OVERSEER Nutrient Budget review

For: Environment Southland – South Pro Maitland

Sense Check -3rd April 2019

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Introduction

1. Regarding the consent application for South Pro Maitland, I have reviewed the following OVERSEER ® Nutrient Budget (OVERSEER) files:
   a) South Pro Maitland Ltd-Proposed -V2
   b) South Pro Maitland Ltd-Proposed -V3

2. Along with the files I have reviewed the following accompany reports:
   - Revised Nutrient Budget Summary Report for App-20181917 South Pro Maitland Ltd – Proposed-V3 prepared by: Nouman Kyamanywa, Ravensdown, January 15, 2019.

3. I have completed a robustness check on the files for sensibility based on data available and checked to ensure the modelling aligns with the OVERSEER Best Practice Data Input Standards for v6.3.0.

4. It must be assumed that the information provided in the OVERSEER files that the current farming system as modelled is a viable farming system, using actual stock and fertiliser inputs. Therefore, the current scenario is also assumed to be appropriate for the location and climate.

5. A 'sensibility test' has been undertaken on the South Pro Maitland Ltd nutrient budget V3 with the following five output screens from OVERSEER forming the basis of the determination of the robustness of the nutrient budget:
   a) Is the nutrient loss consistent with what you would expect for an operation of this type and soils in this location?
   b) Does the summary of inputs and outputs make sense? Especially clover fixation and change in block pools?
   c) Check the 'Other values' block reports for rainfall, drainage, and PAW
   d) Select the Scenario reports other values and check the production and stocking rate
   e) Select the pasture production in the scenario report and check pasture growth.

6. Answers to each of these five points will be provided further in this report and then a final determination of the robustness of the nutrient loss to water will be provided at the end of this report.

OVERSEER AUDIT

Appropriateness of the Overseer inputs

1. The XML files stated in paragraph 1 of this report have been reviewed for consistency between the files and appropriateness of the inputs regarding the farming systems and the Overseer Best Practice Data Input Standard (BPDIS).

2. I concur that there is no deviation from the BPDIS. Only comment here is that under Farm Scenario/Report Settings - should select 'Typical Dairy Farm' for farm type for benchmarking data and GHG emission report units, CO2 Equivalents. No impact on N loss.

3. The model has 205.7 ha total area with 194.5 ha effective. There is an increase in supplement imported to account for the increase in pasture intake and decrease in nitrogen fertiliser applied (explained on page 2 and in table1 of the report produced by Ravensdown.

4. Reviewing the NZ Dairy statistics for the 2017/2018 season, shows the milk solids production on this property is in higher than the Southland regional average of 408 kg MS/cow. The stocking rate is also higher than the Southland average for the 2017/2018 season of 2.64 cows/ha. No change in milk production or stocking rate between V2 and V3 of proposed scenarios.

Table 1: Summary of Production and stocking rate

	Proposed V2	Proposed V3
Total Ha	205.7	205.7
MS kg/ha grazed	1507	1507
MS kg MS/cow	426.2	426.2
RSU	5536	5536
Lactation Length	268	268
Cows/ha	3.5	3.5
Cows June	150	150
Cows July	150	150
N lost kg/ha/yr	49	48

5. There has been no change to crop details when comparing V2 and V3 proposed scenarios (as seen in table 2 below).

Table 2: Crop Details

	Proposed v2	Proposed v3
Effective Ha	11	11
Yield (tDM/ha)	25	25
Mole/Tile System (% area drained)	18	18

6. An extra 60 tDM of supplements has been imported in Proposed V3 when compared to proposed V2 (see Table 3a below). The proposed V2 Overseer model shows the pasture production 12.37 tDM/ha and the proposed V3 scenario is predicting 12.06 tDM/ha or a 0.31 tDM decrease in pasture production (see Table 3a below) with no change in N fertiliser applied.
7.

Table 3a: Supplements imported and Harvested

	Proposed V2	Proposed V3
Supplements Imported (tDM)	530	590
Supplements Imported (tDM/ha)	2.72	3.03
Effective Area (ha)	194.5	194.5
RSU/ha	5536	5536
N Fertiliser applied (kgN/ha)	246	246
Pasture Intake (tDM/ha)	12.37	12.06
Silage Harvested to storage (tDM)	69	69

8. The increase in supplement imported has average N used over the last 5 seasons has been 264 kgN/ha and the proposed V3 is predicting using 246 kgN/ha or a 0.18 tDM/ha decrease in potential pasture grown through a decrease in N proposed. The supplement used for the last 5 seasons averaged 2.13 tDM/ha and the proposed V3 is predicting using 3.03 tDM/ha or 0.8 tDM/ha increase in supplement used. Based on this information, the proposed V3 scenarios' increase in pasture intake has been justified by the increase in supplement imported (is a difference of 0.08 tDM/ha which I believe is within the limitations of Overseer Modelling).

Table 3b: Comparison of actual and proposed feed availability

(tDM/ha)	Average last 5 season	Proposed V3	Difference
Pasture Intake	11.26	12.06	0.8
Supplements Imported	2.13	3.03	0.9
Pasture Growth from N fertilizer*	2.64	2.46	-0.18

**Pasture growth from N fertilizer have assumed an average 10:1 response*

9. The N lost to water has decreased slightly between proposed V2 and proposed V3 (see Table 4 below). The P loss has remained relatively unchanged. It must be assumed that the information provided in the proposed farming systems are modelled as a viable farming system, using actual stock and fertiliser inputs and are also assumed to be appropriate for the location and climate.

Overseer Outputs

Table 4: OVERSEER outputs

Overseer v6.3.0	Proposed V2	Proposed V3
N lost to water kg/ha/yr	49	48
Total N lost kg/farm	9979	9839
P lost kg/ha/yr	1	1
Total P lost kg/farm	199	199
Other sources – N	441	442
Other sources – P	87	86

Change in block pools

10. Overall there is no significant difference in the change in block pool values between the 2 proposed scenarios for both N and P (Tables 5 and 6).

11. It appears N is potentially being immobilized. This is observed with a positive value in the Organic pool for N. This value remains similar between both models.

Table 5: Change in block pool (N)

	Proposed V2	Proposed V3
Plant Material	-14	-14
Organic Pool	118	122
Inorganic Material	0	0
Inorganic Soil Pool	4	4

Table 6: Change in block pool (P)

	Proposed V2	Proposed V3
Plant Material	-3	-3
Organic Pool	11	12
Inorganic Material	2	2
Inorganic Soil Pool	6	7

Rain/clover N Fixation

12. The Biological fixation for the proposed V2 is greater than proposed V3 (see table 7 below).

13. Average N added to both the proposed scenarios is 246 kg N/ha/yr.

14. The small decrease in biological fixation in proposed V3 will likely be due to the increase in supplement imported. This is deemed to be an acceptable variance and within the limitations of the model.

Table 7: Biological fixation

	Proposed V2	Proposed V3
Biological Fixation	34	30
Average N applied to whole farm kg/ha/yr	246	246

Pasture Production

15. The effluent N inputs remain constant between the proposed scenarios (see table 8 below).

16. Fertiliser inputs of N are consistent between the 2 proposed models.

17. Pond solids and solids from the wintering pad area applied to the non-effluent blocks only in both models. Liquid effluent is only applied to the effluent block in both models using a low application method.

18. Long term pasture growth in Southland between 1979 and 2012 indicated that average pasture growth for newer pastures was 12.7T DM/ha/yr. The pasture production on this property is slightly lower than the long-term growth, even taking into consideration pasture production from added N.

Table 8: Pasture production and N inputs (fertiliser and effluent)

	Proposed V2	Proposed V3
Effluent Area (ha)	68.4	68.4
Pasture Growth (tDM/ha/yr)		
Effluent	16.4	16.0
Non-Effluent	15.5	15.1
N Fertiliser inputs (kg/ha/yr)		
Effluent	252	252
Non-Effluent	287	287
N Effluent Inputs (kg/ha/yr)		
Effluent	36	36
Non-effluent (includes solids)	16	16
Total N Inputs (kgN/ha/yr)		
Effluent	288	288
Non-Effluent	303	303

Mitigations Modelled

19. The table below outlines the changes made to proposed V2 to meet shortfall in feed requirements shown in proposed v3. The table below outlines these changes and indicates if they are accurately modelled.

Table 9: Mitigation option for proposed V3

Increase in supplements imported	Yes, an extra 60 tDM of supplements have been imported

20. The changes made are robust and have shown a reduction in N loss.

CONCLUDING COMMENTS

Determination of the robustness of the nutrient loss to water

21. The questions below were described at Paragraph five of this report. Whilst these have been answered throughput this report, this section summarizes the answer to each question to make an overall conclusion about the robustness of the nutrient budgets.

Is the N loss consistent with what you would expect for an operation of this type and soils in this location?

22. Based on my experience, the N loss estimates are reasonably consistent with an operation of this scale and soil types present.

Does the summary of inputs and outputs make sense? Especially clover fixation and change in block pools?

23. There is no significant difference in the change in block pool values between proposed V2 and proposed V3 models presented for both N and P.

24. There is a decrease in biological fixation in the proposed V3 scenario. This corresponds with an increase in supplement imported. Clover and pasture inputs are the same the 2 scenarios.

25. It is not apparent from reviewing the Overseer technical manuals or the nutrient budgets if the difference in pasture production, supplement imported and N fertiliser use accounts for all the increase in biological fixation.

Check the 'Other values' block reports for rainfall, drainage, and PAW

26. The rainfall and soil information have been entered based on protocols for the location and soil type selected.

Production and stocking rate

27. Based on my experience as well as reviewing NZ Dairy statistics for the 2017/2018 season the stocking rate and milk solid production are higher than the Southland Region average in the 2017/2018 season. The proposed V3 is justified as is the same as proposed V2.

28. The milk solids production per cow on this property at 426.2kg MS/cow/year for the 2 proposed models is higher than the Southland regional average of 408kg MS/cow.

29. The stocking rate is also higher than the Southland average for the 2017/2018 season of 2.64 cows/ha.

30. It is assumed that since proposed scenarios are based on year end information that both scenarios represent viable production and stocking rate.

Select the pasture production in the scenario report and check pasture growth.

31. A detailed explanation of the pasture production has been outlined in the above sections.

32. There is a decrease in pasture production between the proposed V2 scenario and the proposed V3 scenarios and a corresponding increase in supplement being imported.

33. There is a very small shortfall of either supplement imported and/or nitrogen applied to cover the extra pasture production proposed but is within the limitations of Overseer modelling.

34. I have assumed an adequate level of robustness around the proposed Overseer Modelling as it is based on an actual farming system, and with that, I have assumed actual stock and fertiliser inputs used.

35. The data input protocols have been followed for both scenarios with no deviations. This leads to a high level of robustness for the relevant input data for example, climate, soils, and pasture type.

36. Based on the results of this 'Sense Check, I consider that the robustness of the nutrient loss estimates of the proposed scenario V3 to be **high**.

References:

New Zealand Dairy Statistics 2017/2018. Produced by LIC and DairyNZ 2018. https://www.dairynz.co.nz/media/5790451/nz-dairy-statistics-2017-18.pdf
Overseer Definition of Terms, previously Technical Note 6. May 2016
Overseer Technical Manual – Characteristics of Pasture, April 2015

Smith. L. C. 2012. Proceedings of the New Zealand Grassland Association 74: 147-152 (2012) *Long Term pasture growth patterns for Southland New Zealand: 1978-2012*. www.grassland.org.nz/publications/nzgrassland_publication_2284.pdf