ravensdown

Farm Scenario Plan

Current and Proposed System Nutrient Budgets for Effluent consent with Winter Barn Example

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Reviewed by Andrée Callaghan (CNMA)

optimiser™
Environmental analysis and planning

Executive Summary

Woldwide Four farm Ltd, have requested OVERSEER FM® Nutrient Budgets to model current and proposed farm system estimated nutrient losses for their dairy farm. The purpose of this work is to support a renewal of their effluent discharge consent. The proposed nutrient budget also evaluates an expansion of the dairy farm with an addition of part land from a block purchased (63.3 ha). An additional example is provided for a wintering barn that is to be established later on. The 349.3 ha farm is located at 805 Mayfield Road, which includes the 78.8 ha support block located at 477 Gladfield Rd, Heddon Bush, 19 km west north west from Winton Township, 40 km nor-north west from Invercargill city and 36 km from the south west coast (Orepuki). The property is a dryland dairy farm, milking approximately 810 cows (consented numbers 850).

Current (combined) Farm System

Average Nitrogen lost from the root zone, calculated from the combined current farm systems modelled, using OVERSEER FM® Nutrient Budgets (OVERSEER FM6.3.21/2.8.0.2) was **11,978 kg N/year** or **29 kg N/ha/year.**

Average Phosphorus lost from the combined current farm systems modelled using OVERSEER FM® Nutrient Budgets (OVERSEER FM 6.3.21/2.8.0.2) was **343 kg P /year** or **0.9 kg P/ha/year.**

Proposed Transitional (Interim) Farm System

Average Nitrogen lost from the root zone, calculated from the proposed farm system modelled, using OVERSEER FM® Nutrient Budgets (OVERSEER FM 6.3.21/2.8.0.2) was **11,898 kg N/year** or **29 kg N/ha/year. (0.7 % decrease from baseline)**

Average Phosphorus lost from the proposed farm system modelled using OVERSEER FM® Nutrient Budgets OVERSEER FM 6.3.21/2.8.0.2) was **349 kg P /year** or **0.8 kg P/ha/year. (1.7%increase from baseline)**

Final Winter Barn Proposal

Average Nitrogen lost from the root zone, calculated from the proposed farm system modelled, using OVERSEER FM® Nutrient Budgets (OVERSEER FM 6.3.21/2.8.0.2) was **9,727 kg N/year** or **24 kg N/ha/year. (18.8% reduction from baseline)**

Average Phosphorus lost from the proposed farm system modelled using OVERSEER FM® Nutrient Budgets (OVERSEER FM 6.3.21/2.8.0.2) was **371 kg P /year** or **0.9 kg P/ha/year.** Further mitigated losses from other sources can account for a further reduction **of 29 kg P/year** leading to a P loss risk for the farm system now **being 342 kg P/year or 0.9 kg P/ha/year or the same risk** from the combined result (baseline

Factors associated with the farm system that pose risk to N loss include; artificial soil drainage and fodder crops. Comparatively, the gley soils, with a high buffering capacity to leaching (high PAW and deep topsoil's) reduce the risk of leaching.

The additional land modelled in the proposed farm system, enables the property, at an increased milking dairy cow numbers (to consented), reduced supplements imported, and reduced effluent and non-effluent N fertiliser to reduce the overall risk of N and P losses.

The wintering barn proposal negates the effect of cropping losses and increased stock numbers, and enables the farm to reduce the impacts to below the current combined losses calculated

The farm is located in a zone with 'moderate to high' risk nitrate levels. The physiographic zone points to high nitrates in ground water, nitrate accumulation and artificial drains as being risk factors. The proposed farm system, as modelled by OVERSEER FM®, currently has a number of strategies to reduce the risk of Nitrogen loss to water. These include; an effluent system with low application depths and adequate area, a reduced stocking rate, and continued use of crop to minimise soil damage over the early spring period. Riparian strip planting to capture sediment from crops and laneways through adequate buffer zones plus optimal soil test phosphate levels, are all practices which will reduce the risk of P loss. Ensuring the lowest volume applications and depths are applied to the artificially drained soils, with none applied at the highest risk times are further mitigations that are recommended.

The associated parameter reports are available in a separate document.

Overseer Nutrient Budget Version (6.3.2/2.8.0.2) have been used to create the nutrient budgets presented in this report.

Contents

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Mark Crawford

Farm Environmental Consultant

Dated 22nd September 2019

General

Aim and Purpose of Farm Scenario Plan

Woldwide Four Ltd, has requested a current and proposed OVERSEER® Nutrient Budgets to reflect the current and proposed estimated nutrient losses from their dairy farm plus support block as a renewal of their effluent discharge consent, with the addition of 63.3 ha of a 136.3 ha neighbouring sheep farm. An additional example of a wintering barn was included to help show the likely effects on nutrient losses, using Woldwide 4 as the example given it is typical of a representative dairy farm in Southland, with a run off used to winter cows. The farm is at 805 Mayfield Road, plus a 78.8 ha support block at 477 Gladfield Rd, Heddon Bush, 19 km west north west from Winton Township, 40 km nor-north west from Invercargill city and 36 km from the south west coast (Orepuki). The property is a dryland dairy farm, milking approximately 810 cows (consented numbers 850).

The total titled area of the property is 346.2 ha, and the GIS map with paddock areas calculates to 349.3 ha. As a result, the farmed area of 349.3ha has been modelled as the total farm area in Overseer. In this figure there is 3.7 ha of riparian edges. The effective area is calculated at 337.5 ha, close to the owner stated 340 ha of paddocks. In addition there is an estimated 8.1 ha of non-effective area, comprising of sheds, lanes, feed pads and yards. The property is of flat to gently rolling topography (modelled flat).

Soil types on the farm are all homogenous and are Braxton_4a.1, Silt Loam over clay, (Orthic Gley soil, Poorly drained, PAW (plant available water) to 60 cm of 147.6 mm); there is a small area of Drummond soil 0.3 ha which is not modelled and incorporated as a Braxton soil. The Braxton soil is a deep to moderately deep soil with a heavier silty loam texture, this means this soil has a lower risk of nitrogen leaching.

Overseer modelling of the system has been undertaken in accordance with the Overseer 6.3.1 “best practice data input standards” and has been reviewed by a certified nutrient management advisor.
The following report summarises the respective Overseer 6.3.1 nutrient budgets and key assumptions made.

Property Details

Location/address	805 Mayfield Road, plus 477 Gladfield Rd Heddon Bush 9783 RD 3, Winton
Legal Description	Part Lot 2 Deposited Plan 4262 and Lot 7 and Lot 12 Deposited Plan 152, Lot 10 Deposited Plan, Lot 11 and Lot 11A Deposited Plan, Lot 24 Block III Deposited Plan 210
Total area (ha)	346.2 ha titled total farmed land calculated at 349.3 ha including roadside reserves Effective area estimated at 337.5 ha, ***includes*** 78.8 ha *support block* at Gladfield
Owners	A & JJ DE WOLDE
Contact details	
Phone	(03) 2258344 mobile (027) 2272537
Email	abe@woldwide.nz
Farm Type	Seasonal supply Dairy farm and support block

Current Farm System Analysis

Climate

Climate data for the property has been sourced from Overseer's Climate Station Tool data and has been entered as rainfall – 967 mm/year, PET – 716 mm/year and average temperature – 9.8 ^{o}C, based on location close to latitude/longitude -46.94050; 168.108300 (transect 23 co-ordinates). For the Gladfield Rd support block data has been entered is as rainfall – 926 mm/year, PET – 711 mm/year and average temperature – 9.7 ^{o}C, based on location close to latitude/longitude - 46.094050; 168.108300 (transect GF 4 co-ordinates). Climate data has been modelled as per Overseer BPDIS.

Description of Current Farm System

The 349.3 ha property is operated as a seasonal dryland dairy farm ***including*** support block of 78.8 ha, calving 810 cows (850 consented) and peak milking 775 (540 & 500 kg LW) Friesian cows. Milk production averaged for the last five years is 410,452 kg MS/year (510 kg MS/cow). Cow numbers are shown in the table below. All cows are wintered off the farm platform for June and July and are instead wintered on the Gladfield block crops. In addition, the first calving heifers (180 and at 500 kg LW) are wintered on the Gladfield block from , when they come back from grazing off in May, with all cows brought back to the dairy platform in mobs over the month of August. Mean calving date is the 20th August for the main herd, with the first calvers a week earlier on the 12th of August.

The dry-off date is the 1st of June and the 25th of May for the cows and first calving heifers. All replacements (180) are grazed off-the platform until they return as in calf R2 heifers in May. Cows are milked once a day or 16 hourly occasionally over autumn drying off (modelled never) and all calves are fed colostrum and waste milk.

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

The 78.8 ha support block is used to winter the 630 dairy cows, as well as the in calf heifer replacements and cuts silage to be exported and used to feed out on the dairy platform and crops.

Supplements

Supplementary feed imported onto the property and to be fed during the season is as follows:

- 260 T DM Barley grain and 260 T DM distilled Brewers grain imported and used over the season through the milking shed (averaged amount of 520 T DM grain split in half between grain types).
- 66 T DM of Molasses imported and fed through the shed.
- 409 T DM of Palm Kernel Expeller (PKE); 50 % fed through dairy shed and 50 % fed across pastoral areas for dairy cows.
- 253 T DM of baleage (223 T DM) and stored silage (30 T DM) purchased/used on average and fed to dairy cows on blocks.

Supplementary feed made and fed during the season is as follows;

- Approximately 365 T DM of grass silage; made on the support block and fed evenly across pastoral blocks to dairy cows.
- 115 T DM of baleage made on the support block and fed mostly to dry cattle on crop
- 50 T DM silage made on the support block and stored, which forms a small part of the silage used on the dairy platform.

Farm System - Dairy			
Herd Type/Breed	Friesian	**Total Milk Solids (kg/year)**	410,452
Seasonal Supply	Seasonal	**Winter milk**	No
Number of cows	810 at calving	**Milk Solids (kg/cow)**	510 (Overseer calculated)
Stocking rate (cows/ha)	3.1 (3.1/ha grazed)*	**Milk Solids (kg/ha)**	1584/ha platform (1574/ ha grazed)*
Other Information			
Winter off milking platform		Yes, all cows and in calf heifers on support block	
Stock grazed off (%)		100 % (including first calvers) in June and July, returning August	
Young stock reared off milking platform		Yes from weaning until before winter before wintered on support area (May onwards)	
Imported Feeds	520 T DM Grain (50 % each Barley and distilled brewers grain), fed through shed to milking cows, 66 T DM of Molasses to dairy cows through shed; 409 T DM of PKE fed 50 % through milking shed and 50 % evenly on pastoral areas to dairy cows.; 223 T DM Baleage purchased and fed on pastoral blocks to dairy cows and 30 T DM silage fed from storage. Total 1248 T DM		

		Current				
Cows	Av weight kg LW	540 kg LW main herd; 500 kg LW for first calving heifers				
	Median calving Date	20th August for main Herd, 12th August for Heifers				
	Dry-Off date	1st June for main herd and 25th May for Heifers				
	Peak Milk (1 Dec)	775 cows				
	Cow Numbers		**No cows Dairy Herd & first calvers**	**In calf Heifers**	**Dry cows & Bulls**	**In shed feeding (Y/N)**
		Jul	0 & 20	160	630	N
		Aug	250 & 170	10	380	Y
		Sept	625 & 180		0	Y
		Oct	620 & 175		0	Y
		Nov	605 & 170		0	Y
		Dec	605 & 170		0 & 20	Y
		Jan	600 & 170		0 & 20	Y
		Feb	600 & 165		0	Y
		Mar	590 & 165		0	Y
		Apr	590 & 160		0	Y
		May	590 & 120	180	35	Y
		Jun	0	180	630	N
	Production kg/MS	410,452				
	Lactation length	288 days				
	Once a day Milking (e.g half season, dry off, never)	Never				
	Calves fed milk powder (Y/N)	No				
Supplements Imported		**Amount (T/DM)**	**Fed (e.g. paddock, shed, trough, crop)**			
	Barley & distillers grain and Molasses	260 & 260 & 66	Fed to dairy milking cows through shed			
	Silage/Baleage	30 & 223	From storage and fed to dairy cows on pastoral blocks			
	Other PKE	409	Fed to dairy cows on pastoral blocks (204) and through shed (205)			
Supplements Made		**Amount (T/DM)**	**Ha**	**Fed or stored?**		
	Silage/Baleage	365 & 50 T DM Silage & 115 T DM baleage	40.8 ha cut and carry block	Made and fed out evenly across dairy cows on pastoral blocks, or stored. Baleage fed to dry cattle on crop.		
	Fodder beet	25	24	Fed to replacements and dry cows in May, June July and August		
Effluent	Type/system	Holding Pond system after stone trap and applied via K Line pods.				
	Application Depth mm	Application depth at < 10 mm per application (modelled < 12 mm) from August to May (spray infrequently as not modelling June or July to receive effluent)				
Replacements	On/off farm when & what age	Off farm from weaning, back to support block as in calf heifers in May.				

* Calculated on milking platform area only excluding the support area.

Fertiliser

Fertiliser applications have been modelled from Ravensdown past sale records and farmer information, and are based on average monthly rates. Ammo 36 is applied to the whole farm in August at rates of 120 kg/ha. Urea is then applied in October, December, February and March behind the cows at rates of 50 kg/ha. There are liquid applications of Nitrogen in September and April at 100 L/ha at the equivalence of 18 Kg N/ha made with Express a gibberellic acid. The Effluent blocks receive less nitrogen with no urea applications in December and February and only 40 kg urea/ha in October. Maintenance applications of Potash Superphosphate and Flexi N are made in November and January, whilst the effluent areas receive one application of Superphosphate and Flexi N in November as fertility levels are higher. The Gladfield Rd block receives two applications of a Cropmaster DAP, Ammo 36 or sulphate and potassium chloride mix in spring (October and post-harvest December and March) plus a urea potassium chloride mix in January. The total fertiliser nitrogen applied is 222 and 169 kg N/ha/year for the Non effluent and Effluent farm blocks and 195 kg N/ha across all blocks (whole property) on average. Note that a couple of other grazing areas receive no fertiliser (calf blocks, house paddocks and grass laneways etc)

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	18-0-0-0
October	Urea	23-0-0-0
November	Potash Superphosphate and FlexiN	25-14-19-17
December	Urea	23-0-0-0
January	Potash Superphosphate and FlexiN	25-14-19-17
February	Urea	23-0-0-0
March	Urea	23-0-0-0
April	Urea (liquid)	18-0-0-0

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	18-0-0-0
October	Urea	18-0-0-0
November	Superphosphate and FlexiN	25-13-0-16
January	Urea	23-0-0-0
March	Urea	23-0-0-0
April	Urea (liquid)	18-0-0-0

Gladfield Support Block (RO)

Month	Fertiliser	NPKS nutrient rating (kg/ha)
October	Crop DAP & Ammo 36 & KCl	71-15-22-10
December	Crop DAP & Ammo sulphate & KCl	57-15-22-10
January	Urea and KCl (Pot. Chloride)	60-0-60-0
March	Crop DAP & Ammo sulphate & KCl	31-7-37-8

Soil Test Results

Taken from 2016 soil tests for the various areas in table below;

Soil tests	Olsen P	QTK	QT Ca	QT Mg	QT Na	Org S
Brax_4a.1 Non Effluent blocks	38	10	14	38	12	10
Brax_4a.1 Effluent blocks	50	13	16	46	14	10
Support Block (RO)	31	7	11	24	10	11

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks, and 0.8 and 0.5 for the “other areas” grazing blocks on the platform and support block respectively, these being typically areas for calves, small paddocked areas beside houses which are grazed to a lesser extent than main platform paddocks:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	15.5
Brax_4a.1 Non Eff Calf Grazing	0.8	12.4
Brax_4a.1 RO	0.5	7.7
Cut & carry block RO	n/a	12.3

It should be noted that this estimated pasture production is based on default South Island pasture ME values and may be different to actual ME values and utilisation values on this farm which in turn would influence estimated pasture production.

Structures

There are no structures on the property.

Fodder Cropping

A fodder cropping cycle of Pasture to Fodder Beet (two years in beet) before being re sown into pasture in October is practiced for approximately 24 ha or 30 % of the support block so block history is entered as 7 years. Crops are modelled as crop blocks and information entered is;

- Fodder beet are sown in October after full cultivation, with dry cows and replacements grazed over May, June, July, and in August before calving.
- Sown with Cropmaster DAP, Ammonium sulphate, Potassium chloride plus boron and salt mix, NPKS rating (47-30-70-26) and a further application of Urea/potassium chloride/Ammonium sulphate made in January (NPKS rating 47-0-20-10).
- Yields are averaged at 25 T DM/ha and grazed in situ.

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 119 kg N/ha/year (liquid) over the 57 ha (61.7 ha total area less 8 % areas not receiving effluent; calculated to 57 ha, owner stated 56 ha) effluent area, plus 11 kg N/ha/year (solids) applied from pond sludge to the Non effluent areas. Currently, the effluent system has effluent gravity fed into a stone trap and sump then into a holding pond, from which the effluent is pumped through K Line pods applying liquids at depths of 10 mm per application or less by a pulsation system (modelled < 12 mm). The current holding pond is estimated to hold 3801 cubic metres of effluent (owner stated). Liquid effluent is sprayed during the months of August to May inclusive (modelled infrequently spray so as no effluent is modelled to be applied in July). Sludge from the pond is modelled to be spread on all main platform areas in December every year by a slurry tanker.

Artificial Drainage

There are some areas identified by the owner having known tile and mole drains, which were calculated separately and having 90 % of paddock area effectively drained. All of the Braxton soils on the purchased sheep block were tile and mole drained, at the same level of effectiveness

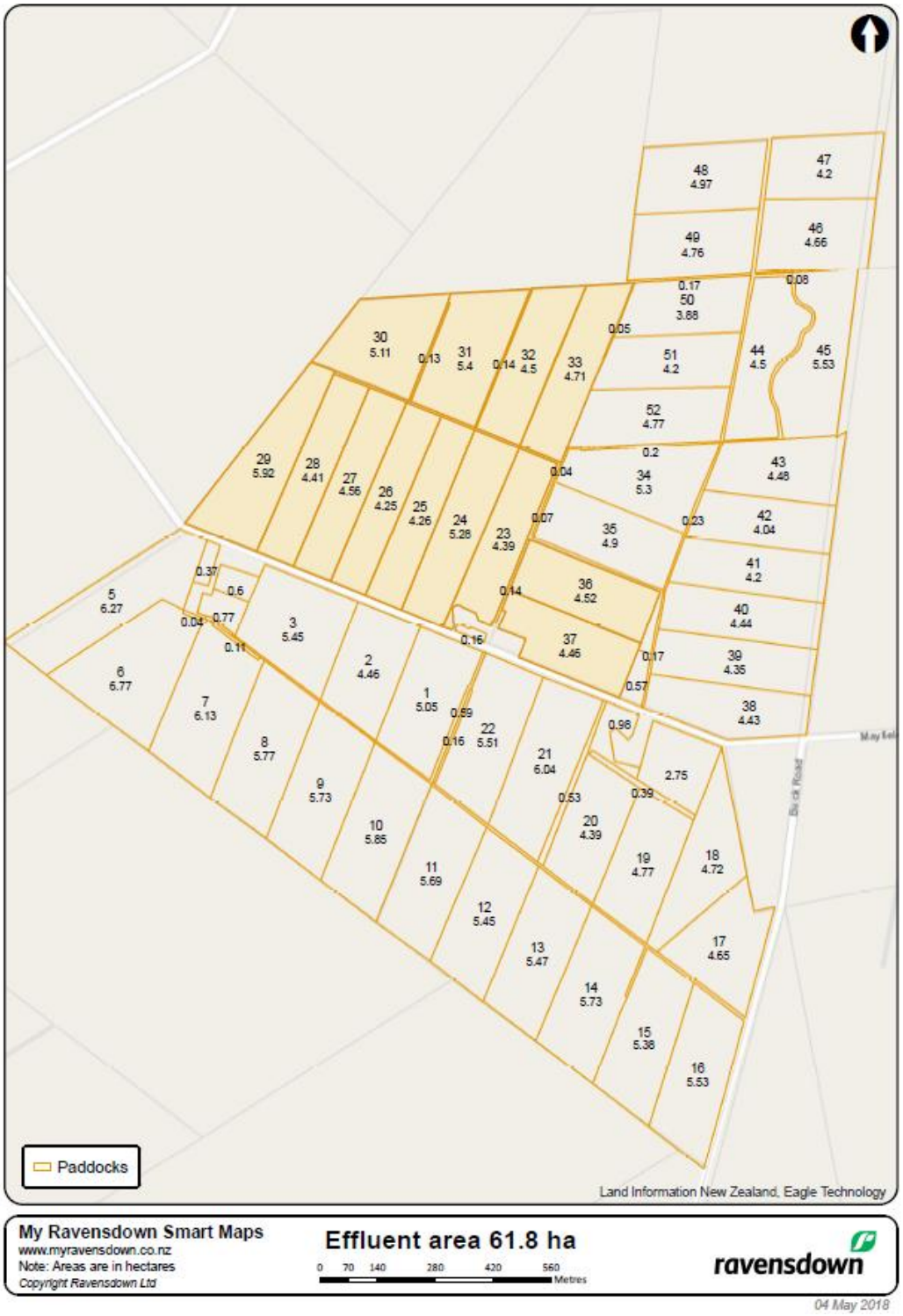
Management Unit details and Soil Information: Table 1

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	25.6
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	36.1
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	120.8
Brax_4a.1 Non Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	71.5
Brax_4a.1 Non Eff Calf Grzng	Dairy	Pastoral	Orthic Gley	Poorly drained	n/a	148.7	5.2
Brax_4a.1 Cut&Carry (RO Gladfield Blk)	Cut & carry	Crop	Orthic Gley	Poorly drained		148.7	40.8
Brax_4a.1 Past>FBt (RO Gladfield Blk)	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0
Brax_4a.1 FBt>FBt (RO Gladfield Blk)	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0
Brax_4a.1 FBt>Past (RO Gladfield Blk)	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0
Brax_4a.1 RO (Other grazing)	Dry stock	Pastoral	Orthic Gley	Poorly drained		148.7	1.5
Riparian 1							3.7
Non-Productive area							8.1
Total							**349.3**

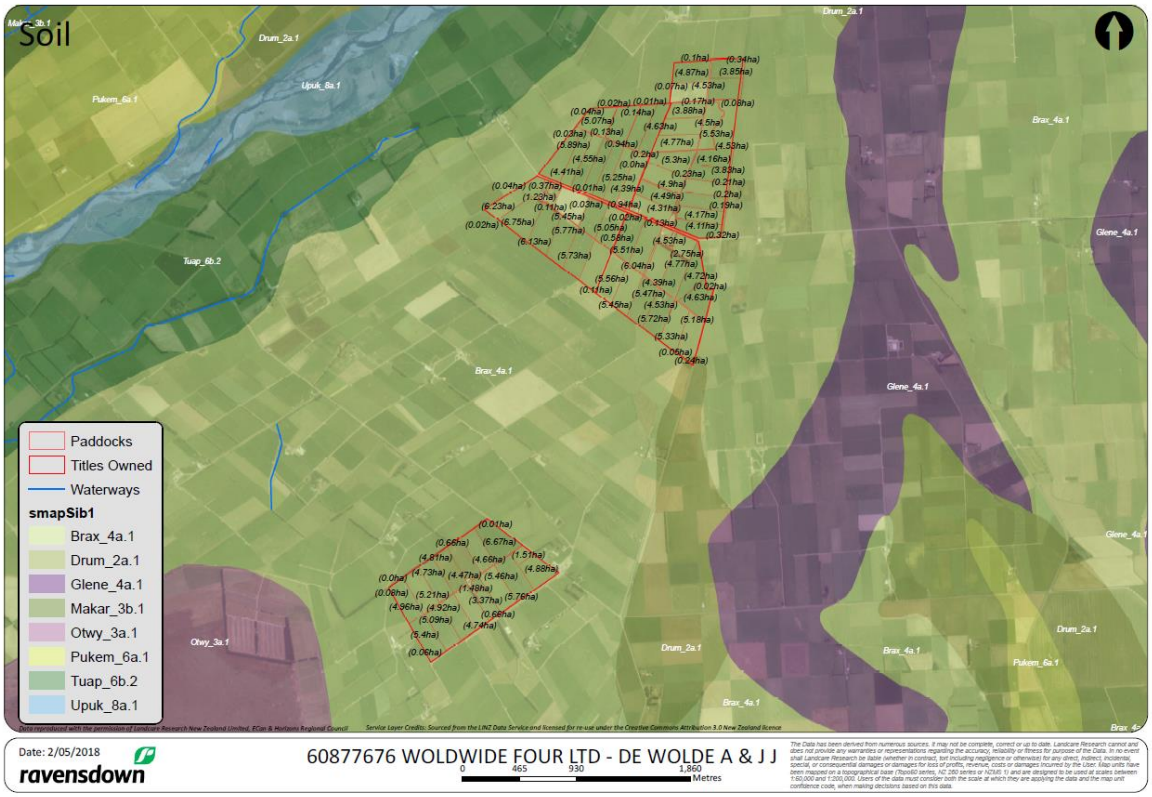
*PAW Landcare S maps calculated

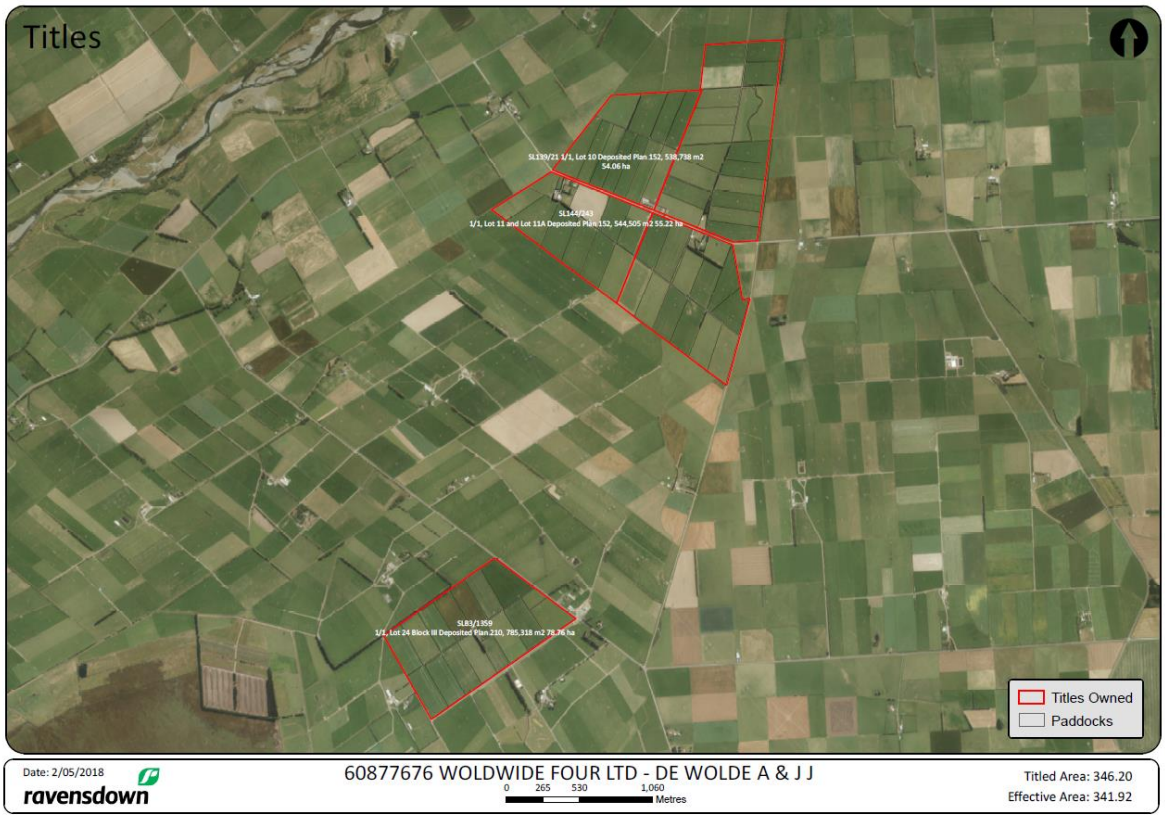
Note shaded areas are the Galdfied Support block (or run off), totally 78.3 ha, with 0.5 ha non productive

Land Management Unit Map and Farm Map



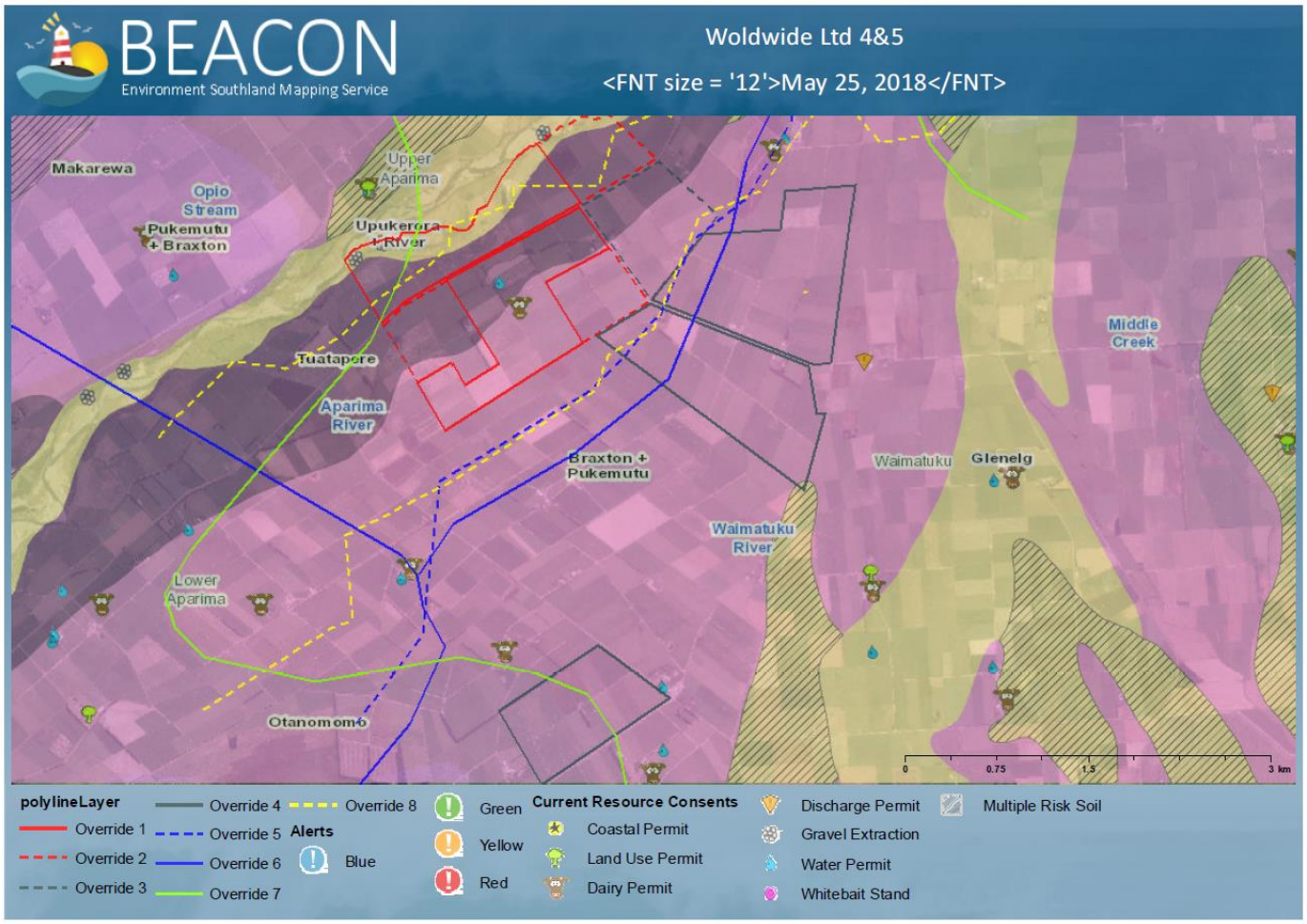
Farm map with Effluent block shaded in yellow, 61.7 ha in total less estimated setback areas based on 92 % equates to 57 ha. Total area with Gladfield support block is 349.3 ha, estimated pastoral area of 337.5 ha.





Title area of 346.2 ha and soils, actual farm area included in paddocks calculated to be 369.3 ha

Nitrate Levels and Physiographic Zonal Environment Southland Beacon Maps



Physiographic zones are Central plains (Braxton plus Pukemutu soils) brown oxidising (Tuatapere) and Riverine (Upukerora) soils (pink, dark and light yellow along river), with the blue dotted line denoting the two different sub catchments of Waimatuku river and the main Coastal catchment plus the Aparima river and the Aparima major catchment. The solid blue line denotes the three different ground water catchment zones, the lower Aparima and Upper Aparima with subsoils of quaternary gravel on top of tertiary sediment, plus the Waimatuku zone of alluvial gravel. The Green line separates minor to moderate (LHS) and moderate to high (RHS) nitrate levels with a hot spot situated nearby at drinking water threshold (not shown) nitrate levels.

The yellow dotted line is the division between the spring fed and lowland hard bed surface water zones.

The farm dairy effluent (FDE) risks are associated with the soil types, with the Braxton being a risk with artificial drainage and coarse soil structure, and the Tuatapere and Upukerora being well drained flat land and other well drained but very stony flat land.

The farms are Woldwide 4 is in dark green and the red line is the boundary for Woldwide 5. The dotted lines are the additions for the proposals.

Nutrient related resource Consents held by the Landowner

Resource Consent No.	Condition No.	Condition Text	Resource consent expiry date
Consent No: 205147	4	The land disposal system is limited to the following: (i) a maximum depth of application of 8 mm for each individual application; (ii) a minimum return period of 28 days between applications; (iii) a maximum combined depth of application of 25 mm per year to any land area; and (iv) a minimum land area of 4 hectares/100 cows for the dairy shed effluent	2 April 2018
	7	The amount of dairy shed effluent disposed of onto land shall not exceed that from 850 cows.	
	8	There shall be no surface run-off/overland flow, ponding or contamination of water resulting from the application of the dairy shed effluent to pasture. To give effect to this condition, the consent holder shall not apply effluent to land when the soils are at or above field capacity. Moisture content is to be determined by either actual monitoring on site by a method to be approved by the Council's Compliance Manager, or by reference to the appropriate Council monitoring site. (b) The land disposal system shall be operated and maintained to ensure that there is no offensive or objectionable odour beyond the property boundary, or any spray drift into or beyond the buffer zones specified in Condition 5. (c) The maximum loading rate of nitrogen onto any land area shall not exceed 150 kg of nitrogen per hectare per year from dairy shed effluent and nitrogen fertiliser combined.	
	9	The consent holder shall provide at least 3,000 m^3 of effluent storage for the purpose of: (i) avoiding irrigation of effluent when soils are at or above field capacity; (ii) providing a contingency measure when the irrigation system is inoperative; and/or (iii) for primary treatment when it is necessary for the proper operation of the effluent disposal system	
	10	The consent holder shall prepare and comply with a Farm Environmental Management Plan. The plan shall: ➢ specify and implement a nutrient budgeting system for the property; ➢ provide for the management of effluent disposal to avoid applications when soils are at or above field capacity; ➢ if relevant, provide for the operation and management of any feedlot and/or wintering pad; ➢ include the provision for monitoring application rates to ensure the consent requirements are being met;	

		➢ include the monitoring requirements specified in this consent; and address ancillary matters such as protecting well-head(s) from contamination; preventing leachate from any silage pits entering water, including groundwater; preventing soil damage; controlling runoff from lanes; and preventing stock access to watercourses on the property	

Proposed Transitional (interim) Farm System Analysis

Description of Proposed Farm System

The farm dairy platform will be increased by including part (63.26 ha) of the purchased sheep block (136.3 ha total). The effluent area remaining the same. The soils now include 23.5 ha of Tuatapere _6b.2, Silt Loam, (Orthic Melanic soil, Well drained, PAW (plant available water) to 60 cm of 81.2 mm) The decision if cropping is to remain on the support block, with the cows and heifers wintered on crop was made to keep it on the support block rather than the new blocks as the losses are likely to be higher by shifting the cropping to the Tuatapere soils as part of the new block, in addition the block history will change in years. There will still be 24 ha of fodder beet grown.

The 412.6 ha property will be operated as a dryland dairy farm, calving 850 cows and peak milking 830 (540 & 500 kg LW) Friesian cows. Milk production aimed for is the same at 421,000 kg MS/year (507 kg MS/cow). Cow numbers are shown in the table below. All cows are wintered off-farm for June and July on the Gladfield block crops plus the first calving heifers (190 and at 500 kg LW), which come back from grazing off in May, with all cows brought back in mobs over the month of August. Mean calving date is the 20th August for the main herd, with the first calvers a week earlier on the 12th of August.

The dry-off dates and other production factors remain the same as before. That is the dry-off date is the 1st of June and the 25th of May for the cows and first calving heifers. All replacements (190) are grazed off-the platform until they return as in calf R2 heifers in May. Cows are milked once a day or 16 hourly occasionally over autumn drying off (modelled never) and all calves are fed colostrum and waste milk.

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

The 78.8 ha support block is used to winter the 660 dairy cows, as well as the in calf heifer replacements and cuts silage to be used on the dairy platform

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	LW (kg)
Dairy cows		260	660	655	650	650	635	630	620	615	590		540
First calving heifers	20	170	190	185	180	180	180	175	175	170	130		500
Dairy grazers (milking cows)	660	400									35	660	540
Dairy grazers (replacements)											190	190	480
Dairy grazers (replacements)	170	20											500
Bulls						20	20						700

Supplements

Supplementary feed imported onto the property and to be fed during the season has changed and is as follows:

- 200 T DM Barley grain and 200 T DM distilled Brewers grain imported and used over the season through the milking shed (averaged amount of 400 T DM grain split in half between grain types).
- 66 T DM of Molasses imported and fed through the shed.
- 309 T DM of Palm Kernel Expeller (PKE);205 T DM fed through the shed, with the remainder fed on pastoral blocks

Because of the reduced stocking given the larger area, imported supplementary feed has reduced to the above amounts to try and reconcile the pastoral productivity between the two systems.

Supplementary feed made and fed during the season is the same and is as follows;

- Approximately 365 T DM of grass silage; made on the support block and fed evenly across pastoral blocks to dairy cows.
- 115 T DM of baleage made on the support block and fed to dry cattle on crop or dry cattle pastoral blocks
- 50 T DM silage made on the support block and stored, which forms a small part of the silage used on the dairy platform (30 T DM from storage).

Fodder Cropping

This remains the same between the two systems modelled. The cropping remains on the Gladfield block as the losses are likely lower than using the new block, which can be improved by grass to grass renewal.

Fertiliser

This changes between the two systems modelled. This is given the reduced need given the lower pastoral productivity (a reduction of approximately 1 T DM/ha), however less nitrogen is available from supplements and more is supplied by effluent, this equates to roughly an estimated reduction of 30 kg of N/ha across all blocks. The total fertiliser nitrogen applied is now 194 and 137 kg N/ha/year for the Non effluent and Effluent farm blocks and 176 kg N/ha across all blocks (whole property) on average. The Gladfield run off block is the same as before.

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	18-0-0-0
October	Urea	23-0-0-0
November	Potash Superphosphate and FlexiN	25-14-19-17
December	Urea	18-0-0-0
January	Potash Superphosphate and FlexiN	25-14-19-17
February	Urea	9-0-0-0
March	Urea	18-0-0-0
April	Urea (liquid)	18-0-0-0

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	18-0-0-0
October	Urea	18-0-0-0
November	Superphosphate and FlexiN	25-13-0-16
March	Urea	23-0-0-0
April	Urea	9-0-0-0

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 124 kg N/ha/year (liquid) over the 57 ha (61.7 ha total area less 8 % areas not receiving effluent; calculated to 57 ha, owner stated 56 ha) effluent area, plus 8 kg N/ha/year (solids) applied from pond sludge to the Non effluent areas. The effluent system remains the same as what was detailed in the “current” farm system analysis.

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks, and 0.8 and 0.5 for the rougher grazing blocks on the platform and support block respectively:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	14.5
Brax_4a.1 Non Eff Grazing	0.8	9.8
Brax_4a.1 RO	0.5	6.5
Cut & carry block Gladfield RO	n/a	12.2

It should be noted that this estimated pasture production is based on default South Island pasture ME values and may be different to actual ME values and utilisation values on this farm which in turn would influence estimated pasture production.

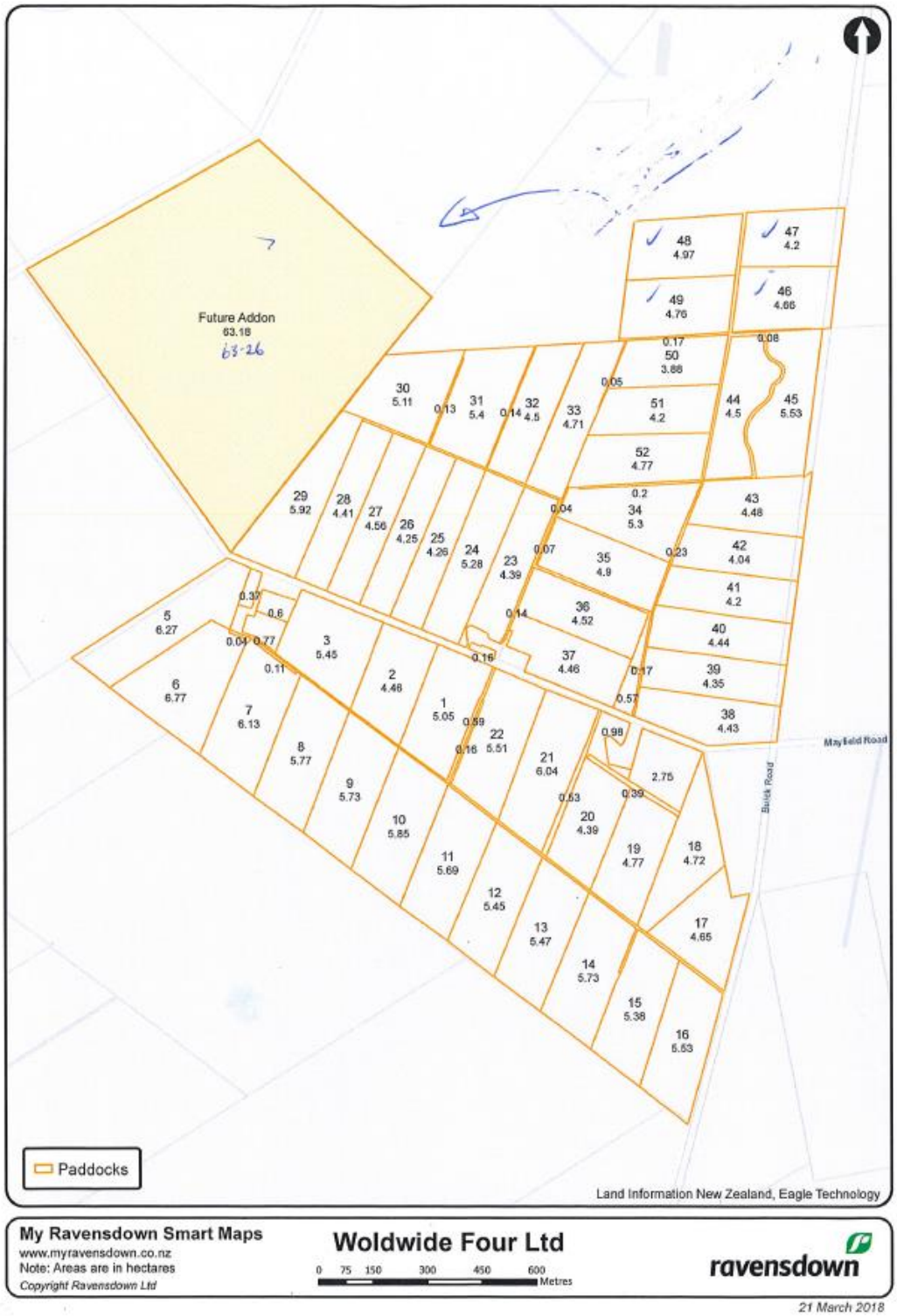
All other factors have remained the same.

Management Unit details and Soil Information: Table 1b

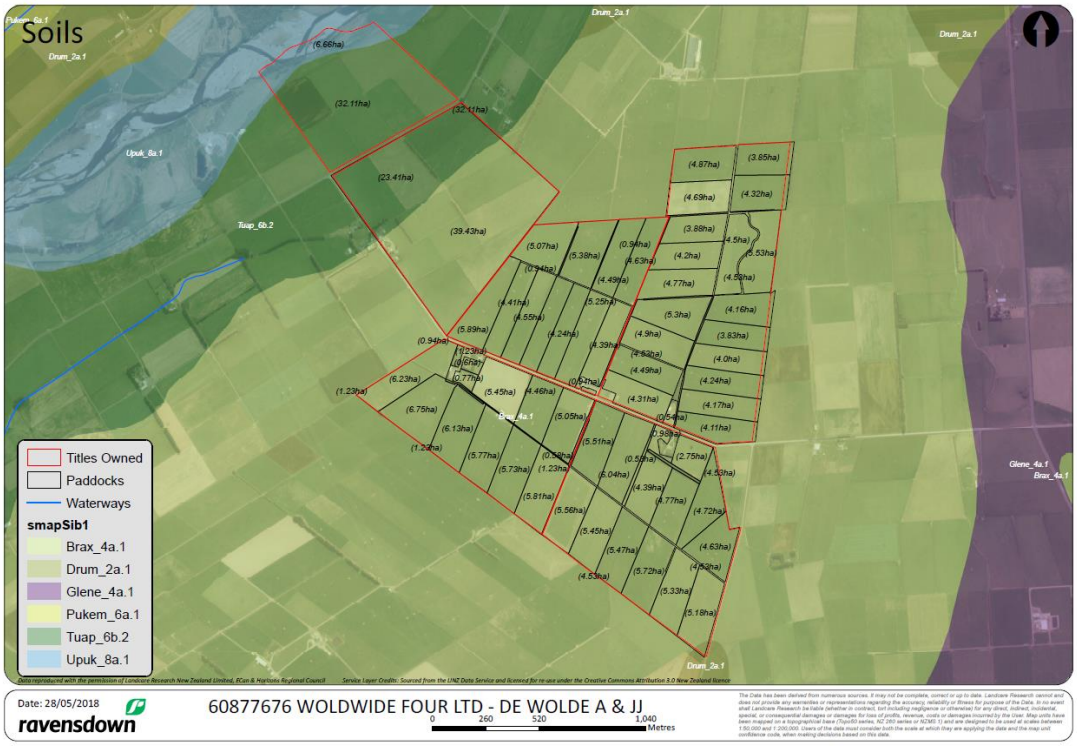
Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)	Increased or Reduced Area Sheep
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	25.6	
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	36.1	
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	120.8	
Brax_4a.1 Non Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	110.0	+ 38.5 (sheep)
Brax_4a.1 Non Eff Grzng	Dairy	Pastoral	Orthic Gley	Poorly drained	n/a	148.7	5.2	
Brax_4a.1 Cut&Carry	Cut & carry	Crop	Orthic Gley	Poorly drained		148.7	40.8	
Brax_4a.1 Past>FBt	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0	
Brax_4a.1 FBt>FBt	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0	
Brax_4a.1 FBt>Past	Dry stock	Crop	Orthic Gley	Poorly drained		148.7	12.0	
Brax_4a.1 RO	Dry stock	Pastoral	Orthic Gley	Poorly drained		148.7	1.5	
Riparian 1							4.1	+ 0.4 (sheep)
Tuap_6b.2 Non Eff	Dairy	Pastoral	Orthic Melanic	Well drained	Pond Sludge	81.2	23.5	+ 23.5 (sheep)
Non-Productive area							9.0	+0.9 (sheep)
Total							**412.6 (349.3+63.3)**	**+63.3 (sheep)**

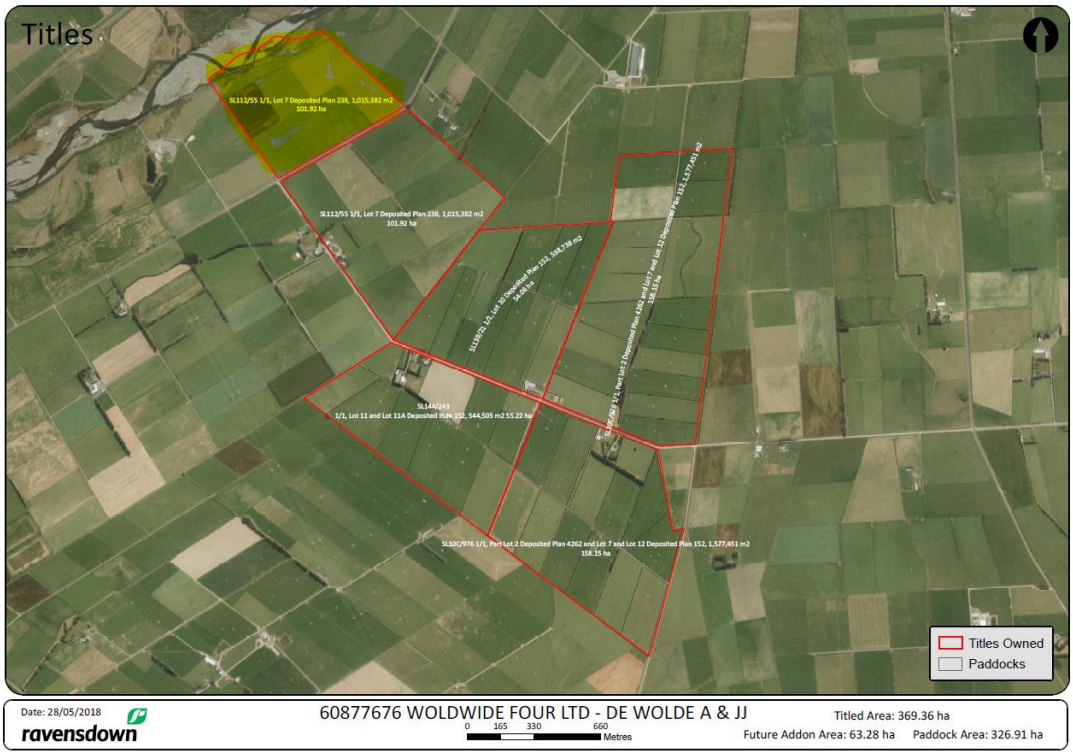
*PAW Landcare S maps calculated

Land Management Unit Map and Farm Map



Farm map with additional block outlined, 63.3 ha in total according to GIS, plus 18.6 ha which remains and no longer added to Woldwide 3. Total area with Gladfield support block is now 412.6 ha, 4.1 ha of riparian and 9.0 ha of non-productive, estimated pastoral area of 399.5 ha.





Title area and soils above includes highlighted are which is part of Woldwide 5, actual farm area included in paddocks calculated to be 412.7 ha

Proposed (Final) Farm System Analysis: Winter Barn Proposal

Description of Winter barn Farm System Proposal

To provide an example of what the effects of a wintering barn would look like, it is easier to use the existing Woldwide 4 platform and run off as this is what most dairy farm systems in Southland have, a dairy platform and run off block to winter there mixed age cows and either provide grazing for the young stock or supplements for the dairy platform with young stock grazed off on someone else's support block. The effluent area will remain the same. With wintering all mixed age cows inside in the barn, there will no longer be 24 ha of fodder beet grown, but to pay for the barn, additional cows are milked with a longer lactation given they can keep milking cows indoors towards the end of the season.

The 412.6 ha property will be operated as a dryland dairy farm, calving 1032 cows and peak milking 1000 (540 & 500 kg LW) Friesian cows. Milk production aimed for is at 570,000 kg MS/year (570 kg MS/cow). Cow numbers are shown in the table below. All mixed age cows are wintered in the barn, plus the in calf first calving heifers which come back from grazing off in mid May. Mean calving date is still the 20th August for the main herd, with the first calvers a week earlier on the 12th of August.

The dry-off date is now the 15th of June and the 31st of May for the cows and first calving heifers. All replacements (260) are grazed off-the platform until they return as in calf R2 heifers in mid May as mentioned. Cows are never milked once a day over autumn drying off (modelled never) and all calves are fed colostrum and waste milk.

Friesian Bulls (20) at 700 kg LW are run with the herd over December and January.

The 78.8 ha support block is now used entirely as a cut and carry block, cutting silage to be used on the dairy platform and in the wintering barn

To mitigate the additional cows, the barn is also used for the milking cows over the April, May, June, July and August months.

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	LW (kg)
Dairy cows		300	769	760	750	750	730	720	710	700	655	295	540
First calving heifers	30	235	260	255	250	250	250	240	240	230	210		500
Dairy grazers (milking cows)	769	469									0	474	540
Dairy grazers (repl. In calf heifers)	233	27									131	263	500
Bulls						20	20						700

Supplements

Supplementary feed imported onto the property and to be fed during the season has changed and is as follows:

- 450 T DM Barley grain and 350 T DM distilled Brewers grain imported and used over the season through the milking shed. A further 35 T DM is fed to milking cows in the wintering barn
- 99 T DM of Molasses imported and fed through the shed.
- 540 T DM of Palm Kernel Expeller (PKE); 350 T DM fed through the shed, with 150 T DM fed on pastoral blocks. A further 40 T DM is fed to milking cows in the wintering barn
- 115 T DM in good quality silage is purchased and fed to replacement heifers in the wintering barn

Because of the increased stocking and longer lactation, imported supplementary feed has increased to the above amounts to mostly reconcile the pastoral productivity between the two systems. Fertiliser and barn slurry is also used to reconcile pastoral productivity and fertiliser nitrogen use also.

Supplementary feed made and fed during the season is changed and is as follows;

- Approximately 680 T DM of grass silage; made on the support block and fed ***evenly across pastoral blocks*** to dairy cows.
- 450 T DM of silage made on the support block and fed to ***dry cattle*** in the wintering barn
- 150 T DM silage made on the support block and fed to the ***milking cows*** in the wintering barn

Fodder Cropping

This is now no longer required compared to the other two systems modelled. The losses are likely lower on blocks which in the past wintered the mixed age cows on crop. Pasture renewal is now by grass to grass renewal.

Fertiliser

This changes again between the two systems modelled. This is given the increased need given the higher pastoral productivity (an increase of 0.5 T DM/ha over the current system), however more nitrogen is supplied either by effluent and barn slurry, so the additional fertiliser nitrogen required equates to roughly an estimated increase of 2 to 25 kg of N/ha for the effluent blocks; a 57 kg of N/ha increase for the tiled non-effluent block but ***a 21 kg N to 46 kg N decrease*** for the non-effluent areas receiving barn slurry (Brax_4a.1 non effluent not tiled, Tuap_6b.2). The total fertiliser nitrogen applied is now either 176, 201 or 279 kg N/ha/year for the Non effluent blocks depending on slurry amounts, and 171 kg N/ha/year to 194 kg N/ha/year for the Effluent tiled and non tiled farm blocks respectively and 205 kg N/ha across all blocks (whole property) on average. The Gladfield run off block is also changed given the additional feed required to be cut, and this receives increased nitrogen (172 kg N/ha/year fertiliser which is reduced) as well as two applications of barn slurry (122 kg N/ha/year), a good management practice to return most of the wintering barn effluent to where the feed has been cut.

Non Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)#	NPKS nutrient rating (kg/ha)*
August	Ammo 31	43-0-0-12	43-0-0-12
September	Urea	23-0-0-0 or 35-0-0-0#	35-0-0-0
October	Urea	23-0-0-0 or 35-0-0-0#	35-0-0-0
November	Potash Superphosphate and FlexiN	34-14-19-17	49-12-67-6 (barn slurry)
December	Urea	23-0-0-0 or 35-0-0-0#	49-12-67-6 (barn slurry)
January	Potash Superphosphate and FlexiN	34-14-19-17	
February	Urea	23-0-0-0	23-0-0-0
March	Urea	23-0-0-0	23-0-0-0
April	Urea (liquid)	18-0-0-0	18-0-0-0
November	Organic Dairy Barn Slurry		98-24-134-12 (2* applications) or 43-11-57-5 (1* application)

* Non effluent receiving barn slurry # Calf grazing areas or Non effluent tile (no slurry) block

Effluent block:

Month	Fertiliser	NPKS nutrient rating (kg/ha)
August	Ammo 31	43-0-0-12
September	Urea	35-0-0-0 or 23-0-0-0*
October	Urea	35-0-0-0 or 23-0-0-0*
November	Superphosphate and FlexiN	25-13-0-16
January	Superphosphate and FlexiN	25-13-0-16
March	Urea	23-0-0-0
April	Urea (liquid)	9-0-0-0

* Effluent area no tiled as more liquid effluent

Gladfield Support Block (Cut and Carry)

Month	Fertiliser	NPKS nutrient rating (kg/ha)
October	Crop DAP & Ammo 36 & KCl	50-30-60-32
December	Crop DAP & Ammo 36 & KCl	31-7-37-8
December	Barn Slurry	103-18-100-9
January	Urea	35-0-0-0
January	Barn Slurry	79-12-67-6
March	Crop DAP & Ammo sulphate & KCl	31-7-37-8

Effluent

Effluent has been modelled as using Overseer default values, and calculated as applying 136 and 91 kg N/ha/year (liquid) over the total 78 ha effluent (48.7 ha) and effluent tiled (36.1 ha) blocks respectively(84.8 ha total area less 8 % areas not receiving effluent; calculated to 78 ha, increased area) effluent area, plus 23 kg N/ha/year (solids) applied from pond sludge to the Non effluent areas. The effluent system remains the same as what was detailed in the "current" farm system analysis. Wintering barn effluent is as detailed in the consent for Woldwide 1&2 and is a slurry which is exported and re imported as a dairy organic fertiliser.

Farm dairy feeding structure: Wintering Barn.

There is one housing barn on farm that has been modelled as three structures so as to contain the milking herd (winter barn plus grazing), replacement in calf heifers and dry cows (winter pad only) at the times specified in table below. In addition, due to a modelling error, the dry cows are required to be grazing a pastoral block for the model to run, however in reality these animals will be all in the barn. To work around this, 99 % of the dry cattle are in the barn in August, with the calf grazing block grazing these dry cattle for only 1% of the time in August.

The nutrient concentration of wintering barn effluent is higher than dairy shed effluent due to lack of dilution and the housing of cows in the barns for up 24 hours per day.

The nutrient content of pond effluent (slurry) was tested as part of a 2011 AgResearch study "Characterising dairy manures and slurries – Case study 15." The nutrient content of slurry at the applicant's pond was measured at: 3,200 g/m^3 N; 800 g/m^3 P; 4,400 g/m^3 K; 400 g/m^3 S
Applying 15.2 m^3/hectare applies slurry effluent at a depth of 1.5 mm. Discharging slurry effluent at 15.2 m^3/hectare applies:
49 kg of N; 12 kg of P; 69 kg of K; and 6 kg of S.

Table: Winter barn management:

Pad type	Covered animal shelter
Bunker lining material	No lining material
Bunker cleaning method	Scraped
Concrete feeding apron	Scraped
Solids separated	No
Solids storage	N/A
Time in storage	N/A
Liquid effluent	All exported as a slurry, as effluent composition different to dairy shed effluent
Solids management	Re imported as slurry, spread on cut and carry block plus Braxton non tiled non effluent block
Months applied	November for non-effluent block and December and January for the cut and carry block
Separated solids from pond and housing barn on pasture N application rate, Kg N/ha/year	122 for cut and carry block, 43 and 97 for Braxton and Tuatapere non effluent blocks respectively.

Table: Feeding management in winter barn:

Herd		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Milking herd	% of cows				50	100	100	100	100				
	Hours/ day grazing				10	10	0	0	10				
Dry cows	% of cows						100	100	99				
	Hours/ day grazing						0	0	0				
Repl. In calf Heifers	% of cows					99	100	100	100				
	Hours/ day grazing					0	0	0	0				

Pasture Production

The predominant pasture species on the dairy farm is ryegrass/white clover. Annual pasture production has been weighted by relative productivity as 1 between dairy blocks, and 0.8 and 0.5 for the rougher grazing blocks on the platform and support block respectively:

Block	Relative productivity	T DM/ha/year
Dairy pastoral areas	1.0	16.0
Brax_4a.1 Non Eff Grazing	0.8	12.8
Cut & carry block Gladfield RO	n/a	16.3

It should be noted that this estimated pasture production is based on default South Island pasture ME values and may be different to actual ME values and utilisation values on this farm which in turn would influence estimated pasture production.

All other factors have remained the same.

Management Unit details and Soil Information: Table 1b

Block Name	Stock	Block Type	Soil Order	Drainage Class	Effluent	PAW (0-60cm)	Effective Area (ha)	Increased or Reduced Area Sheep
Brax_4a.1 Effluent	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	48.7	
Brax_4a.1 Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Liquid	148.7	36.1	
Brax_4a.1 Non Eff	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge & Barn slurry (*1.2)	148.7	97.7	
Brax_4a.1 Non Eff Tile	Dairy	Pastoral	Orthic Gley	Poorly drained	Pond Sludge	148.7	110.0	+ 38.5 (sheep)
Brax_4a.1 Non Eff Grzng	Dairy	Pastoral	Orthic Gley	Poorly drained	n/a	148.7	5.2	
Brax_4a.1 Cut&Carry	Cut & carry	Crop	Orthic Gley	Poorly drained	Barn slurry (*2)	148.7	78.3	
Riparian 1							4.1	+ 0.4 (sheep)
Tuap_6b.2 Non Eff	Dairy	Pastoral	Orthic Melanic	Well drained	Pond Sludge	81.2	23.5	+ 23.5 (sheep)
Non-Productive area							9.0	+0.9 (sheep)
Total							**412.6 (349.3+63.3)**	**+63.3 (sheep)**

*PAW Landcare S maps calculated

Summary of Current and Proposed Farm System Scenario: Table 2

	Current scenario	Proposed scenario	Barn Example
System Type	Seasonal dairy supply and support block	Seasonal dairy supply and support block	Seasonal dairy supply and support block
Total Area (ha)	349.3	412.6	412.6
Effluent area (ha)	57 ha (92% of 61.7) receiving liquids from dairy shed plus 192.3 ha non-effluent having pond sludge from the holding pond applied	57 ha (92 % of 61.7) receiving liquids from dairy shed plus 254.3 ha non-effluent having pond sludge from the holding pond applied	78 ha (92 % of 84.8) receiving liquids from dairy shed plus 231.2 ha non-effluent having pond sludge from the holding pond applied. All wintering barn effluent re imported as fertiliser and applied to cut and carry block and non-tiled non effluent areas
Stocking rate (s.u/ha)	9,578 s.u* or 28.4 s.u/ha effective or 3.1 cows/ha platform (27.4 s.u/ha total or 2.3 cows/ha total)	10,096 s.u* or 31.4 s u/ha effective or 2.8 cows/ha platform (24.5 s u/ha total or 2.1 cows/ha total)	12,570 s.u* or 31.5 s u/ha effective or 3.1 cows/ha platform (30.5 s.u/ha total or 2.5 cows/ha total)
N use (kg N/ha/year)	195 across the whole farm	176 across the whole farm	205 across the whole farm
Production (kg MS/ha grazed)	1,583/ha effective platform (1,574/ha total grazed)	1,417/ha effective platform (1,305/ha total grazed)	1,774/ha effective platform (1,775/ha total grazed)
Supplements Imported (kg DM/ha/year)	1248 T DM in total or 4,815 effective platform. Note also 395 T DM silage is made on the support block and fed out on dairy pastoral blocks including 30 T DM from storage included in above imported figure	805 T DM in total or 2,660 effective platform. Note also 395 T DM silage is made on the support block and fed out on dairy pastoral blocks including 30 T DM from storage included in above imported figure	2,869 T DM in total or 8,582 effective platform. Note also 1,280 T DM silage is made on the support block and fed out on dairy pastoral blocks and wintering barn, included in above imported figure
Wintering system	Off farm on Gladfield support block on crop plus in calf heifers wintered on support block	Off farm on Gladfield support block on crop plus in calf heifers wintered on support block	In wintering barn on platform plus in calf heifers wintered off
Crop Area	24 ha Fodder beet, 12 ha Young Grass	24 ha Fodder beet, 12 ha Young Grass	Nil
Pasture production(kg DM/ha/year) - Platform Pastures - Support Block (Cut and carry)	 15,456** 12,255	 14,462** 12,255	 16,001** 16,347

*As calculated by OVERSEER and including and dry cows**As calculated by OVERSEER with standard default and ME values likely to be lower than Southland values.

Summary of Current Whole Farm Nutrient Loss Indicators: Table 3

	Current average	Sheep Farm (63.3 ha)**	Combined current	Proposed scenario	Barn Example
Nitrogen leaching loss to water (Total kg N) Dairy platform* Support block	10,860 9,315 1,545	1,120	11,978	11,898 10,115 1,759	9,727 9,335 392
Nitrogen leaching loss to water (kg N/ha) Dairy platform Support block	31 34 20	18	29	29 30 22	24 28 5
Phosphorus runoff to water (Total kg P) Dairy platform Support block	318 274 43	25	343	349 306 43	371 357 14
Phosphorus runoff to water (kg P/ha) Dairy platform Support block	0.9 1.0 0.5	0.4	0.8	0.8 0.9 0.6	0.9 1.1 0.2

* Losses split apportionately with riparian, trees and other losses. ** See Report 164 Woldwide 5 for the sheep unit budget details and apportionment of areas and losses as seen below.

Sheep Block (Brax_4a.1)	Pastoral	72.80	38.50	34.30
Sheep Block (Tuap_6b.2)	Pastoral	55.50	23.50	32.00
Sheep Block (Upuk_8a.1)	Pastoral	3.80		3.80
Swedes	Fodder Crop	-	***4.35***	***4.65***
Non prod		4.20	1.30	2.90
Totals		136.3	WW4 (63.3)	WW5 (73.0)

Discussion on Whole Farm Nutrient Loss Indicators

From the information provided by Woldwide Four, farm records, and the assumptions listed above, the N loss from the root zone and P loss to second order streams for the farm system is outlined below.

Current Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER®FM (v6.3.2/2.8.2.0) to be **31 kg N/ha/year or 10,860 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER®FM (v6.3.2/2.8.2.0) to be **0.9 kg P/ha/year or 318 kg P/year.**

Combined Current Farm System

- The N loss from the root zone from the combined farm system modelled was calculated using OVERSEER®FM (v6.3.2/2.8.2.0) to be **29 kg N/ha/year or 11,978 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER®FM (v6.3.2/2.8.2.0) to be **0.8 kg P/ha/year or 343 kg P/year.**

Proposed Transitional (Interim) Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER®FM (v6.3.2/2.8.2.0) to be **28 kg N/ha/year or 11,898 kg N/year.**
- The P loss risk from the farm system modelled was calculated using OVERSEER®FM (v6.3.2/2.8.2.0) to be **0.8 kg P/ha/year or 349 kg P/year.**

Proposed (Final) Winter barn Farm System

- The N loss from the root zone from the farm system modelled was calculated using OVERSEER®FM (v6.3.2/2.8.2.0) to be **24 kg N/ha/year or 9,727 kg N/year. (a 18.8 % reduction from baseline)**
- The P loss risk from the farm system modelled was calculated using OVERSEER®FM (v6.3.2/2.8.2.0) to be **0.9 kg P/ha/year or 371 kg P/year. (a similar risk to baseline)**

Key factors influencing Nutrient Loss include:

- Soil type and Profile Available Water (PAW) plus drainage.

  The soil type has a large impact on N leached. The soils on the property are all poorly drained silt loams over clay. Plant Available Water (PAW) values would be considered 'high' at 148.7 mm (0-60cm). The Plant Available Water is described as "the amount of water potentially available to plant growth that can be stored in the soil to specific soil depths". It therefore makes sense that the soils with high PAW will have lower N leaching as there will be less drainage from these soils. Soils with lower PAW are less able to buffer against changes in nitrogen losses to the bottom of the root zone (from stocking rates, crop yields, irrigation volumes) as the soils have larger pores and are flushed frequently as compared to a poorer draining soil with a higher PAW (see N report in Appendix where the Tuatapere soil in the proposal loses 46 kg N/ha/year compared to the Braxton soils, losing 25 kg N/ha/year respectively on the Non effluent pastoral blocks under the proposed system).

  These heavier soils are often tile drained (artificially drained, and are here) to remove water from the profile and enable higher productivity. The risk is that these drains also provide a conduit to nutrient flows and effluent discharges direct to water ways. Ensuring the nutrients are captured by plant growth and minimising effluent applications when soil PAW are near capacity will reduce this. This is evident with the tiled effluent area which has loses 3 kg N/ha/year higher than the non-tiled effluent block under the current system.

- Pastoral productivity

  The higher the pastoral productivity from dairy land and the associated higher stocking, the higher the risk of N losses on dairy farms, especially under the climatic, rainfall and evapotranspiration rates for Southland. The current system has a higher production per ha (1,574 kg MS/ha) at a high stocking rate of 3.1 cows/ha platform grazed; (cf. to 2.73 cows/ha & 1056 kg MS/ha, NZ Southland Dairy statistics 2015-16) with a high amount (4,815 kg DM/ha) of supplement imported (including only 30 T DM of the stored supplement from the support block), which supports the stocking and consequently the pasture production required at 15,456 kg DM/ha/year as seen in table 2, page 30. This leads to the high amount of urine deposition on pastures from the resulting cow intakes, resulting in increased risk from N leaching. The results point to a similar to slightly lower influence from urinary deposition in the proposals, with the amount of N loss attributed to urine decreasing as a percentage from 52 % to 50 % and 48 % for the interim proposal and final proposed barn example respectively, the rest due to N losses from cropping and effluent applications (other sources) and direct (tiles).

- Cropping

  The crop blocks for the current system contribute 1274 kg N/ha or 35 kg N/ha/year on average (12.0 % of total N losses and yet accounts for 6.9 % of the total land area). (Figures as in Block Nitrogen reports, pages 38, 41 and 43). It is the higher concentration of stock in a smaller area and thus the greater urine deposition which leads to this increased risk of losses. This is also exacerbated by these crops being grazed at a time when drainage events are most likely to occur. The losses are similar between the current and proposed interim scenarios (1,531 kg N/year), however, it is the crop losses on the sheep block which on a proportionate basis contributes 38 % of total losses from 6.9 % of the total 63.3 ha which lifts the sheep losses to the overall N loss of 18 kg N/ha/year (refer to Report 164 Woldwide 5 current and scenario report).

The non-productive areas offset these N losses to an extent.

The other environmental risk indices are the current P losses to surface water at 0.8 kg P/ha/year as seen in the Phosphate reports pages 38,41 & 43, which are low to moderate risk in their impact. The P risk is mostly influenced by losses from other sources (165 kg or 51.3 % of total of 318 kg, refer Phosphorous block reports, pages 31 & 36) which is run off from tracks and yards into drains and ditches from the farm. Riparian strip planting and vegetation buffer zones for crops and lane ways can reduce this and have been implemented on this farm. Olsen P levels are within or above the optimum agronomic ranges, with the areas at above receiving reduced maintenance rates to mitigate this and the topography where the all of the fertiliser is applied is flat, which also helps to minimise P losses. Any new Effluent storage plus low volume applications will help to mitigate this risk and allow applications to be reduced on tiled soils at “at risk” times also. The final proposed P losses are 371 kg P/year, 28 kg P/year higher than the combined P losses and due to increased P losses from the effluent blocks with additional effluent and the other losses on the dairy blocks, which can be mitigated by the above.

A supplementary report identifies the areas where these can be done and calculates the ability to reduce these P losses by 29 kg P/ha/year.

The current scenario is rated 10.0, the upper side of category 1 under the Soil versatility rating system (Landcare Research, 2002), as calculated in the table 4 below. The farm already uses a number of effective Nitrogen mitigation strategies to minimise losses for the proposal culminating in the results above. The proposal also is rated 10 as well with the addition of the Tuatapere soil.

Soil Vulnerability Land Management Rating: Table 4

Soil Type (proposal)	Soil Vulnerability	Vulnerability rating	% Farm	Rating score
Braxt_4a.1	Moderate	10	100.0 (94.0)	10.0 (9.4)
(Tuap_6b.2)	Moderate	10	(6.0)	(0.6)
Total			**100.0**	**10.0 (10.0)**

The property is situated in the Waimatuku and Aparima River sub catchments, and the Coastal and Aparima catchment of the proposed Environment Southland Regional Water and Land Plan. It is 100 % on a Central plain physiographic zone, with no variants. (See map, page 16 and table above), meaning the farm must attach significance to this zone in its environmental management. The farm is within zones having influence in the high nitrate levels in ground water and is at risk from summer shrinking of soils, this would be reduced as the soil develops a higher topsoil depth and more organic matter. Water quality is characterised by lowland hard bed, with quaternary gravel upon tertiary sediment in the Waimatuku groundwater management zones. Implications of this information are unknown at present but some catchment areas will be required to reduce their impacts. The zonal information would point to the presence of nitrate leaching; and nitrogen accumulation as key risk factors for the zone. An additional key risk factor for the Braxton soil is the losses of nitrogen through tiles which is the case here. No effluent applications to the highest risk soil during the highest risk periods would be helpful. This and the created Riparian strips and wetlands would be the activities which would be required to mitigate any overland flows.

Mitigations current and modelled:

A summary of current good practice modelled are summarised from the discussions and report;

1. The stocking intensity for the current system is high, but is reduced on pasture due to the additional supplements used to achieve the high production from the cows, resulting in a moderate level of pastoral production of 15.5 T DM/ha. In the proposal, the stocking intensity is reduced, and with the additional land the level of pastoral production is reduced to 14.4 T DM/ha and there is little need for any additional nitrogen fertiliser from modelling, with a reduction in nitrogen made on both the effluent and non-effluent areas.
2. Effluent is stored and able to be applied at appropriate times. As well the area applied is adequate, given 58 ha is required to apply 150 kg of N/ha from all effluent sources, with the current area modelled as 57 ha including crops, only receiving liquid effluent and the sludge and solids applied to all non-effluent areas, barring the small calf grazed blocks identified.

3. The decision was made to keep the cropping to the Braxton run off given the lighter nature of the new Tuatapere soils.

Summary of Mitigations re winter barn:

	Mitigations modelled:	Reason/Rationale:	Effect:
Winter Barn Farm System	1. Effluent mitigations (area maintained and targeted applications)	Ensure effluent only applied to appropriate areas and spread as widely as possible, with Nitrogen applications taking into account the additional effluent nutrients.	Increase effluent area by 23.1 ha (not tiled) Increase Nitrogen applications by 35 kg N/ha/year over October January period on Effluent spray blocks, and apply 1.2 times annually the imported slurry to Braxton Non effluent area, meaning no additional fertiliser required for this block. Other blocks have additional fertiliser applied. The Cut and Carry block has two applications of the winter barn slurry to return nutrients to the block where the nutrients are being taken.
	2. Alter cropping regime with the Winter Barn	With the winter barn, no crop area is required.	No crop area over winter reduces Nitrogen losses in cut and carry block from 1,545 to 392 kg N/ha, plus the risk of P losses is also reduced.
	3. Winter Barn	With the additional milking cows, the use of the barn over May and August gives the farm system an ability to reduce risk of pugging to pastures over spring and at autumn as required.	The risk of pugging reduces infiltration of soils and increases overland flow of nutrients. Also nutrients are held and spread onto soil by effluent applications when pastures more able to receive the nutrients and thus lowers risk of losses.
	4. Supplementary feed	Additional feed is able to be used for the extended lactation and for the wintering of cattle, with an ability to lower losses and ensure higher utilisation	Higher amounts of grain and PKE can mean one can reduce the pastoral productivity further, and so with a lower pastoral productivity and higher supplement use overall N losses will reduce. It was decided to use slightly more N fertiliser to equate pastoral productivity and the example still shows an equal amount of losses for the system when compared to the interim stage of more cows and added area.

The sum effect from the wintering barn is to maintain the level of environmental losses from the increased farming system intensity (more cows and longer lactation with higher milk production) required to provide an added return on the additional capital invested.

Please see information contained in the Appendices for detail relating to nutrient budgets, nitrogen block reports, phosphorus block reports and estimated pasture production for the current situation and scenario modelled.

OVERSEER v6.3.0 onwards has a new irrigation module to better reflect the management practices of irrigators. The Best Practice Data Input Standards give some guidance on what is now required. The model requires more information from users about their irrigation system and how water application decisions are made on farm. The

extra data needed includes depth of water per application; return time and depending on how soil water is monitored what are the trigger points and targets (mm deficit). Ideally, this data needs to be actual long term average data as OVERSEER uses 30 year average climate data. Best estimates of these data will generally generate more drainage, and hence N loss to water, than has been the case with previous OVERSEER versions.

OVERSEER is a continually developing model with several aspects currently being investigated. In particular there are on-going issues in relation to the modelled nitrogen leaching from grazed crop blocks (and possibly forage blocks also) being less than expected. (Please see www.overseer.org.nz/OVERSEERModel/bugs.aspx for more detail).

When future versions of OVERSEER are stipulated for use associated with Regional Council rules both the current and the proposed farm systems will need to be re-modelled for consistency as the base N lost from the root zone may alter with updated OVERSEER versions.

Appendices

Current farm System Whole Farm Nutrient Budget

Farm nutrient budget

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	10,860	31
Phosphorus	318	0.9

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Fertiliser, lime and other	195	26	49	37	0	0	1
Irrigation	0	0	0	0	0	0	0
Supplements	87	16	39	12	9	7	5
Rain/clover fixation	41	0	2	4	2	5	21

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leached from root zone	31	0.9	18	60	75	2	9
As product	87	15	21	5	19	2	6
Transfer	0	0	0	0	0	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	80	0	0	0	0	0	0

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	97	11	1	-14	0	0	0
Inorganic mineral	0	4	-13	0	-2	-3	-4
Inorganic soil pool	4	9	51	0	-82	11	15

Sheep Farm

Farm nutrient budget

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	2,503	18
Phosphorus	56	0.4

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Fertiliser, lime and other	30	21	8	39	47	0	0
Irrigation	0	0	0	0	0	0	0
Supplements	0	0	0	0	0	0	0
Rain/clover fixation	106	0	2	4	2	5	23

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leached from root zone	18	0.4	8	42	23	3	15
As product	21	2	1	3	4	0	1
Transfer	0	0	0	0	0	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	47	0	0	0	0	0	0

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	48	10	0	-2	0	0	0
Inorganic mineral	0	2	-21	0	-2	-4	-4
Inorganic soil pool	8	8	33	0	26	7	12

Current Farm System Nutrient Loss Indicators

P report

Block P

Phosphorus summary

	TOTAL LOSS (KG)	LOSS PER HA (KG/HA)
BRAX_4A1 CUT&CARRY	7	0.2
BRAX_4A1 EFF TILE	27	0.8
BRAX_4A1 EFFLUENT	12	0.5
BRAX_4A1 NON EFF	47	0.4
BRAX_4A1 NON EFF GRZNG	2	0.4
BRAX_4A1 NON EFF TILE	37	0.5
BRAX_4A1 RO	0	0.2
BRAX_4A1 FBT>FBT	7	0.6
BRAX_4A1 FBT>PAST	5	0.4
BRAX_4A1 PAST>FBT	7	0.6

Sheep Farm

Phosphorus summary

	TOTAL LOSS (KG)	LOSS PER HA (KG/HA)
SHEEP BLOCK (BRAX_4A1)	30	0.4
SHEEP BLOCK (TUAP_6B2)	6	0.1
SHEEP BLOCK (UPUK_8A1)	1	0.3
SWEDES	2	0.2

N report

Nitrogen summary

	TOTAL LOSS (KG)	LOSS PER HA (KG/HA)	N IN DRAINAGE (PPM)	N ADDED (KG/HA)	N SURPLUS (KG/HA)
BRAX_4A1 CUT&CARRY	204	5	2	219	14
BRAX_4A1 EFF TILE	1493	41	12	288	298
BRAX_4A1 EFFLUENT	991	39	12	288	297
BRAX_4A1 NON EFF	3947	33	11	232	239
BRAX_4A1 NON EFF GRZNG	146	28	9	222	279
BRAX_4A1 NON EFF TILE	2342	33	11	232	239
BRAX_4A1 RO	24	16	6	0	142
BRAX_4A1 FBT>FBT	617	51	16	94	168
BRAX_4A1 FBT>PAST	231	19	6	219	122
BRAX_4A1 PAST>FBT	426	36	12	94	182

Block N

* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommeded level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

** Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

The Sheep Farm

Nitrogen summary

	TOTAL LOSS (KG)	LOSS PER HA (KG/HA)	N IN DRAINAGE (PPM)	N ADDED (KG/HA)	N SURPLUS (KG/HA)
SHEEP BLOCK (BRAX_4A1)	667	10	3	28	119
SHEEP BLOCK (TUAP_6B2)	758	15	4	28	118
SHEEP BLOCK (UPUK_8A1)	143	38	9	28	114
SWEDES	890	99	24	71	59

Current System Pasture Production, Other Values and Effluent Report

Pasture/crops

	PASTURE/CROP	YIELD	GROWTH (KG DM/HA)	INTAKE (KG DM/HA)	REMOVED (KG DM/HA)	UTILISATION (%)	TOTAL RSU
BRAX_4A1 CUT&CARRY	Ryegrass/white clover	-	12255	0	12255	0	0
BRAX_4A1 EFF TILE	Ryegrass/white clover	-	15456	13137	0	85	23.66
BRAX_4A1 EFFLUENT	Ryegrass/white clover	-	15456	13137	0	85	23.66
BRAX_4A1 NON EFF	Ryegrass/white clover	-	15456	13137	0	85	23.66
BRAX_4A1 NON EFF GRZNG	Ryegrass/white clover	-	12365	9582	0	77	17.26
BRAX_4A1 NON EFF TILE	Ryegrass/white clover	-	15456	13137	0	85	23.66
BRAX_4A1 RO	Ryegrass/white clover	-	7728	5641	0	73	10.16
BRAX_4A1 FBT>FBT	Fodder beets | Fodder beets |	50 T DM/Ha	0	0	0	0	0
BRAX_4A1 FBT>PAST	Fodder beets | Pasture |	25 T DM/Ha	2500	0	2500	70	0
BRAX_4A1 PAST>FBT	Fodder beets |	25 T DM/Ha	0	0	0	0	0

Farm details

N: 10860 N/ha: 31 P: 318 P/ha: 0.9 GHG/ha: 13818 NCE: 28% v6.3.2

Total area	349.3 ha
Productive block area	337.50 ha
Nitrogen conversion efficiency (NCE)	28%
N Surplus	232 kg/ha
Region	Southland

GHG: Allocation to milk	0.84	Milk solids (kg/ha grazed)	1574
Total liveweight brought (kg/ha grazed)	3276	Milking herd size (peak cows/ha grazed)	3.1
Total liveweight reared (kg/ha grazed)	86	Beef / dairy grazing stock rate (RSU)	942
Total liveweight sold (kg/ha grazed)	3303	Dairy stock rate (RSU)	8636
Default calving date	06 August	Dairy replacements stock rate (RSU)	0
Milk production per cow (kg milk solids / cow)	509.9		

Analysis comments

DATE	BY	COMMENT
10 Jul, 2019, 10:20AM	Mark Crawford	Property name: WoldWide 4 plus Gladfiled Run Off
10 Jul, 2019, 10:20AM	Mark Crawford	Property description, location and valuation numbers: Part Lot 2 Deposited Plan 4262 and Lot 7 and Lot 12 Deposited Plan 152, Lot 10 Deposited Plan, Lot 11 and Lot 11A Deposited Plan, Lot 24 Block III Deposited Plan 210, transect 23: 46..94050; 168.108300 Gladfield transect GF 4 46.094050; 168.108300

Blocks

NAME	TYPE	AREA (HA)	N LOSS	N LOSS/HA	N SURPLUS/HA	P LOSS	P LOSS/HA
Brax_4a.1 Effluent	Pasture	25.6	991	39	297	12	0.5
Brax_4a.1 Eff Tile	Pasture	36.1	1493	41	298	27	0.8
Brax_4a.1 Non Eff	Pasture	120.8	3947	33	239	47	0.4
Brax_4a.1 Non Eff Tile	Pasture	71.5	2342	33	239	37	0.5
Brax_4a.1 Non Eff Grzng	Pasture	5.2	146	28	279	2	0.4
Brax_4a.1 Cut&Carry	Cut and carry	40.8	204	5	14	7	0.2
Brax_4a.1 RO	Pasture	1.5	24	16	142	0	0.2
Brax_4a.1 Past>FBt	Crop	12	426	36	182	7	0.6
Brax_4a.1 FBt>FBt	Crop	12	617	51	168	7	0.6
Brax_4a.1 FBt>Past	Crop	12	231	19	122	5	0.4
Riparian 1	Riparian	3.7	11	3	0	0	0.1
Other sources	Other	-	428	-	-	165	-

Effluent report

The report shows rates and target areas for farm liquid effluent only, assuming it is all applied to pastoral blocks. It excludes any farm solid effluent or imported effluent that may be added to effluent blocks. If this occurs, then target areas may need to be increased.

CURRENT AREA RECEIVING LIQUID EFFLUENT	
Total area including crops	57 ha
Pastoral area receiving liquid	57 ha
% of farm pastoral area	22%
Average liquid effluent	129 kg N/ha/yr
Average fertiliser	169 kg N/ha/yr
Average other	0 kg N/ha/yr
AREA OF FARM TO APPLY ALL EFFLUENT TO ACHIEVE RATES OF	
150 kg N/ha/yr - Liquid	49 ha - based on the amount of effluent generated on the the farm and sprayed from sump.
150 kg N/ha/yr - Solid	14 ha
150 kg N/ha/yr - Total	62 ha
Maintenance K	0 ha
100 kg K/ha/yr	95 ha
Maintenance K Warning	* Average K maintenance rates were zero or close to zero.
SOURCE OF N IN EFFLUENT BLOCK(S)	
Effluent from farm dairy	84%
Effluent from Feed pad	0%
Effluent from Standoff pad	0%
Effluent from Uncovered wintering pad/shelter	0%
Solids	16%
Exported	0%

The Sheep Farm

Pasture/crops

	PASTURE/CROP	YIELD	GROWTH (KG DM/HA)	INTAKE (KG DM/HA)	REMOVED (KG DM/HA)	UTILISATION (%)	TOTAL RSU
SHEEP BLOCK (BRAX_4A.1)	Ryegrass/white clover	-	15590	10831	117	70	19.46
SHEEP BLOCK (TUAP_6B.2)	Ryegrass/white clover	-	15590	10815	140	70	19.44
SHEEP BLOCK (UPUK_8A.1)	Ryegrass/white clover	-	12472	8730	0	70	15.69
SWEDES	Swedes | Pasture |	14 T DM/Ha	0	0	0	0	0

Farm details

N: 2503 N/ha: 18 P: 56 P/ha: 0.4 GHG/ha: 6986 NCE: 17% v6.3.2

Total area	136.3 ha		
Productive block area	132.10 ha		
Nitrogen conversion efficiency (NCE)	17%		
N Surplus	113 kg/ha		
Region	Southland		
GHG: Allocation to wool - breeding mob	0.25	Total liveweight reared (kg/ha grazed)	424
GHG: Allocation to wool - trading mob	0.02	Total liveweight sold (kg/ha grazed)	1117
Total liveweight brought (kg/ha grazed)	831	Sheep stock rate (RSU)	2638

Analysis comments

DATE	BY	COMMENT
10 Jul, 2019, 2:24PM	Mark Crawford	Property name: New Sheep Farm

Blocks

NAME	TYPE	AREA (HA)	N LOSS	N LOSS/HA	N SURPLUS/HA	P LOSS	P LOSS/HA
Sheep Block (Brax_4a.1)	Pasture	72.8	667	10	119	30	0.4
Sheep Block (Tuap_6b.2)	Pasture	55.5	758	15	118	6	0.1
Sheep Block (Upuk_8a.1)	Pasture	3.8	143	38	114	1	0.3
Swedes	Fodder crop	9	890	99	59	2	0.2
Other sources	Other	-	45	-	-	18	-

Current System Parameter Report

Available on request.

Transitional Proposed (interim) farm System Whole Farm Nutrient Budget

Farm nutrient budget

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	11,898	29
Phosphorus	349	0.8

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Fertiliser, lime and other	176	26	47	38	0	0	1
Irrigation	0	0	0	0	0	0	0
Supplements	51	9	19	7	4	4	3
Rain/clover fixation	53	0	2	4	2	5	21

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leached from root zone	29	0.8	17	57	74	2	9
As product	76	13	18	4	16	2	5
Transfer	0	0	0	0	0	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	75	0	0	0	0	0	0

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	84	12	0	-13	0	0	0
Inorganic mineral	0	4	-15	0	-2	-3	-4
Inorganic soil pool	3	5	43	0	-82	9	14

Transitional Proposed (interim) Farm System Nutrient Loss Indicators

P report

Block P

Phosphorus summary

	TOTAL LOSS (KG)	LOSS PER HA (KG/HA)
BRAX_4A.1 CUT&CARRY	7	0.2
BRAX_4A.1 EFF TILE	26	0.7
BRAX_4A.1 EFFLUENT	12	0.5
BRAX_4A.1 NON EFF	47	0.4
BRAX_4A.1 NON EFF GRZNG	2	0.4
BRAX_4A.1 NON EFF TILE	57	0.5
BRAX_4A.1 RO	0	0.2
TUAP_6B.2 NON EFF	4	0.2
BRAX_4A.1 FBT>FBT	7	0.6
BRAX_4A.1 FBT>PAST	5	0.4
BRAX_4A.1 PAST>FBT	7	0.6

Block N

Nitrogen summary

	TOTAL LOSS (KG)	LOSS PER HA (KG/HA)	N IN DRAINAGE (PPM)	N ADDED (KG/HA)	N SURPLUS (KG/HA)
BRAX_4A.1 CUT&CARRY	204	5	2	219	14
BRAX_4A.1 EFF TILE	1234	34	10	261	255
BRAX_4A.1 EFFLUENT	816	32	10	261	254
BRAX_4A.1 NON EFF	3309	27	9	203	196
BRAX_4A.1 NON EFF GRZNG	106	20	7	194	293
BRAX_4A.1 NON EFF TILE	3019	27	9	203	196
BRAX_4A.1 RO	24	16	6	0	84
TUAP_6B.2 NON EFF	1171	50	14	203	203
BRAX_4A.1 FBT>FBT	702	59	18	94	166
BRAX_4A.1 FBT>PAST	322	27	9	219	123
BRAX_4A.1 PAST>FBT	507	42	14	94	180

* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommeded level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

** Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

Transitional Proposed (interim) System Pasture Production, Other Values and Effluent Report

Pasture/crops

	PASTURE/CROP	YIELD	GROWTH (KG DM/HA)	INTAKE (KG DM/HA)	REMOVED (KG DM/HA)	UTILISATION (%)	TOTAL RSU
BRAX_4A.1 CUT&CARRY	Ryegrass/white clover	-	12255	0	12255	0	0
BRAX_4A.1 EFF TILE	Ryegrass/white clover	-	14462	12293	0	85	22.12
BRAX_4A.1 EFFLUENT	Ryegrass/white clover	-	14462	12293	0	85	22.12
BRAX_4A.1 NON EFF	Ryegrass/white clover	-	14462	12293	0	85	22.12
BRAX_4A.1 NON EFF GRZNG	Ryegrass/white clover	-	9772	7664	0	78	13.74
BRAX_4A.1 NON EFF TILE	Ryegrass/white clover	-	14462	12293	0	85	22.12
BRAX_4A.1 RO	Ryegrass/white clover	-	6540	5399	0	83	9.7
TUAP_6B.2 NON EFF	Ryegrass/white clover	-	14462	12293	0	85	22.12
BRAX_4A.1 FBT>FBT	Fodder beets | Fodder beets |	50 T DM/Ha	0	0	0	0	0
BRAX_4A.1 FBT>PAST	Fodder beets | Pasture |	25 T DM/Ha	10760	5782	2500	70	10.4
BRAX_4A.1 PAST>FBT	Fodder beets |	25 T DM/Ha	0	0	0	0	0

Farm details

N: 11898 N/ha: 29 P: 349 P/ha: 0.8 GHG/ha: 12100 NCE: 28% v6.3.2

Total area	412.6 ha
Productive block area	399.50 ha
Nitrogen conversion efficiency (NCE)	28%
N Surplus	201 kg/ha
Region	Southland

GHG: Allocation to milk	0.84	Milk solids (kg/ha grazed)	1305
Total liveweight brought (kg/ha grazed)	2778	Milking herd size (peak cows/ha grazed)	2.6
Total liveweight reared (kg/ha grazed)	74	Beef / dairy grazing stock rate (RSU)	1153
Total liveweight sold (kg/ha grazed)	2802	Dairy stock rate (RSU)	8943
Default calving date	06 August	Dairy replacements stock rate (RSU)	0
Milk production per cow (kg milk solids / cow)	495.3		

Analysis comments

DATE	BY	COMMENT
10 Jul, 2019, 10:22AM	Mark Crawford	Property name: WoldWide 4 plus Gladfiled Run Off
10 Jul, 2019, 10:22AM	Mark Crawford	Property description, location and valuation numbers: Part Lot 2 Deposited Plan 4262 and Lot 7 and Lot 12 Deposited Plan 152, Lot 10 Deposited Plan, Lot 11 and Lot 11A Deposited Plan, Lot 24 Block III Deposited Plan 210, transect 23: 46..94050; 168.108300 Gladfield transect GF 4 46.094050; 168.108300 Include 63.2 ha but 41.7 Braxton less 1.6 ha non productive, 21.5 ha Tuatapere

Blocks

NAME	TYPE	AREA (HA)	N LOSS	N LOSS/HA	N SURPLUS/HA	P LOSS	P LOSS/HA
Brax_4a.1 Effluent	Pasture	25.6	816	32	254	12	0.5
Brax_4a.1 Eff Tile	Pasture	36.1	1234	34	255	26	0.7
Brax_4a.1 Non Eff	Pasture	120.8	3309	27	196	47	0.4
Brax_4a.1 Non Eff Tile	Pasture	110	3019	27	196	57	0.5
Brax_4a.1 Non Eff Grzng	Pasture	5.2	106	20	293	2	0.4
Brax_4a.1 Cut&Carry	Cut and carry	40.8	204	5	14	7	0.2
Brax_4a.1 RO	Pasture	1.5	24	16	84	0	0.2
Tuap_6b.2 Non Eff	Pasture	23.5	1171	50	203	4	0.2
Brax_4a.1 Past>FBt	Crop	12	507	42	180	7	0.6
Brax_4a.1 FBt>FBt	Crop	12	702	59	166	7	0.6
Brax_4a.1 FBt>Past	Crop	12	322	27	123	5	0.4
Riparian 1	Riparian	4.1	12	3	0	0	0.1
Other sources	Other	-	471	-	-	174	-

Effluent report

The report shows rates and target areas for farm liquid effluent only, assuming it is all applied to pastoral blocks. It excludes any farm solid effluent or imported effluent that may be added to effluent blocks. If this occurs, then target areas may need to be increased.

CURRENT AREA RECEIVING LIQUID EFFLUENT	
Total area including crops	57 ha
Pastoral area receiving liquid	57 ha
% of farm pastoral area	18%
Average liquid effluent	135 kg N/ha/yr
Average fertiliser	137 kg N/ha/yr
Average other	0 kg N/ha/yr
AREA OF FARM TO APPLY ALL EFFLUENT TO ACHIEVE RATES OF	
150 kg N/ha/yr - Liquid	51 ha - based on the amount of effluent generated on the the farm and sprayed from sump.
150 kg N/ha/yr - Solid	14 ha
150 kg N/ha/yr - Total	65 ha
Maintenance K	3243 ha
100 kg K/ha/yr	104 ha
Maintenance K Warning	* Average K maintenance rates were less than 20 kg K/ha/yr - use with caution.
SOURCE OF N IN EFFLUENT BLOCK(S)	
Effluent from farm dairy	85%
Effluent from Feed pad	0%
Effluent from Standoff pad	0%
Effluent from Uncovered wintering pad/shelter	0%
Solids	15%
Exported	0%

Transitional Proposed (interim) System Parameter Report

Available on request.

Proposed Final Winter Barn Whole Farm Nutrient Budget

Farm nutrient budget

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	9,727	24
Phosphorus	371	0.9

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Fertiliser, lime and other	244	35	93	43	0	0	0
Irrigation	0	0	0	0	0	0	0
Supplements	102	18	40	13	8	8	5
Rain/clover fixation	68	0	2	4	2	5	21

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leached from root zone	24	0.9	17	57	72	2	8
As product	112	19	26	7	27	2	7
Transfer	0	0	0	0	0	0	0
Effluent exported	85	11	73	8	17	6	4
To atmosphere	87	0	0	0	0	0	0

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	107	15	0	-11	0	0	0
Inorganic mineral	0	4	-19	0	-2	-3	-4
Inorganic soil pool	0	2	38	0	-103	7	11

Proposed Final Farm System Nutrient Loss Indicators

P report

Block P

Phosphorus summary

	TOTAL LOSS (KG)	LOSS PER HA (KG/HA)
BRAX_4A.1 CUT&CARRY	14	0.2
BRAX_4A.1 EFF TILE	23	0.6
BRAX_4A.1 EFFLUENT	25	0.5
BRAX_4A.1 NON EFF	36	0.4
BRAX_4A.1 NON EFF CALF GRZNG	2	0.4
BRAX_4A.1 NON EFF TILE	57	0.5
TUAP_6B.2 NON EFF	3	0.1

Block N

Nitrogen summary

	TOTAL LOSS (KG)	LOSS PER HA (KG/HA)	N IN DRAINAGE (PPM)	N ADDED (KG/HA)	N SURPLUS (KG/HA)
BRAX_4A.1 CUT&CARRY	392	5	2	293	21
BRAX_4A.1 EFF TILE	949	26	8	285	240
BRAX_4A.1 EFFLUENT	1417	29	9	307	263
BRAX_4A.1 NON EFF	2449	25	8	267	216
BRAX_4A.1 NON EFF CALF GRZNG	191	37	12	244	149
BRAX_4A.1 NON EFF TILE	2669	24	8	279	206
TUAP_6B.2 NON EFF	1092	46	13	296	240

* Estimated N concentration in drainage water at the bottom of the root zone. Maximum recommeded level for drinking water is 11.3 ppm (note that this is not an environmental water quality standard).

** Sum of fertiliser and external factory effluent inputs.

N/A: N in drainage not calculated for easy and steep pastoral blocks, or for tree and shrubs, riparian, wetland or house blocks.

Proposed Final System Pasture Production, Other Values and Effluent Report

Pasture/crops

	PASTURE/CROP	YIELD	GROWTH (KG DM/HA)	INTAKE (KG DM/HA)	REMOVED (KG DM/HA)	UTILISATION (%)	TOTAL RSU
BRAX_4A.1 CUT&CARRY	Ryegrass/white clover	-	16347	0	16347	0	0
BRAX_4A.1 EFF TILE	Ryegrass/white clover	-	16001	13600	0	85	24.53
BRAX_4A.1 EFFLUENT	Ryegrass/white clover	-	16001	13600	0	85	24.53
BRAX_4A.1 NON EFF	Ryegrass/white clover	-	16001	13600	0	85	24.53
BRAX_4A.1 NON EFF CALF GRZNG	Ryegrass/white clover	-	12800	10848	0	85	19.42
BRAX_4A.1 NON EFF TILE	Ryegrass/white clover	-	16001	13600	0	85	24.53
TUAP_6B.2 NON EFF	Ryegrass/white clover	-	16001	13584	0	85	24.49

Farm details

N: 9727 N/ha: 24 P: 371 P/ha: 0.9 GHG/ha: 15037 NCE: 48% v6.3.2

Total area	412.6 ha
Productive block area	399.50 ha
Nitrogen conversion efficiency (NCE)	48%
N Surplus	217 kg/ha
Region	Southland

GHG: Allocation to milk	0.85	Milk solids (kg/ha grazed)	1775
Total liveweight brought (kg/ha grazed)	2395	Milking herd size (peak cows/ha grazed)	3.2
Total liveweight reared (kg/ha grazed)	70	Beef / dairy grazing stock rate (RSU)	744
Total liveweight sold (kg/ha grazed)	2480	Dairy stock rate (RSU)	11630
Default calving date	06 August	Dairy replacements stock rate (RSU)	195
Milk production per cow (kg milk solids / cow)	553.9		

Analysis comments

DATE	BY	COMMENT
10 Jul, 2019, 10:23AM	Mark Crawford	Property name: WoldWide 4 plus Gladfiled Run Off
10 Jul, 2019, 10:23AM	Mark Crawford	Property description, location and valuation numbers: Part Lot 2 Deposited Plan 4262 and Lot 7 and Lot 12 Deposited Plan 152, Lot 10 Deposited Plan, Lot 11 and Lot 11A Deposited Plan, Lot 24 Block III Deposited Plan 210, transect 23: 46..94050; 168.108300 Gladfield transect GF 4 46.094050; 168.108300 Include 63.2 ha but 41.7 Braxton less 1.6 ha non productive, 21.5 ha Tuatapere

Blocks

NAME	TYPE	AREA (HA)	N LOSS	N LOSS/HA	N SURPLUS/HA	P LOSS	P LOSS/HA
Brax_4a.1 Cut&Carry	Cut and carry	78.3	392	5	21	14	0.2
Brax_4a.1 Eff Tile	Pasture	36.1	949	26	240	23	0.6
Brax_4a.1 Effluent	Pasture	48.7	1417	29	263	25	0.5
Brax_4a.1 Non Eff	Pasture	97.7	2449	25	216	36	0.4
Brax_4a.1 Non Eff Calf Grzng	Pasture	5.2	191	37	149	2	0.4
Brax_4a.1 Non Eff Tile	Pasture	110	2669	24	206	57	0.5
Tuap_6b.2 Non Eff	Pasture	23.5	1092	46	240	3	0.1
Riparian 1	Riparian	4.1	12	3	0	0	0.1
Other sources	Other	-	556	-	-	210	-

Effluent report

The report shows rates and target areas for farm liquid effluent only, assuming it is all applied to pastoral blocks. It excludes any farm solid effluent or imported effluent that may be added to effluent blocks. If this occurs, then target areas may need to be increased.

CURRENT AREA RECEIVING LIQUID EFFLUENT	
Total area including crops	78 ha
Pastoral area receiving liquid	78 ha
% of farm pastoral area	24%
Average liquid effluent	127 kg N/ha/yr
Average fertiliser	181 kg N/ha/yr
Average other	0 kg N/ha/yr
AREA OF FARM TO APPLY ALL EFFLUENT TO ACHIEVE RATES OF	
150 kg N/ha/yr - Liquid	66 ha - based on the amount of effluent generated on the the farm and sprayed from sump.
150 kg N/ha/yr - Solid	18 ha
150 kg N/ha/yr - Total	84 ha
Maintenance K	1053 ha
100 kg K/ha/yr	126 ha
Maintenance K Warning	* Average K maintenance rates were less than 20 kg K/ha/yr - use with caution.
SOURCE OF N IN EFFLUENT BLOCK(S)	
Effluent from farm dairy	27%
Effluent from Feed pad	0%
Effluent from Standoff pad	0%
Effluent from Uncovered wintering pad/shelter	0%
Solids	5%
Exported	67%

Proposed Final System Parameter Report

Available on request.

Stock Number Reconciliation:

WW4	Current	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2012-2017	Milking herd 1	0	250	625	620	605	605	600	600	590	590	590	0
	Milking herd 2	20	170	180	175	170	170	170	165	165	160	120	0
	Bulls 1	0	0	0	0	0	20	20	0	0	0	0	0
	Dairy grazing (milking cows) 1	630	380	0	0	0	0	0	0	0	0	35	630
	Dairy grazing (replacements) 1	0	0	0	0	0	0	0	0	0	0	180	180
	Dairy grazing (replacements) 2	160	10	0	0	0	0	0	0	0	0	0	0
	Totals	**810**	**810**	**805**	**795**	**775**	**795**	**790**	**765**	**755**	**750**	**925**	**810**

WW4	Proposed 18.6 ha add copy1	july	august	septembe	october	november	december	january	february	march	april	may	june
	Milking herd 1	0	260	660	655	650	650	635	630	620	615	590	0
	Milking herd 2	20	170	190	185	180	180	180	175	175	170	130	0
	Bulls 1	0	0	0	0	0	20	20	0	0	0	0	0
	Dairy grazing (milking cows) 1	660	400	0	0	0	0	0	0	0	0	35	660
	Dairy grazing (replacements) 1	0	0	0	0	0	0	0	0	0	0	190	190
	Dairy grazing (replacements) 2	170	20	0	0	0	0	0	0	0	0	0	0
	Totals	**850**	**850**	**850**	**840**	**830**	**850**	**835**	**805**	**795**	**785**	**945**	**850**

WW4 Barn	barns example copy3 NL adj	july	august	septembe	october	november	december	january	february	march	april	may	june
	Milking herd 1	0	300	769	760	750	750	730	720	710	700	655	295
	Milking herd 2	30	235	260	255	250	250	250	240	240	230	210	0
	Bulls 1	0	0	0	0	0	20	20	0	0	0	0	0
	Dairy grazing (milking cows) 1	769	469	0	0	0	0	0	0	0	0	0	474
	Dairy grazing (replacements) 1	0	0	0	0	0	0	0	0	0	0	0	0
	Dairy grazing (repl) in calf heifers	**233**	**27**	0	0	0	0	0	0	0	0	**131**	**263**
	Totals	**799**	**1004**	**1029**	**1015**	**1000**	**1020**	**1000**	**960**	**950**	**930**	**865**	**769**
	Totals (incl in calf hfrs)	**1032**	**1031**	**1029**	**1015**	**1000**	**1020**	**1000**	**960**	**950**	**930**	**996**	**1032**
	In Barns	1032	1031								465	995	1032

Block Nitrogen Reconciliation:

Current Farm System		Area	N loss	N loss/ha		P loss
Brax_4a.1 Effluent	Pastoral	25.6	991	38		12
Brax_4a.1 Eff Tile	Pastoral	36.1	1493	41		27
Brax_4a.1 Non Eff	Pastoral	120.8	3947	32		47
Brax_4a.1 Non Eff Tile	Pastoral	71.5	2342	32		37
Brax_4a.1 Non Eff Grzng	Pastoral	5.2	146	28		2
Brax_4a.1 Cut&Carry	Cut and Ca	40.8	204	5		7
Brax_4a.1 Past>FBt	Crop	12	426	35		7
Brax_4a.1 FBt>FBt	Crop	12	617	51		7
Brax_4a.1 FBt>Past	Crop	12	231	19		5
Brax_4a.1 RO	Pastoral	1.5	24	15		0
Riparian 1	Riparian	3.7	11			0
Non prod		8.1	428			165
			10860			318
Total		349.3	10860	31.1		316
Dairy platform effective	192.3	259.2	**8919**	**34.4**		125
Effluent 92 %	61.7	56.764	**2484**	**40.3**	43.76013	39
Non Eff	197.5		**6435**	**32.6**		86
RO		42.3	**228**	**5.4**		7

Current Sheep Block		Area	N loss	P loss	WW4 adj	N loss	P loss
Sheep Block		Area	N loss	P loss	WW4 adj	N loss	P loss
Sheep Block (Brax_4a.1)	Pastoral	72.8	667	30	38.5	353	16
Sheep Block (Tuap_6b.2)	Pastoral	55.5	758	6	23.5	321	3
Swedes	Fodder Crc	-	890	2		430	1
Sheep Block Upuk_8a.1	Pastoral	3.8	143	1		0	0
Non prod		4.2	45	18	1.3	14	6
Total		136.3	2503	56	63.3	1118	25
Total		136.3	2503	56	63.3	1118	25
Sum total blocks		136.3	2503	57	63.3	1118	25

Combined Situation	Area	N loss	P loss
Brax_4a.1 Effluent	**25.6**	**991**	**12**
Brax_4a.1 Eff Tile	**36.1**	**1493**	**27**
Brax_4a.1 Non Eff	**120.8**	**3947**	**47**
Brax_4a.1 Non Eff Tile	**110**	**2695**	**53**
Brax_4a.1 Non Eff Grzng	**5.2**	**146**	**2**
Brax_4a.1 Cut&Carry	**40.8**	**204**	**7**
Brax_4a.1 Past>FBt	**12**	**426**	**7**
Brax_4a.1 FBt>FBt	**12**	**617**	**7**
Brax_4a.1 FBt>Past	**12**	**231**	**5**
Tuap_6b.2 Non Eff	**23.5**	**321**	**3**
Brax_4a.1 RO	**1.5**	**24**	**0**
Riparian 1	**4.1**	**15.3**	**1.8**
Non prod	**9**	**437.7**	**169.2**
incl crop portion	**0**	**430**	**1**
Total	**412.6**	**11978**	**343**
Sum total blocks	**412.6**	**11978**	**341**

Winter Barn April incl R2 Hfr		Area	N loss	P loss	N loss dffce	P loss dffce
Proposed		**Area**	**N loss**	**P loss**	**N loss dffce**	**P loss dffce**
Brax_4a.1 Effluent	Pastoral	25.6	1417	25	-426	-13
Brax_4a.1 Eff Tile	Pastoral	36.1	949	23	544	4
Brax_4a.1 Non Eff	Pastoral	120.8	2449	36	1498	11
Brax_4a.1 Non Eff Tile	Pastoral	110	2669	57	293	-4.134615
Brax_4a.1 Non Eff Calf Grzng	Pastoral	5.2	191	2	-45	0
Brax_4a.1 Cut&Carry	Cut and Carry	78.3	392	14	1110	12
Tuap_6b.2 Non Eff	Pastoral	23.5	1092	3	-608	-0.459459
Riparian 1	Riparian	4.1	12	0	3.3	1.8
Other sources		9	556	210	-118.3	-40.8
Total		412.6	9727	371	2251	-28
Sum total blocks		412.6	9727	370	2251	-29.59407

NOTE: The green coloured Winter barn N & P blocks are lower than the combined current and sheep unit block totals. The orange coloured blocks are higher in total N & P loss. White cells are no change. There are rounding differences which mean the sum total of the blocks can differ from Overseer reported values. Commentary as to why these differences are lower are contained in the report. The overall difference between the sum totals as opposed to the total reported figures are at the bottom of the tables in green and orange above, the Nitrogen is showing an overall reduction by these amounts, whilst the Phosphorous is showing an overall increase by these amounts and are as reported and confirmed in the main body of the report