BEFORE THE INDEPENDENT COMMISSIONERS

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the Proposed Variation 1 to the Proposed Canterbury Land and Water Regional Plan

REBUTTAL EVIDENCE OF DR ALISON DEWES ON BEHALF OF NORTH CANTERBURY FISH AND GAME COUNCIL AND THE ROYAL FOREST AND BIRD PROTECTION SOCIETY

September 2014

North Canterbury Fish and Game Council

Environmental Advisor – Scott Pearson

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1. My name is Alison Dewes.

2. My Experience is set out in my Evidence in Chief.

3. In preparing this evidence I have reviewed the EIC of:

   (a) Andrew Curtis on behalf of Irrigation NZ

   (b) Stuart Ford on behalf of CPW

   (c) S Hayward on behalf of Dairy NZ & Fonterra

   (d) James Ryan on behalf of Dairy NZ and Fonterra

   (e) Matthew Cullen on behalf of Dairy NZ and Fonterra

   (f) Ron Pellow on behalf of Dairy NZ & Fonterra

   (g) Dr. R Williams on behalf of Federated Farmers

   (h) Duncan Smeaton on behalf of Dairy NZ & Fonterra

Expert Witnesses Code of Conduct

4. I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

5. Andrew Curtis notes in point 29 of his evidence that the current OVERSEER is not able to account for nutrient gains through improvements in irrigation application efficiency due to the inadequacies of its irrigation module. This point reinforces the concerns raised in my EIC that OVERSEER has current inaccuracies for estimating the diffuse N losses under some irrigation practices while in other cases, it is already assuming that “best management practice irrigation management is in place 100% of the time on 100% of farms” thereby resulting in an underestimate of N loads at a farm and catchment level. This “underestimate” results in flawed load assumptions and therefore may result in an underestimate of mitigations required by farmers in order to meet ecological outcomes required by the community (refer to Appendix 1& Table 1).

6. Stuart Ford also raises concern in his evidence regarding the OVERSEER based load calculations (point 21-28) and in point 31, where he concludes the method to allocate and calculate the load to CPW is theoretical in nature. I share this concern: regarding the theoretical nature of the calculations, along with the lack of validation of the model for coarse stony soils, and the reliance on the model to calculate both catchment mitigation solutions and additional catchment loads (CPW).

7. This highlights the urgent need for validation of the model for a range of farming systems on stony soils, in order to be able to deliver legitimate solutions to protect and manage freshwater resources.

8. Although I disagree with Ford's conclusions about total available load in an already over allocated catchment, it appears we both share the same concerns about modelling uncertainty. Chris Keenan para 3.9 (HortNZ) also shares this concern. Stuart Ford notes the variance in OVERSEER outputs (points 47-56) resulting from "method discrepancies" in how data is entered[1], and whether the choice of "method and amount of irrigation" is used. I share this concern and have provided an illustrated example of the issue and degree of discrepancy our consultancy encounters regularly when using OVERSEER in Appendix 1.

9. Amongst our clients, we have witnessed OVERSEER output from fully irrigated farms vary by 50-200% for N loss and up to 50% for P loss as a result of entering "method and amount" in the irrigation details. The change between version 6.0 and the latest version yielded changes of around a 30% increase for P loss from previous versions.

10. As pointed out in my EIC, OVERSEER is still the best tool for farmers to work towards (because it focuses on output controls vs input controls).

11. This reinforces Fish and Game's approach that the theoretical catchment loads urgently require review through a combination of OVERSEER validation with robust ecological monitoring processes that provide legitimate information to prevent further degradation of water bodies.

12. In point 39 of S Ford's evidence, he highlights that the real applicability of OVERSEER is to be used for measuring relative risk rather than absolute. It is the comparison between baseline and the net change using the SAME VERSION that really matters as businesses need certainty to plan. Ford also notes in point 41 that, this limitation is already an issue for CPWL, as there is no connection within Variation 1 that used the earlier version of OVERSEER to calculate the (total catchment) N load and the more recent version (6.1.3).

13. I concur with S Fords concerns regarding uncertainty. The underpinning issues facing all parties here is the failure to have a robust validated model of OVERSEER that reflects the true range in practices on farm (especially with respect to irrigation management) and the subsequent losses that result from the range in practices.

14. This failure to have validated the tool that underpins the numeric methods underpinning assumptions in Variation 1 means there is:

- No certainty for business
- No certainty for the environment
- No certainty for the public that a legitimate solution is proposed

[1] Dairy NZ protocol is to enter method only and NO AMOUNT. Other farm systems do not fall into these criteria (Sheep, Beef, and Deer etc.) The evidence of Ford, quoting Roberts, suggests the most accurate way to reflect losses is to enter method and amount. We have also received this instruction from Dave Horne at Massey. Appendix 1 highlights the discrepancy encountered in outputs when this occurs.

- No certainty for future generations that the life supporting capacity and ecosystem processes of water bodies in Selwyn Waihora will be protected.

15. Furthermore, not only is there a lack of certainty, but the lack of validation and verification of the data inputted creates further uncertainty. Particularly as the poorly verified data (Ford: points 16-31), is subject to continuous change without adequate recognition of how this will be managed. This situation results in an inability for any party to make a plan that will be enduring, legitimate and defendable, and highlights a key oversight in the methodology used to underpin Variation 1.

16. Self-interested parties could take advantage of this lack of rigour and uncertainty, such as farmers wanting to grandparent or even "super-grandparent" their operations and the regional regulator who might select the baselines more suited to their reporting needs and internal policy goals"

17. Further to the points made by Ford with regard to the underestimation of the N loss from farms in points 52-56, in my opinion, the other side of the ledger also needs consideration, specifically that significant over-estimation of load allocation may have occurred. In his paragraph 45 (EIC, 2014), Scott Pearson notes that additional allocation should only occur once 'actual headroom' has been created below limits derived against current state; thereby keeping the responsibility of avoiding externalities with land developers rather than the wider community and environment.

18. While Ford is concerned that the estimates in OVERSEER have been done using "method only without amount" resulting in a significant potential underestimation of the N loss from irrigated intensive systems (reducing the opportunities for farmers under the CPW scheme), the other side of this ledger of uncertainty is that the catchment allocated loads could be significantly overestimated by 50-100%.

19. Thus the table could actually mean that the "mass load of N" as T/catchment/yr could be significantly higher than the current estimate, as per the Table 1 example below:

	2011 (current)	2017	2022 and beyond, to be met by 2037	Assumed % reduction in catchment load from 2017	Example within range of uncertainty	Could mean reducti on of xx%
Total CPW (includes dairy support)	1500	1,944	1,741		3888 (100%more?)*	
Total non CPW	2910	3,366	2,970		5049 (50% more)**	
Catchment agricultural total	4530	5,429	4,830	↓12.5%	8937	↓46%

* 100% was used because this is the discrepancy seen in OVERSEER 6.1.3 output when both method and amount is used. We understand the latest science is updating the model and on this basis shows in many cases a 100% increase in N loss (see Appendix 1) ** 50% was used as an example, due to no data being available from ECAN with regards to actual calculations. I therefore assumed that half the current load is irrigated and if using present input data protocol could be underestimating N leaching significantly. This would be less so on dryland, but the bulk of the increase would come from intensive, irrigated land, and could be 100% more. These properties leach up to 10-15x that of dryland.

20. The above table is an example of the margin of error we are potentially dealing with. This challenge means that "if the desired load is still to the tune of 4830T" to be met in 2037, when coupled with the uncertainty of current loss rates, inevitably it will mean that if community outcomes are to be achieved, (as reinforced by Dairy NZ in pt. 21 of Ryan's evidence), then the catchment load will need to drop by 46% for example.

21. This highlights the level of uncertainty in the method that has been used to underpin the variation to the plan, which has been relied on to inform the Zone Committee and its adopted solutions' package. In response to this uncertainty, several primary sector representative agencies have discussed Good Management Practices and how far farmers can drop their N leaching without being economically penalised.

22. In my opinion, the methodology underpinning Variation 1 is fundamentally flawed and this has been highlighted "neatly and clearly" by Ford. There is an urgency to validate the true land based N and P loss loads <u>prior to the addition of any further loads in an already over allocated catchment.</u>

23. In my view, prior to allowing further loads in an over allocated catchment, caution should be exercised until there is sufficient certainty to be sure there will be no further degradation in line with Objective A2 of the NPS: Objective A2 of the NPS states "The overall quality of fresh water in a region is maintained or improved...."

24. Given the over allocated state of the catchment and the potentially significant effects associated with further allocation in my opinion it would be appropriate to wait until the science is settled before providing additional allocation. The significant effects I am concerned about relate to the:

    (a) the environment, that is at risk from additional N; and

    (b) the farming community, who may have to deal with even more significant costly reductions in N, if the modelling is found to be underestimating N loss.

25. In the evidence of James Ryan from Fonterra/Dairy NZ he notes in point 21 that Dairy NZ recognises nutrient loss must happen for the community vision to occur. I concur with him on this statement. He then goes on to note the initiatives being encouraged through industry collaboration – namely the "Dairy Accord" where stock are to be excluded from all water bodies greater than 1 m wide and 30 cm deep with permanently flowing water .

26. While I agree this approach is important and acknowledge many farmers are doing good work in this area, I would also highlight that <u>OVERSEER already assumes these practices are in place so at a regional level, these mitigations are already accounted for in the (catchment) mass load calculations.</u>

27. The sustainable milk plans (SMPs) as referred to by James Ryan in point 25 are a starting point to raise awareness on farm but will not achieve much more than that in my opinion.

28. Sustainable milk plans are a voluntary process without any compulsion for the farmer to make change; therefore they may in many circumstances be an exercise in public relations.

29. The data collected in these plans is not subject to rigorous process. There is no validation process for the economic data, nor is there a strict process for verification of the OVERSEER output data. This lack of rigor during the data collection process leads to results which are misleading, thereby failing to add any substantiated value to the individual farmer or the industry as a whole.

30. The voluntary process means that motivated farmers will likely implement change but others will not. There is no compulsion for a farmer to make change in the SMPs. In the absence of appropriate resource allocation, coupled with regulation that links to improved ecological outcomes, these plans will be unlikely to create enough change on farm to meet the required community goals and catchment outcomes.

31. For these reasons, my opinion is that a voluntary process is not adequate. .

32. In point 37, Ryan is clear that this is not a "one size fits all solution" for farmers. I concur with him on that point. However, there has been an averaging of farm data to make conclusions with regard to what can be done by farmers on average across the catchment by Smeaton in point 30.5 where he quotes Matthew Newman on behalf of Dairy NZ. Smeaton appears to contradict himself in this point, where in the body of his EIC (point 30.3), he is of the opinion that all farms are different, the net drop achievable by a farm is related to its own unique baseline, and there will be a solution for each farm that is different and farm systems and economic analysis is required to configure a suitable strategy.

33. I agree with Smeaton on his point (30.3), yet it appears that if this is a known fact as represented by the evidence of Dairy NZ and Fonterra, it raises a matter of confusion from the organisation as to why such an extensive approach is being undertaken with "Sustainable Milk Plans" which fail to adopt a robust methodology to analyse the most economic farm system reconfiguration to reduce nutrient losses in the most economic manner. As noted in my EIC for the pCLWP, the method and likely cost to assess farm system reconfiguration to farm within N limits is described in Appendix 2.

34. In point 15.1 Smeaton refers to GMP as described by Mr Ryan and Mr Williams. I note in the evidence of both of these submitters, there is no detail of what GMP actually is. It is unclear how any modelling can be legitimately undertaken about what can be achieved over and above GMP, to quantify net economic changes, if the actions and methods that define GMP are not transparent.

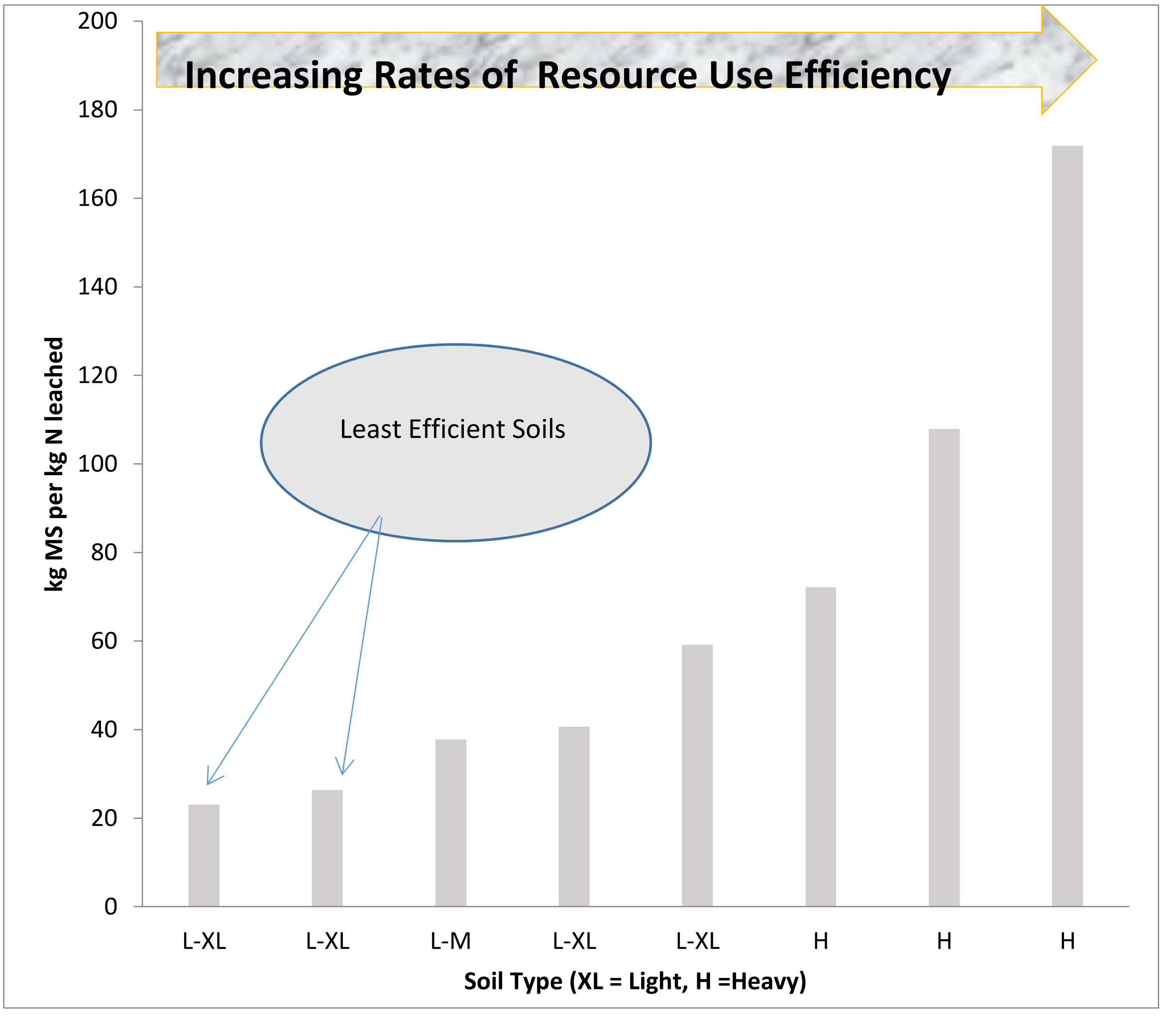
35. I have some concerns about adopting Good Management Practice (GMP). In my opinion, it would be appropriate to assume GMP includes all the assumptions already in Overseer including water and effluent application to SMD, code of practice effluent systems, full stock exclusion from all water bodies, BMP for fertiliser use, etc. Therefore any further

good management practices will be over and above those already accounted for in the mass load accounting used by OVERSEER.

36. In Seaton's point 15.3 he makes a claim that mostly those farms that are N use efficient, have low levels of N loss (for their soil type and climate) and are profitable, cannot easily reduce N losses further without significant negative effects on their profitability. On analysing the 8 farms for nutrient use efficiency, it would appear that some are very nutrient use efficient & consequently resource use efficient, while others are not as illustrated.

Figure 1: Kilograms of Milksolids per kg N leached calculated from the eight farms: Smeaton (Dairy NZ)

The most "resource efficient farms" appear to be on the heavier soils



37. Mr Smeaton refers to kg N loss per kg MS (nutrient use efficiency) which also reflects "resource use efficiency" – the most efficient use of a finite resource for production purposes.

38. In my EIC – Executive Summary, I also raise this issue: (which is supported by Mr Smeaton's study of 8 farms in Figure 1): point 23: *"Is it an efficient use of the resource to require expensive mitigation on soils that have superior assimilative capacity to attenuate discharges from dairying, while allowing significant expansion on soils that do not?"*

39. I understand that the RMA includes directions relating to the efficient allocation of resources and protection of the life supporting capacity of the environment. In the case in Selwyn te Waihora,, it does not appear consistent with these directions to further allocate "already over allocated N loss" rights to less efficient resource users on light soils, while at the same time forcing more efficient resource users on heavier soil types "to increase their businesses risk" as they dig deeper into debt to spend more on advanced mitigations in order to make headroom for irrigation on L and XL soils for CPW to proceed. In my opinion this makes no sense at all.

40. The range in nutrient use efficiency and the corresponding "resource use efficiency" we observe within a sub catchment and across our own consultancy client base is huge. An example of the kg MS per kg N loss is illustrated in the table below, from a study of 25 Upper Waikato Farms (Figure 2).

41. It can be noted that the range varies by 300% and that there is significant heterogeneity in any sample of farmers, reinforcing that blanket claims regarding "average performance and average net changes for farms" alluded to in point 15.6 by Duncan Smeaton is both dangerous and flawed.

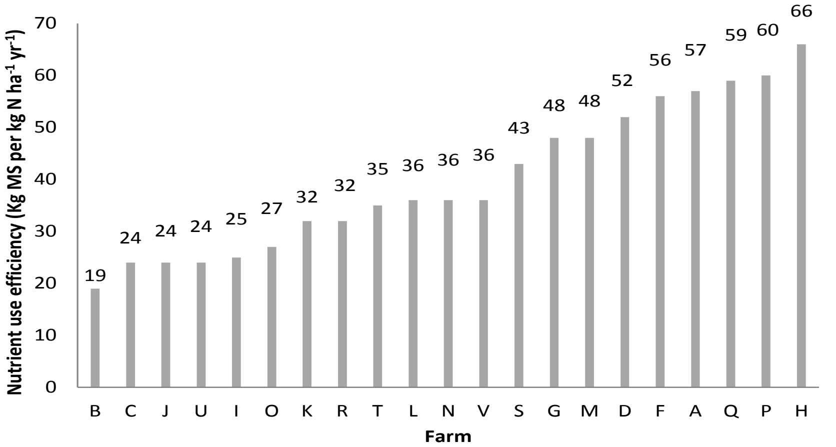
42. In my experience of studying over 150 sets of economic and environmental data of dairy farms in the Upper Waikato and Upper Waipa in 2012-2013, I found no significant correlation between N use efficiency (kg MS/kg N lost) and improved profitability. The only significant correlation with profitability (return on capital, ROC) was a low cost of production.

43. Ironically, the Waikato region faces the same challenges as Selwyn, where land use change is occurring in a catchment where water quality is declining. Since 2003, over 50,000 ha of new pine to pasture conversions have taken place and more is continuing. Irrigated dairying in the upper catchment leaches around 100% more than average farms on ash and sedimentary soils in the lower catchment[2] – illustrating also, a lack of resource use efficiency as a result of intensifying land use on vulnerable soils, generating low milk solids produced relative to N loss risk.

[2] Pine Forest N loss: 3-4 kg N per ha per year, Upper Waikato dryland dairying: 35-45 kg N/ha/yr: Irrigated Upper Waikato Dairy: 65-75 kg N/ha/yr; Lower Waikato, Class 1-3 soils, average 30-40 kg N/ha/yr. Top 10% environmental performance dryland dairying Waikato 15-20 kg N/ha/yr.

Figure 2 : The range in Nutrient Use Efficiency across 25 Upper Waikato Farms.

(The lower nutrient use efficiency figure of 20-24 kg MS/kg N leached is typical of irrigated dairy farms N loss rate in the Upper Waikato Catchment)



44. In point 15.7, Smeaton claims that "deeper cuts in profitability to achieve greater reductions in N loss will further increase the percentage of farms at financial risk, depending on interest rates compared to the status quo or base situation." In my EIC, I refer to the DairyNZ study in the Selwyn Waihora by Howard (2012), demonstrating that 40% of farms were unable to demonstrate an ability to meet obligations at a milk price lower than $6.00 per kg milk solids. This same study also noted that a 32% reduction in N loss was possible with only a small effect on profit (average across farms). This Dairy NZ (2012) study used the (GSL) grazing systems limited model, to analyse farms and report these conclusions (Point 93 of Dewes EIC pCLWP).

The report generated by Dairy NZ in 2012 looking at mitigations possible in the Selwyn – Waihora catchment (Howard, 2012) suggested that there might only be around a <u>5% reduction in profit for a 32% reduction in N leached (Table 17 of Dairy NZ Report).</u> This study is likely to reflect the upper bounds of effects on profitability as a result of the mitigation costs estimated in this report because:

(a) *Assumptions relating to N leaching have not been clearly articulated in the report and may have led to over estimation of the effects of single costs.*

(b) *Precision irrigation was not considered as mitigation, yet this could have yielded the most profitable mitigation approach.*

(c) *Benefits of some mitigations may not have been fully accounted for and have not been clearly stated.*

(d) *Focus on a net change in operating profit rather than full return on capital (ROC) may also lead to underestimation of the benefits of some mitigations.*

45. Of note, is the choice of mitigations used by Smeaton for the modelling of 8 farms undertaken by Alder using Farmax. Despite Dairy NZ's own trial work (and a quote also made by Harris) showing that optimising a farm using a lower stocking rate in some

cases, could improve profitability (win-win), the modelling process used by Smeaton did not use this option to test a farm system reconfiguration option.

46. The rationale used was that the "average farms" in the Selwyn Waihora zone (pt 23.2) were already well "above average".

47. Referencing this from the Dairy NZ Howard (2012) report shows that the range of cow production on light soils ranged from 379 kg MS per cow to 489 kg MS per cow, and on heavy soils, ranged from 351 kg to 461 kg. It is probable that out of this spread of data from the farms surveyed, around half of these herds had cows producing at 75-80% of their efficiency[3]; relying on around 700-800 kg of bought in feed per cow[4] to achieve this level of production. Such a scenario suggests there was a viable reason to consider a degree of destocking, along with optimisation of the farm and improvement in milk production per cow at a lower cost. Despite this assumption in their own evidence suggesting it may be a viable option to test on some of the farms, it was not done.

48. Furthermore, it is confusing why there is a tendency for the submitters (Dairy NZ and Fonterra) to switch between farm system models (GSL and Farmax) when demonstrating a resource efficiency outcome of such significance to the regional industry.

49. The model used by Smeaton and Alder in 2014 was Farmax, despite an earlier study conducted by Dairy NZ in the Selwyn Waihora (2012) where GSL was used and furthermore, Dr David Mc Call suggests GSL is preferable to optimise a farm in the face of resource constraints where GSL <u>optimises</u> farms for resource efficiency, while Farmax <u>simulates</u> present farm practices, and in the case study of Smeaton & Alder, <u>simulated single mitigations only</u>:

> *"The GSL model was chosen over Farmax (which was used for the calculations presented in Brown et al 2011, and of which the author of this evidence was a developer). This was because GSL is more efficient at finding optimal resource use allocations due to it being an optimising, rather than a simulation model. With simulation models (such as Farmax) the definition of optimal resource use requires the user to iterate their way to an optimum solution. This iteration is time consuming, not always full-proof and optima may be missed. Predictions from Farmax and GSL are very close, given similar resource inputs. This is shown in Table 1 where predicted outputs for the current configuration for three of the farms which had previously been loaded into Farmax by another user, were compared with predictions by GSL. It means that the only significant difference between the models is in the model structure (optimising – GSL, versus simulation - Farmax).*
> ***Footnote Page 6 (Evidence of Mc Call on behalf of Fonterra in Hurunui + Waiau River Regional Plan)***

50. I concur with Smeaton in point 34 where he notes that some farmers are already running profitable low N leaching systems while others have more room to move (point 35). This highlights the inequity of the grand parenting approach adopted by the CLWP – innovators are penalised and polluters are rewarded under such a regime.

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[3] 400 kg MS from a 500 kg cow = 80% efficiency in terms of MS per kg bodyweight.

[4] (page 14 "There is a huge range in supplements imported onto milking platforms, with 600-700 kg/cow common. This has large implications for the area of land needed to support the platform" from ***Selwyn-Waihora Nitrogen Loss Reductions and Allocation Systems This report is prepared by DairyNZ for consultation with the Selwyn-Waihora Zone Committee on possible controls on diffuse source nitrogen losses.*** Sam Howard. Alvaro Romera, Graeme J. Doole,.

51. I concur with Smeaton in point 36 also – where he identifies all farms are different and farm systems analysis should be undertaken on a case by case basis to help farmers identify their farm system strategy. This approach would be “money well spent” by the dairy industry in order to help farmers and should be part of the assistance that is offered as part of the Sustainable Milk Plans if true, meaningful change is to occur.

52. It would appear that the Sustainability Leader for Dairy NZ (Dr. Rick Pridmore) is in agreement with Fish and Game’s approach that no further expansion and conversions should be occurring in already over allocated catchments (where water quality is in decline) despite this argument being absent from their experts’ evidence with regard to this critical issue.

> *29 August 2014 – (http://www.stuff.co.nz/business/farming/dairy/10432922/Unchecked-land-conversion-resulting-in-nitrogen-loss)*
>
> ***Unchecked land conversion resulting in nitrogen loss***
>
> *Land use change is the most important driver of nitrogen loss to water, says water quality specialist & DairyNZ strategy and investment leader Rick Pridmore, of Hamilton,*
>
> *..”He said the conversion of land with low nitrogen losses to land that generated high losses should be controlled”*
>
> *“Intensification and poor practice also drove nitrogen loss”.*
>
> *But Pridmore said good environmental practice would not solve water quality issues associated with nitrogen loss.*
>
> *Nor would the deterioration of water quality be halted if land use change continued unchecked.”*
>
> *“Improving skills on farms and removing poor practice could yield a one-off reduction of 10 to 15 per cent.”*
>
> *“Technology and management changes could lower nitrogen loss by 30 per cent.”*

53. Dr Roger Haydn Williams on behalf of Federated Farmers of NZ describes the MGM project without providing any detail. Irrespective of what practices are or are not included in GMP, the crux of the issue at stake is that there will need to be a net reduction in nitrogen loss across the catchment in the mid to longer term to achieve community outcomes. The degree of reduction in N loss will be determined by the ecological health of the catchment over the ensuing decades. The degree of reduction by all farmers will be significantly greater (“deeper cuts”) as a result of the additional nutrient load that will arrive from CPW. This is the real issue at stake here, as illustrated in Table 1 of this evidence.

54. Mathew Cullen on behalf of Fonterra and Dairy NZ notes throughout his evidence the wide range of initiatives that Fonterra are undertaking: The Sustainable Dairying Water Accord, Supply Fonterra and the Living Waters Project. These initiatives are laudable

and are to be commended. However it is important to note that OVERSEER and the mass loads calculated by ECAN for the purposes of this variation, assumes all these BMP and mitigations are "already in place" – so in reality, all these activities, are really just catch up to a numerical point that has already been accounted for.

55. Ron Pellow's example of the LUDF changes that had to occur in order to achieve the baseline N loss for 2013 (pt. 20) reinforces the points I make in both my EIC and this statement, "that any resource allocation needs to be both legitimate and planned, fair to established farmers and as accurate as possible", to avoid "sudden shocks to a farm business" such as the Lincoln University Farm which had to make a sudden unforeseen change to its farm system that had not been planned well in advance, so it could meet a regulation. This case highlights why over allocation of an already over allocated resource[5] is risky to business as well as the environment.

56. The GSL model has been proven empirically via the LUDF project, and was shown to be correct in both economic, production and N leach terms, through the accounting of real time implementation (of proposed management change factors), and secondly through real time monitoring as these changes were implemented[6].

57. The short message is that reductions in N leach are possible with little reduction to profit for a number of farming systems in the Selwyn Waihora Zone. That has been shown possible for top performers also: LUDF providing there is time to plan and adapt to the system strategy.

58. Thus, if this improvement can be found for a dairy farm in the top 2-5% of NZ so most other farms can be too. LUDF is well above average, yet still demonstrated improvement.

59. Mr. Smeaton on behalf of Dairy NZ assumes that the farms he studied were near optimal milk production (point 23.2) when he compared them with the NZ average production per cow (358 kg MS per cow) and so therefore any change will be detrimental. I do not accept this for reasons set out in my EIC.

60. Each one can be identified and managed appropriately as farmers are now showing improvements to both N leaching and profitability are achievable in Horizons, Taupo, Upper and Central Waikato.

61. In my opinion, the way in which the benefits from such N leach reductions are treated should be considered carefully. I do not consider that the most appropriate use is allowing for the conversion of more land to irrigated dairy when significant transferred costs will fall on existing farms. This carries the significant downside that achieving a worthwhile return on capital on existing farms will be much harder when operating with a lower environmental footprint. This is particularly the case with CPW, where leaching on new farms is likely to occur at a significantly higher rate than for existing farms.

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[5] Resource = Ecosystem service – assimilative capacity of the ground and surface waters in the receiving environment

[6] 1. The results are summarised in: http://www.siddc.org.nz/assets/LUDF-Focus-Days/10-May-2012-.pdf.

62. Richard McDowell et al. (In Press) 2014, as referenced in my EIC, concludes that of all the methods to mitigate P losses under irrigated dairying (pts 369 – 371) "…*perhaps the most obvious would be the consideration of the vulnerability of soils and aquifers prior to landuse change or development*." I believe the same logic should be applied for N losses under irrigated dairy as well.

63. Given the rebuttals provided above, I support Fish and Game and Forest and Bird's position which seeks to distribute ecosystem assimilation services responsibly, to incentivise and where necessary regulate more sustainable land use behaviours, and to provide a more realistic trajectory of improvement toward ecosystem health.

Dr Alison Dewes (06/ 09 /2014)

APPENDIX 1: THE VARIATION IN OUTPUTS FROM OVERSEER.

The following slides show the degree of change in OVERSEER outputs when using the Dairy Industry Protocol vs Actual Data (as suggested by Roberts, in Ford's evidence)

Figure 1

Actual Irrigation Rates vs. Overseer Estimates

88% Increase in N leaching on irrigated Selwyn farm

Overseer Estimates

Nutrient Budget | Nitrogen | Phosphorus | Comments | Sum
Footprint product | Effluent | Pasture production | Other values

(kg/ha/yr)	N	P	K	S
Nutrients added				
Fertiliser, lime & other	242	17	0	40
Rain/clover N fixation	102	0	2	4
Irrigation	10	0	7	10
Supplements	115	25	81	20
Nutrients removed				
As products	145	25	33	9
Exported effluent	0	0	0	0
As supplements and crop residues	0	0	0	0
To atmosphere	110	0	0	0
To water	27	1.2	11	55
Change in farm pools				
Plant Material	0	0	0	0
Organic pool	187	15	4	12
Inorganic mineral	0	3	-13	0
Inorganic soil pool	0	-2	55	0

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Actual Irrigation Rates

Nutrient Budget | Nitrogen | Phosphorus | Comments | Summary | Nitrogen ov
Footprint product | Effluent | Pasture production | Other values | Full parameter r

(kg/ha/yr)	N	P	K	S	Ca	Mg
Nutrients added						
Fertiliser, lime & other	242	17	0	40	36	0
Rain/clover N fixation	100	0	2	4	2	4
Irrigation	13	1	9	13	49	12
Supplements	115	25	81	20	11	21
Nutrients removed						
As products	145	25	33	9	35	3
Exported effluent	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0
To atmosphere	110	0	0	0	0	0
To water	51	1.4	11	58	50	1
Change in farm pools						
Plant Material	0	0	0	0	0	0
Organic pool	165	15	4	12	1	1
Inorganic mineral	0	3	-13	0	-2	-3
Inorganic soil pool	0	-3	57	0	16	36

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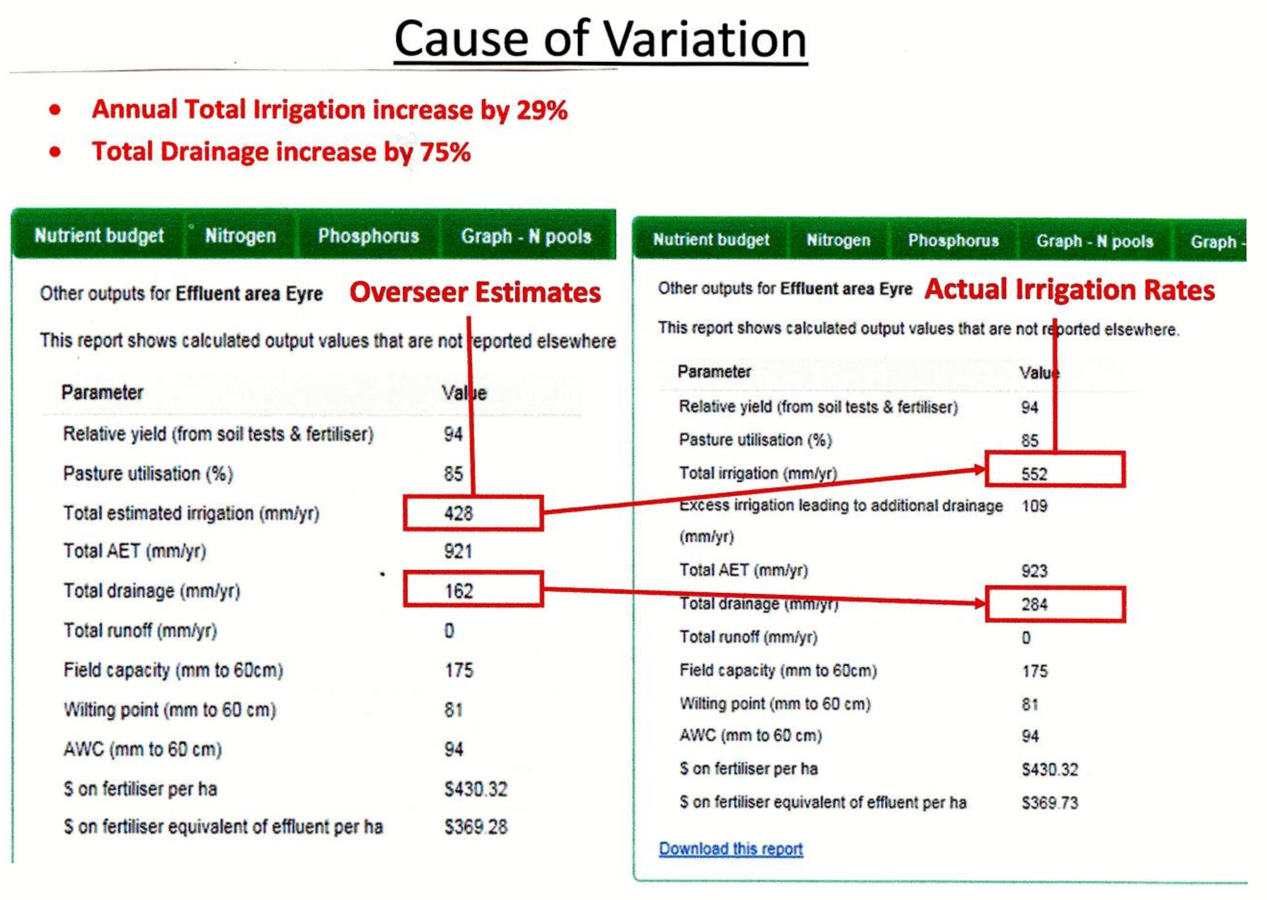
Figure 2.



Nutrient budget | Nitrogen | Phosphorus | Graph - N pools

Other outputs for **Effluent area Eyre**

This report shows calculated output values that are not reported elsewhere

Parameter	Value
Relative yield (from soil tests & fertiliser)	94
Pasture utilisation (%)	85
Total estimated irrigation (mm/yr)	428
Total AET (mm/yr)	921
Total drainage (mm/yr)	162
Total runoff (mm/yr)	0
Field capacity (mm to 60cm)	175
Wilting point (mm to 60 cm)	81
AWC (mm to 60 cm)	94
$ on fertiliser per ha	$430.32
$ on fertiliser equivalent of effluent per ha	$369.28

Nutrient budget | Nitrogen | Phosphorus | Graph - N pools | Graph -

Other outputs for **Effluent area Eyre**

This report shows calculated output values that are not reported elsewhere.

Parameter	Value
Relative yield (from soil tests & fertiliser)	94
Pasture utilisation (%)	85
Total irrigation (mm/yr)	552
Excess irrigation leading to additional drainage (mm/yr)	109
Total AET (mm/yr)	923
Total drainage (mm/yr)	284
Total runoff (mm/yr)	0
Field capacity (mm to 60cm)	175
Wilting point (mm to 60 cm)	81
AWC (mm to 60 cm)	94
$ on fertiliser per ha	$430.32
$ on fertiliser equivalent of effluent per ha	$369.73

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APPENDIX 2 WHOLE FARM PLANS VS SUSTAINABLE MILK PLANS

1. This is to illustrate what is included in the whole farm plan service to clients.

2. 70 Whole Farm plans were generated by our group in the past year.

3. These plans have been generated for between $2500 and $3600 per farm and this has included two visits to each farm: For the money and time spent, our consultants have delivered to farmers the following information:

a. Visit to collect annual farm performance data, set of accounts, overseer 6 information and farm inspection.

b. The report and visit back to the farmers has included most, or all of the following:

c. Full Economic + Farm Performance Analysis and comparison of performance against peers in their locale.

d. An updated Overseer 6 File and Full Reports, that has been aligned with their farm accounts, commodity sales dockets and annual fertiliser purchase documentation

e. A Quantitative Assessment of their Environmental Performance in a “Scorecard approach” that quantifies their farms risk to the receiving environment, taking into account waterway management, their N loss risk, P loss risk, soil protection and loss risk, effluent management + risk, greenhouse gas losses, water use efficiency and biodiversity support. The scorecard serves to highlight areas on the farm that are identified as a risk/threat and that Overseer 6 assumed were already in place. (i.e.: ID of critical source areas and areas for improvement to enhance ecosystem resilience)

f. Some of the 70 farms also received an Effluent System Risk Scorecard, and an estimate from the pond calculator for storage requirements. This effluent scorecard also quantified the key areas they needed to address in order to meet the Dairy NZ Code of Practise Standards.

g. For 10 of the $3600 plans provided, there was also farm system modelling done, in a similar manner to that detailed in Appendix 3 of my EIC. **This provided farmers in sensitive catchments the ability to better understand what farm system re configuration may be required in order ensure their N, P, sediment and pathogen loss risk was reduced. This was linked to economic and risk outcomes for their use.**

h. A revisit to the farm to discuss the report’s findings was included in this overall price of $3600.