

**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 ANNE-MAREE JANE JOLLY ON BEHALF OF THE
MANAWATŪ-WHANGANUI REGIONAL COUNCIL**

COMMERCIAL VEGETABLE GROWING

Dated: 6 October 2023



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STATEMENT OF EVIDENCE OF DR ANNE-MAREE JANE JOLLY**A. INTRODUCTION**

- [1] My full name is Anne-Maree Jane Jolly. I am currently employed as a Senior Primary Industries Consultant – Sustainability at WSP. I have been in that position since July 2022. Prior to that I had been a Rural Environmental Consultant at WSP since April 2017.
- [2] My role at WSP involves providing technical advice on soil and nutrient management across the primary industries. I work across New Zealand with farmers, food processors, district councils, and policy analysts, and regularly provide advice on the use of Overseer. In doing so, I am also involved with the preparation of farm nutrient management plans.
- [3] I hold a Doctorate in Soil Science from Lincoln University and a Bachelor's Degree in Agricultural Science with Honours in Soil Science from Massey University.
- [4] I am a Certified Nutrient Management Advisor and I have recently completed the Advanced Fresh Water Farm Planning Certificate at Massey University.
- [5] I have been involved with Plan Change 2 to the Manawatū-Whanganui One Plan (**PC2**) since December 2019. Between December 2019 and October 2020, the focus was on providing advice and data analysis on good management practices (**GMP**) and best management practices (**BMP**) and the use of Overseer for modelling nitrogen leaching from commercial vegetable growing (**CVG**) in the context of PC2.
- [6] During this time, I co-authored the report *Horizons Regional Council – Proposed Plan Change 2: Farm Scale Financial Impact Model*.¹
- [7] Since June 2022, my role has involved advising Manawatū-Whanganui Regional Council (**Horizons**) in respect of the appeals against the decisions version of PC2 (**DV-PC2**), including working with experts to develop a nitrogen risk assessment tool for CVG.

¹ See Attachment A to the Statement of Evidence of Kerry Mayes, 6 October 2023.

- [8] I provided a section 42A report for the Council-level hearing of PC2 and have participated in mediation and expert conferencing during this appeal. In particular, I have attended five expert conferencing sessions since June 2022 with farm system and planning experts.²
- [9] While my focus has been on CVG, Professor David Horne has advised on pastoral farming matters for Horizons and the role of Overseer. Professor Horne's evidence addresses Overseer, generally, for the purposes of PC2.

B. EXECUTIVE SUMMARY

- [10] I continue to support the inclusion of an alternative consenting pathway, sitting alongside Table 14.2, within PC2. Inserting an alternative consenting pathway into the One Plan which is not reliant on Overseer assists in ensuring a workable pathway is available for existing IFLU.
- [11] Through a series of expert conferences, a risk assessment tool for CVG has successfully been developed for use within PC2. The risk assessment tool assesses risk of nitrogen loss from CVG activities (including farm practices), while having regard to biophysical characteristics of soil type and rainfall.
- [12] As PC2 is focused on nitrogen management (as opposed to other nutrients), the focus of the scorecard within the risk assessment tool has been to target high nitrogen-loss management practices. There are several management practices within CVG systems that have significant impact on nitrogen leaching, and while other management practices are available, their impact on nitrogen loss is smaller. The selection of nitrogen-focused management practices for inclusion in the risk assessment tool will lead to the adoption of GMPs and/or BMPs targeted at the highest leaching risk practices, and will therefore, in my view, lead to the greatest reductions in nitrogen loss.

² Farm system and planning experts (28 June 2022); Farm system experts (25 August 2022); Farm system and planning experts (7 October 2022); Farm system experts – Commercial Vegetable Growing (10 February 2023); and Commercial Vegetable Growing and Planning experts (14 March 2023).

- [13] Although the risk assessment tool cannot quantify nitrogen leaching from a farming activity, it can determine the risk of nitrogen leaching and reduce that level of risk through requiring the adoption of GMPs and/or BMPs.
- [14] As with the CVG specified nitrogen reduction pathway (which required a modelled 35% reduction in nitrogen loss), the risk assessment tool drives the adoption of farm practices which influence nitrogen leaching reductions.
- [15] Like Overseer, the risk assessment tool sits within a framework which includes soil type and rainfall. These biophysical factors significantly influence the rate at which nitrogen is lost through leaching and are appropriately accounted for in the risk assessment tool.
- [16] By requiring growers to achieve the required points reductions outlined in **Figure 1** of my evidence, Dr Snelder is confident that a similar water quality outcome will result from the risk assessment tool approach, as under the DV-PC2. Dr Snelder's assessment of water quality outcomes is explained further in his evidence.
- [17] At this point in time, I consider the Horizons CVG risk assessment tool to be the best available tool for managing the risk of nitrogen leaching from CVG, and it has been developed specifically for the purpose of PC2. While Phase One of the MfE Risk Index Tool (**RIT**) is soon to be released, I am of the view that too little is known about it to rely on it as a regulatory tool. MfE have acknowledged that it will require further work (including at a local level) before it would be suitable for adoption within regional plans.

C. CODE OF CONDUCT

- [18] 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. This 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.

D. SCOPE OF EVIDENCE

[19] My evidence provides an update on the technical work I completed for PC2, which involved defining, tabulating and modelling GMP and BMP with Overseer to determine the effectiveness of possible changes in reducing nitrogen leaching in CVG, and it introduces the new CVG risk assessment tool.

[20] I address the following matters in my evidence:

- (a) On farm practices and the identification of GMP and BMP for CVG farmers, and the development of risk profiles for nitrogen leaching.
- (b) Consenting pathways supported by DV-PC2.
- (c) Potential tool options for determining nitrogen losses on farm.
- (d) The changing role of Overseer and how this impacts the controlled activity pathways under DV-PC2.
- (e) The role of the CVG risk assessment tool.
- (f) Development of the CVG risk assessment tool.
- (g) Implementation of the CVG risk assessment tool.

[21] In addition to my own observations, I rely on the evidence of Professor Horne, Dr Paul le Mierre and the various joint witness conferencing statements prepared since June 2022. Further, in relation to water quality outcomes, I rely on the evidence of Dr Ton Snelder and Dr Tim Cox.

E. BACKGROUND

[22] PC2 was proposed by Horizons to address issues that had arisen in implementation of the nutrient management framework within the One Plan (Chapter 14). There were challenges arising from continuous updates to Overseer and a policy framework which saw competing policies (circling back to compliance with the cumulative nitrogen leaching maximums (**CNLM**) in Table 14.2) allowing only very limited circumstances in which exceptions to

compliance to Table 14.2 could be made. This effectively made the restricted discretionary pathway within the One Plan unusable.

[23] In particular, I note:

- (a) The CNLM in Table 14.2 no longer reflected the modelling assumptions contained in more current versions of Overseer. At the time of notification of PC2, this was the 2020 version of Overseer (v6.3.2). Typically, nitrogen leaching rates estimated using Overseer v6.3.2 were significantly higher than the rates that would have been estimated using the original Table 14.2 Overseer version (5.2.6), even for an unchanged farm system with the same fertiliser and management practices. This meant it was, generally, more difficult to demonstrate compliance with the Table 14.2 CNLM limits.
- (b) The operative provisions of the One Plan were impacted, given that Policy 14-5 required that all existing and new intensive farming land use (IFLU) activities must not exceed the Table 14.2 CNLM limits. Although the plan framework provided for applications to be made to exceed these limits, as I refer to above, Policy 14-5(d) meant that the restricted discretionary pathway was not available in practice.

[24] PC2 sought to resolve both these issues. It was designed to be an interim solution to recalibrate Table 14.2 in line with an updated version of Overseer and to provide a workable consenting pathway for IFLU which did not meet Table 14.2 (i.e. to address the issues with the policy framework). This would enable consent applications to be lodged for the 235 unconsented existing IFLU in the targeted catchments,³ and for on-farm practices (including adoption of GMP and BMP) to be managed in order to reduce nitrogen loss.

[25] The DV-PC2 provided for alternative controlled activity pathways for pastoral and CVG IFLU. These pathways required specified nitrogen leaching reductions to be demonstrated in order to qualify as a controlled activity. For CVG the specified reduction was 35%. This reduction was to be calculated from a 2012-13 baseline year. To make this reduction, growers would be

³ Ms Christine Foster, Statement of Evidence, 6 October 2023, Table 1.

required to adopt a range of nitrogen focused GMPs and BMPs on farm. I discuss development of the 35% reduction pathway below.

- [26] Following the Council-level hearing of PC2, the Government's response to the Overseer peer review report was released (the **Overseer Reports**).⁴ The Overseer Reports identified issues with use of Overseer as a tool for regulatory management of farm practices. I understand that advice to regional councils following the Overseer Reports continues to be to avoid using Overseer modelled nitrogen loss as an absolute number, and for a range of evidence based approaches to be used when assessing farms and catchments when managing nutrients in a regulatory context.⁵
- [27] As a result of this, risk assessment tool has been developed for pastoral and CVG. The risk assessment tools would replace the pastoral and CVG specified nitrogen reduction pathways, and operate as an alternative workable consenting pathway to the Overseer-based CNLM in Table 14.2. The risk assessment tool would assess the risk of nitrogen leaching for CVG, with the accompanying rule framework requiring reduction of diffuse discharge risk to a 'low' level. I discuss the development of the risk assessment tool below.

F. TOOLS FOR MANAGING NITROGEN LEACHING – PC2

- [28] The nutrient modelling tool Overseer was created in the 1980s. The initial use was as a decision-support tool for agricultural producers to support fertiliser recommendations. Significant resources have been used to develop Overseer into a world-class farming decision support tool.
- [29] Although not originally developed as a regulatory tool, Overseer became a tool widely used by regional councils across New Zealand for regulatory purposes, including its use to set limits for diffuse nitrogen discharges.

⁴ Ministry for the Environment and Ministry for Primary Industries *Government response to the findings of the Overseer peer review report* (August 2021) at 12.

⁵ Ministry for Primary Industries and Ministry for the Environment *Overseer Redevelopment Programme Report* (August 2023); Ministry for the Environment and Ministry for Primary Industries *Responding to the Overseer model redevelopment review* (July 2023).

- [30] This largely developed as a question of practicality and availability of options. Nitrogen leaching on farm, either CVG or pastoral, is predominantly through diffuse loss pathways rather than point source. This makes nitrogen loss on farm difficult to measure and quantify. For IFLU applications, when managing water quality with an output-based approach (as the One Plan does), nitrogen loss at the individual farm scale must be determined somehow. Due to the diffuse nature of the movement of nitrogen through a farming landscape, on-farm measurements are near impossible. As such, Overseer has historically been used as the go-to model to estimate this leaching.⁶
- [31] This was the approach taken by the original One Plan, which used Overseer-based modelling to set the CNLM in Table 14.2. A primary purpose of PC2 was to recalibrate Table 14.2 to reflect changes in Overseer versions (which is discussed in evidence by Dr Hanly), so that the CNLMs were as achievable by existing IFLU as they were originally intended.
- [32] However, as I refer to earlier, another purpose of PC2 was to provide a workable consenting pathway for IFLU which did not meet Table 14.2. This initially involved provision of a discretionary pathway, with an updated policy framework. Through the submission and hearing process, an alternative controlled activity pathway was considered. This pathway focused on the adoption of a range of GMP and BMP for CVG, alongside a percentage reduction of nitrogen.
- [33] For the alternative pathway, I considered two key questions:
- (a) What GMPs and BMPs should be adopted by growers?
 - (b) What reduction in cumulative nitrogen leaching loss was appropriate for CVG activities?

Identification of CVG GMP/BMP

- [34] This question was the more straightforward of the two. There are a range of nitrogen focused GMPs and BMPs available for CVG which can play an

⁶ I discuss the issues arising from the whole-model review of Overseer below.

important role in reducing contaminant loss from intensive farming operations.

- [35] As part of farm system expert conferencing for the Council-level hearing, an agreed list of suitable GMPs and BMPs for CVG was agreed between farm system experts. I have included the list at **Attachment A**. I note that the majority of GMPs and BMPs selected were already included in the Horticulture New Zealand Code of Practice for Nutrient Management 2014.
- [36] In differentiating between GMP and BMP, GMP was agreed during the expert conferencing as a practice that a grower or farmer should be doing if they already are not, provided it is deemed suitable for their farming or growing system. BMP was defined as a practice change that has a greater system impact, a greater financial cost to implement or maintain (such as newer technologies), or which is similar to a GMP but more involved (such as different levels of soil testing for CVG). There was the assumption that growers or farmers would adopt a mix of GMP and BMP that fit within their individual farming operation in order to meet their consenting requirements.

Setting an appropriate reduction level

- [37] A focus for the Council-level hearing was around the appropriate reduction to access an alternative consenting pathway (should one be introduced alongside Table 14.2), and when that would be measured from. I considered a 35% reduction in nitrogen loss was reasonably feasible for a range of vegetable growing systems when a combination of GMPs and BMPs are implemented by growers. I had undertaken modelling using Overseer to assess the viability of achieving that level of reduction through the adoption of GMPs and BMPs, which demonstrated that those reductions were viable for many growers.⁷ In summary, I carried out crop rotation modelling in Overseer to feed into the farm financial modelling my colleague Mr McNally undertook. While the modelling did not represent the actual range or location of growing systems in the catchment, it was useful in exploring the

⁷ Further details are provided in Section 4 of the report *Proposed Plan Change 2 Farm Scale Financial Impact Model* (27 August 2020). See Attachment A of the Statement of Evidence, of Mr Kerry Mayes, dated 6 October 2023.

range of nutrient reduction amounts that might be achievable for growers. The modelled range was 22 kg N/ha to 226 kg N/ha (using Overseer v6.3.2). Eight different crop rotations adopting GMP and BMP, covering: potatoes, onions, leafy greens, and brassicas typical of the Horowhenua production area were selected from Bloomer et al (2020).

- [38] The 35% reduction was calculated from a 2012-13 baseline year. This was the preferred baseline as, at that time, minimal on farm GMPs and no BMPs had been adopted by CVG for reducing nitrogen loss. It was also aligned to the CVG rules taking effect in the One Plan, meaning that growers who had implemented practice changes to reduce nutrient loss since the One Plan's regulatory framework came into effect were not disadvantaged.
- [39] The Hearing Panel agreed with this assessment, and an additional controlled pathway for CVG was included in DV-PC2, requiring that (in addition to the other requirements of Rule 14-1):
- (a) The growing area used by the grower did not exceed the growing area used by that grower in the baseline growing period; and
 - (b) The grower would achieve a minimum 35% reduction in nitrogen leaching loss, relative to the 2012-2013 baseline, within 3 years of their consent application being lodged.

G. DEVELOPMENT OF THE RISK ASSESSMENT TOOL

- [40] Although Overseer is a world-class farming decision-support tool, in recent years its suitability as a regulatory tool has been challenged. The Overseer Reports confirmed these issues.⁸ The Overseer Reports led Horizons, along with the parties to the appeals on PC2, to consider the possibility of a new method to determine appropriate nitrogen reductions on farm.
- [41] A risk assessment tool, such as the CVG risk assessment tool, does not attempt to model nitrogen loss. It is not a 1:1 replacement for Overseer.

⁸ I note at the time of finalising this evidence a further Overseer Report has been released by the Government, which while recording increasing confidence in Overseer, reinforces earlier advice to regional councils around the use of Overseer.

However, in my opinion, it can work as a suitable alternative to Overseer-based modelling to support consent decisions for IFLU. Similar to the specified 35% reduction pathway inserted in the decisions version of PC2, the risk tool is based on the adoption of GMP and BMP by farmers. As I explain below, it has been set to require the adoption of the same GMPs and BMPs that would be required to achieve the 35% specified reduction.

- [42] Further, Overseer modelling shows that requiring growers to reduce their risk to a 'low' level under the risk assessment tool reduces modelled nitrogen loss.
- [43] The CVG risk assessment tool was developed across four expert conferences and in preparation for conferencing and mediation between June 2022 and March 2023.
- [44] During the June 2022 farm system expert conferencing it was agreed that a risk scorecard similar to that of the Fonterra nitrogen risk scorecard would be developed for Horowhenua CVG.⁹
- [45] I developed the initial scorecard for the CVG risk assessment tool, which was subsequently refined in conjunction with experts Andrew Barber and Stuart Ford from Horticulture New Zealand, and Brent Clothier from Plant and Food Research. The wider framework within which the CVG scorecard sits was developed by Professor Horne. The suitable risk point values for CVG were ultimately considered and agreed by all CVG farm system experts.¹⁰
- [46] The wider framework was agreed upon during the February 2023 CVG expert conferencing.¹¹ Since mediation, I have had further decisions with Mr Barber which have resulted in further refinements to the framework, allowing for the risk assessment tool to be able to be applied to CVG across all targeted water management sub-zones. Prior to mediation in March 2023, Mr Barber

⁹ Joint Witness Statement of Farm System and Planning Experts (28 June 2022).

¹⁰ Joint Witness Statement of Farm System and Planning Experts (7 October 2022), Annexure A, Topic 3.

¹¹ Joint Witness Statement of Farm System Experts – CVG (10 February 2023).

also engaged with Horowhenua vegetable growers to test the risk scorecard for its usability.

The CVG risk assessment tool

- [47] The risk assessment tool is comprised of two parts: the CVG risk scorecard, and the wider biophysical framework. In summary:
- (a) The CVG risk scorecard assesses the level of risk of nitrogen loss from a CVG property by assigning point values to on-farm practices that influence nitrogen leaching (weighted by the proportion of the productive area of the farm using the particular practice), which are then used to 'score' the nitrogen leaching risk of the enterprise. The higher the risk score, the higher the risk of nitrogen leaching.
 - (b) The wider biophysical framework then takes into consideration how the two key biophysical features of soil type and rainfall influence nitrogen leaching from individual properties.
 - (c) In combination, the risk assessment tool determines the risk profile for a particular property.
- [48] Once the risk profile is determined, growers are then required to adopt farm management practices in order to reduce their risk of nitrogen leaching. The extent of change will depend on the level of risk associated with the CVG activity and the biophysical factors applying to the land on which the grower's enterprise sits.
- [49] As I have noted earlier, the farm management practices within the risk scorecard were those identified during the Council level hearing process.¹² There was a high level of agreement between experts at the time. Two types of management practices have been selected for the scorecard within the risk assessment tool – those focused on nitrogen fertiliser (six practices have been agreed on), and those on soil health (two soil health practices):

¹² See Attachment A; and the Joint Witness Statement of Experts – Farming and Growing Management Practices; Farm Systems Modelling and Farm-Scale Economics (21 and 22 July 2020), Annexure A, Topic 1.

- (a) Nitrogen fertiliser:
 - (i) Nitrogen fertiliser annual application rate;
 - (ii) Nitrogen fertiliser application rate per individual application;
 - (iii) Nitrogen balance/budget;
 - (iv) Nitrogen soil testing;
 - (v) Crop establishment fertiliser application method;
 - (vi) Side fertiliser application method.
- (b) Soil health:
 - (i) Practices between crops;
 - (ii) Catch crop (cut-and-carry).

[50] Grower practices associated with the use of nitrogen fertiliser have the greatest influence on nitrogen leaching within CVG systems. Practices associated with soil health have a lesser, but still important, impact on the amount of nitrogen leached from vegetable systems.

[51] Management practices which increase nitrogen leaching risk are assigned a positive risk point value in the scorecard. Practices which reflect GMP or BMP are assigned a negative risk point value (as they represent a reduction in nitrogen leaching risk). I note that while adoption of GMP/BMP will impact the amount of nitrogen lost from the soil profile, the amount varies by practice.

[52] Although the list of management practices accommodated by the risk assessment tool is short, there is still enough choice to allow a 'toolbox' approach, as was discussed during the Council-level hearing – that is, it allows for individual enterprises adopting the practices that work for their individual systems. The toolbox approach also allows individual growers to choose their level of risk reduction, because different consenting pathways (controlled or discretionary) are available.

- [53] The risk scorecard has not been developed to target or control the growing of high nitrogen leaching crops themselves. Rather, it looks at the improvement of on farm management practices. This results in growers being able to have full choice of crops available to be grown. As such, the risk scorecard focuses on those farm practices which have the largest impact on nitrogen leaching. This is accomplished by targeting a small number of key high-risk practices, with associated GMPs and BMPs that can achieve significant nitrogen reductions when implemented.
- [54] After the scoring of the initial risk of the CVG activity, the points across each management practice are combined to give a risk score. As highlighted in **Figure 1**, each management practice has an assigned risk rating. These risk ratings provide a grower a visual understanding of the impact their current practice is having on nitrogen loss from their system.

Figure 1: CVG on farm practice risk ratings

	Risk Ratings				
	Very Low <20	Low 21-40	Medium 41-60	High 61-80	Very High >81
Nitrogen Fertiliser					
Soil Health					

- [55] The farm management practice risk score is overlayed into the wider biophysical framework developed by Professor Horne, which highlights the influence of soil type and rainfall on the risk score. The overlay highlights the different combinations of rainfall and soil types that influence the risk associated with nitrogen leaching (**Table 1**), but in a way that does not alter the underlying scoring of farm practices with respect to their ability to manage the risk of nitrogen leaching. Rather, the biophysical risk is the driving determinant on the *acceptable level* of risk for a given farm's management practices, dictating allowable risk scores.
- [56] Table 1 (Table 14.2B in Horizons draft plan provisions) has recently been modified following further discussions with Mr Barber. The intention was to address potential uncertainty arising out of the cells shown in the table that

were previously left blank. These were initially left blank as most the CVG in Horizons' targeted water management sub-zones sits in the Horowhenua (i.e. the Hoki_1 water management zone), which has soil with moderate profile available water and moderate rainfall – an environment largely described by the 'Rainfall 2' and '61–150 mm' cell in Table 14.2B.

- [57] However, while the Horowhenua has the largest number of vegetable growers impacted by PC2, it is unknown whether there are any other growers across the remaining targeted water management sub-zones. The modifications therefore allow for any CVG operation affected by PC2 to apply for consent through the CVG risk assessment tool pathway.
- [58] To be able to 'fill in' the CVG risk assessment tool, Mr Barber and I agreed that changing from risk classifications to risk scores was the most suitable approach. This is because a range of risk scores could be assigned within the framework giving effect to the biophysical factors soil type and rainfall. By transferring from a risk classification to a risk score, the data sitting within the scorecard behind the classification is being used. The two management practice scores are added together to provide an overall risk score. This score still represents improved on farm practice and a low nitrogen leaching risk, while ensuring that biophysical characteristics are accounted for. The approach also better aligns with the pastoral risk assessment framework.
- [59] The risk scores in Table 1 are based on the pastoral risk framework. The CVG risk scores are different as the CVG scorecard has two management practices, while the pastoral scorecard has five management practices.

Table 1: CVG matrix framework

	Profile available water		
	151-350 mm	61-150 mm	0-60 mm
Rainfall 1 <1000 mm/yr	72	72	52
Rainfall 2 1000-1300 mm/yr	72	60	48

	Profile available water		
	151-350 mm	61-150 mm	0-60 mm
Rainfall 3 130-1600 mm/yr	60	52	44
Rainfall 4 >1600 mm/yr	60	48	44

- [60] The risk scores required to access the controlled activity consent pathway are outlined in the interior cells of Table 1. All experts that participated in conferencing agreed that by achieving their required score, a grower will have adopted enough GMP and/or BMP to result in their nitrogen risk reducing to similar levels to that which would have been achieved by the 35% modelled reduction in nitrogen loss under the DV-PC2.¹³ I therefore consider these scores to be appropriate for the purposes of a controlled activity.

Modelled nitrogen leaching reductions

- [61] Overseer has been used as a way to gauge the effectiveness of the risk assessment tool. A baseline year of 2018 was used.¹⁴ This baseline was the compared against the improvements in on-farm practices that would be required by the risk assessment tool.
- [62] I note that since the original Bloomer et al 2020 report, another significant update to the crop model within Overseer has occurred. This update was completed in April 2023. The update occurred as continuous improvements around the available data on nutrient loss from New Zealand farming systems are being made, as well as constant development of mitigation options. Each upgrade ultimately makes Overseer a more robust tool and the nitrogen loss estimates become more accurate. The April 2023 update has resulted in nitrogen loss from CVG being less than that modelled by Bloomer et al 2020.

¹³ Joint Witness Statement of Farm System and Planning Experts (7 October 2022), Annexure A, Topic 2.

¹⁴ This baseline was established from the Bloomer et al, 2020 report where nitrogen loss values feed into the D-V PC2 water quality modelling. Bloomer et al modelled current and future nitrogen loss for commercial vegetable systems with current being pre 2019 using data from 2016 through to 2018.

- [63] As explained in Dr Hanly's evidence, updates to Overseer do not impact the actual nitrogen loading in stream/river.¹⁵ The estimate of the nitrogen root zone loss (which in actual or real terms remains the same) has just improved over time with changes to the Overseer model.
- [64] The Bloomer et al 2020 Overseer models were updated and used to reflect the adoption of the CVG risk assessment tool. These models formed the basis of the Overseer modelling undertaken to inform the Council-level hearing process, and the 35% specified reduction pathway. All 62 crop rotations across the three vegetable systems (potatoes and onions, brassica dominant, and intensive vegetables) were updated during the recent modelling.
- [65] As I have noted, Mr Barber had tested the risk assessment tool with four CVG properties in Horowhenua. These four growers informing the case studies cover approximately 90% of the vegetable growing area within the Horowhenua. The information collected and analysed by Mr Barber was farm management data from running through the scorecard with each grower and determining which GMP and/or BMP were needed to be adopted to reduce the nitrogen risk score to low risk.
- [66] The case study information was used alongside Overseer modelling to determine the potential nitrogen reductions when applying the risk assessment tool on CVG operations. The 2018 baseline Overseer crop rotation models were then overlaid with Mr Barber's data to model the impact of the adoption of the risk assessment tool by growers.
- [67] The outputs from the Overseer modelling reflect the farm level nitrogen reductions across CVG if Horowhenua growers reduced their risk to low through the adoption of individual property suitable GMP and/or BMP.
- [68] These results are outlined in Table 2.

¹⁵ Statement of Evidence, Dr James Hanly, 6 October 2023, paragraphs [27] – [33].

Table 2: Nitrogen loss from CVG through the adoption of the risk assessment tool

	N loss hectare kg N/ha	N loss total kg N
Baseline	57	23,992
Future	17	6,985
% Reduction	70	

[69] With the adoption of a range of GMP or BMP, all crop rotations reduced in nitrogen loss from the 2018 baseline. The nitrogen losses ranged from 5 kg N/ha to 86 kg N/ha after the adoption of the practices within the risk assessment tool. This resulted in an average nitrogen loss across the Hoki_1a Water Management Subzone of 17 kg N/ha or 6,985 kg N. This is compared to the 2018 baseline nitrogen losses ranging from 14 kg N/ha to 125 kg N/ha, with an average nitrogen loss of 57 kg N/ha or 23,992 kg N. This equates to a reduction of 70%.

Outcomes

[70] The CVG risk assessment tool has been developed through a collaboration of experts that understand the drivers for the One Plan, and the complexities and uniqueness of CVG throughout the region, including, notably, in the largest vegetable growing area – the Horowhenua Region. In my view, the risk assessment tool provides a robust consenting tool which brings about on farm practice changes that drive reductions in nitrogen leaching from CVG.

[71] Development of the risk assessment tool addresses the issues raised through the Overseer Reports and provides a workable consenting pathway, which can sit alongside Table 14.2 in the One Plan.

[72] The GMPs and BMPs that are used within the risk assessment tool arise out of the earlier expert agreements relating to GMP and BMP for CVG. Those same practices will need to be adopted to achieve the necessary risk threshold. These GMP and BMP were relied on for the original Overseer modelling which determined that a 35% nitrogen loss reduction was a suitable threshold for a controlled activity. As set out in the evidence of Dr

Snelder, the use of the risk assessment tool is expected to result in a similar water quality outcomes for the targeted catchments.¹⁶

[73] As I note above, the risk assessment tool does not model nitrogen loss reductions in the same way as the 35% reduction pathway does. This is because the risk assessment tool is focused on reducing the risk of nitrogen leaching through practice change, rather than attempting to quantify the change in nitrogen leaching.

[74] The percentage reductions in nitrogen from implementing the risk tool are, however, positive, with greater reductions than anticipated under the specified nitrogen reduction pathway within the DV-PC2. While there has been a change in Overseer (with benefits in terms of nitrogen leaching values), in my experience, the extent of change suggests that the risk assessment tool would also be having a significant impact on reducing nitrogen leaching rates from CVG. I note that the evidence of Dr Snelder supports this view.

H. MFE RISK INDEX TOOL

[75] I am aware that another tool soon to be publicly available for initial review is the MFE RIT. It is my understanding that Phase One of the RIT will become available in November 2023.

[76] On reviewing the currently available information on RIT,¹⁷ it is not possible to determine whether it would be a better tool than the one proposed as part of PC2. The information available is too limited currently for the RIT. In responding to the Overseer Reports, as experts, we have considered the best information available to us at the time.

[77] I note the following points:

- (a) Both the RIT and the Horizons CVG risk assessment tool take a similar approach, being the management of risk and the identification of

¹⁶ Statement of Evidence, Dr Ton Snelder, 6 October 2023, paragraph [71].

¹⁷ <https://environment.govt.nz/assets/MfE-RIT-technical-slide-deck.pdf>.

management practices to reduce that risk (noting that the CVG risk assessment tool solely assesses the risk of nitrogen leaching).

- (b) Both tools include the biophysical features of soil type and rainfall.
- (c) The data that feeds into the vegetable component of the RIT does not include any data from Horowhenua vegetable growing systems.
- (d) All mitigations and modifiers within the RIT are derived from published, peer-reviewed accessible literature meaning that is robust. However, there is currently very limited CVG literature available, providing challenges for the vegetable RIT.
- (e) There is no indication on how the vegetable RIT works. Is it at a property level, rotation level or for a single crop? This will influence its suitability and ease of use. In contrast, these factors have been taken into consideration when developing the CVG risk assessment tool. The CVG risk assessment tool has been developed at the property level and encompasses vegetables crops and pastoral phases for two years or less. Where other IFLU are present on-farm, the CVG risk assessment tool does not take them into account.
- (f) MfE have identified in the publicly available information, there is an underestimation of risk relative to measured loss for vegetables, with further work planned to cross check this underprediction.
- (g) MfE anticipates that the RIT will need to be placed within a regional context i.e., the RIT does not categorise outputs as low, medium or high, and Council's will need to determine what the scores mean within catchment contexts and what level of risk is acceptable.

[78] In my opinion, on the information before me, the CVG risk assessment tool presently has several benefits for PC2, when compared to the RIT:

- (a) The water quality improvements resulting from the RIT are unknown, whereas the evidence of Dr Snelder confirms that the risk assessment tool will continue to result in modest water quality improvement on implementation as part of the DV-PC2.

- (b) The RIT, once released, will still need to account for the regional context through specific risk scores and an assessment of the acceptable level of risk. This has already occurred for the CVG risk assessment tool.
 - (c) The risk assessment tool has taken into account the complexity of CVG systems, while developing a pragmatic tool for PC2. This includes different intensities of vegetable system, the complex nature of crop rotations continuously changing, and the fact that nitrogen leaching for CVG is not simply influenced by a single crop.
 - (d) The risk assessment tool is similar enough in approach to that of the RIT, that if there were to be further changes, they could be made easily as part of the freshwater plan review, as I note below.
 - (e) The CVG risk assessment tool is available now.
- [79] I have considered whether there would be some impediment to the risk assessment tool being further considered or revised as part of the freshwater planning process Horizons has underway. I understand that an issue on appeal is whether PC2 fetters or undermines Horizons' ability to make decisions under the freshwater planning process. I do not consider there to be any impediment to Horizons considering the risk assessment tool further as knowledge and understanding around the RIT develops.
- [80] The fundamental building blocks of the RIT and CVG risk assessment tool are similar, such that, in my view, the tool could be further refined as necessary. Both tools account for sources and transport of nitrogen loss for purpose of assessing risk, including biophysical characteristics, and apply farm practice change (either mitigation or additional actions like the GMP and BMP practices agreed by experts as part of PC2¹⁸) to achieve reductions in the risk of nitrogen leaching from farming activities.
- [81] In addition, the risk assessment tool avoids the negativity that has become (rightly or wrongly) associated with the use of Overseer.

¹⁸ Although the CVG risk assessment tool applies to nitrogen only.

- [82] The CVG risk scorecard received positive feedback when engagement occurred and when trialled with industry. Given this, it is my opinion that growers will engage with PC2 once operative, and will apply for consent within the outlined timeframes in PC2. To my knowledge, this level of engagement has not been known to exist with the One Plan by growers since it was first notified in 2007. It is my opinion that this is an important step forward for managing nitrogen loss from CVG within the Region.
- [83] I do not consider that Horizons has to wait for the RIT to become available in order to have an effective risk management approach up and running for CVG in its region – the risk assessment tool fills this role. In addition, the risk assessment tool can always continue to be revised and developed if needed.

I. IMPLEMENTATION

- [84] Currently, Horizons requires a Nutrient Management Plan (**NMP**) as part of an IFLU consent application. NMPs predominately cover the loss of nutrients from a property. I understand that PC2 updates the definition of an NMP, so that it is required to cover all sources of nutrients, sediment, and pathogens (such as *E. coli*). The risk assessment tool is nitrogen focused, and therefore would easily fit within an NMP, including under this new definition.
- [85] The Horizons region will start rolling out the Freshwater Farm Plans (**FFPs**) required by Part 9A of the RMA in April 2024. I understand that consideration has been given to an NMP being incorporated into FFPs, so that duplication can be avoided – particularly, that the definition of NMP amended by PC2 allows for an FFP to be prepared instead of a traditional NMP. I note the definition requires an NMP, where a component to an FFP, to include all sources of nutrients for intensive farming¹⁹ and identify all current and relevant nutrient management practices and mitigations and addresses potential sediment loss and faecal contamination.
- [86] This is positive, as growers and farmers may wish to bypass NMPs entirely and complete an FFP, which encompasses all the required information

¹⁹ Including copies of the input and output files of a recognised nutrient management model used to prepare the plan.

anyway. It also ensures transparency (and enforceability) around the farming activity, and how the nitrogen loss reductions will be achieved on farm.

J. COST ANALYSIS

[87] The cost modelling undertaken by Mr Kerry Mayes has followed the methodology used by Mr Stephen McNally, who prepared the Council-level economic report. This methodology costs eight crop rotations to determine the financial impacts of variations in production costs (including those caused by adoption of GMPs and BMPs). The methodology is described further in the report *Horizons Regional Council – Proposed Plan Change 2: Farm Scale Financial Impact Model*.²⁰

[88] To enable this financial impact assessment I carried out, and provided Mr Mayes with the results of, Overseer crop rotation modelling for each of the eight assessed crop rotations.

[89] The substantive results of the financial impact assessment are discussed in Mr Mayes' evidence.

K. CONCLUSION

[90] Through the adoption of the CVG risk assessment tool, a workable and appropriate controlled activity consenting pathway remains available to growers under PC2. This is consistent with the objective of the plan change.

[91] The CVG risk assessment tool was purposely developed to include GMP and BMP which highly influence nitrogen loss and that have previously been modelled as part of DV-PC2. Therefore, adopting the CVG risk assessment tool is not dissimilar to the 35% reduction pathway. It is simply presented differently. Being based on the same principles – a tool driving on-farm practice change – I am comfortable with the adoption of this tool to result in nitrogen loss reductions from CVG operations.

²⁰ Statement of Evidence, Kerry Mayes, 6 October 2023 at Attachment A.

- [92] Growers would be able to determine high nitrogen risk management practices followed by the adoption of suitable GMP and/or BMP reducing their risk, in a manner which results in good nitrogen loss reductions.

6 October 2023

Dr Anne-Maree Jane Jolly

L. REFERENCES

- Bloomer, D. O'Brien, G. & Postuma, L. 2020. Modelled loss of nutrients from vegetable growing scenarios in Horowhenua: Report for Pattle Delamore Partners.
- Horticulture New Zealand. 2014. Horticulture New Zealand Code of Practice for Nutrient Management.

M. ATTACHMENT A

Agreed List GMPs, BMPs for CVG from joint witness statement for Council-level hearing dated 21 and 22 July 2020.

**Agreed list of GMP and BMP for Commercial Vegetable Growing IFLU from
joint witness statement for Council-level hearing dated 21 and 22 July 2020**

1. GMP soil

- 1.1. Soil type, structure, texture and profile is assessed
- 1.2. Identify site specific risks of each paddock (e.g. soil type, slope, proximity to waterways, critical source areas)
- 1.3. Cultivation of soil when soil moisture conditions are appropriate
- 1.4. Minimise soil tillage as much as practicable
- 1.5. Minimise cultivation passes
- 1.6. Minimise fallow periods between crops
- 1.7. Only cultivate on days when the weather conditions are suitable: not when there are high winds
- 1.8. Planting catch crops in between vegetable rotations where fallow period is more than 12 weeks
- 1.9. Incorporate crop residual where possible
- 1.10. Understand how surface water enters and leaves each paddock
- 1.11. Ensure access ways into paddocks are not at the lowest point
- 1.12. Grassing of buffer strips at the sides of each paddock (1.5 m)
- 1.13. Grassing of buffer strips at the bottom of each paddock (5m)
- 1.14. Retire or actively manage marginal land

2. GMP nutrients

- 2.1. Soil testing for base fertiliser every two years including trace elements, organic carbon and organic matter
- 2.2. Soil testing for nitrogen using quick N test before every planting of crop
- 2.3. Yearly deep nitrogen test (600 mm) to determine the level of residual nitrogen remaining in the soil
- 2.4. Plan fertiliser inputs for each crop taking into account all nutrient inputs (nutrient balance)
- 2.5. Matching soil testing results to plant requirements
- 2.6. Split fertiliser application
- 2.7. Using most suitable types of fertiliser for crops
- 2.8. Applying fertiliser only where it is required, follow instructions for application, avoid waterways
- 2.9. Managed applications of fertiliser taking into account weather and soil conditions
- 2.10. Avoid broadcast fertiliser application where it can be
- 2.11. As much harvestable crop as possible is removed
- 2.12. Fertiliser to be stored and loaded to avoid spillages into waterbodies or transfer into waterbodies
- 2.13. Yearly calibration of fertiliser spreading equipment

3. GMP water and Irrigation

- 3.1. Yearly calibration of irrigators' application rates and uniformity checked
- 3.2. Irrigation applied allows achievement of the yield target for fertiliser applied
- 3.3. On site soil moisture monitoring is conducted on crops that require/prefer 'wet' soils
- 3.4. Irrigation scheduling is tied to the soil moisture monitoring
- 3.5. Irrigation is applied to maintain soil moisture between wilting point and field capacity where possible
- 3.6. Water usage is metered

4. GMP other

- 4.1. Maintain records of activities and applications undertaken
- 4.2. Provide training to all operators: Soil testing, Irrigation and fertiliser equipment
- 4.3. Develop short and long-time environmental objectives

5. BMP soil

- 5.1. GPS map of soil testing locations and use same locations for each soil test
- 5.2. Yearly soil assessment for compaction (e.g. using penetrometer)
- 5.3. Planting or grassing of riparian margins or buffer strips at the sides of each paddock (3 m)
- 5.4. Planting or grassing of riparian margins or buffer strips at the bottom of each paddock (10m)
- 5.5. Implement controlled traffic farming where appropriate

6. BMP nutrients

- 6.1. Soil testing for base fertiliser every year including trace elements, organic carbon and organic matter
- 6.2. Soil testing for nitrogen using quick N test before every nitrogen side dressing
- 6.3. Soil nitrogen quick test results to be calibrated against laboratory testing until confident in field data
- 6.4. GPS monitoring all fertiliser applications: proof of placement
- 6.5. The use of current smart fertilisers where appropriate
- 6.6. Spreadmark accredited fertiliser application contractors are used
- 6.7. Machinery is upgraded to be more efficient/accurate
- 6.8. Leaf tests are conducted to determine nutrient levels in relation to fertiliser plans
- 6.9. Nutrient levels are managed and informed by soil tests to match rainfall/irrigation and yields
- 6.10. Obtain advice from a nutrient advisor or agronomist
- 6.11. Fertiliser plans receive annual audits

7. BMP water and Irrigation

- 7.1. Variable rate irrigation application within the paddock to maximise efficiency where appropriate
- 7.2. Adopt automated irrigation systems that allow more frequent applications of less water
- 7.3. Irrigation efficiency is measurable at greater than 80% (water stays in topsoil)

B. BMP other

- 8.1. Planting of native vegetation in riparian areas where appropriate

