

**IN THE ENVIRONMENT COURT
WELLINGTON REGISTRY**

**I TE KŌTI TAIAO O AOTEAROA
TE WHANGANUI-A-TARA ROHE**

UNDER	the Resource Management Act 1991
IN THE MATTER	of appeals under sch 1, cl 14(1) against the decision of Manawatū-Whanganui Regional Council on Plan Change 2 to the One Plan
BETWEEN	TE RUNANGA O RAUKAWA ENV-2021-WLG-20 NGĀTI TURANGA ENV-2021-WLG-21 ANDREW DAY ENV-2021-WLG-22 WELLINGTON FISH AND GAME COUNCIL ENV-2021-WLG-23 Appellants
AND	MANAWATŪ-WHANGANUI REGIONAL COUNCIL Respondent

**STATEMENT OF EVIDENCE OF DR PAUL FREDERICK LE MIERE ON BEHALF OF THE
MANAWATŪ-WHANGANUI REGIONAL COUNCIL**

PASTORAL FARM SYSTEMS

Dated: 12 October 2023



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STATEMENT OF EVIDENCE OF DR PAUL FREDERICK LE MIERE**A. INTRODUCTION**

- [1] My full name is Paul Frederick le Miere. I am currently employed as Group Manager Regional Policy at Federated Farmers. I have been employed by Federated Farmers since 2008. As part of my present role, I lead the freshwater team that deals with water quality and water quantity matters.
- [2] I have a Bachelor of Science (1st Class Hons) and a PhD in crop physiology, both from the University of Reading in the United Kingdom. My PhD had a specific focus on modelling.
- [3] Since joining Federated Farmers, I have had a particular focus on freshwater, and have been involved in a range of water quality issues:
- (a) At a national level, I have provided technical input into Federated Farmers' response to the Government's Essential Freshwater proposals, the development of good farming practices¹ and I have participated in the Land and Water Forum.
 - (b) At a regional level, I have been involved in the Manawatu-Whanganui One Plan (**One Plan**) and Hawke's Bay Regional Council's Plan Change 9, and I have provided expert farm systems evidence for Federated Farmers in the Environment Court hearings for Bay of Plenty Regional Council's Plan Change 10 (Rotorua) and Waikato Regional Council's Plan Change 1 (Healthy Rivers).
 - (c) The use of Overseer, including participating in an Overseer steering group in 2010, providing technical advice to Federated Farmers on the 2021 Overseer peer review recommendations, implementation advice to Federated Farmers' members in respect of the use of Overseer in the Tukituki catchment (Plan Change 6), Lake Taupō (Variation 5) and Rotorua (Plan Change 10), and in the consideration

¹ Good Farming Practice: Action Plan for Water Quality 2018
https://www.irrigationnz.co.nz/Attachment?Action=Download&Attachment_id=467.

of alternative risk tools such as the Fonterra Nitrogen Risk Scorecard (NRS).

- [4] I was involved with Plan Change 2 to the One Plan (**PC2**) at the Council-level hearing, having prepared a statement of evidence on behalf of Federated Farmers and DairyNZ dated 25 September 2020. My evidence focused on farm systems matters, including my assessment of good and best management practices (**GMPs** and **BMPs**), the use of Land Use Capability (**LUC**) in a nitrogen leaching context, and the use of Overseer.²
- [5] I participated in a number of expert conferences with farm system advisors and planning experts as part of these appeals. I also attended mediation on behalf of Federated Farmers on 12 December 2022 and 15 March 2023.
- [6] I have prepared this statement of evidence for Manawatū-Whanganui Regional Council (**Horizons**) in light of my contribution to the development of the pastoral nitrogen risk assessment tool that is now proposed as part of PC2. My evidence should be read alongside the evidence of Professor Horne.

B. CODE OF CONDUCT

- [7] I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. My evidence has been prepared in accordance with that Code. I confirm that I have not omitted to consider material facts that might alter or detract from the opinions that I express. The evidence I am giving is within my area of expertise, except where I state I am relying on the opinion or evidence of other witnesses. I understand it is my duty to assist the Court impartially on relevant matters within my areas of expertise.
- [8] For the purposes of clause 9.2(c) of the Code of Conduct, I declare that I am an employee of Federated Farmers, who is a s 274 party in this proceeding.

² Statement of Evidence of Dr Paul Frederick le Miere on behalf of Federated Farmers and DairyNZ (25 September 2020).

C. EXECUTIVE SUMMARY

[9] The key conclusions of my evidence are:

- (a) In my opinion, it is important to provide an alternative pathway to the CNLMs in Table 14.2 that does not rely on Overseer. This is in light of the 2021 Science Advisory Panel's findings. I consider the need for caution around relying on Overseer to assess reductions in nitrogen loss remains, notwithstanding the recent release of updates to the Overseer model.
- (b) I support the use of the NRS (with amendments to practices and scores as agreed by experts during conferencing as part of PC2) and a matrix approach that identifies target NRS scores based on soils (profile available water (**PAW**)) and rainfall bands. I consider this approach to be the best option amongst the currently available tools and information. In my view, this approach will also drive farm system practice changes that will reduce nitrogen loss risk.
- (c) Using a dataset of 285 dairy farmers in the targeted Water Management Zones (**WMZs**) (194 of them unconsented), I have assessed the level of reduction required against a weighted average target NRS score and I have modelled the likely level of, and types of, on farm system changes for several case study farms and a synthetic farm.
- (d) I have made adjustments to the original risk matrix proposed by Professor Horne, with the objective of more fairly distributing the level of practice change required across the matrix, while achieving the same overall reduction in NRS score (using a weighted average approach) and therefore the same magnitude of practice change at a catchment scale. These adjustments were incorporated into the risk assessment tool provided as part of the plan provisions previously filed by Horizons.
- (e) In my opinion, the result is a nitrogen scorecard and matrix (together described by Horizons as the risk assessment tool) that are able to

be implemented now to avoid any further delay to improvement in farming practices (and therefore water quality) and is able to provide a workable consenting pathway for unconsented dairy farms.

- (f) The alternative pathway is still stringent, and some farms would likely be required to make significant reductions in their nitrogen risk scores (such that they are not able to comply with the risk assessment tool). In my opinion, it remains important to provide a discretionary pathway for those farmers to utilise to demonstrate why a smaller reduction in nitrogen risk score should be required, or to demonstrate that they have adopted practices to reduce their nitrogen risk score but those practices are not recognised by the risk assessment tool. Likewise, the discretionary pathway might be important for farmers who want to demonstrate that their soils and rainfall have been incorrectly categorised in the mapping that will support the categories in the matrix. In any of these situations, Horizons should still retain the ability to review the appropriateness of activities that do meet the risk threshold, and the reasons for the exceedance.

D. SCOPE OF EVIDENCE

[10] My evidence focuses on the following matters:

- (a) My role in the PC2 process, following the Council-level hearing;
- (b) The reasons I support the use of the pastoral nitrogen risk assessment tool in PC2 as an alternative option to the use of Overseer; and
- (c) My review of Professor Horne's work on the nitrogen risk assessment tool, as it related to intensive pastoral farming land use.

[11] In addition to my own observations, I rely on the evidence of Professor David Horne.

[12] I have also relied on the joint witness statements arising out of expert conferencing which I attended in June, August, and October 2022, and in February and March 2023. I confirm my positions as recorded in those joint witness statements (collectively referred to as the **JWS**), being the statements dated below:

- (a) 28 June 2022;
- (b) 25 August 2022;
- (c) 7 October 2022;
- (d) 3 February 2023;
- (e) 13 March 2023; and
- (f) 15 March 2023.

[13] At the Council-level hearing my evidence addressed concerns with the LUC and natural capital approach utilised within the One Plan for the purpose of managing nitrogen (in particular, the establishment of the limits in Table 14.2.). Ultimately, it was generally agreed by the parties involved in the hearing process that the scope of PC2 did not put those matters at issue. This was also confirmed by the Hearing Panel in its decision.³ Therefore, I do not take those issues further within this statement of evidence.

E. PLAN CHANGE 2

[14] As an expert for Federated Farmers and Dairy NZ at the Council-level hearing, I supported the addition of an alternative controlled activity pathway for dairy farms which required a 20% reduction in nitrogen loss from a specified baseline year (2012/13), or a reduction to the 75th percentile, whichever was greater (the **pastoral pathway**). This pathway was included in the decisions version of PC2 (**DV-PC2**) as a controlled activity.⁴

³ Recommendation of Independent Hearing Panel: Plan Change 2, March 2021, at 3.231, page 71.

⁴ Recommendation of Independent Hearing Panel: Plan Change 2, March 2021, at 3.191, page 64.

- [15] It was accepted that, for the purposes of PC2, the pastoral pathway would sit alongside the Cumulative Nitrogen Leaching Maximums (**CNLMs**) in Table 14.2, as an alternative consenting pathway. This meant that farmers could choose to either meet the CNLMs in Table 14.2 or to demonstrate the 20% reduction in nitrogen loss (or a reduction to the 75th percentile if that resulted in a greater than 20% reduction in nitrogen loss) through a recognised nutrient management model (most likely, Overseer), for the purposes of being a controlled activity. Otherwise, dairy farming in the target WMZs would be a discretionary activity.
- [16] I remain of the opinion that an alternative pathway to the CNLMs in Table 14.2 is important within the DV-PC2 framework. However, for the reasons I discuss below, my concern is that reliance on the CNLMs in Table 14.2 and/or a modelled specified nitrogen reduction will now not provide a workable controlled activity pathway for many dairy farmers.
- [17] Since release of the DV-PC2, serious issues with the use of Overseer in regulation have been reported (such that the Government advice is that other tools should be considered). This reflects reservations I expressed at the Council-level hearing. For these reasons, I consider that it is not only appropriate to provide an alternative pathway, but it is also necessary, so as to ensure there is a pathway independent of Overseer able to be implemented as part of PC2. In other words, my concern is that without the risk-based pathway that has been developed by the experts within these appeals, PC2 will likely fail to address the issues created by the One Plan.
- [18] As I described at the Council-level hearing, all farmers should be adopting GMPs, and they should adopt targeted management practices where additional mitigations are required to achieve catchment-specific targets or limits.
- [19] In my opinion, the use of the pastoral N risk assessment tool that is described in the amendments to PC2 will drive on-farm practice change which, in many cases, is likely to go well beyond GMP and achieve real reductions in N loss.

F. USE OF NRS TOOL AS AN ALTERNATIVE TO OVERSEER**NRS tool**

- [20] Over the past 2 years I have become very familiar with the NRS. This has primarily been through the work I have done in the Waikato and Horizons regions, and through the many discussions I have had with the staff at Fonterra who developed the tool and the staff at Fonterra who implement the tool.
- [21] Through the PC2 process, I have participated extensively in formal and informal discussions with experts about the NRS and I have run scenario farms through the tool. In Waikato Regional Council's Plan Change 1, I have participated in expert conferencing about the potential use of the NRS in that plan change, as well as worked with three case study farms to understand their historical NRS scores (and how they have changed over time), to use the NRS score to model their current risk scores and to test the impacts of different changes in their practices on their NRS scores.
- [22] Compared with Overseer, the NRS is reasonably crude because it only assesses practices and at a reasonably coarse level e.g. it assesses stocking rate per hectare whereas Overseer attempted to model where individual stock units were grazing and how much they were eating. However, in my view this is also the appeal of the NRS – it does not suffer the same uncertainty or subjectivity issues as Overseer because the data entry is simple with very little discretion. It also avoids some of the issues with modelling and attempting to proxy the complexities of real-life farm systems.
- [23] I support the proposal to use the NRS as the basis for the nitrogen risk assessment tool in PC2, as agreed at the farm systems expert conferencing, by:
- (a) Amending certain practices (and their associated scores) in the NRS tool to reflect the situations of farms in the target WMZs and available mitigations (i.e. to make it more bespoke to dairy farming in the targeted Horizons areas).

(b) Adopting a matrix to incorporate consideration of soils and rainfall (I explain below the reasons I suggested changes to the matrix, which were subsequently agreed as part of expert conferencing).

[24] The majority of dairy farms in the targeted WMZs are Fonterra suppliers. Fonterra currently produces a NRS score for all of its suppliers. Rather than providing the NRS score to its farmers, each year Fonterra provides its farmers with a summary of their risk rating (i.e. very high, high, moderate etc) for each of the six factors and a selection of the sub-factors (on the basis that this information is more meaningful for farmers than an absolute score, such as “140”, which without context has no meaning). I note that Fonterra has not used Overseer or provided its farmers with an Overseer number since at least 2018.

[25] For these reasons it is my opinion that the pastoral nitrogen risk assessment tool will likely be understood and implemented by dairy farmers (and without additional Overseer costs, given the uncertainty with the tool⁵).

[26] A key benefit of the nitrogen risk assessment tool over other risk tools (such as MFE’s proposed risk index tool) is that it is based on a tool that currently exists and is being used to drive farm practice change and improvement on Fonterra supplier dairy farms (and has been since the 2017/18 season).

Overseer

[27] I have concerns about reliance on Overseer in PC2 without the ability to use any other alternative tool. The most recent Government guidance (issued by the Ministry for the Environment in July 2023) is that councils need a range of tools to achieve freshwater outcomes and, in the context of current plan hearings and appeals, that guidance acknowledges that councils may wish to consider opportunities to complement the use of Overseer as a nutrient management tool. In my opinion, the use of the nitrogen risk assessment

⁵ The cost of establishing an Overseer file can be between \$2,000 and \$10,000 per farm depending on complexity, as well as the annual Overseer subscription of \$800.

tool in PC2 (alongside the CNLMs in Table 14.2 as appropriate) would be consistent with this guidance.⁶

- [28] The problems with Overseer that were identified by the Independent Scientific Advisory Panel in July 2021 are significant.⁷ Having regard to the issues described in the Science Advisory Panel’s report, the Panel concluded that they could not be confident that Overseer modelled outputs indicate that changes in farm management reduce or increase losses of nutrients, or what the magnitude or error of these losses might be. Their conclusion is that Overseer is “*not adequate to provide more than a coarse understanding of a farm’s nutrient losses.*”
- [29] On 2 October 2023, the Ministry for Primary Industries released an “*Overseer Redevelopment Report*” dated August 2023.⁸ That report explains five changes that were made to address some of the issues identified by the Science Advisory Panel. While those changes are undoubtedly improvements, in my opinion, they do not address the more fundamental issues that arise with the models underpinning Overseer (and how they interact) and the challenges this poses with use of Overseer to assess nitrogen loss against absolute values/thresholds. This view is consistent with MfE advice which remains that Overseer generated limits should not be used as absolute values, and a range of tools and information should be used to assess nitrogen leaching from farms.
- [30] In light of the Science Advisory Panel’s findings, and notwithstanding the recent Overseer Redevelopment Report, my concern is that if Overseer was the only tool available in PC2, and if it was used to model whether practices adopted on farm would achieve a 20% reduction relative to the 2012/13 baseline, there could be uncertainty around the Overseer number in either direction (i.e. it could overstate or understate the level of reduction, or it could be incorrect about whether a reduction is even achieved). The need

⁶ <https://environment.govt.nz/assets/publications/Freshwater/overseer-model-redevelopment-review-guide.pdf>.

⁷ <https://www.mpi.govt.nz/dmsdocument/46360-Overseer-whole-model-review-Assessment-of-the-model-approach>.

⁸ <https://www.mpi.govt.nz/dmsdocument/59020-Overseer-Redevelopment-Programme-Report>.

for additional tools and information to support the assessment of change, particularly of significant on farm practice changes, is therefore important.

G. DEVELOPMENT OF PASTORAL NITROGEN RISK ASSESSMENT TOOL

[31] The appeals against PC2 were already underway (and Federated Farmers a section 274 party) by the time the 2021 Science Advisory Panel report (and related government recommendations) were released.

[32] Following the release of these Overseer reports, Federated Farmers began to engage with Horizons and the other parties on whether PC2 could respond to the issues raised. These discussions ultimately resulted in the scheduling of a facilitated conference between the parties' farm systems and planning experts in June 2022. This was to canvass the possibility of a risk-based approach to managing nitrogen leaching, rather than one based on Overseer.

[33] I attended the June 2022 expert conference as the technical farm systems expert for Federated Farmers. I have remained involved in conferencing and informal meetings with experts through to finalising the pastoral nitrogen risk assessment tool for inclusion in the plan provisions filed with the Court by Horizons on 22 September 2023.⁹

[34] Professor Horne and Dr Jolly provide an overview of the farm systems conferences in their evidence. I agree with their description. Of note:

- (a) The conferences began with the farm system experts identifying underlying characteristics of land and on-farm land use practices, which presented a risk to water quality from nitrogen leaching.
- (b) All experts agreed to use the NRS as the basis for developing a nitrogen risk assessment tool for the purposes of PC2, given it is widely used and tested with regard to scoring risk of nitrogen loss associated with dairy farms. As discussed below, the NRS does not take into account underlying biophysical features of land. Some

⁹ Memorandum of Counsel for the Regional Council dated 22 September 2023.

adaption of the NRS to reflect Horizons' regulatory framework occurred, as discussed by Professor Horne.¹⁰

- (c) The NRS was then used as a basis for creating categories of on-farm practices made up of different practices/factors. The experts broadly adopted the same categories as the NRS, but there were some adjustments to the ways in which risk was described or quantified for each factor to reflect particular characteristics of dairy farms in the Horizons region.¹¹
- (d) Mitigating factors which would have the effect of reducing the risk of nitrogen loss if they were implemented on-farm, were then identified by the experts.¹²
- (e) The pastoral and CVG farm systems experts all agreed that soil type/soil vulnerability (PAW) and rainfall (volume) were the largest contributing biophysical characteristics to nitrogen loss.

[35] The on-farm practices and mitigating factors to be included in the pastoral nitrogen risk assessment tool for PC2 were settled in the JWS dated 25 August 2022. These factors have not changed and have been incorporated into the risk assessment tool proposed by Horizons.

[36] In February 2023, Professor Horne tabled a proposal to incorporate underlying biophysical factors into the nitrogen risk assessment tool by setting risk scores for different soil types (PAW) and rainfall bands in a matrix (**DH Matrix**). This allowed for key biophysical characteristics to be accounted for, but without directly incorporating them into the nitrogen risk scorecard itself (which focuses on farm management practices targeted at matters such as stock management, nitrogen fertiliser practices and soil health).

¹⁰ Statement of Evidence of Professor David Horne dated 6 October 2023, at paragraphs [73] – [79].

¹¹ Joint Witness Statement dated 25 August 2022, Annexure A. Also see Statement of Evidence of Professor David Horne dated 6 October 2023, at paragraph [79].

¹² Joint Witness Statement dated 25 August 2022, Annexure A, Table 3.

- [37] In my opinion, one of the key strengths of the NRS scorecard and matrix approach are that, through expert conferencing, the NRS scorecard has been tailored (practices and scores) to reflect farm systems in the Horizons region.
- [38] However, I am concerned that there could be mitigations that farms have adopted that reduce a farm's nitrogen loss risk but are not currently recognised by the NRS. Therefore, I consider it important that a discretionary activity pathway is available so that farms who are able to demonstrate these types of mitigations, also have an ability to apply for resource consent.
- [39] I would also have some reservations if the risk assessment tool was adopted (with set PAW and rainfall bands) with no ability for farms to be able to make a case (through a discretionary activity pathway) that they have been inaccurately categorised in the matrix or maps that accompany the matrix.

Nitrogen risk assessment tool development

- [40] The DH Matrix, tabled in February 2023, is shown as Figure 1 below.

Figure 1: Professor Horne's matrix tabled in February 2023

		Profile available water		
		151-350mm	61-150mm	0-60mm
Rainfall	<1000	200	200	120
	1000-1300	200	150	100
	1300 -1600	150	120	86
	>1600	150	100	86

- [41] At expert conferencing, it was agreed that I should review the numbers in the DH Matrix using a dataset of NRS scores for Fonterra dairy farmers for the 2021/22 season that I had access to at the time.¹³ The Fonterra dataset contained the NRS scores for 194 Fonterra Farmers in the targeted WMZs. I also had access to a DairyNZ database which identified the numbers of consented dairy farms by Fonterra supplier number. I was able to cross reference the two databases to identify that the Fonterra dataset contained 194 unconsented farms, and the rest had likely been granted consents under the One Plan prior to 2017. I note that the databases I had access to were

¹³ Joint Witness Statement dated 3 February 2023, Annexure A.

earlier versions of the databases that Professor Horne used for his recent analysis (and based on a different season).

- [42] As part of my calibration exercise, I also had access to a spreadsheet created by Fonterra that could be used to generate a nitrogen risk score for a particular farm, and the Fonterra NRS manual (which explains the scores that are allocated to practices for each factor and sub-factor that make up the NRS score).
- [43] To provide an illustration of the distribution of consented and unconsented dairy farms, I asked Federated Farmers' GIS Analyst to create a map showing the percentage of consented farms in each Water Management Sub-Zone (**WMSZ**). A copy of this map is attached as **Annexure PLM1**. To be able to cross reference this with the WMZs and WMSZs, I asked Federated Farmers' GIS Analyst to create a map showing the WMZ and WMSZ names and I have attached that map as **Annexure PLM2**.
- [44] The numbers of consented farms and total dairy farms shown in Annexure PLM1 is based on the DairyNZ dataset (which identified 202 consented and 166 unconsented dairy farms). I was unable to create a map using the Fonterra dataset (which identified 194 unconsented dairy farms) because the data was not linked to addresses and I could not identify which WMSZs farms that were in the Fonterra dataset (but not in the DairyNZ dataset) were in.
- [45] Part of the explanation for the difference in numbers of unconsented farms could be that the Fonterra dataset contains data for the two WMSZs that DairyNZ had no data for (shown in grey shading in Annexure PLM1). However, in my view, it is unlikely that all 28 of the additional unconsented dairy farms in the Fonterra dataset are in these two WMSZs.
- [46] While Annexure PLM1 is based on a slightly smaller sample of farms than the Fonterra dataset, I consider it still provides a useful indication of the location and distribution of unconsented dairy farms. It also reflects the timing at which the rules in 14.1 of the One Plan came into effect, and the timing of when Horizons stopped issuing restricted discretionary activity consents. For example:

- (a) The rules came into effect on 1 July 2014 for Mangapapa and Waikawa (Mana_9b, West_9a and West_9b) and all dairy farms in these WMSZs have consent (shown as green areas with “3/3, 4/4 and 4/4”).
- (b) The rules came into effect on 1 July 2016 for Manawatū above gorge (Mana_6, Mana_9a and Mana_9c) and Annexure PLM1 shows that these WMSZs have between 0% to 42% of farmers consented (shown as “3/9, 0/3 and 8/19”).

Current distribution of nitrogen risk scores

[47] I used the NRS dataset to assess the current distribution of nitrogen risk scores across all of the targeted WMZs (for all Fonterra farmers – consented and unconsented). From this assessment I identified the following:

- (a) 50th percentile nitrogen risk score is 140 (this would represent the “average” risk score for dairy farms in the Fonterra dataset).
- (b) 75th percentile nitrogen risk score is 180.
- (c) 80th percentile nitrogen risk score is 203.

Extent of reductions required

[48] To gain an understanding of the types of practices farmers would need to change and the impact of those changes on their nitrogen risk score, I had three case study farms that I used to:

- (a) create nitrogen risk scores (using the Fonterra spreadsheet and NRS manual);
- (b) assess the practices they could change; and
- (c) the magnitude to which changes in those practices would reduce the risk scores for those farms.

[49] I also created a synthetic farm with a nitrogen risk score of 203. I did this because I wanted to consider the impact of the DH Matrix on a farmer at the

80th percentile. None of my case study farms had a score of 203 so I made assumptions about what the practices for a farm in the targeted WMZs with a nitrogen risk score of 203 would likely be (using the data I had for the three sample farms as a starting point). For example, I assumed that a farm with a nitrogen risk score of 203 would have a peak milking herd stocking rate of 3 cows per hectare, replacement stock grazed on farm, 26 hectares for cropping including winter cropping (fodder beet winter crop, chicory summer crop), and 100kg nitrogen fertiliser per hectare per year.

- [50] I then considered the changes that this synthetic farm would need to make to reduce to a score of 86 (being the lowest score in the DH Matrix).
- [51] One thing to bear in mind is that when making changes on farm to achieve a specified nitrogen risk score in most (if not all) cases it will be necessary to adopt practices that result in a nitrogen risk score that is lower than the target score because the different practices reduce the scores at different rates (and it is not possible to only change a practice to achieve a 1 point reduction in score, for example). For example, the points assigned to the stocking rate “factor” in the nitrogen risk tool increase in magnitudes of 10 or 20 points with each increase of 4 or 8 stock units per hectare (the magnitude of increase depends on the overall stocking rate). Further, adjusting one practice might mean that another practice needs to be adjusted to be able to operate the farm e.g. reducing the application of nitrogen fertiliser might mean less grass is grown and therefore more imported feed is required (and that could, in turn, increase the nitrogen risk score and require consideration of other or different practice changes).
- [52] Another caveat with the exercise I undertook is that I did not consider the personal circumstances of the farmer (such as age, skills, debt levels etc). In reality, a farm planner would work with the farmer to understand how changes to practices and the farm system would operate “on the ground” and whether they were practicable for the particular farmer, farm and location. This would be an iterative process and could be fairly complex.
- [53] For the synthetic farm I created, the closest I could get the nitrogen risk score to the 86 target was a nitrogen risk score of 85. To achieve a reduction from

203 to 85, my 226ha synthetic farm needed to a number of practice changes, including:

- (a) Reduce stocking rate by 25% (from 3.0 cows per hectare to 2.3 cows per hectare);
- (b) Reduced cropping area by 70% and change crop to direct drill chicory;
- (c) Reduce N fertiliser application by 48% to 52kgN/ha/yr;
- (d) Instead of wintering the milking herd on farm, half of the milking herd would need to be grazed off the milking platform; and
- (e) Half of R1 and R2 heifers (rising 1 and 2 year old replacement heifers) would need to be grazed off farm, all year round (instead of grazed on farm).

[54] These mitigations reduced the kilograms of milk solids produced by the synthetic farm by over 20%. I estimate that this would be approximately a 30-40% reduction in operating profit and I do not consider that such a farm would be economically viable. Given that this was the 80th percentile farm, my opinion is that the remaining 20% of farms above the 80th percentile would find it even more difficult to reduce to a nitrogen risk score of 86.

[55] At the other end of the DH Matrix, I was concerned that, based on my assessment of the NRS scores and my case studies, a nitrogen risk score of 200 would likely be too lenient. In other words, I was concerned that the matrix had not achieved the right balance to ensure that everyone was fairly contributing to the required water quality improvements. Therefore, I made adjustments to the DH Matrix to achieve a more equitable distribution of the reduction in risk score (without changing the overall reduction being made).

Weighted average NRS score

[56] Before making adjustments to the DH Matrix, I calculated a weighted average target nitrogen risk score for each targeted WMZ individually, and all five together, using the DH Matrix. I did this because I wanted to ensure that,

after I adjusted the DH Matrix, the matrix would still achieve the same overall reduction in nitrogen risk score.

- [57] By the term “weighted average target nitrogen risk score” I mean a nitrogen risk score that is the average of all of the targets in the DH Matrix and is weighted by the percentage area of dairy farmland in each cell of the DH Matrix. This produces a single nitrogen risk score target for each WMZ. I then weighted the five NRS scores I had for each WMZ by the total dairy farm land area in each WMZ to produce an overall, weighted average NRS target score of 144.
- [58] Another reason that I produced a weighted average target nitrogen risk score for the target WMZs is that the Fonterra NRS database did not have data regarding the rainfall and soils for each farm so I could not assess the targets for any of those farms or the reductions required. The weighted average target nitrogen risk score gave me a reasonable basis for understanding the likely “average” nitrogen risk score target for each WMZ and therefore a basis to consider the likely reduction that would be required.
- [59] Professor Horne provided me matrices for each WMSZ with the dairy farm land area in each cell i.e. for each rainfall band and PAW category. I converted those numbers to a percentage for each WMSZ, then weighted that percentage by the total land area for each WMSZ, then aggregated this by WMZ and finally used that to generate one matrix for the target WMZs as a whole.
- [60] I then multiplied those percentages by the risk scores in the DH Matrix to generate a weighted average target nitrogen risk score of 144.

Adjustments to DH Matrix

- [61] In considering what changes to make to the DH Matrix, I determined that pivoting the scores around the weighted average target nitrogen risk score (144) would be the most equitable way to distribute the targets across all cells (and it would also ensure that the overall reduction being made would not change). This meant that I did not adjust all of the numbers in the DH Matrix but instead increased some and reduced others relative to the score

of 144. For example, if a score in the DH Matrix was more than 60 points below 144, I increased it by around 20 points and if a score was more than 60 points above 144 I reduced it by around 20 points.

[62] To illustrate this:

- (a) For the score in the bottom righthand cell of the DH Matrix (i.e. >1,600mm rainfall and coarse soils), I increased the risk score from 86 to 110.
- (b) For the score in the top lefthand cell of the DH Matrix (i.e. <1,000mm rainfall and fine soils), I reduced the risk score from 200 to 180.

[63] The amended matrix I produced (and was subsequently agreed at expert conferencing) is shown in Figure 2 below (with the numbers I changed shown in red). I refer to this as the “**PleM Matrix**.”

Figure 2: Matrix containing my amendments “PleM Matrix”

		Profile available water		
		151-350mm	61-150mm	0-60mm
Rainfall	<1000	180	180	130
	1000-1300	180	150	120
	1300 -1600	150	130	110
	>1600	150	120	110

Assessment of likely impacts on farmers

[64] To compare the implications of the PleM Matrix with the DH Matrix, I considered the percentage reduction the farm at the 75th percentile for each WMSZ (for unconsented farms in the Fonterra dataset) would need to make to achieve the weighted average nitrogen risk score in the DH Matrix and the PleM Matrix. This is illustrated in Figures 3 and 4 below.

[65] In generating the numbers below, I have relied on two different datasets (Fonterra and DairyNZ) that were prepared at different points in time (the Fonterra dataset is based on the 2021/22 season and the DairyNZ dataset contained only consented farms as at 2017). I have done the best I could to use the DairyNZ dataset to extract the unconsented farms from the Fonterra dataset (by assuming that if a Fonterra farm was not identified in the DairyNZ

dataset it was unconsented). This means that whilst the numbers below are indicative, there may be some changes if the more recent Fonterra dataset is used or if there are additional unconsented dairy farms. I also note that the dataset does not include any unconsented Open Country Dairy suppliers.

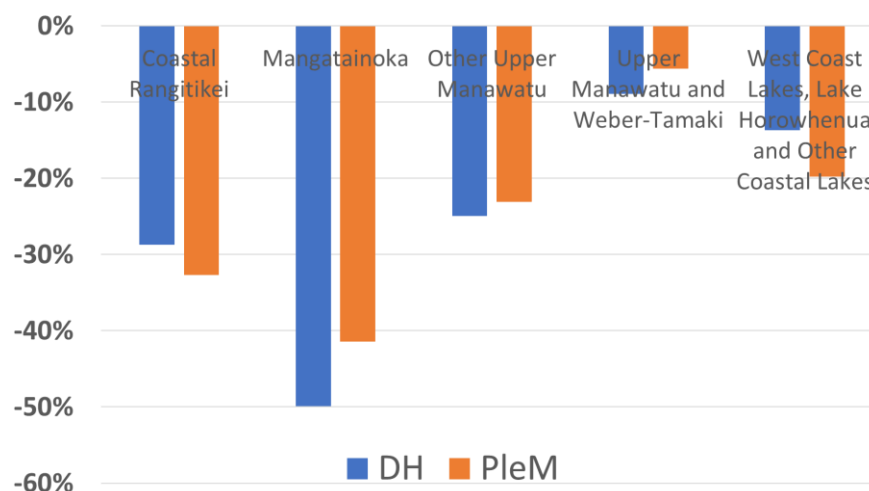
Figure 3: Reduction required by 75th percentile farm relative to DH matrix and PleM Matrix

	No. unconsented farms	Fonterra NRS 75 th percentile	DH matrix target*	DH % change**	PleM matrix target	PleM % change Table
Coastal Rangitikei	20	244	174	-29%	164	-33%
Mangatainoka	28	209	105	-50%	122	-41%
Other Upper Manawatu	80	188	141	-25%	144	-23%
Upper Manawatu and Weber-Tamaki	42	149	136	-9%	141	-6%
West Coast Lakes, Lake Horowhenua and Other Coastal Lakes	25	211	182	-14%	169	-20%

* Weighted average target NRS score using Professor Horne's matrix for each WMZ

** Weighted average target NRS score using my matrix for the WMZ

Figure 4: Percentage reduction of 75th percentile farm under DH Matrix compared with PleM Matrix



- [66] Figure 3 shows that the distribution of reduction (relative to the 75th percentile) is more evenly spread under the PleM Matrix, with the 75th percentile farm in all WMZs making a 20% reduction in nitrogen risk score, except for the Upper Manawatu and Weber-Tamaki WMZ (where the 75th percentile farm makes a 6% reduction under the PleM Matrix and a 9% reduction under the DH Matrix).
- [67] The result for Upper Manawatu and Weber-Tamaki WMZ is a surprise for me. The 75th percentile for this WMZ in my dataset is 149. I have discussed this with Professor Horne, and under his dataset (which is based on the 2022/23 season), the 75th percentile is 169. A difference of 20 points might seem significant on paper but in reality the difference in practices between these two scores may not be significant because the nitrogen risk score is defined in broad categories and one (or a small group of farms) on the cusp of the next risk level within any particular score could increase their risk by 10 or 20 points for a small change in practice e.g. a farmer moving from 16su/ha to 17su/ha (a 6% increase in stocking rate) would receive an extra 20 points. The 75th percentile is also sensitive to the scores of a relatively small group of farms (unlike the 50th percentile, for example). Professor Horne's database also had the scores for two extra farms so that may also partly explain the difference in 75th percentile score.
- [68] If the 75th percentile in my dataset had been 170, then farms in this WMZ would have made a 20% reduction in nitrogen risk score and this would have been commensurate with the reductions being made by farms in the other WMZs.
- [69] The difference could also be partly explained by a relatively small group of farms doing something different in the Upper Manawatu in the 2021/22 season. This could be because they used less N fertiliser that year due to good grass growing conditions, or they were able to purchase cheap palm kernel (which has lower nitrogen content than dried distiller's grain, **DDG**, for example).
- [70] While a reduction in nitrogen risk score is not necessarily the same as a reduction in modelled Overseer N loss, I consider it a reasonable assumption

(given current available tools and information) that a reduction of around 20% in nitrogen risk score at the 75th percentile (with those above the 75th percentile making a much larger reduction) is likely to be the best approximation to the DV-PC2 (where it was assumed that 44% of farmers could achieve the Table 14.2 CNLMs with less than a 20% reduction in Overseer number, around 30-40% of farmers would make a 20% reduction in Overseer number and the rest would make a larger reduction to achieve the 75th percentile number for each WMZ¹⁴).

- [71] In my opinion, it is also relevant that the 20% reduction required in DV- PC2 was relative to an Overseer baseline for the 2012/13 season i.e. a 20% reduction was to be achieved relative to the Overseer number (and farming practices) that a particular farm was adopting more than 10 years ago. Since that time, many farms in the targeted WMZs are likely to have improved practices (with DairyNZ, Fonterra and other dairy companies working closely with farmers to improve nitrogen efficiency, reduce nitrogen loss and improve many other farming practices e.g. stream fencing, riparian planting, effluent management, and critical source area management¹⁵). Accordingly, for many dairy farmers, achieving a 20% reduction in Overseer number (relative to 2012/13) would likely have meant a smaller than 20% reduction relative to their Overseer number for the 2022/23 season (recognising the farm mitigations already adopted).
- [72] To assess the likely impact of the PleM Matrix on farmers I also considered the implications of the lowest target nitrogen risk score (110) for the synthetic farm with a score of 203 (the farm that I had used to assess the implications of reducing to a nitrogen risk score of 86). My assessment was that such a reduction would still result in significant farm system changes that might not be viable (when all the circumstances of the farm and farmer are considered e.g. debt levels, forecast milk payout etc), but there was a higher likelihood of the farm being able to continue to operate going forward.

¹⁴ Recommendation of Independent Hearing Panel: Plan Change 2, March 2021, at 3.193.

¹⁵ This is through initiatives like the Sustainable Dairying Water Accord, the Dairy Tomorrow Strategy and the Fonterra Tiaki Farm Environment Plan project.

[73] The practice changes that I modelled that would reduce the nitrogen risk score from 203 to 110 included:

- (a) Reducing cropping area by 50%.
- (b) Reducing fertiliser application to 61kgN/ha/yr.
- (c) Reducing stocking rate by 17% (from 3 cows per hectare to 2.5 cows per hectare).
- (d) Increasing feed pad use to 4 hours per day, every day between March to August.
- (e) Increasing imported feed by 20% (for feeding on feed pad, etc).
- (f) Sending cull cows to the freezing works earlier.

[74] The above changes reduced the kilograms of milk solids produced per hectare by 15%. As I note above whether the farm would be economically viable (as fixed costs have changed little) will depend on the circumstances of the farm and farmer.

[75] The PleM Matrix is the matrix that has been included in the Council's proposed provisions.

12 October 2023

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H. REFERENCES

- Good Farming Practice: Action Plan for Water Quality 2018, https://www.irrigationnz.co.nz/Attachment?Action=Download&Attachment_id=467.
- Ministry for Primary Industries and Ministry for the Environment, *Overseer Redevelopment Programme Report*, August 2023, <https://www.mpi.govt.nz/dmsdocument/59020-Overseer-Redevelopment-Programme-Report>.
- Ministry for Primary Industries and Ministry for the Environment, *Overseer whole-model review: Assessment of the model approach*, July 2021, <https://www.mpi.govt.nz/dmsdocument/46360-Overseer-whole-model-review-Assessment-of-the-model-approach>.
- Ministry for the Environment, *Responding to the Overseer model redevelopment review*, July 2023, <https://environment.govt.nz/assets/publications/Freshwater/overseer-model-redevelopment-review-guide.pdf>.
- Recommendation of Independent Hearing Panel: Plan Change 2, March 2021.

I. ANNEXURES – PLM1 AND PLM2

