

Weighting Dairy Farm Data for The Southland Economic Model

Technical Paper



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Cover photo: Dairy cows on a dairy farm near Ryall Bush
Source: Lloyd McCallum

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1 Introduction

This paper details the process used to determine weighted dairy sector data for each of the 10 Southland economic zones for *The Southland Economic Model*. This model will be used to estimate the potential economic and social impacts of policies that aim to reduce nutrients in waterways. The process/methodology and Farmax and Overseer modelling outcomes for 41 individual dairy farms are described in *The Southland Economic Project: Agriculture and Forestry Technical Report*.

1.1 Purpose

The modelling of the 41 case study dairy farms provided an estimate of their nitrogen and phosphorus losses in 2013-2014, as well as their ability and cost of mitigating nutrient losses using the set of mitigations available in Overseer at the time. The individual elements of the financial data described below would have changed over this time but the figures are still broadly indicative. These farms are not representative of all dairy farms in Southland but given the wide diversity of location, system type and performance represented here, they provide an adequate description of the potential range of abatement costs for nitrogen and phosphorus loss mitigation within the sector.

The Southland Economic Model needs to describe the 41 case study farms in a way that retains the diversity of dairy farm systems in Southland whilst maintaining the confidentiality of individual farms. For this reason, DairyNZ choose to aggregate the case study farms into a smaller set of representative farms. This paper describes the process of grouping the 41 case study farms into sub-groups (known as economic zones) to be used in the model.

2 Methodology

2.1 Economic zones

The dairy farm results as discussed in the *Southland Economic Project: Agriculture and Forestry Technical Report* study indicated that there were no significant differences in dairying between the four freshwater management units (FMUs) in Southland with large areas of developed land¹. However, the FMUs are still important from Environment Southland's perspective for developing policy under the National Policy Statement for Freshwater Management (NPSFM).

There are multiple drivers of nutrient loss on a pastoral farm. Indeed, a primary driver is nitrogen surplus, which reflects the difference between the amount of nitrogen that enters the farming system and that which leaves through the harvest of product. The set of 41 dairy farms analysed in the case studies carried out as a part of this research represents the largest of its type. Yet, it is not of a sufficient size to investigate multiple interdependent drivers of nutrient loss.

¹ The FMUs investigated were Waiau, Aparima, Oreti and Maitai. Fiordland and the Islands is also an FMU but there is no dairy industry in this FMU so it was not included.

The main drivers of both nitrogen leaching and phosphorus loss from dairy farms in the sample were found to be soil drainage and rainfall. This finding drives the use of Overseer as a tool to measure the nutrient footprint of the case-study farms. Other factors, such as input use, undoubtedly influence nutrient losses for dairy farms. However, in this study these were found to have weaker correlations and/or there was a lack of information about how these factors were distributed across all dairy farms in Southland.

Therefore, given these constraints a structured straightforward approach using soil drainage, rainfall and FMU (due to its importance to policy) was used to help integrate the 41 case study farms into groupings for the Southland Economic Model. The other factors were considered in the aggregation process for each grouping.

Environment Southland provided geographical information system (GIS) data which contained information on these three key factors. Based on an analysis of this data along with a GIS layer of all consented dairy farms in Southland, DairyNZ created 10 sub-groups. These sub-groups were called *economic zones* and were as follows:

- Te Anau
- Waiau
- Aparima and Oreti, wet and well drained (A&O, W/W)
- Aparima and Oreti, wet and poorly drained (A&O, W/P)
- Aparima and Oreti, dry and well drained (A&O, D/W)
- Aparima and Oreti, dry and poorly drained (A&O, D/P)
- Mataura, wet and well drained (M, W/W)
- Mataura, wet and poorly drained (M, W/P)
- Mataura, dry and well drained (M, D/W)
- Mataura, dry and poorly drained (M, D/P)

In this study, dairy farms with over 1,000mm of rainfall per annum² were considered wet for Southland, and farms with rainfall below this were considered dry. Dairy farms with the majority of their milking platform³ on moderately well or well drained soils⁴ were considered well drained, and those with the majority of their milking platform on very poorly drained, poorly drained, or imperfectly drained soils were considered poorly drained.

Te Anau was separated out due to its geographic differences with the rest of developed land in Southland and as it only had a small number of dairy farms. To protect confidentiality, an aggregated farm was created based on information from those Te Anau farms. Waiau (excluding Te Anau) was kept as one zone as there were no significant differences in rainfall throughout this FMU to warrant splitting into dry and wet categories. The farm(s) combined in both of these economic zones covered a range of soil types.

Aparima and Oreti were not considered significantly different from each other and the dry area in each was largely the north of both zones, therefore they were combined. Mataura was kept separate.

² Based on the 10-year-averages as per Overseer which uses NIWA data

³ Area of land used for in milk cows

⁴ As defined by their soil characteristics in SMaps

These areas (Aparima and Oreti combined plus Matura) were then split based on rainfall and soil type.

2.2 Case study farms

Once the 10 economic zones were agreed as being suitable for the model, the 41 case study farms were allocated to a given economic zone. This exercise was based on physical location, soil type and rainfall.

Irrigated farms were treated differently and were considered in relation to the irrigation areas within each of the economic zones that had irrigation. Irrigated farms were found in Matura dry and well drained, Aparima and Oreti- dry and well drained, and Aparima and Oreti- wet and well drained zones.

2.3 Expert weightings

The 41 case study farms were allocated to the relevant economic zones, but represent just a small proportion of the total hectares in dairy in each economic zone. The economic zones provide a total number of hectares (effective and ineffective) used for dairy farms (milking platforms) in each zone. To ensure the total dairy hectares in each economic zone are represented in The Southland Economic Model, the total hectares in each economic zone were allocated to the case study farms in that zone. This was done through consultation with relevant experts.

The experts included in this process were real estate agents, bank managers, farm consultants and the DairyNZ regional team. This team were presented with information on the 41 case study farms including their general location and key physical information including size, production, system type, infrastructure, wintering practises, soil drainage, rainfall and profit bands (classed as low, medium and high). No identifying information was provided. The group decided on agreed percentage weightings for each farm to ensure all dairy hectares in Southland would be assigned to a case study farm and economic zone, therefore capturing all dairy hectares in the CGE model.

This process does not mean the dairy farm data for each of the 10 economic zones represents all dairy farms across Southland. It is just one way of using the sample data available to provide the required inputs for The Southland Economic Model.

2.4 Calculating data for each economic zones

Once the economic zones had been decided and case study farms in each of these had been allocated to the dairy hectares in these zones, data from the 41 case study farms was aggregated into the 10 zones.

One issue with this approach for data aggregation was that while farm mitigation modelling was aimed at a 10%, 20%, 30% and 40% reductions in nitrogen leaching and then phosphorus loss, the modelling is complicated and as such the exact numbers are often not met. For example, a farm may have reached a 7% reduction, then a 15% reduction and then a 28% reduction. This means that the aggregated data does not necessarily meet the targeted percentage reductions.

A second issue was that farm mitigation modelling was stopped once a case study had to retire land. This essentially meant that land use change would occur, which was outside of the scope of the *Southland Economic Joint Venture Farm Level Modelling* study. Some farms could reach a 40% reduction in nitrogen or phosphorus loss but others may have only been able to reach, for example, a 20% reduction. In terms of phosphorus loss, some farms struggled to make a 10% reduction. For more information on the mitigation process used to create abatement curves for each case study farm refer to the *Southland Economic project: Agriculture and Forestry Technical Report*.

When aggregating the case study farms in each economic zone by the weightings the expert workshop provided, some farms could not be included in the sample for as many mitigations as others. To overcome this 'dropping out' effect, some rules were developed. If more than 50% of the case study farms in the zone could not meet the next level of required mitigation or more than 50% of the weight assigned by the expert group could not meet the next level, then any results beyond this were excluded. If it was less than 50% of the farms or 50% of the weight, then the weight of the farms that dropped out were reassigned to the remaining farms based on the relative weights of those remaining. This could be at a different point for nitrogen or phosphorus abatement points.

After this, the 10 sets of aggregated data for the economic zones were considered and if any of the last mitigations were significantly inconsistent with the previous mitigation point, for example if the farm increased in size, then they were also removed. The factors that were checked in this step included size of the farm, production and nutrient losses.

Alternative options of stopping the abatement curve as soon as one farm dropped out would have led to only very small percentage reductions being included in The Southland Economic Model. In contrast, if these farms were included either at 0% abatement cost or 100% abatement cost the aggregated abatement cost would have been under, or over, stated, respectively. The process used was the best solution available and provided a balance between retaining enough data for The Southland Economic Model and ensuring data was representative.

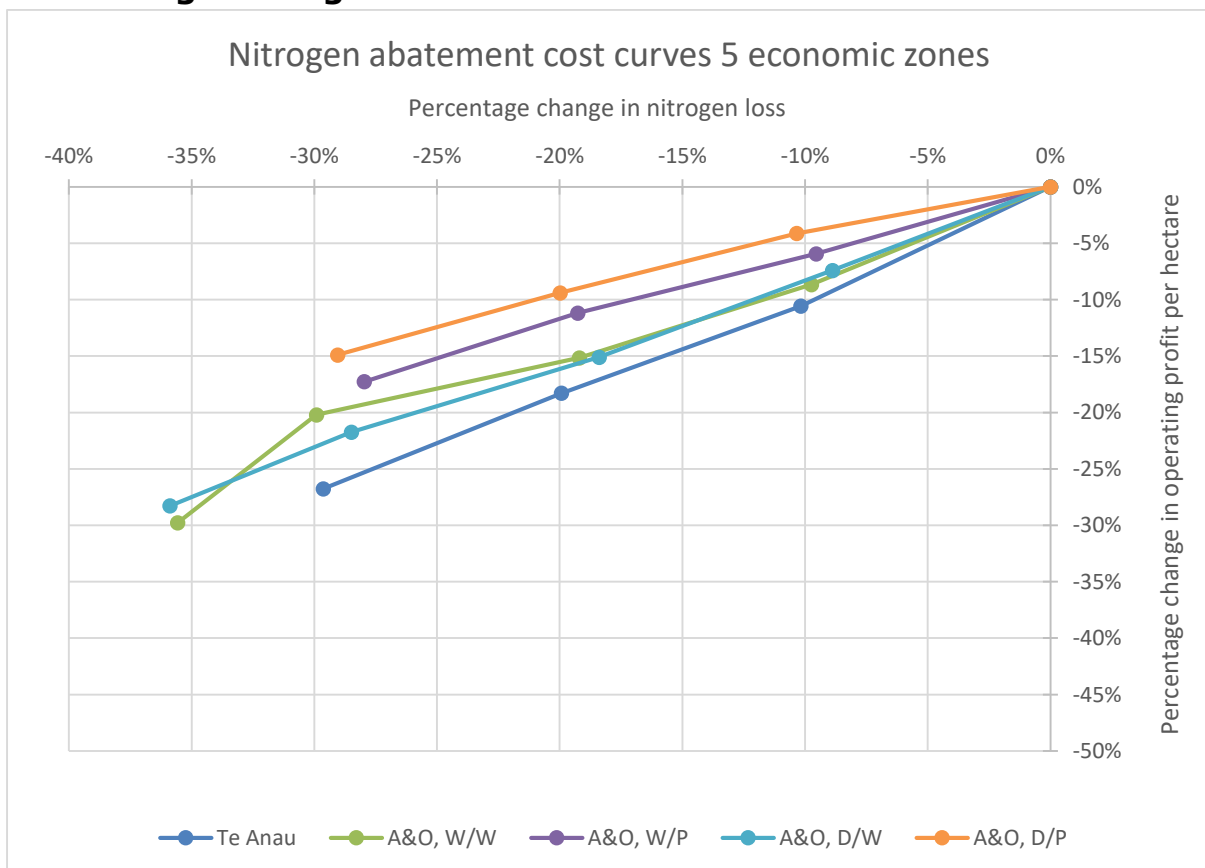
A third issue is that data used in Farmax and Overseer is for a single year while The Southland Economic Model forecasts out 30 years. While the use of static datasets in a dynamic model is imperfect, it is a limitation that was accepted by all members of The Southland Economic Project. Priority was placed on the importance of being able to show the impacts of different pathways through time is critical in freshwater management.

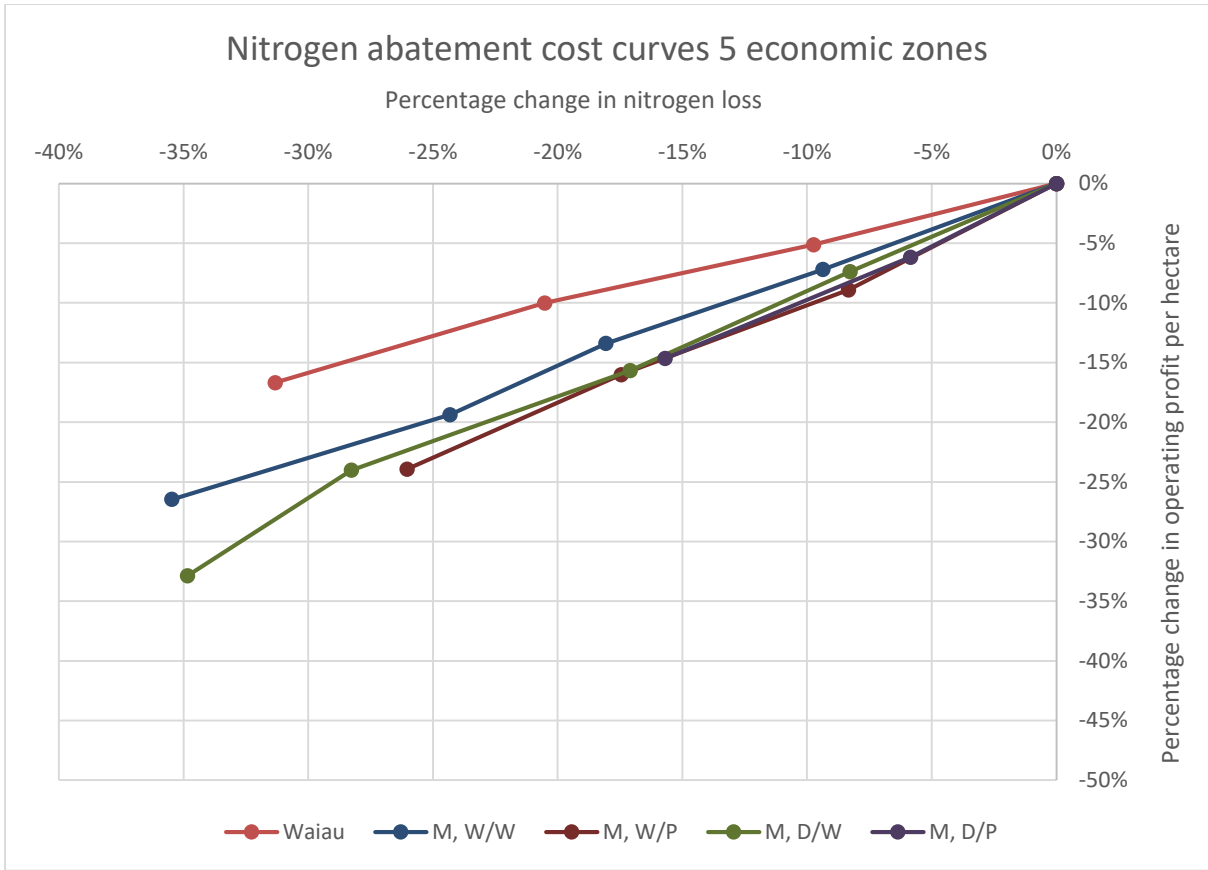
3 Results

Note these results are based on Overseer version 6.2.0. The code for each economic zone is listed in brackets, as follows:

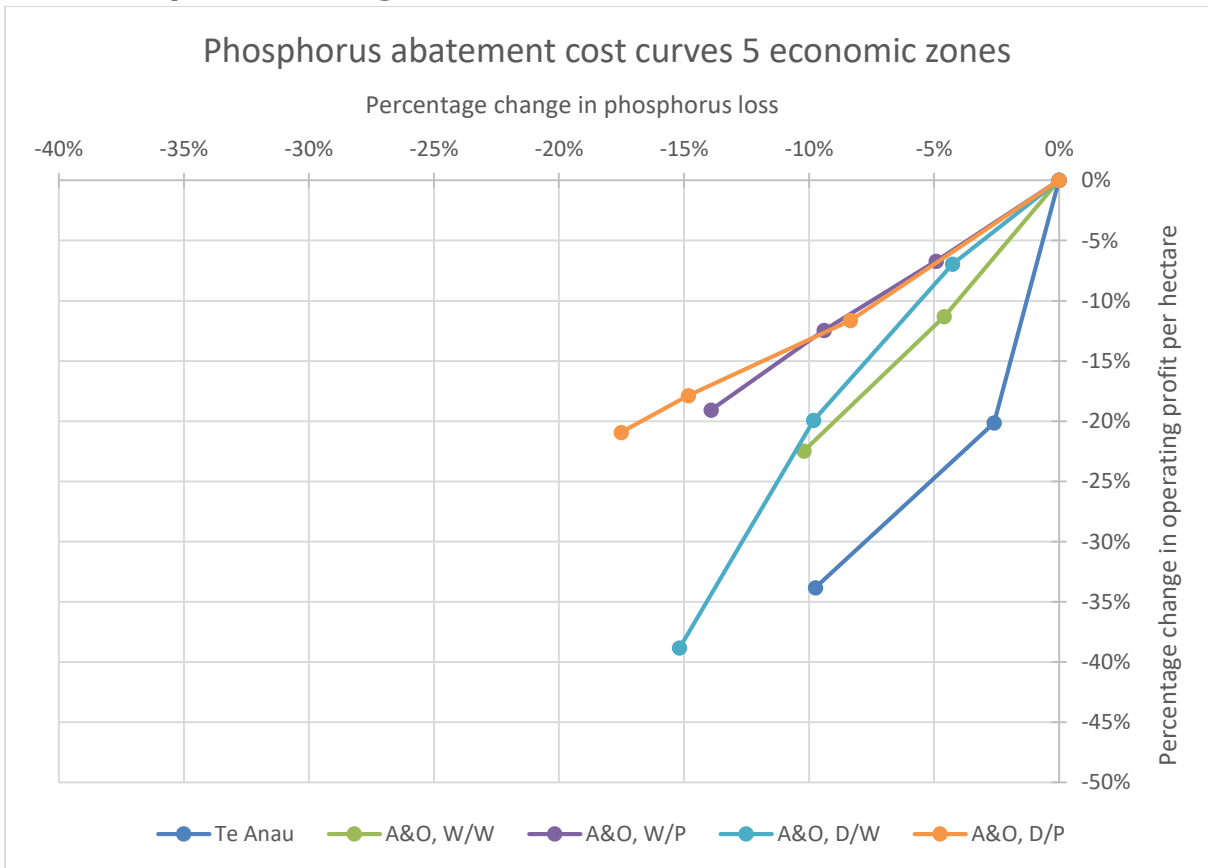
- Te Anau
- Waiau
- Aparima and Oreti, wet and well drained (A&O, W/W)
- Aparima and Oreti, wet and poorly drained (A&O, W/P)
- Aparima and Oreti, dry and well drained (A&O, D/W)
- Aparima and Oreti, dry and poorly drained (A&O, D/P)
- Mataura, wet and well drained (M, W/W)
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- Mataura, dry and well drained (M, D/W)
- Mataura, dry and poorly drained (M, D/P)

3.1 Nitrogen mitigation

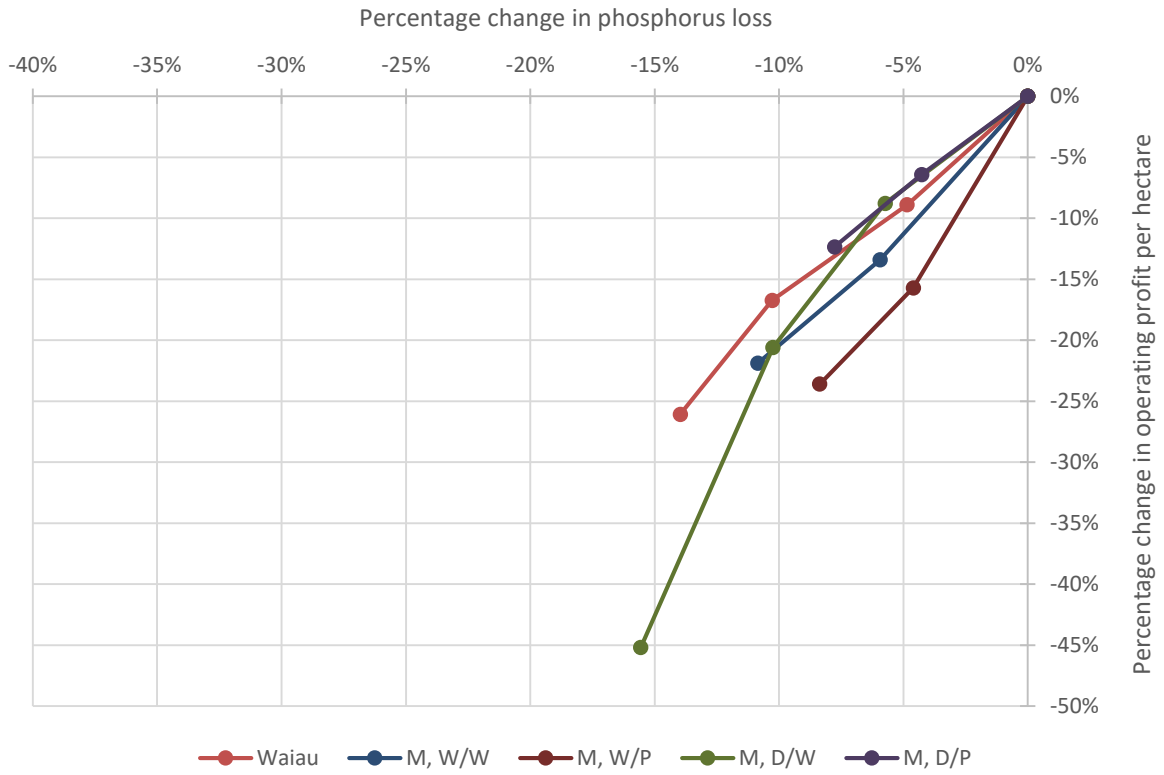




3.2 Phosphorus mitigation



Phosphorus abatement cost curves 5 economic zones



4 Appendix 1 – Nutrient Abatement Results

4.1 Nitrogen abatement results

4.1.1 Te Anau economic zone

Mitigation	Base	N 1	N 2	N 3
Total farm area (ha)	240	240	240	240
Total effective area (MP and SB) (ha)	225	225	225	225
Milking platform effective area (ha)	225	225	225	225
Support block effective area (ha)	0	0	0	0
N leaching (total)	9,712	8,724	7,777	6,834
N leaching (kg N/ total ha)	40	36	32	28
P loss (total)	154	153	150	145
P loss (kg P/ total ha)	0.64	0.64	0.63	0.60
Peak Cows Milked	644	624	601	576
Stocking rate (cows/ha)	2.86	2.77	2.67	2.56
Nitrogen fertiliser applied (kg N/ha)	110	88	65	17
Phosphorus fertiliser applied (kg P/ha)	38	38	38	38
Milksolids (to factory) (kg/ha)	1,322	1,281	1,233	1,182
Milksolids (to factory) (kg/cow)	462	462	462	462
Total crop area (hectares)	6.4	5.0	3.0	2.5
Total Revenue (\$/ha)	\$6,676	\$6,502	\$6,246	\$5,826
Total Farm Expenses (\$/ha)	\$4,968	\$4,974	\$4,850	\$4,575
Economic Farm Surplus (EFS) (\$/ha)	\$1,708	\$1,528	\$1,396	\$1,251

4.1.2 Waiau economic zone

Mitigation	Base	N 1	N 2	N 3
Total farm area (ha)	261	261	261	261
Total effective area (MP and SB) (ha)	218	218	218	218
Milking platform effective area (ha)	176	176	176	176
Support block effective area (ha)	42	42	42	42
N leaching (total)	11,511	10,390	9,150	7,905
N leaching (kg N/ total ha)	44	40	35	30
P loss (total)	225	222	215	209
P loss (kg P/ total ha)	0.86	0.85	0.82	0.80
Peak Cows Milked	522	508	482	454
Stocking rate (cows/ha)	2.97	2.89	2.74	2.58
Nitrogen fertiliser applied (kg N/ha)	134	121	99	72
Phosphorus fertiliser applied (kg P/ha)	33	33	32	32
Milksolids (to factory) (kg/ha)	1,170	1,140	1,076	1,014
Milksolids (to factory) (kg/cow)	394	394	393	393
Total crop area (hectares)	21.0	18.4	16.0	13.4
Total Revenue (\$/ha)	\$7,926	\$7,698	\$7,264	\$6,876
Total Farm Expenses (\$/ha)	\$5,441	\$5,341	\$5,028	\$4,806
Economic Farm Surplus (EFS) (\$/ha)	\$2,485	\$2,357	\$2,236	\$2,070

4.1.3 Aparima and Oreti, wet and well drained economic zone

Mitigation	Base	N 1	N 2	N 3	N 4
Total farm area (ha)	294	294	294	294	294
Total effective area (MP and SB) (ha)	263	263	263	263	263
Milking platform effective area (ha)	208	208	208	208	208
Support block effective area (ha)	55	55	55	55	55
N leaching (total)	15,060	13,594	12,169	10,556	9,702
N leaching (kg N/ total ha)	51	46	41	36	33
P loss (total)	246	242	236	230	221
P loss (kg P/ total ha)	0.84	0.82	0.80	0.78	0.75
Peak Cows Milked	595	575	547	518	476
Stocking rate (cows/ha)	2.86	2.77	2.63	2.49	2.29
Nitrogen fertiliser applied (kg N/ha)	150	132	105	70	37
Phosphorus fertiliser applied (kg P/ha)	34	34	34	34	36
Milksolids (to factory) (kg/ha)	1,222	1,179	1,121	1,061	975
Milksolids (to factory) (kg/cow)	427	426	426	426	426
Total crop area (hectares)	21.3	19.4	17.3	14.1	16.8
Total Revenue (\$/ha)	\$8,343	\$8,030	\$7,626	\$7,247	\$6,637
Total Farm Expenses (\$/ha)	\$6,001	\$5,892	\$5,639	\$5,378	\$4,993
Economic Farm Surplus (EFS) (\$/ha)	\$2,341	\$2,139	\$1,987	\$1,869	\$1,644

4.1.4 Aparima and Oreti, wet and poorly drained economic zone

Mitigation	Base	N 1	N 2	N 3
Total farm area (ha)	255	255	255	255
Total effective area (MP and SB) (ha)	235	235	235	235
Milking platform effective area (ha)	204	204	204	204
Support block effective area (ha)	31	31	31	31
N leaching (total)	8,525	7,712	6,883	6,142
N leaching (kg N/ total ha)	33	30	27	24
P loss (total)	318	314	308	303
P loss (kg P/ total ha)	1.25	1.23	1.21	1.19
Peak Cows Milked	588	568	545	519
Stocking rate (cows/ha)	2.88	2.78	2.66	2.54
Nitrogen fertiliser applied (kg N/ha)	134	116	92	62
Phosphorus fertiliser applied (kg P/ha)	39	40	40	39
Milksolids (to factory) (kg/ha)	1,246	1,202	1,152	1,098
Milksolids (to factory) (kg/cow)	433	433	432	432
Total crop area (hectares)	11.3	10.3	9.5	8.3
Total Revenue (\$/ha)	\$8,472	\$8,165	\$7,832	\$7,486
Total Farm Expenses (\$/ha)	\$5,547	\$5,414	\$5,235	\$5,066
Economic Farm Surplus (EFS) (\$/ha)	\$2,924	\$2,751	\$2,598	\$2,420

4.1.5 Aparima and Oreti, dry and well drained economic zone

Mitigation	Base	N 1	N 2	N 3	N 4
Total farm area (ha)	410	410	410	410	410
Total effective area (MP and SB) (ha)	380	380	380	380	380
Milking platform effective area (ha)	266	266	266	266	266
Support block effective area (ha)	115	115	115	115	115
N leaching (total)	22,026	20,070	17,975	15,753	14,122
N leaching (kg N/ total ha)	54	49	44	38	34
P loss (total)	293	286	279	273	268
P loss (kg P/ total ha)	0.71	0.70	0.68	0.67	0.65
Peak Cows Milked	789	759	723	683	650
Stocking rate (cows/ha)	2.97	2.86	2.72	2.57	2.45
Nitrogen fertiliser applied (kg N/ha)	139	119	91	57	26
Phosphorus fertiliser applied (kg P/ha)	48	48	48	48	48
Milksolids (to factory) (kg/ha)	1,297	1,247	1,188	1,121	1,066
Milksolids (to factory) (kg/cow)	436	436	436	435	436
Total crop area (hectares)	44.7	41.0	38.1	29.2	23.0
Total Revenue (\$/ha)	\$9,032	\$8,661	\$8,222	\$7,723	\$7,336
Total Farm Expenses (\$/ha)	\$5,832	\$5,698	\$5,505	\$5,219	\$5,042
Economic Farm Surplus (EFS) (\$/ha)	\$3,200	\$2,963	\$2,717	\$2,504	\$2,295

4.1.6 Aparima and Oreti, dry and poorly drained economic zone

Mitigation	Base	N 1	N 2	N 3
Total farm area (ha)	219	219	219	219
Total effective area (MP and SB) (ha)	209	209	209	209
Milking platform effective area (ha)	189	189	189	189
Support block effective area (ha)	20	20	20	20
N leaching (total)	6,687	5,995	5,351	4,744
N leaching (kg N/ total ha)	30	27	24	22
P loss (total)	177	173	167	165
P loss (kg P/ total ha)	0.81	0.79	0.76	0.75
Peak Cows Milked	541	531	508	483
Stocking rate (cows/ha)	2.86	2.81	2.69	2.56
Nitrogen fertiliser applied (kg N/ha)	119	96	69	25
Phosphorus fertiliser applied (kg P/ha)	51	51	51	51
Milksolids (to factory) (kg/ha)	1,337	1,305	1,254	1,193
Milksolids (to factory) (kg/cow)	467	464	466	466
Total crop area (hectares)	24.1	18.2	17.1	16.5
Total Revenue (\$/ha)	\$9,091	\$8,868	\$8,516	\$8,103
Total Farm Expenses (\$/ha)	\$5,757	\$5,671	\$5,495	\$5,266
Economic Farm Surplus (EFS) (\$/ha)	\$3,334	\$3,197	\$3,021	\$2,838

4.1.7 Matura, wet and well drained economic zone

Mitigation	Base	N 1	N 2	N 3	N 4
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Total farm area (ha)	194	194	194	194	194
Total effective area (MP and SB) (ha)	183	183	183	183	183
Milking platform effective area (ha)	160	160	160	160	160
Support block effective area (ha)	23	23	23	23	23
N leaching (total)	8,535	7,736	6,993	6,460	5,508
N leaching (kg N/ total ha)	44	40	36	33	28
P loss (total)	112	109	105	103	89
P loss (kg P/ total ha)	0.58	0.56	0.54	0.53	0.46
Peak Cows Milked	476	460	438	414	380
Stocking rate (cows/ha)	2.97	2.87	2.73	2.58	2.37
Nitrogen fertiliser applied (kg N/ha)	119	95	67	39	20
Phosphorus fertiliser applied (kg P/ha)	18	17	17	17	11
Milksolids (to factory) (kg/ha)	1,277	1,231	1,177	1,111	1,020
Milksolids (to factory) (kg/cow)	431	429	431	430	430
Total crop area (hectares)	8.4	8.1	7.4	6.3	5.0
Total Revenue (\$/ha)	\$8,911	\$8,584	\$8,244	\$7,753	\$6,900
Total Farm Expenses (\$/ha)	\$6,119	\$5,994	\$5,826	\$5,502	\$5,091
Economic Farm Surplus (EFS) (\$/ha)	\$2,792	\$2,590	\$2,417	\$2,251	\$2,053

4.1.8 Matura, wet and poorly drained economic zone

Mitigation	Base	N 1	N 2	N 3
Total farm area (ha)	801	801	801	801
Total effective area (MP and SB) (ha)	699	699	699	699
Milking platform effective area (ha)	458	458	458	458
Support block effective area (ha)	241	241	241	241
N leaching (total)	20,089	18,416	16,583	14,860
N leaching (kg N/ total ha)	25	23	21	19
P loss (total)	511	501	493	483
P loss (kg P/ total ha)	0.64	0.63	0.62	0.60
Peak Cows Milked	1,208	1,167	1,126	1,077
Stocking rate (cows/ha)	2.64	2.55	2.46	2.35
Nitrogen fertiliser applied (kg N/ha)	88	68	52	23
Phosphorus fertiliser applied (kg P/ha)	22	22	23	23
Milksolids (to factory) (kg/ha)	1,042	1,005	971	926
Milksolids (to factory) (kg/cow)	395	394	395	394
Total crop area (hectares)	23.6	18.8	14.2	3.7
Total Revenue (\$/ha)	\$7,138	\$6,889	\$6,658	\$6,321
Total Farm Expenses (\$/ha)	\$5,070	\$5,006	\$4,922	\$4,749
Economic Farm Surplus (EFS) (\$/ha)	\$2,067	\$1,883	\$1,736	\$1,573

4.1.9 Matura, dry and well drained economic zone

Mitigation	Base	N 1	N 2	N 3	N 4
Total farm area (ha)	485	485	485	485	485
Total effective area (MP and SB) (ha)	454	454	454	454	454

Milking platform effective area (ha)	291	291	291	291	291
Support block effective area (ha)	162	162	162	162	162
N leaching (total)	22,686	20,810	18,810	16,272	14,782
N leaching (kg N/ total ha)	47	43	39	34	30
P loss (total)	269	261	256	247	243
P loss (kg P/ total ha)	0.56	0.54	0.53	0.51	0.50
Peak Cows Milked	885	851	819	775	734
Stocking rate (cows/ha)	3.04	2.92	2.81	2.66	2.52
Nitrogen fertiliser applied (kg N/ha)	145	126	103	70	37
Phosphorus fertiliser applied (kg P/ha)	55	55	55	55	55
Milksolids (to factory) (kg/ha)	1,289	1,239	1,194	1,127	1,066
Milksolids (to factory) (kg/cow)	424	424	425	423	423
Total crop area (hectares)	55.3	48.7	44.7	34.6	27.2
Total Revenue (\$/ha)	\$9,079	\$8,698	\$8,330	\$7,819	\$7,389
Total Farm Expenses (\$/ha)	\$6,068	\$5,909	\$5,790	\$5,532	\$5,367
Economic Farm Surplus (EFS) (\$/ha)	\$3,011	\$2,789	\$2,539	\$2,288	\$2,021

4.1.10 Matura, dry and poorly drained economic zone

Mitigation	Base	N 1	N 2
Total farm area (ha)	417	417	417
Total effective area (MP and SB) (ha)	407	407	407
Milking platform effective area (ha)	256	256	256
Support block effective area (ha)	151	151	151
N leaching (total)	13,060	12,296	11,011
N leaching (kg N/ total ha)	31	30	26
P loss (total)	326	317	309
P loss (kg P/ total ha)	0.78	0.76	0.74
Peak Cows Milked	672	641	594
Stocking rate (cows/ha)	2.62	2.50	2.32
Nitrogen fertiliser applied (kg N/ha)	98	76	47
Phosphorus fertiliser applied (kg P/ha)	44	44	45
Milksolids (to factory) (kg/ha)	1,101	1,047	973
Milksolids (to factory) (kg/cow)	420	419	420
Total crop area (hectares)	53.2	46.5	42.1
Total Revenue (\$/ha)	\$7,539	\$7,166	\$6,722
Total Farm Expenses (\$/ha)	\$4,786	\$4,583	\$4,372
Economic Farm Surplus (EFS) (\$/ha)	\$2,753	\$2,584	\$2,350

4.2 Phosphorus abatement results

4.2.1 Te Anau economic zone

Mitigation	Base	P 1	P 2
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Total farm area (ha)	240	240	240
Total effective area (MP and SB) (ha)	225	225	225
Milking platform effective area (ha)	225	225	225
Support block effective area (ha)	0	0	0
N leaching (total)	9,712	7,777	6,559
N leaching (kg N/ total ha)	40	32	27
P loss (total)	154	150	139
P loss (kg P/ total ha)	0.64	0.63	0.58
Peak Cows Milked	644	601	546
Stocking rate (cows/ha)	2.86	2.67	2.43
Nitrogen fertiliser applied (kg N/ha)	110	65	17
Phosphorus fertiliser applied (kg P/ha)	38	38	38
Milksolids (to factory) (kg/ha)	1,322	1,233	1,121
Milksolids (to factory) (kg/cow)	462	462	462
Total crop area (hectares)	6.4	3.0	0.0
Total Revenue (\$/ha)	\$6,676	\$6,206	\$5,492
Total Farm Expenses (\$/ha)	\$4,968	\$4,842	\$4,362
Economic Farm Surplus (EFS) (\$/ha)	\$1,708	\$1,364	\$1,130

4.2.2 Waiau economic zone

Mitigation	Base	P 1	P 2	P 3
Total farm area (ha)	261	261	261	261
Total effective area (MP and SB) (ha)	218	218	218	218
Milking platform effective area (ha)	176	176	176	176
Support block effective area (ha)	42	42	42	42
N leaching (total)	11,511	9,908	8,543	7,363
N leaching (kg N/ total ha)	44	38	33	28
P loss (total)	225	214	202	193
P loss (kg P/ total ha)	0.86	0.82	0.77	0.74
Peak Cows Milked	522	494	469	439
Stocking rate (cows/ha)	2.97	2.81	2.67	2.49
Nitrogen fertiliser applied (kg N/ha)	134	114	89	62
Phosphorus fertiliser applied (kg P/ha)	33	33	32	32
Milksolids (to factory) (kg/ha)	1,170	1,106	1,037	961
Milksolids (to factory) (kg/cow)	394	394	389	386
Total crop area (hectares)	21.0	17.4	14.6	13.1
Total Revenue (\$/ha)	\$7,926	\$7,362	\$6,966	\$6,531
Total Farm Expenses (\$/ha)	\$5,441	\$5,099	\$4,897	\$4,694
Economic Farm Surplus (EFS) (\$/ha)	\$2,485	\$2,264	\$2,069	\$1,837

4.2.3 Aparima and Oreti, wet and well drained economic zone

Mitigation	Base	P 1	P 2
Total farm area (ha)	294	294	294
Total effective area (MP and SB) (ha)	263	263	263

Milking platform effective area (ha)	208	208	208
Support block effective area (ha)	55	55	55
N leaching (total)	15,060	13,103	11,268
N leaching (kg N/ total ha)	51	45	38
P loss (total)	246	235	221
P loss (kg P/ total ha)	0.84	0.80	0.75
Peak Cows Milked	595	564	529
Stocking rate (cows/ha)	2.86	2.71	2.54
Nitrogen fertiliser applied (kg N/ha)	150	116	74
Phosphorus fertiliser applied (kg P/ha)	34	34	34
Milksolids (to factory) (kg/ha)	1,222	1,158	1,078
Milksolids (to factory) (kg/cow)	427	427	423
Total crop area (hectares)	21.3	18.7	15.7
Total Revenue (\$/ha)	\$8,343	\$7,803	\$7,315
Total Farm Expenses (\$/ha)	\$6,001	\$5,726	\$5,500
Economic Farm Surplus (EFS) (\$/ha)	\$2,341	\$2,076	\$1,815

4.2.4 Aparima and Oreti, wet and poorly drained economic zone

Mitigation	Base	P 1	P 2	P 3
Total farm area (ha)	255	255	255	255
Total effective area (MP and SB) (ha)	235	235	235	235
Milking platform effective area (ha)	204	204	204	204
Support block effective area (ha)	31	31	31	31
N leaching (total)	8,525	7,606	6,953	5,554
N leaching (kg N/ total ha)	33	30	27	22
P loss (total)	318	303	289	274
P loss (kg P/ total ha)	1.25	1.19	1.13	1.07
Peak Cows Milked	588	567	548	520
Stocking rate (cows/ha)	2.88	2.77	2.68	2.54
Nitrogen fertiliser applied (kg N/ha)	134	114	95	53
Phosphorus fertiliser applied (kg P/ha)	39	39	39	33
Milksolids (to factory) (kg/ha)	1,246	1,198	1,148	1,092
Milksolids (to factory) (kg/cow)	433	432	429	429
Total crop area (hectares)	11.3	10.4	8.8	2.3
Total Revenue (\$/ha)	\$8,472	\$8,153	\$7,828	\$7,458
Total Farm Expenses (\$/ha)	\$5,547	\$5,425	\$5,267	\$5,091
Economic Farm Surplus (EFS) (\$/ha)	\$2,924	\$2,728	\$2,560	\$2,367

4.2.5 Aparima and Oreti, dry and well drained economic zone

Mitigation	Base	P 1	P 2	P 3
Total farm area (ha)	410	410	410	410
Total effective area (MP and SB) (ha)	380	380	380	380

Milking platform effective area (ha)	266	266	266	266
Support block effective area (ha)	115	115	115	115
N leaching (total)	22,026	20,556	16,674	14,441
N leaching (kg N/ total ha)	54	50	41	35
P loss (total)	293	280	264	248
P loss (kg P/ total ha)	0.71	0.68	0.64	0.61
Peak Cows Milked	789	767	698	658
Stocking rate (cows/ha)	2.97	2.89	2.63	2.48
Nitrogen fertiliser applied (kg N/ha)	139	124	71	56
Phosphorus fertiliser applied (kg P/ha)	48	47	47	48
Milksolids (to factory) (kg/ha)	1,297	1,260	1,146	1,021
Milksolids (to factory) (kg/cow)	436	436	436	412
Total crop area (hectares)	44.7	41.0	32.6	21.7
Total Revenue (\$/ha)	\$9,032	\$8,735	\$7,896	\$7,071
Total Farm Expenses (\$/ha)	\$5,832	\$5,757	\$5,334	\$5,114
Economic Farm Surplus (EFS) (\$/ha)	\$3,200	\$2,977	\$2,562	\$1,957

4.2.6 Aparima and Oreti, dry and poorly drained economic zone

Mitigation	Base	P 1	P 2	P 3
Total farm area (ha)	219	219	219	219
Total effective area (MP and SB) (ha)	209	209	209	209
Milking platform effective area (ha)	189	189	189	189
Support block effective area (ha)	20	20	20	20
N leaching (total)	6,687	5,907	4,728	4,249
N leaching (kg N/ total ha)	30	27	22	19
P loss (total)	177	162	151	146
P loss (kg P/ total ha)	0.81	0.74	0.69	0.66
Peak Cows Milked	541	528	487	470
Stocking rate (cows/ha)	2.86	2.79	2.58	2.49
Nitrogen fertiliser applied (kg N/ha)	119	91	33	8
Phosphorus fertiliser applied (kg P/ha)	51	51	52	51
Milksolids (to factory) (kg/ha)	1,337	1,252	1,181	1,134
Milksolids (to factory) (kg/cow)	467	448	458	455
Total crop area (hectares)	24.1	17.9	14.4	7.8
Total Revenue (\$/ha)	\$9,091	\$8,531	\$8,036	\$7,714
Total Farm Expenses (\$/ha)	\$5,757	\$5,584	\$5,297	\$5,078
Economic Farm Surplus (EFS) (\$/ha)	\$3,334	\$2,946	\$2,738	\$2,636

4.2.7 Matura, wet and well drained economic zone

Mitigation	Base	P 1	P 2
Total farm area (ha)	194	194	194
Total effective area (MP and SB) (ha)	183	183	183
Milking platform effective area (ha)	160	160	160
Support block effective area (ha)	23	23	23

N leaching (total)	8,535	7,990	6,359
N leaching (kg N/ total ha)	44	41	33
P loss (total)	112	105	100
P loss (kg P/ total ha)	0.58	0.54	0.51
Peak Cows Milked	476	472	414
Stocking rate (cows/ha)	2.97	2.94	2.58
Nitrogen fertiliser applied (kg N/ha)	119	102	33
Phosphorus fertiliser applied (kg P/ha)	18	17	17
Milksolids (to factory) (kg/ha)	1,277	1,235	1,113
Milksolids (to factory) (kg/cow)	431	420	431
Total crop area (hectares)	8.4	8.1	7.6
Total Revenue (\$/ha)	\$8,911	\$8,579	\$7,779
Total Farm Expenses (\$/ha)	\$6,119	\$6,162	\$5,598
Economic Farm Surplus (EFS) (\$/ha)	\$2,792	\$2,417	\$2,181

4.2.8 Matura, wet and poorly drained economic zone

Mitigation	Base	P 1	P 2
Total farm area (ha)	801	801	801
Total effective area (MP and SB) (ha)	699	699	699
Milking platform effective area (ha)	458	458	458
Support block effective area (ha)	241	241	241
N leaching (total)	20,089	17,186	15,100
N leaching (kg N/ total ha)	25	21	19
P loss (total)	511	488	469
P loss (kg P/ total ha)	0.64	0.61	0.58
Peak Cows Milked	1,208	1,145	1,094
Stocking rate (cows/ha)	2.64	2.50	2.39
Nitrogen fertiliser applied (kg N/ha)	88	67	46
Phosphorus fertiliser applied (kg P/ha)	22	23	23
Milksolids (to factory) (kg/ha)	1,042	979	934
Milksolids (to factory) (kg/cow)	395	391	391
Total crop area (hectares)	23.6	15.3	4.3
Total Revenue (\$/ha)	\$7,138	\$6,718	\$6,378
Total Farm Expenses (\$/ha)	\$5,070	\$4,976	\$4,798
Economic Farm Surplus (EFS) (\$/ha)	\$2,067	\$1,742	\$1,579

4.2.9 Matura, dry and well drained economic zone

Mitigation	Base	P 1	P 2	P 3
Total farm area (ha)	485	485	485	485
Total effective area (MP and SB) (ha)	454	454	454	454
Milking platform effective area (ha)	291	291	291	291
Support block effective area (ha)	162	162	162	162
N leaching (total)	22,686	20,937	17,863	14,924
N leaching (kg N/ total ha)	47	43	37	31

P loss (total)	269	254	242	228
P loss (kg P/ total ha)	0.56	0.52	0.50	0.47
Peak Cows Milked	885	854	796	743
Stocking rate (cows/ha)	3.04	2.93	2.73	2.55
Nitrogen fertiliser applied (kg N/ha)	145	123	84	43
Phosphorus fertiliser applied (kg P/ha)	55	55	55	55
Milksolids (to factory) (kg/ha)	1,289	1,244	1,158	1,020
Milksolids (to factory) (kg/cow)	424	424	424	400
Total crop area (hectares)	55.3	48.8	38.3	28.1
Total Revenue (\$/ha)	\$9,079	\$8,706	\$8,026	\$7,124
Total Farm Expenses (\$/ha)	\$6,068	\$5,959	\$5,635	\$5,473
Economic Farm Surplus (EFS) (\$/ha)	\$3,011	\$2,747	\$2,391	\$1,650

4.2.10 Matura, dry and poorly drained economic zone

Mitigation	Base	P 1	P 2
Total farm area (ha)	417	417	417
Total effective area (MP and SB) (ha)	407	407	407
Milking platform effective area (ha)	256	256	256
Support block effective area (ha)	151	151	151
N leaching (total)	13,060	12,308	11,275
N leaching (kg N/ total ha)	31	30	27
P loss (total)	326	312	300
P loss (kg P/ total ha)	0.78	0.75	0.72
Peak Cows Milked	672	649	607
Stocking rate (cows/ha)	2.62	2.53	2.37
Nitrogen fertiliser applied (kg N/ha)	98	78	44
Phosphorus fertiliser applied (kg P/ha)	44	45	45
Milksolids (to factory) (kg/ha)	1,101	1,060	995
Milksolids (to factory) (kg/cow)	420	419	420
Total crop area (hectares)	53.2	46.9	38.1
Total Revenue (\$/ha)	\$7,539	\$7,260	\$6,810
Total Farm Expenses (\$/ha)	\$4,786	\$4,684	\$4,397
Economic Farm Surplus (EFS) (\$/ha)	\$2,753	\$2,577	\$2,413