PART A

Application for Resource Consent

This application is made under Section 88 of the Resource Management Act 1991 (Form 9)

The purpose of this Part A form and the relevant Part B form(s) is to provide applications with guidance on information that is required under the Resource Management Act 1991. Please note that these forms are to act as a guide only, and Environment Southland reserves the right to request additional information.

To: Environment Southland
Private Bag 90116
Invercargill 9840

1. Applicant(s) Details

A resource consent can only be held by a legal organisation or fully named individual(s).

1.1. Applicant's name (*full name of proposed consent holder*). *Please complete either (a) OR (b) to whom consent is to be issued*

First Name Middle Name Surname

(a) Individual(s) Titipua Limited Partnership

OR

(b) Registered company name

Company number

1.2. Applicant's address *[not consultant's address]*

(a) Individual(s)

Postal Address 354 Hedgehope Block Road

Email bskorteweg@hotmail.com

Phone Mobile Fax

(b) Company

Contact Person

Postal Address

Email

Phone Mobile Fax

2. Consultant/ Agent details (if applicable)

Contact person: Matilda Ballinger

Company: Landpro Ltd

Postal Address: 13 Pinot Noir Drive

Email: matilda@landpro.co.nz

Phone: _____ Mobile: 02758858069 Fax: _____

Note: *All correspondence during the consent process will be directed to this contact person, unless instructed otherwise. Final decision documents will be sent to the applicant.*

Are you the owner or occupier at the site? [x] Yes [ ] No

If not, please complete the following information

Name of owner or occupier at the site (*if different from 1.1.*)

Address of the owner or occupier at the site (*if different from 1.2.*)

2 Site Details

Location of activity (*including street/road name, number, and locality*): 354 Hedgehope Block Road

Map Co-ordinates (NZTM 2000)

1257613 E 4869560 N(NZTM 2000)

Legal description of property at site of activity (*refer to land title or rates notice*): Lot 2 DP 420431, Lot 1 DP 470872, Lot 3 DP 1494, Lot 3 DP 386399, Lot 2 DP 4406, Lot 1 DP 386399, Lot 1 DP 4406

Please attach a map or a coloured aerial photograph, showing at a minimum, the location of the proposed activities.

3. Consents required in relation to this proposal:

Please tick the box for the consent(s) you are applying for and complete the relevant Part B form(s) where available

Water

	Take and use surface water		Divert water
	Take and use groundwater		Dam water

Land Use

	Bore/ Well		Effluent storage
x	New or expanded dairy farming		Cultivation
	Intensive winter grazing		Gravel extraction
x	Feed-pad, wintering pad, calving pad or silage pad		Riverbed activity
	Brides and culverts		Tree planting

Discharge

	To air		To water
	To Land		

Coastal

	Whitebait stand		Structures/occupation of space
	Removal of natural materials		Disturb foreshore/seabed
	Discharge/deposit substances		Commercial surface water activity
	Reclaim/drain foreshore/seabed		Marine farming
	Other coastal activities		

What is the purpose of this application?

New resource consent	x
Renew resource consent	
Variation of conditions according to S 127 RMA	
Certificate of compliance	

Are there any **current** or **expired** consents relating to this proposal? [x] Yes [ ] No

If yes, please provide consent number(s) and description:

Discharge permit: AUTH-301081-V1
Water Permit: AUTH-301082-V1

Are any other consents required from Environment Southland or **other authorities**?

[x] Yes [ ] No

If yes, please state the relevant authority and the type of consent(s) required:

-to use land as dairy support (NES)
-discharge permit to use land as dairy support (NES)
-to convert land on farm to dairy farmland (NES)

For what **purpose** is this consent(s) required: (e.g. discharge of effluent, gravel extraction etc.)

-use of land for farming
-use of land as dairy support
-use of land for feed lot
-use of land for conversion to dairy land

Pre application advise- Have you discussed this proposal with a council staff member?

[x] Yes [ ] No

If yes, please provide name of staff member if known Jade McRae

Any further comments you would like to advise us about this application?

5 Assessment of effects on the environment (AEE)

Please complete the applicable Part B form(s) for the proposed activities. For those activities where no Part B form is available, please attach a written statement that assesses the effects that your activities may have on the environment. An assessment of effects **must** include the following information:

(a) if it likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity;
(b) an assessment of the actual or potential effect on the environment of the activity;
(c) if the activity includes the use of hazardous substances and installations, an assessment of any risks to the environment that are likely to arise from such use;
(d) if the activity includes the discharge of any contaminant, a description of—
(i) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and
(ii) any possible alternative methods of discharge, including discharge into any other receiving environment;
(e) a description of the mitigation measures (safeguards and contingency plans where relevant) to be undertaken to help or prevent or reduce the actual or potential effect;
(f) identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any persons consulted;
(g) if the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved;
(h) if the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).

You should also include:

(a) an assessment of the activity against any relevant provisions of any relevant objectives, policies, or rules;
(b) any information specified to be included in the application in accordance with the relevant regional plan;
(c) for an application to replace an existing consent, an assessment of the value of the investment of the existing consent holder:

An assessment of effects **must** address the following matters:

(a) any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects;
(b) any physical effect on the locality, including any landscape and visual effects;
(c) any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity;
(d) any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations;
(e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants;
(f) any risk to the neighbourhood, the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations.

6 Affected Parties

Please attach written approval from parties who may be affected by your activity. *Written Approval of an Affected Party* forms are available on the Environment Southland website. During the processing of your application, Council may determine that additional approvals are required.

7 Site visit from the Consents Team

Consents staff are able to meet with you, visit your site and see what you are proposing to do. We find that this is beneficial to everyone involved. The cost of the visit will be included in the total cost of processing your consent. We find that applications that have an on-site visit are processed with less congestion and at a similar or lesser overall cost. We will contact you if we consider a site visit to be advantageous in processing your application.

8 How much will it cost to process my application?

The cost of a consent depends on the complexity of the activities. Staff time is charged out at a rate of $145/hr and vehicle use for site visits is charged at $0.73/km (inclusive of GST).

The fees shown below under section two are **deposits to be paid at the time of application**. Due to the complexity of these activities, this deposit will not usually cover the full cost of processing the application. **Further costs may be incurred** relating to staff time, disbursements, legal charges, consultation fees, and hearing commissioner fees. Environment Southland's User Charges and Fees document is available at:

www.es.govt.nz/fees-and-charges

When the consent has been processed you will receive an invoice for an additional fee, or for a refund.

The Council's user charges are fixed under Section 36 of the Resource Management Act 1991. Our fee schedule is:

1. Fixed fee:	
Bores and wells	**$303**
Whitebait stand	**$230**
2. Deposit:	
All other non-notified applications including: • Certificates of compliance • Changes to consent conditions (variations) • Change of lapse date	**$1,500**
Applications that require notification or limited notification	**$2,000**

How to pay

Environment Southland accepts payment in the forms of cash, Eftpos, cheque, or electronic transfer. All electronic transfers must include the applicant's name and "consent application" as a reference. Please make electronic payments to: Environment Southland, 01-0961-0018998-00.

User Charges

Please note that additional Annual User Charges will apply to all consents. These are payable in advance on the first day of July each year. Tables 4, 5 and 6 of the Environment Southland User Charges and Fees Schedule outlines the fees associated with Annual Administration Charges and Annual Consent Monitoring and Inspection Charges. Table 7: Annual Research and Monitoring Charges applies only to surface and groundwater takes and comprises the following:

- **Surface water takes (per consent, for volumes up to 50,000 m^3/day):**
  - A charge of **$2.08** per year per cubic metre authorised as a maximum daily take.
  - Minimum of **$138**, maximum of **$8,363**.
- **Surface water takes (per consent, for volumes over 50,000 m^3/day):**
  - **$0.0031** per cubic metre authorised as a maximum daily take.
- **Groundwater takes (per consent):**
  - A charge of **$0.98** per year per cubic metre.
  - Minimum of **$162**, maximum of **$1,965**.

Municipal and stock water discount (of 50%) no longer applies.

9 Checklist: Have you included the following?

☐	Payment of the required deposit *(see fee schedule)*
☐	Written approval from all potentially affected parties *(forms available from the Environment Southland websit*e)
☐	Site plan/location map/sketch of the proposed activity
☐	A copy of the Certificate of Incorporation (*where applicant is a company*)
☐	Part B form(s) specific to your activity and/or a separate assessment of environmental effects (AEE)

Notes:

(a) If your application does not contain the necessary information and the appropriate fee, Environment Southland may return the application.

(b) Under S35 of the Resource Management Act 1991 your application will be publicly available information and subject to the relevant provisions of the Local Government Official Information and Meetings Act 1987.

Signature of applicant

I hereby certify that to the best of my knowledge and belief, the information given in this application is true and correct.

I undertake to pay all actual and reasonable application processing costs incurred by Environment Southland.

Name (block capitals) MATILDA BALLINGER

Signed Matilda Ballinger **Date** 11/05/2021

(*Signature of applicant or person authorised to sign on behalf of applicant)*

Application to use
Feed Pad/Lot (PART B)

This application is made under Section 88 of the Resource Management Act 1991

A complete Part A form needs to be provided with this Part B form. The purpose of this Part B form is to provide applicants with guidance on information that is required under the Resource Management Act 1991. These forms are to act as a guide only and Environment Southland reserves the right to request additional information. **This form must be used when applying for consent to use a feed pad/lot, including 'sacrifice paddocks', wintering pads, stand-off pads, calving pads, loafing pads, and self-feed silage storage facilities.**

To: Environment Southland
Private Bag 90116
Invercargill 9840

1 Location of the Feed Pad/Lot:

Address: 354 Hedgehope Block Road

Legal Description(s): Lot 3 DP 1494

Map Reference (NZTM 2000): 1257741E 4869400N

2 What is this application for?

	A new feed pad/lot	x	**An existing feed pad/lot**	**Consent number (if applicable):**	**AUTH-**

3 What type of animal is proposed to be accommodated on the feed pad/lot?

x	Dairy Cows
	Beef Cattle
	Deer
	Other, please describe: _____

4 If cattle (dairy or beef) are to be accommodated on the feed pad/lot, is 90% or more of the cattle:

	Yes	No
More than 2 months old	x	
Weigh more than 120kgs	x	

5 What is the proposed dates of use of the feed pad/lot? *Note: this does not include the use of the feed pad/lot during adverse weather events outside of the desired dates such as flooding etc*

Dates of use: Aug -Oct and in adverse weather conditions

See AEE and Nutrient budget

6 What is the proposed number of stock on the feed pad/lot at any one time and the average hours per day the feed pad/lot is proposed to be used for the month?

Month	Number of stock	Average hours on the pad per day
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

7 Are the/some of the animals going to remain on the feed pad/lot for longer than three continuous months?

[ ] Yes
[x] No

8 If cattle (dairy or beef) are to be accommodated on the feed pad/lot, are the cattle:

	Yes	No
Kept for at least 80 days in any six month period?		
Fed exclusively by hand or machine?		

9 Is the feed pad/lot located:

	Yes	No
Within 50m of a subsurface drain, lake, river (excluding ephemeral rivers), artificial watercourse, modified watercourse, natural wetland?		x
Within 50m of another feed pad/lot?		x
Within a microbial health protection zone of a drinking water supply site (identified in Appendix J of the proposed Southland Water and Land Plan)?		x
Within 250m of the abstraction point of a drinking water supply site (identified in Appendix J of the proposed Southland Water and Land Plan)?		x
Within 200m of a dwelling or a place of general assembly (not on the landholding)?		x
Within 20m of the boundary of any other landholding?		x
Within a critical source area?		x

If yes, please explain:

10 Please describe how the feed pad/lot is constructed:

	Yes	No
Is the base area of the feed pad/lot sealed to a minimum permeability standard of 10^{-9} m/s?		x

What is the base area of the feed pad/lot? (m^2): Woodchip/bark base

Provide further details below, including details of any nibbing or mitigations to prevent overland flow from entering the feed pad/lot:

See AEE

11 Please describe how the liquid and solid effluent is going to be managed. If the liquid effluent is to be collected in an agricultural effluent storage facility, you must also attached a Diary Effluent Storage Calculator assessment of storage requirements:

See AEE

12 Please include a map or aerial photograph showing the following:

- the location of the proposed feed pad/lot
- the total property area boundary;
- surface water bodies, artificial watercourses, installed subsurface drains and wetlands nearby;
- water supplies – bores, registered drinking etc.;
- the coastal marine area and distance to it (if relevant);
- the location to any dairy sheds (if relevant) and residential dwellings;
- the location to any agricultural effluent treatment/storage facility (if relevant) and
- any additional points of interest – historic heritage, places of assembly etc.

13 Assessment of effects

See AEE

13 ***continued***

Please note that in accordance with Schedule 4 of the RMA, you must also be required to provide an assessment of whether or not the proposed activity is contrary to any of the relevant provisions of the following documents.

(a) proposed Southland Water and Land Plan (Appeals Version), 2018 (and any proposed/subsequent versions)
(b) Resource Management (National Environmental Standards for Freshwater) Regulations 2020
(c) National Policy Statement for Freshwater Management, 2020
(d) Southland Regional Policy Statement, 2017 (and any proposed/subsequent versions)
(e) Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations, 2007

Staff are able to advise whether this is required, as it is dependant on the location, scale and complexity of your proposal. We invite you to come in for a pre-application meeting with Environment Southland consents staff to discuss this. The first half hour of assistance on any application or proposal is free of charge, with subsequent assistance being charged according to the Environment Southland Fees and Charges schedule.

END OF FORM

c

LANDPRO
Make the most of your land

Resource Consent Application to Environment Southland

Prepared for Titipua Limited Partnership

Prepared For

Titipua Partnership Limited

Prepared By

Landpro Ltd
13 Pinot Noir Drive
PO Box 302
Cromwell
Tel +64 3 445 9905

QUALITY INFORMATION

Reference:	
Date:	10 May 2021
Prepared by:	Matilda Ballinger
Reviewed by:	Mike Freeman
Client Review:	Blake Korteweg
Version Number:	FINAL

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LIST OF APPENDICES

1. INTRODUCTION

1.1 Overview of proposal

Titipua Partnership Limited (the applicant) own a dairy farm located at Hedgehope, consented to milk 600 cows. Discharge Permit AUTH-301081-V1 authorises the discharge of farm dairy effluent (FDE) and Water Permit AUTH-301082-V1 authorises the taking of groundwater at this farm. These consents do not expire until 2022 and applications to replace them will be made closer to expiry. The applicant wishes to expand their dairy platform onto a neighbouring block of land, known as the "Schrama Block" which was purchased by the applicant in mid 2020. The Schrama Block covers 84.2ha. The applicant proposes to milk 600 cows across the new extended dairy platform. Over the last three seasons, the applicant has milked 500 cows on average at peak, and approximately half of the herd was wintered off site. The inclusion of the Schrama Block will allow the applicant to increase their milking herd to the consented 600 cows, winter the whole herd on farm and graze the farm's dairy replacements at home until they are 9mths old, becoming more self sufficient.

Consent is sought for the following:

-**to use land for dairy farming (that did not exist as of May 2016)**

-to use land as dairy support (Schrama Block)

-to convert land on farm to dairy farmland

-to use land for a feed pad/lot

This assessment has been guided by advice from Environment Southland, relevant policies of the proposed Southland Water and Land Plan (pSWLP) and the Regional Water Plan for Southland (RWPS) and the Regional Effluent Land Application Plan (RELAP) and the incorporated water quality technical assessment. This assessment also considers the recent National Environment Standards for Freshwater (NES-FW) and the National Policy Statement for Freshwater Management (NPS-FM). The proposal includes the implementation of a wide range of good management practices and mitigation measures which avoid, and mitigate adverse effects on the environment. These are described in detail in this proposal and are also included in the attached Farm Environmental Management Plan (FEMP).

This proposal includes the recommendation that nitrogen and phosphorus output limits are imposed on the resulting land use consent. These limits would ensure that the activity is undertaken at a contaminant loss level which is significantly less than the existing situation when modelled using the latest version of Overseer. These limits would be implemented via the land use consent conditions and the FEMP that includes all the relevant good management practices (GMPs) and mitigation measures that go beyond GMPs. As part of the proposal, the applicant also plans for a wetland to be planted/enhanced, which will include fencing and

planting. The applicant has been liaising with Environment Southland Land Sustainability team in respect to these works.

1.2 The Applicant

Applicant Address:

Address for Service: C/- Landpro Limited
PO Box 302
Cromwell 9342

1.3 Purpose of documentation

Under Section 88 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 PROPOSAL

2.1 Location

The farm is located along Hedgehope Block Road, Hedgehope. The farm is situated in the Titipua Stream catchment. The farm as well as the Schrama Block is shown in the figure below.

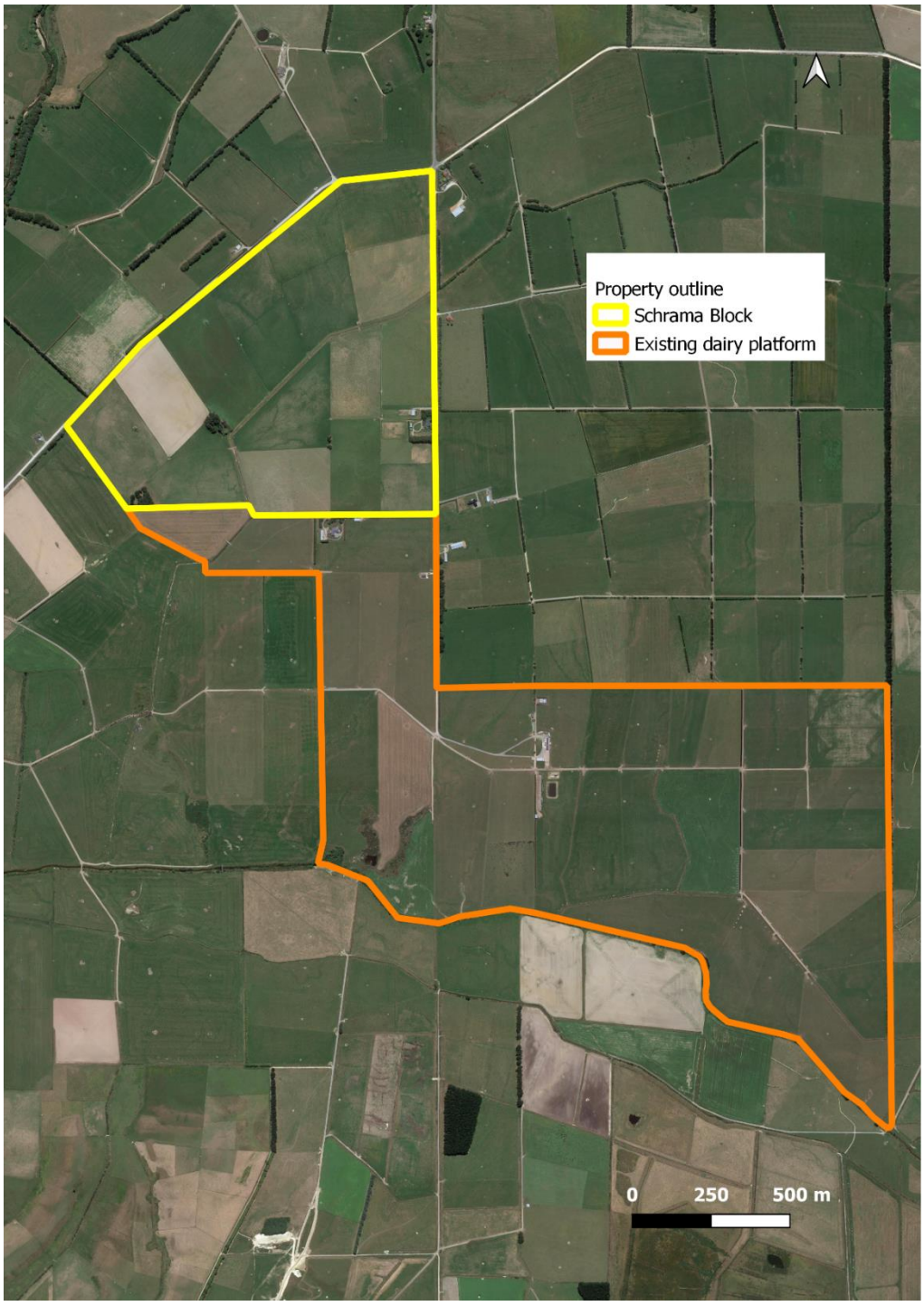


Figure 1: Map showing the locations of the dairy platform and the Schrama Block.

2.2 Details of consents sought

The following provides further details of the farming system proposed.

Details of the changes to the farm system and relevant consents are listed in the tables below. Cow numbers discussed throughout this proposal refer to the peak milking cows on farm. Stock numbers throughout the year are relative to the peak number of cows able to be milked, i.e., only so many replacements and young stock are raised to maintain the milking herd number over time. Complete details of the stock numbers can be found in the attached nutrient budget report (Appendix B).

Table 1: Land Use consent for Farming

Farm Details		
Farming Operation	Dairy	
Address	354 Hedgehope Block Road	
Legal Description	Lot 2 DP 420431 Lot 1 DP 470872 Lot 3 DP 1494 Lot 2 DP 386399 Lot 2 DP 4406 Lot 1 DP 386399	Original Farm
	Lot 1 DP 4406	Schrama Block
Area	181.5 ha (dairy platform) + 84.2 ha (Schrama Block) = 265.7 ha total	

2.3 Details of current consents

Discharge Permit Details	
Permit no.	AUTH-301081-V1
Number of dairy cows	600
Stocking rate (cows/ha)	3.3
Winter milking?	No milking between 20 June and 20 July other than slipped cows
Wintering barn?	No
Feed pad/standoff pad?	Yes
Type of shed	44 aside herringbone shed
Effluent treatment	Weeping wall
Storage available	2,392 m^3
Disposal area	99.7 ha
Irrigator proposed	Low rate cobra travelling irrigator
Application rate and depth	10mm/hr rate and 10mm depth per application

Monitoring	Soil moisture conditions assessed by reference to Environment Southland Beacon website before effluent application.

Water Permit Details	
Replacement of permit no.	AUTH-301082-V1
Freshwater Management Unit	Oreti
Groundwater Zone	Makarewa
Average rate of take of 24 hours	<2L/s
Daily volume	72,000
Allocation per cow	120
Location of point of take	Well number E46/1068 NZTM 1257613E 4869560N

3. DESCRIPTION OF EXISTING ENVIRONMENT

3.1 Land use and topography

The property currently operates as a dairy farm with a 181.5ha dairy platform and using an 84.2ha adjacent block as a support block. The proposed dairy platform will be made up of the existing 181.5ha dairy platform and 84.2ha support block as part of the dairy platform, a total 265.7 ha dairy platform. Currently the support block is used for growing winter crop. This has been undertaken during the NES reference period of 1 July 2014 to 30 June 2019. However, the applicant also wishes to use this land for dairy support which it has not previously been used for in the reference period. Currently an average of 500 cows are being milked and 315 cows are wintering on farm on 12ha of fodder beet. The applicant proposes to increase their milking cows to the consented 600 and winter all cows on farm. The applicant proposes to crop 12 ha of Fodder beet and a further 10ha of baleage/grass for winter grazing, wintering the herd at home. This will allow the operation to be more self sufficient.

The farm is generally 40 meters above sea level. The property is generally rolling with some flat areas.

3.2 Climate

The area receives on average 1121-1130mm of rain per annum and is a moderately wet part of the Southland Region that experiences modest climate extremes with wet and dry conditions. Temperatures are on average 10 degrees Celsius. The area experiences early frosts in April to May, with late frosts uncommon, although these can occur in early October.

3.3 Soils and physiographic zones

3.3.1 Soils

Environment Southland's Beacon indicated that there Pukemutu, Makarewa and Titipua soils on the dairy platform. The neighbouring Schrama Block has been mapped as Pukemutu, Woodlands and Waikiwi soils.

Table 2: Soil type summary on the dairy platform with vulnerability factors (Source: S-Map).

Soil Characteristics			
	Vulnerability Factors		
Soil type	**Structural compaction**	**Nutrient Leaching**	**Waterlogging**
Pukuemutu	Severe	Slight	Severe
Makarewa	Moderate	Slight	Severe
Titipua	Minimal	Slight	Severe

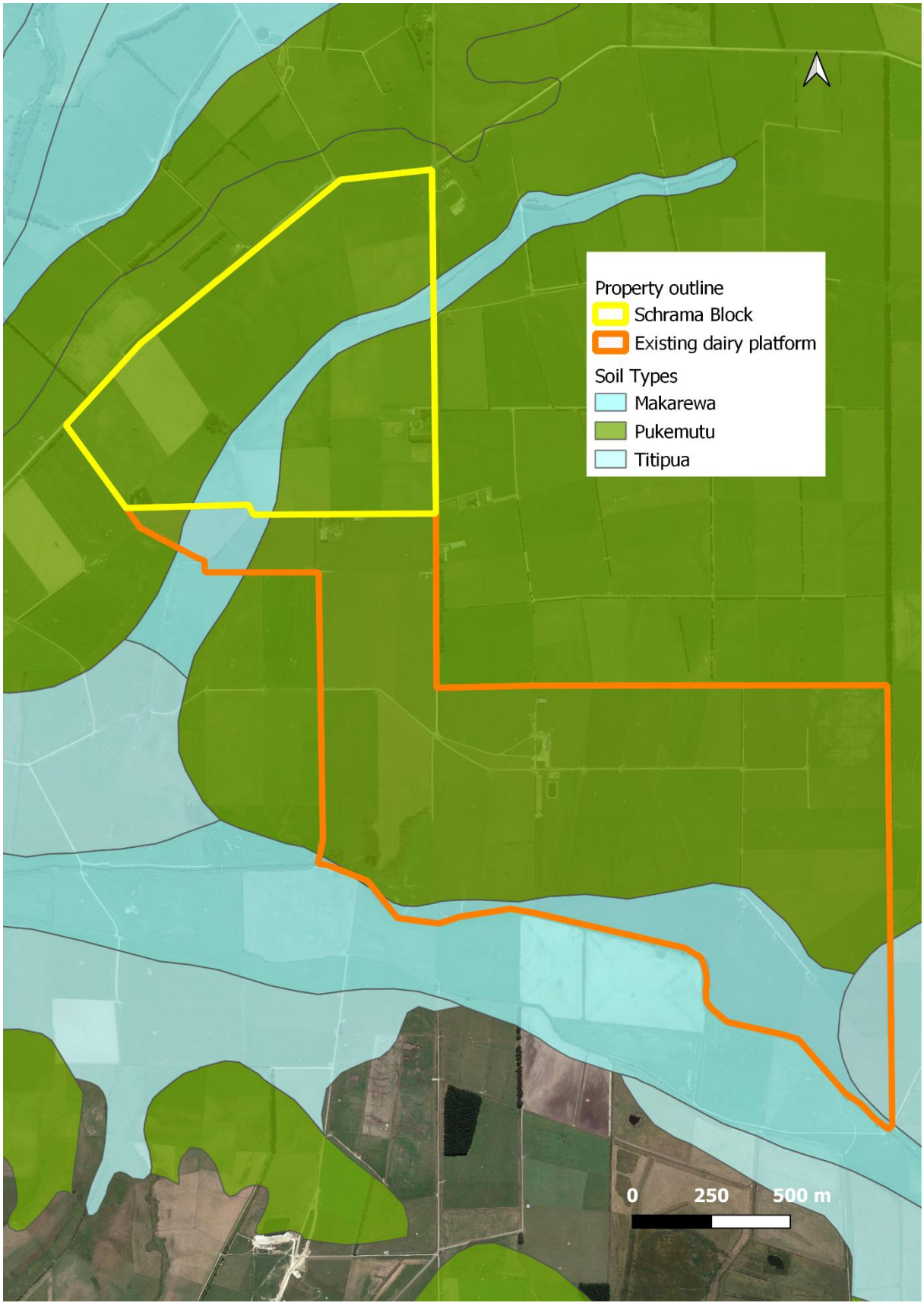


Figure 2: Soil types on the dairy platform and support block.

Pukemutu

A heavy silt loam soil. Pukemutu soil is poorly drained with a moderately deep potential rooting depth, restricted by the fragipan at 60-90cm. There is limited aeration in the root zone. The soil has a moderately high to high PAW. The structural vulnerability of the soil is severe, nutrient leaching vulnerability of the soil is slight, and the water logging vulnerability of the soil is severe.

Titipua

A silt loam to silty clay soil. Titipua soils have poor drainage and slow subsoil permeability. They have a deep rooting depth and very high available soil water. There may be limited aeration during wet periods. The structural compaction vulnerability and the nutrient leaching vulnerability is minimal/slight, and the waterlogging vulnerability is severe.

Makarewa

Texture of Makarewa soils is variable with layered texture profiles common, there is always at least one horizon with silty clay texture. The soils have poor drainage, slow subsoil permeability and may have poor aeration during wet periods. They have a deep rooting depth and moderately high available soil water. Structural compaction vulnerability is moderate, nutrient leaching vulnerability is slight and waterlogging vulnerability is severe.

3.3.2 Physiographic zones

The proposed dairy farming and effluent discharge activities occur within the Gleyed, Lignite/Marine Terraces and the Peat Wetlands Physiographic Zones.

The Gleyed physiographic zone comprises predominately flat to undulating land that occurs between major river systems where soils are fine textured and poorly drained. This zone is characterised by soils which have distinctive redoximorphic features such as mottling and gleying (resulting from extending periods of soil waterlogging). Soils in this zone have some ability to remove nitrogen from water to the atmosphere via denitrification. However, this process can be bypassed when contaminants are flushed to nearby surface water bodies via artificial drains and overland flow following heavy or sustained rainfall events[1].

The Lignite/Marine Terraces physiographic zone comprises predominantly low elevation land, flat to gently undulating, where the geology has high organic content which has a strong influence over groundwater quality. This zone can have high denitrifying potential in groundwater in areas close to organic carbon sediments. Overland flow is common in this zone in areas that are poorly drained and sloping.

Peat Wetlands physiographic zone comprise predominantly low-lying flat land. This zone is characterised by

[1] Environment Southland Physiographic Zone Fact Sheets (2015).

soils which have extremely acidic soils which are prone to waterlogging. Often there is a seasonal water table that sits close to the ground surface resulting in seasonal ponding and overland flow to nearby streams. There is a high soil and aquifer denitrification potential in this zone.

3.4 Water resources

3.4.1 Surface waterways

Three unnamed tributaries of the Titipua Stream run through the property and the Titipua Stream forms the southern boundary of the farm. The tributaries predominantly run in a north-south direction with the Titipua Stream running from east to west. All waterways on the existing dairy platform are fenced and have grassed buffers.

The Titipua Stream joins the Hedgehope River, and latterly the Makarewa River approximately 8.5 km south west of the property.

3.4.2 Groundwater

The property is located within the Makarewa groundwater management zone. Data from Environment Southland's Beacon shows that the estimated total oxidised nitrogen (TON) concertation under the property varies between 3.1 and 5.0 mg/l. The TON estimates are higher at the west and south of the property and lowest in the east and north. Further groundwater data from Environment Southland monitoring bores show that the groundwater data to the south of the property being of varying quality. Ranging from NOF band D to NOF band A. There is an area of elevated nitrogen levels to the south of the property. Groundwater flow detailed below would suggest that activities on farm are not contributing to the elevated levels of nitrogen as groundwater flow is in a more westerly direction.

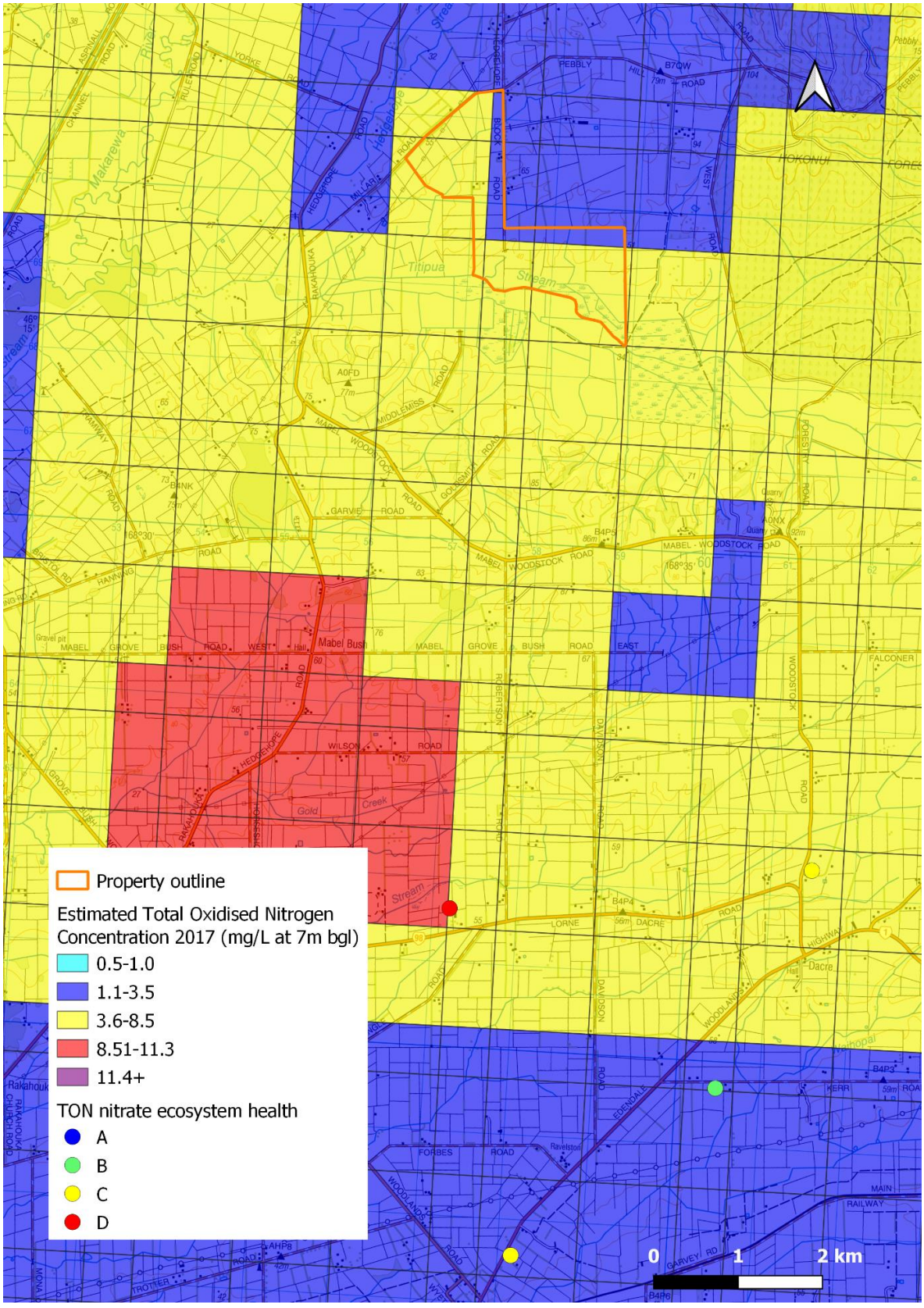


Figure 3: Modelled TON groundwater concentrations from ES data. Background shows estimated total oxidised nitrtogen concentration with coloured dots showing TON nitrate ecosystem health as measured from monitoring bores.

The property is within the Makarewa Groundwater management Zones. According to Environment Southland Groundwater Management Zone Factsheets groundwater flow direction for the Makarewa Zone[2] follows the general drainage pattern of the Makarewa catchment, in this case in a south-westerly direction. At a finer scale groundwater flow is likely to occur obliquely to the local surface waterways.

Figure 4 below estimates the groundwater flow direction. Topographic contours show the southern and western end of the property being lower than the northern proportion of the property, indicating that if following general topographic gradient, groundwater flow would be towards the south west. This is consistent with the information above.

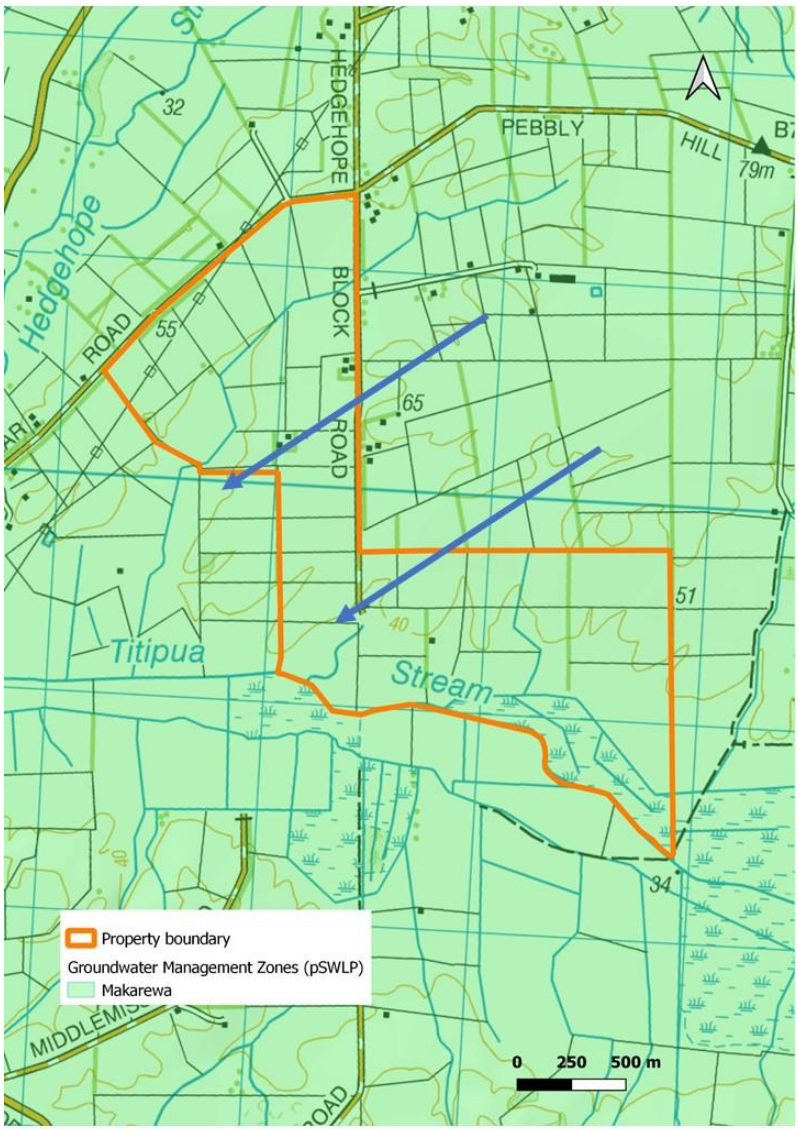


Figure 4: Estimated groundwater flow direction (purple arrows)

[2] https://www.es.govt.nz/environment/water/groundwater/groundwater-management-zones/makarewa (accessed 9/03/2021)

3.4.3 Surface water quality

The following tables provide summary information on the quality of the surface water downstream of the property. There is no water quality data upstream of the property. The water quality data has been sourced from the LAWA (Land and Water Aotearoa) website. LAWA is the most up to date national database which connects people with New Zealand's environmental monitoring data, enabling communities to access information relating to the different pressures and conditions on freshwater resources. The state of water quality presented on the LAWA website compares the median of monitoring results for the last five years at a site with other sites around the country. The median for a site can be compared to all other sites with a similar land use and altitude. The data used to calculate trends is the same as used for the regional state. LAWA displays regional trends for the last five to ten years which helps to identify whether a site has improved, degraded or stayed the same. The state of water quality is assessed against the objectives within the National Policy Statement for Freshwater Management. The table below provides a summary of the state and trend of the Hedgehope Stream 20m upstream of the Makarewa confluence.

Table 3: Water quality data Hedgehope Stream 20m u/s of the Makarewa confluence.

Variable	State	LAWA National Objective Framework (NOF) Band/Attribute State 5-year median (2015-2019)	NOF Trend; and National Policy Statement for Freshwater (NPS-FW) national bottom line (NBL).
E. Coli	In the worst 25% of all sites	E – For more than 30% of the time the estimated risk is >=50 in 10000 (5% risk). 5yr Median: 580 n/100ml	N/A NPS-FW (2020): likely does not meet NBL for 5-yr median. Exceedance data NA.
Clarity	In the worst 25% of all sites	In the worst 25% of all sites. 5yr Median: 0.885 metres	N/A NPS-FW (2020): meets NBL.
Total Oxidised Nitrogen	In the worst 50% of all sites	5yr Median: 0.62 g/m^3	N/A NPS-FW (2020): meets NBL.
Ammoniacal N	In the best 25% of all sites	B - 95% species protection level. Starts impacting occasionally on the 5% most sensitive species 5yr Median: 0.0185 g/m^3	N/A NPS-FW (2020): meets NBL.
Dissolved Reactive P	In the worst 50% of all sites	C- Moderate DRP elevation about natural reference conditions 5yr Median: 0.0105 g/m^3	N/A NPS-FW (2020): meets numeric attribute state for C[1] band status.

[1] Ecological communities are impacted by moderate DRP elevation above natural reference conditions. If other conditions also favour eutrophication, DRP enrichment may cause increased algal and plant growth, loss of sensitive macro-invertebrate and fish taxa, and high rates of respiration and decay.

The water quality trends indicate that the overall water quality in the Hedgehope Stream has raised concentrations of various contaminants. Trend indicators have not been assessed to determine whether there are improvements in water quality or not.

With regards to the National Policy Statement for Freshwater (2020), for the variables assessed, clarity, TON and ammoniacal nitrogen meet the national bottom line (NBL) attribute state for attributes requiring limits. *E. Coli* likely does not meet the NBL. Dissolved reactive phosphorus meets C band attribute status for variables that require action plans.

3.4.4 Estuary

The Makarewa River joins the Oreti River which discharges into the New River Estuary approximately 30km downstream of the property boundary. This estuary drains several coastal catchments including the Makarewa Catchment.

Section 3.11 in the Regional Coastal Plan describes the key values for the New River Estuary. In summary, the key values are the exceptional bird and waterfowl habitat, recreational, shellfish gathering and heritage values which can be adversely affected by excessive levels of microbes, sediment and nutrients. The New River Estuary is listed in Appendix Q of the PSWLP as a sensitive waterbody.

A coastal risk assessment undertaken by Wriggle Coastal Management in 2008 shows that the eutrophication and sedimentation may be poor in some arms of the estuary, overall vulnerability and susceptibility ranges from low to moderate, as shown in the table below, as the estuary is well flushed (low residence time) and is already modified.

Table 4: Risk assessment for the New River Estuary (Source: Wriggle Coastal management, 2008[3])

	Existing condition rating	Susceptibility rating	Vulnerability rating
Sedimentation	Fair	Low	Moderate
Eutrophication	Fair	Low	Moderate
Disease Risk	Fair	Low	Moderate
Contaminants	Good	Low	Low
Habitat Loss	Fair	Moderate	Moderate
Invaders	Fair	Moderate	Moderate
Shellfish	Good	Low	Low

[3] Robertson B & Stevens L (2008) Southland Coast Te Waewae to the Catlins Habitat Mapping, Risk Assessment and Monitoring Recommendations, Report for Environment Southland.

Estimated nitrogen loadings to the estuary are moderate (being the main driver of eutrophication) and the susceptibility of the estuary to stressors is assessed as low-moderate due to the estuary being well flushed (with low residence time) and a wide range of habitat types[4]. However, due to a combination of nutrient loads and excessive sediment deposition, the nutrient enrichment condition of the estuary is poor. A contributing factor is the estuary type; shallow tidal river estuaries can receive an order of magnitude higher nitrogen loads than shallow tidal lagoons for the same nutrient enrichment condition[5].

4. ACTIVITY CLASSIFICATION

We have carefully considered all the applicable regional rules and national regulations that are relevant to the activities on the land proposed to be used by the applicant. We consider that it is unlikely that any critical requirements have been missed or additional consents required. If a rule or consent requirement has been overlooked, we do not consider that it would be critical to the primary suite of resource consent applications.

Given the level of detail provided throughout the entire application it is unlikely that relevant effects are not assessed in this document and therefore the applications are considered to meet Section 88 requirements under the RMA.

4.1 Consents required

The following table summarises the resource consents required.

Table 5: Consents required.

Consent	Plan	Rule	Activity Status
Land use Consent for Farming	PSWLP	20(d)	*Discretionary*
Land use Consent for the use of land as dairy support land	NES-FW 2020	23(1)	*Discretionary*
Discharge Permit for the use of land as dairy support land	NES-FW 2020	23(2)	*Discretionary*
Land use Consent for the use of land for a feedlot	NES-FW 2020	10(1)	*Discretionary*
Discharge Permit for the use of land for a feedlot	NES-FW 2020	10(2)	*Discretionary*
Land use consent for the conversion	NES-FW 2020	19(1)	*Discretionary*

[4] Wriggle Coastal Management, 2008. Southland Coast Te Waewae Bay to the Catlins: Habitat mapping, risk assessment and monitoring
recommendations. Prepared for Environment Southland, August 2008.

[5] Condition grade: >3 is very good condition, 2.6 – 3.0 is good condition, 2.0 – 2.5 is moderate/fair condition and <2 is poor condition.

of land to dairy farmland			
Discharge Permit for the conversion of land to dairy farmland	NES-FW 2020	19(2)	*Discretionary*

Overall, the proposal is 'bundled' to mean that the consent applications are considered as **discretionary activities.**

4.2 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.

Table 6: Activities for which Consent is not required.

Activity	Compliance with the relevant permitted activity rules.
Intensive Winter Grazing under the NES-FW	A Land Use Consent for Intensive Winter Grazing under the NES-FW is determined to not be needed. The Intensive Winter Grazing that does occur meets the permitted activity thresholds and was conducted during the reference period. 12 ha is about 4.5% of the proposed new land area. Significantly less than either the pSWLP or NES thresholds.
Use of land for the maintenance and use of an existing agricultural effluent storage facility (Rule 32D of the pSWLP)	The use of land for the maintenance and use of an existing agricultural storage facility (includes ponds, weeping walls, sumps and stone traps etc) that was authorised before 4 April 2018 is a permitted activity providing the construction of the facility was authorised by a resource consent).
Incidental discharges from farming (Rule 24 pSWLP)	The land use associated with this discharge is or will be authorised under Rule 20, 25 or 70.
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 are 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 silage pad is not hooked up to the effluent system, and therefore silage leachate is discharged to land in accordance with the rules listed in the column to the left.
Sludge (Rule 38 of the pSWLP)	Solid sludge effluent collected from the stone trap and sludge beds will be dried as much as reasonably practical before applying to land when conditions are suitable, observing appropriate separation distances, and there will be no disposal of solids to any waterway.
Cleanfill, Farm Landfills	No more than 500 m^3 of material will be discharged within cleanfill sites.

and Offal Holes (Rules 53, 54 & 55 of the RWPS, and Rule 42 & 43 of the pSWLP).	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 activities. Offal sites are to be covered and the surfaces to be restored to a similar state as surrounding land upon closing.
Stock exclusion from waterbodies (Rule 70 PSWLP)	All water bodies are fenced, and crossings are bridged over unnamed tributaries. Bed disturbance from stock is thus avoided and dairy cattle on the dairy platform are excluded from water bodies.
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.
Wetlands (Rule 74 PSWLP)	In future, once the applicant has constructed a wetland on farm, the continued use of that land as a wetland will be a permitted activity as: The wetland will be maintained or enhanced once constructed, no indigenous vegetation is destroyed or removed, no neighbouring land is flooded, and all endeavours will be undertaken to ensure that no pest species are established.

5. NON-NOTIFICATION & CONSULTATION

A consent authority has the discretion whether to publicly notify an application unless a rule or National Environmental Standard (NES) precludes public notification (in which case the consent authority must not publicly notify) or section 95A(2) applies.

The effects of the activities will be no more than minor, the applicant does not request public notification and there are no rules or NES' which require the public notification of the application. In addition, there are no special circumstances relating to the application. As such, notification of the application is not necessary.

Clause 6(1)(f) of Schedule 4 of the RMA requires the identification of, and any consultation undertaken with, persons affected by the activity. No persons are considered to be adversely affected by the proposal, as determined by the larger assessment of environmental effects (Section 6 below).

Overall, it is considered that this application should be processed non-notified and without the need for written approvals.

6. ASSESSMENT OF ENVIRONMENTAL EFFECTS

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.

6.1 Use of land for dairy farming

This assessment of environmental effects (AEE) describes the risks to the environment resulting from the expansion of the dairy platform.

This assessment below considers the specific surface water quality issues in the existing receiving environment at the nearest monitoring sites. It looks at the property scale and within the property at specific management/landscape blocks, and the likely contaminant pathways that may impact any water quality issues identified. Any potential water quality issue is considered relative to the proposal, including farm system changes proposed and OVERSEER nutrient budgets, GMPs and mitigations, including their effectiveness and appropriateness, and the contribution that these measures would provide to water quality improvements at the catchment scale.

Section 6.1.1 below presents the modelled nutrient losses for the current farm system and presents a table that summarises the estimated nutrient loads from the proposed activity.

6.1.1 OVERSEER Nutrient Budgeting

OVERSEER nutrient budgets have been prepared by Mo Topham of AgriAce Consulting Limited who is a Certified Nutrient Management Advisor (CNMA). These OVERSEER budgets have been used to estimate the annual amount of nitrogen and phosphorus discharged from the property.

There have been two recent 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[6] and Overseer Ltd.'s review contracted to Enfocus titled Using Overseer in water Management Planning[7]. 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 solutions to some of the known limitations. Using output figures in regulation together with various methods to address well known potential issues such as version changes allows a consent holder to demonstrate the improvement in N loss outputs whilst still maintaining the flexibility to farm to conditions as well as provide for innovations on farm.

A copy of all OVERSEER Nutrient Budget Farm Scenario Reports can be found attached to this application (Appendix B). Some of the assumptions and limitations of Overseer are described below.

Overseer Assumptions

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

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

- Long term annual average model- the model uses annual average input and produces annual average outputs
- Near equilibrium conditions- the model assumes that the farm is at a state where there is minimal change each year
- Actual and reasonable inputs- it is assumed that input data is reasonable and a reflection of the actual farm system. If any parameter changes, it is assumed that all other parameters affected will also be changed.
- Good management practices are followed- Overseer assumes the property is managed in line with accepted industry good management practices.

Overseer Limitations

- Overseer does not predict transformations, attenuation or dilution of nutrients between the root zone of farm boundary and the eventual receiving water body. A catchment model is needed to estimate the effects of the nutrient losses from farms on groundwater, river or lake water quality.
- Overseer does not calculate outcomes from extreme events (floods and droughts) but provides a typical year's result based on long-term averages.
- Overseer does not calculate the impacts of a conversion process, rather it predicts the long-term annual average nutrient budgets for changed land use.
- Overseer is not spatially explicit beyond the level of defined blocks.
- Not all management practices or activities that have an impact on nutrient losses are captured in the Overseer model.

Existing scenario nutrient budget modelling

The existing scenario OVERSEER budget modelling includes two different scenario modelling components and is an accurate description of the existing farm systems and consequential N & P losses. The two components include:

1. The Titipua current dairy farm operating between 2017 and 2020
2. The Schrama Block operating between 2019 and 2020, based on BLNZ averages

Please refer to the Overseer Modelling Report contained in Appendix B for full copies of the existing nutrient budget models and a summary of the model inputs and nutrient loss to water estimates.

Table 7: Summary N and P loss estimates for the existing scenario model.

Land Use	Current Dairy Platform	Schrama's Block	Total current existing environment
Area (ha)	181.5	84.2	265.7
Kg N/yr	11,315	1,738	13,053
Kg P/yr	455	190	645

Proposed scenario nutrient budget modelling

The proposed scenario OVERSEER budget modelling includes the expanded dairy platform and is an accurate description of the proposed farm system and consequential N & P losses. The components include:

1. The Titipua proposed dairy farm with 600 cows

The blocks in the proposed scenario have been set up in accordance with the protocols for using OVERSEER® and they are modelled based on proposed land use, soil and management.

Table 8: Summary of Overseer N and P loss estimates outputs for the proposed model.

Land Use	Total existing environment	Proposed scenario	Difference	% change
Kg N/yr	13,053	12,181 (includes outside of overseer calculations)	872 kg	6.7% decrease
N kg/ha/yr	49	46		
Kg P/yr	645	572 (includes outside of overseer calculations)	73 kg	11.3% decrease
Kg P/ha/yr	2.4	2.2		

Additional outside of Overseer calculations

As detailed in the nutrient budget report (Appendix B) Overseer is likely to underestimate nitrogen losses estimated for grass baleage wintering systems. It is predicted that the losses from the grass baleage wintering system will be 173 kgN higher than the estimated OverseerFM proposed scenario.

The nutrient budget report details how the addition of a wetland will help nutrient losses. Environment Southland Land Sustainability Officer, David Moate provided advice on installing a wetland on the property. It was decided that the most effective location for a wetland would be in the south western corner of the farm, This area has an estimated catchment area of 50ha in total, 38ha of this being on the applicant's farm. It is predicted that losses from the wetland will decrease by 741kg N and 43 kg P.

Comparison between existing scenario and proposed scenario modelling

The nutrient budgets contained within the application have been completed to compare the predicted nutrient losses from the proposed self-contained dairy farm, with the existing consented land use.

Overseer modelling has been included to support this application for activities on the property. The overseer models provide two purposes:

1. To describe the activities currently occurring and describe the proposed activities in a concise manner; and
2. To compare the relative change in nutrient losses between the existing and proposed farm scenario

to inform the AEE. The relative change comparison is enabled by ensuring that the existing and proposed Overseer nutrient budgets are comparing 'apples with apples' i.e., uncertainty is significantly reduced when comparing two scenarios for one farm at one location where many of the critical inputs remain unchanged, e.g. soils, climate etc.

6.1.2 Mitigations and GMPs

OVERSEER estimates what the losses of N and P to water will be, but not what the potential or actual effects of that loss on water quality would be. The effects of the proposal on water quality are assessed in this section.

The contaminants of concern are N, P and sediment and microbiological contaminants. These contaminants and their potential adverse effects are outlined below.

- **Nitrogen (N) and phosphorus (P)** (nutrients) are needed by plants for growth but when the concentrations of nutrients in water are high, they can result in excessive growth of plants, e.g. periphyton, macrophytes and phytoplankton. High concentrations of nitrate in water can make it unsafe to drink for humans and can be toxic for sensitive organisms (like young trout and salmon). Ammonia at sufficiently high concentrations can be highly toxic to fish and other aquatic organisms that live in water.
- **Sediment** (as indicated by water clarity) refers to particles or eroded soil and rock. Sediment is also a major source of phosphorus because phosphorus sticks to the surface of soil particles carried to water. When erosion rates are excessive, sediment can smother stream and estuary bed macroinvertebrates and can damage the gills of fish. Finer sediment suspended in water can also reduce light penetration (visibility) which plants need to grow and some creatures need to find food.
- **Faecal indicator micro-organisms** (indicators of microbial pathogens) which can have a detrimental effect on human and animal health, particularly when ingested. The main source of pathogens in fresh water in New Zealand are human sewage and animal manure[8].

Assessing the environmental impact of modelled nutrient losses from a 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 affect the loading and concentrations that result in the receiving water bodies.

Table 9 below summarises the potential effects of each individual farming activity. Then the applicant presents GMPs and mitigations that will/or have been applied to each activity to avoid, mitigate or remedy the effects of each activity of the receiving environment. The outcome column is the resulting likely implications for the consequential environmental effects. The table below forms only one part of the

[8] Parliamentary Commissioner for the Environment, 2012. *Water quality in New Zealand: Understanding the science.* New Zealand Government, Wellington. 76p.

application and assessment and is presented below to give the Consent Authority an overview of each of the individual components of the proposal and to demonstrate that the effects at each scale will be avoided, mitigated or remedied. The table below needs to be read in conjunction with the overall broad scale/cumulative effects assessment in Section 6.

A combination of the farm system changes and GMPs/mitigation measures as demonstrated by the nutrient modelling undertaken will result in significantly less nutrients making their way into water bodies which will make a very small contribution to improving the quality of groundwater and surface water.

Table 9: Potential effects of individual farming activities and mitigations.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Construction of new dairy lanes	New laneways create high risk areas for sediment, microbial and P loss. Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plant and animals due to sedimentation, algae blooms and water temperature increase 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 where appropriate.	The paddock and lane layout have been designed to ensure new lanes are located away from waterways where possible. Where not possible larger buffer zones are implemented.	Overseer assumes 30% of dung deposited on lanes is lost directly to waterways, regardless of where the waterways are located in relation to laneways. The lane ways are in good condition and the new lane ways will be constructed in a way that will ensure that any dung on laneways is transported to land to minimise dung in waterways.
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 are most likely to occur via deep drainage. Phosphorus losses from fertiliser are most likely to occur via soil loss and/or direct loss through runoff or erosion. Adverse effects of inappropriate fertiliser application or excess application to	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 Celsius, 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 between 25 and 35. Use nutrient budgeting and annual soil testing to manage nutrient	Applications of Nitrogen on all blocks occur using a little and often approach. Soil tests are used to inform decisions regarding appropriate P, K and S fertiliser rates.	Adverse effects both avoided and mitigated with use of GMPs for fertiliser usage and further mitigations to better manage fertiliser application across the entire landholding.

	include a loss of excess nutrients to enter 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.	inputs from fertiliser and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.		
Sludge effluent application across entire landholding.	The nutrient concentration of sludge is higher than liquid FDE due to the lack of dilution from rainwater or washdown water. Due to the higher concentration of nutrients, application of sludge 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 of effluent. This loading is achieved by ensuring the land area is large enough and the application depth is restricted to 10mm. 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 ecosystems and the overall health of water bodies. Sludge is generally	The maximum loading rate of nitrogen from the application of effluent (both sludge and liquid) to land is 150 kg N/ha/year. Sludge is not discharged onto the same area any more frequently than once every two months. Sludge is only discharged to land when soil temperature is greater than 5 degrees Celsius in winter and 7 degrees Celsius 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. Effluent area receiving sludge is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kg N/ha/year to avoid excess nutrient		Adverse effects to the environment from the discharge of sludge effluent will be no more than minor. The discharge of sludge is governed by permitted activity rules giving certainty that the activity will be regulated. Application of sludge 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.

	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.	loading. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bored, property boundaries and dwellings.		

In addition to the assessment above, specific comment regarding proposed mitigations of wetlands and sediment traps/pond mitigations are discussed below.

The applicants have sought guidance from David Moate from the Environment Southland Land Sustainability team regarding the installation of a wetland on the property. Potential wetland locations, construction and effectiveness were identified during a visit to the property in Jan 2021.

Following advice received during this site visit (Appendix B) a wetland is to be installed in the South Western corner of the property. The catchment of the wetland is estimated by David Moate to be 50 ha, 38ha of which form part of the applicant's property.

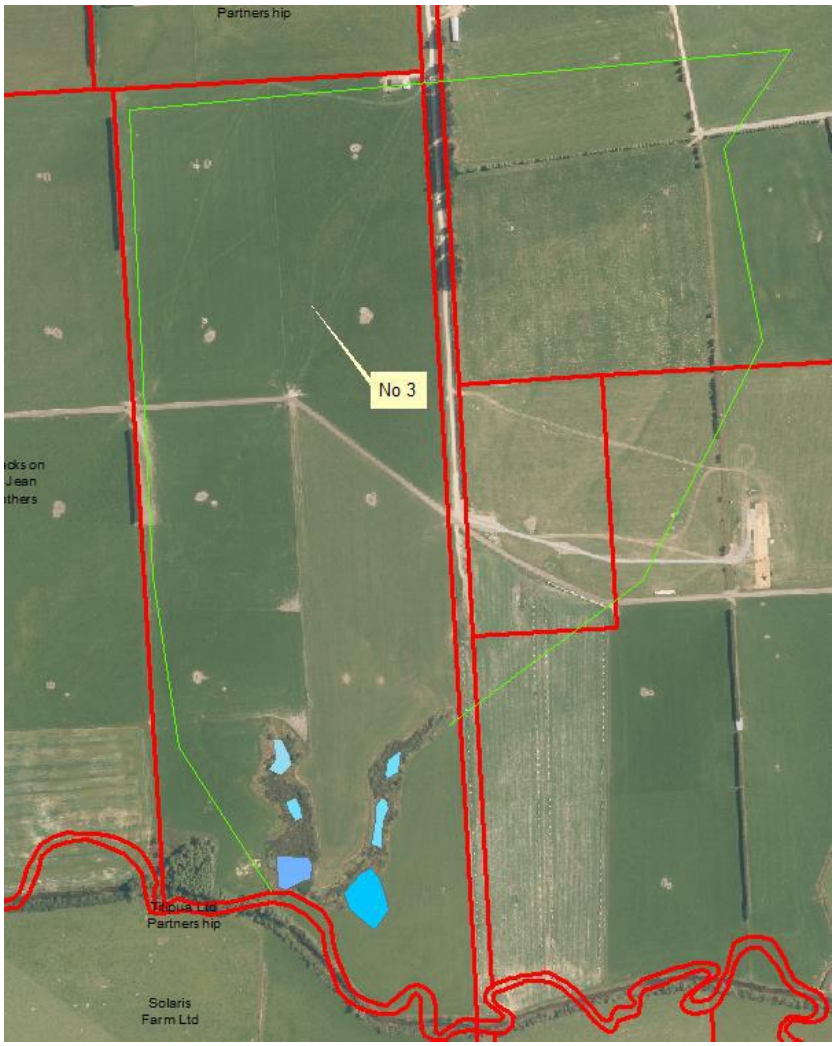


Figure 5: Proposed wetland location and indicative catchment area

Wetlands and sediment ponds are considered 'edge of field mitigations' that aim to reduce runoff velocity and trap suspended sediment. The vegetated margins of a sediment pond and the vegetated areas of wetlands essentially bind soil slowing the water velocity which mitigates direct discharges of overland flows

directly to water bodies. The buffers are the same as riparian buffers which are assigned an estimated effectiveness percentage of 50% reduction in N losses and 48% reduction in P losses. The ponds then have a theoretical added benefit of capturing runoff where flows have the opportunity to stop entirely and suspended sediment can drop out. These mitigations will be effective and efficient at removing contaminants and have not been rewarded in the OVERSEER® nutrient budgets. These are located at appropriate locations and combined with other GMPs and mitigations as assessed extensively above will result in actual reduced contaminants entering water, which will result in small but real improvements in water quality. Without the imposition of catchment wide strategies co-ordinated at the regional level, the rewards of small on farm improvements such as those proposed within this application may not be observed at the catchment scale overall.

Calculations by Mo Topham have indicated that 741 kg N/annum and 43 kg P/annum will be captured by the wetland. Details of these calculations can be found in the nutrient budget report in Appendix B.

6.1.3 Potential water quality effects

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.

There are three registered drinking water supply sites downstream of the property. Drinking water is supplied to Alliance Makarewa, Wallacetown School and Alliance Lorneville, 20km, 25km and 27km respectively downstream of the property. Alliance Makarewa and Wallacetown School sites supply water to 25-501 people. Alliance Lorneville site supplies water to >501 people. Given the estimated reduction in contaminant losses it is highly unlikely that there would be any adverse effects associated with nutrient losses from the proposed activity on this drinking water supply or any other bores that may be nearby. There will be further attenuation, dilution and dispersion processes that will further reduce the concentration of nitrate nitrogen in groundwater between the discharge location and any sensitive receptors.

Groundwater nitrate concentrations are of particular concern to human health. The risk of bottle-fed infants getting 'blue baby syndrome' (methemoglobinemia) from consuming high nitrate nitrogen water is the primary driver for the current NZ Drinking water standard (Maximum Acceptable Value) for nitrate nitrogen (11.3 mg N/l).

In summary, the evidence about the current state of nitrate nitrogen concentrations in groundwater in this area of Southland and the OVERSEER® modelling strongly indicate that drainage nitrogen concentrations at the level predicted by OVERSEER® (Appendix B) are highly likely to result in an extremely small improvement in existing groundwater quality.

Sediment and microbiological contaminants are not modelled within OVERSEER® so attempting to demonstrate a reduction in the annual amount of sediment and microbiological contaminants in the proposed scenario compared to the amount which has been lawfully discharged currently is challenging. P loss modelling can be used as a proxy for sediment and microbiological contaminant losses. The reason is that phosphorus in the soil readily bonds to fine soil particles and is therefore lost to the environment via the same contaminant pathways: runoff/overland flow and erosion. Microbiological contaminants are also lost to the environment by the mechanics of water flow via these same pathways. The P loss modelling in this application indicates sediment and microbiological contaminants will reduce under the proposal. However, P loss prediction is not exactly the same as microbial and sediment losses, and therefore the assessment is an estimate but provides an acceptable indication of likely losses and risks to the environment.

Because of the significant reduction in nitrogen and phosphorus loss from the proposal it is highly likely to result in a real but small overall improvement on local surface water quality. Quantification of the improvement has not been completed because the contaminant load reductions are so small in the context of the wider receiving water catchment and the resulting changes in concentrations would not be measurable with the current surface water quality monitoring programme at the local scale.

The attached FEMP and GMPs detail various management practices which will be adopted to reduce sediment, and bacteria losses via overland flow, artificial drainage channels. The primary mechanisms of mitigating and avoiding these losses are by appropriate management of critical source areas on the farm, efficient effluent management, stock exclusion from riparian margins and CSAs and the adoption of best management practices for intensive winter grazing. These mechanisms are likely to have the greatest impact in reducing sediment losses and microbiological contamination of waterways.

6.1.4 Cumulative Effects

As described above, the proposal is very likely to achieve a nearly 7% reduction in average annual N loss to water and an 11% reduction in average annual P loss to water.

Improvements made under the proposal 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 in water quality mitigation measures and the ongoing restriction on the applicants' operation in accordance with the nutrient output limits will give certainty that water quality will be improved in the long term.

The proposal will result in a reduction in N and P and sediment and microbiological contaminants lost to the environment. The overall effects on water quality will be positive and make a very small contribution to improving water quality at the local and catchment scale.

6.1.5 Other effects

The conversion of the Schrama Block to a dairy farm will enable the applicants to operate a sound and relatively secure dairy farm operation, that is nearly self-contained . The property will directly employ 3 full time equivalents which will support families and local schools. The continuation and prosperity of the business will have economic and social benefits to the landowner and the wider community.

6.2 Use of Land for Intensive Winter Grazing

The applicant has prepared a FEMP which includes a description of the winter grazing practices and Good Management Practices (GMPs). This aims to manage potential environmental effects associated with the farm and IWG activities. This contains details of GMPs adopted by the applicant to ensure that the farm is operated in accordance with industry and promoted good practice.

An assessment of the soils and likely contaminant pathways has identified the GMPs recommended, and this has informed the preparation of the below grazing management GMPs and general farming GMPs included in the table below.

The applicant has been grazing following a top to bottom approach and will continue to do so.
Paddocks grazed will not have a slope of greater than 10 degrees.

To ensure that less animal movement across already grazed soils, portable water troughs will be used, and back fencing set up to ensure limited transport. This will avoid excess pugging.

By selecting appropriate paddocks for winter grazing, at risk paddocks are avoided. Avoiding these paddocks will help protect soil structure and erosion, minimising sediment runoff and P loss. N losses are minimised by keeping the N in the root zone ready for a spring uptake.

The following GMPs are to be implemented for intensive winter grazing.

Table 10: Good management practices for intensive winter grazing.

Activity	Good Management Practices adopted	Outcome
Winter crop	Reduce periods of bare soil between crops and pasture to reduce erosion and leaching. Bare paddocks are re-sown as soon as possible. Erosion damaged areas are rested and re-sown. Compacted soils are subsoiled, ripped or cultivated.	By reducing periods of bare soil, soil structure is protected, and erosion damage minimised. Nutrient losses are reduced, especially P loss.
	Minimise losses of sediment and nutrient to water and maintain soil structure. Pugging and compaction of soil are avoided as much as reasonably practical. No tillage or low impact cultivation methods and timing are considered. Supplement such as baleage is fedaway from waterways and critical source areas. Riparian margins or buffer strips are left beside waterways and other areas where sediment and nutrients may flow such as gullies or swales.	By reducing pugging and compaction, soil structure is protected, and erosion damage minimised. This will help minimise sediment and nutrients from entering waterways. Nutrient losses are reduced, especially P loss.
	Use appropriate paddocks for intensive winter grazing. Low risk paddocks are selected for intensive winter grazing, ideally further away from waterways, with soil least likely to pug and compact. Ideally flatter with as few gullies and swales as possible.	By selecting appropriate paddocks for intensive winter grazing, at risk paddocks are avoided. Avoiding these paddocks will help protect soil structure and erosion, minimising the sediment runoff and P loss. N losses are minimised by keeping the N in the root zone ready for a spring uptake.
Winter Management Plan	Crops grazed on sloping ground are grazed from top of slope to bottom. A 20m last bite strip is used.	The remaining crop acts as a sediment and contaminant buffer, minimising P loss.
	Stock to be back fenced to prevent stock entering previously grazed land.	If stock is prevented from entering previously grazed areas this will reduce pugging and sediment compaction and break down, minimising P loss.
	Portable water troughs are used and shifted weekly.	This will prevent stock moving back to a fixed water trough, leading to pugging and sediment compaction

		and breakdown. Minimises P loss.
	Baleage placed in the breaks prior to the winter and portable ring feeders are used when feeding baleage.	This will prevent tractors etc from driving on vulnerable paddocks, contributing to sediment breakdown and erosion.
	Mob sizes are minimized where practicable.	Minimising stock in a paddock will minimise the movement of stock which leads to sediment breakdown and erosion. Minimises P loss.
	Buffer width from any creek/river to the grazed area to be 5m. Where the grazed area is the area of crop set for IWG activities. To be achieved by temporary fencing and crop sowing plan/s.	This acts as a buffer, filtering sediment before it enters the waterways. Reduced P losses to waterways.
	Straw to be on-hand for bedding in extreme conditions and for possible sediment runoff mitigations.	Reduced erosion during extreme conditions, reducing P loss.
	CSAs to be managed during grazing. Necessary to prevent degraded water quality leaving the farm and stop cows from standing in mud. Last break grazed in the paddock if need to be grazed at all.	Managing CSAs will reduce soil break down and erosion and reduce P losses.

6.3 Use of Land for a Feed Lot

A feed pad is situated to the west of the effluent pond beside a shelter belt. The feed pad is 110m x 13m, split into two pens. A woodchip/bark base is used for bedding and cows are fed silage and hay. The feed pad is used in early spring and during adverse weather. The feed pad naturally slopes to the south and effluent is captured by drains in the pad and collected in a concrete tank. A pump transfers the effluent to the effluent storage pond.

Figure 6 below shows the the layout of the farm with the feed pad in the south west corner.

Figure 6: Farm layout showing feedpad to the south west of the farm infrastructure.

The following table provides further details of the use of each feed pads and assessed this use against the Permitted Activity criteria under Rule 35A of the PSWLP and Subpart 1 of the NES-FW 2020. It is not consistent with Subpart 1 Regulation 9(3) as less than 90% of the cattle held on the feedlot is more than 4 months old. The feedlots do not have a base with a minimum permeability of 10^{-9} m/s are therefore are not consistent with Regulation 10(3)(a).

<table>
<tr><th colspan="3">Feed Pad Details PSWLP</th></tr>
<tr><td colspan="3">PSWLP Rule 35A (a) The use of land for a feed pad/lot is a permitted activity provided the following conditions are met:</td></tr>
<tr><td rowspan="4">(i) if accommodating cattle or deer, each feed pad/lot services no more than 120 adult cattle, or 250 adult deer, or equivalent numbers of young stock at any one time</td><td>Aug</td><td>118</td></tr>
<tr><td>Sep</td><td>73</td></tr>
<tr><td>Oct</td><td>12</td></tr>
<tr><td>Adverse weather conditions outside of these months</td><td></td></tr>
<tr><td>Animals not remain on the feed pad/lot for longer than three continuous months</td><td colspan="2">Feed pads are not used for more than 3 continuous months.</td></tr>
<tr><td>The feed pad/lot is not located
(1) within 50 meters from the nearest waterway or another feed pad/lot on the same landholding.</td><td colspan="2">Feed pads are located approx. 300m from the nearest waterway.</td></tr>
<tr><td>(2) a minimum depth of 500 millimetres of wood-based material across the base of the feed pad/lot</td><td colspan="2">The feed pads have a minimum of 500 millimetres of wood-based material across the base.</td></tr>
<tr><td>(v) any material scraped from the feed pad/lot including sold animal effluent, is collected and if applied to land is in accordance with Rule 38</td><td colspan="2">Solid effluent is scraped from the feed pad and disposed to land in accordance with Rule 38 of the PSLP. Liquid effluent is collected and stored in the effluent storage pond.</td></tr>
<tr><td>(vi) the overland flow of stormwater or surface runoff from surrounding land is prevented from entering the feed pad/lot.</td><td colspan="2">The feed pad is unlikely to receive overland flow form surrounding land, and all runoff and effluent from each feed pad is gravity fed directly to the effluent storage pond.</td></tr>
</table>

Feed Pad Details NES-FW 2020	
(3) The use of land for feed pad/lot is a permitted activity if 90% or more of the cattle held in the feedlot is (a) no more than 4 months old; or	Less than 90% of the cattle held on the feedlot is more than 4 months old and more than 120kg in weight.

(b) no more than 120kg in weight.	
10(3). The use of land for a feed pad/lot is a discretionary activity if (a) The base area of the feedlot is sealed to a minimum permeability standard of 10^{-9} m/s and	The base of the feedlot is not sealed to a minimum permeability standard of 10^{-9} m/s as the base of the feed pad/lot is woodchips/bark.
(b) Effluent expelled in the feedlot is collected, stored, and disposed of in accordance with the rule in a regional or district plan, or a resource consent and	Effluent is collected and stored in the effluent storage pond and will be disposed of in accordance with Discharge Permit AUTH-301081.
(c) The feedlot much be at least 50m away from any water body, any water abstraction bore, any drain, and the coastal marine area.	The feed pads/lots are located 300m from any waterway.

6.4 Positive effects

The continuation of dairy farming will contribute significantly to the social and economic wellbeing of the local and regional community.

The proposal will result in a nearly 7% decrease in nitrogen losses and an 11% decrease in phosphorus losses. This in turn will result in an improvement in water quality.

6.5 Other Assessment Matters

In accordance with Clause 7 of Schedule 4 of the RMA the following provides an assessment of the activity's effects **on the environment:**

a) *any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects*

The immediate neighbourhood and wider community is a small rural Southland town which is serviced by similar land uses to the proposed activity. Land use of this nature is anticipated and widely supported in this area due to the local economic and cultural benefits that dairy farming brings to small rural economies. The proposed activity will employ contractors and consultants from the wider community as well as support local schools and local rural businesses. In a more general sense, the primary industries in New Zealand continue to contribute greatly to the New Zealand economy in many ways including gross domestic productivity, employment, community growth and resilience and reinvestment capacity via tax revenues. The ability for the applicant to continue to operate their entire farming operation will enable them to provide for their own social, economic and cultural wellbeing.

In terms of the potential effects on cultural values, an assessment of the proposal against the Te Tangi a Tairua is the Iwi Environmental Management Plan (applicable to the Southland Region), is made below. The proposal is considered to be wholly consistent with the relevant policies of the Iwi Management Plan.

b) any physical effect on the locality, including any landscape and visual effects

In terms of landscape and visual effects, the presence of effluent infrastructure, other farming equipment and cows is expected within the rural locality and is an existing activity on the applicant's current farm. The proposal will not have any significant physical effects on the locality over and above that currently experienced.

c) any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity

The dairy farm is located within a modified ecological landscape and the proposal will not have any significant adverse effects on ecosystems. The physical works required to convert the support block to a dairy farming land does not involve significant physical changes to the landscape and all works are located well away from environments such as waterways, wetlands and natural bush areas which may contain plant and animal habitats.

d) any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations

The activities will not have any adverse effects on aesthetic values, as the proposed dairy platform will be in keeping with the general rural nature of the area. The land in this area is historically known for farming activity and the presence of a dairy operation on this property does not result in any effect contrary to the historical values associated with the natural and physical resources in the vicinity.

The waterways within the proposed dairy platform are non-navigable and public access would be by permission of the applicant only. There is no evidence to suggest popular recreation fishing spots nearby which may be affected by the proposal. The effects on any cultural values are assessed below.

e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants

Effluent generated on the property will be treated and discharged to land as authorised by AUTH-301081 and is consistent with the discharge methods promoted by industry groups, Regional Councils and by the relevant rules and policies for the Southland region. The assessment of alternatives (below) provided in this report has concluded that this is the preferred solution for managing animal waste generated at the property. Various mitigation measures described in this application are designed to avoid, remedy or mitigate the loss of contaminants to the wider environment with the aim of applying nutrients in a manner which enables them to be efficiently and effectively used for the benefit of pasture and crop growth.

The proposed activity is anticipated within the rural zone and no aspects of the proposal are likely to result in the emission of an unreasonable and unexpected level of noise.

f) any risk to the neighbourhood, the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations

All hazardous materials carried and used onsite will comply with the relevant rules of the Hazardous Substances and New Organisms Act 1996. As such, there will be no risk to the neighbourhood, wider community or the environment due to natural hazards or the use of hazardous substances or hazardous installations.

6.6 Assessment of Alternatives

Schedule 4 of the RMA requires that an assessment of environmental effects must include a description of any possible alternative locations or methods for undertaking the activity if it is likely that the activity will result in any significant adverse effect on the environment and/or if the activity includes the discharge of contaminants. None of the activities described in this report are expected to result in significant adverse effects on the environment.

The alternative to including the Schrama block as part of the milking platform is to continue operations as currently existing. As shown, the proposal results in a significant reduction of contaminant loadings on the property. This will not occur if operations continue as they are.

7. 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.

7.1 Part 2 of the RMA

Section 104(1) RMA states that when considering an application for a resource consent, the matters which we have discussed above are subject to the purpose and principles in Part 2 RMA. However, the Supreme Court in King Salmon found that, in the absence of any uncertainty, invalidity or incomplete coverage in the relevant policy or plan document, there is no need to have recourse to an overall judgement approach under Part 2. We do not consider there are any instances of uncertainty, invalidity, or incomplete coverage in the planning instruments disucessed in the above sections.

Nevertheless, out of an abundance of caution, we have prodived a discussion of the proposal in the light of Part 2. We have provided this discussion in the normal way treating the principles contained in section 6, 7

and 8 as being subordinate to the purpose of the RMA as set out in section 5.

Section 5 RMA – Purpose

The purpose of the RMA is to promote the sustainable management of natural and physical resources. That is, the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety while:

a. Sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and

b. Safeguarding the life supporting capacity or air, water, soil and ecosystems; and
c. Avoiding, remeduing, or mitigating any adverse effects of activities on the environment.

The proposal is for farming activities that use natural resources. The activities 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. Potential adverse effects of the proposal may exist, however the adverse effects have been adequately identified and assessed as able to be reduced or mitigated under the proposal.

Overall, the activity is considered to be consistent with Part 2 of the RMA, given the minor nature of the activity and the proposed mitigations.

Section 6 RMA – Matters of national importance

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.

-The relationship of Maori and their culture and tradiations 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 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 tha their proposal will not comproise or have an adverse impact on Maori culture, traditions or taonga.

Section 7 RMA – Other matters

Section 7 of the RMA lists matters which all persons shall have particular regard to. Relevant to this application, these matters include kaitiakitanga, the efficient use and development of natural and physical resourceds, the intrinsic value of ecosystems, the maintenance and enhancement of the quality of the environment, and the protection of the habitat of trout and salmon.

As previously discussed, the assessment of environmental effects outlines mitigation measures to avoid or minimise adverse effects on water quality which in turn will avoid or minimise impacts on Section 7 matters.

Section 8 RMA – Treaty of Waitangi

Section 8 RMA required that applicants shall take into account the principles of the Treaty of Waitangi (Te Tiriti O Waitangi). Section 8 recognises the relationship of tangata whenua with natural and physical resources and encourages active participation of, and consultation with, tangata whenua in resource management decision-making.

We consider tha the proposed activity is not inconsistent with the principles of the Treaty of Waitangi as required by Section 8.

7.2 Section 104(1) 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 Environmental Standard for Sources of Human Drinking Water, 2007 (NES)
- National Environmental Standard for Freshwater Management, 2020 (NESFM)
- National Policy Statement for Freshwater Management, 2020 (NPSFM)
- Region Water Plan Southland (RWPS), 2010
- Proposed Southland Water and Land Plan (PSWLP), 2018

Under the RMA, regional plans need to give effect to NPSs, NESs and RPSs. For an application of this scale, an assessment of the application against the regional plan is adequate as these plans ultimately give effect to the higher order statutory instruments. As such, no individual assessment has been made against the National Environmental Standard for Sources of Human Drinking Water. A brief assessment has been made against the recently released National Policy Statement for Freshwater Management as it contains the most up to date national policy directions that need to be considered.

Relevant policies from the RWPS, and the PSWLP are considered relevant to this application and are assessed below. The rules and policies in PSWLP have legal effect from the date of notification and weight must be

given to the policies contained in PSWLP alongside the existing policies in the RWPS.

7.2.1 National Policy Statement for Freshwater Management 2020

The National Policy Statement for Freshwater Management 2020 (NPS-FM) recently came into force on 3 September 2020. This document is a national direction for managing freshwater in New Zealand and has been introduced alongside some relevant National Environmental Standards for Freshwater. A detailed assessment of this application against each of the NPS-FM policies is not considered necessary. However, because both the RWPS and PSWLP were given legal effect prior to the NPS-FM coming into effect it is considered appropriate to undertake a brief assessment of the proposal against the objectives and policies of the NPS-FM (2020).

The policies of particular relevance to this application for resource consent are outlined below. The proposal has been carefully considered against Te Mana o te Wai, the objective and all relevant policies listed below and in the context of the detailed assessment of effects is strongly considered to be consistent with all the relevant provisions of the NPS-FM.

The fundamental concept underpinning the NPS-FM (2020) is Te Mana o te Wai, that is recognising the fundamental importance of water and the health of water in protecting the health and well-being of the wider environment. Within the context of the NPS-FM this encompasses 6 principles relating to the roles of tangata whenua and New Zealand in the management of freshwater and the implementation of the NPS-FM.

The NPS-FM (2020) also sets out a hierarchy of obligations and an objective for Te Mana o Te Wai that prioritises first the health and wellbeing of water bodies and freshwater ecosystems over second the health needs of people, and third, the ability of people and communities to provide for their social, economic, cultural well-being.

A number of the principles set out for Te Mana o te Wai are directly relevant to Councils in giving effect to the NPSFM (for example through plan making processes), as they focus on tangata whenua's authority and responsibility and actions, as well as governance by the council. Many of the principles are more difficult for an applicant to give effect to. The two principles that stand out as relevant are the following:

"(e) Stewardship: the obligation of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generation."

"(f) Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation."

This proposal is consistent with the framework that gives direction to restoring and preserving the balance between water, the environment, and the wider community. For the reasons given in the assessment of

effects above in Section 6, this balance will be found by a reduction in nitrogen and phosphorus as proposed by this application and use of mitigation/GMPs across the dairy farm.

Further discussion of relevant policies within the NPS-FW (2020) is provided in the table below.

Table 11: Applicable policies from the NPS-FW (2020).

Policy	Wording	Comment
1	Freshwater is managed in a way that gives effect to *Te Mana o te Wai*.	See above disucssion
2	*Tangata whenua* are actively involved in freshwater management (including decision making processes) and Māori freshwater values are identified and provided for.	See above discussion
3	Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.	Surface water quality in the receiving environment is considered to be generally poor when assessed against the objectives within the NPSFM and the ANZECC guidelines. Trend data indicating improving trends across all parameters. The Overseer modelling of the proposed farm system in its entirety models that nitrogen losses to below the root zone will reduce by 854kg/year equating to a nearly 7% reduction. Phosphorus will reduce by approximately 73kg equating to a roughly 11% reduction. There is also a highly likely reduction in sediment and microbial. The health and well-being of the receiving environments is predicted to improve as a result of the proposal as described.
4	Freshwater is managed as part of New Zealand's integrated response to climate change.	Same as for Policy 3.

5	Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.	Same as for Policy 3.
12	The national target (as set out in Appendix 3) for water quality improvement is achieved.	The national targets from primary contact are based on water quality in terms of E. coli and cyanobacteria. As there are no proposed changes to the effluent system, which has been designed to utilise low-rate application, deferred storage of effluent and strategic application to a variety of soil types, water quality improvements are likely being made.
13	The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.	Water quality monitoring on the Makarewa River is currently undertaken under the State of the Environment monitoring programme to ensure continuous monitoring over time to identify trend data. The proposal includes simultaneous monitoring and management of nutrient inputs and outputs from the farm in order to identify areas of improvement which could improve water quality in the receiving waters.
15	Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement."	The expansion of a dairy farm provides greater opportunities of the local economy in terms of permanent jobs and support of local schools and communities.

		Positive economic, social and cultural well-being should result.

7.2.2 Land Use

Planning Document	Particularly relevant sections
Southland Regional Policy Statement	Objectives RURAL.1, RURAL.2, Policies RURALl.1, RURAL.2
Proposed Southland Water and Land Plan	Policies 6, 13, 16, and 39A
Te Tangi a Tauira	Section 3.5.7, 3, 5, and 13

Policies 6, 13 and 16 of the PSWLP appear to have equal weighing, and the proposal is consistent with each of these.

Furthermore, the amalgamated farm provides for improved farm systems that will over time contribute to improved environmental outcomes and a small but likely reduction in nutrient loading. The continuation of farming would provide for the economic and social well-being of the applicant and the communities they support. The proposal is consistent with the objectives and policies in the SRPS and Policy 13 of the PSWLP by supporting the sustainable use and development of rural land resources, both environmentally and economically, if undertaken in the manner as proposed.

The applicant has implemented a farm environmental management plan which is in accordance with Appendix N of the PSWLP. Good Management Practices and mitigations are most effective at the farm scale if they are targeted to the risk area, in this instance the effects of combined deferred FDE storage, greater flexibility to better utilise the less vulnerable areas of the farm, and adherence to the appropriate buffer zones between water bodies and grazed areas, all successfully avoid or mitigate adverse effects to a practical minimum where they are less than minor. Sediment run-off is managed to a level that it is low risk for the farm system proposed. The FEMP 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.

7.2.3 Water Quality

Planning Document	Particularly relevant sections
Southland Regional Policy Statement	Objectives WQUAL.1, WQUAL.2, Policies WQUAL, 1, 2, 5, 7, 8
Regional Water Plan for Southland	Policies 25, 41 and 42
Proposed Southland Water and Land Plan	Policy A4 of NPS-FM

	Objectives 6 and 8 Policies 6, 12, 15B, 16, 17, 18, and 39A
Te Tangi a Tauira	Section 3.5.13 and 3.6.13

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. The 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 2020;
- Freshwater quality is managed to meet the reasonably foreseeable social, economic and cultural needs of future generations.

The proposed dairy platform is within the Gleyed Lignite/Marine Terraces and the Peat wetlands Physiographic Zones. Policy 6 and Policy 10 requires the implementation of good management practices to manage adverse effects cumulatively and propose GMPs and mitigations (where appropriate) to mitigate and/or avoid effects of the activities on water quality. These GMPs and mitigations are proposed to be implemented by way of a FEMP that has been prepared by the applicant and appended to this application. Genuine attention and thought have been given to the potential adverse effects of the proposal on water quality, in the context of the most likely contaminant pathways. With regards to Policy 15B, effort has been made to provide an assessment of the likely nutrient loading from the property and shows that nutrient loss is unlikely to have an impact on current nutrient loads in the receiving environment and New River Estuary. The proposal would result in a reduction in contaminant losses compared to the legal existing environment over time, as the expanded farm provides greater opportunity to utilise the total farm area that results in positive environmental outcomes. Therefore, the proposal is consistent with the relevant policies noted above.

Policy 16 requires the minimising of adverse environmental effects from farming activities. Part (a) applies as the property is within proximity of the New River Estuary that is identified as a sensitive waterbody in Appendix A of the PSWLP. As noted elsewhere in this proposal, this proposal does not involve an increase in the number of cows over the expanded dairy platform from what is already consented. Therefore, the proposal is consistent with Policy 16(1) as the assessment here demonstrates the GMPs and mitigation applied to minimise adverse environmental effects on the downstream sensitive receiving environments.

Policy 16(1)(b)(iii) likely applies as it is our assumption that no lowland surface water body in Southland meets the Appendix E water quality standards, and there is no data for Titipua Stream to confirm or prove otherwise. However, in the context of demonstrating that there will be some improvement in water quality over time as

a consequence of the amalgamated farm, it is considered that the 'generally' component of the policy applies and Policy 15B and the higher objectives would provide an appropriate approach that would support granting application that have been able to demonstrate that they would result in an improvement in water quality.

Policy 15B requires improvement of water quality where it does not meet Appendix E standards and this proposal is consistent with this policy.

The proposal to expand the dairy platform provides for a variety of measures which either avoid or further mitigate against adverse effects on water quality which are described in detail earlier.

NESFW Regulation 24

Regulation 24 requires that:

> *"(1) A resource consent for an activity that is a discretionary activity under this subpart may be granted only if the consent authority is satisfied that granting the consent will not result in an increase in—*
>
> *(a) contaminant loads in the catchment, compared with the loads as at the close of 2 September 2020; or*
>
> *(b) concentrations of contaminants in freshwater or other receiving environments (including the coastal marine area and geothermal water), compared with the concentrations as at the close of 2 September 2020.*
>
> *Term of resource consent*
>
> *(2) A resource consent granted for the discretionary activity must be for a term that ends before 1 January 2031"*

The assessment in Section 6.1.1 demonstrates through Overseer modelling of the proposed scenario and outside of Overseer mitigations a 6.7% decrease in N losses can be achieved and a 11.3% decrease in P losses. This is in line with the requirements of Regulation 24 in which the consent authority can be satified that there is no increase in contaminant loads in the catchment from 2 September 2020 or that there is no increase in contaminants in freshwater or other receiving environments compare with consentratios as at 2 September 2020.

7.2.4 Effluent discharge

Planning document	Particularly relevant sections
Southland Regional Policy Statement	Objectives WQUAL.1 Policies WQUAL.8, WQUAL.10
Regional Water Plan for Southland	Policies 7, 31A, 31C, 31D and 42A
Proposed Southland Water and Land Plan	Policies 13, 14 and 17

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 produce and protects values as described in Te Tangi a Tauira. The management of effluent in the proposal meets best practice and is designed to avoid any surface runoff, overland flow, ponding, contamination of water via, deep drainage or overland flow from the application of effluent to land. The land which will be receiving effluent is considered suitable and the discharge areas are sized appropriately to lower overall nutrient loads from the application of effluent.

7.2.5 Tangata Whenua

Planning Document	Particularly relevant sections
Southland Regional Policy Statement	Policies TW.3, TW.4
Regional Water Plan for Southland	Polices 1A
Proposed Southland Water and Lan Plan	Policies 1 and 2
Te Tangi a Tauira	Entire document

The Southland Regional Policy Statement describes the resource management issues important to Ngai Tahu in the Southland regional 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 Ngai 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 contained within the property boundaries and with the proposed farm system changes and mitigation/GMPs will ensure that the effects of the activities will not materially impact on tangata whenua values or compromise sites of special significance of food gathering sites. The cumulative effects assessment concludes that any effects felt outside the boundary of the property will not degrade water quality and not impact on cultural values such as mahinga kai.

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 effluent is to land rather than water;
- The applicants already adopts best practice for land application of managing farm effluent;
- The existing riparian margins are protected;
- Deferred application of FDE and solid effluent 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 to be 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.

7.3 Sections 105 and 107 of the RMA

In addition to the matters in Section 104(1) of the RMA, if an application is for a discharge permit a consent authority must have regard to the matters as specified in Section 105. The proposed discharge can be undertaken in a manner which appropriately mitigates contaminants from entering water through controls on application method and conditions of consent. As nutrients can be reused, there is a direct benefit to the property as a method for improving soil fertility.

There are no matters under Section 107(1) of the RMA that would require the consent authority to decline this application.

8. Consent Duration, Review and Lapse

8.1 Consent Duration

With regard to consent duration, special consideration has been given to Policies 14A and 43 of the RWPS and Policy 40 of the pSWLP, and Te Tangi a Tauira which have been grouped below for ease of assessment.

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

The environmental effects of the change in land use and farm system proposed are described in this application. The assessment above and contained within the attached documents explains these activities and effects so that Council may have certainty in their nature (what they are), scale (how minor they are in the wider context of the catchment), their duration and frequency of effects (i.e. ongoing positive effects overall). Potential adverse effects have in the first instance been mitigated by appropriate management techniques on farm followed by contingency planning, ongoing monitoring and reporting in an auditable format.

The existing environment is reasonably well known, and the proposal is very likely to improve water quality beyond that which is observed in the existing environment.

Matching consent duration to the level of risk of adverse effects.

The risk of adverse effects arising from dairy farming land use varies on a case to case basis and for the most part the risk level is greatly controlled by human behaviour and farm management.

The extent and nature of the actual and potential adverse effects of the activities on the existing environment were assessed in this document and concluded to be no more than occurring historically in the consented baseline, with a significant improvement from the consented baseline.

Overall, the risk of unanticipated or unexpected adverse effects occurring is low because of the mitigations and GMPs. Ongoing development and investigation in new technologies and mitigations will ensure that the risks can remain low throughout the consent duration proposed.

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 seeks a 10-year consent duration for all the applications. We consider that this is a reasonable timeframe which would provide adequate time for the applicants to finalise and implement the amalgamation proposal.

The permanence and economic life of any investment

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

The investment in both properties is significant and in the order of millions of dollars. The market for dairy products both nationally and globally is strong. Commodity market influence is always a factor and will influence the profitability of the proposed farm. An appropriate consent duration will encourage investment and improvements on farm which can improve environmental outcomes and buffer the applicant's ability to respond to commodity market changes which secures the permanence of the activity. Furthermore, the permanence of the economic life of the activity requires resource consents to be granted from the Council for a reasonable duration.

Common expiry date for permits that affect the same resource

A common expiry date for all the permits applied for is considered appropriate.

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.

Timing and development of FMUs

Granting 10 year duration resource consents will not adversely affect the development and implementation of any revised framework established in the FMU section of the PSWLP, as Council has the ability to have new rules take effect from the date of notification of a plan change and would also be able to review all contents in the catchment collectively.

NESFW

We note for completeness that the NES provisions provide for a maximum term (to end before 1 Jan 2031) for discretionary activities (Regulation 30(4)).

In conclusion, due to the low level of environmental risk of the proposed activities and substantial value of the investments on the property, 10-year consent durations are considered entirely appropriate.

8.2 Consent Commencement

Any consents granted subject to this application will commence as of the date they are given effect to.

8.3 Review of Lapse

The applicants have no objection to the Environment Southland standard review conditions. In accordance with Section 125 of the RMA, the default 5-year lapse period is appropriate.

9. Conclusion

A decision to grant the resource consent applications under Section 104B and 104C is recommended on the basis that:

a) the adverse effects on the environment are highly likely to be insignificant;
b) The proposal is consistent with the requirements of the RMA, relevant plan objectives and policies and other relevant matters.

Granting the resource consent applications will be consistent with the purpose of the RMA for the reasons explained within this report. The proposed activities are highly unlikely to result in further degradation of water quality and potential adverse effects will be appropriately avoided or mitigated.

Appendix A: Farm Environmental Management Plan

32264

TIAKI FARM ENVIRONMENT PLAN

ABOUT YOUR TIAKI FARM ENVIRONMENT PLAN

This Tiaki Farm Environment Plan document is the result of a tailored farm environment planning service provided to you through the Co-operative Difference. It's part of the advantage you get through Farm Source as a member of the Fonterra Co-Operative. The purpose of this plan is to describe the environmental conditions present on your farm and the management of these conditions. From this, mitigations to potential impacts to water quality are documented and additional mitigations maybe planned, with sensible timeframes. Underpinning this plan, are the agreed national Good Farming Practices that are supported by the agricultural and horticultural sectors. Industry bodies along with Regional Councils and Central Government have developed the Good Farming Practice: Action Plan for Water Quality 2018 in a commitment to swimmable rivers and improving the ecological health of our waterways. The Dairy Industry Strategy (Dairy Tomorrow), as well as the Good Farming Practice: Action Plan for Water Quality 2018, both align with the goal for all dairy farms to have a Farm Environment Plan by 2025. Now that this plan has been created it's the plan owner's responsibility to ensure it is put into action and kept up to date as actions are completed or conditions on farm change. Farm Source is here to help with that implementation and ongoing management through our team of Sustainable Dairying Advisors who can be contacted via the details below.

PHONE: **0800 65 65 68**

EMAIL: **sustainable.dairying@fonterra.com**

CONTENTS:

FARM DETAILS

SUPPLIER NUMBER

32264

FARM OWNER

Titipua Limited Partnership

C/- M Harrington
PO Box 657
Invercargill 9840

PLAN OWNER

FARM ADDRESS

425 Hedgehope Block Road

Edendale

LOCATION

REGIONAL COUNCIL

Southland

PLAN LAST EDITED

22 March 2021

POINTS OF NOTE

* Southland Physiographic Zones
Lignite - Marine Terraces: 195.32 ha - 71.77 %.
Gleyed: 4.07 ha - 1.50 %.
Peat Wetlands: 72.75 ha - 26.73 %.
* Southland Drainage
Kerr\"s Outfall: 1.29 ha - 0.47 %.
Buchanan\"s Outfall: 1.29 ha - 0.47 %.
* Southland Consents
Type:Dairy Consent,ID:AUTH-301081-V1,Expiry:2022-09-01: 0.01 ha - 0.00 %.
Type:Water Permit,ID:AUTH-301082-V1,Expiry:2022-09-01: 0.01 ha - 0.00 %.
* NZLRI Land Use Capability
3w 3: 37.68 ha - 13.85 %.

3c 2: 234.47 ha - 86.16 %.

LAND PARCELS

Fee Simple, 1/1, Lot 2 Deposited Plan 420431, 48,530 m2, Fee Simple, 1/1, Lot 1 Deposited Plan 470872 and Lot 3 Deposited Plan 1494, 1,602,752 m2, Fee Simple, 1/1, Lot 2 Deposited Plan 386399 and Lot 2 Deposited Plan 4406, 69,940 m2, Fee Simple, 1/1, Lot 1 Deposited Plan 386399, 94,045 m2, Fee Simple, 1/1, Lot 1 Deposited Plan 4406, 872,477 m2

FARM OVERVIEW MAP

The map below presents the land in which the farming operations covered in this document occur and identifies some key points of interest. More detailed maps looking at specific environmental management topics are contained throughout the document.

- Major Stock Excluded Waterway
- Major Stock Not Excluded Waterway
- Minor Stock Excluded Waterway
- Minor Stock Not Excluded Waterway
- Farm Boundary
- Compliant Crossing
- Non-Compliant Crossing
- Non-Compliant Non-Regular Crossing
- Dispensation Crossing
- Dairy Shed

GOOD FARMING PRACTICES

This section provides an overall snapshot of the farm's Good Farming Practices (GFPs). Based on industry-agreed identified practices, the GFPs in this Farm Environment Plan are grouped by the six core management areas on farm. Each management area below displays the farm's progress towards achieving all the GFPs within that area. This section also includes additional GFPs relevant to the dairy industry goals.

ACHIEVED	NOT ACHIEVED	N/A
17	6	3

GENERAL FARM

83% ACHIEVED
1 ACTION

LAND & SOIL

100% ACHIEVED

IRRIGATION

N/A

EFFLUENT

40% ACHIEVED
4 ACTIONS

WATERWAYS & BIODIVERSITY

75% ACHIEVED
1 ACTION

NUTRIENT

75% ACHIEVED
1 ACTION

GOOD FARMING PRACTICES

The tables below assess the GFPs recorded in this Farm Environment Plan. GFPs already in place on this farm, will be listed as “Achieved”. GFPs yet to be achieved or in progress, will show the number of open actions required to achieve the GFP. GFPs that are not applicable in this Farm Environment Plan will be listed as “N/A”

GENERAL FARM MANAGEMENT

Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately	ACHIEVED
Maintain accurate and auditable records of annual farm inputs, outputs and management practices	ACHIEVED
Store and load fertiliser with minimal spillage and leaching	ACHIEVED
Store, transport and distribute feed to minimise wastage, leachate and soil damage	1 ACTION(S)
*Farm waste is minimised and managed properly	ACHIEVED
*Water use for the dairy shed and stock water is efficient	ACHIEVED

LAND & SOIL MANAGEMENT

Manage farming operations to minimise direct and indirect losses of sediment and nutrients to water, and maintain or enhance soil structure, where agronomically appropriate	ACHIEVED
Reduce periods of bare soil between crops and pasture to reduce erosion and leaching	ACHIEVED
Retire all LUC 8 land and retire LUC 7e land or ensure that it has soil conservation measures in place	N/A
Use appropriate paddocks for intensive grazing	ACHIEVED
Manage grazing to minimise nutrient loss from risk areas	ACHIEVED

IRRIGATION MANAGEMENT

Irrigation rates and timing match plant requirements	N/A
Design, calibrate and operate irrigation systems to use water efficiently	N/A

*Additional GFP relevant to the dairy industry goals

GOOD FARMING PRACTICES

EFFLUENT MANAGEMENT

Effluent system meets code of practice	ACHIEVED
Sufficient suitable storage available	1 ACTION(S)
Spreading equipment is well maintained and calibrated	1 ACTION(S)
Effluent applied at correct depth, rate and time	ACHIEVED
*All effluent systems	2 ACTION(S)

WATERWAYS & BIODIVERSITY MANAGEMENT

Identify areas where runoff may occur and manage to avoid runoff entering waterways	ACHIEVED
Tracks, feed areas, gateways and troughs are located away from waterways	ACHIEVED
Stock are excluded from waterways	1 ACTION(S)
*Areas of native plants or significant biodiversity are protected	ACHIEVED

NUTRIENT MANAGEMENT

Monitor and maintain P levels at the economic optimum	ACHIEVED
Fertiliser application matches plant requirements and minimises losses	ACHIEVED
Spreading equipment is well maintained and calibrated	ACHIEVED
*General Nutrient Management	1 ACTION(S)

*Additional GFP relevant to the dairy industry goals

ACTIONS & RECOMMENDATIONS

This list includes all actions and recommendations that have been agreed as part of this Farm Environment Plan. Actions are required to achieve Good Farming Practices. Actions that have a target date within 2 years are captured as “Current Actions”. Actions with a target set more than 2 years in the future are captured as “Future Actions”. “Recommendations” cover all other actions that are not related to a GFP.

CURRENT ACTIONS

	Target Date
Complete an Effluent Management Plan	31 Mar 2021
Record effluent applications	30 Apr 2021
Review Farm Dairy Records & the Fonterra Environmental Report	30 Jun 2021
Complete fencing of the northern creek	30 Jun 2021
Improve silage leachate management and storage	30 Sep 2021
Inspect and test effluent ponds	31 Jan 2022
Bucket test the travelling irrigator	31 Jan 2022

FUTURE ACTIONS

	Target Date

RECOMMENDATIONS

	Target Date
Test N levels in crop paddocks	
Investigate environmental mitigations	
Mitigate environmental risks from land in the Lignite Marine Terraces Zone	
Mitigate environmental risks from land in the Peat Wetlands Zone	
Mitigate environmental risks from land in the Gleyed Zone	
Trial additional winter grazing mitigations	
Continue lane maintenance	
Fence off or drain wet areas	
Check Farm Crossings	
Include environmental mitigations when new drains are planned	
Protect and enhance habitat	
Fence off gravel pit and trap sediment	30 Apr 2021
Fence riparian buffer strips beside new lane	30 Jun 2021

Key: Action Priority

Low Medium High Critical

ACTIONS & RECOMMENDATIONS

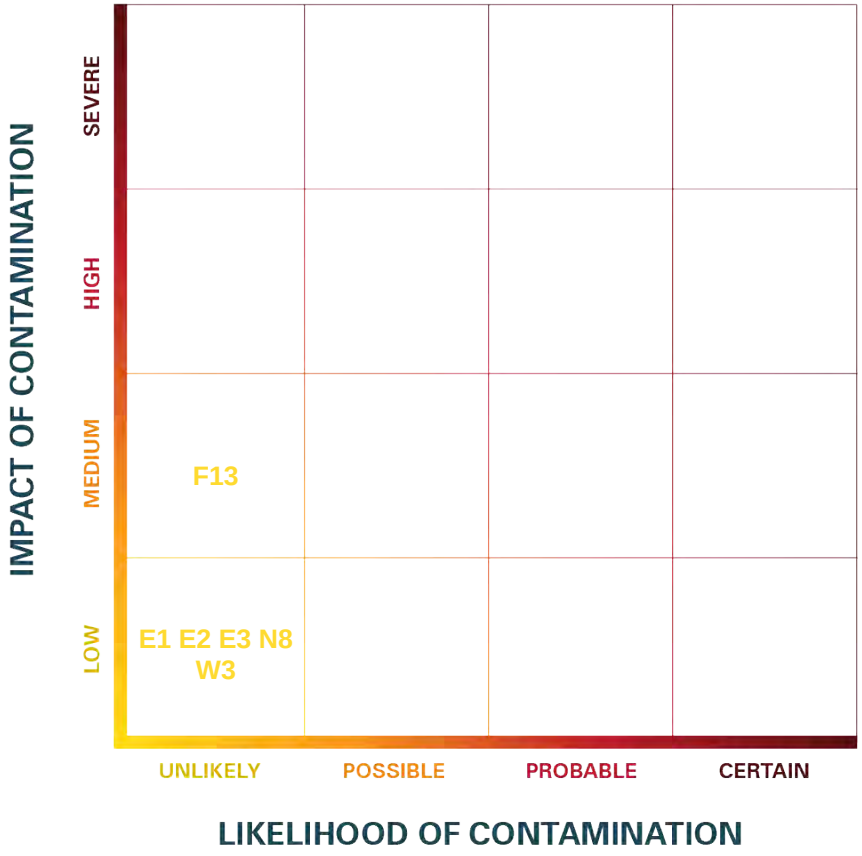
☐	Obtain Resource Consents	30 Sep 2021
☐	Monitor drainage water from around the effluent pond	30 Sep 2021
☐	Review waste management	30 Nov 2021
☐	Renew consents	28 Feb 2022
☐	Draw up a tile drain map	30 Apr 2022
☐	Measure dairy shed and stock water use	31 Jul 2023
☐	Plant out riparian zones	31 Jul 2024
☐	Reshape lanes beside waterways	31 Mar 2025
☐	Identify other sites for sediment traps	31 Mar 2025

Key: Action Priority

Low Medium High Critical

UNDERSTANDING THE RISKS ON YOUR FARM

This section provides some context to help understand the relative impact and likelihood of environmental risks that have been identified on your farm. The chart on this page together with the map on the following page can be useful when thinking about what environmental risk areas on your farm need the most focus.



HOW ARE RISK RATINGS MEASURED?

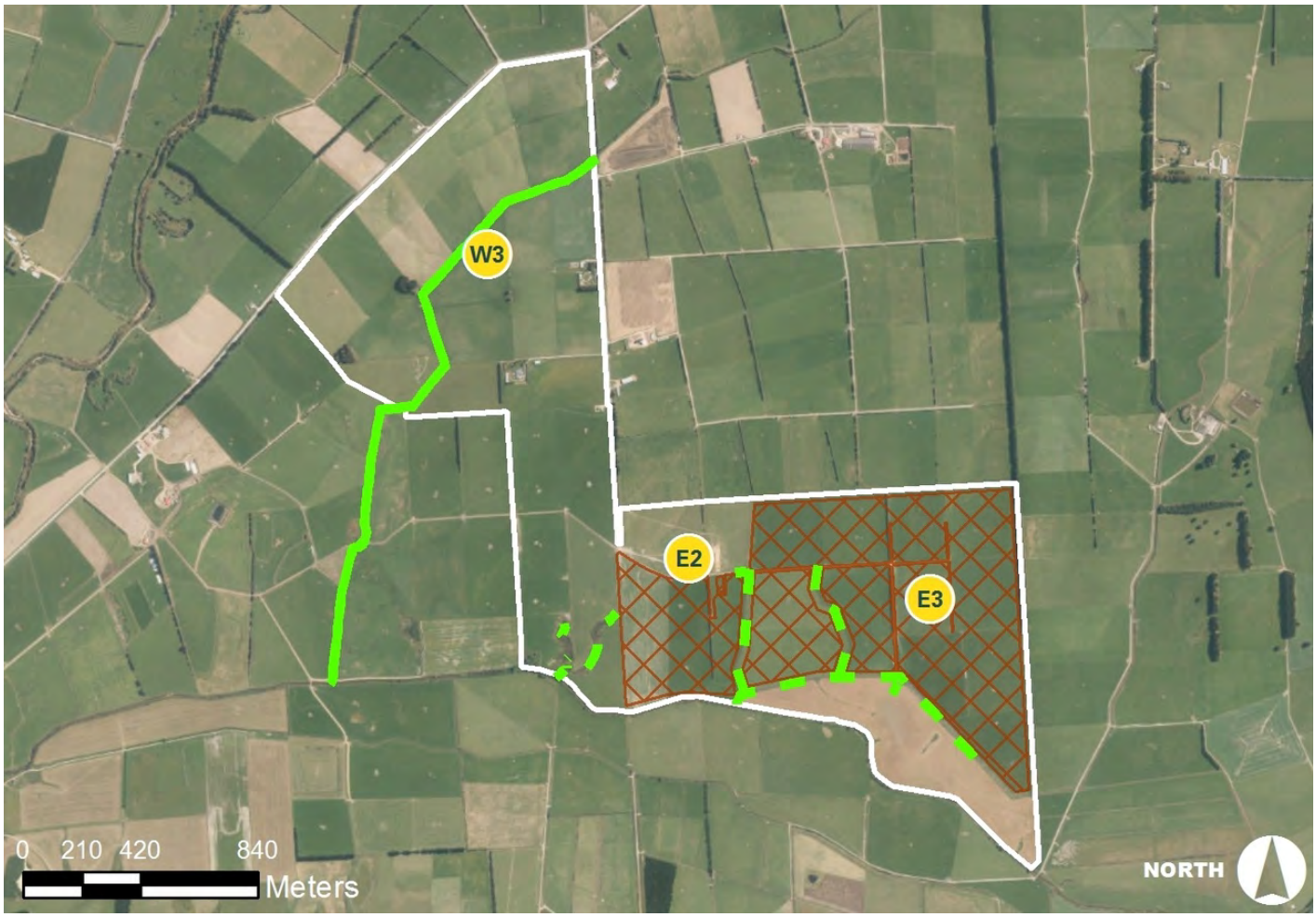
The issues plotted on the chart above have been done so based upon two measures that are assigned to a specific area of your farm where an environmental risk has been identified. 1. Impact of contamination (on the vertical axis, or the first dial) is a measure of the potential scale or significance of contaminants that may be lost from this area of your farm. It's about quantifying how bad could the outcome for the environment be; 2. Likelihood of contamination (on the horizontal axis, or the second dial) is about the chance of the contamination actually occurring from that area of your farm. It takes into account things like how far the area might be from waterways as well as the slope or aspect of the area; When combined together the two measures also give an overall 'risk rating'. The measures and the combined rating are presented for each risk area along with other descriptive information about the risk area on the subsequent pages of this document.

Example:

UNDERSTANDING THE RISKS ON YOUR FARM

The map below shows the location of the risk areas identified on your farm. The Risk Rating presented here is a combined measure of the impact and likelihood of contamination occurring from each risk area.

Low Medium High Critical



F13 Farm Infrastructure Overview

E1 Effluent Overview

E2 Effluent Storage

E3 Effluent Irrigation

W3 Waterways Fencing

N8 Nutrient Reporting

MAHI WHAKAHAERE
GENERAL FARM MANAGEMENT

- F4 Farm Overview
- F10 Resource Consents
- F13 Farm Infrastructure Overview
- F16 Key Feature - Dairy Shed
- F23 Key Feature - Calving Pad
- F26 Key Feature - Silage Stack
- F27 Key Feature - Urea Silo
- F31 Key Feature - Fuel Storage
- F32 Key Feature - Chemical Storage
- F34 Key Feature - Houses
- F35 Water Use Overview
- F36 Key Feature - Bore E46/1068
- F37 Waste Management Overview

FARM MANAGEMENT

GOOD FARMING PRACTICES

Identify a farms environmental characteristics and plan for their management Practices: The physical and biophysical characteristics of the farm system are identified, risk factors to water quality associated with the farm system have been assessed and are managed appropriately	ACHIEVED
Maintain records of good environmental management Practices: Accurate and auditable records of annual farm inputs, outputs and management practices are maintained.	ACHIEVED
Store and load fertiliser with minimal spillage and leaching Practices: The Fertiliser Industry - Code of Practice for fertiliser handling, storage and use is followed Storage sites are located away from waterways Stored fertiliser is covered Evidence: Farm map with storage sites identified	ACHIEVED
Store, transport and distribute feed to minimise wastage, leachate and soil damage	1 ACTION(S)
*Farm waste is minimised and managed properly Practices: Waste is recycled where possible Waste is contained and removed from farm where feasible Dead animals are sent off farm for processing or correctly disposed on-farm On-farm waste pits are small, away from waterways, and above the water table	ACHIEVED
*Water use for the dairy shed and stock water is efficient Practices: All water use on farm is measured (water meters) Water wastage is minimised from the dairy shed All leaks are fixed as soon as possible Water troughs are checked daily where animals are grazing Evidence: Water meter and telemetry records	ACHIEVED

*Additional GFP relevant to the dairy industry goals

FARM MANAGEMENT

FARM OVERVIEW

F4

The dairy farm owned by Titipua Limited Partnership (Fonterra Supply # 32264) is located at Hedgehope in Central Southland. It covers approximately 266 ha, with about 256 ha grazed.

* The farm is currently semi self contained with young stock grazed off after weaning, and some cows wintered off. Note: it is proposed that the farm will winter all of the herd on farm going forward, and young stock will be grazed off from 6mths of age to 18months of age.

* The current dairy herd of 500 cows is milked twice a day. Note: going forward this will increase to 600 cows twice a day.

* The system is low input and grass based, with moderate inputs of silage and some PKE and DDG fed through the milking shed.

* Nitrogen use has been 239kgN/ha, although it is budgeted to decrease to less than 180kgN/ha following inclusion of extra land.

* The farm has rolling contour with swales in many paddocks. There are also several flat paddocks along the Titipua Stream.

* Small waterways on the farm drain into the Titipua Stream (in the Oreti River catchment). Waterways and a pond are fenced off to exclude stock.

* The soils are poorly drained - mostly Pukemutu and Makarewa soils.

* Small areas of habitat and biodiversity remain - mostly associated with the pond/wetlands/waterways.

This Farm Environment Plan is designed to:

• summarise current farming practises and infrastructure

• outline the physical characteristics of the property and any key environmental risks

• review waterways, habitat and biodiversity values that impact or enhance Mahinga Kai (natural resources and wildlife/foods)

• identify any aspects of the farm operation which need to be changed/upgraded to meet national environmental standards or regional council rules

• list industry agreed Good Farming Practises as either achieved or needing to be actioned

• address any issues relating to the Fonterra terms & conditions for milk supply

FARM MANAGEMENT

RESOURCE CONSENTS

F10

Several activities on this farm have been consented by Environment Southland or may require resource consents in future. A 'certified freshwater farm plan' will also be required and may provide an alternative option to resource consents for assessing and controlling the effects of some activities.

Effluent:

Key conditions for the effluent discharge consent (AUTH-301081-V1, expiry 1-9-2022) include:

- no more than 600 cows may be milked on the property (winter milking is excluded)
- effluent applications shall not exceed a depth of 10mm per application and shall not be applied at a rate exceeding 10mm/hour
- the maximum N loading from effluent shall not exceed 150kgN/ha/year on the effluent paddocks
- effluent shall not be applied within buffer zones close to waterways, bores, farm boundaries or houses on neighbouring land

Groundwater Take:

Key conditions for the water take consent (AUTH-301082-V1, expiry 1-9-2022) state that:

- the daily water take shall not exceed 72,000 litres
- the water take shall be metered, with volumes recorded monthly

Land Use Change/Expansion of Dairying:

A land use consent will be required for an increase in the area of land used for dairy farming.

Winter Grazing and Stand-off Facilities:

The National Environmental Standards for Freshwater Management include new regulations which affect wintering of cattle on crops (between 1 May and 30 September) and use of wintering sheds or stand-off/calving pads.

On this farm resource consent may be required for 'Intensive Winter Grazing' (grazing on crops from May to September) if certain permitted activity conditions are not met including:

- winter crop area is less than 50 ha or less than 10% of the farm area (whichever is greater)
- the mean slope of the paddock must not exceed 10 degrees
- pugging must not exceed 20cm or cover more than 50% of the paddock(s)
- stock must be not graze within 5m of waterways, wetlands or surface drains even if these are dry
- the paddock(s) must be resown by 1 November

N.B. Other conditions and rules apply to Intensive Winter Grazing and should also be checked including those relating to any increase in winter grazing.

Resource consent is required for any wintering shed (defined in the regulations as a ‘feedlot’) where cattle are held for at least 80 days in any 6 month period and are mechanically fed. Wintering sheds must be located at least 50m from any drain/waterway and are required to have an impermeable base and an approved effluent collection and application

FARM MANAGEMENT

system. Resource consent may also be required to use a ‘stockholding area’ such as a stand-off/calving pad - unless the farm has a 'certified freshwater farm plan' and effects of this activity are assessed and certified as being equivalent to those from a stand-off pad that meets the permitted activity conditions in the NES:

- effluent cannot leak to groundwater
- effluent is contained and applied to land in a way that complies with Regional Council rules
- the stand-off pad is not within 50m of a waterway or bore.

Nitrogen Fertiliser:

The National Environmental Standards for Freshwater Management include new regulations which limit the use of nitrogen fertiliser on pastoral land (crops are excluded from the 'nitrogen cap'). No more than 190kg/ha of N from manufactured fertilisers can be applied to pasture on any landholding. All dairy farmers must supply fertiliser purchase records and application records to the Regional Council by 31 July each year. On this farm annual fertiliser N use on pastoral land is below the nitrogen cap of 190kgN/ha - but fertiliser records still need to be supplied to the Regional Council annually.

ACTIONS | RECOMMENDATIONS

		Target Date
☐	**Obtain Resource Consents** Review the rules contained in the National Environmental Standards for Freshwater and the Southland Water and Land Plan. Apply for resource consents where necessary and/or ensure key farming activities are assessed and certified as compliant within the freshwater farm plan for this property. New resource consents are likely to include: - Land use consent for expanded dairying - Intensive Winter Grazing	30 Sep 2021
☐	**Renew consents** Complete all tests required for the effluent discharge consent (eg irrigator tests, pond Drop Tests and visual inspections) and collate records that will be required for renewing the effluent discharge and water take consents. Prepare an application to renew these consents and submit this to Environment Southland at least 6 months prior to the expiry of the current consents.	28 Feb 2022

FARM MANAGEMENT

FARM INFRASTRUCTURE OVERVIEW

F13

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Key farm infrastructure includes:

- a herringbone dairy shed
- a calving pad
- a silage stack
- a fertiliser silo and feed silos
- fuel and chemical storage facilities
- three houses

* The dairy shed is a 44 a side herringbone with a rectangular yard. Nib walls and sumps allow full capture of effluent from the yard areas and shed platforms. Over winter rainwater from the yard is diverted to drainage and does not enter the effluent system.

* A calving pad (110m x 13m split into 2 pens) has been set up beside a shelter belt near the dairy shed. Woodchip/bark is used for bedding and cows are fed silage and hay. The pad may hold up to 70 cows per pen in early spring. Liquid effluent is captured by drains under the pad and collected in a concrete tank. A pump with a float switch transfers the effluent to the main holding pond.

* Silage is stacked on a rock/limestone pad (30m x 14m) with earth banks on 3 sides. The stack is over 600m from the Titipua Stream. Leachate is not collected and could damage water quality/stream life if contaminated run-off flows away from the stack and into a tile.

* Storage facilities for fertiliser (urea silo), feed, fuel and chemicals are located in the implement yard and sheds

* The farm has 3 houses. Household sewage and wastewater is discharged through dispersal fields.

ACTIONS | RECOMMENDATIONS

	Target Date
Improve silage leachate management and storage – To Achieve GFP * Investigate options for installing a fully sealed sump or tank to hold leachate and run-off from the silage stack (with a pipe to the sludge beds). * Where possible divert clean rainwater from the stack covers and areas surrounding the stack away from the leachate sump so the volume of run-off is minimised * Minimise leachate by ensuring silage is fully wilted	30 Sep 2021

FARM MANAGEMENT

FARM MANAGEMENT

WATER USE OVERVIEW

F35

Water is pumped from a bore near the dairy shed (Well E46/1068 on the Environment Southland website). The bore is capped and protected from stock or other sources of contamination. The water take is metered, with volumes recorded each month as per consent conditions.

Water efficiency measures include:

- a scraper and jetters are fitted on the backing gate which reduces hosing of the yard
- Greenwash water is recycled for washing the yard
- the shed is pre-wet before milking to reduce washing down
- cooling water is recycled for washing the yard

ACTIONS | RECOMMENDATIONS

		Target Date
☐	**Measure dairy shed and stock water use** Consider installing an extra water meter to measure stock water use (the volume of water used in the dairy shed can then be calculated by subtracting stock use off the total water take). This can help identify water use trends (seasonal peaks in demand or times of year when water supply is constrained or years when water use is much higher/lower) and assist with identifying less obvious leaks or issues that are causing unnecessary water use.	31 Jul 2023

FARM MANAGEMENT

WASTE MANAGEMENT OVERVIEW

F37

Farm waste and dead stock should be handled in a way that minimises the risks of:

- contamination of groundwater and drinking water supplies with toxic chemicals, leachates or discharges high in harmful bacteria etc,
- pollution of waterways and riparian areas,
- air discharges of harmful chemicals and soot from burning
- odour problems from dead stock or organic wastes,
- plastics, treated timber, scrap metal etc being blown, buried or cultivated in
- attracting rats, mice and other vermin

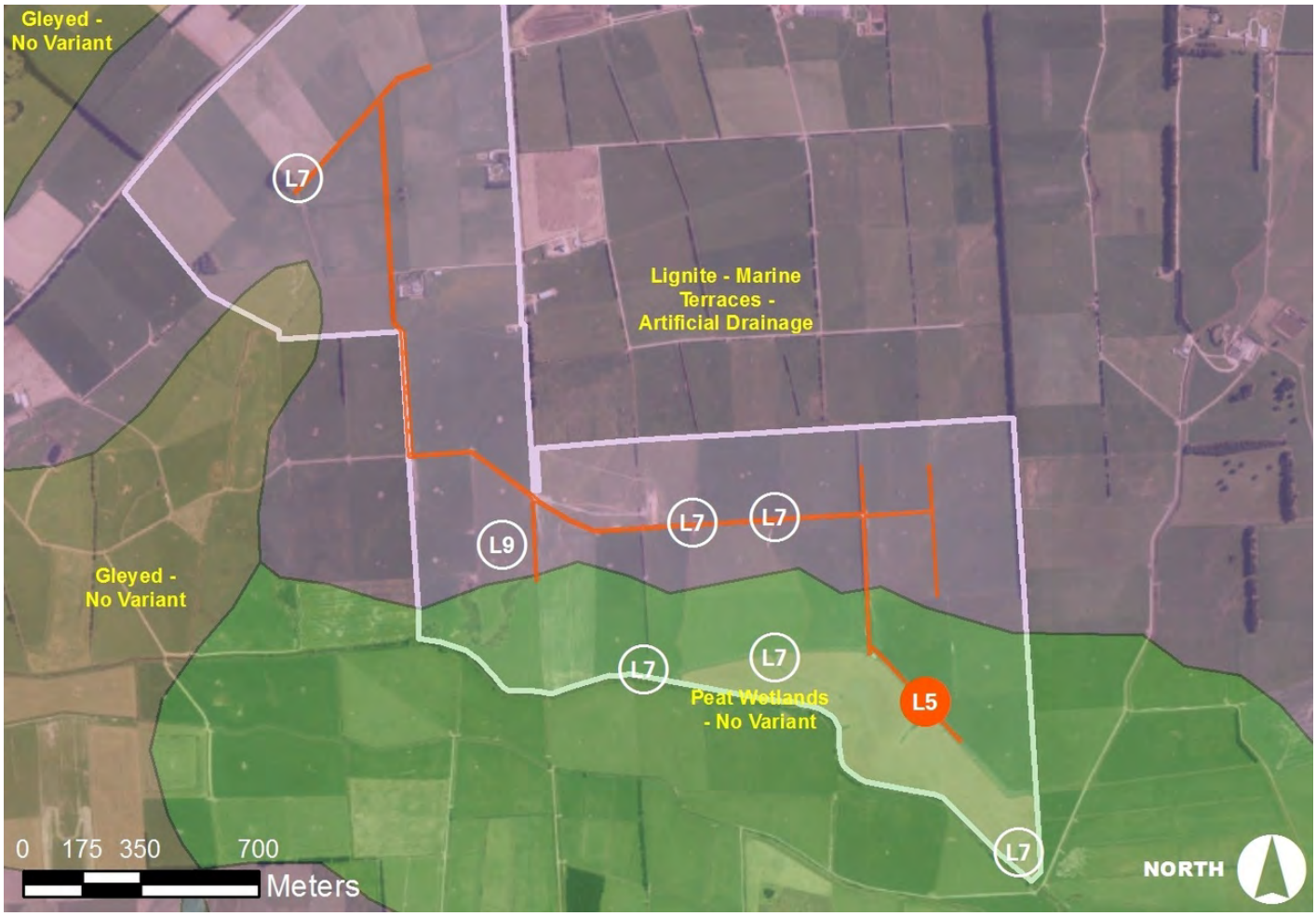
Many waste items are recycled or re-used including chemical containers, baleage wrap, and pallets. Other farm waste is put in a skip and sent to landfill. Dead cows are put in an offal pit.

ACTIONS | RECOMMENDATIONS

		Target Date
☐	**Review waste management** * Check the Environment Southland website information on farm waste (https://www.es.govt.nz/environment/pollution-and-waste/farm-waste) to review the key waste management rules which must be followed * Develop a waste management plan and collection system that incorporates the 6 Rs of waste decision making; Refuse, Reduce, Reuse/Repair, Recycle, Rehome and Rot (or compost). See information on the DairyNZ website: https://www.dairynz.co.nz/media/4209679/waste-management-solutions-technote.pdf * Do an audit/inventory of the types of waste and quantities that are generated on farm to understand where waste is coming from and how much is generated * Minimise farm waste where possible. This may mean choosing products that have less packaging (eg bulk vs bagged) - if practical. * Separate out waste products for collection, recycling, burning or composting/burial as appropriate * Recycle suitable products eg silage covers * Consider ways to reduce use of the offal pit - eg compost dead stock. * Consider setting up a composting system for dead stock https://www.dairynz.co.nz/environment/waste-management/composting-dead-stock/ * Avoid burning or burying non-perishable or plastic rubbish - place this material in a skip so it can be sent to a managed landfill	30 Nov 2021

FARM MANAGEMENT

WHENUA ME TE ONE
LAND & SOIL MANAGEMENT



- L1 Land & Soil Overview
- L2 Southland Physiographic Zone
- L3 Soil Types and Management
- L4 Intensive Winter Grazing
- L5 Race Maintenance & Management
- L6 Critical Source Areas
- L7 Key Feature - Critical Source Areas
- L8 Swales and Gullies
- L9 Gravel Pit

LAND & SOIL MANAGEMENT

GOOD FARMING PRACTICES

Minimise losses of sediment and nutrient to water, and maintain soil structure Practices: Pugging and compaction of soils is avoided No tillage or low impact cultivation methods and timing are considered Supplement feed-out areas are located away from waterways Riparian margins or buffer strips are left beside waterways and other areas where sediment and nutrients may flow such as gullies or swales. Evidence: Wet weather management policies	ACHIEVED
Reduce periods of bare soil between crops and pasture to reduce erosion and leaching Practices: Bare paddocks are re-sown as soon as practical Erosion damaged areas are rest and re-sown Compacted soils are subsoil, ripped or cultivated	ACHIEVED
Retire all LUC 8 land and retire LUC 7e land or ensure that it has soil conservation measures in place	N/A
Use appropriate paddocks for intensive grazing Practices: Low risk paddocks are selected for intensive grazing that are ideally: --Further away from waterways --With soils least likely to pug and compact	ACHIEVED
Manage grazing to minimise nutrient loss from risk areas Practices: If paddocks near waterways are used during wet periods, a buffer strip beside the waterway is fenced off More feed is offered in cold conditions when demand is high and utilization low When break feeding: --Feeding is towards the waterway --Fences are moved daily rather than offering a few days feed at a time --Land that has already been grazed is back-fenced Crops: --Long narrow breaks are offered rather than wide breaks Evidence: Winter management plan	ACHIEVED

LAND & SOIL MANAGEMENT

LAND & SOIL OVERVIEW

L1

The farm has mostly rolling contour with swales in many paddocks. There are also flats along the Titipua Stream and either side of the main creek on the northern block of the farm. Small areas are ineffective/not grazed including a wetland and three small woodlots. Poorly drained Pukemutu and Makarewa soils cover almost all of the effective farm area.

>> Land management practices affecting the environment include:

* Grazing of wet paddocks or high risk areas within paddocks (Critical Source Areas)
* Grazing of winter crops
* Cultivation - bare soil is vulnerable to erosion/scouring

>> High risk areas have been identified:

* Farm races - run-off can contaminate surface water
* Wet and muddy areas - often around gateways or other high traffic areas
* Swales/gullies and other areas where surface water ponds or overland flow occurs following rainfall events.
* Winter crop paddocks

>> Soil health and risks of soil loss are actively managed:

* Paddocks are aerated to improve soil structure/minimise compaction and pugging
* Stand-off facilities are used to minimise pugging/compaction during wet and cold conditions in spring and autumn.
* Drier paddocks are grazed during wet weather and wet paddocks are left out of the rotation temporarily
* Drains (tiles and ditches) minimise waterlogging of soils

LAND & SOIL MANAGEMENT

SOUTHLAND PHYSIOGRAPHIC ZONE

L2

The Physiographics of Southland were developed to give a greater understanding of the key risks to water quality throughout the Region. The risks to water quality are highly linked to where water comes from and the processes it undergoes as it moves through the soil and drainage networks. Physiographic Zones group areas of Southland that have similar landform types and water quality. The Zones have been identified according to water origin, soil type, geology and topography.

The Physiographic Zones found on the property are listed below:

The easy rolling land on the farm (about 195 ha) is classified as part of the Lignite-Marine Terraces Physiographic Zone.

Characteristics of this zone include:

• High denitrifying potential in groundwater in areas close to organic carbon sediments.

• Little to no connection to main river systems, and therefore no dilution by pristine Bedrock/Hill Country and Alpine zone waters.

• Streams are at risk of receiving contaminants from overland flow and artificial drainage.

• Some water will drain to underlying aquifers.

• Limited aquifers that have long ‘residence times’ (slow movement of groundwater through the aquifer).

• Nutrients and other contaminants are mostly lost via artificial drainage and overland flow

The flat paddocks near the Titipua Stream (about 73 ha) are in the Peat Wetlands Physiographic Zone. Characteristics of this zone include:

• High soil and aquifer denitrification potential.

• Very high water table and shallow aquifers that flow into nearby streams.

• Peat soils are prone to waterlogging, and will often have a seasonal water table that sits close to the ground surface. This results in seasonal (or sometimes permanent) ponding and overland flow to nearby streams.

• Extensive artificial drainage (open channels and tile drains) that flow to nearby streams

• Nutrients and other contaminants are mostly lost via overland flow and drains

About 4 ha in the main valley on the northern block of the farm is in the Gleyed Physiographic Zone. Characteristics of this zone include:

• Loss of nutrients, sediments and microbes via artificial drains following heavy or prolonged rainfall

• When soils are wet, excess water from rainfall in flatter areas will flow via an extensive drainage network to nearby streams.

• In undulating areas excess water may also flow across the land surface as overland flow (runoff) during heavy rainfall.

• Key contaminant pathway: Overland flow

LAND & SOIL MANAGEMENT

ACTIONS | RECOMMENDATIONS

Target Date

Mitigate environmental risks from land in the Lignite Marine Terraces Zone

1. Reduce the effects of overland flow by:

• Protecting soil structure, particularly in gullies and near stream areas

• Managing critical source areas (CSA)

2. Reduce the effects of artificial drainage by:

• Protecting soil structure, particularly in gullies and near stream areas

• Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter

• Avoiding preferential flow of effluent through drains

• Capturing contaminants at drainage outflows

Mitigate environmental risks from land in the Peat Wetlands Zone

1. Reduce the effects of deep drainage of phosphorus and microbes by:

• Reducing phosphorus use or loss

• Reducing the transport of microbes

2. Reduce the effects of overland flow by:

• Protecting soil structure, particularly in gullies and near stream areas

• Managing critical source areas (CSA)

• Reducing phosphorus use or loss

3. Reduce the effects of artificial drainage by:

• Protecting soil structure, particularly in gullies and near stream areas

• Reducing phosphorus use and loss

• Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter

• Avoiding preferential flow of effluent through drains

• Capturing contaminants at drainage outflows

Mitigate environmental risks from land in the Gleyed Zone

1. Reduce the effects of artificial drainage by:

• Protecting soil structure, particularly in gullies and near stream areas

• Reducing phosphorus use and loss

• Reducing the accumulation of surplus nitrogen in the soil, particularly during autumn and winter

• Avoiding preferential flow of effluent through drains

• Capturing contaminants at drainage outflows

2. Reduce the effects of overland flow by:

• Protecting soil structure, particularly in gullies and near stream areas

LAND & SOIL MANAGEMENT

- Managing critical source areas (CSA)
- Reducing phosphorus use or loss

LAND & SOIL MANAGEMENT

SOIL TYPES AND MANAGEMENT

L3

The farm has 3 main soil types: Pukemutu, Makarewa and Titipua soils. These soils have different risks for compaction, nutrient leaching etc, and have also been given a risk classification for effluent applications (because of factors such as slope or drainage).

Pukemutu soils cover most of the property (about 215 ha). They are deep, poorly drained soils. Soil texture is heavy silt loam with a silty clay subsoil. They have the following risk ratings:

- Structural compaction: Severe vulnerability
- Nutrient leaching: Slight vulnerability (higher where sub-surface drains are present)
- Topsoil erosion by water: Moderate vulnerability
- Organic Matter loss: Slight vulnerability
- Waterlogging: Severe vulnerability
- Bypass drainage: Medium-high risk of losing contaminants through soil macro-pores/cracks
- Dairy effluent application risk: High risk of losses via bypass drainage or run-off

Makarewa soils are found along the flat beside the Titipua Stream and the creek on the northern block, covering about 38 ha. They are deep, poorly drained silty clay soils and have the following risk ratings:

- Structural compaction: Moderate vulnerability
- Nutrient leaching: Slight vulnerability (higher where sub-surface drains are present)
- Topsoil erosion by water: Minimal vulnerability
- Organic Matter loss: Slight vulnerability
- Waterlogging: Severe vulnerability
- Bypass drainage: High risk of losing contaminants through soil macro-pores/cracks
- Dairy effluent application risk: High risk of losses via bypass drainage or run-off

Titipua soils (6 ha) are located in the SE corner (Pdks 15 & 16) of the farm. They are deep and poorly drained and have a peaty topsoil with silt loam to silty clay texture. They have the following risk ratings:

- Structural compaction: Minimal vulnerability
- Nutrient leaching: Slight vulnerability (higher where sub-surface drains are present)
- Topsoil erosion by water: Slight vulnerability
- Organic Matter loss: Minimal vulnerability
- Waterlogging: Severe vulnerability
- Bypass drainage: High risk of losing contaminants through soil macro-pores/cracks
- Dairy effluent application risk: High risk of losses via bypass drainage or run-off

LAND & SOIL MANAGEMENT

LAND & SOIL MANAGEMENT

INTENSIVE WINTER GRAZING

L4

Cows and R2 heifers are grazed on fodder crops and/or grass paddocks over winter. Baleage is fed out on both the crop and grass paddocks. Most paddocks have at least some high risk zones such as poorly drained areas, waterways beside the crop, or swales. Sediment, nutrients and dung can be lost from these paddocks following cultivation or grazing even though wide buffer zones are left untouched. A number of Good Farming Practices are used to manage these risks - see below and also GFPs listed under the Land Overview section.

* Paddocks which are poorly drained or close to waterways (or other high risk areas) are not winter cropped
* Paddocks are soil tested and fertiliser rates are tailored to crop requirements
* A winter grazing plan is worked out for each paddock
* Critical Source Areas are identified and protected – an extra buffer is left in grass along waterways, fenced off and grazed in spring
* Strip tillage is used to establish some crops, protecting soil structure during the summer-autumn
* Phosphate fertiliser is drilled with the seed to ensure it is used efficiently by the crop
* Bales are set out in crop paddocks pre-winter to minimize tractor use on wet paddocks
* Bale feeders and portable troughs are placed in dry areas/away from swales
* Stock are shifted more frequently in poor weather (twice a day) and offered more supplement
* Sloping areas are grazed from top to bottom
* Portable troughs are used to minimise stock movement within crop paddocks
* Cows on winter crop are grazed in small mobs (100 cows/mob)
* Baleage wrap is collected and removed from the paddock for safe disposal

ACTIONS | RECOMMENDATIONS

Target Date

Trial additional winter grazing mitigations

Look into other options for reducing the effects of winter grazing (pugging, sediment loss, nutrient leaching) including:

- Testing soil nitrogen levels to get a more accurate estimate of crop N fertiliser requirements
- Creating temporary sediment traps (eg placing straw bales in swales)
- Sowing catch crops post-grazing to take up N and other nutrients (if weather and soil conditions allow the crops to be sown early enough)

LAND & SOIL MANAGEMENT

LAND & SOIL MANAGEMENT

RACE MAINTENANCE & MANAGEMENT

L5

Quality lanes allow for good stock flow, which reduces lameness issues and the build-up of effluent on the lane surface and adjacent paddocks. Lanes that run alongside a waterway can be very high risk with direct runoff of sediment and microbial pathogens to water.

The farm lanes have a firm, even surface and should provide good cow flow around the farm. Areas of highest risk are:

* sloping sections of lane, especially where raised edges trap water so it runs down the lane to gullies or waterways carrying sediment, dung and nutrients.

* sections of lane with silty material on the surface which can wash off during heavy rain

* about 950m of lanes run alongside waterways. These sections of lane have narrow riparian buffers but are low risk because they are used less frequently.

ACTIONS | RECOMMENDATIONS

Target Date

Fence riparian buffer strips beside new lane — 30 Jun 2021

Fence off and plant out the riparian strips beside the new lane on the northern block, Ensure the fences are set back from the creek edge to provide a good buffer strip that will filter run-off.

Reshape lanes beside waterways — 31 Mar 2025

Reshape sections of lane that also run alongside ditches whenever maintenance is carried out. Grade the surface so that run-off naturally flows to the paddock rather than carrying sediment, dung etc into the ditch.

Continue lane maintenance

Identify priority areas for lane maintenance:

- lanes with a silty surface

- wet/soft/low spots where water and mud can accumulate

- sloping sections of lane where water runs down the edges to a gully

* Grade lanes to remove fine silt from the surface and provide a hard, compacted surface

* Regularly remove the raised edges on lanes so that rain water can run off to pasture rather than being channelled along the lane to wet or low spots. Alternatively, dig several cut-outs on sloping sections of lane to divert water off the edge of the lane and into the paddock

* Scrape off mud and re-surface soft/damaged sections of lane. Crown the lane so that water runs off to pasture.

LAND & SOIL MANAGEMENT

LAND & SOIL MANAGEMENT

LAND & SOIL MANAGEMENT

CRITICAL SOURCE AREAS

L6

The farm has a number of Critical Source Areas. These are places on the farm which are hotspots for losing nutrients, sediment or other contaminants that impact water quality. On this farm the main risk areas are:

- swales/gullies – especially those with poor drainage,
- old river channels or hollows where water ponds and lies after wet weather
- areas where run-off discharges from lanes
- wet paddock corners where cows mob up in poor weather,
- small boggy/wetland areas that are grazed,
- wet/sloping areas in fodder crop paddocks.

These areas often receive sediment, faecal contamination and nutrients from run-off, and also discharge these pollutants to surface water or to groundwater (via leaching and drainage). Muddy areas are particularly vulnerable to losing sediment because there is little protective vegetation and soil structure is damaged. Swales/gullies can also lose sediment via run-off when they are cultivated or intensively grazed.

Some of these areas have been fenced off eg in Pdks 2 & 3 above the lane.

ACTIONS | RECOMMENDATIONS

Target Date

Fence off or drain wet areas

* Permanently fence off persistently wet areas of land, or use a hotwire to exclude stock from these Critical Source Areas whenever water is ponding or running off.

* Unblock tile drains or lay new Novaflo/tiles in wet areas. If contaminated run-off is likely to enter the drains direct the tile to a sediment trap/wetland where silt and nutrients can settle out and be absorbed. This may involve opening up the lower section of some drains, fencing off this area and planting it with tussocks and other wetland species that will slow water flow, trap silt and take up N & P.

LAND & SOIL MANAGEMENT

LAND & SOIL MANAGEMENT

SWALES AND GULLIES

L8

The farm has many gullies and swales which carry surface water in wet conditions. Tile lines are often located in these areas. When swales are in pasture, well drained/dry, and undisturbed by intensive grazing there is a relatively low risk of significant nutrient and sediment losses. Gullies/swales that are boggy and have poor drainage are much higher risk. During a cropping phase or intensive grazing the risk increases because surface run-off can wash soil and other contaminants from areas with bare soil and/or treading damage.

These risks are being mitigated by:

- avoiding grazing of high risk paddocks in wet weather
- tiles have been laid to minimise the amount of surface water and pugging in these areas

LAND & SOIL MANAGEMENT

GRAVEL PIT

L9

Gravel has been excavated from a pit in Pdk 29 and used for lanes. Topsoil has been heaped up along one side and a ditch has been dug to allow surface water to drain from the pit. There is a risk of sediment loss from the site in its current state.

ACTIONS | RECOMMENDATIONS

Target Date

Fence off gravel pit and trap sediment

30 Apr 2021

Set up a temporary or permanent hotwire around the gravel pit so that stock do not disturb any fresh soil or gravel that has been piled up. Ensure run-off that goes down the ditch passes through a sediment trap - either a scraped out hollow or a round bale of straw placed in the ditch.

WHAKAMĀKŪKŪ
IRRIGATION MANAGEMENT

GOOD FARMING PRACTICES

Irrigation rates and timing match plant requirements	N/A
Design, calibrate and operate irrigation systems to use water efficiently	N/A

PARAKAINGAKI EFFLUENT MANAGEMENT

E1 Effluent Overview

E2 Effluent Storage

E3 Effluent Irrigation

EFFLUENT MANAGEMENT

GOOD FARMING PRACTICES

Effluent system meets code of practice Practices: Effluent is collected from all sources: dairy sheds, yards, feeds pads, underpasses The system design is appropriate for the soil type, topography, and climate	ACHIEVED
Sufficient suitable storage available	1 ACTION(S)
Spreading equipment is well maintained and calibrated	1 ACTION(S)
Effluent applied at correct depth, rate and time Practices: Effluent application timing and rates are adjusted based on soil moisture levels Nutrient load is spread evenly across the largest area practical Tests for high potassium (K) levels on effluent block are done to avoid animal health issues Fertiliser applications are adjusted to effluent areas based on soil tests Odour impact is considered during application	ACHIEVED
*All effluent systems	2 ACTION(S)

*Additional GFP relevant to the dairy industry goals

EFFLUENT MANAGEMENT

EFFLUENT OVERVIEW

E1

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Dairy shed effluent flows to sludge beds which remove solids before the liquid effluent is piped to a synthetically lined holding pond. A low rate travelling irrigator is used to apply effluent and a failsafe device is fitted used to minimise the risk of leaks. Effluent applications are carefully managed to avoid over-application, ponding or run-off. Solid effluent from the sludge beds and calving pad is applied to low fertility and non-effluent paddocks using a muckspreader.

The risks from storing or applying effluent are minimised by:

Effluent volumes are minimised

* Greenwash water is recycled for washing the yard
* The yard is thoroughly cleaned before winter and rainwater is then diverted off the concrete to a drain when the dairy shed is not in use

Pre-application checks

* Checks are carried out on irrigation layout to ensure effluent lines are correctly positioned and high risk areas (near waterways, swales, tile drains etc) are avoided. Soil and pasture conditions are assessed to check if effluent can be applied safely. The irrigator, effluent pipes and fittings are also checked for leaks or signs of wear.

Effluent ponding/spill prevention

* A failsafe system shuts off the pump if the irrigator stops or if effluent line pressure rises/drops because there are leaks or blockages – a monitoring unit is mounted on the irrigator
* An anti-siphoning valve prevents siphoning from the effluent pond
* Over spring a smaller nozzle is fitted on the travelling irrigator to reduce the application rate when soil moisture levels are relatively high
* The irrigator is checked once the pump has started to ensure it is operating correctly.

Effluent pond monitoring and management

* An inspection drain has been installed to allow monitoring of groundwater under/around the pond - any leaks from the pond should be visible in the drainage water.
* The effluent pond level is kept low through autumn so there is adequate storage capacity in spring.
* The irrigator is shifted 2-3 times a day when required so that the pond level can be dropped quickly by applying more effluent.

ACTIONS | RECOMMENDATIONS

	Target Date
Complete an Effluent Management Plan – To Achieve GFP Develop an Effluent Management Plan for staff to use for training and as a	31 Mar 2021

EFFLUENT MANAGEMENT

reference or set of guidelines. This outlines specific details on the overall effluent system from dairy shed to the paddocks and how it is operates. It will highlight areas or risk and how these risks are managed/monitored. It may also provide a plan for ongoing maintenance of the system. Examples are available through the Fonterra Farm Sustainability team or DairyNZ.

EFFLUENT MANAGEMENT

EFFLUENT STORAGE

E2

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Effluent from the dairy shed and yard is piped downhill to two sludge beds (both approximately 29m x 7m). The sludge beds are each cleaned out once they fill (1-2 times/year). Liquid effluent is separated by a weeping wall and runs to the synthetically lined holding pond. The pond measures approximately 46m x 29m. A small volume of effluent from the calving pad is also stored in a concrete tank and then pumped to the main pond.

ACTIONS | RECOMMENDATIONS

	Target Date
Inspect and test effluent ponds – To Achieve GFP * Arrange for a Drop Test to be carried out on the pond in preparation for renewing the effluent discharge consent. The pond would have to be reasonably full for this test. * Arrange a professional assessment of the pond liner and structural integrity when the pond is drop tested.	31 Jan 2022
Monitor drainage water from around the effluent pond Connect a new inspection chamber to the drain under the effluent pond and regularly check that effluent is not seeping into the drain or groundwater.	30 Sep 2021

EFFLUENT MANAGEMENT

EFFLUENT MANAGEMENT

EFFLUENT IRRIGATION

E3

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

A 'low rate' Cobra travelling irrigator is used to apply effluent. It is fitted with a failsafe device that monitors pressure in the effluent line and the movement of the irrigator - if the irrigator stops or there is a leak the failsafe system will shut off the pump. The travelling irrigator is typically operated on a medium speed setting and may be shifted up to 3 times per day if conditions allow or the pond level is high. Smaller nozzles are used at the shoulders of the season (when soils are typically wetter) to reduce the rate and depth of application. Because the irrigator is able to apply large volumes at a low rate, effluent is only applied when the weather forecast is for dry conditions and soils have drained enough to absorb the volume of effluent that is applied. Areas of the effluent block that have low spots or tiles are avoided.

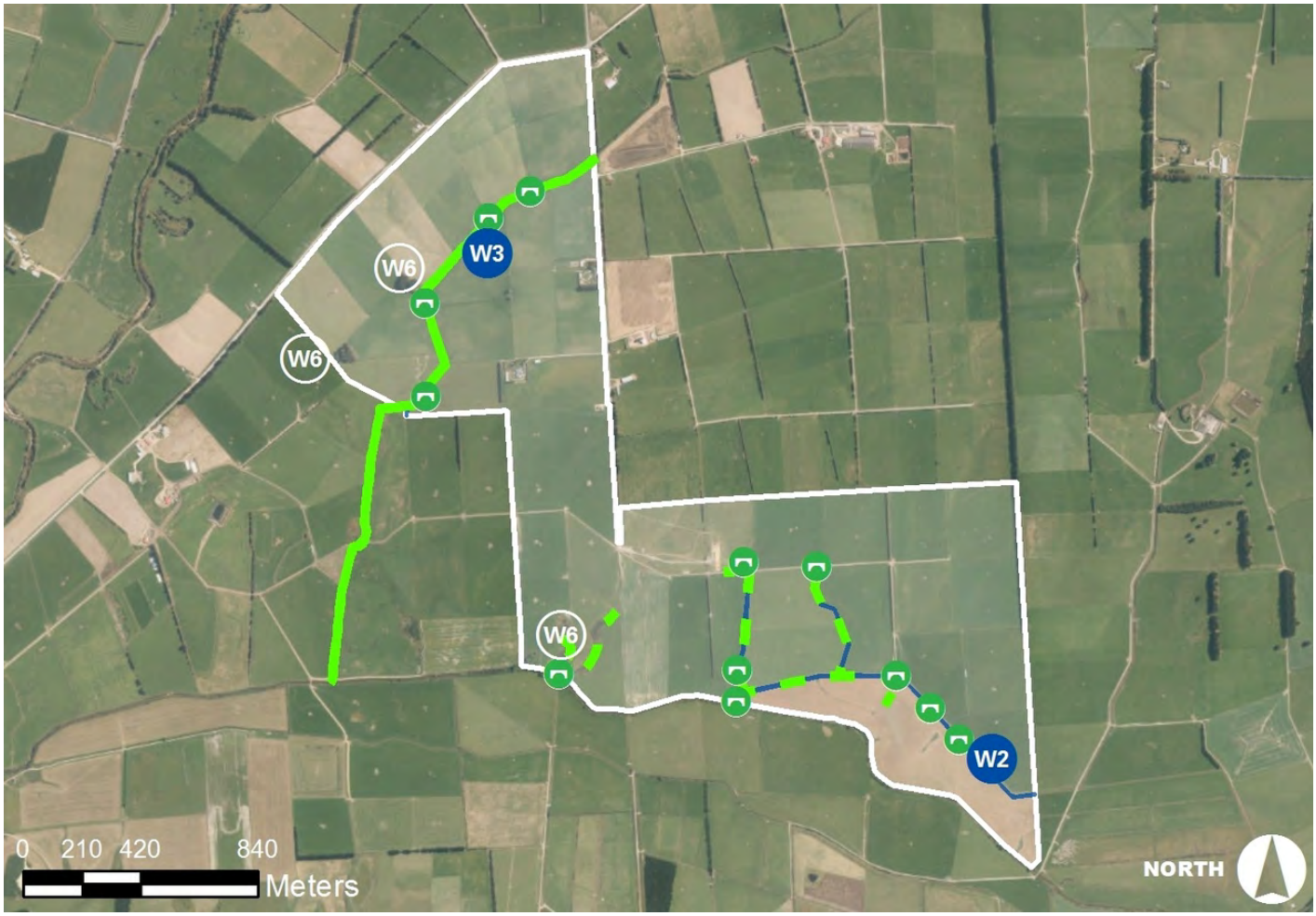
The effluent block covers a total area of 99.7 ha (16.6 ha/100 cows milked). This provides scope to apply effluent (and the nutrients it contains) at low rates across a large area and also some flexibility to choose paddocks which are lower risk when conditions are marginal. All of this block is 'high risk' for effluent application because the soils are imperfectly drained (which can lead to bypass flow of effluent through soil cracks or large macro-pores) and/or sloping (effluent may run off in some conditions). On high risk soils effluent can only be applied when there is a Soil Moisture Deficit greater than the depth that will be applied via irrigation.

ACTIONS | RECOMMENDATIONS

	Target Date
Record effluent applications – To Achieve GFP Use software such as the Dairy Diary or a paper recording system to write down when paddocks have effluent applied - this can help track which paddocks have had high effluent (nutrient) applications that get close to the application limit of 150kgN/ha from effluent.	30 Apr 2021
Bucket test the travelling irrigator – To Achieve GFP Carry out a bucket test on the Cobra irrigator. This will measure the application depth and rate to confirm the system is performing as expected. Testing equipment can be borrowed from Farm Source. Information from the irrigator test should be used in the Dairy Effluent Storage Calculator when pond storage requirements are assessed and also submitted with the application to renew the discharge consent.	31 Jan 2022

EFFLUENT MANAGEMENT

RARENGA RAUROPI
WATERWAYS & BIODIVERSITY MANAGEMENT



- W1 Waterways & Biodiversity Overview
- W2 Fenced Waterways and Riparian Zones
- W3 Waterways Fencing
- W4 Crossings
- W5 Artificial or Tile Drainage
- W6 Wetlands and Sediment Traps
- W7 Habitat and Biodiversity
- W8 Mahinga Kai

WATERWAYS & BIODIVERSITY MANAGEMENT

GOOD FARMING PRACTICES

Identify areas where runoff may occur and manage to avoid runoff entering waterways Practices: Risk areas where surface runoff may enter waterways are identified A grass buffer strip or riparian plantings have been left between waterways and fences When cultivating paddocks an uncultivated buffer strip between cultivation and waterway is left (the steeper the land the wider the buffer strip is)	ACHIEVED
Tracks, feed areas, gateways and troughs are located away from waterways Practices: Tracks are located away from waterways where practical Supplement is fed out away from waterways Water troughs are located away from waterways in a dry area of paddocks Gateways are in a dry point and are wide enough for good cow flow to reduce pugging Evidence: Farm map identifying tracks, feed areas and troughs	ACHIEVED
Stock are excluded from waterways	1 ACTION(S)
*Areas of native plants or significant biodiversity are protected Practices: Areas are identified on the farm map Stock are fenced out of the area Weeds are controlled within the area Animal pests are trapped or poisoned	ACHIEVED

*Additional GFP relevant to the dairy industry goals

WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAYS & BIODIVERSITY OVERVIEW

W1

Small creeks or ditches drain the main gullies and the flats, and flow into the Titipua Stream (a tributary of the Makarewa River) on the southern boundary of the farm. The riparian zones are fenced and rank grass is the main vegetation along the stream banks though some sections of the Titipua have been planted with willows. Crossings have been installed wherever lanes pass over waterways. There are several areas of native biodiversity/habitat such as some small wetland areas and the waterways, ponds and riparian margins.

WATERWAYS & BIODIVERSITY MANAGEMENT

FENCED WATERWAYS AND RIPARIAN ZONES

W2

Small creeks run down two main gullies to the flats and into a ditch that flows into the Titipua Stream. A larger creek drains the main valley on the northern block of the farm. The large ditch on the flats forms part of the Buchanan's Outfall Scheme and the creek on the northern block is in the Kerr's Outfall Scheme - both waterways are maintained by Environment Southland. Most waterways are permanently fenced (the creek on the northern block is partly fenced - see following section). The riparian strips are narrow along small creeks and the ditch on the flats and these areas are dominated by long grass (some planting is planned). The Titipua Stream has wide buffers and some established flax and willow trees but it banks are vulnerable to erosion.

ACTIONS | RECOMMENDATIONS

Target Date

Plant out riparian zones

31 Jul 2024

Work on a riparian planting plan to provide shade and habitat by establishing more trees, shrubs and grasses/flax etc along the main creek in the northern block and other waterways where there is room for plantings. Liaise with Environment Southland about the location and type of plantings that are undertaken so that ongoing drainage maintenance work can still be carried out.

WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAYS FENCING

W3

IMPACT OF CONTAMINATION + LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

The creek which runs through the recently purchased northern block is partly fenced, and a new fence will be erected along the edge once a lane has been formed. The fence should be set back from the bank to create a wide buffer zone.

ACTIONS | RECOMMENDATIONS

Target Date

Complete fencing of the northern creek – To Achieve GFP

30 Jun 2021

Fence off the creek with a permanent post/wire fence. Ensure the fence is set back from the creek edge to allow enough space for riparian planting and provide a good buffer strip that will filter run-off.

WATERWAYS & BIODIVERSITY MANAGEMENT

CROSSINGS

W4

Culverts or bridges have been installed wherever lanes cross waterways and to allow stock or machinery movements where creeks separate paddocks. These crossings are mostly well fenced (at least one crossing could have the fence realigned slightly to fully protect the edge) and sufficiently wide and flat so that there is minimal risk of sediment, dung etc being washed off the lane to the waterway.

ACTIONS | RECOMMENDATIONS

Target Date

Check Farm Crossings

Check farm crossings to ensure there is minimal risk of run-off entering the creek they pass over. For high use crossings construct a raised edge and divert run-off to the grassy riparian strips alongside the creek. Ensure fences fully cover the edges of the crossing. Whenever culverts are replaced ensure that they are set into the stream bed (and do not have a high drop off at the lower end) so that native fish can swim up through them.

WATERWAYS & BIODIVERSITY MANAGEMENT

ARTIFICIAL OR TILE DRAINAGE

W5

The farm has some tile or Novaflo drains, mostly in swales or gullies. These drains have not been mapped and there is no record of where drains were laid by previous owners of the farm. There is a much greater risk of nutrient and effluent losses in areas which are tile drained - especially in very wet conditions or when soils are dry and cracking.

ACTIONS | RECOMMENDATIONS

Target Date

- [ ] **Draw up a tile drain map**

  30 Apr 2022

  Record sub-surface drains on a farm map so that these areas can be managed appropriately when effluent is applied or stock are intensively grazed. Show tile outlets on the map and consider putting up physical markers on the stream bank or fence at these locations - some N & P loss mitigations can be installed at tile outlets. Update the map as new drains are laid and/or discovered.

- [ ] **Include environmental mitigations when new drains are planned**

  Incorporate environmental mitigations when new drains are laid. Examples include:

  * directing drain water through a wetland/pond if possible

  * installation of a carbon rich (woodchip) filter to remove some nitrogen

WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAYS & BIODIVERSITY MANAGEMENT

WETLANDS AND SEDIMENT TRAPS

W6

Two swampy areas (about 2 ha in total) have been fenced off. The larger block in the Duckpond Pdk/Pdk28 is an undeveloped gully next the Titipua Stream with a dense population of flax (harakeke) and other wetland species. A pond has been excavated and planted out. Advice has been sought from the Environment Southland team to redesign and enlarge this area to create a wetland that is able to filter nitrogen, sediment and phosphorus from drain discharges. A smaller wetland on the northern block includes a pond (mostly dry) with some tussocks, flax and cabbage tree (ti kouka) around the margins. Some run-off could be diverted through this area to remove nutrients, sediment etc. The existing wetlands and ponds could be expanded and/or added to (see above) and new wetlands or sediment traps could be created in other locations eg the fenced off hollow above pdk 33.

ACTIONS | RECOMMENDATIONS

Target Date

Identify other sites for sediment traps

31 Mar 2025

Identify places where extra sediment traps could be created in future. In most cases these will be small dams/ponding areas that slow run-off from grazed/cultivated land at the lower end of swales or gullies. The sediment traps could be created whenever these areas are put into crop, fenced or drained.

WATERWAYS & BIODIVERSITY MANAGEMENT

WATERWAYS & BIODIVERSITY MANAGEMENT

HABITAT AND BIODIVERSITY

W7

Protecting waterways, wetlands, native bush and other areas of habitat is an important step in sustaining high water quality and the food species (eg eels, ducks, koura) or plant materials (eg flax, timber) that are associated with these ecosystems. Preserving and enhancing these natural resources or sources of Mahinga Kai is a key objective in the Southland Water and Land Plan and various national environmental policies.

The farm is highly developed and there are only small areas of non-farmed habitat. The key areas include:

- the creeks/riparian areas and ponds

- wetland areas which have flax (harakeke), cabbage tree (ti kouka), cutty grass (rautahi), tussocks, rushes etc

The waterways provide potential 'corridors' for native species to establish and connect with other areas of habitat - especially if they are planted out. Ongoing work will be needed to control weeds such as gorse, elderberry and willows which may crowd out desirable species. Some pest control is carried out (for possums) but stoats, ferrets, cats and hedgehogs are also major threats to native birds, insects and lizards. Planting more native trees, shrubs and grasses will also enhance these blocks of land.

ACTIONS | RECOMMENDATIONS

Target Date

- [ ] **Protect and enhance habitat**

  Control weeds and pests to protect existing areas of habitat, and plant extra natives as time and finances allow.

WATERWAYS & BIODIVERSITY MANAGEMENT

MAHINGA KAI

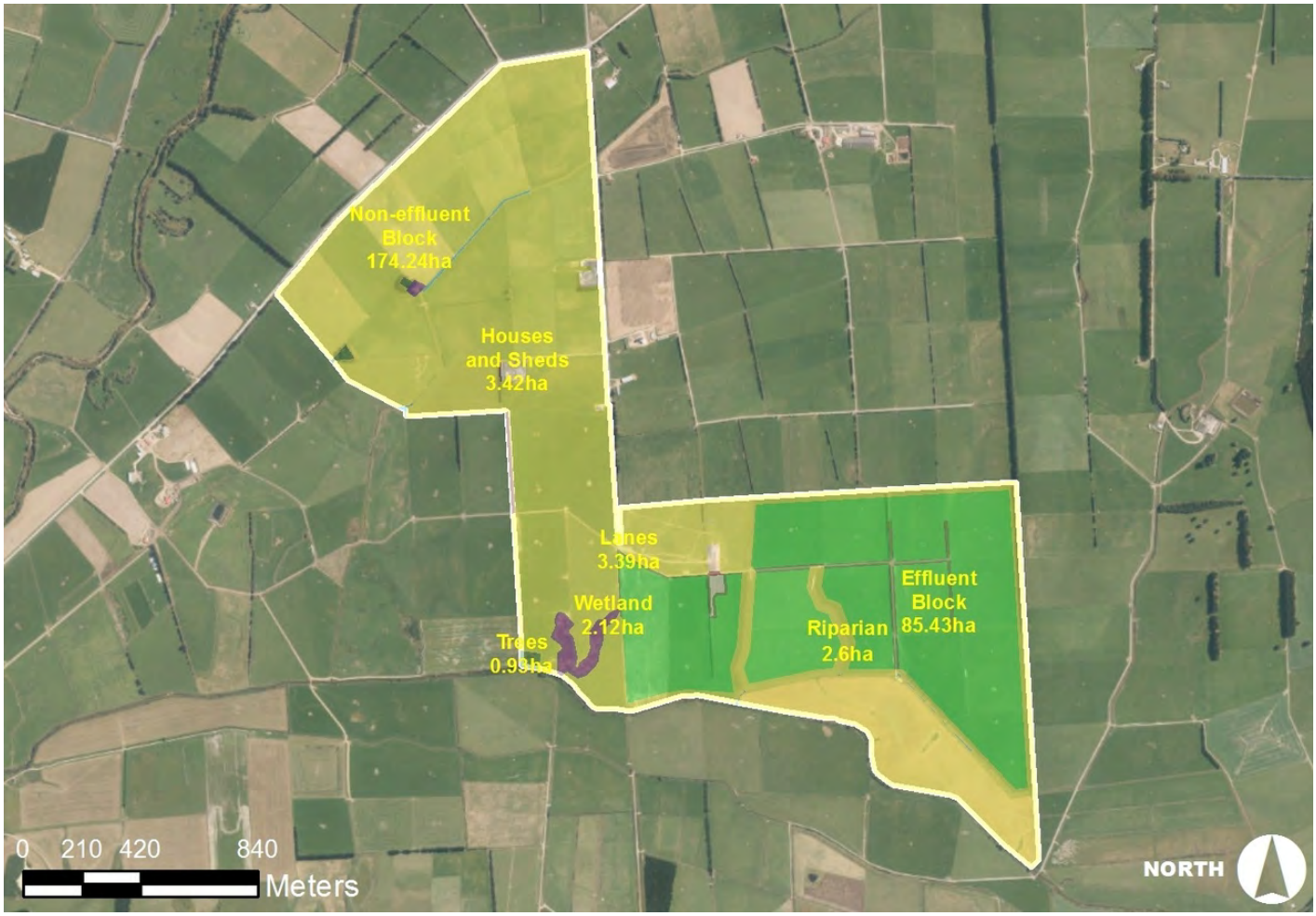
W8

Mahinga kai is about the value of natural resources – our birds, plants, fish, and other animals and resources that sustain life, including the life of people. It is critical to manage these resources to allow people to continue gathering kai (food) in the way the ancestors did. Across Aotearoa as guardians of the land we all have a commitment to work towards meeting Mahinga Kai objectives such as protecting wetlands and fish habitats for species such as inanga and tuna, mitigating the impact of exotic and pest fish species, and ultimately enabling the continued access to healthy mahinga kai species that are safe to eat and in quantities to support local communities. The contribution to Mahinga Kai values doesn't have to be only within the farm boundary, as individual actions on farm will have cumulative effects beyond the farm boundary to the wider catchment.

There are actions done on farm relating to Mahinga Kai and minimising sediment and nutrient loss, these are identified on the farm maps in this report. Specific actions are summarised below

Mahinga Kai access	Access to mahinga kai is allowed for local communities.
Waterways protected	All waterways or areas holding water are fenced to exclude stock with a buffer zone to help filter any run off of nutrients. Any drains are managed to avoid disturbance or damage to mahinga kai species or habitats.
Management of sediment	Lanes and culverts are maintained to divert run off of nutrients away from the waterways.
Management of risk areas	Areas of differing soil types that require different management is done on farm as per land management section of this plan.
Fish habitat protected	Waterways are fenced off and maintained to support fish habitat. If spawning sites are identified, these are prioritised and protected. If pest fish species are present, actions are in place to remove them, or mitigate their impact and distribution further
Management of contaminants	Losses of contaminants from the farm have been mitigated or removed through the actions developed within this farm environment plan. This includes management of nitrogen, phosphorus and faecal matter, which are all detrimental to waterway health and the health of mahinga kai.

TAIORA
NUTRIENT MANAGEMENT



- N3 Nutrient Overview
- N8 Nutrient Reporting
- N15 Soil Nutrient Monitoring Programme
- N18 Fertiliser Plans & Applications
- N22 N & P Loss Mitigations

NUTRIENT MANAGEMENT

GOOD FARMING PRACTICES

Monitor and maintain P levels at the economic optimum Practices: Olsen P trends continue to be monitored over successive years Olsen P is maintained in the optimum range Fertiliser applications are tailored for different management blocks Evidence: Soil test results	ACHIEVED
Fertiliser application matches plant requirements and minimises losses Practices: All fertiliser applications are recorded -- product, rate, date, location (If a contractor is used the information is gathered from them) Soil temperature and moisture levels are assessed before applying fertiliser (i.e. avoid winter months) Fertiliser applications are avoided: --When heavy rainfall is forecast and runoff is likely --Close to waterways N is applied little and often and when pasture is actively growing Pasture or crop growth and feed requirements are assessed before applying N Evidence: Fertiliser proof of placement records - product, rate, date, location Pasture walk data/Feed wedge	ACHIEVED
Fertiliser spreading equipment is well maintained and calibrated Practices: Farm spreading equipment is calibrated regularly -- spreading width and volume checked Spreaders cleaned and greased routinely Paddocks are checked for paddock stripes after spreading	ACHIEVED
*General Nutrient Management	1 ACTION(S)

*Additional GFP relevant to the dairy industry goals

NUTRIENT MANAGEMENT

NUTRIENT OVERVIEW

N3

The farm has a yearly soil testing programme. Results are analysed by a fertiliser advisor and used to develop a fertiliser programme for pasture and crop paddocks, with different rates/products used on blocks which have specific requirements. Applications of fertiliser are timed to ensure effective plant uptake and utilisation. Setbacks are maintained along waterways. Fertiliser is applied by Sinclair Transport or with a farm spreader and recorded on in an app. Fertiliser use and other farm management information is submitted through Fonterra so that an annual Nutrient Budget or Nitrogen Risk Scorecard can be completed. Some mitigations are used to minimise nutrient losses including using a calving pad over spring to reduce pugging/losses of P via sediment.

NUTRIENT MANAGEMENT

NUTRIENT REPORTING

N8

IMPACT OF CONTAMINATION  +  LIKELIHOOD OF CONTAMINATION = LOW RISK RATING

Nitrogen fertiliser use is recorded in the Fonterra Farm Dairy Records each year, along with other farm management data that impacts overall N inputs and losses. Fonterra uses this data to produce either an Overseer Nutrient Budget or a Nitrogen Risk Scorecard. Both models help to identify nitrogen loss risks. An Overseer Nutrient Budget may also be required to meet regulatory requirements (P fertiliser inputs would need to be recorded and entered into Overseer for this). Overseer can also be used to assist with developing a fertiliser programme for the season.

A Nitrogen Risk Scorecard has been produced based on the information provided to Fonterra in the 2019/20 Farm Dairy Records. The Nitrogen Scorecard shows that the farm has a Purchased Nitrogen Surplus of 235kgN/ha. Purchased Nitrogen Surplus reflects the relationship between the amount of nitrogen entering the farming system through fertiliser and feed, versus the amount leaving the farm as product (milk and meat). A low number means purchased nitrogen is used efficiently and losses to the environment are minimised. The 2019/20 Purchased Nitrogen Surplus is considered high compared to similar farms in the region - mainly due to high N fertiliser use that season.

In the 2019/20 N Risk Scorecard the key risk areas were assessed as:

* Stock management - High risk because the stocking rate and grass production is above average
* Nitrogen fertiliser use - Very high risk because total N use was high that season, some applications were greater than 25kg N/ha
* Imported feed - Low risk
* Cropping & Cultivation - Low risk
* Effluent Management - Very low risk
* Irrigation – Not applicable

The Nutrient Budgets completed in 2016/17 and 2017/18 indicated that N leaching losses were 62 and 59 kgN/ha respectively (N.B. version changes in Overseer mean these numbers may not be directly comparable to current or future results). Blocks with the highest N leaching losses are likely to be the winter crops - cows grazing high yielding fodder crops deposit large quantities of urine N on bare soil where it is easily leached. Note that N leaching results may change depending on the farm data that is entered (eg changes in cow numbers, fertiliser use or supplement purchases), but can also change if/when the Overseer model is updated and changed. Nutrient Budgets have been prepared to compare historical nutrient losses from the dairy farm with future N & P losses once the northern block is added to the dairy platform - these Nutrient Budgets show a reduction in nutrient loss due to reductions in stocking rate and supplement use.

ACTIONS | RECOMMENDATIONS

	Target Date
Review Farm Dairy Records & the Fonterra Environmental Report – To Achieve GFP Keep good records of feed, fertiliser, crops and stock throughout the season. Where possible record inputs such as fertiliser for each of the main farm blocks	30 Jun 2021

NUTRIENT MANAGEMENT

(especially effluent or non-effluent blocks and crops) rather than just entering total inputs for the whole farm (this is important if a Nutrient Budget is required). Check data entered into the Farm Dairy Records for accuracy before it is submitted. Review the Fonterra Nitrogen Report once it is sent through to identify any trends in N loss or high risk practices that are highlighted.

NUTRIENT MANAGEMENT

SOIL NUTRIENT MONITORING PROGRAMME

N15

Every 2 years all paddocks on the farm are individually soil tested. Olsen P results are mostly at optimum levels but range from 16 to 48 in the 2021 tests and the results for other nutrients and pH also vary across the farm. Intensive soil testing and a targeted fertiliser programme is being used to ensure pH and soil fertility is 'evened out' across the farm, with levels in the optimum ranges. Trend data is being built up for pH and nutrient levels across the farm to highlight longer term changes in soil test results. Crop paddocks are tested every other year.

ACTIONS | RECOMMENDATIONS

Target Date

- [ ] **Test N levels in crop paddocks**

  Consider including a soil nitrogen test when crop paddocks are sampled to check how much N will be supplied from soil reserves and therefore how much N fertiliser should be applied.

NUTRIENT MANAGEMENT

FERTILISER PLANS & APPLICATIONS

N18

* A fertiliser programme is developed each season with Ballance. In 2021 the fertiliser has been allocated to paddocks based on individual paddock testing - phosphate inputs are lower on paddocks with high Olsen P levels

* Maintenance fertiliser is applied by Sinclair Transport. The spreader driver is informed about avoiding buffer zones along creeks and wet areas.

* Nitrogen fertiliser is applied using a tractor mounted Kuhn spreader and a Teejet GPS system is used for guidance. Spreading rates are checked by calculating volume applied/area spread and with a calibration app. Along creeks an extra 9m buffer (half a spreading width) is missed.

* Applications are recorded in WhatsApp.

* N fertiliser is applied once soil temperatures are at 8 degrees and rising in spring. If pasture growth is over 70kgDM/ha/day N or the conditions are hot and dry N is not applied. Autumn N applications are usually completed by April/early May.

* SustaiN fertiliser is used to ensure volatilisation losses are minimised and N is used efficiently.

* Nitrogen fertiliser use has been 239kgN/ha over the last three seasons. Management strategies have been adopted to reduce this to less than180kgN/ha.

NUTRIENT MANAGEMENT

N & P LOSS MITIGATIONS

N22

Many of the key Good Farming Practices for nutrients are being carried out (see Nutrient Management Overview). Other farm practices are also helping to reduce N & P loss:

> Plantain has been included in the pasture mixes. Some trial work indicates that Ecotain plantain can reduce overall N losses from grazed pasture.

> N fertiliser application rates are adjusted to match the growth/yield requirements of pasture and fodder crops

> A calving pad is used over spring, reducing pugging (and P loss with sediment) and the amount of urine N deposited on wet soils

Other management options for reducing N & P loss are available including:

* Feeding high carbohydrate supplements or fodder (eg PKE, Fodder Beet) to cows in autumn - this reduces the amount of N that is deposited on soils pre-winter and therefore reduces the amount that will leach

* introducing dung beetles (which will bury dung and improve water infiltration/reduce run-off + sediment loss).

* sowing a cereal catch crop after winter crops have been eaten off – this can take up large quantities of N left in the soil post-grazing

ACTIONS | RECOMMENDATIONS

Target Date

Investigate environmental mitigations

Keep up to date with new options that can help to reduce losses of N or P (or other contaminants) and trial these where appropriate.

WHAKAPAPA

History of the farm and local area has not been assessed as part of this Tiaki Farm Environment Plan.

APPENDIX

APPENDIX

GREENHOUSE GAS EMISSIONS

Climate change affects all New Zealanders, including the primary sector. Reducing greenhouse gas emissions is a priority and action is required across New Zealand and internationally. The New Zealand dairy sector is one of the lowest emissions producers of dairy nutrition in the world due to our efficient year-round pastoral grazing system and healthy cows. Through innovation and continued Kiwi ingenuity, our farmers, scientists, and sector partners can ensure New Zealand dairy continues to stay a world leader, while making meaningful contributions to New Zealand's GHG mitigation targets.This section provides an overview of the current GFPs that could have an impact on reducing emissions on farm.

ACHIEVED	NOT ACHIEVED	N/A
8	2	2

GENERAL FARM

67% ACHIEVED
1 ACTION

LAND & SOIL

100% ACHIEVED

IRRIGATION

N/A

EFFLUENT

67% ACHIEVED
1 ACTION

WATERWAYS & BIODIVERSITY

100% ACHIEVED

NUTRIENT

100% ACHIEVED

APPENDIX

GREENHOUSE GAS EMISSIONS

The tables below list the GFPs that have an impact on reducing greenhouse gas emissions on farm.

GENERAL FARM MANAGEMENT

Identify the physical and biophysical characteristics of the farm system, assess the risk factors to water quality associated with the farm system, and manage appropriately	ACHIEVED
Store and load fertiliser with minimal spillage and leaching	ACHIEVED
Store, transport and distribute feed to minimise wastage, leachate and soil damage	1 ACTION(S)

LAND & SOIL MANAGEMENT

Reduce periods of bare soil between crops and pasture to reduce erosion and leaching	ACHIEVED
Retire all LUC 8 land and retire LUC 7e land or ensure that it has soil conservation measures in place	N/A

IRRIGATION MANAGEMENT

Irrigation rates and timing match plant requirements	N/A

EFFLUENT MANAGEMENT

Effluent system meets code of practice	ACHIEVED
Spreading equipment is well maintained and calibrated	1 ACTION(S)
Effluent applied at correct depth, rate and time	ACHIEVED

WATERWAYS & BIODIVERSITY MANAGEMENT

*Areas of native plants or significant biodiversity are protected	ACHIEVED

NUTRIENT MANAGEMENT

Fertiliser application matches plant requirements and minimises losses	ACHIEVED
Spreading equipment is well maintained and calibrated	ACHIEVED

*Additional GFP relevant to the dairy industry goals

APPENDIX

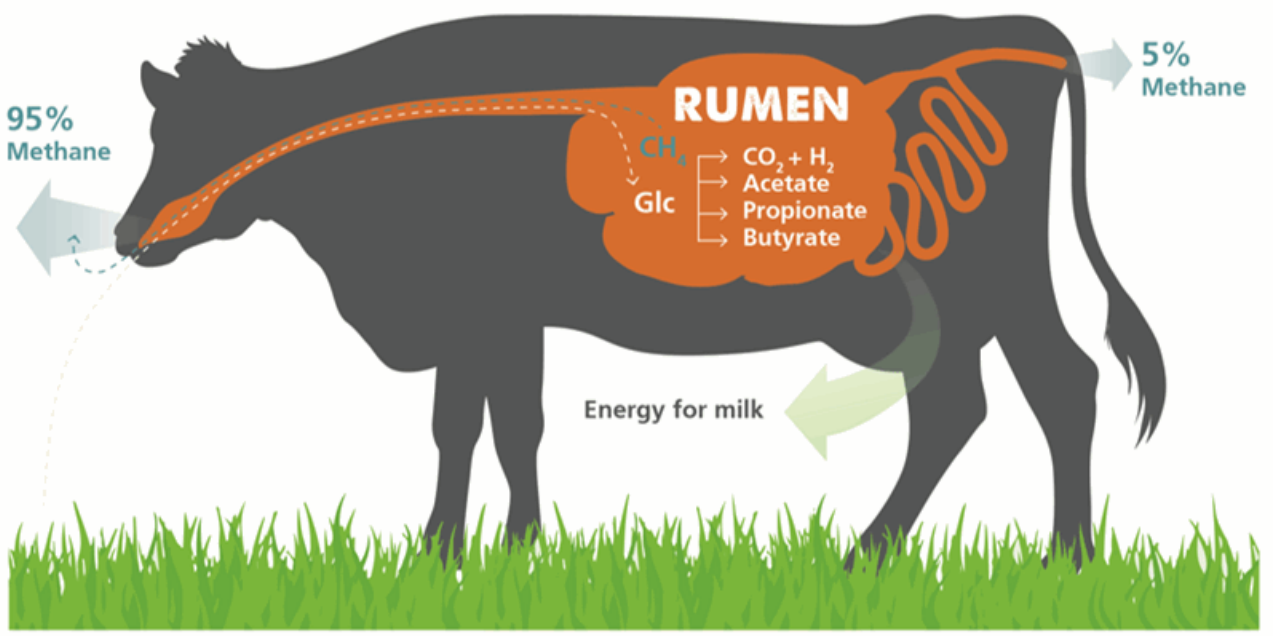
GREENHOUSE GAS EMISSIONS

WHAT ARE GREENHOUSE GAS EMISSIONS?

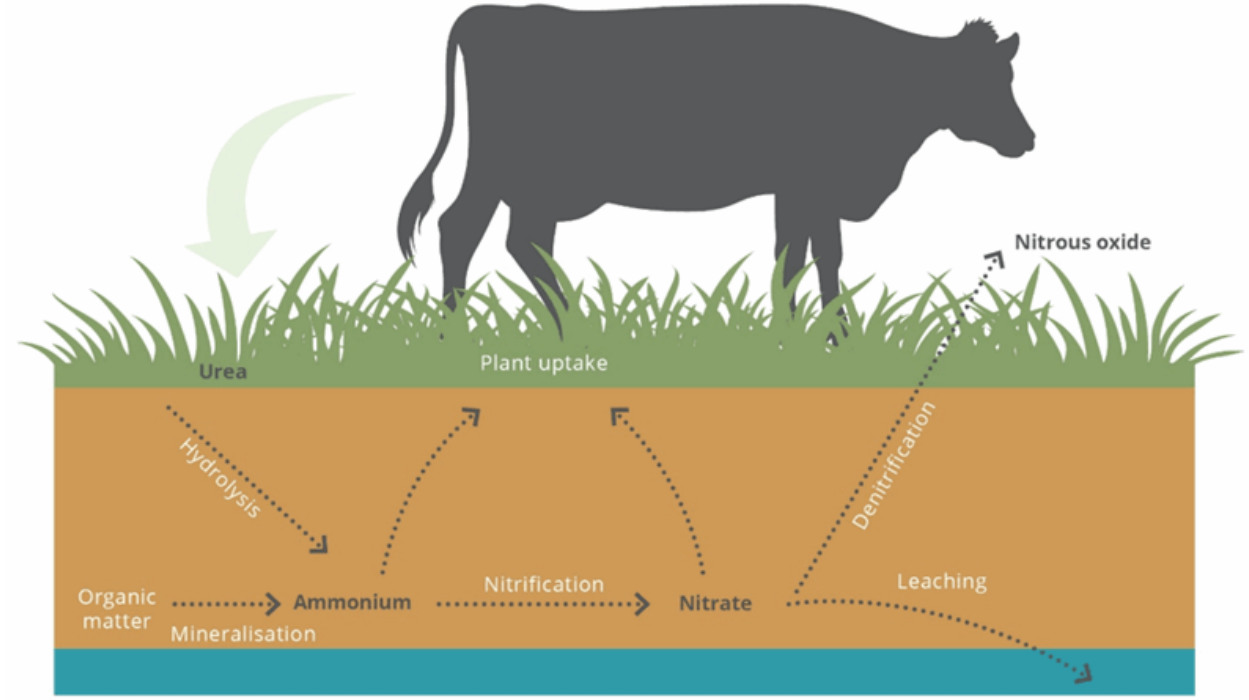
The main agricultural GHGs are methane (CH_4) and nitrous oxide (N_2O). Methane is produced by ruminants (e.g. cows and sheep) by methanogen microbes that are naturally present in the rumen. Most methane is emitted when cattle burp. The amount of methane produced for each farm is directly related to the total feed intake for that farm (including cows, heifers and calves).

Nitrous oxide is emitted from soil when urine, faeces and fertilisers are broken down by microbes in the soil.

How methane (CH_4) is produced



How nitrous oxide (N_2O) is produced



APPENDIX

GREENHOUSE GAS EMISSIONS

ADDITIONAL GREENHOUSE GAS EMISSIONS

Options to reduce and mitigate greenhouse gas emissions on farms fall into three categories: farm management changes, infrastructure investment, and retiring or planting land. The best options for each farm will vary depending on factors such as the farm system and the region. When choosing changes to adopt on your farm, you may find options from all three of these categories work well together.

Farm management changes

The final report of the Biological Emissions Reference Group (BERG), a cumulative effort by the wider agricultural sector, estimated that biological emissions can be reduced by up to 10% for the dairy sector with currently available farm management practices. Most of these mitigations involve good farm practices, such as feed utilisation, choice of feed type and being more selective about how and when to apply fertiliser and effluent to our land. Outlined below are some options to consider. Before you make changes to your farm system or invest in infrastructure, you should seek advice to help determine what will work best for your situation.

OPTIONS TO REDUCE METHANE EMISSIONS

Managing dry matter intake

Current options available to reduce methane emissions are limited, but managing efficient use of dry matter intake (DMI) is the most important. Research shows that for every additional kg of total feed eaten per hectare, total methane emissions increase proportionally. Managing DMI is about reducing the amount of feed eaten per hectare, and increasing per cow performance for every kg of feed that is eaten.

Over time, as cow performance improves it may be possible to adjust stocking rates (but the DMI per cow must remain constant). Increasing reproductive performance of the herd to allow for reduced replacement rates will decrease your emissions as there is less DMI requirement for young stock and less methane emissions.

OPTIONS TO REDUCE NITROGEN LEACHING AND NITROUS OXIDE EMISSIONS

Nitrous oxide emissions occur when bacteria in the soil remove oxygen from nitrate (NO_3-). This mainly happens when the soils are in an anaerobic state (e.g. waterlogged soils). Because nitrogen is supplied to the soil from fertiliser, animal excreta, and effluent irrigation, there are a number of options to manage nitrous oxide emissions and nitrogen leaching.

The mitigations options involve reducing nitrogen loss through:

- better fertiliser application
- planting low-nitrogen forages or crops to reduce nitrogen excretion (eg fodder beet and plantain)
- use of low nitrogen feeds
- improving pasture quality.

APPENDIX

GREENHOUSE GAS EMISSIONS

Reducing nitrogen surplus

Many of the supplementary feeds contain less nitrogen than normal pastures and can help reduce nitrous oxide emissions on farms. You can evaluate supplements used to see if there is potential to change to a lower-emissions feed.

- Evaluate existing cropping activity and the species grown. This can improve nitrogen inputs to the farm and nitrogen surplus through different types of crop and different methods in cultivation/feeding.
- Exploring the use of alternative forages in the pasture sward such as plantain to reduce nitrogen loss to water and atmosphere. These species can retain more nitrogen in the system allowing for less to be lost.

Optimising your fertiliser and effluent use

DairyNZ analysis shows that for every additional 100 kg N/ha applied via fertiliser, total greenhouse gas emissions increase by 2.6 t/ha. As well as using less nitrogen fertiliser per hectare, mitigations strategies include:

- Ensure you are applying the right type of fertiliser in the right places. Test the soil to gauge optimal levels and use precision application to ensure accurate placement.
- Avoid direct leaching and nitrous oxide emissions by not applying in winter or to waterlogged soils.
- Improve effluent management to accurately apply appropriate depths and rates to the soil so that there are less losses.
- Reduce N fertiliser applications on effluent blocks.

Paddock strategies

- Grazing cows off-paddock in the autumn months limits the build-up of nitrate in the soil when the plant growth is reduced. This build-up is then available to be lost to both water and atmosphere of the following winter and spring months. This strategy can reduce nitrogen leaching and nitrous oxide emissions if the associated effluent is well manged.
- Improve irrigation practices so that water is only applied when the soil profile has the capacity to absorb it and the plants need it and that there is no over application. This can be done by using precision water irrigation and scheduling.
- During wintering urine nitrogen leaching and nitrous oxide emissions can be reduced through appropriate paddock selection, grazing time, and grazing regime.
- Using a ‘catch crop’ to minimise the fallow period following a winter crop. This will reduce nitrogen leaching and nitrous oxide emissions during this period.

Planting to offset carbon dioxide

Planting trees can help ‘offset’ emissions from your farm business without impacting on production. As trees grow, they store carbon in trunks, branches, leaves, and roots. Planting will also improve water quality by helping to filter out sediment and nutrients before they enter waterways. Planting could take place in riparian areas, shelter belts, and through retiring land to forestry. Planting also helps to prevent soil erosion and increase the habitat for native wildlife.

DISCLAIMER

*Provision of advice in relation to effluent storage, effluent irrigation systems and the management of other environmental risk areas on farm.

The advice that Fonterra Co-operative Group Ltd (Fonterra, we, us) provides to farmers in relation to effluent storage capacity and other environmental compliance practices, including mitigation actions described in Farm Environment Plans, is based on the information and assumptions that farmers and their agents have provided to us and on our knowledge and understanding of current best practice in the industry. Fonterra does not purport to replace sound engineering or other professional advice and as such we strongly encourage farmers to seek independent expert advice before any construction, upgrades, or other change to your on farm practices. Farmers are ultimately responsible for the environmental compliance of their farm and on farm practices. Fonterra gives no warranties (express or implied) and, to the maximum extent permissible by law, excludes all liability in contract or tort (including, without limitation, liability for negligence) or otherwise in relation to the advice provided.

Appendix B: OVERSEER Nutrient Budget Modelling Report

Titipua Ltd Partnership

OverseerFM farm system modelling to support
a consent application for expanded dairy

Report prepared for:
Titipua Ltd Partnership
336 Hedgehope Block road
Invercargill

Property Address:
425 Hedgehope Block road
RD2
Invercargill 9872

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23rd March 2021

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Contents

1.0 Executive summary:

Titipua Ltd Partnership operate a 181.5ha dairy farm located south of Hedgehope in Central Southland. The farm is currently consented to milk 600 cows. Over the last three seasons the property has milked on average 500 cows at peak, producing 212,000kgMS. Most of the property is rolling although there is a small amount of flat land at the back of the farm running along the Titipua Stream. Currently, 315 cows are wintered on farm on 12ha of Fodder beet.

In mid 2020, the Titipua Ltd Partnership purchased a neighbouring 87.2ha sheep property known as the Schrama block. Upon purchasing the property, the Titipua Ltd Partnership started the process of subdividing and selling 3ha of the Schrama block (including the house and yards).

It is proposed to convert the remaining Schrama block land (84.2ha) and incorporate it into the dairy platform. Cow numbers would increase to 600 at peak producing 254,400kgMS. All cows would be wintered on farm on either a Fodder beet crop or on a grass/baleage system.

Nutrient budgeting has been completed using Overseer version 6.3.5 to support a consent application for expanded dairy. These budgets estimate the nitrogen and phosphorus losses from the farm. Three budgets have been completed:

- The current dairy farm system
  This has been modelled as the average of the last three seasons (17-18, 18-19 and 19-20 seasons).
- The Schrama block
  Please note, detailed records of how the block was operated were not available as the previous owner has died since the property was purchased. As a result, the property has been modelled as an average "Class 7 South Island Finishing" using information in the Beef and Lamb NZ Economic survey (a link to this report is given in the appendices).
- The proposed dairy system
  This has been modelled as a status quo system milking 600cows at peak. Further calculations outside of OverseerFM have been completed to quantify the effect of wintering approximately half of the herd on a baleage/grass system and installing a wetland on farm.

1.1 Nutrient loss estimates including calculations outside of OverseerFM

The table below shows the estimated nutrient losses from the current landuse on the dairy farm and Schrama blocks.

	Current Dairy Platform	Schrama's block	Total current
Area (ha)	181.5	84.2	265.7
Total Farm N Loss (kg)	11,315	1,738	13,053
N Loss/ha (kgN/ha/yr)	62	21	49
Total Farm P Loss (kg)	455	190	645
P loss/ha (kgP/ha/yr)	2.5	2.3	2.4
Pasture Grown (tDM/ha)	16.8	11.2	

The table below compares the estimated nutrient losses from the current landuse with the estimated losses under the proposed system.

	Total current (same as above)	Proposed	
Area (ha)	265.7	265.7	
Total Farm N Loss (kg)	13,035	12,181 *(12,749 modelled plus 173 baleage grass wintering minus 741 wetlands calculated outside OverseerFM)*	6.7% decrease
N Loss/ha (kgN/ha/yr)	49	46	
Total Farm P Loss (kg)	645	572 *(615 modelled minus 43 wetlands calculated outside OverseerFM)*	11.3% decrease
P loss/ha (kgP/ha/yr)	2.4	2.2	
Pasture Grown (tDM/ha)		16.1	

Note:

1. *Estimated pasture grown figures are higher than expected. This is discussed in section 4.1.1*
2. *Calculations outside of OverseerFM have been required in the proposed system modelling. These are explained in full in section 4.2.*

1.2 Drivers of changes in nutrient losses

1.2.1 Nitrogen loss estimates

Nitrogen losses from a farm system can have negative impacts on water quality downstream. This in turn can have negative implications on aquatic life and human health. The use of OverseerFM alongside external calculations has estimated a 6.7% decrease in nitrogen losses between the current and proposed scenarios. This is the cumulative result of many changes to the farm system including:

- A change in culling policy meaning that culls leave the property earlier in the season
- A reduction in imported feed
- Greater use of the calving pad in spring
- Reduced nitrogen fertiliser use

It should also be noted that in the proposed system there will be a reduction in the off-site effect of wintering as all cows will be wintered on farm. There will also be a reduction in the off site effect of the young stock grazing due to a change in grazing policy with these animals. These reductions in offsite effects have not been quantified.

1.2.2 Phosphorus loss estimates

Phosphorus losses from the farm can cause algal growth in surface waterways. The use of OverseerFM alongside external calculations has estimated a 11.3% decrease in Phosphorus losses in the proposed system. Key changes include:

- Reducing the farm Olsen P to 30 and therefore reduce maintenance fertiliser P requirements
- A larger area available for spreading solid effluent

2.0 Report purpose

The results of the budgets will be utilised to support a land use consent application for expanded dairying and the introduction of dairy support.

This report will emphasise the relevant requirements in the proposed Southland Water and Land Plan, and the National Environmental Standards from a nutrient budgeting perspective. The broader range of requirements should be captured in the Farm Environmental Management Plan (FEMP). This report will inform the FEMP which will be completed separately.

Potential environmental risks on the property have been considered and should be included in the FEMP. These include:

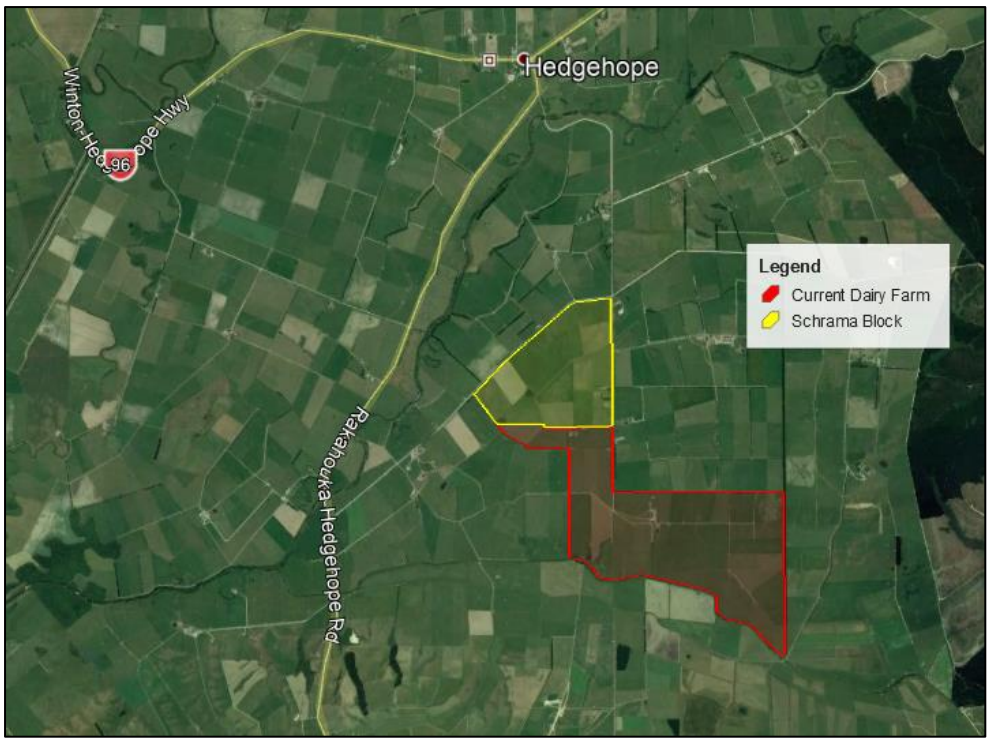
- Contamination of ground water
- Contamination of surface water
- Undesired changes in soil nutrient status
- Nutrient application to non-target land
- Accumulation of non-nutrient impurities in the soil profile
- Excess stocking rate
- Pugging and compaction
- Poor cultivation methods

3.0 Farm overview

3.1 Ownership

The property is owned by the Titipua Ltd Partnership.

3.2 Location



3.3 Farm particulars:

Address	Titipua Ltd Partnership 425 Hedgehope Block road RD2 Invercargill 9872
Legal Description	Current Dairy Platform: • Lot 1 and 2 Deposited Plan 386399 • Lot 1 Deposited Plan 470872 • Lot 2 Deposited Plan 4406 • Lot 2 Deposited Plan 420431 • Lot 3 Deposited Plan 1494 Schrama block • Lot 1 Deposited Plan 4406 – please note, 3ha (the house and stock yards) is in process of being subdivided from this block and sold.
Area	Current dairy platform: 181.5ha Schrama block: 87.2ha (before subdivision) - 3.0ha to be subdivided and sold from Schramas Total area for proposed system: 265.7744ha

3.4 Farm system overview

A detailed description of the modelling methodology and Overseer input data is given in the appendices of this report. This section gives an overview of the farm system modelled in each budget.

3.4.1 Current Dairy Platform

A budget was completed for the average of the last three seasons (2017-18, 2018-19 and 2019-20)

Stock and production:

- 500 cows were milked at peak
- Average seasonal production of 212,000kgMS
- 130 dairy young stock were reared on farm. They were grazed at a third party graziers property from 1st January until returning as incalf heifers
- 30 beef type calves were reared on farm each year and sold in early January
- 315 cows were wintered on the platform on a fodder beet crop while the remaining cows were wintered off farm with a third party grazier

Feed

- Imported feed was:
  - PKE - 200tDM fed in shed
  - Hay – 13tDMfed on the pad
  - DDG – 130tDM fed in shed
  - Baleage – 120tDM fed on the crop
  - Silage – 150TDM fed in paddock or on the calving pad
- An average of 17tDM hay and 24tDM Baleage were harvested on the property each year
- The farm has grown on average 12ha of Fodder beet each year. This is utilised on the shoulders of the season as well as for wintering 315 cows.

Fertiliser

- Soil test results from July 2019 have been used in the nutrient budget. These tests show that the property is operating at, or slightly higher than, optimum soil fertility levels.
- Maintenance fertiliser rates have been entered into Overseer.
- Farm nitrogen was 239kgN/ha applied in split dressings from September to April.

Structures

- Dairy effluent is separated into solids and liquids. The liquid portion is applied to a 99.7ha effluent area using a cobra rain gun. The solid portion is applied during dry weather (usually December) to the non-effluent portion of the property.
- The farm has a calving pad. This is utilised in Aug, Sep and Oct for springer cows. The structure is uncovered with a bark chip base and is fully lined. Liquid effluent is added to the dairy shed effluent system. The solid effluent portion is spread on the non effluent blocks when conditions allow (usually December).

- There is an inshed feeding system installed on farm. This is utilised throughout the milking season when there is a pasture deficit

3.4.2 Schrama Block current system

A budget was completed to estimate the nitrogen and phosphorus losses from the current management of the Schrama block.

Please note, detailed information of the management of the block was unavailable due to the death of the previous owner. Therefore, a nutrient budget has been created using data from the Beef and Lamb NZ economic survey alongside information available from Google earth and the purchaser.

The Schrama block is 87.2ha in total. Upon purchasing the property, the Titipua Ltd Partnership started the process of subdividing and selling 3ha of the Schrama block (including the house and yards).

Stock and production:

- The farm was operated as a sheep property wintering on swedes
- Stock numbers and production have been assumed using information from the Beef and Lamb NZ economic survey. It was considered that the farm is most similar to the "Class 7 South Island, Finishing Otago/Southland" benchmark.
- Wintered sheep numbers are assumed to be:
  - 577MA ewes
  - 218 Hoggets
  - 16 rams
- A 137% lambing rate is achieved (measured as lambs at tailing compared to those mated)
- 4650kg greasy wool is sold

Feed

- An average of 5.4 ha of swedes were planted over the last three seasons. This was verified using Google earth imagery. Fertiliser records were utilised to determine an average crop fertiliser policy for the three years.
- No feed is imported or exported from the property

Fertiliser

- Soil test taken in Nov 2019 and Nov 17 were available. They show that the farm Olsen P averaged 34 and 35 respectively.
- Maintenance fertiliser rates have been entered into Overseer for the pastoral blocks.
- Fertiliser purchase records show that a small application of nitrogen was made to the pastoral area each year. Therefore, it has been assumed that an application of 18kgN/ha is made in March each year.

3.4.3 Proposed Dairy System

A budget was completed for the proposed dairy system

Stock and production:

- 600 cows will be milked at peak
- Production is expected to be 254,400kgMS
- 156 dairy young stock would be reared on farm. They would be grazed on farm until the 1st May when they would be grazed at a third party graziers property. In the following May, 140 in calf heifers will return to the property and be wintered on farm
- The entire herd would be wintered on farm on either a fodder beet crop or a baleage grass wintering system

Feed

- Imported feed in an average season is estimated to be:
  - PKE – 265tDM fed in shed
  - DDG – 175tDM fed in shed
- It is expected that the farm will harvest 48tDM of silage, 349tDM baleage and 36tDM hay
- No feed will be exported
- The farm will grow 12ha of Fodder beet each year. This would be utilised on the shoulders of the season as well as for wintering. A further 10ha would be utilised for a baleage grass wintering system.

Fertiliser

- Soil fertility will target the agronomic optimum. This will mean a decrease in Olsen P from 34 to 30.
- Maintenance fertiliser rates have been entered into Overseer.
- Farm nitrogen use will be reduced on the dairy platform although there will be an increase in nitrogen applied to the Schrama Block.
  - 175kgN/ha on the non effluent blocks (Sep – Apr)
  - 154kgN/ha on the effluent blocks (Sep- Apr)

Structures

- Dairy effluent is separated into solids and liquids. The liquid portion is applied to a 99.7ha effluent area using a cobra rain gun. The solid portion is during dry weather (usually December) to the non-effluent portion of the property.
- The farm has a calving pad. This is utilised in Aug, Sep and Oct for springer cows. The structure is uncovered with a bark chip base and is fully lined. Liquid effluent is added to the dairy shed effluent system. The solid effluent portion is spread on the non-effluent blocks when conditions allow (usually December).

4.0 OverseerFM nutrient loss estimates

4.1 OverseerFM loss estimates

Nutrient budgets have been prepared to support the assessment of effects of the current and proposed dairy systems. The table below shows the OverseerFM version 6.3.5 estimated nutrient losses from the current landuse on the dairy farm and Schrama blocks.

	Current Dairy Platform	Schrama's block	Total current
Area (ha)	181.5	84.2	265.7
Total Farm N Loss (kg)	11,315	1,738	13,053
N Loss/ha (kgN/ha/yr)	62	21	49
Total Farm P Loss (kg)	455	190	645
P loss/ha (kgP/ha/yr)	2.5	2.3	2.4
Pasture Grown (tDM/ha)	16.8	11.2	

The table below compares the OverseerFM version 6.3.5 estimated nutrient losses from the current landuse with the estimated losses under the proposed system.

	Total current (same as above)	Proposed
Area (ha)	265.7	265.7
Total Farm N Loss (kg)	13,053	12,749
N Loss/ha (kgN/ha/yr)	49	48
Total Farm P Loss (kg)	645	615
P loss/ha (kgP/ha/yr)	2.4	2.3
Pasture Grown (tDM/ha)		16.1

4.1.1 Notes for interpretation of OverseerFM outputs

Estimated pasture grown

It should be noted that the estimated pasture grown outputs from Overseer are higher than expected. Overseer uses a default value for ryegrass/white clover pasture quality irrespective of the land use and management. The default Overseer value in Southland ranges from 10.5 to 11.17 MJ ME/ kg DM depending on the month (reference: Characteristics of pasture, June 2018, D M Wheeler AgResearch Ltd). Pasture cuts from an Eastern Southland monitor farm show MEs of 11.5 to 12.2 (reference: Pasture growth and quality on Southland and Otago dairy farms, D. E. Dalley and T. Geddes, DairyNZ, NZ Grasslands Publication 2012).

The Overseer default values have been used throughout the entirety of this modelling as the Best Practice Data Input Standards state that "*there needs to be a very good long-term average evidence of clover content, pasture utilisation, pasture N content and pasture quality to justify changes from the default OVERSEER values. This level of information would be rare.*"

To ensure that comparisons are valid between the baseline and proposed the same method has been used to ensure that an "apples with apples" approach is taken.

4.2 Calculations outside of OverseerFM

Calculations outside of OverseerFM have been completed to account for the baleage grass wintering system and the installation of a wetland on farm. These mitigations cannot be modelled within OverseerFM.

4.2.1 Baleage grass wintering:

OverseerFM has estimated that the loss of nitrogen from the grass baleage system is 523kgN (or 52kgN/ha). Modelling of the grass baleage wintering system in OverseerFM is likely to underestimate nitrogen losses as OverseerFM is not able to adequately reflect the on-farm realities of this system. OverseerFM assumes that the pasture plants will regrow post grazing and take up urinary N from the wintering activity. However, due to the soil type and climate on the applicant's property, the plants are not viable following the winter grazing. As a result, the area is cultivated and regrassed in spring.

I am unaware of any research that has quantified the impact of baleage grass wintering in terms of nitrate and phosphorus loss. I have therefore completed a desktop modelling exercise that attempts to estimate the nutrient losses from this system more accurately.

The following assumptions have been made:

- Same as the proposed system file
    - Soils / climatic conditions
    - Tile drains
    - Stock numbers
    - Imported / exported supplement
    - Fertiliser and nitrogen use

- Different from the proposed system file
    - Used kale instead of pasture to allow a defoliation event and regrassing activity
    - Used kale as has a similar crude protein to average quality pasture
    - Reduced yield of kale to 3TDM/ha to reflect pasture accumulated for winter in practice
    - Regrassed the area in October in line with when the applicant would usually regrass following a grass baleage wintering event
    - Direct drilled kale (rather than conventional cultivation to minimise the impact of the mineralisation of N during cultivation)

Overseer predicted that the losses from the Kale block would be 70kgN/ha (total of 696kgN lost for the 10ha wintered on). Without comparative research, it is difficult to assess the accuracy of the above results. However, from a common sense perspective, losses from the baleage grass system are likely to be more comparable to a traditional fodder crop paddock than a permanent pasture paddock.

Therefore, it is predicted that the losses from the grass baleage wintering system will be 173kgN higher than estimated in the OverseerFM Proposed scenario.

4.2.2 Installation of a wetland

Titipua Ltd Partnership have sought advice from David Moate of the Environment Southland Land Sustainability team regarding the opportunity to install a wetland on the property. David Moate visited the property in January 2021 to identify potential wetland locations, construction, and effectiveness. A short report was then completed to give an estimate of the potential effectiveness of a wetland. This report is attached in full in the appendices.

Titipua Ltd Partnership have agreed to install a wetland in the South Western corner of the property as per David Moate's recommendation. The photo below, taken from David's report, shows the site of the wetland (blue), the catchment area (green outline) and the land titles (red). For orientation purposes, I have marked on the map where the cowshed is with a blue cross.

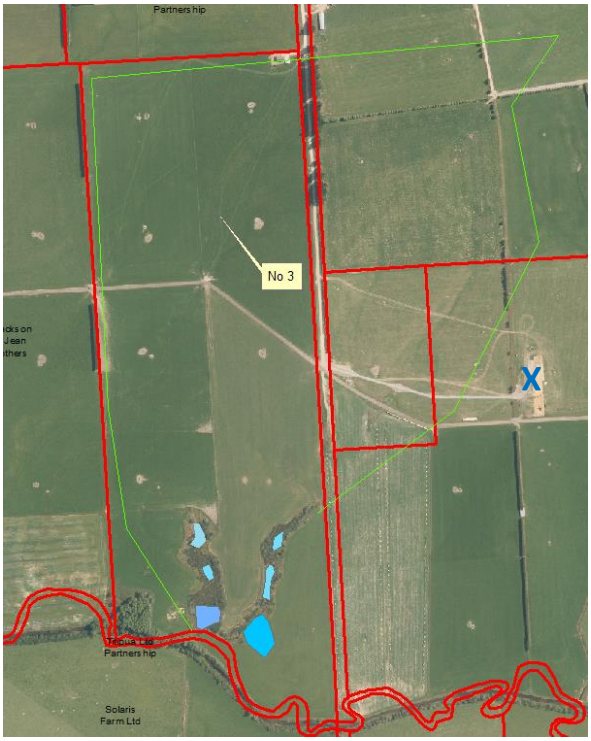


Figure 1. Site of wetland (from David Moate report)

David has estimated that this wetland has a 50ha catchment of land. However, some of this catchment area is outside the Titipua Ltd Partnership farm boundary (North eastern corner). Of the 50ha in the wetland catchment, approximately 38ha is within the Titipua Ltd Partnership farm boundary. The tables below calculate expected reduction in nitrogen and phosphorus loss from the 38ha within the farm boundary.

The table below calculates the expected amount of nitrogen captured by the wetland. Total nitrogen losses captured in the wetland are estimated to be 741kgN/annum.

Overseer block name	Area (ha)	OverseerFM estimated nitrogen leaching loss (kgN/ha)	Reduction in N leaching due to wetland (from David Moate's report) (%)	Total reduction (kgN) (Ha x kgN/ha x %)
Non-Eff, Rolling – Puke, Apar	32.2	40.6	50	653.66
Eff, Rolling – Puke, Apar	2.1	43.0	50	45.15
Non effective area (laneways and tracks) – the losses from this area are accounted for in "other sources" below.	3.7			
Total block Nitrogen loss mitigated	**38.0**			**698.81**
Plus reduction in other sources losses	38/265.7	589	50	42.12
Total farm Nitrogen loss mitigated				**740.93**

The table below calculates the expected amount of phosphorus captured by the wetland. Total phosphorus losses captured in the wetland are estimated to be 43.13kgP/annum.

Overseer block name	Area (ha)	OverseerFM estimated P loss (kgP/ha)	Reduction in P loss due to wetland (from David Moate's report) (%)	Total reduction (kgP) (Ha x kgP/ha x %)
Non-Eff, Rolling – Puke, Apar	32.2	2.14	48	33.08
Eff, Rolling – Puke, Apar	2.1	2.20	48	2.22
Non effective area (laneways and tracks) – the losses from this area are accounted for in "other sources" below.	3.7			
Total block Phosphorus loss mitigated	**38.0**			**35.3**
Plus reduction in other sources losses	38/265.7	114	48	7.83
Total farm Phosphorus loss mitigated				**43.13**

Therefore, it is predicted that the wetland will reduce nutrient losses from the proposed dairy system by 741kgN and 43kgP.

5.0 Conclusions

5.1 Nutrient loss estimates including calculations outside of OverseerFM

The table below shows the estimated nutrient losses from the current landuse on the dairy farm and Schrama blocks.

	Current Dairy Platform	Schrama's block	Total current
Area (ha)	181.5	84.2	265.7
Total Farm N Loss (kg)	11,315	1,738	13,053
N Loss/ha (kgN/ha/yr)	62	21	49
Total Farm P Loss (kg)	455	190	645
P loss/ha (kgP/ha/yr)	2.5	2.3	2.4
Pasture Grown (tDM/ha)	16.8	11.2	

The table below compares the estimated nutrient losses from the current landuse with the estimated losses under the proposed system.

	Total current (same as above)	Proposed	
Area (ha)	265.7	265.7	
Total Farm N Loss (kg)	13,053	12,181 *(12,749 modelled plus 173 baleage grass wintering minus 741 calculated outside OverseerFM)*	6.7% decrease
N Loss/ha (kgN/ha/yr)	49	46	
Total Farm P Loss (kg)	645	572 *(615 modelled minus 43 calculated outside OverseerFM)*	11.3% decrease
P loss/ha (kgP/ha/yr)	2.4	2.2	
Pasture Grown (tDM/ha)		16.1	

5.2 Drivers of changes in nutrient losses

5.2.1 Nitrogen Loss estimates

Nitrogen losses from a farm system can have negative impacts on water quality downstream. This in turn can have negative implications on aquatic life and human health.

OverseerFM has estimated a 6.7% decrease in nitrogen losses between the current and proposed scenarios. This is the cumulative result of many changes to the farm system including:

- A change in culling policy meaning that culls leave the property earlier in the season
- A reduction in imported feed
- Greater use of the calving pad in spring
- Reduced nitrogen fertiliser use

It should also be noted that in the proposed system there will be a reduction in the off-site effect of wintering as all cows will be wintered on farm. There will also be a reduction in the off site effect of the young stock grazing due to a change in grazing policy with these animals. This reduction in offsite effects has not been quantified.

5.2.2 Phosphorus loss estimates

Phosphorus losses from the farm can cause algal growth in surface waterways. OverseerFM has estimated a 11.3% decrease in Phosphorus losses in the proposed system. Key changes include:

- Reducing the farm Olsen P to 30 and therefore reduce maintenance fertiliser P requirements
- A larger area available for spreading solid effluent

5.3 Recommendations from here

OverseerFM can model a specific range of good management practices. Below is a summary of the potential environmental risks on this property and gives recommendations to mitigate these risks.

Good practice for fertiliser use:

- Regular soil testing is used to inform fertiliser recommendations that target agronomic optimum P, K, S, Mg and Ca levels.
- Develop a fertiliser plan with your fertiliser representative. Recommend you make this OverseerFM modelling available to your fertiliser representative to assist them in developing the fertiliser recommendations.
- Apply using a Spreadmark accredited company for fertiliser application – apply at correct rate and with a buffer to waterways.
- Use of Fertmark registered products.
- Record fertiliser applications (location, date of application and amount applied).

Nitrogen:

- Apply nitrogen strategically to meet plant demand.
- Applications should generally be avoided in May due to rapidly declining growth rates.
- Spring nitrogen applications should not be on soil less than 7 degrees Celsius.

Phosphorus:

- OverseerFM is not spatially explicit and a phosphorus mitigation plan should be developed to reduce phosphorus losses.

Critical source areas:

- These include laneways, gateways, swales in paddocks and wallows.
- Review your Farm Environmental Management Plan to update as required and take action on mitigating risk on any new critical source areas identified.

The Proposed Water and Land Plan is currently in the appeals process and is partially operative. It will be important to stay up to date with developments in Environment Southland policy and rules, including the limit setting process which will develop over the next few years.

A National Environmental Standard (NES) has recently been gazetted. This has implications for the wintering of stock on crop, stock exclusion from waterways, nitrogen fertiliser use, changes in landuse and the use of stockholding areas for cattle.

Both the Proposed Water and Land Plan and the National Environmental Standards require a farm of this size to have a farm environmental management plan. This should be updated to include the recommendations within this report.

Appendices

Appendix 1. Modelling Methodology

Nutrient losses have been estimated using the OverseerFM Version 6.3.5 model. OverseerFM is a software application that models nutrient movements within a farm system. Input data detailing the farm system is entered into the software and interpreted through the use of a series of sub-model that calculate the flow of seven major farm nutrients (Nitrogen, Phosphorus, Sulphur, Calcium, Magnesium and Sodium). Output data is reported for interpretation and to inform farm management practices. It currently requires an expert user to describe the physical and management details of a farm.

OverseerFM assumptions

Within the OverseerFM software, assumptions have been made of the farm management:

- Long term annual average model
  The model uses annual average input and produces annual average outputs.
- Near equilibrium conditions
  Model assumes that that the farm is at a state where there is minimal change each year.
- Actual and reasonable inputs
  It is assumed that input data is reasonable and a reflection of the actual farm system. If any parameter changes, it is assumed that all other parameters affected will also be changed.
- Good management practices are followed
  OverseerFM assumes the property is managed at industry agreed good management practice for a specific list of factors including effluent and fertiliser applications. OverseerFM does not assume that all industry agreed good management practices are undertaken on farm.

OverseerFM limitations

Key limitations of the OverseerFM model are:

- OverseerFM does not predict transformations, attenuation or dilution of nutrients between the root zone or farm boundary and the eventual receiving water body. A catchment model is needed to estimate the effects of the nutrient losses from farms on groundwater, river or lake water quality.
- OverseerFM does not calculate outcomes from extreme events (floods and droughts) but provides a typical years result based on a long-term average.
- OverseerFM does not calculate the impacts of a conversion process, rather it predicts the long-term annual average nutrient budgets for changed land use.
- OverseerFM is not spatially explicit beyond the level of defined blocks.
- Not all management practices or activities that have an impact on nutrient losses are captured in the OverseerFM model.
- OverseerFM does not represent all farm systems in New Zealand.
- Components of OverseerFM have not been calibrated against measured data from every combination of farm systems and environment.

Information on OverseerFM can be obtained from the following reports:

- Technical Description of OVERSEER for Regional Councils, September 2015
- Review of the phosphorus loss submodel in OVERSEER®, September 2016
- Using OVERSEER® in Regulation – Technical Resources and Guidance for Regional Councils, August 2016

Data input standards

Nutrient budgets have been constructed using the OverseerFM Version 6.3.5 model.

The nutrient budgets have been developed in accordance with the Overseer data input protocols - "Overseer, Best Practice Data Input Standards, March 2018" and the "OverseerFM User Guide, October 2019." No deviations have been made from these protocols.

Appendix 2. Modelling Inputs

Soil types

Soil type has a large bearing on nutrient loss levels from a property. This is due to different soil types having different water holding capacities, and drainage characteristics. It is therefore important that soil type is inputted correctly.

The table below gives a brief description of the soil types found on the Titipua Ltd Partnership and Schrama property.

S-map ref	Soil Order and Group	Drainage class	Description
Pukem_6a.1	Pallic, Recent/yge/bge	Poor	Moderately deep, poorly drained, silt over clay
Apar_2a.1	Brown, Sedimentary	Imperfect	Deep, imperfectly drained, silt over clay
Makar_3b.1	Gley, Sedimentary	Poor	Deep, poorly drained, clay
Paro_4a.1	Gley, Sedimentary	Poor	Deep, poorly drained, silt
Ymai_25a.1	Gley, Sedimentary	Poor	Deep, poorly drained, loamy peat over silt
Makar_4c.1	Gley, Sedimentary	Poor	Moderately deep, poorly drained, clay

The table below shows the area and the proportion of the block that the soils identified covered:

S-map ref	Total area	% of productive blocks
Pukem_6a.1	127.7 ha	50.0%
Apar_2a.1	85.1 ha	33.3%
Makar_3b.1	22 ha	8.6%
Paro_4a.1	9.2 ha	3.6%
Ymai_25a.1	6.1 ha	2.4%
Makar_4c.1	5.4 ha	2.1%

Climate Data

The following climate information has been used from the OverseerFM climate station tool:

	Current dairy platform	Current Schrama block	Proposed dairy platform
Annual Rainfall (mm)	1122 – 1130	1122	1121 – 1130
Mean Annual Temp (°C)	10 – 10.1	10	10 – 10.1
Annual PET (mm)	735 – 744	734	734 – 744

Blocks

The farms have been split into the following pastoral, riparian and fodder crop blocks based on soil type, contour, drainage and land use.

	Topography	Current dairy platform	Current Schrama block	Proposed dairy platform
			Area (ha)	
Pasture blocks				
Non-effluent				
Non eff, flat - makar, paro	Flat	18.2		18.2
Non eff, flat - ymai	Flat	2.8		2.8
Non eff, rolling - makar	Rolling	4.3		4.1
Non eff, rolling - puke, apar	Rolling	49.5		47.3
Non eff, rolling - makar, paro	Rolling	0.5		0.5
Effluent				
Eff, flat - makar, paro	Flat	2.0		2.0
Eff, flat - puke, apar	Flat	7.2		7.2
Eff, flat - ymai	Flat	3.3		3.3
Eff, rolling - makar, paro	Rolling	2.3		2.3
Eff, rolling - puke, apar	Rolling	84.9		80.9
Schrama block				
Schrama, non eff, rolling - puke, apar	Rolling		71.2	68.0
Schramas, non eff, rolling makar	Rolling		9.3	8.9
Baleage Grass Wintering Blocks				
Baleage/Grass – Non Eff, Makar	Rolling			0.2
Baleage/Grass – Non Eff, Puke Apar	Rolling			2.2
Baleage/Grass – Eff, Puke Apar	Rolling			4.0
Baleage grass - schrama, rolling puke apar	Rolling			3.2
Baleage grass - schrama, rolling, makar	Rolling			0.4
	Productive Block Area	**175.0**	**80.5**	**255.5**
	Riparian area	1.9		1.9
	Non-effective area	4.6	3.7	8.3
	Total area	**181.5**	**84.2**	**265.7**
Rotating fodder crops				
Fodder beet		12		12
Swedes			5.4	

Farm System Inputs

<table>
<tr><th>Description</th><th>Current Dairy Farm</th><th>Current Schrama's Block</th><th>Proposed Dairy platform</th></tr>
<tr><td>Area</td><td>Total: 181.5ha (as per LINZ website)
Productive farm area: 175.0ha</td><td>Total: 84.2ha (excluding the 3ha lifestyle block)
Productive farm area: 80.5ha</td><td>Total: 265.7ha
Productive farm area: 255.5ha</td></tr>
<tr><td>Dairy cows</td><td>Production: 212,000kgMS (424kgMS/cow at peak)

Mean calving date: 25 Aug
Dry off date: 28 May

<table>
<tr><th>Month</th><th>Dairy Herd – Friesian
Default LWT used</th></tr>
<tr><td>Jul</td><td>315</td></tr>
<tr><td>Aug</td><td>515</td></tr>
<tr><td>Sep</td><td>508</td></tr>
<tr><td>Oct</td><td>500</td></tr>
<tr><td>Nov</td><td>500</td></tr>
<tr><td>Dec</td><td>500</td></tr>
<tr><td>Jan</td><td>500</td></tr>
<tr><td>Feb</td><td>500</td></tr>
<tr><td>Mar</td><td>485</td></tr>
<tr><td>Apr</td><td>485</td></tr>
<tr><td>May</td><td>440</td></tr>
<tr><td>Jun</td><td>315</td></tr>
</table>

Breeding bulls: 8 Jerseys, Dec and Jan</td><td>NA</td><td>Production: 254,400kgMS (424kgMS/cow at peak)

Mean calving date: 25 Aug
Dry off date: 28 May

<table>
<tr><th>Month</th><th>Dairy Herd - Friesian
Default LWT used</th></tr>
<tr><td>Jul</td><td>620</td></tr>
<tr><td>Aug</td><td>620</td></tr>
<tr><td>Sep</td><td>610</td></tr>
<tr><td>Oct</td><td>600</td></tr>
<tr><td>Nov</td><td>600</td></tr>
<tr><td>Dec</td><td>600</td></tr>
<tr><td>Jan</td><td>600</td></tr>
<tr><td>Feb</td><td>580</td></tr>
<tr><td>Mar</td><td>550</td></tr>
<tr><td>Apr</td><td>520</td></tr>
<tr><td>May</td><td>490</td></tr>
<tr><td>Jun</td><td>620</td></tr>
</table>

Breeding bulls: 9 Jerseys Dec and Jan

Note: earlier culling in proposed system</td></tr>
<tr><td>Beef calves and replacements</td><td>Calves are reared on farm until early January. The dairy replacements are then grazed at a third-party grazier until their return as in calf heifers in late July (18 months later). The beef type calves are sold.

<table>
<tr><th></th><th>Dairy Calves
Breed: Friesian
Age: 1month</th><th>Beef Calves
Breed: Beef type</th></tr>
<tr><td>Jul</td><td></td><td></td></tr>
<tr><td>Aug</td><td>78</td><td>15</td></tr>
<tr><td>Sep</td><td>130</td><td>30</td></tr>
<tr><td>Oct</td><td>130</td><td>30</td></tr>
<tr><td>Nov</td><td>130</td><td>30</td></tr>
<tr><td>Dec</td><td>130</td><td>30</td></tr>
</table></td><td>NA</td><td>Calves are reared on farm and remain on farm until May 1st. The dairy replacements are then grazed at a third-party grazier until their return as in calf heifers in May (12 months later).

<table>
<tr><th></th><th>Dairy Calves
Breed: Friesian
Age: 1month</th><th>In calf heifers
Breed: Friesian
Age: 22months</th></tr>
<tr><td>Jul</td><td></td><td></td></tr>
<tr><td>Aug</td><td>96</td><td></td></tr>
<tr><td>Sep</td><td>156</td><td></td></tr>
<tr><td>Oct</td><td>156</td><td></td></tr>
<tr><td>Nov</td><td>156</td><td></td></tr>
<tr><td>Dec</td><td>156</td><td></td></tr>
<tr><td>Jan</td><td>156</td><td></td></tr>
<tr><td>Feb</td><td>156</td><td></td></tr>
<tr><td>Mar</td><td>156</td><td></td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Description</th><th>Current Dairy Farm</th><th>Current Schrama's Block</th><th>Proposed Dairy platform</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td>Apr</td><td>156</td><td></td></tr>
<tr><td>May</td><td></td><td>140</td></tr>
<tr><td>Jun</td><td></td><td>140</td></tr>
</table>

Note: Change in young stock policy and removal of beef stock reared.
</td></tr>
<tr><td>Sheep</td><td>NA</td><td>Modelled as an average "class 7, S.I. Finishing Otago/Southland" property using benchmarking data from Beef and Lamb NZ. The report is attached to this document.

Lambing percentage: 137%

Breed: Coopworth

<table>
<tr><td></td><td>Ewes</td><td>Hoggets</td><td>Rams</td><td>Lambs</td></tr>
<tr><td>Jul</td><td>577</td><td>218</td><td>16</td><td></td></tr>
<tr><td>Aug</td><td>577</td><td>218</td><td>16</td><td></td></tr>
<tr><td>Sep</td><td>562</td><td>208</td><td>16</td><td></td></tr>
<tr><td>Oct</td><td>562</td><td>208</td><td>16</td><td></td></tr>
<tr><td>Nov</td><td>547</td><td>208</td><td>16</td><td>1002</td></tr>
<tr><td>Dec</td><td>547</td><td>208</td><td>16</td><td>868</td></tr>
<tr><td>Jan</td><td>532</td><td>208</td><td>16</td><td>738</td></tr>
<tr><td>Feb</td><td>532</td><td>208</td><td>16</td><td>608</td></tr>
<tr><td>Mar</td><td>521</td><td>208</td><td>16</td><td>478</td></tr>
<tr><td>Apr</td><td>521</td><td>208</td><td>16</td><td>348</td></tr>
<tr><td>May</td><td>379</td><td>198</td><td>16</td><td>218</td></tr>
<tr><td>Jun</td><td>379</td><td>198</td><td>16</td><td>218</td></tr>
</table>

Greasy wool: 4650kg</td><td>NA</td></tr>
<tr><td>In shed feeding</td><td>100% of herd fed inshed Aug – May</td><td>NA</td><td>100% of herd fed inshed Aug - May</td></tr>
<tr><td>Structures</td><td>Uncovered calving pad
Carbon rich surface (bark)
Lined

Management:
All animals on for24hrs/day
Aug – 19% of animals (98 cows)
Sep – 12% of animals (61 cows)
Oct – 2% of animals (10 cows)

Effluent:
Liquid effluent added to farm effluent system
Solids are spread on the non effluent blocks in December</td><td>NA</td><td>Uncovered calving pad
Carbon rich surface (bark)
Lined

Management:
All animals on for24hrs/day
Aug – 19% of animals (118 cows)
Sep – 12% of animals (73 cows)
Oct – 2% of animals (12 cows)

Effluent:
Liquid effluent added to farm effluent system
Solids are spread on the non effluent blocks in December</td></tr>
</table>

Description	Current Dairy Farm	Current Schrama's Block	Proposed Dairy platform
Animal distribution	No difference between blocks	No difference between blocks	No difference between blocks
Crop management	<u>Fodder Beet</u> 12ha planted 22TDM/ha yield Rotating through the "rolling" pasture blocks Planted in Nov – conventional cultivation 200kg/ha Cropzeal Boron boost at sowing 500kg/ha Fodder beet base at sowing 120kg/ha sustaiN applied in Jan Grazed in May and Sep for 2hr, and wintered on in June, Jul, Aug 24hrs/day. Sown into permanent pasture in October	<u>Swedes</u> 5.4ha planted (average as seen on Google earth) 12TDM/ha yield Rotating through the pasture blocks Planted in Dec – Conventional cultivation 325kg/ha Cropzeal boron boost at sowing 70kg/ha MOP at sowing 100kg/ha N-rich Urea in February Grazed in Jun, Jul, Aug (24hrs/day) Sown into permanent pasture in November	All cows are wintered on farm on either Fodder Beet or a Baleage/Grass system <u>Fodder Beet</u> 12ha planted 22TDM/ha yield Rotating through the "rolling" pasture blocks Planted in Nov – conventional cultivation 200kg/ha Cropzeal Boron boost at sowing 500kg/ha Fodder Beet Base mix at sowing 120kg/ha of SustaiN applied in Jan Grazed in May and Sep for 2hr, and wintered on in June, Jul, Aug 24hrs/day. Sown into permanent pasture in October <u>10ha Baleage/Grass wintering</u> This area rotates around the "rolling" pasture blocks. 205TDM baleage is fed out in paddock throughout the winter. The paddocks are then regrassed following the winter *Note: OverseerFM is not able to effectively model a Southland Baleage Grass wintering system. This block has therefore been modelled as a pastoral block and an adjustment to expected losses has been calculated outside of OverseerFM*
Imported Supplements	Silage – 150tDM fed in paddock and on pad Hay – 13TDM fed on pad PKE – 200TDM fed in shed DDG – 130TDM fed in shed Baleage – 120TDM fed on the crop	None	PKE – 265TDM fed in shed DDG – 175TDM fed in shed
Exported supplements	None	None	None
Harvested supplements	Hay – 17TDM fed on the pad Baleage – 24TDM fed on the crop	None	Hay – 36TDM fed on the pad Baleage – 144TDM fed on the Fodder beet

Description	Current Dairy Farm	Current Schrama's Block	Proposed Dairy platform
			Baleage – 205TDM fed on the baleage grass wintering paddocks Silage – 48TDM fed on the pad
Soil Fertility	Soil tests were completed in July 2019 Olsen P of 34 QT K of 7 QT Ca of 9 QT Mg of 17 QT Na of 6 SO_4 of 13	Soil tests were completed in November 2019 Olsen P of 34 QT K of 9 QT Ca of 9 QT Mg of 17 QT Na of 9 SO_4 of 13	Soil fertility would be targeted at agronomic optimum Olsen P of 30 QT K of 7 QT Ca of 9 QT Mg of 17 QT Na of 6 SO_4 of 13
Fertiliser	Fertiliser applied to maintenance level. Total P applied – 5,380kg Total K applied – 814kg Total S applied – 3,642kg	Fertiliser applied to maintenance level. Total P applied – 2,070kg Total K applied – 357kg Total S applied – 1,2750kg	Fertiliser applied to maintenance level. Total P applied – 7,728kg Total K applied – 7,222kg Total S applied – 5,855kg
Pastoral Nitrogen Fertiliser	239kgN/ha was applied to the pasture area in split application between Sep and Apr	Taken from fertiliser purchase records 18kg/ha N applied in March	Non Effluent paddocks – 175kgN/ha applied in split applications from Sep – Apr Effluent paddocks – 154kgN/ha applied in split applications from Sep to Apr *Note: No nitrogen fertiliser applied to the baleage grass paddocks in April prior to wintering on them*
Drainage	50% of the property is drained using mole and tile drainage	50% of the property is drained using mole and tile drainage	50% of the property is drained using mole and tile drainage
Effluent system	Holding pond – solids are separated Effluent is applied using a cobra rain gun at an application depth of 12-24mm Liquid effluent is applied to the "eff" blocks Solids are spread on the Non effluent blocks when conditions allow (usually December)	NA	Holding pond – solids are separated Effluent is applied using a cobra rain gun at an application depth of 12-24mm Liquid effluent is applied to the "eff" blocks Solids are spread on the Non effluent blocks when conditions allow (modelled as December)

Appendix 3: OverseerFM Data Outputs

Dairy Farm Current system

Farm nutrient budget

	Total loss (kg/yr)	Loss per ha (kg/yr)
Nitrogen	11,315	62
Phosphorus	455	2.5

Nutrients added (kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Fertiliser, lime and other	224	30	4	20	0	0	3
Irrigation	0	0	0	0	0	0	0
Supplements	81	16	51	10	18	10	7
Rain/clover fixation	78	0	2	5	3	6	27

Nutrients removed (kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Leached from root zone	62	2.5	14	42	69	8	23
As product	92	16	22	5	21	2	6
Transfer	0	0	0	0	0	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	102	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
Change in pools (kg/ha/yr)	**N**	**P**	**K**	**S**	**Ca**	**Mg**	**Na**
Organic pool	121	15	9	-14	2	1	1
Inorganic mineral	0	2	-25	0	-2	-3	-4
Inorganic soil pool	8	10	46	0	-70	8	10

Nitrogen summary

	Total loss (kg)	Loss per ha (kg/ha)	N in drainage (ppm)	Added (kg/ha)	Surplus (kg/ha)	Fertiliser (kg/ha)	Irrigation (kg/ha)	Effluent (kg/ha)
Eff, flat - makar, paro	90	45.2	10	267	257	239	0	28
Eff, flat - puke, apar	392	54.4	12	267	255	239	0	28
Eff, flat - ymai	137	42	9	267	247	239	0	28
Eff, rolling - makar, paro	97	46.2	10	267	257	239	0	28
Eff, rolling - puke, apar	4494	58.2	12	267	257	239	0	28
Non eff, flat - makar, paro	760	41.6	9	262	251	239	0	23
Non eff, flat - ymai	112	40	9	262	244	239	0	23
Non eff, rolling - makar	173	43.4	10	262	255	239	0	23
Non eff, rolling - puke, apar	2419	53.4	12	262	252	239	0	23
Non eff, rolling - makar, paro	21	42.2	9	262	253	239	0	23
Fodder beet	2130	178	32	135	190	135	0	0
Pond and wetland	6	3	-	0	0	0	0	0

Phosphorus summary

	Total loss (kg)	Loss per ha (kg/ha)	Fertiliser (kg/ha)	Irrigation (kg/ha)	Effluent (kg/ha)
Eff, flat - makar, paro	2	0.7	29	0	0
Eff, flat - puke, apar	6	0.8	30	0	0
Eff, flat - ymai	3	0.9	29	0	0
Eff, rolling - makar, paro	5	2.2	33	0	0
Eff, rolling - puke, apar	188	2.4	34	0	0
Non eff, flat - makar, paro	13	0.7	16	0	13
Non eff, flat - ymai	2	0.8	16	0	13
Non eff, rolling - makar	8	2.1	20	0	13
Non eff, rolling - puke, apar	105	2.3	21	0	13
Non eff, rolling - makar, paro	1	2.1	20	0	13
Fodder beet	29	2.4	77	0	0
Pond and wetland	0	0.1	0	0	0

Schrama Block Current System

Farm nutrient budget

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	1,738	21
Phosphorus	190	2.3

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Fertiliser, lime and other	23	25	4	15	0	0	0
Irrigation	0	0	0	0	0	0	0
Supplements	0	0	0	0	0	0	0
Rain/clover fixation	74	0	2	5	3	6	27

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leached from root zone	21	2.3	10	36	44	9	28
As product	11	1	0	2	2	0	0
Transfer	0	0	0	0	0	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	38	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
CHANGE IN POOLS (KG/HA/YR)	**N**	**P**	**K**	**S**	**CA**	**MG**	**NA**
Organic pool	24	12	0	-18	0	0	0
Inorganic mineral	0	2	-21	0	-2	-3	-4
Inorganic soil pool	10	8	27	0	-39	1	3

Nitrogen summary

	Total loss (kg)	Loss per ha (kg/ha)	N in drainage (ppm)	Added (kg/ha)	Surplus (kg/ha)	Fertiliser (kg/ha)	Irrigation (kg/ha)	Effluent (kg/ha)
Rolling - makar	91	10.4	2	18	89	18	0	0
Rolling - puke, apar	809	12.2	3	18	87	18	0	0
Swedes	807	149	26	100	85	100	0	0

Phosphorus summary

	Total loss (kg)	Loss per ha (kg/ha)	Fertiliser (kg/ha)	Irrigation (kg/ha)	Effluent (kg/ha)
Rolling - makar	18	2.1	23	0	0
Rolling - puke, apar	151	2.3	23	0	0
Swedes	12	2.3	63	0	0

Proposed Dairy Farm System

Farm nutrient budget

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	12,749	48
Phosphorus	615	2.3

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Fertiliser, lime and other	158	29	27	22	0	0	2
Irrigation	0	0	0	0	0	0	0
Supplements	45	11	19	6	10	7	5
Rain/clover fixation	113	0	2	5	3	6	27

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leached from root zone	48	2.3	14	42	59	8	23
As product	76	13	18	4	18	2	5
Transfer	0	0	0	0	0	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	86	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
CHANGE IN POOLS (KG/HA/YR)	**N**	**P**	**K**	**S**	**CA**	**MG**	**NA**
Organic pool	102	15	8	-15	2	1	1
Inorganic mineral	0	2	-29	0	-2	-3	-4
Inorganic soil pool	6	8	42	0	-63	6	9

Nitrogen summary

	Total loss (kg)	Loss per ha (kg/ha)	N in drainage (ppm)	Added (kg/ha)	Surplus (kg/ha)	Fertiliser (kg/ha)	Irrigation (kg/ha)	Effluent (kg/ha)
Baleage grass - schrama, rolling puke apar	165	51.4	11	168	493	154	0	13
Baleage grass - schrama, rolling, makar	16	41.4	9	168	586	154	0	13
Baleage/grass - non eff, rolling, makar	8	41.4	9	168	482	154	0	13
Baleage/grass - eff, rolling, puke apar	220	54.8	11	168	485	136	0	32
Baleage/grass - non eff, rolling, puke apar	114	51.4	11	168	451	154	0	13
Eff, flat - makar, paro	66	33	7	186	200	154	0	32
Eff, flat - puke, apar	289	40.2	9	186	198	154	0	32
Eff, flat - ymai	102	31	7	186	188	154	0	32
Eff, rolling - makar, paro	72	34.6	7	186	197	154	0	32
Eff, rolling - puke, apar	3274	43	9	186	196	154	0	32
Non eff, flat - makar, paro	586	32	7	188	189	175	0	13
Non eff, flat - ymai	86	31	7	188	180	175	0	13
Non eff, rolling - makar	129	33	7	188	192	175	0	13
Non eff, rolling - puke, apar	1800	40.6	9	188	188	175	0	13
Non eff, rolling - makar, paro	18	35	8	188	209	175	0	13
Schrama, non eff, rolling - puke, apar	2589	40.6	9	188	188	175	0	13
Schramas, non eff, rolling makar	276	33	7	188	192	175	0	13
Fodder beet	2345	195	36	135	235	135	0	0
Pond and wetland	6	3	-	0	0	0	0	0

Phosphorus summary

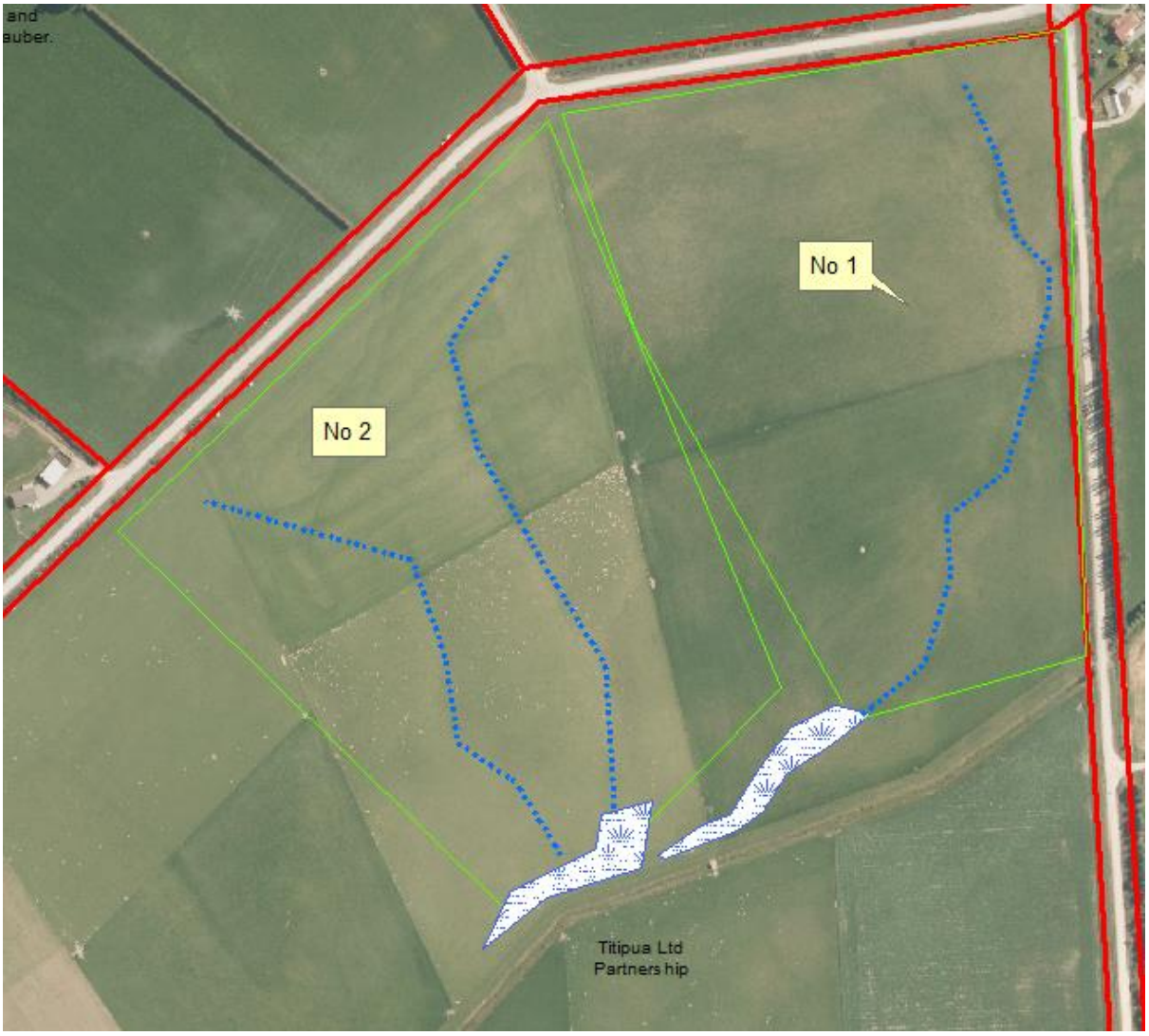
	Total loss (kg)	Loss per ha (kg/ha)	Fertiliser (kg/ha)	Irrigation (kg/ha)	Effluent (kg/ha)
Baleage grass - schrama, rolling puke apar	6	1.9	0	0	8
Baleage grass - schrama, rolling, makar	0	1.7	0	0	8
Baleage/grass - non eff, rolling, makar	0	1.7	0	0	8
Baleage/grass - eff, rolling, puke apar	8	2	0	0	0
Baleage/grass - non eff, rolling, puke apar	5	1.9	0	0	8
Eff, flat - makar, paro	2	0.7	30	0	0
Eff, flat - puke, apar	5	0.7	31	0	0
Eff, flat - ymai	3	0.8	31	0	0
Eff, rolling - makar, paro	5	2	34	0	0
Eff, rolling - puke, apar	168	2.2	34	0	0
Non eff, flat - makar, paro	12	0.7	23	0	8
Non eff, flat - ymai	2	0.8	23	0	8
Non eff, rolling - makar	8	1.9	26	0	8
Non eff, rolling - puke, apar	96	2.1	27	0	8
Non eff, rolling - makar, paro	1	1.9	23	0	8
Schrama, non eff, rolling - puke, apar	136	2.1	27	0	8
Schramas, non eff, rolling makar	17	1.9	26	0	8
Fodder beet	29	2.4	77	0	0
Pond and wetland	0	0.1	0	0	0

Appendix 4: Beef and Lamb NZ Economic Survey Data

The Schrama Block Current farm nutrient budget has been completed using information from a recent Beef and Lamb NZ Economic Survey. This can be found at https://beeflambnz.com/sites/default/files/data/files/2019%20SSI.pdf

Appendix 5: David Moate Wetlands Report

Titipua Ltd Partners Wetland Ideas



No 1

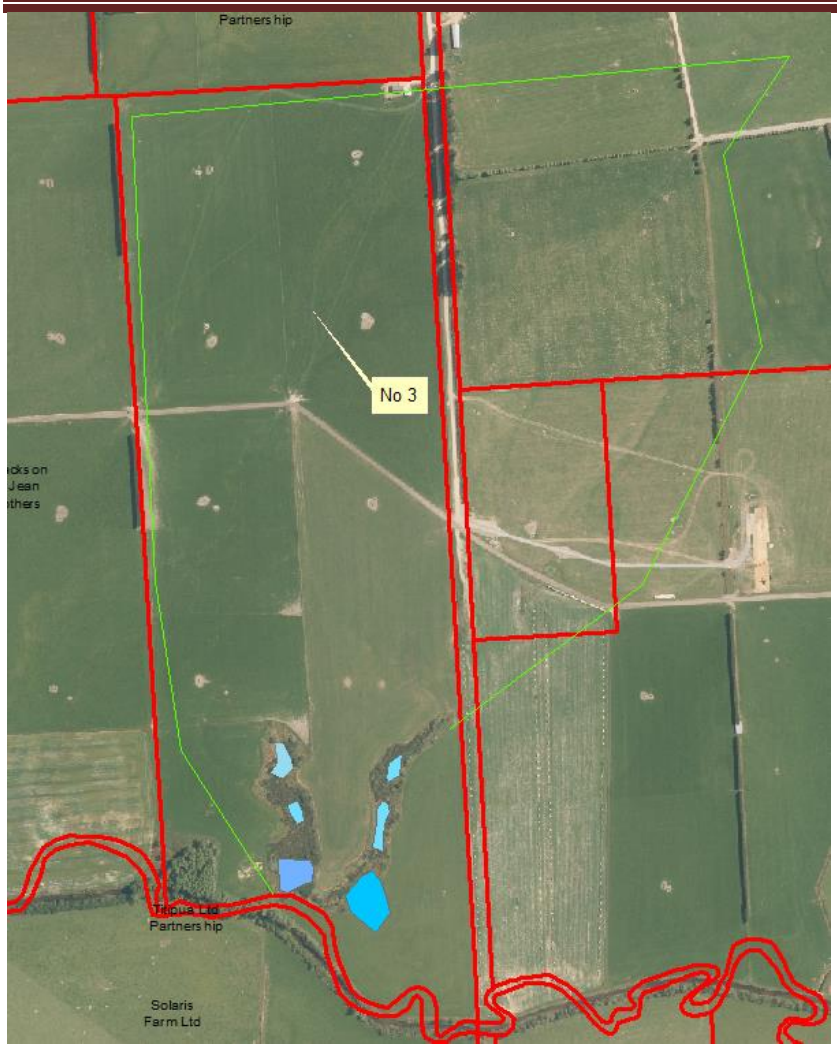
- 9 Ha catchment
- 900m2 wetland = 1 % of the catchment that will remove 50% of sediment, 25% of N, 25% P

No 2

- 10 Ha catchment
- 1000m2 wetland = 1% of catchment that will remove 50% of sediment, 25% of N, 25% P

Design Features

- First half 0.5m deep to improve tile outfalls, collected sediment and kill bacteria
- Second half 0.3m deep planted heavily with Carex secta
- Banks can be planted for in short plants for erosion control and aesthetics
- All 3 options do not require a resource consent



No 3

- 50 Ha
- 2.216 Ha wetland = 4.5% of the catchment that will remove 86% of sediment, 50% of N, 48% of P

Design Features

This existing area can be added too by creating more open water sections to store more water for longer allowing sunlight and wind to kill bacteria, sediment to be stored and N reduced. Open water areas created by bunds or digging out hollows. Make any overflows from earth not pipe and maybe lined with rock to prevent scouring in heavy rain events.

Main Creek

- Too risky trying to build anything in this waterway best to treat water before it gets there
- Permission required from ES catchment for nay planting
- Planting a row of Crow's nest or Tasman poplars or Moutere or Matsudana willow would benefit water quality and farm production and animal welfare
- For free Matsudana willow wands that only require a trim to length (1-1.2m) call Aaron Baird Otautau 021867522