

**Before an Independent Hearings Panel**

**The Proposed Waikato Regional Plan Change 1**

**IN THE MATTER OF** the Resource Management Act 1991 (**RMA**)

**IN THE MATTER OF** the Proposed Waikato Regional Plan Change 1, Block 2 hearings,  
Topics C1 **Diffuse Discharge - Nitrogen Management**

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**PRIMARY EVIDENCE OF DR GAVIN SHEATH  
ON BEHALF OF MIRAKA LIMITED**

**(Corporate)**

**3 May 2019**

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## 1. EXECUTIVE SUMMARY

- 1.1 My full name is Dr Gavin Sheath. I am an Agricultural Systems Consultant and advisor to Miraka Limited. I have given evidence on the importance of practice change in achieving the outcomes sought by the Vision and Strategy and Plan Change 1.
- 1.2 In Block 1 evidence, Miraka advocated that practice change should be emphasised to reduce the diffuse discharge of all four contaminants during the first 10 years. This approach would be based on all enterprises developing and implementing Farm Environment Plans (**FEP**) that embodied relevant Good Farming Practices (**GFP**). Miraka also indicated that it is opposed to the estimate and use of a Nitrogen Reference Point (**NRP**) based on Overseer estimates of nitrogen leached as it is inequitable and potentially pre-emptive from an allocation perspective.
- 1.3 Miraka agrees with the recent Section 42A recommendation that Overseer should not be used in setting absolute limits. However, it continues to oppose the recommendation that estimates of nitrogen leached, as determined by Overseer, should be used to determine the 75<sup>th</sup> percentile of nitrogen leached within an FMU and that those enterprises which exceed this estimate must reduce nitrogen leached below that benchmark.
- 1.4 Since “inherited” physical attributes such as rainfall and soil type determine much of the variation in nitrogen leach estimates, this approach is not equitable or fair during Stage 1. For example, in the Upper Waikato Freshwater Management Unit differences between enterprises of 35-40kg N/ha leached can simply be explained by rainfall and associated drainage.
- 1.5 Miraka’s position during Stage 1 is that emphasis should be placed on practice change. Effective practice change will require the development of quality FEPs that are fully implemented and robustly audited. FEPs should be the basis of compliance. Miraka fully supports the emphasis that the recent Section 42A report places on the importance of FEPs in achieving the desired outcomes of the Vision and Strategy.
- 1.6 Similar to the other three contaminants, the principles and guidelines of GFPs that will reduce the loss of nitrogen to water bodies need to be included in Schedule 1. Miraka agrees with the recommendation in the recent Section 42A report that Schedule 1 of Plan Change 1 should be redrafted by expert caucusing.

- 1.7 Miraka's proposed alternative approach to improving water quality during Stage 1 places emphasis on equity and simplicity. Key components of the approach are to: establish appropriate FMU/sub catchment Units; develop sub catchment plans; and develop, implement and audit FEPs by all land managers in the sub catchment.
- 1.8 Miraka proposes that the baseline and time trends of an enterprise's nitrogen status be determined by estimates of either the potential or net sources of nitrogen loss. These estimates can be calculated by Overseer, or by other means. They reflect the management practices of an enterprise, without the confounding effect of transport processes such as rainfall and soil type that influence nitrogen leach estimates.
- 1.9 As indicated by Doole et al (2016) and Dr Shepherd's evidence, reductions of 5-10% of nitrogen loss can be expected if all land managers are required to implement GFP. If these reductions are insufficient to meet sub catchment targets, my evidence gives examples of how Farm Nitrogen Surplus (i.e. potential source of nitrogen leach) may be used to guide and track nitrogen loss status of an enterprise. This may involve proportionate reductions in nitrogen source and/or the establishment of reference enterprises that exemplify the use of GMPs.

## **2. INTRODUCTION**

- 2.1 My name is Dr Gavin Sheath. I am an Agricultural System Consultant and advisor to Miraka Limited (Miraka).
- 2.2 My qualifications and experience are outlined in the evidence that I provided in Block 1, dated 15 February 2019. Of relevance to the issues covered in Block 2, I have extensive experience in agricultural systems, research and practice that impact on productivity and environmental outcomes; and had a governance role in the environmental programme, Pastoral 21.
- 2.3 I have been part of the team at Miraka which has reviewed Plan Change 1, considered the impact on Miraka and the farming community and helped prepare Miraka's submissions and evidence. I am authorised to provide this evidence on behalf of Miraka.

## **3. SCOPE OF EVIDENCE**

- 3.1 My evidence in Block 1 outlined the importance of practice change in achieving the outcomes sought by Plan Change 1 and Miraka advocated the use of practice change to reduce the loss of all four contaminants to waterways. I noted that Plan

Change 1 was silent on specifying GFPs for reducing nitrogen contamination. Rather, Plan Change 1 depends on the establishment and use of a NRP based on Overseer estimates of nitrogen leach, which Miraka does not support. My evidence in Block 2, will outline the inadequacies of Plan Change 1 as it relates to nitrogen and offer alternative approaches. It draws on the principles and practices of nitrogen management that are provided by Dr Mark Shepherd in his expert evidence and comment on the recent Section 42A report's proposed amendments to Plan Change 1.

3.2 My evidence should be read alongside that of:

- (a) Dr Mark Shepherd regarding the principles and practices of nitrogen management;
- (b) Mr Grant Jackson regarding CISs and FEPs; and
- (c) Ms Kim Hardy regarding planning.

#### **4. NITROGEN MANAGEMENT IN PLAN CHANGE 1**

##### **Concerns with Notified Version**

- 4.1 In my Block 1 evidence, I outlined Miraka's position that practice change should be emphasised to reduce the diffuse discharge of all four contaminants during the first 10 years. This approach would be based on all enterprises developing and implementing FEPs that embodied relevant GFPs. Miraka also indicated that it is opposed to the estimate and use of an NRP based on Overseer estimates of nitrogen leached, as it is inequitable and pre-emptive from an allocation perspective.
- 4.2 Schedule B of Plan Change 1 states that farming enterprises will need to determine an NRP based on Overseer Nitrogen leaching estimates for the 2014-15 or 2015-16 years. Schedule 1 (and other provisions) require those enterprises which exceed the 75<sup>th</sup> NRP percentile (based on dairy farms) within a Freshwater Management Unit (**FMU**) to reduce their nitrogen losses to below that benchmark; and those enterprises below the 75<sup>th</sup> percentile to not exceed their NRP in future years. In the absence of any other guidance or provisions about future allocation, this approach to managing nitrogen loss is effectively a contaminant (nutrient) allocation mechanism. As indicated previously, Miraka's position is that any formal allocation should be handled through a full RMA process that ensures fairness and equity.

- 4.3 The evidence of Dr Shepherd illustrates that both “inherited” biophysical attributes and management practices will determine calculated NRPs. As outlined by Ms Addendbrooke in Block 1, the current FMUs in Plan Change 1 are large and contain a wide range of biophysical characteristics. When the 75<sup>th</sup> percentile is calculated for each FMU, it involves comparing a large number of farms with a wide range of biophysical attributes. Establishing NRP relativity of enterprises across broad FMUs will severely disadvantage those enterprises located in higher rainfall areas and/or on free draining soils. For example, in the Upper Waikato FMU, annual rainfall can vary between 1000-1500mm. Taking Dr Shepherd’s calculations, this means that differences between enterprises of 35-40kg N/ha leached can simply be explained by rainfall and associated drainage. It is possible that where rainfall and/or drainage is lower, an enterprise could operate poor management practices and still sit below the 75<sup>th</sup> percentile while an enterprise could be fully operating GFPs and still sit above the 75<sup>th</sup> percentile benchmark. This is not equitable because land managers acting in similar ways should be treated in the same way. A large number of enterprises within the Upper Waikato, including a number of Miraka’s suppliers are affected by this issue and will be unfairly disadvantaged.
- 4.4 Miraka’s position is that where high rainfall and/or free draining soils are a significant determinant of the variation in estimates of nitrogen loss between enterprises within a catchment, the solution to this situation should be dealt with in Stage 2. These attributes cannot be altered, and it is acknowledged that they are likely to lead to long-term land use changes which will require significant economic and social adjustment. During the first 10 years emphasis should be placed on correcting inappropriate management practices and achieving improvements in water quality through the application of GFPs by all land managers.
- 4.5 Establishing an NRP requires the use of the model, Overseer. It is evident from submissions on Plan Change 1 that the use of this model to determine absolute numbers for regulatory purposes is opposed by many submitters because of uncertainty around the accuracy of input data and of the model’s routines that determine the transport of nitrogen from varying farm systems. Many questions reside around the need for site specific data on climate and soil parameters; on whether surplus nitrogen flows from the farm system as nitrate in drainage or as gaseous nitrous oxide; on the mitigation impact of stand-off pads or housing; and on the levels of attenuation before reaching and within ground water flows.

- 4.6 Given these concerns about the reliability of Overseer as a regulatory tool and the potential for inequitable outcomes arising from the use of Overseer to estimate nitrogen leach, Miraka considers that the NRP and the 75<sup>th</sup> percentile should be removed entirely from Plan Change 1. Instead, Plan Change 1 should focus on GFP for all enterprises. I outline below proposed alternatives to using an NRP based on Overseer estimates of nitrogen leach to establish a baseline for individual enterprises and track improvements.

#### **Section 42A report**

- 4.7 Many of the concerns about Overseer are acknowledged and outlined in the Section 42A report. The report recommends (C.1.1.19) that Overseer should only be used to establish the relative status and trends of nitrogen loss for an enterprise. It states that absolute numbers should not be used as a regulatory limit. I agree with this position and it aligns with Miraka's requested amendments.
- 4.8 Despite this conclusion, the Section 42A report continues to recommend the use of a 75<sup>th</sup> percentile benchmark based on Overseer nitrogen leach estimates and that those enterprises that exceed this estimate must reduce their nitrogen loss below the benchmark. This position must reflect the officers' view that those enterprises with the highest losses should reduce the most (see paragraphs 370, 389 and 397).
- 4.9 This position remains inequitable, as it puts those enterprises with high rainfall and/or free draining soils at a severe disadvantage. This position would be exacerbated if the benchmark was moved to 50<sup>th</sup> percentile nitrogen leached as suggested in paragraph 372 of the report.
- 4.10 The Section 42A report also states that the remainder (i.e. under the 75<sup>th</sup> percentile) are to "hold the line in terms of nitrogen leaching" (paragraph 207). This is surprising and somewhat contradictory given the emphasis that the report now places on FEPs and GMPs. Many other "remaining" enterprises will be able to contribute to reducing nitrogen contamination through the implementation of relevant GFPs as specified in FEPs. It would be unfortunate if bad management practices were grand-parented.
- 4.11 Plan Change 1 has prioritised sub catchments in terms of when the regulation and rules are to take effect. This prioritisation is based on the current status of water quality in the sub catchment and the extent of improvements that are required. The Section 42A report suggests that prioritisation could be based on the land use sector with the dairying and commercial vegetable sectors being first to implement Plan

Change 1. This suggestion is based on a perception of readiness. Miraka opposes the suggestion of sector-based prioritisation as this approach would cut across the principle of establishing Catchment Communities that Miraka advocated during Block 1 evidence.

## **5. MANAGEMENT PRACTICES**

- 5.1 The primary principle that underlies Miraka's submission is that targeted practice change on farms will lead to the improvements in water quality being sought during the first ten years of Plan Change 1. Mr Robert Dragdon's paper that is contained within the Section 42A report supports this position. Such an approach is already evident for reducing phosphorus, sediment and bacterial contamination through surface run off. Management practices such as stock exclusion from waterways, riparian vegetation, cropping off-sets and grazing of forage crops are examples of guidelines to GFPs contained in Schedule 1 of Plan Change 1. Importantly, those practices apply largely to the other three contaminants and not to nitrogen. A similar approach to detailing GMP guidelines for nitrogen should be taken. These management practices should be guided by the principles outlined in the document "Good Farming Practice Action Plan for Water Quality" (2018).
- 5.2 Dr Shepherd's evidence indicates that there is a range of farm management practices that are available to land managers which will reduce the direct and indirect loss of nitrogen to waterways. These practices can range from single factor changes through to farm system changes and therefore, involve different levels of complexity and cost. Plan Change 1 should specify these management options and require them to be considered when FEPs are being developed and implemented. I agree with the Section 42A report recommendation that Schedule 1 should be redrafted by expert caucusing. This will provide an opportunity for nitrogen loss mitigations to be included.
- 5.3 There is good evidence that where there are clear freshwater targets and collaborative community involvement, the implementation of GFPs can improve water quality (Wilcock et al, 2013). However, the authors noted that water quality attributes responded differently to best practice changes; and that monitoring of impacts on water quality needs to be considered with a medium to long term view. These experiences would be supported by the research that involved both management and land use changes in hill catchments at Whatawhata (Hughes & Quinn, 2015).

- 5.4 Doole et al (2016) stated that implementation of Good Management Practices can be assumed to lead to 5-10% reduction in nitrogen loss to water in the Waikato/Waipā catchments. It was also estimated that reductions in nitrogen loss through using the 75<sup>th</sup> percentile rule would lead to a further decrease of 4-5% across both catchments. As previously indicated, Miraka considers the 75<sup>th</sup> percentile rule to be inequitable and unnecessary. All enterprises can in some way directly (e.g. reduced nitrogen leach) or indirectly (e.g. reduced surface runoff) contribute to reductions in nitrogen contamination being sought during Stage 1. As indicated in my Block 1 evidence on practice change, it is important that all land managers are engaged during this 10 year period to ensure cohesive communities and effective practice change.
- 5.5 Effective practice change will require the development of quality FEPs that are fully implemented and robustly audited. Miraka agrees with the strong emphasis that the Section 42A report places on the importance of FEPs in achieving the desired outcomes of the Vision and Strategy. Mr Jackson will provide more detail on FEPs in his evidence.

## **6. ALTERNATIVE APPROACH**

- 6.1 Miraka's proposed alternative approach for Stage 1 places emphasis on equity, simplicity and effectiveness. It is based on encouraging and supporting practice change that will reduce the loss of all four contaminants from farm enterprises to freshwater bodies. With reference to nitrogen, Miraka's position is that the physical attributes that impact on nitrogen leaching (ie: rainfall, soil properties and drainage) should be taken into consideration during Stage 2 following further deliberations on allocation mechanisms.
- 6.2 As described in my evidence on practice change (Block 1) and Ms Addenbrooke's evidence on Freshwater Management Units (Block 5) hybrid FMU/sub catchment Units (perhaps called "Catchment Communities") should be established to generate:
- (a) Clearly defined freshwater targets;
  - (b) Community ownership of targets and necessary changes in farm practice;
  - (c) Robust monitoring and auditing of practice changes and water quality; and
  - (d) Responsiveness of land users, communities and policy makers to on-going learning.

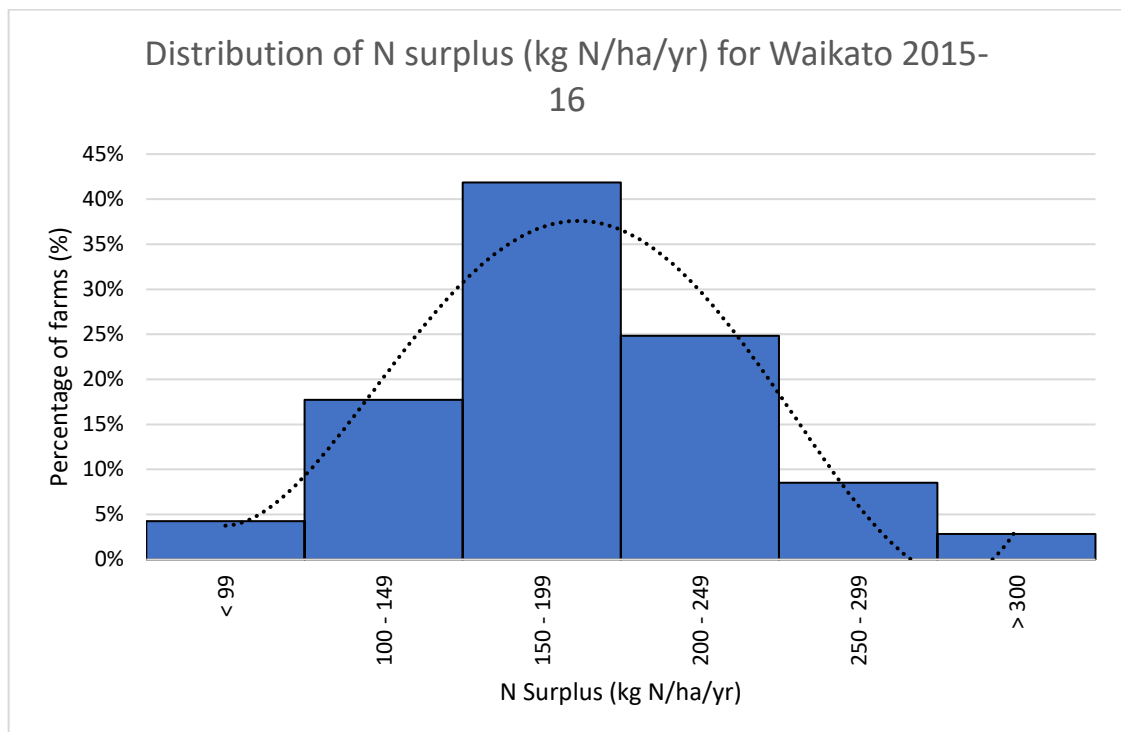


- 6.3 This will be best achieved by the aggregation of sub catchments that are indicated in Plan Change 1 to optimise hydrological connectivity, similar biophysical attributes, social identity and resource requirements.
- 6.4 Community Catchment Plans should be developed taking into consideration the current status of all four contaminants and the future fresh water quality targets of the catchment. I understand that sub catchment planning will be led by Waikato Regional Council.
- 6.5 GFPs that reduce nitrogen losses from farm enterprises need to be agreed and included in Schedule 1 of Plan Change 1, as is the case with the other three contaminants. These practices could be categorised in a similar way to that in Dr Shepherd's evidence. This would provide a range of options ranging from simple, singular changes (e.g. nitrogen fertiliser rate) to more complex farm system changes (e.g. system change of reduced stocking rate and increased animal performance). The choice of which combination would be best will depend on the extent of nitrogen loss reductions required.
- 6.6 As I discussed above, FEPs that embody GFPs should be developed for all enterprises and these plans should use a risk-based approach that identifies the most relevant farm practices that need to change in order to reduce all four contaminants. This approach would take into consideration the current loss and risk status of the enterprise and the extent to which water quality needs to improve in the catchment. The risk status of the enterprise can be assessed by a matrix that takes into consideration those factors that influence source processes (e.g. nitrogen surplus, animal density and type, contour, etc), internal transfer (e.g. effluent application) and transport processes (e.g. drainage, critical source areas, etc).
- 6.7 The notified version of Schedule 1 contains requirements to use Overseer to calculate a nutrient budget (Clause 2e) and an obligation to reduce discharges below the 75<sup>th</sup> percentile nitrogen leached (Clause 5). Implicitly, Overseer is to be used to track the effect of management changes in order to reach the 75<sup>th</sup> percentile. As previously indicated, Miraka strongly opposes the 75<sup>th</sup> percentile rule for nitrogen because it is based on Overseer estimates of nitrogen leached that take account of physical attributes of an enterprise which cannot be altered in the short term.
- 6.8 There are two alternative parameters that can be used and incorporated into FEPs to establish the baseline and trends of nitrogen status of an enterprise:

- (a) Estimate Farm Nitrogen Surplus (**FNS**) as an indicator of potential source of nitrogen loss.
  - (b) Standardise the biophysical inputs and assumptions that are used in Overseer across an FMU/Community Catchment as an indicator of net source of nitrogen loss.
- 6.9 Estimates of either the potential source of nitrogen, or the net source of nitrogen (as described by Dr Shepherd) reflect the management practices of an enterprise and should be used to establish relative differences between systems, enterprises and time during Stage 1. These estimates are good indicators of those enterprises which are most distant from GFPs and therefore, are more equitable and fair benchmarks.
- 6.10 Estimates of Farm Nitrogen Surplus (FNS) can be used as an indicator of the nitrogen status of an enterprise. As explained in Dr Shepherd's evidence, FNS is an estimate of **the potential source of nitrogen loss** and reflects key input-output management decisions and practices of an enterprise. (Note that Beukes et al (2012) reported a strong correlation of  $R^2 = 0.74$  between Overseer estimates of FNS and nitrogen leach for a sample of Upper Waikato dairy farms.) FNS can be estimated by Overseer and used as a baseline measure for the enterprise and to track the impact of changes in farm practices on nitrogen source during Stage 1.
- 6.11 As indicated in Dr Shepherd's evidence, FNS estimates do not account for some GFPs and mitigations that can influence **the net source of nitrogen loss** from an enterprise. Such practices include the timing of nitrogen fertiliser application, effluent applications and cultivation of pastures. Therefore, an alternative to using Overseer to estimate FNS, is to fix the data inputs into Overseer over which the land manager has no control. These inputs would be rainfall and soil type that best reflect the FMU/Catchment Community. Similar to FNS, this approach places emphasis on practices that can be changed by the land manager.
- 6.12 In summary, Overseer can be used to estimate the potential source of nitrogen loss (i.e. farm nitrogen surplus), the net source of nitrogen and nitrogen leached from an enterprise. The first two estimates reflect the management practices operating in the enterprise and the last estimate includes the additional process of nitrogen transport through the soil.
- 6.13 There are several options that can be used to signal the extent and rate of the reductions in source of nitrogen loss for individual enterprises, if the Commissioners

considered that greater changes were created than just establishing GFP. For example, one “blunt” option is to establish an average FNS for a FMU/Catchment Community and require a similar proportional reduction of FNS for all enterprises that exceed the average FNS (e.g. 15%).

- 6.14 The following figure produced by M Newman of Dairy NZ (*pers. comm.* 2019), shows the frequency distribution of NFS for a sample of dairy farms in the Waikato river catchment. If a 15% reduction in FNS was required for those farms that are greater than the mean, the combined reduction in surplus nitrogen in the catchment would be 9-10%. This reduction in potential nitrogen contamination is of a similar magnitude to the reduction that Doole et al (2016) estimated using the 75<sup>th</sup> percentile. As in the Doole (2016) analyses these reductions in source nitrogen would be on top of those generated by the remaining enterprises if they were required to adopt relevant GFPs.
- 6.15 In the above example, a 15% reduction for those enterprises at 300kg/ha FNS would mean an absolute reduction in 45kg/ha, while those enterprises at 200kg/ha FSN would have an absolute reduction of 30kg/ha. This approach supports Miraka’s position that those enterprises that are most distant from GFPs need to reduce the most in absolute terms.



- 6.16 An alternative option would be to identify enterprises in the FMU/Community Catchment that are judged to be implementing GFPs in terms of nitrogen loss. The

FNS of these enterprises could then be used as the target for those enterprises that have higher FNS estimates. If the reference enterprises are operating in a long-term sustainable manner, there is no reason why other enterprises in the catchment need to have higher FNS. These reference enterprises would need to be identified by the Catchment Community for dairying, mixed livestock and cropping operations.

- 6.17 In summary Miraka's alternative approach is that all enterprises in a FMU/Catchment Community should develop and implement a Farm Environment Plan that will reduce the loss of all four contaminants. The practice changes that are required of an enterprise should be guided by an FEP based on risk assessment approach. If required during Stage 1, the nitrogen status of an enterprise should be signalled by estimates of **the source of nitrogen loss** as this best reflects changes in management practices.

**Dr Gavin Sheath**

3 May 2019

## References

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