26 July 2019

Environment Southland
Private Bag 90116
Invercargill 9480

Attention: Consent Manager

To whom it may concern

Re: Application by South Dairy for; land use consent for farming activity, discharge permit to discharge effluent to land, water permit to abstract groundwater for dairy purposes, land use consent to use existing effluent storage ponds, land use consent for feed pad, at Winton.

The applicant seeks to create one combined global dairy platform made up of the total areas of their three existing properties. There is no change in total stock numbers, however there is a 7ha increase in dairy platform land area. Therefore, the applicant seeks consent under Rule 20 (e) for the farming activity.

Consent durations of 15 years is sought for this consent. The attached assessment of effects found that the actual and potential effects of the activities on the surrounding environment are insignificant.

Please find enclosed the above consent application for your consideration.

The $1500 consent processing deposit will be paid via internet banking.

If you have any questions in relation to this application, please don't hesitate to contact myself or Mike Freeman directly.

Yours Sincerely,

Matilda Ballinger

Matilda Ballinger

Graduate Planner

13 Pinot Noir Drive | PO Box 302 | Cromwell 9342
P 03 445 9905
matilda@landpro.co.nz | www.landpro.co.nz

Application for Resource Consent (PART A)

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

environment SOUTHLAND REGIONAL COUNCIL Te Taiao Tonga

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

Full name, address and contact details of applicant *(in whose name consent is to be issued)*

Name: South Dairy C/- Dean and Suzanne Alexander

Address: 11 Mc Conachie Rd
RD1, Winton 9781

Email: alexander.farms01@gmail.com

Phone: ______ *Preferred* ______ *Additional* Fax: ______

Date(s) of birth: ______ ______ ______

Consultant contact details *(if different from above)*

Contact name/agent: Mike Freeman -Landpro Ltd

Address: PO Box 302
Cromwell 5342

Email: mike.freeman@landpro.co.nz

Phone: ______ *Preferred* ______ *Additional* Fax: ______

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

Land Use

- [ ] Bore/well
- [x] New or expanded dairy farming
- [x] Effluent storage
- [ ] Cultivation
- [ ] Tree planting
- [ ] Gravel extraction
- [ ] Feed-pad, wintering pad, calving pad or silage pad
- [ ] Riverbed activity
- [ ] Bridges and culverts

Discharge

- [ ] To air
- [ ] To water
- [x] To land

Water

- [ ] Take and use surface water
- [x] Take and use groundwater
- [ ] Dam water
- [ ] Divert water

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

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

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

AUTH-20147281-01-V1	AUTH-20171309-01
AUTH-20147281-02	AUTH-20171302-02
AUTH-20147281-04	AUTH-20191108

2 Are any other consents required from Environment Southland or **other authorities**? [ ] Yes [x] No

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

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

Discharge effluent to land
Land use: expanded farm, efluent storage, feed pad
Water permit- abstract groundwater

4 **Location** of proposed activity

Address: See attached AEE

Legal Description: ____________

Map Reference (NZTM 2000): ____________ E ____________ N

5 The name and address of the **owner /occupier**: (if other than the applicant)

Name: ____________ Phone: ____________

Address: ____________

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

See attached AEE

7 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.

8 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.

9 Correspondence from Council when using a consultant

It is standard practice that both you and your consultant are copied into all correspondence relating to the consent process. This is so that you know what is going on with your application. Please let us know below if you would like us to only contact your consultant. This means you will only hear from us when your application is/is not accepted, when a decision is made or if we feel that you need to be contacted.

I want all correspondence about my application to go to my consultant only [ ] Yes [x] No

10 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. However, we find that applications that have an on-site visit are processed with less congestion and at a similar or lesser overall cost. Please let us know below if you would like us to come and see your site.

I would like a member of the Consents Team to visit my site [ ] Yes [x] No

11 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	**$297**
Whitebait stand	**$225**
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 **$1.98** per year per cubic metre authorised as a maximum daily take.
  - Minimum of **$138**, maximum of **$7,964**.
- **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 **$0.93** per year per cubic metre.
  - Minimum of **$162**, maximum of **$1,871**.

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

12 Checklist: Have you included the following?

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

Note:

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

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** 26/07/2019

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

South Dairy Limited

Resource Consent Application to
the Southland Regional Council:

- For a land use consent for a farming activity
- For a discharge permit to discharge effluent to land
- For a water permits to abstract groundwater for dairy purposes
- For a land use consent to use existing effluent storage ponds
- For a land use consent for a feed pad/lot

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Prepared For
South Dairy Ltd

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

QUALITY INFORMATION

Reference:	**18247.South Dairy**
Date:	21 July 2019
Prepared by:	Tanya Copeland
Reviewed by:	Mike Freeman
Client Review:	**Dean and Suzanne Alexander**
Version Number:	FINAL

TABLE OF CONTENTS

Table of Contents

LIST OF ATTACHMENTS

Appendix A – Baseline nutrient budget report
Appendix B – Proposed nutrient budget report
Appendix C – Overseer independent audit of baseline nutrient budget
Appendix B – Overseer independent audit of proposed nutrient budget
Appendix E – DESC report for SD1 and SD2
Appendix F – File note from Miranda Hunter
Appendix G – Water quality assessment/technical report
Appendix H – FEMP
Appendix I – Exclusion paddocks at Cameron Road and Browns
Appendix J – SD2 sludge bed drop test report
Appendix K – Herd home certifications

1. INTRODUCTION

1.1 Executive Summary of the application

The applicant, South Dairy Ltd currently own and operate three adjoining properties in the Lochiel area of Central Southland:

- South Dairy 1 is an existing dairy platform
- South Dairy 2 is an existing dairy platform
- A neighbouring support block

Both dairy farms currently operate separately and have existing separate consents in place and the adjacent support block is currently used for intensive winter grazing and winter grazing on grass/baleage.

The application seeks to create one combined global dairy platform made up of the total area of the three existing properties. The global dairy platform will be serviced by the two existing dairy sheds and will allow for flexibility in the way the current infrastructure is able to be managed to make best use of the dairy shed capabilities and off-paddock infrastructure. As a result, the application seeks to apply for a suite of "global" consents across these three adjoining properties. Despite the transition from individual dairy platforms to a larger combined dairy platform, the application results in:

- No change in the total number of cows milked on the dairy platform
- No change in the total number of cows wintered on the landholding
- No change in the total number of young stock numbers on the landholding
- A 7ha increase in dairy platform land area as a result of including the neighbouring support block

This application seeks consent under Rule 20 (e) for the farming activity. The farming activity also extends across three separate runoff blocks which are utilised for dry stock grazing, supplement production, intensive winter grazing and winter grazing on grass/baleage. The landholding is therefore defined as including the amalgamated dairy platform and the three runoff blocks. The assessment of effects contained within this application includes a full assessment of the activities occurring and the actual and potential effects on the environment from the proposed farming activity in its entirety across the landholding.

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

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

1.2 The Applicant

Applicant Postal Address:	South Dairy Ltd C/- Dean and Suzanne Alexander 11 McConachie Road RD1 Winton 9781
Address for Service:	C/- Tanya Copeland Landpro Limited PO Box 302 Cromwell 9342

1.3 Applicant's background, values and objectives

South Dairy Ltd is a family company where all four directors are part of the Alexander family. Director Dean Alexander and his wife Suzanne live on and operate the two dairy farms subject to this application. Dean and Suzanne have put into their own words some information about their background, values and objectives:

> **The Alexander's come from a proud farming background in Scotland, where hardship and the desire for a better future saw them shift to New Zealand where we are part of a family carrying on 4 generations of farming in New Zealand.**
>
> **Over this time so much has changed in the way we go about our everyday lives and business. We have become very aware over the past decade or so as we have matured as people, of how quickly this change happens and will continue to happen. Becoming aware and being open to this change has helped us to be wider thinking, defining who are and how we approach our everyday lives.**
>
> **We have positioned our business over the past few years to be self-contained, where we can have control of as many of the variables as possible. Then if there is an issue, it is our responsibility to fix it.**
>
> **The main way that we have achieved this is through taking on runoff blocks so we control all young stock, winter grazing and supplement requirements. This has enabled us to focus on, and also be responsible for the whole business.**
>
> **One of our main goals is to continually evolve and improve what we are doing in our farming business. We will never be standing still. A lot of thought and planning has gone into the following application over a number of years. One of our main concerns as we move forward is that we may get locked into a 'recipe' for farming through regulatory requirements. It is paramount to us that we maintain flexibility within the decision making of our business with**

the aim to be positioned in the best possible place to innovate, lead and explore new and better ways of farming into the future.

The phrase, 'Overall Sustainability', describes so well what is required in today's world. It is often used without much thought to what it may actually mean. However, it underpins all that we are trying to achieve in our farm business. For us, it falls into five main areas:

- **People**
- **Business Performance**
- **Environment**
- **Community**
- **Animal Welfare**

People

- **Personal growth and development**
- **Family**
- **Training – Helping others to be the best they can be**
- **Others values and customs**
- **Making a positive difference in someone else's life**
- **Job satisfaction – our own and our staff**
- **Health and Safety**

This is an area that has become a huge focus for us over the past 5-10 years and it would be fair to say that it would sit at the top of the list of 5. Being more aware in this area has been game changing. As our business has grown, we have had to become more reliant on the people within and around it if we are to succeed. This is the biggest daily variable in our business. It was only after we sort specific training in this area and placed real value on this that we have been able to truly grow as individuals and a business which has enabled us to take other people on this journey with us.

Business Performance

- **Financial KPI's**
- **Production KPI's**
- **Herd improvement**
- **Production Efficiency**

This is an area that has always been at the core of any successful business. Over time we are all becoming more aware that it is only part of being successful and other objectives play a vital role along side this. We will continue to strive for improvement in this area, especially around overall efficiency, as the success of this underpins the ability to carry out all other objectives.

Environment

- **Natural farm resources**
- **Receiving environment**
- **Business structures and models**
- **Future generations**

This is about being the best custodians that we can be of the land and business that we are farming. We received a fantastic opportunity to be doing what we are doing, it is up to us to leave it better placed for future generations. Being more aware of our regulatory requirements has become a major part of our business with the aim of going 'over and beyond' in order to future proof the business. We are very proud of what we have achieved in this area over the past few years.

Community

- **Public expectations**
- **Understanding**
- **Customer requirements**

We have a requirement to meet certain expectations within the communities that we live in. Dean has taken on a number of roles outside of the farm gate over the past few years. These include Dairy Environmental and Climate Change Ambassador roles. He has had multiple goals in doing this and has gained huge satisfaction in giving back to the industry and community. It has enabled him to better understand and educate on the issues being pushed onto the agricultural sector, advocate for change amongst fellow farmers, while also educate and ask for understanding from those outside the industry where it may be needed.

Animal Welfare

- **Minimising any animal suffering**
- **Herd health and well being**
- **Providing appropriate facilities**

The animal that we are farming are a core part of our operation. We have always had a passion for the animals that we farm, the continued improvement of their genetics and their well-being.

'Average isn't good enough'

This is the motto that we attempt to live by in our everyday lives and within our business. We believe that if we can live by this, instil this in our children and staff, then we will all be striving to improve and be the best that we can be. It starts by understanding where you are at, then knowing where you can improve, but mostly being prepared to accept change.

1.4 Purpose of Documentation

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

2. DETAILS OF THE PROPERTY

2.1 South Dairy landholding

The South Dairy landholding includes the proposed dairy platform (amalgamating the original South Dairy 1 and South Dairy 2 existing dairy platforms and the additional 7ha neighbouring support land) and the Crow Rd, Browns and Cameron Rd runoff blocks. **Figure 1** shows the spatial extent of the South Dairy landholding.

Figure 1: Proposed South Dairy landholding

Property Details under the proposal	
Property owner(s)	South Dairy Ltd – dairy platform and Browns
Legal Description	**Dairy Platform** Sections 49, 51, 52, and 53 Block I Winton Hun Section 11 Block II Winton Hun Lot 2 DP 377137 Part Sections 25, 26, 47 and 48 Block I Winton Hun Sec 14, 15, 16 and 19 Block IX New River Hun Sec 79, 80 and 81 Block IX New River Hun Part Sec 18 Block IX New River Hun Lot 5 DP 363069 Lot 10 DP 363069 **Crow Rd:** Lot 1, 6, 7 and 8 DP 401113 **Browns:** Sec 17, 18 and Pt Sec 19 Block III Winton Hun **Cameron Rd:** Lot 2 DP 439014 Lot 2 DP 494160 Lot 2 and 3 DP 474318 Lot 1 and 2 DP 304455
Property area (ha)	**Dairy platform:** 435ha total, 418ha effective **Crow Rd:** 50ha total, 49ha effective **Browns:** 63ha total, 62ha effective **Cameron Rd:** 100ha total, 94ha effective
Location	**Dairy platform:** NZTM2000 1241701 4872031 (SD2 dairy shed) NZTM2000 1241673 4873824 (SD1 dairy shed) **Crow Rd:** TM2000 1242589 4875777 **Browns:** NZTM2000 1245196 4878869 **Cameron Rd:** NZTM2000 1245287 4874117
Proposed land use	Expanded dairy platform to include 7ha new neighbouring block Continuation of runoff block activities on Crow Rd, Browns and Cameron Rd runoff blocks – no change to extent of runoff blocks
Peak cows	1250
Stocking rate	2.9 cows/ha

3. DESCRIPTION OF EXISTING ENVIRONMENT

The following section describes the existing environment separately for the four main blocks within the landholding: dairy platform, Crow Rd, Browns and Cameron Rd.

3.1 Dairy platform

3.1.1 Soils

The map below shows the soil types and distributions across the dairy platform.

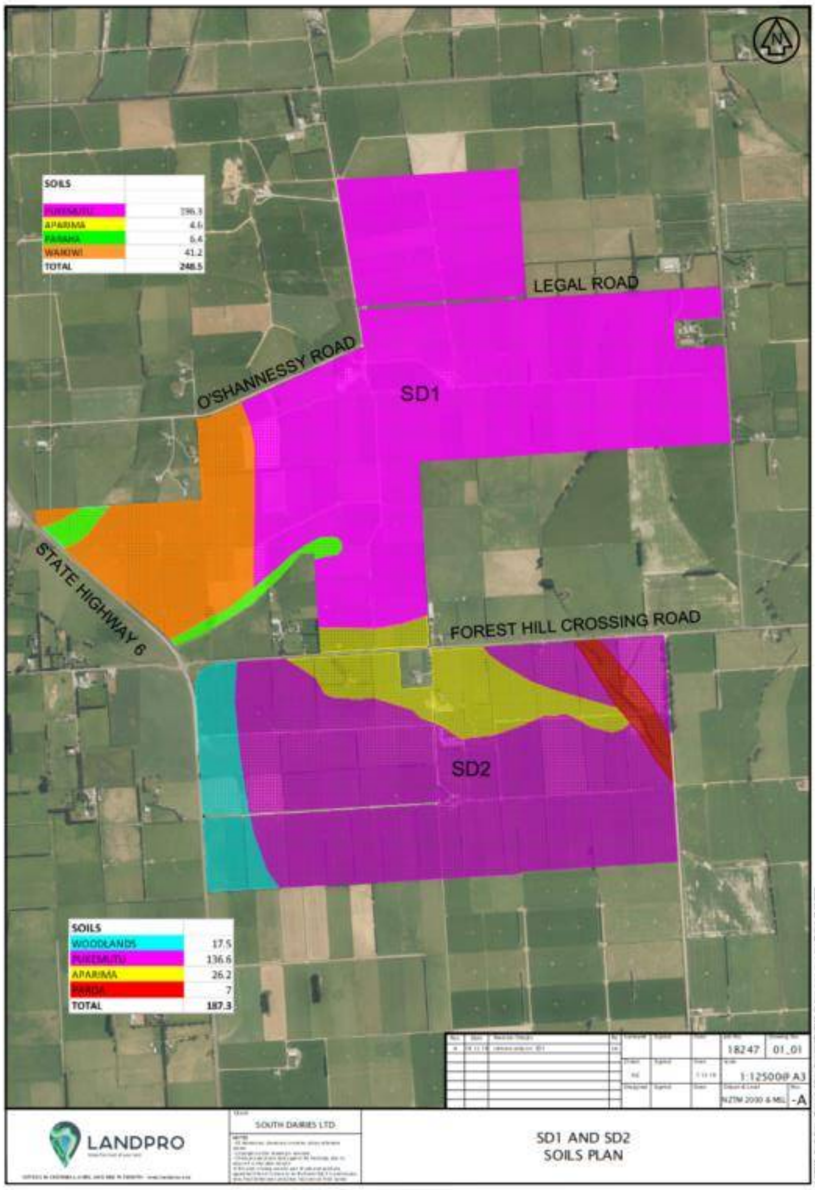

Figure 2: Soil types and distribution across the dairy platform

3.1.2 Physiographic zones

According to Beacon, the majority of the dairy platform is located within the Gleyed physiographic zone. The remainder of the platform located in the area of Waikiwi soils is located within the Oxidizing physiographic zone.

3.1.3 Surface water resources

The dairy platform is located within the Oreti River, Makarewa River and Tussock Creek catchments according to the arbitrary catchment boundaries on Beacon. Topographical mapping shows that there are no surface water bodies arising on the eastern side of the property which drain directly towards Tussock Creek and this is unlikely to be a catchment for the dairy platform.

3.1.4 Groundwater Resources

The dairy platform is located within the Lower Oreti and Makarewa Groundwater Management Zones (GMZ).

3.2 Crow Rd runoff block

3.2.1 Soils

The map below shows the soil types and distributions across the Crow Rd runoff block

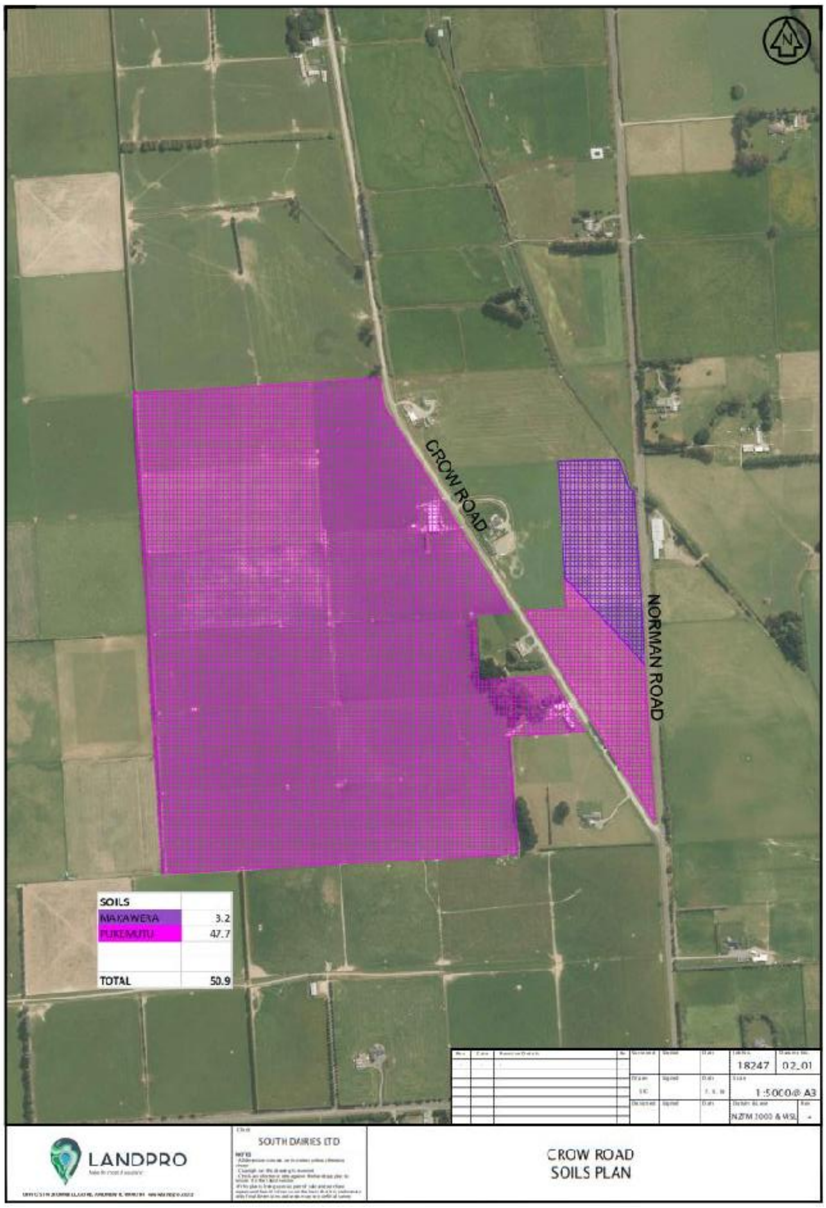

Figure 3: Soil types and distribution across the Crow Rd runoff block

3.2.2 Physiographic zones

According to Beacon, the entire Crow Rd block is located within the Gleyed physiographic zone.

3.2.3 Surface water resources

The Crow Rd block is located within the Oreti River and Tussock Creek catchments according to the arbitrary catchment boundaries on Beacon.

3.2.4 Groundwater Resources

The Crow Rd block is located within the Lower Oreti and Makarewa Groundwater Management Zones (GMZ).

3.3 Browns runoff block

3.3.1 Soils

The map below shows the soil types and distributions across the Browns runoff block

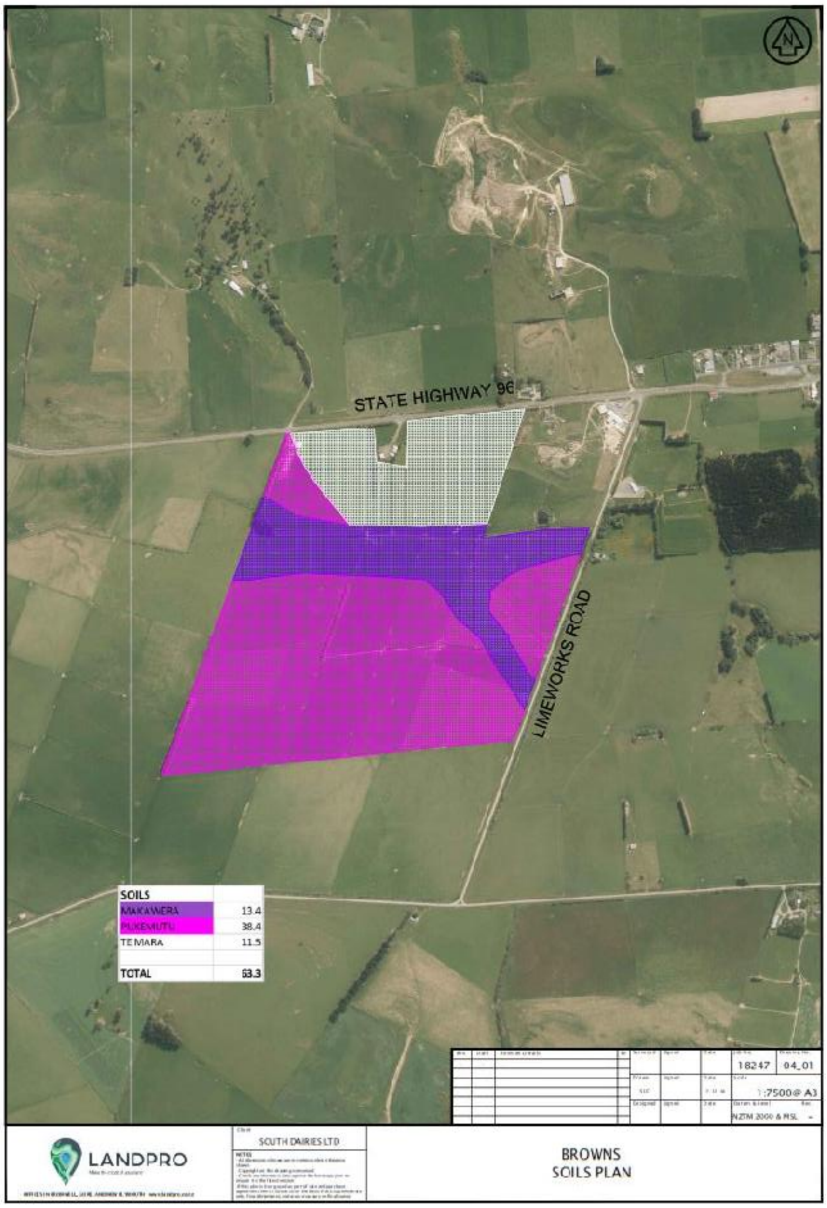

Figure 4: Soil types and distribution across the Browns runoff block

3.3.2 Physiographic zones

According to Beacon, the entire Browns block is located within the Gleyed physiographic zone.

3.3.3 Surface water resources

The Browns block is located within the Tussock Creek catchment according to the arbitrary catchment boundaries on Beacon.

3.3.4 Groundwater Resources

The Browns block is located within the Makarewa Groundwater Management Zones (GMZ).

3.4 Cameron Rd runoff block

3.4.1 Soils

The map below shows the soil types and distributions across the Cameron Rd runoff block

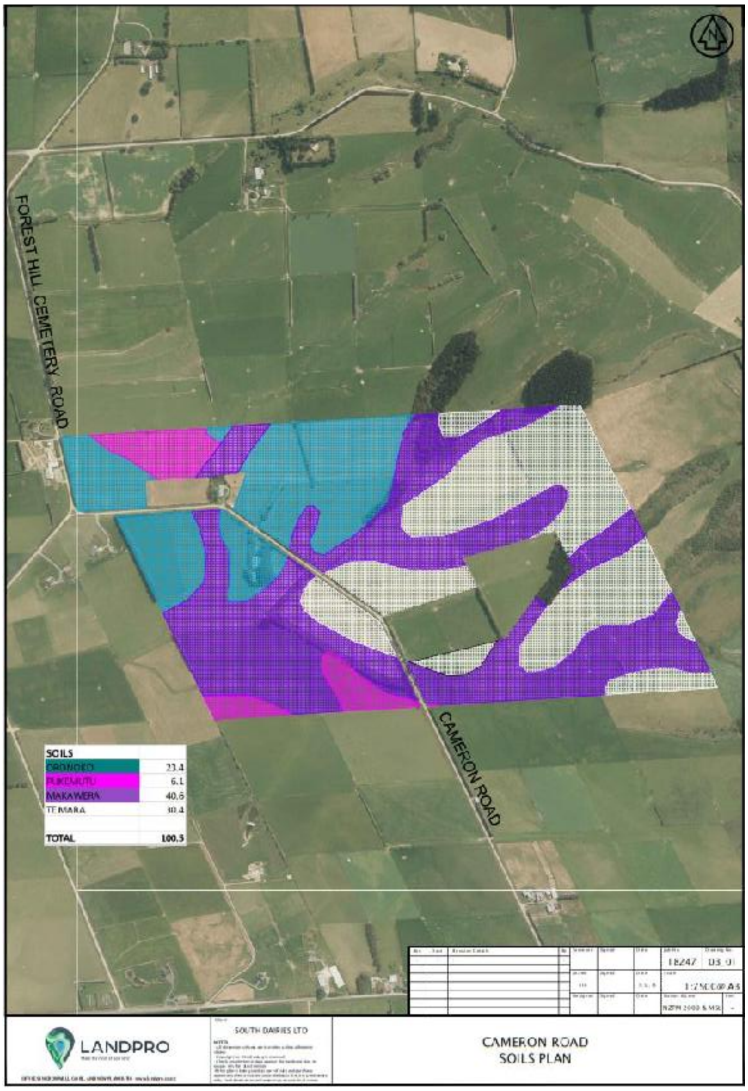

Figure 5: Soil types and distribution across the Cameron Rd runoff block

3.4.2 Physiographic zones

According to Beacon, the entire Cameron Rd block is located within the Gleyed, Oxidising and Bedrock/Hill Country physiographic zones.

3.4.3 *Surface water resources*

The Cameron Rd block is located within the Tussock Creek catchment according to the arbitrary catchment boundaries on Beacon.

3.4.4 Groundwater Resources

The Crow Rd block is located within the Makarewa Groundwater Management Zones (GMZ).

4. ASSESSMENT OF THE EXISTING ENVIRONMENT

Please see attached Water Quality Technical Report by Dr Mike Freeman for a full assessment of the existing environment in relation to surface water quality and groundwater quality.

4.1 Land resource

The physiographic zones present on the landholding have guided the siting of activities and the implementation of specific Good Management Practices (GMPs) the applicant will adopt to ensure that risks of contaminant loss via the key pathways are addressed.

Table 1: Assessment of physiographic zones and key contaminant pathways on the landholding

Location	*Physiographic Zones*	*Key contaminant pathways*
Dairy Platform	Gleyed (no variant) Oxidising	Overland flow and artificial drainage Overland flow, artificial drainage and deep drainage
Crow Rd	Gleyed (no variant)	Overland flow and artificial drainage
Browns	Gleyed (no variant) Gleyed (Overland flow)	Overland flow and artificial drainage Overland flow
Cameron Rd	Gleyed (no variant) Oxidizing – Artificial drainage Bedrock/Hill Country	Overland flow and artificial drainage Deep drainage, artificial drainage Overland flow, artificial drainage and deep drainage

5. ACTIVITY CLASSIFICATION

5.1 Consents Required for the dairy platform

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

Table 2: Applicable Rules for the dairy platform

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

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

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

5.2 Consents Required for the runoff blocks

The following resource consents are required under the Regional Water Plan for Southland, 2010 (RWPS) and the Proposed Southland Water and Land Plan, 2018 (PSWLP) for the three runoff blocks: Browns, Crow Rd and Cameron Rd

Table 3: Applicable rules for the runoff blocks

Consent	Plan	Rule	Activity Status
Land Use Consent – to use land for a farming activity **Browns, Crow Rd and Cameron Rd blocks**	RWPS	17A	Permitted – no new dairy shed proposed
	PSWLP	20 (e)	Discretionary
Land use consent for the use of existing effluent storage facilities **Browns only**	RWPS	N/A	Permitted
	PSWLP	32D (b)	Discretionary
Land use consent for a feed pad/lot **Browns only**	RWPS	N/A	Permitted
	PSWLP	35A (b)	Discretionary

5.3 Consents Not Required

Browns runoff block
The applicant will continue to operate under existing discharge permit AUTH-20171564 which permits the discharge of wintering barn effluent and silage pad leachate to 37ha of land via muck spreader and slurry tanker. The applicant will continue to operate under this consent until its expiry in 2027.

Dairy platform
The applicant has recently been granted land use consent AUTH-20191108 for the construction of a new effluent storage pond and for the continued use and maintenance of this effluent pond. The applicant will continue to operate under this consent until its expiry in 2029.

Until the consents sought under this proposal are granted, the applicant will continue to operate under:

- discharge permits AUTH-20147281-01-V1 and AUTH-20171302-01
- land use consent AUTH-20171302-04
- water permits AUTH-20147281-02 and AUTH-20171302-02

Table 4: Activities for which Consent is not required

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
Incidental discharges from farming (Rule 24 PSWLP)	The land use associated with this discharge will be authorised under Rules 20, 25 or 70 once consents are granted.
Establishment of a New Dairy Farm (Rule 17A RWPS)	The proposal does not seek to intensify the existing operation by the addition of a new dairy shed, so this rule does not apply.
Fertiliser (Rule 10 RWPS & Rule 14 PSWLP)	All practicable measures will be taken to minimise fertiliser drift beyond the target areas. Fertiliser will be applied to selected areas of the farms in accordance with nutrient budget recommendations, and soil tests to avoid excess leaching of nutrients to groundwater. Fertiliser will be applied when a soil water deficit exists, and all waterways will have riparian margins with stock excluded.
Silage storage and silage leachate (Rule 51 of the RWPS, and Rules 40 & 41 of the PSWLP.)	All silage storage facilities 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 existing silage stacks have clean water diversions in place which diverts runoff either to the effluent system or to farm drainage depending on whether the stack is full within the immediate catchment area or not. These forms of manual diversion are extremely common place and are very simple to operate.
Feedpads/lots (Rule 35A(b) of the PSWLP) In relation to the grass/baleage wintering activity	A form of winter grazing is utilized on the dairy platform and runoff blocks which involves the grazing of pasture supplemented with high rates of baleage commencing in the months of May/June and continuing through to calving or approximately August in relation to young stock. Stock progressively graze pasture behind breaks shifted once to twice per day where the size of the breaks is dependent upon pasture cover and feed demand. Stock graze the pasture down to low residuals and remain in the paddock until the feed is fully utilized. The progressive grazing of pasture and supplement in a paddock using break feeding occurs on the landholding 365 days of the year in varying degrees dependant upon pasture cover, feed demand and climatic conditions. The applicant does not accept that undertaking this practice during winter creates a different activity for which consent is required under the PSWLP compared to undertaking this practice during the remainder of the season. This application has referred to this activity as grass/baleage winter grazing and this application is prepared on the basis that this activity does not require consent under the PSWLP. The activity does not fit into the definition of either an intensive winter grazing activity nor a feed pad as discussed below. Specifically; The PSWLP has explicitly excluded the progressive grazing of pasture during the winter period from the definition of intensive winter grazing. In addition, the PSWLP defines a feed pad/lot as: *a fenced in or enclosed area located on production land used for the feeding or loafing of cattle or deer to*

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
	avoid damage to pasture when soils are saturated and which can be located indoors or outdoors. It includes sacrifice paddocks, wintering pads, standoff pads, calving pads, loafing pads and self-feed silage storage facilities. The grass/baleage winter grazing activity does not fit into the above definition of a feed pad/lot as the practice is not used with the objective of avoiding damage to pasture when soils are saturated. This grass/baleage wintering is utilizing existing feed available over the winter to feed stock, whether soils are saturated or not. In a practical context, the grass/baleage grazing paddocks are not able to collect and contain effluent nor do they have a subsurface material which provides any form of sealing or impermeability as Rule 35A refers to. Environment Southland has also published a factsheet on their website[1] which explicitly states that adding supplement to a pasture paddock does not constitute a feed pad: **Q: If I add supplementary feed to pasture or a crop paddock, is this considered a feed pad/lot?** **A:** No, this is not considered a feed pad/ lot The feed pad/lot definition includes the term "sacrifice paddock", however no definition is provided for the term sacrifice paddock anywhere in the PSWLP. The only definition/explanation available is on the same factsheet which describes a sacrifice paddock as: "*A small area of the farm used for stock to avoid damage to valuable pasture. The sacrifice paddock can make problems like mud and manure manageable and decreases pasture maintenance. This paddock is often purposefully located to reduce farm labour when tending to stock and should be located away from waterways.* " Typically a sacrifice paddock is an area used to move cows onto to graze for short periods of time during the milking season to avoid damaging paddocks which are being fully utilized for pasture growth to fuel milk production. Often these paddocks are chosen due to their proximity to the dairy shed or they are the paddocks which will be cultivated in crop the following year. The proposed grass/baleage wintering paddocks are not considered to be sacrifice paddocks as they rotate in location every year across the landholding and are not chosen with the same criteria in mind, nor is their primary purpose to avoid damage to valuable pasture nor are

[1] Factsheet: Feed pad/lots, Environment Southland, April 2018, https://www.es.govt.nz/Document%20Library/Factsheets/Consent%20advice/01029%20FS_FeedpadLots_web.pdf

Activity	Compliance with the relevant permitted rules of the RWPS and PSWLP
	they used to protect milk production. The applicant has no reason to utilize or create sacrifice paddocks on the landholding due to the presence of extensive standoff pad infrastructure (including two wintering sheds, a feed pad and a calving pad) and the significant size of the landholding. This application assessed the grazing of pasture with baleage during the winter period as an activity for which consent is not required under the PSWLP.
Cleanfill, Farm Landfills and Offal Holes (Rules 53, 54 & 55 of the RWPS, and Rules 42 & 43 of the PSWLP)	No more than 500 m^3 of material will be discharged within cleanfill sites. Stormwater will be directed away from fill areas and no unauthorised material will be placed into proposed fill areas. 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.
Drainage of Land (Rule 9 RWPS & Rule 13 PSWLP)	It is not anticipated that any discharge from subsurface drains would result in a conspicuous change to the colour and/or clarity of the receiving waters at a distance of 20 metres from the point of discharge. The proposed good management practices will significantly reduce the likelihood of any contaminants reaching the subsurface drains.

6. DETAILS OF THE PROPOSAL

6.1 Overview of the proposal

Consents are required for the following activities:

- A land use consent for the farming activity triggered by the increase of the size of the dairy platform by 7ha due to the conversion of a neighbouring support block to dairy platform.
- A discharge permit to discharge farm dairy effluent, underpass effluent, silage leachate, feed pad effluent and wintering shed effluent to land from the peak milking of 1250 cows over one dairy platform.
- A land use consent for the use and maintenance of existing effluent storage facilities to hold effluent generated on the farm.
- A land use consent for the use of land for three existing feed pad/lots

6.2 Overview of the proposal in layman's terms

6.2.1 Dairy Platform activities

South Dairy Limited seek to amalgamate two separate and existing dairy platforms under a suite of global consents which will allow them to flexibly operate farm infrastructure and animal grazing across a combined global dairy platform. An adjoining 7ha support block will be converted to dairy platform under the proposal and amalgamated. As a result, **one combined dairy platform** is created serviced by the two existing dairy sheds and their associated effluent management systems and infrastructure.

Total cow numbers peak milked on the dairy platform will not increase and will remain at 1250 cows. The proposal includes activities located on three separate runoff blocks which will be managed collectively under a proposed land use consent.

Why is this being proposed:
To fully understand the proposal it is important to understand the reasoning behind amalgamating the two dairy farms together into one global dairy platform in layman's terms.

To date, South Dairy Ltd has operated the existing two dairy farms (South Dairy 1 and South Dairy 2) separately with their own herds and staff. The farms have been operated with similar overarching management which is lead by Dean and Suzanne Alexander from South Dairy Ltd. Over the period of owning both farms there has been a huge amount of change and development:

- South Dairy 1 was granted consent to expand the dairy platform and increase cow numbers in 2018,
- South Dairy 1 constructed a new effluent management system, feed pad, calving pad and silage pad in 2017,
- South Dairy 2 redesigned and expanded the effluent management system in 2019 and
- Two runoff blocks were leased
- One runoff block was purchased

The Alexanders have been developing ideas and trialling management practices during this period of change and have now entered a phase where they have a clearer idea on works well, what could work well and what provides the best use of the existing infrastructure, facilities and capability of the land. This proposal seeks to establish one combined dairy platform utilizing three runoff blocks as the best option to meet their values and objectives going forward. The essence to the proposal is that the creation of one dairy platform operating under global consents will enable them to both trial and implement a more adaptive/flexible/fluid management of stock and resources across their landholding.

There is a long term plan in place to potentially build a new rotary dairy shed at SD2 to replace the existing rotary shed which has the more limited life of the two existing sheds. This is one of the main drivers behind the amalgamated dairy platform consent as it will allow some of the current SD1 land to be milked unto SD2 facilities once a new shed is build and the existing herringbone shed can drop to more manageable numbers.

What will be the result and how will it play out in reality?
The applicants intend to try a new farm system where they calve all cows on the calving pad and feed pad located on what is currently SD1. Once about 300 cows are calved and established into once-a-day milking through the nearby herringbone shed these will be transferred to the southern part of the new dairy platform which is currently named SD2 and milked twice-a-day through the rotary shed nearby. Cows are progressively rotated through this process until an appropriate number of cows are being milked through the rotary shed. Once this point is reached, cows calved at SD1 on the calving pad and feed pad build up to twice-a-day milking through the herringbone shed and remain there. For

the remainder of the season, the cows will remain in their separate herds close to their respective dairy sheds and a regular rotational grazing and milking regime will be established and will continue. In practice, it is likely that certain paddocks will be allocated to each herd in a grazing rotation based on proximity to each dairy shed and the likelihood of any paddocks being shared and grazed by both herds within a season is minimal because pasture growth wouldn't sustain this practice. In the same vein, it is unlikely that the entire 1250 cows will be located one either one of the two existing platforms at any one time under the proposal because each of the two herd will be rotated around paddocks closest to each respective dairy shed.

What are some of the benefits?

The ability to start calving through just one shed makes the most efficient and practical use of the calving pad and feed pad as they are able to be continually utilized by a rotation of all of the cows on farm. This then leaves the herd home (located on existing SD2) to maintain a higher stocking rate and utilization as it can be also be continually utilized with stock rotated through prior to calving. The overall duration and scale of stock outside grazing on grass/baleage is reduced as a result.

Staff resources are able to be concentrated to just one dairy shed/part of the dairy platform over the busy calving period, especially during the period of training new heifers in the milking sheds. Once-a-day milking during calving frees up staff time and will hopefully bring animal health benefits as cows transition to the new season which should translate into better body condition scores and higher mating rates.

Later-on in the season, cows can start to be moved into calving mobs and strategically placed across the landholding in preparation for the following calving.

What are some of the risks?

The calving activity at existing SD1 will increase, if not double. The excellent state of the calving and feed pad infrastructure will reduce and alleviate some of the pressure.

The increased ability to operate flexibly across a larger dairy platform will create more animal movements which is time intensive and will need to be managed carefully. Staffing levels and capability will be vital to ensuring the success of the proposal.

Stock will be required to transition between a herringbone and rotary shed and vice versa over their lifetime.

All early calvers located at one shed could translate to a concentration of activity at other times of the year i.e during mating.

The most difficult risk to manage will be getting pasture management right particularly early in the season as one part of the farm will require pasture cover to be up and running earlier than the other part of the farm.

How does this fit into a consenting regime?
It needs to be understood that the adaptive/flexible/fluid farm system described above is something new which is being trialled. The applicants are confident it will be a good fit for the farm in the long term and therefore are committing to seeking global consents to ensure the proposal is appropriately consented. The resulting consents will need to be worded and structured to ensure the flexibility the applicants are seeking is maximised as much as practically and reasonably possible.

6.2.2 Runoff block activities

This application seeks that the land use consent issued for the farming activity extends across the three runoff blocks: Crow Rd, Browns and Cameron Rd. A clear distinction will need to be made in the consent conditions to separate out consent conditions related to the runoff blocks from those related to the dairy platform.

Table 5: Runoff block effective areas

Runoff block	Ownership structure	Effective ha
Browns	Owned by South Dairy	62
Cameron Rd	Leased by South Dairy – renewal 31 May 2021	94
Crow Rd	Leased by South Dairy – renewal 30 April 2022	49
TOTAL		**205**

The applicant has chosen to purchase/lease these runoff blocks in order to be able to remain self-contained as much as possible to achieve their goals in the areas of:

- Young stock growth and performance
- Silage/balage quality
- Wintering performance
- Cost control
- Control of environmental responsibilities

Below is a description/management plan for the support blocks at the proposed maximum consented cow numbers of 1250. The management plan is a snapshot of how these support blocks will be used into the future, bearing in mind that some requirements will change from year to year based on a variety of factors including climate, economic conditions and animal health factors. The applicants are of the strong opinion that they will only achieve the above outlined objectives if they can maintain flexibility between all of the blocks for the movement of stock, where and when supplement feeds are made and where and how wintering activities are done. This flexibility is crucial going forward to allow the introduction of new science and technologies which may have an impact on best management practices on farm.

By in large, the nature and scale of the activities on the runoff will not materially change under the proposal because:

- There will be no change in the total number of cows milked on the dairy platform
- There will be no change in the total number of cows wintered on the landholding
- There will be no change in the total number of young stock numbers on the landholding
- There will be no change in the extent of the land used as runoff blocks
- There will be no material change in the nature and scale of activities located on the runoff blocks

Winter

Stock	Description	Location
370 R2 heifers	Wintered on approximately 8ha of grass/baleage starting in May when ground conditions deteriorate. These R2s then shift to the milking platform on about 20-25th July for calving	Browns
150 R2 heifers	Wintered in the herd home at Browns for the later part of May as ground conditions deteriorate. These heifers are then moved out to grass/baleage wintering with the other heifers in early June	Browns
120 MA cows (late calvers)	Wintered in the herd home at Browns from dry off in early June until calving in late August	Browns
R1 heifers	Kept on a rotation around the support block for as long as conditions allow during June. Grass/baleage wintering on 3-4ha during July Set stocked over remaining available land (170ha) during August.	Browns or Crow Rd or Cameron Rd
350 MA cows	Wintered on 12ha grass/baleage for 70 days in mobs of 100-120.	Browns or Crow Rd or Cameron Rd

It is the intention to have wintering on only two out of the three blocks in any one year to minimise stock movement and staff workloads.

Spring

Once all R2 heifers and MA cows have left the support blocks after wintering the only stock remaining will be set stocked R1 heifers and 15-20 empty R2yr heifers. These older heifers are farmed until sent to slaughter in the later spring.

In early spring a dressing of N and S based fertiliser is applied to stimulate early spring growth, either ammo-N or ammonium sulphate.

As feed starts to improve in the later spring the yearling heifers are moved into rotating mobs, mainly on the Cameron Rd block as it is the least suitable for silage.

Remaining areas are locked up for silage production on Browns and Crow Rd. Silage made off these blocks in November and annual fertiliser applied after cutting.

Summer

Yearling heifers remain at Cameron Rd. Calves are moved to Crow Rd and Browns as they are weaned. The aim is to continue to create surplus feed across all blocks which mostly gets made into baleage for wintering. Stock sometimes need to move between the three blocks through the summer period due to feed demand/supply.

Autumn

Large areas of runoff land are locked up for silage requirements through the late summer, early autumn. Stock are moved between blocks to allow this to happen.

Feed budgets have been prepared for the entire farming operation which show a significant deficit (550 t DM) in feed requirements after allowing for all supplements made off the support blocks. It is the intention that this deficit will be monitored and filled as required with purchase of further off farm feeds, probably mainly silage/baleage and imported onto the milking platforms. This requirement will vary considerably from year to year depending on growth and weather conditions. N based fertilisers will be used in an attempt to fill this gap as much as possible, budgeting to apply about 150 kg N/ha/yr which has been allowed for in the budgeted growth rates of the support blocks.

6.3 Land use consent application for farming activity

A land use consent is sought for the proposed farming activity which we are determining includes all activities located on the landholding which are directly associated with the operation of the applicant's dairy farm for 365 days of the year. The proposed farming activity extends across the proposed expanded dairy platform and the three runoff blocks: Browns, Crow Rd and Cameron Rd. One land use consent is sought to legalise the activities on this land with delineations made within the consent document to separate out which conditions of consent apply to each separate block of land (if any).

Table 6: Farm areas and stocking rates under the proposal

	TOTAL FARM AREA (HA)	EFFECTIVE AREA (HA)	STOCKING RATE
Existing	248 (SD1) 179 (SD2)	238 (SD1) 173 (SD2)	3.1 2.8
Proposed	435	418	2.9

6.3.1 Baseline nutrient budget modelling

Overseer 6.3.1 has been used to describe the current farm system to create three baseline models for the existing land use for SD1, SD2 and the neighbouring support block. The baseline models have been generated under strict guidance and instruction from Environment Southland Consent Officer staff and have already been independently reviewed by Environment Southland with no issues or concerns identified (Appendix C).

- South Dairy 1: Has been modelled in accordance with the consent conditions contained within AUTH-20171302-04 with changes only made to ensure the model complies with Overseer input standard protocols. The modelling of this farm system represents a consented baseline. Using a consented baseline in the baseline nutrient budgets has been approved in writing by Aurora Grant, Team Leader Consents, Environment Southland and this approval is provided in the nutrient budget reports in Appendix A.
- South Dairy 2: Has been modelled in accordance with actual cow numbers and using farm records for other inputs as an average over the preceding seasons.
- Neighbouring support block: Has been modelled as an intensive winter grazing and winter grass/baleage block using the applicant's records since purchase in January 2018.

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

Table 7: Summary outputs for the baseline model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
South Dairy 1	14,333	58	338	1.4
South Dairy 2	10,414	58	230	1.3
Support block	218	29	5	0.6
Current combined	24,965	57	573	1.3

Please refer to the Overseer Modelling Report contained in Appendix A for copies of the baseline nutrient budget models and a summary of the model inputs. These modelling reports have been prepared by Miranda Hunter of Roslin Consultancy Ltd (CNMA) and provide commentary around the inputs which have been used. This application document has not repeated these farm system details to avoid duplication.

6.3.2 Proposed scenario nutrient budget modelling

Overseer 6.3.1 has been used as a predictive model to estimate estimates inputs based on the proposed dairy platform farm system under a long-term scenario operating at near equilibrium (i.e. there are minimal changes to the farm system each year). The summary outputs for **proposed model** are:

Table 8: Summary outputs for proposed model

Land Use	Nitrogen Losses (total kg)	Nitrogen Losses (kg/ha/year)	Phosphorus Losses (total kg)	Phosphorus Losses (kg/ha/year)
Proposed dairy platform	24,913	57	576	1.3

Please refer to the Overseer Modelling Report contained in Appendix B for copies of the proposed nutrient budget models and a summary of the model inputs and the results of the independent review in Appendix D. These modelling reports have been prepared by Miranda Hunter of Roslin Consultancy Ltd (CNMA) and provide commentary around the inputs which have been used. This application document has not repeated these farm system details to avoid duplication.

6.3.3 Comparison of the relative change in nutrient losses between the baseline and proposed farm scenarios

6.3.3.1 Dairy Platform

Overseer models have been included to support this application for activities on the dairy platform part of the landholding. The Overseer models provide two purposes:

1. To describe the activities currently occurring and to describe the proposed activities in a concise manner.
2. To compare the relative change in nutrient losses between the baseline and proposed farm scenarios to inform the AEE. The relative change comparison is enabled by ensuring that the baseline and proposed Overseer nutrient budgets are comparing "apples with apples" i.e uncertainty is equalised between the two scenarios by using the same input data to compare and contrast the nutrient losses between the two scenarios.

The Overseer modelling of the dairy platform outlined above indicates that:

- Nitrogen losses from the dairy platform are estimated to reduce comparatively by 52 kg N/year and remain unchanged on a per hectare basis compared to the baseline.
- Phosphorus losses are estimated by Overseer to increase by 3 kg P/year but remain the same on a per hectare basis compared to the baseline.

Phosphorus loss comparative increase between baseline and proposed models

The Overseer nutrient modelling shows an increase of 3kg P/year as a relative change between the baseline and proposed models. It is widely accepted that the Overseer model is likely to have over-estimated phosphorus losses from the proposed scenario due to assumptions built into the model which are not true of the proposal and good management practices proposed cannot be incorporated into the model and are therefore not "rewarded" including:

a) The assumption that 30% of phosphorus deposited on lanes will be lost directly to water
b) Improved management of critical source areas on the dairy platform.

Appendix F contains a file note from Ms Miranda Hunter (CNMA) which addresses the assumptions listed above in relation to the proposal. The file note concludes that:

a) The new 7ha block will not contain new lanes and therefore the additional P loss of 2.6 kg P assumed by Overseer to be deposited on lanes on this new block and lost to water will not occur in reality.
b) The proposal includes further mitigations for phosphorus loss to water from critical source areas on the remainder of the dairy platform. Specifically, two existing laneway crossings will be significantly improved to provide increased buffer zones and contouring to go beyond standard good management practice. This mitigation can potentially reduce P loss by approximately 6.7 kg P based on a conservative 38% improvement.

Therefore, in reality there is likely to be at least 6 kg less P lost to the environment as a result of the proposed mitigation measures compared to that predicted by the Overseer models. We can then conclude that the relative change in phosphorus loss between the baseline and proposed models is a reduction of at least 4 kg P.

Proposed consent condition restrictions

The overall intention of the land use consent sought under this application is to operate the dairy platform at a nitrogen and phosphorus loss level (predicted by Overseer) equal to or less than the nitrogen loss level outputs from the current combined baseline model using a rolling four-year average.

The use of a four-year rolling average was recently approved by independent commissioners in the *M and C Adams as Trustees of the MJ Adams Trust* decision granted on 24 June 2019. In the decision, a four-year rolling average was the preferred method to determine a compliance threshold to avoid inaccuracies which can eventuate from year end farm management decisions which are not aligned with the long term climate data model within Overseer.

This application requests the imposition of a similar set of consent conditions to the *Adams* decision to determine compliance with nitrogen and phosphorus loss limits for the dairy platform.

Table 9: Proposed consent conditions for the land use consent related to activities on the dairy platform.

Condition reference	Proposed consent condition	Explanation/reasoning
A	The Consent Holder must ensure that nitrogen and phosphorous losses from farming activities undertaken on the landholding as described in Condition X, are maintained at, or below the baseline contaminant loss rates of: a) 57 kg/ha/year of nitrogen b) 1.3 kg/ha/year of phosphorus	The nitrogen and phosphorus loss rates are taken from the baseline nutrient budgets using the "current combined" total referenced in the nutrient budget reports by Miranda Hunter, CNMA.

	as estimated by the four-year rolling average loss rates using Overseer Nutrient Budgets (Overseer) version 6.3.1/OverseerFM, undertaken in accordance with the generally accepted best practice modelling including the applicable Best Practice Data Input Standards/OverseerFM User Guide. The four-year rolling average is defined as the average of the most recent four consecutive years' results starting from 1 July 2021. *Advice Note:* *The baseline loss rate for nitrogen and phosphorus is the discharge below the root zone as modelled with OVERSEER® version 6.3.1, the farm system inputs described in the application, and in accordance with the OVERSEER® Best Practice Input Standards as of 8 May 2019. The baseline loss rate for nitrogen and phosphorus is also the discharge modelled by a subsequent version of OVERSEER® in accordance with Condition X.* *The determination of whether the contaminant loss rates have been met will be made using the contaminant loss from the most recent year, modelling using the latest version of OVERSEER®/OverseerFM.*	
B	If OVERSEER® version 6.3.1 is superseded the Consent Holder shall, within 12 months, remodel the baseline nitrogen and phosphorous loss rate described in Condition A using the current version of OVERSEER®, the application inputs and the current version of the Best Practice Data Input Standards.	This condition provides contingency for Overseer version upgrades.
C	The remodelled baseline nitrogen and phosphorous losses modelled in accordance with Condition A shall replace previous versions of the baseline contaminant loss rates under Condition B.	
D	Each and every year for the duration of this consent, using the current version of Overseer®/OverseerFM and in accordance with the generally accepted best practice modelling and the current Best Practice Data Input Standards, the Consent Holder must model: (a) the four-year rolling average of nitrogen and phosphorus loss rates; (b) the nitrogen and phosphorous loss rates for the previous year from 1 July to 30 June.	This condition differs slightly from the condition approved in the Adams decision which also required a predicted model to be completed every year for the upcoming season. The applicant feels that this effectively requires two models to be created every year which is doubling up. A

		predictive model is unnecessary when utilising a four year rolling average combined with baseline limits.
E	A report must be provided to the Consent Authority by 30 September each year summarising the results of Overseer nitrogen and phosphorous loss modelling required by Condition D. The report must include: (a) a review of the Overseer input data to ensure that the annual nutrient budget reflects the farming system; (b) an explanation of any differences between that nutrient budget and the annual nutrient budget of all previous years of farming undertaken under this consent; (c) a comparison of the nitrogen and phosphorous losses in that budget with the baseline contaminant loss rate in Condition A; and (d) the names and summaries of the relevant qualifications and experience of the person(s) who prepared and (if relevant) reviewed the nutrient budget.	
F	If any estimated four year rolling average nitrogen or phosphorus loss rate as modelled in accordance with Condition D exceeds the baseline loss rate set under Condition A, the Consent Holder must, by 30 November of that year, prepare a report for the Consent Authority that details the measures that will be taken to ensure that nutrient losses are reduced to ensure compliance with the baseline contaminant loss rates.	
G	The report required by Condition F must include: (a) a detailed description of the measures to be taken; and (b) for any mitigations proposed a detailed mitigation plan (taking into account contaminant loss pathways) that identifies: i. the mitigations to be undertaken; ii. the physical works required to complete the mitigations; iii. the proposed implementation timeframes for each mitigation; iv. the operation of the mitigation; and v. the mitigations' potential effectiveness.	
	All Overseer modelling required by this consent must be undertaken by: (a) a person who is a Certified Nutrient Management Advisor (CNMA) under the Nutrient Management Adviser Certification Programme (NMACP); or (b) a Suitably Qualified Person who has demonstrated an equivalent level of expertise and whose modelling is reviewed by a CNMA.	

	The Consent Holder may use an alternative model that has been demonstrated to be equivalent to Overseer provided; (a) the evidence to demonstrate equivalence is provided to the Consent Authority at least six months prior to submitting the relevant annual report as required by Condition F; and (b) the use of the alternative model is approved by the Chief Executive of the Consent Authority.	

6.3.3.2 Runoff blocks

The activities at the runoff blocks: Browns, Crow Rd and Cameron Rd have not been modelled using Overseer for either the baseline or proposed scenarios. Overseer was not used for the runoff blocks for a number of important reasons. Primarily, the ownership/management of the three blocks of land is fairly recent for the applicant and a reliable record of the nature and scale of the activities and required input information had not been established or stabilised to a level which we would be comfortable relying on to create a valid baseline model. In addition to this, the applicant has been in the process of increasing cow numbers prior to 2018 in order to enact the recent approved cow number increase on SD1. Other factors include the complexity in modelling the fluidity of the activities across the three blocks to date and the increasing understanding of their suitability for certain activities and their pasture production potential.

As a simplistic starting point, the applicant designed the proposal on the premise that the farming <u>activities</u> <u>occurring on the runoff blocks will be unchanged</u> in nature, scale, intensity and extent under the proposal. This suggests that <u>nutrient losses will be unchanged</u> in nature, scale, intensity and extent under the proposal. Accordingly, it can be argued that <u>adverse effects on water quality will be unchanged</u> in nature, scale, intensity and extent under the proposal compared to those which are currently occurring.

The applicant recognised that several vital policies of the PSWLP requires water quality to be <u>improved</u> in areas where water quality is currently degraded. As a result, the proposal needed to maintain the nature, scale, intensity and extent of the existing farming activities at the runoff blocks but result in a reduction in nutrient losses, reduction in potential adverse effects and demonstrate and some element of improvement to water quality in the receiving environments even if it is unmeasurable. As the applicant is already operating at GMP level, the required reduction in nutrient losses needed to come from additional mitigation measures which could be implemented which didn’t materially impact on the current/proposed farm system combined with specific restrictions on the nature of the activity.

<u>Proposed consent condition restrictions and additional mitigations</u>

The applicant proposes the following restrictions specifically for the three runoff blocks which includes additional mitigation measures and restrictions on the nature of the activity:

Table 10: Proposed restrictions for the land use consent related to activities on the runoff blocks

Proposed restriction	Explanation/reasoning
Permanent exclusion of intensive winter grazing or grass/baleage winter grazing on paddocks highlighted in yellow on map in Appendix I (Cameron Rd runoff block). Note: set stocking of young stock allowed during the winter period on these paddocks.	The paddocks identified on the map in Appendix I are unsuitable due to their topography, proximity to waterways and presence of CSAs and permanent exclusion ensures nutrient losses are reduced over the term of the consent. It is important to note that this application does not propose a restriction on the maximum area of land which can be grazed during the winter period as a grass/baleage winter grazing activity. The reason being is that utilizing more land for this activity with the same amount of stock is likely to result in better environmental outcomes in terms of nutrient losses. Therefore, the applicant wishes to retain the ability to utilize more suitable land for this practice in wetter seasons if required to reduce overall intensity of the activity.
Additional riparian planting implemented within areas marked on the maps in the FEMP in Appendix H.	Greater protection from the loss of nutrients via overland flow and erosion process ensures nutrient losses are permanently reduced for the lifetime of the riparian planting.
Additional fencing of CSAa when cows are grazing paddocks as marked on map in Appendix H (labelled as sloping land).	The additional buffer zone areas identified on the maps in Appendix A of the FEMP (Appendix H) are unsuitable for winter grazing due to topography or their existence as CSAs. Exclusion by way of fencing ensures nutrient losses are reduced over the term of the consent.
Nitrogen fertiliser application will not be applied between 1 June and 1 September	Deferring the first nitrogen fertiliser application of the season from August till September can reduce overall N loss by 2% based on example Overseer files.
A maximum of 700 mixed age/mixed class stock grazed at any one time between 1 June and 31 May each year on Crow Rd, Browns and Cameron Rd landholdings. In addition, a maximum of 350 mixed age cows from the main herd are winter grazed on the runoff blocks.	This restriction is comprised of 350 R1 and 350 R2 stock which is based on a replacement rate of 25% for the full 1250 cow herd plus a 10% contingency in numbers carried to cater for deaths and culls. Stock are grazed all year round at the runoff blocks.
A minimum of 120 mixed age cows in the herd home at Browns landholding from 1 June to 1 August	This restriction is to provide certainty that the herd home is utilized as an important mitigation measure to reduce nutrient losses by ensuring 120 cows are not on pasture during this period.

	Currently there is no requirement to use this facility which technically means that more stock could currently be on pasture during winter.
A management plan is prepared by 1 May each year and submitted to the Consent Authority outlining various aspects of the farm system on the runoff blocks for the upcoming season 1 June to 31 May. The management plan will include: (1) Location and total area of pasture/baleage winter grazing paddocks (2) Approximate mob sizes grazing each winter grazing paddock (3) Approximate duration of grazing by each mob in each winter grazing paddock (4) Total number of cows in the herd home at Browns runoff block and duration (5) Description of proposed fertiliser regime for the year including application product, rate and dates. (6) Approximate quantity of supplement produced for the year. (7) Description of planned stock movements throughout the year (8) Description of any material changes to the farm system	This management plan is primarily for information purposes to advise the Consent Authority on how the runoff blocks will be managed for the upcoming season. This management plan is designed to be supplemented with year end Overseer budgets. The year end nutrient budgets give more certainty to the Consent Authority on the actual nutrient inputs on the blocks over the year and what nutrient losses were predicted by the model.
A year end Overseer nutrient budget must be prepared each and every year for the duration of the consent to model average nitrogen and phosphorus loss rates between 1 July and 30 June, commencing 1 July 2021.	Year end nutrient budgets use actual inputs based on farm records, fertiliser records and invoices etc to give certainty to how the farm operated during the year. These year end nutrient budgets form a four-year rolling average for compliance purposes.
A four-year rolling average nitrogen and phosphorus loss rate be determined as the average of the most recent four consecutive years results starting from 1 July 2021. The applicant must ensure that nitrogen and phosphorous losses (using a four year rolling average) from farming activities undertaken on the three runoff blocks landholding are maintained at, or below the baseline contaminant loss rates.	The use of a four-year rolling average to determine compliance with baseline nitrogen and phosphorus output limits is consistent with recent consent decisions for similar activities.

6.4 Discharge permit application

A new discharge permit is sought for the proposal. A discharge permit is required to allow for the discharge of FDE from 1250 cows, underpass effluent, silage pad leachate, feed pad and wintering shed slurry.

The applicant seeks a global discharge permit covering the collection, treatment and discharge of effluent from both existing dairy platforms (South Dairy 1 and South Dairy 2) under one consent onto a new combined global dairy platform.

It is vital to note that although the proposal creates one global dairy platform, the effluent systems and infrastructure at each existing dairy shed will continue to operate separately with the exception that a linking effluent transfer pipe may be installed in the future to allow the transfer of effluent from one effluent system to the other. This application has been forced to assess effluent management requirements at each dairy shed separately based on the effluent system and infrastructure present on each existing platform due to complexities with using the DESC software. The proposal seeks that the effluent management requirements specified individually for each existing effluent system in the application are combined for the resulting discharge permit.

For clarity: the existing dairy platform areas will no longer be referred to as SD1 and SD2 within this application to describe the proposal to ensure it is clear that distinct platforms will be abolished. The existing dairy sheds and effluent management systems will continue to be referred to as SD1 and SD2 because they remain distinct and operate somewhat separately under the proposal.

Table 11: Discharge Permit application summary

Discharge Permit Details:	
Replacement of consent no.	AUTH-20171302-01 and AUTH-20147281-01-V2
Number of dairy cows	1250
Type of milking shed	Rotary Shed (SD2) and herringbone shed (SD1) (Long term plan for replacement of rotary shed)
Winter milking?	No. Other than slipped cows
Wintering barn?	Herd home for 340 cows located at SD2 – covered, underground bunkers
Feed pad/stand off pad?	Feed pad for 750 cows at SD1 – uncovered, concrete, scraped Calving pad for 170-300 cows at SD1 – uncovered, gravel base
Other sources of effluent?	Stock underpass – not constructed yet but in future plans Silage pads -one located at SD1 and one located at SD2
Effluent treatment	**SD1 -** FDE: gravity from shed, sludge bed/weeping wall, effluent storage pond Feed pad: Scraped to sludge bed, liquids via concrete saucer Calving pad: Liquid drained to liquid effluent system via concrete saucer, solids scraped and gravel washed at end of season Silage leachate: directed to liquid effluent storage facility

	SD2 – FDE: gravity from shed, concrete saucer, sludge bed/weeping wall, effluent storage pond or from existing tanks Wintering shed: Stored in underground bunkers, liquid to effluent storage system Silage leachate: gravity to effluent storage system
Storage available (m^3)	**SD1 –** 6,384m^3 existing pond for liquid effluent 660m^3 in sludge bed/weeping wall for slurry effluent **SD2 –** 5,545m^3 existing pond for liquid effluent 33m^3 in existing tanks for liquid effluent 348m^3 in sludge bed/weeping wall for slurry effluent 854m^3 in wintering shed bunkers for slurry effluent
Storage required (m^3) according to DESC report	**SD1 –** 5,954m^3 for liquid effluent 652m^3 for slurry effluent **SD2 –** 5,038m^3 for liquid effluent 1081m^3 for slurry effluent
Disposal area (ha)	Liquid effluent: 288ha discharge area Slurry effluent: Approx. 130ha being the remainder of dairy platform outside of the approved liquid effluent discharge area
Irrigator proposed	Low rate pods, slurry tanker, muck spreader, umbillical system and travelling irrigator
Application rate and depth	Pods: Max application rate 10mm/hr Travelling irrigator: Maximum depth per application of 8 mm. Total annual application depth of 25 mm Slurry tanker, muck spreader: 5mm depth per application maximum. Umbillical system: 10mm depth per application maximum
Monitoring proposed	Groundwater every 6 months

6.4.1 *Effluent management system*

South Dairy 1

Figure 6: South Dairy 1 effluent system overview

Farm dairy effluent (FDE)

- The herringbone dairy shed and yard is washed twice daily generating 37,500 L/day of FDE
- FDE is gravity fed to the sludge bed/weeping walls.
- Liquid effluent is pumped to the main effluent storage pond and applied to land via travelling irrigator and umbillical system.
- Slurry is retained in the sludge beds and applied to land using a slurry tanker or muck spreader

Feed pad slurry

- Feed pad lanes are scraped down a concrete ramp directly into the sludge bed/weeping walls.
- Excess feed is scraped to concrete triangle feed bin for disposal.
- Liquid collected on the lanes directed to concrete saucer and then into sludge beds.
- Off-season rainwater diversion in place

Figure 7: Images of feed pad and connected effluent structures at SD1

<u>Calving pad effluent</u>

- Liquids drained via subsurface drainage channels to adjacent concrete saucer and then into sludge beds.
- Solids collected on the gravel surface remain in-situ until the end of calving and washed using greenwash from the dairy shed into the sludge beds.

Figure 8: Calving pad with gravel base and connected concrete saucer at SD1

<u>Silage pad leachate</u>

- Drained directly to the sludge bed
- Off-season rainwater diversion in place

Figure 9: Silage pad SD1

South Dairy 2

Figure 10: South Dairy 2 effluent system overview

<u>Farm dairy effluent (FDE)</u>

- The rotary dairy shed and yard is washed twice daily generating 40,000 L/day of FDE
- FDE is gravity fed to the concrete saucers and then into sludge bed/weeping walls currently and may be amended to gravity straight to the weeping walls in the future.

- Liquid effluent is pumped to one 33,000L effluent storage tank or the main effluent storage pond and applied to land via low rate pods, travelling irrigator and slurry wagon or umbillical system.

Figure 11: Concrete saucer and sludge bed/weeping wall at SD2

<u>Wintering shed effluent</u>

- The covered wintering shed contains underground concrete bunkers overlain with slats in the loafing area of the shed. The central feed lane is uncovered.
- Slurry is stored in the bunkers for the duration of the winter period, with the liquid component of the slurry weeping through weeping walls at the western end of the bunkers. Liquid from weeping wall is collected and piped to the main effluent storage pond.

Figure 12: Wintering shed with underground concrete bunkers and weeping wall at front on SD2 and showing uncovered central feed lane

<u>Silage pad leachate/underpass effluent</u>

- Silage leachate is currently directed via gravity to a stone trap. Improvements will be made to collect leachate at the base of the silage stack and pipe directly to the new effluent storage pond.

- Off-season rainwater diversion in place

- An underpass may be constructed in the future so has been included in DESC calculations and in the discharge permit. Exact connections to the effluent system will be decided at the time of construction and appropriate consents sought if needed.

Figure 13: Silage pad at SD2 with current leachate flow path to stone trap

6.4.2 *Storage*

South Dairy 1
Deferred effluent storage at the South Dairy 1 dairy shed will consist of two primary storage areas:

- Liquid effluent will be stored in the 6,384m^3 synthetically lined effluent storage pond. Liquid effluent is comprised of FDE, silage pad leachate and liquid effluent from the feed pad and calving pad.
- Slurry is stored in the 660m^3 double sided sludge bed/weeping wall. Slurry effluent is comprised of the more solid components of FDE, feed pad effluent and washings from the calving pad gravel bedding.

The concrete saucer is used as a transfer sump and will temporarily hold effluent but is not considered a site for deferred storage of effluent.

The Dairy Effluent Storage Calculator (DESC) attached in Appendix E shows that **5,954m^3 of pumpable liquid storage is required** (90th percentile probability) to enable effective deferred irrigation for liquid FDE, silage pad leachate and liquid components of feed pad and calving pad effluent. The DESC shows that **652m^3 of solid storage is required** (maximum volume). The sizing of the effluent storage pond and sludge beds are sufficient to meet the requirements of the DESC.

South Dairy 2
Deferred effluent storage at the South Dairy 2 shed will consist of four primary storage areas:

- Liquid effluent will be stored in the 5,545m^3 synthetically lined effluent storage pond. Liquid effluent is comprised of FDE, silage pad leachate, underpass effluent and liquid effluent from the wintering sheds.
- Liquid effluent is stored in the 33m^3 above ground tank
- Slurry is stored in the 348m^3 double sided sludge bed/weeping wall.
- Wintering shed slurry is stored in the 854m^3 underground concrete bunkers

The concrete saucer is used as a transfer sump and will temporarily hold effluent but is not considered a site for deferred storage of effluent and may be removed and decommissioned in the future.

The Dairy Effluent Storage Calculator (DESC) attached in Appendix E shows that **5,038m^3 of pumpable liquid storage is required** (90th percentile probability) to enable effective deferred irrigation for liquid FDE, silage pad leachate, underpass effluent and liquid components of wintering shed effluent. The DESC shows that **1081m^3 of solid storage is required** (maximum volume). The sizing of the effluent storage pond and sludge beds and underground bunkers are sufficient to meet the requirements of the DESC.

6.4.3 *Discharge Area*

The **liquid** effluent discharge area will be 288ha which represents no change from the existing discharge areas approved under AUTH-20171302-01 (183ha) and AUTH-20147281-01 (105ha). Overseer nutrient budget scenario reports state that 150ha is required to maintain N loading at less than 150 kg N/ha/year from liquid effluent. Liquid effluent will be applied to land all year round when soil conditions permit safe application.

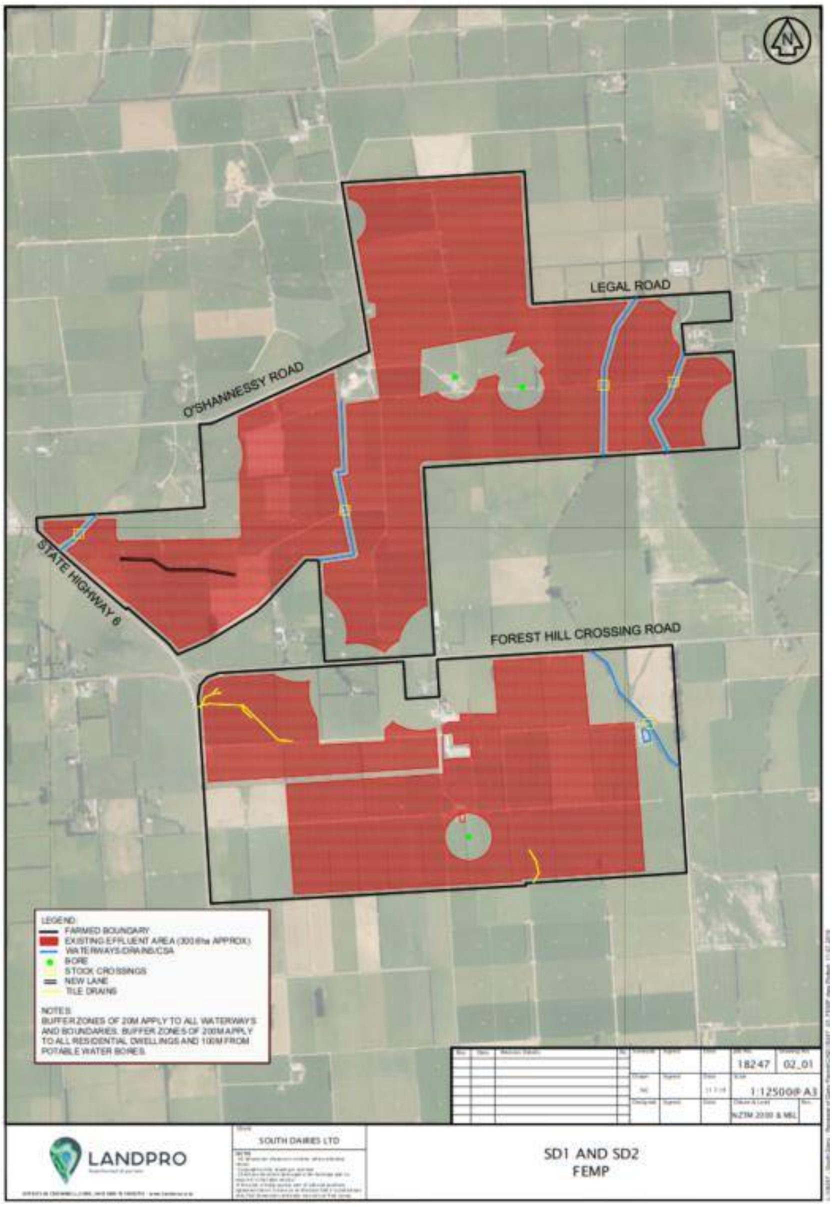

Figure 14: Proposed liquid effluent discharge area

The **slurry** effluent discharge area includes the remainder of the milking platform (i.e blocks/paddocks not in the approved liquid effluent discharge area) and totals approximately 130ha.

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

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

6.4.4 *Discharge Method*

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

- Travelling irrigator: Maximum depth per application of 8 mm, total annual application depth of 25 mm
- Slurry tanker, muck spreader: 5mm maximum depth per application
- Umbillical system: 10mm maximum depth per application
- Low rate pods: Maximum application rate 10mm/hr

6.5 Water Permit Application

A new water permit is sought for the proposal. A water permit is required to allow for the abstraction of groundwater for shed wash down water and stock drinking water from 1250 cows during the milking season, and the abstraction of stock drinking water during winter for 320 cows in the wintering shed and 200 cows grazed on the platform.

6.5.1 *Allocation*

The applicant seeks a continuation of the groundwater abstraction from bores:

- E46/0024 located at NZTM2000 1241737 4871899 and on Sec 79 Blk IX New River HUN and
- E46/0747 located at NZTM2000 1241678 4873831 and on Sec 51 Blk I Winton HUN

The applicant is applying for:

Daily Volume= 150,000 L/day over the 300-day milking season (1 August – 31 May approx.)

Daily Volume= 36,400 L/day over the 65-day winter period (1 June – 1 August approx.)

Annual Volume = 47,366m^3

The proposed abstraction rate during the 300-day milking season of 150,000 L/day equates to a rate of take of 120 L/cow/day broken down as 50 L/cow/day for shed wash down water and 70 L/cow/day for stock drinking water for the 1250 cows on the property.

The proposed abstraction rate during the 65-day winter period of 36,400 L/day equates to a rate of 70 L/cow/day for the 520 cows on the farm over the 65-day winter period.

The proposed abstraction is from the Lower Oreti groundwater zone which has a current allocation of 20% of the discretionary allocation specified in the RWPS and 8.8% of the discretionary allocation specified in the PSWLP.

6.5.2 *Monitoring*

The groundwater abstraction will be monitored at the point of take to ensure compliance with the proposed abstraction volumes. There are 2 x 20,000 L freshwater storage tanks at the SD1 dairy shed and 6 x 20,000 L tanks at the SD2 dairy shed to ensure the instantaneous rate of take is less than 2 L/sec.

6.6 Land Use Consent Application for a feed pad/lot

The dairy platform contains three existing structures which meet the definition of a feed pad/lot under the PSWLP:

- The existing herd home wintering shed is located at SD2. The loafing areas of the wintering shed are covered with underground effluent bunkers and holds a maximum of 340 cows for the duration of the winter period. The central feed lane is uncovered.
- An uncovered concrete feed pad was constructed at SD1 in 2017. The feed pad is used for supplementary feeding of 750 cows throughout the milking season.
- An uncovered calving pad was constructed at SD1 in 2017. The calving pad is currently used for up to 170 cows during the spring/calving period. Future use may include the use of this pad for up to 300 cows for the duration of the winter period as well as during the spring period. Both scenarios are accounted for in the DESC calculations to ensure there is sufficient effluent storage available for both winter and spring use. The intention is that the use of these structures has an element of flexibility and will be described and included in the year end nutrient budgets going forward.

The Browns runoff block contains an existing structure which meets the definition of a feed pad/lot under the PSWLP:

- The existing herd home wintering shed is located on the Browns runoff block which is part of the landholding. The loafing area of the wintering shed is covered with underground effluent bunkers and holds a maximum of 150 young stock for the month of May and for the duration of the winter period. The outside feed lanes are uncovered.

Wintering shed at SD2

The wintering shed is located at SD2 at about NZTM2000 1241703 4872262 on Sec 16 BLK IX New River HUN.

The wintering shed has been constructed as to comply with the setbacks listed in Rule 35 of the PSWLP namely, the wintering shed is not located:

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

All liquid effluent collected from the wintering shed is directed for storage in the main effluent storage pond which is authorised under Land Use Consent AUTH-20191108. All slurry effluent collected from the wintering shed is stored in the underground bunkers which will be authorised by a land use consent sought within this application. Overland flow of stormwater or surface runoff from surrounding land is prevented from entering the feed pad/lot. Effluent generation figures have been considered for the wintering shed under the discharge permit application in Section 6.3.

The typical use of the wintering shed has been modelled in both the DESC in relation to effluent generation predictions and in the proposed scenario Overseer nutrient budget in relation to nutrient management predictions. The use of the wintering shed reflected in the DESC represents worst case or maximum usage of the structure to ensure that maximum effluent volumes are accounted for. The applicant requests that if the Consent Authority requires the usage of this structure to be restricted in the consent conditions, that the restriction does not limit usage below that of the usage in the DESC considering that the use of this structure is a mitigation measure to reduce pasture damage and nutrient losses.

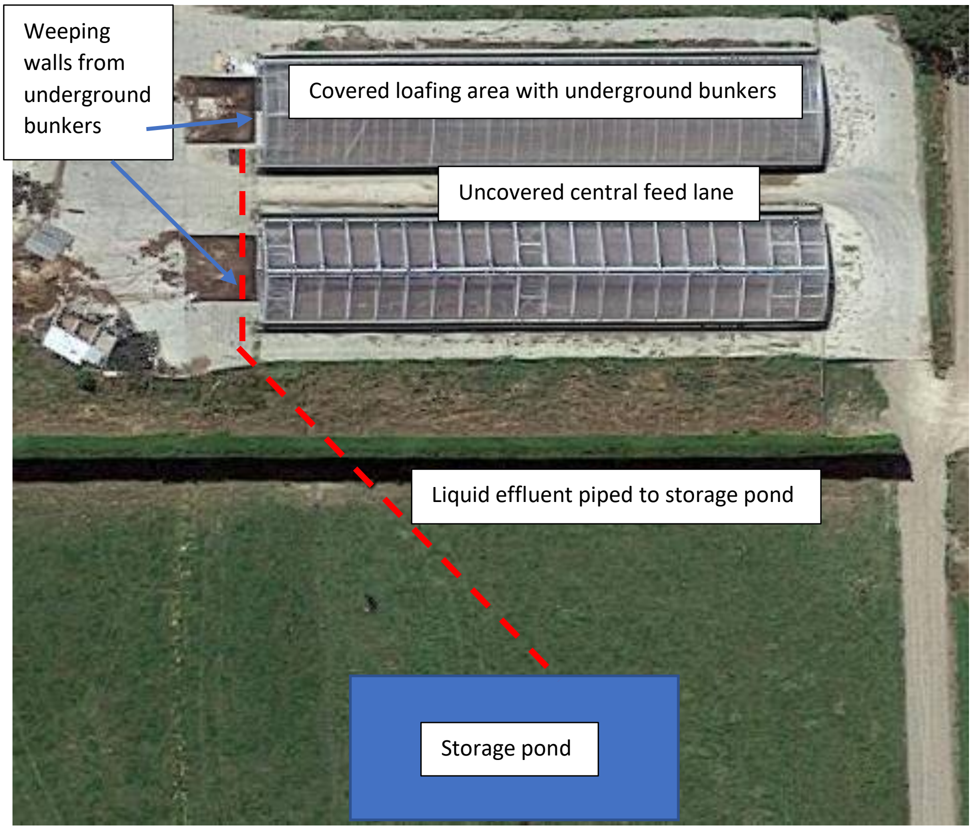

Figure 15:Birds eye view of wintering shed on SD2

Feed pad

The feed pad is located at SD1 at about NZTM2000 1241631 4873760 on Sec 51 BLK I Winton HUN.

The feed pad has been constructed as to comply with the following setbacks listed in Rule 35 of the PSWLP namely, the feed pad is not located:

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

The feed pad on SD1 does not comply with the following setback listed in Rule 35 of the PSWLP:

1) Within 50 meters from another feed pad/lot on the same landholding

As the feed pad is located approximately 10m to the south of the calving pad.

All liquid and slurry effluent collected from the feed pad is directed to the sludge bed/weeping walls which will be authorised by a land use consent sought within this application. Overland flow of stormwater or surface runoff from surrounding land is prevented from entering the feed pad/lot. Effluent generation figures have been considered for the feed pad under the discharge permit application in Section 6.3.

The typical use of the feed pad has been modelled in both the DESC in relation to effluent generation predictions and in the proposed scenario Overseer nutrient budget in relation to nutrient management predictions. The use of the feed pad reflected in the DESC represents worst case or maximum usage of the structure to ensure that maximum effluent volumes are accounted for. The applicant requests that if the Consent Authority requires the usage of this structure to be restricted in the consent conditions, that the restriction does not limit usage below that of the usage in the DESC considering that the use of this structure is a mitigation measure to reduce pasture damage and nutrient losses.

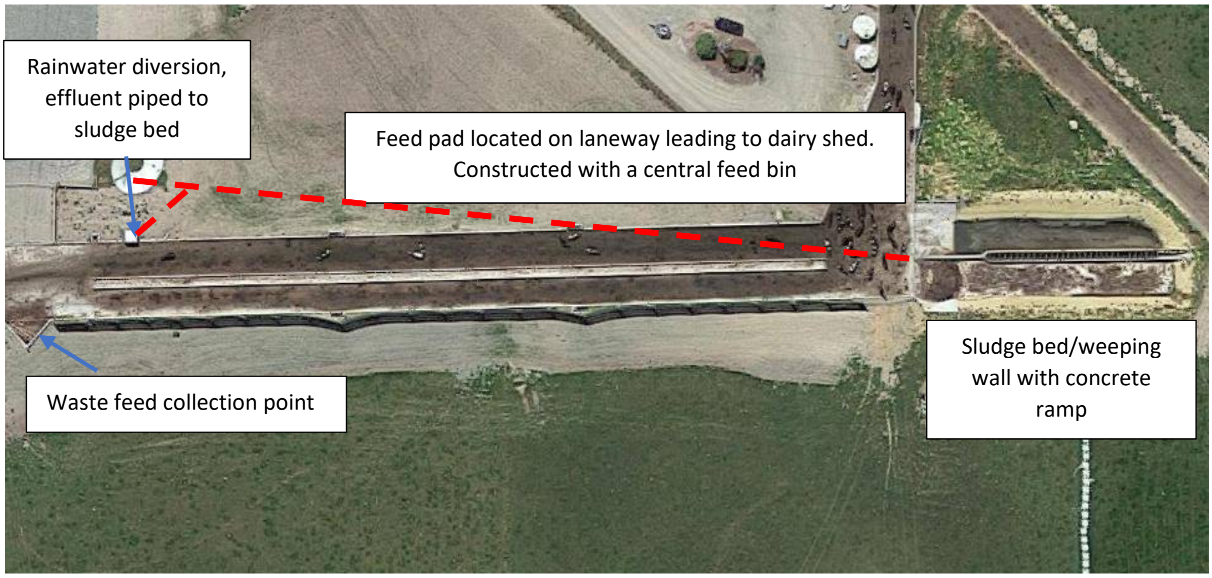

Figure 16: Birds eye view of feed pad on SD1

Calving pad

The calving pad is located at SD1 at about NZTM2000 1241562 4873815 on Sec 51 BLK I Winton HUN. The calving pad has been constructed as to comply with the following setbacks listed in Rule 35 of the PSWLP namely, the calving pad is not located:

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

The calving pad on SD1 does not comply with the following setback listed in Rule 35 of the PSWLP:

1) Within 50 meters from another feed pad/lot on the same landholding

As the calving pad is located approximately 10m to the north of the feed pad.

All liquid collected from the calving pad is directed to the adjacent concrete saucer which will be authorised by a land use consent sought within this application. Slurry effluent from the calving pad will be stored in situ until summer when the gravel will be washed and greenwash stored in the sludge bed. Overland flow of stormwater or surface runoff from surrounding land is prevented from entering the feed pad/lot. Effluent generation figures have been considered for the calving pad under the discharge permit application in Section 6.3.

The typical use of the calving pad has been modelled in both the DESC in relation to effluent generation predictions and in the proposed scenario Overseer nutrient budget in relation to nutrient management predictions. The use of the calving pad reflected in the DESC represents worst case or maximum usage of the structure to ensure that maximum effluent volumes are accounted for. The applicant requests that if the Consent Authority requires the usage of this structure to be restricted in the consent conditions, that the restriction does not limit usage below that of the usage in the DESC considering that the use of this structure is a mitigation measure to reduce pasture damage and nutrient losses.

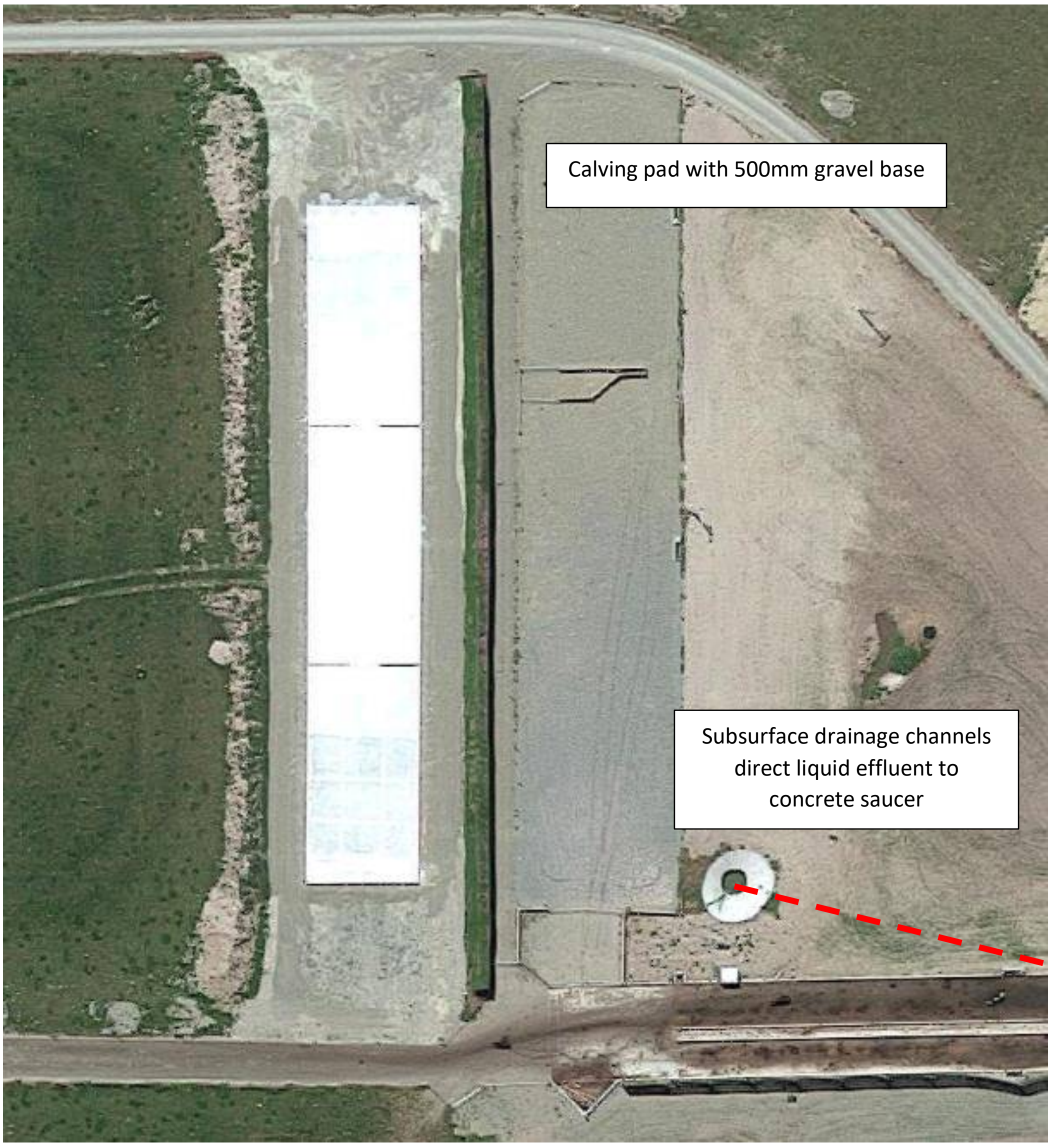

Figure 17: Birds eye view of calving pad on SD1

Wintering shed on Browns runoff block

The wintering shed on the Browns Runoff block is located at about NZTM2000 1245196 4878869 on Pt Sec 19 BLK III Winton HUN.

The wintering shed on the Browns runoff block has been constructed as to comply with the setbacks listed in Rule 35 of the PSWLP namely, the wintering shed is not located:

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

All liquid effluent collected from the wintering shed is directed for storage in two above ground concrete tanks which are less than 35m^3. All slurry effluent collected from the wintering shed is stored in the underground bunkers which will be authorised by a land use consent sought within this application. Overland flow of stormwater or surface runoff from surrounding land is prevented from entering the feed pad/lot. Effluent generation figures have been previously assessed and the effluent discharge authorised under Discharge Permit AUTH-20171564.

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

Land use consent is required for the use and maintenance of all of the existing effluent storage facilities located on SD1, SD2 and Browns runoff block which exceed 35m^3. Our preference is that one land use consent is issued for the use and maintenance of all of these structures to avoid an excessive number of separate land use consents for each structure.

6.7.1 *Effluent storage facilities on SD1*

SD1 contains a sludge bed/weeping wall, main effluent storage pond and concrete saucer. Land use consent is not sought for the use and maintenance of the concrete saucer because it has a volume less than 35m^3 and was only recently constructed in 2017.

Table 12: Effluent storage facilities on SD1 requiring land use consent

	LOCATION	PARCEL DESCRIPTION
Sludge bed/weeping wall	NZTM2000 1241734 4873779	Sec 51 Blk I Winton HUN
Main effluent pond	NZTM2000 1241790 4873878	Sec 51 Blk I Winton HUN

Sludge bed/weeping wall

The sludge bed/weeping wall structure was constructed in 2017 and is 660m^3. The structure is clay lined on the base and side with a concrete ramp. The structure is still considered new and has no visible cracks or defects and there is no evidence that it is leaking or failing. Environment Southland staff have advised that both a drop test and structural assessment does not need to be submitted for this consent application on this structure due to its age. The applicant proposes that this structure is drop tested and assessed structurally prior to the renewal of the resulting land use consent (i.e. in 10 years time).

Figure 18: Sludge bed/weeping wall at SD1 constructed in 2017

Main effluent storage pond

The main effluent storage pond structure was constructed in 2017 and is 6,384m^3. The structure is synthetically lined with HDPE. The structure is still considered new and has no visible cracks or defects and there is no evidence that it is leaking or failing. Environment Southland staff have advised that both a drop test and structural assessment does not need to be submitted for this consent application on this structure due to its age. The applicant proposes that this structure is drop tested and assessed structurally prior to the renewal of the resulting land use consent (i.e. in 10 years time).

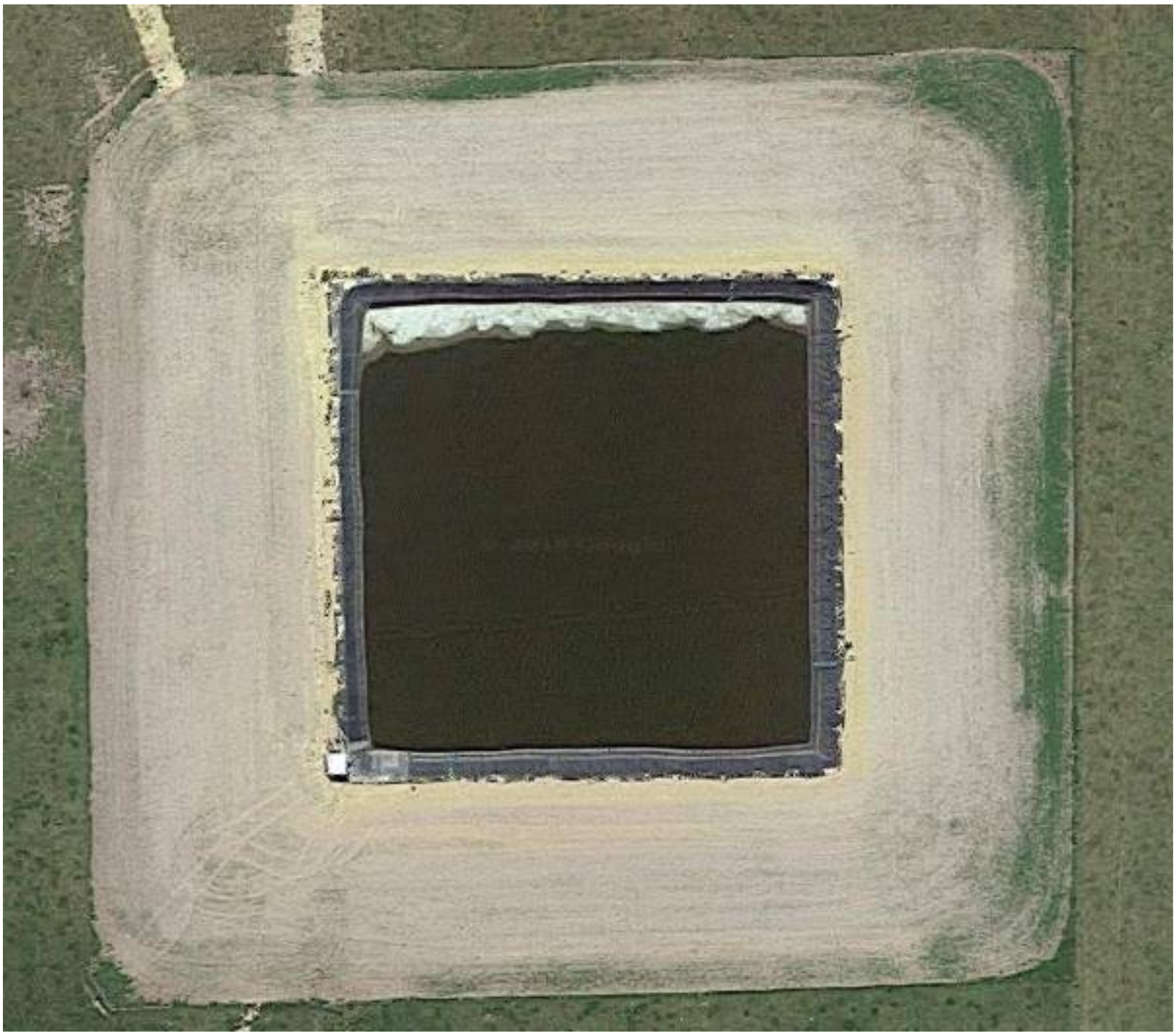

Figure 19: Main effluent storage pond at SD1 constructed in 2017

6.7.2 *Effluent storage facilities on SD2*

SD2 contains a sludge bed/weeping wall, main effluent storage pond, concrete saucer, wintering shed bunkers and above ground tanks. The use and maintenance of the main effluent storage pond was recently approved under AUTH-20191108 and further consent is not required. The above ground storage tank is 33m^3 in volume and does not require land use consent. All other structures require land use consent.

Table 13: Effluent storage facilities on SD2 requiring land use consent

	LOCATION	PARCEL DESCRIPTION
Sludge bed/weeping wall	NZTM2000 1241719 4871952	Sec 79 Blk IX New River HUN
Concrete saucer	NZTM2000 1241698 4871977	Sec 79 Blk IX New River HUN
Wintering shed bunkers	NZTM2000 1241703 4872262	Sec 16 Blk IX New River HUN

Sludge bed/weeping wall

The sludge bed/weeping wall structure is 348m^3. The structure is concrete lined. The structure has no visible cracks or defects and there is no evidence that it is leaking or failing. A recent pond drop down test and structural assessment (Appendix J) shows that the structure is not leaking beyond the parameters in Appendix P of the PSWLP. The applicant proposes that this structure is drop tested and assessed structurally again prior to the renewal of the resulting land use consent (i.e. in 10 years time).

Figure 20: Sludge bed/weeping wall structure on SD2

Concrete saucer

The exact volume of the concrete saucer is unknown but likely to exceed 35m^3. The structure is concrete lined. The structure has no visible cracks or defects and there is no evidence that it is leaking or failing. Recent advice received from an engineer advises against drop testing this structure due to practical limitations. The applicant proposes that a float be installed in this structure to limit the volume to 35m^3. The concrete saucer is likely to be decommissioned at some point in the future as it doesn't play an integral part in the effluent management system.

Figure 21: Concrete saucer on SD2

Wintering shed bunkers

The wintering shed bunkers are 854m^3 in total. The bunkers are concrete lined and sit under the floor of the herd home. The structure has no visible cracks or defects and there is no evidence that it is leaking or failing according to a recent visual assessment (Appendix K) by Murray Gardyne. The applicant proposes that this structure is assessed structurally again prior to the renewal of the resulting land use consent (i.e. in 10 years time).

Figure 22: Underground wintering shed bunkers on SD2

6.7.3 *Effluent storage facilities on Browns runoff*

Browns runoff contains wintering shed bunkers and concrete storage tanks. Both structures require land use consent.

Table 14: Effluent storage facilities on Browns runoff requiring land use consent

	LOCATION	PARCEL DESCRIPTION
Wintering shed bunker	NZTM2000 1245196 4878869	Pt Sec 19 Blk III Winton HUN
Concrete tanks	NZTM2000 1245182 4878831	Pt Sec 19 Blk III Winton HUN

Wintering shed bunkers

The wintering shed bunker is approximately 300m^3 in total based on rough dimensions of 6m wide x 50m long x 1.2m deep. The bunkers are concrete lined and sit under the floor of the herd home and are of the same construction as the wintering shed bunkers on SD2. The structure has no visible cracks or defects and there is no evidence that it is leaking or failing according to a recent structural assessment (Appendix K) by Murray Gardyne. The applicant proposes that this structure is assessed structurally again prior to the renewal of the resulting land use consent (i.e. in 10 years time).

7. ASSESSMENT OF ENVIRONMENTAL EFFECTS FOR THE PROPOSAL

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. The AEE has not used a permitted baseline approach in accordance with Policy 39 of the PSWLP.

This assessment of environmental effects (AEE) is broken into two main parts:

- A separate water quality assessment is provided by Dr Mike Freeman and appended in Appendix G which assesses the state of the existing environment and assesses actual and potential effects from the proposal on water quality in the receiving environment.
- An activity level assessment of effects which assesses individual activities within the entire proposal and directly correlates them to the relevant good management practices and mitigation measures which are part of the proposal which are designed to avoid, remedy and mitigate adverse effects on the environment.

Several separate pieces of work have provided quantification of nutrient losses to inform both parts of the assessment of environmental effects:

- Baseline and proposed Overseer nutrient budgets provide a quantification and comparison of modelled nutrient losses from the dairy platform (Appendix A and B).
- Overseer has been used to provide a comparison of nutrient losses modelled on the new 7ha of milking platform land to better reflect the grass/baleage winter grazing activity (Appendix F).
- Quantification of phosphorus loss reductions across the dairy platform as a result of rewarding good management practice and additional mitigation outside of Overseer (Appendix F).
- Quantification of nutrient loss improvements resulting from the implementation of additional good management practices across the runoff blocks have been provided by Certified Nutrient Management Advisor (CNMA) Miranda Hunter (Appendix F)

7.1 Activity Level AEE for the farming activity

The assessment below assesses the farming activity in its entirety located on the proposed dairy platform and three runoff blocks. Each activity is assessed in relation to potential effects on water quality and describes which GMP's and further mitigation measures are required to avoid, mitigate and remedy adverse effects on the environment.

Table 15: Assessment of effects at activity level

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Capital fertiliser applications during conversion of 7ha of sheep land to dairy farming land	The proposed Overseer model does not include capital fertiliser applications because it is based on a long term average farm system operating in equilibrium. Therefore P losses as result of capital fertiliser applications over the conversion period may be higher than modelled by Overseer. Capital fertiliser applications proposed will apply larger quantities of P and K to land in order to increase fertility. These applications of larger quantities of nutrients have the potential to result in losses to the environment if applied at rates which exceed the plants ability to utilise these applied nutrients. Excess applied P is	Capital fertiliser application timings avoid high drainage periods such as late autumn and winter and periods when soil temperature is less than 7 degrees to maximise plant uptake and minimise losses to the environment. All other fertiliser applications will use a little and often approach to avoid the application of excess nutrients which cannot be utilised. Regular soil testing to guide capital fertiliser requirements to avoid the application of excess fertilizer nutrients which cannot be used for plant uptake to mitigate against losses via artificial drainage.	Capital fertiliser applications will only be done as required by the latest soil test results from the new block and will be undertaken where P, K or S levels are below agronomical optimum levels. P = 20-40 K = 6-10 S= 10-12 March 2018 soil tests indicate capital P and K fertiliser is required. The block will be re-tested once consent is granted to check for changes in soil fertility. Capital P fertiliser applications will be applied at a maximum of 100kg P/ha which may require P fertiliser applications to be split.	Capital fertiliser applications are only undertaken where there is a nutrient deficit and are done at a rate which meets this deficit and avoids the application of excess nutrients. There is a low risk of adverse effects eventuating as application will meet pasture demand and the application area is separated from sensitive receptors such as waterways. The fertiliser regime described in the nutrient budgets will be the default fertiliser regime and capital fertiliser applications will only be done during the early phase of the land conversion and completed using GMP principles and in according to mitigation measures which should adequately mitigate adverse effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	unlikely to be lost directly to water bodies via overland flow due to extensive separation distances between the effective area of the new block and the nearest waterbody. Any excess P in water bodies may lead to water quality degradation resulting in ecological stresses on aquatic life.			
Cultivation of new pastures on new 7ha block	Short term increase in potential sediment, microbial and phosphorus losses to the environment which can cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries	Re-sow bare paddocks as soon as possible Use buffer zones around critical source areas and use direct drilling if possible. Cultivation will be undertaken to meet permitted activity criteria in Rule 25(a) of the PSWLP maintaining a 5 meter buffer zone	Further mitigations not required as land is flat which reduces the risk of overland flow of sediment and phosphorus when cultivating land. No waterways are present on the new block of land.	Adverse effects should be adequately avoided as this is a low risk activity in this location. GMPs provide adequate mitigation of effects.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Land use change on new 7ha block from grass/baleage winter grazing to milking platform	The 7ha block is currently used for winter grazing on grass supplemented with a high rate of baleage. The actual nutrient losses from this existing activity are likely to be underestimated by Overseer in the baseline models as the model assesses this activity as the straight grazing of pasture which is different to the practice in reality. The transition of this block from a grass/baleage wintering and supplement growing block to milking platform is likely to result in less of a comparative increase in modelled nutrient losses than shown in the Overseer nutrient models provided in the application.	Use of nutrient budgeting to manage nutrient inputs and outputs. Use of soil testing to maintain soil nutrients at agronomical optimum levels. Identification of critical source areas and avoidance of high nutrient loss activities near these areas.	Use of feed pads, wintering sheds and calving pads on the dairy platform to enable the removal of stock from pasture during periods when soil damage can occur. The 7ha block of land will now be incorporated into the dairy platform which is a much less intensive land use than the existing grass/baleage wintering activity and is likely to reduce potential non-point source N, P, sediment and microbial losses during the high risk winter period. Fodderbeet crop is rotated across the entire expanded dairy platform and lifted to be fed on the feedpad.	Comparative modelling in Appendix F suggests the land use change on this block will result in a reduction of nitrogen losses closer to 46 kg N/ha/year (i.e 97kg N/ha/year modelled as a Kale block to 51 kg N/ha/year modelled as milking platform). The 7ha block is located within the same groundwater and surface water catchments as the remainder of the dairy platform which ensures that the modelled losses entering the receiving water bodies does not increase under the proposal in its entirety. The 7ha block is located within the same physiographic zones as the remainder of the dairy platform which ensures that the modelled losses from these physiographic zones does not increase under the proposal in its entirety.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Adverse effects from the proposed activity will be comparative in nature and scale to milking platform. Increased nutrient losses from one localised area may have localised water quality effects if good management practices are not implemented, particularly around grazing management when soils are saturated. **See attached comparative modelling from Miranda Hunter for further information (Point #1 on File Note Appendix F)**			All available mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located across the entire dairy platform and therefore will mitigate against contaminant losses from activities located on both the new 7ha block and the existing platform.
Construction of new lane between paddocks R8 and 70/71 on SD1	New laneways create high risk areas for sediment, microbial and P losses. Short term increase in potential sediment, microbial and phosphorus losses to the environment which can	No stockpiling of earthworks material near waterways. Laneways include camber and contouring to direct runoff to pasture and away from waterways Buffer zones will be created in riparian margins to waterways.	The paddock and lane layout have been designed to ensure the new lane does not cross or run parallel to any waterways or CSA's	Overseer assumes 30% of dung deposited on lanes is lost directly to waterways, regardless of where the waterways are located in relation to the laneways. Overseer may have overestimated P losses (and sediment losses) in the proposal model because it doesn't recognise that the applicant

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	cause ecological stresses on plants and animals due to sedimentation, algae blooms and water temperature increases in waterways and estuaries			will be implementing these GMPs and also siting of the lanes away from waterways as a mitigation measure.
Decrease in modelled nitrogen losses from the existing dairy platform	The proposal sees a modelled decrease in N losses on the dairy platform. The N losses decrease from 24,965 kg N to 24,913 kg N. A reduction in nitrogen losses under the proposal is likely to reduce concentrated nutrient accumulation in the soil profile and/or in localised drainage channels which can result in water quality improvement and improvement for aquatic life.	Use of nutrient budgeting to manage nutrient inputs and outputs.	The proposal has made best use of the existing infrastructure on the dairy platform (calving pad, feed pad, wintering sheds, effluent system upgrades) to better utilize and redistribute nutrients across the entire dairy platform. Feed pad, wintering shed and calving pad solids are applied to land in January at a low risk time of the year. Nutrient inputs and outputs are better balanced to reduce overall nitrogen losses. The existing dairy platform and expanded dairy platform (and remainder of the landholding) are located within the same groundwater and surface water catchments which ensures that the modelled losses entering the receiving water bodies should reduce under the proposal. The existing dairy platform and expanded dairy platform (and remainder of the landholding) are located	The reduction in modelled nitrogen losses from the dairy platform are as a result of the implementation of mitigation measures which make more efficient and effective use of nutrients. The proposal results in a reduction in nitrogen losses to water bodies in accordance with the physiographic zone policies and Policy 16 of the PSWLP. The decrease in nitrogen losses should result in a small but unmeasurable improvement to water quality in receiving water bodies.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
			within the same physiographic zones which ensures that the modelled losses from these physiographic zones reduced under the proposal. The mitigation measures to reduce modelled nutrient losses (contained throughout this table) are located across the entire landholding.	
Increase in phosphorus losses from the dairy platform as modelled by Overseer. However, additional quantification outside of Overseer suggests a decrease in actual phosphorus losses from the proposed dairy platform.	The proposal sees a modelled increase in P losses from the entire landholding of 3kg P compared to baseline, representing an increase of less than 1%. Additional quantification outside of Overseer is provided in Appendix F in order to accurately reflect the reward of good management practices adopted across the dairy platform to mitigate against P loss to water. The quantification estimates that an additional 6 kg P will be mitigated in reality resulting	Avoid working CSAs and their margins All riparian margins to be fenced and left to establish with grasses to enable filtration of contaminants that may be transported via overland flow processes and erosion Reduce use of P fertiliser where Olsen P levels are above agronomic optimum. Reduce the risk of runoff from laneways and other sources by ensuring crossings are adequately maintained and maintain gradients to direct runoff to pasture.	A reduction in the number of cows wintered on grass/baleage on farm results in a marginal decrease in modelled P losses All new laneways will be located away from waterways. Two existing laneway crossings will be recontoured and buffers increased to further mitigate P losses to water beyond general GMP level. GMPs listed in the relevant FEMP will be implemented	Phosphorus inputs and outputs have been managed as best as reasonably practical, with the whole proposal resulting in an estimated 3 kg decrease in phosphorus losses which should result in a small but unmeasurable improvement to water quality in receiving water bodies.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	in an overall reduction of 3kg P between the baseline and proposed models.			
Activities on the Runoff blocks - grass/baleage wintering, young stock grazing, supplement production	Nutrient losses from these activities occur via the three primary contaminant pathways: deep drainage through the soil profile into the underlying aquifer or via overland flow into adjacent waterways or artificial drainage channels. Excessive nutrient losses can cause nutrient accumulation in groundwater and excessive nutrient load in waterways causing water quality degradation and the resulting ecological stress on plants and animals when the life-supporting capacity of the water is compromised by excess nutrients.	Buffer zones maintained between grass/baleage winter grazing activities and critical source areas to provide an area where runoff can be filtered and captured limiting risks of entering water. Grass/baleage grazing direction will be away from buffer zones/critical source areas leaving last bite to provide a buffer zone for nutrient capture through until the end of the winter grazing period. Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks of contaminant losses through leaching and overland flow.	The winter grazing will continue to be located on any of the three runoff blocks under this proposal. Crow Rd and Browns are preferentially used for winter grazing because they are predominantly flat with less waterways, critical source areas or artificial drainage channels which avoids the risk of the direct runoff of nutrients (particularly P, sediment and microbials). Winter grazing will be prohibited on the paddocks identified on the attached map (Appendix I). Additional riparian planting is proposed to provide added protection to existing swales/waterways. Young stock are set stocked during high risk times of the year to reduce pasture damage and concentrated nutrient losses. Supplement production is primarily done on the Crow Rd and Browns block as they are the most suitable in terms of topography.	The applicant has proffered additional mitigation measures and more stringent implementation of good management practice to further reduce predicted nutrient losses below baseline levels. The result being that nutrient losses will reduce under the proposal resulting in less adverse effects on water quality and an overall improvement to water quality in the receiving waters as a result of the proposed activities located on the three runoff blocks.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		All other GMPs listed in rule 20 for intensive winter grazing will be implemented for the grass/baleage activity. Bare soils are cultivated using full cultivation and timed to avoid paddocks siting bare for long periods of time which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching.	All activities on the runoff blocks are governed by the FEMP which contains all relevant GMPs which are implemented and any improvement works needed on a year end basis. Stock numbers in each age class are capped at 25% replacement rate plus 10% buffer for culls/deaths in order to give certainty to the scale of the activity in the future. The nitrogen fertiliser application regime is amended to prohibit the application of N fertilizer between 1 June and 1 September.	
Milking of 1250 cows across the entire dairy platform	The grazing of cows on pasture during high risk periods increases the risk of the leaching of nutrients (N,P and microbials) through the soil profile from urine and	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses.	Stocking rate will reduce marginally with the introduction of the additional land to the dairy platform with no change in cow numbers. A stocking rate reduction results in a reduction in concentrated nutrient losses on a per hectare, particularly from urine and dung spots which are significant sources of contaminant losses beyond the root zone.	Adverse effects on the environment adequately mitigated with combination of GMPs and mitigations which have a high level of effectiveness for mitigating risks of grazing cows on pasture throughout the milking season.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	dung spots or transported via subsurface drainage. Pasture damage from cows grazing during adverse periods can result in increased sediment, microbial and P loss if erosion or soil loss occurs from paddocks Any nutrient losses to groundwater and surface water bodies may potentially cause water quality degradation which can cause ecological stresses on aquatic plants and animals from algal growth, temperature increases and eutrophication. Human health concerns can also arise from microbial contamination of waterways upon contact and risks of blue baby syndrome from nitrate accumulation in	Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required. This is to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	Fully utilise the existing feed pad and calving pad at SD1 to remove cows from pasture during high risk periods to avoid pasture and soil structure damage. This can now be done by allowing the flexibility to move stock freely between the two dairy sheds/effluent infrastructure to suit the climatic conditions. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage. Use of in-shed feeding and the feed pad at SD1 when feed deficits occur to ensure stock are well fed prior to entering the paddock break which can limit pugging and treading damage, particularly under adverse weather conditions.	

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	groundwater and potentially bowel cancer.			
Fertiliser application regime across entire landholding (dairy platform and runoff blocks)	The application of nutrients in fertiliser has the potential to result in direct nutrient losses to the environment if fertiliser is applied either in excess to plant requirements or at a time when it cannot be utilised for pasture/crop production. Nitrogen losses from fertiliser application is most likely to occur via deep drainage. Phosphorus losses from fertiliser is most likely to occur via soil loss and/or direct loss through runoff or erosion. Adverse effects of inappropriate fertiliser application or excess application include a loss of excess nutrients to water	Time N, P, K and S fertiliser application to meet crop and pasture demand using split applications and avoid high risk times of the year i.e. when soil temperature is less than 7 degrees, during drought periods and during periods when soils are at field capacity. Reduce use of P fertiliser where Olsen P values are above agronomic optimum. Maintain Olsen P levels at around 35 Use nutrient budgeting and annual soil testing to manage nutrient inputs from fertiliser and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	Urea applications on all blocks occur using a little and often approach. Average application rate of N fertiliser has been reduced on the non effluent areas compared with the baseline scenario due to the better spread and utilisation of nutrients from farm infrastructure. The effluent blocks also receive a reduced rate of N application across the various applications compared to the baseline on the ex-SD2 platform. Fertilise use on the runoff blocks has been amended as part of the proposal to avoid applications of N fertiliser during June, July and August as high risk periods. Fertiliser on the runoff blocks is applied to accurately meet plant demand and is applied under GMP. P fertiliser is applied for maintenance to retain an Olsen P of 35	The proposed fertiliser regime has been improved to make better use of the effluent generated in the farm infrastructure. Adverse effects both avoided and mitigated with use of GMPs for fertiliser usage and further mitigations to reduce fertiliser across the landholding.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	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.			
Imported supplementary feed and feed made on-farm and fed during the season on dairy platform	Supplementary feed usage has an impact on the pasture production of the farm system and can change the quantity of N particularly in the farm system compared to an all-grass based diet. Low N supplementary feeds can reduce estimated N losses to the environment as less N needs to be supplied to fuel pasture production which in turn can have beneficial effects on water quality by reducing nutrient load in groundwater and surface water bodies.	N/A	Supplementary feed imported onto the property has reduced by 10 T of pasture silage. No change in the type of imported feed used but feed is better utilised on the off-paddock structures (feed pad, calving pad and wintering sheds). Supplementary feed exported is unchanged at none.	The reduced stocking rate has necessitated the marginal reduction in imported supplementary feed to reconcile pasture production. Unlikely to have any more than negligible effects on the environment.

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

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	water include water quality degradation which can adversely impact aquatic ecosystems and the overall health of water bodies. Slurry effluent will be applied to areas outside of the liquid discharge area. Slurry effluent is generally considered lower risk to apply to land because it doesn't have the same risks of leaching, overland flow/runoff that purely liquid effluent has.	kgN/ha/year to avoid excess nutrient loading. Utilising low depth effluent application (<5mm) on the poorly drained soils on farm to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of an umbillical system to discharge larger volumes of effluent to low risk soils when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors		

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
		such as bores, property boundaries and dwellings.		
Use of the existing effluent storage facilities on existing dairy platform and Browns runoff block	If a structure is leaking or not structurally sound these is a risk of contaminant losses directly to shallow groundwater. Contaminant accumulation in groundwater can lead to human health issues from blue baby syndrome or *E.coli* contamination if drinking water is abstracted nearby. Contaminants may also reach surface water bodies if there is a groundwater/surface water connection which can cause water quality degradation effects such as algal blooms, smothering and eutrophication in surface water bodies.	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	The main effluent storage pond at SD2 is currently under construction and will contain a synthetic liner and leak detection system. Consent conditions will ensure that a pond drop test is completed in in 10 years time to confirm that it is not leaking beyond normal operating parameters. The effluent storage structures at SD1 are very new and are in exceptional working order. All structures have been designed and signed off by an engineer. A drop tests has been completed on the sludge beds at SD2 and show that leakage does not exceed normal operating parameters. All other structures have been checked for cracks, defects and signs of leakage by a suitably qualified person.	Effluent storage facilities are fit for purpose and leaks are identified through regular testing and checking of the effluent storage structures as will be required by consent conditions on the relevant land use consent authorising these structures. Adverse effects from leakage should be avoided or remedied immediately.

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

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
Use of wintering sheds, feed pads and calving pad	Nutrients in effluent generated by the cows during winter and in marginal periods is stored and applied to land in a manner which matches plant demand and mitigates against excessive leaching processes which can lead to the contamination of groundwater and surface water bodies. An overall reduction in nutrient losses from the landholding reduces nutrient accumulation risks in groundwater and reduces nutrient load in waterways. A reduction in nutrient load can improve water quality and maintain and enhance the life-supporting capacity of water bodies.	Urine and dung deposition during high risk periods is redistributed to pasture using the effluent management system when soils are in a suitable state to receive and utilize applied nutrients. The wintering sheds, feed pads and calving pads are located in accordance with the setbacks listed in Rule 35 of the PSWLP where possible and land use consent is sought under this application for their use.	There is no significant change in how the wintering sheds, feed pad and calving pad are used in the proposal as they are being fully utilised, however their utilisation can now come from the entire herd at different times of the year as opposed to being limited to only the cows on the previously separated plaforms.	Off paddock infrastructure is an effective tool to avoid adverse effects on the environment.

Activity	Potential effects	Good Management Practices adopted	Mitigations over and above GMPs	Outcome
	Standing cows off pasture in late Autumn and early Spring reduces the risk of pugging to pastures which increases the infiltration ability of soils and reduces overland flow of nutrients.			

8. NOTIFICATION AND CONSULATION

A consent authority has the discretion whether to publicly notify an application unless a rule or National Environmental Standard (NES) precludes public notification or section 95A(2) applies.

The effects of the activity 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. The assessment of environmental effects below demonstrates that no persons will be adversely affected by the proposal to a degree that is minor or greater. Overall, it is considered that this application will be processed non-notified and without the need for written approvals

9. 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.

9.1 Part 2 of the RMA

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

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

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

- The preservation of the natural character of the coastal environment, wetlands, and lakes and rivers and their margins and the protection of them from inappropriate subdivision, use and development

- The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga

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

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

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

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

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

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

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

9.2.1 *Water Quantity*

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

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

9.2.2 *Land use change*

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Objectives RURAL.1, RURAL.2 Policies RURAL.1, RURAL.2,
Proposed Southland Water and Land Plan	Policies 6 and 10
Te Tangi a Tauira	Section 3.5.7, 3,5,13

The applicants have made a commitment to enter into a consenting regime which limits nitrogen and phosphorus losses for the duration of the consent term. The proposal is a cumulation of the applicants wanting to farm in an environmentally sustainable manner whilst still enhancing the productive capacity of their farms and providing for their economic and social well-being. The proposal is therefore consistent with the objectives and policies in the SRPS that reiterate the notion of supporting the sustainable use and development of rural land resources, both environmentally and economically, if undertaken in an appropriate manner.

Policies 6 and 10 relate to the physiographic zones on the landholding. All three policies require the avoidance, remedying or mitigation of adverse effects on water quality within these zones by the implementation of GMPs, consideration of the key contaminant pathways and generally not granting consent for expanded dairying or intensive winter grazing where contaminant losses will increase as a result of the proposal. The application is explicit and comprehensive in the implementation of a wide range of GMPs across the landholding and the consideration of key contaminant pathways which guide which GMPs are adopted and which further mitigations are necessary. Our AEE concludes that the range of mitigations will be successful in avoiding or mitigating contaminant loss to the environment. Part 3 of these physiographic policies appears to direct decision makers to generally not grant consent where contaminant losses increase within these physiographic zones. The nutrient budgeting and mitigation quantifications strongly indicated that contaminant losses will decrease under the proposal.

9.2.3 *Water Quality*

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Objectives WQUAL.1, WQUAL.2 Policies WQUAL, 1, 2, 5, 7, 8
Proposed Southland Water and Land Plan	Policy A4 of NPSFM Policies 15A, 15B and 16
Te Tangi a Tauira	Section 3.5.13

The NPSFM promotes improved freshwater management by directing councils to manage water in a sustainable and integrated way, while providing for growth within set water quantity and quality limits. Freshwater quality within a freshwater management unit must be maintained, where community values are currently supported, and improved where they are not. Councils must establish objectives and set limits for freshwater management units in their plans to avoid over-allocation. Freshwater management units have identified in the Southland region, but the necessary freshwater objectives and limits have not yet been set. Until this process is completed, Policy A4 of the NPSFM applies. Policy A4 requires that when considering applications for discharges (including diffuse discharges from stock), regard must be had to the extent to which the discharge avoids contamination that will have an adverse effect on the life-supporting capacity of fresh water and the health of people and communities. Our assessment strongly indicates that the proposal will have positive effects on water quality and negligible effects on water quantity and therefore is consistent with this policy.

The most relevant policies for this application in terms of the effects of diffuse contamination from farming activities on water quality are 15B and 16. Policy 15B aims to improve water quality by reducing nutrient discharge (both direct and diffuse) from the landholding. Our application has strongly indicated that nutrient discharge will be reduced under the proposal across the entire landholding. The water quality assessment concluded that a reduction in total nutrient load and nutrient concentration in the end receiving environments is likely to result in a small yet unmeasurable improvement to water quality. We can confidently say that the proposal is consistent with Policy 15B of the PSWLP.

Policy 16 of the PSWLP holds some of the greatest weight in regard to this application. Policy 16.1 (b) is relevant to this application and fundamentally directs that consents will generally not be granted where adverse effects cannot be avoided or mitigated, existing water quality is degraded to the point of over-allocation and where water quality does not meet water quality standards or sediment guidelines. The evidence within this application strongly indicates that adverse effects of the proposal are very likely to be less than the current and consented land use due to a reduction in nutrient discharge, so clause (b)(i) is not relevant. Allocation limits for water quality have not yet been set, so it is unclear how overallocation in clause (ii) can be determined or defined in relation to this application so clause (b)(ii) can be disregarded due to lack of clarity and direction. Clause (b)(iii) is relevant because the water quality assessment in Appendix G confirms that water quality standards are not fully met in the receiving environment and may provide a direction to not grant consent.

However, when viewing the policy in a holistic manner it appears inconsistent with the wider overall aim of all relevant plans and policies to decline a consent on the grounds of existing water quality where the consent is sought for an activity which will result in an improvement to water quality due to a reduction in nutrient discharge. Therefore despite the application being inconsistent with Clause (b)(iii), the application should be granted in accordance with the exceptions allowed by the policy with the use of the term "generally" not grant.

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

9.2.4 *Effluent discharge*

Regulatory Document	Particularly relevant Sections
Southland Regional Policy Statement	Objectives WQUAL.1, Policies WQUAL.8, WQUAL.10
Proposed Southland Water and Land Plan	Policy 17 Policies 13, 14

Te Tangi a Tauira	Section 3.5.1

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

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

9.2.5 *Tangata Whenua*

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

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

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

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

- The provision of buffer zones to water abstraction sites and waterways;
- The application of effluent is to land rather than water;
- The applicant already adopts best practice for land application of managing farm effluent;
- The existing riparian margins are protected and some areas will be enhanced;
- Deferred application of FDE is provided for;
- Nutrient loading from effluent discharges to land is already within industry best practice limits;
- The system and management practices are considered appropriate for the risks associated with the receiving environment;
- Water abstraction is monitored with metering results to be submitted to Council;
- Regarding Policies 3.5.14.17 and 3.5.1.17, the consent periods proposed are less than 25 years.

10. CONSENT DURATION, REVIEW AND LAPSE

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

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

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

Matching consent duration to the level of risk of adverse effects
The assessment of effects concludes adverse effects will be avoided and mitigated and effects on water quality will be positive. As the risk of adverse effects is low, this suggests that the consent duration should provide for a balance of ensuring these adverse effects are maintained as low and providing for the applicants economic and social wellbeing.

Relevant Tangata Whenua values and Ngai Tahu Indicators of Health
The application has been assessed as consistent with the relevant tangata whenua values as outlined in the iwi management plan, with particular regard to the proposed consent duration being less than 25 years.

Duration sought by the applicant and supporting information
The applicant is seeking a 15 year consent for all consents sought under this application. This term is slightly longer than the typical 10 year consents granted by Environment Southland for similar activities to give credit for the presence of wintering sheds, feed pads and calving pads on the dairy platform which is considered to be one of the most effective and desirable mitigation measures for managing contaminant losses from dairy farms available.

The applicant wishes that all consent terms are aligned.

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

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

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

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

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

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

Some draft consent conditions are discussed in the application.

11. CONCLUSION

Overall, the proposal will result in the improvement of water quality in the receiving environment as a result of a reduction in nutrient discharge.

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

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

Roslin Consultancy Ltd

Overseer Modelling Report

Prepared to establish current nutrient loss

Report prepared for:

South Dairies Limited

C/o D & S Alexander

11 McConachie Road

RD1

Winton 9781

Legal Description

Sections 49, 51, 52, and 53 Block I Winton Hun, Road, Section 11 Block II Winton Hun, Lot 2 DP 377137, Part Sections 25, 26, 47, and 48 Block I Winton Hun, Sec 14 Block IX New River Hun, Sec 15 Block IX New River Hun, Sec 16 Block IX New River Hun, Sec 19 Block IX New River Hun, Sec 79 Block IX New River Hun, Sec 80 Block IX New River Hun, Sec 81 Block IX New River Hun, Part Sec 18 Block IX New River Hun, Lot 5 DP 363069, Lot 10 DP 363069

Report Prepared By:

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B.Agr.Sci

Overseer Files and Report Reviewed By:

Monique Topham, FarmWise Consultant

B.Agr.Sci

11th February 2019

Table of Contents

1.0 Background

South Dairies operate 3 adjoining properties in the Lochiel area of Central Southland:

- South Dairy 1
- South Dairy 2
- Neighbouring 7 ha support.

Both dairy platforms have existing consents in place and the adjacent support land is currently used for intensive winter grazing.

It is intended to apply for a global consent across the adjoining properties to

- Create good environmental outcomes
- Flexibility in the way the farms operate
- Make use of infrastructure to support good animal welfare
- Ensure long term sustainability for staff on farm

The purpose of this report is to model the existing environment using Overseer. Following feedback on this report from Environment Southland modelling for the consenting process can commence to be able to compare estimated current and existing nutrient losses in the forth coming consent application.

2.0 Desired Outcome of Report

Evaluation from Environment Southland (ES) of the Overseer modelling methodology provided in this report.

3.0 Modelling Method Assumptions

3.1 South Dairy 1

South Dairy 1 was granted a new consent in 2018. It has been advised by ES (refer email trail in Appendix 2) that it is appropriate to model consented cow numbers given the expansion consent was granted so recently and the effects of additional cows were considered and accepted through a public hearing process.

3.2 South Dairy 2

Actual cow numbers are to be modelled for South Dairy 2. Note there is no difference between actual and consented cow numbers.

3.3 Neighbouring 7 ha Support

This property was purchased in January 2018 The applicant has operated this as an intensive wintering grazing block since purchase. The previous owned farmed sheep on this block. Records are not available from the previous land owner.

We have been advised by ES to model as per the land use since purchase (records available), refer email trail in Appendix 2

4.0 Overseer Version and Standards

4.1 Overseer Version

Overseer version 6.3.0 has been used for the modelling.

Note: previous modelling for South Dairy 1 (completed in 2017 and early 2018) was utilising Overseer version 6.2.3. There is likely to be a significant difference between outputs in the versions. I do not have Overseer 6.2.3 available so therefore can not run the files through the old version for comparison.

The files have been prepared using the Overseer legacy version which will not be available after June 2019. The files can be transferred to OverseerFM should it be required at a later date. Note - OverseerFM involves a change of interface rather than change of version (therefore will not change modelling results).

4.2 Overseer Standards

Overseer Best Practice Data Input Standards have been followed. There have been no "work arounds" required in the modelling.

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 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 a Central Southland monitor farm show MEs of 11.5 to 12.5 (reference: Pasture growth and quality on Southland and Otago dairy farms, D. E. Dalley and T. Geddes, DairyNZ, NZ Grasslands Publication 2012).

For example overwriting the default pasture quality calculations to the Central Southland data in Overseer would reduce the pasture grown from 17.4 t DM / ha / year to 15.7 t DM / ha / year. This is more consistent with farm systems calculations completed outside Overseer.

The Overseer has been left at default values 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.*"

Going forward, the "proposed" farm system will also be modelled utilising Overseer default pasture quality values. This is important and will ensure that comparisons between the two farm systems are valid.

5.0 Overseer™ Assumptions

- 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 - Overseer™ assumes the property is managed is line with accepted industry good management practice.

6.0 Overseer™ Limitations

Key limitations of the Overseer™ model are:

- Overseer™ 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.
- Overseer™ does not calculate outcomes from extreme events (floods and droughts), but provides a typical years result based on a long-term average.
- 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
- Overseer™ does not represent all farm systems in New Zealand
- Components of Overseer™ have not been calibrated against measured data from every combination of farm systems and environment

7.0 South Dairies 1 Overseer Modelling

7.1 South Dairies 1 - Previous Consenting Process

During the previous consenting process (completed in 2018) several Overseer xlm files were provided to Environment Southland (ES).

On the 12th of December 2018, Alex Erceg (ES Consenting Officer) provided all relevant Overseer files to LandPro.

An analysis of all Overseer files was completed and the following file most closely resembles consent conditions issued "NB 2016-17 Consent DSN 31827 (copy) – UPDATED". This file was prepared by Mark Crawford (Ravensdown, CNMA) and has been run without any alterations in Overseer version 6.3.0.

Summary of Results:

	NB 2016-17 Consent DSN 31827 (copy) – UPDATED ***Version 6.3.0***
Total Farm N Loss	15287 kg
N Loss/ha	61
N Concentration in Drainage	Pastoral – 10.5 to 13.4 ppm Crop – 26.1 ppm
Total Farm P Loss	340 kg
Average P loss/ha	1.4 kg/ha/yr
Pasture Grown T DM / ha / year	16.9

Table 1: Summary of Results ***NB 2016-17 Consent DSN 31827 (copy) – UPDATED,*** *Overseer v6.3.0*

For the Overseer reports (nutrient budget, nitrogen and phosphorus reports) refer Appendix 3.

7.2 South Dairies 1 – Modelled to Consent Conditions

(Overseer file: SD1 Consent Conditions AUTH-20171302- 01/04)

As per advice received from ES, South Dairy 1 was remodelled as per consent conditions. The consent conditions from the previous hearing decision (April 2018) varied from the original Overseeer modelling provided in the application process. The consent holder is legally required to adhere to the conditions detailed in their consent.

Summary of all consent conditions that are able to be reflected in a nutrient budget:

Discharge permit (AUTH-20171302-01)

- Milking of up to 750 cows twice per day
- Effluent discharge area of 183 ha
- Applications of effluent via travelling irrigator (10 mm depth), slurry tanker and umbilical system (5mm depth)
- Nitrogen loading from effluent not to exceed 150 kg N / ha / year
- Discharge of feed pad effluent
  - 400 cows 1 May to 31 May and 1 Sept to 30 Sept
  - 600 cows 1 August to 31 August

Land Use Consent (AUTH-20171302-04)

- 252 ha of land
- Milking of up to 750 cows twice per day
- All cows wintered off the property
- Discharge area of no more than 183 ha
- Good management practices
- 12 ha of fodder beet
- Long term annual (rolling 3 years) average nitrogen application not to exceed 186 kg N / ha / year
- Long term annual (rolling 3 years) average phosphorus application not to exceed 35 kg P / ha / year

Summary of Results:

	SD1 Consent Conditions AUTH-20171302-01/04
Total Farm N Loss	14333 kg
N Loss/ha	58
N Concentration in Drainage	Pastoral – 11.0 to 14.6 ppm Crop – 15.9 ppm
Total Farm P Loss	338 kg
Average P loss/ha	1.4 kg/ha/yr
Pasture Grown Kg DM / ha / year	17.5

Table 2: Summary of Results ***SD1 Consent Conditions AUTH-20171302- 01/04***

For modelling inputs and assumptions refer Appendix 3.

For the Overseer reports (nutrient budget, nitrogen and phosphorus reports) refer Appendix 3.

7.3 South Dairies 1 - Summary of differences

Key differences between the original consented South Dairies 1 Overseer file and the South Dairies consented file are provided in the table below.

Description	NB 2016-17 Consent DSN 31827 (copy) – UPDATED	SD1 Consent Conditions AUTH-20171302- 01/04	Comments
Area	Effective area of 244.0 ha Total area of 249.2	Effective area of 238.1 ha Total area of 248.5	Evidence for change- CTs and lease agreement Note Consent AUTH-20171302-04 references 252 ha
Topography	All flat	Two small areas of rolling land identified (less than 10 ha)	
Soils		Minor differences to soil areas	Soils based on areas provided by LandPro soil mapping (refer appendices)
Soil tests	Actuals	Long term status quo	Predictive long term nutrient budget rather than actual
Drainage	103 ha tiled	230 ha tiled	Evidence for change – tile map provided by South Dairies Ltd
Animals	Cow weight 500 kg Drying off 25th May No bulls included for mating No replacement calves included	Cow weight – default Drying off – 31st May 15 bulls (Dec / Jan) 197 calves September to mid Dec until weaning	No cow weights available therefore used default Drying off date to reflect consent Addition of bulls to reflect standard farm practice Addition of calves to reflect standard farm practice
Structures / Effluent	Farm Dairy Effluent Solids separated Liquid applied October to March at a low rate(121 ha)	Farm Dairy Effluent Solids separated Liquid applied Aug to may at less than 12mm depth (183 ha) Solids applied Jan (to all pastoral block)	Reflect consent conditions and practice

Description	NB 2016-17 Consent DSN 31827 (copy) – UPDATED	SD1 Consent Conditions AUTH-20171302- 01/04	Comments
	Solids applied Dec and Jan (to all pastoral block) Wintering pad April 15% cows 16 hrs May 30% cows for 16 hrs July 100% cows 4 hours August 60% cows 16 hours Sept 30% cows 16 hours October 5% cows 16 hours Liquid to farm dairy effluent Solids applied Nov (to all pastoral blocks)	Feedpad May – 67% (400 cows) for 2 hours per day August – 95% (600 cows) for 1.5 hours per day September – 51% (400 cows) for 1 hour per day Liquid to farm dairy effluent Solids applied Jan (to all pastoral blocks)	
Supplement	Imported 330 t DM in silage (fed on winter pad) 100 t DM in PKE (fed on winter pad) 100 t DM in Brewers grain (fed on winter pad) 80 t DM in baleage (ex storage, fed on winter pad) Made 92 t DM baleage to storage	Imported 430 t DM in silage (fed on feed pad) 100 t DM in PKE (fed on feed pad)	Based on average feed required compared with expected pasture growth rate
Fertiliser and Nitrogen	Average of 35 kg P / ha over whole farm 174 kg / ha on effluent areas (split Aug to May) 210 to 238 kg N / ha to non effluent areas (split Aug to May) Average over whole farm – 186 kg N / ha	Averages 25 kg P /ha 187 kg / ha on effluent areas (split Aug to April) 231 kg N / ha to non effluent areas (split Aug to April) Average over whole farm – 184 kg N / ha	Phosphate fertiliser applied to maintain soil fertility at Olsen P of 35 Nitrogen fertiliser applied to maintain pasture production (with in consent conditions)
Irrigation		None	

Table 3 – Summary of differences between original application Overseer file and Overseer modelled to consent conditions

<u>Summary of Results:</u>

	NB 2016-17 Consent DSN 31827 (copy) – UPDATED *Version 6.3.0*	**SD1 Consent Conditions AUTH-20171302- 01/04**
Total Farm N Loss	15287 kg	14333 kg
N Loss/ha	61	58
N Concentration in Drainage	Pastoral – 10.5 to 13.4 ppm Crop – 26.1 ppm	Pastoral – 11.0 to 14.6 ppm Crop – 15.9 ppm
Total Farm P Loss	340 kg	338 kg
Average P loss/ha	1.4 kg/ha/yr	1.4 kg/ha/yr
Pasture Grown Kg DM / ha / year	16.9	17.5

Table 4: Summary of Results of **NB 2016-17 Consent DSN 31827 (copy) – UPDATED *Version 6.3.0*** *compared with* ***SD1 Consent Conditions AUTH-20171302- 01/04***

8.0 South Dairies 2 Modelling

South Dairies 2 operates at its current consent conditions. A variation to the consent is currently being process (APP-20147281-01-v1) which will improve the effluent system (significantly increased effluent storage, reduced application depth and more even distribution of effluent across the effluent area). The nutrient budgets have been prepared to reflect the improved practice in the current application under processing.

Summary of key consent conditions required to reflected in nutrient budget (Overseer file: SD2 APP-20147281-01-v1):

- Milking up to 500 cows twice per day
- Discharge area of 105.4 ha
- All applications less than 12mm depth
- Nitrogen loading from effluent not to exceed 150 kg N / ha / year
- Discharge of effluent from a wintering shed that is used between 15 May and 7 August

Summary of Results:

	SD2 APP-20147281-01-v1
Total Farm N Loss	10414 kg
N Loss/ha	58
N Concentration in Drainage	Pastoral – 9.5 to 13.1 ppm
Total Farm P Loss	230 kg
Average P loss/ha	1.3 kg/ha/yr
Pasture Grown Kg DM / ha / year	16.7

Table 5: Summary of Results ***SD1 Consent Conditions AUTH-20171302- 01/04***

For modelling inputs and assumptions refer Appendix 3.

For the Overseer reports (nutrient budget, nitrogen and phosphorus reports) refer Appendix 3.

9.0 Neighbouring 7 ha Support Block Modelling

This property operates as an intensive winter grazing block, winter grazing (pasture and baleage) 200 cows.

Summary of Results:

	Neighbouring 7 ha Support
Total Farm N Loss	218 kg
N Loss/ha	29
N Concentration in Drainage	Pastoral – 7.1 to 7.6 ppm
Total Farm P Loss	5 kg
Average P loss/ha	0.6 kg/ha/yr
Pasture Grown Kg DM / ha / year	14.6

Table 6: Summary of Results ***Neighbouring 7 ha Support Block***

For modelling inputs and assumptions refer Appendix 3.

For the Overseer reports (nutrient budget, nitrogen and phosphorus reports) refer Appendix 3.

10.0 Summary

The combined nutrient loss estimated by Overseer from the 3 properties is summarised as follows:

	SD1 Consent Conditions AUTH-20171302-01/04	SD2 APP-20147281-01-v1	Neighbouring 7 ha Support	Combined Total (435.8 ha)
Total Farm N Loss	14333 kg	10414 kg	218 kg	24965 kg
N Loss/ha/yr	58 kg	58 kg	29 kg	57 kg
Total Farm P Loss	338 kg	230 kg	5 kg	573
Average P loss/ha/yr	1.4 kg	1.3 kg	0.6 kg	1.3 kg

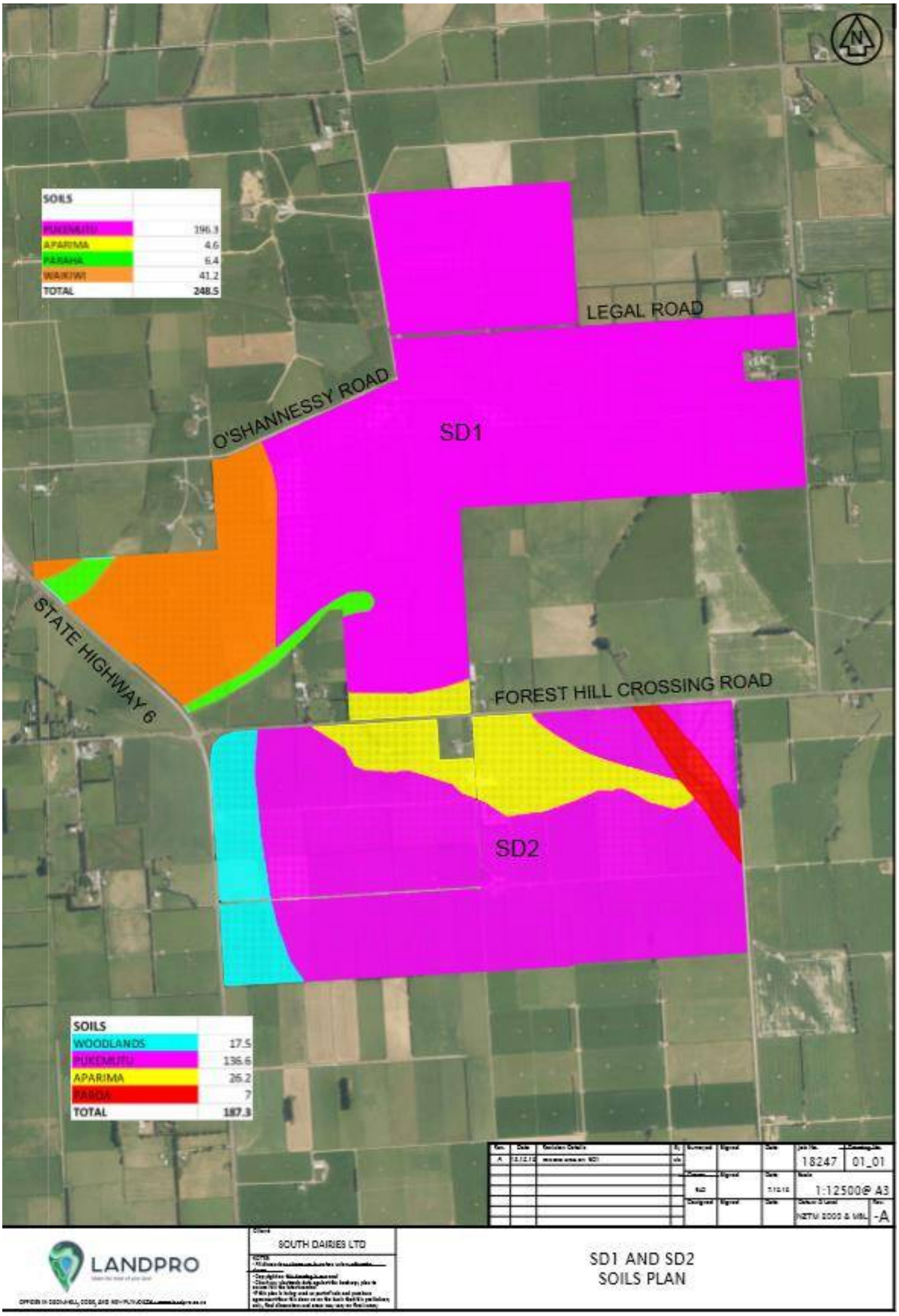
Table 7: Summary of South Dairies Modelling results

Appendices

Appendix 1:

Soils map of South Dairy 1, South Dairy 2 and Adjoining 7 ha support

Tile maps of South Dairy 1, South Dairy 2 and Adjoining 7 ha support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PUKEMUTU 196.3
APARIMA 4.6
PARAHA 6.4
WAIKIWI 41.2
TOTAL 248.5
LEGAL ROAD
O'SHANNESSY ROAD
SD1
STATE HIGHWAY 6
FOREST HILL CROSSING ROAD
SD2
SOILS
WOODLANDS 17.5
PUKEMUTU 136.6
APARIMA 26.2
PAROA 7
TOTAL 187.3
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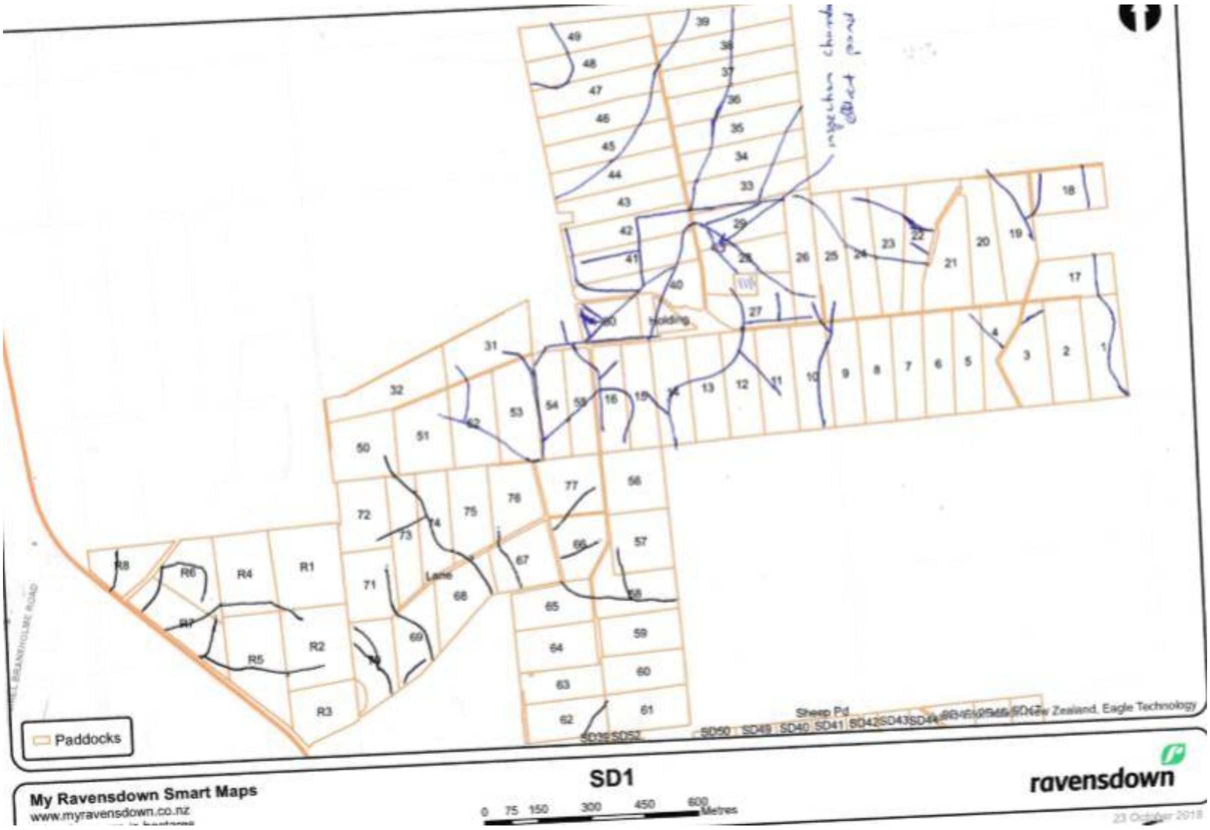
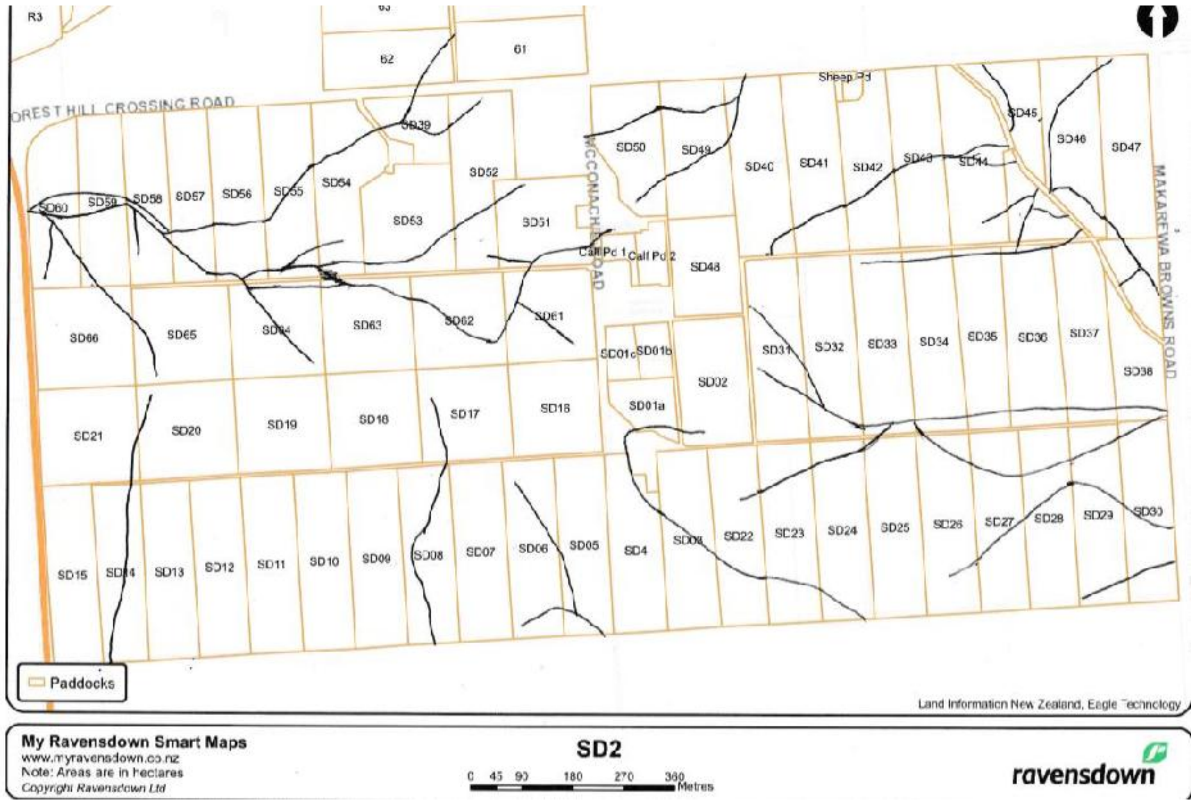
NZTM 2000 & MSL
-A
LANDPRO
SOUTH DAIRIES LTD
SD1 AND SD2
SOILS PLAN



SD1 Tile Map



SD2 Tile Map

Appendix 2:

Emails and file notes in date order (**from most recent**)

From: Aurora Grant <Aurora.Grant@es.govt.nz>
Sent: Wednesday, 16 January 2019 8:01 AM
To: Tanya Copeland <tanya@landpro.co.nz>
Cc: Joanna Gilroy <Joanna.Gilroy@es.govt.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>
Subject: RE: South Dairies Limited - modelling approach confirmation

Thanks Tanya, she's kept me up to speed with that one. No concerns with me using that approach.

Cheers,

Aurora

Aurora Grant
Acting Manager - Consents Division
Environment Southland *Te Taiao Tonga*

P 03 211 5115
Cnr Price St & North Rd, Private Bag 90116, Invercargill 9840
Aurora.Grant@es.govt.nz | www.es.govt.nz | facebook.com/environmentsouthland

From: Tanya Copeland <tanya@landpro.co.nz>
Sent: Wednesday, 16 January 2019 7:07 AM
To: Aurora Grant <Aurora.Grant@es.govt.nz>
Cc: Joanna Gilroy <Joanna.Gilroy@es.govt.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>
Subject: South Dairies Limited - modelling approach confirmation

Hi Aurora,

I have just realised that you were mistakenly not cc'd into the emails below which was sent to Jo and Alex only.

In light of Jo leaving ES soon (sadly) we wanted to make sure that you were also aware of the email I sent on 21st December and to ensure that you will continue to be happy with this approach as agreed going forward.

Thanks

Tanya

From: Joanna Gilroy <Joanna.Gilroy@es.govt.nz>
Sent: Friday, 21 December 2018 12:50 PM
To: Tanya Copeland <tanya@landpro.co.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>
Cc: Miranda Hunter <miranda.hunter@xtra.co.nz>
Subject: RE: South Dairies Limited

Hi Tanya,

Yes to both questions as outlined below.

Kind regards,

Joanna

Joanna Gilroy
Team Leader Consents
Environment Southland *Te Taiao Tonga*

P 03 211 5115
Cnr Price St & North Rd, Private Bag 90116, Invercargill 9840
Joanna.Gilroy@es.govt.nz | www.es.govt.nz | facebook.com/environmentsouthland

From: Tanya Copeland [mailto:tanya@landpro.co.nz]
Sent: Friday, 21 December 2018 9:15 AM
To: Alex Erceg <Alexander.Erceg@es.govt.nz>
Cc: Joanna Gilroy <Joanna.Gilroy@es.govt.nz>; Miranda Hunter <miranda.hunter@xtra.co.nz>
Subject: FW: South Dairies Limited

Hi Alex,

Please see attached email below from Miranda who is doing the nutrient modelling for the South Dairy application which we hope to lodge in the new year.

Miranda raises a couple of points which we would like to highlight to you, and get your written confirmation on.

We need to ensure that we get the baseline file correct for this application. We are constructing our baseline file based on the latest Overseer base file provided for the April 2018 hearing for South Dairy 1 because this forms the consented environment. In Mirandas investigations, she has found that the final Overseer file provided for the hearing differs in a minor way to what has been approved in the consent conditions. My assertion is that the consent conditions are the most legally binding and trump any discrepancies in the Overseer budget and that our baseline model should match the consent conditions. Can you please confirm if this is the correct approach.

Miranda has proposed a modelling method for the new 7ha block which includes modelling the farm system since the applicants purchased it. Can you confirm you are happy with this.

We are still on track for providing you the basefile and modelling method in mid January as we wish for this to be reviewed before we proceed to modelling the proposal.

Thanks

Tanya

From: Miranda Hunter <miranda.hunter@xtra.co.nz>
Sent: Thursday, 20 December 2018 2:35 PM
To: Tanya Copeland <tanya@landpro.co.nz>
Subject: South Dairies Limited

Hi Tanya

Have gone through the discharge and land use consents issued for South Dairies in April 2018. Consent conditions that are relevant to Overseer modelling are:

750 cows peaked milked

183 ha effluent area (252 ha total area)

Feed pad used for 400 cows 1st May to 31st May

Feed pad used for 600 cows 1st August to 31st August

Feed pad used for 400 cows 1st September to 30th September

Low rate effluent application

12 ha of fodderbeet

186 kg N / ha maximum

35 kg / ha maximum

Have been through the Overseer xlm files provided by Alex and the attached xlm file named *Ovr-NB 2016-17 DSN 31827 (copy) – Updated*, most closely reflects the consent conditions.

Can you please confirm with Alex that he is happy to accept that as the base file and I will rerun in the most recent version of Overseer.

Adjacent 7 ha – on the attached file note prepared for the meeting held with ES in November, the following comments have been made:

Farm systems background

SD adjacent block (7ha) – this property was purchased in January 2018 The applicant has operated this as an intensive wintering grazing block since purchase, Prior land use was a calf grazing block and selling supplement. Records are not available from the previous land owner.

Suggested modelling method for baseline (current)

SD 7 ha – model as per the land use since purchase (records available)

Can you please confirm with Alex that he is happy with the suggested modelling method for the 7 ha (as I want to get into that early in the New Year).

Please just contact me should there be any questions / further clarification required

Thanks (and have a great Christmas!)

Miranda

Miranda Hunter

B.Agr.Sc

0274 341 140

CNMA
Certified Nutrient Management Adviser

37G Young Lane, Clyde

R D 1, Alexandra 9391

ROSLIN CONSULTANCY

File Note

Client South Dairies (SD) Limited

Date 14th November 2018

File Note Background

The applicant operates 2 adjacent dairy farms (SD1 and SD2) in the Lochiel area. The applicant also owns an adjoining 7 ha parcel of land (SD 7 ha). To make the best use of the infrastructure on the dairy farms it is intended to apply for a global dairy consent. During this process it is intended to incorporate the adjoining 7 ha of land. It is not intended to increase cow numbers above currently consented cow numbers.

The applicant has had an on site meeting with ES Consenting staff to gain advice on approach for constructing the application (refer email trail in appendices).

Purpose of File Note

The purpose of this file note is to clearly articulate a suggested methodology for construction of the nutrient budgets. The author would appreciate feedback / advice from ES as to the appropriateness of this methodology (and if this methodology should be amended) to ensure that there is confidence in the robustness of the modelling methodology.

Note – the Best practice Data Input Standards will be followed for the modelling. The clarity required is around farm systems assumptions used in the Overseer modelling.

Farm System Background

SD1- the applicant obtained a consent for expanded dairying in April 2018, currently building stock numbers to enable operating to consent conditions

SD2 – the applicant purchased this property in 2016, currently operating at cow numbers as per consent conditions

SD adjacent block (7ha) – this property was purchased in January 2018 The applicant has operated this as an intensive wintering grazing block since purchase, Prior land use was a calf grazing block and selling supplement. Records are not available from the previous land owner.

Draft Proposed Modelling Method

Current (the existing environment)

Suggested modelling method, model 3 separate nutrient budgets

SD1 – model as per consent conditions (as the consent was issued in April 2018 and the effects of the consent were considered and accepted during that process)

Use Overseer information provided in consenting process

Rerun under consented Overseer version 6.3.0 (was constructed under 6.2.3), ES to provide the xlm file from their records. Provide ES with the output reports from version 6.3.0. Please note that results have changed significantly between versions.

Complete a new Overseer file based on consent conditions issued April 2018 (explain any changes from the original consented Overseer file if applicable, including new Overseer protocols)

Submit the above (rerun original file and new file) to ES for comment and review – appreciate feedback as it is critical to get the existing environment correct

SD2 – model as per as per consent conditions (currently peak milking consented cow numbers)

SD 7 ha – model as per the land use since purchase (records available)

Proposed

To reflect the integrated nature of the property it is suggested to model as 1 nutrient budget (as will operate under 1 new consent).

Out of Scope of Overseer Modelling

Run off and support blocks (both owned and leased). There however will need to be an assessment of effects included in the application (including how they are operated)

File note completed by

Miranda Hunter, CNMA

Roslin consultancy Limited

14th Nov 2018

Hi Dean,

Thanks for meeting with us yesterday and showing us around your farms, it was good to get a visual idea of what your proposal will be and to discuss options.

I have added a few points of clarification/ technicalities to your summary below in blue. If you need clarification on anything please let me know.

Kind regards,

Aurora

Aurora Grant
Team Leader - Consents
Environment Southland *Te Taiao Tonga*

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From: alexander.farms01@gmail.com <alexander.farms01@gmail.com>
Sent: Tuesday, 9 October 2018 10:27 PM
To: Miranda Hunter <miranda.hunter@xtra.co.nz>; Tanya Copeland <tanya@landpro.co.nz>
Cc: Aurora Grant <Aurora.Grant@es.govt.nz>; Michael Durand <Michael.Durand@es.govt.nz>
Subject: ES Meeting

Hi Tanya and Miranda

We had a very constructive meeting with Aurora and Michael from ES today. Following is a summary of the main points covered and agreed for our proposed application if we go for a global consent over the 2 dairy platforms:

We will activate rule 20 (a) 3 due to the cow numbers increasing beyond those in the existing effluent discharge consent of SD2. Therefore we are no longer a permitted activity and will require a new consent application

Application will be for a global consent for 1250 cows over the 2 existing milking platforms, therefore no increase on the total consented cow numbers

Global nutrient budgets are to be prepared for the milking platforms showing the effect of the change from 2 existing to 1 new consent. We discussed that it would be an administration exercise to separate out the two in future if you wanted to sell one farm, but it is simpler to do a global consent for this proposal as overall there are no additional cows (accepting that the new land use for expansion on SD1 makes up part of the existing environment) being added to the system if a global consent is applied for– if the two were kept as two separate applications then SD2 would technically be increasing in both cow numbers and land, and this application would need to be assessed separately without considering the effects of the decreasing cow numbers on SD1.

Consented cow numbers are to be used for both existing and proposed budgets with it being accepted that we have not had time to activate the new 750 cow consent that was issued April 2018. This is a different approach than what has been taken with other recent expansions, however we consider it would be unreasonable to base budgets on actual numbers in this instance given the expansion consent was granted so recently and the effects of additional cows were considered and accepted through a public hearing process. We are also open to accepting this approach since there will technically be no additional cows being added to the system over the two properties above what is already allowed by a current expansion consent. This approach will however tip you into Rule 20e – which makes it a discretionary activity. We discussed that there was little difference between 20d and 20e and you would not be disadvantaged by being tipped into this category.

Runoff/support blocks of land do not need to be nutrient budgeted due to there being no expected change in the farming practice of these blocks. We will however need a thorough assessment of the effects from these blocks. Again, we recognise this is different to what is currently being applied to some expansions, but please refer to the above explanation on why we are happy to take a different approach with your proposal.

The runoff/support blocks are to be included in the application with detailed description of how they are to be operated and the effects of this operation. This description can be at a total block level and does not need to be at a level of the specific activity of each individual block to allow for the differing activities that may be done on different blocks in any year. This will need to be clearly explained – e.g. year 1 winter grazing occurs at x block, year 2 no wintering occurs on x block but occurs on y block. This description is to be done at activity levels on these blocks for the consented cow number of 1250 cows.

It is expected that if a runoff/support block changes during the term of the consent then a variation to the consent would likely be required showing the effect of the change. This would be done by nutrient budgeting the block that is being removed against the new activity that is being proposed at that time. We discussed lease blocks and how to be flexible and allow an option for these to be relocated to a different piece of land in the future. As it currently stands you would need to get a new consent to use a different lease block in future. Council is exploring possible consent conditions relating to this at present and looking at ways to allow lease blocks to be “swapped” in future if necessary as described in your point.

All required consents including discharge and water consents are likely to be global consents over the two milking platforms.

Due to us seeking a new consent we would include the 7 ha of new land into the proposed milking area. It was suggested that description be given that if this land was not included and therefore not form part of the milking block then it is likely that it may end up being extensively wintered on which would have detrimental effects.

It was agreed that we should proceed with the application for all the required consents. It was suggested to lodge the effluent discharge consent application ASAP with the other applications to follow in due course once they have been completed. This will help to ensure that we can get our effluent pond and effluent system upgrade done in the early new year when conditions are at their best. Slight correction here - It was suggested you lodge the land use consent for the pond construction on SD2 ASAP and then the application for the expansion, water and discharge consents as these may take longer to process.

We also discussed that we are not able to pre-determine the outcome for your proposal and made you aware that there is always the possibility of it being publically notified and a decision being made by an independent commissioner as happened with SD2.

Aurora and Michael requested that they would like to meet with us once we have completed our application before lodging it so any issues that may exist can be identified.

As you are all aware I am meeting with family later this week to discuss the proposed strategic direction for South Dairy. This proposed scenario is one of the options being considered and is going to require significant capital investment. The other main option is to continue with the existing consents that we have and farm 750 cows on SD1 and 500 on SD2.   The information gathered at todays meeting will allow us to have a fully informed debate and decision making on this direction.

It would be appreciated if Aurora and Michael can add comment to this summary of points and that they agree this covers off the detail of today’s meeting. Feel free to add any points that I may have missed.

Thanks

Dean Alexander

Appendix 3:

Overseer Reports from File NB 2016-17 Consent DSN 31827 (copy) – UPDATED

Modelling Assumptions for SD1 Consent Conditions AUTH-20171302- 01/04

Overseer Reports from File SD1 Consent Conditions AUTH-20171302- 01/04

Modelling Assumptions for SD2 APP-20147281-01-v1

Overseer Reports from File SD2 APP-20147281-01-v1

Modelling Assumptions for Neighbouring 7 ha Support Block

Overseer Reports from File Neighbouring 7 ha Support Block

Overseer Reports from File NB 2016-17 Consent DSN 31827 (copy) – UPDATED, v6.3.0

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	186	35	13	52	233	0	0
Rain/clover N fixation	98	0	3	5	3	7	34
Irrigation	0	0	0	0	0	0	0
Supplements	62	8	38	6	8	4	3
Nutrients removed							
As products	96	16	23	5	21	2	7
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	102	0	0	0	0	0	0
To water	61	1.4	15	75	76	6	22
Change in farm pools							
Plant Material	-5	-1	-6	0	-1	-1	0
Organic pool	88	15	-22	-18	-1	-1	-7
Inorganic mineral	0	1	-19	0	-2	-3	-4
Inorganic soil pool	4	10	63	0	151	8	19

Table 8: Nutrient Budget ***NB 2016-17 Consent DSN 31827 (copy) – UPDATED****, Overseer v6.3.0*

Block name	Total N lost kg N/yr	N lost to water kg N/ha/yr	N in drainage * ppm	N surplus kg N/ha/yr	Added N ** kg N/ha/yr
Puke_6a.1 Effluent	2,124	60	**13.3**	284	339
Puke_6a.1 Effluent Tile	4,735	59	**13.1**	280	339
Puke_6a.1 Effluent Solid Lease	2,007	53	**11.9**	241	298
Puke_6a.1 Effluent SolidTile	990	54	**12.0**	241	298
Puke_6a.1Effluent Solid	630	53	**11.9**	241	298
Riparian Areas	4	3	N/A		
Waiki_30a.1 Eff Solids	866	51	**11.6**	245	326
Waiki_30a.1 Run Off	1,031	46	10.5	228	298
Parah_4a.1 Eff solids	162	62	**13.4**	247	298
Parah_4a.1 Run Off	175	62	**13.4**	247	298
Apar_2a.1 Eff solids Lease	221	51	**11.7**	238	298
Fodder Beet	1,719	143	**26.1**	-336	112
Other sources	624				
Whole farm	15,287	61			
Less N removed in wetland	0				
Farm output	15,287	61			

*Table 9: Nitrogen Report **NB 2016-17 Consent DSN 31827 (copy) – UPDATED**, Overseer v6.3.0*

Block name	Total P lost kg P/yr	P lost to water kg P/ha/yr	P loss categories		
			Soil	Fertiliser	Effluent
Puke_6a.1 Effluent	36	1.0	Medium	Medium	Low
Puke_6a.1 Effluent Tile	82	1.0	Medium	Low	Low
Puke_6a.1 Effluent Solid Lease	33	0.9	Medium	Medium	Low
Puke_6a.1 Effluent SolidTile	18	1.0	Medium	Medium	Low
Puke_6a.1Effluent Solid	12	1.0	Medium	Medium	Low
Riparian Areas	0	0.1	N/A	N/A	N/A
Waiki_30a.1 Eff Solids	3	0.2	Low	Low	Low
Waiki_30a.1 Run Off	4	0.2	Low	Low	Low
Parah_4a.1 Eff solids	2	0.7	Low	Medium	Low
Parah_4a.1 Run Off	2	0.6	Low	Medium	Low
Apar_2a.1 Eff solids Lease	1	0.2	Low	Low	Low
Fodder Beet	16	1.4	N/A	N/A	N/A
Other sources	131				
Whole farm	340	1.4			

*Table 10: Phosphorus Report **NB 2016-17 Consent DSN 31827 (copy) – UPDATED**, Overseer v6.3.0*

Modelling Assumptions for SD1 Consent Conditions AUTH-20171302- 01/04

Modelling Inputs

To construct the nutrient budgets the following assumptions have been made;

Blocks

The farm has been split into the following pastoral and crop blocks:

Block Name	SD1 Consent Conditions AUTH-20171302- 01/04	Contour	Drainage
Pukem_6a.1 Effluent	147.0	Flat	100% tile
Pukem_6a.1 Rolling Effluent	6.0	Rolling	None
Pukem_6a.1 Non Effluent	35.3	Flat	100% tile
Waiki_30a.1 Effluent	27.0	Flat	100% tile
Waiki_30a.1 Non Effluent	11.1	Flat	100% tile
Waiki_30a.1 Rolling Effluent	2.0	Rolling	None
Parah_4a.1 Non Effluent	5.2	Flat	100% tile
Apar_2a.1 Effluent	1.0	Flat	100% tile
Apar_2a.1 Non Effluent	3.5	Flat	100% tile
Effective Farm Area	**238.1**		
Riparian	1.2		
Non productive	9.2		
Total Farm Area	**248.5**		
Fodderbeet (rotating thru all blocks)	**12.0**		

Climate Data

- Climate data from Overseer Climate Station Tool
- 10.1 degrees Celsius has been used as the mean annual temperature
- 1096 mm of rainfall
- 712 mm mean annual PET

Soils

- Soils areas were obtained from soils mapping provided by LandPro (refer appendices)
- Soil settings were obtained from SMap for all soil types
- Drainage – as per map in Appendix 1

Soil Tests

- All paddock soil testing is undertaken (Olsen P currently in the range of 27 to 38). Milk production at 1478 kg ms / ha and 469 kg ms / cow is above Southland average. Southland average is 1093 kg ms / ha and 414 kg ms / cow (source: NZ Dairy Statistics 2017-18). At a high milksolids production an Olsen P of 30 to 40 is justified if the response to pasture production is obtained and the appropriate management system is used to convert the extra pasture to milk solids (Source: Fertiliser Use on NZ Dairy Farms, Fert Research).
- Therefore a long term average status quo Olsen P of 35 has been assumed

Drainage

- Locations of the drains were provide by South Dairies Limited (refer Appendices)

Farm System

Description	SD1 Consent Conditions AUTH-20171302- 01/04
Crops	12 ha fodderbeet, yield 25 t DM / ha / year Conventional cultivation in November 250 kg CM15 per ha at sowing 100 kg urea in Dec Lifted in August, stored and fed on feed pad
Animals	352,000 kg ms Median calving date – 24th August Drying off – 31st May Mature Cows Breed - Kiwi Cross July 32 Aug 630 Sept 780 Oct 760 Nov 750 Dec 750 Jan 700 Feb 700 March 700 April 650 May 600 June 0 22 bulls (Dec / Jan) Replacements 197 calves August to mid Dec
Structures / Effluent	Farm Dairy Effluent Solids separated Liquid applied Aug to May at less than 12mm depth (183 ha) Solids applied Jan (to all pastoral block) Feedpad May – 67% (400 cows) for 2 hours per day August – 95% (600 cows) for 1.5 hours per day September – 51% (400 cows) for 1 hour per day Liquid to farm dairy effluent Solids applied Jan (to all pastoral blocks)
Supplement	Imported 430 t DM in silage (fed on feed pad) 100 t DM in PKE (fed on feed pad) Exported None

Description	SD1 Consent Conditions AUTH-20171302- 01/04
Fertiliser and Nitrogen	Phosphate fertiliser applied to all pastoral areas at maintenance 187 kg N / ha across effluent areas (split Aug to April) 231 kg N / ha across non effluent areas (split Aug to April) Average across whole farm area of 184 kg N / ha
Irrigation	None

Overseer Reports from File SD1 Consent Conditions AUTH-20171302- 01/04

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	184	25	1	29	66	0	0
Rain/clover N fixation	97	0	3	5	3	7	34
Irrigation	0	0	0	0	0	0	0
Supplements	61	7	49	6	9	4	3
Nutrients removed							
As products	96	16	23	5	21	2	7
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	101	0	0	0	0	0	0
To water	58	1.4	15	65	64	5	21
Change in farm pools							
Plant Material	-6	-1	-7	0	-1	-1	0
Organic pool	92	15	-10	-30	-1	-1	-1
Inorganic mineral	0	2	-18	0	-2	-3	-4
Inorganic soil pool	2	-1	48	0	-2	9	14

Table 11: Nutrient Budget ***SD1 Consent Conditions AUTH-20171302- 01/04***

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Puke_6a.1 Effluent	7,855	56	**12.4**	265	243
Puke_6a.1 Effluent Rolling	305	53	**12.0**	264	243
Puke_6a.1 Non Effluent	1,920	57	**12.8**	265	263
Waiki_30a.1 Effluent	1,236	48	11.0	258	243
Waiki_30a.1 Non Effluent	523	50	**11.4**	258	263
Waik_30a.1 Effluent Rolling	91	48	11.0	257	243
Parah_4a.1 Non Effluent	332	68	**14.6**	271	263
Fodder Beet	1,049	87	**15.9**	-336	112
Apar_2a.1 Effluent	48	54	**12.1**	261	243
Apar_2a.1 Non Effluent	182	55	**12.5**	261	263
Riparian Area	4	3	N/A		
Other sources	788				
Whole farm	14,333	58			
Less N removed in wetland	0				
Farm output	14,333	58			

Table 12: Nitrogen Report ***SD1 Consent Conditions AUTH-20171302- 01/04***

Block name	Total P lost	P lost to water	P loss categories		
	kg P/yr	kg P/ha/yr	Soil	Fertiliser	Effluent
Puke_6a.1 Effluent	121	0.9	Medium	Low	Low
Puke_6a.1 Effluent Rolling	18	3.1	High	High **	Low
Puke_6a.1 Non Effluent	29	0.9	Medium	Low	Low
Waiki_30a.1 Effluent	11	0.4	Low	Low	Low
Waiki_30a.1 Non Effluent	5	0.4	Low	Low	Low
Waik_30a.1 Effluent Rolling	1	0.6	Low	Low	Low
Parah_4a.1 Non Effluent	5	1.0	Medium	Low	Low
Fodder Beet	14	1.2	N/A	N/A	N/A
Apar_2a.1 Effluent	0	0.4	Low	Low	Low
Apar_2a.1 Non Effluent	1	0.4	Low	Low	Low
Riparian Area	0	0.1	N/A	N/A	N/A
Other sources	133				
Whole farm	338	1.4			

Table 13: Phosphorus Report ***SD1 Consent Conditions AUTH-20171302- 01/04***

Modelling Assumptions for SD2 APP-20147281-01-v1

Modelling Inputs

To construct the nutrient budgets the following assumptions have been made;

Blocks

The farm has been split into the following pastoral blocks:

Block Name	SD2 APP-20147281-01-v1	Contour	Drainage
Pukem_6a.1 Effluent	91.2	Flat	100% tiled
Pukem_6a.1 Non Effluent	38.6	Flat	100% tiled
Wood_29a.1 Effluent	3.5	Flat	100% tiled
Wood_29a.1 Non Effluent	13.2	Flat	100% tiled
Apar_2a.1 Effluent	10.7	Rolling	100% tiled
Apar_2a.1 Non Effluent	10.1	Rolling	100% tiled
Paro_4a.1 Non Effluent	6.5	Flat	100% tiled
Effective Farm Area	**173.8**		
Non productive	6.0		
Total Farm Area	**179.8**		

Climate Data

- Climate data from Overseer Climate Station Tool
- 10.1 degrees Celsius has been used as the mean annual temperature
- 1096 mm of rainfall
- 712 mm mean annual PET

Soils

- Soils areas were obtained from soils mapping provided by LandPro (refer appendices)
- Soil settings were obtained from SMap for all soil types
- Drainage – as per map in Appendix 1

Soil Tests

- All paddock soil testing is undertaken (Olsen P currently in the range of 24 to 48). Milk production at 1369 kg ms / ha and 476 kg ms / cow is above Southland average. Southland average is 1093 kg ms / ha and 414 kg ms / cow (source: NZ Dairy Statistics 2017-18). At a high milksolids production an Olsen P of 30 to 40 is justified if the response to pasture production is obtained and the appropriate management system is used to convert the extra pasture to milk solids (Source: Fertiliser Use on NZ Dairy Farms, Fert Research).
- Therefore a long term average status quo Olsen P of 35 has been assumed

Drainage

- Locations of the drains were provide by South Dairies Limited (refer Appendices)

Farm System

Description	SD2 APP-20147281-01-v1
Crops	None
Animals	238,000 kg ms Median calving date – 20th August Drying off – 29th May Mature Cows Breed - Kiwi Cross July 320 Aug 515 Sept 510 Oct 500 Nov 500 Dec 490 Jan 490 Feb 490 March 480 April 480 May 460 June 320 15 bulls (Dec / Jan) Replacements 130 calves August to mid Dec
Structures / Effluent	Farm Dairy Effluent Solids separated Liquid applied Aug to May at less than 12mm depth (105.4 ha) Solids applied Jan (to all pastoral block) Wintering Pad Covered June / July – 320 cows 24 hours August – 103 cows on average Liquid to farm dairy effluent Solids applied Feb(to all pastoral blocks)
Supplement	Imported 265 t DM in pasture silage (fed in winter pad) 210 t DM in pasture silage (on pasture blocks) 65 t DM in barley grain (fed in milking shed) 140 t DM in PKE (fed in milking shed) Exported None

Description	SD2 APP-20147281-01-v1
Fertiliser and Nitrogen	Phosphate fertiliser applied to all pastoral areas at maintenance 183kg N / ha across effluent areas (split Aug to April) 227 kg N / ha across non effluent areas (split Aug to April) Average across whole farm area of 194 kg N / ha
Irrigation	None
In shed feeding	100% of the herd – August to May

Overseer Reports from File SD2 APP-20147281-01-v1

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	194	24	0	34	89	0	0
Rain/clover N fixation	89	0	3	5	3	7	35
Irrigation	0	0	0	0	0	0	0
Supplements	92	11	69	9	12	7	4
Nutrients removed							
As products	93	16	22	5	21	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	105	0	0	0	0	0	0
To water	58	1.3	14	70	64	5	20
Change in farm pools							
Plant Material	0	0	0	0	0	0	0
Organic pool	119	16	0	-27	1	0	0
Inorganic mineral	0	2	-17	0	-2	-3	-4
Inorganic soil pool	0	1	52	0	21	10	16

*Table 14: Nutrient Budget **SD2 APP-20147281-01-v1***

Block name	Total N lost kg N/yr	N lost to water kg N/ha/yr	N in drainage * ppm	N surplus kg N/ha/yr	Added N ** kg N/ha/yr
Pukem_6a.1 Effluent	5,284	58	**12.7**	248	251
Pukem_6a.1 Non effluent	2,259	59	**13.1**	247	269
Wood_29a.1 Effluent	198	57	**12.7**	245	251
Wood_29a.1 Non effluent	764	58	**13.0**	244	269
Apar_2a.1 Effluent	596	56	**12.4**	244	251
Apar_2a.1 Non effluent	568	56	**12.8**	243	269
Paro_4a.1 Non effluent	265	41	9.5	236	269
Other sources	480				
Whole farm	10,414	58			
Less N removed in wetland	0				
Farm output	10,414	58			

Table 15: Nitrogen Report SD2 APP-20147281-01-v1

Block name	Total P lost kg P/yr	P lost to water kg P/ha/yr	P loss categories		
			Soil	Fertiliser	Effluent
Pukem_6a.1 Effluent	79	0.9	Medium	Low	Low
Pukem_6a.1 Non effluent	33	0.9	Medium	Low	Low
Wood_29a.1 Effluent	1	0.4	Low	Low	Low
Wood_29a.1 Non effluent	5	0.4	Low	Low	Low
Apar_2a.1 Effluent	8	0.8	Low	Low	Low
Apar_2a.1 Non effluent	8	0.8	Low	Low	Low
Paro_4a.1 Non effluent	4	0.6	Low	Low	Low
Other sources	91				
Whole farm	230	1.3			

Table 16: Phosphorus Report SD2 APP-20147281-01-v1

Modelling Assumptions for Neighbouring 7 ha Support Block

Modelling Inputs

To construct the nutrient budgets the following assumptions have been made;

Blocks

The farm has been split into the following pastoral blocks:

Block Name	Neighbouring 7 ha Support Block	Contour	Drainage
Pukem_6a.1	2.9	Flat	100% tile
Apar_2a.1	3.7	Flat	100% tile
Effective Farm Area	**6.6**		
Non productive	0.9		
Total Farm Area	**7.5**		

Climate Data

- Climate data from Overseer Climate Station Tool
- 10.1 degrees Celsius has been used as the mean annual temperature
- 1096 mm of rainfall
- 712 mm mean annual PET

Soils

- Soils areas were obtained from soils mapping provided by LandPro (refer appendices)
- Soil settings were obtained from SMap for all soil types

Drainage – as per map in Appendix 1

Soil Tests

- All paddock soil testing is undertaken (Olsen P currently in the range of 11 to 47).
- A long term average status quo Olsen P of 30 has been assumed to achieve pasture growth rates

Drainage

- Locations of the drains were provide by South Dairies Limited (refer Appendices)

Farm System

Description	Neighbouring 7 ha Support Block
Crops	None
Animals	Mature Cows Breed - Kiwi Cross July 200 June 200
Structures / Effluent	None
Supplement	Imported 30 t DM in pasture balege (on pasture blocks) Exported None
Fertiliser and Nitrogen	Phosphate fertiliser applied to all pastoral areas at maintenance 110 kg N / ha across pastoral areas (split Sept to April) Average across whole farm area of 97 kg N / ha
Irrigation	None

Overseer Reports from File Neighbouring 7 ha Support Block

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	97	7	0	9	45	0	0
Rain/clover N fixation	44	0	3	5	3	7	35
Irrigation	0	0	0	0	0	0	0
Supplements	56	11	70	8	18	6	5
Nutrients removed							
As products	0	0	0	0	0	0	0
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	27	0	0	0	0	0	0
To water	29	0.6	8	24	42	6	21
Change in farm pools							
Plant Material	0	0	0	0	0	0	0
Organic pool	142	15	26	-2	7	2	1
Inorganic mineral	0	2	-14	0	-2	-3	-3
Inorganic soil pool	0	0	53	0	19	8	20

Table 17: Nutrient Budget ***Neighbouring 7 ha Support Block***

Block name	Total N lost kg N/yr	N lost to water kg N/ha/yr	N in drainage * ppm	N surplus kg N/ha/yr	Added N ** kg N/ha/yr
Pukem_6a.1 Non effluent	98	34	7.6	201	110
Apar_2a.1 Non effluent	116	31	7.1	189	110
Other sources	4				
Whole farm	218	29			
Less N removed in wetland	0				
Farm output	218	29			

Table 18: Nitrogen Report ***Neighbouring 7 ha Support Block***

Block name	Total P lost kg P/yr	P lost to water kg P/ha/yr	P loss categories		
			Soil	Fertiliser	Effluent
Pukem_6a.1 Non effluent	2	0.7	Medium	Low	N/A
Apar_2a.1 Non effluent	1	0.4	Low	Low	N/A
Other sources	1				
Whole farm	5	0.6			

Table 19: Phosphorus Report ***Neighbouring 7 ha Support Block***

Roslin Consultancy Ltd

Overseer Modelling Report

Prepared as part of a consent application for expanded dairying

Report prepared for:

South Dairies Limited

C/o D & S Alexander

11 McConachie Road

RD1, Winton 9781

Legal Description

Sections 49, 51, 52, and 53 Block I Winton Hun, Road, Section 11 Block II Winton Hun, Lot 2 DP 377137, Part Sections 25, 26, 47, and 48 Block I Winton Hun, Sec 14 Block IX New River Hun, Sec 15 Block IX New River Hun, Sec 16 Block IX New River Hun, Sec 19 Block IX New River Hun, Sec 79 Block IX New River Hun, Sec 80 Block IX New River Hun, Sec 81 Block IX New River Hun, Part Sec 18 Block IX New River Hun, Lot 5 DP 363069, Lot 10 DP 363069

Report Prepared By:

Miranda Hunter, Roslin Consultancy Limited

miranda.hunter@xtra.co.nz 0274 341 140

B.Agr.Sci CNMA

Overseer Files and Report Reviewed By:

Mo Topham, AgriAce Consulting Limited

B.Agr.Sci CNMA

14th March 2019

1.0 Executive Summary

South Dairies operate 3 adjoining properties in the Lochiel area of Central Southland:

- South Dairy 1
- South Dairy 2
- Neighbouring 7 ha support

Both dairy platforms have existing consents in place and the adjacent support land is currently used for intensive wintering grazing.

It is intended to apply for a suite of global consents across these adjoining properties to primarily include the support land into the dairy platform and also to:

- Create good environmental outcomes
- Flexibility in the way the farms operate
- Make use of infrastructure to support good animal welfare
- Ensure long term sustainability for staff on farm

Nutrient budgets have been prepared to support the assessment of effects in the consent application.

Advice has been previously sought from Environment Southland to ensure that a robust method has been undertaken to model the existing environment prior to this report being written. Refer Appendices for "Overseer Modelling Report Prepared to establish baseline nutrient loss, prepared for South Dairies". Prepared by M Hunter 11th February 2019.

Predicted results from the Overseer™ modelling are shown below:

	SD1 Consent Conditions AUTH-20171302- 01/04	SD2 APP-20147281-01-v1	Neighbouring 7 ha Support	Combined Total (435.8 ha)
Total Farm N Loss	14333 kg	10414 kg	218 kg	24965 kg
N Loss/ha/yr	58 kg	58 kg	29 kg	57 kg
Total Farm P Loss	338 kg	230 kg	5 kg	573
Average P loss/ha/yr	1.4 kg	1.3 kg	0.6 kg	1.3 kg

Table 1: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd baseline nutrient budgets

	Proposed
Total Farm N Loss	24913
N Loss/ha/yr	57
Total Farm P Loss	576
Average P loss/ha/yr	1.3

Table 2: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd proposed nutrient budget

Using Overseer™, nutrient budgets have been constructed for South Dairy Ltd, comparing the nutrient loss of the baseline farm system against the proposed farm system. Overseer™ has predicted that the nitrogen loss will decrease (by less than 1%). The phosphorus loss is predicted to increase (by less than 1%).

The closeness in results is to be expected as

- There is no change in cows milked on the property
- There is no change of cows wintered on the property
- There is no change in young stock numbers on the property

Recommendations from here

Overseer™ can model a range of good management practices. However, some farm specific good management practices cannot be modelled. It is recommended that the following good management practices are implemented on this property:

- Maintain accurate records of farm inputs, outputs and management practices
- Have sufficient effluent storage so can apply effluent when soil conditions are suitable
- Apply effluents and manures at a depth, rate and time to match plant requirements and minimise risk to water bodied
- Apply fertiliser at a rate which maintain soil fertility at agronomic optimum, and is not applied in close proximity to waterways
- Identify and manage critical source areas to reduce the risk of losses. These include loses from laneways, gateways and high traffic zones.

The nutrient budgets within this report have been developed assuming that soil fertility is at the agronomic optimum and that maintenance fertiliser is applied each year. A soil testing regime should be implemented and fertiliser recommendations should be developed in line with these soil testing results.

The proposed Southland Water and Land Plan is currently in process. 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 farm environmental management plan detailing the recommendations within this report should be developed for the property.

2. Introduction

South Dairies operate 3 adjoining properties in the Lochiel area of Central Southland:

- South Dairy 1
- South Dairy 2
- Neighbouring 7 ha support

South Dairies 1 and 2 operate as milking platforms. South Dairies 1 was granted a new consent in 2018 (AUTH-20171302-01/04), South Dairies 2 currently has a variation to the current consent (APP-20147281-01-v1) in process, this variation will significantly improve the current effluent infrastructure. The adjacent support land is currently used for intensive wintering grazing.

It is intended to apply for a global consent across the adjoining properties to

- Create good environmental outcomes
- Flexibility in the way the farms operate
- Make use of infrastructure to support good animal welfare
- Ensure long term sustainability for staff on farm

Whilst there is no increase in cow numbers over the combined properties, the proposed increase in land area with the inclusion of the 7ha adjacent support land results in the need to obtain consent under Rule 20 (e) of the PSWLP in combination with new discharge and water permits. Nutrient budgets have been prepared to support the assessment of effects in the consent application.

Advice has been previously sought from Environment Southland to ensure that a robust method has been undertaken to model the existing environment prior to this report being commenced. Refer Appendices for "Overseer™Modelling Report Prepared to establish current nutrient loss, prepared for South Dairies". Prepared by M Hunter 11th February 2019.

<u>Local Environment and Current Regulations</u>

The proposed Southland Water and Land Plan has been notified by Environment Southland and is currently in process.

Key elements of the Southland Water and Land Plan are as follows:

- The use of physiographic zones to inform policies in the plan
- Use of good management practices and farm environmental management plans
- Consenting requirements for certain farming activities
- Implementation plan for stock exclusion from waterways
- Buffer zone requirements for cultivation on sloping land
- Importance of discharges from tile drains
- Surface and ground water takes
- Management of biodiversity

This report will emphasise the relevant requirements in the Southland Water and Land Plan from a nutrient budgeting perspective. The broader range of requirements should be captured in the Farm Environment Plan. The Farm Environment Plan is outside the scope of this report, however this report will inform the Farm Environment Plan

3.0 Modelling Method

Nutrient losses have been estimated using Overseer™.

As with any model, Overseer™ has a level of uncertainty. To reduce the impact of uncertainty the following approach is taken:

- Adherence to protocols (Best Practice Data Input Standards)
- Comparing "apples with apples" – consistency in approach between the modelling files
- Expert user (Dairy Farm Systems expertise and CNMA) with a peer review (Dairy Farm Systems Expertise and CNMA)

Further information on Overseer™ can be found in 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 Water Management Planning An overview guideline, Enfocus October 2018

4.0 Overseer™ Version and Protocols

The baseline nutrient budgets were developed using Overseer™ 6.3.0. In the interim Overseer™6.3.1 has been released. The proposed nutrient budgets have been developed using Overseer™6.3.1. The nutrient budgets were rerun in 6.3.1, there was only 1 slight change to the results (the N in drainage on the fodderbeet crop on SD1 increased from 15.9 ppm to 16.0 ppm), there were no other changes to results. " Overseer™ Best Practice Data Input Standards, March 2018". No deviations have been made from the protocol.

5.0 Overseer™ Assumptions

- 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 - Overseer™ assumes the property is managed is line with accepted industry good management practice.

6.0 Overseer™ Limitations

Key limitations of the Overseer™ model are:

- Overseer™ 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.
- Overseer™ does not calculate outcomes from extreme events (floods and droughts), but provides a typical years result based on a long-term average.

- 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
- Overseer™ does not represent all farm systems in New Zealand
- Components of Overseer™ have not been calibrated against measured data from every combination of farm systems and environment

7.0 Current Situation (Baseline)

7.1 Current South Dairies 1 is 248.5 ha (238.1 ha effective). It is mainly of flat contour, with predominately Pukemutu and Waikiwi soils. The property has extensive networks of tile drains. The property is consented to peak milk 750 cows. There is a holding pond and effluent is applied at less than 12mm depth across 183 ha when soil conditions allow. The property has a feed and calving pad infrastructure in place. Replacements are grazed off farm from weaning and return home as in calf heifers. Cows are wintered off farm, with in calf heifers / early calvers returning in late July as springers. Soil testing shows that current Olsen P ranges from 27 to 38. The property is highly productive (above Southland averages for milk production and grass growth). Purchased in feed is calculated at around 700 kg DM per cow (fed to lactating cows). It is assumed that 12 ha of fodderbeet is grown to lift to feed to the feedpad. Average nitrogen use of 184 kg N per ha is assumed across the farm.

7.2 Current South Dairies 2 is 179.8 ha (173.8 ha effective). It is mainly of flat contour, with predominately Pukemutu, Woodlands and Aparima soils. The property has extensive networks of tile drains. The property peak milks 500 cows. Effluent is applied at less than 12mm depth across 105.4 ha. A larger holding pond is currently under construction which will allow effluent to be applied when soil conditions allow. The property has two Herd Homes in place, these are used to winter 320 cows, the balance of the cows are grazed off farm. Replacements are grazed off farm from weaning and return home as in calf heifers. Soil testing shows that current Olsen P ranges from 24 to 48. The property is highly productive (above Southland averages for milk production and grass growth). Purchased in feed is calculated at around 1360 kg DM per cow (for wintered and lactating cows) . No crops are grown on the property. Average nitrogen use of 194 kg N per ha across the farm.

7.3 Current Neighbouring 7 ha is 7.5 ha (6.6 ha effective). It is of flat contour, with Pukemutu and Aparima soils. The property has extensive networks of tile drains. The property winters 200 cows on a grass and baleage paddock wintering system. Soil testing shows that current Olsen P ranges from 11 to 47. No crops are grown on the property. Average nitrogen use of 97 kg N per ha is assumed across the property.

Results from 3 properties is summarised below:

	SD1 Consent Conditions AUTH-20171302-01/04	**SD2 APP-20147281-01-v1**	**Neighbouring 7 ha Support**	**Combined Total (435.8 ha)**
Total Farm N Loss	14333 kg	10414 kg	218 kg	24965 kg
N Loss/ha/yr	58 kg	58 kg	29 kg	57 kg
Total Farm P Loss	338 kg	230 kg	5 kg	573
Average P loss/ha/yr	1.4 kg	1.3 kg	0.6 kg	1.3 kg

Table 3: "Overseer™ Modelling Report Prepared to establish baseline nutrient loss, prepared for South Dairies". Prepared by M Hunter 11th February 2019

8.0 Review of Baseline

An independent peer review of the baseline modelling was commissioned by Environment Southland. Refer OVERSEER Nutrient Budget Review For: Environment Southland – South Dairies Ltd Prepared by: Nicky Watt, CNMA, Irricon. This review concluded the following:

"the robustness of the nutrient loss estimates for models to be as follows:

a) SD1 medium-high

b) SD2 high

c) SD 7ha Support high

d) SD1 2016 2017 as a model originally produced for consent medium"

An issue raised in the review was as follows:

"*There is a shortfall of either supplement imported and/or nitrogen applied to cover the extra pasture production of the SD1 model and it is therefore unlikely that the modelled increase in pasture production in the SD1 model could occur. This would indicate that supplements imported and/or N fertiliser would need to increase to cover the increase in pasture production*".

In response we have provided Environment Southland with the following statement and requested guidance:

"As the reviewer clearly states it is important that the farm system is feasible and is representative of actual practice. Adding extra nitrogen or extra supplement (which this is not in line with practice) to compensate for the model calculations would not provide a correct representation of the farming system. Should I be directed to do this, I feel it would be difficult to defend should it be challenged going forward.

The intention is to use the same method for the proposed modelling, allowing the "apples with apples" comparison, it is hoped that this issue will be resolved with the model review being undertaken by Overseer."

Alex Erceg (Consents Officer), Environment Southland has provided the following statement in response:

"Provided that what is modelled is what is actually occurring on farm and the issue is clearly explained the there are no concerns with how the baseline modelling has been undertaken."

9.0 Proposed Situation

Proposed South Dairies is 435.8 ha (418.5 ha effective). It is mainly of flat contour, with predominately Pukemutu, Waikiwi, Woodlands and Aparima soils. The property has extensive networks of tile drains. It is proposed to peak milk 1250 cows. Effluent will be applied at less than 12mm depth across 288.4 ha. The property will utilise a feed pad, a calving pad and two Herd Homes in place. 520 cows will be wintered on the property the balance will graze off farm. Replacements will be grazed off farm from weaning and return home as in calf heifers. It is assumed that the property will be highly productive (above Southland averages for milk production and grass growth) and that the Olsen P will be at an agronomic optimum of an Olsen P of 35. Purchased in feed is calculated at around 960 kg DM per cow (for wintered and lactating cows) . It is assumed that 12 ha of fodderbeet is grown to lift to feed to the feedpad. Average nitrogen use of 184 kg N per ha is assumed across the farm.

Note:

- There is no increase in cows milked on the property compared to baseline
- There is no increase of cows wintered on the property compared to baseline
- There is no increase of off site effects (cows wintered or young stock) compared to baseline

The intention of the proposal is not to intensify, but rather to make best use of the significant investment in infrastructure (feed pad, calving pad, Herd Homes, effluent system up grades) between the 2 properties. This will create flexibility in the way the properties operate, make it easier to optimise use of infrastructure to lessen environmental impact, and support good welfare outcomes (for animals and the staff on farm).

10.0 Modelling Assumptions for South Dairies Proposed

10.1 Modelling Inputs

To construct the nutrient budgets the following assumptions have been made;

10.2 Blocks

The farm has been split into the following pastoral and crop blocks:

Block Name	South Dairies Proposed	Contour	Drainage
Pukem_6a.1 Effluent	238.2	Flat	100% tile
Pukem_6a.1 Rolling Effluent	6.0	Rolling	None
Pukem_6a.1 Non Effluent	76.8	Flat	100% tile
Waiki_30a.1 Effluent	27.0	Flat	100% tile
Waiki_30a.1 Non Effluent	11.1	Flat	100% tile
Waiki_30a.1 Rolling Effluent	2.0	Rolling	None
Parah_4a.1 Non Effluent	5.2	Flat	100% tile
Apar_2a.1 Effluent	1.0	Flat	100% tile
Apar_2a.1 Non Effluent	3.5	Flat	100% tile
Wood_29a.1 Effluent	3.5	Flat	100% tiled
Wood_29a.1 Non Effluent	13.2	Flat	100% tiled
Apar_2a.1 Effluent	10.7	Rolling	100% tiled
Apar_2a.1 Non Effluent	13.8	Rolling	100% tiled
Paro_4a.1 Non Effluent	6.5	Flat	100% tiled
Effective Farm Area	**418.5**		
Riparian	1.2		
Non productive	16.1		
Total Farm Area	**435.8**		
Fodderbeet (rotating through all blocks)	**12.0**		

10.3 Climate Data

- Climate data from Overseer™ Climate Station Tool
- 10.1 degrees Celsius has been used as the mean annual temperature
- 1096 mm of rainfall
- 712 mm mean annual PET

10.4 Soils

- Soils areas were obtained from soils mapping provided by LandPro (refer appendices)
- Soil settings were obtained from SMap for all soil types
- Drainage – as per map in Appendices

10.5 Soil Tests

- All paddock soil testing has been undertaken (Olsen P currently in the range of 11 to 47). Milk production at 1410 kg ms / ha and 472 kg ms / cow is above Southland average. Southland average is 1093 kg ms / ha and 414 kg ms / cow (source: NZ Dairy Statistics 2017-18). At a high milksolids production an Olsen P of 30 to 40 is justified if the response to pasture production is obtained and the appropriate management system is used to convert the extra pasture to milk solids (Source: Fertiliser Use on NZ Dairy Farms, Fert Research).
- Therefore a long term average status quo Olsen P of 35 has been assumed

10.6 Drainage

- Locations of the drains were provided by South Dairies Limited (refer Appendices)

10.7 Farm System

Description	**South Dairies Proposed**
Crops	12 ha fodderbeet, yield 25 t DM / ha / year Conventional cultivation in November 250 kg CM15 per ha at sowing 100 kg urea in Dec Lifted in August, stored and fed on feed pad
Animals on farm	590,000 kg ms Median calving date – 20th August Drying off – 31st May Mature Cows Breed - Kiwi Cross July 552 Aug 1145 Sept 1290 Oct 1260 Nov 1250 Dec 1240 Jan 1190 Feb 1190 March 1180 April 1130 May 1060 June 520 37 bulls (Dec / Jan only) Replacements 327 calves September to mid Dec
Structures / Effluent	Farm Dairy Effluent Solids separated Liquid applied Aug to May at less than 12mm depth (288.4 ha) Solids applied Jan (to all pastoral blocks) Feedpad May – 38% of cows (400 cows) for 1.5 hours per day August – 52% of cows (600 cows) for 1.5 hours per day September – 31% of cows (400 cows) for 1 hour per day

Description	South Dairies Proposed
	Liquid to farm dairy effluent storage pond Solids applied Jan (to all pastoral blocks) Wintering Pad Covered June / July – 320 cows 24 hours August – 9% of cows (103 cows) Liquid to farm dairy effluent storage pond Solids applied Feb(to all pastoral blocks) Note Effluent area of 288.4 ha receives 29Kg N / ha in liquid effluent Whole farm receives 35 kg N / ha in effluent from solids
Supplement	Imported 430 t DM in silage (fed on feed pad) 100 t DM in PKE (fed on feed pad) 265 t DM in pasture silage (fed in winter pad) 200 t DM in pasture silage (on pasture blocks) 65 t DM in barley grain (fed in milking shed to 40 of cows all season) 140 t DM in PKE (fed in milking shed to 40% of cows all season) Exported None
Fertiliser and Nitrogen	Phosphate fertiliser applied to all pastoral areas at maintenance level 183 kg N / ha across effluent areas (split Aug to April) 220 kg N / ha across non effluent areas (split Aug to April) Average across whole farm area of 184 kg N / ha
Irrigation	None

10.8 Predicted Overseer™ Results

	Proposed Land Use (435.8 ha)
Total Farm N Loss	249413 kg
N Loss/ha/yr	57 kg
N Concentration in Drainage	Pastoral – 10.9 to 14.4ppm Crop 18.6 ppm
Total Farm P Loss	576 kg
Average P loss/ha/yr	1.3 kg
Pasture Grown T DM / ha / year	17.0

Table 4: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd proposed nutrient budget

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 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 a Central Southland monitor farm show MEs of 11.5 to 12.5 (reference: Pasture growth and quality on Southland and Otago dairy farms, D. E. Dalley and T. Geddes, DairyNZ, NZ Grasslands Publication 2012).

The Overseer has been left at default values 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.

11.0 Conclusion

Predicted results from the Overseer™ modelling from the baseline land use modelling is summarised below:

	SD1 Consent Conditions AUTH-20171302-01/04	SD2 APP-20147281-01-v1	Neighbouring 7 ha Support	Combined Total (435.8 ha)
Total Farm N Loss	14333 kg	10414 kg	218 kg	24965 kg
N Loss/ha/yr	58 kg	58 kg	29 kg	57 kg
Total Farm P Loss	338 kg	230 kg	5 kg	573
Average P loss/ha/yr	1.4 kg	1.3 kg	0.6 kg	1.3 kg

Table 5: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd baseline nutrient budgets

Predicted results from the Overseer™modelling from the proposed land use is summarised below:

	Proposed
Total Farm N Loss	24913
N Loss/ha/yr	57
Total Farm P Loss	576
Average P loss/ha/yr	1.3

Table 6: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd proposed nutrient budget

Using Overseer™, nutrient budgets have been constructed for South Dairy Ltd, comparing the nutrient loss of the baseline farm system against the proposed farm system. Overseer™ has predicted that the nitrogen loss will decrease slightly (by less than 1%). The phosphorus loss is predicted to increase slightly (by less than 1%).

The closeness in results is to be expected as:

- There is no change in cows milked on the property
- There is no change of cows wintered on the property
- There is no change in young stock numbers on the property

There are slight changes in the way the infrastructure and imported supplement is being utilised, and nitrogen is being applied more strategically to effluent and non effluent areas.

12.0 Recommendations from here

Overseer™ can model a range of good management practices. However, some farm specific good management practices cannot be modelled. It is recommended that the following good management practices are implemented on this property:

- Maintain accurate records of farm inputs, outputs and management practices
- Have sufficient effluent storage so can apply effluent when soil conditions are suitable
- Apply effluents and manures at a depth, rate and time to match plant requirements and minimise risk to water bodied
- Apply fertiliser at a rate which maintain soil fertility at agronomic optimum, and is not applied in close proximity to waterways
- Identify and manage critical source areas to reduce the risk of losses. These include loses from laneways, gateways and high traffic zones.

The proposed nutrient budget within this report have been developed assuming that soil fertility is at the agronomic optimum and that maintenance fertiliser is applied each year. A soil testing regime should be implemented and fertiliser recommendations should be developed in line with these soil testing results.

The proposed Southland Water and Land Plan is currently in process. 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 farm environmental management plan detailing the recommendations within this report should be developed for the property.

Overseer Reports from South Dairies Proposed

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	184	24	1	31	0	0	0
Rain/clover N fixation	95	0	3	5	3	7	34
Irrigation	0	0	0	0	0	0	0
Supplements	72	9	56	7	10	5	3
Nutrients removed							
As products	91	15	22	5	20	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	102	0	0	0	0	0	0
To water	57	1.3	16	66	63	5	20
Change in farm pools							
Plant Material	-3	0	-4	0	0	0	0
Organic pool	102	16	-8	-28	0	-1	-1
Inorganic mineral	0	2	-18	0	-2	-3	-4
Inorganic soil pool	2	-1	51	0	-67	9	15

Table 7: Nutrient Budget South Dairies Proposed

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Puke_6a.1 Effluent	13,048	56	**12.3**	262	247
Puke_6a.1 Effluent Rolling	310	53	**12.0**	261	247
Puke_6a.1 Non Effluent	4,143	56	**12.4**	255	256
Waiki_30a.1 Effluent	1,264	48	10.9	254	247
Waiki_30a.1 Non Effluent	520	48	11.0	248	256
Waik_30a.1 Effluent Rolling	90	47	11.0	254	247
Parah_4a.1 Non Effluent	342	67	**14.4**	262	256
Fodder Beet	1,217	101	**18.6**	-336	112
Apar_2a.1 Effluent	53	53	**12.1**	257	247
Apar_2a.1 Non Effluent	181	53	**12.1**	251	256
Riparian Area	4	3	N/A		
Wood_29a.1 Effluent	187	55	**12.3**	258	247
Wood_29a.1 Non Effluent	702	55	**12.4**	253	256
Apar_2a.1 Effluent Rolling	563	54	**12.1**	258	247
Apar_2a.1 Non Effluent Rolling	714	53	**12.1**	251	256
Paro_4a.1 Non Effluent	243	39	9.0	244	256
Other sources	1,330				
Whole farm	24,913	57			
Less N removed in wetland	0				
Farm output	24,913	57			

Table 8: Nitrogen Report South Dairies Proposed

Block name	Total P lost	P lost to water	P loss categories		
	kg P/yr	kg P/ha/yr	Soil	Fertiliser	Effluent
Puke_6a.1 Effluent	200	0.9	Medium	Low	Low
Puke_6a.1 Effluent Rolling	18	3.1	High	High **	Low
Puke_6a.1 Non Effluent	64	0.9	Medium	Low	Low
Waiki_30a.1 Effluent	11	0.4	Low	Low	Low
Waiki_30a.1 Non Effluent	5	0.4	Low	Low	Low
Waik_30a.1 Effluent Rolling	1	0.6	Low	Low	Low
Parah_4a.1 Non Effluent	5	1.0	Medium	Low	Low
Fodder Beet	14	1.2	N/A	N/A	N/A
Apar_2a.1 Effluent	0	0.4	Low	Low	Low
Apar_2a.1 Non Effluent	1	0.4	Low	Low	Low
Riparian Area	0	0.1	N/A	N/A	N/A
Wood_29a.1 Effluent	1	0.4	Low	Low	Low
Wood_29a.1 Non Effluent	5	0.4	Low	Low	Low
Apar_2a.1 Effluent Rolling	8	0.8	Low	Low	Low
Apar_2a.1 Non Effluent Rolling	10	0.8	Low	Low	Low
Paro_4a.1 Non Effluent	4	0.6	Low	Low	Low
Other sources	228				
Whole farm	576	1.3			

Table 9: Phosphorus Report South Dairies Proposed

Appendices

Appendix 1

- Overseer™ Modelling Report - Prepared to establish current nutrient loss, 11 Feb 2019

Roslin Consultancy Ltd

Overseer Modelling Report

Prepared to establish current nutrient loss

Report prepared for:

South Dairies Limited

C/o D & S Alexander

11 McConachie Road

RD1

Winton 9781

Legal Description

Sections 49, 51, 52, and 53 Block I Winton Hun, Road, Section 11 Block II Winton Hun, Lot 2 DP 377137, Part Sections 25, 26, 47, and 48 Block I Winton Hun, Sec 14 Block IX New River Hun, Sec 15 Block IX New River Hun, Sec 16 Block IX New River Hun, Sec 19 Block IX New River Hun, Sec 79 Block IX New River Hun, Sec 80 Block IX New River Hun, Sec 81 Block IX New River Hun, Part Sec 18 Block IX New River Hun, Lot 5 DP 363069, Lot 10 DP 363069

Report Prepared By:

Miranda Hunter, Roslin Consultancy Limited

miranda.hunter@xtra.co.nz 0274 341 140

B.Agr.Sci

Overseer Files and Report Reviewed By:

Monique Topham, FarmWise Consultant

B.Agr.Sci

11th February 2019

Table of Contents

1.0 Background

South Dairies operate 3 adjoining properties in the Lochiel area of Central Southland:

- South Dairy 1
- South Dairy 2
- Neighbouring 7 ha support.

Both dairy platforms have existing consents in place and the adjacent support land is currently used for intensive winter grazing.

It is intended to apply for a global consent across the adjoining properties to

- Create good environmental outcomes
- Flexibility in the way the farms operate
- Make use of infrastructure to support good animal welfare
- Ensure long term sustainability for staff on farm

The purpose of this report is to model the existing environment using Overseer. Following feedback on this report from Environment Southland modelling for the consenting process can commence to be able to compare estimated current and existing nutrient losses in the forth coming consent application.

2.0 Desired Outcome of Report

Evaluation from Environment Southland (ES) of the Overseer modelling methodology provided in this report.

3.0 Modelling Method Assumptions

3.1 South Dairy 1

South Dairy 1 was granted a new consent in 2018. It has been advised by ES (refer email trail in Appendix 2) that it is appropriate to model consented cow numbers given the expansion consent was granted so recently and the effects of additional cows were considered and accepted through a public hearing process.

3.2 South Dairy 2

Actual cow numbers are to be modelled for South Dairy 2. Note there is no difference between actual and consented cow numbers.

3.3 Neighbouring 7 ha Support

This property was purchased in January 2018 The applicant has operated this as an intensive wintering grazing block since purchase. The previous owned farmed sheep on this block. Records are not available from the previous land owner.

We have been advised by ES to model as per the land use since purchase (records available), refer email trail in Appendix 2

4.0 Overseer Version and Standards

4.1 Overseer Version

Overseer version 6.3.0 has been used for the modelling.

Note: previous modelling for South Dairy 1 (completed in 2017 and early 2018) was utilising Overseer version 6.2.3. There is likely to be a significant difference between outputs in the versions. I do not have Overseer 6.2.3 available so therefore can not run the files through the old version for comparison.

The files have been prepared using the Overseer legacy version which will not be available after June 2019. The files can be transferred to OverseerFM should it be required at a later date. Note - OverseerFM involves a change of interface rather than change of version (therefore will not change modelling results).

4.2 Overseer Standards

Overseer Best Practice Data Input Standards have been followed. There have been no “work arounds” required in the modelling.

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 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 a Central Southland monitor farm show MEs of 11.5 to 12.5 (reference: Pasture growth and quality on Southland and Otago dairy farms, D. E. Dalley and T. Geddes, DairyNZ, NZ Grasslands Publication 2012).

For example overwriting the default pasture quality calculations to the Central Southland data in Overseer would reduce the pasture grown from 17.4 t DM / ha / year to 15.7 t DM / ha / year. This is more consistent with farm systems calculations completed outside Overseer.

The Overseer has been left at default values 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.”*

Going forward, the “proposed” farm system will also be modelled utilising Overseer default pasture quality values. This is important and will ensure that comparisons between the two farm systems are valid.

5.0 Overseer™ Assumptions

- 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 - Overseer™ assumes the property is managed is line with accepted industry good management practice.

6.0 Overseer™ Limitations

Key limitations of the Overseer™ model are:

- Overseer™ 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.
- Overseer™ does not calculate outcomes from extreme events (floods and droughts), but provides a typical years result based on a long-term average.
- 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
- Overseer™ does not represent all farm systems in New Zealand
- Components of Overseer™ have not been calibrated against measured data from every combination of farm systems and environment

7.0 South Dairies 1 Overseer Modelling

7.1 South Dairies 1 - Previous Consenting Process

During the previous consenting process (completed in 2018) several Overseer xlm files were provided to Environment Southland (ES).

On the 12th of December 2018, Alex Erceg (ES Consenting Officer) provided all relevant Overseer files to LandPro.

An analysis of all Overseer files was completed and the following file most closely resembles consent conditions issued "NB 2016-17 Consent DSN 31827 (copy) – UPDATED". This file was prepared by Mark Crawford (Ravensdown, CNMA) and has been run without any alterations in Overseer version 6.3.0.

Summary of Results:

	NB 2016-17 Consent DSN 31827 (copy) – UPDATED ***Version 6.3.0***
Total Farm N Loss	15287 kg
N Loss/ha	61
N Concentration in Drainage	Pastoral – 10.5 to 13.4 ppm Crop – 26.1 ppm
Total Farm P Loss	340 kg
Average P loss/ha	1.4 kg/ha/yr
Pasture Grown T DM / ha / year	16.9

Table 1: Summary of Results ***NB 2016-17 Consent DSN 31827 (copy) – UPDATED,*** *Overseer v6.3.0*

For the Overseer reports (nutrient budget, nitrogen and phosphorus reports) refer Appendix 3.

7.2 South Dairies 1 – Modelled to Consent Conditions

(Overseer file: SD1 Consent Conditions AUTH-20171302- 01/04)

As per advice received from ES, South Dairy 1 was remodelled as per consent conditions. The consent conditions from the previous hearing decision (April 2018) varied from the original Overseeer modelling provided in the application process. The consent holder is legally required to adhere to the conditions detailed in their consent.

Summary of all consent conditions that are able to be reflected in a nutrient budget:

Discharge permit (AUTH-20171302-01)

- Milking of up to 750 cows twice per day
- Effluent discharge area of 183 ha
- Applications of effluent via travelling irrigator (10 mm depth), slurry tanker and umbilical system (5mm depth)
- Nitrogen loading from effluent not to exceed 150 kg N / ha / year
- Discharge of feed pad effluent
  - 400 cows 1 May to 31 May and 1 Sept to 30 Sept
  - 600 cows 1 August to 31 August

Land Use Consent (AUTH-20171302-04)

- 252 ha of land
- Milking of up to 750 cows twice per day
- All cows wintered off the property
- Discharge area of no more than 183 ha
- Good management practices
- 12 ha of fodder beet
- Long term annual (rolling 3 years) average nitrogen application not to exceed 186 kg N / ha / year
- Long term annual (rolling 3 years) average phosphorus application not to exceed 35 kg P / ha / year

Summary of Results:

	SD1 Consent Conditions AUTH-20171302-01/04
Total Farm N Loss	14333 kg
N Loss/ha	58
N Concentration in Drainage	Pastoral – 11.0 to 14.6 ppm Crop – 15.9 ppm
Total Farm P Loss	338 kg
Average P loss/ha	1.4 kg/ha/yr
Pasture Grown Kg DM / ha / year	17.5

*Table 2: Summary of Results **SD1 Consent Conditions AUTH-20171302- 01/04***

For modelling inputs and assumptions refer Appendix 3.

For the Overseer reports (nutrient budget, nitrogen and phosphorus reports) refer Appendix 3.

7.3 South Dairies 1 - Summary of differences

Key differences between the original consented South Dairies 1 Overseer file and the South Dairies consented file are provided in the table below.

Description	**NB 2016-17 Consent DSN 31827 (copy) – UPDATED**	**SD1 Consent Conditions AUTH-20171302- 01/04**	**Comments**
Area	Effective area of 244.0 ha Total area of 249.2	Effective area of 238.1 ha Total area of 248.5	Evidence for change- CTs and lease agreement Note Consent AUTH-20171302-04 references 252 ha
Topography	All flat	Two small areas of rolling land identified (less than 10 ha)	
Soils		Minor differences to soil areas	Soils based on areas provided by LandPro soil mapping (refer appendices)
Soil tests	Actuals	Long term status quo	Predictive long term nutrient budget rather than actual
Drainage	103 ha tiled	230 ha tiled	Evidence for change – tile map provided by South Dairies Ltd
Animals	Cow weight 500 kg Drying off 25th May No bulls included for mating No replacement calves included	Cow weight – default Drying off – 31st May 15 bulls (Dec / Jan) 197 calves September to mid Dec until weaning	No cow weights available therefore used default Drying off date to reflect consent Addition of bulls to reflect standard farm practice Addition of calves to reflect standard farm practice
Structures / Effluent	<u>Farm Dairy Effluent</u> Solids separated Liquid applied October to March at a low rate(121 ha)	<u>Farm Dairy Effluent</u> Solids separated Liquid applied Aug to may at less than 12mm depth (183 ha) Solids applied Jan (to all pastoral block)	Reflect consent conditions and practice

Description	NB 2016-17 Consent DSN 31827 (copy) – UPDATED	SD1 Consent Conditions AUTH-20171302- 01/04	Comments
	Solids applied Dec and Jan (to all pastoral block) <u>Wintering pad</u> April 15% cows 16 hrs May 30% cows for 16 hrs July 100% cows 4 hours August 60% cows 16 hours Sept 30% cows 16 hours October 5% cows 16 hours Liquid to farm dairy effluent Solids applied Nov (to all pastoral blocks)	<u>Feedpad</u> May – 67% (400 cows) for 2 hours per day August – 95% (600 cows) for 1.5 hours per day September – 51% (400 cows) for 1 hour per day Liquid to farm dairy effluent Solids applied Jan (to all pastoral blocks)	
Supplement	<u>Imported</u> 330 t DM in silage (fed on winter pad) 100 t DM in PKE (fed on winter pad) 100 t DM in Brewers grain (fed on winter pad) 80 t DM in baleage (ex storage, fed on winter pad) <u>Made</u> 92 t DM baleage to storage	<u>Imported</u> 430 t DM in silage (fed on feed pad) 100 t DM in PKE (fed on feed pad)	Based on average feed required compared with expected pasture growth rate
Fertiliser and Nitrogen	Average of 35 kg P / ha over whole farm 174 kg / ha on effluent areas (split Aug to May) 210 to 238 kg N / ha to non effluent areas (split Aug to May) Average over whole farm – 186 kg N / ha	Averages 25 kg P /ha 187 kg / ha on effluent areas (split Aug to April) 231 kg N / ha to non effluent areas (split Aug to April) Average over whole farm – 184 kg N / ha	Phosphate fertiliser applied to maintain soil fertility at Olsen P of 35 Nitrogen fertiliser applied to maintain pasture production (with in consent conditions)
Irrigation		None	

Table 3 – Summary of differences between original application Overseer file and Overseer modelled to consent conditions

Summary of Results:

	NB 2016-17 Consent DSN 31827 (copy) – UPDATED *Version 6.3.0*	**SD1 Consent Conditions AUTH-20171302- 01/04**
Total Farm N Loss	15287 kg	14333 kg
N Loss/ha	61	58
N Concentration in Drainage	Pastoral – 10.5 to 13.4 ppm Crop – 26.1 ppm	Pastoral – 11.0 to 14.6 ppm Crop – 15.9 ppm
Total Farm P Loss	340 kg	338 kg
Average P loss/ha	1.4 kg/ha/yr	1.4 kg/ha/yr
Pasture Grown Kg DM / ha / year	16.9	17.5

Table 4: Summary of Results of **NB 2016-17 Consent DSN 31827 (copy) – UPDATED *Version 6.3.0*** *compared with* ***SD1 Consent Conditions AUTH-20171302- 01/04***

8.0 South Dairies 2 Modelling

South Dairies 2 operates at its current consent conditions. A variation to the consent is currently being process (APP-20147281-01-v1) which will improve the effluent system (significantly increased effluent storage, reduced application depth and more even distribution of effluent across the effluent area). The nutrient budgets have been prepared to reflect the improved practice in the current application under processing.

Summary of key consent conditions required to reflected in nutrient budget (Overseer file: SD2 APP-20147281-01-v1):

- Milking up to 500 cows twice per day
- Discharge area of 105.4 ha
- All applications less than 12mm depth
- Nitrogen loading from effluent not to exceed 150 kg N / ha / year
- Discharge of effluent from a wintering shed that is used between 15 May and 7 August

Summary of Results:

	SD2 APP-20147281-01-v1
Total Farm N Loss	10414 kg
N Loss/ha	58
N Concentration in Drainage	Pastoral – 9.5 to 13.1 ppm
Total Farm P Loss	230 kg
Average P loss/ha	1.3 kg/ha/yr
Pasture Grown Kg DM / ha / year	16.7

Table 5: Summary of Results ***SD1 Consent Conditions AUTH-20171302- 01/04***

For modelling inputs and assumptions refer Appendix 3.

For the Overseer reports (nutrient budget, nitrogen and phosphorus reports) refer Appendix 3.

9.0 Neighbouring 7 ha Support Block Modelling

This property operates as an intensive winter grazing block, winter grazing (pasture and baleage) 200 cows.

Summary of Results:

	Neighbouring 7 ha Support
Total Farm N Loss	218 kg
N Loss/ha	29
N Concentration in Drainage	Pastoral – 7.1 to 7.6 ppm
Total Farm P Loss	5 kg
Average P loss/ha	0.6 kg/ha/yr
Pasture Grown Kg DM / ha / year	14.6

Table 6: Summary of Results ***Neighbouring 7 ha Support Block***

For modelling inputs and assumptions refer Appendix 3.

For the Overseer reports (nutrient budget, nitrogen and phosphorus reports) refer Appendix 3.

10.0 Summary

The combined nutrient loss estimated by Overseer from the 3 properties is summarised as follows:

	SD1 Consent Conditions AUTH-20171302-01/04	SD2 APP-20147281-01-v1	Neighbouring 7 ha Support	Combined Total (435.8 ha)
Total Farm N Loss	14333 kg	10414 kg	218 kg	24965 kg
N Loss/ha/yr	58 kg	58 kg	29 kg	57 kg
Total Farm P Loss	338 kg	230 kg	5 kg	573
Average P loss/ha/yr	1.4 kg	1.3 kg	0.6 kg	1.3 kg

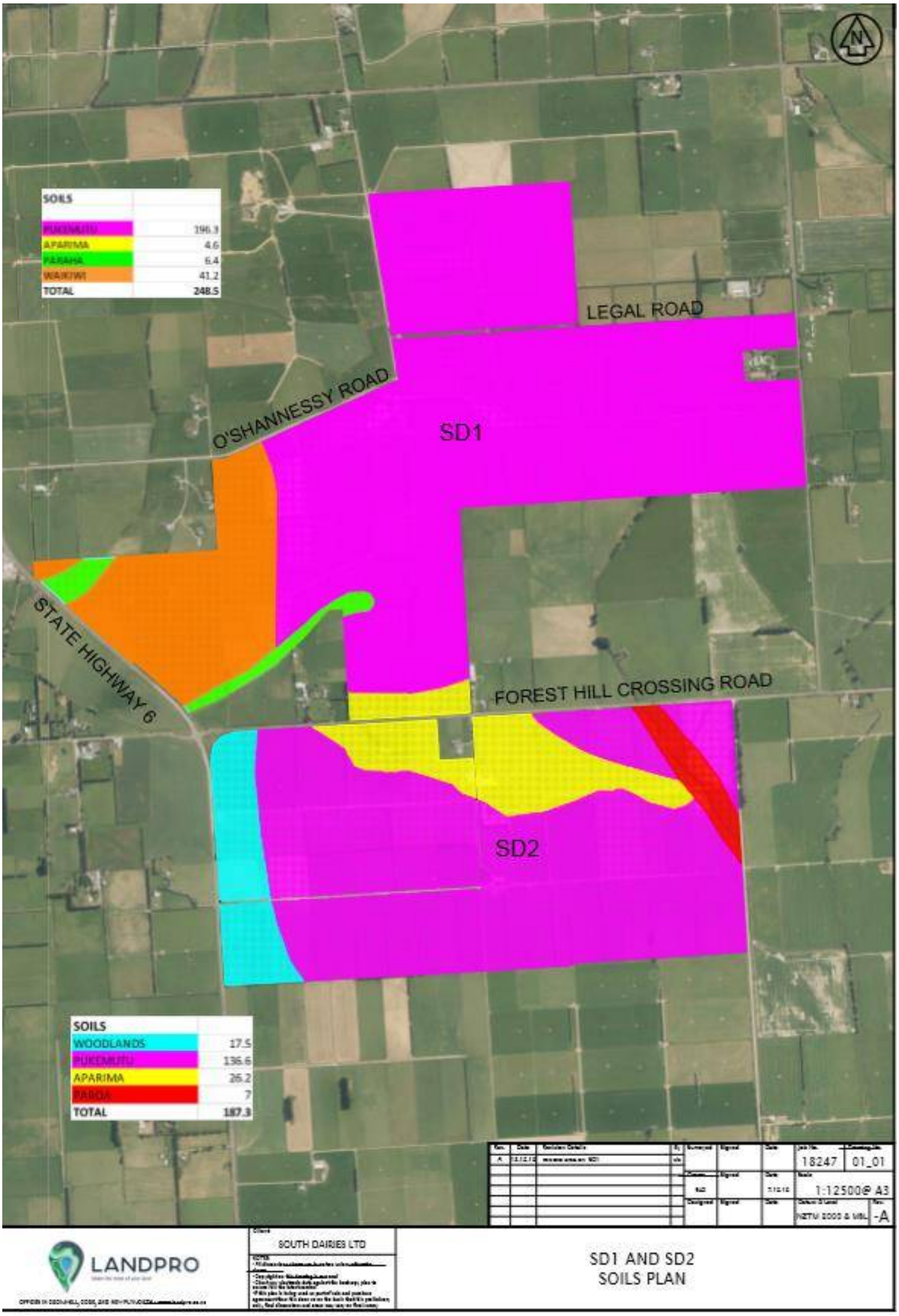
Table 7: Summary of South Dairies Modelling results

Appendices

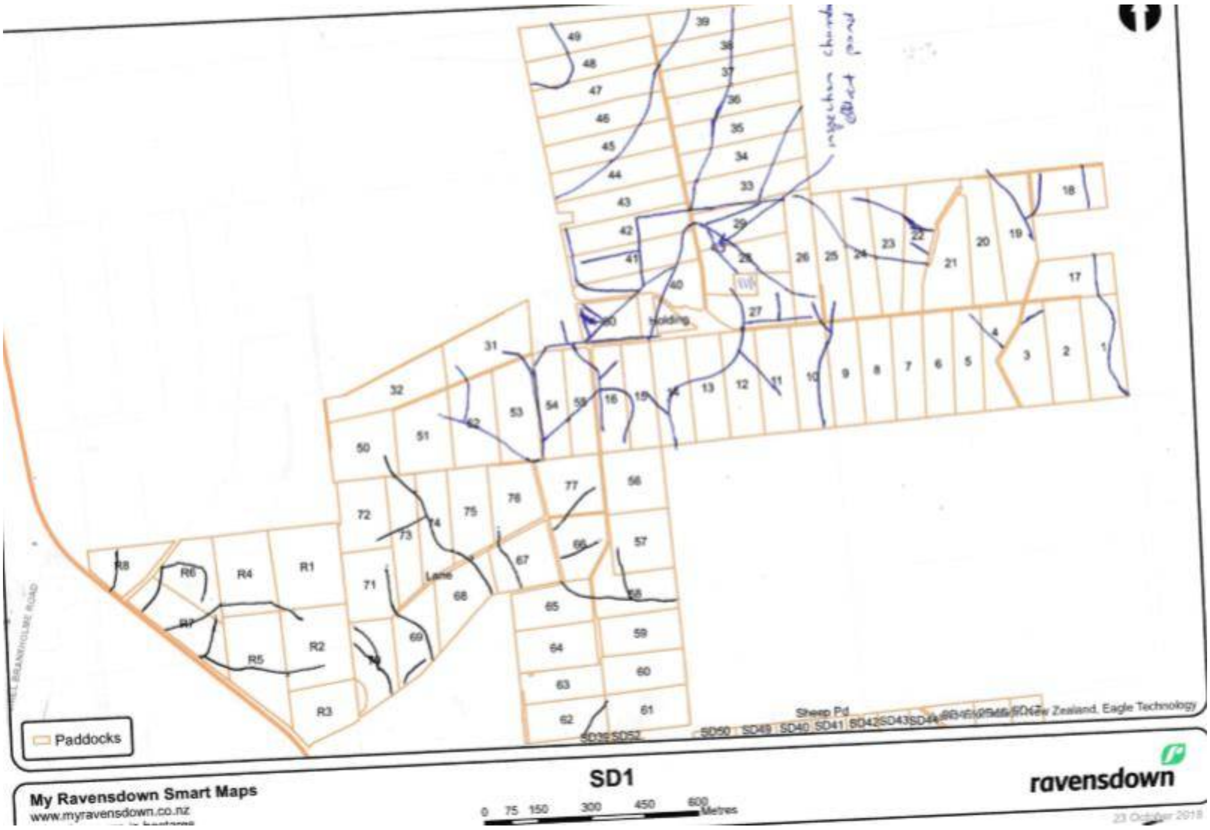
Appendix 1:

Soils map of South Dairy 1, South Dairy 2 and Adjoining 7 ha support

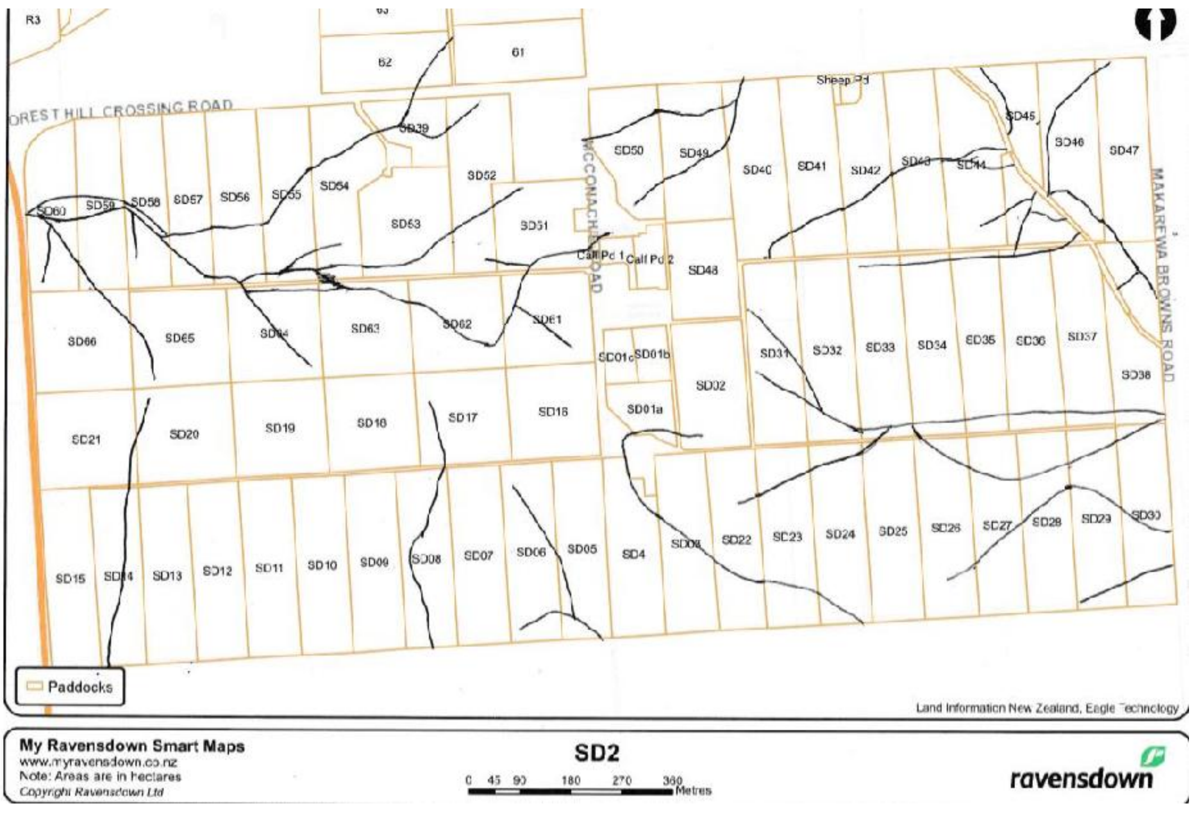
Tile maps of South Dairy 1, South Dairy 2 and Adjoining 7 ha support



SOILS
PUKEMUTU 196.3
APARIMA 4.6
6.4
WAIKIWI 41.2
TOTAL 248.5
N
LEGAL ROAD
O'SHANNESSY ROAD
SD1
STATE HIGHWAY 6
FOREST HILL CROSSING ROAD
SD2
SOILS
WOODLANDS 17.5
PUKEMUTU 136.6
APARIMA 26.2
PAROA 7
TOTAL 187.3
18247
01_01
1:12500@ A3
NZTM 2000 & MSL
-A
LANDPRO
SOUTH DAIRIES LTD
SD1 AND SD2
SOILS PLAN



SD1 Tile Map



SD2 Tile Map

Appendix 2:

Emails and file notes in date order (**from most recent**)

From: Aurora Grant <Aurora.Grant@es.govt.nz>
Sent: Wednesday, 16 January 2019 8:01 AM
To: Tanya Copeland <tanya@landpro.co.nz>
Cc: Joanna Gilroy <Joanna.Gilroy@es.govt.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>
Subject: RE: South Dairies Limited - modelling approach confirmation

Thanks Tanya, she's kept me up to speed with that one. No concerns with me using that approach.

Cheers,

Aurora

Aurora Grant
Acting Manager - Consents Division
Environment Southland *Te Taiao Tonga*

P 03 211 5115
Cnr Price St & North Rd, Private Bag 90116, Invercargill 9840
Aurora.Grant@es.govt.nz | www.es.govt.nz | facebook.com/environmentsouthland

From: Tanya Copeland <tanya@landpro.co.nz>
Sent: Wednesday, 16 January 2019 7:07 AM
To: Aurora Grant <Aurora.Grant@es.govt.nz>
Cc: Joanna Gilroy <Joanna.Gilroy@es.govt.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>
Subject: South Dairies Limited - modelling approach confirmation

Hi Aurora,

I have just realised that you were mistakenly not cc'd into the emails below which was sent to Jo and Alex only.

In light of Jo leaving ES soon (sadly) we wanted to make sure that you were also aware of the email I sent on 21st December and to ensure that you will continue to be happy with this approach as agreed going forward.

Thanks

Tanya

From: Joanna Gilroy <Joanna.Gilroy@es.govt.nz>
Sent: Friday, 21 December 2018 12:50 PM
To: Tanya Copeland <tanya@landpro.co.nz>; Alex Erceg <Alexander.Erceg@es.govt.nz>
Cc: Miranda Hunter <miranda.hunter@xtra.co.nz>
Subject: RE: South Dairies Limited

Hi Tanya,

Yes to both questions as outlined below.

Kind regards,

Joanna

Joanna Gilroy
Team Leader Consents
Environment Southland *Te Taiao Tonga*

P 03 211 5115
Cnr Price St & North Rd, Private Bag 90116, Invercargill 9840
Joanna.Gilroy@es.govt.nz | www.es.govt.nz | facebook.com/environmentsouthland

From: Tanya Copeland [mailto:tanya@landpro.co.nz]
Sent: Friday, 21 December 2018 9:15 AM
To: Alex Erceg <Alexander.Erceg@es.govt.nz>
Cc: Joanna Gilroy <Joanna.Gilroy@es.govt.nz>; Miranda Hunter <miranda.hunter@xtra.co.nz>
Subject: FW: South Dairies Limited

Hi Alex,

Please see attached email below from Miranda who is doing the nutrient modelling for the South Dairy application which we hope to lodge in the new year.

Miranda raises a couple of points which we would like to highlight to you, and get your written confirmation on.

We need to ensure that we get the baseline file correct for this application. We are constructing our baseline file based on the latest Overseer base file provided for the April 2018 hearing for South Dairy 1 because this forms the consented environment. In Mirandas investigations, she has found that the final Overseer file provided for the hearing differs in a minor way to what has been approved in the consent conditions. My assertion is that the consent conditions are the most legally binding and trump any discrepancies in the Overseer budget and that our baseline model should match the consent conditions. Can you please confirm if this is the correct approach.

Miranda has proposed a modelling method for the new 7ha block which includes modelling the farm system since the applicants purchased it. Can you confirm you are happy with this.

We are still on track for providing you the basefile and modelling method in mid January as we wish for this to be reviewed before we proceed to modelling the proposal.

Thanks

Tanya

From: Miranda Hunter <miranda.hunter@xtra.co.nz>
Sent: Thursday, 20 December 2018 2:35 PM
To: Tanya Copeland <tanya@landpro.co.nz>
Subject: South Dairies Limited

Hi Tanya

Have gone through the discharge and land use consents issued for South Dairies in April 2018. Consent conditions that are relevant to Overseer modelling are:

750 cows peaked milked

183 ha effluent area (252 ha total area)

Feed pad used for 400 cows 1st May to 31st May

Feed pad used for 600 cows 1st August to 31st August

Feed pad used for 400 cows 1st September to 30th September

Low rate effluent application

12 ha of fodderbeet

186 kg N / ha maximum

35 kg / ha maximum

Have been through the Overseer xlm files provided by Alex and the attached xlm file named *Ovr-NB 2016-17 DSN 31827 (copy) – Updated*, most closely reflects the consent conditions.

Can you please confirm with Alex that he is happy to accept that as the base file and I will rerun in the most recent version of Overseer.

Adjacent 7 ha – on the attached file note prepared for the meeting held with ES in November, the following comments have been made:

Farm systems background

SD adjacent block (7ha) – this property was purchased in January 2018 The applicant has operated this as an intensive wintering grazing block since purchase, Prior land use was a calf grazing block and selling supplement. Records are not available from the previous land owner.

Suggested modelling method for baseline (current)

SD 7 ha – model as per the land use since purchase (records available)

Can you please confirm with Alex that he is happy with the suggested modelling method for the 7 ha (as I want to get into that early in the New Year).

Please just contact me should there be any questions / further clarification required

Thanks (and have a great Christmas!)

Miranda

Miranda Hunter

B.Agr.Sc

0274 341 140

CNMA

Certified Nutrient Management Adviser

37G Young Lane, Clyde

R D 1, Alexandra 9391

ROSLIN CONSULTANCY

File Note

Client South Dairies (SD) Limited

Date 14th November 2018

File Note Background

The applicant operates 2 adjacent dairy farms (SD1 and SD2) in the Lochiel area. The applicant also owns an adjoining 7 ha parcel of land (SD 7 ha). To make the best use of the infrastructure on the dairy farms it is intended to apply for a global dairy consent. During this process it is intended to incorporate the adjoining 7 ha of land. It is not intended to increase cow numbers above currently consented cow numbers.

The applicant has had an on site meeting with ES Consenting staff to gain advice on approach for constructing the application (refer email trail in appendices).

Purpose of File Note

The purpose of this file note is to clearly articulate a suggested methodology for construction of the nutrient budgets. The author would appreciate feedback / advice from ES as to the appropriateness of this methodology (and if this methodology should be amended) to ensure that there is confidence in the robustness of the modelling methodology.

Note – the Best practice Data Input Standards will be followed for the modelling. The clarity required is around farm systems assumptions used in the Overseer modelling.

Farm System Background

SD1- the applicant obtained a consent for expanded dairying in April 2018, currently building stock numbers to enable operating to consent conditions

SD2 – the applicant purchased this property in 2016, currently operating at cow numbers as per consent conditions

SD adjacent block (7ha) – this property was purchased in January 2018 The applicant has operated this as an intensive wintering grazing block since purchase, Prior land use was a calf grazing block and selling supplement. Records are not available from the previous land owner.

Draft Proposed Modelling Method

Current (the existing environment)

Suggested modelling method, model 3 separate nutrient budgets

SD1 – model as per consent conditions (as the consent was issued in April 2018 and the effects of the consent were considered and accepted during that process)

Use Overseer information provided in consenting process

Rerun under consented Overseer version 6.3.0 (was constructed under 6.2.3), ES to provide the xlm file from their records. Provide ES with the output reports from version 6.3.0. Please note that results have changed significantly between versions.

Complete a new Overseer file based on consent conditions issued April 2018 (explain any changes from the original consented Overseer file if applicable, including new Overseer protocols)

Submit the above (rerun original file and new file) to ES for comment and review – appreciate feedback as it is critical to get the existing environment correct

SD2 – model as per as per consent conditions (currently peak milking consented cow numbers)

SD 7 ha – model as per the land use since purchase (records available)

Proposed

To reflect the integrated nature of the property it is suggested to model as 1 nutrient budget (as will operate under 1 new consent).

Out of Scope of Overseer Modelling

Run off and support blocks (both owned and leased). There however will need to be an assessment of effects included in the application (including how they are operated)

File note completed by

Miranda Hunter, CNMA

Roslin consultancy Limited

14th Nov 2018

Hi Dean,

Thanks for meeting with us yesterday and showing us around your farms, it was good to get a visual idea of what your proposal will be and to discuss options.

I have added a few points of clarification/ technicalities to your summary below in blue. If you need clarification on anything please let me know.

Kind regards,

Aurora

Aurora Grant
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From: alexander.farms01@gmail.com <alexander.farms01@gmail.com>
Sent: Tuesday, 9 October 2018 10:27 PM
To: Miranda Hunter <miranda.hunter@xtra.co.nz>; Tanya Copeland <tanya@landpro.co.nz>
Cc: Aurora Grant <Aurora.Grant@es.govt.nz>; Michael Durand <Michael.Durand@es.govt.nz>
Subject: ES Meeting

Hi Tanya and Miranda

We had a very constructive meeting with Aurora and Michael from ES today. Following is a summary of the main points covered and agreed for our proposed application if we go for a global consent over the 2 dairy platforms:

We will activate rule 20 (a) 3 due to the cow numbers increasing beyond those in the existing effluent discharge consent of SD2. Therefore we are no longer a permitted activity and will require a new consent application

Application will be for a global consent for 1250 cows over the 2 existing milking platforms, therefore no increase on the total consented cow numbers

Global nutrient budgets are to be prepared for the milking platforms showing the effect of the change from 2 existing to 1 new consent. We discussed that it would be an administration exercise to separate out the two in future if you wanted to sell one farm, but it is simpler to do a global consent for this proposal as overall there are no additional cows (accepting that the new land use for expansion on SD1 makes up part of the existing environment) being added to the system if a global consent is applied for– if the two were kept as two separate applications then SD2 would technically be increasing in both cow numbers and land, and this application would need to be assessed separately without considering the effects of the decreasing cow numbers on SD1.

Consented cow numbers are to be used for both existing and proposed budgets with it being accepted that we have not had time to activate the new 750 cow consent that was issued April 2018. This is a different approach than what has been taken with other recent expansions, however we consider it would be unreasonable to base budgets on actual numbers in this instance given the expansion consent was granted so recently and the effects of additional cows were considered and accepted through a public hearing process. We are also open to accepting this approach since there will technically be no additional cows being added to the system over the two properties above what is already allowed by a current expansion consent. This approach will however tip you into Rule 20e – which makes it a discretionary activity. We discussed that there was little difference between 20d and 20e and you would not be disadvantaged by being tipped into this category.

Runoff/support blocks of land do not need to be nutrient budgeted due to there being no expected change in the farming practice of these blocks. We will however need a thorough assessment of the effects from these blocks. Again, we recognise this is different to what is currently being applied to some expansions, but please refer to the above explanation on why we are happy to take a different approach with your proposal.

The runoff/support blocks are to be included in the application with detailed description of how they are to be operated and the effects of this operation. This description can be at a total block level and does not need to be at a level of the specific activity of each individual block to allow for the differing activities that may be done on different blocks in any year. This will need to be clearly explained – e.g. year 1 winter grazing occurs at x block, year 2 no wintering occurs on x block but occurs on y block. This description is to be done at activity levels on these blocks for the consented cow number of 1250 cows.

It is expected that if a runoff/support block changes during the term of the consent then a variation to the consent would likely be required showing the effect of the change. This would be done by nutrient budgeting the block that is being removed against the new activity that is being proposed at that time. We discussed lease blocks and how to be flexible and allow an option for these to be relocated to a different piece of land in the future. As it currently stands you would need to get a new consent to use a different lease block in future. Council is exploring possible consent conditions relating to this at present and looking at ways to allow lease blocks to be “swapped” in future if necessary as described in your point.

All required consents including discharge and water consents are likely to be global consents over the two milking platforms.

Due to us seeking a new consent we would include the 7 ha of new land into the proposed milking area. It was suggested that description be given that if this land was not included and therefore not form part of the milking block then it is likely that it may end up being extensively wintered on which would have detrimental effects.

It was agreed that we should proceed with the application for all the required consents. It was suggested to lodge the effluent discharge consent application ASAP with the other applications to follow in due course once they have been completed. This will help to ensure that we can get our effluent pond and effluent system upgrade done in the early new year when conditions are at their best. Slight correction here - It was suggested you lodge the land use consent for the pond construction on SD2 ASAP and then the application for the expansion, water and discharge consents as these may take longer to process.

We also discussed that we are not able to pre-determine the outcome for your proposal and made you aware that there is always the possibility of it being publically notified and a decision being made by an independent commissioner as happened with SD2.

Aurora and Michael requested that they would like to meet with us once we have completed our application before lodging it so any issues that may exist can be identified.

As you are all aware I am meeting with family later this week to discuss the proposed strategic direction for South Dairy. This proposed scenario is one of the options being considered and is going to require significant capital investment. The other main option is to continue with the existing consents that we have and farm 750 cows on SD1 and 500 on SD2. The information gathered at todays meeting will allow us to have a fully informed debate and decision making on this direction.

It would be appreciated if Aurora and Michael can add comment to this summary of points and that they agree this covers off the detail of today's meeting. Feel free to add any points that I may have missed.

Thanks

Dean Alexander

Appendix 3:

Overseer Reports from File NB 2016-17 Consent DSN 31827 (copy) – UPDATED

Modelling Assumptions for SD1 Consent Conditions AUTH-20171302- 01/04

Overseer Reports from File SD1 Consent Conditions AUTH-20171302- 01/04

Modelling Assumptions for SD2 APP-20147281-01-v1

Overseer Reports from File SD2 APP-20147281-01-v1

Modelling Assumptions for Neighbouring 7 ha Support Block

Overseer Reports from File Neighbouring 7 ha Support Block

Overseer Reports from File NB 2016-17 Consent DSN 31827 (copy) – UPDATED, v6.3.0

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	186	35	13	52	233	0	0
Rain/clover N fixation	98	0	3	5	3	7	34
Irrigation	0	0	0	0	0	0	0
Supplements	62	8	38	6	8	4	3
Nutrients removed							
As products	96	16	23	5	21	2	7
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	102	0	0	0	0	0	0
To water	61	1.4	15	75	76	6	22
Change in farm pools							
Plant Material	-5	-1	-6	0	-1	-1	0
Organic pool	88	15	-22	-18	-1	-1	-7
Inorganic mineral	0	1	-19	0	-2	-3	-4
Inorganic soil pool	4	10	63	0	151	8	19

*Table 8: Nutrient Budget **NB 2016-17 Consent DSN 31827 (copy) – UPDATED**, Overseer v6.3.0*

Block name	Total N lost	N lost to water	N in drainage *	N surplus	Added N **
	kg N/yr	kg N/ha/yr	ppm	kg N/ha/yr	kg N/ha/yr
Puke_6a.1 Effluent	2,124	60	**13.3**	284	339
Puke_6a.1 Effluent Tile	4,735	59	**13.1**	280	339
Puke_6a.1 Effluent Solid Lease	2,007	53	**11.9**	241	298
Puke_6a.1 Effluent SolidTile	990	54	**12.0**	241	298
Puke_6a.1Effluent Solid	630	53	**11.9**	241	298
Riparian Areas	4	3	N/A		
Waiki_30a.1 Eff Solids	866	51	**11.6**	245	326
Waiki_30a.1 Run Off	1,031	46	10.5	228	298
Parah_4a.1 Eff solids	162	62	**13.4**	247	298
Parah_4a.1 Run Off	175	62	**13.4**	247	298
Apar_2a.1 Eff solids Lease	221	51	**11.7**	238	298
Fodder Beet	1,719	143	**26.1**	-336	112
Other sources	624				
Whole farm	15,287	61			
Less N removed in wetland	0				
Farm output	15,287	61			

*Table 9: Nitrogen Report **NB 2016-17 Consent DSN 31827 (copy) – UPDATED**, Overseer v6.3.0*

Block name	Total P lost	P lost to water	P loss categories		
	kg P/yr	kg P/ha/yr	Soil	Fertiliser	Effluent
Puke_6a.1 Effluent	36	1.0	Medium	Medium	Low
Puke_6a.1 Effluent Tile	82	1.0	Medium	Low	Low
Puke_6a.1 Effluent Solid Lease	33	0.9	Medium	Medium	Low
Puke_6a.1 Effluent SolidTile	18	1.0	Medium	Medium	Low
Puke_6a.1Effluent Solid	12	1.0	Medium	Medium	Low
Riparian Areas	0	0.1	N/A	N/A	N/A
Waiki_30a.1 Eff Solids	3	0.2	Low	Low	Low
Waiki_30a.1 Run Off	4	0.2	Low	Low	Low
Parah_4a.1 Eff solids	2	0.7	Low	Medium	Low
Parah_4a.1 Run Off	2	0.6	Low	Medium	Low
Apar_2a.1 Eff solids Lease	1	0.2	Low	Low	Low
Fodder Beet	16	1.4	N/A	N/A	N/A
Other sources	131				
Whole farm	340	1.4			

*Table 10: Phosphorus Report **NB 2016-17 Consent DSN 31827 (copy) – UPDATED**, Overseer v6.3.0*

Modelling Assumptions for SD1 Consent Conditions AUTH-20171302- 01/04

Modelling Inputs

To construct the nutrient budgets the following assumptions have been made;

Blocks

The farm has been split into the following pastoral and crop blocks:

Block Name	**SD1 Consent Conditions AUTH-20171302- 01/04**	**Contour**	**Drainage**
Pukem_6a.1 Effluent	147.0	Flat	100% tile
Pukem_6a.1 Rolling Effluent	6.0	Rolling	None
Pukem_6a.1 Non Effluent	35.3	Flat	100% tile
Waiki_30a.1 Effluent	27.0	Flat	100% tile
Waiki_30a.1 Non Effluent	11.1	Flat	100% tile
Waiki_30a.1 Rolling Effluent	2.0	Rolling	None
Parah_4a.1 Non Effluent	5.2	Flat	100% tile
Apar_2a.1 Effluent	1.0	Flat	100% tile
Apar_2a.1 Non Effluent	3.5	Flat	100% tile
Effective Farm Area	**238.1**		
Riparian	1.2		
Non productive	9.2		
Total Farm Area	**248.5**		
Fodderbeet (rotating thru all blocks)	**12.0**		

Climate Data

- Climate data from Overseer Climate Station Tool
- 10.1 degrees Celsius has been used as the mean annual temperature
- 1096 mm of rainfall
- 712 mm mean annual PET

Soils

- Soils areas were obtained from soils mapping provided by LandPro (refer appendices)
- Soil settings were obtained from SMap for all soil types
- Drainage – as per map in Appendix 1

Soil Tests

- All paddock soil testing is undertaken (Olsen P currently in the range of 27 to 38). Milk production at 1478 kg ms / ha and 469 kg ms / cow is above Southland average. Southland average is 1093 kg ms / ha and 414 kg ms / cow (source: NZ Dairy Statistics 2017-18). At a high milksolids production an Olsen P of 30 to 40 is justified if the response to pasture production is obtained and the appropriate management system is used to convert the extra pasture to milk solids (Source: Fertiliser Use on NZ Dairy Farms, Fert Research).
- Therefore a long term average status quo Olsen P of 35 has been assumed

Drainage

- Locations of the drains were provide by South Dairies Limited (refer Appendices)

Farm System

Description	**SD1 Consent Conditions AUTH-20171302- 01/04**
Crops	12 ha fodderbeet, yield 25 t DM / ha / year Conventional cultivation in November 250 kg CM15 per ha at sowing 100 kg urea in Dec Lifted in August, stored and fed on feed pad
Animals	352,000 kg ms Median calving date – 24th August Drying off – 31st May Mature Cows Breed - Kiwi Cross July 32 Aug 630 Sept 780 Oct 760 Nov 750 Dec 750 Jan 700 Feb 700 March 700 April 650 May 600 June 0 22 bulls (Dec / Jan) Replacements 197 calves August to mid Dec
Structures / Effluent	Farm Dairy Effluent Solids separated Liquid applied Aug to May at less than 12mm depth (183 ha) Solids applied Jan (to all pastoral block) Feedpad May – 67% (400 cows) for 2 hours per day August – 95% (600 cows) for 1.5 hours per day September – 51% (400 cows) for 1 hour per day Liquid to farm dairy effluent Solids applied Jan (to all pastoral blocks)
Supplement	Imported 430 t DM in silage (fed on feed pad) 100 t DM in PKE (fed on feed pad) Exported None

Description	SD1 Consent Conditions AUTH-20171302- 01/04
Fertiliser and Nitrogen	Phosphate fertiliser applied to all pastoral areas at maintenance 187 kg N / ha across effluent areas (split Aug to April) 231 kg N / ha across non effluent areas (split Aug to April) Average across whole farm area of 184 kg N / ha
Irrigation	None

Overseer Reports from File SD1 Consent Conditions AUTH-20171302- 01/04

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	184	25	1	29	66	0	0
Rain/clover N fixation	97	0	3	5	3	7	34
Irrigation	0	0	0	0	0	0	0
Supplements	61	7	49	6	9	4	3
Nutrients removed							
As products	96	16	23	5	21	2	7
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	101	0	0	0	0	0	0
To water	58	1.4	15	65	64	5	21
Change in farm pools							
Plant Material	-6	-1	-7	0	-1	-1	0
Organic pool	92	15	-10	-30	-1	-1	-1
Inorganic mineral	0	2	-18	0	-2	-3	-4
Inorganic soil pool	2	-1	48	0	-2	9	14

*Table 11: Nutrient Budget **SD1 Consent Conditions AUTH-20171302- 01/04***

Block name	Total N lost kg N/yr	N lost to water kg N/ha/yr	N in drainage * ppm	N surplus kg N/ha/yr	Added N ** kg N/ha/yr
Puke_6a.1 Effluent	7,855	56	**12.4**	265	243
Puke_6a.1 Effluent Rolling	305	53	**12.0**	264	243
Puke_6a.1 Non Effluent	1,920	57	**12.8**	265	263
Waiki_30a.1 Effluent	1,236	48	11.0	258	243
Waiki_30a.1 Non Effluent	523	50	**11.4**	258	263
Waik_30a.1 Effluent Rolling	91	48	11.0	257	243
Parah_4a.1 Non Effluent	332	68	**14.6**	271	263
Fodder Beet	1,049	87	**15.9**	-336	112
Apar_2a.1 Effluent	48	54	**12.1**	261	243
Apar_2a.1 Non Effluent	182	55	**12.5**	261	263
Riparian Area	4	3	N/A		
Other sources	788				
Whole farm	14,333	58			
Less N removed in wetland	0				
Farm output	14,333	58			

*Table 12: Nitrogen Report **SD1 Consent Conditions AUTH-20171302- 01/04***

Block name	Total P lost kg P/yr	P lost to water kg P/ha/yr	P loss categories		
			Soil	Fertiliser	Effluent
Puke_6a.1 Effluent	121	0.9	Medium	Low	Low
Puke_6a.1 Effluent Rolling	18	3.1	High	High **	Low
Puke_6a.1 Non Effluent	29	0.9	Medium	Low	Low
Waiki_30a.1 Effluent	11	0.4	Low	Low	Low
Waiki_30a.1 Non Effluent	5	0.4	Low	Low	Low
Waik_30a.1 Effluent Rolling	1	0.6	Low	Low	Low
Parah_4a.1 Non Effluent	5	1.0	Medium	Low	Low
Fodder Beet	14	1.2	N/A	N/A	N/A
Apar_2a.1 Effluent	0	0.4	Low	Low	Low
Apar_2a.1 Non Effluent	1	0.4	Low	Low	Low
Riparian Area	0	0.1	N/A	N/A	N/A
Other sources	133				
Whole farm	338	1.4			

*Table 13: Phosphorus Report **SD1 Consent Conditions AUTH-20171302- 01/04***

Modelling Assumptions for SD2 APP-20147281-01-v1

Modelling Inputs

To construct the nutrient budgets the following assumptions have been made;

Blocks

The farm has been split into the following pastoral blocks:

Block Name	SD2 APP-20147281-01-v1	Contour	Drainage
Pukem_6a.1 Effluent	91.2	Flat	100% tiled
Pukem_6a.1 Non Effluent	38.6	Flat	100% tiled
Wood_29a.1 Effluent	3.5	Flat	100% tiled
Wood_29a.1 Non Effluent	13.2	Flat	100% tiled
Apar_2a.1 Effluent	10.7	Rolling	100% tiled
Apar_2a.1 Non Effluent	10.1	Rolling	100% tiled
Paro_4a.1 Non Effluent	6.5	Flat	100% tiled
Effective Farm Area	**173.8**		
Non productive	6.0		
Total Farm Area	**179.8**		

Climate Data

- Climate data from Overseer Climate Station Tool
- 10.1 degrees Celsius has been used as the mean annual temperature
- 1096 mm of rainfall
- 712 mm mean annual PET

Soils

- Soils areas were obtained from soils mapping provided by LandPro (refer appendices)
- Soil settings were obtained from SMap for all soil types
- Drainage – as per map in Appendix 1

Soil Tests

- All paddock soil testing is undertaken (Olsen P currently in the range of 24 to 48). Milk production at 1369 kg ms / ha and 476 kg ms / cow is above Southland average. Southland average is 1093 kg ms / ha and 414 kg ms / cow (source: NZ Dairy Statistics 2017-18). At a high milksolids production an Olsen P of 30 to 40 is justified if the response to pasture production is obtained and the appropriate management system is used to convert the extra pasture to milk solids (Source: Fertiliser Use on NZ Dairy Farms, Fert Research).
- Therefore a long term average status quo Olsen P of 35 has been assumed

Drainage

- Locations of the drains were provide by South Dairies Limited (refer Appendices)

Farm System

Description	SD2 APP-20147281-01-v1
Crops	None
Animals	238,000 kg ms Median calving date – 20th August Drying off – 29th May Mature Cows Breed - Kiwi Cross July 320 Aug 515 Sept 510 Oct 500 Nov 500 Dec 490 Jan 490 Feb 490 March 480 April 480 May 460 June 320 15 bulls (Dec / Jan) Replacements 130 calves August to mid Dec
Structures / Effluent	Farm Dairy Effluent Solids separated Liquid applied Aug to May at less than 12mm depth (105.4 ha) Solids applied Jan (to all pastoral block) Wintering Pad Covered June / July – 320 cows 24 hours August – 103 cows on average Liquid to farm dairy effluent Solids applied Feb(to all pastoral blocks)
Supplement	Imported 265 t DM in pasture silage (fed in winter pad) 210 t DM in pasture silage (on pasture blocks) 65 t DM in barley grain (fed in milking shed) 140 t DM in PKE (fed in milking shed) Exported None

Description	**SD2 APP-20147281-01-v1**
Fertiliser and Nitrogen	Phosphate fertiliser applied to all pastoral areas at maintenance 183kg N / ha across effluent areas (split Aug to April) 227 kg N / ha across non effluent areas (split Aug to April) Average across whole farm area of 194 kg N / ha
Irrigation	None
In shed feeding	100% of the herd – August to May

Overseer Reports from File SD2 APP-20147281-01-v1

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	194	24	0	34	89	0	0
Rain/clover N fixation	89	0	3	5	3	7	35
Irrigation	0	0	0	0	0	0	0
Supplements	92	11	69	9	12	7	4
Nutrients removed							
As products	93	16	22	5	21	2	6
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	105	0	0	0	0	0	0
To water	58	1.3	14	70	64	5	20
Change in farm pools							
Plant Material	0	0	0	0	0	0	0
Organic pool	119	16	0	-27	1	0	0
Inorganic mineral	0	2	-17	0	-2	-3	-4
Inorganic soil pool	0	1	52	0	21	10	16

*Table 14: Nutrient Budget **SD2 APP-20147281-01-v1***

Block name	Total N lost kg N/yr	N lost to water kg N/ha/yr	N in drainage * ppm	N surplus kg N/ha/yr	Added N ** kg N/ha/yr
Pukem_6a.1 Effluent	5,284	58	**12.7**	248	251
Pukem_6a.1 Non effluent	2,259	59	**13.1**	247	269
Wood_29a.1 Effluent	198	57	**12.7**	245	251
Wood_29a.1 Non effluent	764	58	**13.0**	244	269
Apar_2a.1 Effluent	596	56	**12.4**	244	251
Apar_2a.1 Non effluent	568	56	**12.8**	243	269
Paro_4a.1 Non effluent	265	41	9.5	236	269
Other sources	480				
Whole farm	10,414	58			
Less N removed in wetland	0				
Farm output	10,414	58			

Table 15: Nitrogen Report SD2 APP-20147281-01-v1

Block name	Total P lost kg P/yr	P lost to water kg P/ha/yr	P loss categories		
			Soil	Fertiliser	Effluent
Pukem_6a.1 Effluent	79	0.9	Medium	Low	Low
Pukem_6a.1 Non effluent	33	0.9	Medium	Low	Low
Wood_29a.1 Effluent	1	0.4	Low	Low	Low
Wood_29a.1 Non effluent	5	0.4	Low	Low	Low
Apar_2a.1 Effluent	8	0.8	Low	Low	Low
Apar_2a.1 Non effluent	8	0.8	Low	Low	Low
Paro_4a.1 Non effluent	4	0.6	Low	Low	Low
Other sources	91				
Whole farm	230	1.3			

Table 16: Phosphorus Report SD2 APP-20147281-01-v1

Modelling Assumptions for Neighbouring 7 ha Support Block

Modelling Inputs

To construct the nutrient budgets the following assumptions have been made;

Blocks

The farm has been split into the following pastoral blocks:

Block Name	**Neighbouring 7 ha Support Block**	**Contour**	**Drainage**
Pukem_6a.1	2.9	Flat	100% tile
Apar_2a.1	3.7	Flat	100% tile
Effective Farm Area	**6.6**		
Non productive	0.9		
Total Farm Area	**7.5**		

Climate Data

- Climate data from Overseer Climate Station Tool
- 10.1 degrees Celsius has been used as the mean annual temperature
- 1096 mm of rainfall
- 712 mm mean annual PET

Soils

- Soils areas were obtained from soils mapping provided by LandPro (refer appendices)
- Soil settings were obtained from SMap for all soil types

Drainage – as per map in Appendix 1

Soil Tests

- All paddock soil testing is undertaken (Olsen P currently in the range of 11 to 47).
- A long term average status quo Olsen P of 30 has been assumed to achieve pasture growth rates

Drainage

- Locations of the drains were provide by South Dairies Limited (refer Appendices)

Farm System

Description	Neighbouring 7 ha Support Block
Crops	None
Animals	Mature Cows Breed - Kiwi Cross July 200 June 200
Structures / Effluent	None
Supplement	Imported 30 t DM in pasture balege (on pasture blocks) Exported None
Fertiliser and Nitrogen	Phosphate fertiliser applied to all pastoral areas at maintenance 110 kg N / ha across pastoral areas (split Sept to April) Average across whole farm area of 97 kg N / ha
Irrigation	None

Overseer Reports from File Neighbouring 7 ha Support Block

(kg/ha/yr)	N	P	K	S	Ca	Mg	Na
Nutrients added							
Fertiliser, lime & other	97	7	0	9	45	0	0
Rain/clover N fixation	44	0	3	5	3	7	35
Irrigation	0	0	0	0	0	0	0
Supplements	56	11	70	8	18	6	5
Nutrients removed							
As products	0	0	0	0	0	0	0
Exported effluent	0	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0
To atmosphere	27	0	0	0	0	0	0
To water	29	0.6	8	24	42	6	21
Change in farm pools							
Plant Material	0	0	0	0	0	0	0
Organic pool	142	15	26	-2	7	2	1
Inorganic mineral	0	2	-14	0	-2	-3	-3
Inorganic soil pool	0	0	53	0	19	8	20

Table 17: Nutrient Budget ***Neighbouring 7 ha Support Block***

Block name	Total N lost kg N/yr	N lost to water kg N/ha/yr	N in drainage * ppm	N surplus kg N/ha/yr	Added N ** kg N/ha/yr
Pukem_6a.1 Non effluent	98	34	7.6	201	110
Apar_2a.1 Non effluent	116	31	7.1	189	110
Other sources	4				
Whole farm	218	29			
Less N removed in wetland	0				
Farm output	218	29			

Table 18: Nitrogen Report ***Neighbouring 7 ha Support Block***

Block name	Total P lost kg P/yr	P lost to water kg P/ha/yr	P loss categories		
			Soil	Fertiliser	Effluent
Pukem_6a.1 Non effluent	2	0.7	Medium	Low	N/A
Apar_2a.1 Non effluent	1	0.4	Low	Low	N/A
Other sources	1				
Whole farm	5	0.6			

Table 19: Phosphorus Report ***Neighbouring 7 ha Support Block***

OVERSEER Nutrient Budget Review

For: Environment Southland – South Dairies Ltd

Prepared by: Nicky Watt, CNMA

Introduction

1. Regarding the consent application for South Dairies Ltd, I have reviewed the following OVERSEER ® Nutrient Budget (OVERSEER) files:
   a) SD1 Consent Conditions AUTH-20171302-01/04
   b) SD2 APP-20147281-01-v1
   c) SD 7ha Support
   d) NB 2016-2017 Consent DSN 31827 (copy)-UPDATED (1)

2. Along with the files I have reviewed the following report:
   - Overseer Modelling Report prepared by Miranda Hunter, Roslin Consultancy Limited.

3. I have completed a robustness check on the files for sensibility based on data available and checked to ensure the modelling aligns with the OVERSEER Best Practice Data Input Standards for v6.3.0.

4. It must be assumed that the information provided in the OVERSEER files that the have been modelled are a viable farming system, using actual stock and fertiliser inputs. Therefore, they are also assumed to be appropriate for the location and climate.

5. A 'sensibility test' has been undertaken on the South Dairies Ltd nutrient budgets with the following four output screens from OVERSEER forming the basis of the determination of the robustness of the nutrient budget:
   a) Is the nutrient loss consistent with what you would expect for an operation of this type and soils in this location?
   b) Does the summary of inputs and outputs make sense? Especially clover fixation and change in block pools?
   c) Check the 'Other values' block reports for rainfall, drainage, and PAW
   d) Select the Scenario reports other values and check the production and stocking rate
   e) Select the pasture production in the scenario report and check pasture growth.

6. Answers to each of these five points will be provided further in this report and then a final determination of the robustness of the nutrient loss to water will be provided at the end of this report.

OVERSEER AUDIT

Appropriateness of the Overseer inputs

1. The four XML files stated in paragraph 1 of this report have been reviewed for consistency between the files and appropriateness of the inputs regarding the farming systems and the Overseer Best Practice Data Input Standard (BPDIS).

2. I concur that there is no deviation from the BPDIS for all predictive files.

   NB 2016 2017 Consent DSN 31827 (copy)-Updated (1), which represents original consent conditions, has not been updated (all soils not updated to the latest version, currently soils in v6.2.2). Small point to note is in table 4 of the report provided by Roslin Consultancy Ltd indicates v6.3.0 (could be written there in error as clearly states in section 7.1 that has not been updated). The key differences between this model and SD1 Consent conditions AUTH-20171302-01/04 has been clearly identified in section 7.3 of the report provided by Roslin Consultancy Ltd.

3. All models appear to have the correct area and where there are discrepancies between models this has been clearly mentioned in Section 7.3 of Roslin Consultancy Ltd report.

4. Reviewing the NZ Dairy statistics for the 2016/2017 season, shows the milk solids production on this property is in fact higher than the Southland regional average of 415kg MS/cow. The stocking rate is also higher than the Southland average for the 2016/2017 season of 2.69 cows/ha. Milk solid production per cow is the same for SD1 and SD1 2016 2017 and slightly higher for SD2. Stocking rate is similar for SD1 and SD1 2016 2017 and lower for SD2 (see Table 1).

Table 1: Summary of Production and stocking rate

	SDI*	SD1 2016 2017**	SD2***	7ha Support****
Total Ha	248.5	249.2	179.8	7.5
Effective Ha	238.1	244	173.8	6.6
MS kg/ha grazed	1480	1442	1369	-
MS kg MS/cow	451.3	451.3	462.1	-
RSU	7361	7359	5290	151
Lactation Length	268	268	268	-
Cows/ha	3.3	3.2	3.0	-
Cows June	0	0	320	200
Cows July	32	32	320	200
Peak Cows (Sept)	780	780	510	-
Bulls (Dec/Jan)	22	0	15	0
Young Stock (Aug-Dec)	197	0	130	0
N lost kg/ha/yr	58	61	58	29

*SD1= SD1 Consent Conditions AUT-20171302-01/04
**SD1 2016 2017= NB 2016-17 Consent DSN 31827 (copy) UPDATED (1)
***SD2=SD2 APP-20147281-01-v1
****7ha Support= SD 7ha Support

5. The total crop area of fodder beet is consistent between SD1 and SD1 2016 2017 as can be seen in Table 2 below. Other models have no crops modelled. Note difference in drainage area between SD1 and SD1 2016 2017 (also commented on in Section 7.3 of Roslin Consultancy Ltd report).

Table 2: Crop Details and Drainage

	SDI	SD1 2016 2017	SD2	7ha Support
Crop Effective Ha	12	12	-	-
Yield (tDM/ha)	25	25	-	-
Cultivation	Conventional	Conventional	-	-
Sown	November	November	-	-
Crop	Fodder Beet	Fodder Beet	-	-
Drainage Area (ha)	230	103	173.8	6.6

6. Supplements imported is 80 tDM/ha less for SD1 compared to SD1 2016 2017. Supplements imported for SD2 is 150 tDM/ha higher than SD1 and with 0.3 less cows/ha (see Table 3a below for supplement imported and table 1 for stocking rate).

Table 3a: Supplements imported and Harvested

	SDI	SD1 2016 2017	SD2	7ha Support
Supplements Imported (tDM)	530	610	680	30
Supplements Imported (tDM/ha)	2.21	2.49	3.91	4.55
Effective Area (ha)	238.1	244	173.8	6.6
RSU/ha	7361	7359	5290	151
N Fertiliser applied (kgN/ha)	184	186	194	97
Pasture Intake (kgDM/ha)	14846	14002	14177	3848
Silage Harvested to storage (kgDM/ha)	0	375	0	9148
Pasture Intake including supplement (kgDM/ha)	14846	14377	14177	12996

7. The SD1 Overseer model shows the pasture production is 14.85 tDM/ha and the SD1 2016 2017 is 14.38 tDM/ha or a 0.47 tDM increase in pasture production (see Table 3a above and Table 3b below). The nitrogen fertiliser used is 184 kgN/ha for SD1 and 186 kgN/ha for SD1 2016 2017 or a 0.16tDM/ha decrease in potential pasture grown through a decrease in N used. The supplement used for SD1 is 2.21 tDM/ha and for SD1 2016 2017 is 2.49 tDM/ha or 0.49 tDM/ha decrease in supplement used. Based on this information, adding the extra 80 tDM to the SD1 model will bring the two models back in line.

Table 3b: Comparison of actual and proposed feed availability

(tDM/ha)	SD1	SD1 2016 2017	Difference
Pasture Intake	14.85	14.38	0.47
Supplements Imported	2.21	2.49	-0.49
Pasture Growth from N fertilizer*	1.84	1.86	-0.02

**Pasture growth from N fertilizer have assumed an average 10:1 response*

8. The N lost to water and P loss is similar for the SD1, SD1 2016 2017 and SD2 models, keeping in mind SD1 2016 2017 is modelled with v6.2.2 so is likely to have a much higher N loss than that shown below (see Table 4 below). It must be assumed that the information provided in all the models are farming systems is modelled as a viable farming system, using actual stock and fertiliser inputs and are also assumed to be appropriate for the location and climate.

Overseer Outputs

Table 4: OVERSEER outputs

Overseer v6.3.0	SDI	SD1 2016 2017	SD2	7ha Support
N lost to water kg/ha/yr	58	61	58	29
Total N lost kg/farm	14333	15287	10414	218
P lost kg/ha/yr	1.4	1.4	1.3	0.6
Total P lost kg/farm	338	340	230	5
Other sources – N	788	624	480	4
Other sources – P	133	131	91	1

Change in block pools

9. It appears N is potentially being immobilized for both SD1 and SD1 2016 2017 models. This is observed with a positive value in the Organic pool for N. This value shows no change for SD2 and SD 7ha support.

Table 5: Change in block pool (N)

	SDI	SD1 2016 2017	SD2	7ha Support
Plant Material	-6	-5	0	0
Organic Pool	92	88	119	142
Inorganic Material	0	0	0	0
Inorganic Soil Pool	2	4	0	0

10. Phosphate added to SD1 2016 2017 was between 32-42 kgP/ha where maintenance P requirements were 20-25 kgP/ha which has resulted in the organic P soil P increasing (see table 6 below). The phosphate added to the SD1 and SD2 models was 25-26 kgP/ha which met P maintenance requirements resulting in little to no change the inorganic soil pool for changing. SD 7ha support shows is receiving maintenance P.

Table 6: Change in block pool (P)

	SDI	SD1 2016 2017	SD2	7ha Support
Plant Material	-1	-1	0	0
Organic Pool	15	15	16	15
Inorganic Material	2	1	2	2
Inorganic Soil Pool	-1	10	1	0

Rain/clover N Fixation

11. The average Biological fixation for 7ha support and SD2 are 8% and 56% less respectively when compared to the SD1 and SD1 2016 2017 models (see table 7 below).

12. N added is reasonable consistent for the 3 dairy farm models and half for the support block. In all cases (for the dairy farm models as shown below in table 8) consideration has been given to effluent being applied (less N on effluent blocks).

13. The small decrease in biological fixation for SD2 compared to SD1 and SD1 2016 2017 will likely be due to the increase in average N applied. This is deemed to be an acceptable variance and within the limitations of the model.

Table 7: Biological fixation

	SDI	SD1 2016 2017	SD2	7ha Support
Biological Fixation	95	96	87	42
Average N applied to whole farm kg/ha/yr	184	186	194	97

14. It is not known if the decrease in N applied and slight decrease in biological fixation for SD1 when compared to SD1 2016 2017 will be able to maintain the pasture production modelled for SD1.

Pasture Production

15. The effluent N inputs for SD1 are 66% less compared to SD1 2016 2017 which is due to the increase in effluent area, in SD1, (32% increase in area) being applied (see table 8 below). Important to note N loading from effluent at 165 kgN/ha/annum for SD1 2016 2017 exceeds consent conditions ie 'Nitrogen loading from effluent not to exceed 150 kgN/ha/annum'

16. Fertiliser inputs of N vary across the 3 models with 7% more N fertiliser being applied to the SD1 effluent area and 9% more to the non-effluent area compared to SD1 2016 2017. SD2 model has similar input to SD1.

17. Pond solids, separate solids and solids from the wintering pad area, are all applied to all blocks in all models. Liquid effluent, using <12 mm), is applied for SD1 and a Low application method is applied to SD1 2016 2017.

18. Long term pasture growth in Southland between 1979 and 2012 indicated that average pasture growth for newer pastures was 12.7T DM/ha/yr. The pasture production on this property is higher than the long-term growth. This has been explained by Roslin Consultancy Ltd in Section 4.2.

19. The animal distribution is modelled the same in all scenarios.

Table 8: Pasture production and N inputs (fertiliser and effluent)

	SDI	SD1 2016 2017	SD2	7ha Support
Effluent Area (ha)	183	121	105.4	0
Pasture Growth (tDM/ha/yr)				
Effluent	17.5	16.8	16.7	
Non-Effluent	17.5	16.8	16.7	
N Fertiliser inputs (kg/ha/yr)				
Effluent	187	174	183	
Non-Effluent	231	210	227	
N Effluent Inputs (kg/ha/yr)				
Effluent	56	165	68	
Non-effluent (includes solids)	33	87	42	
Total N Inputs (kgN/ha/yr)				
Effluent	243	339	251	
Non-Effluent	264	297	269	

Changes Modelled

20. As described in the report provided by Roslin Consultancy Ltd, Section 7.3, on a comparison between SD1 and SD1 2016 2017 there are several changes that have been included in the SD1 model that differs from the SD1 2016 2017 model. The table below details if the changes have been included in the SD1 model and shows has been accurately modelled.

Table 9: Changes to SD1

Total Area changed	Yes (249.2 to 248.5 ha)
Effective area changed	Yes (245.2 to 239.3
Increased Effluent area	Yes (121 to 183 ha)
Change application depth effluent applied	Yes. Changed from low application depth to <12mm depth
Months Solids applied	Yes (changed from Dec and Jan to Jan only)
Changed from wintering pad to feedpad and times on	Yes, changes proposed made
Topography changes	Yes (all flat to some areas rolling)
Drainage changes	Yes (103 to 230 ha mole/tile drained)
Animal changes	Yes (cow weight now default, drying off 31st May, bulls included, replacement calves on farm)
Supplement changes	Yes (less supplement imported and no silage harvested however to keep pasture harvest consistent similar supplement should be imported – this will drop N loss further)
Fertiliser and Nitrogen	Yes (less P fertiliser applied to maintain Olsen P levels, slightly less N applied over all farm)

21. Most of the changes look reasonable and are robust.

22. It is important that these changes are measured and monitored as if they are not adhered to the N losses proposed may not occur.

CONCLUDING COMMENTS

Determination of the robustness of the nutrient loss to water

23. The questions below were described at Paragraph five of this report. Whilst these have been answered throughput this report, this section summarizes the answer to each question to make an overall conclusion about the robustness of the nutrient budgets.

Is the N loss consistent with what you would expect for an operation of this type and soils in this location?

24. Based on my experience, the N loss estimates are reasonably consistent with an operation of this scale and soil types present.

Does the summary of inputs and outputs make sense? Especially clover fixation and change in block pools?

25. There was a small decrease in biological fixation for SD2 compared to SD1 and SD1 2016 2017 will likely be due to the increase in average N applied. This is deemed to be an acceptable variance and within the limitations of the model.

Check the 'Other values' block reports for rainfall, drainage, and PAW

26. The rainfall and soil information have been entered based on protocols for the location and soil type selected.

Production and stocking rate

27. Based on my experience as well as reviewing NZ Dairy statistics for the 2016/2017 season the stocking rate and milk solid production are higher than the Southland Region average in the 2016/2017 season.

28. The milk solids production per cow modelled for SD1 and SD1 2016 2017 at 451.3 kgMS/cow/annum and SD2 at 462.1 kg MS/cow/annum is higher than the Southland regional average of 415kg MS/cow.

29. The stocking rate, for all dairy farm models, is higher than the Southland average for the 2016/2017 season of 2.69 cows/ha.

30. It is assumed that all the models are based on actual information and all scenarios represent viable production and stocking rates.

Select the pasture production in the scenario report and check pasture growth.

31. A detailed explanation of the pasture production has been outlined in the above sections.

32. There is an increase in pasture production between the SD1 2016 2017 and the SD1 models and a corresponding small decrease in N applied and decrease in supplement being imported. The pasture production of SD2 and SD 7ha seems in line with expectations.

33. There is a shortfall of either supplement imported and/or nitrogen applied to cover the extra pasture production of the SD1 model and it is therefore unlikely that the modelled increase in pasture production in the SD1 model could occur. This would indicate that supplements imported and/or N fertiliser would need to increase to cover the increase in pasture production.

34. An increase in N fertiliser to grow the additional feed modelled in the SD1 model would likely see an increase in N lost than is currently modelled.

35. An increase in supplements imported on farm to cover the shortfall in feed is unlikely to have a significant impact on the N leaching and would be in line with what was modelled in SD1 2016 2017.

36. I have assumed an adequate level of robustness for all scenario Overseer Modelling as it is based on an actual farming system, and with that, I have assumed actual stock and fertiliser inputs used.

37. The data input protocols have been followed for all scenarios with no deviations. This leads to a high level of robustness for the relevant input data for example, climate, soils, and pasture type.

38. Based on the above information, I consider that the robustness of the nutrient loss estimates for models to be as follows:

    a) SD1 **medium-high**
    b) SD2 **high**
    c) SD 7ha Support **high**
    d) SD1 2016 2017 as a model originally produced for consent **medium**

39. The area of concern in the SD1 model is: the increase in pasture production and the reduction in supplements imported, however increasing the supplement, in SD1 to get the pasture covers back in line, will result in a slightly lower N loss.

40. The area of concern around the SD1 2016 2017 model is: the robustness of the model where farm area; topography; soil areas; drainage; animals on farm; effluent; fertiliser all have had to be changed to meet what happened on farm.

41. It is vital that the proposed plans for the farm system are effectively measured and monitored as if these are not adhered to then the proposed N losses may not occur.

References:

New Zealand Dairy Statistics 2016/2017. Produced by LIC and DairyNZ 2014. https://www.dairynz.co.nz/media/5788533/nz-dairy-statistics-2016-17-web.pdf

Overseer Definition of Terms, previously Technical Note 6. May 2016
Overseer Technical Manual – Characteristics of Pasture, April 2015

Smith. L. C. 2012. Proceedings of the New Zealand Grassland Association 74: 147-152 (2012) *Long Term pasture growth patterns for Southland New Zealand: 1978-2012*. www.grassland.org.nz/publications/nzgrassland_publication_2284.pdf

OVERSEER Nutrient Budget Review of proposed

For: Environment Southland – South Dairies Ltd

Prepared by: Nicky Watt, CNMA

Introduction

1. Regarding the consent application for South Dairies Ltd, I have reviewed the following OVERSEER ® Nutrient Budget (OVERSEER) files:
   a) SD1 Consent Conditions AUTH-20171302-01/04
   b) SD2 APP-20147281-01-v1
   c) SD 7ha Support
   d) Ovr-South Dairies Proposed (1)

2. Along with the files I have reviewed the following report:
   - Overseer Modelling Report prepared as part of a consent application for expanding dairying, prepared by Miranda Hunter, Roslin Consultancy Limited.

3. I have completed a robustness check on the files for sensibility based on data available and checked to ensure the modelling aligns with the OVERSEER Best Practice Data Input Standards for v6.3.1.

4. It must be assumed that the information provided in the OVERSEER files that the have been modelled are a viable farming system, using actual stock and fertiliser inputs. Therefore, they are also assumed to be appropriate for the location and climate.

5. A 'sensibility test' has been undertaken on the South Dairies Ltd nutrient budgets with the following four output screens from OVERSEER forming the basis of the determination of the robustness of the nutrient budget:
   a) Is the nutrient loss consistent with what you would expect for an operation of this type and soils in this location?
   b) Does the summary of inputs and outputs make sense? Especially clover fixation and change in block pools?
   c) Check the 'Other values' block reports for rainfall, drainage, and PAW
   d) Select the Scenario reports other values and check the production and stocking rate
   e) Select the pasture production in the scenario report and check pasture growth.

6. Answers to each of these five points will be provided further in this report and then a final determination of the robustness of the nutrient loss to water will be provided at the end of this report.

OVERSEER AUDIT

Appropriateness of the Overseer inputs

1. The four XML files stated in paragraph 1 of this report have been reviewed for consistency between the files and appropriateness of the inputs regarding the farming systems and the Overseer Best Practice Data Input Standard (BPDIS).

2. I concur that there is no deviation from the BPDIS for all predictive files.

3. All models appear to have the correct area and is summarized in Section 7.0 of Roslin Consultancy Ltd report, dated 14th March 2019.

4. Reviewing the NZ Dairy statistics for the 2017/2018 season, shows the milk solids production on these properties are in fact higher than the Southland regional average of 408kg MS/cow. The stocking rate is also higher than the Southland average for the 2017/2018 season of 2.64 cows/ha. Milk solid production per cow for the SD Proposed model (457.4 MS/ha) is slightly higher when compared to the average (455.9 MS/ha) of SD1, SD2 and 7ha support models (baseline models). The stocking rate for SD Proposed (3.1 cows/ha) is slightly lower when compared to the average (3.17 cows/ha) of the baseline models (see table 1 below).

Table 1: Summary of Production and stocking rate

	SDI*	SD2***	7ha Support****	Baseline Models	SD Proposed**
Total Ha	248.5	179.8	7.5		435.8
Effective Ha	238.1	173.8	6.6		418.5
MS kg/ha grazed	1480	1369	-	1433	1410
MS kg MS/cow	451.3	462.1	-	455.9	457.4
RSU	7361	5290	151		12834
Lactation Length	268	268	-		268
Cows/ha	3.3	3.0	-		3.1
Cows June	0	320	200		520
Cows July	32	320	200		552
Peak Cows (Sept)	780	510	-		1290
Bulls (Dec/Jan)	22	15	0		37
Young Stock (Aug-Dec)	197	130	0		327
N lost kg/ha/yr	58	58	29	57	57

*SD1= SD1 Consent Conditions AUT-20171302-01/04
**SD Proposed= Ovr-South Dairies Proposed (1)
***SD2=SD2 APP-20147281-01-v1
****7ha Support= SD 7ha Support
Baseline Models = Average of SD1, SD2 and 7ha Support

5. The fodder beet has been rotated around each block for SDI and for the SD Proposed. SD2 and 7ha support did not have fodder beet rotated through.

Table 2: Crop Details and Drainage

	SDI	SD2	7ha Support	SD Proposed
Crop Effective Ha	12	-	-	12
Yield (tDM/ha)	25	-	-	25
Cultivation	Conventional	-	-	Conventional
Sown	November	-	-	November
Crop	Fodder Beet	-	-	Fodder Beet
Blocks	All	-	-	All
Drainage Area (ha)	230	173.8	6.6	410.4

6. Supplements imported in SD Proposed at 2.87 tDM/ha is slightly less than the total of the baseline models (SD1, SD2 and 7ha support) at 2.96 tDM/ha. The SD Proposed Overseer model shows the pasture production is 14.4 tDM/ha compared to the baseline models average is 14.54 tDM/ha. This is around 0.1 tDM/ha decrease in pasture production (see Table 3a above) The nitrogen fertiliser used is 184 kgN/ha for SD Proposed which is slightly less than the average of 187 kgN/ha for baseline models.

7. The 0.14 tDM/ha decrease in pasture growth is accounted for in the 0.1 tDM/ha decrease in pasture grown and slight decrease in N fertiliser applied. The stocking rate and cows per month are the same when comparing the average of the baseline models and the SD Proposed model (see Table 3a below).

Table 3a: Supplements imported and Harvested

	SDI	SD2	7ha Support	Baseline Models	SD Proposed
Supplements Imported (tDM)	530	680	30		1200
Supplements Imported (tDM/ha)	2.21	3.91	4.55	2.96	2.87
Effective Area (ha)	238.1	173.8	6.6		418.5
RSU/ha	7361	5290	151		12834
N Fertiliser applied (kgN/ha)	184	194	97	187	184
Pasture Intake (kgDM/ha)	14846	14177	3848		14456
Silage Harvested to storage (kgDM/ha)	0	0	9148		0
Pasture Intake including supplement (kgDM/ha)	14846	14177	12996	14540	14456

8. The N lost to water and P loss is same for the SD Proposed (57 kgN/ha) and average (57 kgN/ha) of the baseline models, and SD2 models, (see Table 4 below). It must be assumed that the information provided in all the models are farming systems is modelled as a viable farming system, using actual stock and fertiliser inputs and are also assumed to be appropriate for the location and climate.

Table 4: OVERSEER outputs

Overseer v6.3.0	SDI	SD2	7ha Support	Baseline Models	SD Proposed
N lost to water kg/ha/yr	58	58	29	57	57
Total N lost kg/farm	14333	10414	218		24913
P lost kg/ha/yr	1.4	1.3	0.6	1.3	1.3
Total P lost kg/farm	338	230	5		576
Other sources – N	788	480	4		1330
Other sources – P	133	91	1		228

Change in block pools

9. It appears N is potentially being immobilized for SD Proposed average of the baseline models. This is observed with a positive value in the inorganic pool for N.

Table 5: Change in block pool (N)

	SDI	SD2	7ha Support	SD Proposed
Plant Material	-6	0	0	-3
Organic Pool	92	119	142	102
Inorganic Material	0	0	0	0
Inorganic Soil Pool	2	0	0	2

10. The phosphate added to all the models met P maintenance requirements resulting in little to no change the inorganic soil pool.

Table 6: Change in block pool (P)

	SDI	SD2	7ha Support	SD Proposed
Plant Material	-1	0	0	0
Organic Pool	15	16	15	16
Inorganic Material	2	2	2	2
Inorganic Soil Pool	-1	1	0	-1

Rain/clover N Fixation

11. N added to the SD Proposed model is slightly below the average of the baseline models (187 kgN/ha). In all cases (for the dairy farm models as shown below in table 8) consideration has been given to effluent being applied (less N on effluent blocks).

12. The small increase in biological fixation in the SD Proposed model when compared to the average of baseline models which will likely be due to the decrease in average N applied. This is deemed to be an acceptable variance and within the limitations of the model.

Table 7: Biological fixation

	SDI	SD2	7ha Support	Baseline Models	SD Proposed
Biological Fixation	95	87	42	97	93
Average N applied to whole farm kg/ha/yr	184	194	97	187	184

13. It is likely the decrease in N applied and slight increase in biological fixation for SD Proposed when compared to the average of the baseline will maintain the pasture production modelled for SD Proposed.

Pasture Production

14. The effluent N inputs for SD Proposed are in line with the average of the baseline dairy models (see table 8 below).

15. Fertiliser inputs of N in the SD Proposed model is 1.3% less on the effluent areas and 4.1% less N fertiliser being applied to the non-effluent areas compared to the average of the 2 dairy farm baseline models.

16. Pond solids, separate solids and solids from the wintering pad area, are all applied to all blocks in all models. Liquid effluent, using <12 mm), is applied for all dairy farm models.

17. Long term pasture growth in Southland between 1979 and 2012 indicated that average pasture growth for newer pastures was 12.7T DM/ha/yr. The pasture production on this property is higher than the long-term growth. This has been explained by Roslin Consultancy Ltd in Section 10.8.

18. The animal distribution is modelled the same in all scenarios.

Table 8: Pasture production and N inputs (fertiliser and effluent)

	SDI	SD2	Baseline Models	SD Proposed
Effluent Area (ha)	183	105.4	288.4	288.4
Pasture Growth (tDM/ha/yr)				
Effluent	17.5	16.7	17.2	17.0
Non-Effluent	17.5	16.7	17.2	17.0
N Fertiliser inputs (kg/ha/yr)				
Effluent	187	183	185	183
Non-Effluent	231	227	229	220
N Effluent Inputs (kg/ha/yr)				
Effluent	56	68	61	64
Non-effluent (includes solids)	33	42	37	35
Total N Inputs (kgN/ha/yr)				
Effluent	243	251	246	247
Non-Effluent	264	269	266	256

Changes Modelled

19. As described in the report provided by Roslin Consultancy Ltd, Section 10.7, on farm system modelling of SD Proposed, the table below details the data that has been included in the SD Proposed model to reflect the 3 baseline models and shows if it has been accurately modelled.

Table 9: Modelling of SD Proposed

Total Area changed	Yes (sum of baseline models, 435.8 ha)
Effective area changed	Yes (sum of baseline models 418.5 ha)
Increased Effluent area	Yes (sum of dairy baseline models 1288.4 ha)
Changed from wintering pad to feed pad and times on	Yes, changes proposed made
Animal changes	Yes (cows each month add to total of cows in baseline models)
Supplement changes	Yes (total supplement imported is slightly less than the total of the baseline models and is reflected in the slightly lower pasture harvest)
Fertiliser and Nitrogen	Yes (P fertiliser applied to maintain Olsen P levels, slightly less N applied in the SD Proposed model)

20. Most of the changes look reasonable and are robust.

21. It is important that these changes are measured and monitored as if they are not adhered to the N losses proposed may not occur.

CONCLUDING COMMENTS

Determination of the robustness of the nutrient loss to water

22. The questions below were described at Paragraph five of this report. Whilst these have been answered throughput this report, this section summarizes the answer to each question to make an overall conclusion about the robustness of the nutrient budgets.

Is the N loss consistent with what you would expect for an operation of this type and soils in this location?

23. Based on my experience, the N loss estimates are reasonably consistent with an operation of this scale and soil types present.

Does the summary of inputs and outputs make sense? Especially clover fixation and change in block pools?

24. There was a small increase in biological fixation for SD Proposed compared to baseline models which is likely be due to the decrease in average N applied. This is deemed to be an acceptable variance and within the limitations of the model.

Check the 'Other values' block reports for rainfall, drainage, and PAW

25. The rainfall and soil information have been entered based on protocols for the location and soil type selected.

Production and stocking rate

26. Based on my experience as well as reviewing NZ Dairy statistics for the 2017/2018 season the stocking rate and milk solid production are higher than the Southland Region average in the 2017/2018 season.

27. The milk solids production per cow modelled for SD proposed at 457.4 kgMS/cow/annum is higher than the Southland regional average of 408kg MS/cow but in line with the average of the 2 dairy farm baseline models milk production.

28. The stocking rate, for all dairy farm models, is higher than the Southland average for the 2017/2018 season of 2.64 cows/ha.

29. It is assumed that all the models are based on actual information and all scenarios represent viable production and stocking rates.

Select the pasture production in the scenario report and check pasture growth.

30. A detailed explanation of the pasture production has been outlined in the above sections.

31. There is a small decrease in pasture production between the SD Proposed and the baseline models and a corresponding small decrease in N applied and decrease in supplement being imported. The pasture production of SD proposed seems in line with expectations.

32. There is a shortfall of pasture production in the SD proposed model, but this is due to the decrease in supplement imported.

33. I have assumed an adequate level of robustness for all scenario Overseer Modelling as it is based on an actual farming system, and with that, I have assumed actual stock and fertiliser inputs used.

34. The data input protocols have been followed for all scenarios with no deviations. This leads to a high level of robustness for the relevant input data for example, climate, soils, and pasture type.

35. Based on the above information, I consider that the robustness of the nutrient loss estimates for models to be as follows:

    a) SD1 **high**
    b) SD2 **high**
    c) Support **high**
    d) SD Proposed **high**

36. It is vital that the proposed plans for the farm system are effectively measured and monitored as if these are not adhered to then the proposed N losses may not occur.

References:

New Zealand Dairy Statistics 2017/2018. Produced by LIC and DairyNZ 2018.
https://www.dairynz.co.nz/media/5790451/nz-dairy-statistics-2017-18-web.pdf

Overseer Definition of Terms, previously Technical Note 6. May 2016
Overseer Technical Manual – Characteristics of Pasture, April 2015

Smith. L. C. 2012. Proceedings of the New Zealand Grassland Association 74: 147-152 (2012) *Long Term pasture growth patterns for Southland New Zealand: 1978-2012.* www.grassland.org.nz/publications/nzgrassland_publication_2284.pdf

Dairy Effluent Storage Calculator
Summary Report

Regional authority:	Environment Southland Regional Council
Authorised agent:	Tanya Copeland - Landpro
Client:	South Dairy 1
Program version:	1.50
Report date:	Thursday, 21 March 2019

General description:

South Dairy 1
Includes feed pad, calving pad and silage pad connected to the effluent system.

Climate

Rainfall site:	Winton
Mean annual rainfall:	958 mm/year

Effluent Block

Area of low risk soil:	10.0 hectares
Minimum area of high risk soil:	17.0 hectares
Surplus area of high risk soil:	166.0 hectares

Wash Water

Yard wash:

- Milking season starts: 01 August
- Milking season ends: 31 May

Month	Number of Cows	Hours in Yard	Wash Volume (cubic metres)
January	750	5.0	37.5
February	750	5.0	37.5
March	750	5.0	37.5
April	750	5.0	37.5
May	750	5.0	37.5
June	0	0.0	0.0
July	0	0.0	0.0
August	750	5.0	37.5
September	750	5.0	37.5
October	750	5.0	37.5
November	750	5.0	37.5
December	750	5.0	37.5

Feedpad wash:

Month	Number of Cows	Hours on Pad	Wash Volume (cubic metres)
January	750	2.0	0.0
February	750	2.0	0.0
March	0	0.0	0.0
April	650	4.0	0.0
May	600	4.0	0.0
June	0	0.0	0.0
July	0	0.0	0.0
August	650	4.0	0.0
September	780	4.0	0.0

October	0	0.0	0.0
November	0	0.0	0.0
December	0	0.0	0.0

Animal shelter wash:

Month	Number of Cows	Hours in Shelter	Wash Volume (cubic metres)
January	0	0.0	0.0
February	0	0.0	0.0
March	0	0.0	0.0
April	0	0.0	0.0
May	0	0.0	0.0
June	300	24.0	0.0
July	300	24.0	0.0
August	300	24.0	0.0
September	170	12.0	0.0
October	0	0.0	0.0
November	0	0.0	0.0
December	0	0.0	0.0

Irrigation

Winter-spring depth:	7 mm
Spring-autumn depth:	10 mm
Winter-spring volume:	70 cubic metres
Spring-autumn volume:	130 cubic metres
Irrigate all year?	Yes

Catchments

Yard Area:	1600 square metres
Diverted?	Yes
- diversion start:	31 May
- diversion end:	01 August
Shed Roof Area:	298 square metres
Diverted?	Yes
Feedpad Area:	2730 square metres
Covered?	No
Diverted?	No
Animal Shelter Area:	2000 square metres
Covered?	No
Diverted?	No
Other Areas:	1162 square metres

Storage

Pond/s present?	Yes
No. of ponds:	1 pond/s
Includes irregular ponds?	No
Pond 1	
- total volume:	6384 cubic metres
- pumpable volume:	5083 cubic metres

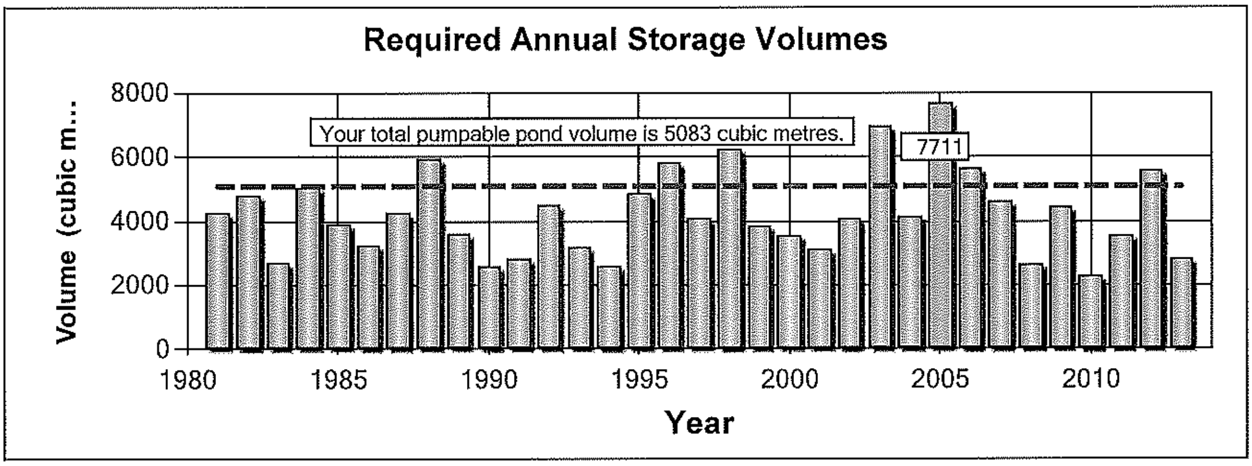
- surface area:	2704 square metres
- width:	52.0 metres
- length:	52.0 metres
- batter:	2.0:1
- total height:	3.0 metres
- pumped?	Yes
Tank/s present?	No
Emergency storage period:	0 days

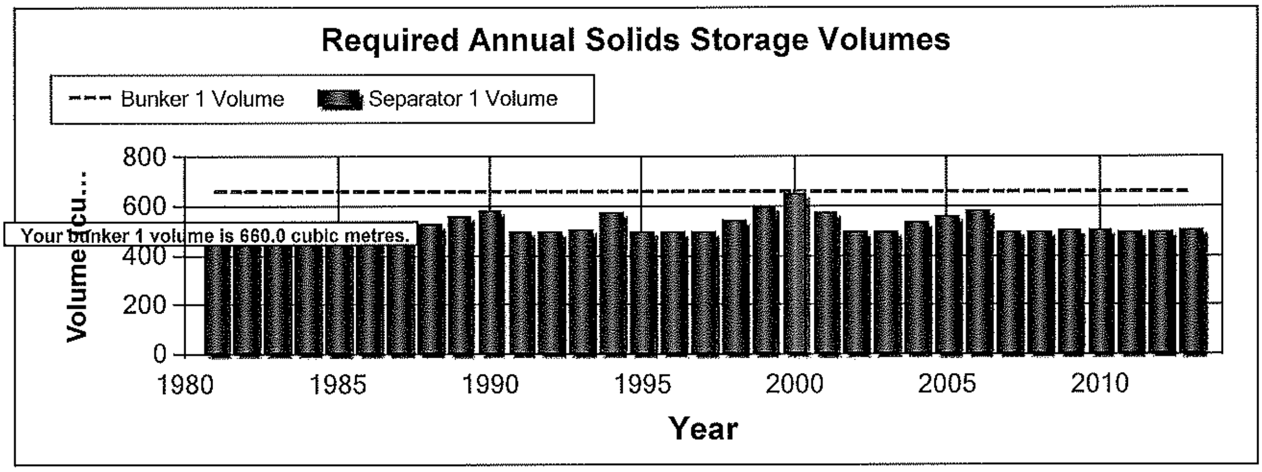
Solids Separation

Solids separator/s present?	Yes
No. of separators:	1 separator/s
Separator 1	
- dry matter:	20 %
- source/s:	Yard
- separation starts:	01 August
- separation ends:	31 May
- bunker length:	40.0 metres
- bunker width:	11.0 metres
- bunker height:	1.5 metres
- minimum SWD:	7 mm
- minimum 4 day SWD excess:	25 mm
- don't empty start:	31 May
- don't empty end:	31 July
- minimum volume before emptying:	75 %

Outputs

Maximum required storage pond volume:	7711 cubic metres
90 % probability storage pond volume:	5954 cubic metres
Maximum required solids bunker volume:	652.5 cubic metres
During the period from:	01 July 1980
To:	30 June 2013


Required Annual Storage Volumes
Your total pumpable pond volume is 5083 cubic metres.
7711
8000
6000
4000
2000
0
Volume (cubic m...
1980
1985
1990
1995
2000
2005
2010
Year


Required Annual Solids Storage Volumes
Bunker 1 Volume
Separator 1 Volume
800
600
400
200
0
Your bunker 1 volume is 660.0 cubic metres.
Volume (cu...
1980
1985
1990
1995
2000
2005
2010
Year

Dairy Effluent Storage Calculator
Summary Report

Regional authority:	Environment Southland Regional Council
Authorised agent:	RES Rural Environmental Solutions- DC
Client:	SOU20125 South Dairy Ltd DSN 31836
Program version:	1.50
Report date:	Monday, 19 November 2018

General description:

11. RES Base Calculation Scenario 8, updated.

800 Cows (no June milking), high risk soils (79ha excludes the slurry tanker area), permanent roof diversion, New shed and Underpass (or current system without underpass), yard diversion when cows are dried off,Herd Home, Silage Pad, 35 and 50 lt/cow/day wash down (green wash installed, used from 1 April till 31 October), 3 sets of pods (20m3/hr for 7.5 hours per day in winter and 10 hours in summer), new pond, application all year round, 3 days emergency storage.

I have only alowed half the total area form the silage pad to be caught as the cover is always diverted away from the system.

No sludge area in the bottom of the pond, a pump sump will be used to pump from in the bottom of the pond.

All information entered and assumptions made in this report are based upon information gathered from management and staff while onsite. Please check that all information and assumptions made in this report are correct.

Under the management system parameters described in this report and on the balance of probability, it is 90% likely that 4,808m^3 of liquid effluent storage will be adequate for storage in any one year.

Based on the pond dimensions of 48m x 48m x 3.5m, with a 2:1 batter, you would have 4,836m^3 which is approximately 90% probability that you will have sufficient storage in any one year.

Good management is essential for liquid effluent storage of this size.

Under the management system parameters described in this report, approximately 1,000m^3 of solids storage is required each year for the dairy shed and herd homes, if the solids storage areas are emptied as described.

Based on the solids storage dimensions sighted during the assessment, you currently have approximately 348m^3 in the weeping walls (1st unit) and 427m3 in each of the herd homes bunkers (2 and 3 unit), being a combined volume of 1,202m3 of solids storage capacity.

Good management is essential for solids storage this size.

Climate

Rainfall site:	Winton
Mean annual rainfall:	958 mm/year

Effluent Block

Area of low risk soil:	0.0 hectares
Minimum area of high risk soil:	79.0 hectares
Surplus area of high risk soil:	0.0 hectares

Wash Water

Yard wash:

- Milking season starts: 01 August
- Milking season ends: 31 May

Month	Number of Cows	Hours in Yard	Wash Volume (cubic metres)
January	800	7.0	40.0
February	800	7.0	40.0
March	800	7.0	40.0
April	700	7.0	24.5
May	650	7.0	22.8
June	0	0.0	0.0
July	0	0.0	0.0
August	350	7.0	12.3
September	650	7.0	22.8
October	800	7.0	28.0
November	800	7.0	28.0
December	800	7.0	40.0

Feedpad wash:

Month	Number of Cows	Hours on Pad	Wash Volume (cubic metres)
January	0	0.0	0.0
February	0	0.0	0.0
March	0	0.0	0.0
April	0	0.0	0.0
May	340	4.0	0.0
June	340	24.0	0.0
July	340	24.0	0.0
August	340	24.0	0.0
September	340	4.0	0.0
October	0	0.0	0.0
November	0	0.0	0.0
December	0	0.0	0.0

Animal shelter wash:

Month	Number of Cows	Hours in Shelter	Wash Volume (cubic metres)
January	0	0.0	0.0
February	0	0.0	0.0
March	0	0.0	0.0
April	0	0.0	0.0
May	0	0.0	0.0
June	0	0.0	0.0
July	0	0.0	0.0
August	0	0.0	0.0
September	0	0.0	0.0
October	0	0.0	0.0
November	0	0.0	0.0
December	0	0.0	0.0

Irrigation

Winter-spring depth:	4 mm
Spring-autumn depth:	8 mm
Winter-spring volume:	160 cubic metres
Spring-autumn volume:	200 cubic metres
Irrigate all year?	Yes

Catchments

Yard Area:	1600 square metres
Diverted?	Yes
- diversion start:	16 June
- diversion end:	31 July
Shed Roof Area:	400 square metres
Diverted?	Yes
Feedpad Area:	1332 square metres
Covered?	Yes
Diverted?	No
Animal Shelter Area:	770 square metres
Covered?	No
Diverted?	No
Other Areas:	500 square metres

Storage

Pond/s present?	Yes
No. of ponds:	1 pond/s
Includes irregular ponds?	No
Pond 1	
- total volume:	5941 cubic metres
- pumpable volume:	4836 cubic metres
- surface area:	2304 square metres
- width:	48.0 metres
- length:	48.0 metres
- batter:	2.0:1
- total height:	3.5 metres
- pumped?	Yes
Tank/s present?	No
Emergency storage period:	3 days

Solids Separation

Solids separator/s present?	Yes		
No. of separators:	3 separator/s		
Separator 1			
- dry matter:	20 %		
- source/s:	Yard		
- separation starts:	01 August		
- separation ends:	31 July		
- bunker length:	24.7 metres		
- bunker width:	12.3 metres		
- bunker height:	1.1 metres		
- minimum SWD:	10 mm		
- minimum 4 day SWD excess:	10 mm		
- bunker emptied on these dates:	25 September	21 January	08 April

Separator 2

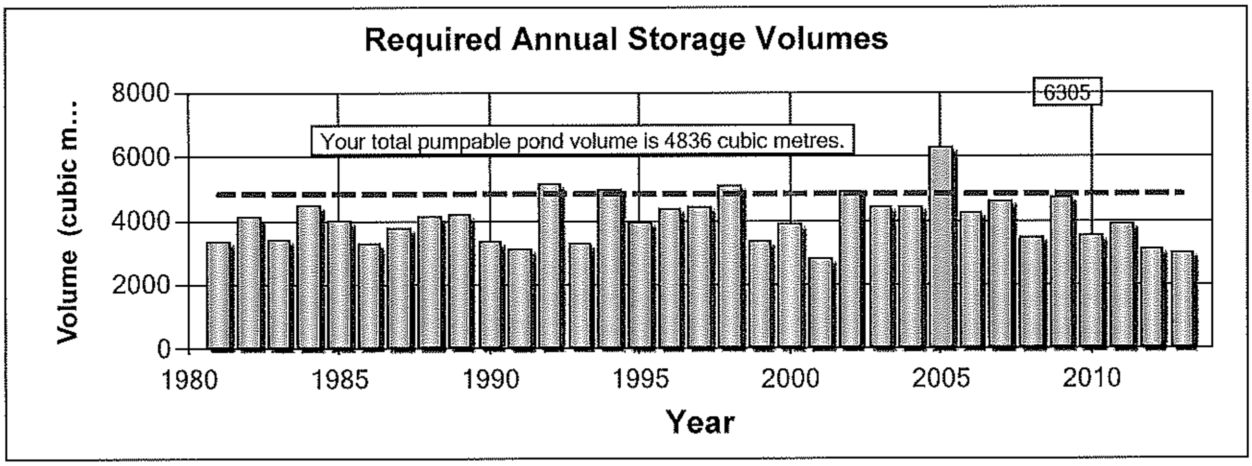
- dry matter:	30 %
- source/s:	Feedpad
- separation starts:	01 August
- separation ends:	31 July
- bunker surface area:	0.1 square metres
- bunker volume:	427.0 cubic metres
- minimum SWD:	10 mm
- minimum 4 day SWD excess:	10 mm
- bunker emptied on these dates:	19 November

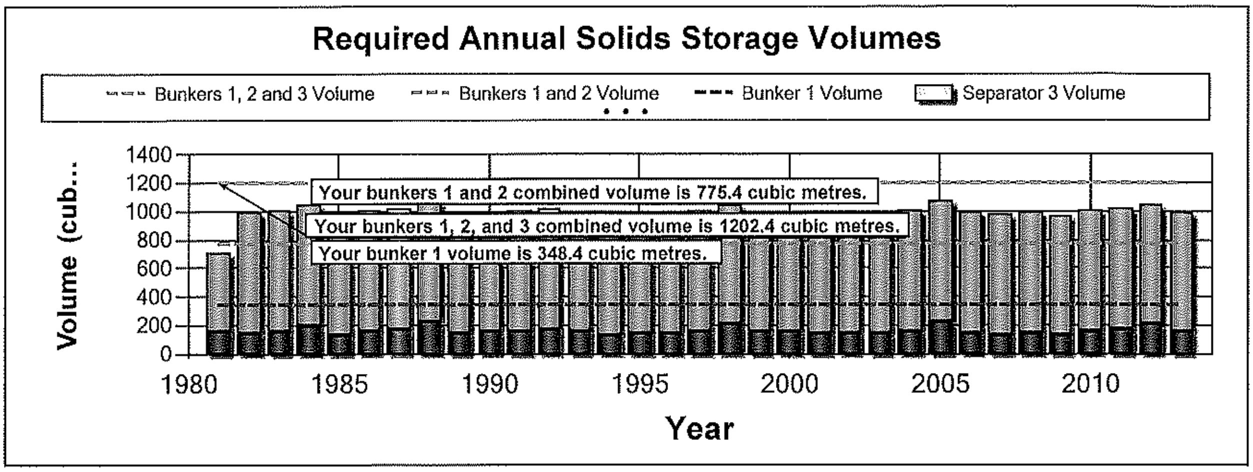
Separator 3

- dry matter:	30 %
- source/s:	Animal Shelter
- separation starts:	01 August
- separation ends:	31 July
- bunker surface area:	0.1 square metres
- bunker volume:	427.0 cubic metres
- minimum SWD:	10 mm
- minimum 4 day SWD excess:	10 mm
- bunker emptied on these dates:	19 November

Outputs

Maximum required storage pond volume:	6305 cubic metres
90 % probability storage pond volume:	5038 cubic metres
Maximum required solids bunker volume:	1081.4 cubic metres
During the period from:	01 July 1980
To:	30 June 2013




Required Annual Solids Storage Volumes
Bunkers 1, 2 and 3 Volume
Bunkers 1 and 2 Volume
Bunker 1 Volume
Separator 3 Volume
Your bunkers 1 and 2 combined volume is 775.4 cubic metres.
Your bunkers 1, 2, and 3 combined volume is 1202.4 cubic metres.
Your bunker 1 volume is 348.4 cubic metres.
Volume (cub...
1400
1200
1000
800
600
400
200
0
1980
1985
1990
1995
2000
2005
2010
Year

File Note – South Dairies Limited

Date 10th July 2019

File Note Background

A request has been made by LandPro to clarify the following points prior to lodging the application:

1. Nutrient loss from the 7 ha pasture grazing (with supplement during the winter period) as modelled in the current scenario

2. Phosphorus loss from the current versus proposed modelling

3. Support land
   a. Quantification of mitigation practices offered

It is recommended that this file note is read in conjunction with the Overseer modelling report prepared as part of the consent application for expanded dairying, prepared for South Dairies Limited, 14th March 2019 by M Hunter of Roslin Consultancy Limited.

The following tables will be referenced in this report:

	SD1 Consent Conditions AUTH-20171302- 01/04	SD2 APP-20147281-01-v1	Neighbouring 7 ha Support	Combined Total (435.8 ha)
Total Farm N Loss	14333 kg	10414 kg	218 kg	24965 kg
N Loss/ha/yr	58 kg	58 kg	29 kg	57 kg
Total Farm P Loss	338 kg	230 kg	5 kg	573
Average P loss/ha/yr	1.4 kg	1.3 kg	0.6 kg	1.3 kg

Table 1: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd baseline nutrient budgets

	Proposed
Total Farm N Loss	24913
N Loss/ha/yr	57
Total Farm P Loss	576
Average P loss/ha/yr	1.3

Table 2: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd proposed nutrient budget

1. Neighbouring 7 ha Support Block

In the baseline/current scenario modelling, the neighbouring 7 ha support block has been modelled as a support block that is used for pasture and baleage wintering. The predicted nitrogen loss from Overseer is 29 kg N / ha / year,

Modelling the pasture and baleage wintering practice in Overseer is not perfect as it does not reflect the reality on the ground and actual losses are likely to be higher than reflected in Overseer. In Overseer it is assumed that the plants are able to grow post grazing and will be starting to take up urinary N from the winter grazing activity. In reality, on these soils and in these climatic conditions the plants are not viable following the winter grazing activity. The grazed area would need to be cultivated and re-grassed in spring (similar to a winter fodder crop paddock).

In the proposed scenario model, the 7ha support block is modelled as milking platform. This quantification exercise below attempts to provide a clearer comparison between the baseline/current scenario modelled losses and the proposed modelled losses to what is likely to occur in reality. In terms of comparing the current and proposed modelling – the pasture and baleage activity is the same across both files so an “apples with apples” approach has been undertaken to allow consistency and comparison.

I have been unable to locate any relevant research (published or unpublished) that would provide a benchmark to be able to assess the pasture and baleage wintering activity in isolation. I have used a desk top modelling exercise in an attempt to more accurately reflect the comparative change in nutrient losses from the proposed land use change.

The following assumptions have been made:

- Same as original Neighbouring 7 ha current file
    - Soils / climatic conditions
    - Tile drains
    - Stock numbers
    - Imported / exported supplement
    - Fertiliser and nitrogen

- Different from the original Neighbouring 7 ha current file
    - Used kale instead of pasture to allow a defoliation to reflect conditions
    - Used kale as has a similar crude protein to average quality pasture
    - Reduced yield of kale to 4 t DM / ha to reflect pasture accumulated for winter in practice
    - Planted annual ryegrass after the kale
    - Direct drilled kale (rather than conventional cultivation to minimise the impact of the mineralisation of N during cultivation)
    - Between kale crops planted annual ryegrass (conventional cultivation to reflect practice)

Results from Neighbouring 7 ha Remodelled (using kale)

	Neighbouring 7 ha Support
Total Farm N Loss	729 kg
N Loss/ha/yr	97 kg
Total Farm P Loss	7 kg
Other sources P Loss	*2*
Average P loss/ha/yr	0.9 kg

Table3: Predicted results from the Overseer™ Neighbouring 7 ha Remodelled (using kale)

Without a research benchmark it is difficult to be conclusive about the above results. But it does reflect from a common sense point of view it is highly likely that the actual nutrient loss in the baseline/current scenario is likely to be somewhere between a pasture and a traditional fodder crop paddock i.e a modelled N loss somewhere between 29 kg N/ha/year and 97 kg N/ha/year and modelled P loss somewhere between 0.6 kg P/ha/year and 0.9 kg P/ha/year. In my opinion it is more likely to be closer to the 97 kg N / ha / year and 0.9 kg P / ha / year as the remodelled block resembles more closely the reality on the ground. I have checked this opinion with a Scientist who works in this field and they agree with this opinion.

Comparison of Results Across Modelling

	Current Neighbouring 7 ha Support	**Current Neighbouring 7 ha Support**	**Proposed Neighbouring 7 ha Support**
	Original current modelling as pasture wintering	Remodelled as a kale block	Separated out from rest of milking platform with other sources pro rata
Total Farm N Loss	218 kg	729 kg	381 kg
N Loss/ha/yr	29 kg	97 kg	51 kg
Total Farm P Loss	5 kg	7 kg	8 kg
Other sources P Loss	1	2	4
Average P loss/ha/yr	0.6 kg	0.9 kg	1.1 kg

Table4: Comparison of predicted results from the Overseer™ for Neighbouring 7 ha Support

2. Phosphorus loss from the current versus proposed modelling

The Overseer report showed a relative change of 3 kg (0.5%) increase in phosphorus loss and a 52 kg (0.2%) decrease in nitrogen loss between the baseline/current model and the proposed model.

Predicted results from the Overseer™ modelling are shown below:

	SD1 Consent Conditions AUTH-20171302- 01/04	SD2 APP-20147281-01-v1	Neighbouring 7 ha Support	Combined Total (435.8 ha)
Total Farm N Loss	14333 kg	10414 kg	218 kg	24965 kg
N Loss/ha/yr	58 kg	58 kg	29 kg	57 kg
Total Farm P Loss	338 kg	230 kg	5 kg	573
Other sources P Loss	*133*	*91*	*1*	*225*
Average P loss/ha/yr	1.4 kg	1.3 kg	0.6 kg	1.3 kg

Table 5: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd baseline nutrient budgets

	Proposed
Total Farm N Loss	24913
N Loss/ha/yr	57
Total Farm P Loss	576
Other sources P Loss	*228*
Average P loss/ha/yr	1.3

Table 6: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd proposed nutrient budget

Overseer assumes that 30% of dung deposited on laneways will be lost to water. Phosphorus is a key component of dung and therefore this is a significant assumption. This loss is included in the “other sources” of the phosphorus report.

The key driver in increase in phosphorus loss in the proposed model is the increase predicted from “other sources”. With the neighbouring 7 ha block being included in the dairying platform, Overseer has assumed that lanes would be installed on this block.

In reality lanes will not be installed on the new block as the existing lane infrastructure is adjacent and can be accessed and therefore the increase of 3 kg P from “other sources” is unlikely to occur in reality. Approximately 2.6 kg P / year is likely to be assumed in Overseer as being derived from dung deposited on lanes and included in the other source. The only real increase would result from P losses at block level..

<u>Modelling Phosphorus Loss Outside of Overseer</u>
So while the phosphorus loss is unlikely to be reflected correctly on the neighbouring 7 ha block, overall phosphorus loss is predicted to increase in the proposed model across the expanded dairy platform. Overseer is not spatially explicit and at a farm scale can not account for farm specific land scape features such as critical source areas.

Table 1.4 The fate of minerals ingested by a lactating dairy cow (ingesting 15.5 kg DM/day) (adapted from During 1984).

Element	Consumption	Percentage in			
	Kg /week	Faeces	Urine	Milk	Retained
N	5.1	26	53	17	4
P	0.4	66	-	26	8
K	2.9	11	81	5	3
Mg	0.2	80	12	3	5
Ca	0.4	77	3	11	9
Na	0.4	30	56	8	6

Source: MASSEY UNIVERSITY SUSTAINABLE NUTRIENT MANAGEMENT , Introductory Notes and Mastery Test

From the above table a cow being fed 15.5 kg DM / cow / day consumes 0.4 kg phosphorus per week, 66% of this leaves the cow in faeces. For a cow with a 270 day lactation (assumed not walking on lanes outside of lactation) this will be 10.2 kg of phosphorus per cow per year that will be in faeces.

If on a farm the cows spend conservatively on average 1 hour per day walking to and from the shed, therefore 4% (1 hour as a percentage of 24 hours) of faeces will be deposited on lanes. Overseer™ assumes that 30% of faeces deposited on lanes will be lost from the farm to water.

Therefore Overseer™ is estimating that approximately 153 kg phosphorus per year will be lost from the dairy platform lanes (this takes no account of any farm specific features or mitigations) to water

((10.2 kg P / cow / yr x 1250 cows) x 4%) x 30% = 153 kg P / year

There is an opportunity to further mitigate the phosphorus loss to water from the lanes by ensuring that any stock crossings have mitigation measures in place.

There are three lane crossings on SD1 and one lane crossing on SD2. There is an opportunity to further mitigate phosphorus loss from 1 crossing on SD1 and the one on SD2.

Should these 2 crossings between them account for 11.5% of the stock movements (approximately 50ha is serviced by these two crossings), there is an opportunity to go beyond standard good management practice and potentially reduce P loss by approximately 6.7kg P / year. Based on the conservative 38% mitigation (using the lower end of the scale of vegetated buffer strip mitigation in the figure below). Because of the closeness of hydrological connection the mitigation is likely to be higher.

153kg P / year x 11.5% land area (50/435) x 38% mitigation = 6.7 kg P / year

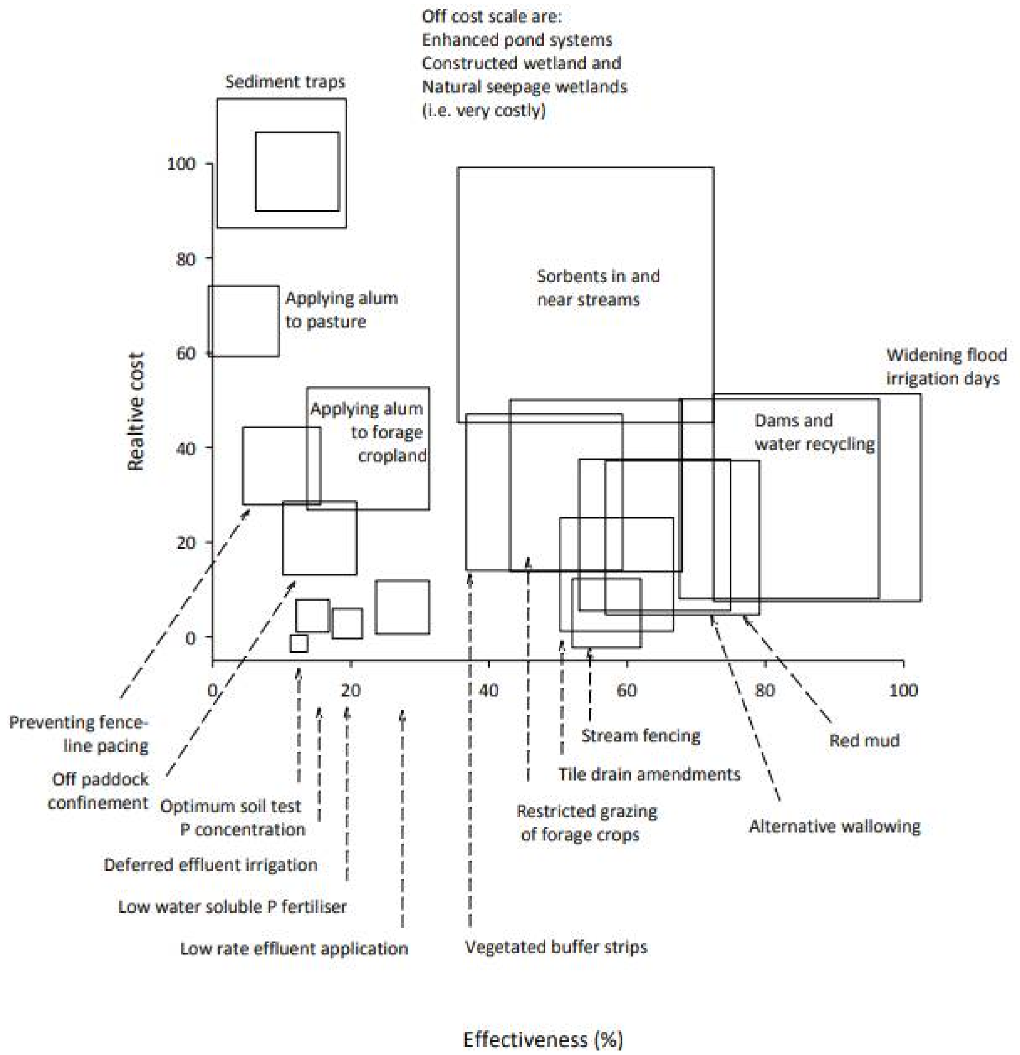


Figure 4. Diagram of the cost and effectiveness of strategies to mitigate **phosphorus** losses to water at the farm-scale. Cost is shown as the cost per kg of P mitigated relative to the most expensive strategy - sediment traps at $360 per kg P retained/ha/yr. The centre of the squares represents the mid-point in the range for each strategy, while the size represents the relative variability of cost-effectiveness for each strategy as the product of the range in percent effectiveness by the range in cost. Enhanced pond systems and the two wetland type were considerably more expensive (1400 – 4000% > sediment traps)

Source - Assessment of Strategies to Mitigate the Impact or Loss of Contaminants from Agricultural Land to Fresh Waters, June 2013

3. Support Land

The support blocks are utilised for young stock grazing and wintering (for mature and young animals).

Standard good management practices for paddock wintering include:

- Maintaining a five metre buffer from waterways
- Stock are grazed strategically on slopes from top to bottom, or a 20 metre 'last bite' is left at the base of the slope
- Stock are back fenced (excluding sheep and deer)
- Transportable water troughs are provided
- Supplementary feed is placed in portable feeders
- The mob size being grazed is no more than 120 cattle or 250 deer
- Critical source areas (including swales) are grazed last

South Dairies have developed a proposal which provides additional mitigation measures which go beyond good management practices to mitigate nutrient loss to water, this includes:

- Excluding "riskier" paddocks from intensive winter grazing and pasture/baleage winter grazing
  - Sloping areas with a higher risk of overland water flow
  - Lower lying wet areas that carry a significant risk of overland flow
  - Specific slope areas above open drain / water courses
- Additional riparian planting to provide added protection to 2 main swales
- Riparian plantings to risk areas of overland flow
- Nitrogen fertilizer – taking a conservative approach to applying nitrogen in early spring (not applying nitrogen until after the 1st of September)

Quantification of the effectiveness of these mitigations in reducing nutrient loss is difficult, and is likely to become guess work.

Research papers show a reduction in phosphorus loss from vegetated buffer strips of 38 to 58% (and sediment loss reduced by 65%). In the strategic grazing trial at Telford the phosphorus and sediment loss was reduced by 80 to 90% (note this was comparing to less than good management practice). If the mitigations proposed above are put in place in the right time and place it is highly likely they will have a strong positive impact on phosphorus, sediment and faecal organism loss as the main contaminant pathway is overland flow.

Mitigations (beyond GMP) to reduce nitrogen loss will need to be in addition to the above mitigations. Suggest timing of nitrogen fertiliser is considered. For example when August applications are moved to September, the overall N loss dropped by 2% in an example Overseer file.

Conclusion

Predicted results from the Overseer™ modelling are shown below:

	Combined Total (435.8 ha)	Proposed	Difference
Total Farm N Loss	24965 kg N / yr	24913kg N / yr	-52 kg N / year
N Loss/ha/yr	57 kg N / ha / yr	57 kg N /ha / year	
Total Farm P Loss	573Kg P / year	576 – 7 = 569 kg P / year	-4 kg P / year
Average P loss/ha/yr	1.3 kg P / ha / year	1.3 kg P / ha / year	

Table 7: Summarised predicted results from the Overseer™ analysis of the South Dairy Ltd proposed nutrient budget

Provided the specified mitigation measures are implemented, modelling indicates that overall annual losses of phosphorus, sediment, faecal microorganism and nitrogen will be reduced are likely to reduce with the implementation of the above mitigation measures by 52 kg of N / year (based on Overseer modelling) and 4 kg P / year (based on modelling outside Overseer)

File Note Prepared by - Miranda Hunter

Roslin Consultancy Limited

11th July 2019

Water Quality Technical Report

Prepared for South Dairy Limited

12 July 2019

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TABLE OF CONTENTS

1 Background and purpose

1.1 The detailed background to the application, including details of the proposal, is covered in detail in the primary assessment of environmental effects (AEE) and is not repeated here. The purpose of this supplementary AEE report is to:

- Summarise information on the state of surface water and groundwater quality in the location of the application, particularly downstream/downgradient from the properties, and specifically with reference to relevant regional and national guidelines and standards.
- Identify the implications of existing water quality for the targeting of mitigation measures for the proposal.
- Identify the implications of contaminant loss modelling for water quality.
- Conclude what the likely effects of the proposal will be on water quality, specifically with reference to relevant regional and national guidelines and standards.

2 Soil and physiographic environment

2.1 The soils and physiographic zones have also been described in detail in the primary AEE together with the implications for contaminant loss and are not repeated here.

3 Receiving water bodies

3.1 The properties are spread across the upper catchment of the Oreti River and the Makarewa River as indicated in the following figure. There are long-term water quality monitoring sites for both the Oreti and Makarewa rivers near Wallacetown. The underlying stream (from NIWA data[1]) and topographic map[2] show that the western parts of the dairy platform drain to the Oreti River and the eastern parts of the dairy platform drain to the Makarewa River, as illustrated in Figure 1. The run-off blocks drain to Tussock Creek that flows into the Makarewa River. The Makarewa River drains to the Oreti downstream of Wallacetown. The New River Estuary receives water from the Oreti River before discharging to the Ocean.

[1] https://data.mfe.govt.nz/layer/53309-river-flows/
[2] www.topomap.co.nz

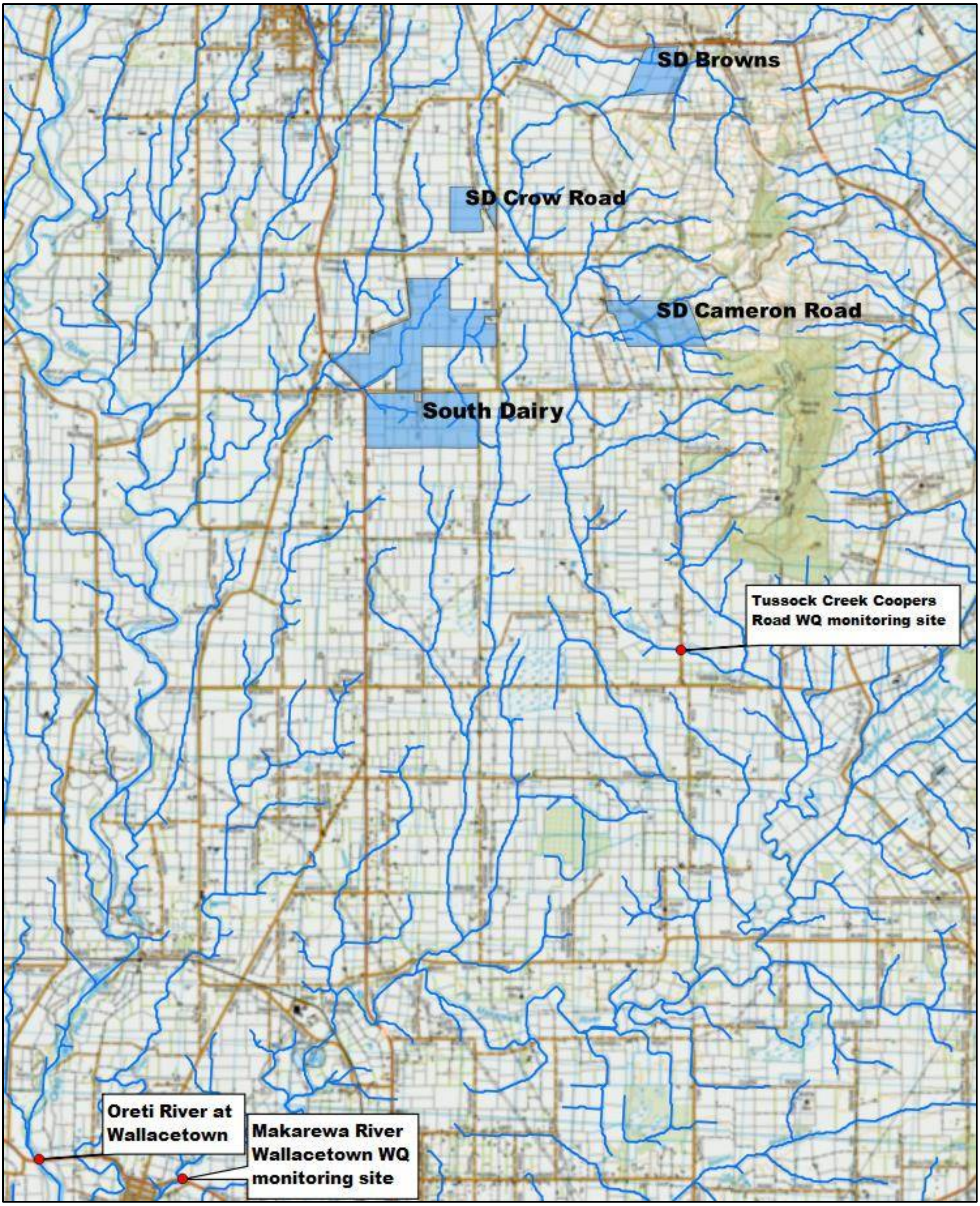

Figure 1: Location of South Dairy dairy platform, runoff blocks and catchment above the Oreti River, Makarewa River and Tussock Creek monitoring sites

3.2 The existing established land use in the Oreti catchment (and Tussock Creek and Makarewa Sub-catchments) is predominantly sheep and beef, dairying, some grain and crop growing and a small amount of forestry. The soils in the immediate location of the dairy platform and in the wider catchment are mainly deep, poorly drained soils e.g., Pukemutu, and provide for significant run-off during rainfall events, unless mitigated by subsurface drainage, where artificial drainage provides an important flow pathway.

3.3 The town of Winton has a number of activities that result in discharges to Winton Stream that joins the Oreti River (upstream of the properties), such as treated wastewater and stormwater. There are also a range of non-rural land uses that can affect water quality such as road runoff and discharges from septic tanks in rural areas. However, agricultural land use is the main source of contaminant loading to Southland surface water and groundwater[3].

3.4 The implications of the soils and the physiographic zones relevant to the properties in the catchment for the loss of contaminants to water are explained in detail in the main AEE. Those conclusions also apply generally to the majority of the catchment (as the catchment has similar physiographic zones throughout). The predominant Gleyed zone with areas of Oxidising zone and some Bedrock/Hill Country zone are illustrated in the following figure. As discussed in the primary AEE document, the main contaminant transport routes are overland flow, artificial drainage and deep drainage.

3.5 There are two relatively long-term surface water quality monitoring sites downstream of the dairy platform: the Oreti River at Wallacetown and the Makarewa River at Wallacetown. The support blocks (run-offs) are all in the Tussock Creek catchment with the nearest downstream water quality monitoring site at Coopers Road (Figure 1).

3.6 The properties are underlain by groundwater that is part of the Lower Oreti and Makarewa groundwater management zones (as specified in the PSWLP). Information used to inform the PSWLP process (LWP 2017[4]) strongly indicates that the groundwater in this general area is primarily recharged via rainfall and some infiltration of runoff from surrounding hills. Groundwater discharge is primarily to drains and streams in the area, and the general direction of groundwater flow is southerly.

[3] R M Monaghan, A Semadeni-Davies, R W Muirhead, S Elliott and U Shankar, 2010, Land use and land management risks to water quality in Southland, AgResearch, Report prepared for Environment Southland

[4] Landwaterpeople (2017) Groundwater Provisions of the Proposed Southland Water and Land Plan, Technical Background, Report for Environment Southland

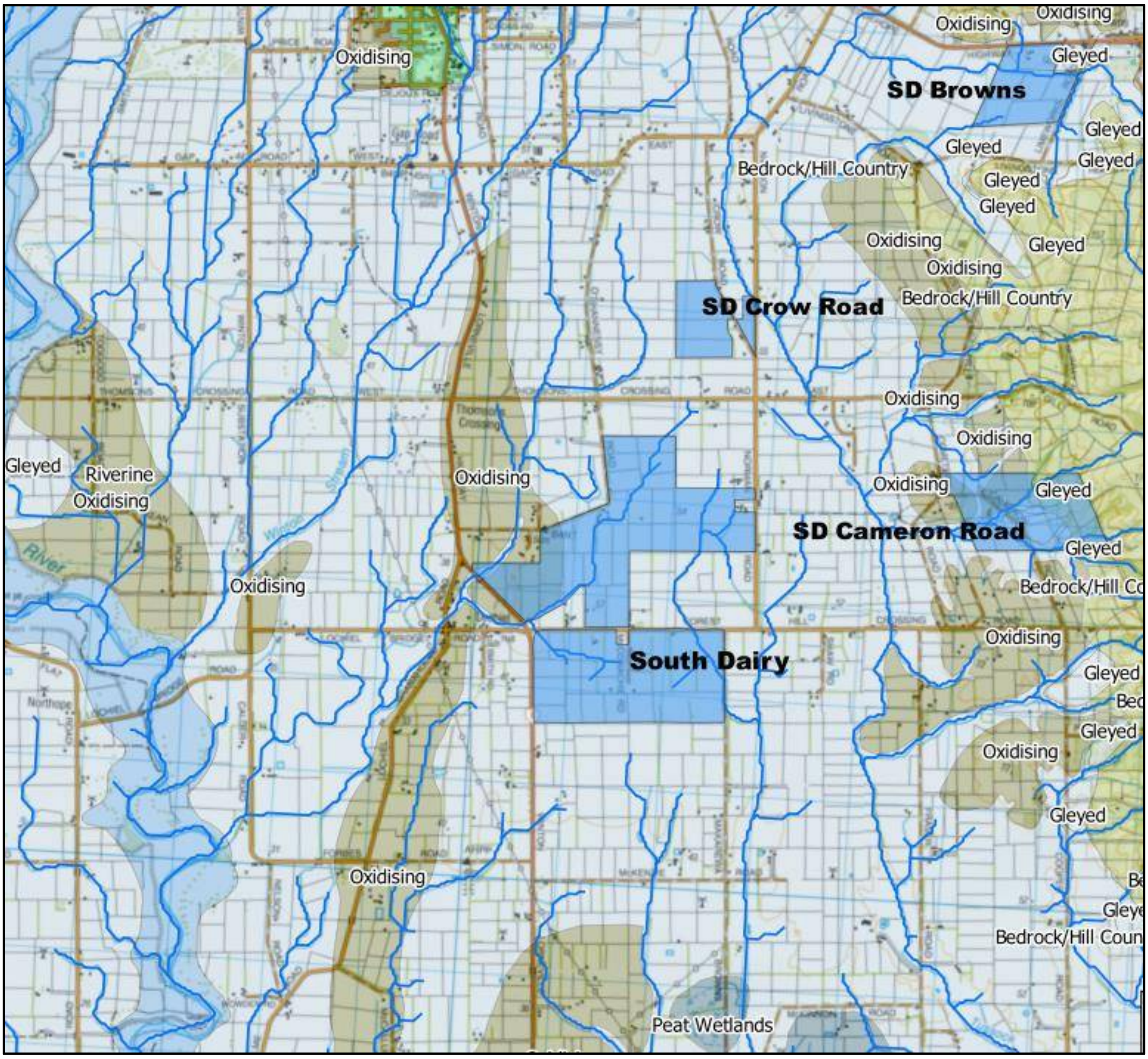

Figure 2: Physiographic zones in the wider area of the dairy platform and runoff blocks.

Regional water quality objectives and standards

3.7 The Regional Water Plan for Southland (RWPS) and the Proposed Southland Water and Land Plan (PSWLP)describe the values, objectives, policies and rules including water quality standards[5] for water in the Southland region.

3.8 Under the RWPS and the PSWLP, surface water bodies on the properties and at downstream monitoring sites appear to be classified as lowland hard bed streams. Table 1 summarises the values associated with lowland hard and soft bed streams as specified in the RWPS. The

[5] Various PSWLP policies and rules refer to Appendix E Water Quality Standards. Appendix E in turn refers to waters with various "classifications" e.g., Lowland Hard Bed. These terms also appear in Map Series 1 in Part B of the PSWLP. However, there does not appear to be any link between Part A of PSWLP and Part B. Environment Southland planning staff have been notified of this potential issue. This report considers the water quality standards as relevant reference points.

PSWLP does not establish values for rivers and streams. However, the relevant regional objectives in the PSWLP are also provided in Table 1.

3.9 The relevant numerical water quality standards and guidelines are included in Section 8 of this report along with the results from water quality monitoring.

3.10 The Southland Regional Coastal Plan (SRCP) also contains a diverse suite of objectives and values that apply to the New River Estuary. Those are not repeated here but it is important to appreciate that there is a relationship between regional plans, the regional coastal plan and the overarching Southland Regional Policy Statement.

Table 1: Summary of key regional plan surface water values & objectives for water in this location

Regional Plan	"Classification"	Values/objectives specified in the relevant plan
Southland Regional Water Plan 2010 Objective 3	Lowland hard and soft bed	- Bathing in those sites where bathing is popular; - Trout where present, otherwise native fish; - Stock drinking water; - Ngāi Tahu cultural values, including mahinga kai;
Proposed Southland Water and Land Plan Objectives 3, 6, 7, & 8	Lowland hard and soft bed	3 The mauri (inherent health) of waterbodies provide for te hauora o te tangata (health of the people), te hauora o te taiao (health of the environment) and te hauora o te wai (health of the waterbody). 6 There is no reduction in the quality of freshwater and water in estuaries and coastal lagoons by, (a) maintaining the quality of water in waterbodies, estuaries and coastal lagoons, where the water quality is not degraded; and (b) improving the quality of water in waterbodies, estuaries and coastal lagoons, that have been degraded by human activities. 7 Any further over-allocation of freshwater (water quality and quantity) is avoided and any existing over-allocation is phased out in accordance with freshwater objectives, freshwater quality limits and timeframes established under Freshwater Management Unit processes. 8 (a) The quality of groundwater that meets both the Drinking Water Standards for New Zealand 2005 (revised 2008) and any freshwater objectives, including for connected surface waterbodies, established under Freshwater Management Unit processes is maintained; and (b) The quality of groundwater that does not meet Objective 8(a) because of the effects of land use or discharge activities is progressively improved so that:

Regional Plan	"Classification"	Values/objectives specified in the relevant plan
		(1) groundwater (excluding aquifers where the ambient water quality is naturally less than the Drinking Water Standards for New Zealand 2005 (revised 2008)) meets the Drinking Water Standards for New Zealand 2005 (revised 2008); and (2) groundwater meets any freshwater objectives and freshwater quality limits established under Freshwater Management Unit processes

3.11 These values and objectives are relevant reference points here to understand the implications of existing water quality particularly where that quality is not consistent with relevant objective and values specified in relevant regional plans.

4 Existing water quality in the vicinity and downstream of the property

Surface water quality

4.1 The following tables and figures provide summary information on the quality of surface water and groundwater in the vicinity of the properties. The water quality data has been provided by Environment Southland via the LAWA (Land Air Water Aotearoa) website[6] or more recent data directly. This water quality information is compared to the most relevant guidelines, specifically the National Objective Framework (NOF) attributes (e.g., *E. coli*, clarity (black disc), dissolved reactive phosphorus, ammonia, etc.) contained within the National Policy Statement Freshwater Management (2017)(NPSFM), the PSWLP Appendix E "Water Quality 'Standards" (referenced via various policies and rules but particularly in Policy 15B and Policy 16 of the PSWLP), and the Australia New Zealand Environment and Conservation Council (ANZECC) water quality 'trigger values'[7].

4.2 The stream definitions (Lowland Hard or lowland Soft) appear to provide direction for both the PSWLP water quality standards and also provide some indication of the likely natural background water quality. The LAWA water quality monitoring information only goes up to

[6] https://www.lawa.org.nz/

[7] Water quality that exceeds an ANZECC trigger value indicates marginal water quality for supporting ecosystem health. If the median value of a water quality variable for a particular site exceeds the trigger value, then it is intended to 'trigger' an investigation response to identify the cause and significance of the degraded water quality. (Hart, B.T., Maher, B., & Lawrence, I. (1999) New generation water quality guidelines for ecosystem protection. Freshwater biology 41: 347-359).

December 2017 (as at mid-July 2019). Additional information was provided separately from Environment Southland for these sites in an Excel file. A comprehensive statistical comparison of this dataset with the LAWA statistical summaries has not been undertaken. However, more recent data has been compiled and presented along with the older data dataset.

Table 2: Summary of state and trend at the Oreti River Wallacetown water quality monitoring site (LAWA/Environment Southland data)

Primary WQ indicators	State	LAWA National Objective Framework (NOF) Band, Annual Median (2008 – 2017) PSWLP Maximum (2009 -18)	Trend	PSWLP water quality standard (Lowland Hard Bed) & ANZECC∞ trigger values
E. Coli	In the worst 50% of all lowland rural sites	**D** – 20-30% of the time, the estimated risk is >=50 in 1000 (>5% risk). The predicted average infection risk is >3%*. 5-year median = **130 n/100ml** Maximum = **10,000 cfu/100ml**	Likely Improving	≤1,000/100ml Faecal coliforms# *Comment: Highly unlikely to meet standard*
Clarity (Black Disc)	In the best 50% of all lowland rural sites	No NOF attribute band set 5-year median = **1.815 metres** Seven results during 2009 – 2018 did not comply with PSWLP WQ standard	Indeterminate	≥ 1.6 m when flow below median flow (27.4 m3/s), Concurrent flow and clarity data not readily available. *Comment: Unlikely to meet standard*
Total Oxidised N	In the worst 25% of all lowland rural sites	**B** – Some growth effect on up to 5% of species. 5-year median = **0.94 g/m³** Maximum = **2.5 g/m³**	Not assessed	≤0.444 g/m³ (ANZECC, 2000)* Greater than this trigger value
Ammoniacal N	In the best 25% of all lowland rural sites	**A** – 99% species protection level. No observed effect on any species tested. 5-year median = **0.005 g/m³** Maximum = **0.04 g/m³**	Not assessed	<2.5-0.9 (pH 6.0-8.0) *Comment: Meets standard*
Dissolved Reactive P	In the best 50% of all lowland rural sites	No NOF attribute set 5-year median = **0.006 g/m³** Maximum = **0.04 g/m³**	Not assessed	≤0.01 g/m³ (ANZECC, 2000)* Less than this trigger value
Macroinvertebrate Community Index	Poor	MCI 5-year median = 95. Fair ecological condition. Indicative of only fair water quality and/or habitat condition.	Likely degrading	>90 *Comment: Meets the standard*
Additional PSWLP Water Quality Stds		**Observed WQ range Jan 2009 – Dec 2018**		**PSWLP water quality standard (Lowland Hard Bed)**
Temperature		4.2 – 21 °C		≤23°C, *Comment: Meets standard*
pH		7.0 – 7.8		6.5 – 9.0, *Comment: Meets standard*
Sediment cover		Not assessed/sampled by ES		
Dissolved oxygen		82 – 132% (7.4 – 14.2 g/m³) NOF Attribute **B** band		> 80 % sat. *Comment: Meets standard*
Bacterial/fungal slime		Not assessed/sampled by ES		
Periphyton		4.5 – 361 mg chl *a*/m² (annual sampling, 2004 - 2018) NOF Attribute possibly **C** band (92%ile = 143) (see later comments)		<120 mg chl *a* /m² filam. algae < 200 mg/m² diatom/cyanob. *Comment: Highly unlikely to meet standard*
Fish		Not assessed/sampled by ES		

∞Australian and New Zealand Environment and Conservation Council, 2000, Australian and New Zealand guidelines for fresh and marine water quality.
PSWLP standard is ≤1,000 faecal coliforms/100 ml. However, *E. coli* is monitored. *E coli* are a subset of faecal coliforms.
* ANZECC trigger values for investigation. These have no legal status in NZ and are included as a reference point only.

Table 3: Summary of State and Trend of the Makarewa River at Wallacetown water quality monitoring site (LAWA/Environment Southland data)

Primary WQ indicators	State	LAWA National Objective Framework (NOF) Band, Annual Median (2008 – 2017) PSWLP Maximum (2009 -18)	Trend	PSWLP water quality standard (Lowland Soft Bed) & ANZECC[∞] trigger values
E. Coli	In the worst 50% of all lowland rural sites	**E** – greater than 30% of the time, the estimated risk is >=50 in 1000 (>5% risk). The predicted average infection risk is >7%*. 5-year median = **335 n/100ml** Maximum = **140,000 cfu/100ml**	Indeterminate	≤1,000/100ml Faecal coliforms[#] *Comment: Highly unlikely to meet standard*
Clarity (Black Disc)	In the worst 25% of all lowland rural sites	No NOF attribute band set 5-year median = **0.84 metres** Two results during 2009 – 2017 did not comply with PSWLP WQ standard	Indeterminate	≥ 1.3 m when flow below median flow River flow not monitored at this site. *Comment: Unlikely to meet standard*
Total Oxidised N	In the worst 25% of all lowland rural sites	**B** – Some growth effect on up to 5% of species. 5-year median = **0.895 g/m^3** Maximum = **4.2 g/m^3**	Very likely improving	≤0.444 g/m^3 (ANZECC, 2000)* Greater than this trigger value
Ammoniacal N	In the worst 25% of all lowland rural sites	**A** – 99% species protection level. Starts impacting occasionally on the 5% most sensitive species 5-year median = **0.004 g/m^3** Maximum = **0.04 g/m^3**	Likely improving	<2.5-0.9 (pH 6.0-8.0) *Comment: Meets standard*
Dissolved Reactive P	In the worst 50% of all lowland rural sites	No NOF attribute set 5-year median = **0.019 g/m^3** Maximum = **0.065 g/m^3**	Indeterminate	≤0.01 g/m^3 (ANZECC, 2000)* Greater than this trigger value
Macroinvertebrate Community Index	Fair	MCI 5-year median = 87. Fair ecological condition. Indicative of only fair water quality and/or habitat condition.	Likely improving	>80 *Comment: Meets the standard*
Additional PSWLP Water Quality Stds		**Observed WQ range Jan 2009 – Dec 2018**		**PSWLP water quality standard (Lowland Hard Bed)**
Temperature		1.3 – 23.6°C		≤23°C, *Comment: Does not meet standard*
pH		6.7 – 7.8		6.5 – 9.0, *Comment: Meets standard*
Sediment cover		Not assessed/sampled by ES		
Dissolved oxygen		62.8 - 184		> 80 % sat. *Comment: Does not meet the standard*
Bacterial/fungal slime		Not assessed/sampled by ES		
Periphyton		6.6 – 468 mg chl *a*/m^2 (annual sampling, 2004 - 2018) NOF Attribute possibly **D** band (83%ile = 281) (see later comments)		<120 mg chl *a* /m^2 filam. algae < 200 mg/m^2 diatom/cyanob. *Comment: Highly unlikely to meet standard*
Fish		Not assessed/sampled by ES		

[∞]Australian and New Zealand Environment and Conservation Council, 2000, Australian and New Zealand guidelines for fresh and marine water quality.
[#] PSWLP standard is ≤1,000 faecal coliforms/100 ml. However, *E. coli* is monitored. *E coli* are a subset of faecal coliforms.
* ANZECC trigger values for investigation. These have no legal status in NZ and are included as a reference point only.

Table 4: Summary of State and Trend of the Tussock Creek at the Coopers Road water quality monitoring site (LAWA/Environment Southland data)

Primary WQ indicators	State	LAWA National Objective Framework (NOF) Band, Annual Median (2008 – 2017) PSWLP Maximum (2009 -18)	Trend	PSWLP water quality standard (Lowland Soft Bed) & ANZECC∞ trigger values
E. Coli	In the worst 25% of all lowland rural sites	**No Band assigned** 5-year median = **1,100 n/100ml** Maximum = **98,000 cfu/100ml**	Indeterminate	≤1,000/100ml Faecal coliforms# *Comment: Highly unlikely to meet standard*
Clarity (Black Disc)	In the worst 25% of all lowland rural sites	No NOF attribute band set 5-year median = **1.0 metres** Maximum **= 2.75**	Indeterminate	≥ 1.3 m when flow below median flow River flow not monitored at this site. *Comment: Unlikely to meet standard*
Total Oxidised N	In the worst 25% of all lowland rural sites	**B** – Some growth effect on up to 5% of species. 5-year median = **1.27 g/m³** Maximum = **5.75 g/m³**	Very likely improving	≤0.444 g/m³ (ANZECC, 2000)* Greater than this trigger value
Ammoniacal N	In the worst 25% of all lowland rural sites	**B** – 95% species protection level: Starts impacting occasionally on the 5% most sensitive species. 5-year median = **0.0245 g/m³** Maximum = **0.44 g/m³**	Likely improving	<2.5-0.9 (pH 6.0-8.0) *Comment: Meets standard*
Dissolved Reactive P	In the worst 25% of all lowland rural sites	No NOF attribute set 5-year median = **0.029 g/m³** Maximum = **0.25 g/m³**	Indeterminate	≤0.01 g/m³ (ANZECC, 2000)* Greater than this trigger value
Macroinvertebrate Community Index	N/A	No MCI data for this site	N/A	>80 Unknown
Additional PSWLP Water Quality Stds		**Observed WQ range Jan 2009 – Dec 2018**		**PSWLP water quality standard (Lowland Hard Bed)**
Temperature		2.9 – 20.2°C		≤23°C, *Comment: Meets standard*
pH		7.0 – 8.5		6.5 – 9.0, *Comment: Meets standard*
Sediment cover		Not assessed/sampled by ES		
Dissolved oxygen		79 - 168		> 80 % sat. *Comment: Does not meet the standard*
Bacterial/fungal slime		Not assessed/sampled by ES		
Periphyton		No periphyton data		<120 mg chl *a* /m² filam. algae < 200 mg/m² diatom/cyanob. *Comment: Can't assess compliance with standard.*
Fish		Not assessed/sampled by ES		

∞Australian and New Zealand Environment and Conservation Council, 2000, Australian and New Zealand guidelines for fresh and marine water quality.
PSWLP standard is ≤1,000 faecal coliforms/100 ml. However, E. coli is monitored. E coli are a subset of faecal coliforms.
* ANZECC trigger values for investigation. These have no legal status in NZ and are included as a reference point only.

4.3 These data indicate that water quality in all three rivers is degraded and does not meet all the relevant numerical standards or guidelines. There are some indications of improving trends, but this is not consistent for all water quality variables and not for all rivers. In addition the LAWA trend assessments only apply for data up to December 2017. It is not possible to provide a comprehensive interpretation of water quality in the context of the PSWLP because not all water quality standards are monitored and determining compliance with the water clarity standard requires concurrent flow gauging.

4.4 Water quality has been compared with these standards on the basis of simple maximum because they are specified as maximum values.

4.5 The simple maximum comparison, based on faecal coliforms, has generally been superseded by a risk-based approach and guidance/standards based on a statistical assessment of results[8]. This is the approach adopted by the NPSFM and also by the LAWA, including Environment Southland, reporting of swimming suitability throughout New Zealand[9,10]. However, while the faecal coliform compliance assessment may not line up with current approaches, the data strongly indicates that all of these water bodies are generally unsuitable for water contact recreation.

4.6 The three most significant water quality related issues in these three rivers from an assessment of these data appear to be:

1. High concentrations of faecal indicator microorganisms;
2. Raised nutrient concentrations leading to plant growth in the river/stream and further downstream; and
3. Apparent relatively poor water clarity.

Catchment drains and creeks

4.7 These assessments focus on the major rivers and have not attempted to assess the water quality of drains or creeks or the effects of the proposed changes on the quality of specific creeks/drains. The nature of the changes are such that it is highly unlikely that there would be any land use change that would result in any sub-catchment specific change in contaminant loss. For example there are no blocks that would receive any significant change in stocking rate or effluent application that would change the baseline contaminant losses. Therefore it has not been necessary to look at specific block or sub-catchment effects.

[8] McBride G, Till D, Ryan T, Ball A, Lewis G, Palmer S, Weinstein P. 2002. Freshwater Microbiological Research Programme: Pathogen Occurrence and Human Health Risk Assessment Analysis. Ministry for the Environment.
[9] Ministry for the Environment 2002 Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas
[10] https://www.lawa.org.nz/learn/factsheets/what-do-the-swim-icons-mean/

Summary of water quality data

This section provides a summary of the water quality for each monitoring site

Table 5: Summary of some key water quality variables for the four rivers (Five-year medians, 2012-2017)

	Oreti River	Makarewa River	Tussock Creek
E. coli (n/100ml)	130	335	1,100
Clarity (BD) (m)	1.815	0.84	1.0
Total oxidised N (g/m^3)	0.94	0.895	1.27
Dissolved reactive P (g/m^3)	0.006	0.019	0.029
MCI	95	87	N/A

4.8 This data provides an indication of the relative water quality of the three rivers with the Oreti River generally having better water quality in terms of these important water quality variables and Tussock Creek generally having the poorest with very high levels of faecal indicator bacteria and relatively higher dissolved nutrient concentrations.

4.9 It is not considered necessary to attempt to assess long-term trends of all the relevant water quality indicators. Nitrate-nitrogen concentrations provide a useful and informative broad indicator of impacts on water quality and the last ten year's data are illustrated in the following figure.

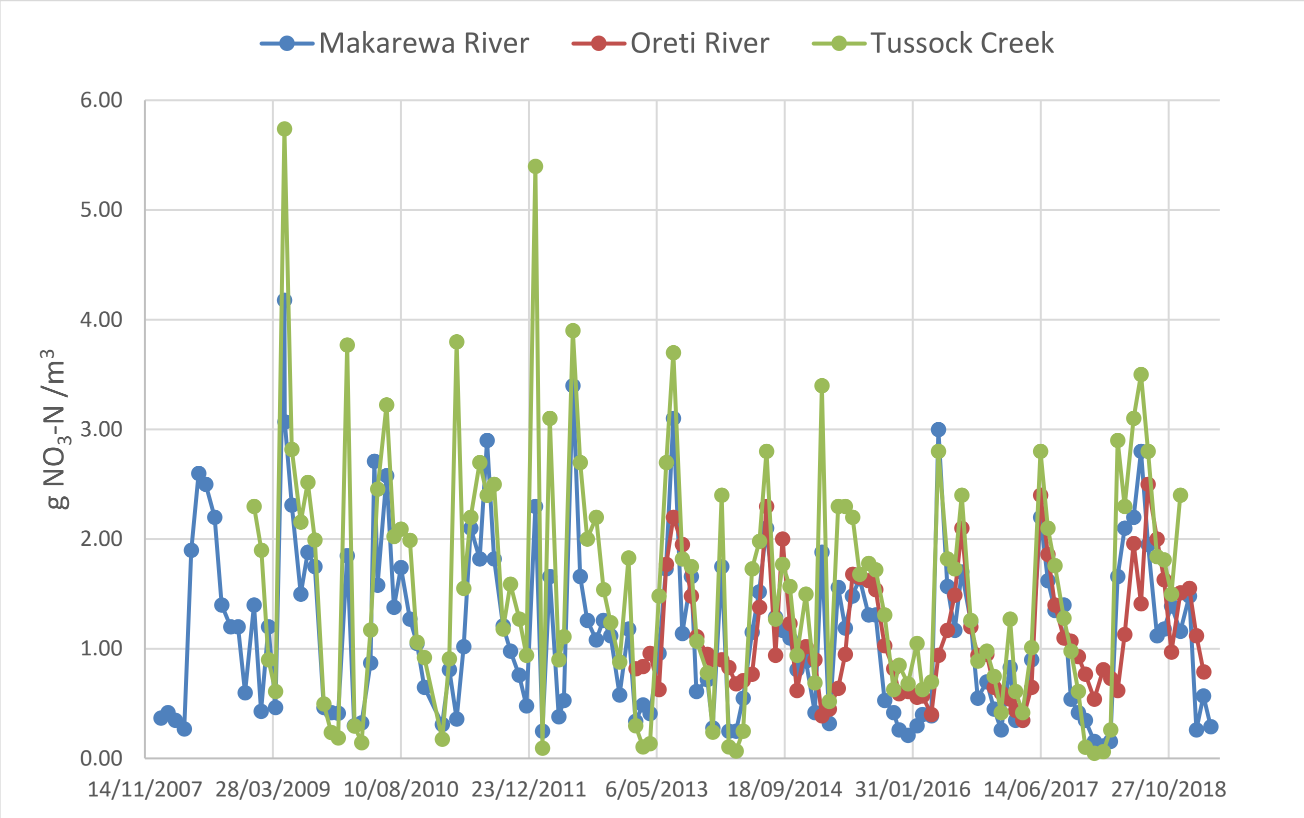

Figure 3: Nitrate nitrogen results (2008 – 2018) for the Oreti River, the Makarewa river and Tussock Creek

4.10 The data illustrated in the above figure indicate the common annual fluctuation in nitrate nitrogen concentrations caused by increased winter-time drainage with high N concentrations moving through into surface waters. The figure also highlights the relatively higher concentrations of nitrate nitrogen in Tussock Creek compared to the Oreti and Makarewa rivers. The simple Excel trend lines for the 10-year period are assessed in the following table

Table 6: Summary of Excel trend lines[11] for nitrate nitrogen in the Oreti River, the Makarewa river and Tussock Creek

	Oreti River	Makarewa River	Tussock Creek
Equation	y = 5E-05x - 1.1046	y = -0.0001x + 5.6205	y = -0.0001x + 7.047
Slope	Positive - increasing	Negative - decreasing	Negative - decreasing
R^2	0.0041	0.0258	0.0157

4.11 The simple 10-year trend line data all have very low R^2 values and therefore even though there is an apparent trend with Tussock Creek decreasing nitrate nitrogen results, with this level of

[11] Linear least squares regression

basic trend analysis there is a low level of confidence that it reflects an actual downward trend. A simple four or two season Kendall test and slope analysis[12] for the Tussock Creek nitrate N data indicates that a "decreasing trend is possible". A more detailed statistical analysis may be appropriate but is beyond the scope of this report. The LAWA site reported "Not assessed" for the Oreti River total oxidised nitrogen trend assessment because as at 2017 there was less than five years continuous data.

Periphyton

4.12 There are no monthly periphyton data available for these monitoring sites. Annual sampling results from 2000 to 2017 for the Oreti and Makarewa rivers are shown in Figure 4.

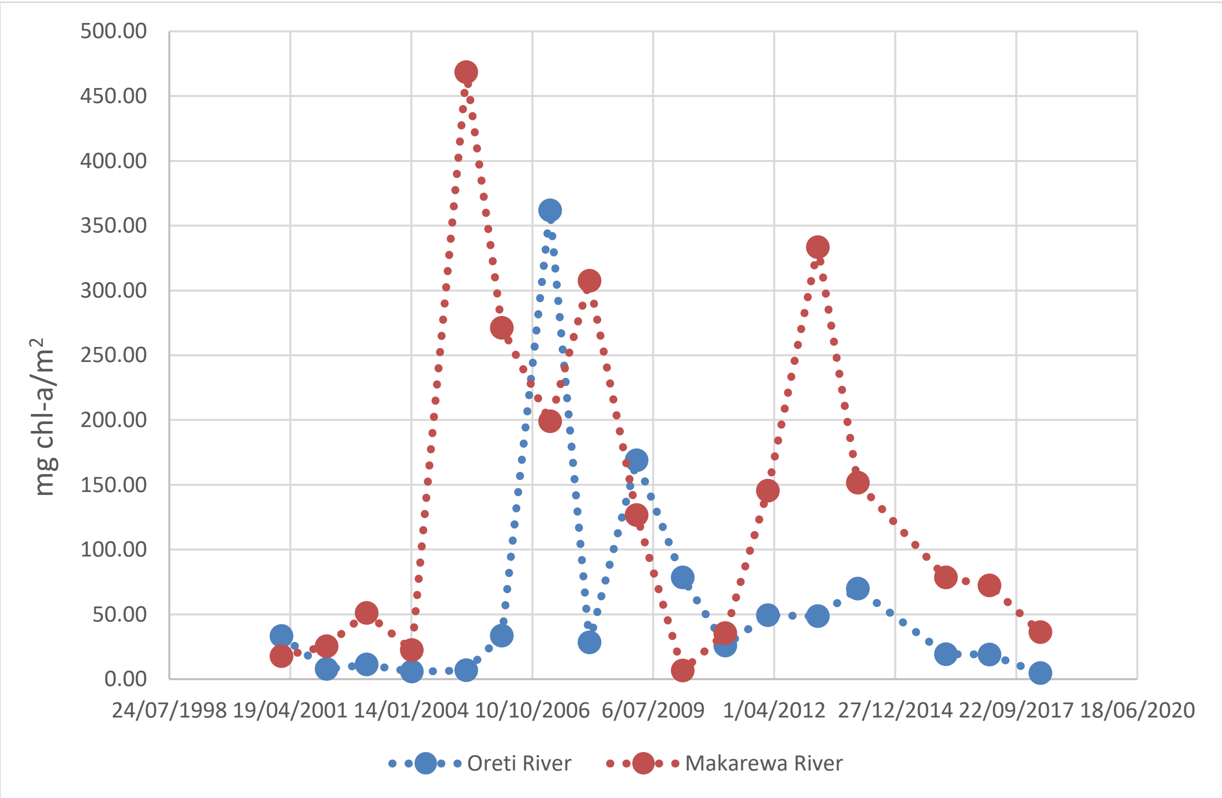

Figure 4: Annual sampling results of periphyton chlorophyll-*a* for the Makarewa and Oreti rivers (no monthly data available & no sampling for Tussock Creek)

4.13 It is challenging to interpret periphyton data in terms of the NPSFM NOF attribute because of the methodology (including sampling frequency required) used in the NPSFM to define

[12] Using the NIWA developed Time Trends software available from http://www.jowettconsulting.co.nz/home/time-1

attribute state and the sampling frequency adopted by Environment Southland. The NPSFM indicates that monthly sampling for a minimum of three years is needed. The NPSFM requires that the River Environment Classification (REC[13]) be used to distinguish between a "Productive" and "Default" category. In this situation the Oreti River is defined as "Default" (Geology is "AL" or Alluvium). In contrast the Makarewa River and Tussock Creek are both defined as Soft Sedimentary and therefore their States are defined in terms of "Productive" (rather than the "Default") category using a percentile assuming monthly sampling for a minimum of three years.

4.14 Using the available data for the period 2001 to 2017 (that does not conform with the NPSFM sampling requirement) indicates a 92%ile of 143 mg chl-*a*/m2 for the Oreti River and an 83%ile of 281 mg chl-*a*/m2 for the Makarewa River.

4.15 This indicates that the Oreti River could (if sampling had been done monthly for a minimum of three years) potentially have an Attribute State of C and the Makarewa an Attribute State of D. These are only very rough comparative indications because the underlying data is annual rather than monthly.

4.16 The data in Figure 4 appears to indicate a downward trend in periphyton cover for both rivers. However, a combination of limitations associated with the timing of sampling (relative to antecedent flow conditions) and the annual frequency means that meaningful conclusions about trends can't be made.

[13] https://data.mfe.govt.nz/data/category/fresh-water/

Macroinvertebrate Community Index

4.17 The annual macroinvertebrate sampling and resultant macroinvertebrate community index (MCI) is illustrated in the following figure.

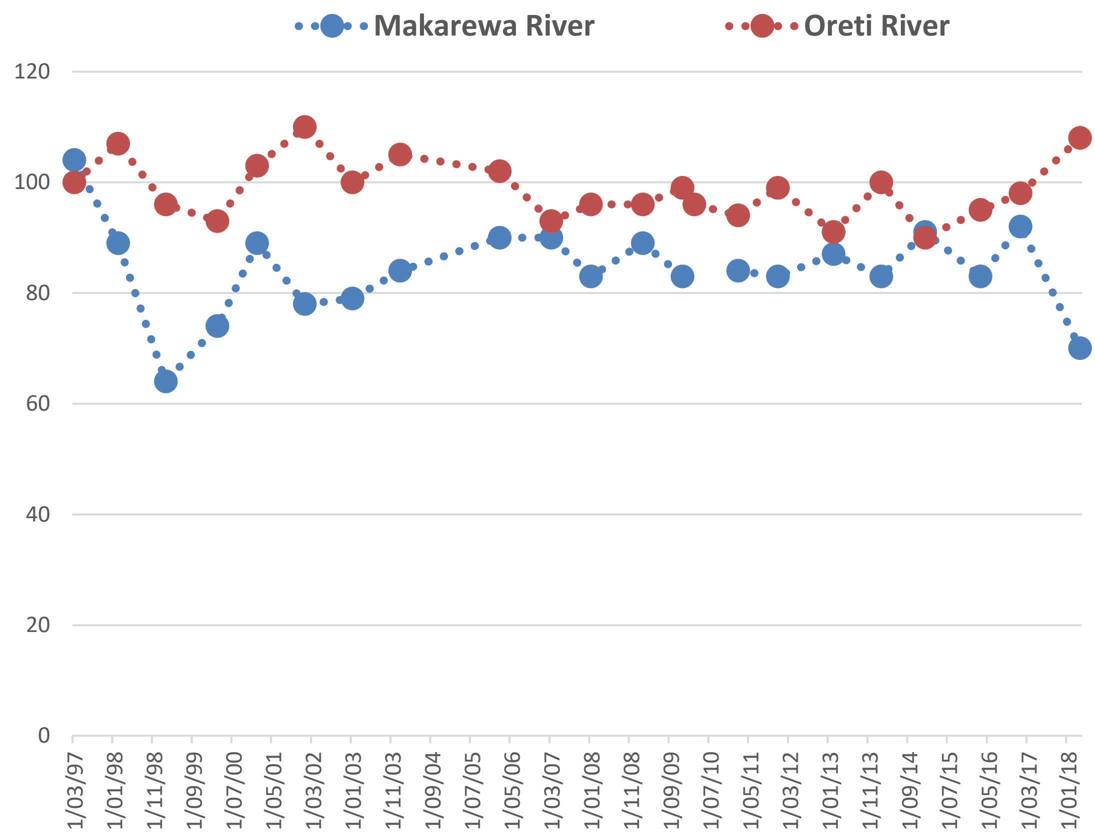

Figure 5: Annual macroinvertebrate community index results for the Makarewa and Oreti rivers at Wallacetown (no sampling for Tussock Creek)

4.18 This data illustrates that the Oreti River generally has a slightly better ecological condition than the Makarewa River at these sampling locations. This may reflect better water quality but also may reflect underlying river substrate and river habitat differences e.g., frequency of flood events, etc. Therefore, it would be premature to make any conclusions about the reasons for apparent differences in MCI for both sites.

Conclusions on river water quality

4.19 The available data indicate that rivers in this area have raised concentrations of faecal indicator bacteria, reduced clarity and raised concentrations of dissolved N and P and are unlikely to comply with all the PSWLP water quality standards, particularly the faecal coliform and water clarity standards. The primary cause of reduced water quality is most likely agricultural land use with relatively minor contributions from other sources e.g., Winton treated sewage discharge, Alliance meatworks discharges, stormwater discharges, septic tank effluent discharges, and roading run-off.

4.20 It is challenging to make statistically meaningful conclusions about surface water quality indicator trends. However, the concentrations of key contaminants are almost certainly greater than they were 35 years ago prior to the significant expansion of dairying in Southland[14].

4.21 The long-term water quality monitoring data indicate that agricultural land use activities in the catchment (and other activities/land uses) are having adverse effects on water quality and that long-term catchment-scale mitigation is needed to reduce the concentrations of contaminants in surface waters to levels consistent with national and regional statutory standards and relevant guidelines.

Groundwater Quality

4.22 The results of Environment Southland's 2007-2012 survey of nitrate nitrogen concentrations in groundwater are provided as a layer within the Beacon public GIS system and indicate that the dairy platform is in an area where the underlying unconfined groundwater was likely to have been between 1.0 – 8.5 mg/l of nitrate nitrogen between 2007 – 2012, or indicative of 'minor to high land use impacts'. This data together with the peak nitrate nitrogen result found for monitoring during 2013 to 2019 is illustrated in the following figure.

[14] Hamil K & McBride K (2003) River water quality trends and increased dairying in Southland, New Zealand, New Zealand Journal of Marine and Freshwater Research, 2003, Vol. 37: 323-332.

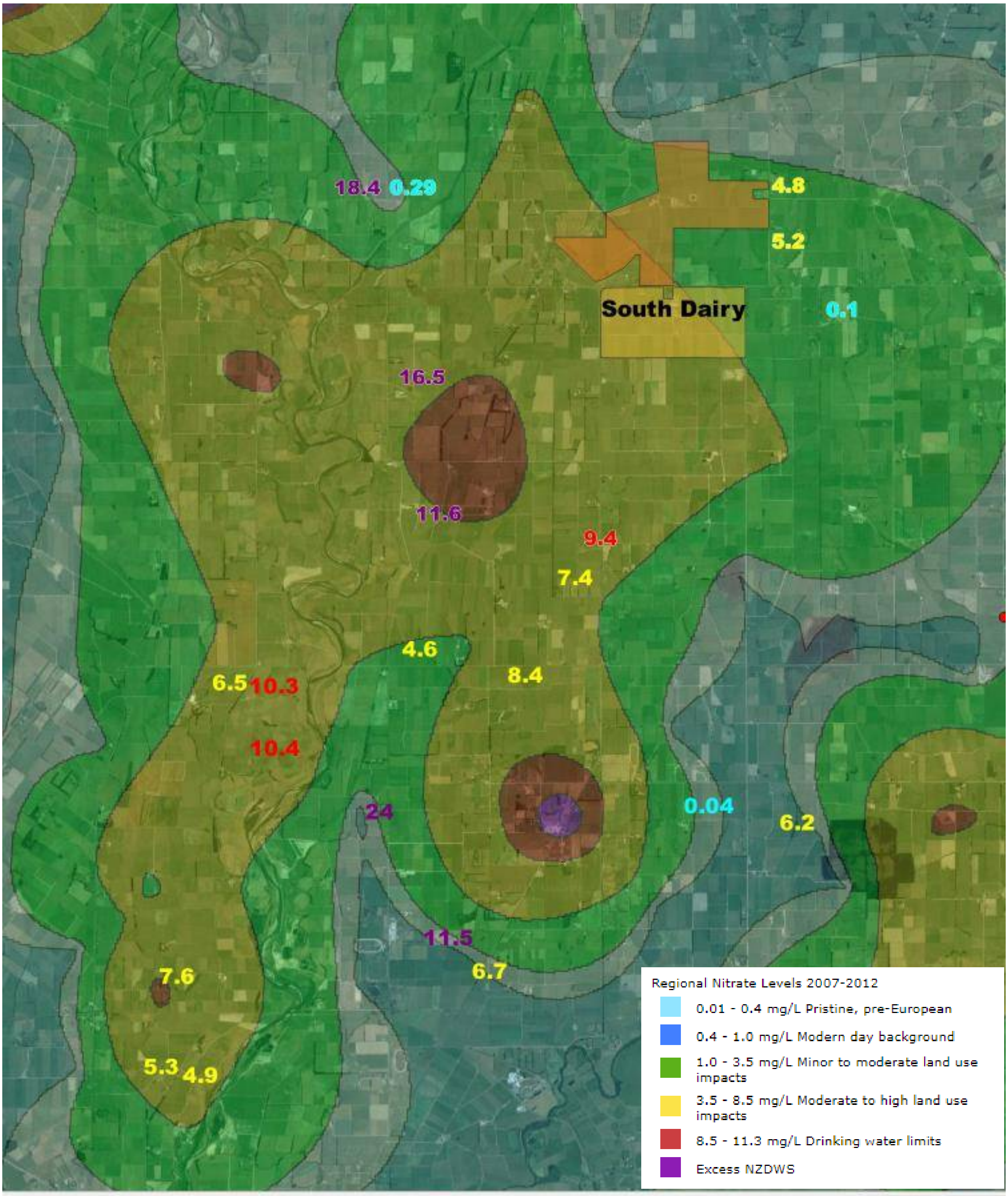

Figure 6: Environment Southland groundwater nitrate nitrogen contour estimates for the period 2007 – 2012 with location of property overlaid, and more recent peak nitrate nitrogen results

4.23 However, the information used to develop this contour map makes it difficult to draw conclusions about the application and significance of the water quality results. Limitations of the information include the data source (coming from both regional and localised groundwater quality monitoring) and the likely occurrence of some poor wellhead protection, leading to occasional potential surface water contamination of water collected from those bores. All groundwater quality data was used to develop this contour and all groundwater data is recorded in the current groundwater quality database. The database information does indicate that some bores have been installed for the purpose of groundwater quality monitoring, but it does not clearly separate out those bores that have been installed to assess localised groundwater quality and the database does not identify those bores with inadequate wellhead protection. For example, many of the results come from shallow bores installed in dairy shed effluent disposal areas specifically to assess the status of localised groundwater quality and may not be indicative of wider regional groundwater quality.

4.24 An example of this can be seen for bore E46/1272 (purple 18.4 in the top middle left of Figure 6) which is a bore of unknown depth that was installed for localised groundwater quality monitoring and has had a high result of 18.4 g NO_3-N/m^3 recorded in 2018. When Environment Southland was asked about this result the following feedback was provided: "*…there is likely a direct or semi-direct contamination issue. More recent samples show low E. coli but elevated or volatile nitrate, conductivity and chloride indicating again a semi-direct contamination issue. I suspect in this case there is considerable ingress of water contaminated with animal urine through the highly permeable gravels immediately surrounding the bore. We also do not know the integrity of the bore construction or the depth.*" This is illustrated in the pattern of nitrate nitrogen results shown in the following figure, with nitrate nitrogen rising from a low of less than 4.0 to a high of over 18 g NO_3-N/m^3.

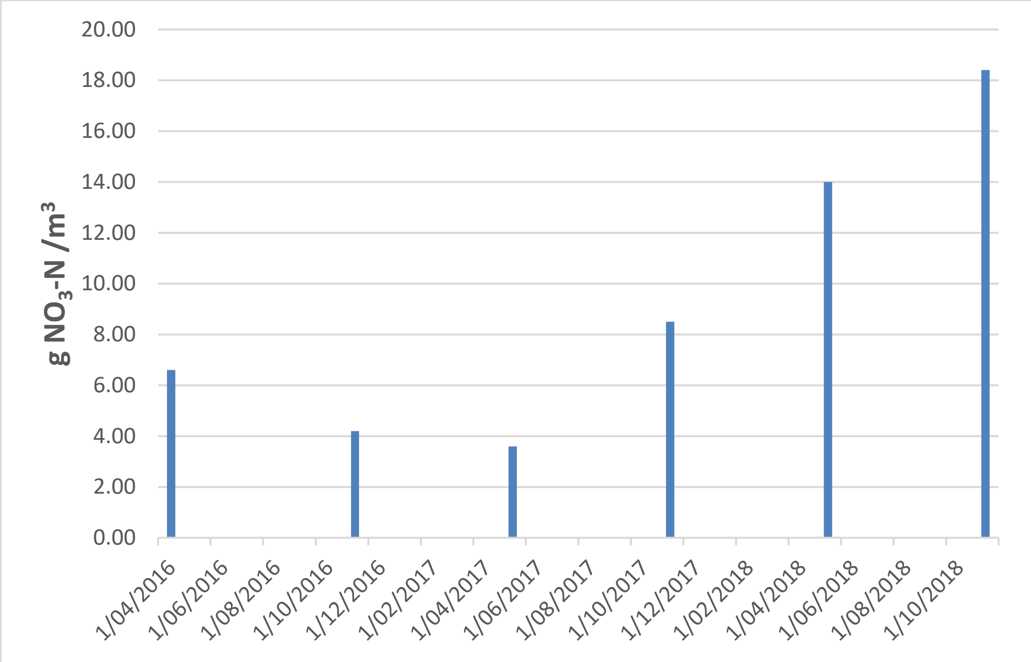

Figure 7: Nitrate nitrogen results from bore E46/1272

4.25 Bore E46/1272 is approximately 450 m west of bore E46/0104, a 4.5 m deep bore with a nitrate nitrogen result for 2013 of 0.29 g NO_3-N/m^3 (0.11 – 1.20 g NO_3-N/m^3 from 2007 – 2012). Conversely, the bore with the highest recorded nitrate nitrogen result in the wider area was a maximum of 24 g NO_3-N/m^3 from bore E46/0105 (lower central half of Figure 6). In contrast to the results from E46/1272 the results from E46/0105 were consistently high (17 – 24 g NO_3-N/m^3 from 2013 – 2018) indicating that the results are not caused by occasional groundwater contamination from surface water.

4.26 Interpretation of the contour data should be done with great care because there are a limited number of results that have been used as the basis for developing these groundwater quality contours, and the source data includes results from a very wide range of bore depths. Some of these bores are relatively shallow (<10 m depth) and the results may not be representative of one aquifer. This is evidenced in the depth investigation of groundwater in one part of Southland that demonstrated that groundwater quality can vary at depth and interpreting the reasons for differences between nitrate-nitrogen concentrations can be challenging[15].

4.27 It is also not clear what extent of wellhead protection exists for these bores, so for example, it is possible that some of these bores do not have adequate well head protection and some surface water with contaminants can move down the bore casing and enter the abstracted

[15] Hughes, B (2009) Review of groundwater quality monitoring results from the Heenans Corner nested piezometer site, Memo/Report to Environment Southland, 21 June 2009.

groundwater. In addition, there is some indication from the reported measurements of water levels that some bores in this area may be tapping a lower confined or semi-confined aquifer that may be separated in part from the overlying unconfined groundwater.

4.28 Some more recent (post-2012) groundwater quality data has been provided by Environment Southland and while very little recent groundwater nitrate-nitrogen data is available for this specific area, what is available indicates a similar general pattern of nitrate-nitrogen concentrations in the area but with many examples of increased concentrations.

4.29 There are only two bores in the general area that have had nitrate nitrogen monitored over a significant period of time, D45/0004 (2000 – 2018, reported 12 m deep, no information on screen depth) and D45/0186 (2009 – 2018, reported 16.5 m deep, no information on screen depth), both relatively close and down-gradient from the property. Nitrate-nitrogen concentrations of groundwater from these bores are illustrated in the following figures.

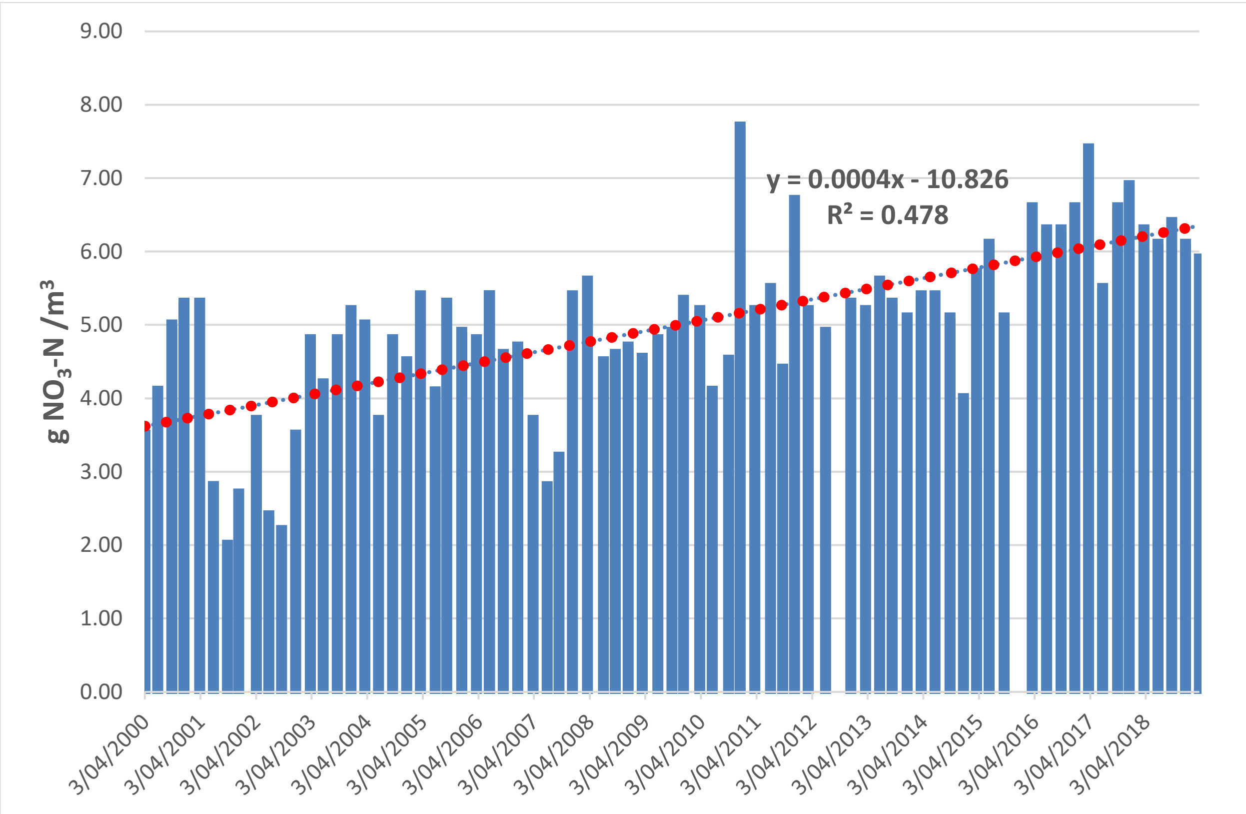

Figure 8: Nitrate-nitrogen concentrations in groundwater from bore E46/0099, 2000-2018 (showing as a yellow '7.4' south of the property in Figure 6)

4.30 The results from this bore (E46/0099) indicate a long-term trend of increasing nitrate-nitrogen concentration in groundwater in this location. The relatively high R^2 value of 0.478 does indicate that this reflects a real long-term trend. However, the surface water quality information provided earlier in this report does not provide the same level of clarity about nitrate nitrogen concentration trends in nearby rivers. This may highlight the complex relationships between groundwater and local and more distant surface water bodies. e.g., this groundwater may be recharging more distant down-gradient surface water. Additionally it could reflect time lags and complexities in identifying trends.

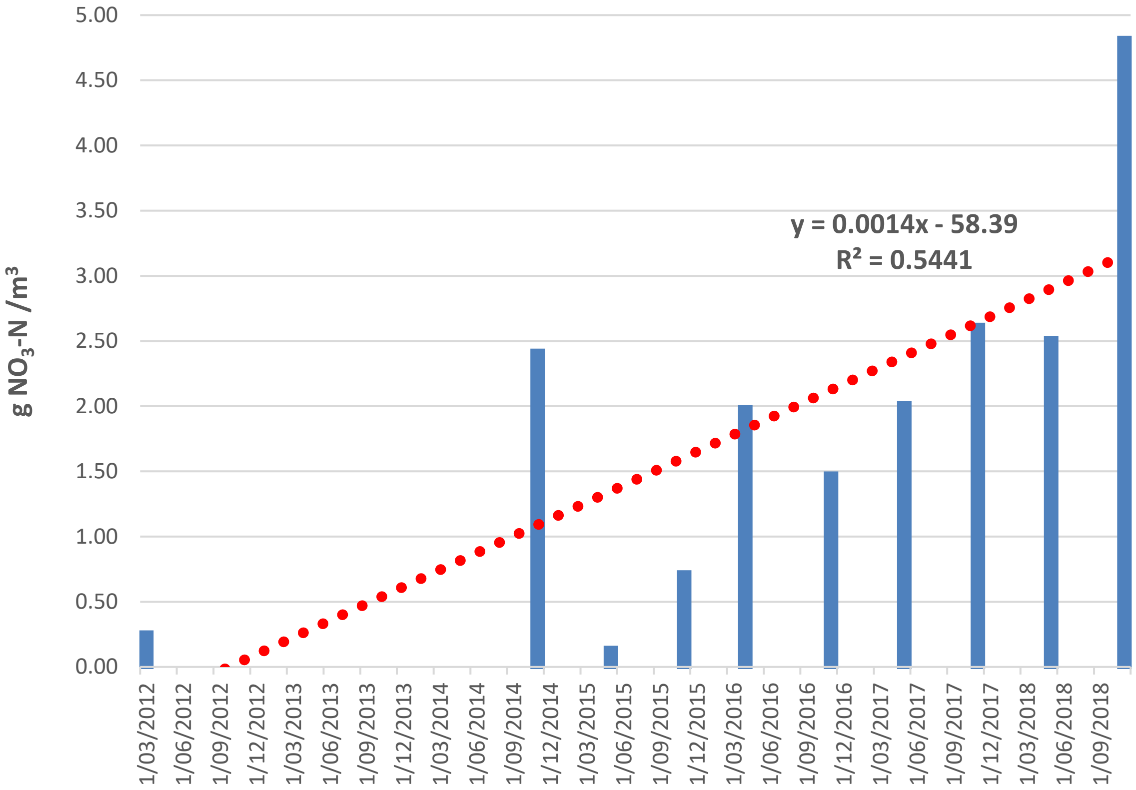

Figure 9: Nitrate nitrogen concentrations in groundwater from bore E46/1083, 2009-2018 (showing as a yellow '4.8' just east of the property on Figure 6)

4.31 The relatively limited data from bore E46/1083 indicate an increased trend in groundwater nitrate nitrogen concentrations in this location. The relatively high R^2 value of 0.5441 does indicate the likelihood that this reflects a real long-term trend.

Conclusions on groundwater quality

4.32 In general, the groundwater quality data reflects the predominant rural land use in the catchment contributing to nitrate nitrogen leaching through to groundwater. The key issues are both the discharge of groundwater with elevated nitrate nitrogen concentrations to surface waters (the contribution of nitrogen to surface waters contributes to plant growth in streams, and the subsequent rivers, and at the bottom of the catchment in the New River

Estuary) and the potential use of shallow groundwater as a source of drinking water (the maximum acceptable value for nitrate nitrogen in drinking water[16] is 11.3 g/m^3).

New River Estuary water quality

4.33 The key water quality issues in the New River Estuary are eutrophication and sedimentation that appears to be driven by N, P and sediment loads to the estuary from the main surface water inputs. Nutrients enter the estuary primarily via the major source of the Oreti River, to a lesser extent the Waihopai River and a number of relatively small creeks. Broad-scale mapping has been undertaken by Wriggle Coastal Management from 2003 to 2018[17]. These studies have highlighted a trend from 2003 to 2018 of increased eutrophication with increased coverage by opportunistic macroalgae, combined with soft, poorly oxygenated mud, and decreasing seagrass and saltmarsh. The estuary is currently defined via the Estuary Trophic Index (ETI) as in a "Poor" condition overall. Table 4 below summarises the eutrophic status of the New River Estuary.

[16] Ministry of Health. 2018. Drinking-water Standards for New Zealand 2005 (revised 2018). Wellington: Ministry of Health.
[17] Stevens, L.M. 2018. New River Estuary: Macroalgal Monitoring 2018. Report prepared by Wriggle Coastal Management for Environment Southland.

Table 7: Primary and supporting indicator values used to calculate an Estuary Trophic Index score for the New River Estuary, February 2018[9]

ETI scoring summary for New River Estuary, February 2018.

	PRIMARY SYMPTOM INDICATORS FOR SHALLOW INTERTIDAL DOMINATED ESTUARIES (AT LEAST 1 PRIMARY SYMPTOM INDICATOR REQUIRED)			Primary Symptom Value	Primary Symptom Score
Required	Opportunistic Macroalgae	OMBT EQR	shallow intertidal	0.284	13
Required	Macroalgal GEZ %	% Gross Eutrophic Zone (GEZ)/Estuary Area	shallow intertidal	15	13
Required	Macroalgal GEZ Ha	Ha Gross Eutrophic Zone (GEZ)	shallow intertidal	428	16
Optional	Phytoplankton biomass	Chl- a (summer 90 pctl, mg/m^3)	water column	-	
Optional	Cyanobacteria (if issue identified) NOTE ETI rating not yet developed		water column	-	
	SUPPORTING INDICATORS FOR SHALLOW INTERTIDAL DOMINATED ESTUARIES (MUST INCLUDE A MINIMUM OF 1 REQUIRED INDICATOR)			**Supporting Indicator Value**	**Supporting Indicator Score**
Required Indicators	Sediment Oxygenation	Mean Redox Potential (mV) at 1cm depth in most impacted sediments and representing at least 10% of estuary area	shallow intertidal	-402	15
Required Indicators	Sediment Oxygenation	% of estuary with Redox Potential <-150mV at 3cm or aRPD <1cm	shallow intertidal	15	13
Required Indicators	Sediment Oxygenation	Ha of estuary with Redox Potential <-150mV at 3cm or aRPD <1cm	shallow intertidal	423	16
Required Indicators	Sediment Total Organic Carbon	Mean TOC (%) measured at 0-2cm depth in most impacted sediments and representing at least 10% of estuary area	shallow intertidal	3.5	14
Required Indicators	Sediment Total Nitrogen	Mean TN (mg/kg) measured at 0-2cm depth in most impacted sediments and representing at least 10% of estuary area	shallow intertidal	4400	16
Required Indicators	Macroinvertebrates	Mean AMBI score measured at 0-15cm depth in most impacted sediments and representing at least 10% of estuary area	shallow intertidal	4.3	13
Optional Indicators	Muddy sediment	Proportion of estuary area with >25% mud content	shallow intertidal	0.27	16
Optional Indicators	Sedimentation Rate	Ratio of mean annual Current State Sediment Load (CSSL) relative to mean annual Natural State (NSSL)	shallow intertidal	-	
Optional Indicators	Dissolved oxygen	1 day instantaneous minimum of water column measured from representative areas of estuary water column (including likely worst case conditions) ($mg.m^3$)	water column	-	
	NZ ETI Score			**Final Primary Indicator Score**	16
				Final Supporting Indicator Score	14.7
				ETI SCORE	**0.96**
				ETI BAND	**POOR**

4.34 Nutrient loads to the New River Estuary have been estimated by Aqualinc[18]. These are outlined in the following table.

Table 8: Summary of estimated N and P loads to eight Southland catchments

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

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

4.35 The Aqualinc report further identified the potential nutrient load reductions that could result from various levels of mitigation. These are summarised in the following two tables.

Table 9 Estimated reductions in the agricultural source loads under three levels of mitigation for all dairy farms in each Southland catchment

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

4.36 The full suite of mitigations assessed by Aqualinc includes the following measures.

Table 10: Description of mitigations assumed to apply under each mitigation level

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

4.37 The proposal provides for all the relevant mitigation measures suggested by the Aqualinc report, with the exception of wetlands.

5 Implications of water quality for targeting of mitigation

5.1 The water quality results indicate that contaminant loss mitigation initiatives should focus on faecal indicator organisms, sediment, N, and P. This is largely reflected in the assessment of the physiographic zones (see main AEE) that indicate risks from both artificial drainage and surface runoff because of the generally heavy soils in the wider area.

5.2 The primary contribution to the observed water quality issues presented earlier in this report will be from land use activities further upstream in the catchment, with only a relatively tiny contribution from the individual properties.

6 Contaminant loss mitigation proposals, modelling and water quality

Existing and proposed good management practices and mitigation

6.1 The AEE, the Farm Environmental Management Plan (FEMP) and the nutrient modelling undertaken by Ms Hunter detail the existing good management practices (GMPs) that are currently being implemented on the property and the additional mitigation practices that will be implemented to mitigate nutrient losses over the entire property including the support blocks. The following assessments build on those assessments, particularly the estimates of contaminant losses to water to estimate the effects on water quality.

Nutrient loss modelling

6.2 The report prepared by Ms Hunter details the Overseer and other modelling undertaken to estimate the N and P loss to water associated with farm system changes including the proposed addition of 7.5 ha to the dairy platform. The following table provides a summary of current and estimated Overseer N and P losses to water for the proposed dairy platform.

Table 11: Summary of the Overseer N and P loss estimates for the current and proposed dairy platform

	Current Total Farm System	Proposed Total Farm system	Reduction/increase
N (kg/yr)	24,965	24,913	-52 (0.2%)
P (kg/yr)	573	576 (with Overseer modelling alone) 570 (with additional modelling)	+ 3 (0.5%) - 3 (0.5%)

6.3 The Overseer modelled very minor increase in P loss is largely a reflection of the assumption in Overseer that any dairy farm expansion involves additional lanes and 30% of dung deposited on lanes would be lost to water. Additional modelling undertaken by Ms Hunter has modelled additional mitigation that is not modelled in Overseer but supported by robust research that strongly indicates that the additional mitigation would reduce P loss by approximately 6 Kg P/yr. This is illustrated in the above table.

6.4 The implementation of the proposed GMPs, additional mitigation and proposed consent conditions for the support blocks will ensure that both N and P losses to water from those blocks will be reduced.

Support blocks

6.5 The detailed GMPs and additional mitigation measures proposed for the support blocks will ensure that contaminant losses from these blocks will be less than currently occur. It has been previously agreed with Environment Southland staff that Overseer modelling of the support blocks is not necessary.

Nutrient loss modelling and water quality effects

6.6 A critical consideration in the context of the application of Overseer under the PSWLP policy framework is that Overseer is not being used to assess compliance with a catchment-based N loss property target. Overseer is being used to establish a comparative baseline between farm systems. Many of the concerns about uncertainties involved in Overseer estimates are focused particularly on the former situation, not this situation. Where the reference point is one existing property, particularly one that is located in a situation that is similar to those used to calibrate key components (or sub-models) of Overseer, the uncertainties are significantly reduced[19]. Indeed, comparisons of modelled and measured nitrate losses for dairy farms in Southland found[20]:

- *"Given the inherent uncertainty associated with measuring and modelling N leaching, there was good agreement between Overseer estimates and measured values reported for 3 key experimental sites in Southland.*
- *Estimates of drainage volumes, based on annual rainfall inputs to the model also agreed reasonably well with those derived from a daily soil water balance model.*
- *The agreement between measured and modelled values indicates that the Overseer model is performing well for this combination of soil-climate-management factors."*

6.7 This investigation was done with Overseer version 6.1 in 2013 prior to a major change to the hydrological model that would likely have significantly improved drainage estimates.

6.8 Therefore, given that the Overseer N and P loss estimates are being used to compare losses for one property on a relative and not absolute basis, there will be a very low level of uncertainty about the extent to which estimated reductions or increases reflect real reductions or increases.

6.9 All modelling of long-term annual average estimates of N and P loss to water involve uncertainties, i.e., limitations in parts of the modelling process that is a result of incomplete knowledge. Uncertainty is the most relevant term to use for annual average estimates of N and P loss from a whole farm system[21]. However, the uncertainties involved in Overseer modelling are not currently able to be quantified. They are probably greater than 30% for both N and P modelling[22].

6.10 There are two significant implications of this:

- The estimated differences between the current and proposed farm system nutrient loss estimates is significantly less than the likely uncertainties involved in Overseer modelling.
- Overseer modelling should be considered in conjunction with the specific farm systems and mitigation measures that are proposed, to provide a reasonable level of certainty about the relativities of nutrient loss estimates.

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[19] Shepherd M *et al* (2013) Overseer: accuracy, precision, error and uncertainty, FLRC workshop proceedings
[20] Smith, C & Monaghan R (2013) Comparing OVERSEER estimates of N leaching from grazed winter forage crops with results from Southland trial sites, Report for Environment Southland, RE500/2013/123
[21] Shepherd M *et al* (2013) Overseer: accuracy, precision, error and uncertainty, FLRC workshop proceedings
[22] Wheeler D & Shepherd M (2013) Overseer: Answers to commonly asked questions, RE500/2012/027

6.11 This means that while there may be a relatively high level of uncertainty about absolute nutrient loss estimates, if there are clear, measurable and verifiable changes to one farm system there will be a high level of certainty about the relative changes to long-tern annual average nutrient loss estimates[23]. Therefore on the basis that the proposed farm system changes are implemented there is a high level of certainty that there will be an extremely small reduction in both long-term annual average N and P losses to water.

Water quality effects on the Oreti River, the Makarewa River and Tussock Creek

6.12 Rather than assume an overall reduction in nutrient losses would automatically result in an improvement in water quality some simple assessments have been undertaken to obtain an understanding of the likely effects on water quality.

6.13 Given the relatively flat nature of the dairy platform and a degree of uncertainty about the exact surface water boundaries (as indicated by the Environment Southland GIS representation of surface water boundaries) as illustrated in Figure 10, it is reasonable to assume that very roughly half of the dairy platform drains to the Oreti River and half to the Makarewa river. All of the support blocks are in the Tussock Creek catchment.

[23] Freeman, M, Robson, M, Lilburne L, McCallum-Clark, M, Cooke, A, & McNae, D. (2016) Using OVERSEER in regulation - technical resources and guidance for the appropriate and consistent use of OVERSEER by regional councils, August 2016. Report prepared by Freeman Environmental Ltd for the OVERSEER Guidance Project Board.

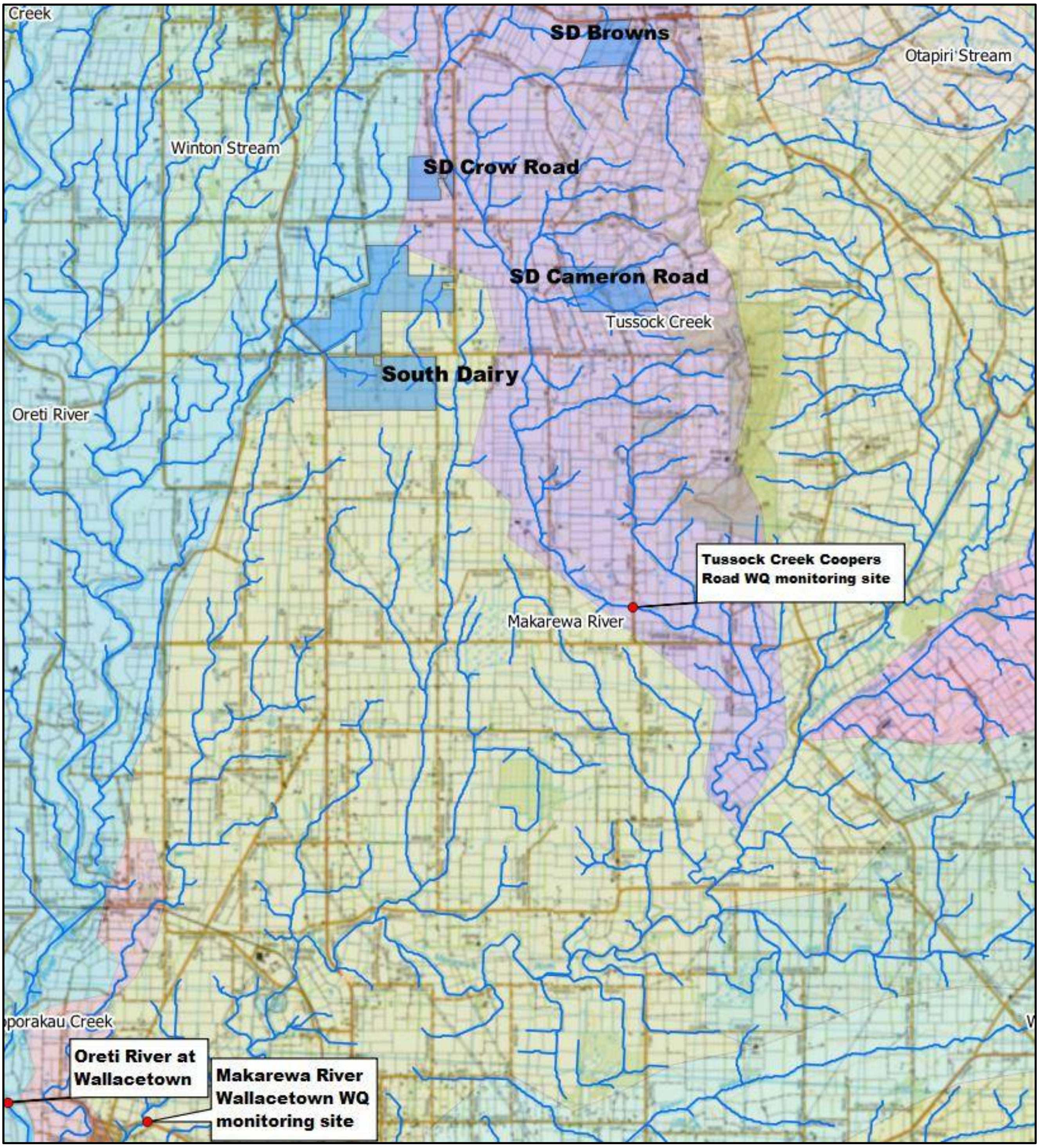

Figure 10: Environment Southland catchment boundary estimates shown together with stream locations.

6.14 The median flow of the Oreti River at the Wallacetown monitoring site has been estimated by Environment Southland to be 27.41 m^3/s. Makarewa River flows are not monitored at the Wallacetown site but are monitored further upstream at the Counsell Road monitoring site where the median flow has been estimated by Environment Southland to be 7.4 m^3/s. Tussock Creek flows are not monitored.

6.15 A very simplistic but useful way to attempt to appreciate the potential effects of the estimated changes in nutrient losses is to assume a worst-case scenario that all the nutrient loss changes occur in the Makarewa River catchment and at the upstream monitoring site at Counsell Road. To do this it has been assumed that the N loss occurs over the whole year and the P loss occurs over a 24-hour period because P loss to water usually occurs during significant rainfall events and a worst case scenario would be for this to all happen in one event over a 24 hour period. This reflects the underlying different transport processes.

Table 12 Summary of a simplistic assessment of the effects of N and P loss reduction/increases on nitrate N and dissolved reactive P concentrations in the worst case Makarewa River scenario

	Change (kg/yr)	Change (g/s)	Change concentration in 7.4 (m^3/s)	Long-term current average river concentration (g/m^3)	Resultant long-term average change
N (annual scenario)	-52	- 0.00164	-0.000222	0.895	Not measurable
P (24 hour scenario)	-3	- 0.0347	-0.00469	0.019	Not measurable

6.16 This assessment is extremely simplistic and makes a number of significant assumptions including that all the N loss reduction occurs as nitrate N and similarly assumes that all the P loss reduction occurs as dissolved reactive phosphorus (DRP). However, this assessment does serve to provide a crude indication that while the changes should contribute to an improvement in water quality they will not result in measurable improvements in nitrate N or DRP concentrations in either the Oreti or Makarewa rivers.

6.17 Another method to appreciate the potential scale of the proposed changes is to compare the estimated property loads (24,913 kg N/yr and 57? kg P/yr) with relatively recent estimates of catchment loads. The only detailed assessment of catchment loads in this general area was done in 2010[24] for the Oreti River (a considerably more detailed assessment of nutrient losses than was done in the later Aqualinc report referred to in Section 4). This report estimated a no mitigation river load (not property loss) of 2,323 tonnes of N/year and 192 tonnes of P/year. This indicates that the percentage contribution of this property to the catchment load

[24] R M Monaghan, A Semadeni-Davies, R W Muirhead, S Elliott and U Shankar (2010) Land use and land management risks to water quality in Southland, AgResearch report for Environment Southland.

will be significantly less than 1% for the catchment N load and significantly less than 0.2% for the catchment P load.

Water quality effects on the New River Estuary

6.18 As a proportion of the estimated catchment loads for the New River Estuary, the overall loads from this property are understandably relatively very small. On a modelled catchment source load basis, using the 2014 Aqualinc data (which is highly likely to need updating) the overall current loads would amount to currently approximately 24.9/14,969 or 0.5% (N) and 0.57/139 or 0.4% (P) of the modelled catchment loads. These figures should be treated with great caution because the catchment load estimates look low based on current dairy farm nutrient loss estimates. As a crude assessment, the contribution at the catchment scale of the proposal will be immeasurable.

6.19 This calculation is useful to get a rough appreciation of the potential scale of the overall current contributions to N and P catchment loads. However, it can't be used in any meaningful way to estimate contributions to concentrations to the New River Estuary because of the complex hydrogeological, physical, chemical and biological processes that operate in the contributing catchments.

7 Estimates of faecal indicator organisms and sediment losses before and after land addition

7.1 It is very difficult to develop quantitative estimates of the loss of faecal indicator organisms or sediment loss. There are no equivalent readily available farm-scale models that can be used. Some sediment loss models such as SedNetNZ, NZeem and HEL have been tested and applied in New Zealand[25]. However, none are currently widely used in RMA planning or regulatory processes. One common approach[26] is to use Overseer modelled P loss as a surrogate for both *E. Coli* and sediment loss from a farm system. This is because a key component of Overseer P loss modelling is based on an assessment of soil loss which will include faecal indicator organisms as well as sediment. Therefore, the Overseer modelled P

[25] Palmer D, Dymond J & Basher L (2013) Assessing erosion in the Waipa catchment using the New Zealand Empirical Erosion Model (NZeem®), Highly Erodible Land (HEL), and SedNetNZ models David Palmer, John Dymond, and Les Basher, Landcare Research Report LCR1685.

[26] It was accepted at a 2018 ES consultant meeting that phosphorus loss modelling can be used as an approximate proxy for sediment and microbiological contaminant losses.

loss provides a good indication that there would be similar negligible improvement in sediment and faecal indicator loss to water as a consequence of the proposal.

8 Conclusions on the effects of the proposal on water quality

Local and cumulative surface water quality

7.2 The estimates of the current and likely future contaminant losses from the proposed property addition and farm system changes provide strong evidence that this would result in an extremely small but unmeasurable improvement in surface water quality in the Oreti River, the Makarewa River and Tussock Creek. The nature of the proposed changes means that this is highly likely to also be the case for the small drains and creeks that leave the properties and drain into these larger rivers.

Local and cumulative groundwater quality

7.3 The information from the Overseer modelling combined with the good management practices/mitigation measures provides strong evidence that the proposed changes would result in an extremely small reduction in the nitrogen loading to groundwater and artificial drainage. Because the scale of the reduction is so small it is highly unlikely that this would result in any measurable changes in groundwater quality.

New River Estuary quality

7.4 The key water quality issues in the New River Estuary appear to be sediment and nutrient loading. Contaminant losses from these properties will be making a negligible contribution to these loadings. The extremely small improvements in contaminant losses associated with the proposed changes would not have a measurable effect on resultant estuary loadings.

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Make the most of your land

South Dairy Limited

Farm Environmental Management Plan

July 2019

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Quality ISO 9001

FARM ENVIRONMENT MANAGEMENT PLAN

A: PROPERTY OVERVIEW

Contact Person(s)	Dean and Suzanne Alexander	**Plan Prepared By**	Landpro Ltd
Contact Phone	0274 066878 – Dean 0277 719957 - Suzanne	**Date**	July 2019
Email Address	Alexander.farms01@gmail.com	**Date of Next Review**	July 2020
Physical Address	11 McConachie Road, Winton		
Consent Numbers and Expiry Dates	TBC		
Farm Area	**Dairy platform:** 435ha total, 418ha effective **Crow Rd:** 50ha total, 49ha effective **Browns:** 63ha total, 62ha effective **Cameron Rd:** 100ha total, 94ha effective	**Peak Milked Herd Size**	1250
Legal Descriptions	**Dairy Platform- (owned by South Dairy Ltd)** Sections 49, 51, 52, and 53 Block I Winton Hun Section 11 Block II Winton Hun Lot 2 DP 377137 Part Sections 25, 26, 47 and 48 Block I Winton Hun Sec 14, 15, 16 and 19 Block IX New River Hun Sec 79, 80 and 81 Block IX New River Hun Part Sec 18 Block IX New River Hun Lot 5 DP 363069 Lot 10 DP 363069 **Crow Rd- (leased by South Dairy Ltd)** Lot 1, 6, 7 and 8 DP 401113 **Browns – (owned by South Dairy Ltd)** Sec 17, 18 and Pt Sec 19 Block III Winton Hun		

	Cameron Rd – (leased by South Dairy Ltd) Lot 2 DP 439014 Lot 2 DP 494160 Lot 2 and 3 DP 474318 Lot 1 and 2 DP 304455

This FEMP sets out the management practices that will be implemented and adopted to actively manage the operation of the property to ensure that environmental risks are managed appropriately, and resource consent conditions complied with.

Objectives of this plan:

- Comply with all legal requirements related to land use and discharge.
- Take all practicable steps to minimise the risk of harm to onsite and nearby water resources.
- Take all practicable steps to ensure that there is an adequate supply of soil nutrients to meet plant needs.
- Take all practicable steps to minimise the risk of harm to significant vegetation and/or wildlife habitat.

This will be achieved through;

- Identifying and documenting contaminant pathways for the property (based on Physiographic Zones);
- Identifying relevant good management practices (GMP) and where they are required to be implemented to minimise environmental risks; and
- Documenting evidence to be provided to show adherence with consent conditions.

As the person responsible for implementing this plan, I confirm that the information provided is correct:

Name:...Signed:..Date:...

B: SITE PLANS

This FEMP contains various site plans identifying key features of the subject property in accordance with Part B(3) of Appendix N of the proposed Southland Water and Land Plan, 2018. The following table can be used as a reference point for locating these features.

KEY FEATURES	PLAN(S) WHERE KEY FEATURES ARE MAPPED
Site boundary	All site plans in this FEMP
Physiographic zones, variants and soil types	Figure 1: Physiographic Plan Appendix B: Soil maps
Lakes, rivers, streams ponds, artificial watercourses, modified watercourses and natural wetlands	Appendix A
Other critical source areas (gullies, swales etc)	Appendix A
Land with a slope greater than 20 degrees	Appendix A
Existing and proposed riparian vegetation and fences (or other stock exclusion methods) adjacent to waterbodies	Appendix A
Places where stock access or cross water bodies (including bridges, culverts and fords)	Appendix A
Known subsurface drainage system(s) and the location of drain outlets	Appendix A
All land that may be cultivated over the next 12 months	TBC – once consent granted
All land that may be intensively winter grazed over the next 12 months	TBC – once consent granted
All land excluded from winter grazing activities	Appendix C

C: PHYSIOGRAPHIC ZONES AND KEY CONTAMINANT PATHWAYS

This section of the FEMP documents the physiographic zones and key contaminant pathways present across the property.

The physiographic plan shows the spatial distribution of the physiographic zones on the entire landholding according to the Environment Southland Proposed Water and Land Plan 2018 (PSWLP) as mapped by Beacon Mapping Service. The mapping system also details the key contaminant pathways present for each physiographic zone and any variants for the location.

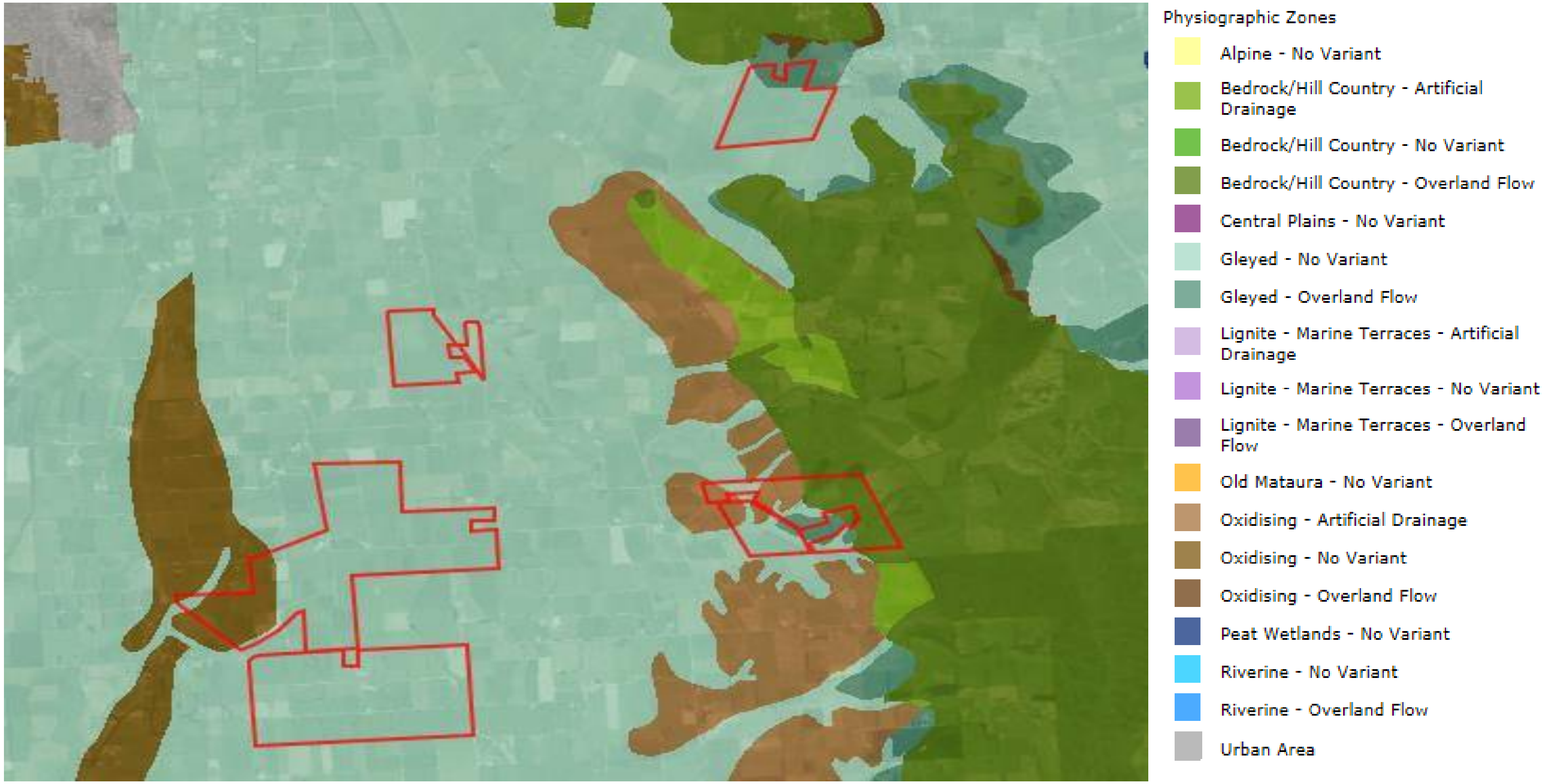


Figure 1: Physiographic zones present across the landholding

Location	Physiographic Zones	Key contaminant pathways
Dairy Platform	Gleyed (no variant) Oxidising	Overland flow and artificial drainage Overland flow, artificial drainage and deep drainage
Crow Rd	Gleyed (no variant)	Overland flow and artificial drainage
Browns	Gleyed (no variant) Gleyed (Overland flow)	Overland flow and artificial drainage Overland flow
Cameron Rd	Gleyed (no variant) Oxidizing – Artificial drainage Bedrock/Hill Country	Overland flow and artificial drainage Deep drainage, artificial drainage Overland flow, artificial drainage and deep drainage

D: SOIL TYPES

This section of the FEMP documents the soil types present across the property. The table below describes the properties of the soils present across the landholding in relation to structural compaction, nutrient leaching and water logging vulnerabilities. The soil maps in Appendix B shows the spatial distribution of the soil types across entire property according to the Environment Southland Beacon Mapping Service.

Soil type	Structural compaction vulnerability	Nutrient leaching vulnerability	Waterlogging vulnerability
Pukemutu	severe	slight	severe
Aparima	moderate	moderate	moderate
Parawa	slight	moderate	slight
Waikiwi	slight	moderate	slight
Te Mara	moderate	moderate	moderate
Oranoko	moderate	moderate	moderate
Woodlands	moderate	slight	moderate
Paroa	moderate	slight	severe

E: GOOD MANAGEMENT PRACTICES AND MITIGAITON MEASURES– ACROSS THE ENTIRE LANDHOLDING

Activity	Good Management Practices adopted	Mitigations over and above GMPs
Fertiliser Application	Capital fertiliser application timings avoid high drainage periods such as late autumn and winter and periods when soil temperature is less than 7 degrees to maximise plant uptake and minimise losses to the environment. Fertiliser applications use a little and often approach to avoid the application of excess nutrients which cannot be utilised. Use of nutrient budgeting to manage nutrient inputs and outputs from fertiliser application. Use of annual soil testing to maintain soil nutrients at agronomical optimum levels.	Capital fertiliser applications will only be done as required by the latest soil test results from the new block and will be undertaken where P, K or S levels are below agronomical optimum levels. P = 30-40 K = 6-10 S= 10-12 Capital P fertiliser applications will be applied at a maximum of 100kg P/ha which may require P fertiliser applications to be split.
Cultivation	Re-sow bare paddocks as soon as possible Use buffer zones around critical source areas and use direct drilling if possible. Cultivation will be undertaken to meet permitted activity criteria in Rule 25(a) of the PSWLP maintaining a 5 meter buffer zone	Increased buffer zone for cultivation on sloping land which is less than 20 degrees.

Activity	Good Management Practices adopted	Mitigations over and above GMPs
Laneway construction	No stockpiling of earthworks material near waterways. Laneways include camber and contouring to direct runoff to pasture and away from waterways Buffer zones will be created in riparian margins to waterways.	The paddock and lane layout have been designed to ensure the new lane does not cross or run parallel to any waterways or CSA's
Liquid effluent application to land	Effluent will always be applied at a depth less than the soil water deficit which ensures nutrients remain in the root zone to be taken up and utilised by plants for pasture production. Effluent area receiving liquid FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilizing low rate effluent application (<10mm/hr) on the more poorly drained soils on the dairy platform ensures effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of a travelling irrigator and slurry tanker to discharge larger volumes of effluent to low risk soils (Waikiwi) when soil moisture deficit levels are appropriate to lower storage volumes.	No further mitigations are required over and above GMP level as liquid effluent management system is designed to meet best practice by utilising low rate application, deferred storage of effluent and application at a rate less than the soil moisture deficit as guided by the ES soil moisture monitoring sites on the website. The effluent discharge area (liquid + slurry) is large enough to cater for all effluent generated on farm whilst maintaining effluent N loadings at less than 150kg N/ha/year.

Activity	Good Management Practices adopted	Mitigations over and above GMPs
	Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.	
Winter grazing	Buffer zones maintained between grass/baleage winter grazing activities and critical source areas to provide an area where runoff can be filtered and captured limiting risks of entering water. Grass/baleage grazing direction will be away from buffer zones/critical source areas leaving last bite to provide a buffer zone for nutrient capture through until the end of the winter grazing period. Back fencing and portable water troughs to limit treading damage over already de-vegetated ground. Cultivation of paddocks timed to avoid paddocks sitting bare for long periods of time which reduces risks of contaminant losses through leaching and overland flow. All other GMPs listed in rule 20 for intensive winter grazing will be implemented for the grass/baleage activity. Bare soils are cultivated using full cultivation and timed to avoid paddocks siting bare for long periods of time which reduces risks of losses of excess nutrients remaining from the grazing activity to the environment via overland flow and leaching.	Winter grazing will be prohibited on the paddocks identified on the attached maps (Appendix C) R1 stock are set stocked during part of the winter to reduce pasture damage and concentrated nutrient losses. Stock numbers in each age class are capped at 25% replacement rate plus 10% buffer for culls/deaths in order to give certainty to the scale of the activity in the future.

Activity	Good Management Practices adopted	Mitigations over and above GMPs
Limiting soil structure damage	Use of selective grazing to avoid grazing very wet paddocks during adverse weather conditions to reduce risks of pugging and treading damage to soil structure which can accelerate contaminant losses. Increase the size of feed breaks during adverse conditions to give animals more of the paddock to graze than the volume of feed required. This is to reduce stocking rate on wet and vulnerable pasture to avoid pugging and treading damage of feed. Use nutrient budgeting to manage nutrient inputs and outputs to guide farm management decisions which can maintain overall nutrient losses at desired level.	Stocking rate reduction with the introduction of the additional land with no change in cow numbers on the dairy platform. No change in stocking rate on runoff blocks. Fully utilise the existing feed pad and calving pad at SD1 to remove cows from pasture during high risk periods to avoid pasture and soil structure damage. Fence off areas where stock camp if pasture damage is occurring to limit risks of further pasture damage. Use of in-shed feeding and the feed pad at SD1 when feed deficits occur to ensure stock are well fed prior to entering the paddock break which can limit pugging and treading damage, particularly under adverse weather conditions.
Slurry effluent application to land	The maximum loading rate of nitrogen from the application of effluent (both slurry and liquid) to land is 150 kg N/ha/year. Slurry effluent is not discharged onto the same area any more frequently than once every two months. Slurry effluent is only discharged to land when soil temperature is greater than 5 degrees in winter and 7 degrees in spring.	Slurry effluent is applied to non-effluent blocks in the Overseer model i.e. blocks where liquid FDE is not applied. Slurry effluent applied to paddocks low in potash (K levels lower than 6-10) and with low Olsen P levels (P levels lower than 25)

Activity	Good Management Practices adopted	Mitigations over and above GMPs
	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 slurry FDE is sized to ensure nutrient loadings from the application of effluent are maintained at less than 150 kgN/ha/year to avoid excess nutrient loading. Utilising low depth effluent application (<5mm) on the poorly drained soils on farm to ensure effluent is only applied when a soil moisture deficit occurs and to avoid losses via artificial drainage by applying effluent in a manner which keeps nutrients in the root zone. Use of deferred storage of effluent to allow effluent to be stored when it is unsafe to apply to land. Use of an umbillical system to discharge larger volumes of effluent to low risk soils when soil moisture deficit levels are appropriate to lower storage volumes. Buffer zones created from effluent application areas to critical source areas and other sensitive receptors such as bores, property boundaries and dwellings.	

Activity	Good Management Practices adopted	Mitigations over and above GMPs
Existing effluent storage facilities and effluent management system	Monthly/frequent effluent system checks will be undertaken in accordance with the farm's maintenance checklist. Leaks will be repaired immediately Fail safe systems will be kept in place and kept in good working order i.e. automatic alarm and shut off system All staff involved in the management of the effluent system are fully trained in its use	All effluent storage structures will be checked for cracks, defects and signs of leakage by a suitably qualified person and pond drop tests undertaken where appropriate based on land use consent conditions.
Water usage	Reduce water usage in the shed by re-using clean water whenever possible. Treating cows gently to avoid upset.	
Riparian management	Maintain buffer zones around CSAs and all riparian margins All riparian margins to be fenced and left to establish with grasses to enable filtration of contaminants that may be transported via overland flow processes and erosion Reduce use of P fertiliser where Olsen P levels are above agronomic optimum. Reduce the risk of runoff from laneways and other sources by ensuring crossings are adequately maintained and maintain gradients to direct runoff to pasture.	All new laneways will be located away from waterways. Additional riparian planting will be implemented as per the plans in Appendix A Re-contouring and buffer zone expansion of 2 culvert crossings on the dairy platform.

F: RIPARIAN MANAGEMENT

The landholding is mapped to drain to the Oreti River as a parent catchment. Parts of the landholding drain to the Makarewa River and Tussock Creek as sub-catchments of the wider Oreti River catchment. The dairy platform, Browns runoff block and Cameron Rd runoff block contain surface waterways which are either tributaries of the Makarewa River or Tussock Creek.

All waterways are already fenced to exclude stock across the landholding. All riparian margins are left to establish with grasses and native vegetation in the first instance or as a minimum. Some waterways contain riparian planting and several areas will receive additional riparian planting as identified in Appendix A.

Where appropriate and as part of good grazing management, temporary fencing will also be erected to prevent any point source discharges occurring. This includes fencing off swale areas where they may directly discharge to surface water or vulnerable critical source areas such as gullies, duck ponds or low points in paddocks. Such practices will be adopted as set out elsewhere in this plan as part of the management of CSAs, and as set out in the Environment Southland Factsheet on *Critical Source Areas*, and *Dairy NZ Wintering in Southland and South Otago Guide*.

Appendix A contains maps which locate the waterways present on the landholding, any stock crossings, other CSA's and further areas for riparian management.

G: NUTRIENT MANAGEMENT

Nutrient management is a key component to ensuring good on farm environmental practice. The farm utilises nutrient budgeting and will append full nutrient budgets for the entire landholding to this FEMP. Any resulting nutrient budgets are reviewed and updated as required especially if farm system changes are proposed, but not less than on an annual basis. Any budget reviews are guided by a fertiliser representative and nutrient management advisor.

Regular soil tests will be undertaken to establish the nutrient status of the soils. Soils should be at nutrient levels which avoid any adverse effects on the environment but maintain good pasture production and animal health, by ensuring that the soils are suitable for optimal plant nutrient uptake.

Areas which are receiving FDE will be carefully managed to ensure nitrogen loadings are at acceptable levels and are compliant with conditions imposed by resource consents. The annual effluent nitrogen loading rate shall not exceed 150kg/N/ha. Effluent will be applied utilising low rate application. Effluent management is discussed in Section H of this FEMP.

The following table sets out the evidence which needs to be collected for nutrient budgeting purposes:

Record	Nature of information/person	Collated (Y or N)
Production	Fonterra App, dockets	
Soil test results	Lab results, Fertiliser rep	
Fertiliser application records	Ravensdown Hawkeye	
Proof of placement	Ravensdown Hawkeye	
Effluent application records	Ravensdown Hawkeye	
Crop rotation records	Farm map with total hectares	
Stock numbers	Culling timeframes Young stock grazed on farm Breeding bulls	
Record of supplements purchased	Invoices	
Records of supplements made on farm	Invoices	
Farm map/effective hectares	Farm manager	

H: COLLECTED AGRICULTURAL EFFLUENT MANAGEMENT PLAN

This section of this plan describes the operation of the Farm Dairy Effluent (FDE) System on the property. The relevant good management practices in relation to effluent discharge (FDE and slurry) are contained in Section E of this plan. The relevant good management practices are designed to ensure that the discharge of effluent occurs in accordance with conditions of consent and avoids the contamination of water bodies.

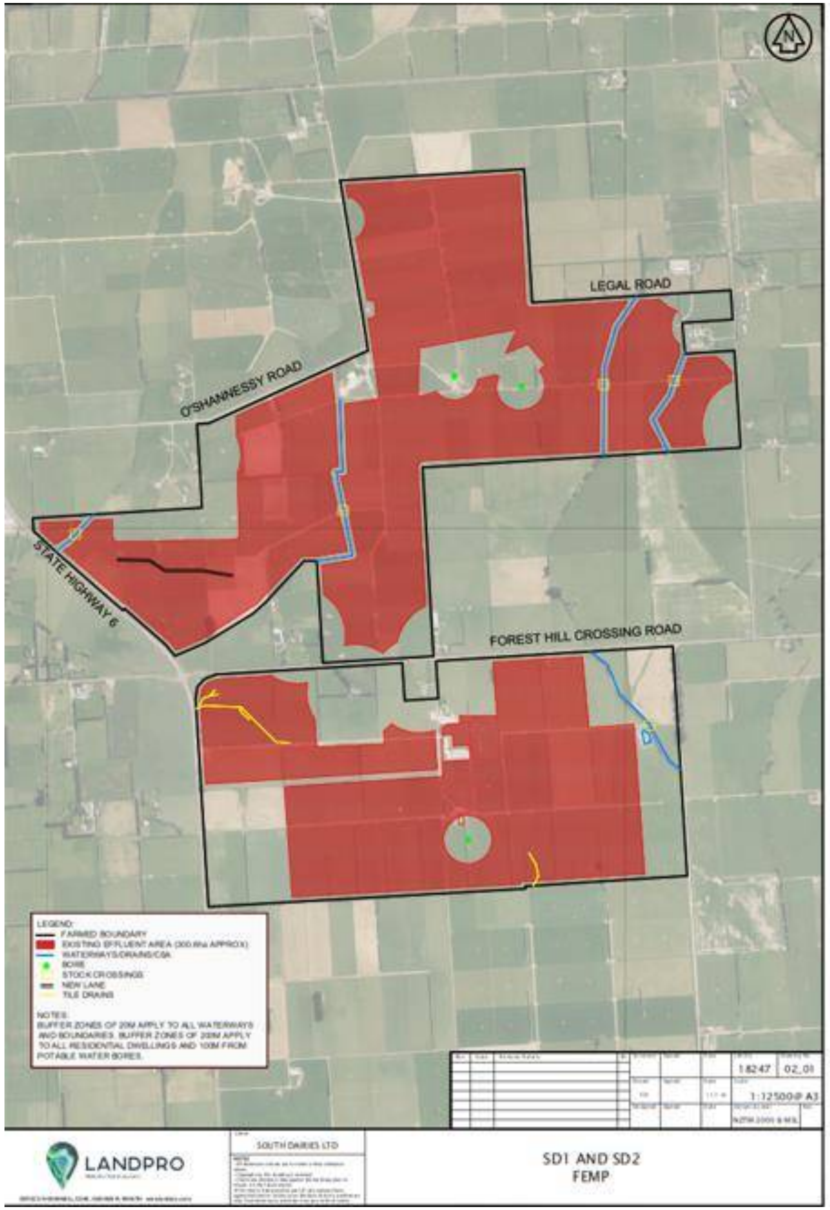
Effluent management system details	
Discharge permit consent no.	AUTH-20171302-01 and AUTH-20147281-01-V2
Number of dairy cows	1250
Type of milking shed	Rotary Shed (SD2) and herringbone shed (SD1) (Long term plan for replacement of rotary shed)
Winter milking?	No. Other than slipped cows
Wintering barn?	Herd home for 340 cows located at SD2 – covered, underground bunkers
Feed pad/stand off pad?	Feed pad for 750 cows at SD1 – uncovered, concrete, scraped Calving pad for 170-300 cows at SD1 – uncovered, gravel base
Other sources of effluent?	Stock underpass – not constructed yet but in future plans Silage pads -one located at SD1 and one located at SD2
Effluent treatment	**SD1 -** FDE: gravity from shed, sludge bed/weeping wall, effluent storage pond Feed pad: Scraped to sludge bed, liquids via concrete saucer Calving pad: Liquid drained to liquid effluent system via concrete saucer, solids scraped and gravel washed at end of season Silage leachate: directed to liquid effluent storage facility **SD2 –** FDE: gravity from shed, concrete saucer, sludge bed/weeping wall, effluent storage pond or from existing tanks Wintering shed: Stored in underground bunkers, liquid to effluent storage system Silage leachate: gravity to effluent storage system
Storage available (m^3)	**SD1 –** 6,384m^3 existing pond for liquid effluent

	660m^3 in sludge bed/weeping wall for slurry effluent **SD2 –** 5,545m^3 existing pond for liquid effluent 33m^3 in existing tanks for liquid effluent 348m^3 in sludge bed/weeping wall for slurry effluent 854m^3 in wintering shed bunkers for slurry effluent
Storage required (m^3) according to DESC report	**SD1 –** 5,954m^3 for liquid effluent 652m^3 for slurry effluent **SD2 –** 5,038m^3 for liquid effluent 1081m^3 for slurry effluent
Disposal area (ha)	Liquid effluent: 288ha discharge area Slurry effluent: Approx. 130ha being the remainder of dairy platform outside of the approved liquid effluent discharge area
Application method	Low rate pods, slurry tanker, muck spreader, umbillical system and travelling irrigator
Application rate and depth	Pods: Max application rate 10mm/hr Travelling irrigator: Maximum depth per application of 8 mm. Total annual application depth of 25 mm Slurry tanker, muck spreader: 5mm depth per application maximum. Umbillical system: 10mm depth per application maximum

Figure 2: Effluent system overview and structures SD1

Figure 3: Effluent system structures at SD1

Figure 4: Effluent system overview and structures at SD2



Effluent discharge area and application conditions

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

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

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

- Travelling irrigator: Maximum depth per application of 8 mm, total annual application depth of 25 mm
- Slurry tanker, muck spreader: 5mm maximum depth per application
- Umbillical system: 10mm maximum depth per application
- Low rate pods: Maximum application rate 10mm/hr

I: COMPLIANCE AND REPORTING

This section sets out the records which are required to be kept which will enable the Consent Holder to demonstrate compliance, as well as detailing the reporting requirements of the consents. The Consent Holder will also participate in annual compliance monitoring inspection programs that are to be implemented by Environment Southland.

Record	Kept	Date of most recent version
Nutrient budget		
Fertiliser application records		
Soil sampling results		
Water meter certification		
Water abstraction records		
Effluent system training record		
Effluent system monthly maintenance checks		
Effluent proof of placement		
Effluent application depth test results		

Annual reporting requirements are set out in the conditions of resource consent and include;

- Prior to the first exercise of the Effluent Discharge Consent the Consent Holder shall notify Environment Southland of the operator of the effluent system
- The Farm Environmental Management Plan shall be reviewed annually, and any amendments reported to Environment Southland by 31 June each year
- The Consent Holder shall provide records from the Water Permit to ES by 31 May each year
- Overseer nutrient budgets TBC

J: ANNUAL REVIEW AND AUDIT OF FEMP

This FEMP shall be reviewed on an at least annual basis. The review shall include (but not be limited to) an assessment of;

- Verification of compliance with conditions of consent
- Details of the implementation of GMPs and identification of any new GMPs that would be appropriate to employ on the farm to manage risks identified
- Review of the data obtained from the monitoring undertaken in accordance with this FEMP and any changes to farming practice required as a consequence
- A report detailing items above shall be submitted to the consent authority each year including an updated version of the FEMP if any amendments made
- Updated maps of winter grazing and cultivation paddocks and CSA's if applicable
- Updated Overseer nutrient budgets

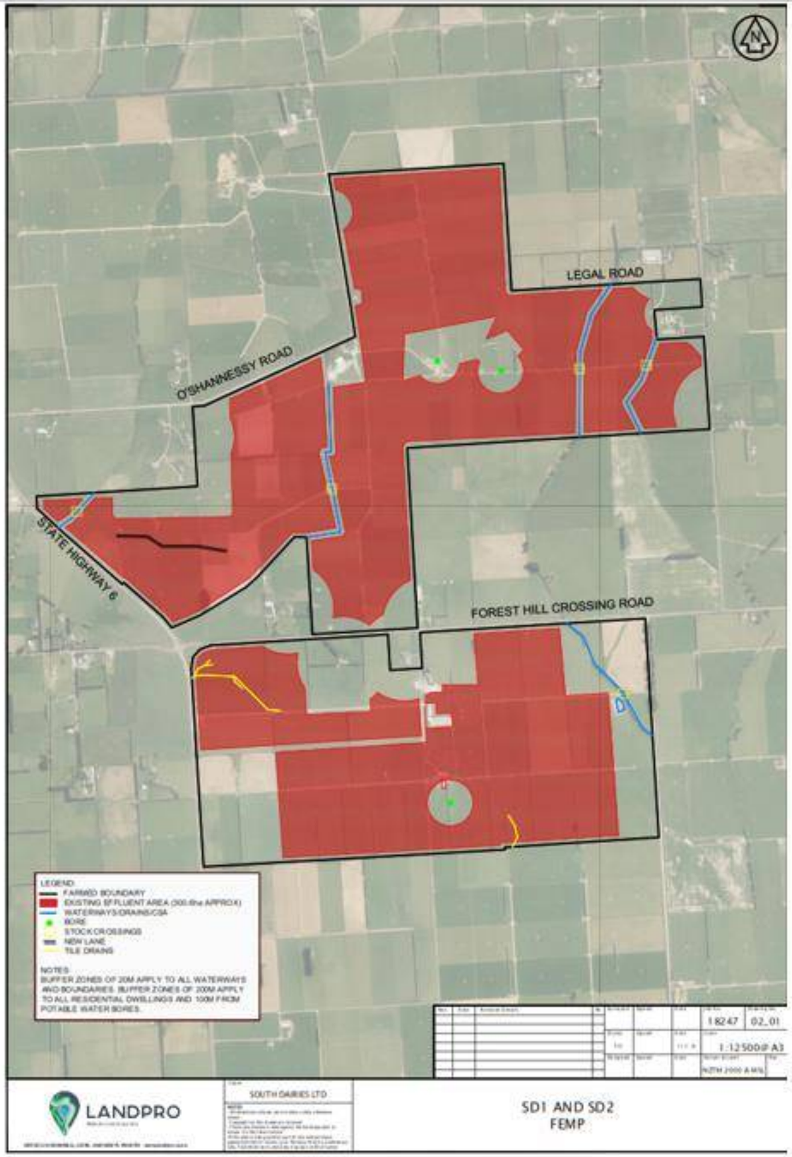
K: INDUSTRY GUIDELINES

A complete list of the industry guidelines which have been referenced in the development of this FEMP are listed below. The Consent Holder is also referred to the following general sources for guidance in respect to the operation and management of their property.

Environment Southland **www.es.govt.nz** **Dairy NZ** **www.dairynz.co.nz** **Fonterra** **www.fonterra.com**

Dairy NZ – A staff guide to operating your effluent irrigation system – Low Rate System
Dairy NZ – A farmer's guide to managing farm dairy effluent – A good practice guide for land application systems
Dairy NZ – Wintering in Southland and South Otago – A land management guide to good environmental practice
Dairy NZ – Land management on Canterbury Dairy Farms – Managing land to reduce sediment and phosphorous loss
Environment Southland Factsheet – Critical Source Areas
Environment Canterbury – Information Sheet for Farmers on OVERSEER®
Sustainable Dairying: Water Accord

Appendix A


LEGAL ROAD
O'SHANNESSY ROAD
STATE HIGHWAY 6
FOREST HILL CROSSING ROAD
LEGEND:
FARMED BOUNDARY
EXISTING EFFLUENT AREA
WATERWAYS/DRAINS/CSA
BORE
STOCK CROSSINGS
NEW LANE
TILE DRAINS
NOTES:
BUFFER ZONES OF 20M APPLY TO ALL WATERWAYS AND BOUNDARIES. BUFFER ZONES OF 200M APPLY TO ALL RESIDENTIAL DWELLINGS AND 100M FROM POTABLE WATER BORES.
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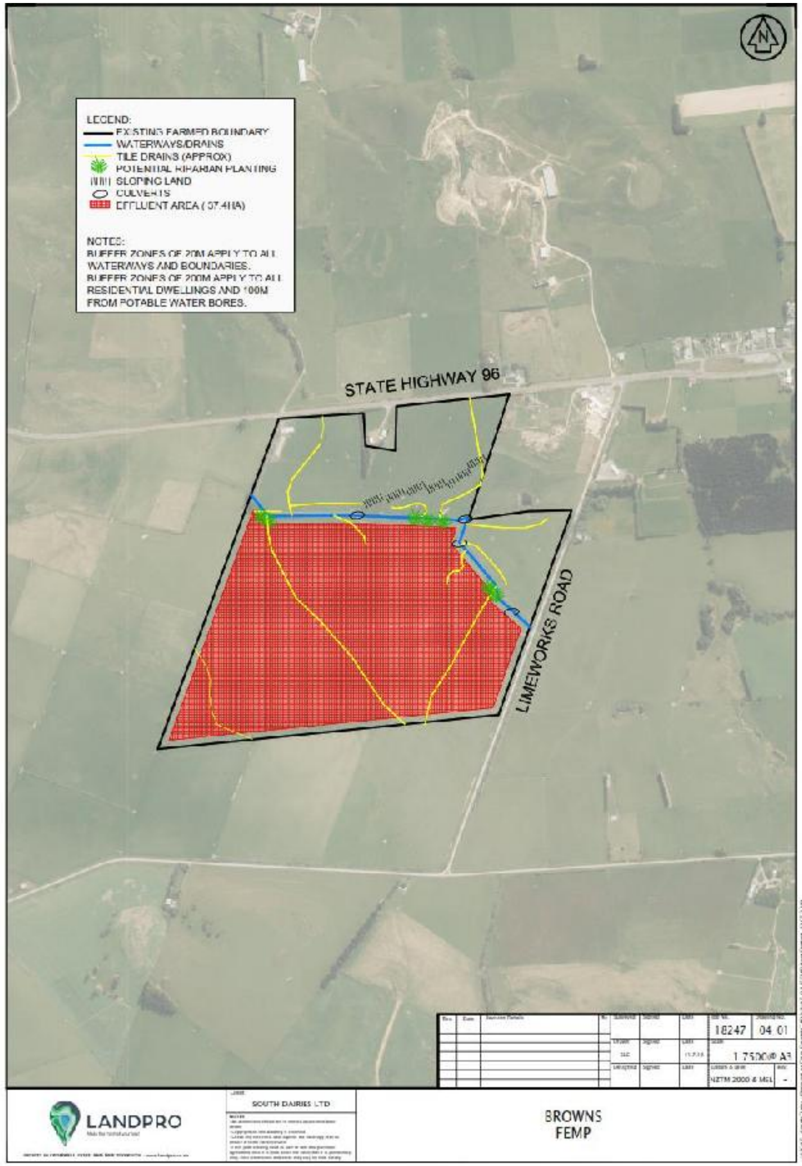
LANDPRO
SOUTH DAIRIES LTD
SD1 AND SD2
FEMP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EXISTING FARMED BOUNDARY
WATERWAYS/DRAINS
TILE DRAINS (APPROX)
POTENTIAL RIPARIAN PLANTING
SLOPING LAND
CULVERTS
EFFLUENT AREA
NOTES:
BUFFER ZONES OF 20M APPLY TO ALL WATERWAYS AND BOUNDARIES.
BUFFER ZONES OF 200M APPLY TO ALL RESIDENTIAL DWELLINGS AND 100M FROM POTABLE WATER BORES.
STATE HIGHWAY 96
LIMEWORKS ROAD
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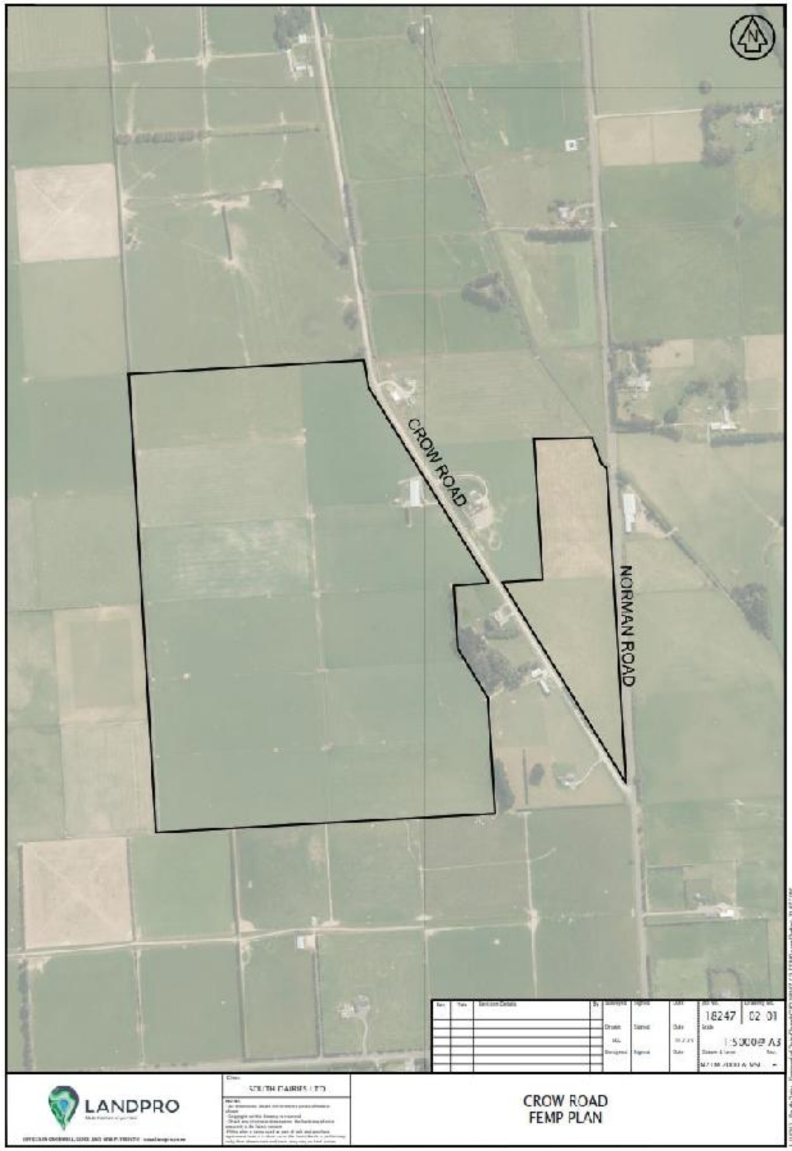
LANDPRO
SOUTH DAIRIES LTD
BROWNS
FEMP


CROW ROAD
NORMAN ROAD
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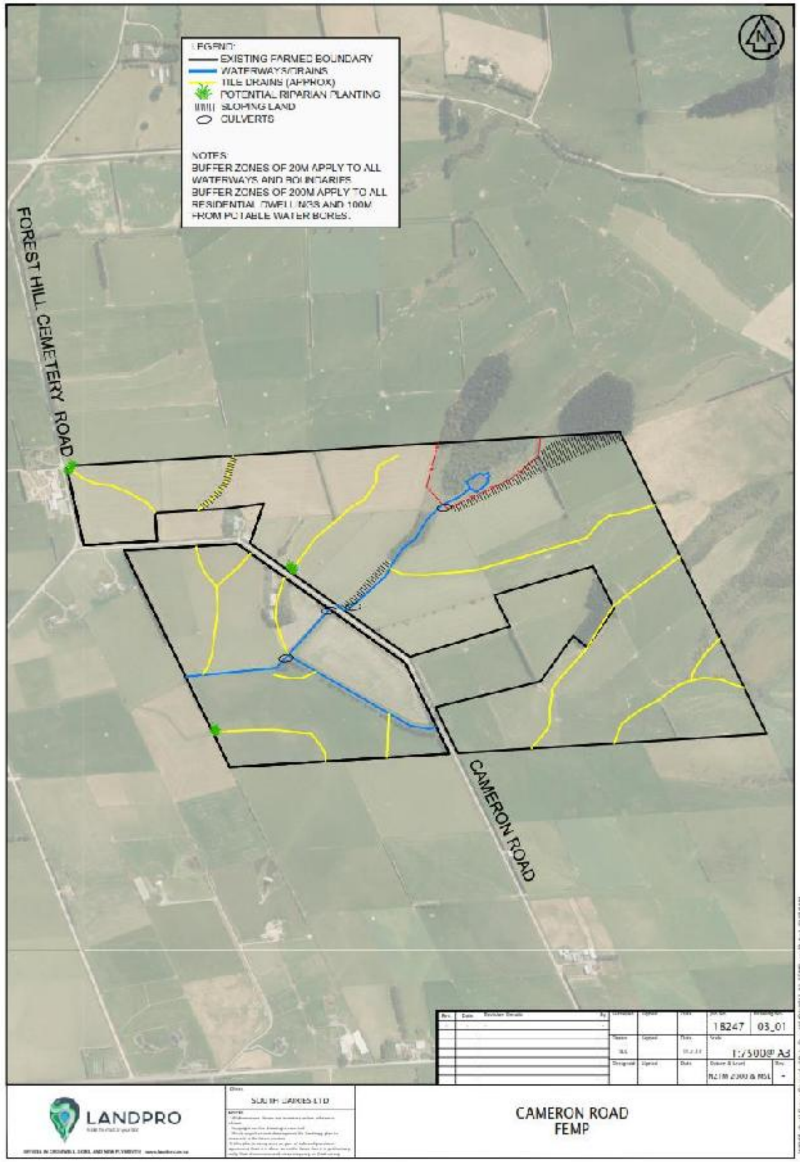
SOUTH DAIRIES LTD
LANDPRO
CROW ROAD
FEMP PLAN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EXISTING FARMED BOUNDARY
WATERWAYS/DRAINS
TILE DRAINS (APPROX)
POTENTIAL RIPARIAN PLANTING
SLOPING LAND
CULVERTS
NOTES:
BUFFER ZONES OF 20M APPLY TO ALL WATERWAYS AND BOUNDARIES
BUFFER ZONES OF 200M APPLY TO ALL RESIDENTIAL DWELLINGS AND 100M FROM POTABLE WATER BORES.
FOREST HILL CEMETERY ROAD
CAMERON ROAD
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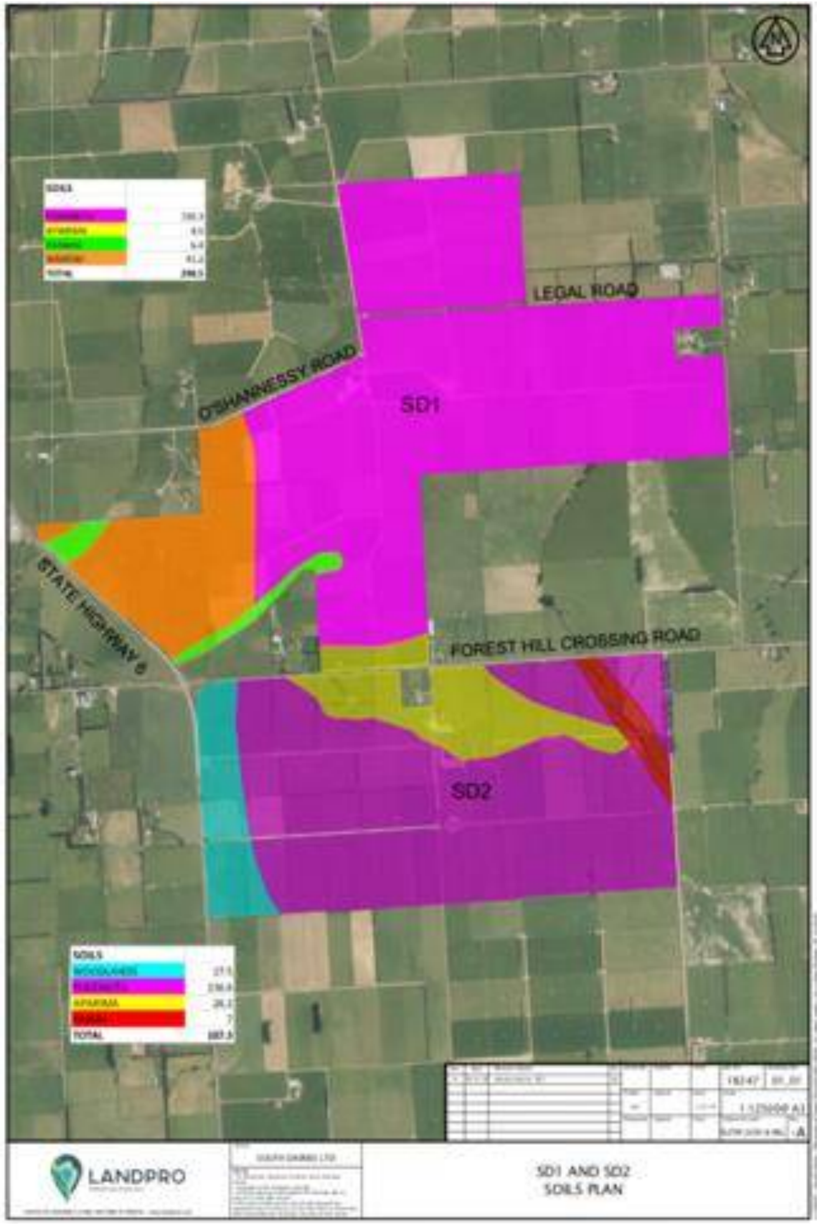
1:7500@ A3
NZTM 2000 & MSL
SOUTH DAIRIES LTD
LANDPRO
CAMERON ROAD
FEMP

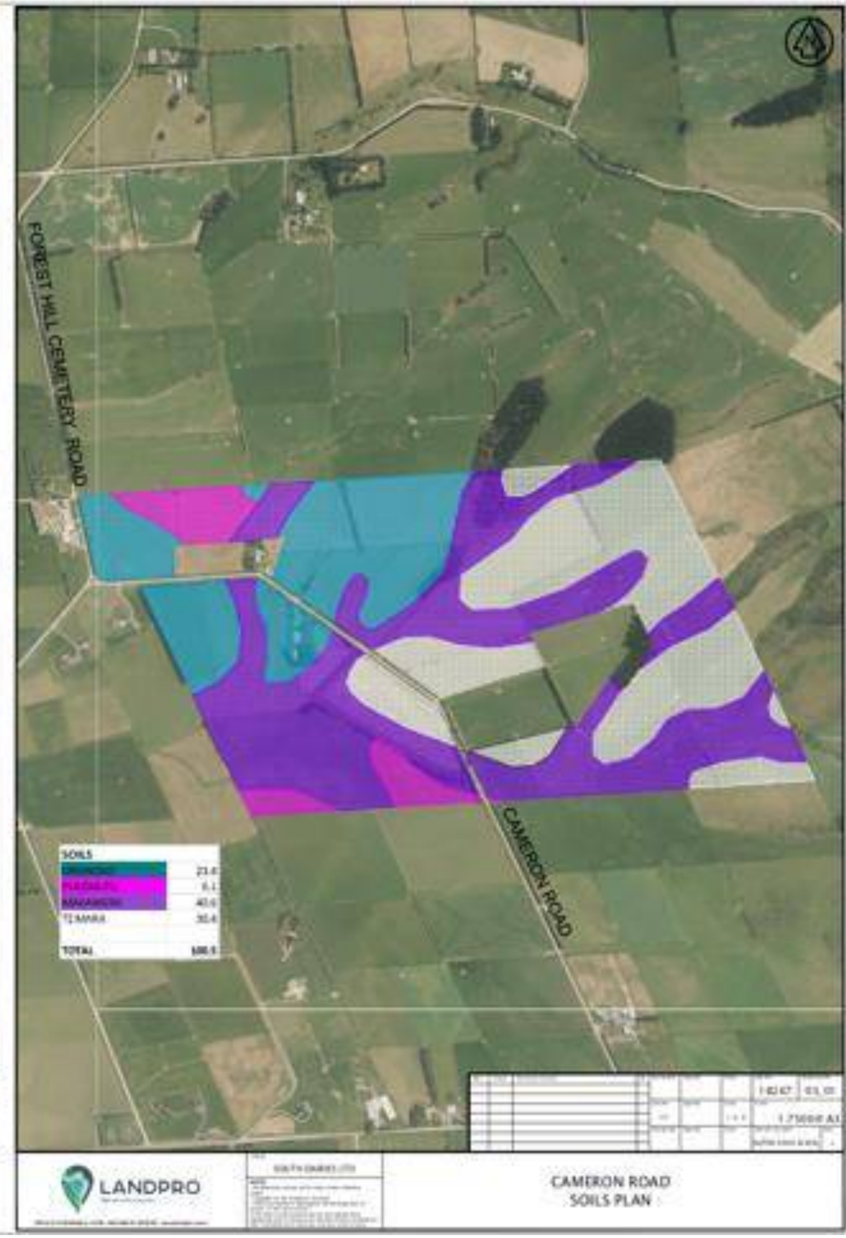
Appendix B


SOILS
TOTAL
LEGAL ROAD
O'SHANNESSY ROAD
SD1
STATE HIGHWAY 6
FOREST HILL CROSSING ROAD
SD2
SOILS
WOODLANDS
APARIMA
TOTAL
LANDPRO
SOUTH DAIRIES LTD
SD1 AND SD2
SOILS PLAN


STATE HIGHWAY 96
LIMEWORKS ROAD
SOILS
TOTAL
LANDPRO
SOUTH DAIRIES LTD
BROWNS
SOILS PLAN

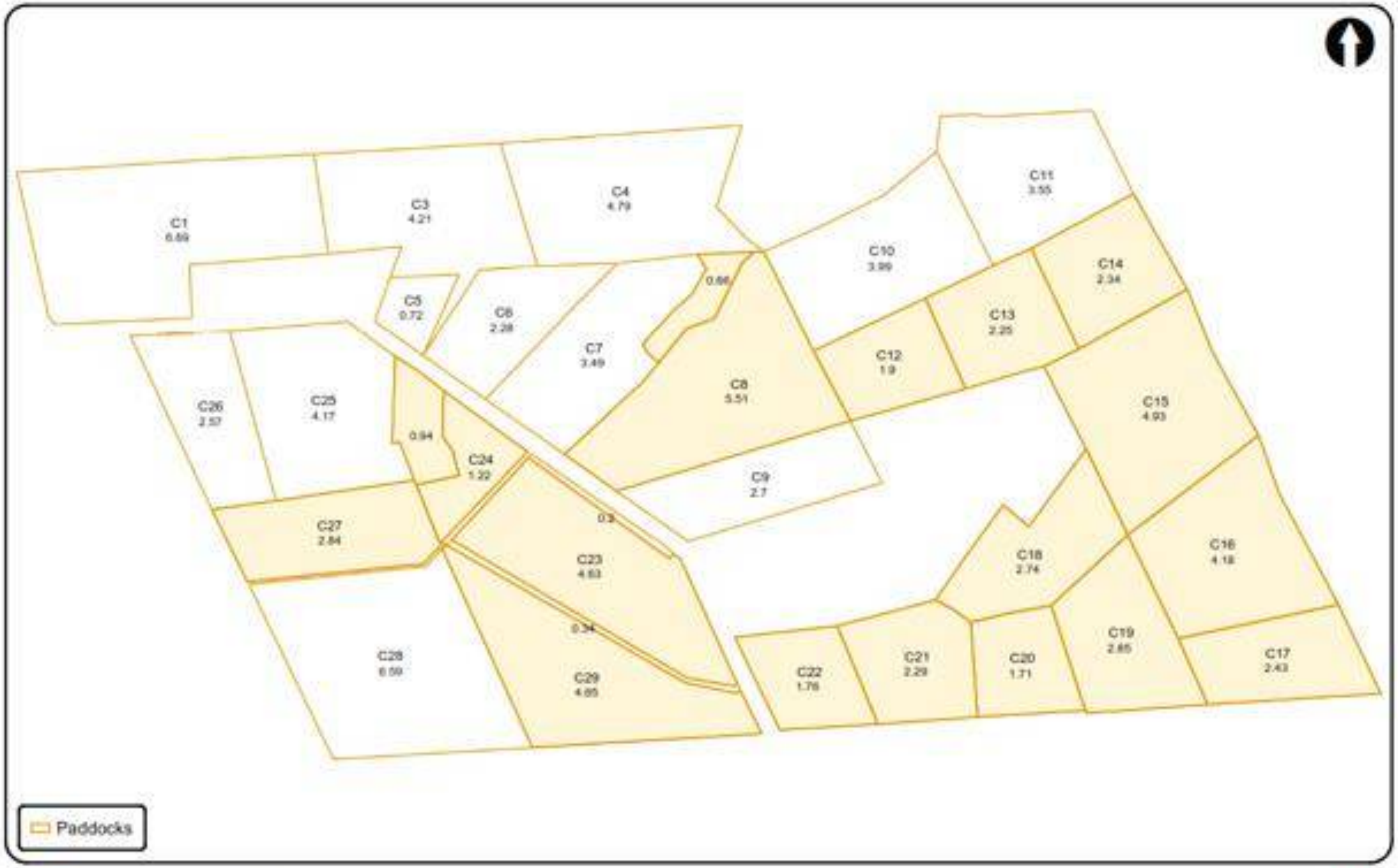
Appendix B

CROW ROAD
NORMAN ROAD
SOILS
TOTAL
LANDPRO
CROW ROAD
SOILS PLAN



FOREST HILL CEMETERY ROAD
CAMERON ROAD
SOILS
TOTAL
LANDPRO
CAMERON ROAD
SOILS PLAN

Appendix C



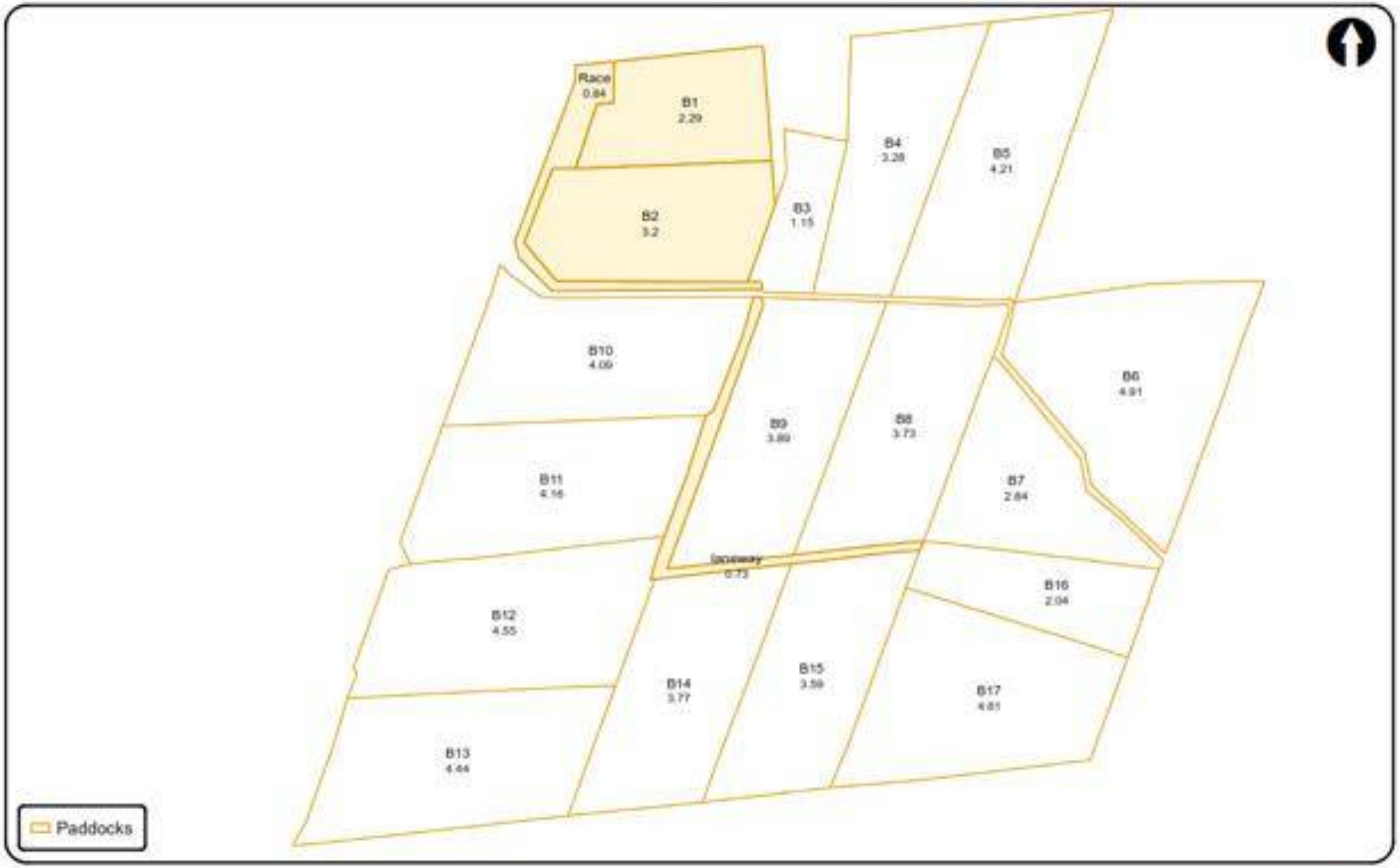
My Ravensdown Smart Maps
www.myravensdown.co.nz
Note: Areas are in hectares

Cameron Rd

0 40 80 160 240 320 Metres

ravensdown

Appendix C

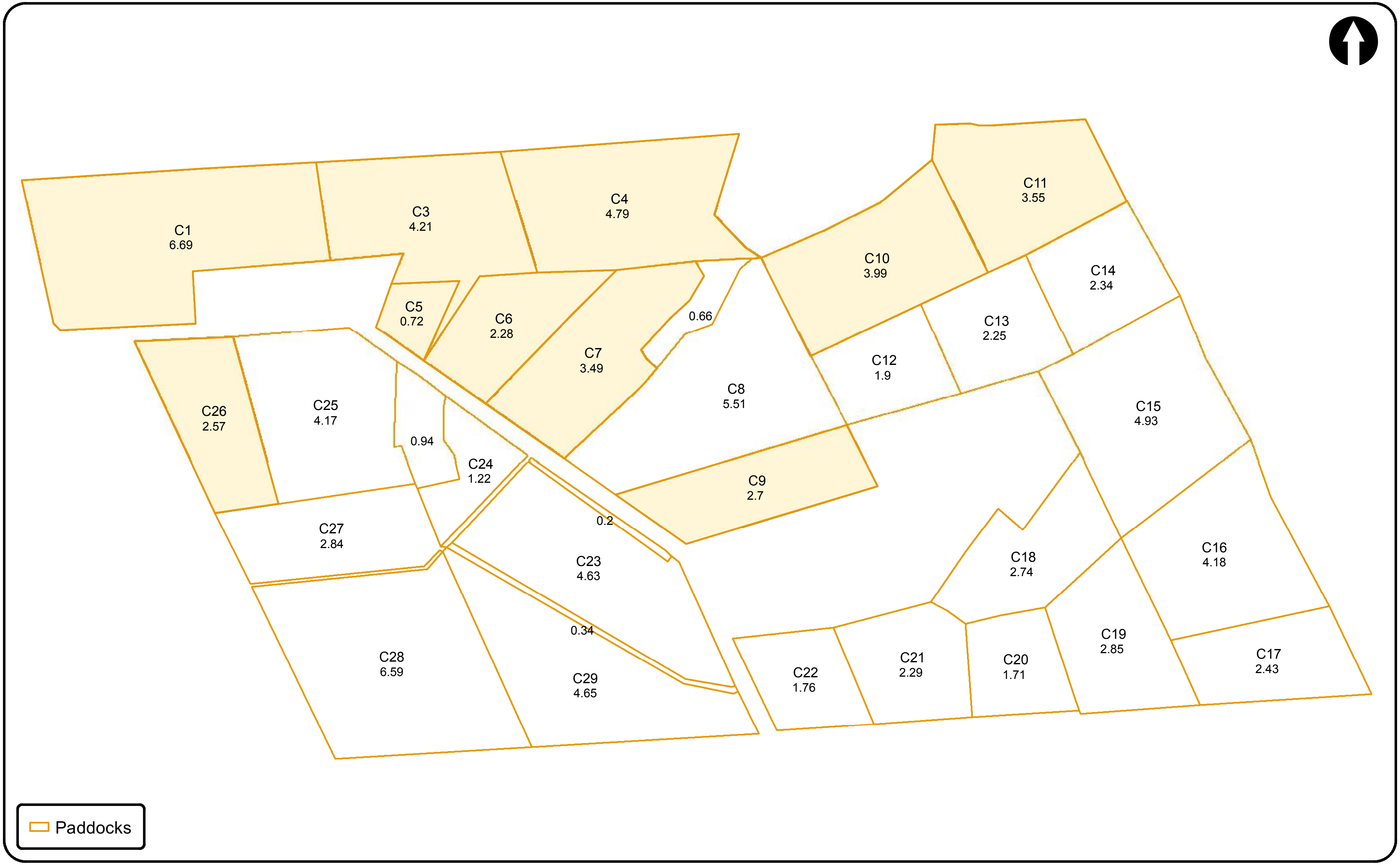


My Ravensdown Smart Maps
www.myravensdown.co.nz
Note: Areas are in hectares

Browns

0 35 70 140 210 280 Metres

ravensdown



My Ravensdown Smart Maps
www.myravensdown.co.nz
Note: Areas are in hectares

Cameron Rd

0 40 80 160 240 320 Metres

ravensdown

23 June 2019

RDA Consulting
GEOTECHNICAL • CIVIL • ENVIRONMENTAL

DAIRY EFFLUENT POND DROP TEST REPORT

JOB TITLE	SOUTH DAIRY LTD
ADDRESS	11 MCCONACHIE ROAD, LOCHIEL.
JOB NUMBER	50905

Client: South Dairy ltd.
11 Mcconachie Rd, Lochiel 9781

TABLE OF CONTENTS

Prepared by

Raphael Karnuth
BSc Environmental Management
Environmental Consultant

Reviewed by

Karen Ladbrook
NZCE (Civil), MEngNZ
Environmental Engineer

1. INTRODUCTION

1.1. SCOPE

RDA Consulting were engaged by South Dairy ltd to perform a drop test on an existing Dairy Farm's effluent sludge beds. The sludge beds are normally used to separate a portion of the solids from the dairy effluent, before the liquid fraction is stored for later irrigation.

Our methodology is based on and in accordance with IPENZ Practice Note 21 Section 8.7, and is consistent with Environment Southland's methodology described in Appendix P of the proposed Southland Water and Land Plan. The methodology is further discussed in the methodology section of this report.

The drop test as set out in IPENZ PN21 is not considered a suitable means of assessing liner permeability, however a carefully run drop test will indicate if there is gross leakage, being a large single-point leakage, or a number of smaller leaks in the liner.

1.2. SUMMARY OF RESULTS

	Value	Source
Maximum Allowable Pond Drop	2mm/day	*Proposed Southland Water & Land Plan Rule 35(b)*
Calculated Daily Pond Drop	+0.8mm/day	*RDAgritech Drop Test*
Interpretation of Result	Pass	**within statistical error & test precision*

The calculated gross leakage rate derived from the above drop test complies with the maximum allowable pond level drop defined in the proposed Southland Water & Land Plan.

This means that, for the purposes of compliance with Regional Council requirements, the pond is considered to meet the regional compliance limits for leakage and is considered acceptable by Environment Southland.

1.3. POND DROP TEST DESCRIPTION

Test start	16:10:00 28/01/2019
Test End	08:22:20 31/01/2019
Test Period	00 hours
Pond Location	11 McConachie Road, Lochiel 9781. GPS 46.124145 S 168.211865 E
Pond Description	Rectangle pond built on ground level. The visible parts of the internal embankments are in reasonable condition with no signs of damage to the concrete.
Liner Description	Concrete lined “Clean Green” dual sludge bed adjacent with weeping walls.
Additional Pond Comments	The sludge bed catchment was measured. The sludge beds/weeping walls were flooded for the test and therefore the catchments below include the weeping wall surface area and catchment. The sump area between the weeping walls was flooded with effluent.
Effluent Surface Area:	24.8m x 11.8m = 287.7m^2
Pond Catchment:	26m x 13m = 338m^2
Pond Depth (as % of design depth)	100%
Pond Last De-sludged:	The sludge beds were completely emptied approximately two weeks before the test was carried out. The system uses a stone trap and sump to remove heavier sediments.
Wind Speed:	Wind speeds did not exceed 10m/s.
Method of Pond Isolation	The effluent was contained in the sump and a tanker used for effluent distribution on the farm.

1.4. DISCUSSION

Event 1: Apparent Increase and Fluctuations in Effluent Level on 3 March

High humidity and in foggy conditions, interspersed with sunny periods on 3 March caused an apparent increase and fluctuations in effluent level. The humid conditions are expected to have caused condensation on the logger cable and an erroneous high reading. The graph shows that when these conditions eased, the logger returned to about the same level as before the period of error.

Event 2: Temporary Increase in Pond Level

Motion-capture footage shows that one of the dairy farm workers walked out along the access planks atop the weeping wall structure mid-morning on the 4 March. Also a Heron (bird) can be seen in footage from around this time, very close to the drop test equipment. It is estimated that one or both of these events caused the apparent “jump” in level.

Sludge/Scum on Effluent Surface

At times during the test, a sludgey-scum can be seen on parts of the effluent surface. The position and extent of this material varies with weather and wind conditions, as would be expected on any effluent storage unit, particularly one as small as this that is receiving whole raw effluent.

There is potential for a sludge/crust layer to impede evaporation and this is a possible explanation for the apparent nett increase in effluent level across the test period.

If evaporation from the effluent (compared to the reference pan) is sufficiently impeded, this could potentially “hide” leakage, however for this test, as there has been an apparent nett gain of 0.8mm/day, it is highly unlikely that leakage of more than 1.8mm drop/day could be occurring.

General Discussion

Although the test result indicates a nett increase in effluent level, there is no reasonable mechanism by which this could occur. The sludge beds are entirely in-ground, however are only 1.5m deep therefore would be above groundwater level at all times of the year. There was no rainfall during the test therefore there could not have been any inflow from the surrounding area. The sludge beds were isolated and did not have any effluent added during the test period.

Although the thermal mass of the floating pan is expected to be in equilibrium with the liquid in the sludge beds, (and therefore evaporate at the same rate) the position of the adjacent shelter belt and also the tanks on the north side of the beds, generates potential for shading of different parts of the sludge beds at different times and consequently evaporation rates could differ slightly as the pan is located at a fixed point in one of the beds.

The trend in effluent level over time does not indicate leakage. Any fluctuations in effluent level observed are in line with the known effects of climatic conditions or other phenomena explained above. Reference measurements taken manually are consistent with electronic data.

2. PHOTOGRAPHS

Overview of Weather station, rain logger and evaporation pan.

Conditions at start of test

Conditions at end of test

Example of foggy conditions

Example of foggy conditions

Farm worker on accessway

Heron observed near test equipment

3. METHODOLOGY

3.1. TEST LIMITATIONS

The drop test will determine if gross leakage occurs, i.e. a single large hole or multiple smaller holes or if the liner permeability is above the required standard. The drop test is not suitable to verify whether a liner has achieved the recommended maximum leakage level due to the limitations in measuring very small changes in level accurately.

3.2. POND INFLOWS & OUTFLOWS

Ideally, no effluent or stormwater should be allowed to flow into or out from the pond during the test period. The pond was fully isolated from any inflows or outflows for the duration of the test.

3.3. RAINFALL

An Odyssey Tipping Bucket Rain Gauge Logger was used to measure total rainfall and rainfall intensity over the test period.

The Odyssey Rain Gauge logger operates based on event-triggered logging. In event triggered logging, the data will be logged only when the sensor triggers an event. In the context of this logger, an “event” is 0.2mm of rainfall. The data has been converted into 5-minute intervals in order to align with the pond level data and allow comparison.

3.4. EVAPORATION

Two evaporation pans were used for this test. One was placed on the pond embankment in the location shown on the test location plan, the other was floated in the pond as required by IPENZ PN21. The on-shore pan measures 362.5mm long x 240mm wide x 210mm high, while the floating pan measures 410mm long x 270mm wide x 210mm high. We estimate the precision of manual water level measurement in the pans as ±0.5 mm.

The floating pan is used as the reference for evaporation, as it most closely represents evaporation conditions in the pond. The second pan on the embankment is used as a back-up and to identify trends in level fluctuation, however, is less representative of overall evaporation conditions in the pond due to its’ different thermal mass.

Water level in the floating pan was recorded at the start and end of the test period. The on-shore pan is logged with a capacitive logger. Capacitive loggers are further discussed below.

3.5. EFFLUENT LEVEL MEASUREMENT

A capacitive water level logger was installed in the pond, to determine the overall change in pond level over time. The logger is protected within a PVC tube covered with filter fabric to prevent fouling of the sensor. Pond level measurements were taken every 10 seconds throughout the test period.

The loggers are both calibrated every time they are used, using effluent from the pond being tested. The precision of pond level measurement is estimated at ±0.8 mm. The pond level data is shown in the site investigation log.

3.6. WEATHER CONDITIONS AND WIND SPEED

An Aercus WS2083 weather station was set up near the pond. The weather station records wind direction, average wind speed, maximum wind gust, temperature, air pressure, humidity. The weather station records a data point every 5 minutes and in the case of maximum wind gust, the value recorded is the maximum obtained over the 5-minute period.

The primary purpose of the weather station is to verify the wind speed during the test period, however other data is useful in providing context to any fluctuations on pond level, or seiche effects.

3.7. POND DROP CALCULATION

Total water level drop was estimated from the pond level change over the test period. The pond level drop due to gross leakage (Δh) is determined by the following formula:

$$\Delta h = Total\ precipitation + Change\ in\ pond\ level - Total\ open\ water\ evaporation$$

4. APPLICABILITY

This report has been prepared based on data and observations collected from a Pond Drop Test conducted in accordance with IPENZ Practice Note 21 Section 8.7 and, where relevant, information provided by the Client or their representative.

While we have exercised due care in assessing the leakage rate through the pond liner, we take no responsibility for the actual rate of leakage that may be occurring and any environmental contamination that may result.

The scope of the pond drop test does not include determination of groundwater levels or assessment of the pond's structural integrity.

This report is only to be used by the parties named above for the purpose that it was prepared and shall not be relied upon or used for any other purpose without the express written consent of RDAgritech Ltd.

Odyssey Tipping Bucket Rain Gauge Logger

The orifice of the rain gauge is 6.5 inches or 165.1 mm. The Davis Tipping Bucket Rain Gauge is factory calibrated and should not normally require any attention other than keeping it clean.

```
   SENSOR Sn: 5228
          TIPPING BUCKET RAIN GAUGE
          LINEAR CALIBRATION


Units Of Measurement     mm

Calibration Unit 1        0     Measured Value       0 mm
Calibration Unit 2      233     Measured Value    46.6 mm

Calculated Slope    5
Calculated Offset   0

Relative Value      0
Number of decimal places    1
```

If the calibration appears to be significantly in error, a calibrated rain gauge located within 600 mm of the tipping bucket logger may be used to compare the readings over the time period. A significant rainfall event will give the best results.

APPENDIX A – DROP TEST SITE PLAN

APPENDIX B – DATALOGGER RESULTS

DROP TEST LOG

Drop Test Log

RDAgritech
ENGINEERED BY NATURE

Job Number:	50905
Project:	South Dairy
Location:	
Test Technician:	RK

Test Period: Start: 2/03/2019 13:56 Finish: 4/03/2019 19:56

Duration: 54.01 hours

Rain Gauge

Rainfall measured over test period: 0.2 mm

Rainfall Added to Effluent Surface: 0.2 mm

Evaporation Pans

	Start Level (mm)	End Level (mm)	Change in Level (mm)	
Evaporation Pan 1	1462.0	1448.0	-14.0	On-shore Pan
Evaporation Pan 2	1370.0	1361.0	-9.0	Floating Pan

Evaporation Ratio :1.5 *(ratio of pond evaporation to on-shore pan evaporation)*

Evaporation Calculation -9.0 Pan level change -9.2 Total evaporation

Weather

At test start:		At test end:	
Sun:	Sunny with clouds	Sun:	Overcast
Temperature:	18.2º	Temperature:	20º
Wind:	3.4m/s, SW	Wind:	3.4m/s N
Rain:	No	Rain:	No

Pond

Effluent Surface Length:	24.8	m	Depth of effluent:	1.2	m
Pond Length:	26.0	m	Pond Design Depth:	1.2	m
Effluent Surface Width:	11.6	m	Pond Total Depth:	1.5	
Pond Width:	13.0	m	Side slopes angle:	2	?(H):1(v)
Effluent Surface Area:	287.7	m^2	Wetted surface area	306	m^2
Pond Surface Area:	338.0	m^2	Base bottom length	20	m
Height @ start of test:	393.4	mm	Base bottom width	6.8	m
Height @ end of test:	386.2	mm			

Percentage of Design Depth 100%

Measured Change in pond level:	-7.2	mm
Angle of Datalogger:	0	º (degrees)
Actual Change in Pond Level:	-7.2	mm
Nett Change in Pond Level over test:	1.8	mm

(excluding evaporation/rainfall)

ES Max. Allowable Drop	-1.8 mm/day
Daily Change in Pond Level	0.8 mm/day
TEST RESULT	PASS

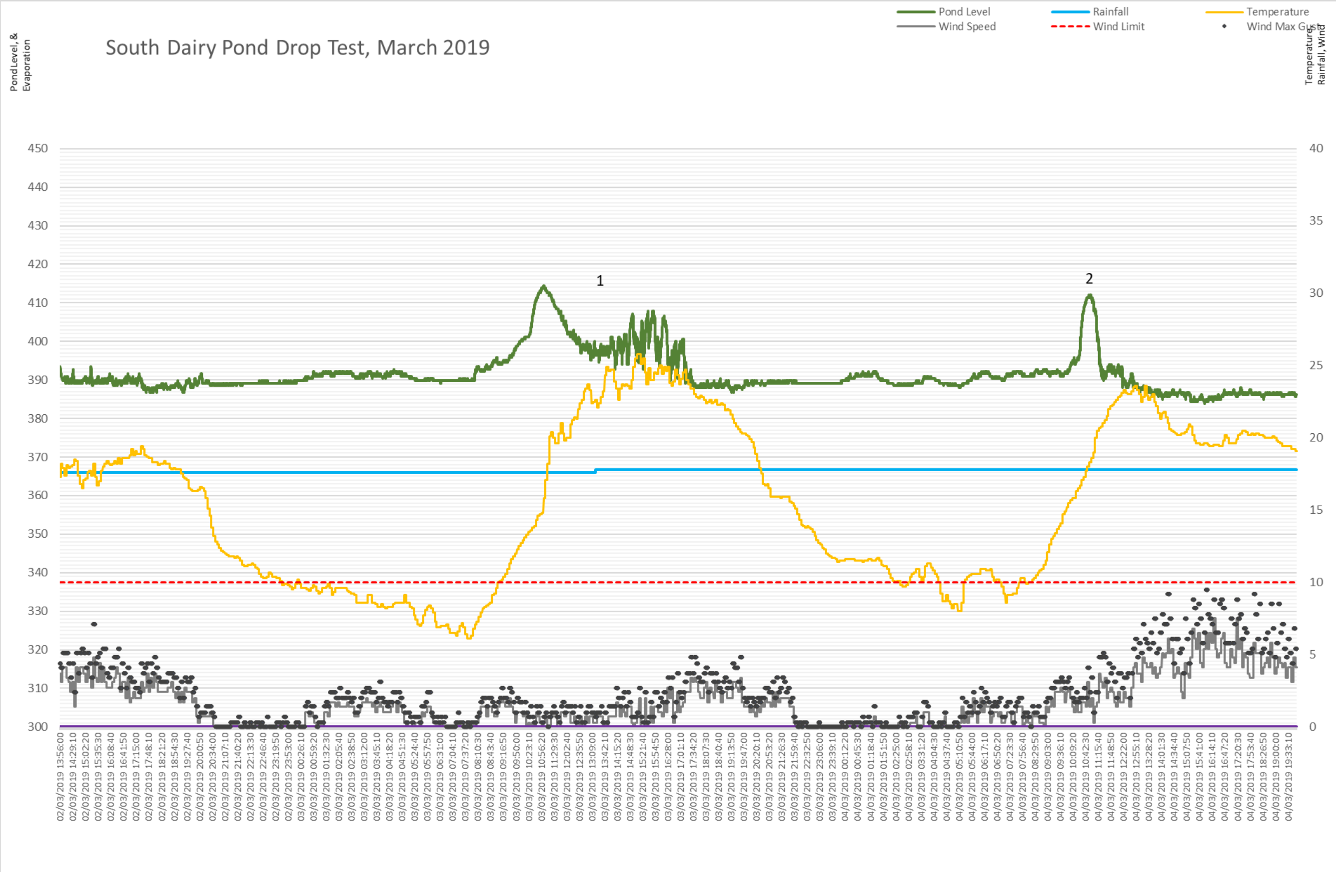
Notes:

1) Effluent was excluded from entering the pond for the duration of the test.

2) Pond depth and % full are calculated on the best available data, which may include: measurements taken from above effluent level, any plans or specifications available and the pond owner's knowledge. It is not possible to confirm pond dimensions without first emptying the pond.

RDAgritech do not take any responsibility for the accuracy of pond dimensions used.

POND LEVEL CHART



AGRICULTURAL EFFLUENT STORAGE FACILITY CERTIFICATION

STRUCTURAL REVIEW

ISSUED BY:	Civil Tech Ltd
TO:	South Dairy Ltd
IN RESPECT OF:	Herd Homes – effluent storage
AT:	11 McConachie Road and 732 Winton Hedgehope Highway
DATE:	5 April 2019
SIGNED	Murray Gardyne

Under Rule 32D (a) (ii) (2) I have inspected the sludge storage beds under three Herd Homes and certify that they have no visible cracks, holes or defects that would allow effluent to leak from these storage facilities.

The structures are precast concrete panels with a cast in-situ floor. There was no movement of these panels and there was consistent line and level.

Civil Tech is operated by Murray Gardyne. The following are my qualifications, experience and competency. In the first 18 years of my career I was a designer, mostly on roading and earthworks but also with 4 years of structural detailing of bridges and multi-storey buildings including concrete and steel. During this time I also inspected building foundations on new buildings, and carried out laboratory testing and engineering survey. I gained NZCE (civil) in 1975. I became a Registered Engineering Associated and in 1985 became the Senior Supervising Draughting Officer in the Invercargill Residency of the Ministry of Works and Development with a staff of 12, the youngest in the largest residency in NZ. I then was employed by a Local Authority as a roading designer and contract manager of roading works. I was then a project manager for earthworks and roading for a maintenance and construction company for 7 years. Most construction projects involved bulk fills and pavements on roads, commercial development, coal mines, forestry roading and fire ponds. I then started Civil Tech and worked for civil engineering consultancies and project managed contracts, from pricing to contract management to completion, for contractors. This work was roading, industrial developments and a large dam for which I offered an alternative design and this was used. After 2 years I joined with MWH in the buy-out of the Southland District Council Design Business Unit and was the Team Leader Projects with a staff of 6 – 9 and was responsible for the survey, investigation, design, documentation and contract management for all Southland District Council, Gore District Council and half New Zealand Transport Agency roading construction works and safety improvements in Southland, to a value of $7m/year. I also reviewed large dam design and construction specifications and multi year roading strategy studies pricing construction of $100m plus. I became a AIPENZ in 2000, now CMEngNZ(ET) but never needed CPEng but could have gained that as well. I left MWH to operate in Civil Tech again in 2006 and in 2007 was requested by Environment Southland to inspect a number of leaking ponds to determine how to remediate them and for several years met on farm with Russell Winter (ES Dairy Liaison Officer) to design well sited ponds. I spent more time on this work as more was required for permits and it became 70% of my work. I have designed more than 350 effluent storage ponds in Otago and Southland and certifying all in Otago and since 2009 in Southland up until June 2016 when a CPEng was required. I also carried out structural inspections and drop tests. I assisted the ORC with their pond design manual and certification process. The design of ponds is the ability to visualise how they will fit into the site. My roading and earthworks work has given me an understanding of the various materials available for pond construction in Southland. This is my 48th year of civil engineering experience. I have also owned and operated farms and commercial property.

11 McConachie Road – two Herd Homes

Looking east toward the twin Herd Homes and the under floor storage bunker.

Looking east into the under floor storage bunker.


Looking west along the slotted floor above the storage bunker.


Looking south east at the south wall precast panel with a top slab that hols the removable panels in place.


Looking east at the storage bunker.

732 Winton Hedgehope Highway – One Herd Home

Looking south at the open effluent storage bunker.

Looking south at the open east bunker.


Looking south at the open west bunker.


The storage tanks that capture the liquid via a subsoil system under the bunkers.

NEW ZEALAND COMPANIES OFFICE
COMPANIES REGISTER

Certificate of Incorporation

SOUTH DAIRY LIMITED
613630
NZBN: 9429038757297

This is to certify that SOUTH DAIRY LIMITED was incorporated under the Companies Act 1955 on the 13th day of December 1993
and was reregistered to become a company under the Companies Act 1993 on the 23rd day of April 1997.

Registrar of Companies
25th day of July 2019

REGISTRAR OF COMPANIES
NEW ZEALAND

Certificate generated 25 July 2019 04:29 PM NZST