

**BEFORE THE ENVIRONMENT COURT
AT WELLINGTON**

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

IN THE MATTER of the Resource Management Act 1991

**AND
IN THE MATTER** of appeals under Clause 14 of Schedule 1 of the
Resource Management Act 1991 against the
decision of the Manawatū-Whanganui Regional
Council on Proposed Plan Change 2 to the One
Plan ("PC 2")

BETWEEN **TE RŪNANGA O RAUKAWA**
(ENV-2021-WLG-00020)

NGĀTI TURANGA
(ENV-2021-WLG-00021)

ANDREW DAY
(ENV-2021-WLG-00022)

WELLINGTON FISH AND GAME COUNCIL
(ENV-2021-WLG-00023)

Appellants

AND **MANAWATŪ-WHANGANUI REGIONAL
COUNCIL**

Respondent

**EVIDENCE IN CHIEF OF DR ELIZABETH HELEN PARLATO
FOR NGĀTI TURANGA AND WELLINGTON FISH AND GAME COUNCIL
(Risk Assessment Tool for Pastoral Farm Systems)**

Dated: 6 November 2023

Counsel:
Sarah Ongley
Barrister
PO Box 8213
NEW PLYMOUTH
Telephone: 0274 467 917
Email: sarah@ongley.co.nz
www.bankchambers.co.nz

1. QUALIFICATIONS AND EXPERIENCE

- 1.1 My full name is Elizabeth Helen Parlato. I am currently employed as a Senior Ecologist at The Catalyst Group. I have been in this position since October 2022. I am also the Principal Investigator on a Marsden Fast-Start research project and am employed as a Research Officer in the Zoology and Ecology Group at Massey University. I have held this position since April 2023. Prior to these positions, I was a postdoctoral fellow in the Zoology and Ecology Group at Massey University (2018–2022). The majority of my work has involved quantitative modelling of ecological systems.
- 1.2 I hold a PhD in Ecology from Massey University. In 2022 I completed certificates in Intermediate Sustainable Nutrient Management and Intermediate Farm Environment Planning from Massey University. I have published 16 peer-reviewed scientific papers and 2 book chapters in the field of Ecology.
- 1.3 I have been involved with Plan Change 2 to the Manawatū-Whanganui One Plan (**PC2**) since February 2023. The focus of this involvement has been the development of a risk assessment tool as an alternative consenting pathway to Table 14.2 through a series of conferences with pastoral farm systems experts.
- 1.4 I was involved in expert conferences for pastoral farm systems held on 3 February 2023, 13 March 2023 and 15 March 2023. I attended expert conferencing for Commercial Vegetable Growing (**CVG**) on 10 February 2023 and 14 March 2023 as an observer. I also attended mediation on 15 March 2023.
- 1.5 I have lived in the Manawatū-Whanganui Region for the past 18 years. I currently reside in Opiki on a family farm, where I have lived for 15 years.

2. CODE OF CONDUCT FOR EXPERT WITNESSES

- 2.1 I confirm that I have read the Environment Court's Code of Conduct for Expert Witnesses as contained in the Environment Court's Practice Note 2023. I have complied with the Code when preparing this written statement and will do so when I give oral evidence before the Court. The data,

information, facts and assumptions I have considered in forming my opinions are set out in this statement to follow. The reasons for the opinions expressed are also set out in the statement to follow. Unless I state otherwise, this evidence is within my sphere of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

- 2.2 My husband's family farming business is a mixed farming operation, including commercial vegetable growing (primarily potatoes and onions), sheep and beef, and dairy goat milking. The farm is located in Moutoa and Opiki, in Surface Water Management Zone Mana_13. On behalf of this business my brother-in-law made a submission on PC2. On 31 January 2023 this relationship was disclosed to all parties to the proceedings, through an email from Wellington Fish and Game Council (**Fish & Game**) and Ngāti Turanga's legal counsel.¹ My understanding is that no party advised any objection to my involvement in the proceedings as an expert witness for pastoral farm systems (for example on the basis of a lack of independence). I consider I bring an independent view to the issues within the scope of my evidence.

3. PURPOSE AND SCOPE OF EVIDENCE

- 3.1 I have been asked by Ngāti Turanga and Fish & Game to give evidence on the development of the proposed risk assessment tool for pastoral farming (**risk assessment tool**). This evidence does not cover the proposed risk assessment tool for CVG.
- 3.2 My evidence covers:
- 3.2.1 Development of the risk assessment tool for pastoral systems.
 - 3.2.2 Questions asked by Fish & Game to the Manawātū-Whanganui Regional Council (**Horizons**) about the risk assessment tool following Joint Witness Conferencing.

¹ The email outlined the relationship and stated: "[i]f any party objects to Dr Parlato's involvement in expert conferencing or in providing evidence to the Court (in the event the matter doesn't settle), can they please advise me urgently".

- 3.2.3 Comparative analyses undertaken by Professor Horne² including between the risk assessment tool and the alternative nitrogen reduction pathway in the Decisions Version of PC2 (**DV-PC2**).
- 3.2.4 Dr Snelder's evidence for Horizons on predicted water quality improvements associated with implementation of the risk assessment tool.
- 3.2.5 Reductions in risk score required by 75th percentile farms³ for each target catchment as set out in the evidence of Dr le Miere.
- 3.2.6 Scoring of the mitigations included in Schedule [X] of the proposed PC2 provisions.⁴
- 3.2.7 Use of the risk assessment tool in a regulatory setting, with brief comment on the Overseer model.

4. DOCUMENTS AND MATERIALS REFERENCED

- 4.1 In producing this statement of evidence, I have reviewed the following evidence and materials:

- 4.1.1 The following evidence in chief filed by Horizons:

- Professor David Horne
- Dr Paul le Miere
- Dr Antonius Snelder
- Ms Maree Patterson
- Dr James Hanly
- Dr Timothy Cox
- Dr Anne-Maree Jolly.

- 4.1.2 The following evidence in chief filed by Federated Farmers of New Zealand Limited:

- Mr Murray Holdaway
- Mr Aaron Passey.

- 4.2 I have also relied on the joint witness statements (**JWSs**) produced from the pastoral expert conferencing, being the statements identified below:

- 4.2.1 JWS of farm system and planning experts dated 28 June 2022;

² As set out in Professor Horne's Evidence in Chief (EIC).

³ These are farms with a nitrogen risk score at the 75th percentile of risk scores for unconsented dairy farms in the target catchment. The 75th percentile values were calculated by Dr le Miere using risk scores for Fonterra farmers for the 2021/22 season.

⁴ Proposed provisions refers to the provisions filed by Horizons on 22 September 2023.

- 4.2.2 JWS of farm system experts dated 25 August 2022;
- 4.2.3 JWS of pastoral farm system and planning experts dated 7 October 2022;
- 4.2.4 JWS of pastoral farm system experts dated 3 February 2023;
- 4.2.5 JWS of pastoral farm system and planning experts dated 13 March 2023; and
- 4.2.6 JWS of pastoral farm system experts dated 15 March 2023.

5. EXECUTIVE SUMMARY

- 5.1 Alongside pastoral farm systems experts Professor Horne and Dr le Miere, I have been involved with the development of a risk assessment tool that Horizons is proposing to use as a controlled activity consenting pathway for existing Intensive Farming Land Uses⁵ (IFLU) within targeted Water Management Sub-Zones.
- 5.2 The risk assessment tool uses a nitrogen risk scorecard that allocates points according to the risk of nitrogen loss associated with farm management practices. The target nitrogen risk scores in the risk assessment tool vary depending on farm rainfall and soil type as these are important influences on the overall risk of nitrogen loss. Farms with greater biophysical leaching risk are required to have lower risk scores, whereas farms with lower biophysical leaching risk can have higher risk scores. The risk assessment tool takes the form of a matrix with 12 cells representing 12 biophysical profiles, with a target risk score assigned to each cell.
- 5.3 Professor Horne initially identified preliminary target risk scores for each cell. Dr le Miere subsequently made some adjustments to Professor Horne's risk matrix values, following an assessment he undertook using a synthetic farm⁶ and a dataset of nitrogen risk scores for Fonterra dairy farmers for the 2021/22 season.
- 5.4 I agreed to the values in the proposed matrix (Dr le Miere's version) on the basis of previous analyses by Professor Horne and Dr le Miere, and Professor Horne's view that the risk assessment tool would lead to similar practice change and reductions in nitrogen leaching as was estimated for

⁵ Dairy farming, commercial vegetable growing, cropping and intensive sheep and beef farming.

⁶ A synthetic farm is a theoretical farm system (i.e., not a real operational farm)

the original PC2, leading to similar modest improvements in water quality. I note that the process by which I was asked to provide a view on the values in the risk assessment tool was very rushed (less than 3 working days from receiving the two versions), and I therefore needed to form an opinion quickly with relatively little information.

- 5.5 Further information on estimated reductions in nitrogen leaching and improvements in water quality associated with the risk assessment tool is now available through the analyses carried out by Professor Horne and Dr Snelder, respectively. The methods and results of these analyses are outlined in their evidence.
- 5.6 The results presented by Professor Horne and Dr Snelder represent the estimated changes in nitrogen losses from a historic baseline (2012), rather than estimated changes from the current time. In addition, my understanding is that the reductions are assumed to apply to IFLU irrespective of whether they hold a consent, whereas PC2 is specifically relevant for existing unconsented IFLU. In my view, this means that the estimated reduction in nitrogen loss and water quality improvements are unlikely to be a realistic reflection of changes in nitrogen loss from the current situation, should the risk assessment tool be implemented.
- 5.7 While I consider it feasible that implementation of the risk assessment tool may start to bring about water quality improvements, in my opinion, the magnitude of nitrogen loss reductions and water quality outcomes associated with implementation of the risk assessment tool remain very uncertain.

6. EVIDENCE

Background

- 6.1 It is my understanding that PC2 originally sought to address two key issues with implementation of the nutrient management framework in the One Plan specifically relating to existing IFLU within targeted Water Management Sub-Zones. These two key issues were:

- 6.1.1 The Cumulative Nitrogen Leaching Maximums (**CNLM**) in Table 14.2 needed to be updated to reflect updates to Overseer. These updates to Table 14.2 are addressed in the evidence of Dr Hanly.
- 6.1.2 The policy framework required amendment to provide improved policy support for consenting IFLU if they were unable to meet the Table 14.2 CNLM limits.
- 6.2 At a Council-level hearing of PC2, additional controlled activity consenting pathways were introduced as alternatives to compliance with Table 14.2. For pastoral systems, these alternative pathways required a 20% reduction from a nitrogen leaching baseline or the 75th percentile nitrogen leaching loss for the relevant water management zone (whichever was the greatest reduction). For CVG, a 35% reduction from a nitrogen leaching baseline was required. These controlled activity pathways were included in DV-PC2.
- 6.3 Following the Council-level hearing, the Government's response⁷ to an Overseer whole-model review report⁸ was released. This response recommended that Councils should be cautious in placing too much emphasis on Overseer modelling in a regulatory context.
- 6.4 My understanding is that in light of the Government response, Horizons sought to develop an alternative method for assessing and setting limits for nitrogen loss from IFLU to reduce reliance on Overseer estimates when considering consent applications.
- 6.5 Consequently, through expert conferencing, a risk assessment tool has been developed for both pastoral and CVG systems to replace the specified nitrogen reduction controlled activity pathways in DV-PC2.

Development of the nitrogen risk assessment tool for pastoral systems

- 6.6 I was not involved with the three initial expert conferences to develop the risk assessment tool. The JWS for these conferences⁹ and Professor

⁷ The Government response to the findings of the Overseer peer review report. Ministry for the Environment and Ministry for Primary Industries, August 2021.

⁸ Overseer whole-model review: Assessment of the model approach. Prepared for the Ministry for Primary Industries and the Ministry for the Environment by the Science Advisory Panel, July 2021.

⁹ Joint Witness Statements dated 28 June 2022, 25 August 2022 and 7 October 2022.

Horne's evidence¹⁰ provide information about aspects of the risk assessment tool development that were covered in these conferences.

- 6.7 To briefly summarise, in a series of expert conferences from June to October 2022, farm systems experts agreed to use the Fonterra Nitrogen Risk Scorecard (**NRS**) as a basis for developing a nitrogen risk assessment tool for pastoral systems for the purposes of PC2. The experts largely adopted the scoring system in the NRS but developed or adjusted the scoring of some NRS factors and identified an agreed list of mitigations.¹¹ The experts agreed that the two most relevant biophysical characteristics influencing nitrogen leaching were: 1) soil type/soil vulnerability to leaching and 2) rainfall volume¹², but that further investigation was required as to whether these factors should be incorporated into the scorecard or incorporated elsewhere in the consenting process.¹³
- 6.8 Following mediation in December 2022, Professor Horne circulated a proposed approach to account for the influence of biophysical characteristics on nitrogen leaching risk.¹⁴ Essentially, the concept was to adjust the allowable level of farm management-related nitrogen risk according to the farm's biophysical nitrogen leaching risk. This approach involved a matrix that included three soil categories (fine, medium and coarse texture, later agreed to be categorised based on profile available water¹⁵) and four rainfall categories (<1000 mm, 1000–1200 mm, 1200–1400 mm and >1400 mm). Professor Horne proposed that farms with moderate biophysical leaching risk (medium texture soil, rainfall 1000–1200 mm) be required to score "low" risk (21–40) across five management factors in the NRS (stock management, nitrogen management, imported feed, cropping & cultivation, and effluent management). Farms with coarse soil and high rainfall (i.e., greater biophysical leaching risk) were required to score 'low' and 'very low' (≤20), and farms with fine soil and low rainfall (i.e., lower biophysical leaching risk) required to score "low" and "medium" across the same five management factors.

¹⁰ Professor Horne's EIC, paragraphs [71] – [82].

¹¹ Joint Witness Statements dated 25 August 2022 and 7 October 2022.

¹² Joint Witness Statement dated 25 August, Annexure A, Table 4, page 16.

¹³ Joint Witness Statement dated 25 August, Annexure A, page 8.

¹⁴ "A matrix to help interpret the Fonterra Risk Scorecard and achieve the improvement in farm management sought by Plan Change 2", Joint Witness Statement dated 3 February 2023, Attachment A, page 13.

¹⁵ Joint Witness Statement dated 13 March 2023, page 8

- 6.9 I suggested there may be advantages to using a numerical score rather than a risk band (very low, low, medium) in the matrix, as some farm's biophysical characteristics may traverse soil or rainfall categories.¹⁶ A numerical value more readily allows the target matrix risk scores to be pro-rata according to the proportion of the effective farm area that falls into each cell.
- 6.10 It was agreed that Professor Horne would translate the matrix scores into numerical values and provide the updated matrix to Dr le Miere for assessment and calibration against the Fonterra dataset of NRS scores.¹⁷
- 6.11 Dr le Miere's evidence describes the process he followed and his rationale for making adjustments to Professor Horne's risk matrix values. These changes were primarily driven by Dr le Miere's view that farms with a high-risk score would have difficulty in meeting the lowest score in Professor Horne's matrix (86). Dr le Miere illustrates this using a synthetic farm with a score of 203, i.e., the 80th percentile risk score of all farms (consented and unconsented) across the target water management zones.¹⁸ Dr le Miere also considered that the highest risk score in Professor Horne's matrix (200) may be too lenient, and accordingly sought to balance increases in the lower scores with decreases in the higher scores.¹⁹
- 6.12 I received both Professor Horne's and Dr le Miere's versions of the risk matrix on Sunday 12 March 2023, ahead of expert conferencing the next day. I did not feel I had enough time to consider the numbers in the matrices, understand Dr le Miere's adjustments, and whether these values were likely to lead to water quality improvements.²⁰ As such, I was unable to confirm an agreed position regarding the values in the matrix at the conference on 13 March 2023.²¹
- 6.13 I met with Dr le Miere on 14 March 2023, where he explained the methods he used for his calculations and rationale for his adjustments to Professor Horne's matrix.
- 6.14 During expert conferencing on 15 March 2023 (break-out from mediation), Professor Horne explained that he had been involved in generating the

¹⁶ Joint Witness Statement dated 3 February 2023, page 7.

¹⁷ Joint Witness Statement dated 3 February 2023, page 8.

¹⁸ Dr le Miere's EIC at [53] – [54].

¹⁹ Dr le Miere's EIC at [55] and [61] – [63].

²⁰ The Council-level hearing panel confirmed that *"the goal in implementing PC2 is to enable environmental improvement"*, Recommendation Report March 2021, page 64.

²¹ Joint Witness Statement dated 13 March 2023, page 6.

inputs to Dr Snelder's modelling to estimate the effects of the original PC2 on water quality, and that the results from this analysis indicated a "modest" improvement in water quality. Based on his prior involvement and knowledge of practice change accounted for in the earlier modelling, Professor Horne was confident that the risk matrix would lead to similar practice change and reductions in nitrogen leaching, leading to similar modest improvements in water quality. This is reflected in the JWS.²²

6.15 I therefore agreed as follows:

On that basis and in conjunction with previous analyses by DH and PL, EP feels comfortable with the values in the pastoral nitrogen leaching risk matrix, and understands that the matrix is likely to have similar modelled outcomes for water quality.²³

6.16 That is, I agreed to the values in the proposed matrix (Dr le Miere's version) on the basis of these likely water quality improvements, as well as the analyses by Dr le Miere indicating substantial reductions to nitrogen risk scores would be required for most farms at the 75% percentile ($\geq 20\%$ reduction in 4 of the 5 target Water Management Zones²⁴), and by Professor Horne indicating that the matrix is likely to require similar adoption of good management practices as Table 14.2.²⁵

Questions from Fish & Game to Horizons about the risk assessment tool

6.17 Following mediation on 15 March 2023 and a meeting between Fish & Game and Professor Horne on 4 April 2023, Fish & Game and Ngāti Turanga had a number of questions about the development, effectiveness and implementation of the risk assessment tool that they provided to Horizons in an email on 21 April 2023.

²² Joint Witness statement dated 15 March 2023, page 4: "In relation to outcomes for water quality, DH supplied Ton Snelder with leaching rates from dairy farms which were inputs into his catchment scale model for quantifying the effects of the original PC2 on water quality. These inputs and subsequent modelling indicated a 'modest' improvement in water quality. Given that the risk matrix will lead to similar adoption of practice change and similar reductions in nitrogen leaching, DH and PL are confident that we will achieve a similar improvement in water quality". **Action Point:** DH to draft a further paragraph to further explain this to the parties by tomorrow (16 March)".

²³ Joint Witness statement dated 15 March 2023, page 4.

²⁴ Figure 3 in Dr le Miere's EIC.

²⁵ "What will the Risk Matrix deliver in terms of nitrate leaching?", Joint Witness Statement dated 3 February 2023, Attachment A.

6.18 These questions were as follows:²⁶

- “1. The Risk Matrix uses Profile Available Water (PAW) and Rainfall.
 - a. Please restate why PAW was chosen in preference to other potentially suitable parameters and/or why others were not included (when Matrix was originally developed) e.g. S Map, slope.
 - b. How extensive is S-Map in the Horizons Region (a) now? (b) in next 2-5 years?
2. Please confirm that Fonterra data is unavailable (or available?) to Fish & Game and/or Professor D. Horne at the sub-catchment level? E.g. for further analysis on real farm systems run through the scorecard of Overseer.
3. Please provide additional analysis to show relationship between reductions in N-loss associated with reductions in risk score (currently done for only 5 farms), across different geophysical profiles.
4. Has any analysis been carried out on the overall effectiveness in meeting Plan objectives for water quality outcomes, of using the tool across consented and unconsented farms in the priority catchments?
5. Examples of practical actions required for given farms to reduce risk to meet matrix requirements - please provide several examples. To illustrate, one example could be for a farm with moderate PAW and rainfall 1000-1300 mm and a current risk score of (e.g.) 200, what changes in farm management practices would be required to meet the matrix requirement of 150?
6. Please set out Dr le Miere's rationale for making adjustments to Professor Horne's matrix numbers. To understand the implications of this, please provide further analysis to understand how Dr Le Miere's adjustments to the risk matrix affect estimated N-loss for example farms. For example, what is the Overseer estimated N-loss for a farm with low PAW and rainfall >1300 mm if it meets the 86 risk score compared to N-loss if it meets the 110 score in the adjusted matrix.
7. As discussed, please provide a formal summary report outlining the approach and any assumptions made, (as will be required in affidavit evidence to support any Consent Order should this matter settle).
8. How are irrigation best practices proposed to be incorporated? (We understand the pastoral experts are to report on this matter shortly.)”

6.19 As I understand it, Fish & Game did not consider Horizons' response adequate. The case for the risk assessment tool approach is now outlined in Horizons evidence.

²⁶ Attachment to email dated 21 April 2023 from Sarah Ongley to Shannon Johnston.

Comparative analysis of nitrogen loss reductions under DV-PC2 versus risk matrix as presented in Professor Horne's evidence

- 6.20 Professor Horne has conducted an analysis to estimate the average percentage reductions in nitrogen leaching for 4 of the 5 targeted catchments under two scenarios: 1) implementation of DV-PC2 (with specified nitrogen reductions) and 2) the risk assessment tool. It is unclear from Professor Horne's evidence why Mangatainoka was excluded from the analysis. (I have discussed this gap with Professor Horne during the development of my evidence.)
- 6.21 Professor Horne explains the approach he used to estimate the percentage reductions under each scenario.²⁷ It is important to note that this exercise has been performed in relation to a 2012 baseline. That is, Professor Horne's baseline data set was Overseer estimated nitrogen loss from 269 dairy farms in the target catchments in 2012.²⁸
- 6.22 My understanding is that the analysis assumes all of these farms implement the controlled consenting pathways of DV-PC2 or the risk assessment tool. As such, the results presented in Table 1 of Professor Horne's evidence do not represent future reductions expected if these pathways were implemented by remaining *unconsented* dairy farmers; rather they represent an average reduction from 2012 leaching rates for those 269 farms (irrespective of whether they currently hold a consent).
- 6.23 Given changes (improvements) to practice since 2012²⁹, the reductions presented in Professor Horne's Table 1 are unlikely to reflect the expected reductions in nitrogen loss from unconsented IFLU farms in the target catchments resulting from implementation of the risk assessment tool. As an example, Professor Horne's analysis indicates that if farms had implemented practices to meet the risk assessment tool thresholds, Upper Manawatū farms would have reduced their nitrogen leaching by 13% on average (the highest reduction of all target catchments) from the 2012 baseline. In contrast, Dr le Miere's analysis indicated that unconsented Upper Manawatū farms with a 75th percentile risk score would have to reduce their score by approximately 6% (the lowest reduction of all target catchments shown in Dr le Miere's Figure 3). This indicates that Professor

²⁷ Professor Horne's EIC at [104] – [108].

²⁸ Professor Horne's EIC at [43].

²⁹ As noted in Footnote 6 on page 9 of Professor Horne's EIC.

Horne's estimated reductions may not accurately reflect reductions in nitrogen loss that would be associated with implementation of the risk assessment tool via PC2.

- 6.24 It is also worth noting that the farms used to assess nitrogen loss reductions under the risk assessment tool were synthetic farms (i.e., not real farming systems). As such, it is unclear whether the Overseer estimated nitrogen loss for the few synthetic farms generated for each cell are representative of nitrogen loss estimates for operational farms that meet the relevant risk score threshold for their biophysical characteristics. In the absence of validation with real farms, it is not possible to ascertain the accuracy of the estimated reductions to the baseline leaching rates for the risk assessment tool. This uncertainty in turn has implications for the reliability of water quality outcomes estimated by Dr Snelder, as his assessment relies on these estimated reductions in nitrogen loss.
- 6.25 I discuss this in the next section.

Impact of the risk assessment tool on water quality improvement predictions as presented in Dr Snelder's evidence

- 6.26 Dr Snelder undertook an analysis to estimate water quality outcomes associated with DV-PC2 and the risk assessment tool.³⁰
- 6.27 Dr Snelder estimated the reduction in total nitrogen loss from each target catchment (with the exception of Mangatainoka) under DV-PC2 and the risk assessment tool. Similarly to Professor Horne's analysis, Dr Snelder's analysis applies to IFLU irrespective of whether they are currently consented or not. That is, the baseline nitrogen loss rates were reduced for all dairy IFLU by the percentages calculated by Professor Horne. To my interpretation, the analysis therefore assumes all IFLU implement either the DV-PC2 or risk assessment tool controlled activity pathways (as was the assumption for Professor Horne's analysis).
- 6.28 As for Dr Horne's analysis, the results³¹ represent the estimated changes in nitrogen losses from a historic baseline³², rather than estimated changes

³⁰ The methods Dr Snelder used to undertake this assessment are provided in his EIC [56] – [62], [64] – [65] and [67].

³¹ Table 5 in Dr Snelder's EIC.

³² Dr Cox's EIC at [47] notes that the land use classes were based on 2008 mapping and 2012 was used as the calibration year.

from the current time. In this sense, the estimated reduction from IFLUs for each catchment do not account for any land use changes, practice changes or intensification since the historic baseline.

- 6.29 In my view, the assumption that all IFLUs implement the controlled activity pathways and the use of a historic baseline, means that the estimated reduction in nitrogen loss is unlikely to be a realistic reflection of changes in nitrogen loss from the current situation, should either DV-PC2 or the risk assessment tool be implemented.
- 6.30 In addition, as noted in paragraph 6.24 above, I consider it is unclear whether the estimated nitrogen losses under the risk assessment tool accurately reflect estimated losses for operational farms.
- 6.31 The estimated reductions in nitrogen losses for each catchment were then used to estimate changes to the mean relative differences in SIN concentrations to One Plan targets resulting from DV-PC2 and the risk assessment tool. As previously noted, I consider it uncertain whether these estimated reductions will be a realistic reflection of nitrogen loss changes from the current situation. In my view, it is therefore unclear whether they are a reliable basis to estimate changes to the mean relative differences in SIN concentrations to One Plan targets as a result of DV-PC2 or the risk assessment tool.
- 6.32 Dr Snelder emphasises that many aspects of the assessment presented in his evidence are uncertain. However, the nature, extent and implications of these uncertainties have not been identified. Uncertainty has also not been quantified in the results. For example, the mean relative difference is presented without a confidence interval³³, meaning the distribution of the values cannot be ascertained. Explicitly identifying and discussing uncertainties in the analysis would help with interpreting the results of the analysis.
- 6.33 Acknowledging uncertainties, Dr Snelder's analysis indicates that there will potentially be a very modest improvement in water quality from the baseline. That is, 24 of the 29 WMSZs were estimated to be non-compliant with One Plan SIN targets for the baseline, with 23 of the WMSZs remaining non-compliant with implementation of DV-PC2 and the risk assessment tool.

³³ A confidence interval is a range of values that is likely to contain the parameter of interest with a certain level of confidence (usually 95%).

- 6.34 Table 6 of Dr Snelder's evidence indicates that the risk assessment tool may slightly reduce the amount by which SIN exceeds the target in Upper Manawatū (41 versus 37 mean relative difference for baseline and risk assessment tool, respectively), with no change predicted for Rangitikei and West Coast Lakes & Horowhenua. Predicted SIN concentration is below the target (on average) for Other Upper Manawatū.
- 6.35 Based on the evidence presented I consider it is uncertain whether there will indeed be detectable improvements to water quality in the target catchments resulting from implementation of the risk assessment tool.

Reductions in risk score required as presented in Dr le Miere's evidence

- 6.36 Dr le Miere's evidence presents a comparison between the reduction in risk score required by 75th percentile farms relative to a weighted average target risk score for each of the target catchments calculated using Professor Horne's matrix and Dr le Miere's matrix.³⁴
- 6.37 During or after expert conferencing on 15 March 2023, the experts realised that Dr le Miere had used Fonterra NRS scores that included points from irrigation. Essentially, this meant that a subset of the unconsented farms Dr le Miere had used to estimate the catchments' 75th percentiles would have elevated scores due to irrigation, which was not accounted for in the risk matrix targets (the risk matrix values were based on five farm management factors that did not include irrigation³⁵).
- 6.38 Consequently, Dr le Miere removed the irrigation management factor points from the scores of irrigated farms. He then re-estimated the 75th percentile for unconsented farms in each target catchment. The results from this re-assessment reduced the 75th percentile for 4 of the 5 target catchments. The exception was Upper Manawatū. This reduction was relatively small for Coastal Rangitikei, Mangatainoka and Other Manawatū. However, removing irrigation scores indicated that 75th percentile farms in the West Coast Lakes & Horowhenua catchment would no longer have to reduce their risk scores

³⁴ Figure 3 in Dr le Miere's EIC.

³⁵ Stock management, nitrogen management, imported feed, cropping & cultivation, and effluent management.

by around 20%; rather a substantially smaller reduction of 5% would be required.

- 6.39 As such, with the exception of Upper Manawatū, the results presented in Figure 3 of Dr le Miere's evidence require amendment to reflect the lesser estimated reductions required for 75th percentile farms. Accordingly, it is likely that less practice change will be required than indicated in Dr le Miere's initial analysis.
- 6.40 Dr le Miere's evidence notes that while his 75th percentile value for Upper Manawatū was 149 (2021/22 data), the 75th percentile for the 2022/23 data was 169.³⁶ This variation in scores among years again highlights the uncertainty around the reductions that will be required by farms. Dr le Miere notes that a difference of 20 points may not reflect a significant difference in practices because the nitrogen risk score is defined in broad categories. The example he uses is a small change in practice moving from 16su/ha to 17su/ha would cause a farm's score to increase 20 points. However, this same rationale applies to reductions in scores – i.e., relatively minor practice changes (e.g., reducing stocking rate from 17su/ha to 16su/ha or reducing annual nitrogen fertiliser application from 230 to 225 kg/ha) can reduce points relatively substantially (by 20 points in these examples).
- 6.41 The nature of categorising management practices into bands means that the corresponding scores will not always reflect changes in nitrogen loss (for another example, increasing the number of animals off the milking platform from 45% to 60% in winter does not change the proportional reduction in risk score). As covered in Dr Dewe's evidence, the risk assessment tool's scorecard-based approach is therefore a coarser representation of nitrogen loss than modelled nitrogen loss in a program such as Overseer.

Mitigations

- 6.42 In conferencing prior to my involvement, the experts agreed to incorporate three nitrogen-loss mitigations into the scorecard³⁷. These were wetlands, bioreactors and plantain. Bioreactors were subsequently excluded due to insufficient information. Wetlands and plantain have been included in Schedule [X] of the proposed PC2 provisions.

³⁶ Dr le Miere's EIC at [67].

³⁷ Joint Witness statement dated 7 October 2022, Annexure A, page 6.

6.43 In reviewing the 2022 JWSs in preparation for the hearing, it came to my attention that the points for the wetland and plantain mitigations included in Schedule [X] are preliminary values, rather than finalised values. I explain this below:

6.43.1 **Plantain:** In the August 2022 expert conferencing a series of percentage reductions associated with percentage plantain cover were identified, noting that there was a need for further work (to be carried out by Mr. Ian McNab).³⁸ The October 2022 JWS presents the results of Mr. McNab's investigations.³⁹ Mr McNab estimated percentage reductions in nitrogen loss associated with percent plantain cover are different from the preliminary values in the August JWS. However, it is the August JWS values that have been included in Schedule [X].

6.43.2 **Wetlands:** In the August 2022 expert conferencing it was identified that Dr le Miere would undertake further work regarding constructed wetlands as a mitigation measure.⁴⁰ The October 2022 JWS presents the results of Dr le Miere's investigations.⁴¹ Dr le Miere identifies that the percentage reduction needs to be adjusted in relation to proportion of the farm that makes up the catchment that drains to the wetland. However, the values included in Schedule [X] do not recognise that this is a percentage reduction (rather than an absolute points reduction) nor that the percentage reduction should be adjusted according to the percentage of the farm that makes up the wetland's catchment.

6.44 I have discussed these issues with Professor Horne, during the preparation of my evidence.

³⁸ Joint Witness Statement dated 25 August 2022, Table 3, page 14.

³⁹ Joint Witness statement dated 7 October 2022, Attachment 1.

⁴⁰ Joint Witness Statement dated 25 August 2022, Table 3, page 14.

⁴¹ Joint Witness statement dated 7 October 2022, Attachment 1.

Use of Overseer and the risk assessment tool in a regulatory setting

- 6.45 As noted in paragraph 6.4, my understanding is that in light of the Government response to the Overseer whole model review report, Horizons sought to develop an alternative method for assessing and setting limits for nitrogen loss from IFLU in target WMSZs.
- 6.46 I therefore consider it relevant to evaluate the risk assessment tool in relation to the overarching issues identified with Overseer. Dr Dewes also addresses this matter.
- 6.47 In the Parliamentary Commissioner for the Environment's 2018 report⁴² it was identified that *"in some important respects, Overseer does not meet the levels of documentation and transparency that are desirable in a regulatory setting. Important issues remain to be clarified concerning the uncertainty that attaches to its outputs"*. A key recommendation was a *"comprehensive and well-resourced"* evaluation of Overseer which should include *"formal sensitivity and uncertainty analyses"*.
- 6.48 Consequently, a review by an independent Scientific Advisory Panel was commissioned by the Ministry for Primary Industries and the Ministry for the Environment.⁴³ The panel concluded that, in Overseer's [then] current form, it would not have confidence that Overseer's estimates of nitrogen lost from farms are suitable for use as a stand-alone measure of total losses.
- 6.49 The Government response to this review⁴⁴ included advice that *"Councils should use all available tools/data and be cautious in placing too much emphasis on Overseer modelling as a means of exercising control through the imposition of consent conditions or in any compliance and enforcement context"*, noting that this is *"considered to be consistent with treating Overseer modelled estimates as providing a coarse representation of nitrogen leaching only"*.⁴⁵ The report also noted that *"statistical testing (such as sensitivity and uncertainty analyses) of all future nutrient management tools will be considered"*.⁴⁶

⁴² Overseer and regulatory oversight: Models, uncertainty and cleaning up our waterways. Parliamentary Commissioner for the Environment. December 2018, Page 9.

⁴³ Overseer whole-model review: Assessment of the model approach. Prepared for the Ministry for Primary Industries and the Ministry for the Environment by the Science Advisory Panel, July 2021.

⁴⁴ The Government response to the findings of the Overseer peer review report. Ministry for the Environment and Ministry for Primary Industries, August 2021.

⁴⁵ Page 15.

⁴⁶ Page 6.

- 6.50 An Overseer redevelopment programme was undertaken to address the issues raised by the Science Advisory Panel.⁴⁷ The Ministry for the Environment's advice following this work remains that Overseer outputs should not be used as absolute numbers and a range of tools are recommended when assessing farms and catchments when managing nutrients in a regulatory context.⁴⁸
- 6.51 As Dr Dewes comments, whereas there is good understanding of Overseer's strengths and weaknesses, in contrast, the risk assessment tool has not been reviewed (apart from one review of its basis, the NRS⁴⁹). The Parliamentary Commissioner's comments around the level of *"documentation and transparency that are desirable in a regulatory setting"* appears to be considerably more lacking for the risk assessment tool than Overseer.
- 6.52 The Government advice has also recommended caution when a tool is considered to have a coarse representation of nitrogen leaching. However, coarse representation of nitrogen leaching is inherent in the risk assessment tool, as noted in Dr Dewe's evidence, and as I illustrated above at paragraphs 6.40 and 6.41.
- 6.53 The advice also recognises the importance of quantifying uncertainty.
- 6.54 In my opinion, it is feasible that implementation of the risk assessment tool will start to bring about water quality improvements in line with the objectives of the One Plan. However, whether the risk assessment tool will achieve this outcome is highly uncertain on the basis of currently available information.

Dr Elizabeth Helen Parlato

⁴⁷ Overseer Redevelopment Programme Report, Ministry for Primary Industries, August 2023.

⁴⁸ Responding to the Overseer model redevelopment review: a guide for councils. Ministry for the Environment. July 2023.

⁴⁹ Evaluation of Fonterra's Scorecard Factors on Overseer Nitrogen Statistics, Abacus Bio Limited, 1 November 2019. The NRS has been amended for the Horizons Nitrogen Risk Scorecard, including amending the scoring of some NRS factors and inclusion of mitigations.

