

**BEFORE INDEPENDANT HEARING COMMISSIONERS  
APPOINTED BY THE CANTERBURY REGIONAL COUNCIL**

**UNDER:** the Resource Management Act 1991

**IN THE MATTER OF:** Proposed Plan Change 7 to the  
Canterbury Land and Water Regional  
Plan – Section 14: Orari-Temuka-  
Opihi-Pareora

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**UPDATE OF THE EVIDENCE OF DR GREGORY IAN RYDER ON BEHALF OF  
OPUHA WATER LTD (SUBMITTER NO. PC7-381); THE ADAPTIVE  
MANAGEMENT WORKING GROUP (SUBMITTER NO. PC7-385); AND THE  
OPIHI FLOW AND ALLOCATION WORKING PARTY (SUBMITTER NO. PC7-382)**

Dated: 27 October 2020

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## **1 INTRODUCTION**

- 1.1 My full name is Dr Gregory Ian Ryder. My experience and qualifications are set out in my primary statement dated 17 July 2020.
- 1.2 The purpose of this statement is to provide an update to my earlier evidence following expert caucusing and the release of the National Policy Statement for Freshwater Management 2020 (NPS-FM 2020).

## **2 UPDATE TO OPUHA WATER LTD EVIDENCE**

- 2.1 At expert conferencing, for Lake Opuha, we reached good agreement on recommended changes to Table 14(b) relating to dissolved oxygen units, the trophic level index (TLI) and the relevance of a lake colour outcome for an artificial lake. We agreed on a Band B for the lake's dissolved oxygen outcome, but did not agree on where in Band B dissolved oxygen concentrations limits should be positioned for lake-bottom and mid-hypolimnion attributes set out in Appendix 2B of the NPS-FM 2020. In my opinion, the purpose of a band system is to allow some level of flexibility on where the actual concentration of a water quality parameter should sit. It is my understanding that a banding approach acknowledges that ecosystem health is relatively unchanged within a range of parameter concentrations (dissolved oxygen in this case) as well as recognising that fluctuations in concentration can be expected, but do not necessarily result in significant ecosystem health degradation. I consider the trend in water quality is what is most useful in determining whether ecosystem health is being threatened (or enhanced). If a water quality parameter is trending down a band, without any obvious sign of possible upward changes, then that should be the trigger for investigation and reassessment. Mr Measures in his update of his evidence in chief on behalf of Opuha Water Limited provides a more detailed assessment of dissolved oxygen effects in lake ecosystems and how these relate to the attribute bands in Appendix 2B of the NPS-FM 2020. He has recommended concentrations limits for the lake-bottom and mid-hypolimnion that are equivalent to the bottom of both relevant Band Bs in the NPS-FM 2020. I do not disagree with Mr Measure's recommendations as they still fall within the Band B range and are thus consistent with my opinion above regarding the approach to banding.

### **3 UPDATE TO THE ADAPTIVE MANAGEMENT WORKING GROUP EVIDENCE**

- 3.1 Since my AMWG evidence in chief was submitted in July 2020, expert witness conferencing took place in August 2020 for freshwater quality and ecology. We (the experts) supported the full allocation regime for the Opihi River at Saleyards Bridge proposed by the AMWG and that its proposed Level 1 regime would provide adequate habitat retention for ecological values for the Opihi River below the Saleyards Bridge. However, we disagreed on the significance of the Level 2 flow regime as drafted in PC7. I considered that it provides an acceptable compromise between preserving lake storage to maintain river connectivity in the future at the risk of losing some ecological values in the short term. Importantly, I consider connectivity to be a critical factor in maintaining overall ecosystem health of the Opihi River. In his update of his evidence in chief on behalf of the AMWG, Mr Webb states that a flow of 3.5 cumecs (AMWG's proposed year-round Level 2 minimum flow regime) maintains salmonid habitat availability at near maximum. Figure 2b of my evidence in chief for the AMWG shows that a flow of 3.5 cumecs provides good to excellent habitat availability for most native fish species modelled by NIWA.
- 3.2 I remain comfortable in my position regarding the AMWG's proposed recommendations to the flow regimes for the Opihi and Opuha rivers (tables 14(v) and 14(w)).

### **4 UPDATE TO OPIHI FLOW AND ALLOCATION WORKING PARTY EVIDENCE**

- 4.1 Firstly, I wish to identify an error in my Opihi Flow and Allocation Working Party evidence in chief. It relates to Figure 25, which is a graph showing correlations between same day flow in the Te Ana Wai River at the ECan Cave flow recorder (Picnic Ground) and downstream flows at Chisholm's Ford and the Tengawai Road Bridge. The blue dotted regression line in Figure 25 has been incorrectly labelled as a relationship between flow at Chisholm's Ford and flow at Cave. This relationship is in fact between the flow at Tengawai Road bridge and the flow at Cave. I have amended this equation and have presented the corrected Figure 25 below along with its caption. This correction makes no difference to my assessments or conclusions.

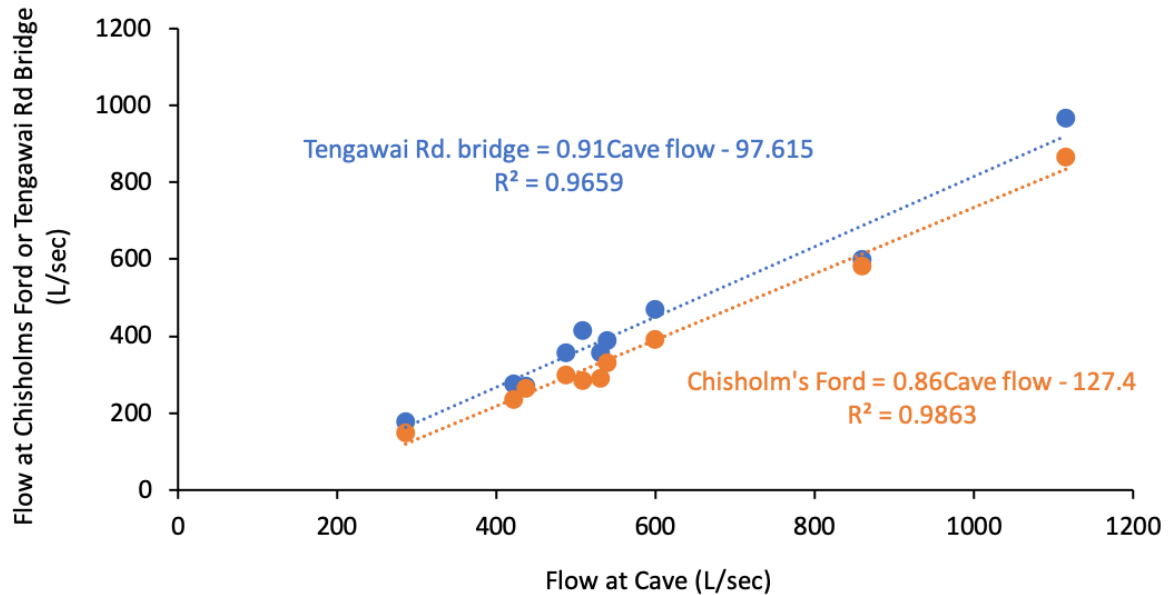


Figure 25. Relationships between same day flow at the ECan Cave flow recorder (Picnic Ground) and downstream flow at Chisholm's Ford and the Tengawai Road Bridge. Data derived from the longitudinal gauging runs presented in Figure 15 and Table 5.

4.2 I also wish to comment on the NPS-FM 2020 attribute states as they relate to the North Opuha, South Opuha, Upper Opihi and Te Ana Wai rivers. In my FAWP evidence in chief, at paragraphs 1.8 and 4.18, I noted that a water quality monitoring programme was undertaken for these rivers and the results were compared against the proposed attribute states in the draft 2019 NPS-FM document. I commented on the results in various paragraphs of my evidence and produced a graphic (Figure 16) summarising the data for various parameters in relation to the relevant attribute bands in the draft 2019 NPS-FM document. Since I undertook that exercise, the draft NPS-FM document was finalised as the NPS-FM 2020 and there were some changes to the attributes listed in Appendices 2A and 2B. Consequently, I note the following changes to my evidence in chief:

- (a) With respect to my Figure 16, a DIN attribute was not included in Appendix 2A of the NPS-FM 2020, however I consider the DIN graph in my Figure 16 is still useful for comparative purposes, but I would like to make it clear that it was not retained in the NPS-FM 2020.
- (b) Table 7 (Ammonia toxicity) in Figure 16 is now Table 5 of Appendix 2A of the NPS-FM 2020, and the National Bottom Lines for the Annual

Median and Annual Maximum concentrations have changed from 1.30 and 2.20 mg/L to 0.24 and 0.4 mg/L, respectively. This does not change my conclusions or bands for the rivers I assessed.

- (c) Table 8 (Nitrate toxicity) in Figure 16 is now Table 6 of Appendix 2A of the NPS-FM 2020, and the National Bottom Lines for the Annual Median and Annual 95th Percentile concentrations have changed from 6.9 and 9.8 mg/L to 2.4 and 3.5 mg/L, respectively. This does not change my conclusions or bands for the rivers I assessed.
- (d) Table 6 (DRP) in Figure 16 is now Table 20 of Appendix 2B of the NPS-FM 2020. The bands are unchanged, and there are no National Bottom Lines. My conclusions for the rivers I assessed remain unchanged.
- (e) Table 23 (E. coli) in Figure 16 is now Table 22 of Appendix 2B of the NPS-FM 2020. The bands are unchanged. My conclusions for the rivers I assessed remain unchanged.
- (f) Table 2 (Periphyton trophic state) in Figure 16 stays as Table 2 of Appendix 2A of the NPS-FM 2020 and the bands are unchanged. My conclusions for the rivers I assessed remain unchanged.

4.3 Since my FAWP evidence in chief was submitted in July 2020, expert witness conferencing took place in August 2020 for freshwater quality and ecology. We reached agreements around the ecosystem health and ecological values of the North Opuha, South Opuha, Upper Opihi and Te Ana Wai rivers.

4.4 We agreed that the level of abstraction and the minimum flow regime in the North Opuha river as proposed under Table 14(m) are unlikely to adversely affect the identified ecological values.

4.5 With respect to the South Opuha river, we agreed that the minimum flow provisions in Table 14(n) of PC7 are an improvement in terms of habitat retention over the current regime (for summertime flows) and that the increases proposed in Table 14(o) of PC7 provide incremental increases in habitat retention. I retain my opinion set out in my evidence in chief that the potential increases in habitat under Table 14(o) (Step 2) are minor and I think would be difficult to quantify in any meaningful way.

- 4.6 For the Upper Opihi River, I agree that the increases in minimum flow under Table 14(p) of PC7 will improve the amount of physical habitat for fish and benthic invertebrates, and partial restrictions will assist in preventing flows from reducing below the monthly minimum limits. For these revised minimum flows, there is some 'cost' to native fish species with respect to potential habitat. This 'cost' accentuates under Table 14(q) minimum flows.
- 4.7 For the Te Ana Wai River, we agreed at expert conferencing that tables 14(r) and 14(s) provide incremental gains in habitat availability over summer time flows for native fish species, mahinga kai species and juvenile salmonids. I reaffirm my comments in my evidence in chief that the frequency of freshes in the river probably has the most influence on the river ecosystem relative to the type of partial restriction used for reducing abstraction under low flow conditions.

**Dr Gregory Ian Ryder**

27 October 2020