Woldwide Four Limited and Woldwide Five Limited

Resource Consent Application to
the Southland Regional Council:

- For two land use consents for a farming activity
- For two discharge permits to discharge effluent to land
- For two water permits to abstract groundwater for dairy purposes
- For two land use consents to use existing effluent storage ponds
- For two land use consents for wintering sheds

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QUALITY INFORMATION

Reference:	**2019 03 28 Application for WW4 and WW5.FINAL**
Date:	28 March 2019
Prepared by:	Tanya Copeland
Reviewed by:	Grace Baldwin
Client Review:	Abe de Wolde
Version Number:	FINAL

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1. INTRODUCTION

1.1 Executive Summary of the application

The applicant (Abe and Anita de Wolde of Woldwide Four Limited, and Woldwide Five Limited) have recently purchased a neighbouring sheep block known as "Cochran's Block". The applicant wishes to split Cochran's block and incorporate it into the existing milking platforms for their two adjoining dairy farms: Woldwide Four (WW4) and Woldwide Five (WW5). The addition of this land to both dairy platforms triggers the need to apply for land use consents for the farming activity under Rule 20(e) of the PSWLP. The "farming activity" for both WW4 and WW5 extends across a dry stock block located near Merrivale named Woldwide Runoff (WRO) and accordingly, WRO is included in the landholdings for both WW4 and WW5.

The proposal will be undertaken in two phases. Under phase 1, a portion of Cochrans block will be added to each dairy platform will allow the herd sizes on each farm to increase to maximum current discharge permit levels. Phase 1 will continue for a maximum of five years from the date of granting.

Under phase 2, the applicant will construct a 1050 cow wintering shed on each farm as a major mitigation measure in order to remove intensive winter grazing from the Central Plains area and ensure the farming activity does not result in an adverse effect on water quality in the receiving environment.

This application seeks consent under Rule 20 (e) for the farming activities on WW4 and WW5 which extend to WRO. The assessment of effects contained within this application includes a full assessment of the activities occurring and the actual and potential effects on the environment from the proposed farming activity in its entirety across the WW4 and WW5 landholdings which both include WRO.

The proposal includes the implementation of a wide range of good management practices and mitigation measures which avoid, remedy and mitigate adverse effects on the environment. These are described in detail in this application and are also included in the attached Farm Environmental Management Plans which support the application for WW4, WW5 and WRO.

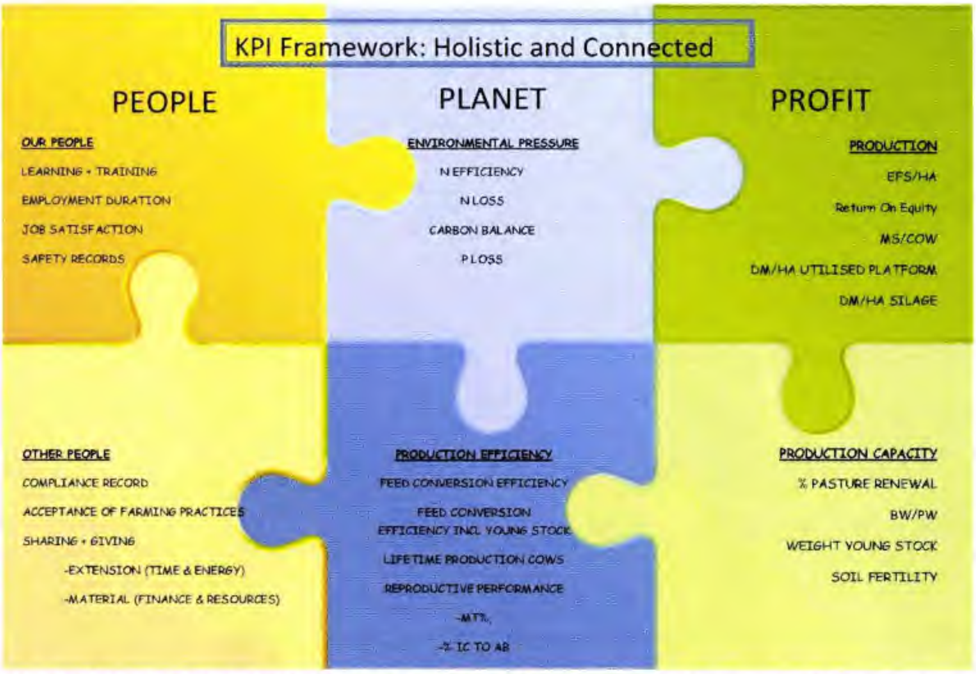
This proposal includes the recommendation that a nitrogen output limit is imposed on the resulting land use consents for WW4 dairy platform/Gladfield and the WW5 dairy platform only. This limit ensures that the activity is undertaken at a nitrogen loss level which is equal to or less than the baseline when modelled using the latest version of Overseer. Other methods to control and restrict nutrients are imposed by way of the implementation of the Farm Environmental Management Plans.

Applicants Philosophy

Abe and Anita de Wolde of Woldwide Farming Group have created a farming philosophy. In their words:

Sustainability (environmental, economic and social) has been at the core of all we do at Woldwide

Farming group. To us these principles flow out of a desire to be good stewards, and they are all interlinked as shown in the picture.



We were the first to build free stall barns in Southland to reduce outside crop wintering and we were the first (and only) ones to feed fresh grass to our cows in winter to reduce silage making losses and runoff. In 2013 we were supreme winners of the Southland Ballance Farm Environment Awards.

Ever since we came to New Zealand we have been trying to improve the sustainability of our farms with a long decision-making horizon and an innovative mind-set. We have now come to a point in our farming career where we wish to cap our growth ambitions and truly focus on environmental sustainability. Keeping our stock off wet soils in winter is pivotal in this endeavour. We aim to have all our adult stock from all our farms indoors within five years (and work on housing all young stock after that). We believe wintering animals outside on wet soils is very damaging for the following reasons:

- Nitrogen is lost because it is deposited on the ground (in the mud) when there are no plants actively taking it up and locking it in.

- Sediment and top soil are displaced because of the following reasons:

  o The ground is disturbed when it is wet

  o Root structures are destroyed

  o Overland flow (of Phosphate, sediment, bacteria) increases due to soil compaction

  o Rain events during cropping season when soils are worked up fine and crops have not yet established can be very risky

- Lots of chemicals are used in the cultivation of winter crops

- It takes 85 m of wrap to produce a bale of baleage and we want to reduce our reliance on this

We are convinced that 90 % of the environmental issues caused by farming in Southland stem from the 10 % of ground that is winter cropped. Just because something is common practice does not mean that the effects are acceptable. It is time to change this!

It needs to be kept in mind though that land previously used for winter cropping is vacated under our new plans and a small increase of stock numbers is needed to make up for that.

Our passionate desire is to go beyond compliance and to produce top quality food with a reduced environmental footprint. And that is the mindset behind this application.

1.2 The Applicant

Applicant Postal Address:	Woldwide Four Ltd and Woldwide Five Ltd C/- Abe and Anita de Wolde 104 Shaws Trees Road RD3 Winton
Address for Service:	C/- Tanya Copeland Landpro Limited PO Box 302 Cromwell 9342

1.3 Purpose of Documentation

Under s88 of the Resource Management Act 1991 (the RMA), this report provides an assessment of the activities effects on the environment as required by Schedule 4 of the RMA.

2. DETAILS OF THE PROPERTY

2.1 Woldwide Four (WW4)

WW4 is located 10km to the north of Otautau township and includes the dairy platform and the associated support block called Gladfield. Figure 1 shows the spatial extent of the current dairy platform, the proposed addition to the dairy platform, the location and extent of Gladfield block and the extent of the proposed effluent discharge area.

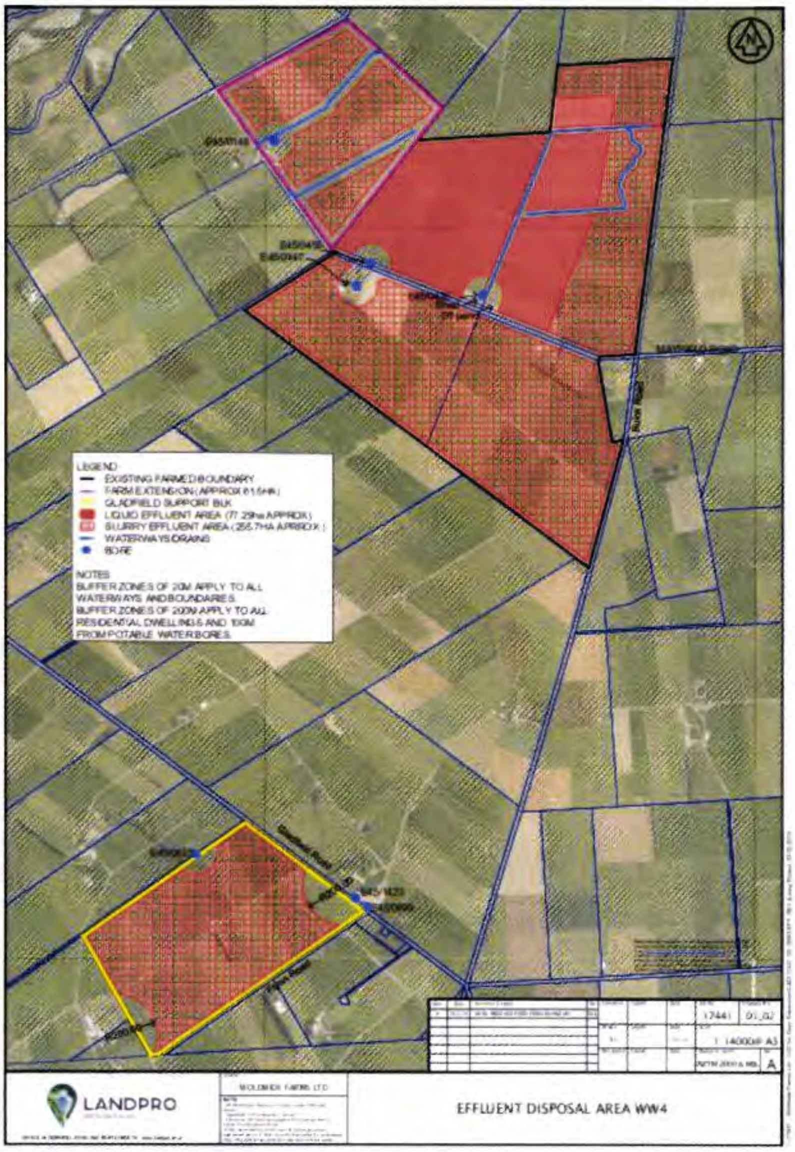


Figure 1: Proposed farm boundary and effluent discharge area for WW4

Property Details under the proposal – WW4	
Property address	305 Mayfield Road, Bayswater
Property owner(s)	Woldwide Four Ltd
Legal Description	Lot 7 DP 152 Lot 10 DP 152 Lot 11 DP 152 Lot 11 A DP 152 Lot 12 DP 152 Pt Lot 2 DP 4262 Lot 26 BLK III DP 210 (Gladfield) Lot 7 DP 238 (new block from Cochran's)
Property area (ha)	380 ha effective (302ha effective dairy platform, 78ha Gladfield)
Location	NZTM2000 1221173E, 4884494N
Proposed land use	Expanded dairy platform to include 63ha new block Continuation of supplement growing on Gladfield block – no change to extent of Gladfield block
Peak cows	1000
Stocking rate	3.3 cows/ha
Discharge Permit	FDE from 1000 cows Wintering barn effluent from 1050 cows Underpass effluent Low rate application Deferred storage Use of existing pond which meets pond drop test criteria New effluent storage facilities to cater for liquid and slurry effluent
Water Permit	Groundwater abstraction

2.2 Woldwide Five (WW5)

WW5 is located 10km to the north of Otautau. Figure 2 shows the spatial extent of the current dairy platform, the proposed addition to the dairy platform and the extent of the proposed effluent discharge area.

Under the proposal, 70ha of Cochran's block will be added to the WW5 dairy platform from Cochran's block and 45ha will be added to WW5 from Collies block.

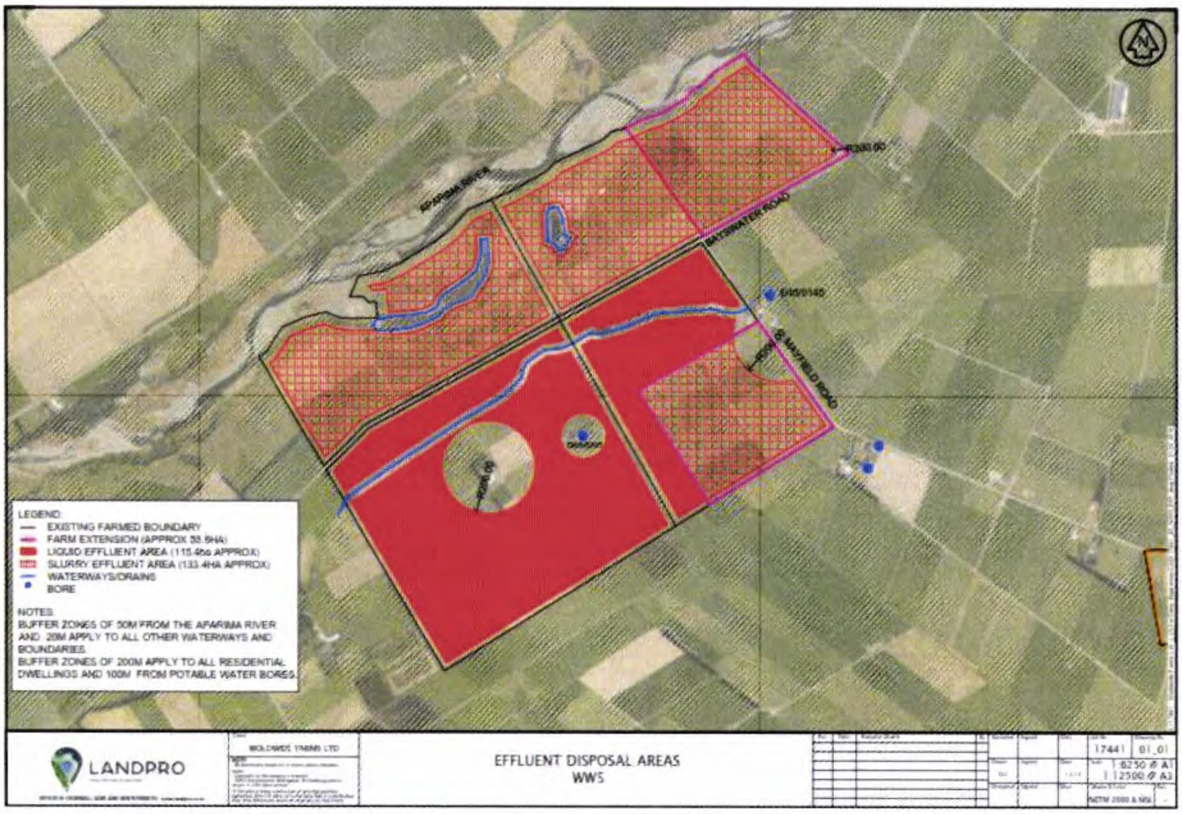


Figure 2: Proposed dairy farm boundary and effluent discharge area for WW5

Figure 3: Proposed dairy platform boundary with addition of a portion of Cochrans block (blue) and Collies block (yellow)

Property Details under the proposal– WW5	
Property address	760 Bayswater Road, Bayswater
Property owner(s)	Woldwide Five Ltd
Legal Description	Lot 1 Deposited Plan 344176, Lot 2 Deposited Plan 344176, Lot 1 Deposited Plan 310140, Part Lot 12 Deposited Plan 238 and Lot 2-3 Deposited Plan 478843, Lot 1 Deposited Plan 12253 Lot 1 DP 478843 (new block called Collies Block) Lot 7 DP 238 (new block from Cochrans) Lot 2 DP 310140 (new block from Cochrans)
Property area (ha)	311 ha effective, 335ha total
Location	NZTM2000 1220657E, 4885096N
Proposed land use	Expanded dairy platform to include 70ha new Cochran's block Expanded dairy platform to include 45ha new Collies block
Peak cows	930
Stocking rate	3.2 cows/ha
Discharge Permit	FDE from 930 cows Wintering barn effluent from 1050 cows Underpass effluent Low rate application Deferred storage Use of new effluent storage pond for slurry and liquid effluent
Water Permit	Groundwater abstraction

2.3 Woldwide Runoff (WRO)

Woldwide Runoff is located 20km to the west of Otautau, on the western side of the Longwood ranges. WRO is comprised of two separate blocks. The Merrivale Block is owned by Woldwide Runoff Limited and the Merriburn block which is leased.

The extent of the property boundary on this block will not change under the proposal.

Figure 4: Current/proposed farm boundary for WRO.

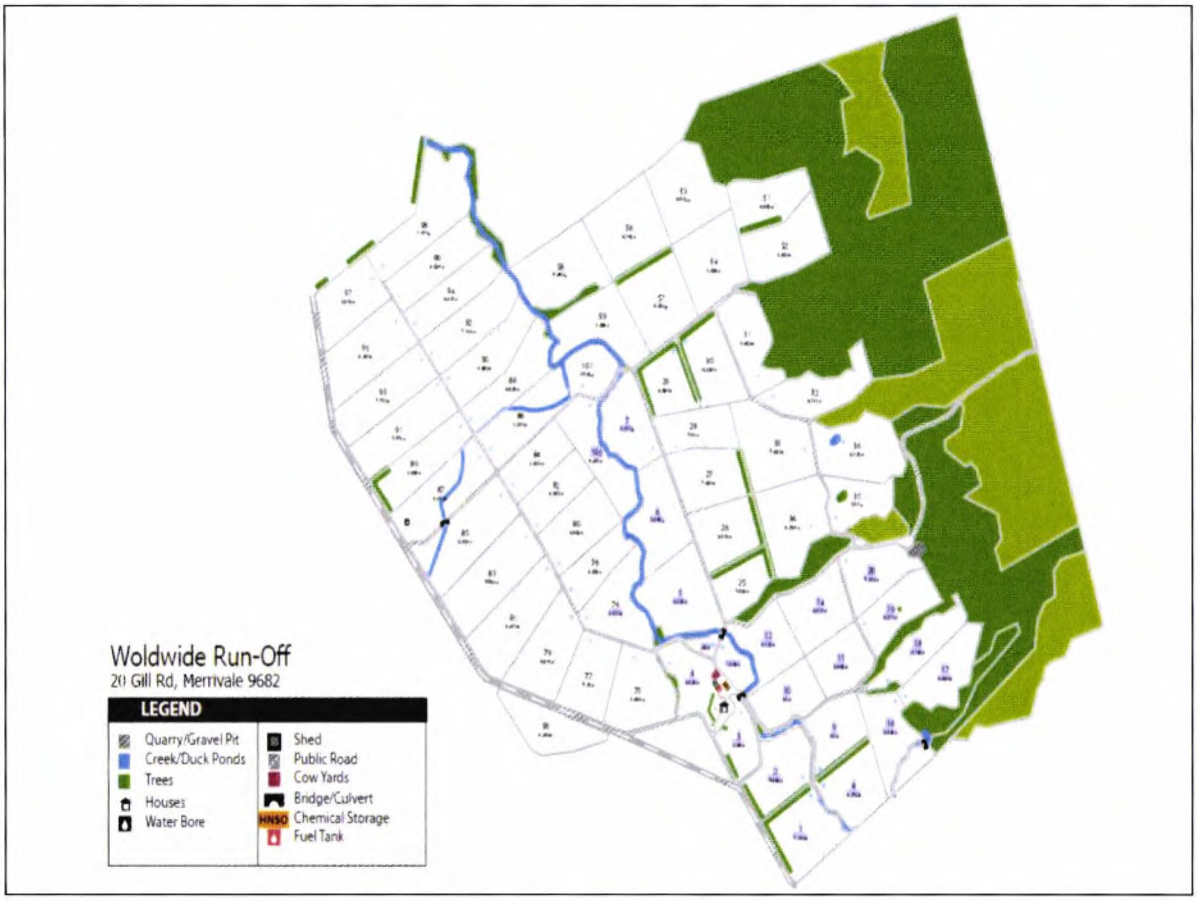


Figure 5: Farm Map for Merrivale Block

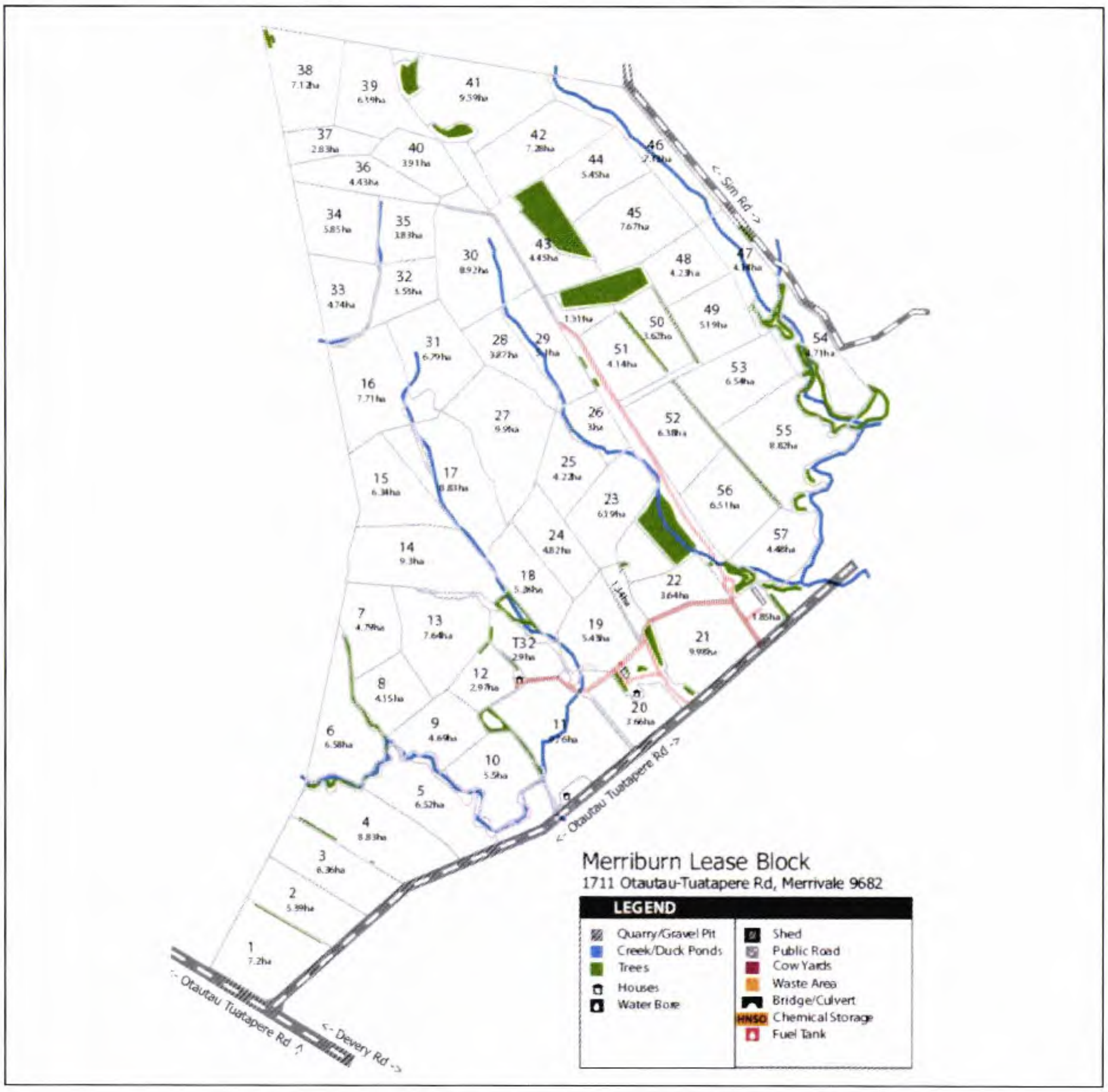


Figure 6: Farm Map for Merriburn Block (leased)

Property Details – WRO	
Property address	20 Gill Road – Merrivale block 1711 Otautau Tuatapere Road – Merriburn block
Property owner(s)	Woldwide Runoff Ltd
Legal Description	Merrivale Block: Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Part Section 7 Block XII Waiau SD Lot 1 DP 3537

	Merriburn Lease Block: Lot 1 DP 302409 Sec 26 Merrivale Settlement No. 1 Sec 27 Merrivale Settlement No. 1
Property area (ha)	507 ha total, 321 ha effective – Merrivale 385ha total, 338 ha effective - Merriburn
Location	NZTM2000 1201022E, 4893762N – Merrivale NZTM2000 1200812E, 4890495N - Merriburn
Proposed land use	Both blocks are run as a single operating unit. Grazing of dry stock: R1 and R2 heifers, grazing of carry over cows and grazing of mating bulls all year round (includes intensive winter grazing) Production of baleage 100ha of commercial pine plantation 60ha beech forest under sustainable management
Peak dry stock numbers 2018/2019 season	1265 R1 1265 R2 37 carry over cows 70 mating bulls

3. DESCRIPTION OF EXISTING ENVIRONMENT

The following section describes the existing environment separately for the three main blocks: WW4, WW5 and WRO.

3.1 Woldwide Four (WW4)

The existing environment comprises of existing activities which are occurring under enduring resource consents or existing use rights. Permitted activities occurring are also included in the assessment of the existing environment, however a permitted baseline approach is not used in accordance with Policy 39 of the PSWLP.

For this assessment, the existing environment on the area of the proposed WW4 landholding includes:

- The use of land (239ha effective) for dairy farming
- The discharge of FDE and underpass effluent to land from the peak milking of 775 cows
- The abstraction of 100,000 L/day of groundwater
- The use of land (24ha) for intensive winter grazing – Gladfield
- The use of land (54ha) for grass silage production - Gladfield
- The use of land (63ha) for sheep farming – Cochrans block

3.1.1 *Soils, Physiographic Zones and FDE Classifications*

Table 1: Soils, Physiographic Zones and FDE Classifications for WW4

		Soil Type	Vulnerability Factors		
			Structural Compaction	Nutrient Leaching	Waterlogging
	Existing Dairy Platform	Braxton	Moderate	Slight	Severe
	Additional Land (63.3ha)	Braxton	Moderate	Slight	Severe
		Tuatapere	Slight	Moderate	Slight
FDE land classification	Existing Dairy Platform	Category A (Artificial drainage or coarse soil structure)			
	Additional Land	Category A (Artificial drainage or coarse soil structure) Category D (Well drained flat land)			
Physiographic Zone	Existing Dairy Platform	Central Plains			
	Additional Land	Central Plains (39ha) Oxidising (24.3ha)			

Table 2: Soils, Physiographic Zones and FDE Classification for Gladfield block

	Soil Type	Vulnerability Factors		
		Structural Compaction	Nutrient Leaching	Waterlogging
	Braxton	Moderate	Slight	Severe
FDE land classification	Category A (Artificial Drainage or coarse soil structure)			
Physiographic Zone	Central Plains			

3.1.2 *Surface Water Resources*

The dairy platform is located within the Waimatuku Stream and Aparima River catchments. All surface water from the property flows via artificial drainage channels in a southerly direction towards the Waimatuku Stream. These drainage channels intersect with groundwater and eventually move into underground tile drains at the southern boundary of the farm.

The new part of Cochran's block is located within the Aparima River catchment and contains a small tributary of the Aparima within the farm boundary.

Gladfield block is located within the Waimatuku Stream catchment but has no surface water ways.

The Bayswater Bog lies to the south of both the WW4 platform and Gladfield block. The Bayswater Bog is purely rain fed[1] meaning the surrounding surface water and groundwater drainage does not flow towards or through the bog and is recharged only via rainfall on the surface area of the peatland. The Bayswater bog is therefore not considered to be a receiving environment for surface water flow from this landholding.

3.1.3 *Groundwater Resources*

The dairy platform is located within the Upper Aparima and Waimatuku Groundwater Management Zones (GMZ). The new block is located within the Upper Aparima GMZ. Gladfield is located within the Waimatuku GMZ.

3.2 Woldwide Five (WW5)

The existing environment comprises of existing activities which are occurring under enduring resource consents or existing use rights. Permitted activities occurring are also included in the assessment of the existing environment, however the assessment follows Policy 39 of the PSWLP.

For this assessment, the existing environment on the area of the proposed WW5 landholding includes:

- The use of land (262ha) for dairy farming
- The discharge of FDE and underpass effluent to land from the peak milking of 665 cows
- The abstraction of 72,000 L/day of groundwater
- The use of land (28ha approximately) for intensive winter grazing of mixed age cows and additional heifers from a neighbouring farm
- The use of land (70ha) for sheep farming – Cochrans block
- The use of land (45ha) for sheep farming – Collies block

In 2015, WW5 was granted land use consent AUTH-20157537-04, discharge permit AUTH-20157537-01 and water permit AUTH-20157537-02. Land use consent AUTH-20157537-04 was granted to establish a dairy farm on the property on a proposal which detailed that the majority of the proposed dairy platform was to be converted in 2015 and the remaining 45ha Collies block would be purchased by the applicant in 2019 and converted into dairy platform at the time of purchase. The land use consent and the conditions it contained were worded as such to allow for the two phased conversion of this property to occur. At the time, both Environment Southland and Fonterra were encouraging consent holders who were converting farms under these consents to "establish a dairy farm" to get the consents signed off as complete once the farm was converted, the consent given effect to and all conditions were met in order to enable supply to Fonterra to commence. Accordingly, the applicants surrendered the consent with Environment Southland in April 2016. The issue now arises that a consent was surrendered,

[1] M. Hitchcock, June 2014, *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland*

either mistakenly or unwillingly by both the applicant and Environment Southland which had ongoing conditions and ongoing obligations for the conversion of Collies block.

In order to resolve this situation, this application seeks land use consent under Rule 20(e) for the conversion of Collies block to dairy land in recognition of the fact that the land use consent which has previously approved the conversion of this land to dairy land has been surrendered. In order to give credit for the fact that the conversion of Collies block has already been assessed under proper process in 2015, and that the land use consent was surrendered in error, the applicant has agreed in writing with Environment Southland that this block can be modelled in the baseline models as already being dairy land.

3.2.1 *Soils, Physiographic Zones and FDE Classification*

Table 3: Soils, Physiographic Zones and FDE Classifications for WW5

		Soil Type	Vulnerability Factors		
			Structural Compaction	Nutrient Leaching	Waterlogging
	Existing Dairy Platform	Tuatapere	Slight	Moderate	Slight
		Braxton	Moderate	Slight	Severe
		Upukerora	Moderate	Slight	Severe
	Additional Land (70ha)	Braxton	Moderate	Slight	Severe
		Tuatapere	Slight	Moderate	Slight
		Upukerora	Moderate	Slight	Severe
FDE land classification	Existing Dairy Platform	Category D (Well drained flat land) Category A (Artificial drainage or coarse soil structure) Category E (Other well drained but very stony flat land)			
	Additional Land	Category A (Artificial drainage or coarse soil structure) (33.4ha) Category D (Well drained flat land) (31ha) Category E (Other well drained but very stony flat land) (5.6ha)			
Physiographic Zone	Existing Dairy Platform	Oxidising Central Plains Riverine			
	Additional Land	Central Plains (33.4ha) Oxidising (31ha) Riverine (5.6ha)			

3.2.2 *Surface Water Resources*

The existing dairy platform is located within the Aparima River catchment. The new parts of Cochran's block is also located within the Aparima River catchment.

3.2.3 *Groundwater Resources*

The dairy platform is located within the Upper Aparima GMZ. The new block is located within the Upper Aparima GMZ.

3.3 Woldwide Runoff

For this assessment, the existing environment on the area of the WRO includes:

- The use of land (732ha) for dry stock farming
- The use of land (160ha) for commercial pine plantation and native bush
- The grazing of 1265 R1 and 1265 R2 stock plus a small number of additional mating bulls in the 2017/2018 season
- The use of land (52ha approximately) for intensive winter grazing of dry stock in the 2017/2018 season

3.3.1 *Soils and Physiographic Zones*

Table 4: Soils and Physiographic Zones on WRO

	Soil Type	Vulnerability Factors		
		Structural Compaction	Nutrient Leaching	Waterlogging
	Waimatuku	Slight	Moderate	Slight
	Makarewa	Moderate	Slight	Severe
	Malakoff	Slight	Severe	Slight
FDE land classification	Category C (Sloping Land) Category D (Well drained flat land) Category A (Artificial drainage or coarse soil structure)			
Physiographic Zone	Bedrock / Hill Country (Overland flow variant) Oxidising (Artificial drainage variant) Gleyed (No variant) Peat Wetlands (No variant)			

3.3.2 *Surface Water Resources*

WRO is located within the Fenham and Merry Creek catchments.

3.3.3 *Groundwater Resources*

WRO is located within an unclassified groundwater management zone

4. ASSESSMENT OF THE EXISTING ENVIRONMENT

4.1 Aparima River

The Aparima is the smallest of Southland's four main catchments. It extends from the Takitimu Mountains west of Mossburn to the Jacobs River Estuary at Riverton and the headwaters drain alpine, native tussock and forested land.

Figure 7: Aerial extent of Aparima catchment showing water quality monitoring sites (white dots)

The closest state of the environment (SOE) water quality monitoring site for the Aparima River catchment is at Otautau, however it only records ecological indices. This assessment has used the SOE water quality monitoring site at Thornbury which measures both water quality and ecological indices. Information from the Land and Water website (www.lawa.org.nz) collates water quality data from a number of sources and provides the most recent water quality data available. **Table 5** below gives a summary of the state and trend measured at the Thornbury site for key river water quality indicators.

Table 5: Summary of Measurement and State Aparima River at Thornbury

Variable	State	Quality	NOF Band Annual Median	Trend
E.Coli	In the worst 50% of all lowland rural sites	195 n/100ml (median)	A	Meaningful improvement
Clarity	In the best 50% of all lowland rural sites	2.03 metres (median)	N/A	Indeterminate
Total Oxidised N	In the worst 50% of all lowland rural sites	0.675 g/m^3 (median)	A - median B – 95%ile	Meaningful improvement

		1.595 g/m^3 (95%ile)		
Ammoniacal N	In the best 25% of all lowland rural sites	0.0038 g/m^3 (median) 0.0148 g/m^3 (maximum)	A – 99% species protection level. No observed effect on any species tested.	N/A
Dissolved Reactive P	In the best 50% of all lowland rural sites	0.0065 g/m^3 (median)	N/A	Indeterminate

The water quality trends indicate that the overall water quality in the Aparima River is good with all relevant water quality parameters rated as A and one B (TON 95%ile) with either no trend or meaningful improvement. The ecological data for the Thornbury site shows that Macroinvertebrate Community Index was rated as fair with occasional ratings of good between 2007 and 2017 - suggesting the river is in fair to good ecological condition indicative of fair to good water quality and/or habitat. The EPT richness (species sensitive to water quality) shows fluctuations between 28% and 55% for the period 2008 to 2016.[2]

4.2 Waimatuku Stream

The Waimatuku Stream flows from the vicinity of the Bayswater Bog in a southerly direction towards the sea in the absence of a receiving estuary.

[2] https://www.lawa.org.nz/explore-data/southland-region/river-quality/aparima-river/aparima-river-at-thornbury/

Figure 8: Aerial extent of Waimatuku Stream catchment showing water quality monitoring site

There is a state of the environment (SOE) water quality monitoring site on the Waimatuku Stream at the Lorneville Riverton Highway. Information from the Land and Water website (www.lawa.org.nz) collates water quality data from a number of sources and provides the most recent water quality data available. **Table 6** below gives a summary of the state and trend measured at this site for key river water quality indicators.

Table 6: Summary of Measurement and State Waimatuku Stream at Lorneville[3]

	State	Quality	NOF Band Annual Median	Trend
E.coli	In the worst 25% of all lowland rural sites	500 n/100ml (median)	B	Indeterminate
Clarity	In the worst 50% of all lowland rural sites	1.12 metres (median)	N/A	Indeterminate
Total Oxidised N	In the worst 25% of all lowland rural sites	3.35 g/m^3 (median) 5.5 g/m^3 (95%ile)	C - median C – 95%ile	Meaningful improvement

[3]https://www.lawa.org.nz/explore-data/southland-region/river-quality/waimatuku-stream/waimatuku-stream-at-lorneville-riverton/

Ammoniacal N	In the worst 50% of all lowland rural sites	0.0104 g/m³ (median) 0.0416 g/m³ (maximum)	A – 99% species protection level. No observed effect on any species tested.	N/A
Dissolved Reactive P	In the worst 25% of all lowland rural sites	0.042 g/m³ (median)	N/A	Meaningful degradation

The water quality trends indicate that the Waimatuku Stream catchment has degraded in regards to dissolved reactive phosphorus over the period 2008 to 2016. Conversely, total oxidised nitrogen concentration has improved, albeit at relatively high absolute concentrations. The overall impact of the trends in nutrient concentrations is not clear at this stage. There is very limited published information on periphyton extent or macroinvetebrate community status in the Waimatuku Stream, so it is difficult to assess the current status or trend in biological quality of the stream. However, it is accepted that any increase in nutrient concentrations is likely to create the potential for an increase in periphyton and/or other plant biomass in the stream.

4.3 Fenham and Merry Creeks

WRO is located within both the Fenham and Merry Creek catchments. Both creeks are tributaries of the Orauea River which flows south-westerly towards Tuatapere township and joins the Waiau River. There is a SOE monitoring site on the Orauea River at Orawia Pukemaori Road which is used to measure water quality information data. The Land and Water website (www.lawa.org.nz) collates this water quality data and provides the most recent water quality data and trends available. **Table 7** below gives a summary of the state and trend measured at this site for key river water quality indicators.

Table 7: Summary of Measurement and State of Orauea River at Orawia[4]

	State	Quality	NOF Band Annual Median	Trend
E. coli	In the worst 25% of all lowland rural sites	315 n/100ml (median 5 year)	E	Likely improving
Clarity	In the worst 25% of all lowland rural sites	1.13 metres (median 5 year)	N/A	Indeterminate
Total Oxidised N	In the worst 25% of all lowland rural sites	0.415 g/m³ (median)	A - median	Meaningful improvement
Ammoniacal N	In the best 25% of all lowland rural sites	0.0005 g/m³ (median)	A – 99% species protection level.	N/A
Dissolved Reactive P	In the worst 50% of all lowland rural sites	0.011 g/m³ (median)	N/A	Indeterminate

4 https://www.lawa.org.nz/explore-data/southland-region/river-quality/waiau-river/orauea-river-at-orawia-pukemaori-road/

The water quality medians indicate that the Orauea catchment is degraded in regards *E. coli*, however there is a definite trend of improvement. High *E. Coli* levels are a concern for overall water quality within a waterway due to human health risks. Typically *E. coli* contamination of waterways is caused by stock contact with surface water, point source discharges from septic tanks, wastewater treatment at upstream towns and effluent discharges to land reaching surface water. A high proportion of land within the Orauea catchment is both intensive and extensive sheep farms which is likely to contribute to the high *E. coli* levels because stock on sheep farms are not excluded from waterways in the same manner in which it is compulsory on dairy farms. The other activities listed above may also be contributing factors. *E. coli* is rated as E band in the National Objectives Framework (NOF) of the National Policy Statement for Freshwater Management. An E band rating equates to an average infection risk of greater than 7%.

Conversely, total oxidised nitrogen concentration has improved and is rated as A band under the NOF which means that water quality is considered suitable for the designated use and associated with a high conservation values ecosystem where there is unlikely to be effects even on sensitive species. The national bottom line value is 6.9 mg/L which far exceeds the 0.415 mg/L median at this site.

The median dissolved reactive phosphorus (DRP) is below ANZECC guideline levels and is not showing an evident trend. The raw data shows that DRP is low on the majority of the sampling dates, with spikes most likely occurring during rainfall events where phosphorus can be transported to surface water bodies via runoff and erosion.

The overall impact of the trends in nutrient concentrations is not clear at this stage, however the receiving water is considered low in relation to nitrogen and phosphorus concentrations overall. There is very limited published information on periphyton extent or macroinvetebrate community status in the Orauea River, so it is difficult to assess the current status or trend in biological quality of the stream. However, it is accepted that any increase in nutrient concentrations is likely to create the potential for an increase in periphyton and/or other plant biomass in the stream.

4.4 Upper Aparima GMZ

The proposed farm boundaries for WW4 and WW5 lie within the Upper Aparima GMZ according to Beacon Mapping. The Upper Aparima GMZ is classified as a terrace aquifer. The Upper Aparima GMZ encompasses the flat-lying portion of the upper Aparima River catchment. The quaternary gravel deposits of the Upper Aparima groundwater zone occur in a series of broad alluvial terraces that flank the recent floodplain of the Aparima River. The gravel deposits underlying the higher terrace surfaces tend to be relatively clay-bound and weathered incorporating early-mid Quaternary gravels deposited by the Aparima River along with locally derived alluvial fan deposits sourced from the surrounding foothills. The terrace aquifers are recharged by direct rainfall recharge and infiltration of runoff from the surrounding hills and streams which drain the hills. There is limited riparian recharge from the Aparima River except along the riparian margins. Lincoln Environmental (2003) estimated mean annual land surface recharge in the Aparima groundwater zone at 417 mm/year. Groundwater is discharged into the Aparima River via spring-fed streams or throughflow through the unconfined aquifer along the riparian margin of the river.[5]

WW4 and WW5 are situated at the very south-eastern extent of the Upper Aparima groundwater zone and is in close proximity to the mapped boundary extents of both the Lower Aparima groundwater zone and the Waimatuku groundwater zone.

Groundwater quality in the Upper Aparima groundwater zone is varied with groundwater nitrate concentrations measured between 0.4 and 8.5 mg/L from monitoring bores within the wider groundwater management zone (Beacon mapping). The variation in groundwater nitrate nitrogen concentrations is synonymous with the variation in soil types and properties (land uses) within the area. The section of the groundwater management zone beneath the landholding mapped for the 2007-2012 period as having groundwater nitrate nitrogen concentrations between 3.5 and 8.5 mg/L which is consistent with the presence of free draining soils underneath parts of the applicant's subject property which are prone to low denitrification potential and therefore the accumulation of nitrate within the soil profile.

A 2011 report by Dr Clint Rissmann undertook regional mapping of groundwater denitrification potential and aquifer sensitivity throughout the Southland region. The report categorized different areas with a Combined Denitrification Potential (CDNP) sensitivity based on both surficial and sub-rock denitrification potential. The CDNP is a measure of the sensitivity of aquifers to nitrate contamination and a low or very low CDNP aquifer will have a high to very high sensitivity to nitrate accumulation. Conversely, a high or very high CDNP aquifer will have a low or very low sensitivity to nitrate accumulation due to the prevalence of denitrifying conditions.[6]

Figure 9 below shows the spatial distribution of CDNP and aquifer sensitivity as mapped by Dr Rissmann. The subject property is mapped as having low to very low dentification potential and is therefore classified as being highly sensitive to nitrate contamination. The map shows a domination of the green/light green colours indicating that the majority of the southern Southland region shares similar low denitrification potential.

[5] Environment Southland, *Upper Aparima Information Sheet*

[6] C. Rissmann, 2011, *Regional Mapping of Groundwater Denitrification Potential and Aquifer Sensitivity*, Environment Southland

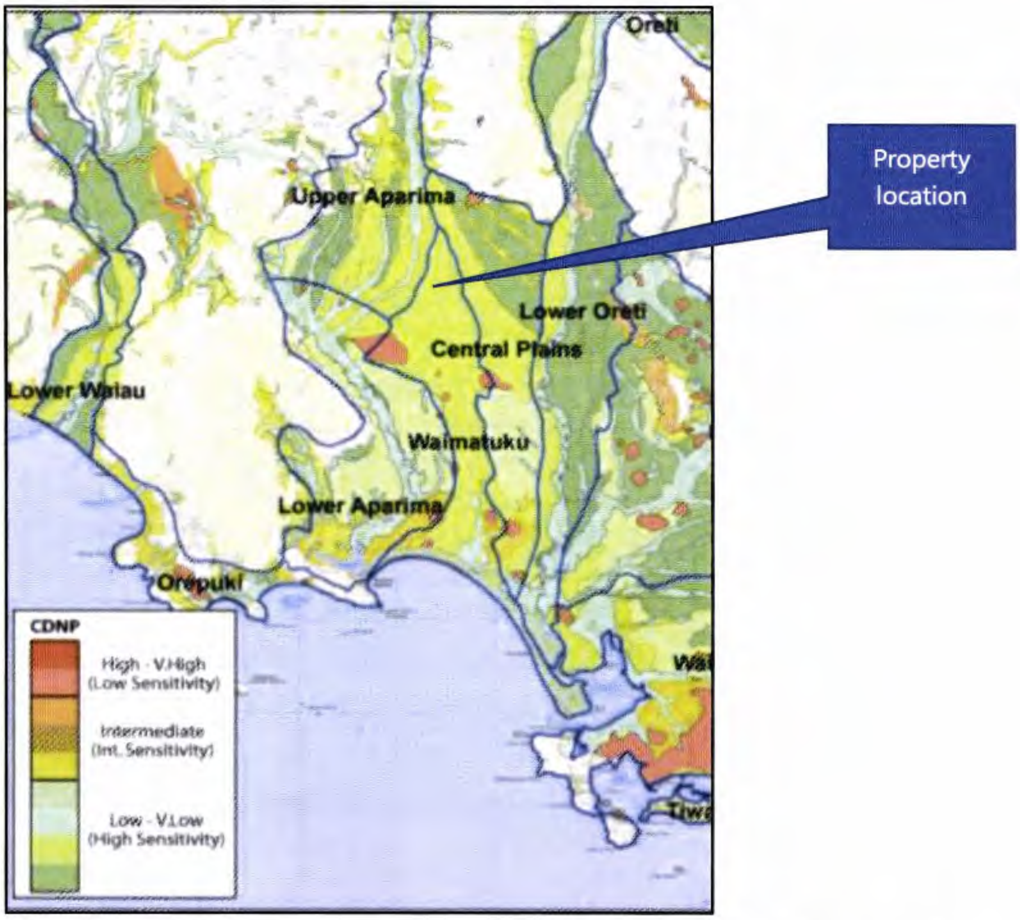


Figure 9: Spatial distribution of Combined Denitrification Potential (CDNP)(Aquifer Sensitivity)[7]

Very little information is published regarding the extent of groundwater and surface water interaction in this location. The proximity of the property to the main stem of the Aparima River suggests that there may be some level of riparian recharge along the riparian margins[8]. Typically terrace aquifers are recharged by direct rainfall recharge and infiltration of runoff from the surrounding hills and streams which drain the hills. Lincoln Environmental (2003) estimated mean annual land surface recharge in the Aparima groundwater zone at 417 mm/year. The direction of groundwater flow can be significant in terms of quantifying effects on water quality from the proposed activity,

4.5 Waimatuku GMZ

The proposed WW4 farm boundary including Gladfield is likely to drain to the Waimatuku GMZ. Although this property is technically not mapped by Beacon as being in the Waimatuku groundwater zone, the direction of drainage systems on farm, particularly from the area of Braxton soils, suggest both surface water and groundwater drainage drain away from the Aparima River. The Waimatuku

[7] C. Rissmann, 2011, *Regional Mapping of Groundwater Denitrification Potential and Aquifer Sensitivity*, Environment Southland

[8] Environment Southland, *Upper Aparima Groundwater Zone Information Sheet*

GMZ was the subject of an intensive MSc thesis study by M. Hitchcock in 2014 titled *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland.* Hitchcock studied the groundwater flow movements throughout the Waimatuku Stream catchment using potentiometric surveys. **Figure 10** from the thesis below show modelled groundwater flow directions throughout the catchment and appears to confirm this by also indicating that groundwater flow underneath the applicant's property flows in a south to south-easterly direction.

We can then expect that groundwater from beneath the property flows partially towards the Bayswater Bog, partially towards the Waimatuku Stream and partially towards the Aparima River however we cannot determine in what ratios. Where groundwater flows towards the Bayswater Bog, which is a raised peat bog (as seen from the contour lines) from the location of the dairy farming activity, it may undergo a certain amount of nutrient attenuation as a result of the sub-surface and wetland ecosystem processes. Where groundwater from the location of the dairy farming activities flows south easterly towards the Waimatuku Stream or towards the Aparima River there will be higher connectivity with surface water and less opportunity for attenuation of nutrients.

In equilibrium, the Waimutuku Stream is a source of groundwater recharge further down the catchment where groundwater flows at a tangent to the stream[9] and can act to mitigate potential effects based on this connectivity by providing additional groundwater baseflow and therefore dilution.

[9] M. Hitchcock, June 2014, *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland*

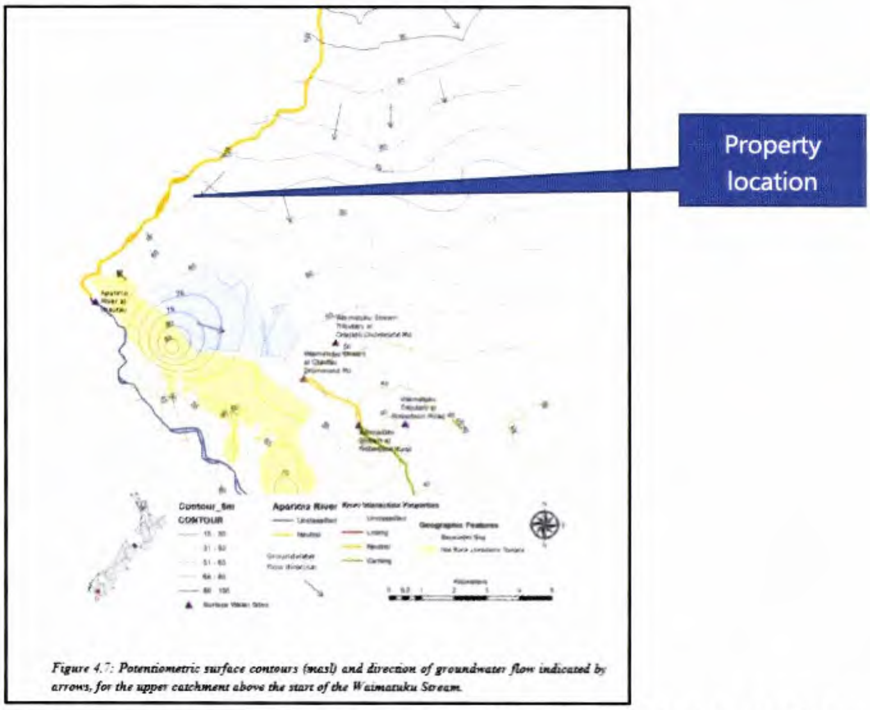


Figure 10: Potentiometric surface contours and direction of groundwater flow for the Waimatuku Stream[10]

The thesis concluded that the Waimatuku Stream was highly connected with groundwater providing a steady and large discharge to the surface water system. **Figure 11** below is an abstract from this report which clearly shows the surface water and groundwater relationships in the Waimatuku Stream catchment with the correlation between rainfall, stream flow, soil moisture and groundwater level.[11]

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[10] M. Hitchcock, June 2014, *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland*

[11] M. Hitchcock, June 2014, *Characterising the surface and groundwater interactions in the Waimatuku Stream, Southland*

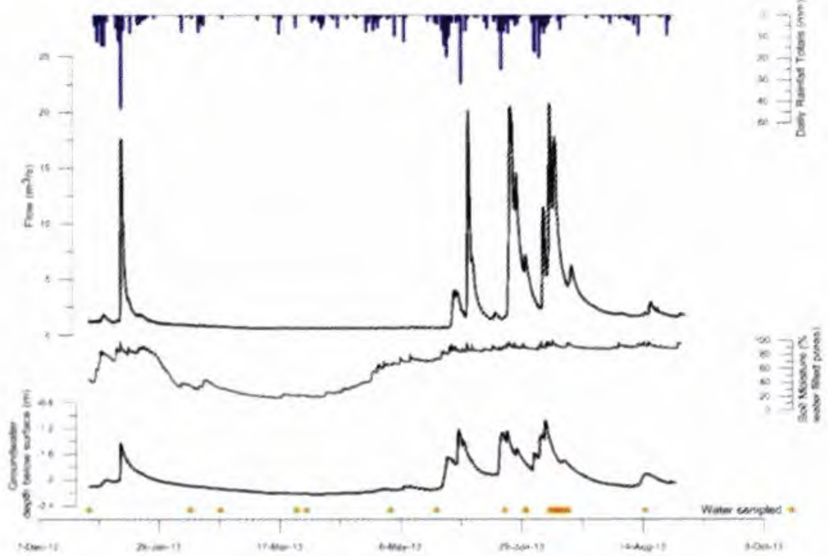


Figure 4.1: Catchment responses during the research period of December 2012 through to August 2013. Top to bottom including: Rainfall (mm daily total) at Otahuti; Stream flow at Township Road (m^3/s); Soil moisture (% water filled pores) at Isla Bank; Groundwater level (m) below the surface at Isla Bank; and day water sample collected indicated by orange star.

Figure 11: Rainfall, Stream Flow, Soil Moisture and Groundwater Level in the Waimatuku Stream

The nearest shallow groundwater monitoring to WW4 is from Bore D45/0350 which is located on the effluent discharge area on WW5 and is drilled to a depth of 6m and is therefore only representative of shallow drainage water quality. This bore has returned groundwater nitrate nitrogen results of 2.1 g/m^3 (December 2017), 0.97 g/m^3 (April 2017) and 3.0 g/m^3 (November 2016). *E.coli* results have returned as 134, 11 and 15 MPN/100mL in all three corresponding samples.[12]

4.6 Unclassified GMZ

WRO is located in an area of unclassified groundwater management zone. Groundwater nitrate levels in the vicinity of WRO are in the range 0.01 – 1.0 g/m^3, regarded as pristine to modern day background levels. Due to a combination of the topography, depth of groundwater and drainage channels there is a low risk of nitrate accumulation in groundwater in this area. This is supported by the very low mapped nitrate levels.

[12] Source: Environment Southland, water quality data D45/0350

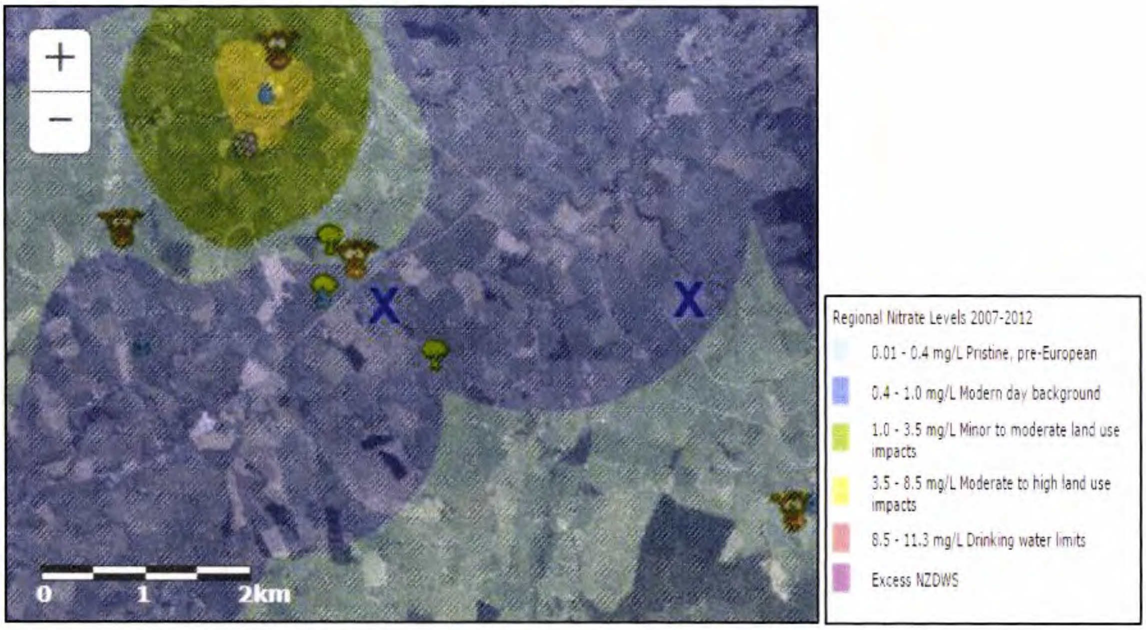


Figure 12: Groundwater nitrate in the vicinity of WRO (approximate location of WRO blocks marked with X)[13]

4.7 Jacobs River Estuary

The Aparima River discharges into the Jacobs River Estuary approximately 40 km downstream of the property boundary for WW5 (which is within the Aparima River catchment) near the township of Riverton. This estuary drains three nearby catchments namely the Pourakino River, Opouriki Stream and the Aparima River.

[13] Beacon mapping service, Environment Southland website, accessed 13 February 2019.

Figure 13: Aerial extent of the three catchments that drain to Jacobs River Estuary at Riverton

Section 3.6 in the Regional Coastal Plan describes the key values for the Jacobs River Estuary at Pourakino River. As a summary, the key values relevant to this application are the high values placed on the estuary for waterfowl and waders habitat. The area has high recreational value with activities such as shooting, whitebaiting, fishing and boating. The estuary does not have particularly high natural character values but Ngai Tahu regard the northern areas as having historical pa sites. Water quality and thereby ecosystem health are sensitive to excessive levels of microbes, sediment and nutrients. [14]

The Jacobs River Estuary is not listed in Appendix A of the PSWLP as a sensitive waterbody nor is it listed in the Operative Southland Regional Water Plan.

A literature search showed no published monitoring or scientific study of the Jacobs River Estuary since 2013. A 2012/13 broad scale habitat mapping report made various conclusions about the overall state of the estuary. Of relevance to this application, the report states that

[14] Regional Coastal Plan for Southland – March 2013 – Chapter 3 page 14

"The rapid increase in nuisance macroalgal growth since 2003, combined with the presence of soft muds, have seen widespread gross eutrophic conditions develop in the sheltered upper reaches of both arms (gross nuisance conditions now cover 30% of the estuary, compared with 4% in 2008 and <4% in 2003). These conditions have caused the displacement of seagrass beds, are stressing saltmarsh habitat, are causing significant adverse ecological impacts to sediment dwelling organisms, and creating conditions unfavourable for birds and fish. Aesthetic and amenity values in these parts of the estuary are now also severely compromised. The primary driver of the eutrophication symptoms being expressed is considered to be excessive catchment nutrient loads. In Jacobs River, >80% of the nutrient load is likely to be entering from the more heavily developed Aparima Arm, with many of the impacts evident in the Pourakino Arm also likely to be driven by inputs from this source. [15]

The 2013 report contained the following table which summarised the broad scale mapping results for the estuary. The table below shows that eutrophication indices deteriorated between 2003 and 2013 going from a Fair gross eutrophic condition area to Very Poor. [16]

Table 8: Summary of broad scale condition ratings for Jacobs River Estuary 2003-2008 and 2013

RATINGS			CONDITION RATINGS			CHANGE RATINGS
Major Issue	Overall Rating	Indicator	2003	2008	2013	Change from 2003 Baseline
Muddiness	POOR	Soft mud area	Very Poor	Very Poor	Very Poor	Small Increase
Eutrophication	POOR	Low density macroalgal cover	Low	Moderate	Moderate	Early Warning Trigger - trend of increase
		High density macroalgal cover	Low	Very High	Very High	Very Large Increase
		Gross eutrophic condition area	Fair	Poor	Very Poor	Very Large Increase
Habitat Modification	MODERATE	Seagrass Coefficient/area	Fair	Fair	Fair	Very Large Decrease
		Saltmarsh area	Moderate	Moderate	Moderate	Small Decrease
		Densely vegetated margin area	Poor	Poor	Poor	Small Decrease

An earlier 2009 report by the same authors assessed the macroalgal coverage of the Jacobs River Estuary based on the preceding three years of data. This report highlighted that the overall rating of the estuary for macroalgal condition as fair. However, the report noted that the central basin of the estuary surrounding the outlet of the Aparima River had low macroalgal counts due to extensive flushing. The higher macroalgal areas were in the sheltered upper arms of the estuary which are prone to sedimentation, runoff from the surrounding farmland and low flushing. [17]

[15] Wiggle Coastal Management, Stevens and Robertson, 2013, *Jacobs River Estuary Broad Scale Habitat Mapping 2012/13*

[16] Wiggle Coastal Management, Stevens and Robertson, 2013, *Jacobs River Estuary Broad Scale Habitat Mapping 2012/13*

[17] Wiggle Coastal Management, Stevens and Robertson, 2013, *Jacobs River Estuary Macroalgal Monitoring 2008/09*

5. ACTIVITY CLASSIFICATION

5.1 Consents Required for WW4

The following resource consents are required under the Regional Water Plan for Southland, 2010 (RWPS), Proposed Southland Water and Land Plan, 2018 (PSWLP) and Regional Effluent Land Application Plan ,1998 (RELAP)

Table 9: Applicable Rules for WW4

Consent	Plan	Rule	Activity Status
Land Use Consent – to use land for a farming activity **PHASE 1 & 2**	RWPS	17A	Permitted – no new dairy shed proposed
	PSWLP	20 (e)	Discretionary
Land use consent for the use of existing effluent storage facilities **PHASE 1 & 2**	RWPS	N/A	Permitted
	PSWLP	32D (b)	Discretionary
Discharge Permit to discharge agricultural effluent to land **PHASE 2**	RWPS	50 (d)	Restricted discretionary
	RELAP	5.3.2	Discretionary (sludge discharge)
	PSWLP	35 (c)	Discretionary
Water Permit to abstract groundwater for dairy shed wash down and stock drinking **PHASE 2**	RWPS	23 (d)	Discretionary
	PSWLP	54 (d)	Discretionary
Land use consent for a wintering shed **PHASE 2**	RWPS	N/A	Permitted
	PSWLP	35A (b)	Discretionary

Overall, the proposal for WW4 is a **discretionary** activity.

5.2 Consents Required for WW5

The following resource consents are required under the Regional Water Plan for Southland, 2010 (RWPS) and Proposed Southland Water and Land Plan, 2018 (PSWLP) and Regional Effluent Land Application Plan ,1998 (RELAP).

Table 10: Applicable Rules for WW5

Consent	Plan	Rule	Activity Status
Land Use Consent – to use land for a farming activity **PHASE 1 & 2**	RWPS	17A	Permitted – no new dairy shed proposed
	PSWLP	20 (e)	Discretionary
Land use consent for the use of an existing effluent storage facility **PHASE 1 & 2**	RWPS	N/A	Permitted
	PSWLP	32D (b)	Discretionary
Discharge Permit to discharge agricultural effluent to land **PHASE 2**	RWPS	50 (d)	Restricted discretionary
	RELAP	5.3.2	Discretionary (sludge discharge)

Consent	Plan	Rule	Activity Status
	PSWLP	35 (c)	Discretionary
Water Permit to abstract groundwater for dairy shed wash down and stock drinking **PHASE 2**	RWPS	23 (d)	Discretionary
	PSWLP	54 (d)	Discretionary
Land use consent for a wintering shed **PHASE 2**	RWPS	N/A	Permitted
	PSWLP	35A (b)	Discretionary

Overall, the proposal for WW5 is a **discretionary** activity.

5.3 Consents Required for WRO

The use of land at WRO for a farming activity at WW4 and WW5 is a **discretionary activity** under Rule 20 (e) of the PSWLP. This application seeks that the land at WRO is included in the land use consents sought under Rule 20 (e) for WW4 and WW5 respectively. A separate land use consent for WRO is not sought.

5.4 Consents Not Required

In accordance with Schedule 4 of the RMA, an application must describe and demonstrate compliance with any permitted activity that is part of the proposal to which the application relates.

<u>WW4</u>

The applicant will operate under the existing discharge permits under Phase 1 of the application.

WW4 currently operates under Discharge permit AUTH-20181320-01 which permits the milking of 850 cows with effluent spread over a 56ha block using a slurry tanker, travelling irrigator and pods. The existing effluent pond has an active storage volume of 3,801m^3. WW4 holds Water Permit AUTH-20181320-02 to abstract 100,000 L of groundwater per day for dairy purposes.

Discharge Permit 20181320-01 for WW4 does not need to be amended during phase 1 for the following reasons:

- The discharge permit already specifies that effluent will be applied to Lot 7 and 10 DP 152 which is not changing.
- Condition 1 refers to the effluent discharge being in accordance with the application submitted for APP-20181320 which is not changing in nature, scale or extent under this proposal.
- Condition 1 refers to the "discharge of agricultural effluent to an area of 56 hectares as per the plan attached as Appendix 1." The current Appendix 1 map accurately reflects the 56ha which is being utilised under this proposal. Condition 1 does not specifically refer in any way to the farm boundary as having specific relevance or restriction to the consent holder in fulfilling the requirements of Condition 1. The mapping of the farm boundary on the Appendix 1 map therefore only gives context to the discharge area, and does not define the nature, scale and extent of the discharge activity.

- Condition 2 states that "Notwithstanding these conditions, this permit shall be exercised in accordance with the Collected Agricultural Effluent Management Plan." This proposal does not seek to alter the nature, scale and extent of the discharge activity as described in the existing Collected Agricultural Effluent Management Plan.
- Condition 8 states that "Where there is inconsistency between the plan attached as Appendix 1 and the conditions of this consent, the conditions of this consent shall prevail." We believe that the imposition of Condition 8 gives a significant amount of clarity that the effluent discharge activity is appropriately outlined and restricted.
- Alongside all of the other consent conditions, the Council should be satisfied that the consent clearly describes what was applied for and is lawful.

<u>WW5</u>

WW5 operates under Discharge permit AUTH-20157537-01 which permits the milking of 800 cows with effluent spread over a 126ha block using low rate pods. Effluent is also spread on this property from a neighbouring WW3 farm which has been included in both the current and proposed models. The farm has effluent storage capacity of 166m^3. WW5 holds Water Permit AUTH-20157537-02 to abstract 72,000 L of groundwater per day for dairy purposes.

Discharge Permit 20157537-01 does not need to be amended under phase 1 for the following reasons:

- The discharge permit already specifies that effluent will be applied to Pt Lot 12 DP 238, Lot 13 DP 238, Lot 1 & 2 DP 344176, Lot 1 DP 310140, Lot 1 DP 12253 which is not changing.
- Condition 2 refers to the effluent discharge being in accordance with the application submitted which is not changing in nature, scale or extent under this proposal.
- Condition 2 refers to the "discharge of agricultural effluent to an area of 126 hectares as per the plan attached as Appendix 1." The current Appendix 1 map accurately reflects the 126ha which is being utilized under this proposal. Condition 2 does not specifically refer in any way to the farm boundary as having specific relevance or restriction to the consent holder in fulfilling the requirements of Condition 2. The mapping of the farm boundary on the Appendix 1 map therefore only gives context to the discharge area, and does not define the nature, scale and extent of the discharge activity.
- Condition 5 states that "Where there is inconsistency between the plan attached as Appendix 1 and the conditions of this consent, the conditions of this consent shall prevail." We believe that the imposition of Condition 5 gives a significant amount of clarity that the effluent discharge activity is appropriately outlined and restricted.
- Condition 10 (d) states that "This permit shall be exercised in accordance with the Farm Effluent Management Plan at all times. Where there is inconsistency between the Farm Effluent Management Plan and the conditions of this consent, the conditions of this consent shall prevail. "This proposal does not seek to alter the nature, scale and extent of the discharge activity as described in the existing Farm Effluent Management Plan.
- Alongside all of the other consent conditions, the Council should be satisfied that the consent clearly describes what was applied for and is lawful.

WRO

The other activities located on WRO which are not considered to form part of the respective farming activities, nor located on the landholdings for WW4 and WW5 include:

- Commercial pine plantation
- Rotten rock quarry operation
- Native bush block

These activities are permitted activities under the PSWLP as they do not contravene Section 13(1), 14(2), 14(3) or 15(1) of the RMA as detailed in Rule 4 of the PSWLP and they are located outside of the respective landholdings for which land use consent is sought under this application.

Table 11: Activities for which Consent is not required for WW4, WW5 and WRO

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
Incidental discharges from farming (Rule 24 PSWLP)	The land use associated with this discharge will be authorised under Rules 20, 25 or 70 once consents are granted.
Establishment of a New Dairy Farm (Rule 17A RWPS)	The proposal does not seek to intensify the existing operation by the addition of a new dairy shed, so this rule does not apply.
Fertiliser (Rule 10 RWPS & Rule 14 PSWLP)	All practicable measures will be taken to minimise fertiliser drift beyond the target areas. Fertiliser will be applied to selected areas of the farms in accordance with nutrient budget recommendations, and soil tests to avoid excess leaching of nutrients to groundwater. Fertiliser will be applied when a soil water deficit exists, and all waterways will have riparian margins with stock excluded.
Silage storage and silage leachate (Rule 51 of the RWPS, and Rules 40 & 41 of the PSWLP.)	All silage storage facilities will be located away from sensitive receiving environments, in accordance with permitted rule setbacks and no direct discharge of silage leachate to any waterbody is proposed. The proposed silage stacks have a couple of clean water diversions along their length. These diversions work in a similar way to yard diversions where the pipe is manually blocked off which diverts runoff either to the effluent system or to farm drainage depending on whether the stack is full within the immediate catchment area or not. These forms of manual diversion are extremely common place and are very simple to operate.
The use of land for feed pads/lots (Rule 35A of the PSWLP)	WW5 has three small pads which are used for less than 120 adult cattle and are constructed in accordance with Rule 35A including all separation distances. These will be used during phase 1 of the application.
Cleanfill, Farm Landfills and Offal Holes (Rules 53, 54 & 55 of the RWPS, and Rules 42 & 43 of the PSWLP)	No more than 500 m^3 of material will be discharged within cleanfill sites. Stormwater will be directed away from fill areas and no unauthorised material will be placed into proposed fill areas. No naturally formed limestone rock is known to reside within the property. Excavation of fill holes do not intercept springs and are not below the seasonal mean groundwater level in that location. Sensitive areas can be easily avoided when undertaking these associated

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
	activities. Offal sites are to be covered and the surfaces to be restored to a similar state as surrounding land upon closing.
Drainage of Land (Rule 9 RWPS & Rule 13 PSWLP)	It is not anticipated that any discharge from subsurface drains would result in a conspicuous change to the colour and/or clarity of the receiving waters at a distance of 20 metres from the point of discharge. The proposed good management practices will significantly reduce the likelihood of any contaminants reaching the subsurface drains.

6. DETAILS OF THE PROPOSAL FOR WW4

6.1 Overview of the proposal

Woldwide Four Limited will be undertaking an increase to the size of the milking platform and number of cows on farm in two phases. Phase 1 will continue for a maximum of five years from the date of granting of the land use consent and involves expanding the dairy platform and increasing actual cows milked on farm to existing discharge permit levels. Phase 2 will continue thereafter at the expiry or surrender of the phase 1 consents for the duration of the consents sought (15 years) and includes an increase in cow numbers and the construction of a wintering shed. This gives a total consent period sought for the entire proposal of 20 years cumulatively.

Phase 1:

- A land use consent for the farming activity to increase the size of the dairy platform by 63ha to convert a portion of Cochran's block to dairy platform.
- The applicant will exercise existing discharge permit AUTH20181320-01 and water permit AUTH20181320-02 which permit the milking of up to 850 cows.
- A land use consent for the use and maintenance of existing effluent storage facilities to hold effluent generated on the farm.

Phase 2:

- A land use consent for the farming activity to increase the size of the herd to 1000 cows and continue to utilise the expanded dairy platform from phase 1.
- A land use consent for the construction of a 1050 cow wintering barn on the farm
- A discharge permit to discharge farm dairy effluent, underpass effluent, silage leachate and wintering shed slurry to land from the peak milking of 1000 cows.
- A land use consent for the use and maintenance of existing effluent storage facilities to hold effluent generated on the farm.

Note: New effluent storage facilities will be required for phase 2. Consents to construct, use and maintain these new effluent storage facilities will be applied for prior to the commencement of phase 2 when exact details, plans and locations are finalized. According to s91 of the RMA, additional consents that may be required can be requested for the purpose of better understanding the nature of the proposal. In this instance, this proposal should be able to be fully understood without the exact details of the storage facilities as this application details their minimum storage requirements using DESC, material they will hold and timeframe for construction.

6.2 Land use consent application for farming activity

A land use consent is sought for the proposed farming activity which we are determining includes all activities located on the landholding which are directly associated with the operation of the applicant's dairy farm for 365 days of the year. The proposed farming activity extends across the WW4 dairy platform, Gladfield support block and WRO, and accordingly, one land use consent is sought to legalise the activities on this land.

The proposed farming activity will occur in two phases. Phase 1 of the proposal is to add 63ha of an existing 136ha sheep farm named Cochran's block to the existing dairy platform on WW4 and to increase cows to consented discharge permit levels. In order to facilitate phase 2 of the proposal, a 1050 cow wintering shed will be constructed on the dairy platform within a maximum 5 year timeframe which will allow for the increase of the herd size to 1000 cows (from 850 cows). Under phase 2, intensive winter grazing will cease on the Gladfield block and the block will be used for grass silage production as a cut and carry block. All mixed age stock will be wintered in the wintering sheds. R2s will be either wintered in the wintering sheds or at WRO with an assessment of effects for both scenarios assessed in this application and the AEE for WRO respectively.

Table 12: Farm areas and stocking rates for WW4 under the proposal

	TOTAL FARM AREA (HA)	EFFECTIVE AREA (HA)	STOCKING RATE
Existing	349	337	3.2
Proposed phase 1	412	398	2.1
Proposed phase 2	412	398	3.1

Overseer 6.3.0 has been used to describe the current farm system to create a baseline model for the existing land use (based on the existing environment described in Section 3.1). The baseline model consists of <u>one</u> nutrient budget based on actual data from the applicants records to create <u>five year average input values</u> for the preceding five years.

Overseer 6.3.0 has then been used to model the farm system under phase 1 to estimate nutrient outputs under this part of the proposal. Nutrient inputs have been carefully considered to ensure viable farm systems are modelled.

Phase 2 has been modelled using **an example Overseer nutrient budget for WW4** to give an prediction of how the wintering barn can maintain and/or reduce nutrient losses when included in the farm system. The meaning of **an example Overseer nutrient budget** is that the model uses more assumptions and typical industry-wide input values due to the inherent uncertainties which exist modelling a farm system so much further into the future. This example model must only be viewed as an example, not representing the exact and absolute farm system the applicant proposes to implement in the future. We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

Please refer to the Farm Scenario Plan in Appendix A for a full description of the baseline and proposed phase 1 farm systems and the winter barn example for WW4: Cochrans block, WW4 platform and Gladfield. This report details the inputs which have been used and this report has not repeated these farm system details to avoid duplication. The AEE section of this document assesses the inputs used in the proposed phase 1 model as both mitigation methods and good management practices.

The Overseer nutrient budgets have been prepared by Mark Crawford of Ravensdown who is a Certified Nutrient Management Adviser (CNMA). These Overseer budgets have been used to show the annual amount of nitrogen and phosphorus discharged from WW4.

The summary outputs for the **baseline model** are:

Table 13: Summary outputs for the baseline model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Self-contained dairy unit	10,558	30	312	0.9
Sheep farm (63 ha)	1,120	19	26	0.4
Current combined	11,678	30	338	0.9

The summary outputs for **proposed phase 1** model are:

Table 14: Summary outputs for proposed phase 1 model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Proposed phase 1	11,298	27	343	0.8

The summary outputs for the **winter barn example** model are:

Table 15: Summary outputs for winter barn example model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Winter barn example	11,142	27	368	0.9

Overall, modelling of phase 1 of the application indicates that at a farm system/landholding level nitrogen losses are estimated to reduce by 380 kg N/year and 3 kg N/ha/year compared to the baseline. Phosphorus losses are estimated by Overseer to increase by 30 kg P/year but remain the same on a per hectare basis compared to the baseline.

Overall, modelling of phase 2 (winter barn example) of the application indicates that at a farm system/landholding level nitrogen losses are estimated to reduce by 536 kg N/year and 3 kg N/ha/year compared to the baseline. Phosphorus losses are estimated by Overseer to increase by 5 kg P/year and 0.1kg P/ha/year compared to the baseline.

The overall intention of the land use consent under phase 2 is to operate at a nitrogen loss level (predicted by Overseer) equal to or less than the nitrogen loss level outputs from the baseline model. Please see Section 8.3 for specific details on how we propose to condition nitrogen loss outputs in the land use consent to account for Overseer version changes.

6.3 Discharge permit application

Phase 1:
The applicant will be operating under the existing discharge permit AUTH- 20181320-01 under phase 1 of the proposal. This discharge permit allows for the milking of up to 850 cows and the discharge of Farm Dairy Effluent (FDE) via low rate irrigation and slurry tanker. Under phase 1, the applicant will increase actual cow numbers milked on farm to consented cow numbers. Land use consent is sought under phase 1 for the use of the existing effluent storage facilities (see Section 6.6)

Our assessment is that AUTH-20181320-01 does not need to be amended for phase 1 as described in Section 5.3 of this report.

Phase 2:
A new discharge permit is sought for phase 2 of the proposal. A discharge permit is required to allow for the discharge of FDE from 1000 cows, underpass effluent, silage pad leachate and wintering shed slurry from a maximum of 1050 cows.

The effluent generated in the wintering shed and held within the sludge bunker is more solid in nature than typical FDE and could be considered a sludge. The PSWLP provides for a very simple definition of sludge: "*The solid residues from effluent*". The PSWLP does not provide a definition for the term slurry. We have used an Agresearch document by Houlbrooke et al which has characterised and evaluated dairy manures and slurries. The following diagrams are an excerpt from this report and indicates that barn slurry has an average of 8% dry matter which classifies it as liquid. Effluent from herd homes has an average of 23% dry matter which classifies it as semi-solid.

MANURE CHARACTERISTICS (mean values)

Manure system	% DM	Total N kg/t	Mineral N kg/t	Total P kg/t	K kg/t	Carbon %
Barn slurry [1]	8	3.2	1.4	0.8	4.2	3
Static screen [2]	11	2.3	-	0.4	0.7	-
Mechanical	25	3.6	0.2	0.6	1.0	10
Weeping wall	23	2.4	0.3	0.6	0.9	5
Feed pad	26	5.9	0.4	1.3	7.7	8
HerdHomes®	23	5.6	1.6	1.4	6.7	10
Carbon pads	38	3.7	0.5	1.1	5.3	15

[1] kg/m³

[2] Data supplied by Murray McEwan GEA Farm Technologies NZ Ltd, Cambridge

agresearch

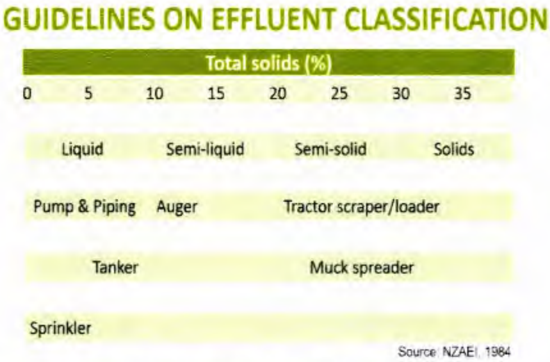


Figure 14: Effluent characteristics and classifications[18]

The applicant has taken a conservative approach and classifies effluent from the wintering sheds as slurry which means that the effluent generated in these sheds requires a discharge permit in order to apply the slurry to land on both the dairy platform and Gladfield block.

Table 16: Discharge Permit application summary

Discharge Permit Details:	
Replacement of consent no.	AUTH-20181320-01
Number of dairy cows	1000
Type of milking shed	Rotary Shed
Winter milking?	No milking between 16 June and 31 July other than slipped cows
Wintering barn?	Yes – for 1050 cows
Feed pad/stand off pad?	No separate structure present but the wintering shed used can be used as a standoff pad for milking cows for approximately 10 hours per day during May and August.
Other sources of effluent?	Stock underpass Silage leachate
Effluent treatment	FDE: Slurry scraped from yard to concrete sludge pit, liquids drained to liquid effluent storage facility Wintering Barn: scraped to slurry effluent storage facility Underpass effluent: directed to liquid effluent storage facility Silage leachate: directed to slurry effluent storage facility
Storage available (m^3)	3801m^3 existing pond will be re-constructed with a liner in phase 2 to provide liquid storage. New pond – 7,979m^3 for slurry effluent storage
Storage required (m^3)	Liquid effluent: 3,660m^3 (as per attached dairy effluent storage calculator for FDE from 1000 cows in Attachment E)) plus underpass effluent Slurry effluent: 7,979m^3 for wintering shed effluent, silage leachate and excess sludge bunker effluent

[18] Houlbrooke et al, Dairy Manures and Slurries: Characteristics and Evaluating current practice, AgResearch accessed at http://envirolink.govt.nz/assets/Envirolink/1204-ESRC15320Dairy20manures20and20slurries-characteristics20and20evaluating20current20practice20.pdf on 1 February 2019

Disposal area (ha)	Liquid effluent: 78ha discharge area Slurry effluent: Approx 320ha being the remainder of dairy platform and entire Gladfield block
Irrigator proposed	Pods, slurry tanker and travelling irrigator
Application rate and depth	Travelling irrigator: Maximum depth per application of 8 mm. Total annual application depth of 25 mm Slurry tanker: 2.5mm depth per application maximum. Typical application at 1.5mm depth Pods: Max application rate 10mm/hr
Monitoring proposed	Groundwater every 6 months

6.3.1 *Effluent management system description*

Farm dairy effluent

- The dairy shed yard is mechanically scraped to collect the more solid component of the effluent (slurry) which is scraped into a 100m³ concrete sludge bunker at the far end from the dairy yard. The yard has a downward gradient towards the milking shed to effectively allow solid and liquid effluent to be separated by gravity on the yard. The slurry is stored in the above ground concrete bunker for a maximum of 4 weeks before it is applied to land using an on-site slurry tanker. Slurry is applied to the remainder of the farm outside the liquid effluent discharge area.

- The rotary platform and dairy shed are washed twice daily with a maximum of 25,000 L equating to 25 L/cow/day. This volume has been measured by the applicant and is accurate for the system on farm.

- Liquid effluent collected from the yard, dairy shed and underpass is pumped either directly out to the 78ha effluent discharge area using a combination of low rate pods, slurry tanker and travelling irrigator or stored in the effluent storage pond (to be constructed).

- The slurry tanker can apply effluent at a depth of 1.5-2.5mm per application and will be preferentially used when a lower soil moisture deficit exists. The travelling irrigator applies effluent at a depth of 7-8mm and will be preferentially used when a higher soil moisture deficit exists. The low rate pods apply effluent at a maximum rate of 10mm/hr and can be used all year round provided an adequate soil moisture deficit exists.

6.3.2 *Storage*

The effluent storage at the farm under phase 2 will consist of three primary storage areas:

- Liquid effluent from the washdown of the platform and rainwater on the yard is stored temporarily in a pump sump before it is applied directly to the approved liquid discharge area.

- Liquid effluent will also be stored in the 3,801m³ re-constructed lined effluent storage pond and applied to land with a combination of the pods, slurry tanker and travelling irrigator. This will be completed prior to phase 2 commencing and will require a further land use consent application to be made when details are finalised as discussed above.

- Underpass effluent is pumped to the liquid effluent storage pond.
- Slurry from the yard is stored in the 100m^3 concrete pit attached to the far end of the yard and applied to land using a slurry tanker on a monthly basis. Slurry collected during the first two weeks of June and during spring is stored with wintering shed effluent in the slurry effluent storage facility.
- All wintering shed effluent is stored for the duration of winter in the new slurry effluent storage facility and applied to land from October through to May when soil moisture conditions are suitable.

Note: Consents will be applied for to re-construct, use and maintain any new or existing effluent storage structures under phase 2 prior to the commencement of this discharge permit.

Liquid effluent

The Dairy Effluent Storage Calculator (DESC) attached in Attachment E shows that **3,660m^3 of pumpable liquid storage is required** (90th percentile probability) to enable effective deferred irrigation for liquid FDE and underpass effluent (included in the other catchments section total 480m^2).

A condition of consent is required on the Discharge Permit (phase 2) to ensure that the new effluent storage facility for liquid effluent will be constructed of at least 3,660m^3 in volume.

Slurry effluent

The wintering shed is used for a maximum of 1050 cows for the entire winter period. During some seasons, the shed may only contain mixed age cows with the R2 cows remaining at WRO.

The wintering shed is used as a standoff pad during late Autumn and early spring as a measure to remove cows from pasture. The use of this facility as a standoff pad will change continually every season based on frequency and severity of adverse weather events and soil moisture levels. A conservative estimate is that the wintering shed could be used 24 hours per day for 45 days as a standoff pad.

The applicant has slurry effluent storage available within the concrete bunker for yard scrapings. The applicant has the ability to empty the concrete bunker monthly using the on-site slurry tanker during the majority of the milking season. Slurry from the concrete bunker will preferentially be stored in the same facility as the wintering shed effluent during the first 15 days of June or during spring which is calculated above to equate to 195m^3.

Silage leachate is collected with the slurry effluent. The silage pad is drained by a series of four drains along the length of the pad which can be manually diverted to storage or freshwater discharge depending on whether silage is stacked on this portion of the pad or not. Leachate volumes are therefore hard to calculate due to the changing nature of a silage stack with the pad completely empty for 3-4 months of the year and partially empty for another 2 months. A conservative estimate sees a catchment of 800m^2 entering the slurry effluent storage facility based on 50% of average annual rainfall.

Below, a manual calculation has been used for slurry effluent including wintering shed effluent, slurry from the yard and silage pad leachate because the applicant wishes to provide storage for all of the slurry effluent produced and does not wish for a model to discount storage volumes based on soil types.

Wintering shed: 1050 cows x 50 L/cow/day x 95 days = 4,988m^3 (includes June, July and August)

Wintering shed: 1050 cows x 50 L/cow/day x 45 days = 2,362m^3 (used as standoff pad)

Slurry from yard: 1000 cows x 3 L/cow/day x 65 days = 195m^3

Silage pad leachate 800m^2 x 0.53m rainfall = 424m^3

Total required for slurry = 7,979m^3

A condition of consent is required on the Discharge Permit (phase 2) to ensure that the new slurry effluent storage facility will be constructed of at least 7,979m^3 in volume.

6.3.3 *Discharge Area*

The **liquid** effluent discharge area will be approximately 78ha which represents an increase from 56ha under the existing discharge permit. Overseer reports state that 62ha is required to maintain N loading at less than 150 kg N/ha/year from effluent. Liquid effluent (FDE plus underpass effluent) will be applied to land all year round as soil conditions permit safe application.

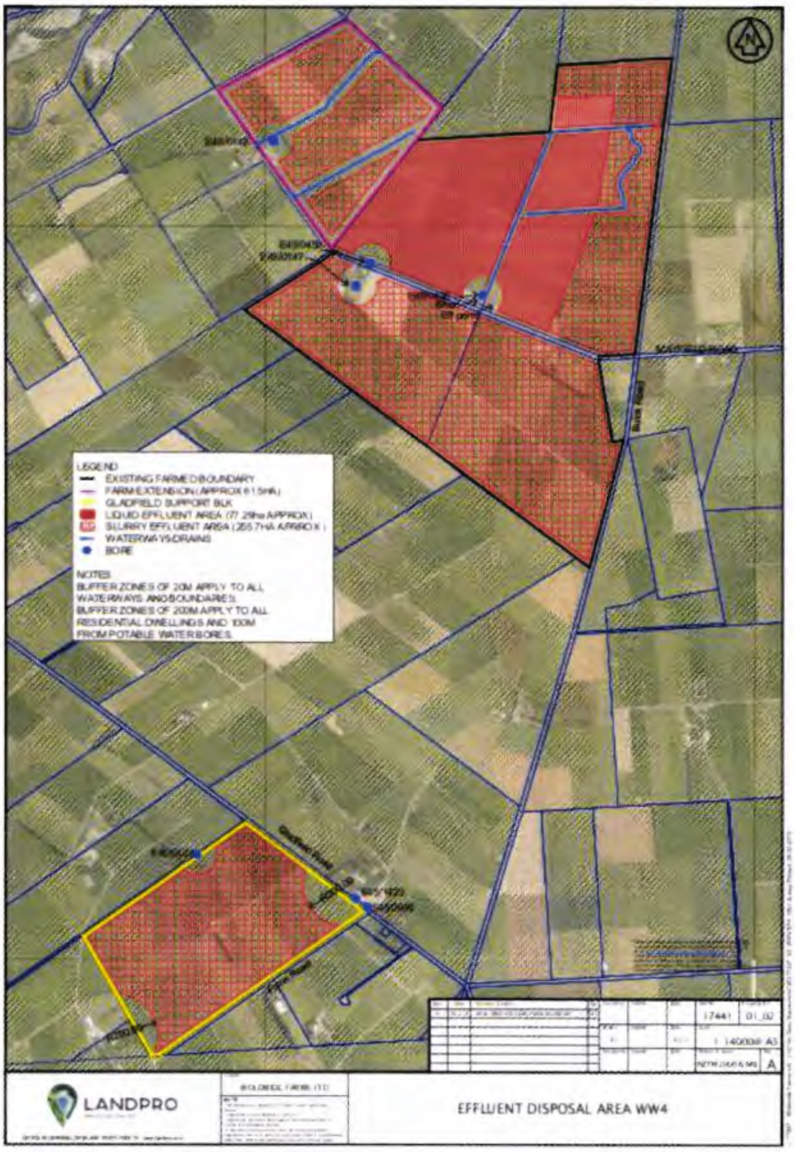


Figure 15: Proposed effluent discharge area

The **slurry** effluent discharge area includes the remainder of the milking platform (i.e blocks/paddocks not in the approved liquid effluent discharge area) and the total area of Gladfield block totals approximately 320ha.

Liquid or slurry effluent will not be applied within the following buffer zones as per standard discharge permit conditions:

- 20 m of any surface watercourse
- 100 m of any potable water abstraction point
- 20 m to any landholding boundary; and
- 200 m of any residential dwelling on a neighbouring property

In addition, the applicant will not discharge effluent where the soil has cracked.

6.3.4 *Discharge Method*

Liquid effluent will be applied to land using low rate pods, slurry tanker and travelling irrigator. Slurry will be applied to land using slurry tanker only. Proposed application rates are:

- Travelling irrigator: Maximum depth per application of 8 mm, total annual application depth of 25 mm
- Slurry tanker: 2.5mm maximum depth per application. Application depths between 1.5mm and 2.5mm.
- Low rate pods: Maximum application rate 10mm/hr

6.4 Water Permit Application

Phase 1:
The applicant will be operating under the existing water permit AUTH- 20181320-02 under phase 1 of the proposal. This water permit allows for the abstraction of 100,000 L/day of groundwater over a 300 day milking season. This volume accounts for shed wash down water and stock drinking water for 850 cows.

Phase 2:
A new water permit is sought for phase 2 of the proposal. A water permit is required to allow for the abstraction of groundwater for shed wash down water and stock drinking water from 1000 cows during the milking season, and the abstraction of stock drinking water during winter for 1000 cows in the wintering shed.

6.4.1 *Allocation*

Under phase 2 of the application, the applicant seeks a continuation of the proposed groundwater abstraction from bore E45/0426 located at NZTM2000 1221869E 4883664N and on Lot 10 DP152.

The applicant is applying for a continuation in the existing volume of groundwater:

Daily Volume= 100,000 L/day over the 300-day milking season (2 August – 31 May approx.)

Daily Volume= 75,000 L/day over the 65-day winter period (1 June – 1 August approx.)

Annual Volume = 34,875m^3

The proposed abstraction rate during the 300-day milking season of 100,000 L/day equates to a rate of take of 100 L/cow/day broken down as 25 L/cow/day for shed wash down water and 75 L/cow/day for stock drinking water for the 1000 cows on the property.

The proposed abstraction rate during the 65-day winter period of 75,000 L/day equates to a rate of 71 L/cow/day for the 1050 cows on the farm over the 65-day winter period.

The proposed abstraction is from the Waimatuku groundwater zone which has a current allocation of 10% of the discretionary allocation specified in the RWPS and 12.4% of the discretionary allocation specified in the PSWLP.

The groundwater abstraction represents no change from the applicant's current abstraction volume.

6.4.2 *Monitoring*

The groundwater abstraction will be monitored at the point of take to ensure compliance with the proposed abstraction volumes. There are 2 x 20,000 L freshwater storage tanks at the dairy shed to ensure the instantaneous rate of take is less than 2 L/sec.

6.5 Land Use Consent Application for wintering shed

The wintering shed will be built on the farm within a 5-year timeframe from the date of granting. Once the shed is built and commissioned, phase 2 of the proposal commences and the applicant will begin exercising the land use consent for the wintering shed and also the phase 2 discharge permit.

The wintering shed will be used to winter the majority of the milking herd from June through till calving dates. Two primary scenarios would exist under the land use consent:

- All mixed age cows and R2 replacements are wintered in the sheds for the winter period totalling 1030-1050 cows.
- All mixed age cows are wintered in the sheds for the winter period totalling 770 and R2 replacements are grazed on fodder crop at WRO and return to the platform towards the end of July/beginning of August for calving.

The wintering shed will be located close to the dairy shed and constructed using the same concept drawings as the existing wintering sheds on the applicant's other dairy farms (Woldwide 1 and Woldwide 2). The concept design includes a central concrete feed lane, individual stalls for loafing, walking alleys with manure scrapers, a drop pit and a slurry effluent storage facility. Effluent is collected from the walking alleys and scraped to the collection point.

Effluent generation figures have been considered and included under the discharge permit application in Section 6.3.2 and are based on the volume of effluent generated by a housed animal 24 hours per day.

The wintering shed will be constructed as to comply with the setbacks listed in Rule 35 of the PSWLP namely, the feed pad/lot will not be located:

1) Within 50 meters from the nearest sub-surface drain, lake, river, artificial watercourse, modified watercourse, natural wetland or another feed pad
2) Within a microbial health protection zone of a drinking water supply site or within 250 meters of a drinking water supply
3) Within 200 meters of a place of general assembly or dwelling not on the same property

4) Within 20 meters of the boundary
5) Within a critical source area

The wintering shed will have a sealed and impermeable base and any liquid animal effluent or stormwater containing animal effluent discharging from the feed pad/lot is collected in a sealed animal effluent storage system which will be authorised under Rule 32B or Rule 32D in the future. Overland flow of stormwater or surface runoff from surrounding land is prevented
from entering the feed pad/lot.

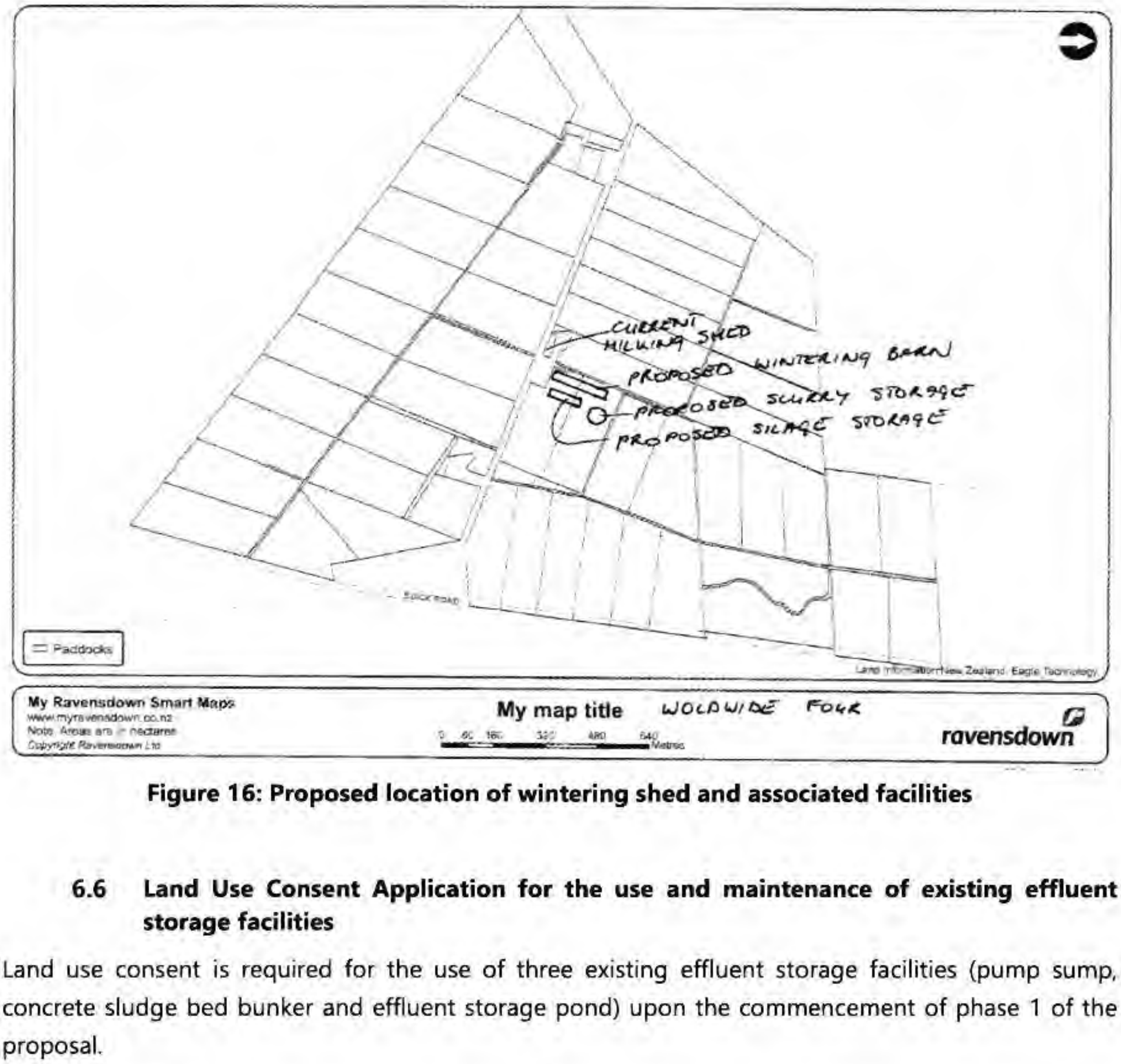


Figure 16: Proposed location of wintering shed and associated facilities

6.6 Land Use Consent Application for the use and maintenance of existing effluent storage facilities

Land use consent is required for the use of three existing effluent storage facilities (pump sump, concrete sludge bed bunker and effluent storage pond) upon the commencement of phase 1 of the proposal.

Concrete sludge bunker

The concrete bunker has a total volume of $100m^3$ and is fully lined with concrete and sits partly above ground. The concrete bunker has no visible cracks or defects and there is no evidence that it is leaking or failing. The applicant will undertake a drop test on this structure by July 2019 during the off season.

A drop test prior to this date is not possible as the concrete bunker is a first collection point within the effluent system and effluent cannot be diverted elsewhere for the duration of the drop test.

The applicant proposes that a land use consent is issued requiring the concrete bunker to be drop tested by July 2019 and regularly thereafter. The consent sought would be for 20 years for the continued use and maintenance of this structure (equating for 5 years under phase 1 and 15 years under phase 2).

Pump sump

The pump sump has an approximate volume of 30m^3 and holds liquid FDE prior to discharge to land or transfer to the main effluent storage pond. The structure is essentially an in-ground concrete tank.

The applicant proposes that a land use consent is issued requiring the concrete bunker to be drop tested by July 2019 and regularly thereafter. The consent sought would be for 20 years for the continued use and maintenance of this structure (equating for 5 years under phase 1 and 15 years under phase 2).

Figure 17: Photograph of existing pump sump

Clay lined effluent storage pond

The existing 3,801m^3 effluent storage pond is not showing obvious signs of leakage which has been confirmed in the attached pond certification from Mr Murray Gardyne (Attachment H) A pond drop down test was completed and passed in July 2018 and is also attached in Attachment H. The proposed conditions below ensure a regular pond drop down testing regime is in place.

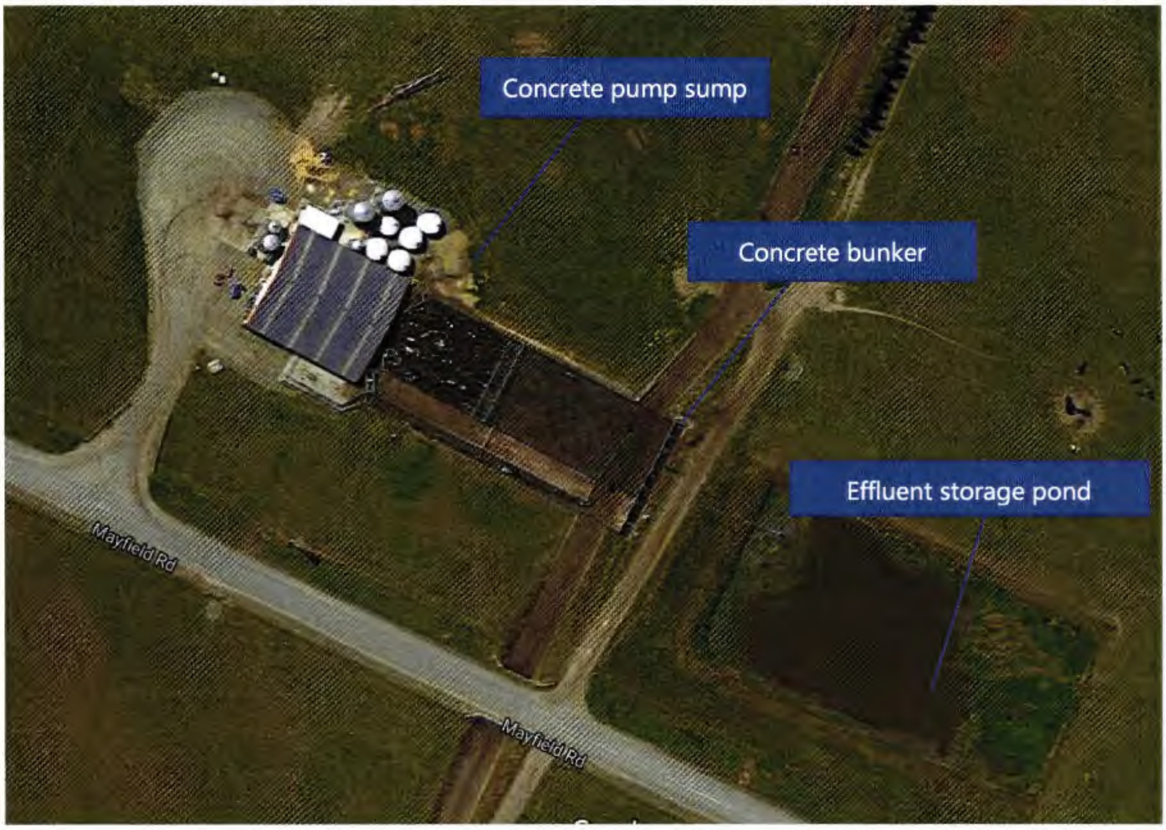


Figure 18: Layout plan of effluent storage facilities

Proposed consent conditions for the existing effluent storage facilities.

Proposed conditions relating to drop test requirements only are included below. The proposed conditions state that the concrete bunker and pump sump will be drop tested by 30 July 2019 and thereafter all three effluent storage facilities will be drop tested regularly. The applicant expects Council to impose other related conditions on these consents (not included below) in relation to the ongoing maintenance and contingencies measures should the ponds fail the drop tests.

1. *This consent authorises the maintenance and use of agricultural effluent storage facilities as described in the application for resource consent dated xxxxxx 2019, and any incidental discharge of agricultural effluent direction onto or into land from the facilities which is within the normal operating parameters of a drop down test as set out in Appendix XX. The effluent storage facilities described in the application are:*
    - *(a) An effluent storage bunker with capacity to store no more than 100 cubic meters of effluent*
    - *(b) An effluent storage pump sump with capacity to store no more than 30 cubic meters of effluent*
    - *(c) An effluent storage pond with capacity to store no more than 3,801 cubic meters of effluent.*

2. *By 30 July 2019, the consent holder shall demonstrate that the concrete bunker and pump sump described in Condition 1 (a) and (b)are structurally sound and fit for purpose by:*
   (a) *obtaining written certification from a Suitably Qualified Person, in accordance with Appendix XX of this consent that the structures meet the relevant drop test criteria and*
   (b) *obtaining confirmation from a Suitably Qualified Person that the structures have no visible cracks, holes of defects that would allow effluent to leak from the structures.*

3. *(a) By the 30 of August each year in XXXX, XXXX and XXXX the consent holder shall:*

   i. Obtain written certification from a Suitably Qualified person, in accordance with Appendix 2 of this consent that the structures meet the relevant pond drop test criteria of Appendix 2; and

   ii. Confirmation from the Suitably Qualified person that the structures have no visible cracks, holes or defects that would allow effluent to leak from the structures.

   (b) The certification required by conditions 2 and 3 shall be accompanied by photographs of the structures (date and time stamped) and be supplied to the Consent Authority within one month of receiving the certification.

   (c) The confirmation required by condition 5(a) and (b) shall be undertaken within the same month each year in XXXX, XXXX and XXXX.

7. DETAILS OF THE PROPOSAL FOR WW5

7.1 Overview of the proposal

Woldwide Five Limited will be undertaking an increase to the size of the milking platform and number of cows on farm in two phases. Phase 1 will continue for a maximum of five years from the date of granting of the land use consent which will be specified as a consent condition. Phase 2 will continue thereafter for the duration of the consents.

Phase 1:

- A land use consent for the farming activity to increase the size of the dairy platform by 70ha to convert a portion of Cochran's block to dairy platform and convert 45ha of Collies block to dairy platform
- The applicant will exercise existing discharge permit AUTH20157537-01 and water permit AUTH20157537-02 which permit the milking of up to 800 cows.
- A land use consent for the use of existing effluent storage facilities to hold effluent generated on the farm.

Phase 2:

- A land use consent for the farming activity to increase the size of the herd to 930 cows and continue to utilize the expanded dairy platform from phase 1.
- A land use consent for the construction of a 1050 cow wintering barn on the farm

- A discharge permit to discharge farm dairy effluent, underpass effluent, silage leachate and wintering shed slurry to land from the peak milking of 930 cows.
- A land use consent for the use and maintenance of existing effluent storage facilities to hold effluent generated on the farm.

7.2 Land use consent application for farming activity

A land use consent is sought for the proposed farming activity which we are determining includes all activities located on the landholding which are directly associated with the operation of the applicant's dairy farm for 365 days of the year. The proposed farming activity extends across the WW5 dairy platform and WRO, and accordingly, one land use consent is sought to legalise the activities on this land.

The proposed farming activity will occur in two phases. Phase 1 of the proposal is to add 73ha of an existing 136ha sheep farm named Cochran's block to the existing dairy platform on WW5 and add 45ha of Collies block. Cow numbers will be increased from current levels to maximum consented cow numbers under the current discharge permit. In order to facilitate phase 2 of the proposal, a 1050 cow wintering shed will be constructed on the dairy platform within a maximum 5 year timeframe which will allow for the increase of the herd size to 930 cows (from 800 cows). Under phase 2, intensive winter grazing will cease on the dairy platform. All mixed age stock will be wintered in the wintering sheds. R2 stock will either be wintered in the wintering sheds or at WRO.

Table 17: Farm areas and stocking rates for WW5 under the proposal

	TOTAL FARM AREA (HA)	EFFECTIVE AREA (HA)	STOCKING RATE
Existing	262	241	3.3
Proposed phase 1	335	311	2.1
Proposed phase 2	335	311	3.2

Overseer 6.3.0 has been used to describe the current farm system to create a baseline model for the existing land use (please see explanation of modelling scenario for Collies block in Section 3.2). The baseline model consists of <u>one</u> nutrient budget based on actual data from the applicants records to create <u>three year</u> <u>average input values</u> for the preceding three years since the farm was converted in 2015.

Overseer 6.3.0 has then been used to model the farm system under phase 1 to estimate nutrient outputs under the proposal. Nutrient inputs have been carefully considered to ensure viable farm systems are modelled.

Phase 2 has been modelled using **an example Overseer nutrient budget for WW5** to give an prediction of how the wintering shed can maintain and/or reduce nutrient losses when included in the farm system. The meaning of **an example Overseer nutrient budget** is that the model uses more assumptions and typical industry-wide input values due to the inherent uncertainties which exist modelling a farm system so much further into the future. This example model must only be viewed as an example, not representing the exact and absolute farm system the applicant proposes to implement in the future. We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

Please refer to the Farm Scenario Plan in Attachment B for a full description of the baseline, proposed and winter barn example farm systems for the WW5 farm: Cochrans block, Collies block and WW5 platform. Overseer nutrient budgets have been prepared by Mark Crawford of Ravensdown who is a Certified Nutrient Management Adviser (CNMA). These Overseer budgets have been used to show the annual amount of nitrogen and phosphorus discharged from the farm.

The summary outputs for the **baseline model** are:

Table 18: Summary outputs for the baseline model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Self-contained dairy unit	14,493	55	207	0.8
Sheep farm (73 ha)	1,389	18	30	0.4
Current combined	15,882	47	237	0.7

The summary outputs for **proposed phase 1** model are:

Table 19: Summary outputs for proposed phase 1 model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Proposed phase 1	15,937	47	231	0.7

The summary outputs for the **winter barn example** model are:

Table 20: Summary outputs for winter barn example model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Proposed phase 2	15,639	47	245	0.7

Overall, modelling of phase 1 of the application indicates that at a farm system/landholding level nitrogen losses are estimated to increase by 55 kg N/year and remain unchanged on a per hectare basis compared to the baseline. Phosphorus losses are estimated by Overseer to decrease by 7 kg P/year but remain the same on a per hectare basis compared to the baseline.

Overall, modelling of phase 2 (winter barn example) of the application indicates that at a farm system/landholding level nitrogen losses are estimated to reduce by 243 kg N/year and remain unchanged on a per hectare basis compared to the baseline. Phosphorus losses are estimated by Overseer to increase by 8 kg P/year and remain unchanged on a per hectare basis compared to the baseline.

The overall intention of the land use consent under phase 2 is to operate at a nitrogen loss level (predicted by Overseer) equal to or less than the nitrogen loss level outputs from the baseline model. Please see Section 8.3 for specific details on how we propose to condition nitrogen loss outputs in the land use consent to account for Overseer version changes.

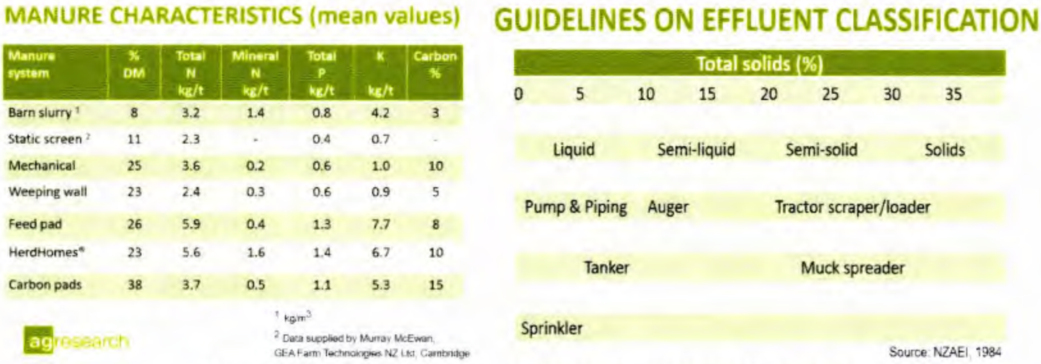
7.3 Discharge permit application

Phase 1:
The applicant will be operating under the existing discharge permit AUTH- 20157537-01 under phase 1 of the proposal. This discharge permit allows for the milking of up to 800 cows and the discharge of Farm Dairy Effluent (FDE) via low rate irrigation and slurry tanker.

Our assessment is that AUTH-20157537-01 does not need to be amended for phase 1 as described in Section 5.3 of this report.

Phase 2:
A new discharge permit is sought for phase 2 of the proposal. A discharge permit is required to allow for the discharge of FDE from 930 cows, underpass effluent, silage pad leachate and wintering shed slurry from a maximum of 1050 cows.

The effluent generated in the wintering shed and held within the sludge bunker is more solid in nature than typical FDE and could be considered a sludge. The PSWLP provides for a very simple definition of sludge: "*The solid residues from effluent*". The PSWLP does not provide a definition for the term slurry. We have used an Agresearch document by Houlbrooke et al which has characterised and evaluated dairy manures and slurries. The following diagrams are excerpt from this report and indicates that barn slurry has an average of 8% dry matter which classifies it as liquid and effluent from herd homes has an average of 23% dry matter which classifies it as semi-solid.



MANURE CHARACTERISTICS (mean values)

Manure system	% DM	Total N kg/t	Mineral N kg/t	Total P kg/t	K kg/t	Carbon %
Barn slurry [1]	8	3.2	1.4	0.8	4.2	3
Static screen [2]	11	2.3	-	0.4	0.7	-
Mechanical	25	3.6	0.2	0.6	1.0	10
Weeping wall	23	2.4	0.3	0.6	0.9	5
Feed pad	26	5.9	0.4	1.3	7.7	8
HerdHomes®	23	5.6	1.6	1.4	6.7	10
Carbon pads	38	3.7	0.5	1.1	5.3	15

[1] kg/m³
[2] Data supplied by Murray McEwan, GEA Farm Technologies NZ Ltd, Cambridge

Figure 19: Effluent characteristics and classifications[19]

The applicant has taken a conservative approach and classifies effluent from the wintering sheds as slurry which means that the effluent generated in these sheds requires a discharge permit.

Table 21: Discharge Permit application summary

Discharge Permit Details:	
Replacement of consent no.	AUTH-20157537-01
Number of dairy cows	930
Type of milking shed	Rotary Shed
Winter milking?	No milking between 16 June and 31 July other than slipped cows
Wintering barn?	Yes – for 1050 cows
Feed pad/stand off pad?	Yes – three existing standoff pads not drained to effluent system
Other sources of effluent?	Stock underpass Silage leachate
Effluent treatment	FDE: Slurry scraped from yard to concrete sludge pit, liquids drained to liquid effluent storage facility Wintering Barn: scraped to slurry effluent storage facility Underpass effluent: directed to liquid effluent storage facility Silage leachate: directed to slurry effluent storage facility
Storage available (m^3)	Liquid: 180m^3 in existing tanks. Plus new effluent storage facility to meet DESC requirements. Slurry- 7,955m^3 from wintering shed, silage leachate and excess slurry from concrete sludge bunker. To be constructed under phase 2
Storage required (m^3)	Liquid: 335m^3 (as per attached dairy effluent storage calculator in Attachment E) Slurry: 7,955m^3 for wintering shed,
Disposal area (ha)	Liquid: 126ha Slurry: 133ha
Irrigator proposed	Pods, slurry tanker with umbillical

[19] Houlbrooke et al, Dairy Manures and Slurries: Characteristics and Evaluating current practice, AgResearch accessed at http://envirolink.govt.nz/assets/Envirolink/1204-ESRC15320Dairy20manures20and20slurries-characteristics20and20evaluating20current20practice20.pdf on 1 February 2019

Application rate and depth	Slurry tanker: 2.5mm depth per application Pods: Max application rate 1mm/hr, max depth 1mm. Combined 25mm application rate per year
Monitoring proposed	Groundwater every 6 months

7.3.1 ***Effluent management system description***

Farm dairy effluent

- The dairy shed yard is mechanically scraped to collect slurry effluent which is scraped into a 125m^3 concrete bunker at the far end from the dairy yard. The yard has a downward gradient towards the milking shed to effectively allow solid and liquid effluent to be separated by gravity on the yard. The slurry effluent is stored in the above ground concrete bunker for a maximum of 4 weeks before it is applied to land using an on-site slurry tanker. Slurry is applied to the remainder of the farm outside the liquid effluent discharge area.

- The rotary platform and dairy shed is washed twice daily with a maximum of 3,000 L equating to 3 L/cow/day. This volume has been measured by the applicant and is accurate for the system on farm.

- Liquid effluent collected from the yard, dairy shed and underpass is pumped either directly out to the 126ha effluent discharge area using a combination of low rate pods and slurry tanker or stored in the existing and proposed liquid effluent storage tanks.

- The slurry tanker can apply effluent at a depth of 1.5-2.5mm per application and will be preferentially used when a lower soil moisture deficit exists. The low rate pods apply effluent at a maximum rate of 1mm/hr and can be used all year round provided an adequate soil moisture deficit exists.

7.3.2 ***Storage***

Currently, effluent storage at the farm consists three primary storage areas:

- Liquid effluent from the washdown of the platform and rainwater on the yard is stored temporarily in a pump sump before it is pumped to the storage tanks.
- Liquid effluent will be stored in the six existing storage tanks plus a proposed additional facility and applied to land using a combination of the pods and slurry tanker.
- Yard slurry is stored in the 125m^3 concrete pit attached to the far end of the yard and applied to land using a slurry tanker on a monthly basis. Slurry collected during the first two weeks of June and during spring is stored with wintering shed slurry effluent.

- All wintering shed effluent is stored for the duration of winter in a new slurry effluent storage facility and applied to land from October through to May when soil moisture conditions are suitable.

Liquid effluent

The Dairy Effluent Storage Calculator (DESC) attached in Attachment E shows that **335m^3 of pumpable liquid storage is required** (90th percentile probability) to enable effective deferred irrigation for liquid FDE and underpass effluent (included in the other catchments section total 480m^2).

A condition of consent is required on the Discharge Permit (phase 2) to ensure that the new liquid effluent storage facility will be constructed of at least 335m^3 in volume.

Slurry effluent

The wintering shed is used for a maximum of 1050 cows for the entire winter period. During some seasons, the shed may only contain mixed age cows with the R2 cows remaining at WRO.

The wintering shed is used as a standoff pad during late Autumn and early spring as a measure to remove cows from pasture. The use of this facility as a standoff pad will change continually every season based on frequency and severity of adverse weather events and soil moisture levels. A conservative estimate is that the wintering shed could be used 24 hours per day for 45 days as a standoff pad.

The applicant has slurry storage available within the concrete bunker for yard scrapings. The applicant has the ability to empty the concrete bunker monthly using the on-site slurry tanker during the majority of the milking season. Slurry from the concrete bunker will preferentially be stored in the same facility as the wintering shed effluent during the first 15 days of June or during spring which is calculated above to equate to 195m^3.

Silage leachate is collected with the other slurry effluent. The silage pad is drained by a series of four drains along the length of the pad which can be diverted to storage or freshwater discharge depending on whether silage is stacked on this portion of the pad or not. Leachate volumes are therefore hard to calculate due to the changing nature of a silage stack with the pad completely empty for 3-4 months of the year and partially empty for another 2 months. A conservative estimate sees a catchment area of 800m^2 entering the slurry effluent facility based on 50% of average annual rainfall.

Below, a manual calculation has been used for slurry effluent including wintering shed effluent, slurry from the yard and silage pad leachate because the applicant wishes to provide storage for all of the slurry produced and does not wish for a model to discount storage volumes based on soil types.

Wintering shed: 1050 cows x 50 L/cow/day x 95 days = 4,988m^3 (includes June, July and August)

Wintering shed: 1050 cows x 50 L/cow/day x 45 days = 2,362m^3 (used as standoff pad)

Slurry from yard: 930 cows x 3 L/cow/day x 65 days = 181m^3

Silage pad leachate 800m^2 x 0.53m rainfall = 424m^3

Total required for slurry = 7,955m^3

A condition of consent is required on the Discharge Permit (phase 2) to ensure that the new slurry effluent storage facility will be constructed of at least 7,955m^3 in volume.

7.3.3 *Discharge Area*

The **liquid** effluent discharge area will be 126ha (115 ha with buffers) which is unchanged from the area approved under the existing discharge permit. Overseer reports state that 55ha is required to maintain N loading at less than 150 kg N/ha/year from effluent. Liquid effluent will be applied to land all year round as soil conditions permit safe application.

The **slurry** effluent discharge area includes the remainder of the milking platform (i.e. blocks/paddocks not in the approved liquid effluent discharge area) and totals approximately 133ha.

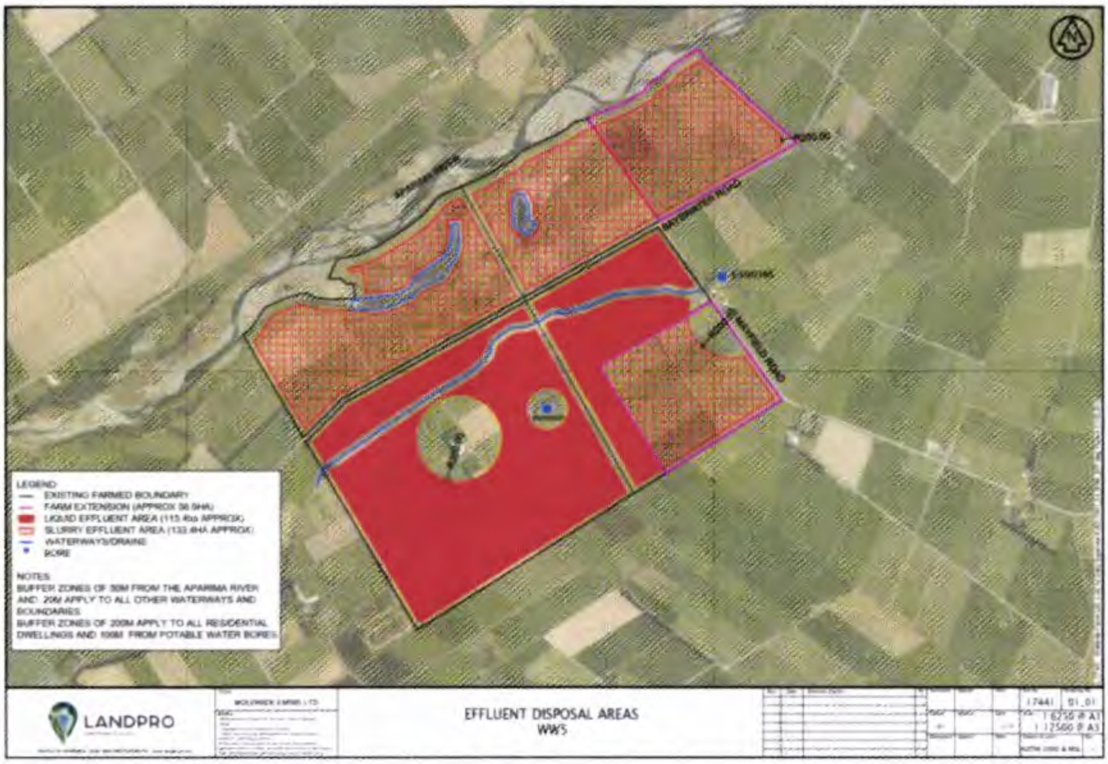


Figure 20: Effluent discharge area map for WW5

Effluent will not be applied within the following buffer zones as per standard discharge permit conditions:

- 20 m of any surface watercourse

- 100 m of any potable water abstraction point
- 20 m to any landholding boundary; and
- 200 m of any residential dwelling on a neighbouring property

In addition, the applicant will not discharge effluent where the soil has cracked.

7.3.4 *Discharge Method*

FDE will be applied to land using low rate pods and slurry tanker. Proposed application rates are:

- Slurry tanker: 2.5mm maximum depth per application. Application depths between 1.5mm and 2.5mm.
- Low rate pods: Maximum application rate 10mm/hr

7.3.5 *Standoff Pads*

There are three standoff pads on the property, left by the previous owner which have not been currently used. When fully constructed, each pad has a rotten rock base which a knap rock layer on top and covered with at least 500mm of bark chips.

Each pad will stand off mobs of about 100 cows, with a maximum of 120 cows held on any of the pads. Cows will be fed ad-lib using baleage in ring feeders.

Effluent will be stored in-situ in the bark and scraped after each season and applied to land in accordance with Rule 38 of the PSWLP.

The standoff pads will be constructed as to comply with the setbacks listed in Rule 35 of the PSWLP namely, the feed pad/lot will not be located:

1) Within 50 meters from the nearest sub-surface drain, lake, river, artificial watercourse, modified watercourse, natural wetland or another feed pad
2) Within a microbial health protection zone of a drinking water supply site or within 250 meters of a drinking water supply
3) Within 200 meters of a place of general assembly or dwelling not on the same property
4) Within 20 meters of the boundary
5) Within a critical source area

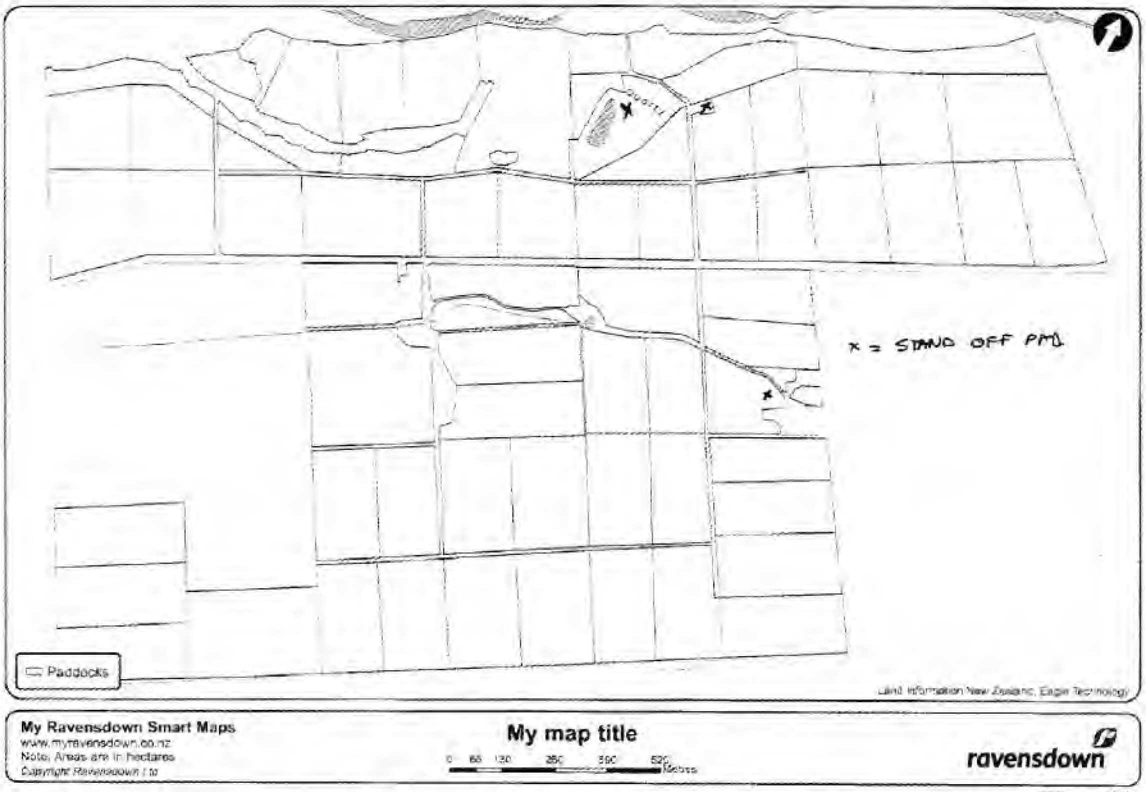


Figure 21: Location of three standoff pads on WW5

7.4 Water Permit Application

Phase 1:

The applicant will be operating under the existing water permit AUTH- 20157537-02 under phase 1 of the proposal. This water permit allows for the abstraction of 72,000 L/day of groundwater for 365 days of the year. This volume accounts for shed wash down water and stock drinking water for 800 cows at a rate of 90L/cow/day accounting for the fact that the yard is scraped not washed.

Phase 2:

A new water permit is sought for phase 2 of the proposal. A water permit is required to allow for the abstraction of groundwater for shed wash down water and stock drinking water from 1000 cows during the milking season, and the abstraction of stock drinking water during winter for 1000 cows in the wintering shed.

7.4.1 *Allocation*

The applicant will continue the proposed groundwater abstraction from bore D45/0345 located at NZTM2000 1219900E 4884030N and on Lot 1 DP12253.

The applicant is applying for the following volumes of groundwater:

Daily Volume= 100,000 L/day over the 300-day milking season (2 August – 31 May approx.)

Daily Volume= 75,000 L/day over the 65-day winter period (1 June – 1 August approx.)

Annual Volume = 34,875m^3

The proposed abstraction rate during the 300-day milking season of 100,000 L/day equates to a rate of take of 100 L/cow/day broken down as 25 L/cow/day for shed wash down water and 75 L/cow/day for stock drinking water for the 1000 cows on the property.

The proposed abstraction rate during the 65-day winter period of 75,000 L/day equates to a rate of 71 L/cow/day for the 1050 cows on the farm over the 65-day winter period.

The proposed abstraction is from the Upper Aparima groundwater zone which has a current allocation of 4% of the discretionary allocation specified in the RWPS and 7.2% of the discretionary allocation specified in the PSWLP

The groundwater abstraction represents an increase from the applicant's current abstraction volume to account for the additional cows on farm.

7.4.1 *Monitoring*

The groundwater abstraction will be monitored at the point of take to ensure compliance with the proposed abstraction volumes. There are 4 x 30,000 L freshwater storage tanks at the dairy shed to ensure the instantaneous rate of take is less than 2 L/sec.

7.5 Land Use Consent Application for Wintering Shed

The wintering shed will be built on the farm within a 5 year timeframe from the date of granting. Once the shed is built and commissioned, phase 2 of the proposal commences and the applicant will begin exercising the land use consent for the wintering shed and also the phase 2 discharge and water permits.

The wintering shed will be used to winter the majority of the milking herd from June through till calving dates. Two primary scenarios would exist under the land use consent:

- All mixed age cows and R2 replacements are wintered in the sheds for the winter period totalling 1030-1050 cows.
- All mixed age cows are wintered in the sheds for the winter period totalling 770 and R2 replacements are grazed on fodder crop at WRO and return to the platform towards the end of July/beginning of August for calving.

The wintering shed will be located close to the dairy shed and constructed using the same concept drawings as the existing wintering sheds on the applicant's other dairy farms (Woldwide 1 and Woldwide 2). The concept design includes a central concrete feed lane, individual stalls for loafing, walking alleys with manure scrapers, a drop pit and a slurry effluent storage facility. Effluent is collected from the walking alleys and scraped to the collection point.

Effluent generation figures have been considered and included under the discharge permit application and are based on the volume of effluent generated by a housed animal 24 hours per day.

The wintering shed will be constructed as to comply with the setbacks listed in Rule 35 of the PSWLP namely, the feed pad/lot will not be located:

6) Within 50 meters from the nearest sub-surface drain, lake, river, artificial watercourse, modified watercourse, natural wetland or another feed pad
7) Within a microbial health protection zone of a drinking water supply site or within 250 meters of a drinking water supply
8) Within 200 meters of a place of general assembly or dwelling not on the same property
9) Within 20 meters of the boundary
10) Within a critical source area

The wintering shed will have a sealed and impermeable base and any liquid animal effluent or stormwater containing animal effluent discharging from the feed pad/lot is collected in a sealed animal effluent storage system which will be authorised under Rule 32B or Rule 32D in the future. Overland flow of stormwater or surface runoff from surrounding land is prevented
from entering the feed pad/lot.

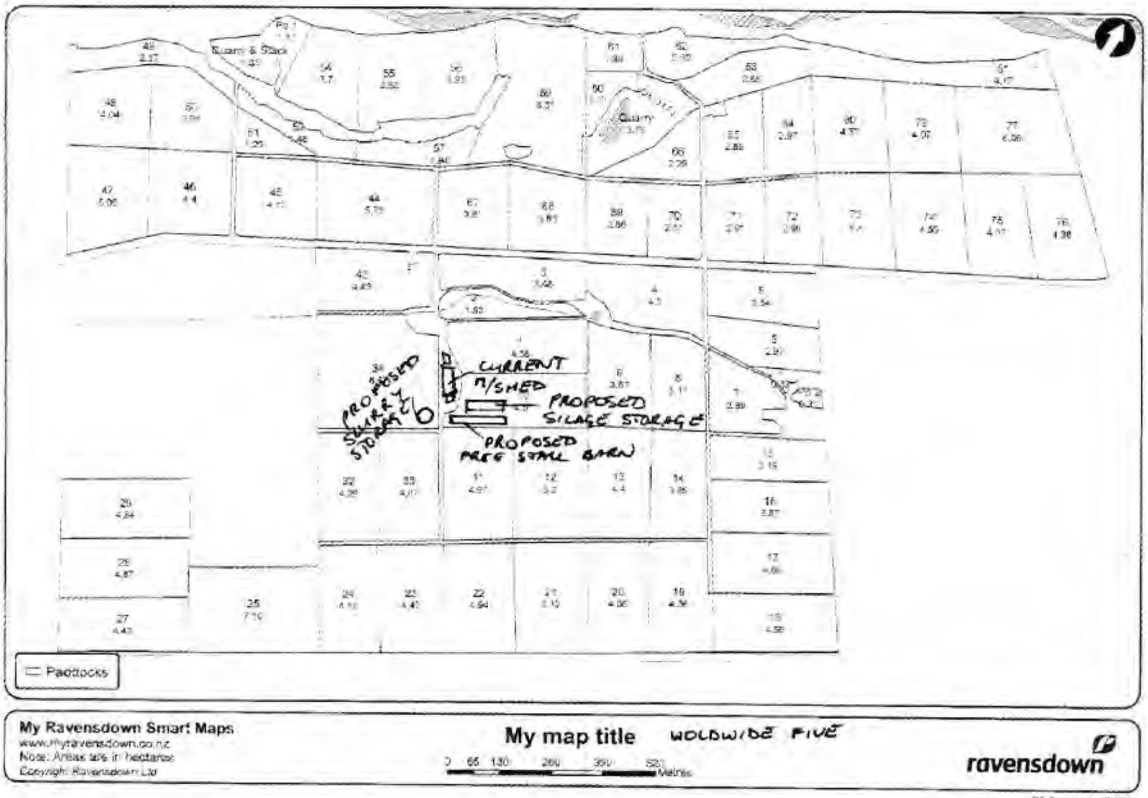


Figure 22: Proposed location of wintering shed and associated facilities

7.6 Land Use Consent Application for the use of an existing effluent storage facility

Land use consent is required for the use of one as existing concrete sludge bunker as a storage facility upon the commencement of phase 1 of the proposal.

Concrete sludge bunker

The concrete bunker has a total volume of 125m^3 and is fully lined with concrete and sits partly above ground. The concrete bunker has no visible cracks or defects and there is no evidence that it is leaking or failing. The applicant will undertake a drop test on this structure by July 2019 during the off season. A drop test prior to this date is not possible as the concrete bunker is a first collection point within the effluent system and effluent cannot be diverted elsewhere for the duration of the drop test.

The applicant proposes that a land use consent is issued requiring the concrete bunker to be drop tested by July 2019 and regularly thereafter. The consent sought would be for 20 years for the continued use and maintenance of this structure (equating for 5 years under phase 1 and 15 years under phase 2).

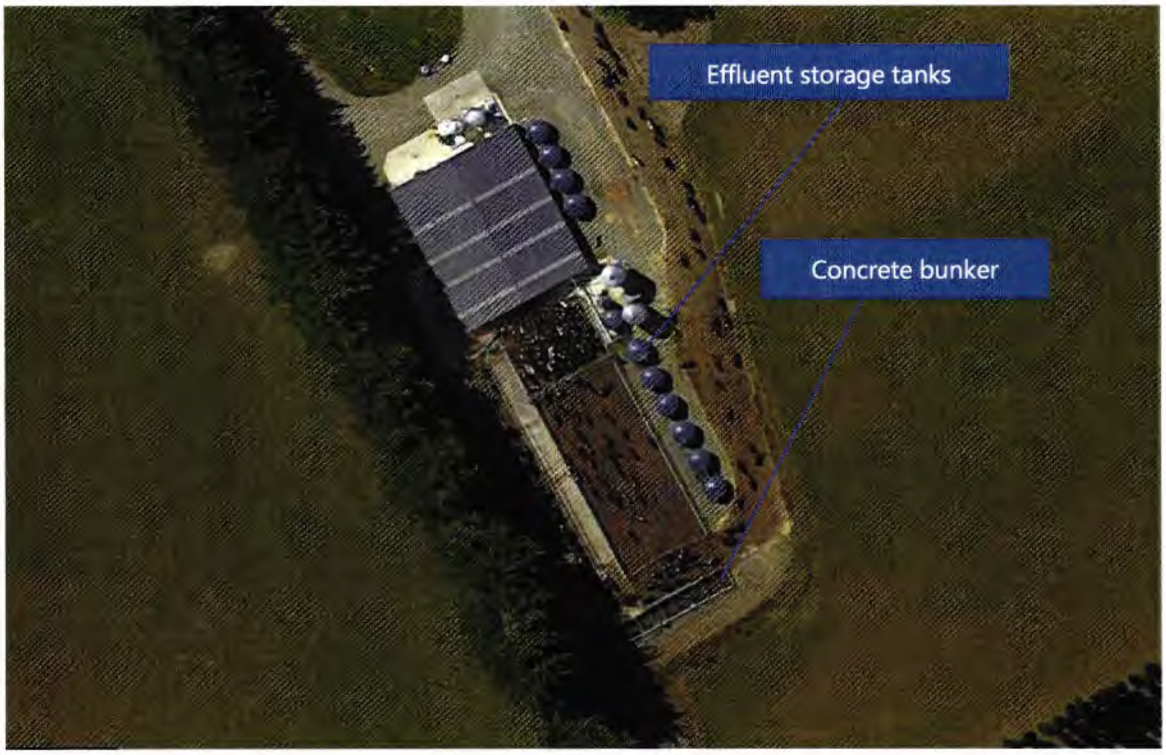


Figure 23: Layout plan of existing effluent storage facilities

Proposed consent conditions for the existing effluent storage facilities.

Proposed conditions relating to drop test requirements only are included below. The proposed conditions state that the concrete bunker will be drop tested by 30 July 2019 and thereafter will be drop tested regularly. The applicant expects Council to impose other related conditions on these consents in relation to the ongoing maintenance and contingencies measures should the ponds fail the drop tests.

1. *This consent authorises the maintenance and use of agricultural effluent storage facilities as described in the application for resource consent dated xxxxxx 2019, and any incidental discharge of agricultural effluent direction onto or into land from the facilities which is within the normal operating parameters of a drop down test as set out in Appendix XX. The effluent storage facilities described in the application are:*
    - *(a) An effluent storage bunker with capacity to store no more than 100 cubic meters of effluent*

2. *By 30 July 2019, the consent holder shall demonstrate that the concrete bunker described in Condition 1 (a) is structurally sound and fit for purpose by:*
    - *(c) obtaining written certification from a Suitably Qualified Person, in accordance with Appendix XX of this consent that the structure meets the relevant drop test criteria and*

(d) obtaining confirmation from a Suitably Qualified Person that the structure has no visible cracks, holes of defects that would allow effluent to leak from the structure.

3. *(a) By the 30 of August each year in XXXX, XXXX and XXXX the consent holder shall:*

   i. Obtain written certification from a Suitably Qualified person, in accordance with Appendix 2 of this consent that the structure meets the relevant pond drop test criteria of Appendix 2; and

   ii. Confirmation from the Suitably Qualified person that the structure has no visible cracks, holes or defects that would allow effluent to leak from the structure.

   (b) The certification required by conditions 2 and 3 shall be accompanied by photographs of the structures (date and time stamped) and be supplied to the Consent Authority within one month of receiving the certification.

   (c) The confirmation required by condition 5(a) and (b) shall be undertaken within the same month each year in XXXX, XXXX and XXXX.

8. DETAILS OF THE PROPOSAL FOR WRO

The land use consent applications for the farming activities for WW4 and WW5 seek consent for all activities located on the landholding which are directly associated with the operation of the respective dairy farms for 365 days of the year. A separate proposal, AEE and nutrient budget has been provided for WRO in Attachments F and G and should be referred to for specific details of the proposal.

The proposed farming activity for WW4 and WW5 includes the grazing of dry stock all year round at WRO. Dry stock includes R1 and R2 grazing, mating bull grazing and carry over cow grazing. In this respect, WRO is considered to be part of the landholding for WW4 and WW5 and the grazing of dry stock at WRO must be included in the respective land use consent applications.

WRO is also a separate and distinct landholding in its own right. WRO operates as a single business entity with an individual set of accounts and company structure. WRO therefore operates as an individual landholding as well as being part of the landholdings for the respective dairy farms. The other activities located on WRO which are not considered to form part of the respective farming activities for WW4 and WW5 include:

- Commercial pine plantation
- Rotten rock quarry operation
- Native bush block

Accordingly, consent is not sought for these activities and this application proposes that the resulting land use consents for WW4 and WW5 which refer to the land parcels on WRO specifically exclude restrictions, references or details regarding these activities which are not part of the farming activity. These activities are permitted activities under the PSWLP as they do not contravene Section 13(1), 14(2), 14(3) or 15(1) of the RMA as detailed in Rule 4 of the PSWLP.

When considering WRO as an individual landholding, the use of land at WRO for the current and proposed activities in their entirety would otherwise be a **permitted activity** under Rule 20(a) of the PSWLP:

- There is no dairy platform on the landholding
- There is no associated discharge permit which specifies a maximum number of cows
- A FEMP in accordance with Appendix N of the PSWLP has been prepared for the landholding and implemented (see attached).
- The landholding contains no more than 100ha of intensive winter grazing
- The good management practices for intensive winter grazing specified in Rule 20(a)(iii)(3) have been implemented and detailed in the FEMP.
- A vegetated strip including stock inclusion will be in place adjacent to any water bodies in accordance with the setbacks in Rule 20(a)(iii)(4-6)

The applicant accepts that the activities at WRO which form part of the farming activity on WW4 and WW5 require land use consent. However, it is important and vital to note that when viewing WRO as an individual landholding then the current and proposed activities would otherwise be a permitted activity under the PSWLP and would remain so at any point in the future as long as they comply with any requirements, conditions and permissions specified in the RMA, detailed in Rule 20(a) and any applicable regional plans.

The applicant has included WRO in the application as part of the farming activity and landholding for WW4 and WW5 at the request of Environment Southland staff in Attachments F and G, however the matter of whether it should be included in the respective farming activity and the landholdings for WW4 and WW5 is a matter which the applicant wishes to thoroughly discuss and assess at the upcoming hearing.

9. ASSESSMENT OF ENVIRONMENTAL EFFECTS FOR PROPOSAL ON WW4

In addition to the application being made in the prescribed forms and manner, Section 88 of the RMA also requires that every application for consent includes an assessment of the effects of the activity on the environment as set-out in Schedule 4 of the RMA.

This assessment of environmental effects (AEE) is broken into two parts: a broad scale/cumulative effects assessment and an assessment of the individual activities within the individual management blocks for both phase 1 and phase 2 individually.

9.1 Broad scale/cumulative effects assessment

The AEE below concludes that the implementation of targeted mitigation measures on-farm will ensure that adverse effects on water quality from activities within the proposal are either avoided or mitigated to levels that are consistent with the relevant regional plan water quality objectives whilst still maintaining a viable, efficient and profitable farm system. The AEE is written in a holistic way and does not solely refer and relate to Overseer outputs because Overseer only models nitrogen and phosphorus lost from the farm to water below the root zone and overland beyond the farm boundary. Overseer does not model nutrient loss into final receiving groundwater or surface water bodies. The amount of these nutrients which may end up in these water bodies depends on a wide range of different factors often collectively referred to as attenuation rates. Similarly, the catchment hydrology and characteristics are critical in affecting the resultant concentration and/or mass loadings of nutrients and other contaminants in water bodies.[20]

This broad scale/cumulative effects assessment includes a catchment scale assessment in relation to attenuation and hydrology processes, characteristics of the catchment and consideration of the state of the receiving environment. This assessment also assesses the proposed activity in its entirety against the actual existing environment, i.e. not using a permitted or consented baseline approach. The term

[20] Enfocus, *Using Overseer in Water Management Planning*, October 2018.

"practicable minimum" is used frequently and is used to portray the fact that any dairy farming activity results in nutrient losses to the environment of some scale and that the applicant has reduced nutrient losses as far as they are practically able to do so given available mitigations, innovations and technology whilst still maintaining an efficient and profitable farm system that meets their social and economic needs. The term "practicable minimum" does not refer to an effect on the environment. The summary to this AEE concludes that water quality will be maintained in the receiving environments given the proposed mitigations, the characteristics of the catchment and the predicted changes to water quality as a result of the proposed activity.

Attenuation

Section 3.4 includes a map of the denitrification potential across the subject catchment. The map shows that the area of the subject landholding has low to very low denitrification with pockets of the lower catchment having higher denitrification potential. Broadly, this means that risk of a greater proportion of the modelled N losses from below the root zone ending up in groundwater and eventually surface water bodies is high, especially on the free draining Tuatapere soils. The applicant has recognised this risk and sited high contaminant loss activities (particularly high N loss activities such as intensive winter grazing and discharge of slurry and liquid effluent) on the lower risk Braxton soils which are more poorly drained with less vulnerability to nitrogen leaching and therefore less risk of N loss below the root zone and through the soil profile. The siting of these activities on lower risk soils has been a conscious decision by the applicant for a number of years and has therefore reduced N leaching risk and is included in the nutrient budgets attached to the application... The Braxton soils are known to be prone to cracking however the attached report in Attachment I from Environment Southland Scientist, Michael Killick confirms that the Braxton soils in this specific location have not shown evidence of cracking thereby reducing potential risks of contaminant loss during dry periods from these soils.

The proposed inclusion of a wintering shed is one of the most effective and significant mitigation measures available for NZ dairy farms for reducing effects of N leaching beyond the root zone through to groundwater and surface water receiving bodies. The wintering shed allows the applicant to remove cows from pasture and hold them inside during high risk drainage periods. In doing so, N deposited via urine and dung patches is collected within the effluent system and can be redistributed to pasture evenly, at a lower rate and timed to avoid high risk drainage periods. This significantly reduces the risk of N leaching through the soil profile as it is preferentially used in the root zone. As a result, the mitigation measures put forward by the applicant, as detailed in the AEE tables below, will reduce the amounts of nitrogen that drain to groundwater within the Waimatuku GMZ and the Aparima GMZ to a practicable minimum and effects on these water bodies will result in the maintenance of water quality.

Groundwater nitrate concentrations are of particular concern to human health. The risk of bottle fed infants getting 'blue baby syndrome' from consuming high nitrate nitrogen water is widely accepted and is the primary driver for the current NZ Drinking water standard for nitrate nitrogen. The proposal sees a reduction in drainage N concentrations at a block level predicted by Overseer, particularly with the removal of intensive winter grazing from the Gladfield block. Other studies indicate that other contaminants, or dietary nitrate sources, may also play a role in the syndrome.[21] A recent Danish study suggested a link between groundwater nitrates and bowel cancer. The study found that those people exposed to nitrate levels in excess of 9.3 mg/L (NZ drinking water standard is 11.3 mg/L) had a 15% increased carcinogenic risk. In December 2018, Agriview NZ published an article attempting to correlate the Danish study within the New Zealand agricultural context. The article noted that "most of the international research conducted throughout the past four decades on this topic has found either a negligible or only slight correlation between nitrates in drinking water and colon/bowel cancer rates" and also that "the idea that colon cancer is heavily influenced by diet surfaces in many of the studies evaluating its link to the intake of nitrate through drinking water." The article further noted "Ian Shaw, professor of toxicology at the University of Canterbury, says it is this very factor that makes the associations between water nitrate and colon cancer unconvincing:

"In my opinion nitrate is associated with colon cancer because it can be converted to nitrite by gut bacteria and form nitrosamines with dietary amino compounds. Nitrosamines are profound carcinogens. Links with water nitrate would, therefore, not be definitive because other components of the diet would be necessary to facilitate carcinogenesis. If exposure to an appropriate dietary mixture, plus the right bacterial species in the microbiome do not coincide carcinogenesis will not occur. This is a complex scenario that cannot be attributed to a single exposure to a single chemical."

In other words, attributing high colon cancer rates to nitrates in drinking water would be oversimplifying things to a considerable level. One must consider the variations of diet and lifestyle also considered potential factors for increasing colon cancer risk, and this is something the Danish study failed to do."[22]

In summary, the evidence about the current state of nitrate nitrogen concentrations in groundwater in this area and the Overseer modelling that strongly indicates that drainage nitrogen concentrations at the level predicted by Overseer will not have a significant adverse effect on actual existing groundwater quality.

Phosphorus, Sediment and Microbial losses

The loss of P, sediment and faecal indicator microorganisms may enter surface water bodies via artificial drainage channels via fertiliser application, intensive winter grazing activities, effluent application or by the grazing of animals during high drainage periods (such as late autumn and mid-spring). The AEE below has identified specific good management practices (GMPs) and further mitigations required to mitigate against losses of contaminants via artificial drainage pathways from these specific activities to a practicable minimum.

Another factor to consider is the risk of P, sediment and microbial losses directly or indirectly to surface water bodies within this catchment via overland flow – primarily occurring from runoff from laneways

[21] https://en.wikipedia.org/wiki/Blue_baby_syndrome accessed 8 February 2019

[22] https://www.agriview.nz/forum/2018/12/11/investigating-the-nitrate-colon-cancer-link accessed 8 February 2019

and via critical source areas. Overall losses of these contaminants directly to waterways is considered low risk in this catchment and on the applicants' property due to the flat topography. Overseer gives an estimate of what P may be lost directly to the environment from laneways, waterway crossings and critical source areas in the 'other sources' output within the model. The model does not consider sediment and microbial losses, however as all three contaminants typically enter surface water bodies via the same transport pathways then P loss modelled by Overseer can be used as a proxy for estimating sediment and microbial losses to the environment also.

The problem with the 'other sources' output estimated by Overseer is that it is not spatially explicit and does not account for site-specific mitigation measures which may be in place on a farm to mitigate losses directly to waterways from these laneways and critical source areas. The nutrient budgets provided with this application model an increase in total P loss of 30kg over the whole farm between the baseline and the winter barn example model. The key driver for this increase in P loss is from 'other sources' as classified in Overseer and equates for about 50% of total P losses. Overseer is known to assume 30% of P deposited on a lane is lost directly to water[23]. Therefore, when a dairy farm is expanded such as in the proposal, more lanes generally need to be constructed, and the model then assumes that additional phosphorus is lost from those lanes.

GMPs and mitigation measures to reduce P, sediment and microbial losses

As part of the proposed dairy expansion, the applicant will be constructing new lanes and new culvert crossings to allow access from the current dairy platform to the new block. The applicant will be implementing specific critical source area GMPs which are detailed in the FEMP that will seek to minimise potential P loss via overland flow from these new lanes and/or culvert crossings such as the fencing of all waterways, establishing vegetated riparian margins, contouring lanes to direct runoff to pasture, installing bargeboards on culvert crossings and locating laneways away from waterways. The implementation of these GMPs by the applicant are not rewarded by Overseer as the model is not spatially explicit as explained above.

The following calculations have been adapted from workings by Mo Topham, Farmwise Consultant (CNMA) and seek to explain how actual P losses (and sediment and microbial losses by proxy) have been reduced to a practicable minimum and are likely to be lower than those modelled by Overseer due to the implementation of these GMPs which are not rewarded in Overseer. According to a Massey University publication[24], a lactating cow consumes 0.4kg P per week or 16.6 kg P per milking season. Of this amount consumed 66% or 10.9kg is estimated to be deposited as dung. Assuming cows spend 2 hours per day (or 8% of their day) on the lanes then 0.87 kg P of this dung deposited would be deposited on lanes within the platform. Overseer assumes that 30% of the P in this dung is then lost directly to

[23] Gray et al (2016) Review of the phosphorus loss submodel in OVERSEER®, Report prepared for OVERSEER® owners under AgResearch core funding contract A21231(A)

[24] https://www.massey.ac.nz/~flrc/shortcourses/IntroNotes&MastTest.pdf accessed 24 January 2019

waterways. Research indicates that there is opportunity to mitigate these losses as described above which are likely to reduce P loss by 38% to 58% beyond that modelled by Overseer[25].

In the examples below, the baseline has been assessed to be currently implementing laneway P loss management at GMP level at the lower end of effectiveness estimates (38% reduction). Under the winter barn example, laneway P loss GMP will be improved and extended by:

- The addition of 1.5km of vegetated buffer zones around riparian areas, including fences around waterways which will ensure that dung deposited on the laneway near where it crosses a waterway will be captured and filtered by the vegetation.
- New culvert crossings (constructed under permitted activity rules) with appropriate cut-outs to direct runoff to pasture primarily. The secondary area of filtration and capture is the vegetated riparian buffer zone
- Contouring of the new lane along its entire length to direct runoff to pasture
- Locating the new lane perpendicular to the two waterways on the new block to maximise buffer distance between the new lane and surface water bodies

The implementation of these expanded and improved GMPs has been assessed to conservatively add a further 10% improvement (up to a total of 48% reduction).

Under the baseline:

850 cows x 10.9kg P x 0.08 x 0.3 = 222kg P

222 kg P x 38% effectiveness = 84.36 kg P mitigation with current laneway mitigations.

Under the winter barn example:

1000 cows x 10.9kg P x 0.08 x 0.3 = 261 kg P

261 x 48% effectiveness = 125 kg P mitigation with current, improved and extended laneway mitigations.

[25] https://www.mfe.govt.nz/sites/default/files/assessment-strategies-mitigate-impact-loss-contaminants-agricultural-land-freshwater_0.pdf accessed 24 January 2019

The baseline Overseer model estimates total P losses at 338kg P - 84.36 kg P of mitigations = 253 kg P revised Overseer P loss to water.

The phase 2 Overseer model estimates total P losses at 368 kg P – 125kg P of mitigations = 243 kg P revised Overseer P loss to water.

Therefore, P losses will be less than those predicted by the Overseer models appended to this application. P losses are likely to be 10kg P less under phase 2 than the baseline accounting for the lack of reward in Overseer for laneway mitigations which will be implemented under both scenarios to differing degrees of effectiveness. P losses have therefore been reduced to the practicable minimum under the proposal. The implementation of targeted GMPs and mitigation measures should result in no adverse effects on the environment

Hydrology of the catchment

Section 4.5 described the high level of connectivity between both the Waimatuku GMZ and the Upper Aparima GMZ with surface water bodies. This connectivity provides for a large and steady discharge of groundwater to surface water bodies with a high correlation between rainfall, stream flow, soil moisture and groundwater levels.

The Waimatuku Stream is also recharged via the Bayswater Bog which is a 210 hectare raised peat wetland. The Bayswater Bog derives its water and nutrients solely via rainfall over the surface area and discharges flow to the Waimatuku Stream and the Aparima River. This means that surface water from the land surrounding the raised peat wetland is diverted around the bog and doesn't flow through it towards the Waimatuku Stream. [26]

Catchment Characteristics

The WW4 farm sits within both the Aparima River and Waimatuku Stream catchments. The Aparima River is a braided gravel bed river and for the majority of its reach, drains farmland of the Southland plains and discharges to the Jacobs River Estuary. According to a 2014 Aqualinc Report[27], the Aparima River catchment is 156,474ha comprised of 102 dairy farms, 10 forestry blocks and 233 sheep and beef farms. The Waimatuku Stream is different to many Southland streams in the fact that its headwaters are fed by a large swamp and is fed along its reach by springs. The Waimatuku Stream underwent significant river bed works in the 1920's to straighten the bed which has created uniform bank margins

[26] Robertson, C. 1983. Hydrological Characteristics of Bayswater Peat Bog. Southland Catchment Board Publication No. 95

[27] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

and moved the river bed away from swampy areas in the catchment and stopped the meandering nature of the river[28].

Nutrient Load to the Jacobs River Estuary

We have used some of the workings in this report to illustrate how nutrient load can be reduced within a water body. The calculations below are purely an illustration to demonstrate potential nutrient load reductions and are based on significant assumptions and generalised workings and should not be treated as absolute figures in the context of this application.

Total nutrient load within the Jacobs River Estuary catchment have been estimated in the Aqualinc report to assess how much impact the implementation of mitigation measures on farms may reduce N and P load within the estuary at the base of the catchment. The table below estimates three loads:

- the total load from each catchment estimated from catchment models
- the realised load which is based on water quality data and is the load exported from the catchment and includes an attenuation factor
- source load which is the loads delivered to the root zone from the source and doesn't include attenuation.

The table estimates the total source load within the catchment at 2133 T N/year undergoing attenuation to result in an estimated 1300 T N/year as a nutrient load within the receiving waters at the Jacobs River Estuary.

Table 22: Estimated loads of nitrogen and phosphorus in the eight study catchments[29]

Catchment	Current catchment agricultural source loads (t/year)		Total catchment source nitrogen load (t/yr)	Estimated realised nitrogen loads (t/yr)	Estimated attenuation (%)
	Nitrogen	Phosphorus			
Bluff_Harbour	19	1	36	29	20
Haldane_Estuary	23	0	39	26	33
Jacobs_River_Estuary	1958	53	2133	1300	39
Lake_Brunton	20	0	20	14	30
New_River_Estuary	4969	139	5513	3718	33
Toetoes_Harbour	6256	142	6617	4392	34
Waiau_River	2714	35	4970	1864	62
Waikawa_Harbour	144	4	176	180	-2
Total/average	16,102	374	19, 404	11,524	31 (average)

[28] https://www.lawa.org.nz/explore-data/southland-region/water-quantity/surface-water-zones/waimatuku-surface-water-zone/ accessed 4 February 2019

[29] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

Aqualinc further estimates that in the Jacobs River Estuary catchment, dairy farming contributes 50% of nitrogen load and 64% of phosphorus load. In the context of WW4, a quarter of the farm is within this catchment and therefore may contribute 1,781 kg N to this receiving water based on the Overseer modelling and the attenuation rate from Table 22 above. Our modelling shows that WW4 may contribute 52 kg P to receiving waters in this catchment including attenuation.

The report then estimated how much these loads may reduce if mitigation scenarios are imposed on only dairy farms within the catchment. For the Jacobs River Estuary catchment, N could be reduced by 18% and P reduced by 31% under the full suite of mitigations (M3).

Table 23: Estimated reductions in the agricultural source loads under three levels of mitigation for all dairy farms in the catchment[30]

Catchment	M1			M2			M3		
	Nitrogen	Phosphorus	Overall[1]	N	P	Overall[1]	N	P	Overall[1]
Bluff_Harbour	4	26	2	4	29	2	12	29	6
Haldane_Estuary	0	0	0	0	0	0	0	0	0
Jacobs_River_Estuary	6	28	5	8	31	6	18	31	15
Lake_Brunton	0	0	0	0	0	0	0	0	0
New_River_Estuary	6	29	5	8	32	7	18	32	15
Toetoes_Harbour	3	17	3	4	19	4	10	18	9
Waiau_River	1	9	0	1	9	1	4	9	2
Waikawa_Harbour	1	4	1	1	5	1	2	5	2

The full suite of mitigations assessed by Aqualinc includes:

Table 24: Description of mitigations assumed to apply under each mitigation level[31]

[30] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

[31] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

Mitigation level	Name	Sheep & Beef	Dairy
Mitigation level 1	M1	• Optimised nutrient inputs • Low solubility P • Wetlands	• Stock exclusion from streams • Improved nutrient management • Improved farm dairy effluent (FDE) management
Mitigation level 2	M2	• Stock exclusion from streams • Reduced stocking rates, improved productivity	• Wetlands • Improved FDE management • Reduced stocking rates, improved per animal productivity
Mitigation level 3	M3	• Grass buffer strips • Feed pad for beef cattle	• Restricted grazing strategies • Grass buffer strips • Improved FDE management

In the context of WW4, and according to the table above, the farm is currently operating at M3 level excluding the provision of wetlands which is not practical on the property. The mitigations proposed in the application are more specific, comprehensive and likely to be more effective at reducing N, P, sediment and microbial contaminant losses compared to M3 level. Our Overseer modelling showed approximately a 4.5% reduction in overall N losses with the implementation of the improved GMPs and mitigation measures and an estimated 2% reduction in overall P losses using calculations of GMP effectiveness outside of Overseer. Using these estimates, then the proposed WW4 farm may reduce its contribution to nutrient load within this catchment by a further 89kg N/year and 1 kg P/year with the implementation of the proposal in its entirety.

Nutrient load information is difficult to find on the smaller 6,138 ha Waimatuku catchment. The catchment characteristics are similar, with possibly a greater percentage of the catchment developed and farmed as either dairy land or sheep and beef farms. Total nutrient load will be smaller than the Jacobs River Estuary catchment but the principles of a reduction in nutrient load to the receiving water bodies will apply equally to this catchment. Approximately 312ha of WW4 is contained within the Waimatuku catchment which represents 5% of the land area of the catchment. This is in comparison to the section of the farm within the Aparima catchment which represents 0.06% of the catchment area. The portion of WW4 in the Waimatuku catchment may contribute roughly 5,343 kg N and 155 kg P. The implementation of the proposed mitigation measures and further refinement of the GMPs within the application will reduce this contributing load to the receiving waters by 240 kg N (4.5% reduction) and by 6 kg P (2% reduction) at the minimum.

As the figures above show, the applicant's operation represents a small proportion of the total Aparima River catchment and therefore contributes a small proportionate amount of total nutrient load to the Aparima River (approximately 0.1%). The applicant's operation represents a larger portion of the Waimatuku Stream catchment and will therefore contribute a larger proportion of total nutrient load to this water body. Currently the applicant is operating their dairy farms under restrictions imposed on the discharge activity only and there is no capping or restriction on the amount of nutrients "lost" to the environment contributing to the nutrient load in the receiving waters. Under the proposal, the applicant volunteers both an ongoing restriction on the level of nitrogen outputs modelled by Overseer and the ongoing implementation of specific GMPs and mitigation measures. The result of long term restrictions on the applicant as an operator is that they will be unable to further increase their contribution to contaminant load within either of the receiving water catchments. The Aqualinc report discussed above concluded that if mitigations were implemented on all farms within the catchment, not just dairy farms, then both N and P loads would decrease even more significantly to 30% for N and 39% for P. Therefore, in time, as other operators in the catchment are restricted in the same manner then there is an expectation that overall nutrient loads will reduce which will further improve water quality.

Nutrient Concentrations

As described above, the proposal will see a 4.5% and 2% reduction in the applicant's contribution to nitrogen and phosphorus load respectively for both the Aparima River and Waimatuku Stream catchments. A reduction in the long-term average concentration of these nutrients in these waterways is highly likely. Section 4.1 and 4.2 of this report detailed the median concentration of nutrients within both the Aparaima River and Waimatuku Stream between 2009 and 2017. For example, WW4 contributes in the vicinity of 0.1% of the nutrient load to the Aparima catchment and the proposal is likely to result in a 5% improvement to nutrient load. Nutrient concentrations are then likely to follow suit and result in a 0.005% improvement to median nutrient concentrations in the Aparima River catchment. The median concentrations would then reduce by such a miniscule amount that the reduction in nutrient concentration would be unlikely to show in water quality testing or show a reduction in water quality effects within this catchment on a year end basis. The applicant's contribution to the Waimatuku Stream total nutrient load is proportionally larger. Therefore, nutrient concentration reductions based on the mitigation measures in the proposal may be discernible in water quality testing and there may be a more measured improvement in water quality within the Waimatuku Stream. As both receiving waters are showing signs of water quality degradation, it can be concluded that the proposal is likely to at a minimum maintain water quality, and at best, marginally enhance water quality on a long-term basis.

This illustration shows that the applicants operation contributes small proportions of the total nutrients to the receiving waters. Improvements made under the proposal are likely to reduce total nutrient load and nutrient concentration but in isolation from other farms will only have an extremely small impact on long-term water quality. This highlights the importance of catchment wide implementation of water quality mitigation measures and the ongoing restriction on the applicant's operation in accordance with nutrient output limits to give certainty that water quality will not be further degraded in the long term.

Summary

The proposal will result in a reduction in P, N, sediment and faecal indicator organisms lost to the environment and a concurrent reduction in the resulting concentration of these contaminants in receiving waters, albeit at an extremely low level. The overall effects on water quality will be positive and make a very small contribution to the existing trends of improving water quality.

9.2 Overseer Modelling for WW4

Overseer models have been included to support this application at the request of Environment Southland as it is their current preference to have Overseer models to guide an assessment of the overall proposal. Overseer nutrient budgets for the proposed landholding need to be provided by May 2019 according to Appendix N of the PSWLP.

The baseline Overseer model is an accurate description of the applicant's farm system averaged over the preceding five years. All inputs into the model have been taken from five years of farm records and/or accounts and are actual figures and therefore fairly represent the scale of the farm system as it has been operating since 2013.

The proposed phase 1 model is a predictive model which estimates inputs based on what is planned to happen for the next five years.

The example phase 2 model is also a predictive model which estimates inputs based on what is planned to happen at least five years in the future. This example model uses more assumptions and typical industry-wide input values due to the inherent uncertainties which exist modelling a farm system so much further into the future. This example model must only be viewed as an example, not representing the exact and absolute farm system the applicant proposes to implement in the future. We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

In recent months, there have been two publications of note regarding the use of Overseer in both a regulatory framework and for water management planning. These include the Parliamentary Commissioner for the Environment's Report on Overseer[32] and Overseer Ltd's review contracted to Enfocus titled Using Overseer in Water Management Planning.[33] Both reports highlight various issues associated with using Overseer models in a regulatory context, as a decision-making tool and for compliance. The Enfocus report specifically provides for a solution to some of these known limitations and issues by advising that N loss output figures are used in a regulatory context. Using an output figure in regulation enables Overseer version changes to be accounted for, and allows the applicant to demonstrate improvement in N loss outputs whilst still maintaining the flexibility to farm to environmental, political and economic conditions as well as provide for innovations on farm. We concur with these recommendations in light of the fact that the Resource Management Act is an effects-based piece of legislation.

The applicant requests that the land use consents for phase 1 and 2 include a restriction on the nitrogen output from the baseline (current combined) Overseer model. An example condition would be:

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[32] Parliamentary Commissioner for the Environment, *Overseer and regulatory oversight: Models, uncertainty and cleaning up our waterways*, December 2018

[33] Enfocus, *Using Overseer in Water Management Planning*, October 2018.

X	(a) The subject land shall only be used in a manner such that when modelled with the current version of OVERSEER, the OVERSEER estimated losses of N to water shall not exceed the Nitrogen Baseline (current combined). The determination of compliance with this condition will be made using the modelled N loss from the most recent reporting year. (b) The Nitrogen Baseline means the OVERSEER estimated N loss to water using the current version of OVERSEER using (as far as possible) the original OVERSEER input file information provided with the application for consent *dated February 2019* to demonstrate the long-term baseline N loss to water from the consented activity.	This condition essentially provides a compliance limit, which is assessed based on the baseline file provided in the application. The condition ensures that version changes in Overseer are accounted for.

This application proposes that there are no P output loss figure limits imposed as a consent condition. The reason being is that Overseer models farm system P losses at a block scale based on topography, land use, soil type and climate. The calibrations within Overseer for phosphorus are not spatially explicit and although assume good management practice around critical source areas, do not reward spatially specific mitigations. It is therefore difficult for users of Overseer/consent holders to lower P output figures by implementing specific mitigation measures because the modelled P loss output would not be able to accurately reflect these initiatives. The GMPs detailed in the FEMP relate in detail to mitigating P, sediment and microbial losses and the application details further mitigation measures which will be implemented under the proposal. Imposing a requirement to implement these GMPs and mitigations measures is a meaningful and effective way of managing the risk of P loss to water.

The applicant accepts that the resulting land use consents for phase 1 and 2 will need some restrictions on inputs to ensure there is certainty over the scale of the activity and of the implementation of the mitigations which are crucial to the proposal only as opposed to determining the nature of the farm system. The applicant suggests inputs from the nutrient budget be inserted into the consent conditions for the following matters:

- Land area to be used as WW4 milking platform and land area to be used as Gladfield block
- Liquid effluent discharge area
- Slurry effluent discharge area
- Peak cow numbers milked
- Minimum and maximum number of cows housed in wintering barns (this restriction in effect controls the number of cows wintered off site)

Overseer is an incredibly useful tool to be able to understand the nutrient interactions of a farm system based on soil properties, rainfall, drainage and feed requirements. The output from the model gives an indication of how much nutrient may be lost beyond the root zone. The model does not tell us what the environmental impact of these losses is likely to be. Assessing the environmental impact of modelled nutrient losses from a subject property is complex because these nutrients travel via a number of different pathways through the receiving environment undergoing attenuation, mixing, dilution and dispersion processes which can significantly change the quantity and nature of these nutrients in the receiving water bodies. The assessment in Sections 9.3 and 9.4 attempts to show how the applicant has assessed the suitability of individual activities within the proposal against likely effects, available mitigations and likely outcome in terms of whether effects are likely to be avoided, mitigated or both.

9.3 AEE for the farming activity under phase 1 of the proposal on WW4

Section 3.1 of this report described the existing environment on the area of the proposed WW4 dairy platform and Gladfield. These activities are currently occurring as either permitted activities or consented activities under current and enduring resource consents. Policy 39 of the PSWLP directs an assessment of the adverse effects from the activity as a whole, where the permitted baseline cannot be used to justify an existing level of effects or used to justify the effects of a proposal.

The assessment below assesses the farming activity in its entirety located on the proposed WW4 dairy platform and Gladfield block and doesn't use a permitted baseline approach to the assessment. This assessment under Section 8.1 is restricted to the proposed activity under phase 1 of the proposal. Activities on WRO are assessed in an attached document in Attachment F.

Table 25: Assessment of effects at activity level for phase 1 on WW4

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Capital fertiliser applications during conversion of 63ha of sheep land to dairy farming land	The phase 1 Overseer model does not include capital fertiliser applications because it is based on a long term average farm system operating in equilibrium. Therefore N and P losses as result of capital fertiliser applications over the conversion period may be higher than modelled by Overseer. Capital fertiliser applications will apply larger quantities of N, P, K and S to land in order to increase fertility. These applications of larger quantities of nutrients have the potential to result in losses to the environment if applied at rates which exceed the plants ability to utilise these applied nutrients. Excess applied N	Capital fertiliser application timings avoid high drainage periods such as late autumn and winter and periods when soil temperature is less than 7 degrees to mitigate against excess N leaching through the soil profile. All other fertiliser applications will use a little and often approach to avoid the application of excess nutrients which cannot be utilised. Regular soil testing to guide capital fertiliser requirements to avoid the application of excess N and P which cannot be used for plant uptake to mitigate against losses via artificial drainage.	Capital fertiliser applications will only be done as required by the latest soil test results from the Cochrans block and will be undertaken where P, K or S levels are below agronomical optimum levels. P = 20-40 K = 6-10 S= 10-12 Capital P fertiliser applications will be applied at a maximum of 100kg P/ha which may require P fertiliser applications to be split.	Capital fertiliser applications are only undertaken where there is a nutrient deficit and are done at a rate which meets this deficit and avoids the application of excess nutrients. There is a low risks of adverse effects eventuating as application will meet pasture demand. The fertiliser regime described in the nutrient budgets will be the default fertiliser regime and capital fertiliser applications will only be done during the early phase of the land conversion and completed using GMP principles and in according to mitigation measures which should adequately mitigate adverse effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	is likely to be lost to water bodies via nutrient leaching and artificial drainage channels on both Braxton and Tuatapere soils. Excess applied P is likely to be lost to water bodies via overland flow on Braxton soils only. Excess N and P in water bodies may lead to water quality degradation resulting in ecological stresses on aquatic life and human health consequences such as blue baby syndrome.			
Cultivation of new pastures on new 63ha block	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Re-sow bare paddocks as soon as possible Use buffer zones around critical source areas and use direct drilling if possible. Cultivation will be undertaken to meet permitted activity criteria in	Further mitigations not required as land is flat which reduces the risk of overland flow of sediment and phosphorus when cultivating land. Riparian buffer zones will be installed with stock fencing and vegetated filter areas .	Adverse effects should be adequately avoided as this is a low risk activity in this location. GMPs provide adequate mitigation of effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		Rule 25(a) of the PSWLP maintaining a 5 meter buffer zone		
Construction of new lanes on new 63ha block	New laneways create high risk areas for sediment, microbial and P losses. Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	No stockpiling of earthworks material near waterways. Laneways include camber and contouring to direct runoff to pasture and away from waterways Buffer zones will be created in riparian margins to waterways.	The paddock and lane layout have been designed to ensure new lanes are perpendicular to adjacent waterways. Where the lane crosses a waterway, an appropriately sized culvert will be used (within permitted activity rules) with runoff directed to adjacent pasture.	Overseer assumes 30% of dung deposited on lanes is lost directly to waterways, regardless of where the waterways are located in relation to the laneways. Overseer may have overestimated P losses (and sediment losses) in phase 1 proposal model because it doesn't recognise that the applicant will be implementing these GMPs and also siting of the lanes away from waterways as a mitigation measure.
Increase of nutrient losses from the 63ha new block	The land use change on the 63ha block from sheep farming to dairy platform results in an increase of modelled nutrient loss on this specific block of land. The N losses from the 63ha sheep block is modelled to increase by 1,211 kg N and by 19 kg P/ha/year.	N/A	The modelled nutrient losses from the WW4 dairy platform and Gladfield block have been reduced under the proposal by 1,132 kg N to offset the increase in contaminant losses from the 63ha sheep block. This concurrent reduction of losses on the platform and Gladfield block ensures that overall, nutrient losses are kept to a practical minimum The 63ha existing sheep block is located within the same groundwater and surface water catchments as the	The increased modelled contaminant losses from the 63ha block are mitigated by the concurrent reduction in modelled contaminant losses across the remainder of the landholding. The new block and the existing landholding are located within the same catchments and physiographic zones meaning that there will be no modelled increase in

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Excess nutrients lost from one specific area of land may result in water quality degradation in the receiving waters causing ecological stress for plants and animals.		remainder of the landholding which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal in its entirety. The 63ha existing sheep block is located within the same physiographic zones as the remainder of the landholding which ensures that the modelled losses from these physiographic zones does not increase under the proposal in its entirety. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located across the entire landholding and therefore will mitigate against contaminant losses from activities located on both the new 63ha block and the existing platform.	contaminant losses to water bodies in accordance with the physiographic zone policies and Policy 16 of the RWPS.
Increase in nutrient losses from the existing dairy platform	The proposal sees a modelled increase in N and P losses (potentially also sediment and microbial losses) on the dairy platform. The N losses on this particular block of land increase from 9,016 kg N to 9,756 kg N. The P losses increase from 270 kg P to 300 kg P. Excess losses from	N/A	Although total modelled nitrogen and phosphorus losses from the WW4 dairy platform have increased, there is a reduction of nutrient losses on a per hectare basis of 4 kg N/ha/year and 0.1 kg P/ha/year meaning that nutrients losses are being spread over a larger area in the proposal as opposed to being more concentrated on one particular block of land (existing dairy platform) The existing dairy platform and expanded dairy platform (and remainder of the landholding) are located within the same groundwater and surface water	The increased modelled contaminant losses from the dairy platform are mitigated by the wider distribution of modelled contaminant losses across the remainder of the landholding. The existing dairy platform and the expanded dairy platform are located within the same catchments and physiographic zones meaning that there will be no modelled increase in contaminant losses to water bodies in

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	one particular block of land may result in concentrated nutrient accumulation in the soil profile and/or in localised drainage channels which can result in water quality degradation and ecological stressors on aquatic life and human health issues.		catchments which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal. The existing dairy platform and expanded dairy platform (and remainder of the landholding) are located within the same physiographic zones which ensures that the modelled losses from these physiographic zones does not increase under the proposal. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located across the entire landholding and therefore will mitigate against contaminant losses from activities located on both the existing platform and the expanded dairy platform.	accordance with the physiographic zone policies and Policy 16 of the PSWLP.
Discharge of liquid effluent to land via low rate application predominantly using pods and occasional discharge via travelling irrigator and slurry	The proposal sees an increase in the number of cows milked on farm from 775 to 850 which means more effluent will be generated which needs to be discharged to land. Potential for contaminant losses via all three pathways:	Effluent will always be applied at a depth less than the soil water deficit which ensures nutrients remain in the root zone to be taken up and utilised by plants for pasture production. Effluent area receiving liquid FDE is sized to ensure nutrient loadings from the application of effluent are	No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilising low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area at 56ha is large enough to cater for the additional effluent generated by the additional cows and maintain effluent N loadings at less than 150kg N/ha/year.	Adverse effects to the environment from the discharge of effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
tanker/umbillical to existing effluent discharge area (existing platform)	leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain pathways on the Braxton soils In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilizing low rate effluent application (<10mm/hr) on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of a travelling irrigator and slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are appropriate to lower storage volumes.		discharge permit giving certainty that the activity will be regulated.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Activities on the Gladfield block - Intensive winter grazing	Potential for significant amounts of contaminants (N, P, sediment and microbials) to be lost to both surface and groundwater bodies as a result of the complete de-vegetation of pasture/crop, treading damage on soil structure and runoff following rainfall events. Nutrient losses from this activity occur via deep drainage through the soil profile into the underlying aquifer or via overland flow into adjacent waterways (Waimuatuku Stream) or artificial drainage channels.	Buffer zones maintained between crop cultivation and critical source areas to provide an area where runoff can be filtered and captured limiting risks of entering water. Grazing direction will be away from buffer zones/critical source areas leaving last bite to provide a buffer zone for nutrient capture through until the end of the fodder grazing period. Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks	The intensive winter grazing will continue to be located on the Gladfield block under this proposal because it is predominantly flat with no waterways or artificial drainage channels which avoids the risk of the direct runoff of nutrients to the Waimatuku Stream (particularly P, sediment and microbials). When this activity was modelled as occurring on the Tuatapere soils on the new block, modelled losses were significantly higher due to nutrient leaching risks and the siting of the activity on the new block was subsequently discounted. The activity is located on the Braxton soils which presents less risk of nutrient leaching to shallow groundwater and therefore significantly lower N loss results modelled in Overseer. However, the Braxton soils are known to be prone to cracking which is not a factor which is considered in the Overseer model. The applicant has seen little evidence of cracking on the Gladfield block and cracking does not generally occur in	Adverse effects potentially still exist from this activity due to the high level of contaminant losses which occur from intensive winter grazing despite the implementation of GMPs and mitigations. The overall nutrient budget has taken this high contaminant loss activity into account and provided mitigations and reductions in nutrient loss in other areas and activities across the landholding to offset adverse effects to ensure overall nutrient losses are kept to a practical minimum. The GMPs and the mitigations proposed will mitigate adverse effects to a certain extent, with the long term goal of the applicant to abolish

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Excessive nutrient losses can cause nutrient accumulation in groundwater and excessive nutrient load in waterways causing water quality degradation and the resulting ecological stress on plants and animals when the life-supporting capacity of the water is compromised by excess nutrients. Groundwater and surface water flow from the Gladfield block is primarily in a south to south-easterly direction towards the Waimatuku Stream and away from the Bayswater Bog. The bog is recharged purely via rainfall and accordingly effects on the Bog are discounted because it is not a receiving environment.	of contaminant losses through leaching and overland flow. All other GMPs listed in rule 20 will be implemented by May 2019. Bare soils are cultivated using full cultivation and tide to avoid paddocks siting bare for long periods of time which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching.	the winter period because it is a condition impacted by drier temperatures and low soil moisture levels. To mitigate against the risk of contaminant losses via cracking, the applicant will cultivate intensive winter grazing paddocks in early spring to ensure pasture cover is established going into summer which can suck up nutrients for their growth and soil moisture is maintained and held in the profile as much as possible over the spring and summer. This will mitigate against risks to water quality in the underlying aquifer and the Waimatuku Stream	intensive winter grazing from the dairy platforms/Central Plains area. The effects of this activity will be limited to a five-year timeframe. Under phase 2, Gladfield block becomes a cut and carry block.
Increase in cow numbers to	The grazing of more cows on pasture during high risk	Use of selective grazing to avoid grazing very wet paddocks during	Stocking rate will reduce from 3.2 cows/ha to 2.1 cows/ha with the introduction of the additional land to the dairy	A reduction in stocking rate mitigates effects of the small increase in cow

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
consented discharge permit levels across the entire landholding	periods increases the risk of the leaching of nutrients (N,P and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage. Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Increased nutrient losses as total figures due to more cows, to groundwater and surface water bodies may potentially cause water quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also	adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses. Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required. This is to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	platform with a comparatively smaller increase in cow numbers. A stocking rate reduction results in a reduction in nutrient losses on a per hectare basis as a result of an increase of cows producing urine and dung spots which are significant sources of contaminant losses to the root zone over a larger area of land, thereby reducing per hectare nutrient loadings. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage. Use of in-shed feeding when feed deficits occur to ensure stock are well fed prior to entering the paddock break which can limit pugging and treading damage, particularly under adverse weather conditions.	numbers on total nutrient losses modelled by Overseer. Adverse effects on the environment adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate accumulation in groundwater and potentially bowel cancer as discussed in section 8.1 above.			
Fertiliser application regime across entire landholding	The application of nutrients in fertiliser has the potential to result in direct nutrient losses to the environment if fertiliser is applied either in excess to plant requirements or at a time when it cannot be utilised for pasture/crop production. Nitrogen losses from fertiliser application is most likely to occur via deep drainage. Phosphorus losses from fertiliser is most likely to occur via soil loss and/or direct loss through runoff or erosion.	Time N, P, K and S fertiliser application to meet crop and pasture demand using split applications and avoid high risk times of the year i.e. when soil temperature is less than 7 degrees, during drought periods and during periods when soils are at field capacity. Reduce use of P fertiliser where Olsen P values are above agronomic optimum. Maintain Olsen P levels at around 30-40. Use nutrient budgeting and annual soil testing to manage nutrient inputs from fertiliser and outputs to	Urea applications on all blocks occur using a little and often approach with a reduction in the application rate compared to the baseline scenario. The effluent blocks also receive a reduced rate of N application across the various applications compared to the baseline. The total fertiliser nitrogen applied to the milking platform is reduced for non effluent blocks and for effluent blocks. An overall reduction in fertiliser rate across the entire farm compared to baseline. Total fertiliser use on the Gladfield block is maintained at baseline levels as it accurately meets crop demand and is applied under GMP	The proposed fertiliser regime under phase 1 has been improved given the ned for lower pastoral production (of 1 T DM/ha) with the stocking rate reduction. Less nitrogen is available from supplements and more is supplied by the additional effluent which equates to an overall reduction in fertiliser needed under the proposal. Adverse effects both avoided and mitigated with use of GMPs for fertiliser usage and further mitigations to reduce fertiliser across the dairy platform.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Adverse effects of inappropriate fertiliser application or excess application include a loss of excess nutrients to water causing water quality degradation in both groundwater and surface water bodies. Water quality degradation can adversely impact aquatic plant and animal ecosystems and impact on human health.	guide farm management decisions which can maintain overall nutrient losses at desired level.		
Imported supplementary feed and feed made on-farm and fed during the season across existing platform and new block	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N needs to be supplied to fuel pasture production which in	N/A	Supplementary feed imported onto the property has reduced by 60 T of barley grain and brewers grain and 100 T of PKE. Supplementary feed made and fed during the season is unchanged.	The reduced stocking rate has necessitated the reduction in imported supplementary feed to reconcile pasture production between the two systems. Likely to have positive effects on the environment.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.			
Slurry effluent application across entire landholding	The nutrient concentration of slurry effluent is higher than liquid or FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application of slurry effluent to land needs to be carefully managed to ensure that nutrient loadings on any particular land area do not exceed the recommended level of 150 kg N/ha/year from effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted to 2.5mm. If nutrient loadings exceed 150 kg N/ha/year or nutrients are applied in excess then there is	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees in spring. Effluent will always be applied at a depth less than the soil water deficit which ensures nutrients remain in the root zone to be taken up and utilized by plants for pasture production.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e. blocks where liquid FDE is not applied. The non-effluent blocks are the same in terms of FDE classification, soil type and physiographic zone to the approved effluent blocks so is considered equally as suitable for receiving slurry effluent. Slurry effluent applied to paddocks low in potash (K levels lower than 6-10) and with low Olsen P levels (P levels lower than 25)	Adverse effects to the environment from the discharge of slurry effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated. Application of slurry effluent to paddocks low in P and K can act as a capital fertiliser application and bring soil test levels up to agronomical optimum which will increase pasture productivity.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	a risk of contaminant loss (N, P, sediment and microbial) to groundwater and surface water bodies. Adverse effects from contaminant loss to water include water quality degradation which can adversely impact aquatic ecosystems and the overall health of water bodies. Slurry effluent will be applied to areas outside of the liquid discharge area. Slurry effluent is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that purely liquid effluent has.	Effluent area receiving slurry FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilising low depth effluent application (<2.5mm) on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of a slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are		

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Use of the existing effluent storage facilities on existing dairy platform	If a structure is leaking or not structurally sound these is a risk of contaminant losses directly to shallow groundwater. Contaminant accumulation in groundwater can lead to human health issues from blue baby syndrome or *E.coli* contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	The main effluent storage pond which contains a clay liner has passed a drop down test in 2018 to confirm that it is not leaking beyond normal operating parameters. The pond also has had written confirmation from an engineer that the pond has no visible cracks or defects. Drop tests will be completed on the pump sump and solids bunker in July when milking stops for the season as these areas are first collection points for effluent and there is no mechanism by which to divert effluent during the 48hour drop test period.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided or remedied immediately.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	cause water quality degradation effects such as algal blooms, smothering and eutrophication in surface water bodies.			
Groundwater abstraction on existing dairy platform	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users. Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset.	The yard is scraped to reduce fresh water use at the dairy shed.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	the more water used, the more effluent generated which needs to be discharged to land.			

9.4 AEE for the farming activity under phase 2 of the proposal

Phase 2 of the application involves the introduction of a wintering shed into the farm system as a major mitigation measure for reducing nutrient losses across the landholding. The transition to a farm system which includes a wintering shed enables the removal of high-risk activities for nutrient losses from high risk areas on the farm.

We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

The intention of phase 2 is to introduce wintering sheds into the farm system which will significantly reduce nutrient losses on the landholding. The applicant proposes that the land use consent be issued requiring them to operate the farm system in phase 2 at a level equal to or less than the modelled nutrient losses (predicted by Overseer) submitted in the baseline models. Therefore, we are applying for phase 2 of the application to be governed by a land use consent based on an Overseer output figure to enable the applicant to operate an entirely flexible farm system under the resulting land use consent. Our proposal is that only input values relating to the scale of the activity derived from the example nutrient budget are inserted as consent conditions in the land use consent.

The assessment below attempts to show how the applicant has assessed the suitability of individual activities within the proposal against likely effects, available GMPs and mitigations and likely outcome in terms of whether effects are likely to be avoided, mitigated or both. The assessment lacks reference to specific input figures to show that an output-based land use consent is appropriate and still provides certainty of effects and effectiveness of mitigations.

Table 26: Assessment of effects at activity level for phase 2 on WW4

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Decrease in nitrogen losses from the entire landholding	The proposal sees a modelled decrease in total N losses on the landholding. The N losses decrease from 11,298 kg N to approximately 11,142 kg N. An overall reduction in total nitrogen losses from the landholding reduces nitrate accumulation risks in groundwater and reduces nitrogen load in waterways. A reduction in overall nitrogen load can improve water quality and maintain and enhance the life-supporting capacity of water bodies.		The removal of the winter grazing activity from the farm system results in a significant reduction in modelled N losses at the Gladfield block from 1,542kg N down to 448kg N. The use of wintering sheds provides additional mitigation of nitrogen losses across the platform.	The reduction in modelled nitrogen losses from the landholding to the lowest practical level should correlate with a nutrient load reduction in the receiving water bodies and/or physiographic zones in accordance with the physiographic zone policies and Policy 16 of the RWPS.
Increase in phosphorus losses from the entire landholding	The proposal sees a modelled increase in P losses from the entire landholding	Avoid working CSAs and their margins	Removal of intensive winter grazing activity from the farm system results in a marginal decrease in modelled P losses from the Gladfield block.	Please see section 8.4 of this report for full assessment of expected P losses and full assessment of

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	of 30kg P compared to baseline.	All riparian margins to be fenced and left to establish with grasses to enable filtration of contaminants that may be transported via overland flow processes and erosion Reduce use of P fertiliser where Olsen P levels are above agronomic optimum. Reduce the risk of runoff from laneways and other sources by ensuring crossings are adequately maintained and maintain gradients to direct runoff to pasture. Please see section 8.4 of this report which discusses further P loss GMPs proposed by the applicant and discusses how P (and sediment and microbial) losses are likely to be misrepresented by Overseer modelling.	All new laneways will be located away from waterways and riparian margins implemented.	proposed mitigations and their effectiveness.
Increase in nutrient losses	The proposal sees a modelled increase in N and P	Use of selective grazing to avoid grazing very wet paddocks and	Although total modelled nitrogen and phosphorus losses from the WW4 dairy platform have increased,	The increased modelled contaminant losses from the dairy platform are

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
from the dairy platform	losses (potentially also sediment and microbial losses) on the dairy platform. The N losses on this particular block of land increase from 9,016 kg N in the baseline to 10,694 kg N in phase 2. The P losses increase from 270 kg P to 353 kg P. Excess losses from one particular block of land may result in concentrated nutrient accumulation in the soil profile and/or in localised drainage channels which can result in water quality degradation and ecological stressors on aquatic life and human health issues.	open the breaks up to avoid pugging and treading damage. Use nutrient budgeting to manage nutrient inputs and outputs Time N application in fertiliser and effluent to meet pasture demand and avoid high risk times of the year when soil temperature is low, soils are at field capacity or during drought periods.	there is a reduction of nitrogen losses on a per hectare basis of 1 kg N/ha/year compared to baseline meaning that nutrients inputs and outputs are being carefully managed, balanced, sited and spread over the entire landholding to ensure total nitrogen losses do not increase from the landholding as a whole and are kept at the practical minimum. The wintering shed is located on the dairy platform ensuring the presence of a large mitigation measure to reduce nutrient losses from activities on this block. P losses are not described well within Overseer. Therefore, the applicant has assessed their mitigation of P losses through a series of improvements and extension of laneway management as described in depth in section 8.4 of this report. The dairy platform and remainder of the landholding are located within the same groundwater and surface water catchments which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal. The dairy platform and remainder of the landholding are located within the same physiographic zones which	mitigated careful consideration and distribution of nutrient inputs and outputs across the entire landholding. The dairy platform and the remainder of the landholding are located within the same catchments and physiographic zones meaning that there will be no modelled increase in contaminant losses, and contaminant losses are at the lowest practical level, in accordance with the physiographic zone policies and Policy 16 of the RWPS.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
			ensures that the modelled losses from these physiographic zones does not increase under the proposal. The mitigation measures to reduce modelled nutrient losses contained throughout this table are located across the entire landholding and therefore will mitigate against contaminant losses from activities located on the dairy platform.	
Use of wintering sheds	Nutrients in effluent generated by the cows during winter and in marginal periods is stored and applied to land in a manner which matches plant demand and mitigates against excessive leaching processes which can lead to the contamination of groundwater and surface water bodies. An overall reduction in nutrient losses from the landholding reduces nutrient accumulation risks in	Urine and dung deposition during high risk periods is redistributed to pasture using the effluent management system when soils are in a suitable state to receive and utilize applied nutrients. The wintering sheds are located in accordance with the setbacks listed in Rule 35 of the PSWLP.	The wintering sheds will be used to winter the majority of the milking herd from June through till calving dates. Two primary scenarios would exist under an output-based land use consent: - All mixed age cows and R2 replacements are wintered in the sheds for the winter period totalling 1030-1050 cows. - All mixed age cows are wintered in the sheds for the winter period totalling 770 and R2 replacements are grazed on fodder crop at WRO and return to the platform towards the end of July/beginning of August for calving. Intensive winter grazing will cease entirely on the Gladfield block under this proposal and will be used solely as a cut and carry block providing silage for the dairy platform and wintering shed.	Adverse effects from winter grazing on the Gladfield block are ceased. Wintering sheds significantly reduce nutrient losses to the environment and can offset adverse effects from activities on the remainder of the landholding by lowering the total quantity of nutrients lost to the environment.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	groundwater and reduces nutrient load in waterways. A reduction in nutrient load can improve water quality and maintain and enhance the life-supporting capacity of water bodies. Standing cows off pasture in late Autumn and early Spring reduces the risk of pugging to pastures which increases the infiltration ability of soils and reduces overland flow of nutrients.		The dry of date is extended to 15th June because cows are able to be kept indoors towards the end of the milking season. The wintering sheds can be used during the autumn and spring to remove cows from pasture during high drainage periods to protect soil structure, avoiding tramping of feed and avoid urine and dung deposition.	
Increase in cow numbers to 1000 across dairy platform	The grazing of more cows on pasture during high risk periods increases the risk of the leaching of nutrients (N,P and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage.	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses.	Stocking rate will increase from 2.1 cows/ha under phase 1 to to 3.2 cows/ha under phase 2 with the introduction of more cows onto the same land area as phase 1. Overall, there is a marginal stocking rate reduction of 0.1 cows/ha compared to the baseline scenario. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage.	The marginal stocking rate reduction is unlikely to have a discernible impact on per hectare nutrient loadings which is why the introduction of the wintering shed forms the most significant mitigation measure alongside other minor mitigations.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Increased nutrient losses as total figures due to more cows, to groundwater and surface water bodies may potentially cause water quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate accumulation in groundwater.	Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	Use of in-shed feeding when feed deficits occur to ensure stock are well fed prior to entering the paddock break which can limit pugging and treading damage, particularly under adverse weather conditions. Use of the wintering shed as a standoff area to offset additional nutrient losses that may occur with higher number of cows grazing during adverse weather conditions. Use of the wintering shed to winter the majority of the herd off the support block and the subsequent removal of intensive winter grazing from Gladfield block.	Adverse effects on the environment will be adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Discharge of liquid effluent to land via low rate application predominantly using pods, occasional discharge via travelling irrigator and slurry tanker/umbillical to existing effluent discharge area (existing platform)	The proposal sees an increase in the number of cows milked on farm from 850 to 1000, plus the introduction of a wintering shed as a generation area for effluent which means more effluent will be generated which needs to be discharged to land. Potential for contaminant losses via all three pathways: leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain	Effluent will always be applied at a depth less than the soil water deficit which ensures nutrients remain in the root zone to be taken up and utilized by plants for pasture production. Effluent area receiving liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilising low rate effluent application on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when	Liquid effluent discharge area increased to 78ha covering the same soil types and physiographic zones as the existing effluent discharge area. No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilising low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area at 56ha is large enough to cater for the additional effluent generated by the additional cows and maintain effluent N loadings at less than 150kg N/ha/year.	Adverse effects to the environment from the discharge of effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	pathways on the Braxton soils In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	soil conditions are unsuitable to receive effluent Use of a travelling irrigator and slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Imported supplementary feed and feed made on-farm and fed during the season across the entire landholding	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N	N/A	Supplementary feed imported onto the property is likely to increase under this scenario. The example Overseer budget modelled an increase in the vicinity of 150 T of barley grain, 150 T of distilled brewers grain, 33 T of molasses, 191 T PKE and allows for lactation to be extended. Supplementary feed made and fed during the season is increased to 1200 T DM silage.	The increased number of cows and longer lactation requires the need to increase supplementary feed to reconcile pasture production. Additional fertiliser and barn slurry also needed to reconcile pasture production. Increased supplementary feed can reduce overall N cycling in a system

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	needs to be supplied to fuel pasture production which in turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.			which can result in less overall N losses to the environment and the mitigation of adverse effects on water quality.
Slurry effluent application across the entire landholding	The nutrient concentration of slurry effluent is higher than liquid or FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application of slurry to land needs to be carefully managed to ensure that nutrient loadings on any particular land area do not exceed the recommended level of 150 kg N/ha/year from effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted to 2.5mm. If nutrient loadings exceed 150 kg	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees in spring.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e. blocks where FDE is not applied. The non-effluent blocks are the same in terms of FDE classification, soil type and physiographic zone to the approved effluent blocks so is considered equally as suitable for receiving slurry effluent. Slurry effluent generated in the wintering shed is exported to both the Gladfield block to return the nutrients to the cut and carry block and to the non-tiled non-effluent blocks. Slurry effluent applications occur twice per season in December and January which are low risk times of the year and are at rates less than 150 kg N/ha/year.	The application of slurry effluent to land will be undertaken under the conditions and provisions of the discharge permit and adverse effects from this activity are expected to be no more than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	N/ha/year or nutrients are applied in excess then there is a risk of contaminant loss (N, P, sediment and microbial) to groundwater and surface water bodies. Adverse effects from contaminant loss to water include water quality degradation which can adversely impact aquatic ecosystems and the overall health of water bodies. Slurry effluent will be applied to areas outside of the liquid discharge area. Slurry effluent is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that pure liquid effluent has. A significant amount of additional slurry effluent is			

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	generated from the wintering sheds which needs to be redistributed to land evenly and at a rate which matches pasture and crop demand to avoid direct losses of nutrients to the environment as described above.			
Use of the existing effluent storage facilities on dairy platform	If a structure is leaking or not structurally sound these is a risk of contaminant losses directly to shallow groundwater. Contaminant accumulation in groundwater can lead to human health issues from blue baby syndrome or *E.coli* contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can cause water quality degradation effects such as algal blooms, smothering and	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately. Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	The applicant will be continuing to operate under the existing land use consents for the use and maintenance of these structures granted under phase 1.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided or remedied immediately.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	eutrophication in surface water bodies.			
New effluent storage facilities on dairy platform	New effluent storage facilities are designed in accordance with current specifications and will include leak detection systems which ensures that any leakages can be quickly identified and remedied. Adverse effects from leakage are the same as described above for existing effluent storage facilities	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	New effluent structures will contain leak detection systems and will be consented by way of land use consents applied for prior to the commencement of phase 2. A regular drop testing regime will be implemented in accordance with likely consent conditions.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided or remedied immediately.
Groundwater abstraction on the dairy platform	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users.	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset.	The yard is scraped to significantly reduce fresh water use at the dairy shed which considerably lowers effluent generation throughout the milking season. Effluent storage requirements are reduced.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because the more water used, the more effluent generated which needs to be discharged to land.	Monitoring of the groundwater abstraction volumes on a monthly basis.		

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS FOR PROPOSAL ON WW5

In addition to the application being made in the prescribed forms and manner, Section 88 of the RMA also requires that every application for consent includes an assessment of the effects of the activity on the environment as set-out in Schedule 4 of the RMA.

This assessment of environmental effects (AEE) is broken into two parts: a broad scale/cumulative effects assessment and an assessment of the individual activities within the individual management blocks for both phase 1 and phase 2 individually.

10.1 Broad scale/cumulative effects assessment

The AEE below concludes that the implementation of targeted mitigation measures on-farm should ensure that adverse effects on water quality from activities within the proposal are either avoided or mitigated as far as reasonably practical whilst still maintaining a viable, efficient and profitable farm system. The AEE below was written in a holistic way and did not solely refer and relate to Overseer outputs because Overseer only models nutrients leached below the root zone and does not model nutrient loss directly to either groundwater or surface water bodies. The amount of these nutrients which may end up in these water bodies depends on a variety of different factors including the extent of denitrification in the vadose zone referred to as the attenuation rate and the catchment hydrology and characteristics which impacts the resulting concentration of these nutrients in water bodies.[34]

This broad scale/cumulative effects assessment includes a catchment scale assessment in relation to attenuation and hydrology processes, characteristics of the catchment and consideration of the state of the receiving environment. This assessment also assesses the proposed activity in its entirety, i.e not using a permitted or consented baseline approach. The term "practical minimum" is used frequently and is used to portray the fact that any dairy farming activity results in nutrient losses to the environment of some scale and that the applicant has reduced nutrient losses as far as they are practically able to do so given available mitigations, innovations, technology whilst still maintaining an efficient and profitable farm system that meets their social and economic needs. The term "practical minimum" does not refer to an effect on the environment. The summary to this AEE concludes that effects on the environment should be less than minor given the proposed mitigations, the characteristics of the catchment and the predicted changes to water quality as a result of the proposed activity.

Attenuation

Section 3.4 included a map of the denitrification potential across the subject catchment. The map showed that the area of the subject landholding having low to very low dentification with pockets of the lower catchment having higher denitrification potential. Broadly, this means that risk of a greater proportion of the modelled N losses from below the root zone ending up in groundwater and eventually surface water bodies is high, especially on the free draining Tuatapere and Upukerora soils. The applicant has recognised this risk and sited high contaminant loss activities (particularly high N loss activities such as intensive winter grazing and discharge of slurry and liquid effluent) on the more poorly

[34] Enfocus, *Using Overseer in Water Management Planning*, October 2018.

drained Braxton soils which have less vulnerability to nitrogen leaching and therefore less risk of N loss below the root zone and through the soil profile. The siting of these activities on lower risk soils has been a conscious decision by the applicant for a number of years and has therefore reduced N leaching risk to a practical minimum. The Braxton soils are known to be prone to cracking however the attached report in Attachment I from Environment Southland Scientist, Michael Killick confirms that the Braxton soils in this specific location have not shown evidence of cracking thereby reducing potential risks of contaminant loss during dry periods from these soils.

The inclusion of a wintering shed within the end goal farm system is one of the most effective and significant mitigation measures available for NZ dairy farms for reducing N leaching beyond the root zone through to groundwater and surface water receiving bodies. The wintering shed allows the applicant to remove cows from pasture and hold them inside during high risk drainage periods. In doing so, N deposited via urine and dung patches is collected within the effluent system and can be redistributed to pasture evenly, at a lower rate and timed to avoid high risk drainage periods which significantly reduces the risk of N leaching through the soil profile as it is preferentially used in the root zone. As a result, the mitigation measures put forward by the applicant will avoid risks of N accumulation in groundwater within the Aparima GMZ to a practical minimum and effects on this water body should be less than minor.

Groundwater nitrate levels are of particular concern to human health. The link between groundwater nitrates and blue baby syndrome is a fairly widely accepted and is one of the origins of the NZ Drinking water standard. Other studies indicate that other contaminants, or dietary nitrate sources, may also play a role in the syndrome.[35] A recent Danish study suggested a link between groundwater nitrates and bowel cancer. The study found that those people exposed to nitrate levels in excess of 9.3 mg/L (NZ drinking water standard is 11.3 mg/L) had a 15% increased carcinogenic risk. In December 2018, Agriview NZ published an article attempting to correlate the Danish study within the New Zealand agricultural context. The article noted that "most of the international research conducted throughout the past four decades on this topic has found either a negligible or only slight correlation between nitrates in drinking water and colon/bowel cancer rates" and also that "the idea that colon cancer is heavily influenced by diet surfaces in many of the studies evaluating its link to the intake of nitrate through drinking water." The article further noted "Ian Shaw, professor of toxicology at the University of Canterbury, says it is this very factor that makes the associations between water nitrate and colon cancer unconvincing:

"In my opinion nitrate is associated with colon cancer because it can be converted to nitrite by gut bacteria and form nitrosamines with dietary amino compounds. Nitrosamines are profound carcinogens. Links with water nitrate would, therefore, not be definitive because other components of the diet would be necessary to facilitate carcinogenesis. If exposure to an appropriate dietary mixture, plus the right bacterial species in the microbiome do not coincide carcinogenesis will not occur. This is a complex scenario that cannot be attributed to a single exposure to a single chemical."

[35] https://en.wikipedia.org/wiki/Blue_baby_syndrome accessed 8 February 2019

In other words, attributing high colon cancer rates to nitrates in drinking water would be oversimplifying things to a considerable level. One must consider the variations of diet and lifestyle also considered potential factors for increasing colon cancer risk, and this is something the Danish study failed to do."[36]

Given the level of current science, effects on human health should be protected under the proposal which is likely to result in less than minor adverse effects on groundwater quality due to the imposition of mitigation measures to address nitrate accumulation.

Phosphorus, Sediment and Microbial losses

The loss of P, sediment and microbials via erosion of the main river banks and within the tributaries of the Aparima River is likely to primarily occur during flood events and will be partly mitigated by the presence of established vegetation along the river margins which stabilizes the adjoining land and the flat topography of the applicants property and the wider catchment which slows erosion and the surface runoff processes.

These contaminants may also enter artificial drainage channels if applied to land inappropriately via fertiliser application, intensive winter grazing activities, effluent application or by the inappropriate grazing of animals during high drainage periods (such as late autumn and mid-spring). The AEE below has correlated which GMPs and further mitigations are required to mitigate against losses of contaminants via artificial drainage pathways from these specific activities to a practical minimum.

Another factor to consider is the risk of P, sediment and microbial losses directly to surface water bodies within this catchment via overland flow – primarily occurring from runoff from laneways and via critical source areas. Overall losses of these contaminants directly to waterways is considered low risk in this catchment and on the applicants' property due to the flat topography. Overseer gives an estimate of what P may be lost directly to the environment from laneways, waterway crossings and critical source areas in the 'other sources' output within the model. The model does not consider sediment and microbial losses, however as all three contaminants typically enter surface water bodies via the same transport pathways then P loss modelled by Overseer can be used as a proxy for estimating sediment and microbial losses to the environment also.

The problem with the 'other sources' output estimated by Overseer is that it is not spatially explicit and does not account for site-specific mitigation measures which may be in place on a farm to mitigate losses directly to waterways from these laneways and critical source areas. The nutrient budgets provided with this application model an increase in total P loss of 8kg over the whole farm between the baseline and the winter barn example model. The key driver for this increase in P loss is from 'other sources' as classified in Overseer and equates for about 50% of total P losses. Overseer is known to assume 30% of P deposited on a lane is lost directly to water[37]. Therefore, when a dairy farm is expanded such as in the proposal, more lanes generally need to be constructed, and the model then assumes that additional phosphorus is lost from those lanes.

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[36] https://www.agriview.nz/forum/2018/12/11/investigating-the-nitrate-colon-cancer-link accessed 8 February 2019

[37] Gray et al (2016) Review of the phosphorus loss submodel in OVERSEER®, Report prepared for OVERSEER® owners under AgResearch core funding contract A21231(A)

GMPs and mitigation measures to reduce P, sediment and microbial losses

As part of the proposed dairy expansion, the applicant will be constructing new lanes and new culvert crossings to allow access from the current dairy platform to the new block. The applicant will be implementing specific critical source area GMPs that will seek to minimise potential P loss via overland flow from these new lanes and/or culvert crossings such as the fencing of waterways, establishing vegetated riparian margins, contouring lanes to direct runoff to pasture, installing bargeboards on culvert crossings and locating laneways away from waterways. The implementation of these GMPs by the applicant are not rewarded by Overseer as the model is not spatially explicit as explained above.

The following calculations have been adapted from workings by Mo Topham, Farmwise Consultant (CNMA) and seek to explain how actual P losses (and sediment and microbial losses by proxy) have been reduced to a practical minimum and are likely to be lower than those modelled by Overseer due to the implementation of these GMPs which are not rewarded in Overseer. According to a Massey University publication[38], a lactating cow consumes 0.4kg P per week or 16.6 kg P per milking season. Of this amount consumed 66% or 10.9kg is estimated to be deposited as dung. Assuming cows spend 2 hours per day (or 0.08% of their day) on the lanes then 0.8kg P of this dung deposited may be deposited on lanes within the platform. Overseer assumes that 30% of the P in this dung is then lost directly to waterways. Research indicates that there is opportunity to mitigate these losses as described above which are likely to be between 38% and 58% effective at reducing P beyond that modelled by Overseer[39].

In the examples below, the baseline has been assessed to be currently implementing laneway P loss management at GMP level at the lower end of effectiveness estimates (38% effectiveness). Under the winter barn example, laneway P loss GMP will be improved and extended by:

- The addition of 0.8km of vegetated buffer zones around riparian areas, including fences around waterways which will ensure that dung deposited on the laneway near where it crosses a waterway will be captured and filtered by the vegetation.
- new culverts crossings (constructed under permitted activity rules) with appropriate cutouts to direct runoff to pasture primarily. The secondary area of filtration and capture is the vegetated riparian buffer zone
- Contouring of the new lane along its entire length to direct runoff to pasture
- Locating the new lane perpendicular to the two waterways on the new block to maximise buffer distance between the new lane and surface water bodies

The implementation of these expanded and improved GMPs has been assessed to conservatively add a further 10% improvement (up to a total of 48% effectiveness).

[38] https://www.massey.ac.nz/~flrc/shortcourses/IntroNotes&MastTest.pdf accessed 24 January 2019

[39] https://www.mfe.govt.nz/sites/default/files/assessment-strategies-mitigate-impact-loss-contaminants-agricultural-land-freshwater_0.pdf accessed 24 January 2019

Under the baseline:

850 cows x 10.9kg P x 0.08 x 0.3 = 222kg P

222 kg P x 38% effectiveness = 84.36 kg P mitigation with current laneway mitigations.

Under the winter barn example:

930 cows x 10.9kg P x 0.08 x 0.3 = 243 kg P

243 x 48% effectiveness = 116 kg P mitigation with current, improved and extended laneway mitigations.

The baseline P losses estimated at 237kg P - 84.36 kg P of mitigations = 153 kg P revised Overseer P loss to water.

The phase 2 P losses estimated at 245 kg P – 116 kg P of mitigations = 129 kg P revised Overseer P loss to water.

Therefore, P losses are likely to be less than those predicted by Overseer under both the baseline and phase 2 of the proposal. P losses are likely to be 24 kg P less under phase 2 than the baseline accounting for the lack of reward in Overseer for laneway mitigations which will be implemented under both scenarios to differing degrees of effectiveness. P losses have therefore been reduced to the practical minimum under the proposal. The implementation of targeted GMPs and mitigation measures should result in effects on the environment which are less than minor.

Hydrology of the catchment

Section 4.4 described the high level of connectivity of the Upper Aparima GMZ with surface water bodies. This connectivity provides for a large and steady discharge of groundwater to surface water bodies with a high correlation between rainfall, stream flow, soil moisture and groundwater levels. The local hydrology of the area indicates that significant amounts of groundwater, recharged via rainfall, discharges into surface water bodies which will provide for considerable mixing and dilution of nutrients from either source (groundwater or surface water). The dilution of nutrients can reduce the concentration of these nutrients in these water bodies which can lead to less prevalence of the adverse effects of water quality degradation and can partly mitigate against the low denitrification potential of the soils in the area.

Catchment Characteristics

The WW5 farm sits within the Aparima River catchment. The Aparima River is a braided gravel bed river and for the majority of its reach, drains farmland of the Southland plains and discharges to the Jacobs

River Estuary. According to a 2014 Aqualinc Report, the Aparima River catchment is 156,474ha comprised of 102 dairy farms, 10 forestry blocks and 233 sheep and beef farms.

Nutrient Load

We have used some of the workings in this Aqualinc report to illustrate how nutrient load can be reduced within a water body. The calculations below are purely an illustration to demonstrate nutrient load reductions and are based on various assumptions and generalized workings and should not be treated as absolute figures in the context of this application.

Total nutrient load within the Jacobs River Estuary catchment have been estimated in the Aqualinc report to assess how much impact the implementation of mitigation measures on farms may reduce N and P load within the estuary at the base of the catchment. The table below estimates three loads:

- the total load from each catchment estimated from catchment models
- the realised load which is based on water quality data and is the load exported from the catchment and includes an attenuation factor
- source load which is the loads delivered to the root zone from the source and doesn't include attenuation.

The table estimates the total source load within the catchment at 2133 T N/year undergoing attenuation to result in an estimated 1300 T N/year as a nutrient load within the receiving waters at the Jacobs River Estuary.

Table 27: Estimated loads of nitrogen and phosphorus in the eight study catchments[40]

Catchment	Current catchment agricultural source loads (t/year)		Total catchment source nitrogen load (t/yr)	Estimated realised nitrogen loads (t/yr)	Estimated attenuation (%)
	Nitrogen	Phosphorus			
Bluff_Harbour	19	1	36	29	20
Haldane_Estuary	23	0	39	26	33
Jacobs_River_Estuary	1958	53	2133	1300	39
Lake_Brunton	20	0	20	14	30
New_River_Estuary	4969	139	5513	3718	33
Toetoes_Harbour	6256	142	6617	4392	34
Waiau_River	2714	35	4970	1864	62
Waikawa_Harbour	144	4	176	180	-2
Total/average	16,102	374	19, 404	11,524	31 (average)

Aqualinc further estimates that in the Jacobs River Estuary catchment, dairy farming contributes 50% of nitrogen load and 64% of phosphorus load. In the context of WW5, the entire farm is within this catchment and therefore may contribute 9,689 kg N to receiving waters based on our Overseer modelling including attenuation at 39%. Realised loads for P are not estimated, so using our Overseer modelling, WW5 may contribute 94 kg P to receiving waters in this catchment using an attenuation rate of 39%.

[40] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

The report then estimated how much these loads may reduce if mitigation scenarios are imposed on only dairy farms within the catchment. For the Jacobs River Estuary catchment, N could be reduced by 18% and P reduced by 31% under the full suite of mitigations (M3).

Table 28: Estimated reductions in the agricultural source loads under three levels of mitigation for all dairy farms in the catchment[41]

Catchment	M1			M2			M3		
	Nitrogen	Phosphorus	Overall[1]	N	P	Overall[1]	N	P	Overall[1]
Bluff_Harbour	4	26	2	4	29	2	12	29	6
Haldane_Estuary	0	0	0	0	0	0	0	0	0
Jacobs_River_Estuary	6	28	5	8	31	6	18	31	15
Lake_Brunton	0	0	0	0	0	0	0	0	0
New_River_Estuary	6	29	5	8	32	7	18	32	15
Toetoes_Harbour	3	17	3	4	19	4	10	18	9
Waiau_River	1	9	0	1	9	1	4	9	2
Waikawa_Harbour	1	4	1	1	5	1	2	5	2

The full suite of mitigations assessed by Aqualinc includes:

Table 29: Description of mitigations assumed to apply under each mitigation level[42]

Mitigation level	Name	Sheep & Beef	Dairy
Mitigation level 1	M1	• Optimised nutrient inputs • Low solubility P • Wetlands	• Stock exclusion from streams • Improved nutrient management • Improved farm dairy effluent (FDE) management
Mitigation level 2	M2	• Stock exclusion from streams • Reduced stocking rates, improved productivity	• Wetlands • Improved FDE management • Reduced stocking rates, improved per animal productivity
Mitigation level 3	M3	• Grass buffer strips • Feed pad for beef cattle	• Restricted grazing strategies • Grass buffer strips • Improved FDE management

In the context of WW5, the farm is currently operating at what could be considered M3 level. Therefore, Aqualinc suggests that WW5 operating at M3 may have resulted in a historic reduction of their contribution to the receiving water load. The mitigations proposed in the application are more specific, comprehensive and likely to be more effective at reducing N, P, sediment and microbial contaminant losses as described in detail in the AEE. Our Overseer modelling for the proposal showed approximately a 1.5% reduction in overall N losses with the implementation of the improved GMPs and mitigation measures and an estimated 15% reduction in overall P losses using calculations of GMP effectiveness

[41] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

[42] Aqualinc, *Assessment of farm mitigation options and land use change on catchment nutrient contamination loads in the Southland region*, 2014

outside of Overseer. This could result in a further reduction of 145 kg N and 14kg P to nutrient load given attenuation.

As the figures above show, the applicant's operation represents a small proportion of the total Aparima River catchment and therefore contributes a small proportionate amount of total nutrient load to the Aparima River (approximately 0.4%). Currently the applicant is operating their dairy farms under restrictions on the discharge activity only and there is no capping or restriction on the amount of nutrients "lost" to the environment contributing to the nutrient load in the receiving waters. Under the proposal, the applicant volunteers both an ongoing restriction on the level of nitrogen outputs modelled by Overseer and the ongoing implementation of specific GMPs and mitigation measures. The result of long term restrictions on the applicant as an operator is that they will be unable to further increase their contribution to contaminant load within any of the receiving water catchments. The Aqualinc report discussed above concluded that if mitigations were implemented on all farms within the catchment, not just dairy farms, then both N and P loads would decrease even more significantly to the tune of 30% for N and 39% for P. Therefore, in time, as other operators in the catchment are restricted in the same manner then there is an expectation that overall nutrient loads will reduce which is likely to improve water quality.

Nutrient Concentration

As described above, the proposal may see a 1.5% and 15% reduction in the applicant's contribution to nitrogen and phosphorus load to the Aparima River catchment. A concurrent reduction in the concentration of these nutrients in these waterways is possible. Section 4.1 of this report detailed the median concentration of nutrients within the Aparaima River between 2009 and 2017. These concentrations would include the implementation of M3 level mitigations on WW5, but will not show the expected improvement in nutrient load under the proposal. For example, WW5 contributes in the vicinity of 0.4% of the nutrient load to the Aparima catchment and the proposal is likely to result in a further 1.5% improvement to nutrient load. Nutrient concentrations are then likely to follow suit and result in a similar and concurrent improvement to median nutrient concentrations in the Aparima River catchment. The median concentrations would then reduce by such a miniscule amount that the reduction in nutrient concentration would be unlikely to show in water quality testing or show a reduction in water quality effects within this catchment on a year end basis. The Aparima River is showing signs of water quality degradation and therefore the proposal is likely to, at a minimum, maintain water quality, and at best, marginally enhance water quality on a long-term basis.

This illustration shows that the applicants operation contributes a small proportion of the total nutrients to the receiving waters. Improvements made under the proposal are likely to reduce total nutrient load and nutrient concentration but will only have a negligible measured impact on water quality on a year end basis. This highlights the importance of catchment wide implementation of water quality mitigation measures and the ongoing restriction on the applicants operation in accordance with nutrient output limits to give certainty that water quality will not be further degraded in the long term.

Summary

The proposal will result in a reduction in P, N, sediment and faecal indicator organisms lost to the environment and a concurrent reduction in the resulting concentration of these contaminants in receiving waters, albeit at an extremely low level. The overall effects on water quality will be positive and make a very small contribution to the existing trends of improving water quality.

10.2 Overseer Modelling for WW5

Overseer models have been included to support this application at the request of Environment Southland as it is their current preference to have Overseer models to guide an assessment of the overall proposal. Overseer nutrient budgets for the proposed landholding need to be provided by May 2019 according to Appendix N of the PSWLP.

The baseline Overseer model is an accurate description of the operation of the applicant's existing dairy platform averaged over the preceding three years since it was converted. All inputs into the model have been taken from three years of farm records and/or accounts and are actual figures and therefore fairly represent the scale of the farm system as it has been operating since 2015. As discussed in Section 3.2, WW5 was granted land use consent AUTH-20157537-04 in 2015 which granted the establishment of a dairy farm on the property under a proposal which detailed that the majority of the proposed dairy platform was to be converted in 2015 and the remaining 45ha Collies block would be purchased by the applicant in 2019 and converted into dairy platform at the time of purchase. The land use consent and the conditions it contained were worded as such to allow for this the two phased conversion of this property. At the time, both Environment Southland and Fonterra were encouraging consent holders who were converting farms under these consents to "establish a dairy farm" to get the consents signed off as complete once the farm was converted, the consent given effect to and all conditions were met in order to enable supply to Fonterra to commence. Accordingly, the applicants surrendered the consent with Environment Southland in April 2016. The issue now arises that a consent was surrendered, either mistakenly or unwillingly by both the applicant and Environment Southland which had ongoing conditions and ongoing obligations for the conversion of Collies block.

In order to resolve this situation, this application seeks land use consent under Rule 20 for the conversion of Collies block to dairy land in recognition of the fact that the land use consent which has previously approved the conversion of this land to dairy land has been surrendered. In order to give credit for the fact that the conversion of Collies block has already been assessed under proper process in 2015, and that the land use consent was surrendered in error, the applicant has agreed in writing with Environment Southland that this block can be modelled in the baseline models as already being dairy land.

The proposed phase 1 model is a predictive model which estimates inputs based on what is planned to happen for the next five years.

The example phase 2 model is also a predictive model which estimates inputs based on what is planned to happen at least five years in the future. This example model uses more assumptions and typical industry-wide input values due to the inherent uncertainties which exist modelling a farm system so much further into the future. This example model must only be viewed as an example, not representing the exact and absolute farm system the applicant proposes to implement in the future. We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels under phase 2.

In recent months, there have been two publications of note regarding the use of Overseer in both a regulatory framework and for water management planning. These include the Parliamentary Commissioner for the Environment's Report on Overseer[43] and Overseer Ltd's review contracted to Enfocus titled Using Overseer in Water Management Planning.[44] Both reports highlight various issues associated with using Overseer models in a regulatory context, as a decision-making tool and for compliance. The Enfocus report specifically provides for a solution to some of these known limitations and issues by advising that N loss output figures are used in a regulatory context. Using an output figure in regulation enables Overseer version changes to be accounted for, and allows the applicant to demonstrate improvement in N loss outputs whilst still maintaining the flexibility to farm to environmental, political and economic conditions as well as provide for innovations on farm. We concur with these recommendations in light of the fact that the Resource Management Act is an effects based piece of legislation.

The applicant requests that the land use consents include a restriction on the nitrogen output from the baseline Overseer model. An example condition would be:

X	(a) The subject land shall only be used in a manner such that when modelled with the current version of OVERSEER, the OVERSEER estimated losses of N to water shall not exceed the Nitrogen Baseline. The determination of compliance with this condition will be made using the modelled N loss from the most recent reporting year. (b) The Nitrogen Baseline means the OVERSEER estimated N loss to water using the current version of OVERSEER using (as far as possible) the original OVERSEER input file information provided with the application for consent *dated February 2019* to demonstrate the long-term baseline N loss to water from the consented activity.	This condition essentially provides a compliance limit, which is assessed based on the baseline file provided in the application. The condition ensures that version changes in Overseer are accounted for.

This application proposes that there are no P output loss figure limits imposed as a consent condition. The reason being is that Overseer models farm system P losses at block scale based on topography, land use, soil type and climate. The calibrations within Overseer for phosphorus are not spatially explicit and although assume good management practice around critical source areas, do not reward spatially specific mitigations. It is therefore difficult for users of Overseer/consent holders to lower P output figures by implementing specific mitigation measures because the modelled P loss output would not be able to accurately reflect these initiatives. The GMPs detailed in the FEMP relate in detail to mitigating P, sediment and microbial losses and the application details further mitigation measures

[43] Parliamentary Commissioner for the Environment, *Overseer and regulatory oversight: Models, uncertainty and cleaning up our waterways*, December 2018

[44] Enfocus, *Using Overseer in Water Management Planning*, October 2018.

which will be implemented under the proposal. Imposing a requirement to implement these GMPs and mitigations measures is a meaningful and effective way of managing the risk of P loss to water.

The applicant accepts that the resulting land use consents will need some restrictions on inputs to ensure there is certainty over the scale of the activity and of the implementation of the mitigations which are crucial to the proposal. The applicant suggests inputs from the nutrient budget be inserted into the consent conditions for the following matters:

- Land area to be used as WW5 milking platform
- Liquid effluent discharge area
- Slurry effluent discharge area
- Peak cow numbers milked
- Minimum and maximum number of cows housed in wintering barns (this restriction in effect controls the number of cows wintered off site)

Overseer is an incredibly useful tool to be able to understand the nutrient interactions of a farm system based on soil properties, rainfall, drainage and feed requirements. The output from the model gives an indication of how much nutrient may be lost beyond the root zone. The model does not tell us what the environmental impact of these losses is likely to be. Assessing the environmental impact of modelled nutrient losses from a subject property is complex because these nutrients travel via a number of different pathways through the receiving environment undergoing attenuation, mixing, dilution and dispersion processes which can significantly change the quantity and nature of these nutrients in the receiving water bodies. The assessment in Sections 9.3 and 9.4 attempts to show how the applicant has assessed the suitability of individual activities within the proposal against likely effects, available mitigations and likely outcome in terms of whether effects are likely to be avoided, mitigated or both.

10.3 AEE for the farming activity under phase 1 of the proposal on WW5

Section 3.2 of this report described the existing environment on the area of the proposed WW5 landholding . These activities are currently occurring as either permitted activities or consented activities under current and enduring resource consents. Policy 39 of the PSWLP directs an assessment of the adverse effects from the activity as a whole, where the permitted baseline cannot be used to justify an existing level of effects or used to justify the effects of a proposal.

The assessment below assesses the farming activity in its entirety and doesn't use a permitted baseline approach to the assessment. This assessment within Section 9.1 is restricted to the proposed activity under phase 1 of the proposal.

Table 30: Assessment of effects at activity level for phase 1 on WW5

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Capital fertiliser applications during conversion of 70ha of sheep land (Cochrans) and 45ha of sheep land (Collies) to dairy farming land	The phase 1 Overseer model does not include capital fertiliser applications because it is based on a long term average farm system operating in equilibrium therefore N and P losses as result of capital fertiliser applications over the conversion period may be higher than modelled by Overseer. Capital fertiliser applications will apply larger quantities of N, P, K and S to land in order to increase fertility. These applications of larger quantities of nutrients have the potential to result in losses to the environment if applied at rates which exceed the plants ability to utilize these applied nutrients. Excess applied N likely to be lost to water bodies via nutrient leaching and artificial drainage	Capital fertiliser application timings avoid high drainage periods such as late autumn and winter and periods when soil temperature is less than 7 degrees to mitigate against excess N leaching through the soil profile. All other fertiliser applications will use a little and often approach to avoid the application of excess nutrients which cannot be utilized. Regular soil testing to guide capital fertiliser requirements to avoid the application of excess N and P which cannot be used for plant uptake to mitigate against losses via artificial drainage.	Capital fertiliser applications will only be done as required by the latest annual soil test results from the Cochrans and Collies blocks where P, K or S levels are below agronomical optimum levels. P = 20-40 K = 6-10 S= 10-12 Capital P fertiliser applications will be applied at a maximum of 100kg P/ha which may require P fertiliser applications to be split.	Capital fertiliser applications are only undertaken where there is a nutrient deficit and are done at a rate which meets this deficit and avoids the application of excess nutrients. There is a low risk of adverse effects eventuating as application will meet pasture demand. The fertiliser regime described in the nutrient budgets will be the default fertiliser regime and capital fertiliser applications will only be done during the early phase of the land conversion and completed using GMP principles and in according to mitigation measures which should adequately mitigate adverse effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	channels on the Braxton, Upukerora and Tuatapere soils. Excess applied P likely to be lost to water bodies via overland flow on Braxton soils only. Excess N and P in water bodies may lead to water quality degradation resulting in ecological stresses on aquatic life and human health consequences such as blue baby syndrome.			
Cultivation of new pastures on new 70ha Cochrans block and 45ha Collies block	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Re-sow bare paddocks as soon as possible Use buffer zones around critical source areas and use direct drilling if possible. Cultivation will be undertaken to meet permitted activity criteria in Rule 25(a) of the PSWLP maintaining a 5 meter buffer zone.	Further mitigations not required as land is flat which reduces the risk of overland flow of sediment and phosphorus when cultivating land. The block contains one waterway (on Collies block) which has riparian buffer zone margins which significantly reduces risks of contaminants entering water bodies directly from cultivation activity.	Adverse effects should be adequately avoided as this is a low risk activity in this location. GMPs provide adequate mitigation of effects.
Construction of new lanes on new 70ha block and new 45ha block	New laneways create high risk areas for sediment, microbial and P losses.	No stockpiling of earthworks material near waterways.	The paddock and lane layout have been designed to ensure new lanes are perpendicular to waterways. Where the lane crosses a waterway, an appropriately	Overseer assumes 30% of dung deposited on lanes is lost directly to waterways, regardless of where the waterways are located in relation to

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Laneways include camber and contouring to direct runoff to pasture and away from waterways Buffer zones will be created in riparian margins to waterways.	sized culvert will be used (within permitted activity rules) with runoff directed to adjacent pasture.	the laneways. Overseer may have overestimated P losses (and sediment losses) in phase 1 proposal model because it doesn't recognise that the applicant will be implementing these GMPs and also siting of the lanes away from waterways as a mitigation measure.
Increase of nutrient losses from the 70ha new block and 45ha new block	The land use change on the two blocks from sheep farming to dairy platform results in an increase of modelled nutrient loss on these specific blocks of land. The N losses from the 70ha sheep block have been modelled to increase by 1,730 kg N and by 25 kg N/ha/year. Under the agreed modelling method, Collies block is not modelled in the baseline as sheep land. It can be assumed that nutrient losses will increase at a proportional rate to the Cochrans block.		The modelled nutrient losses from the WW5 dairy platform have increased under the proposal by a small total of 55 kg N which means that losses on the existing dairy platform have been reduced in general to counteract the increase in contaminant losses from the 73ha sheep block. This concurrent reduction of losses on the platform ensures that overall, nutrient losses do not increase under the proposal on a per hectare basis. The 73ha existing sheep block and 45ha Collies block are both located within the same groundwater and surface water catchments as the remainder of the dairy platform which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal in its entirety. The 73ha existing sheep block and 45ha Collies block are located within the same physiographic zones as the remainder of the dairy platform which ensures that the	The increased modelled contaminant losses from the new blocks are mitigated by the concurrent reduction in modelled contaminant losses across the remainder of the dairy platform. The new blocks and the existing dairy platform are located within the same catchments and physiographic zones meaning that there will be no modelled increase in contaminant losses to water bodies in accordance with the physiographic zone policies and Policy 16 of the RWPS.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Excess nutrients lost from one specific area of land may result in water quality degradation in the receiving waters causing ecological stress for plants and animals.		modelled losses from these physiographic zones does not increase under the proposal in its entirety. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located across the entire dairy platform and therefore will mitigate against contaminant losses from activities located on both of the new blocks and the existing platform.	
Increase in nutrient losses from the existing self-contained dairy platform	The proposal sees a modelled increase in N losses on the self-contained dairy platform. The N losses on this block of land increase by 55 kg N which represents a 0.3% increase. The P losses decrease by 6 kg P and therefore it is expected that sediment and microbial losses also will decrease. Excess nutrients lost from one specific area of land may result in localised water quality degradation in the receiving waters causing ecological stress for plants and animals.		Although modelled N losses from the WW5 platform have increased, there is no change in the per hectare N losses meaning that nutrient losses are being spread over a larger area in the proposal as opposed to being more concentrated on a smaller block of land. The existing dairy platform and the expanded dairy platform are located within the same groundwater and surface water catchments which ensures that the modelled losses entering the receiving water bodies increases by only 0.3% under the proposal. The existing dairy platform and expanded dairy platform are located within the same physiographic zones which ensures that the modelled losses from these physiographic zones increases by only 0.3% under the proposal. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located	The increased modelled contaminant losses from the dairy platform are mitigated by the wider distribution of modelled contaminant losses across the remainder of the landholding. The existing dairy platform and expanded dairy platform are located within the same catchments and physiographic zones meaning that there will be a negligible modelled increase in contaminant losses to water.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
			across the entire dairy platform and therefore will mitigate against contaminant losses from activities located on both the existing platform and expanded platform.	
Discharge of liquid effluent to land via low rate application predominantly using pods and slurry tanker with umbillical	The proposal sees an increase in the number of cows milked on farm from 665 (theoretical) to 800 which means more effluent will be generated which needs to be discharged to land. Potential for contaminant losses via all three pathways: leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain pathways on the Braxton soils	Effluent will always be applied at a depth less than the soil water deficit which ensures nutrients remain in the root zone to be taken up and utilized by plants for pasture production. Effluent area receiving liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilizing low rate effluent application on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone.	No liquid effluent is applied to the Upukerora soils due to their high risk of nutrient leaching/ deep drainage. No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilizing low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area at 133ha is large enough to cater for the additional effluent generated by the additional cows and maintain effluent N loadings at less than 150kg N/ha/year.	Adverse effects to the environment from the discharge of effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of a slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Intensive winter grazing on the WW5 platform	Potential for significant amounts of contaminants (N, P, sediment and microbials) to be lost to both surface and groundwater bodies as a result of the complete de-vegetation of pasture/crop, treading damage on soil structure and runoff following rainfall events.	Buffer zones maintained between crop cultivation and critical source areas to provide an area where runoff can be filtered and captured limiting risks of entering water. Grazing direction will be away from buffer zones/critical source areas leaving last bite to provide a buffer zone for nutrient capture through until the end of the fodder grazing period.	The intensive winter grazing will continue to be located on the milking platform under this proposal because it is predominantly flat with no waterways or artificial drainage channels which avoids the risk of the direct runoff of nutrients to surface water bodies. Cropping is ceased on the Upukerora soils and cropping is now located on the Braxton and Tuatapere soils which have lower N leaching risk compared to Upukerora. However, the Braxton soils are known to be prone to cracking which is not a factor which is considered in the Overseer model. The applicant has	Adverse effects potentially still exist from this activity due to the high level of contaminant losses which occur from intensive winter grazing despite the implementation of GMPs and mitigations. The overall nutrient budget has taken this high contaminant loss activity into account and provided mitigations and reductions in nutrient loss in other areas and activities across the dairy platform to offset adverse effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Nutrient losses from this activity occur via deep drainage through the soil profile into the underlying aquifer or via overland flow into adjacent waterways or artificial drainage channels. Excessive nutrient losses can cause nutrient accumulation in groundwater and excessive nutrient load in waterways causing water quality degradation and the resulting ecological stress on plants and animals when the life-supporting capacity of the water is compromised by excess nutrients. In the current scenario, cropping on the existing dairy platform represents 26% of the N losses within the farm system on 12% of the land area due to the higher concentration of stock in a small area and thus greater urine deposition. On the	Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks of contaminant losses through leaching and overland flow. All other GMPs listed in rule 20 will be implemented by May 2019. Bare soils are cultivated using full cultivation and timed to avoid paddocks siting bare for long periods of time which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching.	seen little evidence of cracking on the Gladfield block and cracking does not generally occur in the winter period because it is a condition impacted by drier temperatures and low soil moisture levels. To mitigate against the risk of contaminant losses via cracking, the applicant will cultivate intensive winter grazing paddocks in early spring to ensure pasture cover is established going into summer which can suck up nutrients for their growth and soil moisture is maintained and held in the profile as much as possible over the spring and summer. This will mitigate against risks to water quality in the underlying aquifer and surface water receiving bodies. Crop area is reduced by 4ha. The additional dairy replacements from other Woldwide dairy farms previously grazed on crop on WW5 have been removed.	The GMPs and the mitigations proposed will mitigate adverse effects to a certain extent, with the long term goal of the applicant to abolish intensive winter grazing from the Central Plains/Heddon Bush area. The effects of this activity will be limited to a five-year timeframe.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	existing Cochrans block, cropping contributes 33% of total losses from 6% of the total land area. Nutrient losses from the crop block reduce under the proposal to 15% of total losses over 11% of the land area.			
Increase in cow numbers to consented discharge permit levels.	The grazing of more cows on pasture during high risk periods increases the risk of the leaching of nutrients (N,P and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage. Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Increased nutrient losses as total figures due to more cows, to groundwater and surface water bodies may potentially cause water	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses. Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which	Stocking rate will reduce from 3.2 cows/ha to 2.1 cows/ha with the introduction of the additional land to the dairy platform with a comparatively smaller increase in cow numbers. A stocking rate reduction results in a reduction in nutrient losses on a per hectare basis as a result of an increase of cows producing urine and dung spots which are significant sources of contaminant losses to the root zone over a larger area of land, thereby reducing per hectare nutrient loadings. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage. Use of in-shed feeding when feed deficits occur to ensure stock enter paddock break having already eaten some food which can limit pugging and treading damage, particularly under adverse weather conditions.	A reduction in stocking rate mitigates effects of the small increase in cow numbers on total nutrient losses modelled by Overseer. Adverse effects on the environment adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate accumulation in groundwater and potentially bowel cancer as discussed in section 9.1 above.	can maintain overall nutrient losses at desired level.		
Fertiliser application regime across the entire landholding	The application of nutrients in fertiliser has the potential to result in direct nutrient losses to the environment if fertiliser is applied either in excess to plant requirements or at a time when it cannot be utilized for pasture/crop production. Nitrogen losses from fertiliser application most likely to occur via deep drainage. Phosphorus losses from	Time N, P, K and S fertiliser application to meet crop and pasture demand using split applications and avoid high risk times of the year i.e. when soil temperature is less than 7 degrees, during drought periods and during periods when soils are at field capacity. Reduce use of P fertiliser where Olsen P values are above agronomic optimum. Maintain Olsen P levels at around 30-40.	Urea applications on all blocks occur using a little and often approach. Applied N in fertiliser has reduced across the whole property. N fertiliser has reduced on non-effluent blocks and on effluent blocks. These changes have been enabled due to the increase in land area, decrease in urea applied and increase in the spread of effluent. January fertiliser application on the Upukerora blocks has been ceased.	The proposed fertiliser regime under phase 1 has been improved given the need for lower pastoral production (of 1 T DM/ha) with the stocking rate reduction. Less nitrogen is available from supplements and more is supplied by the additional effluent which equates to an overall reduction in fertiliser needed under the proposal. Adverse effects both avoided and mitigated with use of GMPs for fertiliser usage and further mitigations

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	fertiliser most likely to occur via soil loss and/or direct loss through runoff or erosion. Adverse effects of inappropriate fertiliser application or excess application include a loss of excess nutrients to water causing water quality degradation in both groundwater and surface water bodies. Water quality degradation can adversely impact aquatic plant and animal ecosystems and impact on human health.	Use nutrient budgeting and annual soil testing to manage nutrient inputs from fertiliser and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.		to reduce fertiliser across the dairy platform.
Imported supplementary feed and feed made on-farm and fed during the season	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N needs to be supplied to fuel pasture production which in		Supplementary feed imported onto the property has reduced by 39 T of barley grain and brewers grain. Supplementary feed made and fed during the season is unchanged.	The reduced stocking rate has necessitated the reduction in imported supplementary feed to reconcile pasture production between the two systems. Likely to have positive effects on the environment.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.			
Slurry effluent application across the entire landholding	The nutrient concentration of slurry effluent is higher than liquid or FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application of slurry effluent to land needs to be carefully managed to ensure that nutrient loadings on any particular land area do not exceed the recommended level of 150 kg N/ha/year from effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted. If nutrient loadings exceed 150 kg N/ha/year or nutrients are applied in excess then there is a risk of contaminant loss (N, P, sediment and microbial) to groundwater and surface	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees in spring. Effluent will always be applied at a depth less than the soil water deficit which ensures nutrients remain in the root zone to be taken up and utilized by plants for pasture production.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e. blocks where FDE is not applied. The non-effluent blocks are the same in terms of FDE classification, soil type and physiographic zone to the approved effluent blocks so is considered equally as suitable for receiving slurry effluent. Slurry effluent applied to paddocks low in potash (K levels lower than 6-10) and with low Olsen P levels (P levels lower than 25) . Slurry effluent from neighbouring Woldwide Three is approved under an existing discharge permit to be exported to WW5 and is therefore included in the baseline and phase 1 models.	Adverse effects to the environment from the discharge of slurry effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects is supported by Policy 42 of the RWPS. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated. The application of slurry effluent to paddocks low in P and K can act as a capital fertiliser application and bring soil test levels up to agronomical optimum which will increase pasture productivity.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	water bodies. Adverse effects from contaminant loss to water include water quality degradation which can adversely impact aquatic ecosystems and the overall health of water bodies. Slurry effluent will be applied to areas outside of the liquid discharge area approved under the discharge permit. Slurry effluent is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that liquid effluent has.			
Use of three small standoff pads on the dairy platform	Standing cows off pasture in marginal periods especially during late Autumn and early Spring reduces the risk of pugging to pastures which reduces the infiltration ability of soils and reduces overland flow of nutrients.	Urine and dung deposition during high risk periods is redistributed to pasture when soils are in a suitable state to receive and utilize applied nutrients. The standoff pad is located in accordance with the setbacks listed in Rule 35 of the PSWLP and is constructed, used and maintained	The standoff pads will be used occasionally to stand between 100 and 120 cows each off pasture during the milking season (modelled as during April, May, August and September).	Standoff pads are used as an effective and simple environmental mitigation tool to reduce nutrient losses to the environment which can occur primarily during high risk and high drainage periods. Soil degradation is protected as a result which increases pasture productivity and nutrient utilization.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Nutrients in effluent generated by the cows during these periods spent on standoff structures coincides with high drainage periods which ensures that these nutrient can be stored in situ and applied to land in a manner which matches plant demand and mitigates against excessive leaching processes which can lead to the contamination of groundwater and surface water bodies. An overall reduction in nutrient losses from the landholding reduces nutrient accumulation risks in groundwater and reduces nutrient load in waterways. A reduction in nutrient load can improve water quality and maintain and enhance the life-supporting capacity of water bodies.	under the permitted activity criteria meaning that the pads themselves do not require resource consent. The solid effluent is applied to land in accordance with permitted activity criteria in Rule 38 of PSWLP.		

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Use of the existing effluent storage facilities on the dairy platform	If a structure is leaking or not structurally sound there is a risk of contaminant losses directly to shallow groundwater. Contaminant accumulation in groundwater can lead to human health issues from blue baby syndrome or E.coli contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can cause water quality degradation effects such as algal blooms, smothering and eutrophication in surface water bodies.	Monthly effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately. Fail safe systems will be kept in place and kept in good working order i.e automatic alarms and shut off system. All staff involved in the management of the effluent system are fully trained in its use.	Drop tests will be completed on the slurry bunker in July when milking stops for the season as these areas are first collection points for effluent there is no mechanism by which to divert effluent during the 48hr drop test period.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided and remedied immediately.
Groundwater abstraction	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users.	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset.	The yard is scraped to significantly reduce fresh water use at the dairy shed.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because the more water used, the more effluent generated which needs to be discharged to land.			

10.4 AEE for the farming activity under phase 2 of the proposal

Phase 2 of the application involves the introduction of a wintering shed into the farm system as a major mitigation measure for reducing nutrient losses across the dairy platform. The transition to a farm system which includes a wintering shed enables the removal of high-risk activities for nutrient losses from high risk areas on the farm.

We also note that Environment Southland consent staff have advised the applicant that a nutrient budget for phase 2 is not considered a requirement for this application, however the applicant has chosen to provide one to strengthen their proposal and to show that nutrient losses can be reduced to baseline levels.

The intention of phase 2 is to introduce wintering sheds into the farm system which will reduce nutrient losses on the dairy platform. The applicant proposes that the land use consent be issued requiring them to operate the farm system in phase 2 at a level equal to or less than the modelled nutrient losses (predicted by Overseer) submitted in the baseline models. Therefore, we are applying for phase 2 of the application to be governed by a land use consent based on an Overseer output figure to enable the applicant to operate an entirely flexible farm system under the resulting land use consent. Our proposal is that only input values relating to the scale of the activity derived from the example nutrient budget are inserted as consent conditions in the land use consent.

The assessment below attempts to show how the applicant has assessed the suitability of individual activities within the proposal against likely effects, available GMPs and mitigations and likely outcome in terms of whether effects are likely to be avoided, mitigated or both. The assessment lacks reference to specific input figures to show that an output-based land use consent is appropriate and still provides certainty of effects and effectiveness of mitigations.

Table 31: Assessment of effects at activity level for phase 2 on WW5

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Decrease in nitrogen losses from the entire dairy platform	The proposal sees a modelled decrease in total N losses on the landholding. The N losses decrease from 15,882 kg N in the baseline to approximately 15,639 kg N. An overall reduction in total nitrogen losses from the dairy platform reduces nitrate accumulation risks in groundwater and reduces nitrogen load in waterways. A reduction in overall nitrogen load can improve water quality and maintain and enhance the life-supporting capacity of water bodies.		The removal of the winter grazing activity from the dairy platform results in a significant reduction in modelled N losses from the dairy platform. The intensive winter grazing activity is removed from the central plains area and either relocated to WRO or reduced in intensity by utilizing the wintering sheds. The use of wintering sheds provides additional mitigation of nitrogen losses across the platform.	The reduction in modelled nitrogen losses from the landholding to the lowest practicable level should correlate with a nutrient load reduction in the receiving water bodies and/or physiographic zones in accordance with the physiographic zone policies and Policy 16 of the RWPS.
Modelled Increase in phosphorus losses from the entire landholding	The proposal sees a modelled increase in P losses from the entire landholding of 8kg P compared to baseline, however this increase is not expected to occur in reality.	Avoid working CSAs and their margins All riparian margins to be fenced and left to establish with grasses to enable filtration of contaminants that	All new laneways will be located away from waterways and riparian margins implemented.	Please see section 8.4 of this report for full assessment of expected P losses and full assessment of proposed mitigations and their effectiveness.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		may be transported via overland flow processes and erosion Reduce use of P fertiliser where Olsen P levels are above agronomic optimum. Reduce the risk of runoff from laneways and other sources by ensuring crossings are adequately maintained and maintain gradients to direct runoff to pasture. Please see section 8.4 of this report which discusses further P loss GMPs proposed by the applicant and discusses how P (and sediment and microbial) losses are likely to be misrepresented by Overseer modelling.		
Use of wintering sheds	Nutrients in effluent generated by the cows during winter and in marginal periods is stored and applied to land in a manner which matches plant demand and mitigates against excessive leaching processes which can	Urine and dung deposition during high risk periods is redistributed to pasture using the effluent management system when soils are in a suitable state to receive and utilize applied nutrients.	The wintering sheds will be used to winter the majority of the milking herd from June through till calving dates. Two primary scenarios would exist under an output based land use consent: - All mixed age cows and R2 replacements are wintered in the sheds for the winter period totalling 1030-1050 cows.	Adverse effects from winter grazing on the high risk soils on the dairy platform are ceased. Wintering sheds significantly reduce nutrient losses to the environment and can offset adverse effects from activities on the remainder of the

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	lead to the contamination of groundwater and surface water bodies. An overall reduction in nutrient losses from the landholding reduces nutrient accumulation risks in groundwater and reduces nutrient load in waterways. A reduction in nutrient load can improve water quality and maintain and enhance the life-supporting capacity of water bodies. Standing cows off pasture in late Autumn and early Spring reduces the risk of pugging to pastures which reduces the increases the infiltration ability of soils and reduces overland flow of nutrients.	The wintering sheds are located in accordance with the setbacks listed in Rule 35 of the PSWLP.	- All mixed age cows are wintered in the sheds for the winter period totalling 770 and R2 replacements are grazed on fodder crop at WRO and return to the platform towards the end of July/beginning of August for calving. Intensive winter grazing will cease entirely on the dairy platform under this proposal and the land will be used as dairy platform. The dry of date is extended to 15th June because cows are able to be kept indoors towards the end of the milking season. The wintering sheds can be used during the autumn and spring to remove cows from pasture during high drainage periods to protect soil structure, avoiding tramping of feed and avoid urine and dung deposition.	landholding by lowering the total quantity of nutrients lost to the environment.
Increase in cow numbers to 930 across dairy platform	The grazing of more cows on pasture during high risk periods increases the risk of the leaching of nutrients (N,P	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading	Stocking rate will increase from 2.1 cows/ha under phase 1 to to 3.2 cows/ha under phase 2 with the introduction of more cows onto the same land area as phase 1.	The marginal stocking rate reduction is unlikely to have a discernible impact on per hectare nutrient loadings which is why the introduction of the

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	and microbials) through the soil profile from urine and dung spots or transported via subsurface drainage. Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Increased nutrient losses as total figures due to more cows, to groundwater and surface water bodies may potentially cause water quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate	damage to soil structure which can accelerate contaminant losses. Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	Overall, there is a marginal stocking rate reduction of 0.1 cows/ha compared to the baseline scenario. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage. Use of in-shed feeding when feed deficits occur to ensure stock enter paddock break having already eaten some food which can limit pugging and treading damage, particularly under adverse weather conditions. Use of the wintering shed as a standoff area to offset additional nutrient losses that may occur with higher number of cows grazing during adverse weather conditions. Use of the wintering shed to winter the majority of the herd off the support block and the subsequent removal of intensive winter grazing from the dairy platform	wintering shed forms the most significant mitigation measure alongside other minor mitigations. Adverse effects on the environment will be adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	accumulation in groundwater.			
Discharge of liquid effluent to land via low rate application predominantly using pods, and slurry tanker will umbillical to existing effluent discharge area (existing platform)	The proposal sees an increase in the number of cows milked on farm from 850 to 930, plus the introduction of a wintering shed as a generation area for effluent which means more effluent will be generated which needs to be discharged to land. Potential for contaminant losses via all three pathways: leaching (N), artificial drainage (N, P, microbials) and overland flow (N, P, microbials) when nutrients in effluent are applied to land. Potential for contaminant losses to cause excess nutrients in surface water and groundwater bodies in the vicinity of the property, particularly via tile drain pathways on the Braxton soils	Effluent will always be applied at a depth less than the soil water deficit which ensures nutrients remain in the root zone to be taken up and utilized by plants for pasture production. Effluent area receiving liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilizing low rate effluent application on the Braxton soils which are poorly drained to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land.	No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilizing low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area is large enough to cater for the additional effluent generated by the additional cows and maintain effluent N loadings at less than 150kg N/ha/year.	Adverse effects to the environment from the discharge of effluent should be no more than minor. Effluent application rates, GMPs and the resulting avoidance of effects supported by Policy 42 of the RWP. The discharge of effluent is governed by the consent conditions in the discharge permit giving certainty that the activity will be regulated.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	In general, excess nutrients result in water quality degradation causing ecological stress for plants and animals.	Use of a slurry tanker to discharge larger volumes of effluent to low risk soils (Tuatapere) when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.		
Imported supplementary feed and feed made and fed during the season across the entire landholding	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N needs to be supplied to fuel pasture production which in turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.		Supplementary feed imported onto the property is likely to increase under this scenario. The example Overseer budget modelled an increase in the vicinity of 135 T of barley grain, 35 T of distilled brewers grain, 300 T PKE and allows for lactation to be extended. Supplementary feed made and fed during the season is increased to 1250 T DM silage.	The increased number of cows and longer lactation requires the need to increase supplementary feed to reconcile pasture production. Additional fertiliser and barn slurry also needed to reconcile pasture production. Increased supplementary feed can reduce overall N cycling in a system which can result in less overall N losses to the environment and the mitigation of adverse effects on water quality.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Slurry effluent application across the entire landholding	The nutrient concentration of slurry effluent is higher than liquid or FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application o fslurry to land needs to be carefully managed to ensure that nutrient loadings on any particular land area do not exceed the recommended level of 150 kg N/ha/year from effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted. If nutrient loadings exceed 150 kg N/ha/year or nutrients are applied in excess then there is a risk of contaminant loss (N, P, sediment and microbial) to groundwater and surface water bodies. Adverse effects from contaminant loss to water include water quality degradation which can adversely impact aquatic	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees in spring.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e blocks where FDE is not applied. The non-effluent blocks are the same in terms of FDE classification, soil type and physiographic zone to the approved effluent blocks so is considered equally as suitable for receiving slurry effluent. Slurry effluent is applied at a depth of no more than 2.5mm to maintain effluent loadings. Effluent from WW3 is applied evenly to the approved discharge area.	The application of slurry effluent to land will be undertaken under the conditions and provisions of the discharge permit and adverse effects from this activity are expected to be no more than minor.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	ecosystems and the overall health of water bodies. Slurry effluent will be applied to areas outside of the liquid discharge area. Slurry effluent is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that pure liquid effluent has. A significant amount of additional slurry effluent is generated from the wintering sheds which needs to redistributed to land evenly and at a rate which matches pasture and crop demand to avoid direct losses of nutrients to the environment as described above.			
Use of the existing effluent storage facilities on dairy platform	If a structure is leaking or not structurally sound these is a risk of contaminant losses directly to shallow groundwater. Contaminant	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist.	The applicant will be continuing to operate under the existing land use consents for the use and maintenance of these structures granted under phase 1.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	accumulation in groundwater can lead to human health issues from blue baby syndrome or E.coli contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can cause water quality degradation effects such as algal blooms, smothering and eutrophication in surface water bodies.	Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use		Adverse effects from leakage should be avoided or remedied immediately.
New effluent storage facilities on dairy platform	New effluent storage facilities are designed in accordance with current specifications and will include leak detection systems which ensures that any leakages can be quickly identified and remedied. Adverse effects from leakage are the same as described above for existing effluent storage facilities	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	New effluent structures will contain leak detection systems and will be consented by way of land use consents applied for prior to the commencement of phase 2. A regular drop testing regime will be implemented in accordance with likely consent conditions.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures. Adverse effects from leakage should be avoided or remedied immediately.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Groundwater abstraction on the dairy platform	Groundwater abstractions must be at a rate which doesn't cause drawdown effects on adjacent bores which can compromise the availability and reliability of the resource for other users. Groundwater abstractions must be at a level which does not result in an over-allocation of the resource which can adversely impact on drinking water availability, water availability for commercial and industrial uses. Water use in the dairy shed should be managed to ensure there is little wastage because the more water used, the more effluent generated which needs to be discharged to land.	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset. Monitoring of the groundwater abstraction volumes on a monthly basis.	The yard is scraped to significantly reduce fresh water use at the dairy shed which considerably lowers effluent generation throughout the milking season. Effluent storage requirements are reduced.	No adverse effects on aquifer sustainability or the availability and reliability of water for other users. Groundwater usage is reasonable in terms on end use. Adverse effects should be less than minor.

11. ASSESSMENT OF ENVIRONMENTAL EFFECTS FOR PROPOSAL ON WRO

Please see attached document in Appendix F named "Woldwide Runoff – Proposal and AEE" for a full assessment of environmental effects on WRO.

12. NOTIFICATION AND CONSULATION

The applicant requests that the consent authority publicly notify this application in accordance with s95A of the Resource Management Act.

13. STATUTORY CONSIDERATIONS

Schedule 4 of the RMA requires that an assessment of the activity against the matters set out in Part 2 and any relevant provisions of a document referred to in Section 104 of the RMA is provided when applying for a resource consent for any activity. These matters are assessed as follows.

13.1 Part 2 of the RMA

Part 2 of the RMA states the general purpose to the Act which is to promote the sustainable management of natural and physical resources. Sustainable management is explained to mean managing the use, development, and protection of natural and physical resources in a way which enables people and their communities to provide for their economic social and cultural wellbeing while sustaining the reasonably foreseeable needs of future generations, or on the life-supporting capacity of the environment and any ecosystems associated with it and avoiding remedying and mitigating adverse effects on the environment.

The proposal is for a farming activity which utilizes natural resources. The continuation of the activity as proposed will enable the applicant to provide for their economic and social wellbeing, and that of the immediate small Southland community and the wider regional economy in which it operates. The applicant has described that potential adverse effects of the proposal may exist, however they consider that these adverse effects have been adequately identified and assessed as able to be avoided, remedied and mitigated under their proposal.

Section 6 of the RMA requires consideration of several matters of natural importance. The matters specifically relevant to this proposal include:

- The preservation of the natural character of the coastal environment, wetlands, and lakes and rivers and their margins and the protection of them from inappropriate subdivision, use and development
- The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga

The proposed activities will not impact directly on the coastal environment, wetlands, lake and rivers however there is the potential for water quality effects on the wider receiving environment which includes these features. The applicants assessment of environmental effects identifies potential effects on these receiving water bodies and provides appropriate and adequate mitigation measures to avoid adverse effects. The applicant acknowledges Maori have a long history and relationship with the area and consider that their proposal will not compromise or have an adverse impact on Maori culture, traditions or taonga.

Section 7 lists matters which all persons shall have regard to. This application has given particular regard to the efficient use and development of natural resources, intrinsic values of ecosystems and the maintenance and enhancement of the quality of the environment. The proposed activity is not inconsistent with the principles of the Treaty of Waitangi as required by Section 8.

Overall, the activity is considered to be consistent with Part 2 of the RMA, given the incorporation of proposed mitigations for the activity.

13.2 Section 104(1)(b) of the RMA

In accordance with Schedule 4 of the RMA, an assessment of the activity against the relevant provisions of a document referred to in 104(1)(b) of the RMA must be included in an application for resource consent. Relevant documentation covered by this section are:

- National Policy Statement for Freshwater Management, 2014
- Te Tangi a Tauira - The Cry of the People, Ngai Tahu Ki Murihiku, Natural Resource and Environmental Iwi Management Plan, 2008
- Regional Policy Statement for Southland, 2017 (SRPS)
- Regional Water Plan for Southland, 2010 (RWPS)
- Proposed Southland Water and Land Plan, 2018 (PSWLP)

For ease, policies from these documents have been grouped together under subjects relevant to this application. The most relevant objectives and policies to this application have been selected, with particular weighting and consideration given to the policies contained with the Proposed Southland Water and Land Plan 2018 (PSWLP). We appreciate that the PSWLP is currently under appeal and is therefore still a moving entity, however we consider that the background to this plan including the policies it contains has considered all of the other planning documents in its development and therefore a higher level of assessment is provided for the policies it contains.

13.2.1 *Water Quantity*

Regulatory Document	Particularly relevant Sections
National Policy Statement for Freshwater Management	Objective B5 Policies B1, B2, B4, B8
Southland Regional Policy Statement	Policy WQUAN.3, WQUAN.6, WQUAN.7
Regional Water Plan for Southland	Policy 21, 28
Proposed Southland Water and Land Plan	Policy 20, 21
Te Tangi a Tauira	Section 3.5.14 Policies 4, 16

These objectives and policies set a clear direction that freshwater needs to be allocated to safeguard the life supporting capacity of freshwater ecosystems whilst still enabling communities to provide for their economic well-being. The policies of particular relevance from the Southland Policy Statement relate to ensuring that the volume of water abstracted is needed for a particular use and is allocated to it. In this instance, the groundwater abstractions are required for dairy farming purposes and are set at a quantity which is suitable for the intended end use based on nutritional requirements of dairy cows and the infrastructure setup at the dairy sheds. This notion is supported by policy 21 of the RWPS. This application is consistent with Policy 28 of the PSWLP and Policy 21 of the RWPS as effects on aquifer storage volumes, existing water users, surface water flows and groundwater quality will not be adversely affected due to the proposed decrease in water quantity sought by the applicant. The proposal is consistent with all water quantity policies in Te Tanga a Tauira specifically Policy 4 preferring groundwater abstractions and policy 16 requiring monitoring devices which will be installed.

13.2.2 *Land use change*

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Objectives RURAL.1, RURAL.2 Policies RURAL.1, RURAL.2,
Proposed Southland Water and Land Plan	Policy 15A, 16 Policies 5, 10, 12
Te Tangi a Tauira	Section 3.5.7, 3,5,13

The applicants have made a commitment to abolish intensive winter grazing from their farm systems within the high risk Central Plains area and introduce wintering sheds to house all cows inside over high risk drainage periods. The proposal is a cumulation of the applicants wanting to farm in an environmentally sustainable manner whilst still enhancing the productive capacity of their farms and providing for their economic and social well-being. The proposal is therefore consistent with the objectives and policies in the SRPS that reiterate the notion of supporting the sustainable use and development of rural land resources, both environmentally and economically, if undertaken in an appropriate manner.

Policy 16 of the PSWLP holds some of the greatest weight in regards to this application. The policy includes a number of different issues and factors, so only the parts of relevance to this application have been extracted and assessed and emphasis has been added. Policy 16.1 (a) only refers to new dairy farming of cows in close proximity to regionally significant waterways which this application is not for as the application is for the expansion of an existing dairy operation.

Policy 16.1 requires the minimisation of adverse environmental effects from farming activities as a priority. Part (b) of the policy states that this can be done by generally not granting consents for expanded dairying or intensive winter grazing activities where adverse effects on water quality cannot be avoided or mitigated. Our assessment of effects has assessed the expanded dairy farming activity in its entirety in the absence of a permitted baseline or consented baseline approach which has allowed us to show how nutrient losses from the activity have been minimised as far as practicable whilst still maintaining a viable farm system. Nutrient budgeting has been used extensively to model the applicant's operations in the decision making process for this proposal. In the course of deciding on a final proposal, numerous farm systems were investigated and run through nutrient budget software which sited different activities on different parts of the landholding under various forms of management. The resulting proposal provides for the greatest minimisation of nutrient losses that could be sustained by the applicant. Our cumulative effects assessment concluded that this minimisation of nutrient losses and the subsequent reduction in nutrient losses under the proposal will result in adverse effects on water quality which are less than minor considering the scale of the applicants operation within the receiving environments.

The policy provides for a method by which adverse effects can be minimised which is by the avoidance or mitigation of these effects. The policy specifically uses the term "or" suggesting that methods which either avoid or mitigate are acceptable. Our proposal adopts a variety of measures which either avoid or mitigate against adverse effects on water quality which are described in detail in Sections 8.3, 8.4, 9.3 and 9.4. For example, the use of a wintering shed avoids direct deposition of nutrients in dung and urine to land during the winter period. The removal of intensive winter grazing from the Central Plains area avoids soil damage and direct losses of nutrients via all three transport pathways during the winter period from soils present on the Gladfield block and on the WW5 platform which are susceptible to nutrient leaching and nitrate accumulation. The implementation of a fertiliser regime that uses partial substitution of fertiliser with effluent and a little and often approach mitigates against nutrient losses particularly through deep drainage processes. GMPs in relation to riparian management, laneway runoff and CSA management mitigates against nutrient losses directly to surface water bodies. The cumulative effects assessment in Section 8.1 and 9.1 and in the WRO AEE brought all of the proposed activities with their corresponding mitigation measures and GMPs together and assessed the effect that this might have on the receiving environments. Our assessment concluded that the proposal will result in a long-term reduction in the nutrient load it will contribute to receiving waters in terms of N, P, sediment and microbials given the mitigations proposed and the imposition of nutrient limits. In turn, a reduction in total nutrient load in the receiving waters combined with the attenuation processes and hydrological processes at work in the catchment should reduce the concentration of nutrients in the receiving waters. A reduction in both nutrient load and concentration should result in the maintenance and possible enhancement of water quality in receiving waters and therefore the avoidance or mitigation of adverse effects on aquatic ecosystems and the life-supporting capacity of freshwater in accordance with both Policy 16 and 15A.

Policy 16.2 is met in its entirety by the Farm Environmental Management Plan submitted with the application. This plan identifies the critical source areas on the landholding and describes how they will be managed by the applicant to minimise nutrient losses at these points.

Policies 5, 10 and 12 relate to the physiographic zones on the two landholdings. All three policies require the avoidance, remedying or mitigation of adverse effects on water quality within these zones by the implementation of GMPs, consideration of the key contaminant pathways and generally not granting consent for expanded dairying or intensive winter grazing where contaminant losses will increase as a result of the proposal. The application is explicit and comprehensive in the implementation of a wide range of GMPs across both landholdings and the consideration of key contaminant pathways which guide which GMPs are adopted and which further mitigations are necessary. Our AEE concludes that the range of mitigations will be successful in avoiding or mitigating contaminant loss to the environment. Part 3 of these physiographic policies appears to direct decision makers to generally not grant consent where contaminant losses increase within these physiographic zones. The nutrient budgeting attached to this application has not blocked the farm systems in accordance with physiographic zoning as it is not considered the most representative method of blocking the farm because these zones contain different soil types and management.

The existing WW4 landholding is located on the Central Plains physiographic zones. The new sheep block being brought into the WW4 dairy platform is located on the Central Plains and Oxidizing physiographic zones. As described in the AEE, contaminant losses may increase under the proposal on the dairy platform, but that will be offset with concurrent reductions in other parts of the landholding due to mitigation measures spread over the entire landholding. As such, the Oxidizing physiographic zone may see an increase in contaminant loss under the proposal because of the land use change on the 63ha part of Cochrans block. The portion of the landholding within the Oxidizing zone is 24ha which represents 5% of the total area of the WW4 landholding. This equates to approximately 27kg N increase in total N losses within the Oxidizing Zone and 2kg P increase in total P losses within the Oxidizing Zone. We submit that increases in losses of this magnitude over the entire Oxidizing Zone in this catchment would create de minimis effects within the receiving water bodies. A similar correlation can be made to the potential increase in intensive winter grazing at WRO where an increase in losses would create a de minimis effect within the surrounding low risk receiving environment. As the RMA is an effects-based piece of legislation, we assert that the application is consistent with Policy 10.3 due to the de minimis effects and accordingly there is no reason why consent should not be granted.

The new block on WW5 is located within the same three physiographic zones as the existing WW5 landholding and therefore no parts of the landholding within specific physiographic zones will see an increase in contaminant losses because all increases are offset within the same physiographic zone, thereby being consistent with Policies 5.3, 10.3 and 12.3.

13.2.3 ***Water Quality***

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Objectives WQUAL.1, WQUAL.2 Policies WQUAL, 1, 2, 5, 7, 8
Proposed Southland Water and Land Plan	Policy A4 of NPS Policies 15A, 15B
Te Tangi a Tauira	Section 3.5.13

Objective WQUAL.1 is of significant relevance to the proposal as it sets the water quality framework for the management of water quality in Southland. This objective requires four primary things:

- The life supporting capacity of water and related ecosystems is safeguarded
- The health of people and communities is safeguarded
- Water quality is maintained or improved in accordance with the National Policy Statement for Freshwater Management 2014
- And freshwater quality is managed to meet the reasonably foreseeable social, economic and cultural needs of future generations.

The concurrent policies expand and re-iterate on the functions of this overarching principle. The PSWLP adds a couple of policies in the form of Policy 15A and 15B which are of vital importance to this application. These policies apply the same notion of maintaining and improving water quality in water bodies which meet or do not meet relevant water quality standards respectively.

Our application has discussed these issues in depth, particularly in the three cumulative effects assessments where we have illustrated the likely effect that this proposal will have on total nutrient load and nutrient concentration in the end receiving environments. Our illustration showed that the proposal represents a very miniscule proportion of the total nutrient load to receiving waters and the proposal will have a de minimis effect on water quality which will ensure water quality is at least maintained, and at best, enhanced. We can confidently say that the proposal is consistent with these objectives and policies listed above.

13.2.4 ***Effluent discharge***

Regulatory Document	Particularly relevant Sections

Southland Regional Policy Statement	Objectives WQUAL.1, Policies WQUAL.8, WQUAL.10
Proposed Southland Water and Land Plan	Policy 17 Policies 13, 14
Te Tangi a Tauira	Section 3.5.1

Policies throughout the relevant planning documents stress a preference for the discharge of contaminants to land as it creates less environmental effects, enables an effective and efficient re-use of a waste product and protects cultural values as described in Te Tangi a Tauira. The management of effluent in the proposal meets best practice and is designed to completely avoid any surface runoff, overland flow, ponding, contamination of water via subsurface drainage channels from the application of effluent to land. The land which will be receiving effluent has been considered suitable and the discharge areas are sized appropriately to lower overall nutrient loads from the application of effluent.

The effluent discharge activities will continue for the duration of the consents in the manner in which they have been described in the application. However, there is scope within the system to ensure new technologies and innovations can be incorporated in the future if need be which will only but improve the effluent discharge activity.

13.2.5 *Tangata Whenua*

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Policies TW.3, TW.4
Proposed Southland Water and Land Plan	Policy 1, 2, 3
Te Tangi a Tauira	Entire document

The Southland Regional Policy Statement describes the resource management issues important to Ngai Tahu in the Southland region and includes ensuring tangata whenua is considered in decision making, iwi management plans are recognised, taonga and sites of special significance are protected and food gathering resources are protected. Te Tangi a Tauira is the iwi management plan recognised by Ngāi Tahu which encompasses the Southland region. Policies TW.3 and Policy 2 of the PSWLP require iwi management plans to be taken into account.

This proposal includes activities which are primarily contained within the applicants property boundary and should not materially impact on tangata whenua values or compromise sites of special significance or food gathering sites. The cumulative effects assessment concludes that any effects felt outside the boundary of the property will negligible and not impact on cultural values.

In addition, the application provides for the following in accordance with Te tangi a tauira:

- The provision of buffer zones to water abstraction sites and waterways;
- The application of effluent is to land rather than water;
- The applicant already adopts best practice for land application of managing farm effluent;
- The existing riparian margins are protected;
- Deferred application of FDE is provided for;

- Nutrient loading from effluent discharges to land is already within industry best practice limits;
- The system and management practices are considered appropriate for the risks associated with the receiving environment;
- Water abstraction is monitored with metering results to be submitted to Council;
- Regarding Policies 3.5.14.17 and 3.5.1.17, the consent periods proposed are less than 25 years.

14. CONSENT DURATION, REVIEW AND LAPSE

With regard to consent duration, special consideration has been given to Policy 16 and 40 of the PSWLP, which have been grouped below for ease of assessment.

Certainty of the nature, scale, duration and frequency of effects

Potential effects of the proposed activities are understood reasonably well and these are to be managed as far as reasonably practicable. Council's level of knowledge regarding the underlying aquifer, the receiving soils and surface water management zone is improving on a continuing basis, with ongoing knowledge and research of Southland and the site being achieved in the form of the proposed physiographic units and future catchment specific studies.

Potential adverse effects have been mitigated by appropriate management techniques on farm which are detailed within this application and in the FEMP for each farm. Whilst the potential effects are reasonably well understood, the advances in research and development suggest that there is still a lot to be understood. It is because of this that a 35-year term is not proposed.

Matching consent duration to the level of risk of adverse effects

The assessment of effects concludes adverse effects should be no more than minor. As the risk of adverse effects is low, this suggests that the consent duration should provide for a balance of ensuring these adverse effects are maintained as low and providing for the applicants economic and social wellbeing.

Relevant Tangata Whenua values and Ngai Tahu Indicators of Health

The application has been assessed as consistent with the relevant tangata whenua values as outlined in the iwi management plan, with particular regard to the proposed consent duration being less than 25 years.

Duration sought by the applicant and supporting information

The applicant is seeking a 5 year consent for each consent granted under phase 1 of the application. This will ensure that this phase of the proposal is restricted to the term assessed in the application.

The applicant is then seeking a 15 year consent for each consent granted under phase 2 of the application. This term is slightly longer than the typical 10 year consents granted by Environment Southland for similar activities to give credit for the construction of wintering sheds on both farms which is considered to be one of the most effective and desirable mitigation measures for managing contaminant losses from dairy farms available.

The applicant wishes that the consent terms for WW4 and WW5 are aligned.

The permanence and economic life of any investment

Significant investment has been required just to get to the point of making application with expenditure on professional services, including business feasibility studies, nutrient advice, effluent system review, water quality and policy and planning assessments.

Commodity market influence is always a factor in the permanence of individual dairying units, hence why these activities are often considered to have semi-permanent economic life. The economic life of the farm is firstly dependent on the granting of the relevant consents. Should consents be granted, the permanence of the dairying operation and associated activities should be inter-generational. Furthermore, the permanence of the economic life of the activity requires resource consents be granted from the Council for a reasonable duration. Wintering sheds and their associated infrastructure is a significant investment for the applicant to the tune of $1.2million on each farm. This level of investment needs to be recognised with the granting of a longer term consent to give the applicant certainty of the permanence of their activity.

Common expiry date for permits that affect the same resource
A common expiration date for all the permits applied for is considered appropriate as discussed above.

Applicant's compliance history
The applicant has demonstrated an overall good compliance history with the existing resource consents and there is no evidence to suggest that future compliance will not continue to be good, and water records will be provided to Council on time in future.

Timing and development of FMUs
The granting of a 15 year consent duration may better enable implementation of the impending limit setting process.

Review and Lapse
The applicant is happy for ES to impose standard review conditions in accordance with Sections 128 and 129 of the RMA. In accordance with Section 125 of the RMA, the applicant seeks a 5-year lapse period for these consents.

Some draft consent conditions are discussed in the application.

15. CONCLUSION

Overall, the proposal will result in the maintenance of water quality in the receiving environment.

The proposal enables opportunities for the applicant to sustainably, efficiently and profitably run their dairy farms whilst still maintaining environmental outcomes desired in the Southland region. The adherence to the proposed conditions, the full implementation of good management practices and the proposed mitigation measures will mean that that potential adverse effects will be avoided, remedied and mitigated in a manner that is consistent with all relevant RMA requirements and all policies of the relevant planning documents.

Granting of consent, conversely enables the consent authority a pathway to pre-emptively restrict nutrient losses from two large dairy farms via a resource consent process. The modelled nutrient budgets have been completed by an experienced and qualified professional, and the integrity of the nutrient budgets combined with the above (and attached) assessments, we believe will give the consent authority sufficient certainty that the proposal meets the sustainable management purpose of Part 2 of the RMA.