An Impact Assessment of One Plan policies and rules on farming systems in the Tararua District and the Manawatu Wanganui Region

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KapAg

Growing for Good

Title: An Impact Assessment of One Plan policies and rules on farming systems in the Tararua District and the Manawatu Wanganui Region. With appendices.

Date: 1st January 2018

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1. Acknowledgements

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Katie Bicknell, lecturer in applied econometrics at Lincoln University, has checked the report to ensure that the appropriate methods for this analysis have been applied.

Despite my very heart-felt appreciation for the above people, they are in no way responsible for the opinions expressed in this report. I take full responsibility for its contents.

2. A Guide for Readers

This report has been prepared for the Councillors of the Manawatu-Wanganui Regional Council and for the staff working with them in policy development for the One Plan. The report may also help to inform discussions between the Council and industry and environmental groups. It will have done its job if this report helps makes Council's decisions easier and not harder.

In this report I have focussed on the financial implications to farmers of changes in the consenting process. For that reason the report describes its results at the farm scale. They have not yet been multiplied up to the whole of the catchment or the region, although that is possible at some stage in the future. I have not addressed the cultural outcomes, environmental outcomes and the needs of other social groups that might be described in other work.

After the summary and introduction, the next section of the report describes its purpose and how I went about responding to that. You may prefer to go straight to the results section and that should be able to be read without referring to any of the other chapters. The farm data is difficult to present clearly. I expect that if you have a lot of farming experience, that I have not provided enough information and if you have no farming knowledge, there may not be quite enough.

After the results section there is a discussion and conclusions section. Like the results section this is intended for you to be able to jump straight in and read from here. There are no recommendations in the discussion. Like this report, it is intended to be informative rather than directive. I have included a graph in here summarising the results to save people having to flick back to the results section. The last chapter is about the assumptions and limitations and ways in which this report could be improved still further.

Appendices G-I contain detailed farm modelling information printed from Farmax Dairy. These were added after the rest of the report and been finished in order to assist the re-assessment of the results, carried out by Barrie Ridler of Kikorangi Farm Systems Analysis.

3. Executive Summary

This report has been prepared for the Councillors of the Manawatu-Wanganui Regional Council and for the staff working with them on policy implementation and a review of the One Plan. In this report I have focussed on the financial implications to farmers of meeting the requirements of the intensive farming land use provisions in the One Plan following the Regional Council's response to a recent declaration by the Environment Court specifying opportunities for improvement. For that reason the report describes its results at the farm scale. They have not yet been multiplied up to the whole of the catchment or the region, although that will be possible at some stage in the future.

The purpose of this report is to "calculate the costs associated with applications for intensive land use activities and the economic impact of mitigations to reduce nitrogen leaching likely to be incurred as a result of the recommended improvements in the consenting process." It is a small-scale study of on-farm economic impacts associated with Council's intensive land use consenting and policy framework. It is intended to provide information to Council staff implementing and reviewing the existing rules and policies in the One Plan. For the latter, further work at a catchment and regional scale will be needed.

The author responded to the project brief by focussing on four dairy farms in the Tararua District and two arable farm systems in the Rangitikei District. These farming systems have been described and mitigations applied to achieve the standards in Table 14.2 and Table E2 of the One Plan. Appendix A of this report includes a copy of Table 14.2 . The costs of applying for the modified landuse consents have also been calculated. Taken together these form the basis of the discussion and conclusions towards the end of the report.

To determine the costs to individual farmers of obtaining and implementing their landuse consents, a farm management approach was taken in this report. This approach involved considering the operation of specific farming systems and attaching costs and returns to each of those operations. These costs and returns are then accumulated into an operational profit. The operational profit of farms before and after they have obtained a landuse consent is the main method used to show its economic impact. Some of the mitigations involve significant capital investments. These changes are evaluated in this report by calculating the return on capital on the farms before and after the mitigations have been introduced. The farms each have a calculated capital value and some commentary is provided on how that might be affected on farms that have been modified like these.

The process that was used involved selecting suitable farm systems, determining the changes needed in those systems for them to apply to the Council for a consent, and then evaluating the costs of introducing those changes. The farms were not existing farms. Instead each model farm was created around a particular farm system. The models were synthesised from many different farms known to exist in the region and adjusted to represent dairy farming systems that can be found in the Tararua District and arable farms in the Rangitikei District. These districts were selected because that is where most of the unconsented farms can be found.

The farm management changes between the base farms and the adjusted farms will require many farmers to grow their capability in managing pasture cover and pasture quality. The costs of a change in capability has not been included in this analysis.

The analytical results that were used were:

Farm Model: Self-contained dairy farm

This farm model has all the heifers grazed off the farm for 12 months from 9 months of age. It assumes that there has already been some adjustment to reducing its environmental footprint by grazing half the dairy cows off the farm over winter. Regular soil tests are taken and maintenance phosphate fertiliser is applied. A summer forage crop of turnips is grown to manage a possible risk of a dry summer. On average 30kg N/ha is applied in early spring and autumn to extend pasture production in those seasons.

To meet Table 14.2 in the One Plan, the farm has to reduce the number of dairy cows from 270 to 140 animals. It can no longer apply nitrogen fertiliser and must stop all cropping. The farm is expected to no longer bring in feed supplements for the cows. Instead it harvests 288 tonnes of pasture DM and sells most of this off the farm. The sale of surplus feed is a very important part of pasture management on this farm because animal consumption has dropped to almost 6,000 kgDM/ha/yr. Without harvesting surplus feed, the quality of the pasture would fall and in a few years pasture composition would suffer.

The farm started with leaching 32 kgN/ha and was modified to be leaching only 18 kgN/ha, a reduction of 44%. These changes reduced the expected farm profit from $1,627/ha to $629/ha, a drop of over 60%. The return on assets dropped from 5.3% to 2.0%.

The self-contained farm model has had to reduce its labour but it has surplus pasture available for alternative landuses, and therefore its adaptability might increase overall. Nitrogen conversion efficiency has increased to 66% and so it can be expected to be more sustainable in its use of natural resources. However, its profitability is not enough to support the level of debt found on many farms in this region. The return on assets is insufficient to attract off-farm investment, should that be required for future improvements. Unless farms like this have less than half the amount of debt as the model farm, they will not survive the changes required to address Table 14.2 .

Farm Model: Low-intensity dairy farm

The low-intensity dairy farm is very common in the Tararua District and in the region generally. In this model there are more cows and they have greater production than the self-contained farm. On this farm there is more supplementary feed (260 tonnes DM) brought onto the farm and greater use is made of cropping in both winter and summer. Over the whole farm more than 100 kgN/ha is applied, mainly to lengthen the grass growing season in spring and autumn.

To meet Table 14.2 in the One Plan, the farm has to reduce the number of cows from 400 to 250 animals. They will also need to reduce nitrogen fertiliser applications to an average of 5 kgN/ha/yr and stop importing supplementary feed and growing a winter crop. The summer crop remains, and 443 tonnes of DM are conserved. Three quarters of the conserved feed is sold off the farm to maintain pasture quality.

The farm started with leaching 42 kgN/ha and was modified to be leaching only 17 kgN/ha, a drop of 60%. These changes reduced the expected farm profit from $1,848/ha to $1,064/ha, a drop of over 40%. The return on assets dropped from 6.4% to 3.7%.

The low intensity farm model has not reduced its labour and it has surplus pasture available for alternative landuses. It’s adaptability might increase overall. Nitrogen conversion efficiency has increased to 56% and so it can be expected to be more sustainable in its use of natural resources. However, its profitability is not enough to pay tax and support the level of debt found on many farms in this region. The return on assets is insufficient to attract off-farm investment, should that be required for future improvements. Unless farms like this can reduce the amount of debt below that of the model farm they will not survive the changes required to address Table 14.2 .

Farm Model: Moderate-intensity dairy farm

This farm has 600 cows and achieves high production. The farm imports 757 tonnes DM, grows winter and summer crops and applies an annual application of over 150 kgN/ha.

To achieve Table 14.2 in the One Plan this farm has a covered barn installed for all the cows so that they can be housed all year. Although inside for much of the time, the cows are grazed outside for fixed periods throughout the year – 8 hours per day while lactating and 2 hours per day over winter. The farm imports the same amount of supplementary feed as it did previously and harvests another 38 tonne of supplements to maintain production. Dairy effluent is applied across the whole of the milking platform and nitrogen fertiliser applications reduced to 50 kgN/ha.

The farm started with leaching 54 kgN/ha and was modified to be leaching only 17 kgN/ha, a drop of almost 70%. These changes reduced the expected farm profit from $2,283 /ha to $1,745/ha, a drop of almost 25%. The return on assets dropped from 7.0% to 5.0%.

The moderate intensity farm model has not reduced its labour but it has had to increase its overall pasture utilisation. Its adaptability might therefore decrease overall. Nitrogen conversion efficiency only increases slightly to 27% and so there is not much improvement expected in the sustainable use of natural resources. However, the profitability of this farm is sufficient to support its expected level of debt and it has sufficient return on assets to provide financial security for its owners.

Farm Model: Irrigated high-intensity farm

The irrigated high intensity dairy farm in the base model has 640 cows and has a centre pivot irrigator and a feed pad. The farm imports 757 tones DM per year as a supplement or 1,180 kgDM/cow. It uses 187 kgN/ha of nitrogen a year.

To meet the requirements of Table 14.2 in the One Plan this farm has built housing for the cows so that they can be kept inside all year. The farm already had a feed pad and so the effluent system for housing the animals was already in place. While they are lactating, the cows are grazed outside for up to 8 hours per day. The amount of imported supplements on this farm is increased to 1,170 tonnes DM and 22 tonnes of supplements are made on the farm.

The farm started with leaching 64 kgN/ha and was modified to be leaching only 17 kgN/ha, a drop of over 70%. These changes reduced the expected farm profit from $2,456/ha to $1,850/ha, a drop of 25%. The return on assets dropped from 6.8% to 4.8%.

The irrigated high intensity farm model has not reduced its labour but it has had to increase its overall pasture utilisation. Its adaptability might therefore decrease overall. Nitrogen conversion efficiency only increases slightly to 28% and so there is not much improvement expected in the sustainable use of natural resources. However, the profitability of this farm is sufficient to support its expected level of debt and it has sufficient return on assets to provide financial security for its owners.

Farm Model: Arable farm with livestock

Both the arable farms are larger than the typical farms to be found in the Manawatu. Making them larger makes it easier to compare these farms with the dairy farms that have a similar size. This farm specialises in grain production over summer. It has been able to do that without irrigation. Half of the farm is used for growing barley and in winter it has been growing ryegrass for finishing livestock. The farm finishes lambs and heavy cattle over a 12 month period. Over the year 150 kgN/ha is applied to the cropping area or an average of 60 kgN/ha across the whole farm.

The changes required to meet Table 14.2 in the One Plan are to dispose of all the livestock and harvest as silage and hay the permanent pasture and ryegrass green crop. The area in barley had to be reduced from 100ha to 70 ha. Over a whole year 1,399 tonnes of pasture dry matter was made and exported from the farm.

The farm started with leaching 39 kgN/ha and was modified to be leaching only 24 kgN/ha, a drop of almost 40%. These changes decreased the expected farm profit from $915/ha to $477/ha, a decrease of 47%. The return on assets dropped from 2.6% to 1.3%.

The arable with livestock farm model has not reduced its labour but it has become dependent on the supplementary feed market. Its adaptability might therefore decrease overall. Nitrogen conversion efficiency has increased to 89% and so natural resource sustainability has also increased. The profitability of this arable farm is insufficient to support its expected level of debt and it has insufficient return on assets to provide much financial security for its owners.

Farm Model: Arable farm with potatoes

This model farm was again large for a cropping farm. This time there were no livestock and instead two different rotations were modelled. The second rotation of potatoes and brussels sprouts required a total application of 428 kgN/ha over a year. The other rotation of maize silage and winter oats for forage only needed 110 kgN/ha. Irrigation was used over summer on the potato crop and 500mm/yr was used.

The changes required for meeting Table 14.2 in the One Plan included reducing the amount of nitrogen fertiliser going on to the potato rotation (332 kgN/ha) and better timing fertiliser applications to align with crop requirements. A new rotation growing barley for grain was introduced to replace some of the area originally in a high nitrogen feeding crop (potatoes). To reduce drainage from excess irrigation a moisture probe was installed and a water budget put in place. This reduced the amount of water needed to 380mm/yr.

The farm started with leaching 60 kgN/ha and was modified to be leaching only 25 kgN/ha, a drop of almost 60%. These changes reduced the expected farm profit from $3,192/ha to $1,152/ha, a drop of over 64%. The return on assets dropped from 8.2% to 3.0%.

The arable with potato farm model has some reduction in casual labour and it has had to increase the range of crops being grown. Its adaptability might therefore increase overall. Nitrogen conversion efficiency has increased to 94%, a big improvement in the sustainable use of its natural resources. However, the profitability of this farm is insufficient to support its expected level of debt and it has insufficient return on assets to provide financial security for its owners.

Costs of Consents

There are expected to be four consent application pathways for farmers:

- An existing farm may already be able to meet the conditions and standards of a controlled activity in the One Plan. That means that it can show that it will be able to meet the cumulative nitrogen leaching maximum in Table 14.2 of the One Plan and has appropriate mitigation of waterway contamination from phosphorus, sediment, and E.coli. The application will need to provide enough evidence from Overseer® to support the Council approving a controlled consent. The main costs will be for an agricultural consultant to describe the existing farm system and carry out a standard AEE. This should show that the farming business can operate within the effects anticipated by the One Plan. The total cost for a consent application is likely to be about $8,200.

- Some existing farms may be able to meet the leaching caps in Table 14.2 of the One Plan and mitigate any potential waterway contamination from phosphorus, sediment, and E.coli but their mitigations cannot be calculated using Overseer. These will require extra preparation work to quantify the benefits of these mitigations. Such farms will need to apply for a restricted discretionary consent that shows calculations of the effectiveness of their mitigations. Generally the size of the benefits from these mitigations will be quite site specific and so information about the site as well as the mitigation will need to be provided. For example, the use of high carbon ditches to intercept nitrogen leaching will depend on the hydrology of the site. An agricultural consultant working with a farmer can provide the Council with this information with the support of industry scientists. The total cost for a consent application is likely to be about $12,500.

- Farms that can meet the nitrogen leaching caps in Table 14.2 within four years will need to address through their AEE the effects of the four year delay in meeting the Table. The additional costs for these farmers are generated from needing the advice of a professional ecologist and obtaining information about the cumulative effects for the catchment. The total cost for a consent application is likely to be about $22,000.

- The farms that are not anticipated to meet the nitrogen caps in Table 14.2 will need to apply for a restricted discretionary consent and prepare a very robust AEE. They will need to employ technical expertise to show that their effects on the environment are less than minor. The total cost for a consent application is likely to be about $25,500. It is probable that these applications could be publically notified and an additional deposit for this will need to be made to Horizons. The deposit may be around $20-30,000 in addition to these costs.

These costs could easily vary by 20% either up or down depending upon the complexity of the work involved.

Adaptability, Sustainability and Viability

The model farm systems are changed significantly in order to meet the criteria for consents in the One Plan. The self-contained dairy farm, the low intensity dairy farm and the arable farm with potatoes might become more adaptable as a result of these changes. All of the model farms improved their efficiency of nitrogen use for production. They might therefore be considered to have become more sustainable production systems.

However, all of the model farms became less profitable as a result of introducing the mitigations necessary to comply with the conditions in the One Plan. The self-contained dairy farm and the low intensity dairy farm do not have sufficient profit to remain viable at typical industry levels of debt. All the model farms returned less than 5% on assets except for the moderate intensity dairy farm (ROA=5%). Therefore, all their owners now lack future financial security from their investment in these farming businesses. The reduced profitability is likely to result in a downward pressure on the future property values for these farms.

4. Introduction

This report and the work described, was produced at the request of the Manawatu Wanganui Regional Council (Horizons). A summary of the brief for this work is provided in Appendix B.

The One Plan for managing all the natural resources in the Manawatu Wanganui Region became fully operational in 2012. It was called the One Plan because it combined the previous regional policy statement (RPS) and the regional plan (RP) in one document. There are two chapters relating to the management of freshwater in the region. Chapter five has the objectives and policies for water quality to achieve the values and standards in Schedule B, Table 1 and Schedule E, Table 2. It could be considered the RPS part of the plan. Chapter 14 has the policies and rules relating to discharges to land and water. It is the RP part of the plan. The One Plan sets out a framework for managing water quality in fresh water and seeks to control the effects of both point source and non-point source discharges to maintain good water quality and enhance poor water quality. Through the One Plan, intensive farming land users require resource consents in the targeted water management sub-zones identified in the Plan.

Landuse consents for dairy and arable farms consider four main risk areas from non-point sources affecting waterways. These are: nitrogen losses, phosphorus losses, sediment and pathogens (e.g. E.coli). The latter three are managed through the adoption of good management practices. and nitrogen losses are managed through the cumulative nitrogen leaching maximums set out in Table 14.2. Applicants for land use consents use the Overseer software package and farm system inputs to model on-farm nitrogen leaching loads and determine their activity status for the consenting process.

Dairy and arable farmers have been applying to Horizons for landuse consents to continue their existing or establish new farming activities in the region. Horizon’s consenting process was challenged in the Environment Court earlier this year and their decision identified some opportunities for improving Horizon’s processes. Changes to the consenting processes are likely to have economic implications for applicants and Horizon’s intends to quantify these as much as possible.

This report was commissioned in June 2017 to “calculate the costs associated with applications for intensive land use activities and the economic impact of mitigations to reduce nitrogen leaching likely to be incurred as a result of the recommended improvements in the consenting process.”

The author responded to the project brief by focussing on four dairy and two arable farm systems. These farming systems have been described and mitigations applied to achieve the standards in Table 14.2 and Table E2. The costs of applying for the modified landuse consents have also been calculated. Taken together these form the basis of the discussion and conclusions towards the end of the report.

In order to progress this report in the time available some assumptions have had to be made and these are described in the penultimate chapter. There are some limitations to the report, particularly if its results are being applied outside the original brief. Finally, in the last chapter there is some further reading to assist those readers that want to examine further the principles behind this study.

5. Purpose

Natural resource management in the Manawatu Wanganui Region requires both voluntary efforts by land owners and their compliance with the policies and rules contained in the One Plan. The policies and rules in the One Plan are intended to achieve natural resource improvements benefiting the values of all people in the region. Achieving these improvements now and in the future requires time, effort and resources. Farmers will face new and additional costs in order to mitigate the impact on waterways of their farming activities.

The purpose of this report is to "calculate the costs associated with applications for intensive land use activities and the economic impact of mitigations to reduce nitrogen leaching likely to be incurred as a result of the recommended improvements in the consenting process." It is a small-scale study of on-farm economic impacts associated with Council's intensive land use consenting and policy framework and it is intended to provide information to Council staff considering implementation of the existing rules and policies; and preparing for future One Plan development. For the latter, further work at a catchment and regional scale will be needed. A summary of the project brief is included in Appendix B.

6. Problem Solving Approach

To determine the costs to individual farmers of obtaining and implementing their landuse consents, a farm management approach was taken in this report. This approach involved considering the operation of specific farming systems and attaching costs and returns to each of those operations. These costs and returns are then accumulated into an operational profit. The operational profit of farms before and after they have obtained a landuse consent is the main method used in this report to show its economic impact. Some of the mitigations involve significant capital investments. These changes are evaluated by calculating the return on capital on the farms before and after the mitigations have been introduced. The farms each have a calculated capital value and some commentary is provided on how that might be affected on farms that have been modified like these to achieve Table 14.2 in the One Plan.

The problem solving approach used here involved selecting suitable farm systems, determining the changes needed in those systems for them to apply to the Council for a consent, and then evaluating the costs of introducing those changes. The farms were not existing farms. Instead each model farm was created around a particular farm system. The models were synthesised from many different farms known to exist in the region and adjusted to represent farming systems that can be found in the Tararua and Rangitikei Districts. These districts were selected because that is where most of the remaining unconsented farms can be found for dairying and cropping respectively.

Four dairy farm systems were selected to reflect the different farm systems to be found in the Tararua District. The dairy farms were standardised for land area, rainfall and soil types. Each farm was then adjusted to reflect the differences in farm system and matched to the expected nitrogen loss rate.

The analysis followed the following steps for each dairy farm:

(i). The base farm was established in Overseer®, compared to the initial specifications and modified if necessary to better fit these.
(ii). The farm was entered into Farmax® and the stock reconciliation checked and the supplementary feed inventory checked.
(iii). Any changes in Overseer as a result of the Farmax exercise were made.
(iv). The farm's operational profit and loss account was finalised to provide the base farm information summarised in the results section.
(v). The farm in Overseer was modified until it could achieve the nitrogen loss profile in year 20 of Table 14.2
(vi). The modified farm was again checked in Farmax.
(vii). Any consequential changes in Overseer were made.
(viii). The farm's new operational account was finalised and compared to the base farm account
(ix). Return on capital was calculated.

The two cropping farm systems were processed in a similar way to the four dairy farms.

The analyses have included considerable changes in the way that farming – both dairy and arable will need to be done in the future. The adjustments require growing farming capability and building new expertise amongst the professionals advising them. The structures and costs of human development have not been addressed in these analyses.

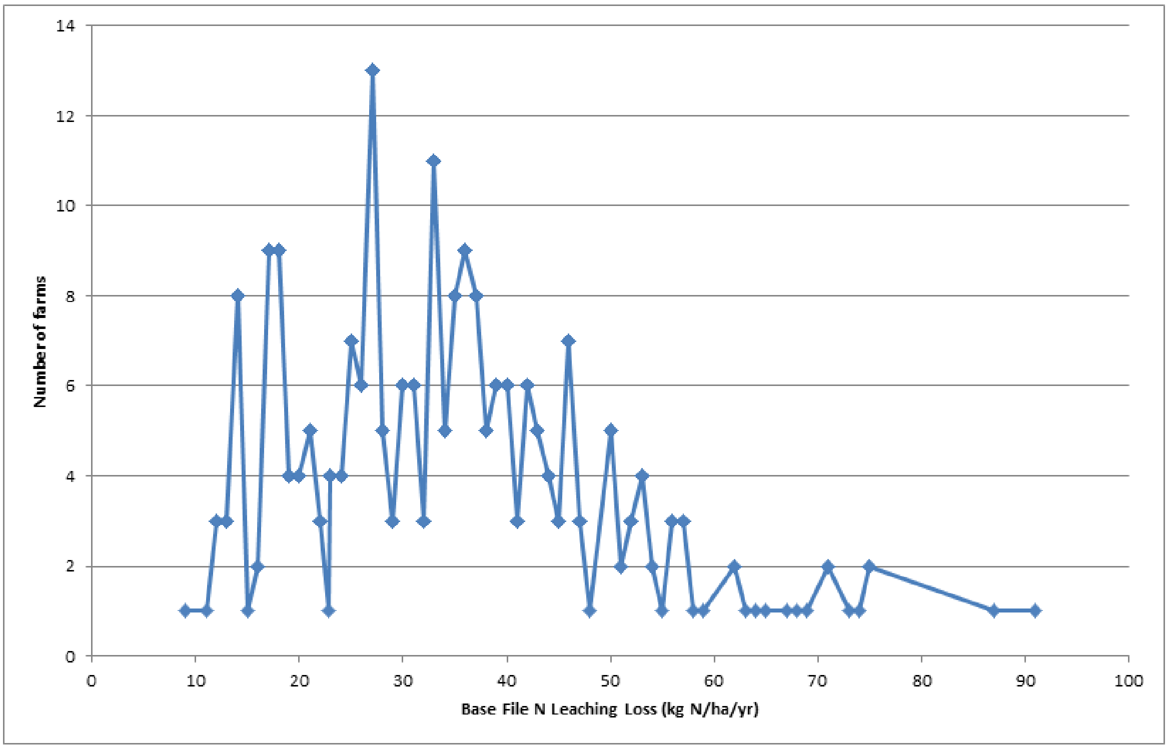
In this report the initial state of each of the farming businesses has been compared with those same farming businesses in year 20 of Table 14.2. At the end of year 20 each of the farms would be fully compliant with the intensive land use rules in the One Plan. Between year 1 and year 20 in Table 14.2 the model farms would need to step down their nitrogen leaching by almost 25%. However, due to the length of time involved, on many farms, the completion of this transition process is likely to occur after there have also been changes in farm ownership. The uncertainty of the transition is increased by a possible plan review of the One Plan during that time and structural adjustments in the market to accommodate the adaptations required in farming systems.

7. Results

7.1 Farming Systems

There were no figures from industry available to guide the development of representative dairy farms in the region. However, Horizons were able to provide a chart of base file nitrogen losses found in the region and this was used to guide the development of the model farms (Figure 1).

Figure 1. Base file nitrogen leaching of resource consents currently granted in the Horizons region.



The data below 20 kgN/ha in Figure 1 are likely to be from specialist dairy farms or discrete parcels of land on part-farm's that required consenting rather than whole-farms. The figures above 60 kgN/ha are likely to be from high-input farms in high rainfall areas and on soils with a propensity for high nitrate leaching.

Farm consultant's in the region work with a range of farm systems, from low intensity to high intensity systems. For this study, different dairy farm systems were matched with the likely nitrogen loss rates to be found in Tararua District (Table 1). The table highlights that only four combinations of farm systems and nitrogen losses were selected in this study. However they are spread out across the table. Although other combinations of farm systems and nitrogen loss rates might be possible in the region it was hoped that their results could be approximated using the results of this study.

The two arable farms were modelled as farms similar in size to the dairy farms (200 ha). One arable farm included livestock as a significant source of its nitrogen losses, the other arable farm had no livestock but did have potatoes and brussels sprouts as the most significant sources of its nitrogen losses.

Table 1. Selected dairy farm systems and their associated nitrogen loss rates

Expected Annual	Dairy System			
Nitrogen Loss (kgN/ha)	Type 1-2 System	Type 2-3 System	Type 3-4 System	Type 3-4 System
30 kgN/ha	Self-contained			
40 kgN/ha		Low intensity		
50 kgN/ha			Moderate intensity	
70 kgN/ha				Irrigated

The non-irrigated Tararua dairy farms shared the same soil types and had an annual average rainfall of 1200-1300mm. The irrigated dairy farm was modelled in a slightly drier area in the Tararua District. It had an average annual rainfall 100mm lower than the other dairy farms, and used irrigation to add an additional 600mm. The three most intensive farm models included runoffs for grazing replacement animals and wintering non-lactating (dry) cows. The runoffs were also sometimes used for cropping and making surplus grass into supplementary feed. The self-contained farm had no runoff. In Table 14.2 the dairy farms all had the same mix of land classes. The milking platforms were: LUC II (20%), LUC III (65%) and LUC IV (15%). The runoffs were: LUC III (40%) and LUC IV (60%). The dairy farms had to operate inside a leaching cap by year 20 of 18 kgN/ha per year.

The Rangitikei arable farms were both on the same soil type in an area receiving about 900mm annual rainfall. The arable farm with irrigation added a further 500mm/ha. In Table 14.2 the cropping farms each operated on LUC II with a leaching cap in year 20 of 21 kgN/ha.

There were no farms modelled that in their initial state could reach Table 14.2 in the One Plan without making some changes to their farming practices. The expected trajectory in nitrogen leaching loss of the farms modelled is shown in Figure 2. In the Figure all the dairy farm models have to be leaching below 24 kgN/ha by year 1, and the arable farms below 27 kgN/ha. By year 20 the dairy farms have to be below 18 kgN/ha and the arable farms below 21 kgN/ha. The modelled dairy farms in Tararua District had to reduce their nitrogen leaching to between 60-25% of their current leaching. The modelled arable farms in the Rangitikei District had to reduce their nitrogen leaching to 50-35% of their current leaching.

In the next section a one page summary of each of the farms is provided before their farm systems have been modified to achieve the expected results in Table 14.2. The summary of each farm is divided into four sections. At the top is a description of the farm infrastructure and soils. This includes the amount of maintenance fertiliser required annually that has been calculated by Overseer.

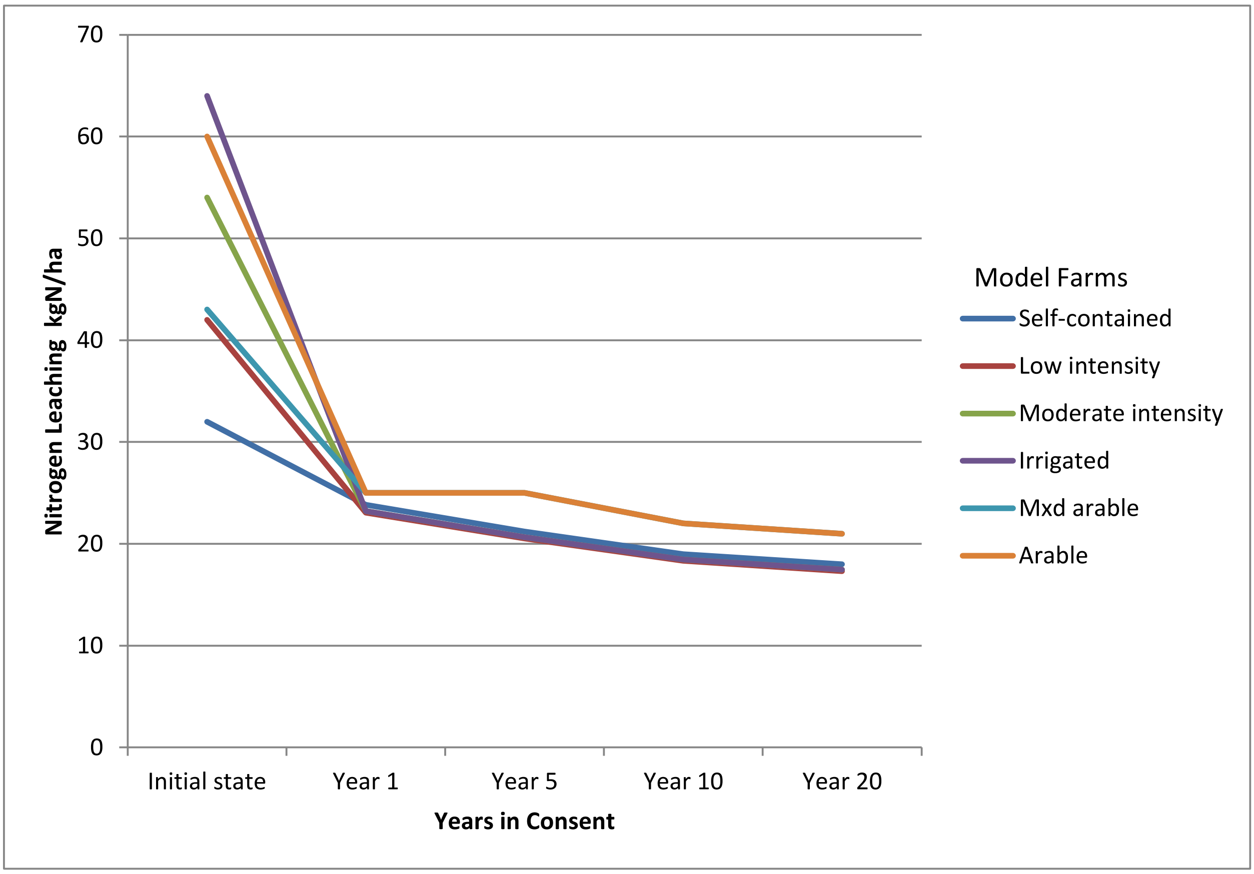
The next sections are labelled “herd” and “pasture and feed”. For each farm the balance between feed supply and animal requirements has been checked in Farmax to ensure that it is a feasible farming system and that it is in a stable equilibrium.

The "nutrients" section of each farm summary provides results from the nutrient budget in Overseer. This includes both nitrogen losses to water (mainly as leaching) and phosphorus losses to water (mainly as runoff).

The final section in the summary addresses the operational profit for each of the farms. See Appendix E for some of the financial assumptions applied in this analysis. Each dairy farm has milk and livestock income. They have fixed farm overheads such as repairs and maintenance, land costs such as weed spraying, and livestock costs such as animal health.

The depreciation costs for plant and machinery, and the costs of labour and drawings are all in the fixed farm overheads. The farmers' operational profits are what they use to reinvest in the farm and to repay mortgages and loans.

Figure 2. The nitrogen-loss trajectory of all the models in this study



The farm's return on assets (ROA) indicates how much better (or worse) the farm might be if it is compared with selling the farm and investing the money in an alternative business. Even money in the bank can return around 5% to its investor and most of the farms started out in this study earning their owners above that amount.

The arable farm models have profiles that have similar information to the dairy farms except that the description of the cropping rotations has also been included.

7.2 Base-line Farm Results

PRODUCTION SYSTEM	**Self-Contained**			
INFRASTRUCTURE				
Farm Area	125 ha	**Milking platform**	120 ha	
Feedpad	N/A	**Effluent system and area**	Sump, to pond and travelling irrigator	17 ha
		Irrigation system	N/A	
Soils	Dannevirke SL	Flat	Fert (PKS): 32.38.07	102 ha
	Matamau SL	Rolling	Fert (PKS): 29.51.20	18 ha
HERD				
270 cows	59 replacements (grazed off for 12 months from 9 months of age)	**Cow wintering**	Half the herd for 2 months	
86,163 kgMS	718 kgMS/ha MP	319 kg MS/cow		
PASTURE AND FEED				
Pasture eaten (Overseer)		10,010 kgDM/ha/yr		
Imported feed		23 T DM		
Winter forage crop		N/A		
Summer forage crop		6 ha	Crop - Turnips	10 T/ha yield
Imported feed and grazing off as a percentage of the total feed offered		21%		
NUTRIENTS				
Clover nitrogen	136 kg/ha	**Other nitrogen**	5 kg/ha	
Imported nitrogen	30 kg/ha	**Available nitrogen**	171 kg/ha	
Surplus nitrogen	119kg/ha	**Nitrogen conversion efficiency**	29 %	
Lost nitrogen to water	32 kg/ha	**Phosphorus losses**	0.6 kg/ha	
OPERATIONAL PROFIT				
Farm fixed overheads	$151,230	**Milk income**	$551,444	
Land operational costs	$96,605	**Livestock income**	$25,822	
Livestock & feed costs	$135,284	**Operational profit**	$195,291	
Farm working expenses	$4.45/kgMS	**Per eff. hectare**	$1,627	
		Per cow	$723	
Capital Value (total assets)	$3,685,428	**Return on assets**	5.3%	

PRODUCTION SYSTEM	**Low Intensity**			
INFRASTRUCTURE				
Farm Area	210 ha			
Milking platform	150 ha	**Irrigation system and area**	N/A	
Runoff	50 ha	**Effluent system and area**	Sump, to pond and travelling irrigator	25 ha
Soils	Dannevirke SL	Flat	Fert (PKS): 27.22.06	127.5 ha
	Kopua SL	Flat	Fert (PKS): 26.31.10	20 ha
	Matamau SL	Rolling	Fert (PKS): 25.33.15	52.5 ha
HERD				
400 cows	91 replacements grazed on runoff from weaning until 23 months		**Cow wintering**	Half herd on MP, half herd on RO on crop
144,312 kgMS	962 kgMS/ha MP		361 kg MS/cow	
PASTURE AND FEED				
Pasture eaten (Overseer)			10,644 kgDM/ha/yr	
Pasture conserved			50 T DM	
Imported feed T DM			260 T DM	
Winter forage crop			9 ha | Kale | 12 T DM/ha yield	
Summer forage crop			9 ha | Turnips | 10 T DM/ha yield	
Imported feed and grazing off as a percentage of the total feed offered			13.2%	
NUTRIENTS				
Clover nitrogen		93 kg/ha	**Other nitrogen**	28 kg/ha
Imported nitrogen		101 kg/ha	**Available nitrogen**	222 kg/ha
Surplus nitrogen		171kg/ha	**Nitrogen conversion efficiency**	23 %
Lost nitrogen to water		42 kg/ha	**Phosphorus losses**	0.7 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$228,250	**Milk income**	$923,595
Land operational costs		$184,957	**Livestock income**	$40,350
Livestock costs		$180,971	**Operational profit**	$369,682
Farm Working Expenses		$4.12/kgMS	**Per eff. hectare**	$1,848
			Per cow	$936
Capital Value (total assets)		$5,810,922	**Return on assets**	6.4%

PRODUCTION SYSTEM		**Moderate Intensity**		
INFRASTRUCTURE				
Farm Area	262 ha	**Milking platform (MP)**	200 ha	
		Runoff (RO)	50 ha	
Feedpad	N/A	**Effluent system and area**	Sump, to pond and travelling irrigator	42 ha
		Irrigation system and area	N/A	
Soil Type	Dannevirke SL	Flat	Fert (PKS): 24.05.03	170 ha
	Kopua SL	Flat	Fert (PKS): 24.25.08	20 ha
	Matamau SL	Rolling	Fert (PKS): 25.30.16	60 ha
HERD				
600 cows	136 calves grazing on the runoff from weaning with half grazed off for a further 12 months from 11 months old		**Cow wintering**	Half herd on MP, half herd on RO on crop
240,677 kgMS	1203 kgMS/ha MP		401 kg MS/cow	
PASTURE AND FEED				
Pasture eaten (Overseer)		11,753 kgDM/ha/yr		
Pasture conserved		30 T DM		
Imported feed T DM		757 T DM		
Winter forage crop		14 ha	Kale	12 T DM/ha yield
Summer forage crop		14 ha	Turnips	10 T DM/ha yield
Imported feed and grazing off as a percentage of the total feed offered		26%		
NUTRIENTS				
Clover nitrogen		72 kg/ha	**Other nitrogen**	65 kg/ha
Imported nitrogen		151 kg/ha	**Available nitrogen**	288 kg/ha
Surplus nitrogen		222 kg/ha	**Nitrogen conversion efficiency**	23 %
Lost nitrogen to water		54 kg/ha	**Phosphorus losses**	0.7 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$396,050	**Milk income**	$1,540,331
Land operational costs		$243,751	**Livestock income**	$64,011
Livestock costs		$393,708	**Operational profit**	$570,834
Farm Working Expenses		$4.29/kgMS	**Per eff. hectare**	$2,283
			Per cow	$951
Capital Value (total assets)		$8,183,862	**Return on assets**	7.0%

PRODUCTION SYSTEM		**High Intensity with Irrigation**		
INFRASTRUCTURE				
Farm Area	210 ha	**Milking platform (MP)**	200 ha	
		Runoff (RO)	50 ha	
Feedpad	Yes	**Effluent system and area**	Sump, to pond and travelling irrigator.	90 ha
		Irrigation system and area	Centre pivot	80 ha
Soils	Dannevirke SL	Flat	Fert (PKS): 24.14.00	170 ha
	Kopua SL	Flat	Fert (PKS): 23.15.07	20 ha
	Matamau SL	Rolling	Fert (PKS): 28.47.18	60 ha
HERD				
640 cows	145 calves grazing on the runoff from weaning with half grazed off for a further 12 months from 11 months old.		**Cows wintered off**	Half herd on MP, half herd on RO on crop
281,376 kgMS	1407 kgMS/ha MP		440 kg MS/cow	
PASTURE AND FEED (Milking platform)				
Pasture eaten (Overseer)		13,103 kgDM/ha/yr		
Pasture Conserved		38 T DM		
Imported feed T DM		757 T DM		
Winter forage crop		15 ha	Kale	12 T DM/ha yield
Summer forage crop		15 ha	Turnips	10 T DM/ha yield
Imported feed and grazing off as a percentage of the total feed offered		29%		
NUTRIENTS				
Clover nitrogen		63 kg/ha	**Other nitrogen**	73 kg/ha
Imported nitrogen		187 kg/ha	**Available nitrogen**	323 kg/ha
Surplus nitrogen		247 kg/ha	**Nitrogen conversion efficiency**	24 %
Lost nitrogen to water		64 kg/ha	**Phosphorus losses**	0.8 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$473,350	**Milk income**	$1,800,806
Land operational costs		$280,322	**Livestock income**	$72,250
Livestock costs		$505,504	**Operational profit**	$613,881
Farm Working Expenses		$4.48/kgMS	**Per eff. hectare**	$2,456
			Per cow	$959
Capital Value (total assets)		$9,053,006	**Return on assets**	6.78%

PRODUCTION SYSTEM		**Arable with Livestock**		
INFRASTRUCTURE				
Farm Area	210 ha	**Permanent pasture**	100 ha	
Effective farm area	200 ha	**Cropping area**	100 ha	
		Irrigation	Nil	
Animals				
Cattle sold store	80	**Cattle sold prime**	220	
Lambs sold store		**Lambs sold prime**	1,200	
CROPS				
Rotation				
Spring Sown Barley 100ha		8 T/ha/yr		
Autumn Sown Annual Ryegrass 100ha		6 T/ha/yr (grazed)		
NUTRIENTS				
Clover nitrogen		78 kg/ha	**Other nitrogen**	2 kg/ha
Imported nitrogen		88 kg/ha	**Available nitrogen**	168 kg/ha
Surplus nitrogen		115 kg/ha	**Nitrogen conversion efficiency**	31 %
Lost nitrogen to water		45 kg/ha	**Phosphorus losses**	0.3 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$128,250	**Cropping income**	$269,730
Land operational costs		$98,265	**Trading sheep & wool income net of purchases**	$44,020
Livestock costs		$7,841	**Trading beef income net of purchases**	$240,221
Cropping costs		$136,710		
Operational profit		$182,905		
Per eff. hectare		$915		
Capital Value (total assets)		$7,125,000	**Return on assets**	2.6%

PRODUCTION SYSTEM		**Arable with Potatoes**		
INFRASTRUCTURE				
Farm Area	210 ha	**Permanent pasture**	Nil	
Effective farm area	200 ha	**Cropping area**	100 ha	
		Irrigation	Travelling Irrigator	100 ha
Animals				
Cattle sold store	Nil	**Cattle sold prime**	Nil	
Lambs sold store	Nil	**Lambs sold prime**	Nil	
CROPS				
Rotation				
Spring Sown Maize Silage 100ha		17 T/ha/yr		
Autumn Sown Forage Oats 100ha		7 T/ha/yr		
Rotation				
Spring Sown Potatoes 100ha		55 T/ha/yr		
Autumn Sown Brussel Sprouts		12 T/ha/yr		
NUTRIENTS				
Clover nitrogen		2 kg/ha	**Other nitrogen**	7 kg/ha
Imported nitrogen		280 kg/ha	**Available nitrogen**	289 kg/ha
Surplus nitrogen		31 kg/ha	**Nitrogen conversion efficiency**	89 %
Lost nitrogen to water		50 kg/ha	**Phosphorus losses**	0.8 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$175,050	**Cash Cropping income**	$1,690,272
Land operational costs		$39,500	**Forages Sold**	$461,700
Cropping costs		$1,299,000		
Operational profit		$638,422		
Per eff. hectare		$3,192		
Capital Value (total assets)		$7,785,000	**Return on assets**	8.2%

7.3 Mitigations for Reducing Environmental Effects under the One Plan

The least difficult mitigating practices to introduce on farm are operational changes that don't disrupt existing farming systems. These are generally also the most preferred by farmers. However, to achieve larger reductions in nitrogen losses, farmers may need to make system changes. The dairy farm systems have not been optimised to minimise their costs of production. Instead farm practices have been introduced that suit the existing systems and the assumed managerial capability required to operate them at their current level of efficiency. Opportunities for farmers to increase cow performance are assumed to equally exist both now and in the future and have not been changed in this analysis.

In higher rainfall areas and free-draining soils such as can be found in the Tararua District, capital investments may have to be made to enable the farm system to be adapted further to meet Table 14.2 in the One Plan. The mitigations applied to each dairy farm system in this report are shown in Table 2. Further information on these practices can be found in Appendix C.

The dairy farms were each expected to have one or more wetlands and riparian areas that could be fenced off from livestock. The fenced wetlands and riparian areas could protect native habitat and also trap runoff coming from farms containing sediment and phosphorus. The farms are expected to have to provide extra cutoffs along farm races and around the farm dairy to ensure that stormwater travels across grassy paddocks before entering water channels. The grassy paddocks act as filters. On some farms, drains may be converted to swales to increase nutrient filtering. Some drains may be shortened to stop them discharging directly into streams. Instead they may be able to allow water to run over grassy areas or riparian vegetation. As part of their consent, each model farm is expected to invest $10,000 towards these mitigations.

The model dairy farms were assumed to be fully fenced from waterways, including their run-offs. This mitigation was considered the main way of reducing E.coli losses into nearby waterways and so no further action was taken.

Table 2. The mitigations applied on the dairy farms in the order in which they were applied

	Dairy Farm System			
Mitigations	Self-contained	Low intensity	High intensity	Irrigation and high intensity
Operational practice changes				
Remove nitrogen fertiliser from the effluent area	✓	✓	✓	✓
Remove winter applications of nitrogen (April to July inclusive)	✓	✓	✓	✓
Reduce nitrogen to a maximum of 60 kgN/ha	✓	✓	✓	✓
Aggressive summer culling of cows	✓	✓	✓	✓
Replace high protein feed with low protein	✓	✓	✓	✓
System practice changes				
Spread effluent to reduce rates to 100kgN/ha	✓	✓		
Remove all nitrogen fertiliser and export surplus feed	✓	✓		
Irrigation applications optimised				✓
Winter cows off the farm	✓	✓		
Reduce cow numbers and bring grazed off heifers home to replace them	✓	✓	✓	✓
Reduce overall stocking rates	✓	✓	✓	✓
Use a stand-off pad in wet winter weather			✓	✓

<u>Structural practice change</u>		
Covered feed pad	✓	✓
Housed cows with duration controlled grazing	✓	✓

The arable farms had simple crop rotations on the two different blocks on each farm. For the mitigations added to the arable farms see Table 3. Further information on these practices can be found in Appendix D. On the mixed livestock arable farm, in order to reduce nitrogen leaching enough for Table 14.2, all the livestock had to be removed from the system and surplus stock feed sold off the farm. The arable farm with potatoes was able to reduce some nitrogen use and reduce its use of irrigation by installing a moisture meter and water budgeting. On this farm the area in the potato crop rotation also needed to be reduced. It was replaced with a grain crop rotation that included a green mulch to incorporate some nitrogen back into the soil organic matter.

Both of the arable farms avoided having extended fallow periods between crops. They provided enough space to add a bund around their intensively cropped areas to reduce runoff containing sediment and nutrients from running into nearby waterways.

Table 3. The mitigations applied on the arable farms in the order in which they were applied

	Arable Farm System		Notes on Overseer
Mitigations	Arable with livestock	Arable with potatoes	
<u>Operational practice changes</u>			
Use minimal tillage and direct drilling between crops in rotation	✓	✓	Able to be modelled in Overseer
Minimise nitrogen applications to industry good practice	✓	✓	Able to be modelled in Overseer
Apply nitrogen fertiliser in side dressings		✓	Not able to be modelled
Spread nitrogen applications of over 45kgN/ha over several weeks.	✓	✓	Difficult to model
Add a bund between the block	✓	✓	Difficult to model the effect of a bund but reduced crop area can

and waterways to catch runoff			be included.
System practice changes			
Install moisture metering probe and move to active water management	✓	✓	Able to be modelled in Overseer
Replace fallow periods with actively growing crops or 'green mulch'	✓	✓	Able to be modelled in Overseer
Remove livestock	✓		Able to be modelled in Overseer
Harvest and export surplus green feed as fodder	✓	✓	Able to be modelled in Overseer
Replace heavy nitrogen feeding crops with grain crops		✓	Able to be modelled in Overseer

7.4 Mitigated Farm Results

PRODUCTION SYSTEM		**Self-Contained**		
INFRASTRUCTURE				
Farm Area	125 ha	**Milking platform (MP)**	120 ha	
Feedpad	N/A	**Effluent system and area**	Sump, to pond and travelling irrigator	17 ha
		Irrigation system and area	N/A	
Soils	Dannevirke SL	Flat	Fert (PKS): 28 0 06	102 ha
	Matamau SL	Rolling	Fert (PKS): 35 71 21	18 ha
HERD				
140 cows	28 replacements grazed on the farm from weaning to calving, but wintered off as yearlings (May-July)		**Cows wintering**	Half the herd for 2 months
49,522 kgMS	496 kgMS/ha MP		354 kg MS/cow	
PASTURE AND FEED				
Pasture eaten (Overseer)		6,028 kgDM/ha/yr		
Imported feed		Nil		
Supplements Made		288 TDM	**Supplements Exported**	212 TDM
Imported feed and grazing off as a percentage of the total feed offered		11.3%		
NUTRIENTS				
Clover nitrogen		127 kg/ha	**Other nitrogen**	2 kg/ha
Imported nitrogen		0 kg/ha	**Available nitrogen**	129 kg/ha
Surplus nitrogen		43 kg/ha	**Nitrogen conversion efficiency**	66 %
Lost nitrogen to water		18 kg/ha	**Phosphorus losses**	0.5 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$131,230	**Milk income**	$316,940
Land operational costs		$94,973	**Livestock income**	$13,718
Livestock & feed costs		$103,128	**Income from Capital Released**	$21,095
Operational profit		$75,510	**Income from Exported Supplements**	$53,100
Per eff. hectare		$629		
Farm Working Expenses		$6.65/kgMS		
Capital Value / Employed		$3,695,428	**Return on assets**	2.0%

PRODUCTION SYSTEM		**Low Intensity**		
INFRASTRUCTURE				
Farm Area	210 ha	**Milking platform**	150 ha	
		Runoff	50 ha	
Feedpad	N/A	**Effluent system and area**	Sump, to pond and travelling irrigator	25 ha
		Irrigation system and area	N/A	
Soils	Dannevirke SL	Flat	Fert (PKS): 32.44.08	127.5 ha
	Kopua SL	Flat	Fert (PKS): 26.31.10	20 ha
	Matamau SL	Rolling	Fert (PKS): 28.38.19	52.5 ha
HERD				
250 cows	55 replacements grazed on runoff from weaning until 21 months, but with all heifers off for the months of May, June and July		**Cows wintering**	100 % of cows off for 2 months
100,364 kgMS	669 kgMS/ha MP		401 kg MS/cow	
PASTURE AND FEED				
Pasture eaten (Overseer)		5,835 kgDM/ha/yr	**Imported feed T DM**	0
Supplements Made		443 TDM	**Supplements Exported**	293 TDM
Summer forage crop		9 ha	Turnips	10 T DM/ha yield
Imported feed and grazing off as a percentage of the total feed offered		12.5%		
NUTRIENTS				
Clover nitrogen		119 kg/ha	**Other nitrogen**	4 kg/ha
Imported nitrogen		5 kg/ha	**Available nitrogen**	128 kg/ha
Surplus nitrogen		56kg/ha	**Nitrogen conversion efficiency**	56%
Lost nitrogen to water		17 kg/ha	**Phosphorus losses**	0.6 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$210,150	**Milk income**	$642,333
Land operational costs		$160,732	**Livestock income**	$25,593
Livestock & feed costs		$185,842	**Income from Capital Released**	$28,424
Operational profit		$212,813	**Income from Exported Supplements**	$73,188
Per eff. hectare		$1,064		
Farm Working Expenses		$5.55/kgMS		
Capital Value / Employed		$5,820,922	**Return on assets**	3.7%

PRODUCTION SYSTEM		Moderate Intensity		
INFRASTRUCTURE				
Farm Area	262 ha	**Milking platform**	200 ha	
		Runoff	50 ha	
Barn with Feed Pad	Used Feb – Aug	**Effluent system and area**	Sump, to pond and travelling irrigator	170 ha
		Irrigation system and area	N/A	
Soils	Dannevirke SL	**Flat**	Fert (PKS): 31.0.0	170 ha
	Kopua SL	**Flat**	Fert (PKS): 32.13.20	20 ha
	Matamau SL	**Rolling**	Fert (PKS): 23.20.06	60 ha
HERD				
550 cows	120 replacements grazed on runoff from weaning with half grazed of at 11 months from May to May		**Cows wintering**	All cows wintered on – grazing 2 hours/day and then in barn
238,892 kgMS	1194 kgMS/ha MP		434 kg MS/cow	
PASTURE AND FEED				
Pasture eaten (Overseer)		10,779 kgDM/ha/yr	**Imported feed T DM**	814 T DM
Supplements Made		38 TDM	**Supplements Exported**	nil
Summer forage crop		12 ha	Turnips	10 T DM/ha yield
Imported feed and grazing off as a percentage of the total feed offered		25.7%		
NUTRIENTS				
Clover nitrogen		136 kg/ha	**Other nitrogen**	58 kg/ha
Imported nitrogen		51 kg/ha	**Available nitrogen**	245 kg/ha
Surplus nitrogen		222 kg/ha	**Nitrogen conversion efficiency**	27 %
Lost nitrogen to water		17 kg/ha	**Phosphorus losses**	0.8 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$419,900	**Milk income**	$1,528,099
Land operational costs		$267,897	**Livestock income**	$57,451
Livestock costs		$395,261	**Other income**	$-
Cost of Additional Capital		$65,958		
Operational profit including capital cost		$436,321	**Profit per eff. hectare**	$1,745
Farm Working Expenses (incl cost of additional capital)		$ 4.82/kgMS		
Capital Value / Employed		$8,784,602	**Return on assets**	5.0%

PRODUCTION SYSTEM		High Intensity with Irrigation			
INFRASTRUCTURE					
Farm Area	262 ha	**Milking platform**	200 ha		
		Runoff	50 ha		
Barn with Feed Pad	Used from Feb through to Aug	**Effluent system and area**	Sump, to pond and travelling irrigator.		170 ha
		Irrigation system and area	80 ha centre pivot		
Soils	Dannevirke SL	Flat	Fert (PKS): 03.02.03		170 ha
	Kopua SL	Flat	Fert (PKS): 23.15.06		20 ha
	Matamau SL	Rolling	Fert (PKS): 31.20.20		60 ha
HERD					
620 cows	136 replacements with half grazed off from 1 May for 12 months		**Cows wintered off**		Nil (all wintered on in barn)
277,200 kgMS	1386 kgMS/ha MP		470 kg MS/cow		
PASTURE AND FEED (Milking platform)					
Pasture eaten (Overseer)		11,207 kgDM/ha/yr	**Imported feed T DM**		1,170 T DM
Supplements made T DM		Nil	**Supplements Exported**		Nil
Summer forage crop		15 ha	Turnips	10 T DM/ha yield	
Imported feed and grazing off as a percentage of the total feed offered		32%			
NUTRIENTS					
Clover nitrogen		135 kg/ha	**Other nitrogen**		83 kg/ha
Imported nitrogen		51 kg/ha	**Available nitrogen**		269 kg/ha
Surplus nitrogen		194 kg/ha	**Nitrogen conversion efficiency**		28 %
Lost nitrogen to water		17 kg/ha	**Phosphorus losses**		0.8 kg/ha
OPERATIONAL PROFIT					
Farm fixed overheads		$495,250	**Milk income**		$1,790,445
Land operational costs		$295,839	**Livestock income**		$70,839
Livestock costs		$533,105	**Income from Capital**		$
Cost of Additional Capital		$74,512	**Income from Exported Supplements**		
Operational profit including capital cost		$462,578			
Per eff. hectare		$1,850			
Farm Working Expenses		$5.00/kgMS			
Capital Value/Employed		$9,731,656	**Return on assets**		4.8%

PRODUCTION SYSTEM		Arable with Livestock		
INFRASTRUCTURE				
Farm Area	210 ha	**Permanent pasture**	150 ha all harvested & exported for pasture silage	
Effective farm area	200 ha	**Cropping area**	50 ha	
		Irrigation	Nil	
Animals				
Cattle sold store	Nil	**Cattle sold prime**	Nil	
Lambs sold store	Nil	**Lambs sold prime**	Nil	
CROPS				
Rotation				
Spring Sown Barley 50ha		8 T/ha/yr		
Autumn Sown Annual Ryegrass 50ha		6 T/ha/yr (harvested and sold as baleage)		
Supplements Made		1,549 TDM		
Supplements Exported		1,549 TDM		
NUTRIENTS				
Clover nitrogen		61 kg/ha	**Other nitrogen**	2 kg/ha
Imported nitrogen		38 kg/ha	**Available nitrogen**	101 kg/ha
Surplus nitrogen		11 kg/ha	**Nitrogen conversion efficiency**	89 %
Lost nitrogen to water		20 kg/ha	**Phosphorus losses**	0.2 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$128,250	**Cropping income**	$119,880
Land operational costs		$76,800	**Sale of Surplus Feed**	$277,500
Livestock costs		$0		
Cropping costs		$95,760		
Cost of Additional Capital		$1,098		
Operational profit including capital cost		$95,472		
Per eff. hectare		$477		
Capital Value (total assets)		$7,135,000	**Return on assets**	1.3%

PRODUCTION SYSTEM		Arable with Potatoes		
INFRASTRUCTURE				
Farm Area	210 ha	**Permanent pasture**	nil	
Effective farm area	200 ha	**Cropping area**	200 ha	
		Irrigation	Travelling Irrigator	100 ha
Animals				
Cattle sold store	Nil	**Cattle sold prime**	Nil	
Lambs sold store	Nil	**Lambs sold prime**	Nil	
CROPS				
Rotation				
Spring Sown Maize Silage 100ha		17 T/ha/yr		
Autumn Sown Forage Oats 100ha		7 T/ha/yr		
Rotation				
Spring Sown Potatoes 10ha		55 T/ha/yr		
Autumn Sown Brussel Sprouts 10ha		12 T/ha/yr		
Rotation				
Spring Sown Barley 90ha		7 T/ha/yr		
Autumn Sown Annual Rye 90ha		5 T/ha/yr		
NUTRIENTS				
Clover nitrogen		1 kg/ha	**Other nitrogen**	4 kg/ha
Imported nitrogen		186 kg/ha	**Available nitrogen**	191 kg/ha
Surplus nitrogen		11 kg/ha	**Nitrogen conversion efficiency**	94 %
Lost nitrogen to water		19 kg/ha	**Phosphorus losses**	0.4 kg/ha
OPERATIONAL PROFIT				
Farm fixed overheads		$175,050	**Cash Cropping income**	$819,538
Land operational costs		$39,500	**Forages Sold**	$191,250
Cropping costs		$564,812		
Cost of Capital		$1,098		
Operational profit		$230,328		
Per eff. hectare		$1,152		
Capital Value (total assets)		$7,795,000	**Return on assets**	3.0%

7.5 Changes in Farm Profitability

All the modelled farms had reduced profitability after making the system changes. In Table 4 the future profitability of the self-contained and low intensity dairy farms and the arable farms are very dependent on being able to sell their surplus feed to other livestock farmers.

Table 4. Summary of profit, capital and labour changes between the base farm models and their profitability after farm system adjustments

Farms	Self-Contained ($)	Low Intensity ($)	Moderate Intensity ($)	High Intensity with Irrigation ($)	Arable with Livestock ($)	Arable with Potatoes ($)
Base Total Income	578,411	963,860	1,604,343	1,873,057	553,971	2,151,972
Base Total Expenses	383,120	594,178	1,033,509	1,259,176	371,066	1,513,550
Base Profit	**195,291**	**369,682**	**570,834**	**613,881**	**182,905**	**638,422**
Base Profit / ha	1,627	1,848	2,283	2,456	915	3,192
Extra Income (from invested capital)	21,095	28,424	N/A	N/A	N/A	N/A
Extra Income (from exported supps)	53,100	73,188	N/A	N/A	277,500	191,250
Additional Capital Costs	N/A	N/A	65,958	74,512	1,098	1,098
Adj Income (From Produce)	330,646	67,925	1,585,337	1,861,284	119,880	819,538
Total Adj Expenses	329,331	556,724	1,083,058	1,324,194	300,810	779,362
Change in Expenses	-53,789	-37,454	49,549	65,018	-70,256	-734,188
Adjusted Future Profit	**75,510**	**212,813**	**436,321**	**462,578**	**95,472**	**230,328**
Adjusted Future Profit / ha	629	1,064	1,745	1,850	477	1,152
Change In Profit	-119,781	-156,869	-134,513	-151,303	-87,433	-408,094
Change In Profit / ha	-998	-784	-538	-605	-437	-2,040
% Change in Profit	-61%	-42%	-24%	-25%	-48%	-64%
Net Capital Investment	10000	10000	600740	678650	10000	10000
Base Capital Value	3,685,428	5,810,922	8,183,862	9,053,006	7,125,000	7,785,000

Base Return on Assets	5.3%	6.4%	7.0%	6.8%	2.6%	8.2%
New Capital Employed	3,695,428	5,820,922	8,784,602	9,731,656	7,135,000	7,795,000
Adjusted Return on Assets	2.0%	3.7%	5.0%	4.8%	1.3%	3.0%
Change in ROA	-61%	-43%	-29%	-30%	-48%	-64%
Base Farm Labour	Owner plus casual	Owner plus 1 FTE	Owner plus 3 FTE	Owner plus 3 FTE	Owner plus casual	Owner plus casual
Adjusted Future Labour	Owner	Owner plus 1 FTE	Owner plus 3 FTE plus casual	Owner plus 3 FTE plus casual	Owner plus casual	Owner plus casual

Two of the dairy farmers have additional income provided from the capital value of the livestock that they sold. The more intensively managed farms with greater supplementary feed inputs are able to consider housing their cows. In these models the cows were able to be housed and effluent systems expanded for less than $1,200 per cow.

On current valuations, all the initial farms were expected to return over 5% on capital except for the arable farm with livestock. After the farm systems had been adjusted, all the dairy farm models had returns drop to 5% or less than assets. The results suggest that there will be a contined downward pressure on dairy farm valuations to readjust for improved returns on assets.

It is common in the dairy industry for farmers to have about $21/ kgMS of debt on their farms. Based upon an interest rate of 7% that would mean each of the model farms has the following annual interest payments.

Self-contained: $126,660

Low intensity: $212,139

Moderate intensity: $353,795

Irrigation and high intensity: $413,623

Arable with livestock: $157,576

Arable with potatoes: $530,134

All of the model farms in their base operation would be able to pay this amount of debt from their profit. After the farms have been adjusted to achieve Table 14.2 only the dairy farms at moderate to high intensity could still cover this amount of debt. The low intensity dairy farm might need a slight reduction in debt to survive. The self-contained dairy farm and the two arable farms would need to almost halve their debt.

The reduction in profitability of the modelled farms in order to meet the requirements of Table 14.2 is likely to reduce their market value while they are under these constraints. In the case of farms where their intensive use and profitability is reduced, the market would “consider” what the resulting highest and best use of the farm could be after these changes.

The market for dairy milking platforms that are no longer viable may change to them being viewed as a dairy run off or intensive finishing farms for dry stock. Both of these options would reduce their value on a per hectare basis. While the underlying value of the bare land may only experience a small decrease (say 5%) the value of the specialist dairy improvements (cowshed, effluent system, races) would be virtually nil under an alternative land use scenario.

In the case of farms that have used capital expenditure (e.g. cow housing) to meet Table 14.2, the market would factor in the added value of these new assets to a degree, but probably not enough to reflect the total capital cost of installing the infrastructure.

In the example in Table 5 it has been assumed that 70% of the cost to install the cow housing is reflected in changed capital value. This is reflective of how the market “prices” such infrastructure at present.

Table 5. Hypothetical examples of changes in farm capital value following mitigation

Self-Contained Farm		**125ha**	**Irrigated high Intensity farm**		**262ha**
Status Quo Value		**$3,000,000**	Status Quo Value		**$6,200,000**
Split as: -			Split as: -		
	Land Value	2,600,000		Land Value	5,000,000
	Cowshed	120000		Cowshed	600000
	Effluent System	50000		Effluent System	120000
	Races	25000		Races	50000
	Other Improvements	$205,000		Other Improvements	$430,000
Value After System Change		**$2,680,000**	Value After System Change		**$6,550,000**
Split as: -			Split as: -		
	Land Value	2,470,000		Land Value	5,000,000
	Cowshed	nil		Cowshed	600000
	Effluent System	nil		Effluent System	120000
	Races	5000		Races	50000
	Other Improvements	$205,000		Cow housing (70% of cost)	350000
				Other Improvements	$430,000

8. Costs Associated with the Consenting Process

The One Plan in Chapter Five has objectives and policies regarding the management of water quality in sensitive catchments identified within the Manawatu and Wanganui region. The water quality values for each subzone within the catchments are shown in Table B2 of the One Plan and the water quality targets are shown in Table E2.

Under policies 14.5 and 14.6 of the One Plan the owners of all existing intensive farming operations must apply for a land use consent to continue operating. Rule 14.1 and Table 14.2 describe the conditions under which the Council can issue a controlled consent. If the conditions for a controlled consent cannot be met, the alternative is a restricted discretionary consent. The focus of this chapter in this report is on the costs for applicants of applying for a consent, with particular application to dairy farmers applying for a restricted discretionary consent.

There are expected to be five consent application pathways for existing farmers. These are shown at the top of Table 6, note that pathway 2&3 are combined in the Table. Each pathway to a consent is expected to require the following sources of information, although the level of detail and the amount of background evidence required will need to be matched to the assessment needs for that particular pathway.

- Farm Management and nutrient management information to describe the existing farming activity, and quantifying this activity in relationship to the objectives, policies and rules in the One Plan. Particularly this involves information about nutrient, sediment and pathogen losses, riparian and habitat management, fertiliser inputs, bridging and culverting, animal effluent management and nearby sources of community drinking water. The farm management information includes a description of the steps already being taken to avoid, remedy, and mitigate the effects of the farming activity on the environment and proposed steps to address the objectives, policies, and rules in the One Plan. The intensity and volume of the information being provided to Council is not expected to change across the different consenting pathways, except that in some pathways, as alternative operational and system changes are proposed by the other 'experts' employed, these will have to be evaluated, adjusted and potentially incorporated in any proposal.

- Policy analysis information that assesses the proposed activity against the relevant objectives and policies of the One Plan, the National Policy Statement for Freshwater Management (NPSFM), the 'discharge' sections of the RMA, and the National Environmental Standard for Sources of Human Drinking Water (NESHDW). In this report it is expected that suitably experienced people could provide the information for controlled consents but that policy specialists would be required for restricted discretionary applications.

- Hydrogeological information to describe the pathways for freshwater between farming activities, and wetlands, groundwater, lakes and surface water. This includes information about attenuation and lag-times. In this report it is expected that for controlled consents, experienced people could provide the information required from public records. Restricted discretionary consents would require specialists in hydrogeology using local (farm specific) information. Farm specific information may require placing a number of bores for sampling groundwater in the relevant areas.

- Assessment of environmental effects information to evaluate the impacts of farming activities on surface water management values for the affected catchment/s (Schedule B in the One Plan), and surface water quality targets for the catchment/s (Schedule E in the One Plan). For controlled consents the information could be provided by experienced people to show that the effects are consistent with meeting the standards for controlled consents in the One Plan. For restricted discretionary consents, a specialist may be required to carry out a physical assessment of effects at the farm scale and the catchment scale.

The consenting pathways shown in Table 6 are described as follows:

- Where an existing farm is able to meet the nitrogen leaching caps in Table 14.2 of the One Plan and to mitigate any potential waterway contamination from phosphorus, sediment, and E.coli, their application will need to provide enough evidence from Overseer® to support the Council approving a controlled consent. The main costs will be for an agricultural consultant to describe the existing farm system and carry out a standard policy statement and AEE. This should show that the farming business can operate within the effects anticipated by the One Plan.

- Some existing farms may be able to meet the leaching caps in Table 14.2 of the One Plan and mitigate any potential waterway contamination from phosphorus, sediment, and E.coli but their mitigations cannot be calculated using Overseer. These will require extra preparation work by a farm management specialist to quantify the benefits of these mitigations. Such farms will need to apply for a restricted discretionary consent that shows calculations of the effectiveness of their mitigations. Generally the size of the benefits from these mitigations will be quite site specific and so information about the site as well as the mitigation will need to be provided. For example, the use of high carbon ditches to intercept nitrogen leaching will depend on the hydrology of the site.

  In the same category are farms meeting Table 14.2, but failing to meet other standards in Rule 14.1. These require additional material in their application to describe ow the effects on the standards will be mitigated.

  An agricultural consultant working with a farmer can provide the Council with this information with the support of industry scientists.

- Farms that can meet the nitrogen leaching caps in Table 14.2 within four years will need to address through their AEE the effects of the four year delay in meeting the Table. The additional costs for these farmers are generated from needing the advice of a professional water quality scientist.

- The farms that are not anticipated to meet the nitrogen caps in Table 14.2 will need to apply for a restricted discretionary consent and prepare a very robust AEE. They will need to employ technical expertise to show that their effects on the environment are less than minor. It is probable that these applications could be publically notified and an additional deposit for this will need to be made to Horizons. The deposit may be $20,000 - $30,000 in addition to the costs already shown in Table 6.

The costs shown in Table 6 could easily vary by 20% either up or down depending upon the complexity of the work involved.

Table 6. Detailed costing of consent application options

	Controlled Consent	Restricted Discretionary Consents		
Costs Generated in the Consent Application	Existing farm system meets Table 14.2 ($)	Existing farm system could meet Table 14.2 with customised mitigations ($)	Delayed farm system change to meet Table 14.2 with mitigations ($)	Restricted Discretionary consent outside Table 14.2 ($)
Farm Consultant	1000	1000	1000	1000
Site with farm system description				
Activity proposal – basic (Overseer)	4000	4000	4000	4000
Activity and proposal (Overseer plus additional options)	-	2500	2500	6000
Initial assessment against One Plan objectives, policies and rules	500	500	500	500
Assessment of environmental effects - local	1500	2500	-	-
Specialists				
• Planner			4000	4000
• Ecologist			4000	4000
• Hydrogeologicalist			4000	4000
Consent application fee	1200	2000	2000	2000 Plus $20-30,000 if notified

Total	$8,200	$12,500	$22,000	$25,500 Plus $20-30,000 if notified

Farmers are annually required to provide information to Horizons so that the Council can monitor their consent conditions. If farm consultants provide this for their clients the cost could be about $1500 per farm.

The costs for individual farmers obtaining a consent may be able to be reduced if the fertiliser companies and milk processing companies provide the base farm information and annual monitoring services for their clients. It may be that the owners of the Overseer Company decide not to introduce charging, and it may be possible for all the farms in a subzone to share a single environmental assessment. Industry groups may be able to provide templates for completing an assessment of mitigations not included in Overseer.

9. Discussion and Conclusions

There were six farm models developed in this study. The summarised results are shown in Figure 3. The figure is a graph of profit ($/ha) related to nitrogen leaching (kgN/ha). In the graph the lowest leaching farm in its initial state is the self-contained dairy farm. That farm has a profit of $1,627/ha and nitrogen leaching of 32 kgN/ha. The highest leaching farm is an irrigated highly intensive dairy farm with a profit of $2,456/ha and nitrogen leaching of 64 kgN/ha.

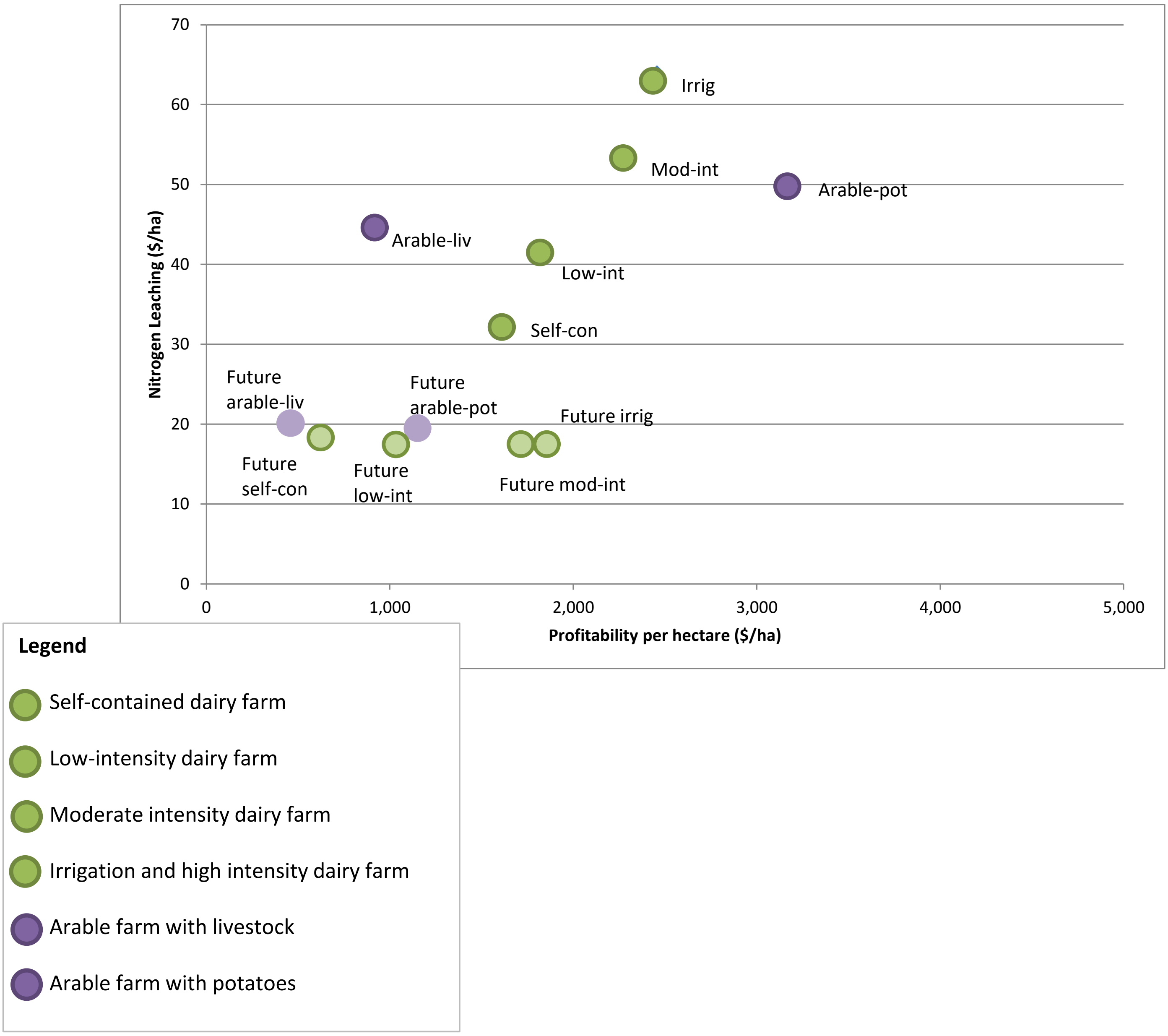
The graph also displays in striped colours where each of the farms moves towards after they have been adjusted to meet the requirements of Table 14.2. In that case, all the dairy farms on soils in the Tararua District are below 18 kgN/ha. Both the arable farms on soils in the Rangitikei District are below 20 kgN/ha.

The significance of these changes can be determined from how much they might affect the adaptability, the sustainability, and the viability of farms like these in the region. Their adaptability could be influenced by how much change in management intensity these farms require. The more intensive the management, the less opportunity there is for farmers to explore new ways of doing things. In this report, any farms that have to reduce the amount of labour they can employ and that have to increase pasture utilisation can be considered to be becoming less adaptable. Diversifying their product range can also increase the adaptability of farming systems.

The sustainability of the farm systems can be related to the efficiency with which they utilise available natural resources. In this report farms that are able to increase their nitrogen efficiency can be considered to be becoming more sustainable in their use of natural resources.

The viability of the farm businesses will be related to their profitability and their ability to service their debt and achieve sufficient return on investment to provide financial security for their owners.

Figure 3. A graphical representation of the model farms before and after they have been adjusted to meet the nitrogen caps in year 20 of Table 14.2 of the One Plan



Self-Contained dairy farm

This farm model has all the heifers grazed off the farm for 12 months from 9 months of age. It assumes that there has already been some adjustment to reducing its environmental footprint by grazing half the dairy cows off the farm over winter. Regular soil tests are taken and maintenance phosphate fertiliser is applied. A summer forage crop of turnips is grown to manage a possible risk of a dry summer. On average 30kg N/ha is applied in early spring and autumn to extend pasture production in those seasons.

To meet Table 14.2 in the One Plan, the farm has to reduce the number of dairy cows from 270 to 140 animals. It can no longer apply nitrogen fertiliser and must stop all cropping. The farm is expected to no longer bring in feed supplements for the cows. Instead it harvests 288 tonnes of pasture DM and sells most of this off the farm. The sale of surplus feed is a very important part of pasture management on this farm because animal consumption has dropped to almost 6,000 kgDM/ha/yr. Without harvesting surplus feed, the quality of the pasture would fall and in a few years pasture composition would suffer.

The farm started with leaching 32 kgN/ha and was modified to be leaching only 18 kgN/ha, a reduction of 44%. These changes reduced the expected farm profit from $1,627/ha to $629/ha, a drop of over 60%. The return on assets dropped from 5.3% to 2.0%.

The self-contained farm model has had to reduce its labour but it has surplus pasture available for alternative landuses, and therefore its adaptability might increase overall. Nitrogen conversion efficiency has increased to 66% and so it can be expected to be more sustainable in its use of natural resources. However, its profitability is not enough to support the level of debt found on many farms in this region. The return on assets is insufficient to attract off-farm investment, should that be required for future improvements. Unless farms like this have less than half the amount of debt as the model farm, they will not survive the changes required to address Table 14.2 .

Low-intensity dairy farm

The low-intensity dairy farm is very common in the Tararua District and in the region generally. In this model there are more cows and they have greater production than the self-contained farm. On this farm there is more supplementary feed (260 tonnes DM) brought onto the farm and greater use is made of cropping in both winter and summer. Over the whole farm more than 100 kgN/ha is applied, mainly to lengthen the grass growing season in spring and autumn.

To meet Table 14.2 in the One Plan, the farm has to reduce the number of cows from 400 to 250 animals. They will also need to reduce nitrogen fertiliser applications toan average of 5 kgN/ha/yr and stop importing supplementary feed and growing a winter crop. The summer crop remains, and 443 tonnes of DM are conserved. Three quarters of the conserved feed is sold off the farm to maintain pasture quality.

The farm started with leaching 42 kgN/ha and was modified to be leaching only 17 kgN/ha, a drop of 60%. These changes reduced the expected farm profit from $1,848/ha to $1,064/ha, a drop of over 40%. The return on assets dropped from 6.4% to 3.7%.

The low intensity farm model has not reduced its labour and it has surplus pasture available for alternative landuses. It's adaptability might increase overall. Nitrogen conversion efficiency has increased to 56% and so it can be expected to be more sustainable in its use of natural resources. However, its profitability is not enough to pay tax and support the level of debt found on many farms in this region. The return on assets is insufficient to attract off-farm investment, should that be required for future improvements. Unless farms like this can reduce the amount of debt below that of the model farm they will not survive the changes required to address Table 14.2 .

Moderate-intensity dairy farm

This farm has 600 cows and achieves high production. The farm imports 757 tonnes DM, grows winter and summer crops and applies an annual application of over 150 kgN/ha.

To achieve Table 14.2 in the One Plan this farm has a covered barn installed for all the cows so that they can be housed all year. Although inside for much of the time, the cows are grazed outside for fixed periods throughout the year – 8 hours per day while lactating and 2 hours per day over winter. The farm imports the same amount of supplementary feed as it did previously and harvests another

38 tonne of supplements to maintain production. Dairy effluent is applied across the whole of the milking platform and nitrogen fertiliser applications reduced to 50 kgN/ha.

The farm started with leaching 54 kgN/ha and was modified to be leaching only 17 kgN/ha, a drop of almost 70%. These changes reduced the expected farm profit from $2,283 /ha to $1,745/ha, a drop of almost 25%. The return on assets dropped from 7.0% to 5.0%.

The moderate intensity farm model has not reduced its labour but it has had to increase its overall pasture utilisation. Its adaptability might therefore decrease overall. Nitrogen conversion efficiency only increases slightly to 27% and so there is not much improvement expected in the sustainable use of natural resources. However, the profitability of this farm is sufficient to support its expected level of debt and it has sufficient return on assets to provide financial security for its owners.

Irrigated high-intensity farm

The irrigated high intensity dairy farm in the base model has 640 cows and has a centre pivot irrigator and a feed pad. The farm imports 757 tones DM per year as a supplement or 1,180 kgDM/cow. It uses 187 kgN/ha of nitrogen a year.

To meet the requirements of Table 14.2 in the One Plan this farm has built housing for the cows so that they can be kept inside all year. The farm already had a feed pad and so the effluent system for housing the animals was already in place. While they are lactating, the cows are grazed outside for up to 8 hours per day. The amount of imported supplements on this farm is increased to 1,170 tonnes DM and 22 tonnes of supplements are made on the farm.

The farm started with leaching 64 kgN/ha and was modified to be leaching only 17 kgN/ha, a drop of over 70%. These changes reduced the expected farm profit from $2,456/ha to $1,850/ha, a drop of 25%. The return on assets dropped from 6.8% to 4.8%.

The irrigated high intensity farm model has not reduced its labour but it has had to increase its overall pasture utilisation. Its adaptability might therefore decrease overall. Nitrogen conversion efficiency only increases slightly to 28% and so there is not much improvement expected in the sustainable use of natural resources. However, the profitability of this farm is sufficient to support its expected level of debt and it has sufficient return on assets to provide financial security for its owners.

Arable farm with livestock

Both the arable farms are larger than the typical farms to be found in the Manawatu. Making them larger makes it easier to compare these farms with the dairy farms that have a similar size. This farm specialises in grain production over summer. It has been able to do that without irrigation. Half of the farm is used for growing barley and in winter it has been growing ryegrass for finishing livestock. The farm finishes lambs and heavy cattle over a 12 month period. Over the year 150 kgN/ha is applied to the cropping area or an average of 60 kgN/ha across the whole farm.

The changes required to meet Table 14.2 in the One Plan are to dispose of all the livestock and harvest as silage and hay the permanent pasture and ryegrass green crop. The area in barley had to be reduced from 100ha to 70 ha. Over a whole year 1,399 tonnes of pasture dry matter was made and exported from the farm.

The farm started with leaching 39 kgN/ha and was modified to be leaching only 24 kgN/ha, a drop of almost 40%. These changes decreased the expected farm profit from $915/ha to $477/ha, a decrease of 47%. The return on assets dropped from 2.6% to 1.3%.

The arable with livestock farm model has not reduced its labour but it has become dependent on the supplementary feed market. Its adaptability might therefore decrease overall. Nitrogen conversion efficiency has increased to 89% and so natural resource sustainability has also increased. The profitability of this arable farm is insufficient to support its expected level of debt and it has insufficient return on assets to provide much financial security for its owners.

Arable farm with potatoes

This model farm was again large for a cropping farm. This time there were no livestock and instead two different rotations were modelled. The second rotation of potatoes and brussels sprouts required a total application of 428 kgN/ha over a year. The other rotation of maize silage and winter oats for forage only needed 110 kgN/ha. Irrigation was used over summer on the potato crop and 500mm/yr was used.

The changes required for meeting Table 14.2 in the One Plan included reducing the amount of nitrogen fertiliser going on to the potato rotation (332 kgN/ha) and better timing fertiliser applications to align with crop requirements. A new rotation growing barley for grain was introduced to replace some of the area originally in a high nitrogen feeding crop (potatoes). To reduce drainage from excess irrigation a moisture probe was installed and a water budget put in place. This reduced the amount of water needed to 380mm/yr.

The farm started with leaching 60 kgN/ha and was modified to be leaching only 25 kgN/ha, a drop of almost 60%. These changes reduced the expected farm profit from $3,192/ha to $1,152/ha, a drop of over 64%. The return on assets dropped from 8.2% to 3.0%.

The arable with potato farm model has some reduction in casual labour and it has had to increase the range of crops being grown. Its adaptability might therefore increase overall. Nitrogen conversion efficiency has increased to 94%, a big improvement in the sustainable use of its natural resources. However, the profitability of this farm is insufficient to support its expected level of debt and it has insufficient return on assets to provide financial security for its owners.

Future farming systems

It is likely that the farming systems described here will be greatly modified after their first few years under consented conditions. It is likely that dairy farms with cows grazing outside all year will develop contracts for supplying surplus supplementary feed to other farmers with their cows housed indoors. The housed cow farmers are likely to expand the size of their operations until constrained by the efficiency of their effluent systems and the maximum loading of effluent that they are able to apply to land.

Some farmers may choose to winter some dairy cows on what would otherwise be arable farms growing grain. These farmers will need to use well designed stand-off pads to minimise the leaching of nitrogen over the winter months.

Consent Applications

The model farms above have been developed to show how these farms could be adapted to meet the nitrogen caps in Table 14.2 of the One Plan. They may need a number of years to put all the identified mitigations in place, in which case they will need to apply for a restricted consent to enable them to operate outside Table 14.2 over a transition period.

10. Assumptions, Limitations and Further Work

I have written this report in a style that is without references. The conclusions are evidenced based from a number of sources, using the information contained within the reported material, the client information held in company databases owned by KapAg Ltd, BakerAg Ltd and RD Consulting and the experience of the author. In addition, some of the costs used in this report were sourced from Dairy Base a national database of dairy farm physical and financial performance.

Further information about the author's experience is contained on the KapAg website listed under further reading.

At the time of preparing this report the costs of the consenting process were drawn from those associated with the processing of existing consents and estimates based on possible future requirements. A process for making an Assessment of Environmental Effects (AEE) had not been suggested by staff at Horizons. For this study it was assumed that the AEE could be carried out by a suitably qualified farm consultant that had received additional training from NIWA to be able to use the extended Stream Health Monitoring and Assessment Kit – ESHMAK. If there was a surface waterway available, the most significant of these on each property would be measured at two points along it. The results of the waterway assessment would be included in the AEE describing the effects of the farming activities on Table B1 values and Table E2 targets. These results in the AEE would be conveyed in narrative farm using numeric scores from the ESHMAK where these were available.

The nutrient budgeting software – Overseer, is currently available 'free' to registered users. In this report a cost is assumed. The Farmax ® charging policy has been used, that is: $200 per farm and unlimited scenarios per farm. If a farm system has significant changes made a new charge would be generated and three 'farms' have been used in the costing section of this report.

This report has not considered all the combinations of farm systems and nitrogen loss rates in the region but the results should still be indicative of the likely ranges of these. While the author has made full use of the information available at the time, this report can undoubtedly be enhanced by further input from industry experts.

11. Further Reading

Dairybase web site: https://www.dairynz.co.nz/business/dairybase/

DairyNZ 2010. Facts and Figures: For New Zealand dairy farmers

Denzin NK (Ed), 2009. Sociological Methods: A Sourcebook. Transaction Publishers, New Jersey.

Denzin NK and Giardina MD (Eds), 2008. Qualitative Inquiry and the Politics of Evidence. Left Coast Press Incorporated, California.

Farmax web site: http://www.farmax.co.nz/

KapAg Ltd web site: http://kapag.nz/

Overseer web site: https://www.overseer.org.nz/

Parminter TG, 2013. Of my own free will: voluntary approaches to environmental policy. LAP Lambert Academic Publishing, Germany.

Parminter TG and Grinter J 2016. Farm-scale Modelling Report: Ruamāhanga Whaitua Collaborative Modelling Project. Ministry for Primary Industries, Wellington, New Zealand.

Waikato Regional Council. Menus of practices to improve water quality: https://www.waikatoregion.govt.nz/community/your-community/for-farmers/healthy-farms/farm-menus

12. Appendix A. Glossary

Table 14.2 sets the nitrogen caps for farmers and growers operating in the Manawatu Wanganui Region.

Nitrogen caps for intensively farmed land, from Section 14.3 of the One Plan

Period (from the year that the rule has legal effect)	LUC I	LUC II	LUC III	LUC IV	LUC V	LUC VI	LUC VII	LUC VIII
Year 1	30	27	24	18	16	15	8	2
Year 5	27	25	21	16	13	10	6	2
Year 10	26	22	19	14	13	10	6	2
Year 20	25	21	18	13	12	10	6	2

Model Farm: Self-contained farm. The farm is described as self-contained although to start with there is some feed imported and some cows are grazed off the farm for two months over winter. Milk production in this model is not dependent on imported feed. Although clearly a system II farm, it approaches the type 1 system defined by the industry.

Model Farm: Low intensity. This farm is described as low intensity because it has a low level of imported feed. It fits a system II farm although it does support the lactation over summer and autumn with supplements and a summer crop.

Model Farm: Moderate intensity. This farm imports feed to support lactating cows and grazes dry cows off during the winter. The farm was considered to be a system IV farm.

Model Farm: High intensity. This farm feeds supplements to the cows through most of the year.

13. Appendix B. Project Brief

The following are abridged selections from the project brief supplied by email on the 6th June 2017. "Horizons Policy and Regulatory teams are undertaking a review of the policy and rule framework for nutrient management and intensive landuse provisions.

This work is required to address the need for applications to contain fuller assessments of environmental effects, including cumulative effects which consider impacts on the wider catchment. Consideration must also be given to all of the relevant objectives and policies in the One Plan, as well as, the capacity to maintain or enhance Schedule B values and Schedule E targets.

Additionally, the consent must contain an assessment against the objectives and policies of the National Policy Statement for Freshwater Management, … section 105 of the RMA, and the National Environmental Standard for Sources of Human Drinking Water.

It is important for Council to understand all issues of cost and practicability in respect of consenting requirements for intensive land use activities. To this end, Council wishes to obtain advice through assessing the on-farm economic impacts on future consent applicants to compile, lodge and implement a land use consent for intensive agriculture or horticulture in the target catchments which fully address effects , and fully addresses the relevant objectives, policies, rules, schedules of the One Plan and the provisions of other relevant legislation.

The purpose of this study is to calculate the costs associated with applications for intensive farming land use activities and the economic impact of mitigations to reduce nitrogen leaching likely to be incurred as a result of the recommended improvements to the consenting process."

14. Appendix C. Farming practices introduced to the Livestock Farms

Remove winter applications of nitrogen (May to July inclusive)

Farmers apply nitrogen fertiliser in winter (typically May or late July) if they have insufficient feed and if conditions are suitable. Only the high intensity farm with irrigation applied nitrogen during this time and these applications have been removed as a mitigation.

Reduce nitrogen to a maximum of 100kg/ha/yr

Although the extra feed grown may be needed to support a farming system, reducing the amount of nitrogen fertiliser applied through a year reduces the amount of nitrogen leached. This was applied across all farms as a mitigation. As nitrogen fertiliser is decreased, so is the amount of pasture grown which requires either a decrease in stocking rate or a decrease in per cow performance.

Aggressive summer culling of cows

Removing cull cows in Autumn (around March) when the non-pregnant (empty cows) are known, reduces feed demand during a time when feed may be limiting. The reduced numbers also reduces nitrogen leaching. This was applied across all farms.

Replace high protein feed with a low protein feed

Replacing high protein feeds (nitrogen boosted pasture, high quality grass silage) with a low protein feed (starch based grains, maize silage) reduces urinary nitrogen and therefore decreases nitrogen leaching. The low protein feeds have to be 'imported' onto farms to replace the 'homegrown' feeds and they generally cost more to purchase. This change was applied to the moderate intensity and the high intensity with irrigation farms as a mitigation.

Spread effluent to reduce rates to 100kgN/ha

Reducing effluent nitrogen loadings from the consented 150 kgN/ha towards 100 kgN/ha application generally leads to a reduction to nitrogen leaching. This was applied to the self-contained farm and the low intensity farm. However, this was unable to be implemented on the other two farms because they had insufficient area available. This is due to the high effluent loading created with cows in a barn and higher rates of effluent nitrogen applied over the farms. On the two more intensive farms the effluent areas had to be increased to 85% of the farm to meet the consented 150kgN/ha N limit.

Remove all nitrogen fertiliser and export surplus feed

Reducing or eliminating nitrogen fertiliser reduces nitrogen leaching. However, as discussed, it also reduces grass growth and therefore stocking rate has to be reduced accordingly. This was applied as a mitigation to the self-contained and low intensity farms.

Export surplus feed

Where farms are forced to reduce stocking rate to meet nitrogen leaching limits, pasture demand is also reduced. Uneaten surplus pasture can lead to a decline in pasture quality and pasture species. To maintain pasture quality, silage or hay is made which can either be stored on farm, or sold off farm. In this report, unwanted surplus feed is sold off farm. This strategy was applied over the self-contained and low intensity farms.

Optimise Irrigation

Optimising water efficiency and therefore minimising drainage through the soil profile reduces nitrogen leaching. This mitigation was only applicable and applied to the high intensity farm with irrigation and the arable farm with potatoes.

Winter cows off the farm

Grazing dry cows off the farm during winter is a significant nitrogen mitigation, assuming that cows are grazed outside catchment. This mitigation was applied to the self-contained and low intensity farms.

Reduce cow numbers and bring grazed off heifer's home to replace cows

Reducing lactating cow numbers and replacing them with heifers reduces stocking rates and the cost of off-farm grazing. This is a nitrogen leaching mitigation was applied to the self-contained and low intensity farms.

Reduce Overall Stocking Rate

Reducing overall stocking rate is a significant nitrogen mitigation. This was implemented on the self-contained and low intensity farms to a major degree. Farmers with housed cows are able to adjust their effective stocking rate through controlling the duration of time that their cows are grazing outside. Because of this there was only a minor decrease required in stocking rate on the moderate intensity and high intensity with irrigation farms.

Use a standoff pad in wet winter weather

This mitigation enables cows to be held off paddocks for significant time during the winter and when it is wet. This prevents pugging and captures urinary nitrogen for treatment through a farm effluent system. This mitigation was applied to the moderate intensity and high intensity with irrigation farms.

Build a covered feed pad/ area

This mitigation enables supplementary feeds to be fed to cows when off paddocks. Feed pads are typically made of concrete. They are suitable to feed cows on, but are not suitable for stand cows on for long periods of time. This mitigation was applied to the rate on the moderate intensity and high intensity with irrigation farms.

Housed cows with duration controlled grazing

This mitigation allows cows to graze on pasture for short periods and then be kept in a barn with a soft litter area during the times of the year when the risks of urinary nitrogen leaching are high. During this time they may also have access to supplements fed on a concrete apron. In the modelled farm systems they grazed on pastures for eight hours per day in February, March, April and May, two hours in June and July and twelve hours in August. As a purpose-built barn it combines the "use a standoff pad in wet weather" and "a covered feed pad" during lactation.

Effluent from the housed cows is captured and along with bedding material is applied to paddocks during low risk periods of nitrogen leaching. This mitigation has been applied to the moderate intensity and high intensity with irrigation farms.

15. Appendix D. Farming Practices on Arable Farms

Minimal tillage

Minimal tillage and direct drilling are used to reduce the amount of cultivation applied between crops. The reduced cultivation reduces farm costs and nitrogen leaching from organic matter breakdown in the soil. In the arable models conventional tillage was used to cultivate pasture in both the base and modified models and minimal tillage between crops.

Minimal nitrogen applications

Nitrogen applications can be reduced to replace the amount of nitrogen being removed in produce and losses incurred during crop growing. There was limited ability to reduce applications in the model base farms although some reduction was applied to the arable with potatoes model.

Nitrogen fertiliser applied in side dressings

Nitrogen fertiliser can be applied to horticultural crops as side-dressings near the plant roots to improve uptake efficiency. This was not possible to model in Overseer but was assumed to be applicable on the arable farm with potatoes.

Spread nitrogen applications

Instead of applying nitrogen fertiliser in one dressing at heavy rates (over 45 kgN/ha) leaching will be reduced if the same amount of fertiliser is spread over a number of weeks or even months. There is limited ability to model this in Overseer, but both arable farms had large applications split over more than one month.

Bunding to capture runoff

There are advantages on bare ground of capturing stormwater to hold back sediment, nutrients and pathogens. On both arable farms bunds were assumed to be put in place, reducing the cultivatable area for cropping.

Active water management

To reduce annual water use on the modelled arable-with-potatoes farm a moisture probe was introduced to monitor soil moisture and establish a water budget. Using a water budget reduces water use to calculated deficits and reduces nutrient losses.

Reduce fallow

Fallow periods of bare soil increase nitrogen leaching. By using a cover crop, when the land is next cultivated, surplus nitrogen is captured and returned to the soil in organic matter.

Remove livestock

Livestock on arable farms concentrate nitrogen when they urinate in patches. Removing livestock reduces this source of nitrogen leaching.

Export green crops

Harvesting green crops captures the nitrogen they contain and enables surplus to be exported off the farm. It is better than grazing with livestock if the intention is to reduce nitrogen leaching.

Reduce the area of heavy nitrogen feeding crops

Crops that have a high proportion of their biomass harvested have a high requirement for nitrogen fertiliser and so increased nitrogen losses. Replacing heavy nitrogen feeders with grain crops reduces nitrogen requirements and nitrogen losses. The arable-with-potato farm had a proportion of potatoes replaced with barley.

16. Appendix E. A summary of Commodity and Service Prices

Dairy	**Amount**	**Notes**
Milk solids payout (kg MS)	$6.00	
Dividend	$0.40	Assumes fully shared up Fonterra suppliers
Management fee	$75,000 pa	Owners wage of management
Senior farm staff	$60 - $75,000 pa	2IC – farm manager
Farm hand	$50,000 pa	
Fertiliser Phosphate	$3.70 / kgP	High analysis fertiliser on arable farms used cost price
Fertiliser potash	$1.50 / kgK	As above
Fertiliser Nitrogen (Urea)	$700 / T incl spreading	As above
Off farm grazing - weaners	$5 / head / week	
Off farm grazing – Rising 1yr May to May	$8.50 / head / week	
Off farm grazing – winter mixed age cows	$27 / head / week incl transport	
Feed Prices – PKE	$280 / T delivered	
Pasture Silage Imported	$250 / TDM	
Maize Silage Imported	$320 / TDM	
Barley Grain	$400 / TDM	
Hay	$85 / bale delivered	
Sale Price of Exported Pasture Silage	$150 / TDM	

Arable Farms	Sale Price / T	Crop Cost $ / ha
Barley price	$333 / T	$1,344 / ha
Pasture silage	$150 / TDM	NA
Oat Silage	$150 / TDM	$500 / ha
Maize silage	$240 / TDM	$2,400 / ha
Potatoes	$300 / T	$9,519 / ha
Brussel Sprouts	$385.70	$3,456 / ha
	Sale Price	Purchase Price
Finished lambs (average)	$6.60 / kg cw	$2.87 kg lw
Store cattle (average)	$2.87 / kg LW	$3.71 / kg lw
Finished cattle (average)	$5.73 / kg cw	$3.71 / kg lw

Other	
Farm consultants	$150/hr
Technical specialists	$250/hr
Council staff	$100/hr
Interest rate on annuity for additional capital requirements	7%

17. Appendix F. Costs of Housing Dairy Cows

The following costs were used to estimate the costs of housing dairy cows.

Items Included	$/cow	$/550 cows	$/630 cows
Plastic covered shelter	500	275,000	315000
8m^2 per cow			
Redpath NZ			
Earthworks, bedding and concrete feed lanes (covered)	300	165,000	189,000
Solids bunker	55	30,250	34,650
Effluent system – main line, pump, hydrants, irrigator		100,000	100,000
Pond for additional solids[1]		70,000	-
Total per farm		640,250	638,650
Total per cow ($)		1,164	1,014

1. This is already in place for farm dairy effluent and the feed pad on Farm IV.

18. Appendix G. Farming system information for the Self-contained Dairy Farm

The following are screen shots from Farmax Dairy for this farm.

Physical Summary

Category	Description	Value	Units
Farm	Effective Area	120	ha
	Stocking Rate	2.3	cows/ha
	Comparative Stocking Rate	87.0	kg Lwt/t DM offered
	Potential Pasture Growth	11.1	t DM/ha
	Nitrogen Use	32	kg N/ha
	Feed Conversion Efficiency (offered)	15.1	kg DM offered/kg MS
Herd	Cow Numbers (1st July)	280	cows
	Peak Cows Milked	275	cows
	Days in Milk	256	days
	Avg. BCS at calving	4.6	BCS
	Liveweight	949	kg/ha
Production	Milk Solids total	86,800	kg
(to Factory)	Milk Solids per ha	723	kg/ha
	Milk Solids per cow	316	kg/cow
	Peak Milk Solids production	1.61	kg/cow/day
	Milk Solids as % of live weight	76.3	%
Feeding	Pasture Offered per cow *	4.0	t DM/cow
	Supplements Offered per cow *	0.5	t DM/cow
	Off-farm Grazing Offered per cow *	0.3	t DM/cow
	Total Feed Offered per cow *	4.8	t DM/cow
	Pasture Offered per ha	9.6	t DM/ha
	Supplements Offered per ha	1.2	t DM/ha
	Off-farm Grazing Offered per ha	1.9	t DM/ha
	Total Feed Offered per ha	12.7	t DM/ha
	Supplements and Grazing / Feed Offered *	16.6	%
	Bought Feed / Feed Offered *	3.7	%

Pasture Supply

Month	Potential Growth	Adjust for Crop Area	Nitrogen Boost	kg DM/ha/day Potential + N	Loss of Potential	Decay	Net Growth
Jun 17	16.0	0.0	0.0	16.0	0.8	2.7	12.4
Jul 17	13.0	0.0	0.0	13.0	0.8	1.6	10.6
Aug 17	22.0	0.0	2.4	24.4	1.5	0.0	22.9
Sep 17	34.0	0.0	3.4	37.4	2.1	0.0	35.3
Oct 17	46.0	0.0	0.7	46.7	3.4	0.0	43.3
Nov 17	55.0	0.0	0.9	55.9	9.4	0.0	46.5
Dec 17	42.0	0.0	0.8	42.8	2.8	0.0	40.0
Jan 18	25.0	0.0	1.2	26.2	1.7	0.0	24.5
Feb 18	25.0	0.0	0.9	25.9	1.8	0.9	23.1
Mar 18	29.0	0.0	0.6	29.6	1.6	0.2	27.7
Apr 18	35.0	0.0	3.0	38.0	1.9	0.0	36.1
May 18	22.0	0.0	3.2	25.2	1.3	2.6	21.3
Total (kg DM/ha)	**11,069**	**0**	**516**	**11,585**	**884**	**245**	**10,456**

Feed Supply and Demand

Month	Supply kg DM Daily/ha (grazing)					Demand kg DM Daily/ha (grazing)				Difference
	Pasture Net Growth	Crop Adjustment	Supplements	Utilisation Waste	Total	Pasture	Supplements	Deficit	Total	
Jun 17	12.4		2.3	2.3	12.4	7.2	1.8		9.0	3.4
Jul 17	10.6		2.6	2.3	10.8	7.3	2.0		9.3	1.4
Aug 17	22.9		4.0	5.7	21.2	20.6	3.5		24.1	-2.9
Sep 17	35.3		2.7	3.4	34.6	29.8	2.6		32.4	2.2
Oct 17	43.3		2.4	4.2	41.5	37.4	2.4		39.8	1.7
Nov 17	46.5			2.3	44.2	42.8			42.8	1.4
Dec 17	40.0	0.0		1.9	38.1	35.3			35.3	2.8
Jan 18	24.5		2.3	2.1	24.7	33.1	2.0		35.0	-10.3
Feb 18	23.1		9.3	3.0	29.4	26.4	7.7		34.1	-4.6
Mar 18	27.7		9.1	2.9	33.9	25.6	7.5		33.1	0.8
Apr 18	36.1		5.9	2.7	39.3	23.3	4.4		27.7	11.6
May 18	21.3		2.5	4.4	19.4	21.6	1.9		23.5	-4.1
Average	**28.6**	**0.0**	**3.5**	**3.1**	**29.1**	**25.9**	**2.9**	**0.0**	**28.8**	**0.3**
Total	**10,456**	**-1**	**1,295**	**1,132**	**10,617**	**9,440**	**1,076**	**0**	**10,515**	**102**

Pasture Quality

Month	kgDM/ha (end of month) Green	Dead	Stem	Total	Total Cover MJME/kgDM
Start	1,706	246		1,951	11.1
Jun 17	1,899	156		2,055	11.4
Jul 17	1,994	105		2,099	11.7
Aug 17	1,908	100		2,008	11.8
Sep 17	1,921	154		2,075	11.3
Oct 17	1,812	213	103	2,128	10.7
Nov 17	1,684	217	270	2,171	10.4
Dec 17	1,556	318	270	2,144	10.1
Jan 18	1,276	409	138	1,823	9.9
Feb 18	1,226	424	44	1,693	9.7
Mar 18	1,331	388		1,719	9.9
Apr 18	1,703	363		2,067	10.3
May 18	1,695	244		1,940	10.8

Landuse

Month	Area (ha)					
	Pasture - N	Pasture + N	Feed Crop	Cash Crop	Conservation	Total
Jun 17	120.0					120.0
Jul 17	120.0					120.0
Aug 17	27.7	92.3				120.0
Sep 17		120.0				120.0
Oct 17	88.8	18.1	2.1		11.0	120.0
Nov 17	74.2	19.8	6.0		20.0	120.0
Dec 17	92.9	19.2	6.0		1.9	120.0
Jan 18	89.3	24.7	6.0			120.0
Feb 18	95.8	18.2	6.0			120.0
Mar 18	97.0	17.0	6.0			120.0
Apr 18	3.8	110.2	6.0			120.0
May 18		114.0	6.0			120.0
Average	**66.3**	**47.3**	**3.7**	**0.0**	**2.7**	**120.0**

The column 'Pasture-N' takes into account the nitrogen being returned in applied dairy effluent

Supplements

Supplement	Units	Open	Buy	Produce	Sell	Feed	Close
Hay big Bought	big bales		125.3			125.3	
Calf Meal	tonnes		2.0			2.0	
Bulb Turnip	tonnes DM			60.0		54.5	5.5
Pasture Silage	tonnes DM			50.0		44.6	5.4
Total Feed	**tonnes**	**0.0**	**35.8**	**110.0**	**0.0**	**134.9**	**10.9**
Total DM	**tonnes DM**	**0.0**	**30.5**	**110.0**	**0.0**	**129.6**	**10.9**

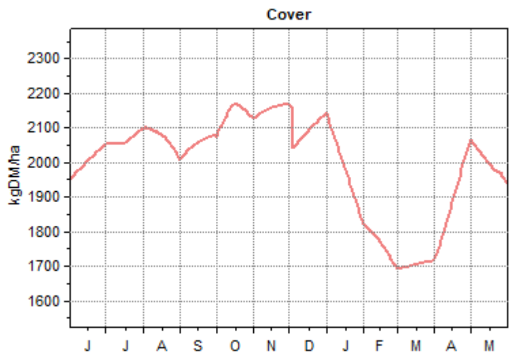
Annual Livestock Reconciliation

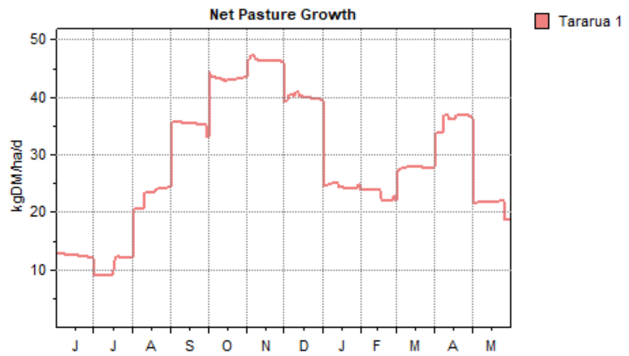
Stock Class	Open	Aged Out	Aged In	Wean	Die	Buy	Sell	Tr.In	Tr.Out	Close
Heifer Calf		59								
R1 Heifer	59	59	59							59
R2 Heifer			59						59	59
Cow	221				6		53	59		221
Bull								8	8	
Mixed Calves							219			
Total	**280**	**118**	**118**		**6**		**272**	**67**	**67**	**339**

Monthly Livestock Reconciliation

(end of month)	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Heifer Calf		10	59	59	59	59	59					
R1 Heifer	59							59	59	59	59	59
R2 Heifer		59	59	59	59	59	59	59	59	59	59	59
Cow	280	280	278	275	270	270	265	265	260	225	222	221
Bull						8	8					
Mixed Calves		6	18	3								
Total	**339**	**355**	**414**	**396**	**388**	**396**	**391**	**383**	**378**	**343**	**340**	**339**

Pasture Cover





		Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Cover	(kg DM/ha)	2,055	2,099	2,008	2,075	2,128	2,171	2,144	1,823	1,693	1,719	2,067	1,940
Net Pasture Growth	(kg DM/ha/d)	12.4	10.6	22.9	35.3	43.3	46.5	40.0	24.5	23.1	27.7	36.1	21.3
Demand	(kg DM/ha/d)	9.0	9.3	24.1	32.4	39.3	42.8	35.2	35.0	34.1	33.1	27.7	23.5

KPIs	**Milk Solids**			**BCS**	**Operating Profit**	
	kg Total	**kg/ha**	**kg/cow**	**31 May 18**	**$ Total**	**$/ha**
	86,800	723	452	4.27	200,460	1,671

Pasture Silage and Fodder Crops

Pasture Silage
Block 1

Name	Pasture Silage	Yield	2.5 tonnes DM/ha
Feed Type	Pasture Silage	Total Yield	50 tonnes DM
Area	20.0 ha	Dry Matter	100 %
Date In	15 Oct 17	**Model**	
Date Out	03 Dec 17	Crop Cost $	7000
Days	50	Regrassing $	0
		Total Cost $	7000
Comment:			

Bulb Turnip
Block 1

Name	Bulb Turnip	Yield	10.0 tonnes DM/ha
Feed Type	Bulb Turnip	Total Yield	60 tonnes DM
Area	6.0 ha	Dry Matter	100 %
Date In	21 Oct 17	**Model**	
Date Out	31 May 18	Crop Cost $	4500
Days	223	Regrassing $	3600
Followed by	New Pasture	Total Cost $	8100
Comment:			

Nitrogen Fertiliser

Nitrogen
Block 1

Name	Nitrogen	Area	120.0 ha
Date	10 Aug 17	Block Area	120.0 ha
Rate	15 kgN/ha	Total Amount	1800 kgN
		☑ Cost Applies	
Response	10 kgDM/kgN	**Model**	
Duration	50 days	Total Cost $	2736
Comment:			

Management Events

Cows

- 19 Oct 16 Mate 221
- 01 Jun 17 Open 221
- 01 Jun 17 Tfr In 59
- 01 Jun 17 Send Off 145
- 01 Aug 17 Bring Back 145
- 16 Aug 17 Died 2
- 16 Sep 17 Died 2
- 30 Sep 17 Sell 1
- 16 Oct 17 Died 1
- 26 Oct 17 Mate 274
- 31 Oct 17 Sell 4
- 31 Dec 17 Sell 5
- 28 Feb 18 Sell 5
- 31 Mar 18 Sell 35
- 30 Apr 18 Sell 3
- 16 May 18 Died 1
- 21 May 18 Dry Off 221
- 31 May 18 Close 221

2yr Heifers

- 19 Oct 16 Mate 59
- 01 Jun 17 Open 59
- 01 Jun 17 Tfr Out 59
- 21 Apr 18 Reduce 0
- 21 May 18 Dry Off 0
- 31 May 18 Close 0

1yr Heifers

- 01 Jun 17 Open 59
- 01 Jun 17 Send Off 59
- 19 Oct 17 Mate 59
- 01 May 18 Bring Back 59
- 31 May 18 Close 59

Heifer Calves

- 01 Jun 17 Open 0
- 31 Jul 17 Born 10
- 10 Aug 17 Born 33
- 20 Aug 17 Born 16
- 01 May 18 Send Off 59
- 31 May 18 Close 59

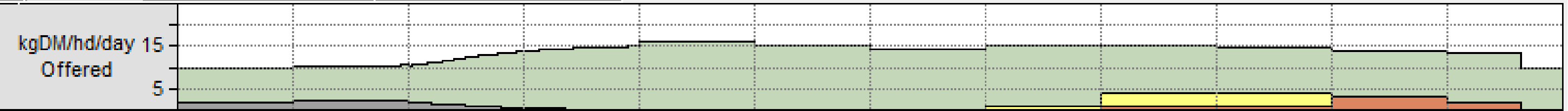
Bulls

- 01 Jun 17 Open 0
- 16 Nov 17 Tfr In 8
- 16 Jan 18 Tfr Out 8
- 31 May 18 Close 0

Bobby Calves

- 01 Jun 17 Open 0
- 31 Jul 17 Born 10
- 31 Jul 17 Sell 4
- 10 Aug 17 Born 32
- 10 Aug 17 Sell 24
- 20 Aug 17 Born 55
- 20 Aug 17 Sell 42
- 31 Aug 17 Born 51
- 31 Aug 17 Sell 60
- 10 Sep 17 Born 34
- 10 Sep 17 Sell 41
- 20 Sep 17 Born 24
- 20 Sep 17 Sell 27
- 30 Sep 17 Born 12
- 30 Sep 17 Sell 17
- 10 Oct 17 Born 1
- 10 Oct 17 Sell 4
- 31 May 18 Close 0

Animal Performance – Milkers



Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture	8.0	8.1	11.1	14.3	16.0	15.0	14.5	14.0	11.0	10.7	11.0	10.8
Hay big Bought	2.0	2.3	1.1	0.2								
Bulb Turnip								1.0	3.0	3.0		
Pasture Silage									1.0	1.0	3.0	1.3
Total (Utilised)	8.0	8.3	9.8	13.1	14.4	14.3	13.8	14.1	13.8	13.5	12.7	10.1
Pasture (diet) MJME/kgDM	11.6	11.9	12.0	11.6	11.2	11.1	11.0	10.8	10.6	10.6	10.9	11.2
Pasture Utilisation %	80	80	80	90	90	95	95	95	95	95	95	85

Production

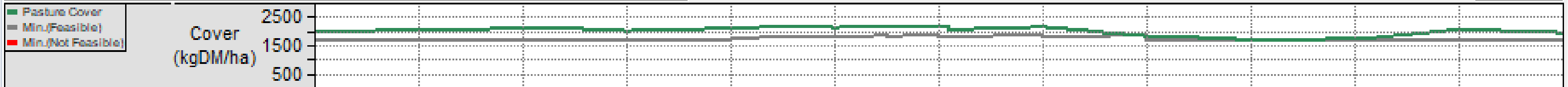
Print | All | Milkers | Dries

MS | BCS | Lwt

	Start	J	J	A	S	O	N	D	J	F	M	A	M
MS (kg/hd/d)			0.00	0.55	1.45	1.60	1.51	1.36	1.22	1.03	0.92	0.83	0.41
BCS	4.1	4.5	4.6	4.4	4.1	3.9	3.9	3.8	3.9	3.9	4.1	4.1	4.3
Lwt (kg)	454	472	488	449	427	423	422	422	425	430	440	446	458

Pasture Cover

Print | Smooth Minimum | Calibrate Pasture… | Hide



(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	1,951	2,055	2,099	2,008	2,075	2,128	2,171	2,144	1,823	1,693	1,719	2,067	1,940
Minimum	1,285	1,226	1,211	1,194	1,548	1,819	1,852	1,863	1,841	1,408	1,389	1,545	1,628
Potential Pasture Growth (kgDM/ha/d)		16	13	22	34	46	55	42	25	25	29	35	22

Animal Performance – dry cows

kgDM/hd/day Offered

Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M	M	M
Pasture	8.0	8.0	8.0	8.0								10.0	10.0	10.0
Hay big Bought	2.0	2.3	2.0	2.0										
Bulb Turnip														
Pasture Silage														
Total (Utilised)	8.0	8.2	8.0	8.8								8.5	8.5	8.5

Production

Print | All | Milkers | Dries

MS | BCS | Lwt

Milk Solids (kg/hd/d)

	Start	J	J	A	S	O	N	D	J	F	M	A	M	M	M
MS (kg/hd/d)															
BCS	4.1	4.5	4.6	4.7	4.1										4.3
Lwt (kg)	454	472	493	511	497										458

Pasture Cover

Print | Smooth Minimum | Calibrate Pasture... | Hide

Pasture Cover / Min.(Feasible) / Min.(Not Feasible)

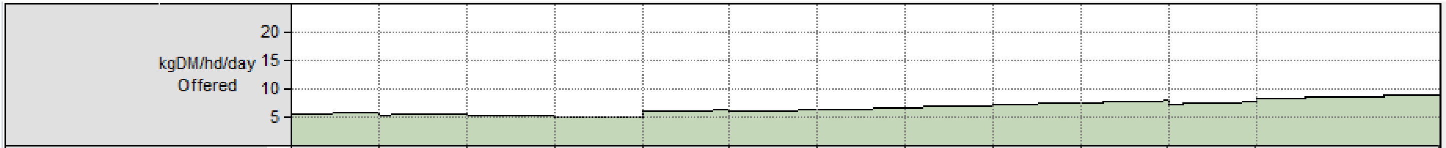
Cover (kgDM/ha)

(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M	M	M
Pasture Cover	1,951	2,055	2,099	2,008	2,075	2,128	2,171	2,144	1,823	1,693	1,719	2,067	2,022	1,978	1,940
Minimum	1,285	1,226	1,211	1,194	1,548	1,819	1,852	1,863	1,841	1,408	1,389	1,545	1,503	1,508	1,628
Potential Pasture Growth (kgDM/ha/d)		16	13	22	34	46	55	42	25	25	29	35	22	22	22

Performance - 2yr heifers

These are off-farm

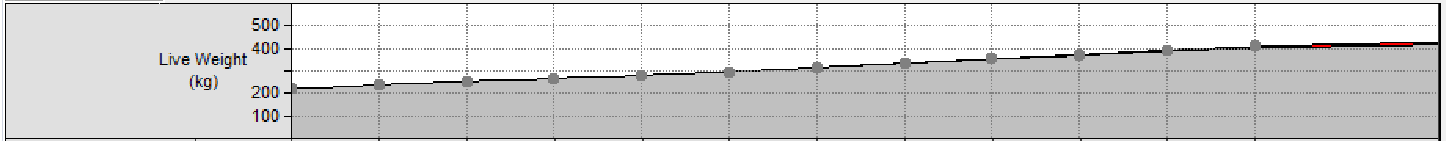
Performance – 1yr heifers



Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M		
Pasture	5.7	5.5	5.3	5.0	6.1	6.2	6.5	6.9	7.4	7.7	7.5	8.4	8.6	8.9
Total (Utilised)	4.5	4.4	4.2	4.5	5.5	5.9	6.2	6.5	7.0	7.3	7.1	7.2	7.3	7.5

Live Weight

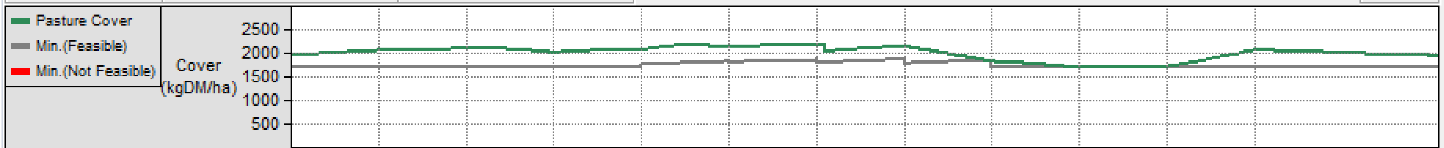
Print



	Start	J	J	A	S	O	N	D	J	F	M	A	M		
BWG (kg/d)		0.6	0.5	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
Lwt (kg)	220	238	253	266	278	296	315	334	353	371	392	409	415	422	429

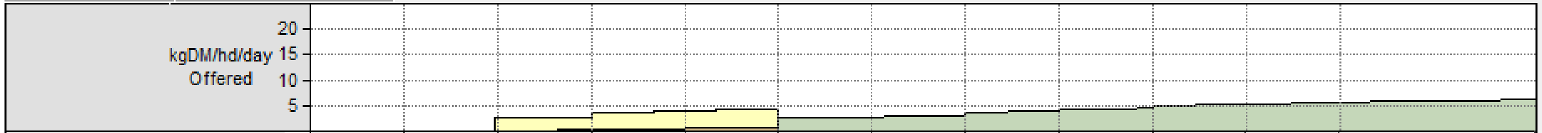
Pasture Cover

Print | Smooth Minimum | Calibrate Pasture… | Hide



(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M		
Pasture Cover	1,951	2,055	2,099	2,008	2,075	2,128	2,171	2,144	1,823	1,693	1,719	2,067	2,022	1,978	1,940
Minimum	1,285	1,226	1,211	1,194	1,548	1,819	1,852	1,863	1,841	1,408	1,389	1,545	1,503	1,508	1,628
Potential Pasture Growth (kgDM/ha/d)		16	13	22	34	46	55	42	25	25	29	35	22	22	22

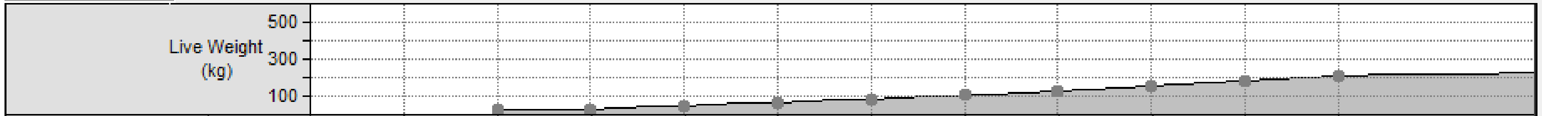
Performance - Calves



Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M	M	M
Pasture		0.0	0.0	0.0		2.6	2.9	3.8	4.3	5.0	5.4	5.8	6.0	6.1
Colostrum/Milk litres/h/d		2.6	2.6	3.4	3.7									
Calf Meal			0.1	0.3	0.6									
Milk Replacer litres/h/d														
Total (Utilised)						2.5	2.8	3.6	4.1	4.8	5.1	5.0	5.1	5.2

Live Weight

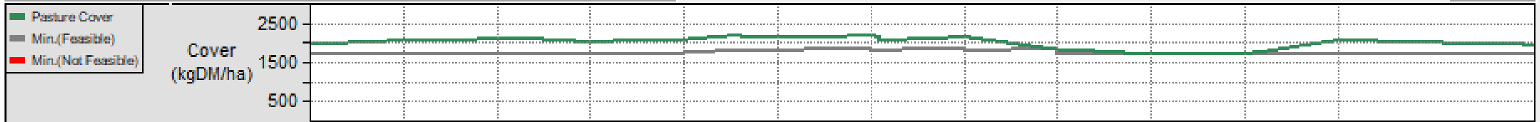
Print



	Start	J	J	A	S	O	N	D	J	F	M	A	M	M	M
BWG (kg/d)			0.4	0.4	0.6	0.6	0.6	0.6	0.8	0.8	0.9	0.9	0.8	0.8	0.8
Lwt (kg)			23	31	49	68	86	105	129	152	180	207	215	223	231

Pasture Cover

Print | Smooth Minimum | Calibrate Pasture... | Hide

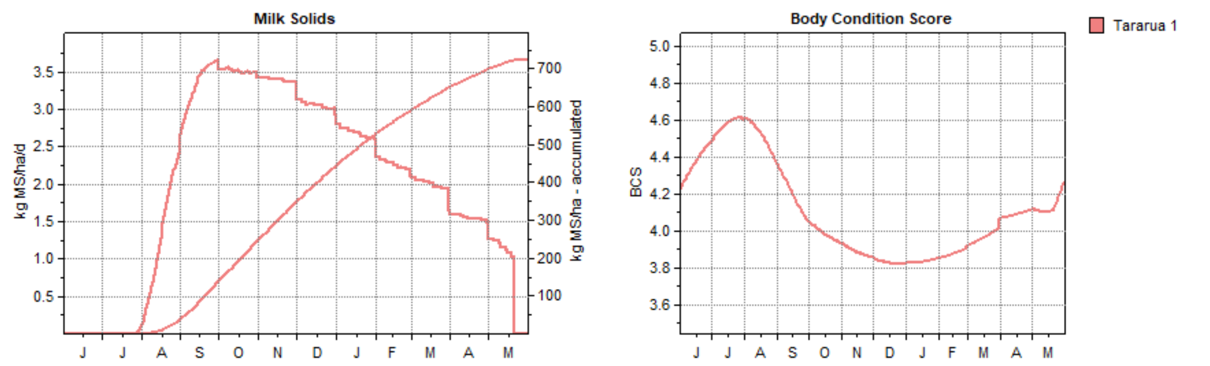


(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M	M	M
Pasture Cover	1,951	2,055	2,099	2,008	2,075	2,128	2,171	2,144	1,823	1,693	1,719	2,067	2,022	1,978	1,940
Minimum	1,285	1,226	1,211	1,194	1,548	1,819	1,852	1,863	1,841	1,408	1,389	1,545	1,503	1,508	1,628
Potential Pasture Growth (kgDM/ha/d)		16	13	22	34	46	55	42	25	25	29	35	22	22	22

Milk Production

Month	Milkers	Milk Solids kg Produced	Calves/Penicillin	to Factory
Jun 17				
Jul 17	1	22.9		22.9
Aug 17	100	4,778		4,778
Sep 17	241	12,048	56.7	11,991
Oct 17	274	13,601	562	13,039
Nov 17	270	12,208		12,208
Dec 17	270	11,343		11,343
Jan 18	265	10,004		10,004
Feb 18	265	7,604		7,604
Mar 18	259	7,421		7,421
Apr 18	225	5,582		5,582
May 18	143	2,805		2,805
Total	**275**	**87,418**	**618**	**86,800**

Milk Production Summary



		Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Milk Solids	(kg MS/ha/d)		0.01	1.28	3.33	3.51	3.39	3.05	2.69	2.26	1.99	1.55	0.75
Total Milk Solids	(kg MS/ha - accumulated)		0	40	140	249	350	445	528	592	653	700	723
Body Condition Score	(BCS - end of month)	4.5	4.6	4.4	4.1	3.9	3.9	3.8	3.9	3.9	4.1	4.1	4.3

Cow Sales

Date	To	Works Sales Number	Cwt kg	$ Per kg	$ Per hd	$ Total
30 Sep 17	Works	1	164	2.58	422.85	423
31 Oct 17	Works	4	181	2.66	480.46	1,922
31 Dec 17	Works	5	159	2.32	368.83	1,844
28 Feb 18	Works	5	148	2.09	308.55	1,543
31 Mar 18	Works	35	171	2.29	390.35	13,662
30 Apr 18	Works	3	202	2.33	470.58	1,412
[06 Mar 18]	**Total (Works Sales)**	**53**	**170**	**2.31**	**392.56**	**20,806**

Profit and Loss Account

			$ Total	$/ha	$/cow	$/kg MS
Revenue	Stock	Net Milk Sales - this season	555,518	4,629	2,057	6.40
		Net Milk Sales - last season	0	0	0	0.00
		Net Milk Sales - dividend	0	0	0	0.00
		Net Livestock Sales	25,822	215	96	0.30
		Contract Grazing	0	0	0	0.00
		Change in Livestock Value	0	0	0	0.00
		Total	**581,341**	**4,845**	**2,153**	**6.70**
	Crop & Feed	Capital Value Change	1,144	10	4	0.01
		Total	1,144	10	4	0.01
	Total Revenue		**582,485**	**4,854**	**2,157**	**6.71**
Expenses	Wages	Wages	20,000	167	74	0.23
		Management Wage	75,000	625	278	0.86
	Stock	Animal Health	21,330	178	79	0.25
		Breeding	14,310	119	53	0.16
		Farm Dairy	7,020	59	26	0.08
		Electricity	12,960	108	48	0.15
	Feed/Crop	Pasture Conserved	7,000	58	26	0.08
		Feed Crop	4,500	38	17	0.05
		Bought Feed	10,647	89	39	0.12
		Calf Feed	1,917	16	7	0.02
	Grazing	Grazing	54,505	454	202	0.63
	Other Farm Working	Fertiliser (Excl. N)	15,120	126	56	0.17
		Nitrogen	5,885	49	22	0.07
		Regrassing	3,600	30	13	0.04
		Weed & Pest Control	4,320	36	16	0.05
		Vehicle Expenses	15,720	131	58	0.18
		Fuel	9,360	78	35	0.11
		R&M Land/Buildings	25,680	214	95	0.30
		R&M Plant/Equipment	10,800	90	40	0.12
		Freight & Cartage	6,120	51	23	0.07
	Overheads	Administration Expenses	14,640	122	54	0.17
		Insurance	8,280	69	31	0.10
		ACC Levies	3,600	30	13	0.04
		Rates	14,760	123	55	0.17
	Total Farm Working Expenses		**367,075**	**3,059**	**1,360**	**4.23**
	Depreciation		14,950	125	55	0.17
	Total Farm Expenses		**382,025**	**3,184**	**1,415**	**4.40**
Economic Farm Surplus (EFS)			**200,460**	**1,671**	**742**	**2.31**
Farm Profit before Tax			**200,460**	**1,671**	**742**	**2.31**

Livestock Capital Values

Mob	Open					Close					Change
	Number	kg/hd	$/hd	$/kg	$ Total	Number	kg/hd	$/hd	$/kg	$ Total	$ Total
Cows	221	460	1,649	3.58	364,429	221	458	1,649	3.60	364,429	
2-Year Heifers	59	430	1,421	3.30	83,839						-83,839
1-Year Heifers	59	220	819	3.72	48,321	59	429	1,421	3.32	83,839	35,518
Heifer Calves						59	231	819	3.54	48,321	48,321
Total					**496,589**					**496,589**	**0**

19. Appendix H. Farming system information for the Low-intensity Dairy Farm

The following are screen shots from Farmax Dairy for this farm.

Physical Summary

Category	Description	Value	Units
Farm	Effective Area	200	ha
	Stocking Rate	2.0	cows/ha
	Comparative Stocking Rate	79.1	kg Lwt/t DM offered
	Potential Pasture Growth	10.6	t DM/ha
	Nitrogen Use	96	kg N/ha
	Feed Conversion Efficiency (offered)	14.6	kg DM offered/kg MS
Herd	Cow Numbers (1st July)	412	cows
	Peak Cows Milked	403	cows
	Days in Milk	254	days
	Avg. BCS at calving	4.7	BCS
	Liveweight	832	kg/ha
Production	Milk Solids total	144,322	kg
(to Factory)	Milk Solids per ha	722	kg/ha
	Milk Solids per cow	358	kg/cow
	Peak Milk Solids production	1.80	kg/cow/day
	Milk Solids as % of live weight	86.7	%
Feeding	Pasture Offered per cow *	4.0	t DM/cow
	Supplements Offered per cow *	1.2	t DM/cow
	Off-farm Grazing Offered per cow *	0.0	t DM/cow
	Total Feed Offered per cow *	5.2	t DM/cow
	Pasture Offered per ha	9.6	t DM/ha
	Supplements Offered per ha	2.6	t DM/ha
	Off-farm Grazing Offered per ha	0.0	t DM/ha
	Total Feed Offered per ha	12.1	t DM/ha
	Supplements and Grazing / Feed Offered *	22.5	%
	Bought Feed / Feed Offered *	11.6	%

Pasture Supply

Month	Potential Growth	Adjust for Crop Area	Nitrogen Boost	Potential + N (kg DM/ha/day)	Loss of Potential	Decay	Net Growth
Jun 17	14.5	0.2	0.0	14.7	0.9	3.2	10.6
Jul 17	11.7	0.2	0.0	11.9	0.6	1.7	9.6
Aug 17	21.0	0.1	3.5	24.6	1.2	0.0	23.4
Sep 17	33.5	0.1	7.9	41.4	2.9	0.0	38.6
Oct 17	44.5	0.2	2.9	47.6	5.2	0.0	42.4
Nov 17	52.5	0.7	0.5	53.7	11.3	0.0	42.5
Dec 17	41.0	0.3	7.5	48.8	5.4	0.0	43.4
Jan 18	24.3	0.2	9.8	34.2	3.6	0.0	30.6
Feb 18	23.8	0.2	0.6	24.5	1.5	1.6	21.3
Mar 18	28.0	0.1	0.5	28.6	1.4	1.4	25.8
Apr 18	33.8	0.1	5.3	39.2	2.0	0.0	37.2
May 18	21.5	0.0	5.8	27.4	1.8	2.2	23.4
Total (kg DM/ha)	**10,645**	**75**	**1,358**	**12,077**	**1,151**	**308**	**10,618**

Feed Supply and Demand

Month	Supply kg DM Daily/ha (grazing)					Demand kg DM Daily/ha (grazing)				Difference
	Pasture Net Growth	Crop Adjustment	Supplements	Utilisation Waste	Total	Pasture	Supplements	Deficit	Total	
Jun 17	10.6		13.3	5.4	18.5	9.5	10.2		19.8	-1.3
Jul 17	9.6		12.3	5.2	16.7	9.6	9.5		19.0	-2.3
Aug 17	23.4		8.3	5.9	25.8	17.3	6.8		24.0	1.8
Sep 17	38.6		5.7	4.1	40.2	29.7	4.9		34.6	5.5
Oct 17	42.4		5.4	4.4	43.4	33.7	4.7		38.4	4.9
Nov 17	42.5		0.5	2.2	40.8	40.5	0.5		41.0	-0.2
Dec 17	43.4			2.2	41.2	41.3			41.3	-0.1
Jan 18	30.6		7.7	3.1	35.2	33.3	6.4		39.7	-4.4
Feb 18	21.3	0.0	13.2	3.9	30.6	28.4	10.8		39.2	-8.6
Mar 18	25.8		11.4	3.9	33.2	28.1	9.0		37.1	-3.8
Apr 18	37.2		10.2	3.7	43.6	26.6	7.8		34.4	9.2
May 18	23.4		3.7	4.4	22.6	20.2	2.8		23.0	-0.4
Average	**29.1**	**0.0**	**7.6**	**4.0**	**32.6**	**26.5**	**6.1**	**0.0**	**32.6**	**0.1**
Total	**10,618**	**0**	**2,769**	**1,473**	**11,914**	**9,673**	**2,217**	**0**	**11,890**	**24**

Pasture Quality

Month	kgDM/ha (end of month)				Total Cover
	Green	Dead	Stem	Total	MJME/kgDM
Start	1,815	262		2,077	11.1
Jun 17	1,884	155		2,038	11.4
Jul 17	1,868	98		1,966	11.7
Aug 17	1,921	101		2,022	11.8
Sep 17	2,026	162		2,188	11.3
Oct 17	1,994	234	113	2,341	10.7
Nov 17	1,812	234	290	2,335	10.4
Dec 17	1,693	346	293	2,333	10.1
Jan 18	1,536	492	166	2,195	9.9
Feb 18	1,394	482	50	1,926	9.7
Mar 18	1,399	408		1,807	9.9
Apr 18	1,717	366		2,084	10.3
May 18	1,811	261		2,072	10.8

Landuse

Month	Area (ha)					
	Pasture - N	Pasture + N	Feed Crop	Cash Crop	Conservation	Total
Jun 17	191.0		9.0			200.0
Jul 17	191.0		9.0			200.0
Aug 17	96.4	94.6	9.0			200.0
Sep 17		191.0	9.0			200.0
Oct 17	101.2	85.7	13.1			200.0
Nov 17	151.2	20.8	26.4		1.6	200.0
Dec 17	47.5	121.0	23.5		8.0	200.0
Jan 18	14.2	159.8	18.0		8.0	200.0
Feb 18	155.0	25.0	18.0		2.0	200.0
Mar 18	157.0	25.0	18.0			200.0
Apr 18	31.7	150.3	18.0			200.0
May 18	25.9	156.1	18.0			200.0
Average	**94.4**	**88.3**	**15.7**	**0.0**	**1.6**	**200.0**

The column 'Pasture-N' takes into account the nitrogen being returned in applied dairy effluent

Supplements

Supplement	Units	Open	Buy	Produce	Sell	Feed	Close
Kale	tonnes DM			108.0		108.0	0.0
Calf Meal	tonnes		5.9			5.9	
Hay big	big bales	125.0		124.0		125.0	124.0
Hay big Bought	big bales		165.3			165.3	
Bulb Turnip	tonnes DM			90.0		90.0	
Palm Kernel	tonnes DM		106.2			106.2	
Pasture Silage Bought	tonnes DM		104.6			104.6	
Total Feed	**tonnes**	**30.0**	**256.5**	**227.8**	**0.0**	**484.5**	**29.8**
Total DM	**tonnes DM**	**30.0**	**255.8**	**227.8**	**0.0**	**483.8**	**29.8**

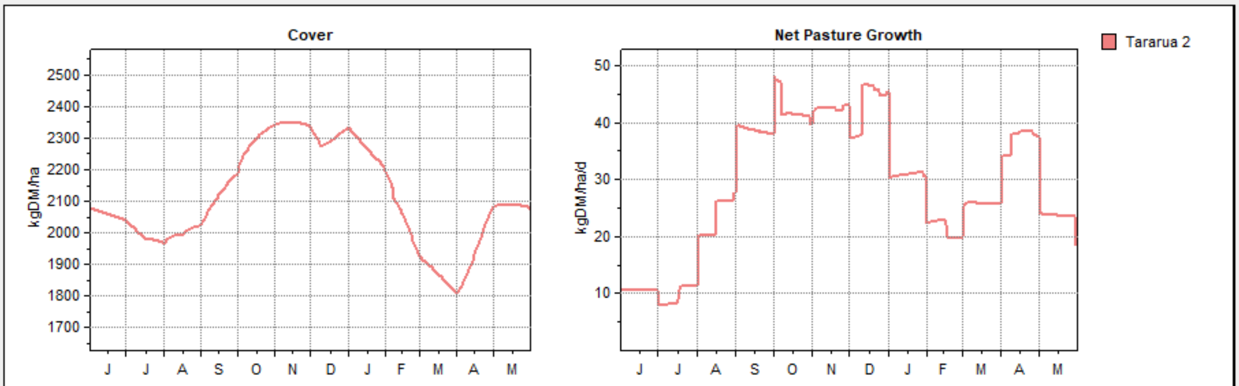
Annual Livestock Reconciliation

Stock Class	Open	Aged Out	Aged In	Wean	Die	Buy	Sell	Tr.In	Tr.Out	Close
Heifer Calf		91			2					
R1 Heifer	91	91	91							91
R2 Heifer			91						91	91
Cow	321				9		82	91		321
Mixed Calves							317			
Total	**412**	**182**	**182**		**11**		**399**	**91**	**91**	**503**

Monthly Livestock Reconciliation

(end of month)	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Heifer Calf		15	93	92	91	91	91					
R1 Heifer	91							91	91	91	91	91
R2 Heifer		91	91	91	91	91	91	91	91	91	91	91
Cow	412	412	410	403	400	400	395	395	395	395	370	321
Mixed Calves		8	25	4								
Total	**503**	**526**	**619**	**590**	**582**	**582**	**577**	**577**	**577**	**577**	**552**	**503**

Pasture Cover



		Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Cover	(kg DM/ha)	2,038	1,966	2,022	2,188	2,341	2,335	2,333	2,195	1,926	1,807	2,084	2,072
Net Pasture Growth	(kg DM/ha/d)	10.6	9.6	23.4	38.6	42.5	42.5	43.4	30.6	21.3	25.8	37.2	23.4
Demand	(kg DM/ha/d)	19.8	19.0	24.0	34.6	38.4	41.0	41.3	39.7	39.2	37.1	34.4	23.0

KPIs	**Milk Solids**			**BCS**	**Operating Profit**	
	kg Total	**kg/ha**	**kg/cow**	**31 May 18**	**$ Total**	**$/ha**
	144,322	722	513	4.81	369,746	1,849

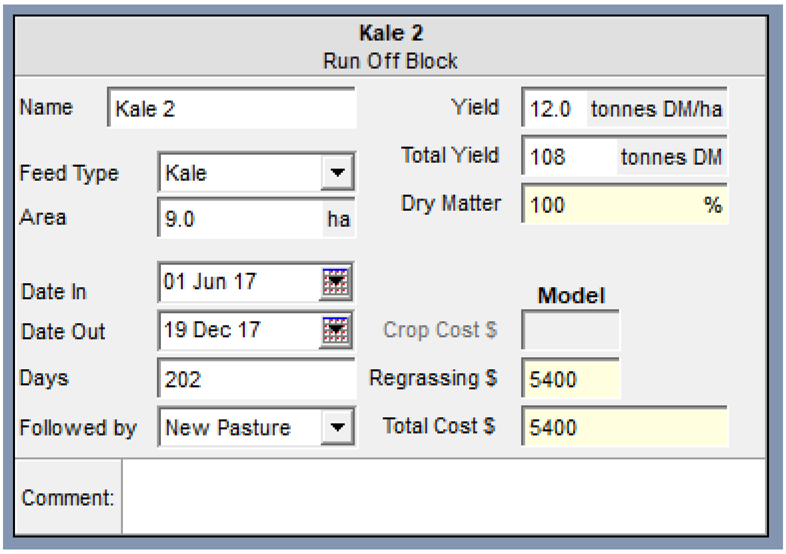
Pasture Silage and Fodder Crops

Milking Platform

Bulb Turnip
Milking Platform

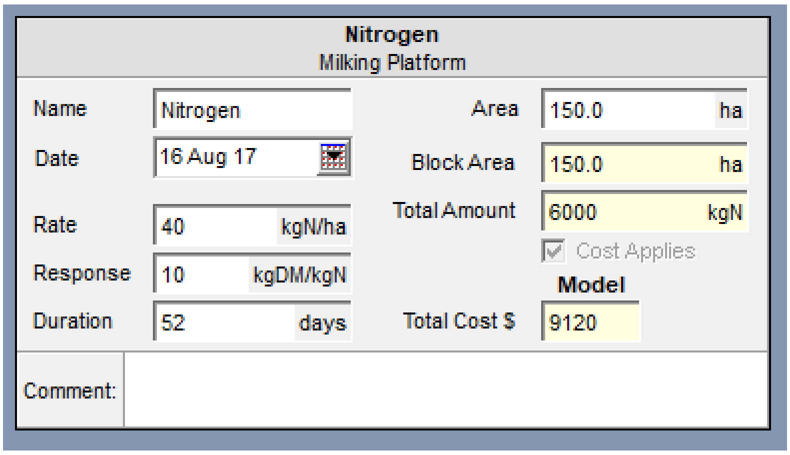
Name	Bulb Turnip	Yield	10.0 tonnes DM/ha
Feed Type	Bulb Turnip	Total Yield	90 tonnes DM
Area	9.0 ha	Dry Matter	100 %
Date In	18 Oct 17		**Model**
Date Out	31 May 18	Crop Cost $	6750
Days	226	Regrassing $	5400
Followed by	New Pasture	Total Cost $	12150
Comment:			

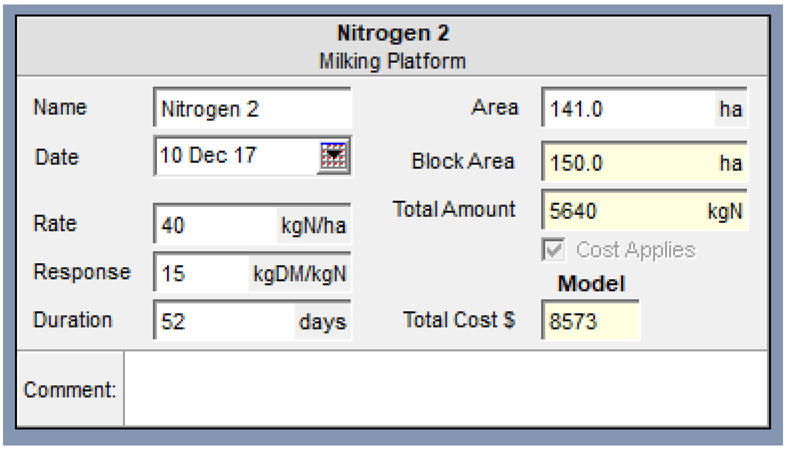
Runoff

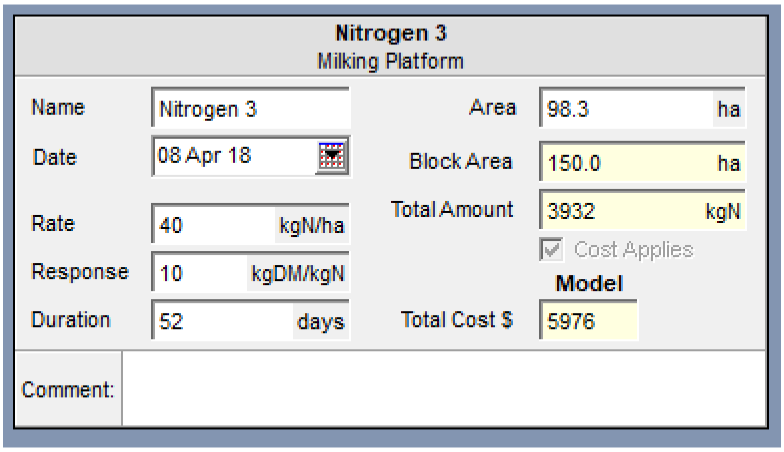


Nitrogen Fertiliser

Milking Platform

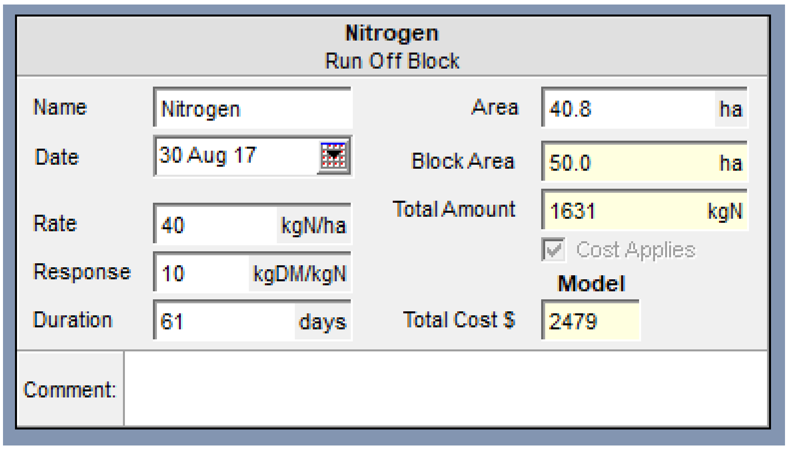




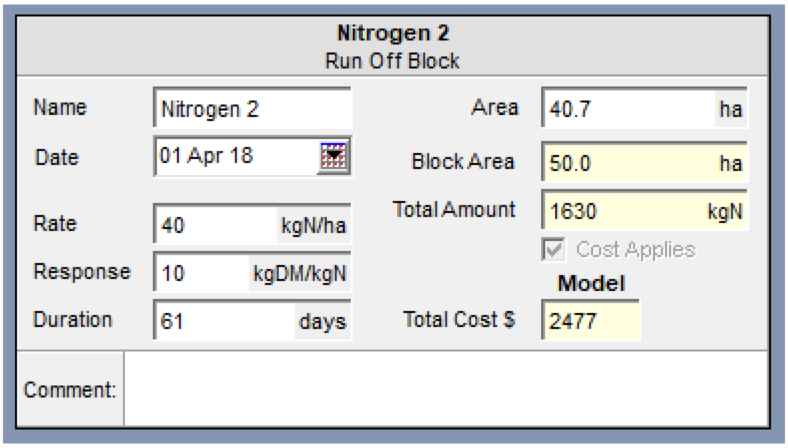


Nitrogen 3
Milking Platform
Name
Nitrogen 3
Date
08 Apr 18
Rate
40
kgN/ha
Response
10
kgDM/kgN
Duration
52
days
Area
98.3
ha
Block Area
150.0
ha
Total Amount
3932
kgN
Cost Applies
Model
Total Cost $
5976
Comment:

Runoff



Nitrogen
Run Off Block
Name
Nitrogen
Date
30 Aug 17
Rate
40
kgN/ha
Response
10
kgDM/kgN
Duration
61
days
Area
40.8
ha
Block Area
50.0
ha
Total Amount
1631
kgN
Cost Applies
Model
Total Cost $
2479
Comment:



Nitrogen 2
Run Off Block
Name
Nitrogen 2
Date
01 Apr 18
Rate
40
kgN/ha
Response
10
kgDM/kgN
Duration
61
days
Area
40.7
ha
Block Area
50.0
ha
Total Amount
1630
kgN
Cost Applies
Model
Total Cost $
2477
Comment:

Management Events

Cows

- 19 Oct 16 Mate 321
- 01 Jun 17 Open 321
- 01 Jun 17 Tfr In 91
- 16 Aug 17 Died 2
- 01 Sep 17 Sell 4
- 16 Sep 17 Died 3
- 16 Oct 17 Died 3
- 26 Oct 17 Mate 400
- 01 Dec 17 Sell 5
- 01 Apr 18 Sell 25
- 01 May 18 Dry Off 37
- 01 May 18 Sell 48
- 15 May 18 Dry Off 297
- 16 May 18 Died 1
- 31 May 18 Close 321

2yr Heifers

- 19 Oct 16 Mate 91
- 01 Jun 17 Open 91
- 01 Jun 17 Tfr Out 91
- 21 Apr 18 Reduce 0
- 21 May 18 Dry Off 0
- 31 May 18 Close 0

1yr Heifers

- 01 Jun 17 Open 91
- 19 Oct 17 Mate 91
- 31 May 18 Close 91

Heifer Calves

- 01 Jun 17 Open 0
- 31 Jul 17 Born 15
- 10 Aug 17 Born 48
- 20 Aug 17 Born 30
- 16 Sep 17 Died 1
- 16 Oct 17 Died 1
- 31 May 18 Close 91

Bulls

- 01 Jun 17 Open 0
- 31 May 18 Close 0

Bobby Calves

- 01 Jun 17 Open 0
- 31 Jul 17 Born 15
- 31 Jul 17 Sell 7
- 10 Aug 17 Born 48
- 10 Aug 17 Sell 34
- 20 Aug 17 Born 72
- 20 Aug 17 Sell 56
- 31 Aug 17 Born 77
- 31 Aug 17 Sell 90
- 10 Sep 17 Born 52
- 10 Sep 17 Sell 58
- 20 Sep 17 Born 34
- 20 Sep 17 Sell 41
- 30 Sep 17 Born 18
- 30 Sep 17 Sell 26
- 10 Oct 17 Born 1
- 10 Oct 17 Sell 5
- 31 May 18 Close 0

Animal Performance – Milkers

kgDM/hd/day Offered

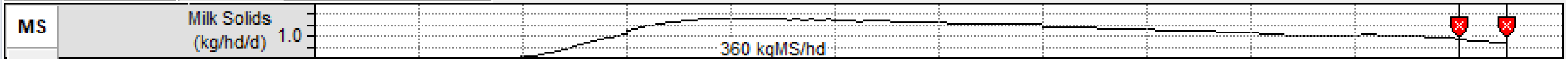
Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture	4.5	4.6	8.9	14.5	16.0	16.3	16.0	13.0	11.0	11.0	11.0	10.0
Kale	3.5	3.5	1.6									
Hay big	2.4											
Hay big Bought		2.0	0.7									
Palm Kernel			0.9	1.8	1.5			1.4		0.5	2.0	0.8
Pasture Silage Bought									2.0	3.0	3.0	1.2
Bulb Turnip								2.0	4.0	1.7		
Total (Utilised)	8.2	7.9	9.6	14.5	15.6	15.5	15.2	15.2	15.3	14.6	14.3	10.1
Pasture (diet) MJME/kgDM	11.6	11.9	12.0	11.6	11.2	11.1	11.0	10.8	10.6	10.6	10.9	11.2
Pasture Utilisation %	80	80	80	90	90	95	95	95	95	95	95	85

Production

Print | All | Milkers | Dries

MS | BCS | Lwt

Milk Solids (kg/hd/d)

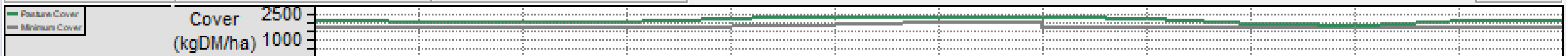


	Start	J	J	A	S	O	N	D	J	F	M	A	M
MS (kg/hd/d)			0.00	0.56	1.63	1.76	1.67	1.55	1.36	1.23	1.03	0.99	0.34
BCS	4.2	4.7	4.7	4.4	4.1	4.0	4.0	4.0	4.0	4.2	4.3	4.5	4.8
Lwt (kg)	453	472	486	446	424	422	421	422	425	430	438	450	467

Pasture Cover

Print | Smooth Minimum | Calibrate Pasture… | Hide

Cover (kgDM/ha)



(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	2,077	2,038	1,966	2,022	2,188	2,341	2,335	2,333	2,195	1,926	1,807	2,084	2,072
Minimum	779	744	758	1,091	1,582	1,832	1,973	2,046	1,677	1,387	1,491	1,533	1,566
Potential Pasture Growth (kgDM/ha/d)		15	12	21	34	45	53	41	24	24	28	34	22

Animal Performance – dry cows

kgDM/hd/day Offered

Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture	4.5	4.5	5.5	10.0								10.0
Kale	3.5	3.5	2.9									
Hay big	2.4											
Hay big Bought		2.0	1.2									
Palm Kernel												
Pasture Silage Bought												
Bulb Turnip												
Total (Utilised)	8.2	7.8	7.5	9.0								8.5

Production

Print | All | Milkers | Dries

MS | BCS | Lwt

Milk Solids (kg/hd/d)

	Start	J	J	A	S	O	N	D	J	F	M	A	M
MS (kg/hd/d)													
BCS	4.2	4.7	4.7	4.7	4.5								4.8
Lwt (kg)	453	472	491	508	536								467

Pasture Cover

Print | Smooth Minimum | Calibrate Pasture… | Hide

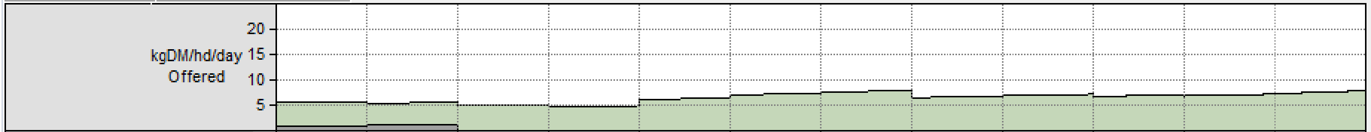
Cover (kgDM/ha)

(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	2,077	2,038	1,966	2,022	2,188	2,341	2,335	2,333	2,195	1,926	1,807	2,084	2,072
Minimum	779	744	758	1,091	1,582	1,832	1,973	2,046	1,677	1,387	1,491	1,533	1,566
Potential Pasture Growth (kgDM/ha/d)		15	12	21	34	45	53	41	24	24	28	34	22

Performance - 2yr heifers

These are off-farm

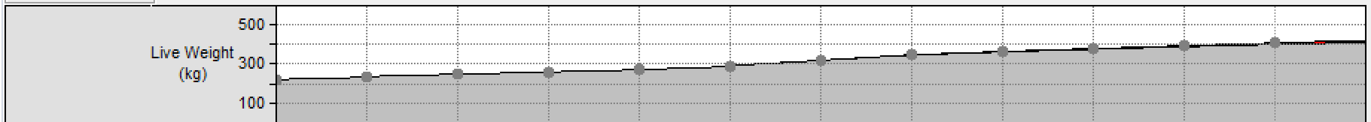
Performance – 1yr heifers



Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture	4.6	4.4	5.1	4.8	6.4	7.3	7.8	6.7	7.1	7.0	7.1	7.6
Hay big Bought	1.0	1.1										
Total (Utilised)	4.5	4.4	4.0	4.3	5.7	6.9	7.4	6.4	6.7	6.6	6.7	6.5

Live Weight

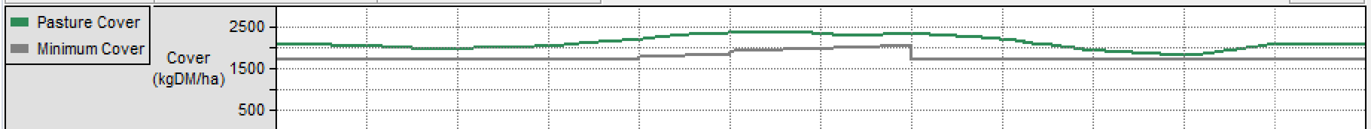
Print



	Start	J	J	A	S	O	N	D	J	F	M	A	M
BWG (kg/d)		0.5	0.4	0.3	0.3	0.7	0.9	0.9	0.5	0.5	0.4	0.4	0.3
Lwt (kg)	220	236	249	260	271	292	319	348	364	379	394	408	421

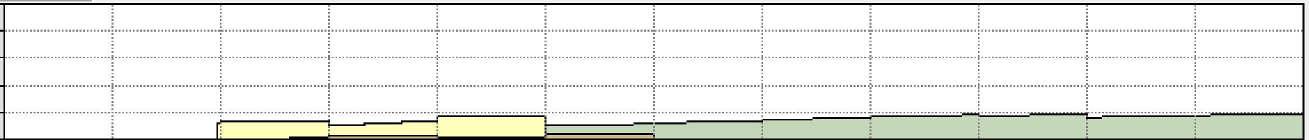
Pasture Cover

Print | Smooth Minimum | Calibrate Pasture... | Hide



(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	2,077	2,038	1,966	2,022	2,188	2,341	2,335	2,333	2,195	1,926	1,807	2,084	2,072
Minimum	779	744	758	1,091	1,582	1,832	1,973	2,046	1,677	1,387	1,491	1,533	1,566
Potential Pasture Growth (kgDM/ha/d)		15	12	21	34	45	53	41	24	24	28	34	22

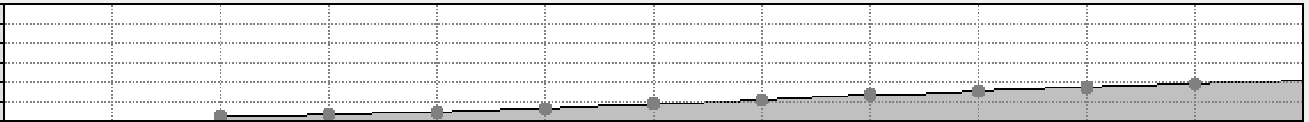
Performance - Calves



Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture			0.0		0.0	1.7	3.2	3.8	4.3	4.5	4.2	4.5
Colostrum/Milk litres/h/d ☒		3.1	3.1	2.6	4.0							
Calf Meal ☒			0.1	0.5	0.3	1.0						
Milk Replacer litres/h/d ☒												
Total (Utilised)						2.5	3.0	3.7	4.1	4.3	4.0	3.8

Live Weight

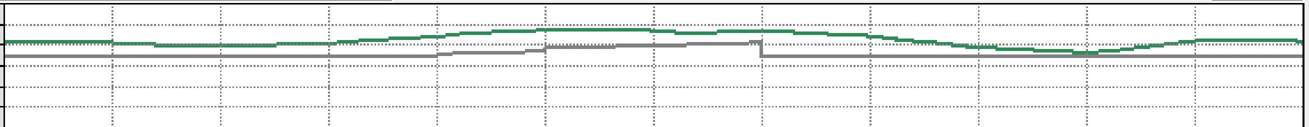
Print



	Start	J	J	A	S	O	N	D	J	F	M	A	M
BWG (kg/d)			0.5	0.5	0.5	0.5	0.7	0.7	0.8	0.8	0.7	0.5	0.4
Lwt (kg)			24	34	50	66	87	108	133	155	176	192	206

Pasture Cover

Print | Smooth Minimum | Calibrate Pasture... | Hide

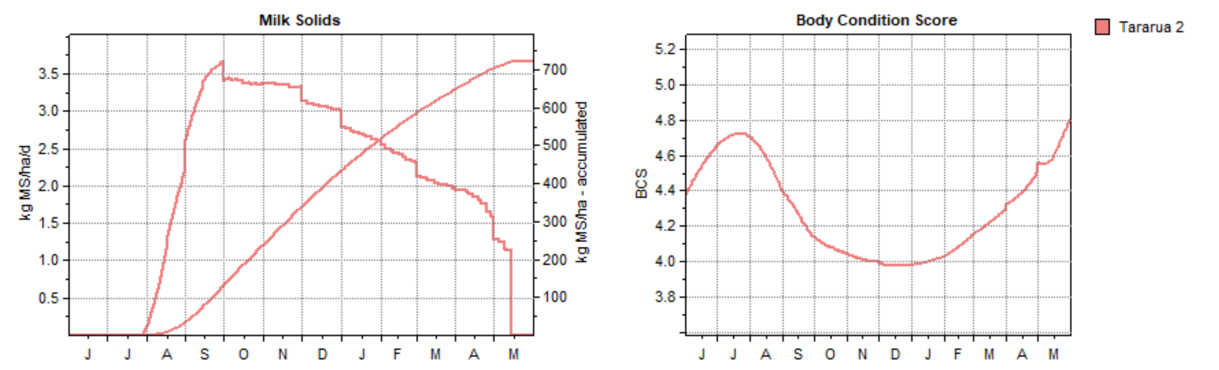


(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	2,077	2,038	1,966	2,022	2,188	2,341	2,335	2,333	2,195	1,926	1,807	2,084	2,072
Minimum	779	744	758	1,091	1,582	1,832	1,973	2,046	1,677	1,387	1,491	1,533	1,566
Potential Pasture Growth (kgDM/ha/d)		15	12	21	34	45	53	41	24	24	28	34	22

Milk Production

Month	Milkers	Milk Volume litres		
		Produced	Calves/Penicillin	to Factory
Jun 17				
Jul 17	1	356		356
Aug 17	147	80,031		80,031
Sep 17	351	231,905		231,905
Oct 17	401	263,329	10,858	252,471
Nov 17	400	240,438		240,438
Dec 17	395	224,354		224,354
Jan 18	395	193,017		193,017
Feb 18	395	154,639		154,639
Mar 18	395	139,998		139,998
Apr 18	370	113,438		113,438
May 18	134	35,013		35,013
Total	**403**	**1,676,519**	**10,858**	**1,665,661**

Milk Production Summary



		Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Milk Solids	(kg MS/ha/d)		0.01	1.15	3.30	3.39	3.35	3.07	2.69	2.42	2.04	1.82	0.55
Total Milk Solids	(kg MS/ha - accumulated)		0	36	135	240	340	435	519	587	650	705	722
Body Condition Score	(BCS - end of month)	4.7	4.7	4.4	4.1	4.0	4.0	4.0	4.0	4.2	4.3	4.5	4.8

Cow Sales

Works Sales						
Date	To	Number	Cwt kg	$ Per kg	$ Per hd	$ Total
01 Sep 17	Works	4	174	2.64	458.68	1,835
01 Dec 17	Works	5	177	2.50	440.82	2,204
01 Apr 18	Works	25	170	2.26	383.11	9,578
01 May 18	Works	48	182	2.33	423.09	20,308
[31 Mar 18]	**Total (Works Sales)**	**82**	**177**	**2.33**	**413.72**	**33,925**

Profit and Loss Account

			$ Total	$/ha	$/cow	$/kg MS
Revenue	Stock	Net Milk Sales - this season	923,659	4,618	2,338	6.40
		Net Milk Sales - last season	0	0	0	0.00
		Net Milk Sales - dividend	0	0	0	0.00
		Net Livestock Sales	40,350	202	102	0.28
		Contract Grazing	0	0	0	0.00
		Change in Livestock Value	0	0	0	0.00
		Total	**964,008**	**4,820**	**2,441**	**6.68**
	Crop & Feed	Capital Value Change	-85	0	0	0.00
		Total	-85	0	0	0.00
	Total Revenue		**963,923**	**4,820**	**2,440**	**6.68**
Expenses	Wages	Wages	50,000	250	127	0.35
		Management Wage	75,000	375	190	0.52
	Stock	Animal Health	31,205	156	79	0.22
		Breeding	20,935	105	53	0.15
		Farm Dairy	10,270	51	26	0.07
		Electricity	18,960	95	48	0.13
	Feed/Crop	Pasture Conserved	4,340	22	11	0.03
		Cash Crop	3,600	18	9	0.02
		Feed Crop	17,550	88	44	0.12
		Bought Feed	67,886	339	172	0.47
		Calf Feed	6,225	31	16	0.04
	Other Farm Working	Fertiliser (Excl. N)	25,000	125	63	0.17
		Nitrogen	29,157	146	74	0.20
		Regrassing	10,800	54	27	0.07
		Weed & Pest Control	7,200	36	18	0.05
		Vehicle Expenses	26,200	131	66	0.18
		Fuel	15,600	78	39	0.11
		R&M Land/Buildings	42,800	214	108	0.30
		R&M Plant/Equipment	18,000	90	46	0.12
		Freight & Cartage	10,200	51	26	0.07
	Overheads	Administration Expenses	24,400	122	62	0.17
		Insurance	13,800	69	35	0.10
		ACC Levies	6,000	30	15	0.04
		Rates	24,600	123	62	0.17
	Total Farm Working Expenses		**559,728**	**2,799**	**1,417**	**3.88**
	Depreciation		34,450	172	87	0.24
	Total Farm Expenses		**594,178**	**2,971**	**1,504**	**4.12**
Economic Farm Surplus (EFS)			**369,746**	**1,849**	**936**	**2.56**
Farm Profit before Tax			**369,746**	**1,849**	**936**	**2.56**

Livestock Capital Values

Mob	Open					Close					Change
	Number	kg/hd	$/hd	$/kg	$ Total	Number	kg/hd	$/hd	$/kg	$ Total	$ Total
Cows	321	460	1,649	3.58	529,329	321	467	1,649	3.53	529,329	
Heifer Calves						91	206	819	3.98	74,529	74,529
2-Year Heifers	91	430	1,421	3.30	129,311						-129,311
1-Year Heifers	91	220	819	3.72	74,529	91	421	1,421	3.37	129,311	54,782
Total					**733,169**					**733,169**	**0**

20. Appendix I. Farming system information for the Moderate-intensity Dairy Farm

The following are screen shots from Farmax Dairy for this farm.

Physical Summary

Category	Description	Value	Units
Farm	Effective Area	250	ha
	Stocking Rate	2.4	cows/ha
	Comparative Stocking Rate	74.6	kg Lwt/t DM offered
	Potential Pasture Growth	11.1	t DM/ha
	Nitrogen Use	158	kg N/ha
	Feed Conversion Efficiency (offered)	14.2	kg DM offered/kg MS
Herd	Cow Numbers (1st July)	618	cows
	Peak Cows Milked	604	cows
	Days in Milk	257	days
	Avg. BCS at calving	5.3	BCS
	Liveweight	1,028	kg/ha
Production	Milk Solids total	242,144	kg
(to Factory)	Milk Solids per ha	969	kg/ha
	Milk Solids per cow	401	kg/cow
	Peak Milk Solids production	1.89	kg/cow/day
	Milk Solids as % of live weight	94.2	%
Feeding	Pasture Offered per cow *	3.9	t DM/cow
	Supplements Offered per cow *	1.8	t DM/cow
	Off-farm Grazing Offered per cow *	0.0	t DM/cow
	Total Feed Offered per cow *	5.7	t DM/cow
	Pasture Offered per ha	10.6	t DM/ha
	Supplements Offered per ha	4.5	t DM/ha
	Off-farm Grazing Offered per ha	0.6	t DM/ha
	Total Feed Offered per ha	15.7	t DM/ha
	Supplements and Grazing / Feed Offered *	31.5	%
	Bought Feed / Feed Offered *	22.0	%

Pasture Supply

Month	Potential Growth	Adjust for Crop Area	Nitrogen Boost	kg DM/ha/day Potential + N	Loss of Potential	Decay	Net Growth
Jun 17	14.8	0.3	0.0	15.1	0.9	3.3	10.9
Jul 17	12.0	0.2	2.1	14.3	0.7	1.7	11.9
Aug 17	23.0	0.2	5.3	28.5	1.4	0.0	27.1
Sep 17	34.6	0.1	6.1	40.8	2.0	0.0	38.8
Oct 17	46.8	0.4	9.9	57.0	4.0	0.0	53.0
Nov 17	55.0	1.2	8.4	64.6	12.0	0.0	52.6
Dec 17	44.0	0.4	11.5	55.8	4.4	0.0	51.4
Jan 18	26.2	0.2	3.0	29.4	2.1	0.0	27.2
Feb 18	24.4	0.1	0.8	25.4	1.5	0.9	23.1
Mar 18	28.2	0.2	4.7	33.1	1.7	0.1	31.3
Apr 18	34.0	0.2	6.2	40.3	2.8	0.8	36.8
May 18	21.8	0.0	10.2	32.0	2.3	2.3	27.5
Total (kg DM/ha)	**11,097**	**105**	**2,089**	**13,291**	**1,088**	**272**	**11,931**

Feed Supply and Demand

Month	Supply kg DM Daily/ha (grazing)					Demand kg DM Daily/ha (grazing)				Difference
	Pasture Net Growth	Crop Adjustment	Supplements	Utilisation Waste	Total	Pasture	Supplements	Deficit	Total	
Jun 17	10.9		17.8	6.8	21.9	11.8	14.0		25.8	-3.8
Jul 17	11.9		18.0	6.8	23.1	11.9	14.1		26.0	-2.9
Aug 17	27.1		13.2	7.3	33.0	19.5	10.8		30.3	2.7
Sep 17	38.8		7.6	4.9	41.6	34.0	6.6		40.5	1.0
Oct 17	53.0		6.3	5.4	53.9	41.3	5.5		46.8	7.1
Nov 17	52.6	0.0	4.5	3.5	53.5	50.4	3.6		53.9	-0.4
Dec 17	51.4		5.7	3.7	53.4	48.2	4.5		52.7	0.7
Jan 18	27.2		17.4	5.6	39.1	34.8	13.7		48.5	-9.4
Feb 18	23.1		26.8	6.6	43.3	24.8	21.5		46.3	-3.0
Mar 18	31.3		25.7	6.5	50.5	24.4	20.5		44.9	5.6
Apr 18	36.8		14.9	5.0	46.7	30.6	11.5		42.1	4.6
May 18	27.5		7.5	6.1	28.8	24.9	5.7		30.6	-1.8
Average	**32.7**	**0.0**	**13.7**	**5.7**	**40.7**	**29.7**	**10.9**	**0.0**	**40.7**	**0.0**
Total	**11,931**	**0**	**5,000**	**2,074**	**14,857**	**10,851**	**3,990**	**0**	**14,841**	**16**

Pasture Quality

Month	kgDM/ha (end of month)				Total Cover
	Green	Dead	Stem	Total	MJME/kgDM
Start	1,838	265		2,102	11.1
Jun 17	1,836	151		1,987	11.4
Jul 17	1,801	95		1,896	11.7
Aug 17	1,881	99		1,980	11.8
Sep 17	1,861	149		2,010	11.3
Oct 17	1,899	223	108	2,230	10.7
Nov 17	1,721	222	275	2,218	10.4
Dec 17	1,610	329	279	2,218	10.1
Jan 18	1,349	432	146	1,927	9.9
Feb 18	1,334	461	48	1,843	9.7
Mar 18	1,561	455		2,017	9.9
Apr 18	1,775	379		2,155	10.3
May 18	1,834	264		2,098	10.8

Landuse

Month	Area (ha)					
	Pasture - N	Pasture + N	Feed Crop	Cash Crop	Conservation	Total
Jun 17	236.0		14.0			250.0
Jul 17	119.9	116.1	14.0			250.0
Aug 17		236.0	14.0			250.0
Sep 17		236.0	14.0			250.0
Oct 17		226.0	20.3		3.7	250.0
Nov 17		202.0	42.0		6.0	250.0
Dec 17	27.3	185.2	37.5			250.0
Jan 18	151.4	70.6	28.0			250.0
Feb 18	187.5	34.5	28.0			250.0
Mar 18	96.0	126.0	28.0			250.0
Apr 18	62.6	159.4	28.0			250.0
May 18		222.0	28.0			250.0
Average	**57.5**	**167.0**	**24.6**	**0.0**	**0.8**	**250.0**

The column 'Pasture+N' takes into account the nitrogen being returned in applied dairy effluent as well as the nitrogen applied as fertiliser

Supplements

Supplement	Units	Open	Buy	Produce	Sell	Feed	Close
Calf Meal	tonnes		4.7			4.7	
Bulb Turnip	tonnes DM			140.0		140.0	
Kale	tonnes DM			168.0		168.0	0.0
Pasture Silage	tonnes DM			18.0		18.0	0.0
Hay big Bought	big bales		247.7			247.7	
Pasture Silage Bought	tonnes DM		344.2			344.2	
Palm Kernel	tonnes DM		354.3			354.3	
Total Feed	**tonnes**	**0.0**	**762.7**	**326.0**	**0.0**	**1,088.7**	**0.0**
Total DM	**tonnes DM**	**0.0**	**762.2**	**326.0**	**0.0**	**1,088.2**	**0.0**

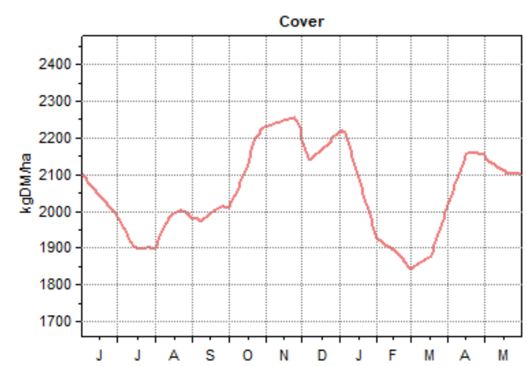
Annual Livestock Reconciliation

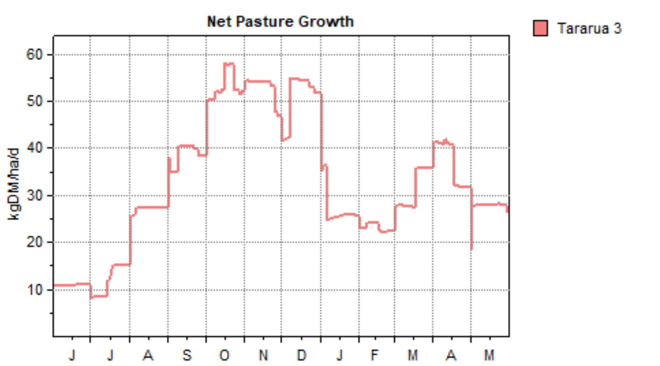
Stock Class	Open	Aged Out	Aged In	Wean	Die	Buy	Sell	Tr.In	Tr.Out	Close
Heifer Calf		136			4					
R1 Heifer	136	136	136							136
R2 Heifer			136						136	136
Cow	482				12		124	136		482
Mixed Calves							478			
Total	**618**	**272**	**272**		**16**		**602**	**136**	**136**	**754**

Monthly Livestock Reconciliation

(end of month)	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Heifer Calf		23	140	138	136	136	136					
R1 Heifer	136							136	136	136	136	136
R2 Heifer		136	136	136	136	136	136	136	136	136	136	136
Cow	618	618	615	604	601	600	595	595	595	595	550	482
Mixed Calves		12	37	6								
Total	**754**	**789**	**928**	**884**	**873**	**872**	**867**	**867**	**867**	**867**	**822**	**754**

Pasture Cover



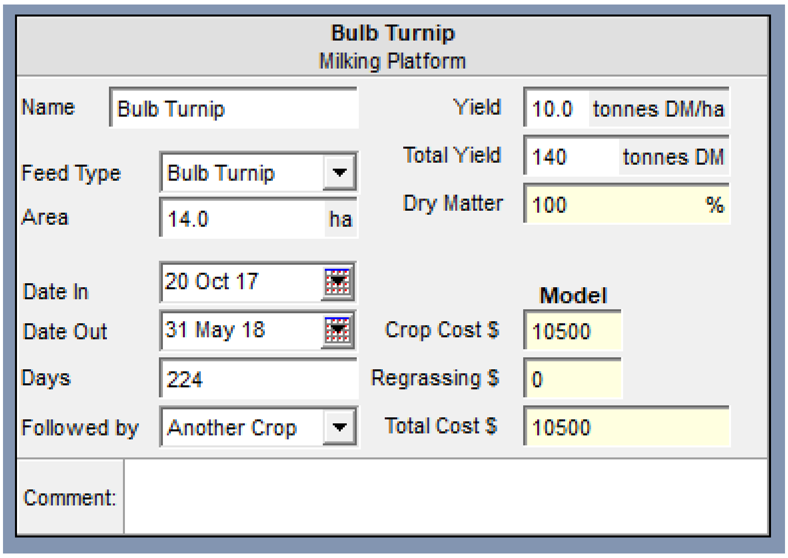


		Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Cover	(kg DM/ha)	1,987	1,896	1,980	2,010	2,230	2,218	2,218	1,927	1,843	2,017	2,155	2,098
Net Pasture Growth	(kg DM/ha/d)	10.9	11.9	27.1	38.8	53.0	52.6	51.4	27.2	23.1	31.3	36.8	27.5
Demand	(kg DM/ha/d)	25.8	26.0	30.3	40.5	46.7	53.9	52.7	48.5	46.3	44.9	42.1	30.6

KPIs	Milk Solids			BCS	Operating Profit	
	kg Total	kg/ha	kg/cow	31 May 18	$ Total	$/ha
	242,144	969	564	5.33	588,988	2,356

Pasture Silage and Fodder Crops

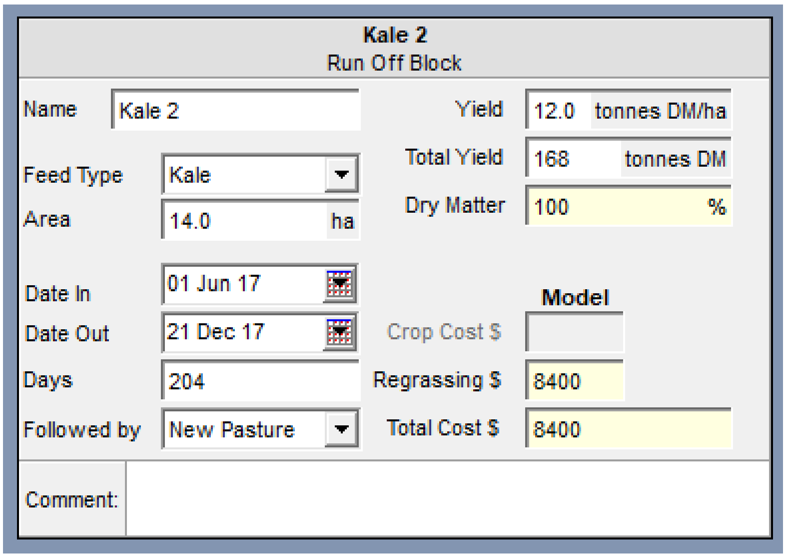
Milking Platform


Bulb Turnip
Milking Platform

Name	Bulb Turnip	Yield	10.0 tonnes DM/ha
Feed Type	Bulb Turnip	Total Yield	140 tonnes DM
Area	14.0 ha	Dry Matter	100 %
Date In	20 Oct 17		**Model**
Date Out	31 May 18	Crop Cost $	10500
Days	224	Regrassing $	0
Followed by	Another Crop	Total Cost $	10500
Comment:			

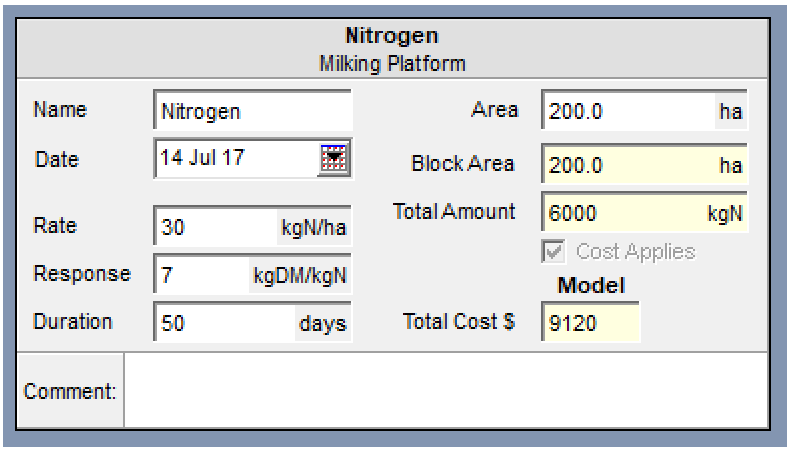
Runoff

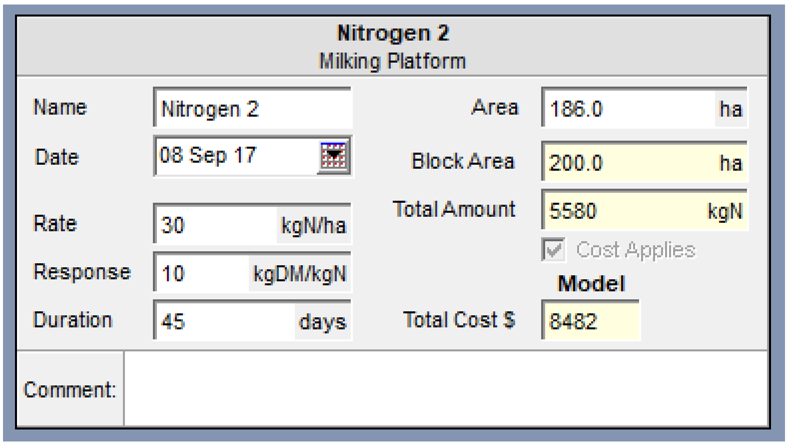
Kale sown 30th October proceeding ‘Kale 2’.



Nitrogen Fertiliser

Milking Platform





Nitrogen 3
Milking Platform

Name	Nitrogen 3	Area	186.0 ha
Date	16 Oct 17	Block Area	200.0 ha
Rate	30 kgN/ha	Total Amount	5580 kgN
Response	10 kgDM/kgN		☑ Cost Applies
			Model
Duration	40 days	Total Cost $	8482
Comment:			

Nitrogen 4
Milking Platform

Name	Nitrogen 4	Area	186.0 ha
Date	07 Dec 17	Block Area	200.0 ha
Rate	30 kgN/ha	Total Amount	5580 kgN
Response	15 kgDM/kgN		☑ Cost Applies
			Model
Duration	30 days	Total Cost $	8482
Comment:			

Nitrogen 5
Milking Platform

Name	Nitrogen 5	Area	186.0 ha
Date	18 Mar 18	Block Area	200.0 ha
Rate	30 kgN/ha	Total Amount	5580 kgN
Response	10 kgDM/kgN		☑ Cost Applies
			Model
Duration	30 days	Total Cost $	8482
Comment:			

Nitrogen 6
Milking Platform

Name	Nitrogen 6	Area	186.0 ha
Date	02 May 18	Block Area	200.0 ha
Rate	30 kgN/ha	Total Amount	5580 kgN
Response	10 kgDM/kgN		☑ Cost Applies
			Model
Duration	30 days	Total Cost $	8482
Comment:			

Runoff

Nitrogen
Run Off Block

Name	Nitrogen	Area	36.0 ha
Date	06 Aug 17	Block Area	50.0 ha
Rate	46 kgN/ha	Total Amount	1656 kgN
			☑ Cost Applies
Response	10 kgDM/kgN		**Model**
Duration	50 days	Total Cost $	2517
Comment:			

Nitrogen 2
Run Off Block

Name	Nitrogen 2	Area	36.0 ha
Date	08 Oct 17	Block Area	50.0 ha
Rate	46 kgN/ha	Total Amount	1656 kgN
			☑ Cost Applies
Response	15 kgDM/kgN		**Model**
Duration	50 days	Total Cost $	2517
Comment:			

Nitrogen 3
Run Off Block

Name	Nitrogen 3	Area	36.0 ha
Date	10 Apr 18	Block Area	50.0 ha
Rate	46 kgN/ha	Total Amount	1656 kgN
			☑ Cost Applies
Response	10 kgDM/kgN		**Model**
Duration	50 days	Total Cost $	2517
Comment:			

Management Events

Cows

- 19 Oct 16 Mate 482
- 01 Jun 17 Open 482
- 01 Jun 17 Tfr In 136
- 16 Aug 17 Died 3
- 16 Sep 17 Died 4
- 30 Sep 17 Sell 7
- 16 Oct 17 Died 3
- 16 Nov 17 Died 1
- 31 Dec 17 Sell 5
- 01 Apr 18 Sell 45
- 01 May 18 Dry Off 55
- 01 May 18 Sell 67
- 16 May 18 Died 1
- 21 May 18 Dry Off 427
- 31 May 18 Close 482

2yr Heifers

- 19 Oct 16 Mate 136
- 01 Jun 17 Open 136
- 01 Jun 17 Tfr Out 136
- 21 Apr 18 Reduce 0
- 21 May 18 Dry Off 0
- 31 May 18 Close 0

1yr Heifers

- 01 Jun 17 Open 136
- 01 Jun 17 Send Off 68
- 01 May 18 Bring Back 68
- 31 May 18 Close 136

Heifer Calves

- 01 Jun 17 Open 0
- 31 Jul 17 Born 23
- 10 Aug 17 Born 71
- 20 Aug 17 Born 46
- 16 Sep 17 Died 2
- 16 Oct 17 Died 2
- 01 May 18 Send Off 68
- 31 May 18 Close 136

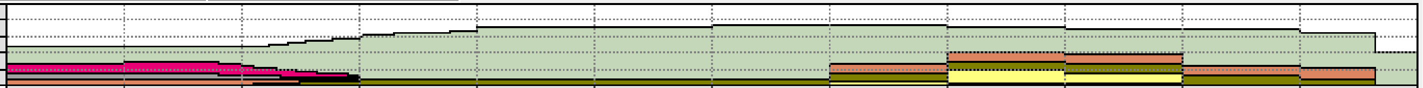
Bulls

No bulls present

Bobby Calves

- 01 Jun 17 Open 0
- 31 Jul 17 Born 22
- 31 Jul 17 Sell 10
- 10 Aug 17 Born 72
- 10 Aug 17 Sell 52
- 20 Aug 17 Born 111
- 20 Aug 17 Sell 84
- 31 Aug 17 Born 115
- 31 Aug 17 Sell 137
- 10 Sep 17 Born 78
- 10 Sep 17 Sell 87
- 20 Sep 17 Born 52
- 20 Sep 17 Sell 62
- 30 Sep 17 Born 26
- 30 Sep 17 Sell 38
- 10 Oct 17 Born 2
- 10 Oct 17 Sell 8
- 31 May 18 Close 0

Animal Performance – Milkers

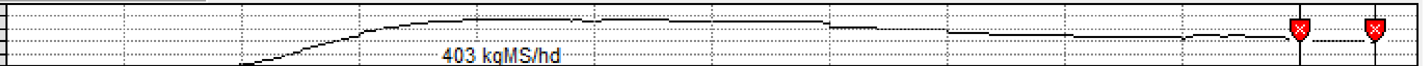


Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture	5.0	5.1	8.8	14.0	16.5	16.5	16.5	12.0	7.9	7.7	11.0	10.6
Kale ☒	3.5	3.6	1.8									
Hay big Bought ☒	1.3	1.3	0.6									
Pasture Silage Bought ☒	2.0	2.0	1.1	0.2				3.0	3.0	3.0	3.0	2.3
Palm Kernel ☒		0.0	0.9	1.8	1.5	1.5	2.0	2.5	2.5	3.1	3.0	1.1
Bulb Turnip ☒								1.0	4.0	3.0		
Pasture Silage ☒									0.5	0.5		
Total (Utilised)	9.3	9.4	10.5	14.2	16.0	16.9	17.3	16.5	15.5	15.0	15.1	11.6
Pasture (diet) MJME/kgDM	11.6	11.9	12.0	11.6	11.2	11.1	11.0	10.8	10.6	10.6	10.9	11.2
Pasture Utilisation %	80	80	80	90	90	95	95	95	95	95	95	85

Production

Print | All | Milkers | Dries

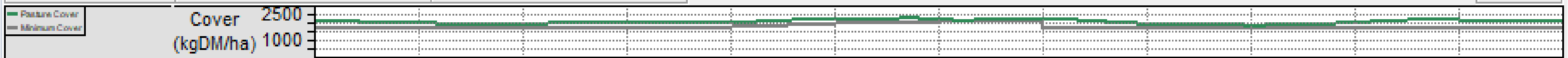
MS | BCS | Lwt



	Start	J	J	A	S	O	N	D	J	F	M	A	M
MS (kg/hd/d)			0.00	0.62	1.68	1.86	1.84	1.78	1.50	1.27	1.16	1.17	0.65
BCS	4.3	4.9	5.2	4.9	4.4	4.3	4.3	4.4	4.5	4.7	4.8	5.0	5.3
Lwt (kg)	453	478	499	458	432	428	428	432	435	439	443	450	456

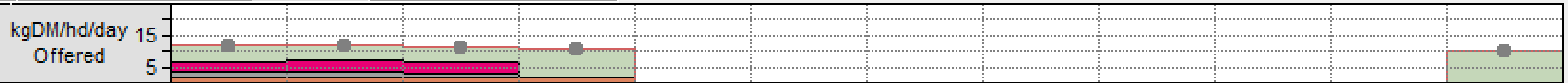
Pasture Cover

Print | Smooth Minimum | Calibrate Pasture… | Hide



(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	2,102	1,987	1,896	1,980	2,010	2,230	2,218	2,218	1,927	1,843	2,017	2,155	2,098
Minimum	833	786	832	1,072	1,529	1,879	2,035	2,114	1,609	1,058	1,091	1,561	1,628
Potential Pasture Growth (kgDM/ha/d)		15	12	23	35	47	56	44	26	25	28	34	22

Animal Performance – dry cows



Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture	5.0	5.0	5.0	9.0								10.0
Kale	3.5	3.6	3.3									
Hay big Bought	1.3	1.3	1.0									
Pasture Silage Bought	2.0	2.0	2.0	2.0								
Palm Kernel												
Bulb Turnip												
Pasture Silage												
Total (Utilised)	9.3	9.4	8.9	9.6								8.5

Production

Print | All | Milkers | Dries

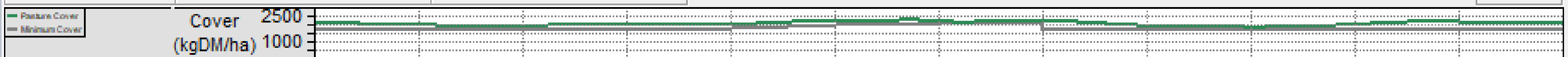
MS | BCS | Lwt

Milk Solids (kg/hd/d) 1.0

	Start	J	J	A	S	O	N	D	J	F	M	A	M
MS (kg/hd/d)													
BCS	4.3	4.9	5.2	5.4	5.1								5.3
Lwt (kg)	453	478	504	526	542								456

Pasture Cover

Print | Smooth Minimum | Calibrate Pasture... | Hide

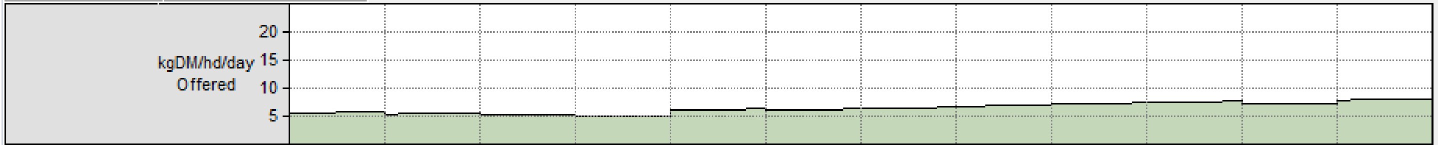


(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	2,102	1,987	1,896	1,980	2,010	2,230	2,218	2,218	1,927	1,843	2,017	2,155	2,098
Minimum	833	786	832	1,072	1,529	1,879	2,035	2,114	1,609	1,058	1,091	1,561	1,628
Potential Pasture Growth (kgDM/ha/d)		15	12	23	35	47	56	44	26	25	28	34	22

Performance - 2yr heifers

These are off-farm

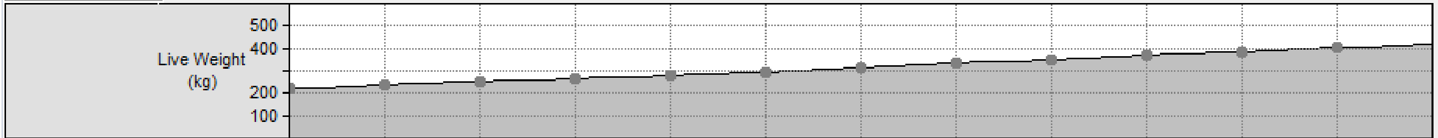
Performance – 1yr heifers



Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture	5.7	5.5	5.3	5.0	6.1	6.2	6.5	6.9	7.3	7.6	7.2	8.0
Total (Utilised)	4.5	4.4	4.2	4.5	5.5	5.9	6.1	6.5	6.9	7.2	6.8	6.8

Live Weight

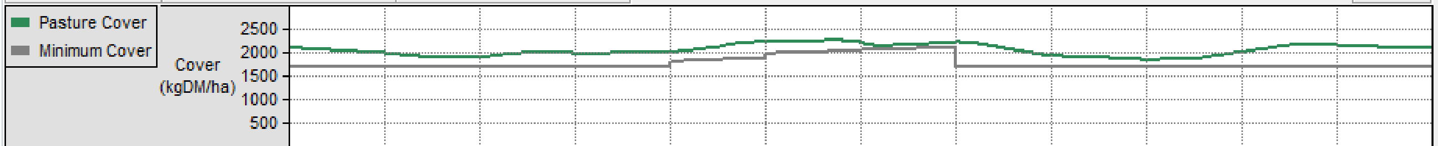
Print



	Start	J	J	A	S	O	N	D	J	F	M	A	M
BWG (kg/d)		0.6	0.5	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5
Lwt (kg)	220	238	253	266	278	297	315	333	352	369	387	402	418

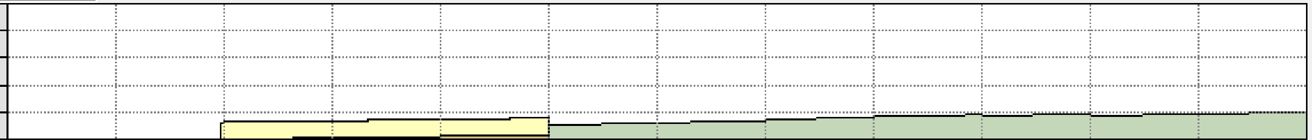
Pasture Cover

Print | Smooth Minimum | Calibrate Pasture... | Hide



(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	2,102	1,987	1,896	1,980	2,010	2,230	2,218	2,218	1,927	1,843	2,017	2,155	2,098
Minimum	833	786	832	1,072	1,529	1,879	2,035	2,114	1,609	1,058	1,091	1,561	1,628
Potential Pasture Growth (kgDM/ha/d)		15	12	23	35	47	56	44	26	25	28	34	22

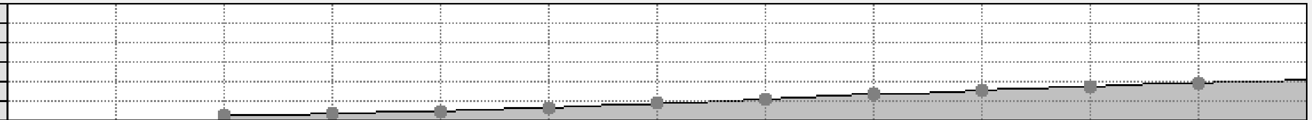
Performance - Calves



Select a Feed	J	J	A	S	O	N	D	J	F	M	A	M
Pasture			0.0	0.0		2.8	3.2	3.8	4.3	4.5	4.4	4.7
Colostrum/Milk litres/h/d		3.1	3.1	3.1	3.2							
Calf Meal			0.1	0.3	0.6							
Milk Replacer litres/h/d												
Total (Utilised)						2.7	3.0	3.7	4.1	4.3	4.2	4.0

Live Weight

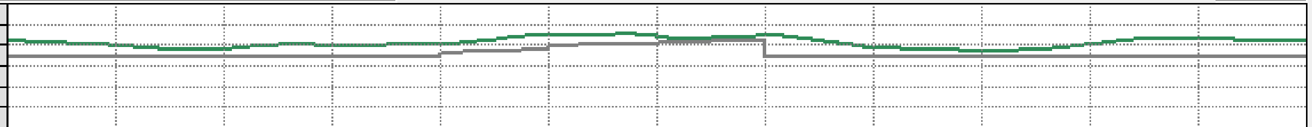
Print



	Start	J	J	A	S	O	N	D	J	F	M	A	M
BWG (kg/d)			0.5	0.5	0.5	0.5	0.7	0.7	0.8	0.8	0.7	0.6	0.5
Lwt (kg)			24	34	49	66	87	108	133	155	177	195	210

Pasture Cover

Print | Smooth Minimum | Calibrate Pasture... | Hide

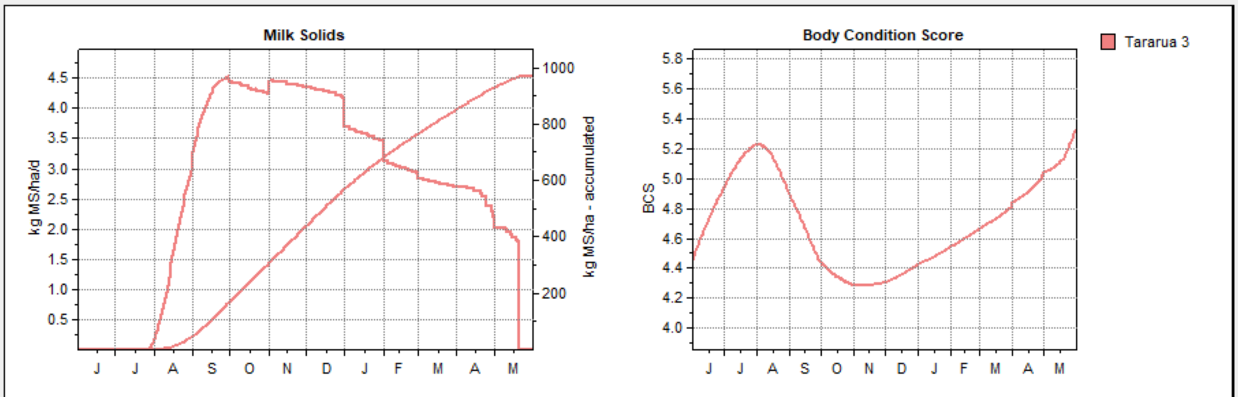


(kgDM/ha)	Start	J	J	A	S	O	N	D	J	F	M	A	M
Pasture Cover	2,102	1,987	1,896	1,980	2,010	2,230	2,218	2,218	1,927	1,843	2,017	2,155	2,098
Minimum	833	786	832	1,072	1,529	1,879	2,035	2,114	1,609	1,058	1,091	1,561	1,628
Potential Pasture Growth (kgDM/ha/d)		15	12	23	35	47	56	44	26	25	28	34	22

Milk Production

Month	Milkers	Milk Solids kg Produced	Calves/Penicillin	to Factory
Jun 17				
Jul 17	1	59.8		59.8
Aug 17	219	11,921		11,921
Sep 17	533	30,848		30,848
Oct 17	602	34,758	1,113	33,646
Nov 17	601	33,099		33,099
Dec 17	600	33,160		33,160
Jan 18	595	27,710		27,710
Feb 18	595	21,167		21,167
Mar 18	595	21,430		21,430
Apr 18	550	19,352		19,352
May 18	276	9,753		9,753
Total	**607**	**243,257**	**1,113**	**242,144**

Milk Production Summary



		Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Jan 18	Feb 18	Mar 18	Apr 18	May 18
Milk Solids	(kg MS/ha/d)		0.01	1.54	4.11	4.34	4.41	4.28	3.58	3.02	2.77	2.58	1.26
Total Milk Solids	(kg MS/ha - accumulated)		0	48	171	306	438	571	682	766	852	930	969
Body Condition Score	(BCS - end of month)	4.9	5.2	4.9	4.4	4.3	4.3	4.4	4.5	4.7	4.8	5.0	5.3

Cow Sales

Date	To	Works Sales Number	Cwt kg	$ Per kg	$ Per hd	$ Total
30 Sep 17	Works	7	127	2.48	314.71	2,203
31 Dec 17	Works	5	171	2.51	429.17	2,146
01 Apr 18	Works	45	180	2.29	412.48	18,562
01 May 18	Works	67	197	2.38	468.89	31,415
[03 Apr 18]	**Total (Works Sales)**	**124**	**186**	**2.36**	**438.11**	**54,326**

KapAg

Profit and Loss Account

			$ Total	$/ha	$/cow	$/kg MS
Revenue	Stock	Net Milk Sales - this season	1,549,722	6,199	2,583	6.40
		Net Milk Sales - last season	0	0	0	0.00
		Net Milk Sales - dividend	0	0	0	0.00
		Net Livestock Sales	64,011	256	107	0.26
		Contract Grazing	0	0	0	0.00
		Change in Livestock Value	0	0	0	0.00
		Total	**1,613,733**	**6,455**	**2,690**	**6.66**
	Crop & Feed	Capital Value Change	0	0	0	0.00
		Total	0	0	0	0.00
	Total Revenue		**1,613,733**	**6,455**	**2,690**	**6.66**
Expenses	Wages	Wages	185,000	740	308	0.76
		Management Wage	75,000	300	125	0.31
	Stock	Animal Health	47,400	190	79	0.20
		Breeding	31,800	127	53	0.13
		Farm Dairy	15,600	62	26	0.06
		Electricity	28,800	115	48	0.12
	Feed/Crop	Pasture Conserved	2,700	11	5	0.01
		Feed Crop	27,300	109	46	0.11
		Bought Feed	206,315	825	344	0.85
		Calf Feed	4,471	18	7	0.02
	Grazing	Grazing	26,059	104	43	0.11
	Other Farm Working	Fertiliser (Excl. N)	19,750	79	33	0.08
		Nitrogen	60,101	240	100	0.25
		Regrassing	8,400	34	14	0.03
		Weed & Pest Control	9,000	36	15	0.04
		Vehicle Expenses	32,750	131	55	0.14
		Fuel	19,500	78	33	0.08
		R&M Land/Buildings	53,500	214	89	0.22
		R&M Plant/Equipment	22,500	90	38	0.09
		Freight & Cartage	12,750	51	21	0.05
	Overheads	Administration Expenses	30,500	122	51	0.13
		Insurance	17,250	69	29	0.07
		ACC Levies	7,500	30	13	0.03
		Rates	30,750	123	51	0.13
	Total Farm Working Expenses		**974,695**	**3,899**	**1,624**	**4.03**
	Depreciation		50,050	200	83	0.21
	Total Farm Expenses		**1,024,745**	**4,099**	**1,708**	**4.23**
Economic Farm Surplus (EFS)			**588,987**	**2,356**	**982**	**2.43**
Farm Profit before Tax			**588,987**	**2,356**	**982**	**2.43**

Livestock Capital Values

Mob	Open					Close					Change
	Number	kg/hd	$/hd	$/kg	$ Total	Number	kg/hd	$/hd	$/kg	$ Total	$ Total
Cows	482	460	1,649	3.58	794,818	482	456	1,649	3.61	794,818	
2-Year Heifers	136	430	1,421	3.30	193,256						-193,256
1-Year Heifers	136	220	819	3.72	111,384	136	418	1,421	3.40	193,256	81,872
Heifer Calves						136	210	819	3.90	111,384	111,384
Total					**1,099,458**					**1,099,458**	**0**