BEFORE THE ENVIRONMENT COURT **ENV-2010-WLG-000148**

IN THE MATTER	of the Resource Management Act 1991 ("**the Act**")
AND	
IN THE MATTER	of an appeal under lause 14 of the First Schedule of the Act
BETWEEN	**FEDERATED FARMERS OF NEW ZEALAND**
	Appellant
AND	**MANAWATU-WANGANUI REGIONAL COUNCIL**
	Respondent

STATEMENT OF EVIDENCE BY RUSSELL WOODFORD TILLMAN IN RELATION TO THE APPEALS ON THE PROPOSED ONE PLAN FOR MANAWATU WANGANUI REGIONAL COUNCIL ON SURFACE WATER QUALITY/NON POINT SOURCE DISCHARGES

QUALIFICATIONS AND EXPERIENCE

1. My name is Russell Woodford Tillman. I have a BSc(Hons) degree in Chemistry from the University of Canterbury and a PhD in Soil Science from Massey University. I am currently (from 2009) a Professor Emeritus in the Institute of Natural Resources at Massey University. Prior to that I was a member of the academic staff at the University for approximately 37 years, the last 13 of which were as Professor of Soil Science and then Head of the Institute of Natural Resources.

2. The Institute of Natural Resources was created in 1997 by the amalgamation of a number of departments in the former Faculty of Agricultural and Horticultural Sciences and the Faculty of Science. It encompassed a range of disciplines including: Soil and Earth Science, Agronomy, Plant Protection, Horticulture, Farm Management and Ecology (including fresh water ecology). I therefore have considerable experience at managing the interface between agriculture and natural systems.

3. Throughout my time at Massey University I have taught and conducted research in the areas of soil chemistry, soil fertility management, nutrient cycling in agricultural systems and the impact of land use practices on the wider environment – including water quality. I assisted in the development, and still contribute to the teaching of, the Sustainable Nutrient Management professional development courses offered by Massey University. I am either the senior author or a contributing author of approximately 94 refereed papers in scientific journals and author or co-author of a further 49 non-refereed articles.

4. For approximately the last 30 years of my time at Massey University I was a member of (and for many years, Chair of) a succession of Safety Committees that oversaw health and safety, initially for the whole university and then just for the Manawatu campus. Therefore, although not formally qualified in safety management or law, I do have considerable experience in working with the Health and Safety in Employment legislation of New Zealand. Of relevance to my evidence here is my experience with the concept of "all practicable steps" as it applies to the management of health and safety risks in a large organisation.

5. Since retiring from my position as Head of the Institute of Natural Resources at Massey University, I have continued to work actively on a number of projects associated in a general sense with agriculture and the environment, both for Massey University and also other entities. Of relevance to the current appeal is my recent appointment as Chair of the Governance Group for the Nutrient Management Advisor Certification Programme.

6. I have been provided with a copy of the Code of Conduct for Expert Witnesses. I have read and agree to comply with that Code. I have not omitted to consider material known to me that might alter or detract from the opinion I express.

SCOPE OF EVIDENCE

7. My evidence will address the proposals in Policy 6-7(a)(i)(A) and (B), Policy 13-2C(c) and (e) and Rules 13-1 and 13-1B of the MV POP (modified version proposed One Plan 14 Feb 2012), to partly manage losses of Soluble Inorganic Nitrogen (SIN) to rivers and lakes by allocating a cumulative nitrogen leaching maximum to individual dairy farms in the Water Management Sub-zones specified in Table 13.1 of the MV POP, and to calculate those leaching maxima from the Land Use Capability (LUC) classes of the land comprising the farm. I will then comment on other possible approaches to reduce SIN loads in rivers and lakes.

ALLOCATION OF A CUMULATIVE NITROGEN LEACHING MAXIMUM TO INDIVIDUAL FARMS

8. I accept the evidence of Dr Roygard , Ms McArthur and Ms Clark on the state and trends in water quality at sites across the region, as presented in their Joint Technical Expert Statement dated 14 February, 2012, and their earlier Section 42A and supplementary reports (Roygard: TEB v1, p 193-500; Clark: TEB v 2, p 501-582; McArthur: TEB v 2, p 591-928). I note the summary statement in Paragraph 35 of their Joint Technical Expert Statement dated 14 February, 2012 that "The state of water quality in the region is generally poor in catchments that have high proportions of pastoral land use and/or significant point source discharges".

9. I accept the evidence of Dr Roygard (Section 42A report, paragraph 214) and Dr Wilcock (Section 42A report, paragraphs 37 and 38) that at this stage, control of both dissolved reactive phosphate (DRP) and SIN is required to manage periphyton growth throughout the stream network, and that this control is required throughout the year – with the exception of during flood flows.

10. I also accept the evidence of Dr Clothier (Section 42A report, paragraph 110, Figure 10.4) that in the two sub-catchments he studied, there is an average attenuation factor of approximately 0.5 between the quantity of SIN leached beyond the root zone and the quantity of SIN appearing in the river. I accept that with our current knowledge of the attenuation processes within catchments, the most practical approach is to assume that this attenuation factor of 0.5 applies equally to all farms.

11. Although accepting that with our current knowledge, the approaches outlined in paragraphs 8 and 9 are the most practical currently available, it is very likely that in the future our knowledge will increase. We may have a better understanding of the relationships between nutrient concentration and periphyton growth in different parts of the stream network and at different times of the year. We may also find that the attenuation factor varies between farms depending on their location in the catchment. If and when we gain this knowledge we will be in a position to better target remediation strategies. This is not a reason to delay taking action now, but it suggests that any regulatory framework put in place should be able to accommodate change as easily as possible. I will return to this point near the end of my evidence.

12. I accept the target concentrations for DRP and SIN proposed in Schedule D of the decisions version of the Proposed One Plan (DV POP) as being appropriate to achieve the water body values described by Ms McArthur in her S42A evidence. I also accept the procedure outlined by Dr Roygard (Section 6.14.2 of his S42A evidence) by which these target concentrations were translated into the target loads that are presented in Table 6 of Dr Roygard, Ms McArthur and Ms Clark's Joint Technical Expert Statement dated 14 February, 2012.

13. I accept the evidence by Dr Briggs (Supplementary Evidence in the End of Hearing Report) that relates concentrations of SIN and DRP to periphyton growth. I have plotted data from Tables 2 and 3 of Dr Brigg's evidence to establish that in situations where periphyton growth is limited by SIN there is an approximately linear relationship between SIN concentration and periphyton growth – at least at SIN concentrations that are likely to be achievable in the medium term.

14. My purpose in doing this was to establish that there was no "critical" SIN concentration below which periphyton growth was severely curtailed and above which there was a "step-change" and periphyton growth increased rapidly. If such a "critical" SIN concentration existed then this would provide a logical upper limit for management of SIN concentrations in the river. Instead, the evidence of Dr Briggs suggests that if SIN concentrations decreased from current levels there would be a gradual reduction in periphyton growth (and associated improvement in water quality). And conversely, if SIN concentrations increased still further above current levels there would be a gradual increase in periphyton growth (and deterioration in water quality). I will return to this point later in my evidence.

15. I note from the evidence of Dr Mackay (Paragraphs 115-118 of his S42A evidence) that the cumulative nitrogen leaching maxima for each LUC class listed in Table 13.2 of the MV POP, were derived from OVERSEER modelling of notional farms, assuming annual pasture productions derived from estimates of attainable potential livestock carrying capacity in the LUC scheme. I will address the reasoning behind this approach later in my evidence, but at this stage I merely observe that these proposed cumulative nitrogen leaching maxima are in no way derived from considerations of existing or desired conditions in the rivers and streams in the Water Management Sub-zones.

16. The data in Table 6 of Dr Roygard, Ms McArthur and Ms Clark's Joint Technical Expert Statement dated 14 February, 2012 identify the very wide gaps between the existing SIN loads in the various Water Management Sub-zones and the target loads discussed briefly in Paragraph 11 of this evidence. For example, the first line in the Table refers to the Manawatu River at Weber Road and here the target load is 69.6 tonnes SIN/year and the current load is 297 tonnes SIN/year. In other words, the current load of SIN is over 4 times higher than the target load.

17. Scenarios 3 and 4 in Tables 7 and 8 of the Joint Technical Expert Statement indicate the likely reductions in SIN load if the rules outlined in the MV POP are implemented. Scenario 4 assumes an increase of land used for dairying of 11% and in such a scenario implementation of the MV POP would result in a decrease in the SIN load from the current value of 297 tonnes/year to 286 tonnes/year. This is a decrease of 11 tonnes/year, but the resulting SIN load is still over 4 times the target load presented in table 6.

18. I acknowledge that in some other Water Management Sub-zones the relative difference between the target SIN load and the SIN load that would be achieved by implementation of the MV POP is smaller than in the Manawatu River at Weber Road. For example, in the Mangatainoka River at SH2 the current load is only 2.03 times higher than the target load and this would be forecast to drop to 1.94 times the target load after implementation of the MV POP. But even here the final load is approximately twice the target load.

19. As outlined in Paragraphs 12 and 13 above, the evidence of Dr Briggs indicates that the reductions in SIN load described in the previous paragraphs would result in some improvement in water quality. I also acknowledge that the various "do nothing" scenarios outlined in Tables 7 and 8 of the Joint Technical Expert Statement would result in SIN loads somewhat higher than the current load – and a corresponding further deterioration in water quality.

20. I therefore conclude that although implementation of the MV POP will result in small reductions in SIN loads (compared to the current load, or the loads forecast in the various "do nothing" scenarios), the resulting loads will still greatly exceed the target loads that would be necessary to achieve the desired water body values (as outlined by Ms McArthur in her S42A evidence). For reasons that I discuss later in my evidence, I therefore question whether applying "caps" on SIN loads in rivers (and then on individual farms) in the way proposed is the most effective way of achieving water quality aims in this region.

21. Imposing such a nutrient cap may be appropriate where water quality is already good and the desire is to maintain the status quo. Alternatively, there may be situations where there is a "critical" SIN load that represents a clear boundary between good and poor water quality. In such situations a scientific justification for the level of the cap can be presented – although the financial and social implications of imposing the cap would still have to be assessed. But neither of these considerations applies in the current case.

THE LUC APPROACH

22. The LUC approach proposed in the MV POP and developed initially by Dr Mackay in his S42A evidence proceeds from an implicit decision to cap the SIN loads in specified Water Management Sub-zones. Imposing such a cap then requires cumulative nitrogen leaching maxima to be applied to individual farms. As I have indicated elsewhere in my evidence, I believe there are better ways to improve water quality in the region than applying a SIN cap, but despite this, I will comment in the following paragraphs on the LUC scheme as proposed by Dr Mackay.

23. Once a catchment nutrient cap has been decided on it then needs to be allocated between individual farms. This is always a difficult process and different approaches have been adopted in different regions of the country. In his S42A evidence Dr Mackay provides a good discussion of the various options, before proposing an approach based on LUC.

24. There are a number of criteria that are important when evaluating possible ways of allocating a nutrient cap. One such criterion is what I term "economic efficiency". The major purpose of commercial farming in New Zealand is to generate an economic benefit for the farmer, the region and the country. Therefore, when comparing possible ways of allocating a nutrient cap amongst farms, an important test is the extent to which each option reduces the economic benefits generated by farming operations in the catchment.

25. It is this test that rules out the simplest possible way of allocating the nutrient cap – namely, simply averaging the cap across all the farmed land in the catchment. In such a scheme all farms would have the same nitrogen loss maximum when expressed as kg N/ha. Such an allocation would severely constrain the economic benefit that could be generated from highly productive land in the catchment and this could not be compensated for by increasing economic returns from less productive land, where production is already constrained by factors other than a nutrient cap.

26. It is considerations such as these that I presume led Dr Mackay to base the proposed cumulative nitrogen leaching maxima on the LUC classes of the land comprising each individual farm. This is an innovative attempt to address the concerns described in the previous paragraph. It attempts to allocate the nutrient cap according to the actual or potential economic benefit that can be generated from each individual farm. If this could be achieved it would result in a very "economically efficient" allocation of the SIN cap.

27. Unfortunately, in my opinion there are significant problems with using LUC to approximate the productive potential of individual farms. Many of these problems have been addressed by other expert witnesses (e.g. Dr Edmeades and Dr Roberts). I will not repeat their comments here.

28. Instead, I will explain my reservations using a somewhat different model. Dr Mackay and Dr Clothier make use of the term "Natural Capital" when developing their proposed model. The concept of Natural Capital can be a useful metaphor to convey the idea of a natural resource that can generate an economic benefit. A soil is clearly such a resource, and soils vary considerably in their ability to generate and sustain an economic benefit. In that sense soils can be envisaged as having different levels of Natural Capital.

29. Although (subject to the reservations in Paragraph 26) LUC can give some indication as to the potential productivity of a soil, this is very different from the actual productivity of a farm. Although LUC (or "Natural Capital") is one factor influencing farm productivity, it is not the only factor. It is probably not even the most important factor. To push the "capital" metaphor still further, other forms of capital are also important. Human capital is probably the most important of these. We can see this from the large range in productivity that exists, even between neighbouring farms with similar natural capital. Other forms of capital, such as manufactured capital and access to financial capital are also important determinants of farm productivity.

30. Relying solely on Natural Capital to allocate the SIN cap will result in an economically inefficient outcome. T o give a simple example, a highly educated, highly motivated young farmer capable of generating large economic benefit for himself, the region and the country, but farming on Class III and Class IV soils will be penalised relative to a less capable and less efficient farmer, whose farm is on Class I soils. This penalty of lost economic benefit will apply not only to the farmer concerned but also to the region and country.

ALTERNATIVE APPROACH

31. Although the LUC scheme proposed by Dr Mackay has significant limitations, other methods of allocating the SIN cap will also result in similar economic inefficiencies and other problems of equity and fairness. There may be situations in other regions where the environmental benefits to be gained from applying such caps to individual farms are sufficiently large and clear cut that they justify the economic inefficiencies and inequities inherent in any allocation mechanism. But, as pointed out in Paragraph 20 above, I believe this is not the case in this region. Another approach is called for.

32. In his evidence dated 2 February, 2012, Mr Taylor describes the application of the proposed MV POP to 18 existing dairy farms, originally described in his S42A evidence. He also describes the process of granting consents to 9 new dairy conversions processed under the provisions of the DV POP.

33. Of the 18 existing farms, Mr Taylor states that 8 would comply immediately with the requirements of Rule 13.1 in the MV POP. Of the remaining 10 farms, 5 would be able to comply reasonably easily, but the remaining 5 would have more difficulty. Of these final 5 farms, two would qualify for the alternative regime for reducing N leaching under rule 13.1C.

34. Of the 9 new dairy conversions, 7 of the farms' nutrient management plans met the cumulative nitrogen leaching maxima without amendment and the other two complied after some alteration to management – mainly changes to the stock wintering policy.

35. It would therefore appear that the majority of existing and new dairy farms in the Water Management Sub-zones would be able to comply reasonably easily with the proposed cumulative nitrogen leaching maxima, but a significant minority (~20%) would have more difficulty. For some of these farms there would be considerable expense in complying.

36. We therefore have a situation where the majority of farmers have to make little or no effort to reduce N leaching from their current levels. Indeed, many of these farmers are free to increase N leaching above current levels, so long as they do not exceed the nitrogen leaching maximum assigned to their farm. At the same time a minority of farmers, usually through no fault of their own, have to incur a significant financial penalty in order to comply.

37. In addition, it is apparent that even if all farmers eventually achieve compliance with their cumulative nitrogen leaching maxima, the resulting SIN load in the river will still exceed by a considerable margin the target loads that are required to achieve the Water Body Values described by Ms McArthur.

38. In a situation such as this it is my opinion that an approach similar to that proposed in the DV POP of requiring all farmers to "implement reasonably practicable farm management practices for minimising nutrient leaching, faecal contamination and sediment losses from land" is most appropriate and should apply to both existing and new dairy farms.

39. Such an approach would require the 75-80% of farmers who already comply, or who can reasonably easily comply with the proposed nitrogen leaching maxima, to attempt to reduce the SIN leaching from their properties still further, if it was reasonably practicable to do so. At the same time, it would relieve the minority of farmers who cannot easily comply with the LUC scheme from a requirement to adopt strategies that are not reasonably practicable. I believe that if done well, such an approach would achieve a better environmental outcome than that proposed in the MV POP.

40. In light of my comments in the previous paragraph, I was interested in the categorical assertion by Ms Barton in Paragraph 53(a) of her evidence that, using the Manawatu River at Hopelands as an example, "the approach taken in the DV POP will not maintain or enhance water quality based on annual averages for loads". I note that Scenario 2 in the Joint Technical Expert Statement of Dr Roygard, Ms McArthur and Ms Clark models the expected outcome of applying the requirements of the DV POP, assuming an 11% increase in the land used for dairying and assuming current loss rates on the land currently used for dairying remain the same. Using these assumptions it is predicted in Table 8 that the SIN load in the Manawatu River at Hopelands would increase by 2%. I presume therefore that in order for Ms Barton to assert that "the approach taken in the DV POP will not maintain or enhance water quality .....", she has evidence that requiring all existing farmers to "implement reasonably practicable farm management practices for minimising nutrient leaching,

faecal contamination and sediment losses from land" (as outlined in the DV POP) will not result in a reduction in the SIN load of more than 2%. I readily acknowledge that such evidence may have been presented elsewhere, but I would welcome advice on where such information is presented.

41. Ms Barton expresses concern in several sections of her evidence that by requiring implementation of reasonably practicable measures to reduce N leaching, rather than imposing a definite limit, there will be uncertainty in the minds of farmers as to what will be required and in the minds of other parties as to the resulting environmental outcomes. I believe this concern is overstated.

42. The concept of "all reasonably practicable steps" is already in place in the management of health and safety in the workplace in New Zealand. In my experience at Massey University the concept was useful and although there were occasional debates as to what was reasonably practicable, agreement could usually be reached. In this regard, industry benchmarks and codes of practice were often helpful guides.

43. Although a definition of "reasonably practicable" appropriate to the One Plan would need to be written, I reproduce below an explanation of the term as it applies in health and safety legislation in New Zealand. I do his in order to highlight some of the benefits of such an approach.

> ".... all practicable steps in relation to achieving any result in any circumstances, means all steps to achieve the result that it is reasonably practicable to take in the circumstances, having regard to-
>
> (a) the nature and severity of the harm that may be suffered if the result is not achieved; and
>
> (b) the current state of knowledge about the likelihood that harm of that nature and severity will be suffered if the result is not achieved; and
>
> (c) the current state of knowledge about harm of that nature; and
>
> (d) the current state of knowledge about the means available to achieve the result, and about the likely efficacy of each of those means; and
>
> (e) the availability and cost of each of those means.

44. One of the few certainties in this whole process is that in 5 or 10 years we will know more than we do now – both about the factors affecting water quality in the various rivers and streams and about the ways in which SIN loss from farms can be reduced. Currently, very large amounts of money are being spent by a range of stakeholders on research to develop ways of reducing N leaching from

dairy farms. This research includes efforts to identify "minimal footprint, optimal profit" farms and discover what contributes to these highly desirable attributes. The "reasonably practicable" approach outlined in the previous paragraph explicitly includes our current state of knowledge and thus can adapt constantly over time.

45. If the concept of cost in Paragraph 43(e) is widened to take into account the current financial circumstances of individual farmers then all farmers should be confident that they will not be required to accept an onerous financial burden when they are least able to afford it.

46. There is now a considerable body of evidence accumulated throughout New Zealand on what constitutes good environmental practice in dairy farm management. In the MV POP (13-2C (g)) the council has outlined a list of management strategies that are available to reduce SIN leaching from farms and Dr Edmeades describes in his evidence (Paragraphs 44 – 55) a rigorous 11-step process for developing nutrient management plans.

47. High level training programmes in Sustainable Nutrient Management have been operating in New Zealand for many years and there are now large numbers of highly skilled individuals who can assist farmers to create and implement high quality nutrient management plans. These same skilled individuals would then be in a position to advise the Council on the extent to which individual farms are implementing all reasonably practicable measures to reduce N leaching. Initiatives to create a formal and rigorous accreditation scheme for such advisors are now well advanced and this will add further credibility and certainty to such an approach.

48. There is no doubt that what is reasonably practicable will vary from farm to farm, and also over time on the same farm – as the farmer's skills develop and the financial position of the farm improves. But that is reality. Imposing a formulaic regulatory regime over such a range of individual circumstances does not remove that variability. It may create an illusion of certainty, but it simply creates inefficiencies and inequities. Indeed, the only certainty in implementing the MV POP is that the environmental outcome will still not be very good. I am focussed strongly on finding practical ways by which this environmental outcome can be improved.

49. A further advantage of the "reasonably practicable" approach proposed in the DV POP is that it requires close engagement with farmers in a relatively non-threatening environment. This would help allay some of the fears currently held by many farmers about the POP. At a recent Workshop on Advanced Nutrient Management held at Massey University there were several reports of

successful farmer-led catchment groups that had achieved notable improvements in farm environmental performance. A common feature of these groups was the extent to which the regional Council had relinquished "ownership" of the programmes to the farmers. I believe there are lessons here for the POP.

CONCLUSIONS

50. The water quality in much of the region is already poor and even if the approach proposed in the MV POP can be implemented successfully, it will only result in a small improvement in water quality.

51. Despite these predictions of ongoing poor water, many dairy farmers in the region will be required to make little or no effort to reduce the quantities of SIN leaching from their farms. Many of these farmers could reduce leaching of SIN to some extent with little or no cost, and in some instances carefully formulated nutrient management plans could even increase farm profitability. At the same time some other farmers are having unfair constraints imposed on their farming operation.

52. The unsatisfactory situation outlined in Paragraphs 49 and 50 arises because the LUC-based mechanism that is proposed for allocating cumulative nitrogen leaching maxima to farms is ill-suited to the task. Application of such a formulaic approach that does not accurately reflect the circumstances of individual farmers inevitably results in inequities and inefficiencies.

53. The concept of requiring "reasonably practicable farm practices ....." as proposed in the DV POP embraces the notion of case by case farm management in order to achieve the best environmental outcomes for the surface water bodies in the Horizons region. It also requires a close relationship between council and farmer to be built. This is most likely over the long term to deliver the desired water quality outcomes

Russ Tillman

March 2012