

**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

**FIFTH STATEMENT OF EVIDENCE OF DAVID HORNE ON BEHALF OF MANAWATŪ-
WHANGANUI REGIONAL COUNCIL**

FARM SYSTEMS

Dated: 18 March 2024


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FIFTH STATEMENT OF EVIDENCE OF DAVID HORNE**A. INTRODUCTION**

- [1] My full name is David John Horne.
- [2] My experience and qualifications are set out in my statement of evidence dated 6 October 2023.
- [3] I repeat the confirmation given in my Evidence that I have read and will comply with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023, and that my evidence has been prepared in compliance with that Code.

B. SCOPE

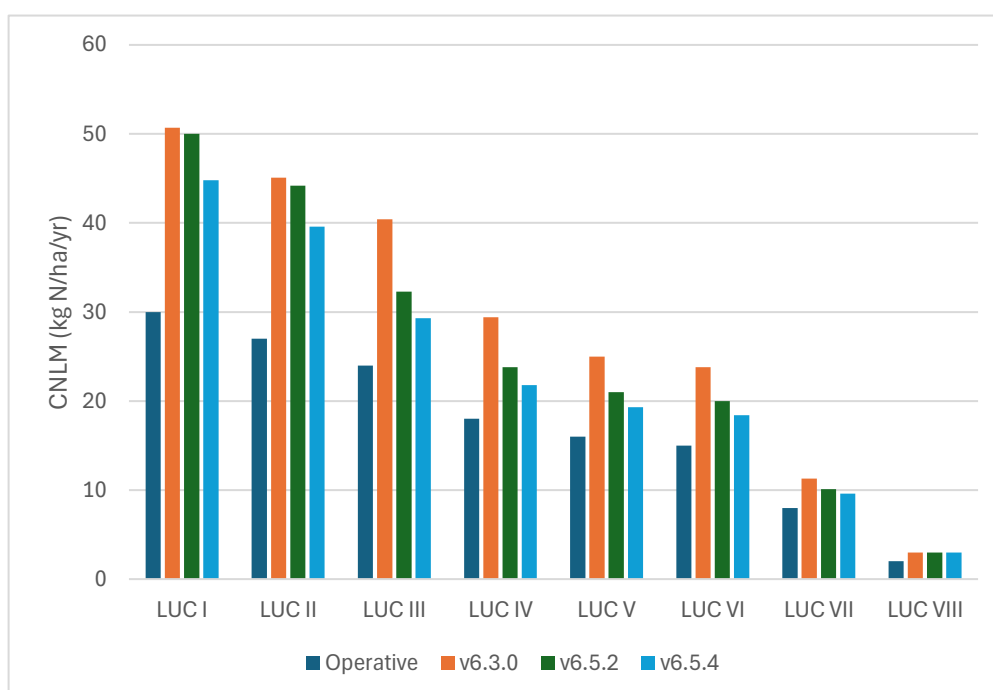
- [4] This statement of evidence primarily addresses the situation where:
- (a) a different version of Overseer is used to estimate on-farm nitrogen leaching than that used to derive the CNLMs; and
 - (b) nitrogen leaching estimates using that version of Overseer show that the farm does not exceed the CNLMs and would not be required to implement any on farm practice change to reduce nitrogen loss; but
 - (c) if that same version of Overseer was also used to derive the CNLMs as well as to estimate nitrogen leaching, then the farm would exceed the CNLM and would be required to implement any on farm practice change to reduce nitrogen loss.
- [5] I refer to this as the **Overseer Version Issue**.
- [6] In this statement I provide an overview of this problem from a farm systems perspective, and outline the implications for my assessment of potential farm compliance with Table 14.2 and the specified reduction pathway (as shown in the tables presented in my statement of evidence dated 17 January 2024) arising from this issue.
- [7] In this statement I also:

- (a) Discuss the nitrogen leached to the environment over time under the specified reduction pathway, as compared to the Table 14.2 pathway;
- (b) Provide further detail in relation to the tables in my supplementary evidence dated 17 January 2024, as requested by counsel for Mr Day and by the Court; and
- (c) Provide some explanation of the Overseer 'reference file' system.

C. MANAGING UPDATES TO OVERSEER

- [8] One of the chief merits or advantages of Overseer is that it is constantly being developed and improved. The Overseer company seeks to incorporate, or build into the model, the advancements in science which are based on rigorous, peer-reviewed research. Given this ongoing refinement of the Overseer model, it is unsurprising that the nitrogen leaching estimates that it generates have changed over time.
- [9] To help visualise the effect of these updates since the time of DV-PC2, I have plotted the Table 14.2 CNLMs in Figure 1, as calculated by some of the progressive versions of Overseer.

Figure 1: Changes to CNLM for each LUC across Overseer versions.



- [10] As can be seen in Figure 1, the fluctuations in the CNLMs are significant and they are not always evenly spread across LUC classes (note, for example, the differences between v6.3.0 and v6.5.2 for LUC III, when compared to LUC I and II).
- [11] While the evolution of Overseer is beneficial to our understanding of nitrogen leaching from farms, it presents some challenges to its use in regulation. These updates (and the fact that previous versions of Overseer are not available once they are superseded) can cause nitrogen leaching estimates to quickly become out of step with the fixed CNLMs in Table 14.2. This is one of the core issues that PC2 seeks to address.
- [12] As I understand matters, it was recognised in preparing PC2 that once the recalibrated Table 14.2 was inserted into the One Plan, there was a risk that subsequent updates to Overseer would cause the same issue to occur again – that is, that nitrogen leaching estimates would continue to increase as Overseer was updated and that Table 14.2 would again fall out of step with the nitrogen leaching estimates produced by Overseer. If this occurred, a farmer would need to apply for consent as a discretionary activity, but Horizons would be able to consult reference files to see if the only reason the farmer could not meet the CNLMs was due to updates in Overseer. I discuss reference files in more detail below.
- [13] The Overseer Version Issue arises where Table 14.2 is updated following PC2, and subsequent changes to the Overseer model result in *smaller* estimates of nitrogen leaching from farms (using the same input parameters). This is exactly what has happened recently – compared with the DV-PC2 Table 14.2 CNLMs (calculated in v6.3.0), the latest version of Overseer (v6.5.4) predicts substantial decreases in the CNLMs, across all the LUC classes supporting intensive pastoral systems.
- [14] As I mentioned in the hearing, this may result in a farmer who did not meet their CNLMs one day, being able to do so on the next, purely due to a reduction in Overseer nitrogen leaching estimates. That farmer could then access the controlled Table 14.2 consenting pathway and obtain an IFLU consent without needing to make any practice changes on farm. Obviously,

the farmer in this case would fail to achieve any reductions in nitrogen leaching, or any associated environmental improvements, but would still be able to receive consent. In my view, this would be an unacceptable outcome for the plan change.¹

- [15] It should be noted that this Overseer Version Issue applies equally to the pastoral and commercial vegetable growing IFLUs – it arises due to the interaction between Overseer and the fixed CNLMs in the One Plan, rather than being related to the IFLU occurring on-farm.
- [16] The 20%/35% reduction pathway is also affected by the Overseer Version Issue. Farmers have a choice between the controlled activity pathways in DV-PC2 – they can reduce nitrogen leaching to their Table 14.2 CNLM, or by 20%/35%. If a later version of Overseer places them closer to their CNLM, then some farmers could choose to use the Table 14.2 pathway (calculated in a now outdated version of Overseer) instead of the percentage reduction pathway, as the nitrogen leaching reductions needed to reach the Table 14.2 CNLMs may then be less than the full 20%/35% needed to access the percentage reduction pathway. In that case, the farmer would need to make some practice changes on farm to achieve the reduction to the Table 14.2 CNLMs, but not as many as if they had to reduce by the full 20%/35% (or if the Overseer version update had not decreased their leaching estimate).
- [17] I also note that a change in the estimated nitrogen leaching value would affect the absolute reduction needed to access the percentage reduction pathway, a point I made at the hearing.² That is, a dairy farmer with a leaching value of 50 kg/N/ha/yr would need to reduce by 10 kg/N/ha/yr to access the controlled consenting pathway, but if an Overseer update reduced their estimated leaching to 45 kg/N/ha/yr, they would only need to reduce by 9 kg/N/ha/yr. However, the percentage by which a farmer needs to reduce remains the same, and the magnitude of this issue is less than for the fixed values in Table 14.2. The 20% decrease in nitrogen leaching and the practices required to achieve it remain locked once consent is granted, and

¹ See Statement of Reply Evidence of David Horne (13 November 2023) at [57]–[59], CB [[201.0480]]–[[201.0481]].

² Notes of Evidence, page 832, ln 21–25 and page 833, ln 19–31.

these will not be affected by changes in Overseer version. In other words, in my opinion, farmers on the specified reductions pathway will need to make most, if not all, the same practice changes before and after Overseer version changes.

- [18] For the 75th percentile pathway, a similar issue to the Table 14.2 CNLMs arises, as the 75th percentile values are also fixed in the One Plan in Table 14.2A. If Overseer were to suddenly estimate decreased nitrogen leaching for a farm beyond the 75th percentile leaching value, that farmer would not have to make as many practice changes as they otherwise would have before that Overseer update.
- [19] The likely impacts of changes to the Overseer version on Table 14.2 from decreases in estimates of nitrogen leaching can be compared by considering two contrasting cases.
- [20] First, **Table 1** shows the case currently before the Court – that is, Overseer v6.3.0 (on which the DV-PC2 Table 14.2 values are based) as compared to Overseer v6.5.4.³
- [21] **Table 2** shows the percentage of farmers who did not meet their CNLM at the time of DV-PC2, but now do so, due to the changes to Overseer v6.5.4. As can be seen, a significant proportion of farmers would be able to access the Table 14.2 controlled pathway without adopting any on farm changes – approximately one-fifth in the Upper Manawatu, and over one-third in the Horowhenua.
- [22] Second, **Table 3** shows a more likely situation, where there is a smaller difference between two successive versions of Overseer. For example, where the final version of Table 14.2 corresponded to Overseer v6.5.2, and a few months later Overseer version v6.5.4 was released.
- [23] If Overseer v6.5.2 had been used to calculate the CNLMs in Table 14.2, then the update to v6.5.4 would mean that an extra 19%, 20% and 16% of farmers in the Upper Manawatu would have met their Year 1, 10, and 20 CNLMs

³ All the tables referenced in this statement of evidence are included in the **Appendix** at section G.

respectively, with no change to farm management. Although these values are smaller than those associated with the change between the DV-PC2 table and Overseer v6.5.4, they illustrate that on occasions, significant changes can occur to estimates of nitrogen leaching from farms 'overnight', with equally significant consequences for the effectiveness of Table 14.2 as a tool to drive practice change.

D. NITROGEN LEACHING REDUCTIONS OVER TIME

- [24] In the hearing, I offered to provide information showing that the specified reduction pathway resulted in faster improvements in water quality than the Table 14.2 pathway.⁴
- [25] To explain, one of the characteristics of the specified reduction pathway is that farmers are required to make these changes to farm management and their leaching rate within 2 or 3 years, for pastoral farming and CVG respectively.
- [26] The analysis I undertook in my January 2024 evidence demonstrates that a significant proportion of farms in the region (53%, using a 2012 baseline) would achieve their Year 20 CNLMs if they used the specified reduction pathway. As such, those farmers would achieve their Year 20 CNLMs within 2 years, rather than the 10 or more years allowed by Table 14.2.
- [27] Another benefit of the specified reduction pathway was that it required reductions in nitrogen leaching before Table 14.2 did (as it required reductions prior to the Year 10 CNLMs applying). However, this particular benefit of the specified reduction pathway has dissipated over time. Due to the length of the appeal process, by the time PC2 becomes operative, a farmer will now need to meet their Year 10 CNLM at or shortly after the time they apply to get consent (2 years within the Upper Manawatu for example). This means that the specified reduction pathway and the Table 14.2 pathway are now (at least) initially driving farmers to make water quality improvements within roughly the same timeframe.

⁴ Notes of Evidence, page 779, ln 6–25.

- [28] Finally, I note that neither of these points affect the other issues identified with the Table 14.2 pathway, including the Overseer Version Issue.

E. FURTHER FARM DATA

- [29] I have been asked to provide further farm data to expand on the farm data provided as part of my statement of evidence dated 17 January 2024.
- [30] **Table 4** breaks down the underlying numbers of consents in each targeted WMSZ that were used to produce the percentages in Tables 1, 2, 5, and 6 (i.e., for the 2012 baseline year) in my 17 January 2024 evidence.
- [31] **Table 5** provides the same information for Tables 3 and 7, which assessed a 2019 baseline year (noting that the Upper Manawatu is excluded, for the reasons explained at [20] of my 17 January 2024 statement).
- [32] **Table 6** shows the number of farms in each targeted WMSZ which still require consent.
- [33] Finally, the Court has also requested information on the number of farms which still require consent, for which nitrogen loss predictions are available.⁵ The only farms meeting this description are 69 farms from the Upper Manawātū. However, I note that for these farms only their leaching rates from 2012 are available, and the underlying base files are not available to calculate what those leaching rates would be in an up to date version of Overseer.

F. REFERENCE FILE APPROACH

- [34] Mrs Foster discusses the potential utilisation of the reference file system to deal with the Overseer Version Issue.⁶ I provide some brief commentary below on the reference file system, and how it works with successive versions of Overseer.
- [35] As Dr Hanly explains in his evidence, to ‘recalibrate’ Table 14.2, he needed to replicate the input parameter data used to calculate the CNLMs for each

⁵ Minute of 1 March 2024 at [1](a)(i).

⁶ Fourth Statement of Evidence of Christine Foster (18 March 2024).

LUC class in the operative Table 14.2, which has been calculated in a 2007 version of Overseer – v5.2.3. The process by which these parameters were calculated is explained in Hanly et al. (2018a).⁷ I was involved in this process, and coauthored that (and a subsequent) report.

- [36] This input parameter data was then used to generate ‘reference files’ (that is, simulated farms using those input parameters), so that Dr Hanly could determine what the current version of Overseer would estimate the leaching from those farms would be. This process was repeated for each of the reference files, and the nitrogen leaching values were recorded. This resulted in 8 reference file farms being produced in Overseer – one for each LUC, all of which were pastoral (dairy) farms. The nitrogen leaching value from the relevant reference file was then used as the CNLM for that LUC in the notified version of PC2, subject to rounding so the CNLM was a whole number.⁸
- [37] By retaining these ‘reference files’, the automatic ‘updating’ process of Overseer can be utilised to easily understand the impact of Overseer version changes on the Table 14.2 CNLMs, even as Overseer is repeatedly revised.
- [38] As Overseer is currently configured, version changes essentially process the reference files automatically – that is, the original reference file is incorporated into the new/modified version of Overseer to create an updated file. A new CNLM can then be set by the nitrogen losses which are automatically calculated by the new version of Overseer for the reference file.
- [39] Essentially, this allows the process used by Dr Hanly to derive the CNLMs for the recalibrated Table 14.2 to be re-run with each successive version of Overseer with no additional effort. This provides a straightforward way to provide an objective comparison of the CNLMs in Table 14.2 with the nitrogen leaching estimates for any farms seeking an IFLU consent (whether the relevant estimates increase or decrease over time). This process can be

⁷ Statement of Evidence of James Hanly (6 October 2023) at Attachment A, CB [[202.0945]]–[[202.0966]].

⁸ More detail is provided by Dr Hanly in the reports appended to his evidence, at CB [[202.0944]]–[[202.0990]].

completed, and the updated leaching values made available to the public very quickly.

- [40] The only issue with this is the planning side of the problem – the CNLMs will be fixed in the One Plan, once PC2 is made operative. I understand that Mrs Foster is considering options to remedy this issue, both for upward and downward changes in nitrogen leaching estimates.
- [41] Finally, I note that this ‘reference file’ approach can readily be used for any fixed nitrogen leaching value used as a limit in the One Plan. By developing an appropriate reference file for each of the 75th percentile maximum nitrogen leaching loss rates in Table 14.2A, the impact of Overseer version changes can also be clearly understood and accounted for when calculated in successive versions in Overseer, in the same way as the CNLMs in Table 14.2.

18 March 2024

Professor David Horne

G. APPENDIX: TABLES**Table 1:** Differences in Overseer leaching estimates from v6.3.0 as compared to v6.5.4.

	LUC I	LUC II	LUC III	LUC IV	LUC V	LUC VI	LUC VII	LUC VIII
Overseer v6.3.0	50.7	45.1	40.4	29.4	25	23.8	11.3	3
Overseer v6.5.4	44.8	39.6	29.3	21.8	19.3	18.4	9.6	3
% decrease	11.6	12.2	27.5	25.9	22.8	22.7	15.0	0

Table 2: Percentage of farmers who did not meet their CNLM at the time of DV-PC2, but now do due to the changes to Overseer v6.5.4.

Catchment (Number of farms)	Year 1	Year 10	Year 20
Horowhenua (19)	11%	21%	37%
Rangitikei (64)	6%	5%	6%
Upper Manawatu (84)	29%	33%	20%

Table 3: Differences in Overseer leaching estimates from v6.5.2 as compared to v6.5.4.

	LUC I	LUC II	LUC III	LUC IV	LUC V	LUC VI	LUC VII	LUC VIII
Overseer 6.5.2	50	44.2	32.3	23.8	21	20	10.1	3
Overseer 6.5.4	44.8	39.6	29.3	21.8	19.3	18.4	9.6	3
% decrease	10.4	10.4	9.3	8.4	8.1	8.0	5.0	0

Table 4: Number of Overseer files in each targeted WMSZ, used in 17 January 2024 analysis (2012 baseline).

Sub-catchment	Number of Farms for 2012 (Overseer files)
Horowhenua	19
Rangitikei	64
Mangatainoka	61
Upper Manawatu	84

Table 5: Number of Overseer files in each targeted WMSZ, used in 17 January 2024 analysis (2019 baseline).

Sub-catchment	Number of Farms for 2019 (Overseer files)
Horowhenua	16
Rangitikei	52
Mangatainoka	45

Table 6: Consenting status – number of IFLU pastoral farms by sub-catchment.

Sub-catchment	No of consented farms	No of unconsented farms	Total
Rangitikei	53	26	79
Horowhenua	33	17	50
Mangatainoka	71	11	82
Upper Manawatu	45	112	157