MEMORANDUM

TO:	Owners - 2 Akatore Road	Job No.:	842
ATTENTION:	Peter Barnes	Date:	6 August 2024
FROM:	Emma Burford	Page	1 of 13
SUBJECT:	2 Akatore Rd - Onsite Wastewater Feasibility	Reference:	*MM 24-08-01 EB 000842(RevA)*

1.0 Introduction

Fluent Solutions have been engaged by Peter Barnes to provide a response for further information associated with RM3063 - 2 Akatore Road, Taieri Beach. This memorandum presents an assessment of the feasibility for onsite wastewater for Lots 2-5, 2 Akatore Road. The assessment is desktop-based and considers the site in terms of AS/NZ1547:2012 requirements for onsite wastewater. It includes a high level assessment of effects and gives some recommendations for the design and construction of onsite wastewater systems on Lots 2-5.

2.0 Site

The site is located off Akatore Road, north of Taieri Beach School. Coutts Gully Swap is located to the west and the coast of the Pacific Ocean to the east, presented in Figure 2.1 below.

Figure 2.1: Site location

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Phone: (03) 929 1263

Queenstown | Suite 3, 23-27 Beach Street Queenstown 9300
Phone: (03) 974 4586

Figure 2.2: Site Layout

2.1 Description

The site elevation ranges from around 8m to approximately 10m at the highest point. The site slopes down towards the wetland to the west and slopes gently to the north (as indicated above).

A long section through the swamp, the site (northern boundary) and to the ocean is presented in Figure 2.3 below. A short section elevation is presented in Figure 2.4.

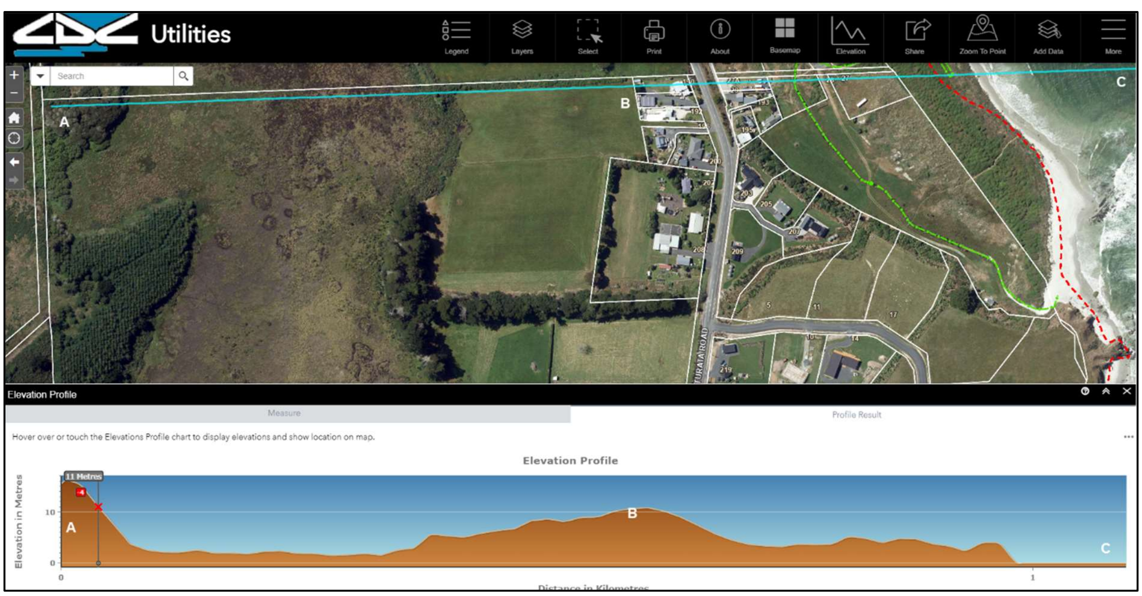

Figure 2.3: Long Section with Elevation Profile through the Site

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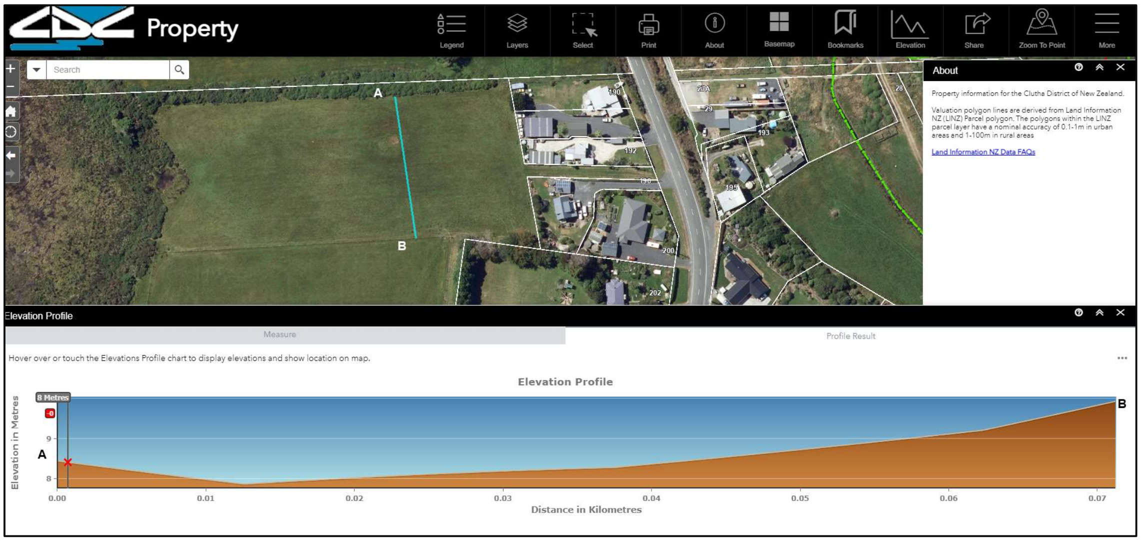

Figure 2.4: Cross Section with Elevation Profile through the Site

The site is currently free draining grass pasture.

2.2 Groundwater

Groundwater depth was estimated based on a high level assessment and local bore information as summarised below.

Groundwater flow direction will generally be east towards the coast, and is therefore likely to have a water elevation of the level of the swamp (2m) dropping to the sea level at the coast.

This is supported by the local bore in the vicinity of the site - I45/0004 presented in Figure 2.5 below. This domestic water supply bore is approximately 250m northeast of the site. The ground level at the bore is approximately 5m[1] and the depth to the ground level is noted as being 3.96m. This results in a calculated ground water level of RL 1.04m above MSL.

[1] Clutha District Council Maps

Figure 2.5: Site Location and Bore Locations Extracted from ORC Website

Groundwater depths on site (assuming a ground elevation on site of 8m) and a ground water elevation of 2m (swamp level), is therefore anticipated to be around 6m. This may decrease in high rainfall, so for the purposes of this assessment we have assumed a depth to groundwater of 5m.

Table R1 of AS/NZ1547:2012 requires a setback from effluent dispersal to groundwater as being 0.6m - >1.5m. Key factors influencing an acceptable setback are the permeability of the soils, sensitivity of the groundwater and receiving environment, rainfall, proximity to drinking water bores, direction of groundwater flow and existing quality of receiving waters.

Meeting this setback requirement is feasible.

2.3 Surface Water

2.3.1 Coutts Gully Swamp

Coutts Gully Swamp is identified as a Regionally Significant Wetland area and is located to the around 133m to the west of the site as shown in Figure 2.6 below.

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Figure 2.6: Coutts Gully Swamp Distance

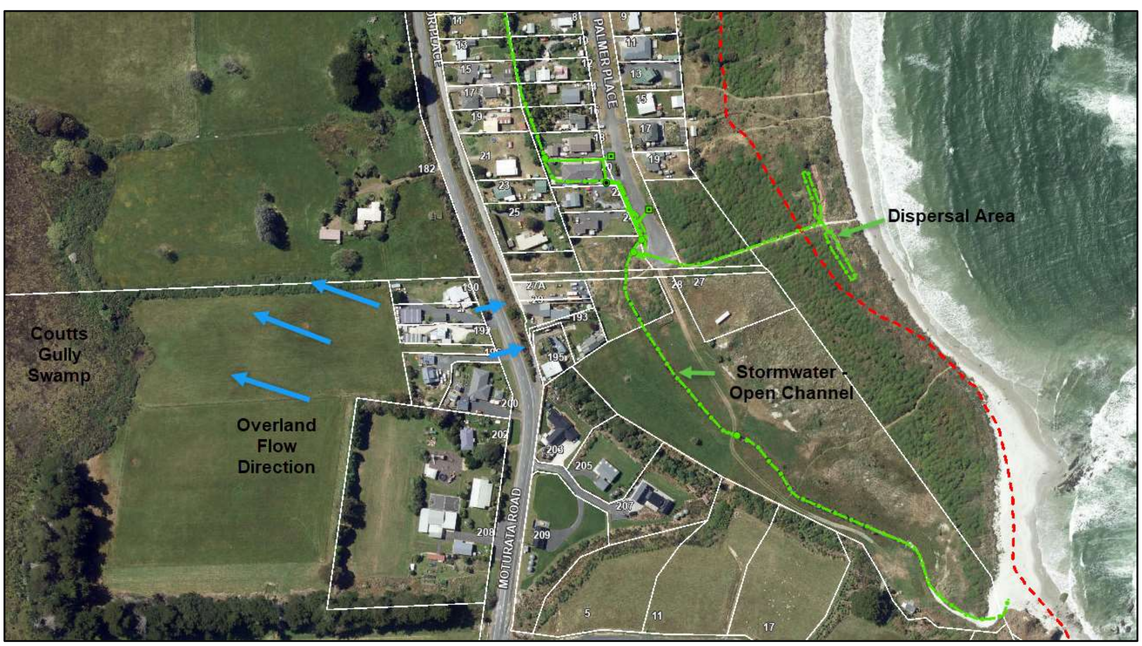
2.3.2 Pacific Ocean

The Pacific Ocean lies around 340m from the site.

2.3.3 Stormwater and Flooding

The site is located outside of Otago Regional Council flood hazard zones. The site is understood to free drain in its predevelopment state, with no known ponding areas. Stormwater overland flow paths are presented in Figure 2.7 below.

The existing stormwater management of the houses to the east is an open channel drainage system to a dispersal area.



2.7: Stormwater Overland Flow Paths

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2.4 Receiving Soils

Soils on the site are presented by Landcare Research as a combination of Timaru (60%) and Claremont soils (40%) as presented in Figures 2.8-2.9 below.

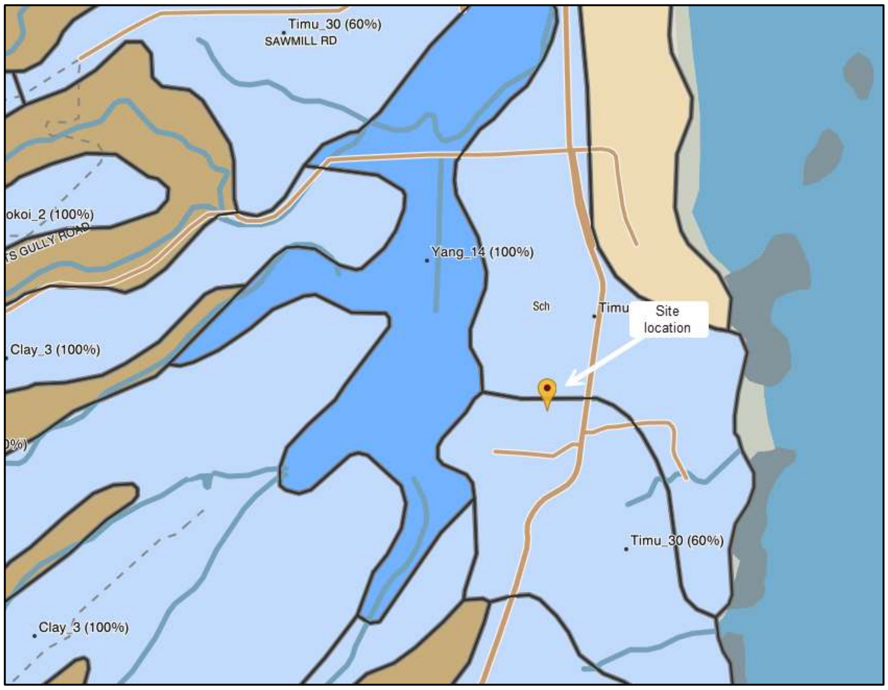

Figure 2.8: Site Location and Soil Map. Extracted from Smaps Online.

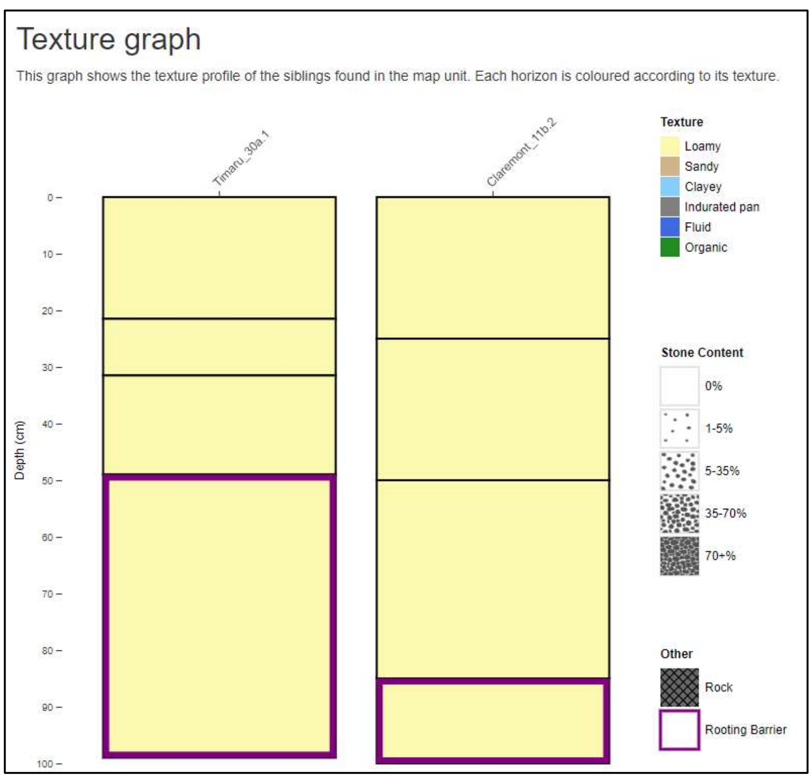

Figure 2.9: Soil Texture. Extracted from, Smaps Online.

The indicative permeability of Claremont and Timaru soils are presented in Figure 2.10 below as being rapid to a depth of 200mm, moderate and moderately slow to depth of 500-850mm with a potential permeability barrier below this.

These permeability rates equate to the following m/day rates:

Permeability	mm/h	m/d
Rapid	>72	1.728
Medium	18 to 72	0.432 to 1.728
MS	4 to 18	0.096 to 0.432

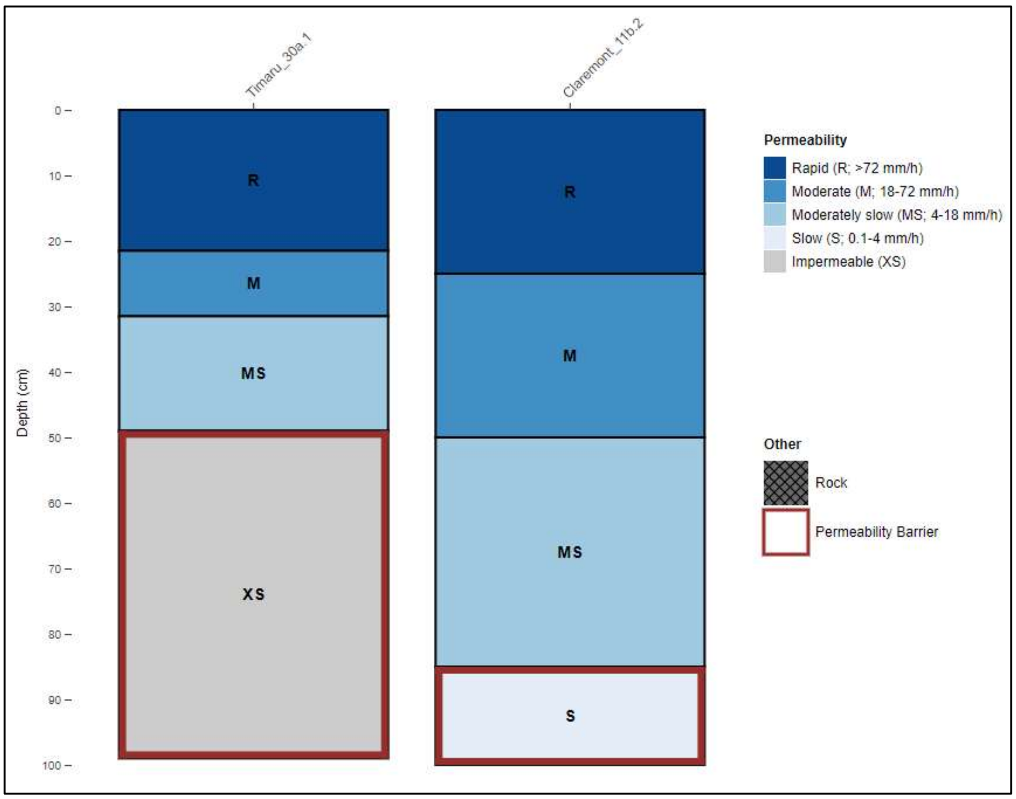

Figure 2.10: Soil Permeability. Extracted from Smaps Online.

Loam soils with these permeability rates are considered to be Category 3 in accordance with AS/NZ15247:2012. The shallow permeability barrier is a constraint to be considered in the design of a dispersal system.

A mound system is recommended in this scenario.

3.0 Onsite Wastewater Management

3.1 Wastewater Flows

Wastewater flows are calculated in accordance with Table H3 AS/NZ1547:2012, presented below. A maximum 180L/person/day is used for this exercise. It is noted that water reduction fixtures in new dwellings can reduce this design flow.

This feasibility assessment assumes a 3-bedroom dwelling on each Lot, accommodating 5 people giving design flows of 900L/day per Lot.

TABLE H3
TYPICAL DOMESTIC WASTEWATER DESIGN FLOW ALLOWANCES
– DOMESTIC WASTEWATER FROM HOUSEHOLDS – NEW ZEALAND

Source	Typical wastewater design flows (L/person/day) (see Note 1)	
	On-site roof water tank supply	Reticulated community or a bore-water supply
Households with standard fixtures (including automatic washing machine)	180	200
Households with standard water reduction fixtures (see Note 2)	145	165
Households with full water-reduction facilities (see Note 3)	120	145
Households (blackwater only) (see Notes 4 and 5)	60	
Households (greywater only) (see Notes 4 and 6)	90	120

Figure 3.1: Wastewater Design Flow Allowances, Table H3 AS/NZ1547:2012

3.2 Wastewater Treatment

Factors that influence the level of wastewater treatment include sensitivity of the receiving environment, proximity to surface water, the permeability of receiving soils, and depth to groundwater.

Secondary level treatment is recommended for Lots 2-5 at 2 Akatore Road. Onsite Wastewater in the Auckland Region GD2021/006 presents expected effluent quality for these levels of wastewater treatment, presented in Figure 3.2 below.

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Table 23: Typical wastewater treatment unit stages and associated effluent quality

Treatment unit stage	Primary treatment	Secondary treatment	Advanced secondary treatment	Advanced secondary treatment with nutrient reduction [Note 2]	Advanced secondary treatment with disinfection [Note 3]
BOD_5 (g/m^3) [Note1]	100-140	≤20	≤10	≤10	≤10
TSS (g/m^3) [Note1]	30-70	≤30	≤10	≤10	≤10
Ammonia (g/m^3)	<30	<5	<5	<5	<5
Total nitrogen (g/m^3)	<100	<40	<40	<25	<40
Total phosphorus (g/m^3)	<20	<10	<10	<8	<10
E. coli (CFU/100 mL) [Note 4]	$10^6 - 10^{10}$	$<10^4$	$<10^4$	$<10^4$	≤200

Notes:

1) 90th percentiles of the samples taken over three testing periods.
2) Enhanced and targeted nitrogen reduction is achieved by recycling nitrified wastewater through an anoxic zone and requires specific design and well-controlled operation.
3) Disinfection can be achieved by either UV or chlorination. The effectiveness of a disinfection system is affected by the wastewater characteristics. High quality of secondary treated effluent is required to ensure effective disinfection.
4) The alternative unit is MPN/100 mL.

Figure 3.2: Wastewater Treatment levels and Effluent Quality. Extracted from Onsite Wastewater in the Auckland Region GD2021/006.

An example of secondary treatment suitable for treating up to 2,000L/day is an Advantex AX 20 Unit, presented below. A smaller unit AX 15, is also available to design flows of up to 1,000L/day. Additional treatment (tertiary), such as UV disinfection, can be added if required.

Figure 3.3: Advantex AX 20 Unit

3.3 Dispersal Method

Mound dispersal systems are suitable for sites with shallow permeability barriers. They can incorporate some planting into the fields, to assist with evapotranspiration.

Figure 3.4 below presents design loading rates for. For Category 3 soils the recommended design loading rate for mound dispersal is 16mm/day.

TABLE 5.2
SOIL CATEGORIES AND RECOMMENDED DESIGN IRRIGATION/LOADING RATES (DIR/DLR) FOR LAND-APPLICATION SYSTEMS

Soil Category	Soil texture	Structure	Indicative permeability (K_{sat}) (m/d)	Design irrigation/loading rate (DIR/DLR) (mm/day) – Trenches and beds (see Table L1) – Primary treated effluent – Conservative rate	Primary treated effluent – Maximum rate	Secondary treated effluent	ETA/ETS beds and trenches (Table L1)	Drip and spray irrigation (Table M1)	LPED irrigation (Table M1)	Mounds (basal area) (Table N1)
1	Gravels and sands	Structureless (massive)	> 3.0	(see Note 1 of Table L1 for DLR values)			(see Note 4 of Table L1)	5 (see Note 2 of Table M1)	(see Note 3 of Table M1)	32
2	Sandy loams	Weakly structured massive	> 3.0						4	24
			1.4 – 3.0	15	25	50				
3	Loams	High/ moderate structured	1.5 – 3.0	15	25	50		4 (see Note 1 of Table M1)	3.5	24
		Weakly structured or massive	0.5 – 1.5	10	15	30				16
4	Clay loams	High/ moderate structured	0.5 – 1.5	10	15	30	12	3.5 (see Note 1 of Table M1)	3	16
		Weakly structured	0.12 – 0.5	6	10	20	8			8
		Massive	0.06 – 0.12	4	5	10	5			(see Note to Table N1)
5	Light clays	Strongly structured	0.12 – 0.5	5	8	12	8	3 (see Note 1 of Table M1)	2.5 (see Note 4 of Table M1)	8
		Moderately structured	0.06 – 0.12		5	10	5 (see Notes 2, 3, and 5 of Table L1)			(see Note to Table N1)
		Weakly structured or massive	< 0.06			8				
6	Medium to heavy clays	Strongly structured	0.06 – 0.5	(see Notes 2 and 3 of Table L1)				2 (see Note 2 of Table M1)	(see Note 3 of Table M1)	
		Moderately structured	< 0.06							
		Weakly structured or massive	< 0.06							

Figure 3.4: Soil Categories and Design Loading Rates, Table 5.2 AS/NZ1547:2012

3.4 Dispersal Field Size

Dispersal field footprint sizes for a mound system for a 3 bedroom dwelling is presented below.

- Design Flow: 900L/day
- Design Loading Rate: 16m/day
- **Mound Area Required: 56m²**

For Lot sizes of 1600m² and 1610m², dispersal fields of 56m² can be easily accommodated if included in early layout design. This footprint size is based on a permeability rate of 0.5-1.5m/day. This should be confirmed with a permeability test prior to detailed design. If permeability was less than this a slightly larger mound system could be feasibly constructed on the site.

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4.0 Assessment of Effects of Onsite Wastewater

It is determined that onsite wastewater is feasible for Lots 2-5 presented above. This is conditional to secondary treated effluent and mound dispersal.

A high level assessment of potential effects on the receiving environment has been undertaken. This is the potential effects of onsite wastewater arrangements with conceptual design parameters described in Section 4 above.

4.1 Pathogens

Regarding pathogen attenuation, the main mechanisms that operate within the soil matrix to ensure pathogen removal, are identified as filtration, adsorption and natural physical wear / die-off.

A study by Bohrer and Converse (2000) [2] was conducted in Wisconsin which evaluated six drip irrigation systems for the treatment of wastewater by septic tanks and aerobic units in soils that ranged from coarse sand to clay loam. They found that beyond approximately 450mm of soil depth the faecal coliform count was below detection limits. At 150 to 300mm soil depth the faecal coliform count ranged from 2 to 24 MPN per gram of soil.

Rubin (2009) (an author of many USEPA publications) in wastewater workshops in NZ stated that they conservatively use one log reduction of bacteria per 150mm of travel through the soil and subsoils. [3]

A high degree of pathogen removal is achieved in just a short travel distance.

Complete attenuation of pathogens is expected through the underlying soils prior to reaching the groundwater.

The effects of pathogens are considered likely to be less than minor.

4.2 Groundwater

The groundwater level is considered to be > 5m depth. The effects of pathogens from secondary treated effluent dispersed via the mound are considered to be minor, as presented above.

As described in Section 2, the closest bore is approximately 250m to the northeast of the site. AS/NZ1547:2012 requires a setback of 15-50m from bores. Groundwater below the site is not expected to flow in this direction; and is therefore not at risk from contamination from the dispersal fields.

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[2] *R. M. Bohrer and J. C. Converse SOIL TREATMENT PERFORMANCE AND COLD WEATHER OPERATIONS OF DRIP DISTRIBUTION SYSTEMS.*

[3] *Rubin, A. R. (2009). Application of Reuse Technology in Onsite Decentralized Systems. Discussion Paper. USEPA Region VI Decentralized Forum.*

AS/NZ1547:2012 gives the required depth from the discharge to seasonal water table as being between 0.6m->1.5m. This can feasibly be met with a mound dispersal over ground water depth of 5m.

The level of treatment of the effluent, and the dispersal method over the receiving soils are such that the potential effects of highly treated effluent on groundwater are considered to be minor.

4.3 Surface Water

4.3.1 Stormwater

AS/NZ1547:2012 requires setback of 15-100m[4] from surface water. Dispersal fields should ideally be located at least 50m from surface water in accordance with permitted activities under the Otago Regional Council Water Plan , including stormwater routes or areas prone to temporary ponding. This is considered feasible on these sites of 1600m^2 if positioning is considered at an early stage of lot layout design.

4.3.2 Coutts Gully Swamp

Coutts Gully Swamp is a Regionally Significant Wetland greater than 130m to the western boundary of Lots 3 and 4. This is considered a surface water requiring a setback of 15-100m under AS/NZ1547:2012. Constraint factors at 2 Akatore Road, such as Category 3 soils, high quality effluent treatment, a gently site slope and the proposed mound dispersal method mitigate the impacts on surface water and would reduce the set back requirements to less than 100m.

However, being a Regionally Significant Wetland the set back distance should be 100m in accordance with the National Environmental Standards – Freshwater Management. This set back distance of 100m can be met for the development.

The potential effects on Coutts Gully Swamp are considered to be less than minor.

4.3.3 Saline Water

The eastern boundary of Lots 2 and 5 is approximately 340m distance from the edge of the coast. At this distance the highly treated effluent would have nil impacts on the coastal waters.

4.4 Natural Hazards

Secondary treatment systems such as the Advantex example presented above provide storage capacity and an alarm system in order to mitigate against effects from minor earthquake damage to dispersal fields, flooding, or effects of wastewater on floodwater.

Dispersal fields should be positioned away from stormwater routes or areas prone to temporary ponding.

[4] Table R1: AS/NZS1547:2012 On-site Domestic Wastewater Management

5.0 Stormwater Management

Currently, rainfall in excess of the soils absorbing capacity flows as sheet flow towards Coutts Gully swamp to the north-west. Overland flow paths are presented in Section 2.3 above.

Managing post-development stormwater would be as follows:

- Reduction in site runoff by utilising rainwater storage tanks (required for water supply)
- Excess discharge could be discharged to on-site soak pit / dispersal area or there is potential to create a small vegetated swale to the north that drains clean water to Coutts Gully Swamp (as occurs now).

Details would need to be assessed at the Building Consent stage.

6.0 Recommendations

This feasibility assessment is for conceptual secondary or advanced level treatment dispersed via mound irrigation and conservative loading rates.

It is considered that AS/NZ1547:2012 requirements can feasibly be met. The following recommendations are made for wastewater management for the development:

1. Test pits be excavated across each Lot to confirm detailed localised soil characteristics, permeability barriers and localised groundwater depth.
2. Detailed design of systems to be undertaken by a qualified experienced wastewater professional, at an early layout stage of lot development. Detailed design to include wastewater treatment and dispersal system including loading rates, dispersal field location and size, level of effluent treatment.
3. Wastewater management should include secondary level effluent treatment and mound dispersal.
4. Provision of water reduction fixtures in dwellings.
5. Assessment of pervious and impervious surface areas should be undertaken at detailed Lot layout. Stormwater management would be provided by rainfall tanks (for water supply) with any excess stormflows discharging to soak pits or a vegetated swale that drains to Coutts Gully Swamp (as occurs now). Any stormwater should be located away from wastewater treatment and dispersal systems.