BEFORE THE HEARING COMMISSIONERS

IN THE MATTER	of the Resource Management Act 1991 ("**the Act**")
AND	
IN THE MATTER	of the Resource Management Act 1991 and the Environment Canterbury (Temporary Commissioners and Improved Water Management) Act 2010
AND	
IN THE MATTER	of the hearing of submissions on Variation 2 of the Proposed Land and Water Regional Plan

STATEMENT OF REBUTTAL EVIDENCE OF NICHOLAS CONLAND FOR HORTICULTURE NEW ZEALAND

29 MAY 2015

ATKINS | HOLM | MAJUREY

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QUALIFICATIONS AND EXPERIENCE

1. My name is Nic Conland, I am an Environmental Scientist. My qualifications and experience were set out in my primary evidence.

SCOPE OF REBUTTAL

2. My rebuttal evidence covers the following:

   (a) Managed Aquifer Recharge;

   (b) Water Allocation;

   (c) Nitrate Loads;

   (d) Model Accuracy; and

   (e) Land Use Flexibility.

MANAGED AQUIFER RECHARGE (MAR)

3. I have read the evidence of Ngai Tahu (Mr Thorley) and support his findings as follows, he:

   (a) highlights the need for very specific targets (flow/groundwater levels) for effective trial and error of adding recharge through MAR (**para 37**).

   (b) identifies poor explanation of numbers used regarding lost recharge due to changed irrigation practices (**para 39).**

   (c) notes improper calculation of MAR 'new water', which is regular land-surface recharge (**para 40**).

   (d) Notes that the land-surface recharge proportion of 'New Water' will not be clean, and may not reduce nitrates as much as has been indicated by Environment Canterbury (**para 41**).

   (e) considers that MAR calculations have been 'conservative', as they have not included temporary and uncertain parts of the water balance as being available for allocation (**para 44**).

   (f) expresses concern with the 'point source' approach for implementing MAR (ie it does not match it's representation in the groundwater model) (**para 48**).

4. I agree with need for clarification of the MAR assumptions and in particular the need for a representation of MAR in the biophysical models which reflects the proposed operation of the MAR scheme(s) and results which provide insight into the potential mitigation sought through the use of MAR in the catchment.

WATER ALLOCATION

5. I also have considered Mr Thorley's consideration of the links between allocation limits and recharge from the irrigation schemes.

6. Mr Thorley observes that groundwater allocation limits based on net land-surface recharge for Mayfield-Hinds and Valetta have not been updated to account for new information and understanding of drainage attributes (climate, irrigation, water usage) which may consequentially influence return drainage and therefore allocation (**para 62**). I agree with this assertion.

7. In the evidence and modelling prepared for Selwyn Waihora our modelling for Variation 1 determined that the relationship between return drainage and allocation can be explicitly represented.

NITRATE LOADS

8. I have read the evidence of Ngai Tahu (Dr Dudley) and support his findings as below.

9. I note that Dr Dudley suggests that the majority of the nitrogen load in the catchment results from irrigated dairy/dairy support and arable land use (82.6% - **para 16**). In my experience while these land uses dominate the land use assessments I have prepared for the primary sector these assessments also reveal that, in practice, many farmers have/share multiple land uses on their properties.

10. Dr Dudley has prepared four scenarios of varying land use, Nitrate-N loads, and Groundwater N concentrations were tested (**para 12**). His results suggest that imposing nitrate-N loading limits of 27/kg/ha/yr to all land within catchment would reduce nitrate-N loading below current levels, without the addition of irrigated land proposed under Variation 2.

11. At Jacobs we have undertaken a similar exercise in multiple scenarios for catchments in New Zealand. The application of theoretical allocations which distribute nitrogen loads arbitrarily such as averaging or an LUC allocation result in actual increases in nitrogen loads to water bodies due to the increased loading to upper catchment areas. This effect is due to the increased loading in areas currently with low leaching levels.

12. In my opinion an averaging approach is only possible if a mechanism for trading is simultaneously developed.

13. Dr Dudley suggests the that availability of phosphorus will limit in-stream algal growth and proportional increases in N and P availability in surface water will not often have the same effects on growth of aquatic plants and algae. I agree that due to the inter-relationship between these nutrients it is not sufficient to treat controls on nitrate-N loss to water as a proxy for preservation of water quality.

MODEL ACCURACY

14. Many of the submitters have commented on the accuracy of the Variation 2 modelling. I summarise my response to their evidence in the following paragraphs.

15. The evidence of Federated Farmers New Zealand (Dr Hume) recognises that N discharges are highly affected by seasonal fluctuations and can occur over extended periods (over four years). Dr Hume identifies these changes as being different to those fundamental changes in landuse type (dryland to irrigated) which have the greatest long term impact on water quality predictions (**para 21 & 22**).

16. I support these observations. Jacobs modelled scenarios developed to test the hypothesis's for planning provisions under the National Policy Statement for Freshwater 2011 (Tukituki, Selwyn Waihora and Rotorua) all indicate the direct relationship between the temporal effects of catchment hydrology and water quality outcomes.

17. Dr Hume describes the impact soil type has on N discharge rates, and expects soil types to be taken into account in establishing discharge thresholds (**paras 23, 24, & 25).** I support the relationship between soil types and discharge thresholds and allocation.

18. The evidence Ms Shirley Haywood for Fonterra is now considered. Ms Haywood is concerned about the OVERSEER nitrogen loss and drainage values, which when used without adjustments made for known deficiencies in irrigation and drainage model, lead to underestimated total nitrogen loads and drainage volumes. If used in the Environment Canterbury modelling, the nitrogen load in Variation 2 is an underestimate of the required load needed to achieve root zone concentration (reaches 7.2 mg/L rather than 9.2) (**para 5.6 & 5.7**).

19. Ms Haywood claims this discrepancy occurs between current and future N loads in recently granted consents and ECan modelled loads. She notes that the RDRML consent had N loss per ha 3 times higher than the ECan catchment load modelling (**para 5.9**).

20. I support Ms Haywood's evidence and make the same point in my Evidence in Chief. The work undertaken by Jacobs also illustrated the same error in load calculated in the Variation 1 Selwyn Waihora load assessment.

21. In principle for Variation 2 the relationship between effects and the load can be simply expressed as:

    Effects = Load x Attenuation

    Where a load is modelled lower than it actually is, the model will also underestimate the true rate of attenuation in the catchment.

22. This is because attenuation is based on the effects to load ratio as observed through time.

23. A higher actual load will mean, as Ms Haywood suggests, a different outcome for groundwater quality than that predicted by the E-Can model.

24. Dr Dudley for Ngai Tahu also identified limits regarding the modelling "*because of the uncertainty of some sub-models and the variability of results produced between versions of Overseer, the results from this analysis should be used with extreme caution*" - Everest et al. Dr Dudley describes Scott's (2013) method as a tool that does not take into account differences in nutrient loading to groundwater in time or in space throughout the watershed, and assumes perfect mixing of leached water (**para 19 & 20**).

25. I support this assessment, however I disagree that the Scott mass balance approach is useful as a management tool. As outlined in my EIC I agree the Scott approach is a good way to calculate a number but should not be used in place a truly predictive model which accounts for temporal and hydrological variability.

26. The evidence of Mr Thorley for Ngai Tahu notes a discrepancy between water balance estimates and modelled estimates used (recharge) (**para 18 & 19**).

27. Mr Thorley also suggests the surface water allocations for streams and recharge are inconsistent and are not well explained in their bearing on the model (**para 20, 21 & 22**).

28. Mr Thorley's concern with the water balance is supported. I also support his suggestion that a consented 'take' utilisation scenario is run to determine not only the likely benefits of MAR but also the effects on reliability for water users.

29. Given the uncertainty in the water balance, a quantification of the allocation requirements for root stock protection water should be included.

30. The Jacobs modelling in the Tukituki Catchment demonstrated that the allocation required to provide root stock protection is within the 0.2% of the pumping withdrawal in the E-Can model.

LANDUSE FLEXIBILITY

31. Many of the submitters discuss both the options and consequences for landuse flexibility under proposed Variation 2 provisions. I have summarised my response to their evidence in the following paragraphs.

32. The evidence of Federated Farmers New Zealand (Dr Hume) is considered and I discuss his findings as follows:

    (a) He notes that a 15kg/ha/year flexibility cap will give reasonable flexibility for those on deep, fine textured soils, but less for those on shallow, coarse textured soils (which have greater drainage vulnerability). He goes on to say that a cap will need to be adjusted in line with versions changes (in nitrogen loss estimates) in OVERSEER (**para 29 & 30**).

(b) I agree and support Dr Hume's evidence and agree with his caution on version changes in OVERSEER requiring either plan changes for new nitrogen loss values or regulatory control to ensure equivalent versions are used.

33. The evidence of Fonterra and DairyNZ (Haywood) explores a scenario for a flexibility cap further for low nitrogen loss values.

34. Ms Haywood's scenario is "*that allow all properties with N losses below 15 kgN/ha/yr to increase to 15 kgN/ha/yr and allow properties with N losses between 15 – 20 kgN to increase up to 20 kgN/ha/yr*" (**para 6.8**). This scenario illustrates the small influence on the overall nitrogen load from these low nitrogen loss landuse types. An assessment of the load based on current landuse (Stuart Ford for DairyNZ) illustrates that the current Horticulture and Arable activities account for just 250 t/yr nitrogen. This is less than 5% of the total current catchment load and is likely to be within the error associated with individual OVERSEER use cumulatively in the load calculation. I also calculated the load for the fertile soils as in my EIC, this totals around 410 t/yr nitrogen.

35. Fonterra and DairyNZ have also provided technical assessments for Ms Haywood's evidence by Aqualinc (Dr Brown). This information is helpful and follows the spatial assessments Jacobs undertook for Variation 1.

36. I note that Haywood and Brown have provided an interesting assessment of the change in irrigation use between the ECan assessment in 2011 and that in 2014. This is important to both the correlated landuse and OVERSEER nitrogen loss predictions.

37. I compared the spatial data for irrigation between the two parties (ie Fonterra and Council) and observed a reasonable difference as follows:

(a) Fonterra/DairyNZ 73% catchment in irrigation

(b) ECan 2011 66% of catchment in irrigation

The effect on the load is a relative increase of around 7% in the catchment load.

38. This raises a challenge for the Variation 2 proposal, in that can ECan realistically provide for 30,000ha of new irrigation

into an over-allocated catchment? This has been sensibly addressed to some degree in the Brown/Haywood evidence which suggests that only a further 15,000ha to a maximum of 19,000ha is likely.

39. I have looked at the proposals from Fonterra/DairyNZ and ECan for reductions/clawbacks in relation to the flexibility cap and future landuse versatility for Horticultural and Arable landuses. I have considered two tests:

    (a) What is the relative change in load available for Horticultural and Arable Crops (% change and mean nitrogen loss)

    (b) What is the relative change in the load available for fertile soils (% change and mean nitrogen loss)

40. The table below shows the findings for these two tests on the proposed clawback mechanisms.

Table 1: Comparison of clawback mechanisms

Proposed option	E-Can Variation 2	Fonterra:DairyNZ proposal	Fonterra:DairyNZ proposal with 15 Kg cap	Fonterra:DairyNZ proposal with 15 and 20 Kg cap	FnG (LUC) - 40%
Test 1 - Hort/Arable	0%	0%	52%	56%	290%
	10.6Kg/Ha/yr	10.6Kg/Ha/yr	16.1Kg/Ha/yr	16.5Kg/Ha/yr	30.8Kg/Ha/yr
Test 2 - Fertile Soils	-28%	-24%	-9%	-8%	49%
	16.9Kg/Ha/yr	17.9Kg/Ha/yr	21.4Kg/Ha/yr	21.7Kg/Ha/yr	35Kg/Ha/yr

41. I have also looked at the evidence of the Central South Island Fish and Game Council (Ms Dewes) in relation to their comments on an allocation for the Hekeo-HIND's catchment under the Land Use Capability attributes.

42. Ms Dewes acknowledges that there is no scope to introduce an alternative allocation regime at this time. However, her comments on the effectiveness of an LUC system are interesting. Our previous assessments of LUC have shown that there is not enough differentiation between the attributes of LUC to provide a distribution of the existing load across the catchment.

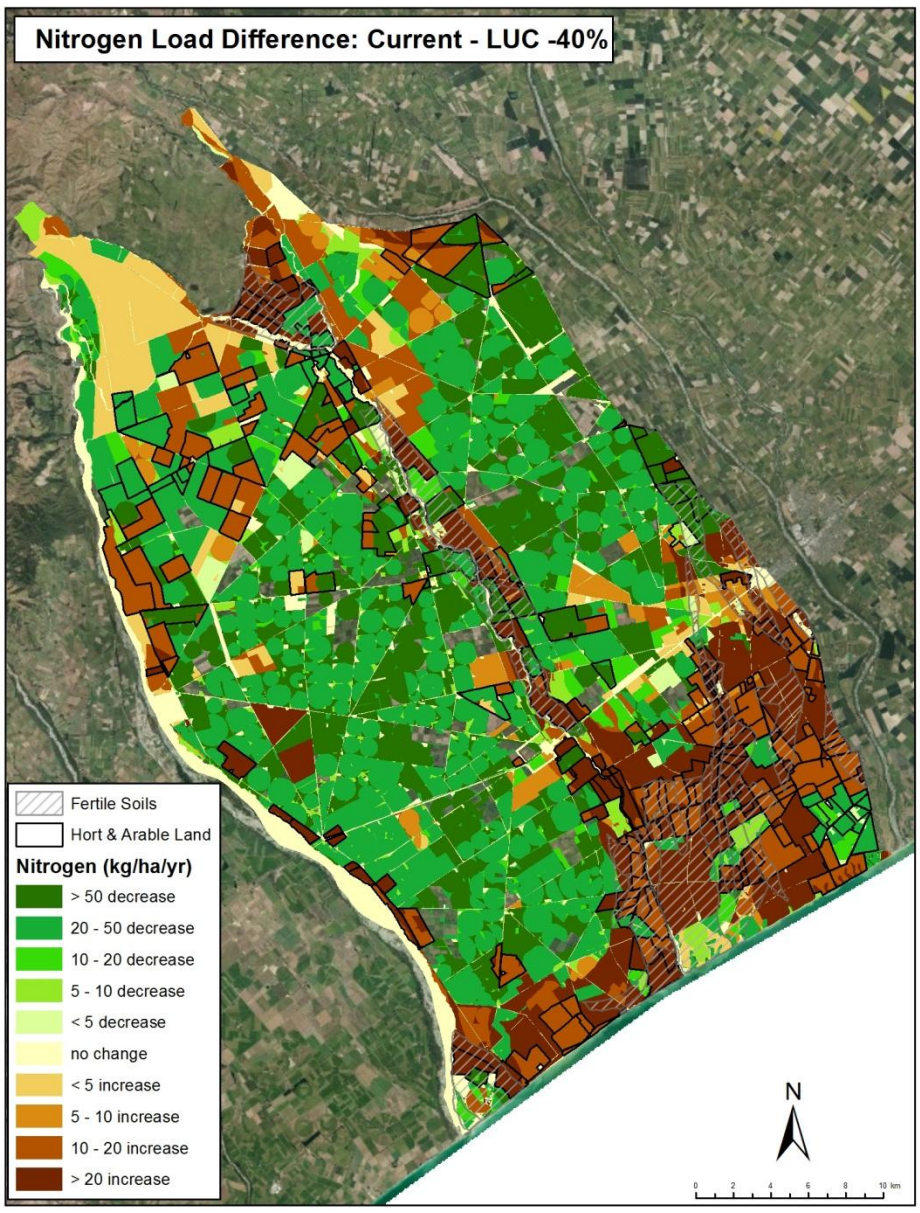
43. I have assessed the changes required to achieve the projected catchment load in the Variation 2 provisions (3400

tons). This requires a relative nitrogen load reduction in the order of 40% and will reallocate nitrogen into the heavy soils following the algorithm from the LUC attributes.

44. A difference map below (figure 1) demonstrates this effect on current landuse.

45. I have included the LUC clawback proposal in the Table 1 assessment above. The tabulated results show the disproportionate shift to the heavy soils.

Figure 1 : Nitrogen load difference : current – LUC – 40%



46. This diversion of load away from present landuse has the unintended consequence of "stranded capital".

47. The LUC mechanism has not been tested for the allocation of phosphorus and could be explored in the future. The Richard McDowell (2014) paper suggests that the attributes relating to phosphorus loss are closely aligned to the soil types and would inevitably lead to a similar distribution if applied through LUC.

CONCLUSION ON EVIDENCE REVIEW

48. I have reviewed the submitters' evidence and made further comments as above. Nothing I have reviewed alters what I have given in my evidence in chief.

49. The evidence provided by Fonterra and DairyNZ as alternative clawback mechanisms has been compared with the ECan proposal.

50. The following three figures provide a graphical image of the relative changes at a property level from the proposals. As in the Table 1, the figures illustrate the relative changes for land currently in horticultural or arable production or land with the potential for horticultural production.

51. I note that Fonterra/DairyNZ propose a planning provision for an allotment of 17 t/year for nitrogen losses exceeding 15 Kg/Ha/yr to increase to a restricted discretionary limit of 20Kg/Ha/yr.

52. The current Horticultural and Arable landuse in the Hinds catchment would account for 10 t/yr of this proposed allocation. The inclusion of the fertile soils under this provision would only marginally increase the allocation to 10.5 t/yr.

53. The below figures show the change at a landuse level the property based changes in nitrogen losses for each of the proposed clawbacks as applied to the current load to a 2035 load.

54. I believe that the information as presented by ECan and Fonterra/DairyNZ shows that the Horticultural and Arable landuse in the catchment can be supported by a flexibility cap and that the proportional effects from the load attributed to these landuses is minimal.

55. This can also be applied to the fertile soils in the wider Hekeo-Hinds catchment.

Figure 2: ECan's clawback provisions

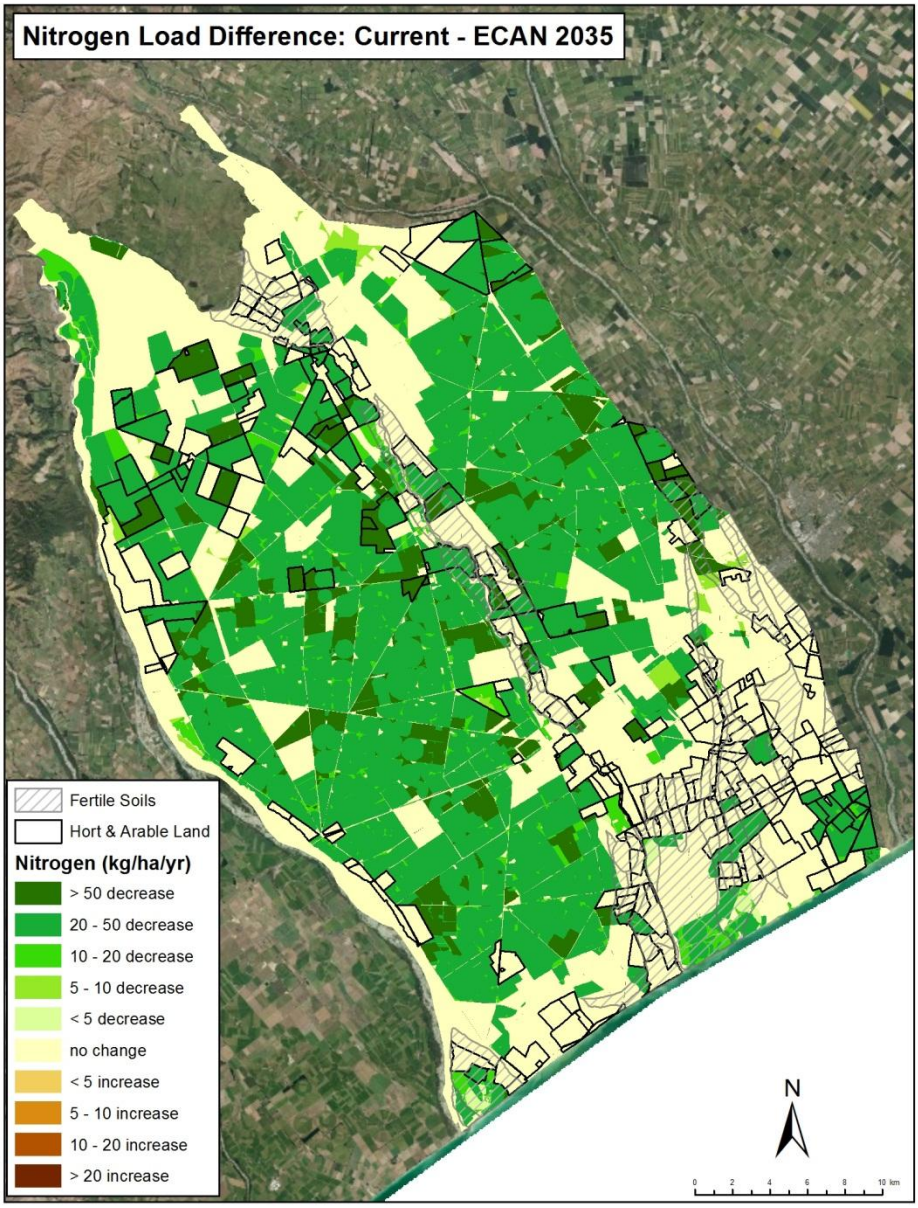


Figure 3: Fonterra/DairyNZ's clawback provisions

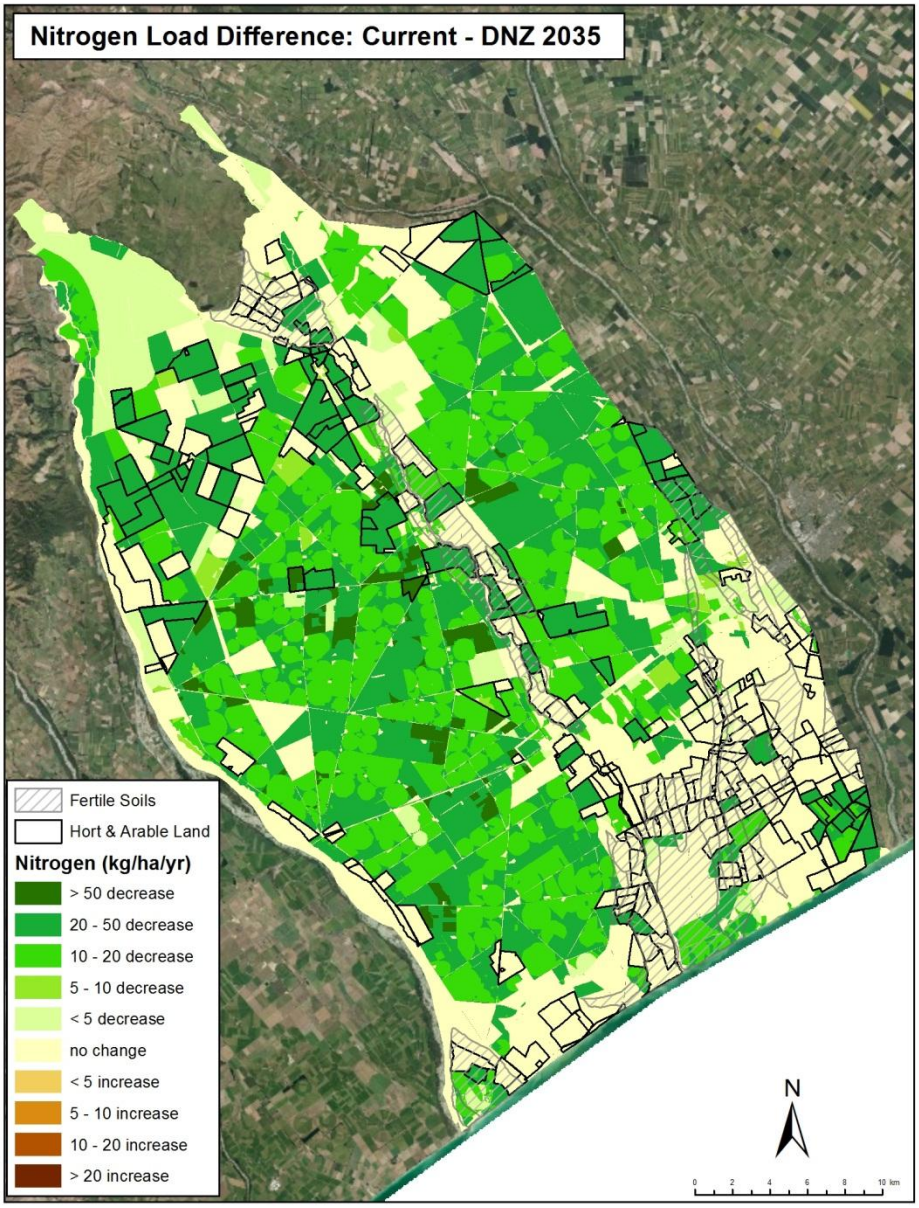
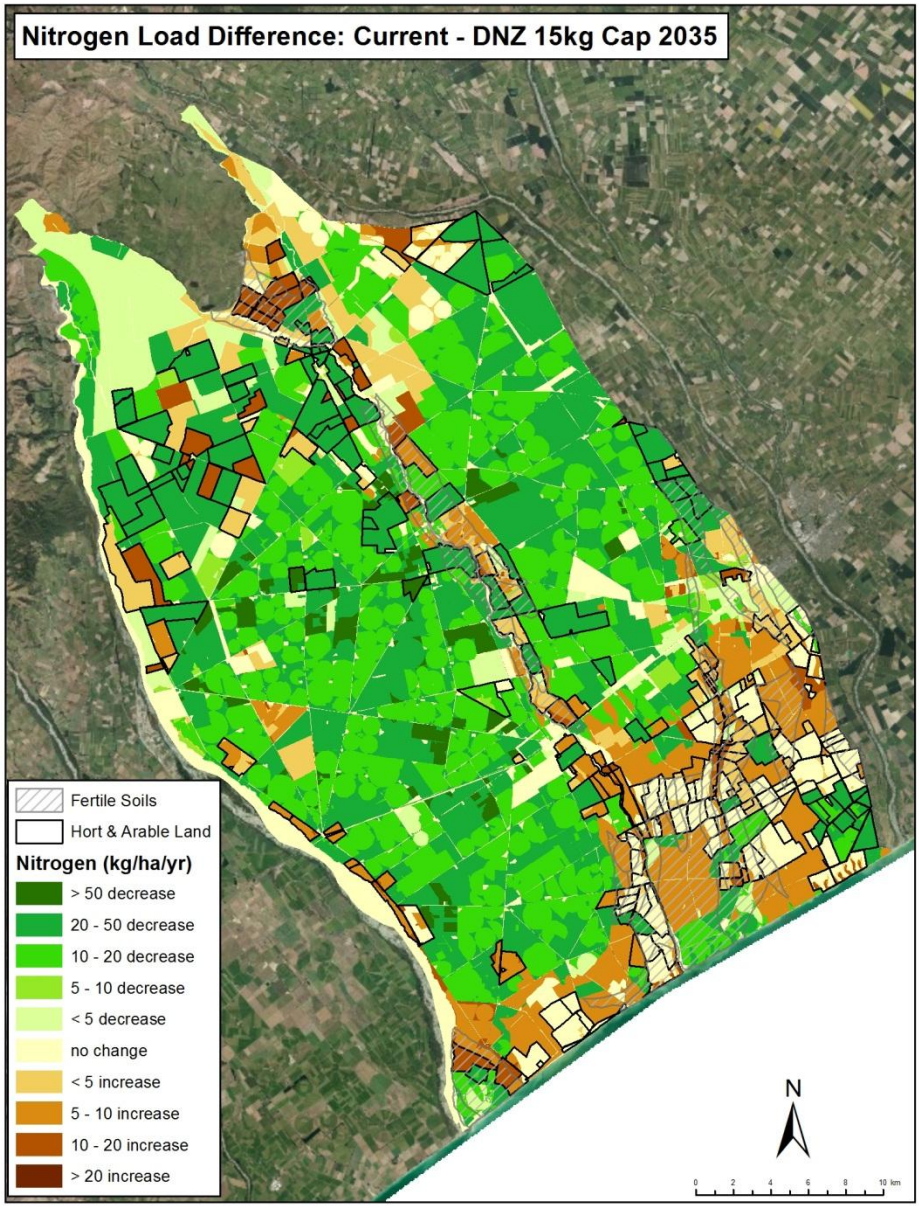


Figure 4: Fonterra/DairyNZ's clawback provisions (15Kg Cap)



Nicholas Conland

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