

IN THE MATTER

of the Resource Management Act 1991

AND

IN THE MATTER

of appeals lodged against proposed Plan Change 2
to the Manawatu-Whanganui One Plan

**JOINT WITNESS STATEMENT OF FARM SYSTEM EXPERTS –
COMMERCIAL VEGETABLE GROWING**

10 February 2023

INTRODUCTION

1. This joint expert witness statement relates to the appeals lodged against proposed Plan Change 2 (**PC2**) of the Manawatu-Whanganui One Plan which focuses on existing intensive farming land use activities within targeted water catchments in the region.
2. At mediation held on 12 December 2022 it was agreed that a risk framework approach should be initially explored further between the experts, with a view to reporting back to parties at a further mediation in early 2023. The matters agreed to, along with agreed next steps, are within a Mediation Agreement dated 12 December 2022.
3. The Mediation Agreement includes a range of questions for experts (farm system advisors and planners) to consider regarding the (then) proposed risk framework. A particular focus is on the range of biophysical characteristics in any risk framework, however the issues for discussion between the experts were also to include the extent of reduction required by any risk framework, and whether Table 14.2 can be amended to reflect risk. The questions posed by the parties are at paras [9] and [10] of the Mediation Agreement, but for ease of reference, are also set out below at paragraph [9] for completeness.
4. It is agreed that the most relevant biophysical characteristics to be considered as part of the risk assessment are soil type/soil vulnerability to N leaching and rainfall/sub-soil drainage.¹
5. Since mediation, Professor David Horne has circulated an alternative proposal for consideration with the pastoral experts.² For consistency between the proposed pastoral risk matrix and proposed commercial vegetable risk matrix, Dr Anne-Maree Jolly has incorporated the alternative proposal into the commercial vegetable context for discussion purposes.³
6. The experts agree it is necessary to discuss the merits of the alternative proposal before the questions within the Mediation Agreement. This allows them to also address the alternative proposal as they respond to the questions posed to them in the Mediation Agreement. Where questions are not relevant to the alternative proposal (as opposed to the original risk framework proposal, as discussed at mediation) this has been identified.

¹ Paragraph 8.

² See “What will the Risk Matrix deliver in terms of nitrate leaching?” and “A matrix to help interpret the Fonterra Risk Scorecard and achieve the improvement in farm management sought by Plan Change 2”.

³ Memorandum circulated by Dr Anne-Maree Jolly on 7 February 2023.

7. Farm system experts attending the conference were:
 - (a) Dr Anne-Maree Jolly (**AJ**) for Manawatu-Whanganui Regional Council (**Horizons**);
 - (b) Stuart Ford (**SF**) for Horticulture New Zealand (via AVL);
 - (c) Andrew Barber (**AB**) for Potatoes NZ & Horticulture New Zealand (via AVL); and
8. Dr Liz Parlato (**LP**) for Wellington Fish and Game and Ngati Turanga attended the conferencing session as an observer only.

Agreed Questions

9. The questions set out at paras [9] and [10] of the Mediation Agreement, are set out below. The experts responses are set out in **Annexure A**.

Biophysical factors⁴

- (a) Should soil type/soil vulnerability to N leaching and rainfall/sub-soil drainage be added to the risk tool?
- (b) What are the graduations for each biophysical factor?
- (c) What factor or multiplier should apply to each biophysical factor?
- (d) Do questions (a)-(c) change which farms are in any particular category (compared with the scorecard without biophysical factors)?

Reduction required⁵

- (e) How much reduction would asking farms to reduce to the 75th percentile deliver?
- (f) Does a 20% reduction in risk equal a 20% reduction in N loss? If not, how can you translate the 20% reduction in N leaching to risk (or actions and mitigations to achieve N loss reductions)?
- (g) Does the answer to questions (e) and (f) change depending on whether you include biophysical factors or not?
- (h) Is it possible to maintain the 2012/13 baseline? i.e. is there sufficient data for individual farmers to calculate a risk score as at 2012/13?

⁴ As set out at paragraph [9] of the Mediation Agreement.

⁵ As set out at paragraph [9] of the Mediation Agreement.

Revised table 14.2B (which accounts for risk):⁶

- (a) How are the table values calculated?
- (b) How does it ensure that there are no duplications or double counting as between soil types, rainfall, use of Overseer etc?
- (c) How accurate is it?
- (d) How does Table 14.2B account for LUC?
- (e) What is the purpose of Table 14.2B?

CODE OF CONDUCT

- 10. This joint witness statement is prepared in accordance with section 9.5 of the Environment Court Practice Note 2023.
- 11. We confirm that we have read and complied with the Code of Conduct for Expert Witnesses.

PURPOSE AND SCOPE OF CONFERENCING

- 12. Refer paragraphs [2] – [4] above.
- 13. This conferencing session builds on earlier discussions between the experts as part of a suite of workshops, with expert conferencing statements dated 28 June 2022, 25 August 2022, and 7 October 2022 having previously been agreed to by the participating experts.
- 14. The scope of the issues covered at the conference included:
 - (a) Discussion of the alternative proposal of Professor Horne and further work by Dr Anne-Maree Jolly. Dr Anne-Maree Jolly's memorandum, as circulated to the experts in advance of expert conferencing is at **Attachment A**.
 - (b) The questions at paras [9] and [10] of the Mediation Agreement.
 - (c) Further work required.

KEY FACTS AND ASSUMPTIONS

- 15. Discussions around the alternative proposal were based on background papers circulated by Professor Dave Horne on 25 January 2023 and 2

⁶ As set out at paragraph [10] of the Mediation Agreement.
GB-030235-404-1092-V2-e

February 2023 respectively and a memorandum circulated by Dr Anne-Maree Jolly on 7 February 2023.⁷

AGREED ISSUES

16. Refer to Annexure A.

DISAGREEMENT AND REASONS

17. Refer to Annexure A.

Date: 10 February 2023



Dr Anne-Maree Jolly



Andrew Barber



Stuart Ford



Dr Liz Parlato (observer)

⁷ See "What will the Risk Matrix deliver in terms of nitrate leaching?" and "A matrix to help interpret the Fonterra Risk Scorecard and achieve the improvement in farm management sought by Plan Change 2".
GB-030235-404-1092-V2-e

ANNEXURE A

In the matter of Proposed Plan Change 2

Expert conferencing – Intensive Farming Risk Scorecard Continuation (Commercial Vegetable Experts – AJ, AB, SF)

Issue	Statements	Agreed Position	Disagreements, with reasons
Topic 1 – Alternative Proposal			
Alternative January 2023 approach	AJ discussed progress made since October witness conferencing and mediation. Spoke through Professor Horne's alternative approach and how she has applied this to the commercial vegetable matrix. Both the December 2022 approach and alternative January 2023 approach are on the table to be discussed.		AB raised that the scorecard in the alternative approach goes back to the start of expert conferencing by adding other practices back in.
Biophysical factors in the scorecard vs elsewhere in the consenting framework	The December 2022 approach for commercial vege was the October scorecard with biophysical factors added as a multiplier (as presented by Professor Horne at mediation). SF suggested turning the soil types in the January 2023 matrix into quantitative figures (providing the values of the profile available water). Professor Horne took these categories from S-Map and the headings can be changed to values. If the headings were changed to low, med and high with the relevant figures showing the profile available water range, SF would agree to including the biophysical matrix as in the January 2023 approach.	All agree with assigning a risk rating based on biophysical factors as they understand that it places the risk ratings within the wider context. It seems a pragmatic way of assigning risk ratings. All agree that the soil types along the top of the wider framework (Figure 2, AJ memorandum circulated on 7 Feb) should be converted into quantitative values of profile available water. All agree with placing the biophysical factors in the risk matrix instead of elsewhere in the consenting process.	AB and SF disagree with the biophysical factors being included as a multiplier to the scorecard. SF does not think that the December 2022 approach could accurately come up with a score. SF agrees that there should be a scorecard but does not think it is worthwhile including biophysical factors because they are all the same in the commercial vege sector. If a grower wanted to assess their farm on biophysical things, SF thinks you could use Overseer.

Issue	Statements	Agreed Position	Disagreements, with reasons
	AB raised a question to check that the rainfall is measured from the long-term average. Therefore, it is the current rainfall that will determine the grower's practices, however, the long-term average is used to determine the risk rating.		AJ believes that biophysical factors are such major influences on N leaching that they should be included in the framework even if all CVG's fit within one category (Soil type B / Rainfall 2) and therefore they do not make a difference to the target Risk Rating. AJ prefers the January 2023 matrix but supports both in principle.
Added practices	AJ has added in crop removal, cultivation practice and compaction into the scorecard. AJ explained how she came to her proposed scoring, as in Appendix A of her paper circulated on 7 February. AJ sees the scorecard as a work in progress and refinements can be made after road testing. AJ also discussed that if the experts decide to remove the additional practices after road testing and focus on the simpler format of the scorecard, there may just be a general practice category and in this case, she would advocate for the target risk rating to be low. AJ explained that there may be a concern that any negative scores in the risk rating could give the impression that there is no risk of N leaching (when this is not the case).	All agreed that some scoring may need to be refined (SF raised issue with scoring of "Fallow" and "Catch crops" and AJ agreed that they could be revised to better offset each other).	AB disagrees that these should be added because the experts had previously agreed that they would focus on the 2 main practices – soil testing and nitrogen budgeting. This adds a level of complexity which is unnecessary. It would also take additional time for the experts to agree on the definitions and scoring of these added practices. SF agrees.

Testing the alternative approach	Discussed testing the alternative matrix before the planning expert conference before the end of February. AJ noted that the December 2022 approach also has not been tested. AB conducted a conference call with growers on 7 December sharing and working through the updated vegetable risk scorecard (from 7 October JWS). SF suggested putting the alternative approach forward to the planning conference with the proviso that the scoring and risk ratings may be further refined.	AB will undertake to road test the January 2023 scorecard to determine what should and should not be included in the scorecard part of the matrix. AB and AJ will then meet to refine the scoring and adjust the risk ratings. AB and AJ will then call SF to put forward their final scoring for the scorecard to be agreed to take to mediation. Road testing and AB AJ SF discussion will occur between 7–9 March 2023. All agree that the overall risk rating categories (Very low being <20 – Very high being >81) should remain the same as the pastoral scorecard, however, the scoring behind reaching those categories can be refined and adjusted. While road testing, the experts can adjust the scoring for each practice in the scorecard but the values in the overall risk rating table will stay the same.	
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Topic 2 – Biophysical Factors			
(a) Should soil type/soil vulnerability to N leaching and rainfall/sub-soil drainage be added to the risk tool?		See above. All agree with the January 2023 approach which uses profile available water for soil type and uses rainfall (not drainage).	
(b) What are the graduations for each biophysical factor?		See above. All agree to convert soil type into quantitative values.	
(c) What factor or multiplier should apply to each biophysical factor?		SF and AB disagree with using a multiplier. All experts prefer the January 2023 approach to biophysical factors.	
(d) Do questions (a)-(c) change which farms are in any particular category (compared with the scorecard without biophysical factors)?		All agree that this is irrelevant for commercial vege as all growers fall into one category (Rainfall 2 and Soil type B).	

Topic 3 – Reduction Required			
(e) How much reduction would asking farms to reduce to the 75th percentile deliver?		All agree that the January 2023 approach moves away from a percentage reduction approach for commercial vege. All agree that a suitable risk category is low for nitrogen fertiliser and medium for crop and soil management (but this is pending confirmation from road testing).	
(f) Does a 20% reduction in risk equal a 20% reduction in N loss? If not, how can you translate the 20% reduction in N leaching to risk (or actions and mitigations to achieve N loss reductions)?		Not applicable to commercial vege based on the experts' current position as set out above.	
(g) Does the answer to questions (e) and (f) change depending on whether you include biophysical factors or not?			
(h) Is it possible to maintain the 2012/13 baseline? i.e. is there sufficient data for individual farmers to calculate a risk score as at 2012/13?			

Topic 4 – Revised table 14.2B (which accounts for risk)			
(a) How are the table values calculated?		The experts do not feel comfortable answering these questions without Professor Horne present, however, they do not believe these are applicable given the new January 2023 approach is preferred.	
(b) How does it ensure that there are no duplications or double counting as between soil types, rainfall, use of Overseer etc?			
(c) How accurate is it?			
(d) How does Table 14.2B account for LUC?			
(d) What is the purpose of Table 14.2B?			
Topic 5 – Any other matters			
Further work		See above at pg 8.	



Memorandum

To	Horizons Regional Council
Copy	Shannon Johnston
From	Anne-Maree Jolly
Office	Palmerston North
Date	3 February 2023
File/Ref	5-P1366.02
Subject	Vegetables risk matrix update

Introduction

As part of the appeals on Plan Change 2 (PC 2) a risk matrix framework is being explored by the parties as a possible alternative to Overseer within the intensive farming rules of the One Plan. This work has evolved as a result of the report on Overseer usage and regulatory suitability being released in August 2021, post the PC 2 Council hearing and resultant decisions. Over the last six months, farm system technical experts across different land uses have developed two risk matrices for this purpose: a pastoral matrix, and a commercial vegetable matrix. Until this point, the development of these matrices focused on management practice, with soil type and rainfall effects not considered within the framework. Although all the experts agree that these geophysical features are important drivers of nitrate leaching, there has been disagreement about whether those factors should be included.

Horizons experts have argued that both soil type and rainfall should be included in the risk matrix framework, however the method of inclusion has not yet been confirmed. Professor Dave Horne previously proposed one option during the December 2022 mediation¹, however since then he has proposed an alternative for consideration (January 2023). As a consequence, the form of the commercial vegetables risk matrix framework has required modifications to maintain consistency with the newly proposed pastoral matrix. This paper sets out those changes for the purpose of discussion with the farm system experts and parties to the PC 2 appeals. It is likely that the change in matrix form will necessitate some changes to the consenting pathways for a controlled activity. The consenting pathways will be considered by the planning and legal experts, and for the purpose of this paper, are not discussed further.

Development of the vegetable risk matrix

The farm practices within the risk matrix were originally identified during PC 2 as practices that can influence the amount of nitrate leached through the soil profile. Within PC 2, these practices were identified as either good management practices (GMP) or best management practices

¹ Horne, D. (2022) A proposal to modify the Fonterra Risk Matrix to identify the Overall Risk Matrix for N leaching from pastoral farms to help achieve the PC2 outcomes for improved water quality: a discussion document

(BMP), with a high level of agreement between the farm system experts as to what good and/or best management practices were for commercial vegetable growing. The intention is that if enough GMP and/or BMP were adopted by a grower, their nitrate leaching number would reduce enough to be able to meet Table 14.2 of the One Plan or make a 35% reduction in nitrogen loss. Achieving either of these would result in a grower falling within a controlled activity pathway under the proposed PC 2 provisions.

Although the adoption of any GMP or BMP will impact the amount of nitrate lost from the soil profile, the amount varies between practices. It has been agreed between the relevant experts that grower practices associated with the use of nitrogen fertiliser have the greatest influence on nitrate leaching losses. Practices associated with soil and crop management have a lesser, but still important, impact on the amount of nitrate leached from vegetable systems.

The current vegetable risk matrix (developed June-October 2022) began with the inclusion of a large range of farm management practices. The final version has now been refined to include only the most practical practices with the greatest influence on nitrate leaching. This approach was considered suitable as the matrix was reliant on an overall score. Using a score-based approach aligned with the controlled activity pathways within PC 2 (a 35% reduction in nitrate loss or meeting Table 14.2 of the One Plan).

Refining the practices available under the matrix in effect has limited the original toolbox of options farmers had available to pick and choose from as long they met Table 14.2 or achieved a 35% reduction in nitrate leaching. However, the experts have been satisfied that the refined list captured those practices most likely to be effective at reducing nitrate leaching while being practical to implement, thereby improving water quality while still allowing growers to operate.

As highlighted in the introduction, there is no agreement between experts yet on whether the biophysical features should be included in the risk matrix. The vegetable matrix to date is management practice base only. In December 2022, Professor Dave Horne proposed the use of a 'multiplier' for including biophysical features in both the pastoral and vegetables risk matrices. Soil type and rainfall would be used to define a property-specific number which would be multiplied by the existing matrix score to produce a final risk score. This method is discussed in more detail in Professor Horne's December 2022 mediation paper.

Since the December mediation, Professor Horne has proposed an alternative approach to including the biophysical factors. Rather than taking a score-based approach, the newly proposed risk matrix framework is driven by risk categories. When assessing the ability of the current vegetable risk matrix to address the approach recommended by Professor Horne, it was identified that the scoring was too coarse and not enough GMP and BMP were included. As a result, a further proposed vegetable risk matrix has been developed for discussion purposes.

Additional work has been undertaken on the vegetable risk matrix so that it can be usable within the proposed new framework. Changes that have been made to the risk matrix include:

- The addition of more crop and soil management GMP and BMP.
- Updating the scoring so that it could fit within the proposed risk matrix framework (the pastoral framework has been adopted from the Fonterra score card).
- The grouping of grower management practices into either nitrogen fertiliser practices, or crop and soil practices.

The inclusion of biophysical information in the risk matrix

Professor Horne's proposed alternative risk matrix framework² keeps the farm management practice scoring separate to that of the biophysical features. It ensures that biophysical features are accounted for within a broader framework/context, but in a way that does not alter the scoring of farm practices in regard to their ability to manage the risk of nitrate leaching.

² Horne, D. (2023) A matrix to help interpret the Fonterra Risk Scorecard and achieve the improvement in farm management sought by Plan Change 2

The risk scoring approach proposed by Professor Horne for the pastoral intensive farming land uses (IFLU) has five different management practices scored against several GMP. The vegetable risk matrix has been modified so there are now two different management practices scored against several GMP and BMP. After the scoring of the initial risk, each farm management practice is assigned a risk rating ranging from 'very low' risk to 'very high' risk (Figure 1).

Figure 1: Vegetable farm management practice risk rating

Farm Management Practices				Risk Ratings				
				Very Low	Low	Medium	High	Very High
				<20	21-40	41-60	61-80	>81
Nitrogen fertiliser								
Crop and soil management								

The farm management practice score is overlayed into a wider framework which highlights the influence soil type and rainfall on the risk score. The overlay highlights the different combinations of rainfall and soil types that influence the risk associated with nitrate leaching (Figure 2). The biophysical risk is the driving determinant on the acceptable level of risk for a given farm's management practices, dictating allowable risk matrix scores.

Figure 2: Highlighting how biophysical factors could be included within the risk matrix

	Soil type A (Fine texture)	Soil type B (Medium texture)	Soil type C (Coarse texture)
Rainfall 1 <1000 (mm)	Small geophysical risk allows for greater management risk		
Rainfall 2 (1000 – 1200 mm)			
Rainfall 3 (1200 – 1400 mm)			
Rainfall 4 >1400			Large geophysical risk must be matched by small management risk

Unlike the pastoral IFLU systems which are located across the Horizons region, the vegetable growers impacted by PC 2 are all located within the Horowhenua region. Soil type and rainfall have limited variation in this relatively small region. As the result, the biophysical risk for all vegetables growers affected by PC 2 would be the same under this proposal. The commercial vegetables biophysical risks all fall within soil type B and rainfall 2, highlighted by the red square in Figure 2.

An updated commercial vegetable growing risk matrix

Within Figure 2, the vegetable growers are located within the soil type B and rainfall 2 risk. Overlaying this with farm practices, a grower will be required to gain a low-risk score for nitrogen fertiliser practices and a medium risk score for soil and crop management practices.

The updated commercial vegetable growing risk matrix is set out in **Appendix A**.

Meeting a nitrogen fertiliser low risk score will likely result in a grower having to adopt a range of GMP and BMP. As highlighted above, the adoption of GMP and BMP was part of the original intent of PC 2 and the controlled activity pathways. Therefore, achieving a low-risk score for nitrogen fertiliser practices keeps in line with the original intent of PC 2.

Meeting a medium risk score for crop and soil management will still require growers to improve practices across several GMP or BMP. To meet the proposed risk scores, significant improvements will still be required (or in some cases, may have already been made since the One Plan became operative in December 2014) under the risk matrix.

Although a higher risk score is allowed for crop and soil management practices, water quality improvements will still be made through practice change compared to the originally proposed vegetable risk matrix. This reflects the addition of practices within the updated risk matrix.

Nitrogen fertiliser practices are prioritised over crop and soil management practices via stricter requirements ('low' vs 'medium' risk) because the experts agree that nitrogen fertiliser poses a greater risk to water quality. Therefore, in our view, it is appropriate to enforce stricter conditions on nitrogen fertiliser but allow a more tolerant approach to crop management practices.

Scenario modelling with proposed risk matrix

Using the 2020 Bloomer Overseer modelling³ and the PC 2 GMP and BMP list, three mock vegetable growing systems were modelled using the newly updated vegetable risk matrix. The current system is defined as the grower system in 2018, with the future system being defined as after the adoption of all suitable GMP and BMP.

This modelling was undertaken to test the workability of the updated risk matrix. Firstly, it has been used to identify what level of risk each current vegetable system presents at. Secondly, it investigates how the current risk could reduce through the adoption of GMP and BMP. Although information from the 2020 Bloomer Overseer report was used, not all GMP or BMP were part of the Bloomer work and therefore some assumptions have been made. It is because of these assumptions and that actual grower systems are unknown that the systems are being referred to as mock systems.

It must be noted that the pastoral risk matrix relies on the Fonterra score card scoring system and has been tested over several years. A risk-based approach is new to the commercial vegetable industry, and while there is confidence in the scoring and risk allocation, discussions with farmers as to usability of the risk framework in practice would be useful, and it is understood that Hort NZ are intending to (or are already) working with industry.

Figure 3 highlights the results of modelling the PC2 mock vegetable systems through the updated risk matrix. Apart from the intensive vegetable system nitrogen fertiliser practices, all systems across both nitrogen fertiliser and crop and soil practices resulted in the risk being assessed as very high risk. Through adopting a range of GMP and BMP (not necessarily the same across each system), risk significantly decreased. All systems were able to meet the very low risk classification for nitrogen fertiliser and the intensive vegetable systems for crop and soil management was also able to meet a very low risk classification. The other two systems (potatoes/onions and brassica) were able to adopt enough suitable GMP and BMP to meet to low-risk classification.

This preliminary modelling exercise has also highlighted the potential for growers to reduce their risk scores further, thus indicating the requirements should be achievable in practice.

Figure 3: Lowering the nitrate leaching risk through the adoption of GMP and BMP

Vegetable system	Current risk	Future risk
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³ Bloomer et al. (2020) Modelled loss of nutrients from vegetables growing scenarios in Horowhenua: OverseerFM 6.3.2 Modelling of Representative Rotations within Hokio_1a, Hokio_1b, and Ohau_1b WMSZ

	N fertiliser	Crop and soil	N fertiliser	Crop and soil
Potatoes/onion	220	200	-80	25
Brassica	220	190	-65	30
Intensive vegetable	65	130	-185	5

Issues identified after trialing score cards

Overall, we are of the view that the updated commercial vegetable risk matrix can achieve the intentions of PC 2 to improve water quality. Through the addition of more GMP and BMP this improvement is most likely greater than version one of the vegetable risk matrix.

However, trialing of both proposed vegetable risk matrices has highlighted several potential issues regarding use. It should be noted that the significance of these points is difficult to assess on the limited data available to date, but they are included for the purpose of discussion going forward: Although these points need to be worked through, none appear to be insurmountable in terms of delivering a risk matrix tool or its implementation.

- In general terms, the completion of the risk matrix for an individual grower is going to be a lot less time-consuming and cost significantly less compared to the use of Overseer. However, time is still required to collate and sort information so that appropriate information is in the correct format to be entered into the risk matrix.
- Evidence of the information entered into the risk matrix will need to be summarised in the consent application and be available on request from the council. Therefore, it will be important to clarify and provide guidance on what evidence is required in this context.
- If granted a consent, a farmer/grower's entire property is consented (productive and un-productive areas). This includes owned and leased land; however, all current risk matrix modelling has only modelled the productive growing area. Therefore, (average) risk matrix scores will be lower if un-productive areas are to be included. Currently the commercial vegetable risk matrix framework does not allow for the inclusion of un-productive areas in a straightforward manner.
- The risk matrix framework for commercial vegetable growers has been simplified to property scale. Unlike in Overseer, where each individual crop rotation is required to be modelled, the design and expectation of the risk matrix framework is to average data out to a farm scale. This averaging process is relatively straightforward when determining nitrogen fertiliser inputs, however other practices such as management between crops and fertiliser application method are more challenging to average out if these vary between crops. One example of this is the modelled scenario for a potato and onion grower where 55% of the area grows onions and 45% grows potatoes. The onions during the baseline year had three nitrogen fertiliser applications across a single crop, while the potatoes only had one nitrogen fertiliser application for a single crop.
 - To address this issue, a simple approach would be to assess the N leaching risk based on the practice covering the majority of the farm (for example, over 60% of the productive area) If the primary practice covers less than 60% (e.g., 55/45) the whole farm would be assessed based on the practice carrying the highest risk.
 - If there were three management practice options, I recommend that the middle of the practices is assigned the score unless one of the other two practices has a majority of 60% or more.
 - If planning provisions allow, I also propose that a condition of the consent be that when management practices are split, the lower practice standard must improve to match the higher standard across the property. E.g., If soil testing across the property is split between at the beginning of each crop and once a year, the condition of consent would be that soil testing practices need to be at a minimum of at the beginning of each crop.

- Secondly, if planning provisions allow, I would also propose providing for an exception to the rule where vegetable crops vary greatly and there may be a sound reason why practices are different between crops. If differences in practice are reasonably explained and evidence provided in a consent application, crop specific exceptions should be allowed.
- Commercial vegetable systems often vary the crops they grow year-to-year, unlike a typical pastoral system. This crop variations often result in year-to-year variations in nitrogen fertiliser usage. Therefore, there is the potential for change in a grower's nitrogen risk. To get the most representative risk score, it is recommended that a grower completes the risk matrix using a two-year crop rotation, like that of Overseer. It is likely that each year a grower will be required to submit an annual risk score and ensure it remains within acceptable limits.
- I recommend the development of a guidance note that will outline how the risk matrix is to be used and the expectation what is suitable grower information. This will give guidance to the growers on what information is required for the risk matrix and how it needs to be inputted into the matrix. The guidance note will give confidence to Horizons staff that the data entered into the risk matrix is suitable.

Appendix A

Farm Management Practices	Risk Ratings				
	Very Low <20	Low 21-40	Medium 41-60	High 61-80	Very High >81
Nitrogen fertiliser					
Crop and soil management					

Nitrogen fertiliser practices

Annual	Points	Risk rating on report
N fertiliser: <100 kgN /ha	0	
N fertiliser: 101-150 kgN /ha	30	
N fertiliser: 151-200 kgN /ha	60	
N fertiliser: 201-250 kgN /ha	90	
N fertiliser: 251-300 kgN /ha	150	
N fertiliser: 301-400 kgN /ha	200	
N fertiliser: >400 kgN /ha	250	

Individual application	Points	Risk rating on report
N fertiliser: <25kg /ha	-25	
N fertiliser: 25-50 kg /ha	0	
N fertiliser: 51 - 75 kg /ha	25	
N fertiliser: 76-100 kg /ha	50	
N fertiliser: >100 kg /ha	75	

Base fertiliser application	Points	Risk rating on report
Incorporated, GPS banded	-20	
Surface, GPS banded	-15	
Incorporated, banded	-10	
Surface, banded	-5	
Surface broadcast, incorporated	10	
Surface broadcast	20	

Side fertiliser application	Points	Risk rating on report
GPS banded	-15	
Banded	-5	
Broadcast	20	

Split application	Points	Risk rating on report
Base application and 2 side dressing	-20	
Base application and 1 side dressing	-10	
Base application only	50	

Nitrogen Soil testing	Points	Risk rating on report
Before every nitrogen fertiliser application	-100	
At the beginning of each crop cycle	-75	
One a year	0	
Never	50	

Nitrogen balance/budget	Points	Risk rating on report
Nitrogen budget: Yes	-75	
Nitrogen budget: No	0	

Crop and soil management

Crop removal	Points	Risk rating on report
Harvest as much crop as possible and incorporate residual	-15	
Harvest as much crop as possible	-10	
Harvest high value crop only (marginal crop left in paddock)	30	

Fallow	Points	Risk rating on report
< 1 month	-10	
1 - 3 months	40	
> 3 months	50	

Cultivation practice	Points	Risk rating on report
Minimal tillage every sowing	-15	
Minimal tillage where possible	-10	
Minimal tillage of catch crops only	30	
Conventional	40	

Compaction	Points	Risk rating on report
Controlled trafficking	-15	
Annual compaction testing and minimum tractor passes	-10	
Minimum tractor passes	30	
No mitigation	40	

Catch crops (cut-and-carry)	Points	Risk rating on report
> 5 months	-15	
3 - 5 months	-10	
< 3 months	-5	
No catch crop	50	

