

**BEFORE THE HEARING COMMISSIONERS  
AT HAMILTON**

**IN THE MATTER** of the Resource Management Act 1991  
(**"the Act"**)

**AND**

**IN THE MATTER** of the hearing of submissions on The  
Proposed Waikato Regional Plan Change 1 –  
Waikato and Waipa River Catchments: Block  
3

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**STATEMENT OF EVIDENCE BY STUART FORD  
FOR HORTICULTURE NEW ZEALAND**

**9 JULY 2019**

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## SUMMARY STATEMENT

1. This evidence addresses the Horticulture New Zealand (“**HortNZ**”) submission, further submissions and the Waikato Regional Council’s (“**WRC**”) Section 42A Report responses to the submissions on the Proposed Waikato Regional Plan Change 1 – Waikato and Waipa River Catchments (“**PC1**”).
2. There is a very strong case, on balance of the considerations, for the inclusion of an allowance for expected growth of the CVP sector to be included in PC1 and a relatively straight forward pathway for the allowance of new CVP land to be provided for if it can meet the desired impact on the fresh water objectives as stated in Table 3.11-1.
3. None of the scenarios that I have tested are realistic in terms of offering new CVP growers the opportunity to offset their production. In my opinion it is not realistic to expect that there is an offset of all four contaminants but it is realistic to assess the net effect of the activity on the fresh water objectives as stated in Table 3.1-11, and granting consent if the assessment indicates that there would not be a net deterioration in those values.
4. I strongly support inclusion of the proxy table as recommended by HortNZ because it is my opinion that it is an entirely appropriate means of solving the problem of not having an accurate means of calculating these figures because of the comparative lack of access to modelling capability in APSIM.
5. It is my opinion, that the panel should have every confidence that the HortNZ solution, that is to developed a range of proxies using APSIM as the decision support tool, is an appropriate method to model the performance of the CVP sector and to achieve the necessary progress in achieving the fresh water objectives that are stated in Table 3.11-1.
6. The adoption of the measures of N and P surplus, as defined in the marked up version of the plan, would add nothing in terms of assessing the potential for N and P to get into the Waikato River and would add to the complexity of the reporting requirements completely unnecessarily.
7. It is my assessment that the amendments that are proposed will be far more effective in achieving the objectives and will be far more efficient in terms of minimising the cost of achieving them than those that are proposed by the notified and amended version of PC1.
8. I support the amendments as proposed in Mr Vances evidence at Attachment A as being a very effective and efficient means of incorporating the CVP sector into PC1 and achieving a balanced

approach to both the necessary growth of the sector and the fresh water objectives as stated in Table 3.11-1.

### **QUALIFICATIONS AND EXPERIENCE**

9. My full name is Stuart John Ford. I have the qualifications and experience set out in my Statements of Evidence for Blocks 1 and 2.
10. My statement of evidence has been prepared in accordance with the Code of Conduct for Expert Witnesses set out in Section 7 of the Environment Court of New Zealand Practice Note 2014.

### **SCOPE OF EVIDENCE**

11. I have been asked by HortNZ to provide you evidence on:
  - (a) The special nature and contribution to the wider economy of the Commercial Vegetable Production (CVP) sector.
  - (b) The economics of the offset potential for CVP.
  - (c) The impact of deintensification of their systems on the economics of growing.
  - (d) The calculation of proxies in the CVP sector.
  - (e) An evaluation of the potential alternative metrics such as N Surplus.
  - (f) My evaluation of the amendments to PC1 as proposed by HortNZ.

### **THE SPECIAL NATURE OF THE CVP SECTOR**

12. In my Block 1 evidence I discussed the special nature of the CVP sector in the Waikato region and the fact that the special combination of climatic conditions and the soil type meant that much of the output in the winter and spring months was not substitutable in New Zealand. Much of the other seasons' production was not able to be produced as efficiently and for a relatively low cost anywhere in New Zealand because of the lower yields that are achievable in other locations and the relatively high transport costs to get it to the main source of consumers, Auckland.
13. Ms Sands and Mr Keenan in their Block 1 and 2 submissions have also given you evidence about our national desire to provide the healthy eating choices that are offered by the production of the CVP sector in an affordable form for all of the citizens of our country.

14. If we look at it from a purely economic framework we can see in Table 1 the relative contribution that is made by the CVP sector compared to the other alternatives. What I have done is to compile the gross income achieved per annum from the three rotations which I modelled for my report “Nutrient Performance and Financial Analysis of Lower Waikato Horticulture Growers”, which was also used in Mr Dooles’ modelling, and averaged it across the whole rotation. I have compared the results of that analysis with the gross returns from dairy farming and maize growing, which are the two comparable land uses for the same class of land.
15. I have calculated it for an area of a farm of 120 ha for comparison. I have used multipliers created by Insight Economics. The value added multiplier reports the gross revenue minus all the costs of production and employment which reports the total number of jobs expressed as full time equivalents (FTE).
16. For the value added and employment multipliers for the CVP I have used the Horticulture land use category which is not specific to the CVP sector but includes a multitude of different land uses and for the dairy data I have used the specific dairy multipliers.

**Table 1: The relative economic contribution of the CVP, Dairy Farming and Maize Growing sectors to the wider economy.**

	<b>Gross Revenue / ha (\$m)</b>	<b>Value Added Multiplier (\$m)</b>	<b>Employment Multiplier (FTE)</b>
Root Crop	2.23	1.16	8.6
Leafy Greens	2.99	1.55	11.4
Market Garden	3.65	1.90	14.0
Dairy	0.80	0.42	2.4
Maize	0.65	n / a	n / a

17. What we can take from Table 1 is that the CVP sector is between 2.8 and 4.6 times more productive than the dairy sector in terms of the gross revenue and between 3.5 and 5.7 times more productive than the maize growing industry. In terms of value added it produces between 2.7 and 4.5 times more than the dairy industry and in terms of employment it creates between 3.5 and 5.7 more FTE’s than the dairy industry.
18. In my Block 1 evidence I discussed the fact that in terms of considering the combined impacts of the environmental, economic,

social and cultural factors it is a balancing act. It is therefore a balancing act between the apparent negative impact of the CVP sector in terms of meeting the fresh water objectives of PC1, which Ms Holmes in Block 2 and Mr Baker in Block 3 has demonstrated is well below the margin for error in the total calculation. This is against the very positive impact which the CVP sector has in terms of achieving high economic performance and employment and which Ms Sands has pointed out in terms of community health outcomes.

19. In my opinion there is a very strong case, on balance of the considerations, for the inclusion of an allowance for expected growth of the CVP sector to be included in PC1 and a relatively straight forward pathway for the allowance of new CVP land to be provided for if it can meet the desired impact on the fresh water objectives as stated in Table 3.11-1.
20. Therefore, I very strongly support the proposed amendments to PC1 as stated in the evidence of Mr Baker, Ms Sands, Mr Keenan and Mr Hodgson to allow for some growth in the CVP sector.

#### **THE ECONOMIC COSTS OF OFFSETS**

21. In the Block 3 Section 42A report at para 99 the Officers' discuss the fact that "*In order to better enable the expansion of existing CVP operations or new entrants, greater policy support is recommended for new areas of CVP land, provided that there are offsets, within the sub-catchment of the losses of all four contaminants that are equal to or greater than the increase from the CVP production.*" In further discussion about the potential for offsets they state "*a CVP production could be established on part of an existing dairy farm, with the remainder being converted to a low loss activity, such as dryland sheep finishing, such that overall losses of all four contaminants would be no greater than before the CVP increase occurred.*"
22. While the creation of an offset is a technically feasible alternative that would allow for a new area of CVP land to be achieved the financial impact of such an activity has not been considered by the Officers in their analysis.
23. If we consider the provision of providing for an offset in three ways:
  - (a) De-intensifying the productive system.
  - (b) An enterprise off set whereby additional productive land is purchased and it is converted to low leaching land use.
  - (c) An on farm offset whereby an existing land uses high leaching activity is replaced with CVP production.

24. My workings as to how I derived the values in Table 2 are in Appendix A. A brief explanation of how each option has been modelled is as follows.
25. Deintensification is modelled as the new CVP producer buying a new dairy farm and operating it at its existing leaching value which means that there is a much higher proportion of the low leaching crop which is barley.
26. The enterprise example models a new CVP producer buying an existing dairy farm and planting as much of it as is required in Forestry to ensure that the N leaching value is the same as the existing use.
27. The on-farm offset models a new CVP producer leasing land off a dairy farmer (the feed cropping block) and the dairy farmer winter grazing their cows elsewhere and the loss of some milksolids production.

**Table 2: The cost of maintaining the current CVP gross margin in various offset scenarios.**

	<b>Deintensification</b>	<b>Enterprise</b>	<b>On farm</b>
Additional area required per ha of CVP area.	1.74	1.05	-
Additional cost to maintain existing gross margin.	9,115	6,280	5,653*
Change in average crop revenue to maintain the existing gross margin.	+ 50%	+ 30%	+ 16%

\* includes the existing lease cost of \$2,000 per ha.

28. The additional areas of land that would be required in each of the offset scenarios are 1.74 ha of additional land for every 1 ha of CVP land in the deintensification scenario and an additional 1.05 ha of land for every 1 ha of CVP land in the enterprise scenario. In the on farm scenario there is sufficient spare nutrients from the crop area to allow for an additional 29.8 ha of dairy land to also be involved in the lease.
29. The additional cost to maintain the existing gross margin in the deintensification and enterprise scenario reflect the cost to the CVP grower of having to buy additional land to use as an offset. In the case of the on farm scenario this figure has been calculated from the point of view of the lessor and reflects the amount that they would have to receive, at the minimum, to compensate them for the lost productivity of their land.

30. The final row is an approximation of how much the returns for each crop would have to rise to compensate the growers for the additional costs and maintain their existing gross margins. This is on the assumption that the CVP growers were price setters and that the market would respond by paying that price ie: that demand was inelastic. Neither of those two assumptions is true because CVP growers are price takers and demand for their product is very elastic according to the price of the produce on offer. We can see that just to maintain their present returns that the price of vegetables would have to increase by between 16 and 50 %.
31. In relation to the on-farm scenario what this would mean would be that the commercial vegetable grower might only be accommodated within the dairy farm for 3 years of the 20 year consent of the dairy farm. While it would be technically possible for this to occur, a dairy farmer could apply to consent and submit their FEP and nutrient model to accommodate vegetable growing, it would mean that the farmer would need to anticipate the desire of growers to come onto their land and obtain a (discretionary) consent to provide for that.
32. This was what was envisaged in the Horizons One Plan in the High Court decision, but as was predicted in my evidence in that case that has not occurred. The reason for that is the people who decide where the vegetable growing will occur are the growers rather than the land owner, and they need to be able to have consent for the land they lease rather than searching for land which has enough consented capacity to allow the CVP grower to grow their crops.
33. None of these scenarios are realistic in terms of offering new CVP growers the opportunity to offset their production. In my opinion it is not realistic to expect that there is an offset of all four contaminants but it is realistic to assess the net effect of the activity on the fresh water objectives as stated in Table 3.1-11, and granting consent if the assessment indicates that there would not be a net deterioration in those values.

## **THE CALCULATION OF PROXIES IN THE CVP SECTOR**

34. In the Block 3 Section 42 A report at para 88 the officers state that *“There appears to be justification for removal of the Overseer-based NRP requirement altogether for CVP, if only from an Overseer workability point of view. However, Officers are conscious that the CVP industry has not been able to suggest a generally accepted and available alternative. If a requirement to establish an NRP is removed for CVP, there still needs to be confidence that this would not compromise the achievement of the Vision and Strategy, the NPS-FM and the objectives of PC1. Officers consider that the required confidence has not been evident in the CVP discussions to date. Officers are hopeful that evidence will establish viable*



*alternatives, so that an unwieldy or compromised solution does not need to be presented by Officers in the final recommendations.”*

35. I agree entirely with the assessment that Overseer is not suitable to be used in order to calculate a NRP for the CVP sector. I have given you extensive evidence in my Block 1 and 2 evidence about the inadequacy of Overseers modelling capabilities to depict a CVP operation.
36. I cannot agree that the CVP industry has not been able to suggest a generally accepted and available alternative or that the required confidence has not been evident in CVP discussions to date.
37. The CVP sectors response to the requirement for a satisfactory alternative is that an appropriate range of proxy CVP rotations could be developed and modelled against the required variations in climate and across the various soil types available. Those proxies would be made available to the CVP sector and the growers would be able to choose which combination best matched their operation and would use them in constructing their Farm Environment Plan (FEP).
38. The proxies would be developed at Good Farming Practice (GFP) and then the person that was constructing the FEP would be able to evaluate as to whether the grower was operating at GFP and if not should set them objectives in improvement of their operations which are designed to improve the fresh water objectives as stated in Table 3.11-1.
39. It should be remembered that achieving GFP is the objective for the time frame in PC1. There is no requirement for the growers to show through modelling that they have achieved GFP rather that they have achieved their objectives in their FEP.
40. This is exactly the same process that the horticultural sector has in operation in Canterbury. The major difference with the Canterbury situation is that in Canterbury the vast majority of the CVP crops are grown within an arable rotation so it was decided that even given the known inaccuracies in Overseer modelling, it would be appropriate to use the proxies that are modelled in Overseer.
41. The CVP sector in Waikato is much more intensive and the emphasis is the other way around with the vast majority of crops being from the CVP sector and much fewer being from the arable sector, so having their operations modelled in Overseer is not attractive because of the inaccuracies that you get trying to model CVP operations in Overseer.
42. Therefore, what we suggested was that the proxies would be modelled in APSIM. I gave you evidence in Block 2 that APSIM is

appropriate because of the known accuracy of the crop models within it. Also the fact that it can be modelled on a daily time step basis and so is able to more accurately reflect the actual operations. It is also flexible in the way that it incorporates the addition of fertilisers and irrigation events is an appropriate decision support tool that can be used to model the CVP sector.

43. This was the approach which was part of the discussions that were held between HortNZ and WRC staff for which I prepared the document "Discussion on the treatment of vegetable production in the EW Healthy Rivers planning process" in April 2015 during the process of the CSG. In that report I recommended that that "*an allowance be made for the Vegetable sector to carry out a trial on the applicability of the use of APSIM to best describe the N leaching performance of that sector.*"
44. This approach was discussed at a meeting in Pukekohe between Waikato Regional Council (WRC) staff and representatives of the CVP sector at the end of 2018. The feedback that we received from that meeting from the WRC staff was that they saw real merit in what we proposed and that we should meet again to further develop the approach. We then got notice from the WRC staff that they were too busy to meet again and that we should continue to advocate our approach in the hearings.
45. The next time that the approach was presented was in the CVP forum. Although there was significant agreement on HortNZ approach at the first day of the CVP forum at the second day the WRC staff turned up with a completely different mindset and approach to the HortNZ solution. That is why the forum ended up with no general agreement on an appropriate approach. While the WRC staff are perfectly entitled to change their view on the HortNZ proposed solution it is difficult to understand how we could have got so far before they changed their position.
46. I cannot agree with the officers' contention that the "required confidence" has not been evident to date.
47. It is disappointing to me that the WRC's officers have not to date and are either unwilling or unable to evaluate the full range of possible decision support tools that are available to model the four contaminants. Rather they seemed to be wedded to the concept that Overseer is the preferred decision support tool. This is despite the fact that it is entirely inadequate for the purpose of modelling at least the CVP sector.
48. This remains the case despite the fact that in the Block 3 Section 42A report at para 43 and 44 officers explain how Overseer results were compared to APSIM results in order to identify discrepancies in the Overseer results. A number of major discrepancies were

identified in Overseer as a result of that exercise and recommendations were made about the necessity of further work to identify exactly what was causing those discrepancies in Overseer. That work has not proceeded.

49. Therefore, it is difficult to understand the contention made in the Block 3 section 42A report at para 44 “ *that research is underway to improve the accuracy ( of Overseer) for horticulture*”. As far as I am aware the focus, because of limited funds for the development of Overseer, is entirely based on development of the pastoral modelling capability. There is no development of the modelling capability of Overseer in the arable or horticultural sectors in place at present and it is well down the task list for future attention. The officers’ report is suggesting that it would be appropriate to wait while Overseer fixes all its modelling problems with the sector and then utilise it.
50. At para 47 the officers report that “*there have been discussions between WRC and HortNZ about the use of an Overseer proxy tool*”. Every discussion about this issue that I have been involved in since those first discussions in April 2015 have been about the use of APSIM to develop a proxy tool not Overseer.
51. During these discussions it was always my hope that the CVP industry and WRC could come to an agreement as to what would be an appropriate proxy table. In the absence of that agreement I have suggested an appropriate table that could be used as a proxy for the CVP sector to use. You will note that in my suggested Table that I have not entered the data as to the leaching information. I will suggest some appropriate values when I present my oral evidence which will have been modelled in APSIM.

**Table 3: Proxy table on losses of N and P to be used by the CVP sector to calculate their NRP and to use in their FEP.**

	<b>Volcanic Clay Loam (Putamahoe)</b>	<b>Silt Loam (Karaka, Horotiu)</b>
Root Vegetable Rotation	x	X
Leafy Greens Rotation	x	X
Market Garden Rotation	x	x

52. The three rotations that I have suggested are taken from my report “Nutrient Performance and Financial Analysis of Lower Waikato Horticulture Growers”. These are the rotations that were used to create the proxy leaching data that was used in Ms Holmes Block 1 and 2 and Mr Baker and Mr Easton’s Block 3 evidence (and in the Jacobs reports attached to HortNZ submission) which is based on

the NIWA data which also used the values that I arrived at in my report.

53. There is no doubt that the APSIM calculated values will be different than the values used in the Jacobs modelling which has the potential to change the results of the Jacobs modelling as to the proportion of the CVP sector compared to the other sectors. I would just like to remind you that in my Block 1 and 2 evidence presented to you on behalf of Wairakei Pastoral Limited that I discussed the considerable unreliability of the data that was used in Mr Dooles economic modelling and in particular the fact that the dairy farm data that was used was created using the dairy farm protocol which used some short cuts in the data entry requirements which meant that it had the potential to under report the amount of N leaching by up to 45%.
54. No matter what the changes are in the CVP sectors leaching values as a result of recalculating them in APSIM if the other sectors were also recalculated using the Overseer data entry standards and either using the OverseerFM, the latest version, or APSIM modeling capability it is my opinion that the relative performance of the CVP sector would have diminished in comparison to the alternatives. It is my opinion that the conclusions that can be taken from the Jacobs work would still be valid.
55. In my report the rotations are described as:
- (a) Rotation one (Root Vegetable) was designed to represent the more extensive rotation of growing the major large scale crops. It is estimated that this rotation represents approximately half the area grown in the Lower Waikato. The rotation is as follows:
- Potato (summer) > Onions > Carrots > Squash > Oats and Rye > Barley (grain) > Oats and Rye
- (b) Rotation 2 ( Leafy Greens) is a more intensive rotation with the inclusion of more green crops. It is estimated that this rotation represents approximately 45% of the area grown in the Lower Waikato. The rotation is as follows:
- Squash > Broccoli > Oats and Rye > Lettuce (summer) > Mustard > Onions > Oats and Rye > Potato (Winter).
- (c) The traditional market garden rotation is much more intensive and is designed to represent the sort of rotation grown in market gardens and was somewhat limited by the range of crops available. It is estimated that this rotation represents approximately 5% of the area grown in the Lower Waikato. The rotation is as follows:

Broccoli > Mustard > Lettuce > Cabbage > Mustard >  
Spinach > Cauliflower > Cabbage > Mustard.

56. It is my opinion that this set of rotations is an appropriate range to be used by the CVP sector to allow the growers to assess whether they are at GFP or if there are improvements in their practices that will bring them up to the standard of GFP.
57. As part of the discussions I have always advocated for consideration of the variances of climate in such a table. In my oral evidence I will discuss whether it is necessary to include consideration of alternative climatic areas after trialling them to determine whether there is significant variance caused by shifting the location of the land.
58. My suggested proxy table has been included in the Schedule B as amended by HortNZ as an element that can be used in both calculation of the NRP and in the FEP.
59. I strongly support inclusion of the proxy table as recommended by HortNZ because it is my opinion that it is an entirely appropriate means of solving the problem of not having an accurate means of calculating these figures because of the comparative lack of access to modelling capability in APSIM.
60. It is my opinion, that the panel should have every confidence that the HortNZ solution, that is to develop a range of proxies using APSIM as the decision support tool, is an appropriate method to model the performance of the CVP sector and to achieve the necessary progress in achieving the fresh water objectives that are stated in Table 3.11-1.

#### **THE POTENTIAL USE OF N AND P SURPLUS**

61. In the Block 3 section 42A report, in the marked up version of PC1 Rule 3.11.5.5 - Controlled Restricted Discretionary Activity Rule – Existing commercial vegetable production at point e iii (which details what information would need to be provided to the Council) it states that “*quantification of nitrogen and phosphorus surpluses for each commercial vegetable production crop and a description of sediment control measures.*”
62. It is my understanding that this is the only time the concepts of nitrogen (N) and phosphorus (P) surpluses have been mentioned in the formation of PC1. This makes it difficult for us to understand exactly what is meant by the terms, that is what is an appropriate definition, and exactly what purpose is expected to be achieved by requiring them to be reported. The rest of the discussion in the development of the plan and particularly the section 32 and 42A reports are silent on the issue.

63. In the document “Nitrogen leaching varies significantly depending on soil type and climate, which means it’s not a straightforward performance indicator. An alternative approach is to look at a farm’s nitrogen surplus.” Which can be found on the Dairy N website<sup>1</sup>the define nitrogen surplus as “*Nitrogen surplus is the balance between N inputs and N outputs, i.e., how much N was lost in the N cycle of the production of milk, meat, wool, crops, etc.*”
64. The authors also go on to say “*While N surplus is an important indicator for the amount of N that **could** be leached, other aspects of the farm’s environment and farm management drive the actual loss due to drainage of water with dissolved N to below the root zone and out of the reach of plants. These are soil type and climate, and irrigation system and management (if applicable).*” Emphasis added.
65. Overseer produces a figure for the N surplus of any modelled farm. In Table 4 I report the N leaching, N surplus and the N conversion efficiency results that are reported on the OverseerFM version for the CVP and dairy farm scenarios which I modelled to be able to calculate the economic costs of the offsets. It is important to note that they are both on exactly the same soil type and climatic zone.

**Table 4: Reporting of N leaching, surplus and conversion efficiency for two farm types.**

<b>Farm Type</b>	<b>N leaching Kg / ha</b>	<b>N Surplus Kg / ha</b>	<b>N conversion efficiency %</b>
CVP	81	31	76
Dairy	41	187	34

66. What we can see from Table 4 is that although the N leaching values are twice the amount for the CVP model than the dairy farm that the N surplus calculation and the N conversion efficiency result of the CVP sector are far superior to those of the dairy industry.
67. What the N surplus tells us is that the CVP sector is very efficient in its use of N. In other words a very high proportion of the N which is added to the system is actually taken off in the product. While I am sure that the CVP sector would be delighted to adopt such a measure because their performance is far superior to those of other sectors it is impossible to determine exactly what the point of doing so would be in terms of meeting the fresh water objectives as stated in Table 3.11-1.

<sup>1</sup> [www.dairynz.co.nz/news/latest-news/n-surplus-shows-performance/](http://www.dairynz.co.nz/news/latest-news/n-surplus-shows-performance/)

68. This is because the N surplus is a completely inadequate measure of the performance of a farm in terms of the potential for N to leach from the system. The take up of N in a system includes exported as product, transfer off the paddocks, to the atmosphere, to the organic pool and to the inorganic pool as well as what is leached below the root one.
69. There are far more preferable means of indicating the N leaching performance of a CVP property than by using N surplus which is a very inadequate proxy for the N leaching status of the property.
70. The P surplus metric is equally perplexing as to what would be achieved by reporting it. The objective is to prevent P from getting into the Waikato River. P is available to be transferred across the surface of the soil for a relatively short period of time after it has been applied to the soil while it is absorbed into the soil. Once it is absorbed into the soil it is fixed and does not move so the only way that it could get into the river is by transfer of the soil particle itself.
71. The P surplus figure reports the surplus of P added to the system from the P removed from the system. It has no connection at all to the degree of risk factors that would determine the amount of P getting into the river. Therefore, it is a completely inadequate measure of the amount of P that is getting into the river.
72. It is my opinion that the adoption of the measures as defined in the marked up version of the plan would add nothing in terms of assessing the potential for N and P to get into the Waikato River and would add to the complexity of the reporting requirements completely unnecessarily.

#### **EFFECTIVENESS AND EFFICIENCY OF THE AMENDMENTS TO PC1 AS PROPOSED BY HORTNZ**

73. HortNZ proposes amendments to PC1 which will result in:
- (a) A clear pathway being established that will result in adequate capacity for existing CVP and the opportunity for new CVP if they can demonstrate a net gain in the four contaminants from the existing position.
  - (b) Development of some proxy N and P loss figures that are connected to GFP which growers can choose to enter into their FEP.
  - (c) The main driver for change to contaminant loss metrics will be driven by the FEP which will be constructed to assess the risk factors that must be attended to in order to meet the fresh water objectives as stated in Table 3.11-1.

74. It is my assessment that the amendments that are proposed will be far more effective in achieving the objectives and will be far more efficient in terms of minimising the cost of achieving them than those that are proposed by the notified and amended version of PC1.
75. I support the amendments as proposed in Mr Vance's evidence at Attachment A as being a very effective and efficient means of incorporating the CVP sector into PC1 and achieving a balanced approach to both the necessary growth of the sector and the fresh water objectives as stated in Table 3.11-1.

**Stuart Ford**  
**9 July 2019**



**APPENDIX A: EXPLANATION OF THE DATA USED TO DERIVE THE VALUES IN TABLE 2.**

<b>Data Description</b>	<b>Numeric Value Used</b>	<b>Derivation</b>
CVP N leaching.	81	Root vegetable rotation used in report Nutrient Performance and Financial Analysis of Lower Waikato Horticulture Growers modelled in OverseerFM.
Dairy N leaching.	41	The representative Waikato dairy farm as described in the MPI Farm Monitoring report modelled in OverseerFM.
Forestry N leaching	3	OverseerFM
CVP gross margin information.	3,866	Nutrient Performance and Financial Analysis of Lower Waikato Horticulture Growers
Forestry gross margin information.	1,340	Methodology and Results of the RDST Scenario Financial and Economic Modelling
Financial performance of the dairy farm.		The representative Waikato dairy farm as described in the MPI Farm Monitoring report.
Price of land \$/ ha.	\$80,000	An estimated mid point of quoted cost of dairy land in the South Waikato.

Deintensification is modelled as the new CVP producer buying a new dairy farm and operating it at its existing leaching value which means that there is a much higher proportion of the low leaching crop which is barley. Calculation of the amount of land required to reduce the N leaching to the Dairy level.

Difference between existing N leaching and the crop N leaching.	23 kg / ha
Reduction in the total average leaching value.	40 kg / ha
Amount of land required to reduce the N leaching to that of a dairy farm.	1.74
Total additional cost	\$139,130
Annual cost of additional land	\$8,348
Amount required to restore the Gross Margin to where it was before.	\$9,115

The enterprise example models a new CVP producer buying an existing dairy farm and planting as much of it as is required in Forestry to ensure that the N leaching value is the same as the existing use.

Difference between existing N leaching and the crop N leaching.	38kg / ha
Reduction in the total average leaching value.	40 kg / ha
Amount of land required to reduce the N leaching to that of a dairy farm.	1.05
Total additional cost	\$ 84,211
Annual cost of additional land	\$5,053
Amount required to restore the Gross Margin to where it was before.	\$6,280

The on-farm offset models a new CVP producer leasing land off a dairy farmer (the feed cropping block) and the dairy farmer winter grazing their cows elsewhere and the loss of some milksolids production.

Dairy farm winter crop N leaching	240 kg / ha
Area that could be offset per area in CVP	2.96
Area available	7.5
area available for CVP production	22.2
Dairy farm cost of graing the cows somewhere else	\$13,500
Loss of milk production	95,400 kg milksolids
Amount required to replace losses plus a normal rental.	\$5,653