

**BEFORE THE HEARING PANEL**

**AT HAMILTON**

**IN THE MATTER**

of the Resource  
Management Act 1991

**AND**

**IN THE MATTER**

of the Proposed Waikato  
Regional Plan Change 1  
Waikato and Waipā River  
Catchments

**AND**

**IN THE MATTER**

of Variation 1 to the  
Proposed Waikato  
Regional Plan Change 1  
Waikato and Waipā River  
Catchments

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**STATEMENT OF EVIDENCE OF KATHRYN JANE MCARTHUR FOR THE  
DIRECTOR-GENERAL OF CONSERVATION**

**BLOCK 3**

5 July 2019

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Submission Number 71759

## **INTRODUCTION**

1. My full name is Kathryn Jane McArthur.
2. I have been engaged by the Director-General of Conservation to provide evidence on freshwater management, water quality and ecosystem health, with a particular focus on streams and rivers, for the hearing on proposed Plan Change 1 for the Waikato and Waipā Rivers (PC1).
3. I am the Practice Leader – Water, at The Catalyst Group, an environmental consultancy based in Palmerston North.

## **QUALIFICATIONS AND EXPERIENCE**

4. My qualifications and experience are set out in my Evidence in Chief dated 15 February 2019.

## **CODE OF CONDUCT**

5. I have read the Environment Court “Code of conduct for expert witnesses”, and I agree to abide by it. I have prepared this Statement in accordance with that Code. I confirm that my evidence is within my area of expertise. I have not omitted to consider any material facts known to me that alter or detract from the opinions I express in this Statement. I have acknowledged the material used or relied on in forming my opinions and in the preparation of this Statement.

## **SCOPE OF EVIDENCE**

6. The scope of my evidence for the Block 3 hearing includes:
  - a. Diffuse discharge management – future allocation regime;
  - b. Sub-catchment mitigation planning;
  - c. PC1 implementation methods; and
  - d. Schedule 1 – FEP requirements.

## **DIFFUSE DISCHARGE MANAGEMENT – FUTURE ALLOCATION REGIME**

7. Diffuse discharges are the predominant source of nutrients (Vant 2014), sediment (Hughes 2015) and microbial pathogens (Moriarty 2015) in waterways of the Waikato and Waipā River catchments. The Director General of Conservation's submission identifies the need to manage diffuse contaminants from land, which I support. The submission considers that there is sufficient information available at the present time to provide a land-based allocation regime and seeks that this be implemented through the proposed plan change.
8. In my opinion, there are a number of immediate steps that need to be reflected in PC1 and implemented now to better manage diffuse contaminant discharges in the short-term, prior to allocation (see below under the headings PC1 implementation methods, and Schedule 1 – FEPs). There is inadequate development of water quality data (e.g., calculation of sub-catchment nutrient loads) and insufficient information on contaminant losses from land to fully inform a long-term allocation regime for nitrogen (N) and phosphorus (P) at this time, in order to move beyond the 'interim' PC1 approach and work towards achieving the 80-year targets. The development of an allocation regime and utilisation of the information collected via the PC1 process needs to begin as soon as possible to enable better management of diffuse contaminants to meet the 80-year targets. This should be enabled by PC1 methods now.
9. In my opinion, in order to implement an allocation regime to achieve 80-year N and P targets, methods are needed in PC1 which firstly enable the following steps to be undertaken:
  - a. Identify the target concentrations of N and P in Table 3.11-1 for each sub-catchment to ensure the sub-catchment effects of

nutrients are managed and the N and P targets for the Waikato River mainstem will also be met;

b. Calculate sub-catchment loads to meet the instream N and P target concentrations;

c. Allocate N and P loads (losses) to land users in each sub-catchment to achieve sub-catchment loads and thereby the instream sub-catchment and mainstem targets.

10. The joint witness statement on Table 3.11-1 (JWS) has identified that experts reached a “general consensus”<sup>1</sup> on the need for N and P water quality targets for each sub-catchment. I agree with this view. Targets for the mainstem Waikato River and all sub-catchments are discussed in the nutrient attribute paper of the JWS (Attachment 2). The experts recommended a range of changes to the 80-year N and P targets for the mainstem of the Waikato River, although the final targets for Table 3.11-1 were not agreed (see approaches 1A, B and C and approach 2A, B and C in Attachment 2 of the JWS). Sub-catchment nutrient targets are somewhat dependant on targets for the mainstem being set, using one of the approaches presented in the JWS. In my view (and that of some other experts) the sub-catchment N and P targets also need to be set to achieve outcomes for the tributaries themselves (e.g., to manage the risks from nutrients to ecosystem health and periphyton growth where applicable), where these are more stringent than the sub-catchment targets calculated to meet mainstem targets.

11. Some form of allocation regime is needed to effectively manage diffuse contaminant losses from land in order to restore and protect the water quality and ecosystem health of the Waikato and Waipā Rivers and to meet the 80-year targets. However, in my opinion, at this time the information is not far enough advanced to develop an effective long-term allocation regime as sub-catchment targets and loads have not yet been set. This indicates a need for PC1 to both effectively achieve the short-term targets within the timeframe of the current Plan in all sub-catchments, and to clearly signal the work needed to develop an

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<sup>1</sup> Joint Witness Statement of Table 3.11-1, top paragraph of page 6.

allocation approach as the next step in implementing the Vision and Strategy for the river and to meet the 80-year targets.

12. An allocation regime which follows the steps outlined in paragraph 9 of my evidence above is dependent on sub-catchment N and P targets being set, so that nutrient loads for each sub-catchment can be determined to meet these instream targets, and then allocation of the sub-catchment load to diffuse losses from land can occur. In my opinion, Table 3.11-1 of PC1 should take *at least* the first step towards allocation now by setting N and P targets for all sub-catchments (including tributaries) and PC1 should strongly signal the need to determine sub-catchment loads for the development of an allocation regime, to be implemented as soon as possible.
13. Proposed Policy 7 relates to preparing for allocation in the future and is recommended to be deleted by the s42A officer's report. I do not support this recommendation. Given the intergenerational nature of the Vision and Strategy and the lack of available approaches in the proposed PC1 framework to reach the 80-year water quality targets, PC1 should clearly signal the need for a future allocation regime, and Policy 7 and the associated implementation methods (3.11.4.7, 3.11.4.8 and Fish and Game's proposed new method 3.11.4.X) must be included in PC1 in some form. Inclusion of these methods sets up a framework for reducing nutrient losses from land to contribute to achieving the 80-year targets. Methods in PC1 should be as specific as possible to ensure adequate information is collected and appropriate work undertaken to develop an allocation regime as soon as possible, to continue working towards the 80-year targets. Without this, there is a risk that work towards the 80-year targets will not commence until after PC1 is reviewed, further delaying improvements in water quality.
14. There is still a long way to go to meet the 80-year targets, further information and technical work is needed to facilitate allocation and this should begin as soon as possible if targets are to be realised over the long-term. The current approach to contaminant reductions (via FEPs and NRPs) is a critical first step, and this step must be effectively and appropriately managed within PC1 now. Clear minimum standards for land use are needed within the current framework of PC1 to ensure FEPs are effective at reducing contaminant losses to water in the PC1

catchments, at least to meet the short-term targets in Table 3.11-1 (including sub-catchment nutrient targets as recommended by the experts).

### **SUB-CATCHMENT MITIGATION PLANNING – POLICY 9**

15. Proposed Policy 9 provides useful guidance on a possible sub-catchment approach as a pre-cursor to a sub-catchment based allocation regime. Collective mitigations for multiple enterprises/farms could work in theory (particularly if the mitigations were to tackle a critical source area or areas). However, mitigations to reduce the overall flux (discharge) of contaminants on each farm are likely to also be needed, given the degree of change needed over the long-term to reach the 80-year targets. A collective mitigation shouldn't be the only approach to reducing discharge of contaminants on a sub-catchment basis but could be useful in making larger scale reductions in contaminants beyond that possible by individual farmers/enterprises alone.
  
16. I support the s42A report recommendation in Policy 9(b) requiring assessment of the reasons for current water quality and sources of contaminant discharge, at various scales in a sub-catchment. The ability to undertake this assessment would be improved by the setting of sub-catchment targets for all of the contaminants in Table 3.11-1, as agreed by the experts with respect to nutrients. The recommended reference to 'freshwater objectives' in Policy 9(e) is confusing. It would be clearer to refer to Table 3.11-1 directly, particularly if sub-catchment targets are included in the Table. This would enable a mitigation to be specific to the contaminants at issue in a sub-catchment, as well as assessing the contribution of a mitigation to any reduction in contaminants needed at the FMU scale. It is important that any sub-catchment mitigation works towards outcomes for the catchment as a whole (i.e., mainstem and lake targets), in addition to addressing sub-catchment targets effects on values such as ecosystem health. Clearer

reference to the whole of catchment scale is needed in Policy 9 to ensure this.

## **PC1 IMPLEMENTATION METHODS**

17. The s42A report recommends the deletion of all implementation methods from PC1. The s42A officers note that many of the implementation methods are “business as usual” for WRC. I do not support this recommendation. WRC are required to undertake activities such as monitoring as part of their core regional council functions. However, funding for specific monitoring to measure the effectiveness of PC1, tracking of progress towards the 80-year targets and other implementation methods such as preparing for an allocation regime, are not automatically assured through other Council processes (e.g. Long Term Plan or LTP processes) and are not necessarily ‘business as usual’. Highlighting the need through the PC1 methods assists the Council in securing adequate funding through LTP processes for specific monitoring, sub-catchment planning and the considerable work that will need to be done to prepare for allocation. Alongside this, the implementation methods signal to the community what work is needed to prepare for the next steps in achieving the Vision and Strategy for the Waikato and Waipā Rivers and meeting the 80-year targets.

18. From a technical perspective I support retaining implementation methods in PC1 (with amendments as detailed by Ms Kissick) for the following methods:

- a. 3.11.4.5 Sub-catchment scale planning;
- b. 3.11.4.7 Information needs to support any future allocation;
- c. 3.11.4.8 Reviewing Chapter 3.11 and developing an allocation framework for the next Regional Plan;
- d. 3.11.4.9 Managing the effects of urban development;
- e. 3.11.4.10 Accounting system and monitoring;
- f. 3.11.4.11 Monitoring and evaluation of the implementation of Chapter 3.11; and

- g. 3.11.4.12 Support research and dissemination of best practice guidelines to reduce diffuse discharges.

19. I also support the inclusion of the new implementation method proposed by Fish and Game to initiate allocation of diffuse discharges<sup>2</sup> (3.11.4.X).

The proposed new method states:

*“The Waikato Regional Council will initiate a framework for the allocation of diffuse discharges including reductions in nitrogen load according to specified timeframes for reductions by sub-catchment. The Waikato Regional Council will:*

- a. Use science-based limits for the total allowable load of a contaminant for a sub-catchment which will meet the water quality objectives of the plan;*
- b. Implement contaminant leaching rates for diffuse discharges from properties and enterprises by allocating to limits, targets and timeframes;*
- c. Quantify nitrogen load reductions based on over-allocation of nitrogen beyond the science-based limit for sub-catchments;  
and*
- d. Define timeframes for sub-catchment nitrogen load reductions to be made.”*

20. In my view this method could be better targeted through direct reference at clause (a) to the targets in Table 3.11-1 (and by inference those targets should include sub-catchment targets for N and P as agreed by the experts).

21. Some experts also agree in the JWS on the need for sub-catchment contaminant loads to be developed. An indication of the necessary reduction in sub-catchment loads is contained within Attachment 2 (Table 6) of the JWS, based on a sub-catchment nutrient target approach. I support the need to develop sub-catchment load limits to meet the PC1 targets and to facilitate an allocation regime.

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<sup>2</sup> Discussed at paragraph 327 of the s42A report for block 3.



22. A number of monitoring requirements have been highlighted in the JWS to fill water quality knowledge gaps to enable more effective measurement of effects on ecosystem and human health values across the PC1 sub-catchments. Some of these requirements were signalled by the TLG in their recommendations on water quality attributes for PC1 some time ago<sup>3</sup> and have yet to be implemented. The TLG recommendations identified a need to:

- a. Apply a planktonic cyanobacteria attribute to the lower river;
- b. Develop narrative attributes relating to aesthetics, habitat condition and access, light climate, submerged macrophytes (rivers), heavy metals, and food chain intactness;
- c. Surveillance and monitoring of periphyton cover;
- d. Develop a dissolved oxygen attribute for all rivers – not just those below point sources;
- e. Develop a temperature attribute;
- f. Develop a deposited sediment attribute;
- g. Develop a submerged macrophyte attribute for rivers; and
- h. Develop a set of ‘norms’ for total and dissolved nutrients for waterbodies not covered by TN and TP recommendations (i.e., tributaries/sub-catchments).

23. Specific implementation methods are needed in PC1, based on the recommendations of the water quality and ecology experts in the JWS, to ensure they are included and funded in WRC’s monitoring network and if necessary to support further work towards attribute development, to fully implement the Vision and Strategy and meet 80-year targets. The JWS attachments for additional attributes have gone some way towards further developing many of the recommendations of the TLG. I maintain the view held in my evidence in chief for Block 1 and in the

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<sup>3</sup> Summarised in Table 1 of Scarsbrook (2016) Water Quality Attributes for Healthy Rivers: Wai Ora Plan Change. Report No. HR/TLG/2016-2017/2.1A

JWS<sup>4</sup> that many of these attributes can be applied to sub-catchments in PC1 now to provide for ecosystem and human health.

24. If the hearing panel decide the additional attributes suggested by the experts for ecosystem and human health are not to be included in Table 3.11-1 or PC1 in some form, they could be included as methods in PC1 as an alternative (although it is my expert view that they can and should be included in Table 3.11-1 now) along with the necessary monitoring methods to fill knowledge gaps and measure progress. Specific methods for monitoring or further development of attributes identified within the JWS could be included as a package of monitoring and attribute development (if not included in PC1) methods for:
- a. Dissolved oxygen monitoring and establishment of baseline reference condition and a bottom line for lowland sites and peat lakes – dissolved oxygen in other systems is appropriate to include in PC1 now in my view;
  - b. Statistical methods to determine if water quality is being maintained or improved;
  - c. Monitoring of additional sub-catchments;
  - d. The need to review N and P short-term targets recommended in Approach 3, Attachment 2 of the JWS;
  - e. Monitoring and investigation of TN and TP thresholds for the Waikato Estuary;
  - f. Monitoring and reporting on submerged macrophytes as key indicators of ecosystem health (noting that a bottom line for nuisance submerged macrophytes can be included now);
  - g. Additional temperature monitoring; and
  - h. A periphyton risk assessment of hard substrate sites in wadable tributaries, their nutrient status (and that of contributing sub-

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<sup>4</sup> As indicated in Tables 1 and 2 and in my views stated in Attachment 17 of the JWS on Table 3.11-1.

catchments), periphyton monitoring at these sites and assessment of periphyton against national bottom lines at these sites.

## **SCHEDULE 1 - FEPS**

25. In the absence of an agreed and certain allocation regime for nutrients at the sub-catchment level, PC1 is reliant on the effective implementation of FEPs and NRPs as the key ways to manage diffuse contaminants, as a first step towards achieving the Vision and Strategy in the short-term.
26. The recommendations for Schedule 1 in the s42A report and the included report "*Proposed revisions to Schedule 1 to incorporate Good Farming Practice into Farm Environment Plans*" are useful and provide greater certainty around FEP development, approval and review and audit processes. I generally support the s42A recommended amendments to Schedule 1, subject to the recommendations of Ms Kissick. In addition, given the importance of these methods in PC1 to manage contaminants in the interim (e.g., before an allocation regime is implemented), FEPs should be specifically linked to the reductions needed to achieve the short-term water quality outcomes in Table 3.11-1 and any proposed mitigations should be supported by empirical evidence. For example, FEPs should be required as a minimum to also implement: riparian set backs as set out in my Block 2 evidence<sup>5</sup>, management of nutrient inputs from the urine and faeces of farmed animals (Silva et al. 1999; Clothier et al. 2007; Selbie 2014) and better effluent management, storage and pond sealing (Houlbrooke 2008; Longhurst et al. 2013).
27. I support the inclusion of an outcome statement for FEPs in Schedule 1 (as proposed by Ms Kissick) as this clearly links the importance of FEPs to the need for contaminant reduction in PC1. I also support inclusion of reference in Schedule 1 to the need for identification of ephemeral waterbodies, alongside or included as critical source areas, as discussed in the Block 2 evidence of Dr Stewart<sup>6</sup> and myself<sup>7</sup>. I also support Ms Kissick's proposed referencing of Schedule 1 to the targets

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<sup>5</sup> Paragraphs 49 to 55 of the evidence in chief of Kathryn McArthur, Block 2.

<sup>6</sup> Paragraphs 61 to 64 of the evidence in chief of Dr Simon Stewart, Block 2.

<sup>7</sup> Paragraphs 45, 47, 49 and 52 of the evidence in chief of Kathryn McArthur, Block 2.

in Table 3.11-1 as this makes it clear what the outcome to be achieved by FEPs is, at least with respect to the short-term targets. This FEP outcome would be clearer and more effective if sub-catchment nutrient targets are also included for the sub-catchments/tributaries in Table 3.11-1, as recommended by the experts.

28. In my opinion, Objective 2 – principle 5 (of the s42A version of Schedule 1) should contain a reference to including consideration of the nutrient losses from a farming system generated by the urine and faeces of animals, as these are key contributors to diffuse nutrients (particularly losses from urine patches).
29. I support the inclusion of reference to the minimum setbacks (as proposed by Ms Kissick) in the principles for Objectives 4, 5 and 6 of Schedule 1 as this directly references setbacks which are known to reduce contaminant transport from land to water and are supported by the empirical evidence cited in my Block 2 evidence.
30. In my opinion, Objective 7 – principle 12 should require as a minimum the sealing/lining of effluent storage ponds, as unlined ponds are known to contribute disproportionately large amounts of diffuse N and P to shallow groundwater or adjacent waterbodies (Houlbrooke 2008; Longhurst et al. 2013). This principle would also be improved by ensuring the risks from effluent (Longhurst et al. 2013) are identified and mitigated in FEPs. Longhurst et al. (2013) note with respect to dairy effluent ponds that there are “*approximately 2000 farms in the Waikato Region that leak at a greater rate than IPENZ<sup>8</sup> recommendations or WRC rules*”. If a clay liner is used the clay thickness and compaction in a farm dairy effluent pond influences the degree of N and P losses to shallow groundwater (Longhurst et al. 2013). The proximity of ponds to surface waterbodies greatly increases the potential of nutrient leakage from effluent ponds to reach surface water via hydraulic connectivity (Houlbrooke 2008). The contaminants reaching ground or surface water from farm dairy effluent can be greatly reduced by FEPs considering and requiring the avoidance or effective mitigation of the greatest risks identified by Longhurst et al. (2013).

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<sup>8</sup> Institution of Professional Engineers in New Zealand (IPENZ), now known as Engineering New Zealand.

## SUMMARY

31. Diffuse discharges are the predominant source of nutrients, sediment and microbial pathogens in waterways of the Waikato and Waipā River catchments.
32. There is inadequate development of water quality data (e.g., calculation of sub-catchment loads) and insufficient information on contaminant losses from land to fully inform a long-term allocation regime for N and P at this time. However, the development of an allocation regime and utilisation of the information collected via the PC1 process needs to begin as soon as possible if 80-year targets are to be achieved.
33. To implement an allocation regime to achieve 80-year targets, methods are needed in PC1 to enable the following steps to be undertaken:
  - 1) Identify the target concentrations of N and P in Table 3.11-1 for each sub-catchment to ensure the sub-catchment effects of nutrients are managed and the N and P targets for the Waikato River mainstem will also be met;
  - 2) Calculate sub-catchment loads to meet the instream N and P target concentrations;
  - 3) Allocate N and P loads (losses) to land users in each sub-catchment to achieve sub-catchment loads and thereby the instream sub-catchment and mainstem targets.
34. Proposed Policy 7, the proposed implementation methods and the new method recommended by Fish and Game should be included in PC1 to set up a framework for further reducing nutrient losses from land to contribute to achieving the 80-year targets. Further implementation methods are also needed in PC1 to specifically measure success against the short-term water quality targets and to fill critical monitoring knowledge gaps.
35. If the hearing panel decides not to include the additional attributes suggested by the experts for ecosystem and human health in PC1 in some form (although it is my opinion that they can and should be included in PC1 now), methods will be needed to develop attributes to

more comprehensively provide for ecosystem and human health in all sub-catchments, to achieve the Vision and Strategy. Such methods should be time-bound.

36. In the absence of an allocation regime for nutrients, PC1 relies on the effective implementation of FEPs and NRPs to manage diffuse contaminants as a first step towards achieving the Vision and Strategy.

37. The s42A recommended changes to FEPs in Schedule 1 are supported. In addition, FEPs should be specifically linked to achieving the short-term water quality outcomes and mitigations should be proven to be effective and supported by empirical evidence. FEPs should be required as a minimum to also implement: effective riparian set backs, management of nutrient inputs from the urine and faeces of farmed animals and better effluent management, storage and pond sealing.

A handwritten signature in black ink, appearing to read 'KJ McArthur', with a long horizontal line extending to the right.

**Kathryn Jane McArthur**

5 July 2019

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