IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of the Proposed Canterbury Land and Water Regional Plan

REBUTTAL EVIDENCE OF SHIRLEY ANN HAYWARD FOR THE GROUP 1 HEARING

1. INTRODUCTION

1.1 My name is Shirley Ann Hayward and I have the qualifications and experience described in my Evidence in Chief dated 4 February 2013. I repeat the confirmation given in that statement that I have read and agree to comply with the Code of Conduct for Expert Witnesses.

2. SCOPE OF EVIDENCE

2.1 In this statement of evidence, I address issues raised by Mr Percy and Associate Professor Death with regard to changes and additions to Table 1a of the proposed Land and Water Regional Plan (proposed plan) and changes to Schedule 5 water quality standards for rivers.

3. FRESH WATER QUALITY OUTCOMES

3.1 Associate Professor Death and Mr Percy propose changes and additions to Table 1a of the proposed plan and changes to Schedule 5 water quality standards for rivers. Associate Professor Death has proposed including water quality attributes such as pH and nutrient concentrations in the water quality outcome Table 1a. I am of the view that these measures are not appropriate as water quality outcomes or objectives.

3.2 The indicators included in the outcomes tables have the purpose of providing observable attributes that relate directly to community values sought for

waterways as described in my evidence in chief. These indicators also integrate a range of natural and anthropogenic influences that allow an integrated management strategy.

3.3 Measures of pH and nutrients are causative factors that in combination with other factors can have an effect on attributes that affect community values. The classic example is nutrient concentrations, which in combination with climatic, substrate, riparian and flow conditions determine whether nuisance periphyton or macrophytes develop. These causative factors are more appropriate as discharge standards (for point source and diffuse discharges) or as limits established for individual catchments. By setting objectives for measures of periphyton and macrophytes, policies and rules that control discharges of sediment and nutrients, riparian margins and flow regimes will collectively determine whether the objectives can be met.

3.4 Dr Meredith makes similar comments in Appendix 1 of the Section 42a report, and I support those views of Dr Meredith.

3.5 This is not to say that establishing nutrient limits (either as loads and/or concentrations) is not important. Establishing nutrient limits (and other critical limits) will be an important management strategy that contributes to achieving the outcomes sought. However, in my view this needs to be done at an appropriate scale such as on a catchment scale through a process of establishing community values.

3.6 I do support Associate Professor Death's recommendations to include water clarity in Table 1a as this an appropriate indicator that relates directly to community values (e.g., aesthetic, recreational and ecological values).

3.7 Associate Professor Death recommends changes to numeric criteria for periphyton biomass (chlorophyll *a*) that relate directly to the criteria for filamentous algae. However, the chlorophyll *a* criteria relate to the total amount of all forms of periphyton present, not just filamentous algae. The (total) chlorophyll *a* thresholds of 50 mg/m^2 broadly represents the boundary between oligotrophic and mesotrophic states, 120 mg/m^2 is in the mid-range of mesotrophic state and 200 mg/m^2 represents the boundary between

mesotrophic and eutrophic states[12]. Setting the annual maximum chlorophyll *a* criteria at the upper boundary of the mesotrophic state will maintain healthy and moderately productive ecosystems of the lower alpine and hill-fed rivers, lake-fed rivers and spring-fed streams of the lower basins and plains. I therefore, recommend retaining the criteria for chlorophyll *a* as originally proposed in Table 1a.

4. WATER QUALITY STANDARDS

4.1 Associate Professor Death also recommends changes to numeric criteria for nitrate and toxicants in Schedule 5. His recommendations include changing the level of protection for alpine-lower rivers from 95% to 99%. In my view this is not consistent with the description of the level of protection criteria provided in the ANZECC 2000 water quality guidelines[3] (which were the basis for the toxicant criteria in Schedule 5). Rivers with high conservation/ecological values that are effectively unmodified are recommended to be assigned the highest level of protection (99%), while slightly to moderately disturbed systems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity are recommended to be assigned a 95% level of protection. The lower reaches of alpine rivers of Canterbury have all been modified to various degrees by water abstractions, flood engineering works, and nutrient enrichment such that they more appropriately fit the description of a slightly to moderately disturbed system and should be assigned a 95% level of protection regarding toxicant criteria.

Shirley Hayward

13 February 2013

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[1] Biggs BJF, 2000. *New Zealand periphyton guideline: detecting, monitoring and managing enrichment of streams.* Ministry for the Environment, Wellington.

[2] Dodds WK, Jones JR, Welch EB, 1998. Suggested classification of stream trophic state: distributions of temperate stream types by chlorophyll, total nitrogen, and phosphorus. *Water Research,* 32: 1455-1462.

[3] Australian and New Zealand Environment and Conservation Council (ANZECC), 2000. *Australian New Zealand guidelines for fresh and marine water quality.* Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.