**BEFORE THE COMMISSIONER APPOINTED BY
ENVIRONMENT SOUTHLAND**

IN THE MATTER		of an application for resource consent APP-20211381
BY		**CASHMERE BAY DAIRY LIMITED**
		Applicant

**BRIEF OF EVIDENCE OF MIRANDA JANE HUNTER ON BEHALF OF
CASHMERE BAY DAIRY LIMITED**

DATED 6 MAY 2022

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BRIEF OF EVIDENCE OF MIRANDA JANE HUNTER

BACKGROUND AND QUALIFICATIONS:

1.   My name is Miranda Jane Hunter. I hold a Bachelor of Agricultural Science Degree from Lincoln College. I am member of the New Zealand Institute of Primary Industry Management and have been involved in the dairy industry in consultancy, practical farming and dairy industry leadership roles since 1986.

2.   I am qualified to complete farm systems appraisals. I have developed my skills through 30 plus years working in dairy farm systems. This level of experience has been recognised nationally and internationally through judging roles, senior leadership roles and consultancy contracts.

3.   I have completed the Sustainable Nutrient Management Courses, (Intermediate and Advanced) and am a Certified Nutrient Management Adviser (certified in 2014). I have also completed a course in Greenhouse Gases and am a certified Greenhouse Gas Advisor (certified in 2019).

4.   I am a Director and Shareholder of South Coast Dairies Limited which owns and operates a 135 ha dairy platform in Southland. My involvement with this property, with my other business partners, has been to develop a sustainable farming business in all facets, including environmental. The business has been awarded several environmental awards including winner of the 2011 Environment Southland Farming Award.

5.   I was previously employed by DairyNZ as Regional Leader for the Southern South Island. In this role I lead the extension team (of Consulting Officers) working with dairy farmers to achieve adoption of new practices and technologies on farm (including environmental).

6.   I resigned from DairyNZ in June 2012 and I am now self employed as a Farm Consultant (trading as Roslin Consultancy Limited). I work with dairy farmers throughout Southland and Otago supporting them in analysing the environmental impact of their farm systems and improving their on farm management to meet their environmental goals. I also undertake environmental projects (contracted by Industry and Government Agencies) supporting the development of good practice resources for farmers and Overseer modelling to analyse effectiveness of mitigation practices at farm scale.

7.   I have read the Code of Conduct for Expert Witnesses within the Environment Court Consolidated Practice Note 2014 and I agree to comply with that Code. This evidence is within my area of expertise, except where I state I am relying on what I have been told by another person. To the best of my knowledge, I have not omitted to consider any material facts known to me that might alter or detract from the opinions I express.

SCOPE OF EVIDENCE

8.   This evidence addresses the following matters raised in the s42a report:

(a)   Clarification of Overseers ability to model GMP / mitigation in section 3.3.2.1

(b)   Commentary around the use, uncertainty, and accuracy of the Overseer model in light of the Government's Science Advisory Panel's review

BACKGROUND

9.   Cashmere Bay Dairy Limited operate three adjoining blocks:

• Milking platform – 353 ha total (344.4 ha effective)

 • Support block 1 – 89.6 ha total (89.6 ha effective)

• Support block 2 – 80.3 ha total (76.5 ha effective)

10.   It is intended to integrate the current milking platform and support block 2. Support block 2 is located in close proximity to the farm dairy and aligns well with the milking platform. Currently support block 2 is utilised as dairy support (predominately wintering). Milking on support block 2 would allow wintering to be spread across the entire area (current milking platform and support block 2) to allow a more sustainable crop rotation. The use of support block 1 would not change significantly.

11.   The following nutrient budgets have been completed as part of this application:

Nutrient budgets the current farm system:

- Milking platform 19/20

- Support block 1 19/20

- Support block 2 19/20

Nutrient budgets for the proposed farm system:

- Proposed milking platform (incorporating the existing milking platform and support block 2)

- Proposed support block 1

12. The nutrient budgets were prepared using "Overseer Best Practice Data Input Standards, March 2018". No deviations from these protocols were made during the modelling assumptions. Farm systems information was provided by George Raymond on behalf of the Cashmere Bay Dairy Limited.

13. Soils areas were obtained from soils mapping provided by OverseerFM and soils settings from SMap. Climate settings were obtained from the Overseer climate station tool. This approach has been consistent throughout all of the nutrient budgets completed. All assumptions have been discussed in detail with the applicant. The applicants display a good level of understanding of the inputs and assumptions that have been used.

14. <u>Cashmere Bay Dairy Limited – OverseerFM Modelling, 20th August 2021[1]</u>

(a) Overseer modelling was completed using Overseer version 6.4.0. Summarised results from this modelling are in Table 1 and estimate a decrease in N loss (8.7%) and P loss (5.2%).

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[1] *Cashmere Bay Dairies Limited – OverseerFM farm system modelling to support a consent application for expanded dairy – 20th August 2021, Miranda Hunter, Roslin Consultancy Limited*

Table 1.

Predicted nitrogen and phosphorus losses in the current and proposed systems under Overseer version 6.4.0

	Milking Platform 19/20	Support 1 19/20	Support 2 19/20	19/20 Total
Total Farm N Loss (kg N / yr)	18053	2186	3760	23999
N loss per ha (kg N / ha / yr)	51	24	47	
Total Farm P Loss (kg P / yr)	333	32	40	405
P loss per ha (kg P / ha / yr)	0.9	0.3	0.5	
Pasture Grown (t DM / ha)	17.1	15.1	13.8	

	Proposed Milking Platform	Proposed Support 1	Proposed Total	Difference Between 19/20 and Proposed
Total Farm N Loss (kg N / yr)	19563	2344	21907	8.7% decrease
N loss per ha (kg N / ha / yr)	45	26		
Total Farm P Loss (kg P / yr)	357	27	384	5.2% decrease
P loss per ha (kg P / ha / yr)	0.8	0.3		
Pasture Grown (t DM / ha)	16.3	14.4		

(b)   The reductions in Nitrogen and Phosphorus losses estimated above are the combined effect of a number of changes to the farm system . The key drivers

to the estimated changes in nutrient loss between the current 19/20 season and the proposed farm system are as follows:

(i)   Increase in milking cow numbers

(ii)   Reduced nitrogen fertiliser use

(iii)   Removal of beef animals

(iv)   Reducing the farm Olsen P to 30

(c)   Council commissioned Irricon to complete a Nutrient Budget Review[2]. The review was completed by Irricon on the 29th of October 2021. The review concluded the modelling was completed with an **adequate** level of robustness for the current Overseer modelling and a **high** level of robustness for the proposed Overseer modelling.

(d)   The Irricon Nutrient Budget Review raised two points for further explanation (refer page 11 of the review):

Please explain why:

(i)   The numbers of animals wintered have increased from 1210 (1000 cows + 210 yearling heifers) in YE 2020 models to 1460 (1195 cows and 265 yearling heifers) in the Proposed models. This is a 17% increase in numbers over June/July.

(ii)   How the Olsen p levels will drop allowing the P fertiliser applied slightly exceeds maintenance P requirements.

My explanation to these points was included in a wider Section 92(1) response which is included below in paragraph 14 (iii) and 14 (iv)

SECTION 92(1) REPORT

15.   A request for further information under Section 92(1) of the Resource Management Act 1991 was received dated 22nd November 2021. A response to this was provided from Landpro, dated 19th January 2022.   Points raised in that request specifically relating to the nutrient budgets were as follows:

(i)   *Discussion on how the proposed activity will affect the future state of the environment. In particular, with regard to N losses and comparison*

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[2] *Overseer Nutrient Budget Review for Environment Southland – Cashmere Dairies Ltd, Irricon 29th October 2021*

between the existing activity continuing (with required synthetic N cap) and the proposed activity occurring.

Response:

Overseer modelling has been completed for the 20/21 season for all blocks. The 20/21 season reflects a transition to lower nitrogen fertilizer use, as required of the NESF to reduce nitrogen fertiliser use to no more than 190 kg N/ha, thus taking into account the required reduction in nitrogen. Results from the 20/21 season Overall, between the proposed farm system and the 20/21 season (that reflects a decrease in nitrogen fertilizer use), N loss decreased by 5% and P loss by 12%.

(ii) *The application states that there is a decrease in (cow) stocking rate, however the nutrient budgets show that there is an overall increase in stocking rate (RSU) on both the proposed dairy platform and the Support Block 1, from the existing operation (dairy platform + support block 2, and support block 1, respectively) to the proposed activity. Please confirm if this is correct.*

Response:

The RSU increases from 13,985 to 15,030 (an increase of 7%) is driven by the increase in dairy cow numbers, and the removal of beef animals. As covered in the original report overall nutrient loss reduction is driven by multiple factors.

(iii) *Address the concerns regarding the Proposed model raised by the Nutrient Budget auditor in the attached Irricon review.*

Original Irricon point - *The numbers of animals wintered have increased from 1210 (1000 cows + 210 yearling heifers) in YE 2020 models to 1460 (1195 cows and 265 yearling heifers) in the Proposed models. This is a 17% increase in numbers over June/July.*

Response to above point - There are errors in the above calculation, it should read ~~1210~~ 1420 (1000 cows + ~~120~~ 210 yearling heifers + 120 yearling steers + 90 2 yr old steers) in YE 2020 models to 1460 (1195 cows and 265 yearlings) in the proposed.

    (iv)   Original Irricon point - *How the Olsen p levels will drop allowing the P fertiliser applied slightly exceeds maintenance P requirements.*

    Response to above point - Phosphorus has been applied as per maintenance requirements.

OVERSEER VERSION CHANGE

16.   On the 7th of April 2022, after the consent was lodged, Overseer released a new version (6.4.3). As is typical with Overseer version updates, this resulted in changes (shown in red in table 2) to the estimated losses of N and P from the current and proposed systems. No changes were made to modelling inputs.

Table 2.

Predicted nitrogen and phosphorus losses in the current and proposed systems under Overseer version 6.4.3

	Milking Platform 19/20	Support 1 19/20	Support 2 19/20	19/20 Total
Total Farm N Loss (kg N / yr)	~~18053~~ 18537	~~2186~~ 2282	~~3760~~ 4151	~~23999~~ 24970
N loss per ha (kg N / ha / yr)	~~51~~ 53	~~24~~ 25	~~47~~ 52	
Total Farm P Loss (kg P / yr)	333	32	40	405
P loss per ha (kg P / ha / yr)	0.9	0.3	0.5	
Pasture Grown (t DM / ha)	17.1	15.1	13.8	

	Proposed Milking Platform	Proposed Support 1	Proposed Total	Difference Between 19/20 and Proposed
Total Farm N Loss (kg N / yr)	~~19563~~ 20059	~~2344~~ 2453	~~21907~~ 22512	~~8.7~~ 9.8% decrease
N loss per ha (kg N / ha / yr)	~~45~~ 46	~~26~~ 27		
Total Farm P Loss (kg P / yr)	357	27	384	5.2% decrease
P loss per ha (kg P / ha / yr)	0.8	0.3		
Pasture Grown (t DM / ha)	16.3	14.4		

17.   I note that in the s42A report, section 3.3.2.1 that Ms McRae has not raised any further concerns regarding the appropriateness and robustness of the Overseer modelling completed. Furthermore, I note that no further audits of more recent nutrient budgets have been requested by Ms McRae.

GOOD MANAGEMENT PRACTICES AND MITIGATIONS

18. Section 3.3.2.1 in the s42A report provides table 6, detailing good management practices (GMPs) and mitigation measures which have either occurred or are proposed to be undertaken on farm.

19. The allocation of two practices as a mitigation measure or a GMP (table 6 of the s42A report) require clarification or are incorrect. Specifically, these practices (referenced from table 6 of the s42A report) are:

Mitigation / GMP	Implementation timeframe	Mitigation measure or GMP?
Catch crop	To be used on an as required / where practical basis	**Mitigation measure**
Reducing Olsen P levels to 30	From first exercise of new consent	Good management practice

20. With regard to the use of catch crops, the 6.3.3.2.1 of the s42A report states the following:

"Catch crops is another measure that the applicant has offered to mitigate N losses to water. However, the applicant has also stated that it will only "use catch crops on an as required/where practicable basis." This suggests the applicant is not considering including this measure in consent conditions nor has it offered a condition regarding catch cropping. Therefore, I have placed less weight on this mitigation to avoid, manage or remedy the adverse effects due to the uncertainty of it occurring when excess nitrogen is available in the deep draining soils. Considering the landholding is approximately 80% deep draining and 20% overland flow, I consider the property suitable for catch crops post annual intensive winter grazing on any of the deep draining soils."

21. For clarity it should be noted that catch crops have not been included in the Overseer modelling.

22. Mitigation achieved by the use of catch crops (also known as crop sequencing) in a Canterbury trial[3] reduced nitrogen leaching losses by 25 to 30%. Critical requirements to achieve a successful catch crop and thus mitigation were found to be:

- Soil conditions

- High utilisation of previous crop

- Sowing date of catch crop

23. I am not aware of Southland specific trial data for catch cropping. It is my opinion that the use of catch cropping would achieve a significant mitigation of nitrogen losses (in the right soil conditions at the right time). However the mitigation is unlikely to be at the level achieved in Canterbury due to the difference in soil types and the soil temperatures in the early spring period.

24. Any mitigation achieved from catch cropping will be in addition to the Overseer modelling provided in the application for this property.

25. With regard to reducing the Olsen P levels to 30, Phosphorus is an essential macro nutrient for the successful growth of pasture and crops and Olsen P is a measure of the plant available phosphorus in the soil. In simple terms Overseer estimates a higher loss of phosphorus as the Olsen P increases.

26. Target Olsen P links to pasture production. Overseer estimates that the pasture grown on this property is between 14 and 17 t DM (depending on the block). This property is performing at a high level of pasture production as is evidenced by it being well above district average milk production (19/20 milk production was 1424 kg ms / ha compared with the Gore average for 19/20 of 1022 kg ms / ha[4]). It can be concluded that some of this higher milk production is a result of higher than average pasture production which in part is due to good soil fertility.

27. The target Olsen P ranges for a dairy farm on sedimentary soils is 20 to 40, with the target Olsen P for a high performing dairy farm at 35 to 40[5].

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[3] Winter sequence cropping kale and oats on winter support land for increased production and reduced nitrogen leaching, DairyNZ

[4] *New Zealand Dairy Statistics 2019-20, LIC and DairyNZ*

[5] *Fertiliser Use on New Zealand Dairy Farms, Third Edition, Fert Research*

28. It should be noted that soil tests were taken in June 2021 by Ballance Agrinutrients had an average Olsen P of 39 across the property.

29. Constraining Olsen P to 30 (and thereby reducing phosphorus loss from soil) is likely to have an impact on pasture growth on a high performing farm and therefore in my opinion should be considered a mitigation.

OVERSEER UNCERTAINTY, LIMITATIONS AND ASSUMPTIONS

30. Section 3.3.2.1 in the s42A report states the following;

"In light of the Government's Science Advisory Panel's review of the effectiveness of Overseer in assessing and predicting farm-scale nitrogen losses, and the conclusion that the current Overseer model is not fully fit for purpose in the way it is being currently used in the consenting process, mitigation measures are of the utmost importance when assessing this application."

31. It is my opinion it is appropriate that Ms McRae has sought further mitigation measures outside of Overseer. However, Overseer used in the correct way does provide relativity in comparing between two scenarios.

32. The following steps were taken during the modelling process to minimise the impact of uncertainties:

(a) Adherence to Best Practice Data Input Standards (BPDIS)

(No deviations to BPDIS were made, no work arounds required)

(b) Use of Overseer is within the model's parameters (for soils, climate and farm system)

(Standard approach)

(c) Method and consistent methodology between scenarios

(Standard approach)

(d) Site visit to cross check information

(Standard approach - Understanding the property and the management blocks is critical to blocking in Overseer)

(e) Blocking completed taking into account land use, management systems, soils, topography and enterprise

(Standard approach – consistent with BPDIS)

(f) Consistency in modelling between the current and proposed files (Standard approach - "apples with apples")

(g) Expertise, experience and qualifications of the user

(Standard approach - Certified Nutrient Management Adviser and Dairy Farm Systems Expertise)

(h) Outputs are reviewed against expected results relative to soils, climate, land use and inputs

(Standard approach – reviewed against previous modelling results and research trials)

(i) Overseer files are internally peer reviewed (for adherence to BPDIS, feasible farm systems and data entry)

(Standard approach - Certified Nutrient Management Adviser and Dairy Farm Systems Expertise)

33. The use of Overseer as a modelling tool is recognised in the Proposed Southland Water and Land Plan (PSWLP). Appendix N (of PSWLP) indicates that the latest version of the Overseer model (or an approved alternative model) should be used on properties over 20ha or when a material change in land use occurs. As far as I am aware no alternative to Overseer has been approved by Environment Southland to date.

34. Uncertainty around Overseer model estimates tends to be lower within the range of the calibration data set i.e. where we have the most information. Most of the calibration data used to date is focused on flat, pastoral, dairy enterprises, with primarily free-draining soils and moderate rainfall. Pastoral farms in the Waikato, Southland, Canterbury and Manawatu, form the OVERSEER calibration data set. Consistency in modelling when developing scenarios is a key to creating equivalence in uncertainty. When scenarios are compared focus should be on the difference in estimated outputs, rather than absolute numbers.

35. In July 2021, a report "Overseer whole model review – assessment of the model approach" was released by[3] the Science Advisory Panel for the Ministry for the environment. The report raised concerns that Overseer:

(a) Assumes a steady state system when farm systems are in reality dynamic

(b) Assumes average climate data and therefore cannot model episodic events

(c) Uses monthly time steps

(d) Does not balance mass

(e) Does not account for variation in water and nutrient distribution through the soil profile

(f) Does not adequately accommodate deep rooting plants

(g) Focuses on nitrates (and omits ammoniacal N and organic matter)

(h) Is not spatially explicit with regards to surface water, nutrient transport and critical landscape factors

36. The government responded to the Science Advisory Panel report described in the previous paragraph in August 2021. The government identified four options to address the concerns raised in the report including the creation of a *new risk index tool,* development of a next generation Overseer, to have greater use of *controls on practices and inputs* to manage nitrogen loss or a completely new approach to managing and understanding diffuse nutrient loss risk. I note that, of the options given by the government, only the option of *greater use of controls on practices and inputs* is available to regulators currently.

37. The recommended consent conditions proffered by Environment Southland in the s42A report include both Overseer output figures and farm system input parameters. The farm system input parameters that have been recommended as conditions of consent include those identified as key reasons for a nutrient loss reduction in the proposed system, that is

(i) Stock numbers (for all ages / classes of stock)

(ii) Area of land to be winter cropped

      (iii)   Olsen P to 30 (recommend range of 28 to 32 due to testing variance)

      (iv)   Use of calving pad

      (v)   Effluent area and method of application

38.   Applying Overseer output figures and farm system input parameters , combined with mitigations outside of Overseer are well established methods to reduce contaminant loss to water.

CONCLUSION

39.   Reduction in the Olsen P should be considered a mitigation

40.   Overseer modelling uncertainties, assumptions and limitations are acknowledged, and steps have been taken to minimise the impact of these factors.

41.   Modelling using Overseer version 6.4.3 estimate that losses of Nitrogen and Phosphorus would decrease by 9.8% and 5.2% respectively.

Miranda Hunter

6th May 2022