CARRY SYSTEM

For cut and carry systems forage or pasture crops are grown on the land disposal site. These crops are routinely harvested and removed. The concept behind this system is that the growing crops will uptake the nutrients, which will be removed when the plants are harvested. This allows the system to assimilate more nutrients by minimising nutrient leaching into the ground water. Similar cut and carry system designed for wastewater effluent disposal have been designed on an assumed maximum TN loading rate of 300 kg-TN/ha.y.

For this option treatment upgrades would be necessary to maintain the effluent quality the plant is currently achieving, these would be similar to what has been described in Section 4.1.1.2. Based on the estimated 2050 nitrogen loading, a land area of approximately 401 ha (including 25% buffer) will be required. At the estimated 2050 flow, this corresponds to a hydraulic loading rate of 2.7 mm/d.

The treated effluent would be irrigated using pivot irrigators. Council would be required to arrange for the crops to be harvested on a regular basis. The harvested crops are also a potential revenue source that could be used to help fund the wastewater scheme.

The treatment process for this option will be similar to what has been shown in Figure 9.

The expected effluent quality for this option is presented in Table 6. The concentrations and loads presented in the table represent the effluent quality as it leaves the treatment plant.

4.2 MATAURA WWTP LONG LIST OPTIONS

The long list options for the Mataura WwTP have followed the three approaches for the potential upgrades to the wastewater scheme:

1. Improvements to the existing treatment system with discharge to the Mataura River;
2. Upgrades to a mechanical treatment plant with discharge to the Mataura River;
3. Discharge to land.

The expected effluent quality for the treatment options that have been considered under each approach are compared in Table 9 below.

Similar to Table 6, the “Current Plant” column in the table shows the average effluent concentration currently observed at the plant. The loads for this scenario have been calculated using the current flow presented in Table 5 above. This column has been included to provide comparative loadings against the various long list options.

Future anticipated loads that greatly exceed the current loading have been highlighted. This is an indication that these options may have limited environmental acceptability. Further ecological work is required to determine what effects the estimated future loading will have on the discharge. This assessment may take into account the combined effect of the loading from both plants. It is possible that the preferred solution for one of the plants will offset the loading from the other plant.

The loading for the “Gore and Mataura Combined Mechanical BNR Plant” has been calculated using the combined 2050 flow from both plants as for this option the wastewater from both towns will be treated and discharged from a single treatment facility.

TABLE 9: MATAURA WWTP LONG LIST OPTIONS EXPECTED EFFLUENT QUALITY

OPTION	CURRENT PLANT		DISCHARGE THROUGH ROCK FILTER ⁴		ADDITIONAL POLISHING WETLANDS WITH DISCHARGE THROUGH ROCK FILTER		TERTIARY TREATMENT UPGRADE		MATAURA WWTP MECHANICAL BNR PLANT		GORE AND MATAURA COMBINED MECHANICAL BNR PLANT	
PARAMETER	AVERAGE CONC. ² (g/m ³)	AVERAGE CURRENT LOAD ³ (kg/d)	AVERAGE CONC. (g/m ³)	AVERAGE 2050 LOAD (kg/d)	AVERAGE CONC. (g/m ³)	AVERAGE 2050 LOAD (kg/d)	AVERAGE CONC. (g/m ³) ⁶	AVERAGE 2050 LOAD (kg/d)	AVERAGE CONC. (g/m ³)	AVERAGE 2050 LOAD (kg/d)	AVERAGE CONC. (g/m ³)	AVERAGE 2050 LOAD (kg/d) ⁵
TSS	11	7.3	15	13	12	11	<3.0	2.7	<5.0	4.5	<5.0	48
cBOD ₅	5.9	3.8	10	9.0	6.0	5.4	6.0	5.4	<5.0	4.5	<5.0	48
TN	12	7.7	12-15	11-13	10-12	9-11	12-15	11-13	10	9.0	10	97
Nitrate	0.04	0.03	2.0	1.8	2.0	1.8	2.0	1.8	7.0	6.3	7.0	68
Ammonia	9.5	6.2	10	9.0	10	9.0	10	9.0	<3.0	2.7	<3.0	29
TP	0.9	0.6	1.0	0.9	1.0	0.9	1.0	0.9	1.0	0.9	1.0	9.7
DRP	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.1	0.2	1.5
E.coli ¹	520	-	600	-	600	-	<10	-	<50	-	<50	-

Notes:¹ Unit is MPN/100ml

² Current effluent concentration taken from compliance monitoring data over the period from 2015-2018.

³ Loads calculated based on current flow as stated in Table 5 above.

⁴ Expected effluent quality also applies to the land disposal options. Concentrations and loads are in an indication of the effluent as it leaves the treatment plant and does not take into account any additional treatment that may result from the land disposal.

⁵ Loads calculated based on the combined wastewater flows from Gore and Mataura.

⁶ Tertiary treatment option effluent TSS and E coli based on membrane plant outlet.

4.2.1 IMPROVEMENTS TO EXISTING TREATMENT SYSTEM – DISCHARGE TO MATAURA RIVER

Figure 11 summarises the treatment options that have been considered for the Mataura WwTP for the discharge to river disposal method. Further details on each of the treatment options is provided below.

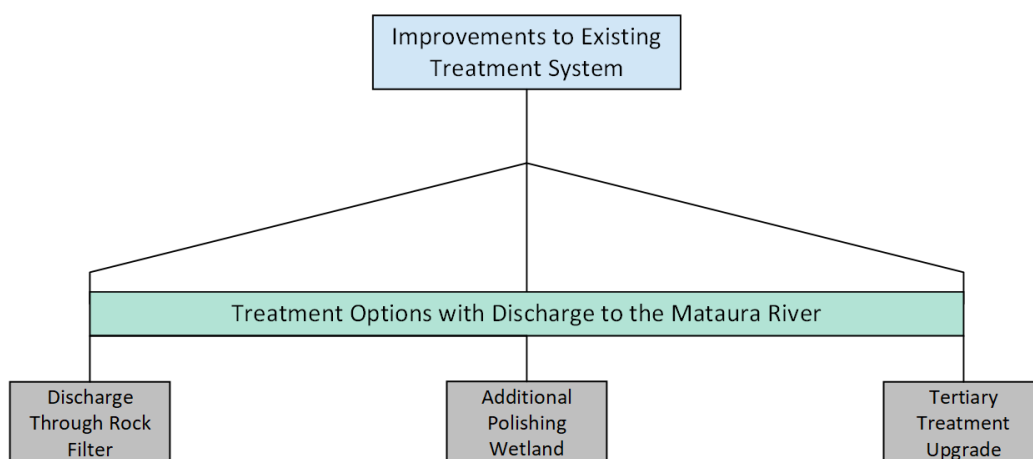


FIGURE 11: MATARUA WWTP LONG LIST TREATMENT OPTIONS

4.2.1.1 – DISCHARGE THROUGH ROCK FILTER

The Mataura WwTP operates well and is compliant with the conditions of the operative consent. This option will maintain the existing treatment system, recognising that the oxidation pond has sufficient capacity to treat the additional flows that will result from the minimal growth that is anticipated in the area. Upgrades to the plant will include the installation of a new rock filter to improve the cultural acceptance of the discharge structure.

The upgrade approach for the plant will focus on continuous improvements to the treatment system and consider enhancements such as an inlet screen, pipework modifications and updating the telemetry/SCADA system. The treatment process for this option will be very similar to what has been shown in Figure 2

While minor, the increase in flow may reduce the hydraulic retention time through the wetlands. This will likely cause a slight deterioration in effluent quality compared to what the plant is currently achieving.

The expected effluent quality for this option has been presented in Table 9.

4.2.1.2 - ADDITIONAL POLISHING WETLAND AND ROCK FILTER

For this option additional wetland cells will be installed to provide further polishing of the final effluent. This will allow for greater retention time through the wetland system. Further improvements to the plant by means of a new inlet screen, pipework modifications and updating the telemetry/SCADA system will also be considered as part of this option. A schematic of this treatment process is shown in Figure 12.

Additional wetland cells and associated pipework will be constructed to cater for the increase in wastewater flows.

The expected effluent quality for this option has been presented in Table 9.

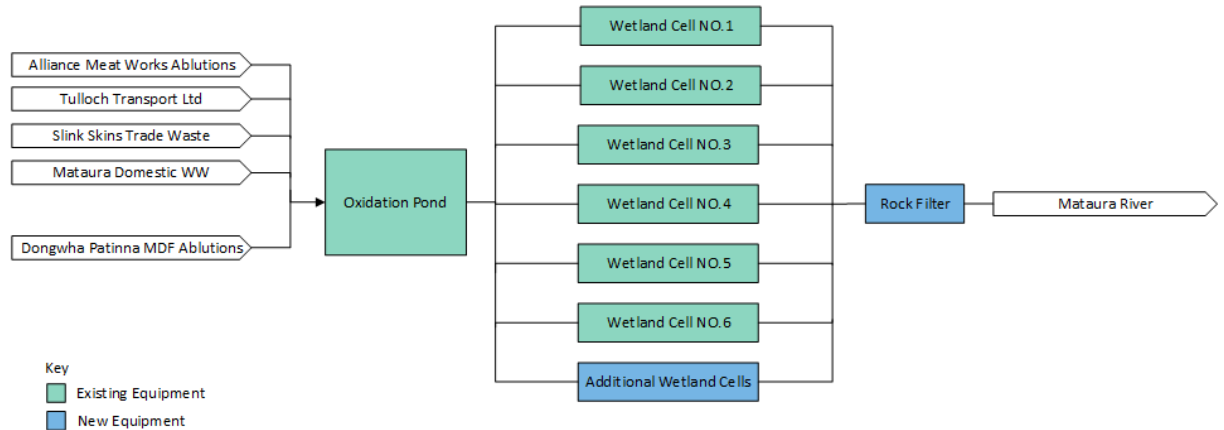


FIGURE 12: MATAURA WWTP ADDITIONAL POLISHING WETLAND

4.2.1.3 - MATAURA WWTP TERTIARY TREATMENT UPGRADE

This option will involve installing a tertiary filtration system to improve the final effluent quality prior to the wetland disposal. The tertiary filtration system will be located downstream of the oxidation pond, and the membrane permeate will be discharged into the existing six wetland cells. A rock filter can be added to this treatment option. Under this option, general enhancement of inlet screen and SCADA/telemetry upgrade will also be considered.

A schematic of this treatment option is presented in Figure 13.

The requirements for this option are summarised below:

- Installation of new membrane plant including associated pre-screening, chemical storage and dosing equipment;
- Installation of a new membrane building.

The expected effluent quality is presented in Table 9 above.

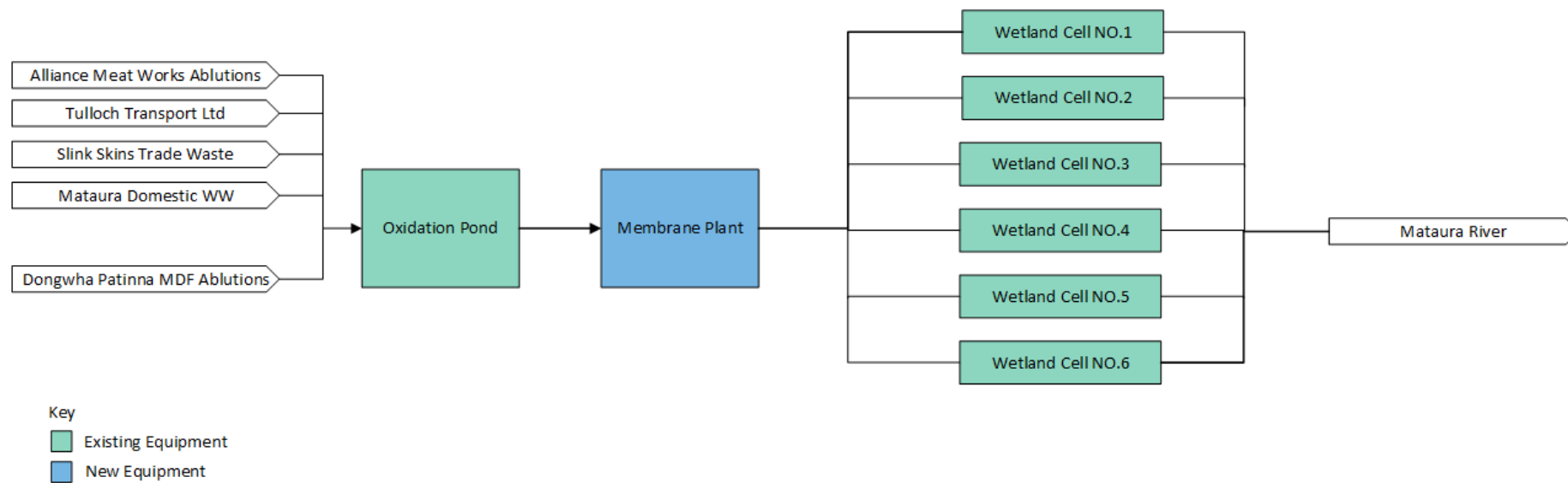


FIGURE 13: MATAURA WWTP TERTIARY TREATMENT UPGRADE

4.2.2 MECHANICAL TREATMENT PLANT – DISCHARGE TO MATAURA RIVER

The options to upgrade the wastewater treatment scheme to a nutrient removal mechanical treatment plant are summarised in Figure 14. Further details on each of the options are discussed in the sections below.

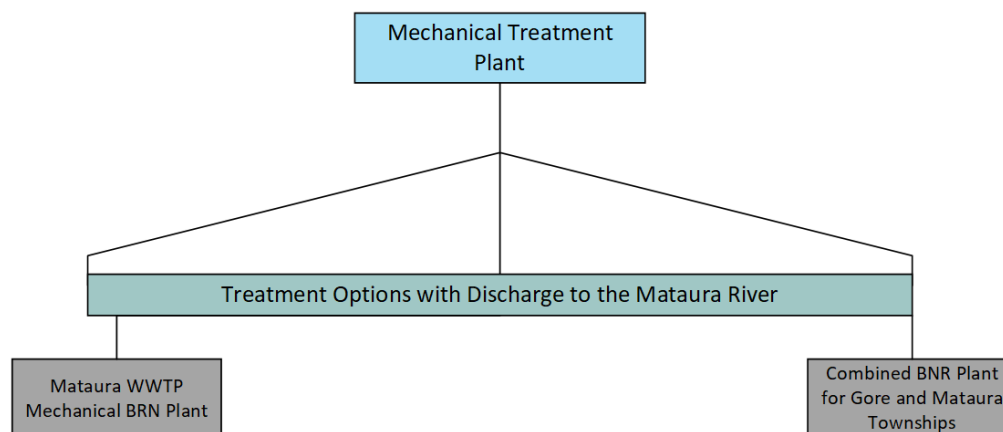


FIGURE 14: MATAURA WWTP MECHANICAL TREATMENT PLANT

4.2.2.1 – MATAURA WWTP BIOLOGICAL NUTRIENT REMOVAL PLANT

This option will involve installing a new BNR plant to replace the existing pond system. This would require the installation of activated sludge reactors, followed by either membrane filtration or clarifiers, cloth-media filters and UV disinfection. The existing pond will be retained for flow balancing.

This system will produce more sludge than what is currently produced at the plant. A new solids handling system will be required to dewater the sludge from the BNR process. Alternatively, part of the pond could be partitioned and converted into a sludge holding pond. A schematic of this system is shown in Figure 15.

The requirements for this option are summarised below:

- Installation of new activated sludge reactors plant;
- Installation of new clarifiers/membranes;
- Installation of new tertiary filters and UV;
- Installation of sludge handling plant for sludge thickening and dewatering/partitioning of pond for sludge storage;
- Decommissioning of existing wetland cells.

The expected effluent quality for this option is presented in Table 9 above.

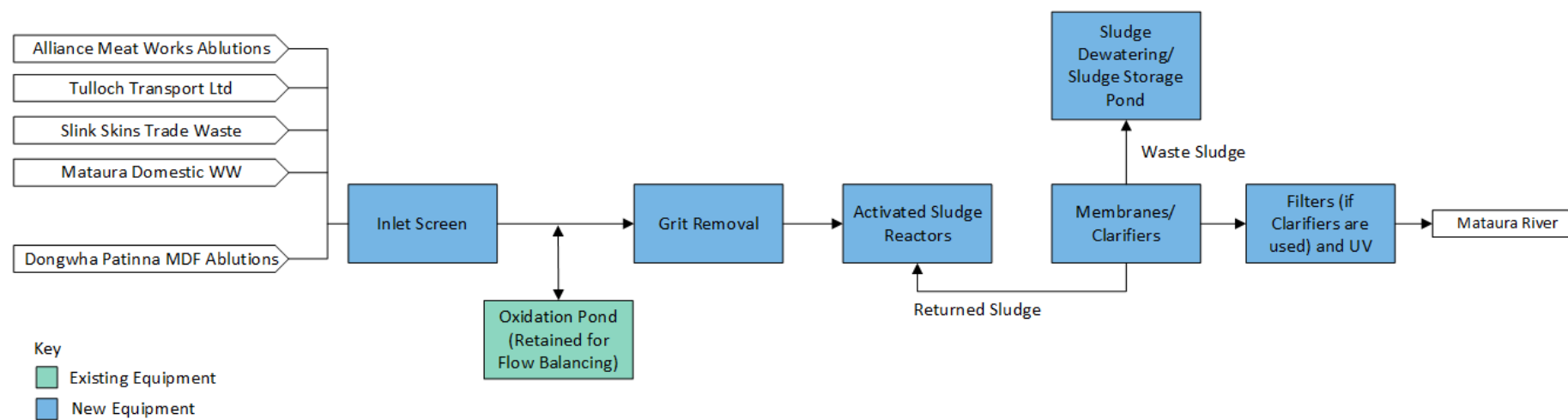


FIGURE 15: MATAURA WWTP BNR TREATMENT PROCESS

4.2.2.2 - COMBINED WWTP FOR GORE AND MATAURA TOWNSHIPS

For this option, the wastewater from Gore and Mataura would be treated at a single wastewater water treatment facility at the site of the existing Gore WwTP. This will require significant upgrades to the Gore WwTP, which will need capacity to treat the combined flow of over 9,600 m³/d from both townships. The upgrades of the Gore WWTP will be similar to those described in Section 4.1.2.1, except the treatment system will be larger.

A pre-screening plant will be installed at the Mataura WwTP before the wastewater is pumped to Gore via a new rising main and transfer pump station. The existing pond at Mataura will be retained for flow balancing, when the incoming flows exceed the capacity of the new transfer pump station. A schematic of this treatment option is shown in Figure 16.

The requirements for this option are summarised below:

- Installation of new mechanical screen(s) at Mataura;
- Construction of a conveyance pipeline and transfer pump station(s) to convey wastewater from Mataura to Gore;
- Construct a larger BNR plant similar to option discussed in Section 4.1.2.1;
- Decommissioning of oxidation pond 2 at Gore WwTP;
- Decommissioning of existing Actiflo and UV;
- Decommissioning of the wetlands at Mataura WwTP.

The expected effluent quality for this option is presented in Table 9.

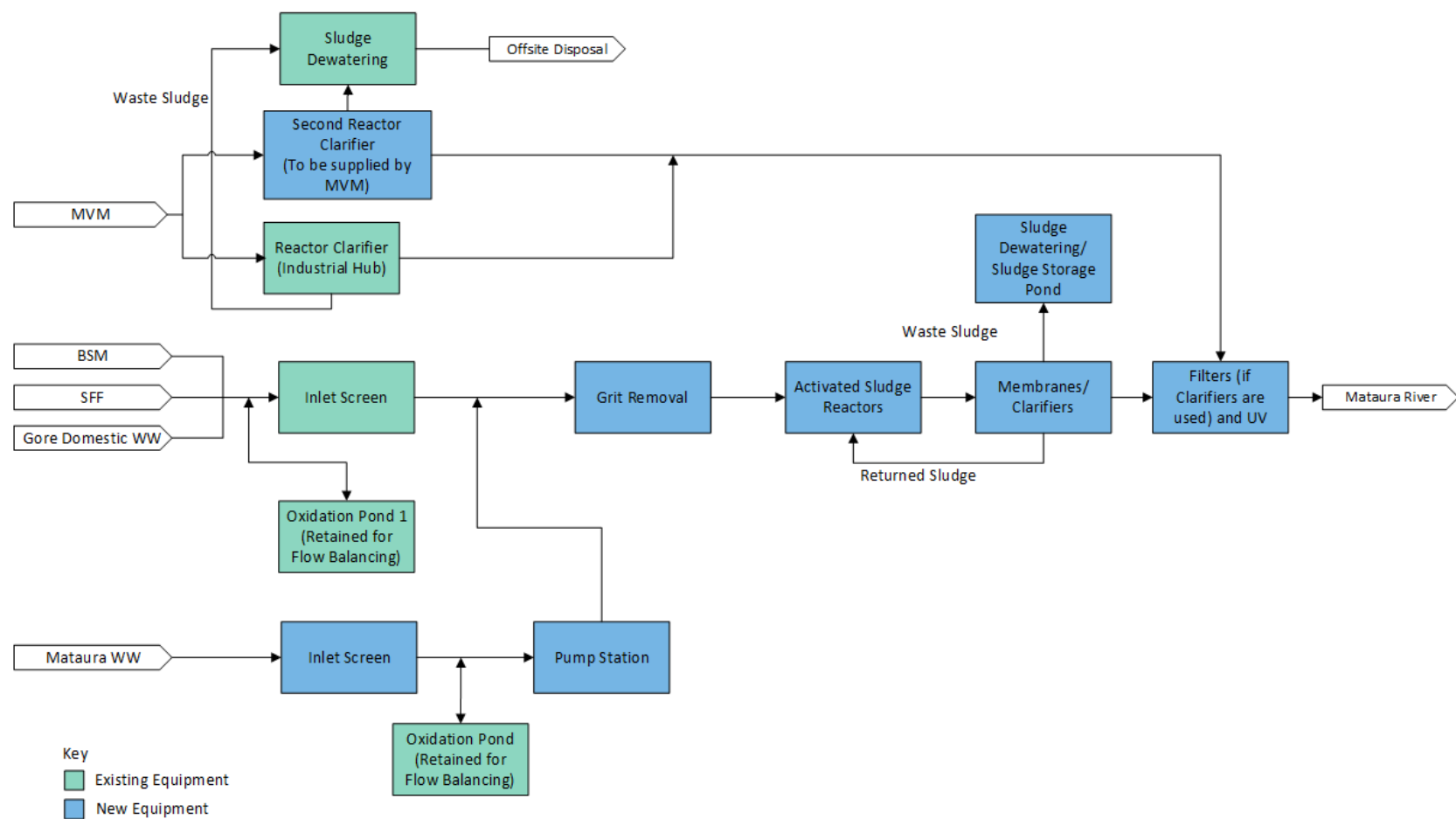


FIGURE 16: GORE AND MATAURA COMBINED BNR PLANT

4.2.3 DISCHARGE TO LAND

Figure 17 summarises the treatment options that have been considered in conjunction with land disposal at the Matura WwTP.

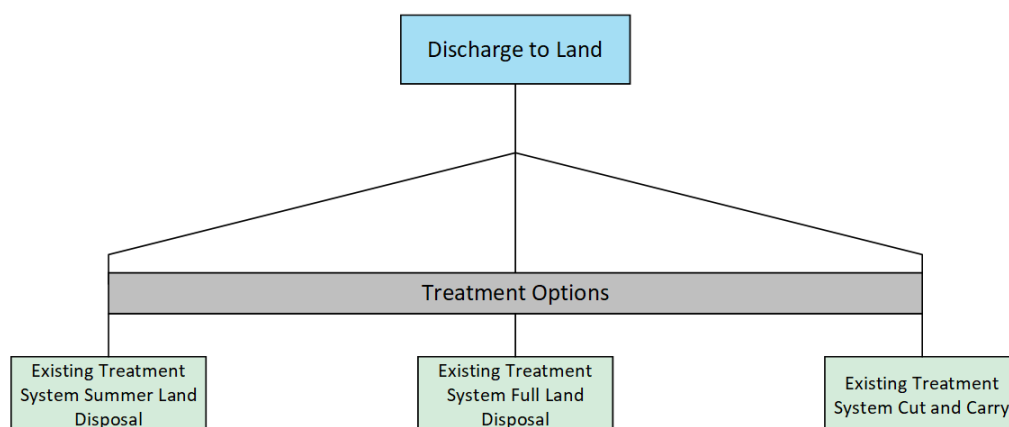


FIGURE 17: MATAURA WWTP LONG LIST OPTIONS – DISCHARGE TO LAND

4.2.3.1 - EXISTING TREATMENT SYSTEM

For this option the treated system at the Matura WwTP would remain the same. After passing through the wetland cells the treated effluent would be irrigated to land using spray irrigators. This could either be done all year round for full land disposal or only in the summer months for partial land disposal. The required land area for these two scenarios is summarised in Table 10.

	SUMMER LAND DISPOSAL	FULL LAND DISPOSAL
Required Land Area Excluding Buffer (ha)	22	44
Required Land Area Including 25% Buffer (ha)	27	55
Hydraulic Loading Rate (mm/d)	4.1	2.1

The land area requirements have been estimated by applying a maximum loading rate of 150 kg-TN/ha.y to the estimated future TN effluent concentration (20 g/m³) and the future 2050 flow. The corresponding hydraulic loading rates for these land areas are also included in the table. The maximum TN loading rate has been taken from regional plan rule 50 relating to discharge of dairy effluent to land.

A schematic of this option is shown in Figure 18.

The requirements for this option are summarised below:

- Pipeline and pump stations to the land disposal site;
- Acquisition of land disposal area;
- Installation of irrigation system.

The expected effluent quality for this option is the same as what has been presented for discharge through rock filter option in Table 9. The concentrations and loads presented in the table represent the effluent quality as it leaves the treatment plant.

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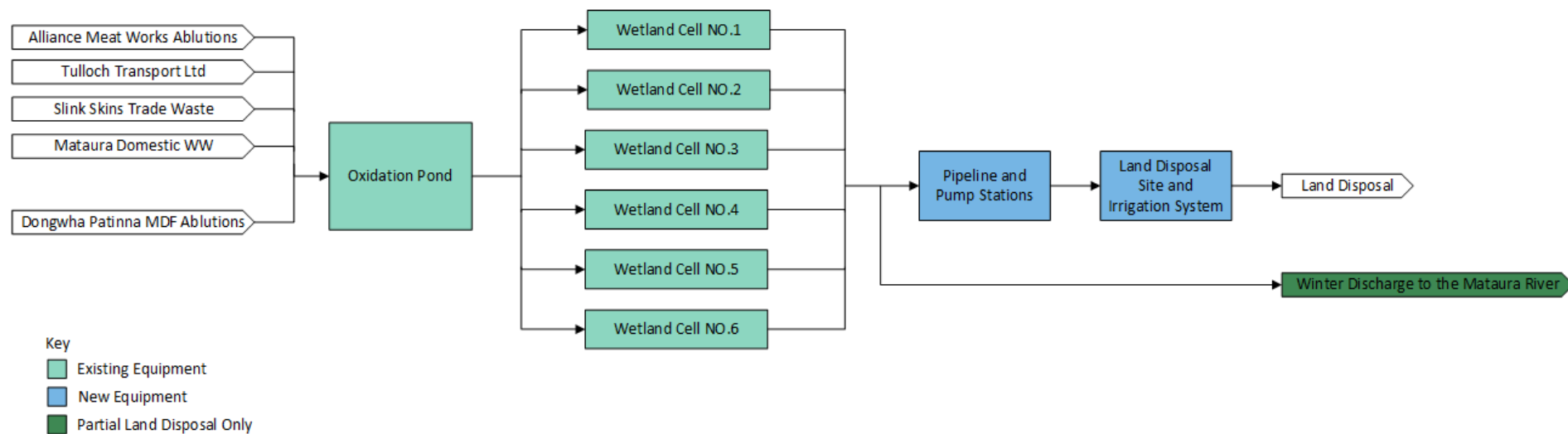


FIGURE 18: MATAURA WWTP EXISTING TREATMENT SYSTEM

4.2.3.2 – MATAURA WWTP CUT AND CARRY – DISCHARGE TO LAND

For this option the cut and carry system will be used to minimise that land area required for the disposal filed. Based on a maximum TN loading rate of 300 kg-TN/ha.y an estimated land area of 27 ha (including 25% buffer) would be required. At the estimated 2050 flow this corresponds to a hydraulic loading rate of 4.1 mm/d.

The treatment process for this option will be similar to what has been shown in Figure 18.

The expected effluent quality for this option is the same as what has been presented for discharge through rock filter option in Table 9. The concentrations and loads presented in the table represent the effluent quality as it leaves the treatment plant.

5.0 EVALUATION CRITERIA

The selection of the preferred option for the wastewater scheme will be based on a Multi Criteria Analysis (MCA). The MCA will consider each of the options in terms of the following categories:

1. Cultural beliefs and aspirations;
2. Environmental impact and drivers;
3. Cost to the Council and community;
4. Social impacts;
5. Technical feasibility and operability.

ASSESSMENT OF THE LONG LIST OPTIONS

The options evaluation process has included rating the long list options against these categories using a colour coded traffic light system, where each option was given a rating of low, medium or high based on a qualitative application of the MCA. The definitions used to determine the rating are included in Table 11 below.

TABLE 11: LONG LIST OPTION RATING DEFINITIONS

RATING	DEFINITION
Low	Option has a potential fatal flaw making it unlikely that it will be acceptable.
Medium	Implementing option may require overcoming some opposition/obstacles.
High	Option addresses the required needs.

The most favourable option under each of the upgrade approaches (improvement to existing treatment system, mechanical treatment plant and land disposal) have been taken forward to the short list. These options will be developed in further detail to allow for a more informed assessment during the short list evaluation.

ASSESSMENT OF SHORT LIST OPTIONS

The short list options will be assessed against the same criteria using a quantitative approach. Each of the categories will be given a weighting and the options will be rated from 1-10 against the criteria. Based on this, an overall score will be developed for each option using the score and weighting of the criteria. The highest scoring option will be selected as the preferred option.

5.2 CRITERIA AND DRIVERS

5.2.1 CULTURAL BELIEFS AND ASPIRATIONS

The cultural acceptability of each option has been assessed based on the following factors:

- Continuous Improvement – Does the option demonstrate improved cultural and environmental outcomes compared to the existing scheme?
- Land Contact – Will the option provide some kind of land contact for the treated effluent?

5.2.2 ENVIRONMENTAL DRIVERS

The environmental drivers for the upgrade options have been based on the water quality standards outlined in the Water Conservation Order for the Mataura River and Environment Southland's Operative and Proposed Regional Water Plans. These documents contain water quality standards specifically derived for the Mataura River.

In addition to the regional plan the environmental drivers have also considered the objectives outlined in National Policy Statement for Fresh Water Management (NPS-FM) and the ANZECC Guidelines for recreational water use.

WATER CONSERVATION ORDER – MATAURA RIVER

The water conservation order for the Mataura River was put in place in 1997 to protect fisheries, angling and amenity features. The Mataura Water Conservation order prohibits any discharge into the river that would reduce the water quality of the Mataura River below what has been outlined in the conservation order.

The provisions relating to discharge in Water Conservation Order are summarised below:

- The discharge must not cause the natural temperature of the receiving water to change by more than 3°C.
- The pH of the receiving environment must be within the range of 6-9.
- The receiving waters must not be unpalatable or unsafe for consumption by humans or farm animals.
- The concentration of toxic substances in the discharge must not result in the destruction of natural aquatic life.
- The discharge must not result in any obvious change in the natural clarity and colour of the receiving environment.
- The dissolved oxygen concentration in the receiving environment must be a minimum of 5.0 g/m³.

REGIONAL PLANS

The Regional Water Plan for Southland outlines Environment Southland's plan for the sustainable management of rivers, lakes and water resources in the region. The plan became operative in January 2010.

The proposed Southland Water and Land Plan is expected to become operative in 2019.

The policies in both plans state a preference for discharge to land over discharges to waterbodies. Where this is not practicable the rules governing discharges to surface waterbodies are based on water quality standards have been specified for receiving environments. The water quality standards have been set based on the classification of the water body and its current condition.

The receiving environment for the discharge from the Gore and Maitava WwTPs falls under the Maitava 3 category. This category recognises the status of the river as a protected waterbody under the water conservation order.

Under the Regional Water Plan, any discharge into the Maitava River should not reduce the water quality below the standards set out in the plan. These water quality standards are similar to the standards from the Water Conservation Order, with the addition of the parameters listed below.

- The discharge must be substantially free from suspended solids, grease and oil.
- The receiving water must be free of visible bacteriological or fungal slime growths. This applies within the zone of reasonable mixing.
- The change in sediment cover should not exceed 10%.
- The median concentration of pathogens in the receiving environment should not exceed the following:
 - Faecal coliforms – 1,000 MPN/100mL;
 - E.coli – 130 MPN/100mL (only applicable 1 km upstream of “Popular Bathing Sites”. (There are no “Popular Bathing Sites” in the proximity of the Gore or Maitava WwTP discharge.)
- Fish in the waterbodies must be suitable for human consumption.

NATIONAL POLICY STATEMENT FOR FRESHWATER MANAGEMENT

National policy statements are issued by central government for the use of local government authorities.

The National Policy Statement for Freshwater Management (NPSFM) was enacted in 2014 and amended in 2017. It provides direction to local authorities on their responsibilities under the Resource Management Act 1991 regarding the management of freshwater.

The freshwater objectives within the NPSFM are provided as numerical standards when applicable, but otherwise, narrative standards are used.

The narrative standards are listed at the beginning of the document as a series of objectives, while the numerical standards are included in Appendix 2 as attribute tables, alongside further narrative standards. The parameters for each water quality variable are dictated by the attribute state of the waterbody. For the Maitava River, the attribute state is A.

The numerical standards for A class rivers are:

- For periphyton, no more than 8% of samples may exceed ≤ 50 mg chl-a/m²
- For nitrate (toxicity) the annual median must be ≤ 1.0 mg NO₃-N/L and the annual 95th percentile must be ≤ 1.5 mg NO₃-N/L
- For ammonia (toxicity) the annual median must be ≤ 0.03 mg NH₄-N/L and the annual maximum must be ≤ 0.05 mg NH₄-N/L
- For dissolved oxygen the 7-day mean minimum over the summer period must be ≥ 8.0 mg/L and the 1- day minimum for the summer period must be ≥ 7.5 mg/L

- For E.coli, the median concentration must be ≤ 130 cfu/100mL and the 95th percentile must be ≤ 540 E.coli/100mL.

MICROBIOLOGICAL WATER QUALITY GUIDELINES FOR MARINE AND FRESHWATER RECREATIONAL AREAS

The Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas were created in 2003 by the Ministry of Health and the Ministry for the Environment.

The purpose of the document is to aid councils and agencies in informing communities about water quality in recreational areas to control public health risks.

The standards within the document are advisory only and have no legislative status. Freshwater sites are graded using the Sanitary Inspection Category and Microbiological Assessment Category methods which combine to provide an overall Suitability for Recreational Grade. An action level is determined based on the results of bacterial sample, with each level requiring different management approaches.

The standards which trigger the three actions levels are:

- Acceptable/Green Mode: No single sample greater than 260 E. coli/100 mL
- Alert/Amber Mode: Single sample greater than 260 E. coli/100 mL.
- Action/Red Mode: Single sample greater than 550 E. coli/100 mL.

ANZECC GUIDELINES

The ANZECC guidelines outlines a set of water quality standards for the recreational use of fresh waterbodies. Suggested limits are provided for the flowing parameters:

- Microbial concentrations;
- Algae;
- Colour and clarity;
- pH;
- Temperature;
- Oil;
- And toxic chemicals.

Consideration to these guidelines has been given for the parameters that are typically associated with effluent discharge from WwTPs.

5.2.3 COST

A rating will be given to each option based on its estimated cost.

For the long list, each option will be categorised as high, medium or low in terms of rough order capital cost estimates. For options that are progressed to the short list, more detailed estimates of the capital and operational costs will be developed.

The long list options for Gore and Mataura will be rated according to the cost ranges presented in Tables 12 and 13.

TABLE 12: GORE WWTP LONG LIST OPTIONS COST RANGES

RATING	CAPITAL COST RANGE
High	>\$50M
Medium	\$15M-\$50M
Low	<\$15M

TABLE 13: MATAURA WWTP LONG LIST OPTIONS COST RANGES MATAURA

RATING	CAPITAL COST RANGE
High	>\$15M
Medium	\$2M-\$15M
Low	<\$2M

5.2.4 SOCIAL IMPACTS

The assessment of the social impacts of the options will evaluate the effect of each option on the community with consideration to the following parameters:

- Disruption During Construction – This will consider the noise, odour and traffic impact of the option on the community.
- Recreational Use of Waterbodies – This will assess if the option will limit the recreational use of the waterway in terms of swimming, boating aesthetic value.
- Public Health Risk – This will assess the risk to public health that each option poses.
- Odour – This will consider the potential for odour.
- Loss of Productive Land – This will consider the implications converting farm land into an effluent irrigation system.

5.2.5 TECHNICAL FEASIBILITY

The assessment of technical feasibility will consider the following factors:

- Suitability – This will consider whether the proposed option is suitable or technically appropriate for the scheme.
- Future Expansion – This will consider the modularity, footprint and expansion capacity of proposed option.
- Process Reliability – This will look at the performance of other WwTPs with similar treatment technologies, with particular consideration given to the consistency of the effluent quality.
- Operability – This will be assessed based on how much operator input will be required for the proposed option, and how different it is from the existing system.
- Constructability – This will consider the complexity of the construction process for each of the proposed options.

A preliminary land feasibility assessment was separately undertaken using the available Geographic information System (GIS) data, refer to Appendix 1 for details.

6.0 LONG LIST OPTIONS EVALUATION

TABLE 14: GORE WWTP LONG LIST OPTIONS EVALUATION

UPGRADE APPROACH	TREATMENT UPGRADE	CULTURAL	ENVIRONMENTAL	COST	SOCIAL	TECHNICAL FEASIBILITY	KEY ISSUES	SHORTLISTED?
Improve Existing Treatment System, Discharge to River	Do Nothing	1,2	1,2		3	3	¹ Reduced effluent quality, poor social & cultural ² Increase in discharge loads to receiving environment ³ Poor effluent quality will affect recreation uses	No
	Additional Actiflo and UV	1	1		2		¹ Increase in discharge loads as flow will increase ² Poor effluent quality will affect recreation uses	No
	Tertiary Treatment Upgrade		1		2	3	¹ Some improvement in effluent quality. Still considerable increase in TN and AmmN loading as a result of flow increase. ² Recreational value of the waterbody will increase as a result of improved bacteria and virus removal. ³ A number of WWTPs have successfully implemented this as a short term upgrade option. Wetland can be added for cultural acceptance.	Yes
	Additional Actiflo and UV with Discharge Through Wetland		1			1	¹ Converting part of Pond 2 as wetland may be difficult and minimal improvement across wetland.	No
Mechanical Plant,	BNR Plant for Gore						Significant increase in CapEx and OpEx	Yes

TABLE 14: GORE WWTP LONG LIST OPTIONS EVALUATION

UPGRADE APPROACH	TREATMENT UPGRADE	CULTURAL	ENVIRONMENTAL	COST	SOCIAL	TECHNICAL FEASIBILITY	KEY ISSUES	SHORTLISTED?
Discharge to River								
Discharge to Land	Additional Actiflo and UV - Summer Land Disposal			¹		¹	¹ Land feasibility assessment has indicated that required land area of ~ 401 ha is feasible.	Yes
	Additional Actiflo and UV - Full Land Disposal			¹		¹	¹ Land requirements (~802 ha) will be very difficult to meet and manage.	No
	BNR Plant Summer Land Disposal			¹		²	¹ Option includes significant upgrades to the treatment plant as wells as land disposal. CapEx and OpEx will be very high. ² Land feasibility assessment has indicated that required land area of ~ 214 ha is achievable.	No
	BNR Plant Full Land Disposal			¹		²	¹ Option includes significant upgrades to the treatment plant as wells as land disposal. CapEx and OpEx will be very high. ² Land requirements (~535 ha) will be very difficult to meet.	No
	Cut and Carry			¹		^{1, 2}	¹ Uncertain market acceptability of the harvest product. ² Land feasibility assessment has indicated that required land area of ~ 401 ha is achievable.	No

TABLE 15: MATAURA WWTP LONG LIST OPTIONS EVALUATION

UPGRADE APPROACH	TREATMENT UPGRADE	CULTURAL	ENVIRONMENTAL	COST	SOCIAL	TECHNICAL FEASIBILITY	KEY ISSUES	SHORTLISTED?
Improvements to Existing Treatment System, Discharge to River	Discharge Through Rock Filter	¹	¹				¹ Ryder to confirm current environmental impact, especially with small increase in contaminant loading.	No
	Additional Polishing Wetland		¹				¹ Ryder to confirm current environmental impact.	Yes
	Tertiary Treatment Upgrade				¹		¹ Recreational value of the waterbody will increase as a result of improved bacteria and virus removal.	No
Mechanical Treatment Plant, Discharge to River	BNR Plant for Maitara						Significant increase in CapEx and OpEx. High operator input required for small flow.	No
	Combined BNR Plant at Gore						Significant increase in CapEx and OpEx	Yes
Discharge to Land	Existing Treatment System – Summer Land Disposal					¹	¹ Land feasibility assessment has indicated that required land area of ~ 27 ha is achievable.	Yes
	Existing Treatment – Full Land Disposal					¹	¹ Land feasibility assessment has indicated that required land area of ~ 55 ha is achievable.	No
	Cut and Carry			¹		^{1,2}	¹ Uncertain market acceptability of the harvest product.	No

TABLE 15: MATAURA WWTP LONG LIST OPTIONS EVALUATION

UPGRADE APPROACH	TREATMENT UPGRADE	CULTURAL	ENVIRONMENTAL	COST	SOCIAL	TECHNICAL FEASIBILITY	KEY ISSUES	SHORTLISTED?
							² Land feasibility assessment has indicated that required land area of ~ 27 ha is achievable.	

7.0 SHORT LIST OPTIONS

The following options have been selected for the short list based on the long list options evaluation presented in Tables 14 and 15. These options have been selected with input from GDC.

TABLE 16: SHORT LIST OPTIONS		
IMPROVEMENT APPROACH	GORE WWTP	MATAURA WWTP
Improvement to Existing WwTP	Tertiary Treatment Upgrade	Additional Polishing Wetland
Mechanical Treatment Plant	BNR Plant for Gore	Combined BNR for Gore and Mataura
Discharge to Land	Additional Actiflos and UV with Summer Land Disposal	Summer Land Disposal

The next steps in this process have been to develop the short list options in more detail. For each option, a short description of the proposed location of the new equipment has been given to build on what has been discussed in Section 4.0.

COSTING ASSUMPTIONS

The short list options have also been presented with a rough order of magnitude estimate of the Capital (CAPEX) and Operational (OPEX) cost of each option. The estimates have been developed for comparison purpose only, based on the following assumptions:

- The cost estimates prepared for the short list options have been developed for comparison purposes only. These costs have been estimated based on a concept level details of each option to an accuracy of -5% to +30%. Further design is necessary to refine the cost estimates.
- Plant operating costs are derived from current GDC operating expenditures and rates provided from vendors. GDC general expenses and asset depreciation is not included.
- The annual maintenance costs for the options have been estimated as a percentage of the capital mechanical, electrical and structural costs of the upgrade. An allowance has been made of 2% per annum for the mechanical and electrical costs and 1% per annum for the structural and civil costs.
- The cost of land acquisition for the land disposal options has been estimated based on an assumed land cost of \$20,000/ha.
- Power costs for the OPEX cost estimates have been estimated based on a power cost of \$0.01/kWhr provided by GDC.
- Costing has been based on the estimated future flows as they are presented in Tables 2 and 5 for Gore and Mataura respectively. The domestic flow estimates for Gore have assumed some reduction in I&I over the design horizon.

- The cost estimates for all the Gore WwTP options, including the combined treatment plant with Mataura, have included an allowance to desludge the oxidation ponds. The cost estimate for this has been developed based on the "Pond 1 desludging Options Assessment" prepared by WSP OPUS in May 2018. For options that continue to use the existing ponds it has been assumed that the ponds will have to be desludged periodically to maintain good operating conditions. The desludging frequency for Ponds 1 and 2 are assumed to be every 15 and 25 years respectively. Should the performance of the ponds decrease after desludging it will be possible to add a small quantity of seed sludge from the Industrial Hub.

This cost has been presented separate to the annual OPEX. The percentage added for Preliminary and General and Non-works Costs has not been included for the desludging costs. No allowance has been made to de-sludge the pond at the Mataura WwTP.

- GDC have indicated that only a small section of the area at the northern border of the Gore WwTP has been raised above the flood level, and that the ground conditions surrounding this section are poor. For all options that require new plant equipment to be installed outside the existing flood protection area, an allowance has been made to create a raised platform.

7.1 GORE WWTP SHORT LIST OPTIONS

7.1.1 IMPROVEMENTS TO EXISTING PLANT – TERTIARY TREATMENT UPGRADE

For the tertiary treatment upgrade the plant will follow a similar treatment process to what has been presented in Figure 5.

Clarifiers have been included in this option for coagulation to form phosphorus precipitates and lower solids loads to the membranes by removing precipitates and algal solids as sludge.

It has been assumed that the new clarifier and membrane plant will be installed at the northern border of the site. As the new equipment will not fit on the existing raised flood protection platform, some allowance has been made for ground remediation.

This option will require a new pipeline to transfer the effluent from Oxidation Pond 2 to the membrane plant. The pipeline will continue from the membrane plant to the outfall located near the existing Actiflo. The cost estimates for this option is presented in Table 17 below.

ITEM	COST RANGE (-5 TO +30%)
Preliminary and General (10%)	\$950,000 - \$1,300,000
Site Preparation	\$1,400,000 - \$1,900,000
Pond Desludging	\$4,000,000 - \$5,500,000
Oxidation Pond Upgrades	\$490,000 - \$675,000
Clarifiers	\$2,400,000 - \$3,300,000
Membrane Plant and Feed Pump Station and Pipeline	\$4,100,000 - \$5,600,000
Site Wide Items	\$1,200,000 - \$1,600,000

TABLE 17: GORE WWTP TERTIARY TREATMENT UPGRADE COST ESTIMATE

ITEM	COST RANGE (-5 TO +30%)
Non-Physical work Costs (design, project management and contract administration) (10%)	\$1,000,000 - \$1,400,000
Contingency (25%)	\$3,600,000 - \$4,900,000
Total CAPEX	\$19 to \$26M
Annual OPEX	\$560,000 - \$765,000
Pond Desludging Every 15-25 Years	\$4,000,000 - \$5,500,000

7.1.2 MECHANICAL TREATMENT PLANT - GORE WWTP BNR

The treatment process for this option will be similar to what has been presented in Figure 7.

The cost estimates for this option have been developed based on installing clarifiers and filters after the activated sludge reactors rather than membranes. A new sludge dewatering plant for the BNR process has also been included in the cost estimate.

It has been assumed that the new BNR plant will be installed at the northern border of the site. Some allow allowance has been made for ground remediation. Preliminary sizing of the ASR tanks indicate that they will fit on this section of the site. However, it should be noted that the constrained site area is a risk to this option. Part of Pond 1 will be partitioned and lined with polyethylene liner as part of re-purposing the pond as peak wet weather storage basin.

The cost estimate for this option has assumed that both pond 1 and 2 will be desludged and decommissioned. It may be possible that the ponds could backfilled without removing the sludge, this will be confirmed in detailed engineering.

The cost estimate for the BNR plant at Gore WwTP is presented in Table 18.

TABLE 18: GORE WWTP BNR PLANT COST ESTIMATE

ITEM	COST RANGE (-5 TO +30%)
Preliminary and General (5%)	\$1,300,000 - \$1,800,000
Site Preparation	\$5,800,000 - \$7,900,000
Pond Desludging*	\$4,000,000 - \$5,500,000
Lift Pump Station	\$690,000 - \$940,000
Grit Removal	\$960,000 - \$1,300,000
Activated Sludge Reactors	\$7,400,000 - \$10,100,000
Clarifiers	\$3,600,000 - \$4,900,000
Tertiary Filters and UV	\$2,300,000 - \$3,100,000
Solids Dewatering	\$2,500,000 - \$3,400,000
Site Wide Items	\$ 3,200,000 - \$4,400,000
Non-Physical Costs (design, project management and contract administration) (6%)	\$1,700,000 - \$2,300,000
Contingency (25%)	\$7,900,000 - \$10,800,000
Total CAPEX	\$41 to \$56M

TABLE 18: GORE WWTP BNR PLANT COST ESTIMATE

ITEM	COST RANGE (-5 TO +30%)
Annual OPEX	\$1,400,000 – 1,900,000

7.1.3 DISCHARGE TO LAND – GORE WWTP SUMMER LAND DISPOSAL

For this option the treatment process will be similar to what has been presented in Figure 9.

It has been assumed that the two new Actiflo units will be installed on the opposite side of the road to the existing Actiflo.

Effluent from the plant will be discharged to land during the summer months. Costing for this option has been developed assuming that the disposal site will be located within Area 4, identified in the Land Disposal Options Assessment Memo (Appendix 1). With any land disposal scheme there is a risk that the land disposal site may become saturated with nutrients. In this situation the nutrient application rate will need to be reduced. To achieve this either the WwTP will need to produce higher quality effluent or a larger land area will be required.

The cost estimate for this option is presented in Table 19. The cost estimate has not considered potential revenue generated from growing crops or land appreciation.

TABLE 19: GORE WWTP ACTIFLO UPGRADE AND SUMMER LAND DISPOSAL COST ESTIMATE

ITEM	COST RANGE (-5 TO +30%)
Preliminary and General (5%)	\$1,600,000 - \$2,100,000
Site Preparation	\$600,000 - \$820,000
Pond Desludging	\$4,000,000 – \$5,500,000
Oxidation Pond Upgrades	\$490,000 - \$675,000
Actiflos	\$3,000,000 - \$4,200,000
Sand Traps and UV	\$970,000 - \$1,300,000
Land Purchase, Pipeline and Irrigation System	\$24,500,000 - \$33,500,000
Sitewide Items	\$1,600,000 - \$2,300,000
Non-Physical works Costs (design, project management and contract administration) (6%)	\$2,000,000 - \$2,700,000
Contingency (25%)	\$9,200,000 - \$12,600,000
TOTAL CAPEX	\$48 to \$66M
Annual OPEX	\$820,000 - \$1,120,000
Pond Desludging Every 15-25 Years	\$4,000,000 - \$5,500,000

7.2 MATAURA WWTP SHORT LIST OPTIONS

7.2.1 IMPROVEMENTS TO EXISTING PLANT – ADDITIONAL POLISHING WETLAND

For this option the treatment process at the Mataura WwTP will be similar to what has been presented in Figure 12.

The cost estimates for this option have assumed that one additional wetland cell will be constructed to supplement the capacity of the existing treatment system. A rock filter will also be included in this option.

A lump sum allowance has also been made for additional improvements to the plant such as pipework modification and telemetry/SCADA upgrades. The cost estimates for this option are presented in Table 20 below.

TABLE 20: MATAURA WWTP ADDITIONAL POLISHING WETLAND COST ESTIMATE	
ITEM	COST RANGE (-5 TO +30%)
Preliminary and General (10%)	\$100,000 - \$145,000
Site Improvements	\$380,000 - \$520,000
Additional Wetland and Rock Filter	\$670,000 - \$915,000
Non-Physical work Costs (design, project management and contract administration) (10%)	\$115,000 - \$160,000
Contingency (25%)	\$290,000 - \$400,000
Total CAPEX	\$1.6 to \$2.1M
Annual OPEX	\$80,000 - \$110,000

7.2.2 MECHANICAL TREATMENT PLANT – GORE AND MATAURA COMBINED BNR PLANT

The treatment process for this option will be similar to what has been presented in Figure 16.

The assumption basis for this option costing is similar to the construction of a BNR plant specifically for the Gore community (Section 7.1.2). The proposed location for the new equipment is at the northern border of the site. Some allowance has been made for ground remediation in this area. Similar to the Gore only BNR option, the tight available space is a constraint and risk for this option.

The cost estimate for the combined BNR plant for Gore and Mataura is presented in Table 21. The represents the combined cost for the upgrades required for Gore and Mataura. The additional cost associated with connecting the Mataura wastewater scheme to the Gore WwTP is between \$22 - \$30M.

TABLE 21: GORE AND MATAURA COMBINED WWTP COST ESTIMATE	
ITEM	COST ESTIMATE
Preliminary and General (5%)	\$2,100,000 - \$2,900,000
Site Preparation	\$6,600,000 - \$9,000,000
Pond Desludging at Gore	\$4,000,000 - \$5,500,000
Pipeline from Mataura WwTP to Gore WwTP	\$7,900,000 - \$10,800,000
Lift Pump Station	\$790,000 - \$1,100,000
Grit Removal	\$1,100,000 - \$1,500,000
Activated Sludge Reactors	\$8,800,000 - \$12,100,000
Clarifiers	\$6,900,000 - \$9,500,000
Tertiary Filters and UV	\$2,500,000 - \$3,400,000

TABLE 21: GORE AND MATAURA COMBINED WWTP COST ESTIMATE

ITEM	COST ESTIMATE
Solids Dewatering	\$2,900,000 - \$3,900,000
Site Wide Items	\$4,700,000 - \$6,400,000
Non-Physical work Costs (design, project management and contract administration) (6%)	\$2,600,000 - \$3,600,000
Contingency (25%)	\$12,000,000 - \$16,500,000
Total CAPEX	\$63 to \$86M
Annual OPEX	\$1,780,000 - \$2,430,000

7.2.3 DISCHARGE TO LAND – MATAURA WWTP SUMMER LAND DISPOSAL

The treatment process for this option will be similar to what has been presented in Figure 18.

Effluent from the plant will be discharged to land during summer. The cost estimate presented in Table 22 has assumed that the irrigation system will be installed with in Area 7 identified in the Land Disposal Options Assessment Memo (Appendix 1). As with the land disposal option for Gore, there is also a risk that the disposal area will become saturated with nutrients.

The cost estimate has not considered potential revenue generated from growing crops or land appreciation

TABLE 22: MATAURA WWTP SUMMER LAND DISPOSAL COST ESTIMATE

ITEM	COST ESTIMATE
Preliminary and General (10%)	\$1,100,000 - \$1,500,000
Site Improvements	\$380,000 - \$520,000
Land Purchase, Pipeline and Irrigation System	\$10,300,000 - \$14,100,000
Site Wide Items	\$310,000 - \$420,000
Non-Physical work Costs (design, project management and contract administration) (10%)	\$1,200,000 - \$1,700,000
Contingency (25%)	\$3,000,000 - \$4,100,000
Total CAPEX	\$16 to \$22M
Annual OPEX	\$230,000 - \$320,000

7.3 SUMMARY OF COST ESTIMATES

The cost estimates for the short list options for both Gore and Mataura have been summarised in Table 24 below. The costs have also been divided by both the current and future number of wastewater connections in Gore and Matura communities to give an indication of the financial impact of the upgrade options. The current and estimated future number of connections are summarised in Table 23 below. For the purposes of this exercise, it has been assumed that the number of connections will increase at the

same rate as the population. This corresponds to a 15% increase by 2030, with a further 20% increase by 2050.

TABLE 23: CURRENT AND FUTURE WASTEWATER CONNECTIONS		
NO. OF CONNECTIONS	GORE	MATAURA
Current	3,793	730
Future (2050)	5,234	1,007

The future flow estimated used for this evaluation have also allowed for an increase in the trade waste discharges to the WwTPs. At this stage, no consideration has been given to what proportion of the cost will be borne by industry.

TABLE 24: COST ESTIMATE SUMMARY

PLANT	OPTION	CAPEX			ANNUAL OPEX		
		TOTAL	COST PER CURRENT CONNECTIONS	COST PER FUTURE CONNECTIONS	TOTAL	COST PER CURRENT CONNECTIONS	COST PER FUTURE CONNECTIONS
GORE	Tertiary Treatment Upgrade	\$19 - \$26M	\$5.0 – \$6.9k	\$3.7 - \$5.0k	\$560- \$765k	\$150 - \$200	\$100 - \$150
	BNR Plant	\$41 - \$56M	\$11 - \$15k	\$7.9 - \$11k	\$1.4 - \$1.9M	\$370 - \$500	\$270 - \$370
	Additional Actiflos and UV with Summer Land Disposal	\$48 - \$66M	\$13 - \$17k	\$9.0- \$13k	\$0.82 - \$1.1M	\$220 - \$300	\$160 – \$210
MATAURA	Additional Polishing Wetland	\$1.6 - 2.1M	\$2.1 - \$2.9k	\$1.5 - \$2.1k	\$80 – 110K	\$110 - \$150	\$80 - \$100
	Combined BNR for Gore and Mataura*	\$22 - \$30M	\$30 - \$41k	\$22 - \$29k	\$380- \$520k	\$520 - \$710	\$370 - \$510
	Sumer Land Disposal	\$16 - \$22M	\$22 - \$31k	\$16 - \$22k	\$230 - \$320k	\$320 - 430	\$230 - \$310

Note: * Costs presented for this option represent only the cost associated with connecting the Mataura scheme to the Gore WwTP. The full cost of the option will be the sum of the Gore BNR plant and the combined BNR plant for Gore and Mataura.

8.0

SHORT LIST OPTIONS EVALUATION

For the short list options evaluation, the MCA used to evaluate the long list has been refined to allow for a quantitative evaluation of the options using weighted scores. For each of the categories used in the long list evaluation representative criteria has been developed to capture the main drivers under each category. The weighting given to the categories has been divided evenly amongst the criteria. The criteria and weighting used for the short list evaluation are presented in Table 25 below.

TABLE 25: SHORT LIST OPTIONS EVALUATION CRITERIA AND WEIGHTING	
CATEGORY (TOTAL WEIGHTING)	CRITERIA
Cultural (15%)	Improvement to Current Discharge
	Land Disposal/Land Contact Before Discharge to River
Environmental (30%)	Nutrient Loading
	Pathogens and Viruses
	Impact on Flora and Fauna
Financial (25%)	CAPEX and OPEX
Social (10%)	Disruption During Construction
	Loss of Productive Land
	Recreational Use of Waterbody
	Public Health Risk
	Odour
Technical (20%)	Future Expansion
	Process Reliability
	Operability
	Required Consents
	Suitability

The MCA evaluation of the short list options is summarised in Table 26 below. The full MCA showing the score given to each criteria is presented in Appendix 2. The financial score given to the combined BNR plant for Gore and Mataura has been based on the additional cost of connecting the Mataura wastewater scheme to the new BNR plant at Gore.

TABLE 26: SHORT LIST EVALUATION SUMMARY						
CATEGORY	WEIGHTED SCORE					
	GORE WWTP TERTIARY TREATMENT UPGRADE	GORE WWTP BNR PLANT	GORE WWTP NEW ACTIFLOS AND UV WITH SUMMER LAND DISPOSAL	MATAURA WWTP ADDITIONAL POLISHING WETLAND	COMBINED BNR PLANT FOR GORE AND MATAURA	MATAURA WWTP SUMMER LAND DISPOSAL
Cultural	4.5	7.1	11.3	7.5	7.5	10.5
Environmental	13.5	24.5	25	12.5	24.5	27

TABLE 26: SHORT LIST EVALUATION SUMMARY

CATEGORY	WEIGHTED SCORE					
	GORE WWTP TERTIARY TREATMENT UPGRADE	GORE WWTP BNR PLANT	GORE WWTP NEW ACTIFLOS AND UV WITH SUMMER LAND DISPOSAL	MATAURA WWTP ADDITIONAL POLISHING WETLAND	COMBINED BNR PLANT FOR GORE AND MATAURA	MATAURA WWTP SUMMER LAND DISPOSAL
Financial	25	8.75	2.5	25	2.5	8.8
Social	7.5	7.8	5.1	4.8	6.6	4.75
Technical	10.3	14.2	4.8	14.5	12.8	8.6
Total Score	60.8	62.3	48.6	64.2	53.9	59.6

9.0 RECOMMENDATION

The recommended BPO for the Gore and Mataura WwTPs are:

- Gore WwTP – Upgrade to a BNR Plant;
- Mataura WwTP – Additional Polishing Wetland.

These options have been selected based on the outcomes of the MCA process. The Gore WwTP has been the focus of major upgrades. This is the larger of the two WwTPs, which also discharges further up in the catchment. Upgrades to this plant will therefore provide the most significant environmental benefit. The Mataura WwTP is operating well with minimal growth predicted over the proposed consent period. The proposed improvements are aimed at optimising the plant's performance.

The upgrades will take place over the consent period in a staged approach. This will consider the financial impact of the upgrades on the Gore and Mataura communities as well as GDC's larger infrastructure strategy. The final BPO for the catchment will be confirmed subject to consultation with the community and Hokonui Rūnanga, as well as an assessment of the financial viability of the option.

10.0 LIMITATIONS

10.1 GENERAL

This report is for the use by Gore District Council only, and should not be used or relied upon by any other person or entity or for any other project.

This report has been prepared for the particular project described to us and its extent is limited to the scope of work agreed between the client and Harrison Grierson Consultants Limited. No responsibility is accepted by Harrison Grierson Consultants Limited or its directors, servants, agents, staff or employees for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.

10.2 ESTIMATES

Should this report contain estimates for future works or services, physical or consulting, those estimates can only be considered current and will only reflect the extent to which the detail of the project is known to the consultant (feasibility, concept, preliminary, detailed, tender etc) at the time given.

The client is solely responsible for obtaining updated estimates from the consultant as the detail of the project evolves and/or as time elapses.



APPENDICES



APPENDIX 1

LAND DISPOSAL FEASIBILITY ASSESSMENT

GORE AND MATAURA WASTEWATER RESOURCE CONSENT RENEWALS



Land Disposal Options Assessment Gore District Council

TO: Hashem Ramezan-zadeh
FROM: Adriene Grafia
REVIEWED BY: Ian Ho & Gillian Crowcroft

HG PROJECT NO : 1020-143820-01
DATE: 30 May 2019

1.0 INTRODUCTION & SCOPE

Gore District Council (GDC) are currently in the process of preparing for discharge consents renewals for the Gore and Mataura Wastewater Treatment Plants (WWTPs). An options evaluation process is in progress to identify the Best Practicable Option (BPO) to provide future wastewater services for the community.

The proposed Southland regional plan policies and rules for wastewater discharges (which have legal effect) identify land disposal as the preferred discharge option. While our early options assessment findings show that it is likely to be one of the most expensive and technically challenging options, we know that Environment Southland (ES) will expect GDC to have considered this option in some detail within the BPO assessment.

We have evaluated options for land disposal for both plants (both in full or as part of a “hybrid” land disposal and discharge to water model) as requested by you. Our evaluation is based on an assessment of land suitability undertaken using spatial analysis tools. Data from GDC, Environment Southland and other sources was used to identify potential land disposal locations.

This memo provides our key findings, which will be used in the WWTP options evaluation process.

2.0 THE METHOD

The spatial analysis of land disposal locations focuses on a 20km radius area surrounding each WWTP. This provides an indication of the properties considered to be within ‘close’ proximity to each WWTP. This distance is a practical limit of constructing an effluent conveyance pipeline and potential pumping costs. The following tables list the key considerations for identifying potential disposal sites.

TABLE 1: PRIMARY CONSIDERATION FACTORS FOR SUITABLE SITE IDENTIFICATION

FACTOR	SPECIFIC CRITERIA
Proximity to the WWTPs	Within a radius of 20km of the WWTPs
Topography	Relatively flatter sites (identified by where contours are further apart and an average maximum slope of approximately 10 degrees¹).
Floodplains/Flood prone areas	Not within identified floodplains/flood prone areas
Community drinking water sites	Not within a 2km radius of a municipal and community drinking water site
Environment Southland Groundwater Management Zone	Not within the Environment Southland Groundwater Management Zone

¹ A maximum average slope of 10° was applied, this is to minimise potential surface run-off of effluent. This is similar to the Irrigation NZ Guideline for Pivot irrigators. According to the Irrigation NZ, application rate for slope between 9 to 12.5° should not exceed 17mm/hr in sand-loam soil.

TABLE 2: OTHER CONSIDERATION FACTORS

FACTOR	SPECIFIC CRITERIA
Land area and ownership	- Fewer land owners and/or site fragmentation - Required irrigation/land area of approximately (excluding reserve and buffer area): - Gore WWTP – 222 to 665 hectares - Mataura WWTP – 22 to 44 hectares - The approximate area required has been determined by the latest wastewater flow estimates (refer to Attachment 2)
Elevation	Lower elevation differential (maximum elevation of approximately 50m above the WWTP)
Waterbodies (lakes and rivers)	Not within 20m of a waterbody
Conservation land	Not within conservation land
Soil Properties	Better draining soils
Other resource consents	Avoiding close proximity to other groundwater take consents
Activity and land use	Avoiding close proximity to land use activities sensitive to irrigation i.e. residential

3.0 THE FINDINGS

We have identified eight general areas (Figure 1) that could be suitable for land disposal of treated wastewater using the Table 1 criteria. The areas vary in size and proximity to the WWTPs. We have identified that:

- Seven of the areas are within 20km radius of Gore WWTP.
- Five of the areas are within 20km radius of Mataura WWTP.

3.1 EVALUATION AND ANALYSIS

To determine a suitable disposal site from the initial selection, the primary factors in Table 1, along with other factors identified in Table 2, are used to evaluate their viability. This is discussed in the following sections.

LOCATION AND PROXIMITY

Location and proximity to the WWTPs impacts on the costs associated with infrastructure needed between the WWTPs to the disposal site.

The approximate horizontal distances between each area and the WWTPs are identified in Table 3.

TABLE 3: APPROXIMATE DISTANCE TO GORE AND MATAURA WWTPS

AREA	DISTANCE FROM GORE WWTP (KM)	DISTANCE FROM MATAURA WWTP (KM)
Area 1	17.7 km (north)	29.5 km (northeast)
Area 2	11.2 km (north)	24.6 km (northeast)
Area 3	15.5 km (northeast)	29.5 km (northeast)
Area 4	4.5 km (northeast)	18.6 km (northeast)
Area 5	11.0 km (southeast)	17.7 km (northeast)
Area 6	12.3 km (southeast)	7.9 km (east)
Area 7	16.6 km (south)	5.5 km (southeast)
Area 8	22.3 km (south)	9.3 km (southeast)

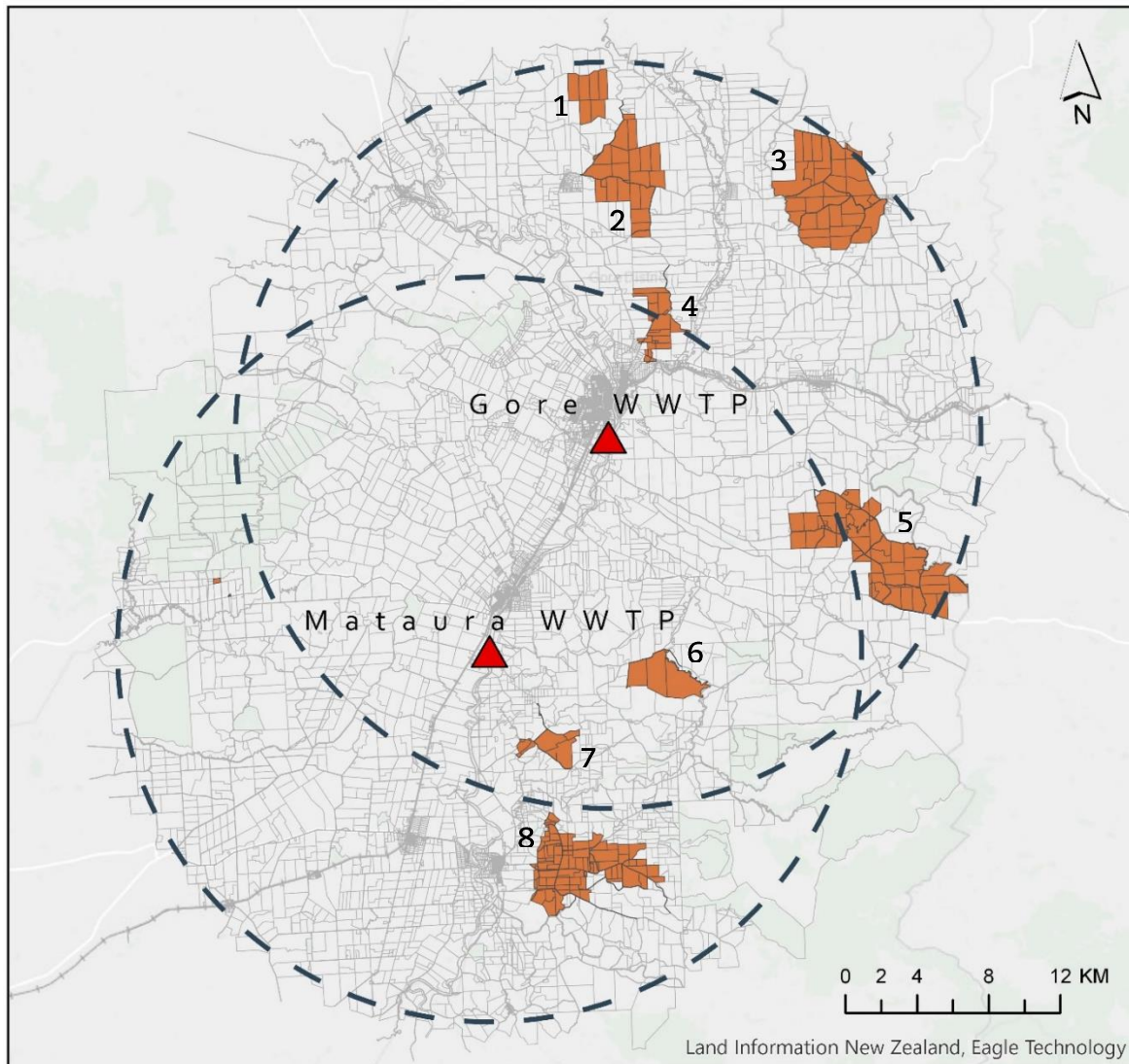


FIGURE 1 - IDENTIFIED OPPORTUNITY AREAS 1-8

TOPOGRAPHY AND ELEVATION

Site topography is an important consideration factor for land disposal, with flatter land being preferable. In the context of this analysis, land with a maximum average slope of 10 degrees is considered 'suitable for minimising potential surface run-off of effluent from the disposal field.

As explained earlier, this slope is similar to the Irrigation New Zealand Guideline for Pivot irrigators, which may be employed due to large irrigation areas. According to Irrigation New Zealand, application rate for slope between 9 to 12.5 degrees should not exceed 17mm/hr in sand-loam soil. Actual soil characteristics and appropriate irrigation application rate will be determined during field studies if the sites are selected for further feasibility studies. Higher slope will increase the risk of potential runoff. Figure 2 shows the identified areas and the topographic contours. The darker areas indicate areas where contours are closer together and the topography is steeper.

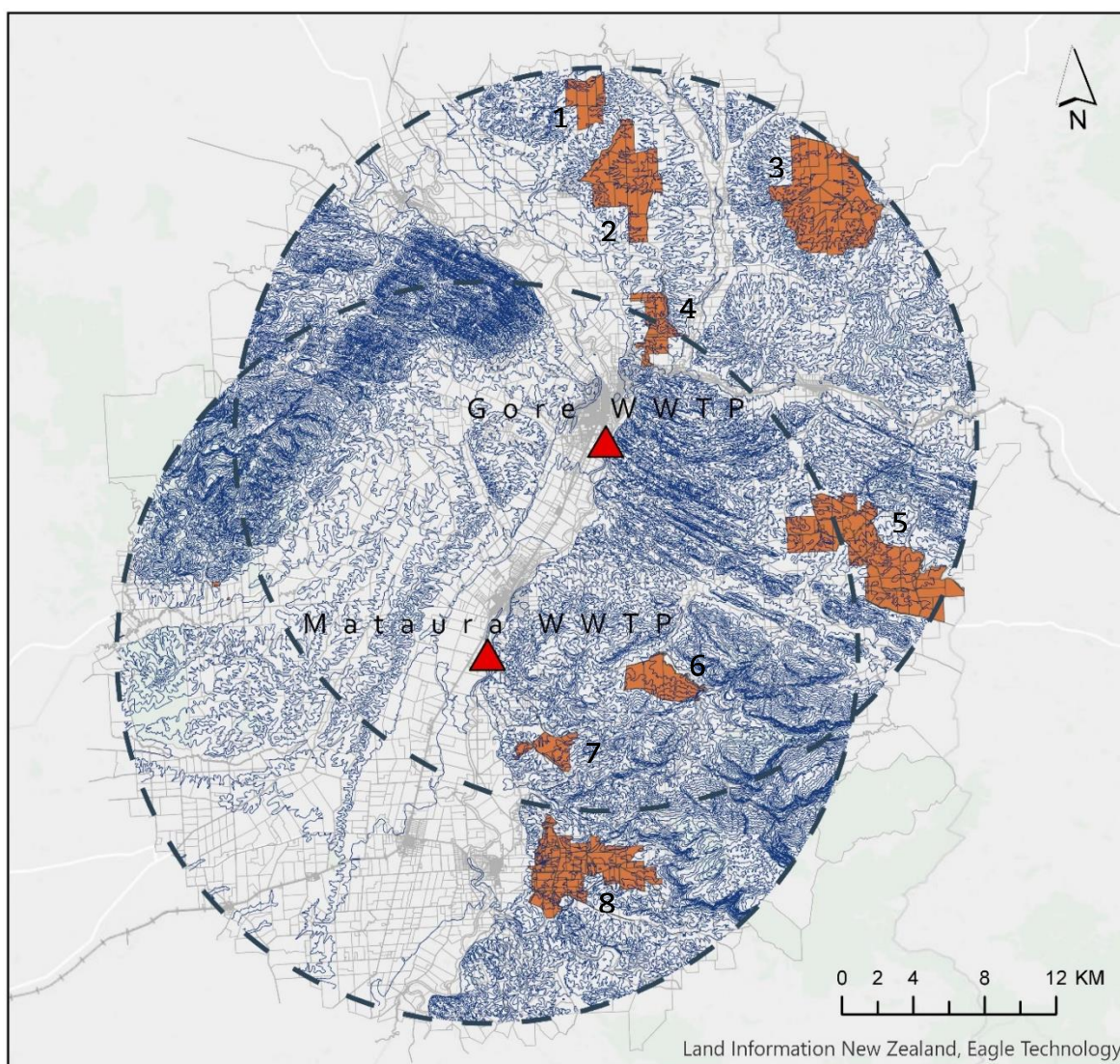


FIGURE 2 - TOPOGRAPHY AND CONTOURS WITHIN 20KM RADIUS OF GORE AND MATAURA WWTPS

Areas 1-8 have all been identified as having an average slope of less than 10 degrees (Table 4). Comparatively, Areas 3 and 8 are generally flatter with Areas 4 and 6 the steepest. It is important to note that all Areas are undulating to some degree. Therefore, the average slope of individual lots may vary.

In conjunction with slope it is also important to consider elevation and the difference in elevation between potential land disposal site and the WWTPs (Table 5 and Figure 3). Sites that are higher in elevation than the WWTP can pose challenges as piping effluent uphill often requires a more complex system with associated capital, operational and maintenance costs.

TABLE 4: APPROXIMATE AVERAGE SLOPE IN EACH IDENTIFIED AREA

AREA	AVERAGE SLOPE (DEGREES)
Area 1	1.2
Area 2	1.0
Area 3	0.6
Area 4	1.6
Area 5	0.9
Area 6	1.6
Area 7	1.2
Area 8	0.8

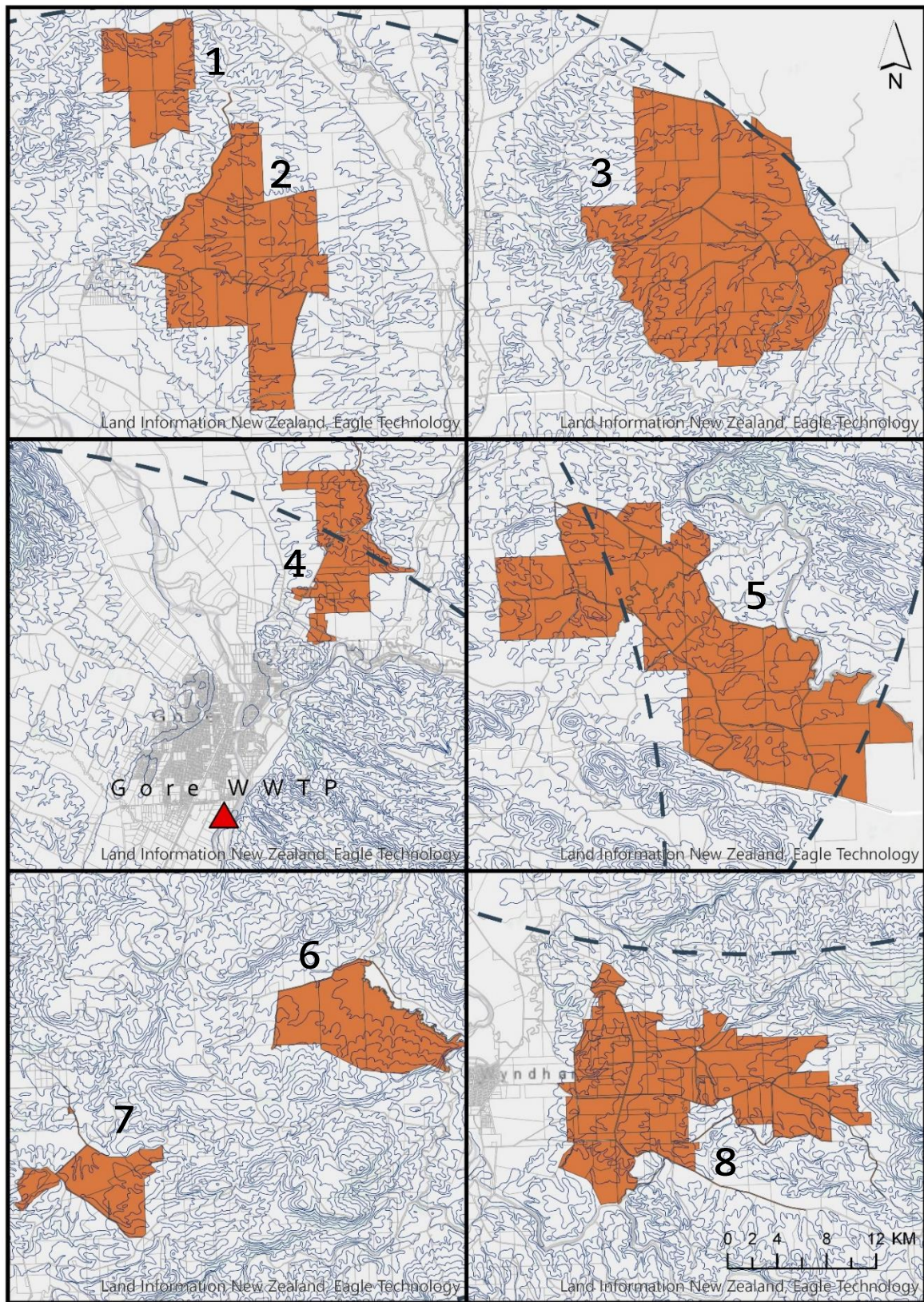


FIGURE 3 - AREAS 1-8 SHOWING TOPOGRAPHY AND CONTOURS

TABLE 5: APPROXIMATE AVERAGE ELEVATION ACROSS EACH IDENTIFIED AREA

AREA	AVERAGE ELEVATION (M)	ELEVATION DIFFERENCE (M)	
		(GORE WWTP)	(MATAURA WWTP)
Area 1	147	77	107
Area 2	170	100	130
Area 3	180	110	140
Area 4	122	52	82
Area 5	200	130	160
Area 6	180	110	140
Area 7	110	40	70
Area 8	90	20	50

Note:

- Gore WWTP approximate elevation is 70m amsl
- Mataura WWTP approximate elevation is 40m amsl
- Area 8 is outside 20km buffer for Gore WWTP
- Areas 1-3 are outside 20km buffer for Mataura WWTP

LAND AREA AND OWNERSHIP

Each WWTP has their own land area requirements which are estimated based on latest wastewater flow estimates. Attachment 2 provides a list of the estimated land area required for different upgrade options. The Gore WWTP requires an irrigation area of at least 222 hectares or more. The Mataura WWTP requires an irrigation area of between 22-24 hectares.

The required irrigation area can be comprised of multiple lots. However, it is generally desirable for the area to comprise of only one or a few sites (i.e. less fragmentation). This reduces the number of landowners for Council to undertake negotiations with regarding land acquisition or placing easements on property.

The total area available in each Area is shown in Table 6 below. The smallest area is 363 hectares (Area 7) and the largest is 2928 hectares (Area 3).

TABLE 6: TOTAL AREA AVAILABLE IN EACH IDENTIFIED AREA

AREA	TOTAL NUMBER OF LOTS IN AREA	TOTAL AREA (HA.)
Area 1	6	495
Area 2	45	1524
Area 3	69	2928
Area 4	28	591
Area 5	91	2904
Area 6	10	668
Area 7	18	363
Area 8	131	1919

The average lots size in each area are identified in Table 7 below and the subdivision patterns shown in Figure 4. Areas 4, 7 and 8 comprise smaller sites and have greater fragmentation. The average site area in Areas 4, 7 and 8 are 21 hectares, 20 hectares and 15 hectares respectively. However, Area 7 still shows some potential as the larger sites to the east offer a less fragmented and solid block of land.

Sites within Areas 1, 2, 3, 5 and 6 more desirable as individual sites are larger and only a few sites would be needed to achieve the irrigation area required.

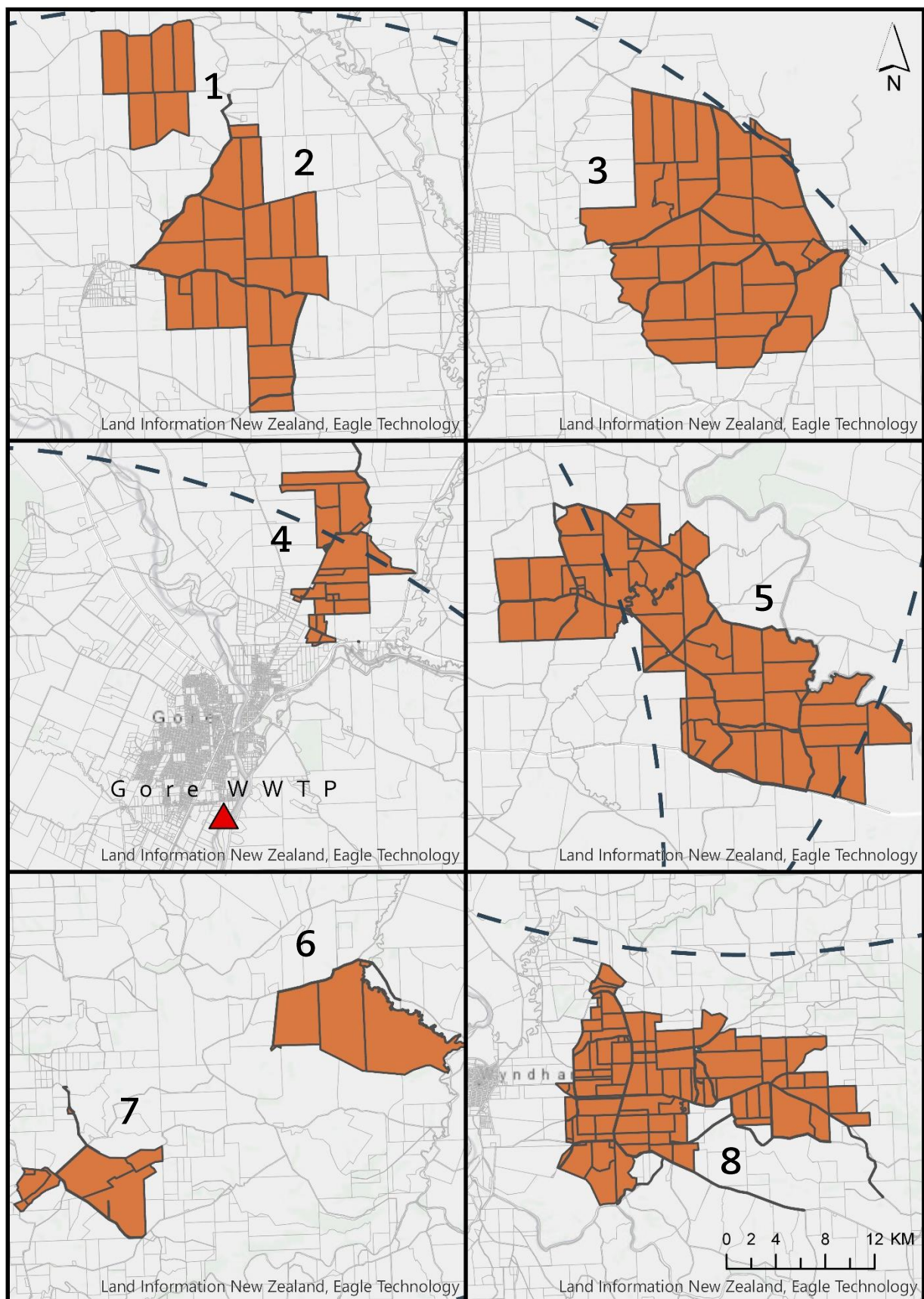


FIGURE 4 - SUBDIVISION PATTERN AND LAND FRAGMENTATION WITHIN IDENTIFIED AREAS 1-8

TABLE 7: AVERAGE LOT SIZE IN EACH IDENTIFIED AREA

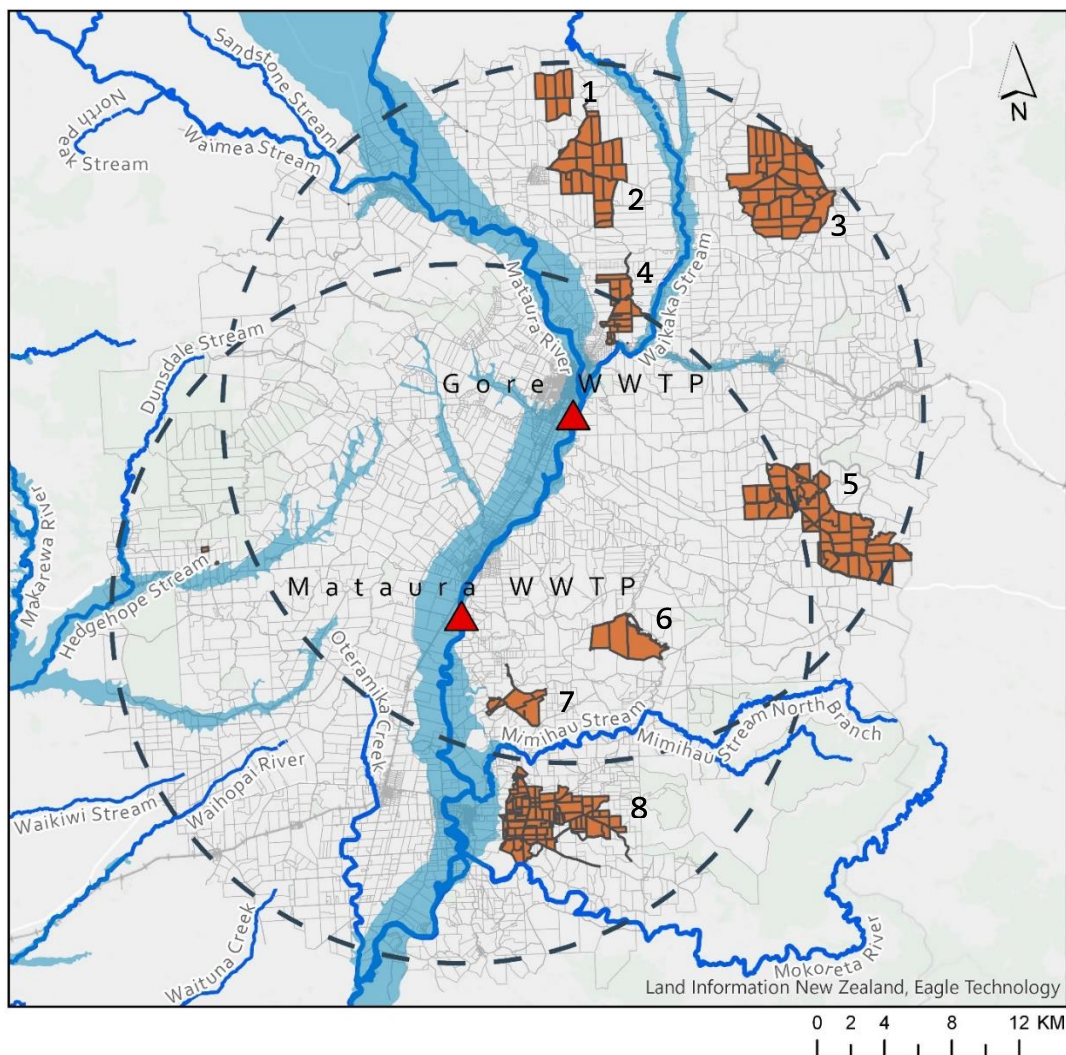
AREA	AVERAGE LOT SIZE (HA.)
Area 1	82
Area 2	34
Area 3	42
Area 4	21
Area 5	32
Area 6	67
Area 7	20
Area 8	15

FLOODING

Environment Southland has identified a Significant Floodplain area located primarily around the Maitara River and other rivers/streams flowing to it. This area generally aligns with areas that Gore District Council identifies as prone to actual or potential flooding in the Gore District Plan.

We would have preferred to have used data that indicated flood events of different return periods. The return period is a useful risk criteria in options assessment. However, as far as our enquiries went, we did not find this data and have used the available data set for significant floodplain area.

Since all land within the Significant Floodplain area has been excluded from being considered for land disposal none of the Areas 1-8 are within a floodplain or at risk of actual or potential flooding.

**FIGURE 5 - SIGNIFICANT FLOODPLAIN AREA AND WATERCOURSES**

PROXIMITY TO OTHER WATER BODIES (LAKES, RIVERS AND STREAMS)

A 20m exclusion area has been applied around all lakes², rivers and streams identifiable within the 20km radius of each WTPP). The exclusion area is based on Plan rules requiring no discharge within 20m of water bodies included in both the operative Environment Southland Effluent Land Application Plan (Rule 5.3.1.f) and proposed Southland Water and Land Plan – Part A – Decisions Version (Rule 33).

No sites within Areas 1-8 overlap with the 20m exclusion area around rivers and streams. Therefore, does not impact on the irrigable land area available. However, as there are many identifiable lakes in the analysis area(s), the 20m setback influences minor fragmentation and reduction in available irrigable area in Areas 3, 4, 5, 6 and 8 (Table 8).

TABLE 8: IMPACT OF 20M EXCLUSION AREA AROUND LAKES ON AVAILABLE IRRIGABLE AREA

AREA	TOTAL LAND AREA (HA)	LAKE AND EXCLUSION AREA (HA)	REMAINING IRRIGABLE AREA (HA)
Area 3	2928	3	2925
Area 4	591	0.6	590.4
Area 5	2904	3	2901
Area 6	668	1	667
Area 8	363	2	361

²'lakes' are defined as any standing body of fresh inland water. Further analysis may be required to determine whether all identifiable lakes are sensitive and require the 20m exclusion area.

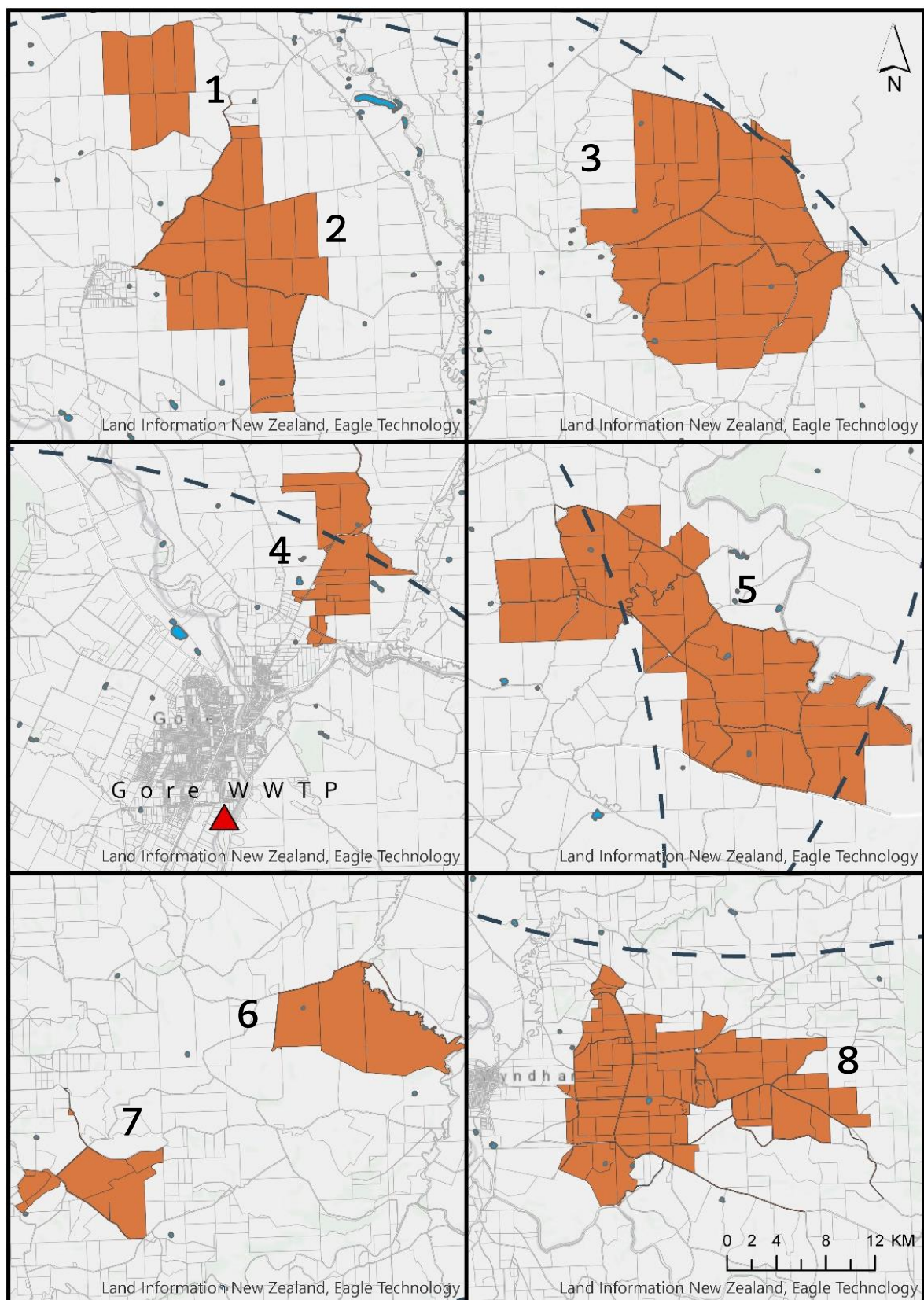


FIGURE 6 - IDENTIFIED LAKES (INCLUDING 20M BUFFER) WITHIN IDENTIFIED AREAS 1-8

ENVIRONMENT SOUTHLAND GROUNDWATER MANAGEMENT ZONES

Environment Southland groundwater resources unconfined aquifers by subdividing them into 26 groundwater management zones based on hydrogeological characteristics. All land within the zone that is underlain by these management areas have been excluded from being considered for land disposal i.e. all sites within Areas 1-8 are outside this Groundwater Management Zone (figure 7).

The reason for exclusion of these areas is that the groundwater resources in the alluvial aquifers in the Mataura River Catchment are known to be shallow and highly connected to the Mataura River. The Mataura Catchment Strategic Water Study³ states that there is extensive interaction between the river and these aquifers, with alternate river reaches gaining or losing flow depending on the local hydrogeological setting. Baseflow (groundwater) discharge to the river helps maintain river flows during periods of low rainfall and has a significant influence on surface water quality (particularly in terms of nutrients) during periods of low flow. Land disposal of treated wastewater close to the river is therefore expected to have negligible positive effect on water quality in the Mataura River. The benefit of land disposal over direct discharge to the river would be difficult to quantify.

The shallow Lower Mataura Aquifer and Edendale Aquifer underlie most of the flatter river plain to the west of the river in the Gore and Mataura areas. These shallow aquifers have a large number of water supply bores supplying rural properties that may not have alternative water supplies. Land disposal upgradient of these supplies is a risk to the security of these supplies.

For the reasons above we believe that all groundwater management areas should be excluded from land disposal suitability assessments. Section 3.2 indicates the potential land available if groundwater constraints are removed.

³ Mataura Catchment Strategic Water Study report prepared for Environment Southland dated May 2011. Prepared by Liquid Earth, Aqualic Research and Harris Consulting.

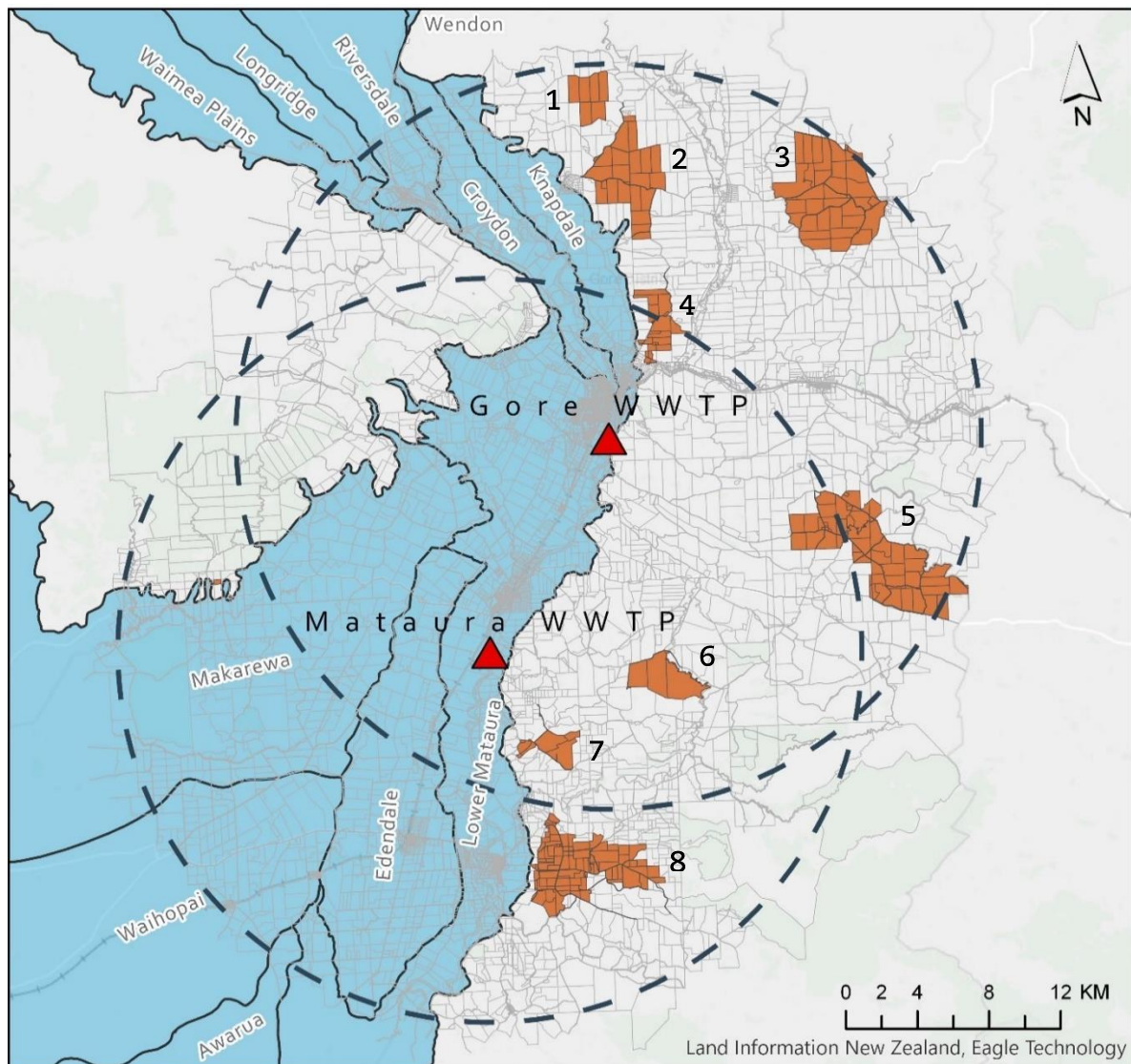


FIGURE 7 - ENVIRONMENT SOUTHLAND GROUNDWATER MANAGEMENT ZONES

PROXIMITY TO MUNICIPAL AND COMMUNITY DRINKING WATER SUPPLIES

A 2km exclusion area has been applied around registered municipal and community drinking water supply sites⁴. Any disposal of effluent to land should be sufficiently separated from drinking water supply bores to prevent contamination risk. The 2km buffer is a considered suitable indicative distance at this preliminary stage.

All land within or intersecting the 2km buffer has been excluded from being considered for land disposal. Therefore, all sites within identified Areas 1-8 are at a 'safe' distance from any municipal and community drinking water supply bore (Figure 8).

⁴This is based on ES consent applications assessment of effects of proposed discharges to land in the Maitaurua Catchment.

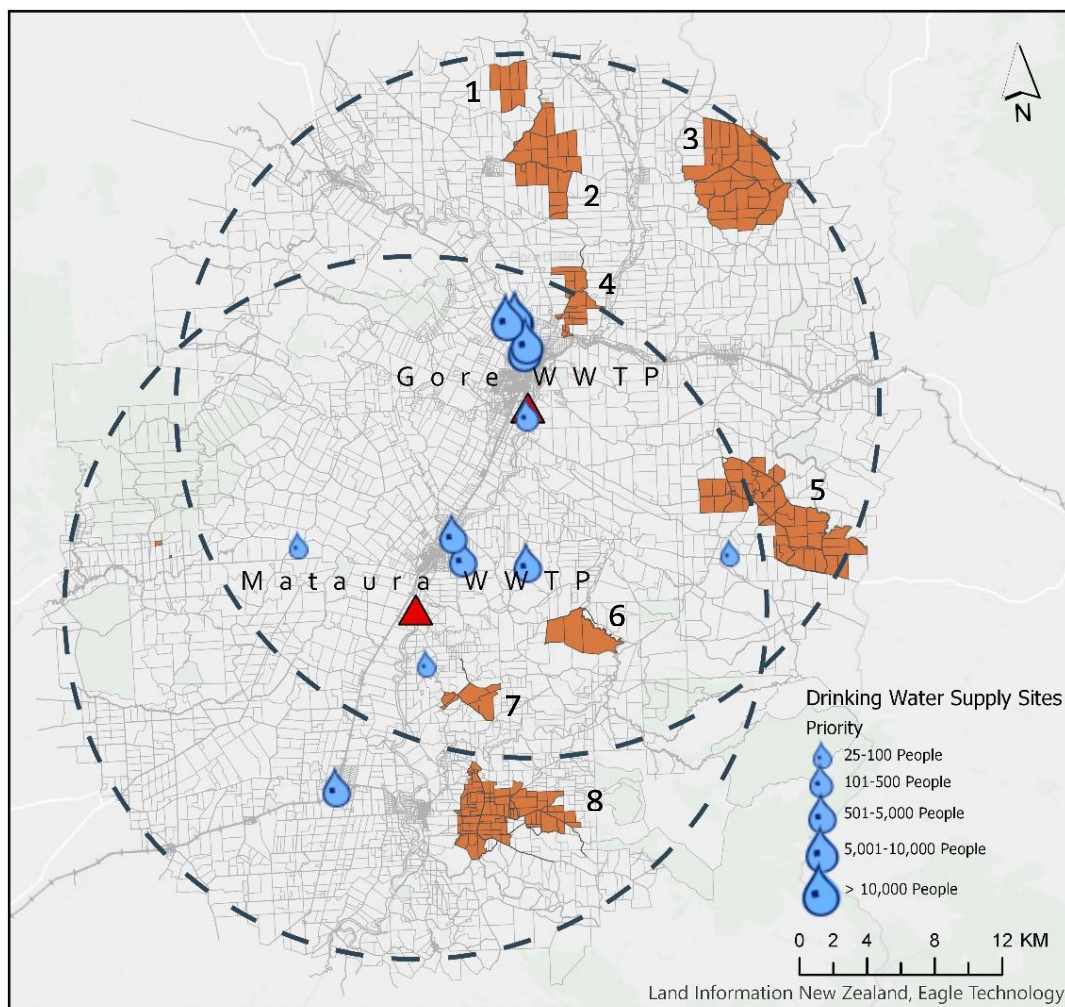


FIGURE 8 - MUNICIPAL AND COMMUNITY DRINKING WATER SUPPLY SITES

OTHER WATER TAKE (CONSUMPTION) CONSENTS

The location of other water take consents should also be considered in the identification process so as to avoid contamination risk. The location of these consents can also reduce the available irrigable area and increase fragmentation which may require additional considerations surrounding the management of irrigation.

There are no water take (for consumption) consents within Areas 1, 3 and 4. However, Areas 2, 5, 6, 7 and 8 have the following consents within them (Table 9).

AREA	TOTAL LAND AREA (HA)	NUMBER OF CONSENTS	NUMBER OF SITES AFFECTED
Area 2	1524	7	4
Area 5	2928	1	1
Area 6	668	2	2
Area 7	363	1	1
Area 8	1919	4	4

Figure 9 below identifies the location of these other water take (consumption) consents. Some of these consents overlap with one another. We note this the water take consents will not be a complete set of all domestic drinking water supplies since they do not require consent to take water and many will pre-date ES record keeping. This information will need to be collated if further assessment is required of specific areas.

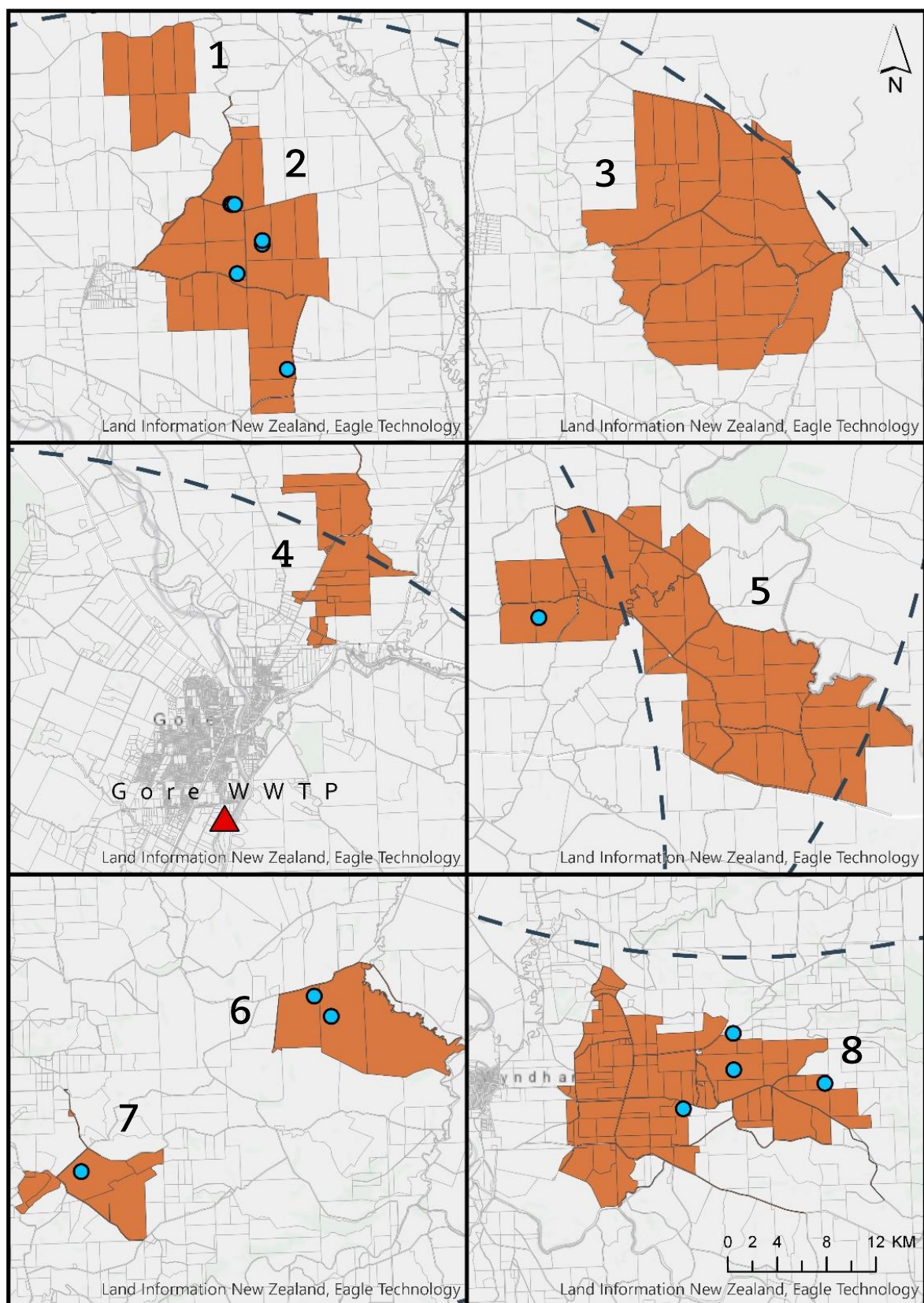


FIGURE 9 - LOCATION OF OTHER WATER TAKE (FOR CONSUMPTION) CONSENTS WITHIN IDENTIFIED AREAS 1-8

CONSERVATION LAND

The Department of Conservation ('DOC') have identified land areas to be conserved for various purposes including National Parks, Conservation Parks, Wildlife Management Areas and Specially Protected Area. Some of these areas contain native or protected species of flora and fauna, special ecosystems or are used for public recreation. Therefore, are sensitive to the potential adverse effects of effluent land disposal including contamination.

No sites within the identified Areas 1-8 contain DOC Public Conservation Land.

SOIL PROPERTIES

The properties of soil within sites is an important factor in identifying viable areas suitable for effluent land disposal. Some soils are better suited for land disposal due to their strong drainage qualities. The major classes of soils identified in Areas 1-8 are identified in Table 10.

TABLE 10: SOIL CLASSES		
AREA	ORDER	GROUPS
Area 1	Unknown	Unknown
Area 2	Brown, Ultic, Brown, Pallic,	Firm, Yellow, Fragic, Laminar, Perch-gley
Area 3	Gley, Ultic, Pallic,	Orthic, Yellow, Perch-gley
Area 4	Brown, Ultic, Pallic, Gley,	Firm, Orthic, Yellow, Fragic, Orthic, Acid
Area 5	Brown, Gley, Organic, Pallic	Firm, Allophanic, Orthic, Mesic, Perch-gley
Area 6	Unknown	Unknown
Area 7	Brown, Gley	Firm, Orthic
Area 8	Brown, Gley	Firm, Orthic, Allophanic

ACTIVITY AND LAND USE

It is important to consider the existing or anticipated land use surrounding potential land disposal sites to avoid reverse sensitivity effects. The operative Environment Southland Effluent Land Application Plan (Rule 5.3.1.f) and proposed Southland Water and Land Plan – Part A – Decisions Version (Rule 33) also specifies setbacks of 100m and 200m respectively from adjacent residential dwellings.

All identified Areas 1-8 are located within Rural Zoned areas with primary activities being farming. Where there are residential properties, they are individual dwellings within large lots, typical of rural zones.

Area 4 is located in closest proximity to urban residential activity within Gore township. As such, it is the most likely of all Areas to be desirable for town growth and land development in the future. The application of treated wastewater to the land would limit its future use for residential purposes. Land disposal areas are best located away from urban and peri urban areas to avoid sensitivity issues.

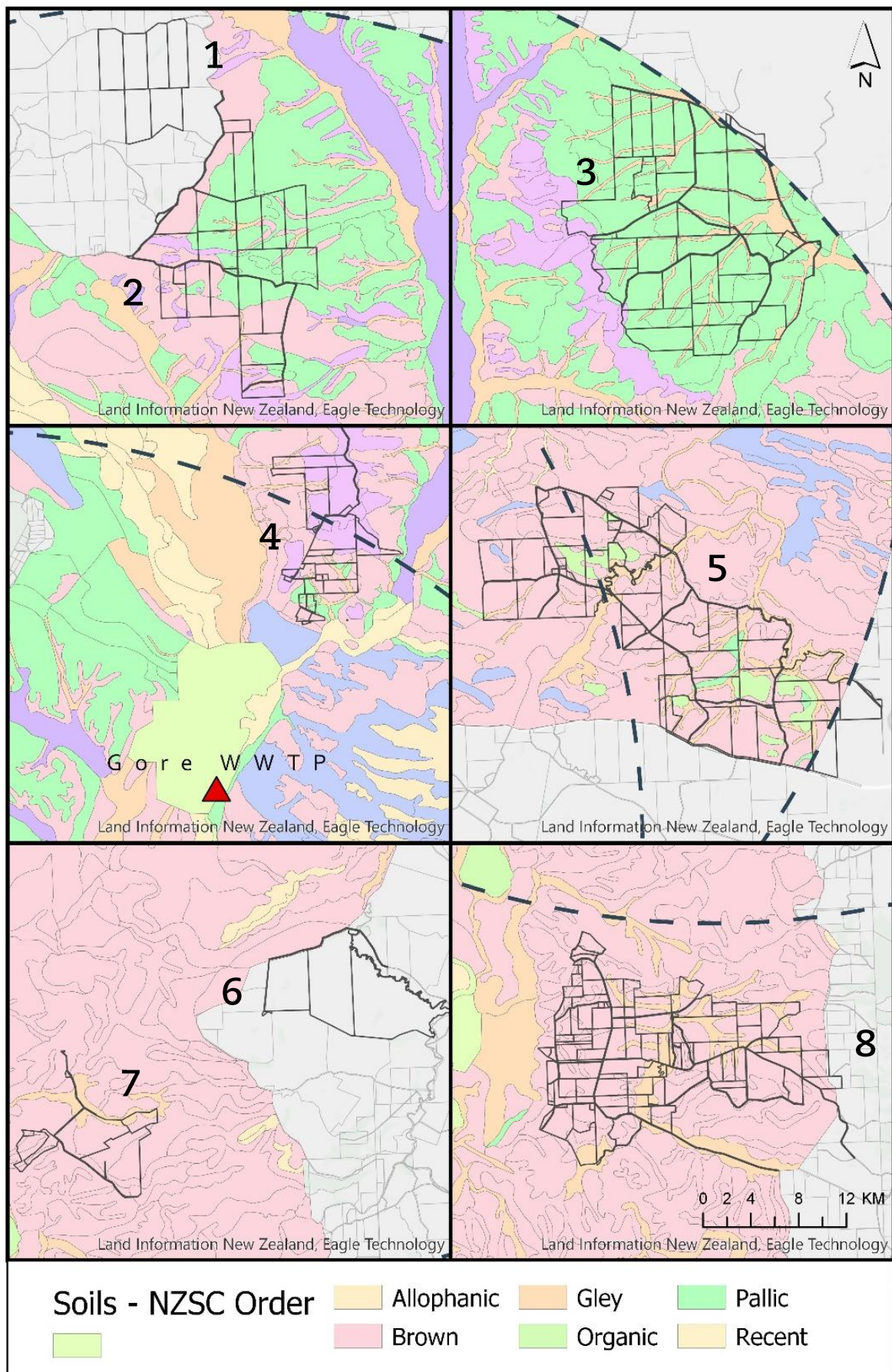


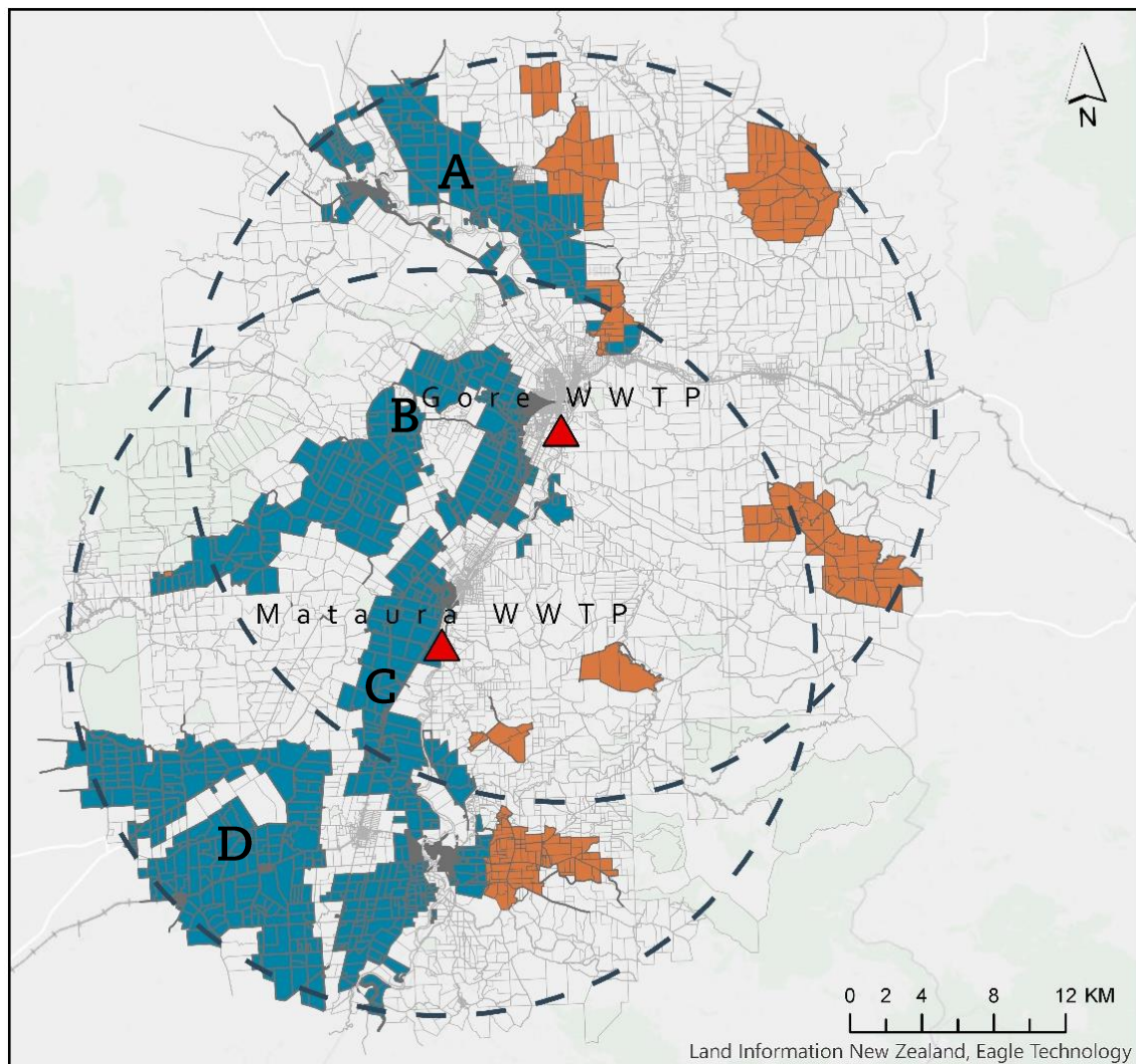
FIGURE 10 - SOILS (NZSC - ORDER) WITHIN IDENTIFIED AREAS 1-8

3.2 ANALYSIS OF ALTERNATIVE SCENARIOS - EXCLUSION OF CONSIDERATION FACTORS

In the previous sections of this memo, Environment Southland's Groundwater Management Zones and Significant Floodplain are primary consideration factors.

Our analysis shows that these constraints cover a large spatial extent. Therefore, a noticeable land area within each of the 20km-radius catchments is excluded from the evaluation and analysis undertaken above.

The following section provides an overview of the land excluded as a result of the Groundwater Management Zones and Significant Floodplain constraints. We note that while additional 'opportunity' areas are identified as shown in Figure 11 below, they may not correlate to suitability for land disposal. Further investigation is required to determine the scope of environmental effects.



Legend

- Identified Areas 1-8
- Land within Ground Water Management Zone and/or Significant Floodplain

FIGURE 11 - LAND EXCLUDED AS WITHIN GROUNDWATER MANAGEMENT ZONE AND SIGNIFICANT FLOODPLAIN

The key characteristics of the additional areas identified in Figure 11 are:

- They are relatively flat with slopes of less than 10 degrees; however, all have some undulation;
- The areas south of the Matura W W T P (Areas C-D) range between 40-100m amsl;

- The areas west of the Gore WWTP (Area B) range between 40-180m amsl, while land north of the Gore WWTP (Area A) range between 100-140m amsl;
- Overall, the subdivision patterns and fragmentation across all Areas A-D are similar;
- None of the areas are within the 20m exclusion area around rivers and streams;
- Lakes are identified across all Areas A-D, however, there tends to be more within Area D;
- Other water take (for consumption) consents are scattered across all Areas, but there is a greater concentration of consents within Areas A and D; and
- All Areas are rural zoned land, however, there is some land in all areas in the periphery of Wyndham, Mataura and Gore townships.

3.3 SUMMARY OF FINDINGS

A summary of each Area and their characteristics are provided in Table 11. Table 11 and the analysis shows that:

Overall

- There is land within Areas 1-8 with opportunity to accommodate land disposal.
- There is no one 'perfect' area/site(s) that meet all desired characteristics or criteria identified.
- All sites have strengths, weaknesses and potential challenges. This includes, capital costs, maintenance costs, engineering services, planning constraints, health and contamination risks and land fragmentation.

Gore WWTP

- Land within **Area 4** shows more suitability for accommodating land disposal.
- Gore WWTP requires an irrigable area of 222 hectares or more.
- Area 4 is a total of 590ha. However, with lot sizes smaller within Area 4, more lots will be required and therefore more land owners involved in land acquisition.
- Area 4 is undulating and comparatively steeper than the other Areas, with an average slope of 1.6 degrees. However, Area 4 is closest to Gore WWTP, approximately 4.5km north and has a lower elevation (+52m).
- There is one waterbody within Area 4 leaving an irrigable area of approximately 590.4 hectares, but there is no other water take (for consumption) consents within it.
- Area 4 is within a Rural zoned area but also has the advantages of being closer to the Gore township.

Mataura WWTP

- Comparatively, land within **Area 7** shows more suitability for accommodating land disposal.
- Mataura WWTP requires an approximate irrigable area of 22-24 hectares. All sites within Area 7 offer a total land area of 363 hectares. However, most of the sites individually provide the minimum 22 hectares required.
- While land in Area 7 has some undulation and not completely flat, it is lower in elevation compared to other Areas and in closest proximity to Mataura WWTP (approx. 5.5km southeast).
- Area 7 is within Rural zoned land and not adjacent to any townships with urban residential activity.

TABLE 11: SUMMARY OF CONSIDERATIONS FOR SITE SELECTION⁵
PRIMARY CONSIDERATIONS

	AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	AREA 6	AREA 7	AREA 8
Distance to Gore WWTP	17.7 km (north)	11.2 km (north)	15.5 km (northeast)	4.5 km (northeast)	11.0 km (southeast)	12.3 km (southeast)	16.6 km (south)	22.3 km (south)
Distance to Mataura WWTP	29.5 km (northeast)	24.6 km (northeast)	29.5 km (northeast)	18.6 km (northeast)	17.7 km (northeast)	7.9 km (east)	5.5 km (southeast)	9.3 km (southeast)
Slope (less than 10 degrees)	1.2 degrees	1.0 degrees	0.6 degrees	1.6 degrees	0.9 degrees	1.6 degrees	1.2 degrees	0.8 degrees

OTHER CONSIDERATIONS

Total Land Area available	495 ha	1524 ha	2928 ha	591 ha	2904 ha	668 ha	363 ha	1919 ha
Number of Lots	6	45	69	28	91	10	18	131
Average Lot sizes	82 ha	34 ha	42 ha	21 ha	32 ha	67 ha	20 ha	15 ha
Elevation difference with Gore WWTP *outside 20km buffer	77m	100m	110m	52m	130m	110m	40m	20m*
Elevation difference with Mataura WWTP *outside 20km buffer	107m*	130m*	140m*	82m	160m	140m	70m	50m
Within 20m exclusion area around lakes	No	No	Yes	Yes	Yes	Yes	No	Yes
Remaining irrigable land factoring lakes and exclusion area	495 ha	1524 ha	2925 ha	590.4 ha	2901 ha	667 ha	363 ha	361 ha
Number of other water take for consumption consents	0	7	0	0	1	2	1	4
Soil Properties (Order)	Unknown	Brown, Ultic, Brown, Pallic,	Gley, Ultic, Pallic,	Brown, Ultic, Pallic, Gley,	Brown, Gley, Organic, Pallic	Unknown	Brown, Gley	Brown, Gley

⁵ Areas 1-8 are all outside the Significant Floodplain area, 20m exclusion area around rivers and streams, Environment Southland Groundwater Management Zone, DOC Conservation Land and the 2km exclusion area around identified municipal and community drinking water sites.

ATTACHMENT 1 DATASETS AND SOURCES



ATTACHMENT 1: DATASETS USED	
DATASET	SOURCE
Topoclimate	Environment Southland
General - Southland Rivers	
Consents - Resource consents	
Consents – Surface Water Management Zones	
Consents – Drinking Water Sites	
Natural Hazards – Flooding (ES Dams, ES Stopbanks, Significant Floodplains)	
WaterAndLand – Groundwater Management Zones	
WaterAndLand – Fresh Water Management Units	
ES Bores	
New Zealand Lakes	
New Zealand Contours (1:50k, 1:250k, 1:500k)	Land Information New Zealand
New Zealand Primary Parcels	
Current Wetland Extent (2013)	Ministry for the Environment
Wetland Extent 2001-2016	
DOC Conservation Land	Department of Conservation
Property Ownership	Quickmaps

ATTACHMENT 2

ESTIMATED LAND AREA REQUIREMENTS

AREA/LOCATION	TREATMENT PLANT UPGRADE OPTIONS	REQUIRED IRRIGATION AREA (HA) - EXCL BUFFER AND RESERVE AREAS
Gore	Additional Actiflo/UV – all year land disposal	665
	Additional Actiflo/UV – summer only land disposal	333
	BNR Plant – all year land disposal	444
	BNR Plant – summer only land disposal	222
	Cut and carry	333
	Combined Gore/Matarua – summer only land disposal	244
Matarua	All year land disposal	44
	Summer only land disposal	22
	Cut and carry	22

APPENDIX 2

SHORT LIST EVALUATION MCA

Gore and Matura WWTps Short List Options Evaluation

Multi Criteria Analysis
N:\1020\143820_01\400 Tech\420 Calculations\Short List Options\MCA\Copy of Short List MCA Rev 1.7 - Updated based on GDC's comments - Matts email.xlsx\Short List Evaluation with Comm
Scoring Levels 1-10

No.	Category	Criteria	Weightage	Gore - Improvement to Existing WwTP				Gore - Mechanical Treatment Plant				Gore - Discharge to Land				Mataura - Improvements to Existing WwTP				Mataura - Mechanical Treatment Plant				Mataura - Discharge to Land																							
				Tertiary Treatment Upgrade				BNR Plant for Gore				Additional Actiflo and UV with Summer Land Disposal				Additional Polishing Wetland				Combined BNR for Gore and Mataura				Summer Land Disposal																							
				Score	Weighted Score	Comment	Total Category Score	Score	Weighted Score	Comment	Total Category Score	Score	Weighted Score	Comment	Total Category Score	Score	Weighted Score	Comment	Total Category Score	Score	Weighted Score	Comment	Total Category Score	Score	Weighted Score	Comment	Total Category Score																				
1	Cultural	Improvement to Current Discharge	7.5%	5.00	3.75	Some improvement in effluent quality in terms of solids, organics and pathogen removal.		8.50	6.38	Significant improvement to the effluent quality.		7.00	5.25	Improvements to effluent quality in terms of solids and organic loading and pathogens. Reduced loading to the river due to land disposal.		5.00	3.75	Effluent quality similar to current averages.		9.00	6.75	Significant improvement to the effluent quality for Gore and Mataura.		6.00	4.50	Effluent quality similar to current averages. Reduces loads to the river by due to summer land disposal.																					
		Land Disposal/Land Contact Before Discharge to River	7.5%	1.00	0.75	No land contact before discharge to water body.		1.00	0.75	No land contact before discharge to waterbody.		8.00	6.00	Removes direct discharge to waterbody for half the year.		5.00	3.75	Some land contact through wetlands and rock filter before discharge.		1.00	0.75	No land contact before discharge to waterbody.		8.00	6.00	No change to effluent quality. Removes direct discharge to waterbody for half the year.																					
						4.50					7.13					11.25					7.50					7.50					10.50																
2	Environmental	Nutrient Loading	10%	2.00	2.00	Significant increase in nitrogen loading. Minimal increase in phosphorus loading due to increased flows.		8.00	8.00	Significant reduction in nitrogen loading. Minimal increase in phosphorus loading due to increased flows.		7.00	7.00	Significant reduction in nutrient loading to waterbody as a result of summer land disposal.		4.00	4.00	Small increase in nutrient loads due to flow increase in the catchment		8.00	8.00	Reduction in combined nitrogen loading from the two WwTPs. Minor increase in phosphorus loading due to increased flows.		9.00	9.00	Significant reduction in nutrient loading to waterbody as a result of summer land disposal.																					
		Pathogens and Viruses	10%	8.00	8.00	Significant reduction in expected E.coli levels in treated effluent.		8.00	8.00	Significant reduction in treated effluent entering waterbodies via summer irrigation, when river flow is lower.		9.00	9.00	Significant reduction in expected E.coli levels in treated effluent compared to average levels in current plant discharge.		5.00	5.00	E.coli level in the discharge is expected to be similar to current level. Increase in discharge flow is expected to cause "no more than minor" effect in stream quality (Tyder to confirm)		8.00	8.00	Significant reduction in expected E.coli levels in treated effluent compared to average levels in current plant discharge.		9.00	9.00	Significant reduction in treated effluent entering waterbodies via summer irrigation, when river flow is lower.																					
		Impacts on Flora and Fauna	10%	3.50	3.50	Increase in nitrogen loading may have negative impacts on flora and fauna. (Tyder ecological assessment required)		8.50	8.50	High quality treated effluent. Any impacts on flora and fauna are likely to be minor.		9.00	9.00	Significant reduction in pollutant loading to stream, esp in summer. Effect of plant discharge on flora and fauna is likely to be minor.		3.50	3.50	Likely to be some impact on flora and fauna due to increased pollutant loading from the plant.		8.50	8.50	High quality treated effluent. Any impacts on flora and fauna are likely to be minor.		9.00	9.00	Significant reduction in pollutant loading to stream. Effect of plant discharge on flora and fauna is likely to be minor.																					
						13.50					24.50					25.00					12.50					24.50					27.00																
						25.00					8.75					2.50					25.00					2.50					8.75																
3	Financial	CAPEX	25%	10.00	25.00					3.50	8.75					1.00	2.50					10.00	25.00					1.00	2.50					3.50	8.75												
								25.00					8.75					2.50					25.00					2.50					8.75														
4	Social	Disruption During Construction	1%	8.00	0.80	Minimal public disruption as upgrades are confined to existing WwTP site.		8.00	0.80	Minimal public disruption as upgrades are confined to existing WwTP site.		2.00	0.20	Option requires pipeline (7.5 km) to be constructed along public roads resulting in disruptions to traffic. Properties adjacent to land disposal site may also be negatively impacted during construction.		8.00	0.80	Minimal public disruption as upgrades are confined to existing WwTP site.		2.00	0.20	Option requires pipeline (15.5 km) to be constructed along public roads resulting in disruptions to traffic. Properties adjacent to land disposal site may also be negatively impacted during construction.		2.00	0.20	Option requires pipeline (16.5 km) to be constructed along public roads resulting in disruptions to traffic. Properties adjacent to land disposal site may also be negatively impacted during construction.																					
		Loss of Productive Land	1%	10.00	1.00	No land required for effluent irrigation.		10.00	1.00	No land required for effluent irrigation.		1.00	0.10	Estimated land disposal area 416 ha.		10.00	1.00	No land required for effluent irrigation.		10.00	1.00	No land required for effluent irrigation.		4.00	0.40	Estimated land disposal area 27 ha.																					
		Recreational Use of Waterbodies	3%	7.50	2.25	Significant improvement to effluent quality in terms of pathogen levels.		7.50	2.25	Significant improvement to effluent quality in terms of pathogen levels.		8.50	2.55	Effluent discharge to waterbodies removed for half the year.		4.00	1.20	Minor increase in expected E.coli levels in the treated effluent.		7.00	2.10	Significant improvement to effluent quality in terms of pathogen levels.		8.50	2.55	Effluent discharge to waterbodies removed for half the year.																					
		Public Health Risks	3%	8.00	2.40	Risk to public health reduced by tertiary treatment through membrane.		8.00	2.40	Risk to public health reduced through tertiary filter and UV treatment.		4.00	1.20	Risk to public health due to aerosolization of pathogens and viruses in the treated effluent through irrigation system.		2.50	0.75	Some deterioration expected in effluent quality in terms of pathogen levels.		7.00	2.10	Risk to public health from Gore and Mataura discharge reduced through Filter and UV treatment.		2.00	0.60	Risk to public health due to aerosolization of pathogens and viruses in the treated effluent through irrigation system.																					
		Odour	2%	5.00	1.00	Pond based treatment system can be susceptible to odour issues. Similar to existing risk		6.50	1.30	Mechanical treatment system with more process control is less susceptible to odour issues. Potential odour issue related to sludge processing		5.00	1.00	Pond based treatment system can be susceptible to odour issues. Similar to existing risk		5.00	1.00	Pond based treatment system more prone to odour issues. Similar to existing		6.00	1.20	Mechanical treatment system less prone to odour issue. However sludge processing and conveyance pipeline may have higher odour potential		5.00	1.00	Pond based treatment system more prone to odour issues. Similar to existing																					
						7.45					7.75					5.05					4.75					6.60					4.75																
5	Technical	Future Expansion	4.0%	2.50	1.00	Treatment system relies on oxidation ponds. No additional space on site for new ponds to facilitate future expansion.		8.50	3.40	Existing pond 1 can be reclaimed if further land is required in future		2.50	1.00	Treatment system relies on oxidation ponds. No additional space on site for new ponds to facilitate future expansion. Future expansion of irrigation may also be limited by land availability.		7.50	3.00	Existing pond has some additional treatment capacity. Space available onsite to construct an additional pond if required.		7.50	3.00	Existing pond 1 can be reclaimed if further land is required in future		3.50	1.40	Existing pond has some additional treatment capacity. Additional discharge to land disposal scheme will be limited by hydraulic and nitrogen loading.																					
		Process Reliability	4.0%	6.00	2.40	Limited process control with pond based system. Membrane plant increases process reliability.		9.00	3.60	Mechanical treatment plant with high levels of process control.		4.50	1.80	GDC Ops has difficulty operating Actiflo in the past. Additional complexity with managing very large disposal field (416ha)		5.00	2.00	Limited process control with pond based system, similar to existing		9.50	3.80	Mechanical treatment plant with high levels of process control.		4.50	1.80	Additional complexity related to operating the disposa field																					
		Operability	3.0%	6.00	1.80	Pond based treatment system requiring limited process inputs. Additional operator input required for membrane plant.		6.00	1.80	Mechanical treatment plant requiring high levels of operator input, significant change.		1.00	0.30	GDC Ops has difficulty operating Actiflo in the past. Additional complexity with managing very large disposal field (416ha)		8.50	2.55	Pond based system requiring limited operator input.		7.00	2.10	Mechanical treatment plant requiring high levels of operator input. Plant operation limited to one site.		4.00	1.20	Pond based system requiring limited operator input. Additional operational input required to manage land disposal site.																					
		Constructability	2.0%	6.50	1.30	Moderate levels of construction required at WwTP site.		4.00	0.80	Significant construction required at WwTP site.		2.00	0.40	Complex construction required over large land area.		8.00	1.60	Minor construction required at WwTP site.		2.00	0.40	Large scale construction required in public area to construct pipe line. Significant upgrades at Gore WwTP.		2.50	0.50	Large scale construction required over large land area.																					
		Ease of Obtaining Consents	3.0%	6.00	1.80	Plant upgrade would require building consents for construction on existing plant site. Land disposal drivers need to be addressed in consent application		6.00	1.80	Plant upgrade would require building consents for construction on existing plant site. Land disposal drivers need to be addressed in consent application.		1.00	0.30	Land disposal element will require negotiation with land owners and a consent for land discharge, very complex for establishing such a large scheme		7.00	2.10	Plant upgrade would require building consents for construction on existing plant site. Land disposal drivers need to be addressed in consent application		3.50	1.05	Plant upgrade would require building consents for construction on existing plant site. Land disposal drivers need to be addressed in consent application		3.00	0.90	Land disposal element will require negotiation with land owners and a consent for land discharge																					
		Technical Suitability	4.0%	5.00	2.00	This technology has been successfully implemented at other pond based WwTPs. Success of option will depend on environmental effects.		7.00	2.80	Option will produce high quality effluent and provide a long term strategy for the treatment plant. However there are significant costs associated with implementing it.		2.50	1.00	Complexity and practicality issues related to such large land for irrigation.		8.00	3.20	Current plant is operating well. Growth in Mataura is predicted to be minimal.		6.00	2.40	Option will produce high quality effluent and provide a long term strategy for both treatment plants. However there are significant costs associated with implementing it.		7.00	2.80	Option has good cultural and environmental outcomes. Significant cost associated with the options.																					
						10.30					14.20					4.80					14.45					12.75					8.60																
		TOTAL OPTION SCORE				60.8				TOTAL OPTION SCORE				62.3				TOTAL OPTION SCORE				48.6				TOTAL OPTION SCORE				64.20				TOTAL OPTION SCORE				53.85				TOTAL OPTION SCORE				59.60	

100%