

IN THE MATTER

of the Resource Management Act 1991

AND

IN THE MATTER

of the proposed Variation 2 to the Proposed
Canterbury Land and Water Regional Plan -
Section 13 Ashburton

**STATEMENT OF PRIMARY EVIDENCE OF BRIAN BELL FOR FONTERRA CO-
OPERATIVE GROUP LIMITED AND DAIRYNZ LIMITED**

15 MAY 2015

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CONTENTS

1. INTRODUCTION.....3

2. SCOPE OF EVIDENCE4

3. EXECUTIVE SUMMARY5

4. CONTEXT AND ISSUES7

5. DIRECT ECONOMIC IMPACT OF VARIATION 210

6. DIRECT ECONOMIC IMPACT OF ALTERNATIVE SOLUTIONS FROM
DAIRYNZ/FONTERRA11

7. DISCUSSION.....12

1. INTRODUCTION

1.1 My full name is Brian Albert Bell. I have a Masters in Agricultural Science (Honours) from Lincoln University majoring in natural resource economics and a PhD in environmental economics from Waikato University. I am a Founding Partner and Shareholder Director of Nimmo-Bell & Company Ltd ("**Nimmo-Bell**"), a company providing advisory services related to agribusiness to corporate and government clients within New Zealand and internationally.

Qualifications and experience

1.2 I have over 40 years experience as a natural resource economist and financial analyst, specialising in economic analysis, research, promotion and policy development. I have provided consultancy services to government, industry organisations and corporates on many issues and in particular on challenges related to natural resource management.

1.3 My current interests are centred on the interface between economics and the environment, extending cost benefit analysis ("**CBA**") to quantify environmental and social values using stated preference tools such as discrete choice modelling. My key areas of analysis include estimating dollar values for indigenous biodiversity and assessing the balance between income and environmental outcomes for intensive pastoral systems.

1.4 I have an ongoing interest in developing and applying methodology for natural resource management and R&D evaluation using CBA and risk analysis. Nimmo-Bell has trade marked a framework for quantitative risk analysis called QuRA™, which utilises a risk simulation tool for quantifying uncertainty in project appraisal and financial feasibility.

1.5 I have recently assessed the economic impact of environmental policy change for some of New Zealand's most sensitive waterways, including the Waikato River, Rotorua Lakes, Horizons Region, Tasman District, Southland and Selwyn/Te Waihora.

1.6 I have provided an independent assessment for dairy levy payers of the value that DairyNZ adds by achieving strategic industry targets. This includes an \$80 million investment (2009 – 2015) by DairyNZ leveraged

by a further \$29 million from other investors targeting the programme "farming with environmental limits".

Background

- 1.7 My involvement in the proposed Variation 2 to the Proposed Canterbury Land and Water Regional Plan - Section 13 Ashburton ("**Variation 2**") commenced in November 2014. My role has been to quantify in aggregate the direct benefits and costs to the dairy industry from the adoption of Variation 2 and to compare this with an alternative solution put forward by DairyNZ/Fonterra. In doing this I have worked closely with Mark Neal and Shirley Hayward from DairyNZ in relation to on-farm systems and farm representation, and on scheduling of the nitrogen reductions and background information to Variation 2, respectively. Mr Neal provided the budgets for the representative farms that were the basis for the aggregation of benefits and costs over the 20 year life of the analysis.
- 1.8 I am familiar with the provisions of Variation 2 to which these proceedings relate. In preparing my evidence I have reviewed the relevant parts of the section 32 Report and the section 42A Report.
- 1.9 I have also read the evidence of Mr Neal, Ms Hayward, Dr Brown, Dr Fairgray and Mr Willis.

Code of Conduct

- 1.10 I have read the Code of Conduct for expert witnesses contained in the Environment Court's Practice Note as updated in 2014 and 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. I record that I am a contractor to DairyNZ.

2. SCOPE OF EVIDENCE

- 2.1 In my evidence I have provided an assessment of the aggregate direct benefits and costs to the dairy industry of Variation 2, as proposed by Environment Canterbury. The cashflows of the various options produced by my analysis form the underlying building blocks for the economic

impact analysis undertaken by Dr Fairgray of Market Economics. As such, my work forms the link between the representative farm budget information provided by Mr Neal, and the wider indirect and induced economic impacts at the regional, South Island and national levels generated by Dr Fairgray.

2.2 I have also assessed the same effects with DairyNZ/Fonterra's proposed alternative solution, as set out in the proposed amendments to the rules in Appendix 2 of the evidence of Mr Willis.

2.3 I have reviewed and agree with the evidence of Mr Neal, who has assessed the financial impacts at a farm scale, and Dr Fairgray, who has assessed the wider indirect and induced economic impacts at a regional scale and beyond.

2.4 My evidence is structured as follows:

- (a) Context and issues;
- (b) Direct economic impact of proposed Variation 2;
- (c) Direct economic impact of two alternative solutions from DairyNZ/Fonterra, namely implementation of nitrogen leaching reductions over four stages and three stages; and
- (d) Comparison and discussion of the direct economic impacts between the proposed Variation 2 and DairyNZ/Fonterra solutions.

3. EXECUTIVE SUMMARY

3.1 My evidence forms the link between the representative farm budget information provided by Mr Neal, and the wider indirect and induced economic impacts generated by Dr Fairgray.

3.2 My assessment modelled the direct economic impacts of the proposed Variation 2, and two alternative DairyNZ/Fonterra solutions, firstly as a Four Stage implementation schedule with the same timing as the proposed Variation 2 and secondly assuming a Three Stage implementation schedule, but arriving at the same reduction in nitrogen loss by 2035. My analysis focussed on existing dairy and dairy support

farmers, dry stock farmers converting to dairy, and dairy support farmers intensifying their operations.

- 3.3 A standard quantitative CBA framework was used where cashflows were developed over 20 years and discounted to a Net Present Value ("**NPV**"). In estimating the cashflows I relied on the information provided by DairyNZ, including details of the scheduling of nitrogen restrictions. For the dairy farms the stages for the proposed Variation 2 solution were good management practice ("**GMP**"), -15%, -25%, -35% and -45% and for dairy support GMP, -10%, -15%, -20% and -25%. Under the DairyNZ/Fonterra Four Stage solution the stages were GMP, -9%, -18%, -27% and -36% for both the dairy and dairy support farms and under the Three Stage solution -15%, -25% and -36% at 2025, 2030 and 2035 respectively.
- 3.4 The area currently in dairy (49,089 ha) was divided into free draining soils (represented by seven farms) and poor draining soils (three farms). Intensive dairy wintering support units (11,047 ha) were represented by one farm. Additionally, I modelled the conversion of 5,000 ha of sheep and beef to dairy, the intensification of 10,000 ha of sheep and beef and some dairy support, and a flexibility cap on 22,000 ha for arable/mixed cropping farms on heavier soils.
- 3.5 Mr Neal provided budgets for Variation 2 and I used these to generate budgets for the DairyNZ/Fonterra solutions for each stage for the representative farms, giving a detailed breakdown of Revenue, Expenditure and Earnings before Interest and Tax ("**EBIT**"). These details allowed the wider economic impacts to be assessed by Dr Fairgray. Standard assumptions were used for milksolids ("**MS**") payout, mixed age cow price and Fonterra shares. Budgets for the DairyNZ/Fonterra solutions were interpolated from the Variation 2 budgets.
- 3.6 Results showed the marginal change in the Variation 2 solution for existing dairy and dairy support is \$22m (8% more costly in NPV terms) compared with the marginal change in the DairyNZ/Fonterra Four Stage solution, and \$74m (28% more costly) compared with the Three Stage solution.
- 3.7 Discount rates have a highly significant impact on the results, particularly in the development scenario where the front loading of conversion costs

caused the greatest sensitivity. Modelling shows development from sheep and beef to dairy is marginally economic being negative at 8% discount rate and positive at 5% discount rate.

- 3.8 Under the Variation 2 solution, by 2035 total annual milk solids production on existing dairy and dairy support farms is expected to fall by 16% compared with GMP. Under the DairyNZ/Fonterra solutions production is expected to fall by 13% compared with GMP. The marginal change under the DairyNZ/Fonterra solution is 15% less than the marginal change in the Variation 2 solution.

Table 1: Summary of Results for existing Dairy and Dairy Support comparing Variation 2 (Var2) with DairyNZ/Fonterra (DNZ/F) solutions

NPV EBIT \$m, 8% discount rate	GMP to Var2 and DNZ/F							
	GMP	Var2			DNZ/F			Marginal change Var2 v DNZ/F
		Solution	Reduction	%change	Solution	Reduction	%change	
DNZ/F 4	2,110	1,848	262	-12%	1,870	240	-11%	-8%
DNZ/F 3	2,110	1,848	262	-12%	1,923	188	-9%	-28%
Milk Solids (tonnes)	75,336	63,952	11,885	-16%	65,728	10,108	-13%	-15%
Cow numbers	176,780	150,926	25,854	-15%	154,790	21,990	-12%	-15%
N fertilizer (\$m)	19	9	10	-52%	11	8	-41%	-20%

- 3.9 Significant variation exists among the eleven representative farms used in the analysis. Under average conditions, without severe weather events or price shocks, I consider the adjustments required to achieve the reductions in nitrogen leaching appear achievable with good management. However, it is likely that there will be significant numbers of farmers who will struggle financially and who will find it difficult to adapt their farming systems, particularly those with high levels of debt and those with below average levels of management.

4. CONTEXT AND ISSUES

- 4.1 My assessment modelled the direct economic impacts of Variation 2, as assessed by Mr Neal, on existing dairy and dairy support farmers, dry stock farmers converting to dairy, and dairy support farmers intensifying their operations. It also included analysis of the direct economic impacts on arable/mixed cropping farms on heavier soils from the possible introduction of a flexibility cap on nitrogen leaching (as is being sought by DairyNZ/Fonterra).
- 4.2 My analysis employed a standard quantitative CBA framework where Variation 2 was compared with the status quo situation depicted by budgets assuming GMP. Cashflows were developed over 20 years from 2015/16 to 2034/35 for both situations and discounted to a NPV using the

standard Treasury discount rate of 8% (with a sensitivity analysis on discount rates at 5% and 2%). As the final level of nitrogen reduction was assumed to take place in 2034/35, the longer term impact of this was taken into account by capitalising that cashflow in the following year as a terminal value in the NPV calculation. This analysis was then repeated for the DairyNZ/Fonterra alternative solution.

4.3 In estimating the cashflows I relied on the information provided by DairyNZ. Key input data provided included:

- (a) Details of the scheduling of nitrogen restrictions on existing dairy farms are set out in Table A1 in the Appendix. There are two scenarios: staged and smoothed. Under the Variation 2 staged introduction, it was assumed farmers would delay until the deadline for each stage before making changes. Under a smoothed introduction, it was assumed a straight line introduction between stages. This had the effect of bringing forward the introduction (and hence effects/impact) of the policy and increasing costs over time. For dairy farms (milking platform) the stages are GMP, -15%, -25%, -35% and -45% and for dairy support GMP, -10%, -15%, -20% and -25% achieved at 2020, 2025, 2030 and 2035 respectively. Under the Fonterra/DairyNZ solution two options are modelled. In the first option there are four stages GMP, -9%, -18%, -27% and -36% for both dairy and dairy support for the same time steps as for Variation 2. In the second option there are three stages with implementation of management changes to achieve -15% nitrogen leaching at 2025, -25% at 2030 and -36% at 2035. While I have modelled both the staged and smoothed introduction of both the Variation 2 and DairyNZ/Fonterra solutions, and present the results for both in the **Appendix**, my evidence focuses on the smoothed scenario as that is more likely to be the actual adoption path followed by farmers. The DairyNZ/Fonterra Three Stage solution is modelled assuming a smoothed introduction only.
- (b) Allocation of areas to representative farms: DairyNZ estimate the area in milking platform at 49,089 ha, of which 92% is effective. This was divided into free draining soils (seven farms) and poor draining soils (three farms), based on a percentage of

area basis (details are set out in Table A2 in the **Appendix**). The budgets for each farm were reduced to a per hectare basis then multiplied by the number of hectares relating to each representative farm (e.g. 5,935 ha for Farm 1).

- (c) **Farm Budgets:** Mr Neal provided budgets for each stage for 11 representative farms including one for dairy support units, making 55 budgets in total. Each budget gave details of revenue, expenditure and EBIT (as shown in Table A3 in the **Appendix**) so that the wider economic impacts could be assessed.
- (d) **Standard Assumptions:** The budgets had standardised inputs for MS payout (including Fonterra dividend) at \$6.61/kg MS, mixed age cow price at \$1,653 and Fonterra shares at \$5.62, all the average of the last five years in 2013 prices. Using the average mixed aged cow price was considered reasonable given the small proportion of cows in the region affected with a maximum of -1.7% reduction per year under the Variation 2 smoothed solution. Budgets for the DairyNZ/Fonterra stages were interpolated from the Variation 2 budgets (e.g. the budget for -9% nitrogen leached was a weighted average of the GMP and -15% budget, in the ratio of 60:40).
- (e) In addition to existing dairy farms the analysis for both the Variation 2 and DairyNZ/Fonterra solutions included the conversion of 5,000 ha of sheep and beef to dairy at 1,000 ha per year over 5 years, the intensification of 10,000 ha of sheep and beef and some dairy support at 1,000 ha per year over 10 years, and a flexibility cap for arable/mixed cropping farmers on heavier soils. This scenario (referred to as Tier 1) was for farms leaching less than 15kg nitrogen (17,500 ha in total) that could increase up to 15kg, and the analysis assumed this was fully taken up. The flexibility cap would also apply for properties leaching between 15kg and 20kg (4,500 ha in total) to increase up to 20kg (referred to as Tier 2 farms).

5. DIRECT ECONOMIC IMPACT OF VARIATION 2

5.1 My analysis uses the Variation 2 solution discussed in the evidence of Mr Neal. Mr Neal has replaced a number of the input assumptions used by Environment Canterbury to provide a more comprehensive, accurate and realistic model of the overall impacts.¹

5.2 The key results of the analysis of direct benefits and costs (ie at the aggregate farm level) for the Variation 2 solution over 20 years, estimated in NPV terms at 8% discount rate are as follows (for further details see Table A4 in the Appendix):

(a) Existing dairy farms: Marginal change from GMP to a reduction in nitrogen leaching on the dairy farms by -15%, -25%, -35% and -45% and for dairy support -10%, -15%, -20% and -25% achieved at 2020, 2025, 2030 and 2035 respectively (see Table A1 for details).

- GMP EBIT	\$2,110m
- Marginal change GMP to smoothed EBIT	-\$262m (-12%)

(b) Conversion of 1,000 ha/year sheep and beef to dairy for five years (total 5,000 ha) with increased nitrogen leaching from 18 to 27kg/ha.

- Sheep and beef EBIT at 18kg N leaching	\$27m
- Dairy EBIT at 27kg N leaching	\$115m (+326%)
- Less conversion costs	-\$105m
- Marginal change sheep and beef to dairy	-\$11m

(ie a net loss at a discount rate of 8%)

(c) Intensification of 1,000 ha/year sheep and beef plus some dairy support for ten years with increased N leaching from 18 to 27kg/ha.

- Sheep and beef EBIT	\$53m
- Marginal change sheep and beef to intensified	\$11m

(d) Flexibility cap for arable/mixed cropping farmers.

- Current EBIT	\$479m
- Marginal change with flexibility cap	\$26m (+5%)

¹ See the evidence of Mark Neal at paragraph 3.3.

- 5.3 I note that while EBIT is the criteria for assessing GMP profitability, the scenarios that involve changes to capital structure have EBIT adjusted for this.

6. DIRECT ECONOMIC IMPACT OF ALTERNATIVE SOLUTIONS FROM DAIRYNZ/FONTERRA

- 6.1 The results of the analysis of direct benefits and costs (ie at the aggregate farm level) for the DairyNZ/Fonterra solutions over 20 years estimated in NPV terms at 8% discount rate are as follows and summarised in Table 2 (for further details see Table A5 in the **Appendix**):

- (a) Existing dairy farms Four Stage: Marginal change from GMP to a reduction in nitrogen leaching on the milking platform and support units -9%, -18%, -27% and -36% achieved at 2020, 2025, 2030 and 2035 respectively (see Table A1 for details of scheduling).

- GMP EBIT	\$2,110m
- Marginal change GMP to smoothed EBIT	-\$240m (-11%)

- (b) Conversion of 1,000 ha/year sheep and beef to dairy for five years (total 5,000 ha) with increased nitrogen leaching from 18 to 27kg/ha.

- Sheep and beef EBIT	\$27m
- Dairy EBIT	\$115m (+326%)
- Less conversion costs	-\$105m
- Marginal change sheep and beef to dairy	-\$11m (-141%)

- (c) Intensification of 1,000 ha/year sheep and beef plus some dairy support for ten years with increased nitrogen leaching from 18 to 27kg/ha.

- Sheep and beef EBIT	\$53m
- Marginal change sheep and beef to intensified	\$11m (+21%)

- (d) Flexibility cap for arable/mixed cropping farmers.

- Current EBIT	\$479m
- Marginal change with flexibility cap	\$26m (+5%)

6.2 Existing dairy farms: Three Stage introduction with marginal change from GMP to a reduction in nitrogen leaching on the milking platform and support units by -15%, -25% and -36% at 2025, 2030 and 2035 respectively (see Table A1 for details of scheduling). Table 2 summarises the results with greater detail provided in Table A6.

- GMP EBIT	\$1923m
- Marginal change GMP to smoothed EBIT	-\$188m (-28%)

6.3 Results for conversions, intensification and flexibility cap are the same as for the Variation 2 and DairyNZ/Fonterra Four Stage solution.

7. DISCUSSION

7.1 For existing dairy and dairy support farms, the change in the Variation 2 solution is \$22m (or 8% more costly in NPV terms) compared with the change in the DairyNZ/Fonterra Four Stage solution. If, however, implementation is scheduled over three stages as proposed in the DairyNZ/Fonterra Three Stage solution, the change in the Variation 2 solution is \$74m (or 28% more costly).

7.2 When the changes from conversions, intensification and the flexibility cap are also taken into account, the marginal reduction in EBIT for the Variation 2 solution is \$22m (or 9% greater than DairyNZ/Fonterra's Four Stage solution) (see Table 2). Similarly for the Three Stage solution the marginal reduction in EBIT is \$75m (or 32% greater).

	GMP	Variation 2			DNZ/F 4 Stage			Marginal	DNZ/F 3 Stage			Marginal			
		Total	Reduction	%change	Total	Reduction	%change		Var2 v DNZ/F4	Total	Reduction		%change	Var2 v DNZ/F3	
NPV \$m*															
Existing	2,110	1,848	-	262	-12%	1,870	-	240	-11%	8%	1,923	-	188	-9%	28%
Conv	27	15	-	11	-41%	16	-	11	-41%	-	15	-	11	-41%	-
Int	53	65		11	21%	65		11	21%	-	65		11	21%	-
Flexi	479	504		26	5%	504		26	5%	-	504		26	5%	-
Total	2,668	2,433	-	236	-9%	2,453	-	214	-8%	9%	2,507	-	161	-6%	32%

* 8% discount rate

7.3 For both the Variation 2 and DairyNZ/Fonterra solutions, I assume farmers adopt a linear approach to transitioning to the required reduction in nitrogen losses, which is 14% more costly in NPV terms compared with adoption at each stage immediately before required. In spite of this, practical considerations mean most farmers will not leave making the changes until the last minute.

- 7.4 Discount rates have a highly significant impact on the results. This is most apparent in the development scenario where the front loading of conversion costs causes the greatest sensitivity (e.g. the marginal change from sheep and beef at 8% discount rate in NPV terms is a net loss of \$11m, and at a 5% discount rate a positive \$46m).
- 7.5 On existing dairy farms, cow numbers decrease from 176,780 at GMP to 150,926 (-15%) under the Variation 2 solution, and to 154,790 under the DairyNZ/Fonterra solution (-12%), a marginal difference between solutions of 2.5%.
- 7.6 Total nitrogen fertiliser use by 2035 under the Variation 2 solution is expected to be 52% less than GMP, while under the DairyNZ/Fonterra solutions the reduction is expected to be 41%.
- 7.7 Under the Variation 2 solution, by year 2035 total annual MS production on existing farms is expected to fall to 64.0m kg MS, -16% compared with GMP at \$75.9m kg MS. Under the DairyNZ/Fonterra solutions, total MS production is expected to be 65.7m kg MS, -13% compared with GMP and 3% more than under the Variation 2 solution.
- 7.8 These results assume technology is constant and average economic and physical conditions prevail. In reality there is considerable uncertainty around these and other key variables, such as the absolute level of nitrogen loss as estimated by Overseer under different management and physical conditions. These uncertainties exist for both the Variation 2 and DairyNZ/Fonterra solutions.
- 7.9 Significant variation exists among the eleven representative farms used in the analysis. Farms on lighter soils will be required to make the largest adjustments with consequent negative impacts on EBIT, while other farms on heavier soils may have little or no impact from the policy change. Figure A1 in the **Appendix** highlights these changes by representative farms on a per hectare basis for N fertiliser use, cows, and EBIT.
- 7.10 Under average conditions, without severe weather events or price shocks, I consider the adjustments required to achieve the reductions in nitrogen leaching appear achievable with good management. However, it is likely there will be significant numbers of farmers who will struggle financially and who will find it difficult to adapt their farming systems,

particularly those with high levels of debt and those with below average levels of management, as discussed in the evidence of Mr Neal.

Dr Brian Bell

15 May 2015

Appendix

Environment Canterbury: Variation 2 CBA																				
Table A1: Scheduling of Variation 2, DairyNZ Four and Three Stage Solutions																				
Project year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Years beginning 1 June	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35
Years beginning 1 January	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Variation 2 Solution																				
Milking platform																				
Staged	GMP	GMP	GMP	GMP	-15%	-15%	-15%	-15%	-15%	-25%	-25%	-25%	-25%	-35%	-35%	-35%	-35%	-35%	-35%	-45%
Smoothed (% of total area)																				
GMP	100%	100%	67%	33%																
-15%			33%	67%	100%	80%	60%	40%	20%											
-25%						20%	40%	60%	80%	100%	80%	60%	40%	20%						
-35%											20%	40%	60%	80%	100%	80%	60%	40%	20%	
-45%																20%	40%	60%	80%	100%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Dairy Support																				
Staged	GMP	GMP	GMP	GMP	-10%	-10%	-10%	-10%	-10%	-15%	-15%	-15%	-15%	-20%	-20%	-20%	-20%	-20%	-20%	-25%
Smoothed (% of total area)																				
GMP	100%	100%	67%	33%																
-10%			33%	67%	100%	80%	60%	40%	20%											
-15%						20%	40%	60%	80%	100%	80%	60%	40%	20%						
-20%											20%	40%	60%	80%	100%	80%	60%	40%	20%	
-25%																20%	40%	60%	80%	100%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DairyNZ Four Stage Solution																				
Milking platform & Dairy Support																				
Staged	GMP	GMP	GMP	GMP	9%	9%	9%	9%	9%	18%	18%	18%	18%	18%	27%	27%	27%	27%	27%	36%
Smoothed (% of total area)																				
GMP	100%	100%	67%	33%																
-9%			33%	67%	100%	80%	60%	40%	20%											
-18%						20%	40%	60%	80%	100%	80%	60%	40%	20%						
-27%											20%	40%	60%	80%	100%	80%	60%	40%	20%	
-36%																20%	40%	60%	80%	100%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
DairyNZ Three Stage Solution																				
Milking platform & Dairy Support																				
Staged	GMP	GMP	GMP	GMP																
Smoothed (% of total area)																				
GMP	100%	100%	100%	100%	100%	80%	60%	40%	20%											
-15%						20%	40%	60%	80%	100%	80%	60%	40%	20%						
-25%											20%	40%	60%	80%	100%	80%	60%	40%	20%	
-36%																20%	40%	60%	80%	100%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Permitted activity as long as the N loss does not exceed 20 kgN/ha/yr																				

Table A2: Allocation of representative farms

Milking Platform Drainage	Free								Poor			Total
	Soils (medium, light to extremely light)								Soils (heavy, deep, poordraining)			
Area in dairying (ha)	41,960								8,772			49,089
% of dairying area (milking platform)	83%								17%			
Number of dairy farms	165								35			200
Individual farm ID	Farm 1	Farm 2	Farm 3	Farm 4	Farm 6	Farm 8	Farm 10	Farm 5	Farm 7	Farm 9		
% representation of farm (area and No.)	13%	5%	13%	13%	13%	13%	13%	4%	4%	9%	100%	
Effective Ha % of area basis	5,935	2,160	5,935	6,062	5,616	5,935	6,318	1,865	1,748	3,799	45,973	
Support units												
Total area (ha)	11,947											
Effective area (ha)	10,163											

Table A3: Example of representative farm budgets

		Farm 1				
N losses per ha	N Leaching DNZ Protocol, kg N/ha	59.0	50.1	44.2	38.3	32.4
N losses	Total N leached, kg	11,083	9,421	8,312	7,204	6,096
	Policy targets: N leached/ha	-	0.15	0.25	0.35	0.45
Farm	Effective Area, ha	175	175	175	175	175
	Stocking Rate	3.7	3.6	3.5	3.3	3.2
Herd	Cow Numbers (1st July)	670	638	623	603	573
	Peak Cows Milked	650	618	603	583	553
Production			32	15	20	30
	Milk Solids total, kg	279,393	265,924	259,276	250,723	237,533
Revenue						
Stock	Net Milk Sales - this season, \$	1,806,553	1,719,461	1,676,478	1,621,178	1,535,890
	Net Milk Sales - last season	-	-	-	-	-
	Net Milk Sales - dividend	-	-	-	-	-
	Net Livestock Sales, \$	80,847	76,336	74,927	71,950	66,290
	Contract Grazing, \$	-	-	-	-	-
	Change in Livestock Value	-	-	-	-	-
	Total	1,887,401	1,795,797	1,751,405	1,693,128	1,602,181
Crop & Feed	Capital Value Change	- 32,598	- 30,611	- 31,730	- 31,768	- 31,193
	Total	- 32,598	- 30,611	- 31,730	- 31,768	- 31,193
Total Revenue		1,854,802	1,765,186	1,719,675	1,661,359	1,570,988
Farm Working Expenses						
Wages	Wages	182,650	182,650	182,650	182,650	182,650
	Management Wage	36,400	36,400	36,400	36,400	36,400
Stock	Animal Health	54,600	51,900	50,615	48,975	46,428
	Breeding	29,250	27,803	27,115	26,237	24,872
	Farm Dairy	14,950	14,211	13,859	13,410	12,712
	Electricity	24,307	23,135	22,557	21,813	20,665
Feed/Crop	Pasture Conserved	6,300	7,700	7,700	8,537	9,724
	Feed Crop	32,400	32,400	32,400	32,400	32,400
	Bought Feed	100,543	74,279	73,644	79,789	64,761
	Calf Feed	3,250	3,089	3,013	2,915	2,764
Grazing	Grazing	312,947	297,726	290,232	281,228	264,649
	Farm Environment Plan (FEP)	2,500	2,500	2,500	2,500	2,500
Other Farm Working	Fertiliser (Excl. N)	118,300	118,300	118,300	118,300	118,300
	Nitrogen	69,783	60,763	53,584	44,677	30,122
	Irrigation	37,275	37,275	37,275	37,275	37,275
	Regrassing	17,500	17,500	17,500	17,500	17,500
	Weed & Pest Control	6,475	6,475	6,475	6,475	6,475
	Vehicle Expenses	34,125	34,125	34,125	34,125	34,125
	R&M Land/Buildings	67,375	67,375	67,375	67,375	67,375
	Freight & Cartage	7,800	7,414	7,231	6,996	6,633
Overheads	Administration Expenses	22,925	22,925	22,925	22,925	22,925
	Insurance	13,300	13,300	13,300	13,300	13,300
	ACC Levies	6,300	6,300	6,300	6,300	6,300
	Rates	11,900	11,900	11,900	11,900	11,900
Total FEW		1,213,155	1,157,446	1,138,975	1,124,003	1,072,755
Net interest change		-	9,014	4,382	5,620	8,694
Depreciation		100,625	100,625	100,625	100,625	100,625
Operating Expenses		1,313,780	1,249,057	1,235,217	1,219,008	1,164,686
EBIT (adjusted)						
		561,654	527,590	500,475	457,037	417,767
EBIT/ha		3,209	3,015	2,860	2,612	2,387
		3,209	3,093	2,968	2,810	2,589

Table A4: Hinds Variation 2 Solution - Results Summary									
(Based on total farm areas)									
Annual change									
Catchment Total						Percent change from GMP			
Reduction in N Leached									
Milking Platform	GMP	-15% NL	-25% NL	-35% NL	-45% NL	-15% NL	-25% NL	-35% NL	-45% NL
Support Units	GMP	-10% NL	-15% NL	-20% NL	-25% NL	-10% NL	-15% NL	-20% NL	-25% NL
Catchment totals									
Area in Dairy									
	Effective	Total							
Effective Area Sub-total ha	55,536	60,136							
Milking platform ha	45,373	49,089							
Support units ha	10,163	11,047							
Impact over 20 years and beyond									
Net Present Values \$									
Discount rate		2%	5%	8%					
GMP									
Revenue		29,017,762,606	11,551,215,205	7,234,614,215					
Milk Sales		24,733,174,254	9,845,632,221	6,166,394,579					
Operating Expenses		20,554,515,055	8,182,216,874	5,124,584,856					
EBIT		8,463,247,551	3,368,998,331	2,110,029,359					
Marginal Change in NPV of GMP									
						Per cent change			
Staged reduction in NL									
Revenue	-	3,435,720,036	1,042,731,001	514,267,885		2%	5%	8%	
Milk Sales	-	3,176,426,678	961,720,769	473,192,032		-12%	-9%	-7%	
Operating Expenses	-	1,764,335,416	557,382,707	284,775,919		-13%	-10%	-8%	
EBIT	-	1,671,384,619	485,348,295	229,491,966		-9%	-7%	-6%	
						-20%	-14%	-11%	
Smoothed reduction in NL									
Revenue	-	3,547,497,685	1,126,819,962	579,374,792		-12%	-10%	-8%	
Milk Sales	-	3,280,313,046	1,039,731,065	533,472,012		-13%	-11%	-9%	
Operating Expenses	-	1,816,912,718	598,273,618	317,448,261		-9%	-7%	-6%	
EBIT	-	1,730,584,968	528,546,344	261,926,531		-20%	-16%	-12%	
Smoothed - Staged reduction in NL									
Revenue	-	111,777,649	84,088,961	65,106,907		-3%	-8%	-13%	
Milk Sales	-	103,886,368	78,010,296	60,279,980		-3%	-8%	-13%	
Operating Expenses	-	52,577,301	40,890,911	32,672,342		-3%	-7%	-11%	
EBIT	-	59,200,348	43,198,050	32,434,565		-4%	-9%	-14%	
NPV of Marginal EBIT									
Development		304,555,961	45,897,080	-10,967,408					
Intensification		57,793,802	20,296,577	11,340,741					
Flexi Cap				0					
Combined Marginal EBIT									
Staged	-	1,309,034,857	419,154,638	229,118,633					
Smoothed	-	1,368,235,205	462,352,687	261,553,198					
Smoothed - Staged	-	59,200,348	43,198,050	32,434,565					

Table A5: Hinds Fonterra / DairyNZ Four Stage Solution - Results Summary

(Based on total farm areas)

Annual change

Catchment Total						Percent change from GMP			
Reduction in N Leached									
Milking Platform	GMP	-9% NL	-18% NL	-27% NL	-36% NL	-9% NL	-18% NL	-27% NL	-36% NL
Support Units	GMP	-9% NL	-18% NL	-27% NL	-36% NL	-9% NL	-18% NL	-27% NL	-36% NL
Existing dairy and dairy support farms									
Area in Dairy		Effective	Total						
Effective Area Sub-total ha		55,536	60,136						
Milking platform ha		45,373	49,089						
Support units ha		10,163	11,047						
Nitrogen Use \$	18,562,871	17,144,603	15,611,238	13,615,329	10,901,076	-8%	-16%	-27%	-41%
Cow Numbers (1st July)	176,780	170,866	165,485	160,747	154,790	-3%	-6%	-9%	-12%
Milk Solids total kg	75,836,325	73,189,188	70,779,554	68,604,977	65,728,144	-3%	-7%	-10%	-13%

Impact over 20 years and beyond

Net Present Values \$			
Discount rate	2%	5%	8%
GMP			
Revenue	29,017,762,606	11,551,215,205	7,234,614,215
Milk Sales	24,733,174,254	9,845,632,221	6,166,394,579
Operating Expenses	20,554,515,055	8,182,216,874	5,124,584,856
Operating Profit	8,463,247,551	3,368,998,331	2,110,029,359
Marginal Change in NPV of GMP			
Staged reduction in NL			
Revenue	- 4,743,094,168	- 1,252,046,699	- 545,449,926
Milk Sales	- 2,627,885,235	- 764,966,690	- 363,339,602
Operating Expenses	- 3,096,058,778	- 799,343,107	- 341,836,587
EBIT	- 1,747,474,608	- 474,560,647	- 211,173,796
Smoothed reduction in NL			
Revenue	- 4,946,814,903	- 1,349,512,479	- 610,057,630
Milk Sales	- 2,720,211,540	- 832,272,335	- 413,951,075
Operating Expenses	- 3,144,249,774	- 835,794,990	- 370,217,262
EBIT	- 1,802,565,129	- 513,717,489	- 239,840,369
Smoothed - Staged reduction in NL			
Revenue	- 203,720,736	- 97,465,780	- 64,607,704
Milk Sales	- 92,326,306	- 67,305,644	- 50,611,473
Operating Expenses	- 48,190,996	- 36,451,883	- 28,380,674
EBIT	- 55,090,521	- 39,156,842	- 28,666,572
NPV of Marginal EBIT			
Development	304,555,961	45,897,080	-10,967,408
Intensification	57,793,802	20,296,577	11,340,741
Flexi Cap	103,052,367	41,022,462	25,692,681
Combined Marginal EBIT			
Staged	- 1,282,072,478	- 367,344,528	- 185,107,782
Smoothed	- 1,337,162,999	- 406,501,370	- 213,774,354
Smoothed - Staged	- 55,090,521	- 39,156,842	- 28,666,572

Per cent change

	2%	5%	8%
Revenue	-16%	-11%	-8%
Milk Sales	-11%	-8%	-6%
Operating Expenses	-15%	-10%	-7%
EBIT	-21%	-14%	-10%
Revenue	-17%	-12%	-8%
Milk Sales	-11%	-8%	-7%
Operating Expenses	-15%	-10%	-7%
EBIT	-21%	-15%	-11%
Revenue	-4%	-8%	-12%
Milk Sales	-4%	-9%	-14%
Operating Expenses	-2%	-5%	-8%
EBIT	-3%	-8%	-14%

Table A6: Hinds Fonterra / DairyNZ Three Stage Solution - Results Summary

(Based on total farm areas)

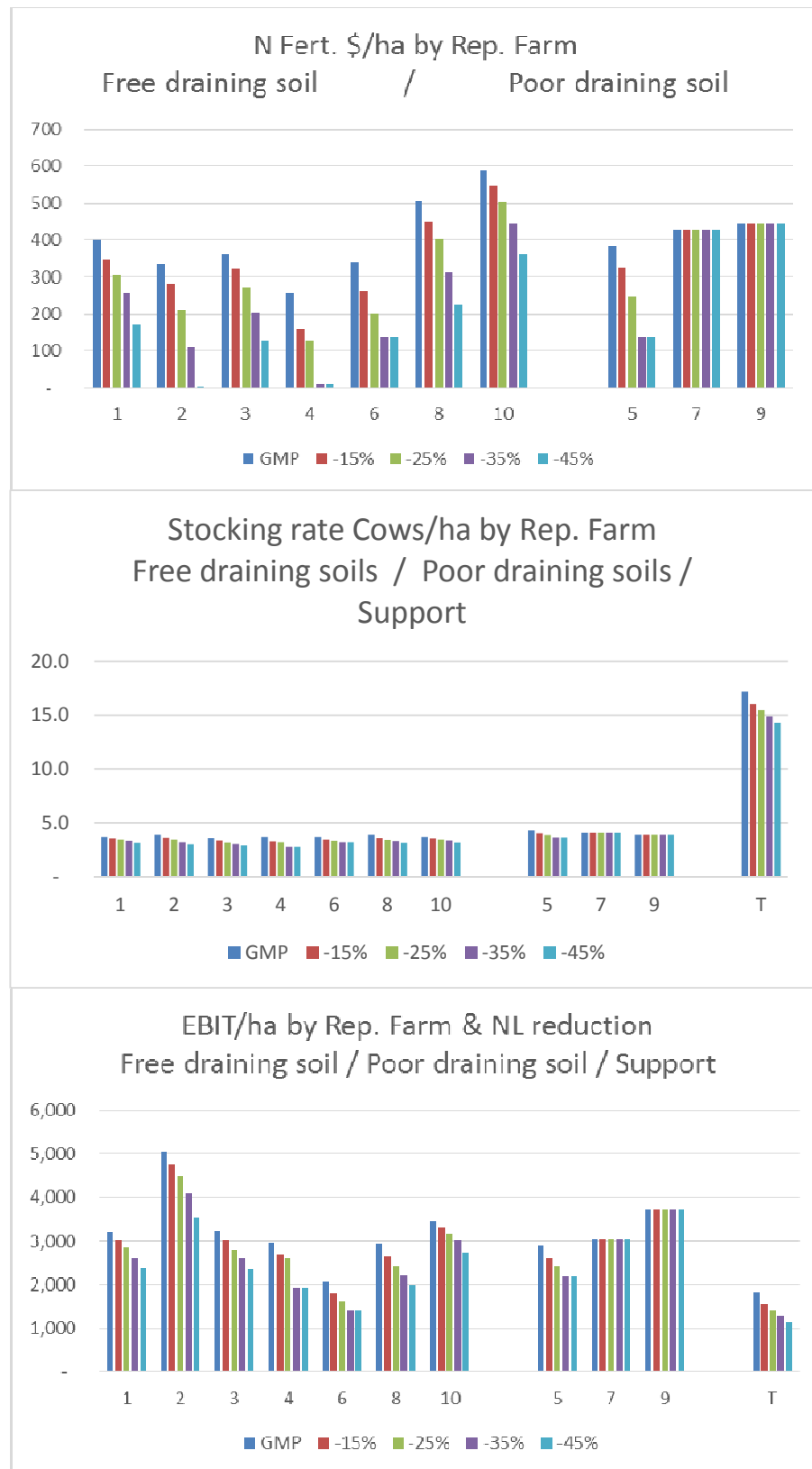
Annual change

	Catchment Total				Percent change from GMP		
Reduction in N Leached							
Milking Platform	GMP	-15% NL	-25% NL	-36% NL	-15% NL	-25% NL	-36% NL
Support Units	GMP	-15% NL	-25% NL	-36% NL	-9% NL	-18% NL	-27% NL
Existing dairy and dairy support farms							
Area in Dairy	Effective	Total					
Effective Area Sub-total ha	55,536	60,136					
Milking platform ha	45,373	49,089					
Support units ha	10,163	11,047					
Nitrogen Use \$	18,562,871	17,144,603	15,611,238	10,901,076	-8%	-16%	-41%
Cow Numbers (1st July)	176,780	166,923	162,129	154,790	-6%	-8%	-12%
Milk Solids total kg	75,836,325	73,189,188	70,779,554	68,604,977	-3%	-7%	-10%

Impact over 20 years and beyond

Discount rate	Net Present Values \$			Percent change		
	2%	5%	8%			
GMP						
Revenue	29,017,762,606	11,551,215,205	7,234,614,215			
Milk Sales	24,733,174,254	9,845,632,221	6,166,394,579			
Operating Expenses	20,554,515,055	8,182,216,874	5,124,584,856			
Operating Profit	8,463,247,551	3,368,998,331	2,110,029,359			
Marginal Change in NPV of GMP						
Smoothed reduction in NL						
Revenue	- 4,747,921,198	- 1,198,868,183	- 493,515,023	-16%	-10%	-7%
Milk Sales	- 2,539,761,008	- 695,760,531	- 308,476,130	-10%	-7%	-5%
Operating Expenses	- 3,038,808,961	- 754,261,976	- 305,986,332	-15%	-9%	-6%
EBIT	- 1,709,112,237	- 444,606,207	- 187,528,691	-20%	-13%	-9%
NPV of Marginal EBIT						
Development	304,555,961	45,897,080	-10,967,408			
Intensification	57,793,802	20,296,577	11,340,741			
Flexi Cap	103,052,367	41,022,462	25,692,681			
Combined Marginal EBIT						
Smoothed	- 1,337,162,999	- 406,501,370	- 161,462,677			

Figure 1: N Fert., Cows and EBIT /ha by Rep. farm and N leaching reduction



Note: Farm T is representative of dairy support farms