IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	Proposed Waikato Regional Plan Change 1: Waikato and Waipa River Catchment

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STATEMENT OF PRIMARY EVIDENCE OF MATTHEW NEWMAN FOR DAIRYNZ LIMITED

15 FEBRUARY 2019

DairyNZ

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INTRODUCTION

1.1 My name is Matthew Glen Newman. I am employed as the Senior Economist with DairyNZ and I have been with DairyNZ since April 2005.

1.2 I graduated from Massey University, Palmerston North in 1997 with a Bachelor in Agricultural Economics and a Diploma in Rural Studies focusing on rural valuation and farm management.

1.3 I have practical dairy farm experience, working for a couple of sharemilking farm businesses before managing a small dairy herd in the Franklin district.

1.4 I have twenty years' experience as an Agriculture Economist having worked for both the Meat & Wool New Zealand Economic Service and DairyNZ. The role covers a broad range of activities from compiling the annual economic survey, regional forecasting, recording and analysis of industry performance statistics, industry cost-share analysis and environmental-economic (nutrient loss and Greenhouse gas emissions) analysis.

1.5 Over the past seven years I have managed the Environmental-Economics programme of work for DairyNZ. This involves ensuring we have sufficient farm level data, appropriate analysis and expertise for several environmental projects, often with Central Government and/or Regional Councils throughout New Zealand. The team (under my guidance) have undertaken numerous projects using OVERSEER and FARMAX to model the impacts of reducing nutrient losses and Greenhouse emissions on dairy farms.

1.6 I have appeared as an expert witness on dairy farm impacts for the Horizons One Plan hearings and have contributed to many other submissions for hearings before councils on plan proposals.

1.7 I am currently a member of the New Zealand Agricultural Resource Economics Society (NZARES) and was president from 2013 to 2015. I am also a member of the New Zealand Institute of Primary Industry Management (NZIPIM).

Background

1.8 I am familiar with the Proposed Waikato Regional Plan Change 1: Waikato and Waipa River Catchment (hereafter referred to as PC1).

1.9 My direct involvement in this plan change process began after PC1 was notified in 2016 when I was asked to comment on some aspects for the DairyNZ submission. Before that time, I was involved in the DairyNZ farm-level modelling (DairyNZ Economics Group, 2014) in the Waikato River catchment that was done as part of a Government, River Iwi and Regional Council investigation into the impacts of the national Policy Statement for Freshwater Management. In 2015 I presented the results of this work to Waikato Regional Council staff and the Collaborative Stakeholder Group. I attended the information forum and science and economics experts' days on 21-22 November 2018.

1.10 I have been asked by DairyNZ to provide economics evidence to describe the DairyNZ farm-level modelling and the contribution of dairy farming to the Waikato economy.

Code of Conduct

1.11 I have read the Environment Court's Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note 2014, and I agree to comply with it. In that regard, I confirm that this evidence is within my area of expertise except where I state that I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

2 SCOPE OF EVIDENCE

2.1 My evidence addresses the following matters:

(a) Outlines the size and importance of the dairy sector to the Waikato region and where possible, the Waikato River Catchment;

(b) Describes the Waikato Economic Impact Joint Venture project and the dairy farm modelling completed by DairyNZ.

(c) Discusses the variability of farm practices, farm management skills and performance in relation to the PC1.

(d) Reviews and comment on the Waikato Regional Council section 42A report; and

(e) Conclusions.

3 SUMMARY STATEMENT

3.1 Dairy is one of the largest industries in the Waikato and its contribution is significant to the regional economy. Dairy farming occupies approximately a third of the land area in the Waikato River Catchment and employs approximately 7,000 people on-farm, with a further 3,000 employed at the seven dairy processing sites. Dairying is regarded as a mature industry in the Waikato with limited potential for further dairy conversions (ref).

3.2 There is a wide range in nitrogen losses between farms in the Waikato River Catchment due to differences in soil drainage, rainfall, farm systems and management. To cover this variability, in 2013 DairyNZ modelled 26 Waikato commercial dairy farms, 14 in the Lower Waikato (Waipa-Franklin) and 12 in the Upper Waikato. This modelling used the nutrient loss model OVERSEER and farm systems model FARMAX, to estimate the impacts of reducing nitrogen losses as part of the Waikato Economic Impact Joint Venture project. This project aimed to develop a base of information that would be used in the collaborative decision-making process to set water quality outcomes. The abatement cost curves created were used in the Healthy Rivers Wai Ora model described by Dr Graeme Doole in his primary evidence to PC1.

3.3 The weighted average base nitrogen (N) loss per hectare (ha) was 40 kilograms in the Upper Waikato region and 30 kilograms in the Waipa-Franklin region. In the absence of any policy, an output approach was adopted where a 10%, 20%, 30% and 40% reduction in nitrogen losses were targeted for each farm, regardless of the base nitrogen loss. The mitigation strategies applied in this modelling were the most cost-effective method of reducing nitrogen losses in OVERSEER given the assumptions used and available technologies.

3.4 In general, the more mitigation required (larger reduction in nitrogen leaching) the higher the cost or reduced operating profits. A 10% reduction in nitrogen leaching will result in a reduction in operating profit of between 1% and 10%, while a 20% reduction in nitrogen loss will likely reduce operating profit by 5% to 20%. A reduction of more than 30% will have a larger impact on operating profit, in the range of 10% to 35%. Sensitivities to milk prices and viability analysis (including interest and drawings) was also undertaken.

3.5 OVERSEER and FARMAX were used simultaneously to validate changes occurring as a result of mitigations and to capture the production and financial impacts of these changes. A mitigation strategy for reducing nitrogen was developed, so that all farms followed the same process. However, there were some differences in the mitigations between farms due to their individual characteristics. A key assumption used throughout the DairyNZ work was that the mitigations had to be realistic for a dairy farm to implement at the time and major farm system changes should be avoided, unless there were no other mitigation options. This is on the basis that farmers operate a particular system and may not want to, or have the skills to significantly change the farm system. Altering this substantially is likely to be undesirable for many farmers and it is unclear how the farmers would manage with large changes. This does not mean some farms won't choose to make radical system changes in the future. Assumptions used in the farm mitigation modelling include standardised feed and fertiliser prices, long run average milk price, and farmer skill levels assumed to be constant throughout the application of increasingly large N reductions applied.

3.6 Mitigation costs are not linear, as increase as the reduction in N becomes larger. Due to the diversity of farms, different types of mitigations should be applied so that the most cost-effective options are utilised first, enabling reductions in nitrogen loss to be achieved efficiently. If interest and variable milk prices are accounted for, the remaining operating profit was considerably reduced, meaning some farmers will struggle to afford to pay for nitrogen mitigation, while remaining a viable farm business. For example, at a $5.50 milk price (instead of $6.50 applied in the original modelling), and if interest and drawings are included, only a quarter of farms have a positive operating profit, prior to mitigations.

3.7 Economic modelling required to describe the likely impacts of reducing nitrogen losses on farms is challenging and time consuming. There are a number of assumptions required. In my opinion, OVERSEER and FARMAX are the right tools to model the likely impacts of reducing nitrogen losses on dairy farms. The modelling provided a range and reasonable estimation of costs for farms reducing nitrogen loss. I acknowledge that more economic modelling can always be undertaken, particularly to understand the distribution of costs amongst farmers.

STATEMENT OF EVIDENCE

4 WAIKATO DAIRY SECTOR

4.1 The Waikato region has historically been a primary area for dairying in New Zealand, contributing 27% of the national milk supply. The region exhibits a range of soil types, with the temperate climate and good spring and autumn rainfall is ideal for pasture production.

4.2 Dairy farming occupies approximately a third of the land area in the Waikato River Catchment, with approximately 2,800 herds[1] on 370,000 effective milking platform hectares. Stocking rates have not changed much over the last decade. At an average stocking rate of 2.7 cows per hectare this means about one million cows are milked in this catchment each season and is the largest dairy region in the country.

4.3 According to NZIER (New Zealand Institute of Economic Research) estimates, the dairy sector directly contributed 10 per cent of Waikato's GDP in 2017. Dairy is one of the largest industries in the Waikato and its contribution is significant to the regional economy. The dairy sector also indirectly contributes to the regional economy through its links with supporting sectors, such as freight transport, storage, packaging and agricultural services.

4.4 The dairy sector employed more than 10,000 workers in the Waikato River catchment with 7,000 of these jobs on-farm. There are currently seven dairy processing sites in the catchment producing a wide range of dairy products. The value of dairy exports from the Waikato has helped New Zealand's trade balance over the last couple of decades.

5 FARM VARIBILITY

5.1 There is a diverse range of soil types and wide distribution of rainfall in the Waikato River catchment. This means the biophysical (rainfall, soil drainage, and slope of land) components contributing to nitrogen loss to water are variable. There is also a wide range of farm systems in the Waikato, which means varying stocking rates, amount of supplementary feed use, fertiliser use, timing of calving and use of irrigation. This diversity means there are variations in milk production and risk of diffuse contaminants leaving the farm. These are not uniformly spread, i.e. one neighbour could have quite a different system compared to another, even with similar biophysical components. These factors along with farm efficiency, resulting from farm management decisions all contribute to a wide distribution in nitrogen losses from dairy farms, as shown in Figure 1. To fully understand nitrogen losses on-farm, these should be estimated for each farm property. In the farm mitigation modelling work I am involved with at DairyNZ, my opinion is that OVERSEER is the most appropriate tool to do this.

5.2 This wide variation in farm systems and nitrogen loss means that requirements to reduce nitrogen loss will have differing impacts across individual farms. Each farm is unique and what may be an effective and viable mitigation for one farm may not be for

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[1] Waikato Dairy Farm Nitrogen Mitigation Impacts, DairyNZ Economics Group, November 2014, page 5.

another. In my opinion the variable impact of farm-level policy limits is important to understand, when making judgements about efficiency and equity across the dairy farming sector.

6 WAIKATO ECONOMIC IMPACT JOINT VENTURE

6.1 In early 2013 the Waikato Economic Impact Joint Venture was established to gather and develop an information base, help inform decisions and better understand the impacts of potential water quality targets and nutrient limits. The primary project partners were the Ministry for Primary Industries (MPI), the Ministry for the Environment (MfE), the Waikato River Authority (WRA), Waikato Regional Council (WRC) and DairyNZ. "The partners aimed to develop a base of information that would support the Waikato community in its process of collaborative decision-making to set water quality outcomes (objectives and limits) for the Waikato and Waipa Rivers, that is the Healthy Rivers/Wai Ora project." [2]

6.2 The Joint Venture started well ahead of the decision-making process and prior to the Collaborative Stakeholder Group (CSG) being established. Doing this work in advance was helpful, as it takes time to gather the necessary farm-level information and modelling the impacts is complex and time-consuming. The Joint Venture partners were careful to ensure that they were comfortable with the approach taken and the quality of information in the absence of knowing what any farm-level limits might be. The major reports were all independently peer-reviewed.

6.3 The Waikato Economic Impact Joint Venture commissioned a number of projects, with the information being used to develop a catchment model to estimate the cost to land users of achieving certain targets. DairyNZ was responsible for providing dairy sector data, including OVERSEER and FARMAX modelling results to show the cost of reduced nitrogen losses. I led the dairy project for DairyNZ, reporting to the Waikato Economic Impact Joint Venture Governance group. A description of this project is provided in section 7.

6.4 OVERSEER is currently the most commonly used model for calculating nutrient losses from New Zealand farms. It is used by farmers to improve nutrient use on farms, and more contentiously by regional councils to help inform regulations around water quality[3]. FARMAX is an energy-based farm system model. These are used to derive abatement curves for the reduction of nitrogen losses, which were used in the catchment model. Phosphorous loss changes were recorded from the mitigations targeting nitrogen reductions, but no specific mitigations were applied for phosphorous. The overall aim of the dairy project was to gain a better understanding of nitrogen loss on dairy farms in the Waikato River Catchment (Lower Waikato or Waipa-Franklin and the Upper Waikato Catchment).

7 WAIKATO DAIRY FARM NITROGEN MITIGATION IMPACTS

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[2] A tool for freshwater nutrient management in the Waikato-Waipa catchment: Summary of work by the Waikato Economic Impact Joint Venture, April 2015; page 4.
[3] Parliamentary Commissioner for the Environment website, Publications - https://www.pce.parliament.nz/publications/overseer-and-regulatory-oversight-models-uncertainty-and-cleaning-up-our-waterways

7.1 The Waikato Regional Council had identified and mapped 66 sub catchment zones (at the time of the study – note this has been updated since) in the Waikato, 45 in Waipa-Franklin and 21 in Upper Waikato. These were then grouped into 10 sub regions, six in Waipa-Franklin and 4 in Upper Waikato, based on similar biophysical components (rainfall and soil type). It is important when doing nutrient mitigation modelling that farms with different biophysical components, farm systems and a range of performance are selected to show the diversity and variability in impacts of achieving a certain level of nutrient reduction.

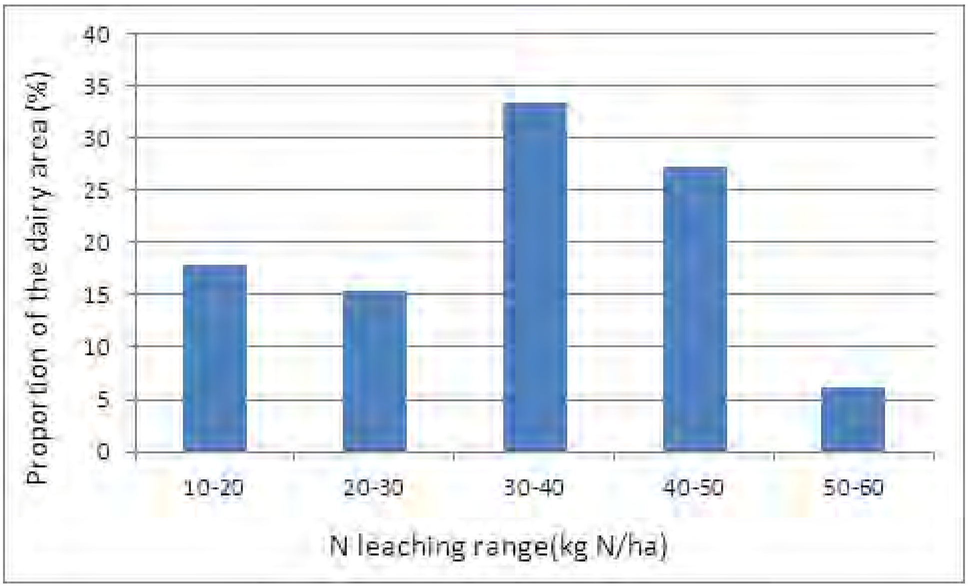
7.2 Twenty-six actual, commercial dairy farms were selected from a pool of farms that had data collected through DairyBase[4]. These selected case study farms were chosen based on their physical location (within the 10 sub-regions), farm characteristics (such as stocking rate, volume of supplementary feed, infrastructure, irrigation) and performance data (such as milk production and operating profit). The aim was to have a diversity of farms across the two catchments. The use of actual farm data collected through DairyBase provides data that is realistic, validated and is treated consistently between farms.

7.3 Each of the 26 case study farms was given a weight (within the 10 sub-regions), based on how typical the farm was to the general population of farms within the sub-region. The assignment of weights was through an agreement with Waikato DairyNZ Consulting Officers. Most farms represented 10,000 to 20,000 hectares, but there were four farms that represented between 50,000 and 80,000 hectares each. If more farms were modelled, they would have likely been in the large sub-region 5 (Cambridge, in the North to the bottom of the catchment, including Waitomo) in the Waikato-Franklin where, three of the four farms represented over 50,000 hectares. While it would have been ideal to be able to model more farms, the time and resources required to do this limited the study to 26 farms in total.

7.4 OVERSEER (Version 6.1.2) was used to create base files for each of the 26 farms. Since 2013, OVERSEER has been updated several times, which has resulted in changes to modelled N leaching figures. However, it is important to note the distribution of N leaching and a wide range in values regardless of the OVERSEER version. The weighted (farms had weightings assigned subjectively, within each sub catchment based on how typical the farm was within the sub catchment) average nitrogen (N) loss per hectare (ha) was 40 kilograms in the Upper Waikato region. This was higher than the base N loss/ha of 30 kilograms in the Waipa-Franklin region. A distribution of these base nitrogen losses/ha for the Waikato River Catchment is shown in Figures 1. Sixty per cent of dairy farms had a N leaching range between 30 and 50 kilograms per hectare.

[4] DairyBase is the dairy industry's benchmarking tool for physical and financial farm performance. It is owned and operated by DairyNZ, using detailed farmer-supplied data, which DairyNZ verifies and regularly updates with the farmer

Figure 1: Waikato River Catchment dairy farm nitrogen loss range using OVERSEER 6.1.2



Note: these estimates from OVERSEER version 6.1.2 are for nitrogen coming out at the root zone and does not show what is actually ending up in the waterways.

7.5 Support blocks were excluded from this analysis on the basis that the data that feeds into the catchment model treats milking platforms and dairy support as separate enterprises. It also removes the issue where support blocks are located outside of the catchment. Once a farm's base OVERSEER file was completed and checked, a base FARMAX file was also created with the farms physical and financial data.

7.6 OVERSEER and FARMAX were used simultaneously to validate changes occurring as a result of mitigations and to capture the production and financial impacts of these changes. A mitigation strategy for reducing nitrogen was developed, so that all farms followed the same process. However, there were some differences in the mitigations between farms due to their individual characteristics. A key assumption used throughout the DairyNZ work was that the mitigations had to be realistic for a dairy farm to implement at the time and major farm system changes should be avoided, unless there were no other mitigation options. This is on the basis that farmers operate a particular system and may not want to, or have the skills to significantly change the farm system. Altering this substantially is likely to be undesirable for many farmers and it is unclear how the farmers would manage with large changes. This does not mean some farms won't choose to make radical system changes in the future. A list of assumptions used in the farm mitigation modelling is provided further in my evidence (paragraph 7.11).

7.7 There are limitations in using OVERSEER and FARMAX in this type of modelling. One of these is that it does not allow for the transition pathways but rather, describes the farm physical, financial and nitrogen and phosphorus losses from the farm currently, compared to what they are expected to be following the mitigations applied. The other limitation is that OVERSEER is really only appropriate for considering nitrogen losses on a farm (not the other nutrients, although it does report phosphorous losses). Not all possible mitigations for reducing nitrogen loss are available for modelling in OVERSEER. For example, at the time of modelling riparian planting could not be used as a mitigation in OVERSEER.

7.8 The mitigation strategies applied in this modelling were the most cost-effective method of reducing nitrogen losses in OVERSEER given the assumptions used and currently available technologies. They are not the only possible ways to reduce nitrogen losses.

7.9 In the absence of any policy (at the time of the study) it was decided to target reduced nitrogen loss on each of the 26 farms by 10% of the base N loss figures, then by 20%, then by 30% and finally by 40%. The mitigations applied are cumulative and build on each other. At each mitigation point a set of interdependent mitigations are presented and the results recorded. These points form the abatement cost curve. A mitigation cost curve is a well-recognised way of showing the relationship between reduced contaminant loss and the cost to entities from making changes to reduce contaminant loss[5]. If a farmer knew at the outset, that they had to reduce contaminants by 30%, they may choose a different set of mitigations, compared to the method used by DairyNZ, which is a step-wise addition of mitigations to reduce N by 10%, then by 20% and then by 30%.

7.10 Mitigations were applied in two stages:

Stage 1: De-intensification, a stepwise process in which reductions in farm inputs are sequentially applied on the base farm

Stage 2: Restricted grazing, a standoff pad is incorporated with each of the scenarios modelled in stage 1

Stage 1 followed a standardised sequence, where agreed measures are applied:

1. If the farm has an existing feed pad or standoff pad its use is optimised i.e. increased time for cows off pasture
2. Autumn nitrogen fertiliser applications are reduced and then removed
3. Spring nitrogen fertiliser applications are reduced and then removed
4. Supplements imported were reduced (up to 20% reduction from the base)
5. Stocking rate was reduced (up to 20% reduction of cow numbers from the base).

7.11 With any level of modelling there are a number of assumptions required. A list of the key assumptions are provided below:

1. Standardised milk price at the long-term average of $6.50/kg milksolids.

[5] A tool for freshwater nutrient management in the Waikato-Waipa catchment: Summary of work by the Waikato Economic Impact Joint Venture, April 2015; page 17.

2. Standardised feed and fertiliser prices, in order to realistically reflect the change in volumes of these inputs following various mitigations.

3. Size of effluent area would not increase (due to lack of reliable data on the suitability on individual farms)

4. Labour is treated as fixed, unless cow numbers drop significantly, (over 100 cows)

5. The standoff pad was constructed of concrete with bark covering and was utilised for up to 12 hours per day during lactation and 18 hours a day for dry cows. The additional cost of incorporating a standoff pad was calculated at $113 per cow, based on increased depreciation, repairs and maintenance, and fuel.

6. Farmer skill levels were assumed to be constant and therefore production per cow was held constant and feed demand and supply were balanced by reducing cow numbers or increasing the amount of energy provided through imported feed.

7. Mitigations stopped if the land was no longer required e.g. feed supply exceeds feed demand in perpetuity, or the land use changes from dairy. Land use changes were beyond the scope of the dairy project, but were considered in the Healthy Rivers Wai Ora model.

7.12 The main financial metric used in this work was operating profit, this is essentially an EBIT (Earnings Before Interest and Tax) measure which includes cash expenses and depreciation. This measure excludes interest so that all farms were comparable in terms of the mitigation cost curves. The operating profit levels needs to be sufficient to service interest, drawings and tax. However, it should be noted that measures of liquidity, profitability and wealth creation are all required to fully understand the impacts on farm businesses. Some analysis was conducted by the DairyNZ Economics Group in September 2015 to consider the viability of each farm if interest was included – see paragraph 7.14 for a summary.

7.13 The impact on operating profit was similar between farms within the Waipa-Franklin (lower Waikato) and farms in the Upper Waikato catchment were also similar as shown in figures 2 and 3 below. In general, a 10% reduction in nitrogen leaching will result in a reduction in operating profit of between 1% and 10%, while a 20% reduction in N loss will likely reduce operating profit by 5% to 20%. A reduction of more than 30% will have a larger impact on operating profit, in the range of 10% to 35%. It is likely that the farms with high nitrogen leaching due to free draining soils will require considerable effort to achieve the required level of compliance.

Figure 2: Lower Waikato (Waipa-Franklin) distributions of mitigation impacts

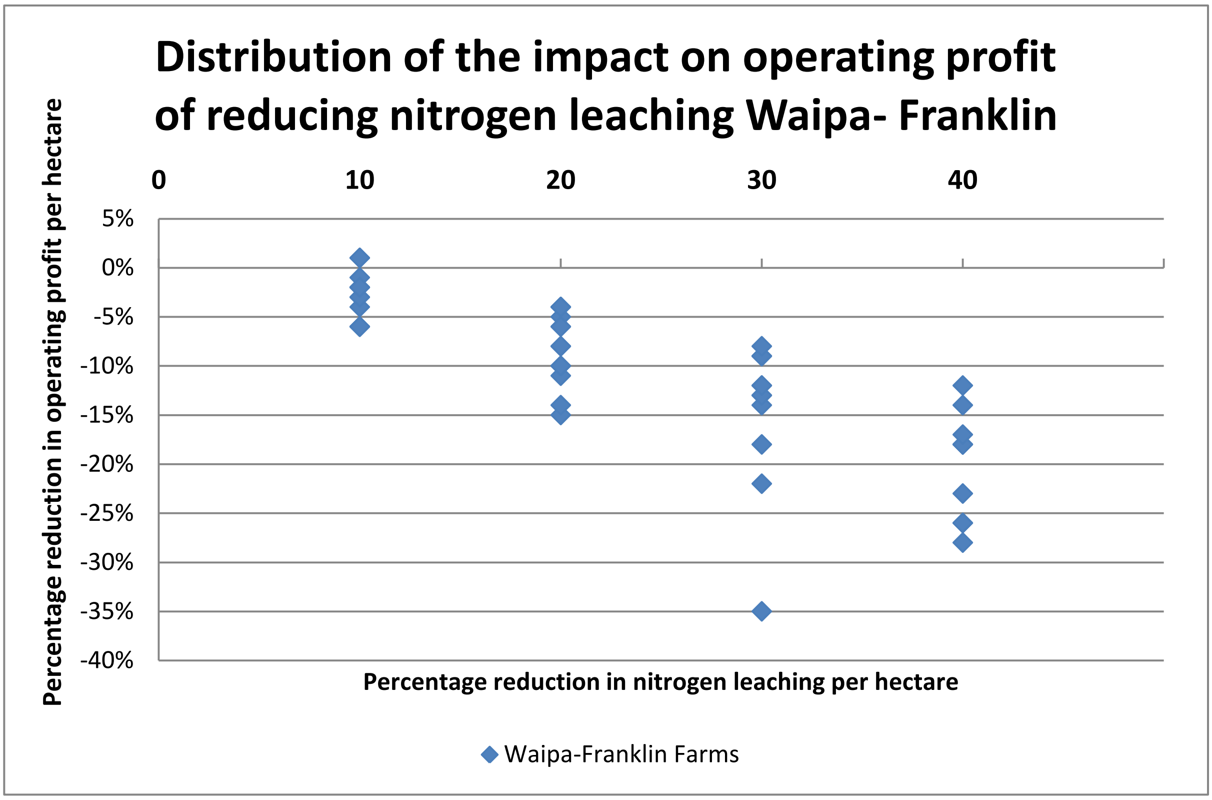
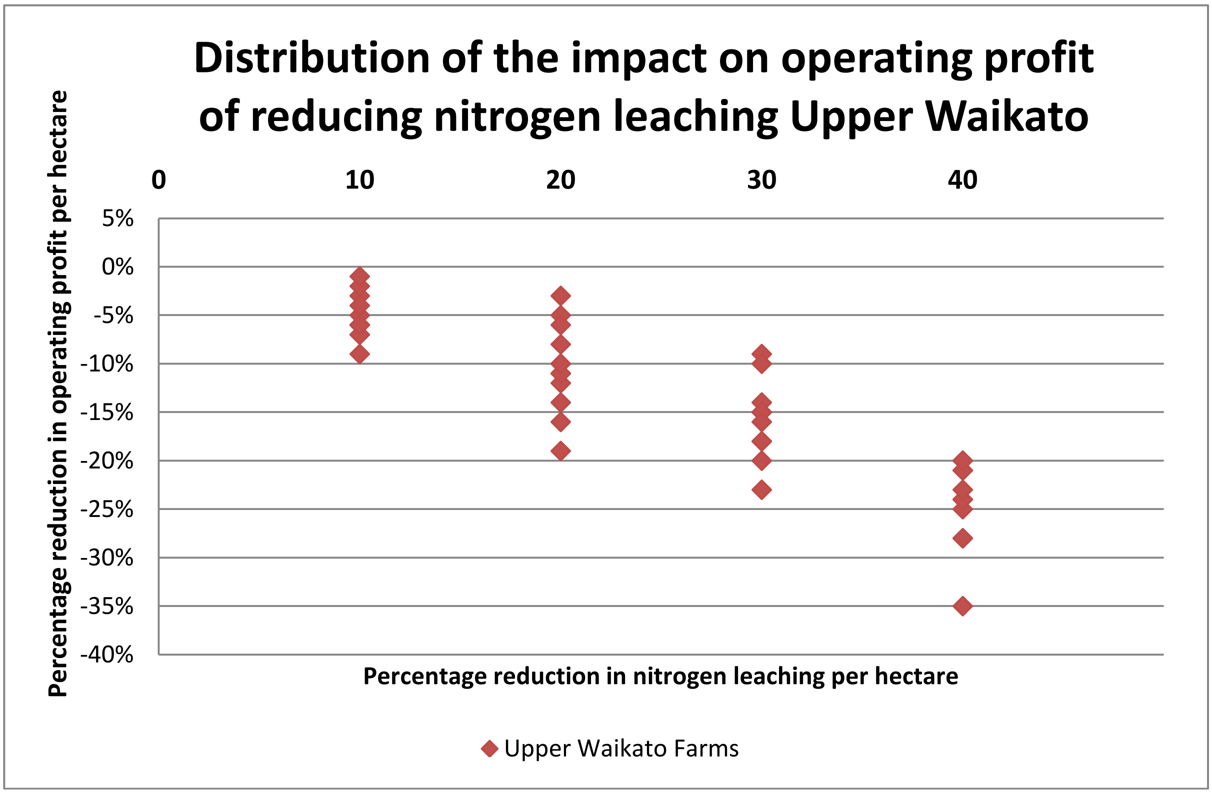


Figure 3: Upper Waikato distributions of mitigation impacts



7.14 In general, the more mitigation required (larger reduction in nitrogen leaching) the higher the cost. Mitigation costs are not linear, and increase as the reduction in N becomes larger. Due to the diversity of farms, different types of mitigations should be applied so that the most cost-effective options are utilised first, enabling reductions in nitrogen loss to be achieved efficiently. If interest and variable milk prices are accounted for, the remaining operating profit was considerably reduced, meaning some farmers will struggle to afford to pay for nitrogen mitigation, while remaining a viable farm business. For example, at a $5.50 milk price (instead of $6.50 applied in the original modelling), and if interest and drawings are included, only a quarter of farms have a positive operating profit, prior to mitigations.

8 REVIEW AND COMMENT ON WAIKATO REGIONAL COUNCIL SECTION 42A REPORT

8.1 I have read Section B3 Science and Economics of the Officers report - Section 42A of the Waikato Regional Council's report of the Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments.

8.2 I concur with the general statements from the Officers who "consider the science and economic analysis and modelling to be both comprehensive and adequate to enable the RMA requirements in S32 to be fulfilled[6].." There are alternative methodologies and numerous assumptions to consider when undertaken economic modelling. These have been documented and will be scrutinized throughout the hearings. There are resource and time constraints to consider when undertaken analysis for these purposes. Despite this I feel the modelling provided a range and reasonable estimation of costs for farms reducing nitrogen loss. There can always be more done, especially when testing the effectiveness and equity of PC1.

8.3 The use of OVERSEER to estimate farm nitrogen losses is reasonable, although the cost and time required to develop individual farm nutrient budgets should not be underestimated. I have read the recent Parliamentary Commissioners for the Environment report about the various uses of OVERSEER[7]., and in my opinion, it is the most appropriate nutrient model for the dairy farm mitigation work that I describe in my statement of evidence.

[6] Waikato Regional Council – Section 42A Report, Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments, page 47
[7] Parliamentary Commissioner for the Environment, Overseer and Regulatory Oversight: models, uncertainty and cleaning up our waterways, December 2018, page 9.

9 CONCLUSIONS

9.1 Dairy farming in the Waikato River Catchment is a significant contributor to the regional economy and employment. The DairyNZ submission generally supported PC1 and its part in achieving the Vision and Strategy by making improvements to water quality and manging point source and diffuse contaminants. Given the large land use for dairy in the catchment, dairy farmers can play an important role in helping the community to achieve the necessary targets.

9.2 DairyNZ was involved in pre-policy modelling to determine the likely impacts of reducing nitrogen losses on-farm. OVERSEER and FARMAX were used to create the abatement cost curves that were supplied for inclusion in the catchment model. These models are appropriate for this type of modelling. While a number of assumptions are required in the economic modelling, I am confident that the analysis was robust and consistent and this methodology of modelling has been proven and replicated throughout the country.

9.3 Given the diversity in rainfall, soil drainage, farm systems and management, each farm is unique and will have different approaches to achieving certain nutrient loss targets. I acknowledge that more economic modelling can always be undertaken, particularly to understand the distribution of costs amongst farmers. However, in my opinion, the models and methodologies described in my evidence are suitable and of a high standard.

Matthew Glen Newman
15 February 2019