IN THE MATTER of the Resource Management Act 1991

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IN THE MATTER of submissions and further submissions by Rangitata Diversion Race Management Limited (**RDRML**) on proposed Variation 2 to the proposed Canterbury Land & Water Regional Plan

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STATEMENT OF REBUTTAL EVIDENCE OF GREGORY IAN RYDER

Introduction

1. My full name is Gregory Ian Ryder.

2. I provided a statement of evidence dated 15 May 2015 in connection with submissions by RDRML on Variation 2 to the proposed Canterbury Land & Water Regional Plan (pL&WRP).

3. I have read the evidence of the following submitters and wish to provide rebuttal evidence on aspects of their material:

   (a) Adam Canning on behalf of New Zealand Fish & Game Council;
   (b) Mark Webb on behalf of Central South Island Fish & Game Council;
   (c) Peter Wilson on behalf of Central South Island Fish & Game Council;
   (d) Greg Burrell on behalf of Te Rūnanga O Ngai Tāhu.

4. I set out my rebuttal evidence under the following sections:

   (a) Table 13(a) (Freshwater Outcomes for Hinds/Hekeao Plains Area Rivers) - outcomes versus limits;
   (b) Nutrient management for surface water ecosystem health;
   (c) Sediment management for surface water ecosystem health;
   (d) Temperature limits and biotic indices for fish community health;
   (e) Riparian management for stream ecosystem health.

5. I confirm that this rebuttal evidence is also prepared in accordance with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014.

Table 13(a) Freshwater Outcomes for Hinds/Hekeao Plains Area Rivers

6. New Zealand Fish & Game's witness, Mr Canning, discusses at length in-stream water quality and ecosystem 'limits' to manage freshwater ecosystem health. He strongly recommends more limits to be included in Table 13(a) as well as modifications to those that are already proposed under Variation 2. He has presented these recommendations in a table appended to his evidence (Table 1) titled, **"***Proposed limits to ensure the safeguarding of ecosystem health within Hinds/Hekeao River Catchment Area*".

7. With respect to Mr Canning, in my opinion he has misinterpreted the intent of Table 13(a). Table 13(a) is essentially a derivative of Table 1a of the pL&WRP (Freshwater Outcomes for Canterbury Rivers) tailored for the Hinds/Hekeao Plains Area. I gave evidence at the pL&WRP hearing and, along with other technical witnesses, raised issues around how Table 1a (and Table 1b relating to lakes) outcomes were to be interpreted.

8. Mr Canning frequently describes the freshwater outcomes listed in Table 13(a) as 'limits'. Limits imply a standard which, if not met, will result in some form of non-compliance. It is my understanding from previous pL&WRP hearings that this is not the purpose of Table 1a of the pL&WRP or that of Table 13(a) of Variation 2. This issue is perhaps best clarified within the technical memorandum[1] prepared by Environment Canterbury's Principal Water Quality Scientist, Dr Adrian Meredith, that was attached to the Section 42A Report for the pL&WRP. He noted that the tables identify 'outcomes' for Canterbury rivers and lakes, "*which at times may be aspirational*". He went on to state in the memorandum that they are not intended as water quality guidelines or standards that set numerical limits at specific points as for consent compliance purposes.

9. Dr Meredith went on to make the point that the indicators in Tables 1a and 1b of the pL&WRP are composed of parameters of direct relevance to maintaining 'life supporting capacity' and do not include 'detailed' parameters such as chemical water quality parameters. In other words, the tables set higher level outcomes and hence should be regarded more as aspirational targets than limits.

10. Consequently, I do not consider it is appropriate to include additional ecosystem and water quality metrics in Table 13(a) and use these as default limits and/or standards. To do so would in my opinion raise a number of issues around interpretation and response. For example, how would occasional exceedances of a nutrient limit to manage nuisance periphyton growths be regarded if the growths themselves (which have outcomes of their own in Table 13(a)) did not exceed their indicator value?

11. Further, I consider that the structure of Table 13(a) is such that using the indicators outcomes currently included in the table, and those recommended for inclusion by Mr Canning in Table 1 of his evidence in chief, as limits would be inappropriate for a number of reasons relating to monitoring methodology and interpretation of ecosystem indices in relation to environmental character.

12. By way of example, in paragraph 26 of his evidence, Mr Canning directs the reader to a paper by Dewson, James and Death (2007[2]) for a comprehensive review of the ecological consequences of reducing flow. A more recent paper by these same three authors (Death et al. 2009[3]), which is not referred to by Mr Canning, also assesses the effects of flow reductions on stream communities. The more recent study found that reduced stream flow had no effect on invertebrate density, MCI and QMCI scores, or percentage EPT in streams with mildly impaired or lower water quality.

[1] Appendix 1. Submission on Table 1(A, B) pLWRP. From Adrian Meredith to Matthew McCallum-Clark, Peter Constantine. 7 January 2013.

[2] Dewson, James and Death. 2007. A review of the consequences of decreased flow for instream habitat and macroinvertebrates. - Journal of the North American Benthological Society 26: 401-415.

[3] Death, R.G., Dewson, Z. S. And A. B. W. James. 2009. Is structire or function a better measure fo the effects of water abstraction on ecosytem integrity? *Freshwater Biology*, **54**: 2027-2050.

MCI, QMCI and percentage EPT are all ecosystem indicators recommended for inclusion by Mr Canning as limits in Table 13(a).

Nutrient management for surface water ecosystem health

13. Mr Canning states that management should not be based on a single nutrient (para. 13 of his evidence in chief), and recommends dual nutrient management (N & P) for setting in-stream nutrient concentration limits for the management of nuisance periphyton growths and general ecosystem health. Dr Burrell also appears to support limits of phosphorus in streams (para. 59 of his evidence in chief). As I stated in my evidence in chief (para. 11), the freshwater outcomes as currently worded in under Table 13(a) are in my opinion mostly appropriate and achievable by 2035 provided the additional mitigation measures identified under Variation 2, including MAR and/or TSA, are fully implemented.

14. As with Variation 1 (Selwyn/Te Waihora catchment) of the pL&WRP, no 'outcomes' or limits are proposed for phosphorus in freshwater outcomes for rivers, however, in my opinion these are not necessary if the ecological outcomes for invertebrate communities, macrophytes, periphyton and general water quality under Table 13(a) are met. This approach is similar to the one I recommended to, and subsequently adopted by, Environment Southland in developing its regional water plan (Ryder 2004[4]).

15. While phosphorus limits (either as concentration limits in surface waters or loads from the land) do not form part of Variation 2, the need to manage phosphorus losses from land to water is clearly identified and required. Policy 13.4.10 states:

Reduce discharges of microbes, phosphorus and sediments in the Hinds/Hekeao Plains Area by:
(a) excluding intensively farmed stock from drains in addition to the region-wide stock exclusion rules; and
(b) implementing the farm practices in Schedule 24a; or
(c) preparing and implementing Farm Environment Plans.

16. While Policy 13.4.11 states:

Maintain water quality in the Upper Hinds/Hekeao Plains Area by capping discharges of nitrogen at 114 tonnes of nitrogen per year and requiring all farming activities to operate at good management practice to maintain current phosphorus losses.

17. Mr Webb (para. 67) cites a recent study on the toxicity of nitrate on brown trout in New Zealand by Taylor and Marshall (2014[5]). He reports findings of this laboratory study that show effects of increased nitrate nitrogen concentrations on brown trout egg incubation and survival of alevin. Mr Webb uses this study to recommend a nitrate limit of 2 mg/L as a long term goal for nitrate concentration in several drains to protect trout spawning productivity and recruitment.

18. I have reviewed the relevant sections of the Taylor and Marshall (2014) report and note that the design of the laboratory trial did not include any replication of the

[4] Ryder, G.I. 2004. Environment Southland water quality and the Draft Regional Water Plan: An examination of possible water quality standards. Prepared for Environment Southland.
[5] Taylor, M. and Marshall, W. 2014. Influence of nitrate on the egg development of brown trout. Prepared for Fish & Game New Zealand. AEL Report No. 107. 2nd draft.

nitrate concentration treatments, and as identified by the authors one of the three experimental treatments, was significantly affected by an outside perturbation. In my opinion, the findings of this study, should not be given the weight suggested by Mr Webb.

Sediment management for surface water ecosystem health

19. Mr Canning expresses considerable concern surrounding the adverse effects of high turbidity and deposited sediment on stream communities and recommends turbidity limits of between 5 (Hill-fed rivers) and 10 (Spring-fed plains) NTU for inclusion in Table 13(a).

20. While I understand the potential effects of suspended and deposited sediment on stream ecosystems, the limits proposed by Mr Canning are in my experience highly conservative and not required given the ecosystem indicators already included in Table 13(a). While the effects of suspended sediment on New Zealand fish species are highly variable, in general, they are tolerant of high levels if required. For example, Boubée *et al.* (1997) found banded kokopu (a whitebait species) displayed a 50% avoidance response at turbidity levels of 17-25 NTU, while koaro and inanga (other whitebait species) were found to be less sensitive, with a 50% avoidance response at 70 and 420 NTU respectively. Shortfin and longfin elvers and redfin bullies showed no avoidance behaviour, even at the highest turbidities tested (1,100 NTU) (Boubée *et al.* 1997). Rowe *et al.* (2004) determined the maximum turbidity levels that could be tolerated by four native fish species over a 24-hour period. Juvenile banded kokopu and adult redfin bullies were able to tolerate turbidity levels of up to 38,000 NTU with low mortality. In contrast, smelt and inanga were much more sensitive to high turbidity levels. Fifty per cent mortality rates ranged from 1,700 to 3,000 NTU for smelt, and 17,500 to 21,000 NTU for inanga (Rowe *et al.* 2004).

Temperature limits and biotic indices for fish community health

21. Mr Canning recommends temperature limits based on sensitivity of brown trout feeding and spawning. Not all fish species are sensitive to the levels of temperature recommended and my reading of Variation 2 is that it is not the intention of the plan change to manage primarily for the purposes of supporting a brown trout fishery.

22. Notwithstanding the above comment, Mr Canning has ignored that fact that many large South Island rivers exhibit peak summer temperatures much greater than he has proposed as limits, yet continue to support healthy macroinvertebrate populations and trout fisheries that are highly regarded. I have presented some continuous temperature data for two Southland rivers I am familiar with (Mataura and Oreti), as gathered through regional council monitoring (Figures 1 and 2). These are large rivers and have summer temperatures which consistently peak above 19°C and regularly exceed 20-21°C. They both have well recognised trout fisheries, the Mataura having an international reputation, and both have water conservation orders in recognition of their brown trout fisheries.

Mataura at Gore

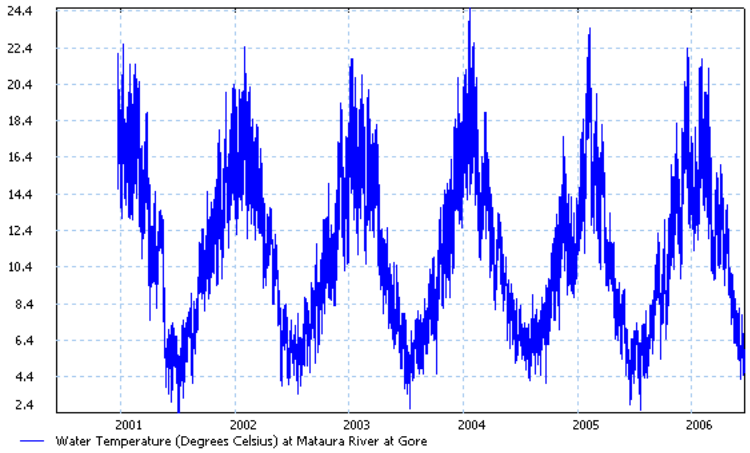
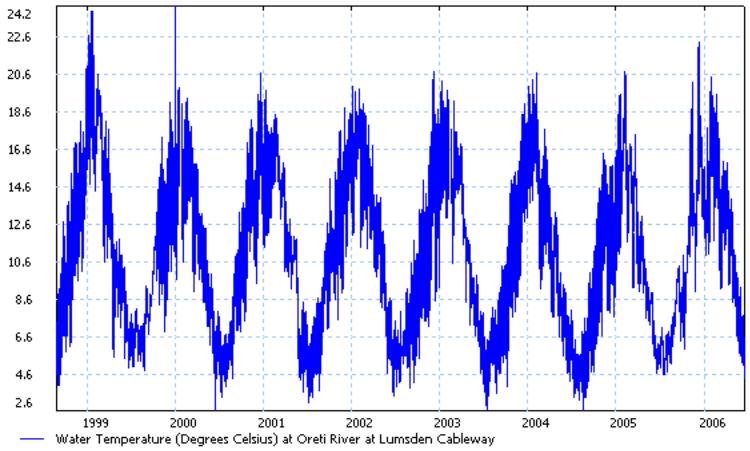


Figure 1 Continuous temperature data for the Mataura River at Gore (data source: Environment Southland).

Oreti River At Lumsden – upper catchment



Oreti River at Wallacetown– lower catchment

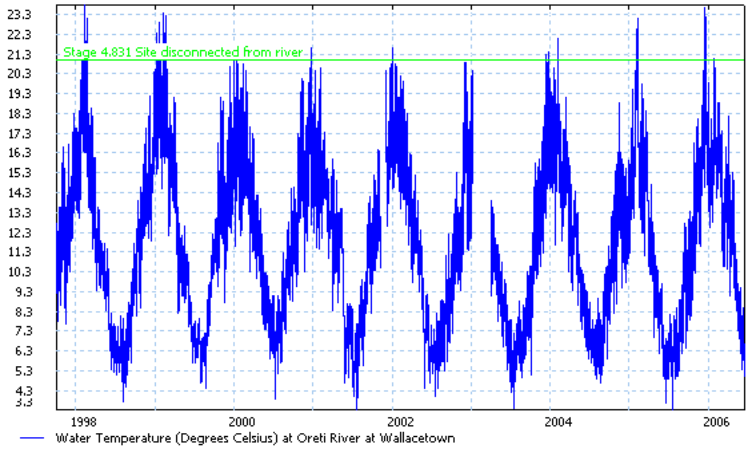


Figure 2 Continuous temperature data for the Oreti River at Lumsden (top) and at Wallacetown (bottom) (data source: Environment Southland).

23. Mr Canning (para. 19 of his evidence in chief) proposes that a minimum score of 40 on the New Zealand Freshwater Fish Index of Biotic Integrity (IBI), which was

developed by Mr Canning's PhD supervisors (Joy and Death 2004[6]), should be incorporated into Table 13(a). The IBI compares the fish species found at a site with those expected to be present, with these expectations based on the actual data available. Mr Canning does not provide any justification of why the IBI score of 40 should be adopted for the Hinds catchment (e.g., no information is presented as to what expected IBI scores in the Canterbury region are), but presumably this recommendation is based on the national data discussed in Joy and Deaths' (2004) paper. Subsequent work by Joy (2010[7]) in the Southland region has demonstrated the importance of developing IBI scores based on regional rather than national data (i.e., Southland pastoral sites were found to have higher IBI scores than native forest sites, in contrast to what was found nationally by Joy and Death (2004)).

24. In their paper about the development of the IBI Joy and Death (2004) also noted that further knowledge was needed about the accuracy of the IBI in comparison to other river assessment systems. I am not aware of this information having been collected, and am therefore not confident about the appropriateness of the IBI for inclusion as an ecosystem indicator for the Hinds/Hekeao Plains Area.

Riparian management for stream ecosystem health

25. I support the measures in Variation 2 that relate to management of riparian buffers. Mr Canning (para. 34) has made further suggestions for the width of riparian buffer strips necessary to effectively manage freshwater ecosystem health. Mr Canning's recommendations are related to the mean annual flow in the waterway, with streams with a lower flow recommended to have a narrow riparian strip than those with a larger flow. Mr Peter Wilson has incorporated the recommendations of Mr Canning into Table 13(j), however I note that Mr Wilson's amendment to Table 13(j) refers to the mean annual ***low*** flow of the waterway (i.e., the MALF) rather than the mean annual flow as stated by Mr Canning. There is typically a large difference in the relative magnitude of these two flow statistics, and it therefore needs to be clarified which was actually intended to be included in Table 13(j).

26. Regardless of which flow statistic was intended for use, Mr Canning does not provide any justification as to why riparian buffer strip width should be related to waterway flow. There are a number of studies that compare the effectiveness of buffers of differing width for removing sediment to the steepness of the slope of surrounding land (reviewed in Ritchie 2011[8]), and recently my colleagues and I conducted a technical review for Environment Southland of the environmental effects of activities within the riparian zone (Ryder Consulting 2013[9]). However I am not aware of any studies relating the effectiveness of the riparian strips of differing width to mean annual flow. Without such studies, I would be reluctant to endorse the recommendations of Mr Canning.

Name: Greg Ryder
Date: 29th May 2015

[6] Joy, M. K. and Death, R. G. 2004. Application of the Index of Biotic Integrity Methodology to New Zealand Freshwater Fish Communities. - Environmental management 34: 415-428.
[7] Joy, M. 2010. Freshwater fish in the Southland region: Spatial distribution in relation to landcover and temporal trends. A report for the Southland Regional Council. Wairesearch Limited.
[8] Ritchie, H. 2011. Diffuse sediment in Waikato waterways – sources, practices for reduction, and policy options. Waikato Regional Council Technical Report 2012/02.
[9] Ryder Consulting 2013. Environmental effects of activities within the riparian zone: Technical Review. Prepared for Environment Southland by Goldsmith, R., Olsen, D. and Ryder, G.