

BEFORE THE HEARING PANEL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of proposed Plan Change 2 for the One Plan

**JOINT WITNESS STATEMENT OF EXPERTS
FARMING AND GROWING MANAGEMENT PRACTICES**

12 August 2020

INTRODUCTION

1. This joint witness statement relates to proposed Plan Change 2 (PC2) of the One Plan and is on the topic of Farming and Growing Management Practices.
2. It follows on from expert conferencing on 21-22 July 2020 where the experts met to discuss (among other things) the on-farm practicability and N leaching loss benefits of 'good management practices', 'best management practices', and the merits of 'additional innovations' in minimising N leaching loss. This Joint Witness Statement should be read in conjunction with the previous Joint Witness Statement of 21-22 July 2020.
3. The expert conferencing was held 12 August at Palmerston North.
4. Attendees at the conference were:
 - (a) **Dr Jane Chrystal;**
 - (b) **Adam Duker;**
 - (c) **Dr Paul Le Miere;**
 - (d) **Dr David Horne;**
 - (e) **Stephen McNally;**
 - (f) **Dr Anne-Maree Jolly;**
 - (g) **Stuart Ford;**
 - (h) **Jack Feltham;** and
 - (i) **Dr Iain Kirkwood.**

CODE OF CONDUCT

5. We confirm that we have read the Environment Court Practice Note 2014, and in particular Appendix 3 – Protocol for Expert Witness Conferences, and agree to abide by it.

PURPOSE AND SCOPE OF CONFERENCING

6. Following the provision of further information (as explained in the attached agenda) the purpose of conferencing was to revisit earlier questions posed to the experts relating to farming and growing management practice issues. This included consider the matters previously recorded as reservations within

the Joint Witness Statement dated 22 July 2020. In addition there have been questions for the experts tabled as part of the RMA planning conference.

7. The scope of the issues covered at this resumed conference included:

(a) Farming and Growing management Practices

KEY FACTS AND ASSUMPTIONS

8. [None]

METHODOLOGIES AND STANDARDS

9. [None]

AGREED ISSUES

10. Refer to Annexure A.

DISAGREEMENT AND REASONS

11. Refer to Annexure A.

PRIMARY DATA

12. [None]

RESERVATIONS

13. [None]

Date: 12 August 2020

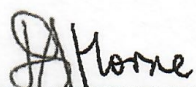

Dr Jane Chrystal

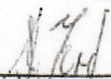

Adam Duker

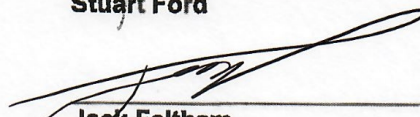

Dr Paul Le Miere

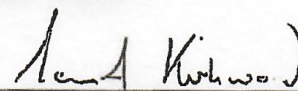

Stephen McNally


Dr Anne-Maree Jolly


Dr David Hojne


Stuart Ford


Jack Feltham


Dr Iain Kirkwood

ANNEXURE A

In the matter of Proposed Plan Change 2

Expert conferencing – Farming and Growing Management Practices (12 August 2020)

Issue	Statements	Agreed Position	Disagreements, with reasons
1. What is the range of good management practices for intensive farming land use activities within Horizons region? (as defined by the One Plan). Specifically, for: a) Dairy farming b) Commercial vegetable growing c) Cropping d) Intensive sheep and beef farming	Good Management Practices is what all farmers are expected to be doing now. Dairy AMJ: All points 1 - 7 (inclusive) on proposed list of GMP from D Horne is considered GMP, excluding winter cropping that would change to reduced area without increasing livestock intensity. Commercial Vegetable Growing (CVG) Cropping is analogous of CVG – no changes. SF: CVG as discussed on 21-22 July has not changed. AMJ: WSP modification: Grass buffer strip has changed for GMP (1.13) bottom of paddock has decreased to 3 metres. Side buffer is not expected where the same crop is continuous in adjoining paddocks and there is no different adjoining land use.	All agreed Agreed – JC, DH, AMJ, JF	GMPs as discussed on 22 July, have not changed. – PLM, SF, AD Justification – some of these are encroaching into BMP Abstaining – IK, SMC

Issue	Statements	Agreed Position	Disagreements, with reasons
	Intensive Sheep and Beef JC: A lot of dairy principles apply to intensive sheep and beef farming, but additional list provided of high risk activities (for intensive areas only). (see Appendix 1) Initial assessments indicate that in Horizons region, intensive drystock farming irrigation area is generally rolling, flat, easy hill, sand country – primarily around Bulls (400ha) and Foxton (50ha). JF: Farming operations receiving Municipal Wastewater is unlikely to comply with nutrient and irrigation GMPs, in particular, point 6.2 of D Horne's list and points 11 & 12 of JC's list.	All agreed, within areas of expertise D Horne agrees Outside expertise of others	
2. What management practices are considered to be 'best management practice' or 'additional innovations' for each of the above listed intensive farming land use activities within the Horizons region?	Commercial Vegetable Growing SMc: – no changes to definition of BMP. AMJ: WSP modification: Grass buffer strip has changed for BMP (5.4) bottom of paddock has decreased to 6 metres. 5.3 is removed completely. Already covered by GMP. No recommended changes for cropping / arable. Sheep & Beef: JC: Changing farming system – reducing/eliminating cash cropping and/or irrigation, changing stocking policy (less cattle, more sheep) Eliminating winter grazing (fodder crops) (if it was a situation where it was the main enterprise on the property). Breeding/genetics – faster growing animals, animals that are more efficient at converting N in feed to product.	SF, AMJ, SMC, IK, DH agree. Outside expertise of others. JC, PLM, DH, AMJ, SMC, SF, JF agree Outside expertise of others.	

Issue	Statements	Agreed Position	Disagreements, with reasons
	DH: For majority of farmers (60%) should be able to comply, 10kg per ha reduction needs to be achieved. Dairy: Based on DH modelling, with implementation of GMP and BMP practices in the list discussed Questions 1 & 2 above, the majority of dairy farmers who are required to reduce, in general, should be able to reduce N leaching by approximately 10 -20%, depending on starting point. AD: For farms operating close to GMP, little reduction can be made from GMP. Implementation of BMP has seen a range of 0 – 35% reduction with an average of 8% for 161 restricted discretionary consented farms. The implementation for consented farms considered both management and economics at farm level. CVG: WSP Modelling has advanced. For mixed crop vegetable rotation examples, (Bloomer), for GMP the range of N reduction is 36 – 94%. For BMP, the reduction is 55 – 94% over two years, from a 2014 baseline, with very little previous GMP implementation.	No agreement or disagreement on these statements, as they relate to dairy and CVG and there has been no opportunity to review the modelling so cannot comment.	
4. Should any of the GMPs, BMPs or additional innovations identified under (a) and (b) above be specified as minimum requirements for achieving consent under PC2?	Irrespective of where the IFLU sits in relation to a consent process, you would expect all IFLU to have a Nutrient Management Plan – this is the only practice identified in Q.1 and Q.2 that is a minimum requirement across all IFLU. All other practices would be specific to the individual farm.	All agreed.	
5. What are the merits and disadvantages of including a list of agreed minimum GMPs or BMPs in the	Definition should include good management practice and best management practice, separately. PLM: A toolbox that would change over time	All agreed	

Issue	Statements	Agreed Position	Disagreements, with reasons
	Stand-off pad for winter or periods of bad weather (issues with pasture-fed image and marketing) Bioreactors and constructed wetlands Fence off unproductive areas and retire Dairy: BMP new additions to the list: Remove winter crops Breeding and genetics 12.1 would fit better under 13. Add to this list items 13 - 13.1 on D Horne's list, Appendix 2, with amended wording "A consideration / analysis of the following options 13.1– 13.4". Additional innovations across all IFLU can include 14.1-14.7 on D Horne's list (Appendix 2) with a new 14.8 – change to land use. BMP will continue to be an evolving list and some of these new innovations will move in priority through the incorporation into OVERSEER.	All agreed. IK – outside field of expertise.	
3. What range of on-farm N loss reduction should be expected to result from implementation of the (agreed above) GMPs and BMPs and additional innovations in the targeted water management sub-zones?	Experts do not consider that they can at present address this. Many experts are working on this currently and will emerge from further work streams of modelling. JC: Farm case study required due to small numbers. Upon implementation of BMP, expected percentage reduction cannot be defined unless all of the farm is irrigated. Modelling has been undertaken by DH, SMC and AMJ, in respect of dairy and CVG.	All agreed	

Issue	Statements	Agreed Position	Disagreements, with reasons
proposed definition of 'good management practices'?	AD: It still needs to be a consideration of matters and not a requirement to meet all. DH: A list would help guide the consent process for both farmers and advisors to consult when applying for consent. AMJ: Gives certainty for consideration about what consent processing would consider. Merits • Help council identify practices that farmers could implement • Gives farmers an idea of management practices and mitigation strategies they could implement to reduce their contaminant losses or achieve consent. • It facilitates the consent application under the new controlled activity pathway that requires best management practice. Disadvantages • May stifle innovation • Farms are complex and diverse, and it is impossible to provide a comprehensive list that covers every scenario that may occur. • May be seen as a definitive list and other mitigations that are not on the list may be seen as inferior. • GMP and BMPs are always changing and new technologies being developed that means that either a list becomes old/redundant or it needs to be regularly updated JC: A risk of having a list of BMPs is could result in farms who exceed the table figures locking in farm systems	All agreed JC, AMJ agrees	PLM disagrees with 'Natural Capital' element.

Issue	Statements	Agreed Position	Disagreements, with reasons
	that are farming beyond what their land can sustain. It inhibits farm optimisation within the constraints of the natural capital. So instead of incentivising the farm to innovate and reduce losses to meet the LUC table, it locks in those higher losses.		
6. Within what time frame is it reasonable to expect adoption and implementation by growers and farmers of the GMPs and BMPs identified above?	Fencing pastoral land and within CVG, such as soil nitrogen quick tests: 6 months GMPs: up to 5 years BMP: Up to 10 years to implement and completion – capital and infrastructure additions.	All agreed	
Alternative (without prejudice) controlled activity pathway			
7. What would the BMPs be for each of the controlled activity pathways – CVG and dairy and other IFLU?	DH: We would expect all BMPs listed in Appendix 2 to be considered as part of analysis of consenting pathway to achieve the required percentage decrease in N loss. If the farmer doesn't reach Table 14.2, the process will revolve around BMP to achieve an alternative consenting pathway. PLM: I consider that if farmers meet the 14.2 pathway they shouldn't be expected to do BMP as part of this process.	All agreed All agreed	
8. What N reductions are expected to result from implementation of the range of BMPs and GMPs discussed by the farm system experts?	See question 3 DH: We note that the potential amendments to Policy 14.6 require percentage reductions. These weren't able to be provided, but will be addressed in evidence.	All agreed	

Issue	Statements	Agreed Position	Disagreements, with reasons
9. What baseline period should be adopted for CVG and dairy and other IFLU?	2012/2013 Dairy or the two seasons immediately prior if impacted by drought. AMJ: For some CVG, IFLU, data may not be available for 2012/2013 season. Anecdotally, 2013-2019 few practice changes occurred and 2019 may represent the best baseline data. IK notes that some CVG have made significant changes in this time and will have data. For CVG, lack of consistent baseline data will make the percentage change being sought difficult to calculate.	All agreed SF, IK, SMC and AMJ agree Outside field of expertise of others.	
Planning Questions			
10. Is it possible to adjust your farm system to enable irrigation with municipal wastewater and be able to be consented?	JF: As per previous conferencing JWS, the discharge to land activity is unlikely to comply with Table 14.2 or with the GMP for "irrigation", therefore consenting pathways are limited. Adjusting farm systems to meet table 14.2, where combined with municipal wastewater irrigation, is not considered realistic/practicable. Where municipal wastewater is discharged to land used for sheep and beef farming, the discharge of wastewater activity will be the key driver for nutrient loss, due to timing and depth of irrigation and nutrient application. The nitrogen loss of sheep and beef operations is generally low, compared to where it is receiving municipal wastewater. As an example, for the Foxton WWTP Land Discharge Consent, the AEE assessed an increase in nitrogen leaching from sheep and beef areas from 7 kgN/ha/yr	DH agrees. Outside field of expertise of others.	

Issue	Statements	Agreed Position	Disagreements, with reasons
	pre-irrigation to 63 kgN/ha/yr post-irrigation for irrigation areas, or as a whole farm average from 7 kgN/ha/yr to 28 kgN/ha/yr. On a farm average basis alone this is a 300% increase in N leaching. Farming changes that will reduce nutrient loss and achieve compliance with Table 14.2 for land treatment activities is unlikely. Reduction in sheep and beef farming intensity will have very little impact on nitrogen loss as a proportion of the overall nitrogen loss from land treatment to sheep and beef areas. The expectation to achieve reductions through farming operation changes will likely restrict opportunities for use of third party sheep and beef farms for land treatment. The control of nitrogen loss is best managed through management of the land discharge activity, as this is the key driver for nitrogen loss. Land discharge consent is also where consideration against alternatives is best e.g. direct discharge to surface water.		
11. Is it possible to adjust your farm system to enable irrigation with industrial wastewater and to be consented?	JF: Industrial wastewater will face the similar constraints as for above item 10, if occurring to sheep and beef farms. For dairy farms, the nitrogen loss from dairy farms is generally higher than sheep and beef. However, where nitrogen loss is increased by discharge of wastewater to dairy farm land, the ability to reduce nitrogen loss to meet Table 14.2 through farm management is also likely to be limited.	Outside field of expertise of all others.	

Question No.

1. Within the Horizons region what is the range of "good" management practices for intensive farming land use activities as defined by the One Plan? Specifically for:

- i. Dairy farming
- ii. Commercial vegetable growing
- iii. Cropping/arable
- iv. Intensive sheep and beef farming (irrigated)

List of some GMPs for intensive sheep and beef properties

1. Have an advanced farm plan based on a Land Resource Inventory (LRI) and Land Use Capability (LUC) map of the property at the farm or paddock scale
2. Identify critical source areas and overland flow pathways. (P, SS, E. coli)
3. Mitigate losses from CSA's and overland flow pathways. This can be done any number of ways – below are some examples.
 - a. Leave uncultivated
 - b. Leave ungrazed
 - c. Fence off
 - d. Use sediment traps to capture losses
 - e. Use strategic grazing practices
4. Fence cattle out of waterways on flat land (>18su/ha entire farm) and when being grazed on forage crops. Can be single wire, temporary, or virtual.
5. Use of reticulated stock water.
6. Provide adequate shade and shelter to reduce animal pacing etc resulting in potential loss of contaminants.
7. Stocking density managed to reduce the risk of soil damage and contaminant loss.
8. Adverse weather plans in place.
9. Stock type matched with land capability Identify at-risk areas and graze with younger/smaller animals during at-risk times.
10. Fertiliser additions to crops should be aligned with crop requirements (N and P)
11. Fertiliser additions to pasture aligned with pasture requirements (N and P)
12. Irrigation (Dave H is the expert here)– maintain equipment, monitor soil moisture and schedule irrigation to irrigate from the refill point (see page 10/11 DairyNZ 1) to field capacity. Irrigate when according to plant requirement as well as soil moisture. Use WSP list.
13. Winter cropping – see table below (All contaminants– the ones of concern depend on soil type and topography)
14. Crop management – non grazed crops – WSP list.
15. Grazed crop management - summer and winter crops

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High risk activities (and suggested GMP and BMPs) for intensive sheep and beef farms include:

1. Irrigation – GMPs and BMPs as agreed in the earlier meeting WSP list
2. Cropping – GMPs and BMPs as agreed in earlier meeting WSP list
3. Winter grazing of a brassica crop – I provided a list of GMPs last time = see below
4. (Feed lotting)
5. Animal containment areas – effluent management (storage and application), lining of floor. GMPs and BMPs will be the same as dairy although sheep/deer excrete less than dairy. Manage losses of nutrient to waterways (direct and indirect flow pathways)
6. Cattle. Higher cattle numbers or larger animals (bulls/dairy cows)– comes down to stock management – stocking density

Winter grazed forage crops:

Management Practice	GMP/BMP	Contaminant
Paddock selection -		All – mainly overland flow pathways
Soil testing		All
Crop establishment – cultivation method		All – mainly overland flow pathways
Crop establishment – direction of rows – across hills		P, SS, E.coli
Crop establishment – crop type – lower yielding crops result in lower stocking densities = potentially lower contaminant losses. Also fodder beet or low N feeds can result in lower urinary N – may be cancelled out by higher yield and thus higher stocking density		N
Crop establishment – identify CSA's leave uncultivated		Overland flow pathways
Leave ungrazed buffer zones near waterways		All
Fertiliser inputs – use fert guidelines, fert recommendations, match to crop requirements		Overland flow pathways
Set out supplementary feed ahead of time to reduce tractor traffic during winter		Overland flow pathways and soil damage
Crop grazing – stock type (sheep/deer<young cattle<male cattle<female cattle – for N)		(sheep/deer<young cattle<male cattle<female cattle – for N) Sheep<young cattle<Deer/mature cattle – overland flow pathways
Hills – graze from top down where practicable		Overland flow pathways
Or graze along the slope leaving a buffer near waterways. The greater the slope the larger the buffer.		Overland flow pathways
Graze towards a waterway so the standing crop can act as a buffer		Overland flow pathways
CSAs – fence off and leave ungrazed		Overland flow pathways

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Break-feed using long narrow breaks		Overland flow pathways and soil damage
Provide adequate water, feed, shelter and a dry loafing area		Sediment etc
Place water troughs and supplementary feed in drier areas of the paddock		Overland flow pathways
Reduce the amount of time animals are grazing the crop – use a stand-off pad		All
Have a plan for bad weather events		All
Reduce the fallow period following a winter crop. Plant a catch crop as soon as possible – once soil conditions allow		N

Beef and Lamb has winter grazing factsheets that can be found:

<https://beeflambnz.com/knowledge-hub/PDF/winter-forage-crops-management-grazing.pdf>

<https://beeflambnz.com/knowledge-hub/PDF/winter-forage-crops-management-during-grazing.pdf>

<https://beeflambnz.com/knowledge-hub/PDF/winter-forage-crops-management-after-grazing.pdf>

<https://beeflambnz.com/knowledge-hub/PDF/ten-top-tips-winter-grazing-crops.pdf>

Dairy NZ has similar winter grazing resources found:

<https://www.dairynz.co.nz/feed/crops/wintering-cows-on-crops/paddock-selection/>

<https://www.dairynz.co.nz/feed/crops/wintering-cows-on-crops/winter-crop-establishment/>

<https://www.dairynz.co.nz/feed/crops/wintering-cows-on-crops/grazing-the-winter-crop/>

DairyNZ has some good irrigation resources:

<https://www.dairynz.co.nz/media/757905/guide-to-good-irrigation-part-1.pdf>

<https://www.dairynz.co.nz/publications/environment/guide-to-good-irrigation-part-2/>

Irrigation NZ has some GMPs for Spray Irrigation

https://www.irrigationnz.co.nz/PracticalResources/GMP/Attachment?Action=Download&Attachment_id=490

And border dyke irrigation

https://www.irrigationnz.co.nz/PracticalResources/GMP/Attachment?Action=Download&Attachment_id=491

An overview is found here <https://www.irrigationnz.co.nz/PracticalResources/GMP/Overview>

They have some irrigation management and Irrigation essentials booklets but they are only available for Irrigation NZ members

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2.

What management practices are considered to be "best" management practices or 'additional innovations' for each of the above listed intensive farming land use activities within the Horizons region?

Changing farming system – eliminating cash cropping, changing stocking policy (less cattle, more sheep)

Eliminating winter grazing (fodder crops) (if it was a situation where it was the main enterprise on the property).

Breeding/genetics – faster growing animals, animals that are more efficient at converting N in feed to product.

Stand-off pad for winter or periods of bad weather

Nitrification inhibitors

Bioreactors and constructed wetlands

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Proposed list of GMP

1. A nutrient management plan (based on a tool such as Overseer)

2. Effluent management

- 2.1 Adequate storage (as defined by Horizons use of the FDESC)
- 2.2 Application depths of 12 mm, or less, in winter/spring
- 2.3 Limit applications of all forms of N to FDE blocks to 150 kg N/ha/yr
- 2.4 Approved scheduling technique for day to day management of FDE Irrigation (moisture monitoring or water balance)
- 2.5 Ponds solids applied in low risk period (runoff unlikely)
- 2.6 Three- yearly calibration of Irrigators' application rates and uniformity

3. Fertiliser management

- 3.1 Remove all N fertiliser application from high risk period (April to August)
- 3.2 Limit single applications to 40 kg N/ha
- 3.3 Limit annual N fertiliser application to 190 kg N/ha

4. Crops

- 4.1 Remove winter crops

5. Herd management

- 5.1 Cull aggressively and early in autumn

6. Irrigation management

- 6.1 Improve scheduling (moisture monitoring or water balance)
- 6.2 Modify 'trigger' and 'target' values in scheduling regime (as 'dry' as practicable)
- 6.3 Yearly calibration of Irrigators' application rates and uniformity
- 6.4 Water use is metered

7. Protect soil structure and infiltration rates

- 7.1 Have strategies in place to minimise pugging/treading damage

Proposed list of BMPs

8. Supplement management

- 8.1 Replace N boosted pasture with low CP content supplements

9. Crops

- 9.1 Reduce area of summer crops (grass to grass, replace with other supplements)
- 9.2 Use minimum tillage

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Ross Monaghan's list 2009

A nutrient management plan (based on a tool such as Overseer)

Effluent management

Adequate pond storage

low depth applications

Low rate applications

Improved scheduling of FDE irrigation

Stock exclusion from streambank riparian margins

Fertiliser management

Timing (avoid high risk periods)

Form

Rate

Supplement management

Low N feed in diet (e.g. maize, cereal silage)

Use of standoff facilities

Particularly in summer/autumn

Edge of field techniques

Constructed wetlands

grass buffer strips

nutrient adsorbing materials in flow pathways

harvest of nutrients in water crops (e.g. watercress)

Impoundment structures

#2 TAN N Plan JF
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10. Use of standoff facilities

- 10.1 Where standoff facilities are in place, practise standoff (e.g. overnight) during late summer/autumn
- 10.2 Where standoff facility is not in place then look to install over the next 5 years

11. Herd management

- 11.1 Increase number of cows grazed off farm over winter
- 11.2 Dry cows off earlier (shorten lactation period)
- 11.3 Graze dry cows off in autumn
- 11.4 Reduce/optimize cow numbers/herd size

12. Emerging technology

- 12.1 Incorporate Plantain into swards

Systems interventions and edge of field techniques

13. Systems interventions

- 13.1 Larger reduction in herd size/stocking rate
- 13.2 Build animal shelters (such as a barn)
- 13.3 Fence off less productive areas and retire
- 13.4 Organic farming

14. Edge of field techniques

- 14.1 Constructed wetlands
- 14.2 Bioreactors
- 14.3 Grass buffer strips
- 14.4 Nutrient adsorbing materials in flow pathways
- 14.5 Harvest of nutrients in water crops (e.g. watercress) in internal surface drains on farm
- 14.6 Impoundment structures such as Detainment bunds
- 14.7 Controlled drainage

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