BEFORE THE INDEPENDENT COMMISSIONERS

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the Proposed Canterbury Land and Water Regional Plan

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APPENDIX A

SUPPLEMENTARY EVIDENCE OF DR ROGER GRAEME YOUNG & ASSOCIATE PROFESSOR RUSSELL GEORGE DEATH ON BEHALF OF NELSON/MARLBOROUGH, NORTH CANTERBURY AND CENTRAL SOUTH ISLAND FISH AND GAME COUNCILS
10 MAY 2013

ANDERSON LLOYD
LAWYERS
DUNEDIN

Solicitor: Maree Baker-Galloway

Level 10, Otago House
Cnr Moray & Princes Street,
Private Bag 1959,
DUNEDIN 9054
Tel 03 477 3973
Fax 03 477 3184

QUALIFICATIONS AND EXPERIENCE

1. My name is Dr Roger Graeme Young. My qualifications and evidence were set out in my Evidence in Chief, dated 4 February 2013.

2. My name is Associate Professor Russell George Death. My qualifications and evidence were set out in my Evidence in Chief, dated 4 February 2013.

3. We have again prepared this evidence in compliance with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2011.

4. We have provided this supplementary brief of evidence in response to questions from the hearing panel on hearing group 1 hearing (dated 8 April 2013).

QUESTIONS OF CLARIFICATION

Q.1 Asked for an amended version of Table 1a that noted how compliance with each of the limits should be measured and that noted deviations from the Hayward report, explanations as to why. Further specific questions in respect of limits also follow.

5. As recommended by Dr Young in paragraph 97 of his evidence in chief, Table 1a would be more helpful if it noted how compliance with the proposed limits is to be measured.

6. Mr Van Voorthuysen requested that Dr Young and Assoc. Prof Death provide an amended version of the table detailing how compliance for each of the limits should be measured.

7. A revised version of Table 1a has been prepared and highlights differences between the notified version, the original recommendations in Hayward et al. 2009 and the version that was attached to Assoc. Prof Death's evidence in chief. Some additional changes are also highlighted. The amended table is attached.

8. A footnote at the bottom of the table has been added to describe the appropriate measurement statistics that in our opinion should be applied for each indicator. For each parameter we've considered the frequency of sampling, compliance statistic and any restrictions relating to flow conditions at the time of sampling. In our opinion, all of these elements are critical but are often ignored.

9. In a series of questions, Mr Van Voorthuysen requested clarification of particular numbers in Table 1a or Schedule 5 so that reasoning for that particular number was made clear, particularly where it deviated from that in the Hayward report. Particular queries are as follows:

Q.5 In relation to Schedule 5 and Table 1a why is change for pH of no more than 0.5 recommended, is there support in the Hayward Report for this?

10. The 0.5 unit pH change is adopted from the ANZECC (2000) guidelines. We see no reason not to adopt these guidelines; the ANZECC guidelines are generally very conservative, pH can be an important limiting variable, and there is no evidence for an alternative limit number. Hayward et al, 2009 did recommend a pH range of 6.5 to 8.5 to be included in Schedule WQL1 of NRRP (Table 7.5, Pg 115) but a pH change of 0.5 unit is a better measure of effect for Schedule 5. We support this range being included as a limit in Table 1a but a more appropriate measure of effect with regards to specific activities would be a pH unit change standard. We support the 0.5 pH unit change for this, to be included in Schedule 5.

Q.7 Why is 11 degrees recommended to apply from April to October compared to what Hayward recommended which was 16 degrees. Is 11 degrees achievable or realistic?

11. We have proposed temperature limits to be incorporated into Table 1a specific for trout spawning. Hayward et al. (2009) also proposed a maximum temperature of 16 degrees to be applied during trout spawning but this is higher than the upper threshold for optimum hatch success (Death 2002). Thus to maximise trout hatching success and

provide for this value temperatures should not exceed 11 degrees. Figure 2.5 in Hayward et al. (2009) presents data on temperatures in Canterbury streams during the spawning times and illustrates that temperatures naturally seldom exceed the critical 11 degrees. It therefore seems a more effective and achievable limit to achieve the value of sustainable trout spawning. As trout spawning is the most temperature sensitive value at this time the 11 degree temperature threshold will also provide for the other values.

Q.8 Should Schedule 5 include ammonia value?

12. We think ammonia should be considered as just another contaminant with appropriate protection levels applied i.e. 99%, 95% etc.

Q.6 In Schedule 5 DOC is changed from 2 to 1 – why?

13. The DOC recommended standard of 1 is from Hayward et al. 2009, (Table 7.5 P 115). The pCLWRP recommended a standard of 2, however no data has been provided to support this change from Hayward et al (2009) recommendation. Thus we recommend returning the standard to 1.

Q.3 In relation to cyanobacteria what are the absolute limits that should be in the table?

14. In the attached version of Table 1 we have changed the limits for benthic cyanobacteria to 50% cover as a bottom line so it is consistent with the interim benthic cyanobacteria guidelines.

Q.2 & Q.4 In respect of the management unit Alpine-Lower the Hayward Report recommends 95% but Roger Young recommends 99% why is there a difference in respect of nitrate and other toxicants in Schedule 5 and in Table 1 and the Hayward Report?

15. The 99% protection limit is proposed for the Alpine Lower group due to the very high instream values that are supported by rivers in this river management unit. This unit presumably includes the lower reaches of the Rangitata, Rakaia and Waimakariri rivers, which are recognised as supporting nationally important salmon fisheries, support very diverse native fish populations, still have good water quality due to the large contribution of flow from the alps and in the case of the Rangitata and Rakaia the importance of these values have been recognised in water conservation orders.

ANSWERS FROM RUSSELL DEATH SPECIFICALLY:

Q.19 Asks for clarification on what was intended by the statement "adverse effects and significant adverse effects" are the same thing?

16. In point 7 of my EIC I clarify that as an ecologist “adverse effects” and “significant adverse effects” are the same thing and I use the terms interchangeably. In ecology we do not understand non-significant adverse effects, therefore when I am referring to “adverse effects” in my evidence they are “significant”.

Q.20 What is a meandering stream; what are the impacts of allowing stock into meandering streams; and is it practical and appropriate to exclude all animals from meandering streams?

17. A meandering stream is one that follows its natural course creating winding curves, with a clearly defined wetted channel that fits closely within its active channel (the active channel is the wetted channel along with the gravel bars that are mobilized during high flows). A braided river might create numerous wetted channels which fit within the active channel, and which may move within that channel. The

active channel will be proportionately much wider in a braided river than a meandering one. The impacts of allowing stock into meandering streams is the same as for other rivers as discussed extensively in my EiC for HG1 (dated 4 February 2013, paras 62 – 67), and HG2 (dated 2 April 2013, para 36 - 51).

18. I believe that stock should be excluded from meandering streams. The fence line does not necessarily need to follow the stream bank exactly. In most cases the fence line will more practically be placed to fit the practical constraints of the land typography around the stream. Thus in some places the fenced off riparian strip will be wider in some areas than others, and different on different sides of the stream. This also avoids expensive fencing being washed away in floods etc, as the stream moves around meanders.

DATED this 13TH day of June 2013

Dr Roger Young
Associate Professor Russell Death

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Management Unit	Subunit	Freshwater Objective	Critical Values	QMCI	Dissolved oxygen [minimum daily concentration] (%)	Temperature [daily max] (°C) to comply from October to May inclusive during	Temperature [max] (°C) to	Emergent Macrophytes [Max. cover of Bed](%)	Total Macrophytes [Max. cover of bed](%)	Chlorophyll *a* [max. biomass] (mg/m²)	Filamentous algae >20mm [max. cover of bed](%)	Benthic cyanobacteria [max	Fine Sediment <2mm diameter [max. cover of	Suitability for Contact Recreation [SFRG] Value 8	pH	Nitrate & Other toxicants (Protection level)	DIN (mg/L)	DRP (mg/L)	Clarity black disk (m)
~~Natural State~~						~~Rivers are maintained in a natural state~~													
Alpine – Upland		1,2,3,4,6,7	High biodiversity Salmonid Fishery	~~5 – 6~~ 6	90	~~20~~ 19	~~16~~ 11			50	10	~~20~~ 50	10	Good	Maintain between 6 and 8.5 [~~no greater than 0.5 change~~]	99%	0.08	0.005	1.6
Alpine – Lower		1,2,3,4,6,7,8	Salmonid Fishery Amenity		90	~~20~~ 19				120	20	~~20~~ 50		Good to Fair		~~95%~~ 99%	0.18	0.007	1.6
Hill-fed Upland		1,2,3,4,6,7	High Biodiversity Salmonid Fishery		90	~~20~~ 19		No Set Value	No Set Value	50	10	~~20~~ 50	15	Good		99%	0.21	0.006	4
Hill-fed Lower		1,2,3,4,6,7,8	Salmonid Fishery Amenity Contact recreation		90	~~20~~ 19				~~200~~ 120	30	~~20~~ 50		Good to Fair		95%	0.47	0.006	4
	Urban	1,2,3,5,6,7,8	Amenity	~~3 – 5~~ 4	90	20	~~16~~ 20			~~200~~ 120	30	~~20~~ 50	20	No Value Set		95%	0.47	0.006	4
Lake – fed		1,2,3,4,6,7,8	Salmonid Fishery High Biodiversity	6	90	20	~~16~~ 20			~~200~~ 120	30	~~20~~ 50	10	Good		99%	0.21	0.003	3
Banks Peninsula		1,2,3,4,6,7,8	High Biodiversity	~~4 – 5~~ 5	90	20	~~16~~ 20			120	20	~~20~~ 50	20	No Value Set		99%	0.09	0.025	2
Spring-fed Upland		1,2,3,4,6,7	High Biodiversity Salmonid Spawning	6	90	~~20~~ 19	~~16~~ 11	20	30	50	10	~~20~~ 50	10	Good		99%	0.10	0.007	3
Spring-fed lower basins		1,2,3,4,6,7	High to moderate Biodiversity Salmonid Fishery	5	90	20	~~16~~ 11	30	30	~~200~~ 120	30	~~20~~ 50	10	Fair		95%	0.47	0.010	3
Spring-fed – plains		1,2,3,4,6,7,8	Moderate Biodiversity Salmonid Fishery	~~4.5 – 5~~ 5	~~70~~ 80	20	~~16~~ 11	30	50	~~200~~ 120	30	~~20~~ 50	20	No Value Set		95%	1.5	0.016	3
	Urban	1,2,3,5,6,7,8	Moderate Biodiversity Amenity	~~3 .5~~ 4	~~70~~ 80	20	~~16~~ 11	30	50	~~200~~ 120	30	~~20~~ 50	~~30~~ 20	No Value Set		95%	1.5	0.016	2

1 Ensure diverse and abundant aquatic ecosystems of indigenous flora and fauna
2 Protect habitat of salmonids (trout or salmon)
3 Maintain amenity values
4 Ensure water quality is safe for contact recreation
5 Ensure water is suitable for secondary contact recreation
6 Safe guard Ngai Tahu cultural values including; mauri, mahinga kai, wahi tapu and wahi taonga
7 Ensure water is suitable for stock drinking water supply
8 Support the functioning and health of estuaries and coastal lagoons

Red text denotes changes from pCLWRP table 1a (notified) as shown in Appendix 1 of EiC of Associate Professor Death
~~Strike through text~~ indicates deletions from pCLWRP Table 1a (notified) as shown in appendix 1 of EiC of Associate Professor Death
Blue text denotes changes from the Hayward et al table 7.1 as proposed in appendix 1 of EiC of Associate Professor Death
Green shaded columns have been moved from table 7.5 of the original Hayward Report with any additions or ~~deletions~~ marked as above. The temperature column has been moved from table 7.7 Hayward et al (2009) column iii which set temperature standards which applied during salmonid spawning period "the water temperature shall not exceed […] degrees Celsius as a daily maximum temperature during May to September inclusive" (table 7.5 Hayward et al, 2009).

Measurement statistics to assess whether limits have been met

Agreed compliance limits for table 1a

QMCI: Three year rolling mean of annual measurements is greater than…..
DO: The 5th percentile of daily minimum DO saturation from 24 hour continuous monitoring shall be greater than…..
Temperature: The 95th percentile of daily maximum temperature from 24 hour continuous monitoring shall be less than …..
Nitrate and other toxicants: The 95th percentile of monthly measurements shall be less than…..
Macrophytes: The 95th percentile of monthly measurements shall be less than…..
Periphyton chlorophyll *a*: The 95th percentile of monthly measurements shall be less than…..
Filamentous algal cover: The 95th percentile of monthly measurements shall be less than…..
Benthic cyanobacteria: The 95th percentile of monthly measurements shall be less than……
Deposited fine sediment: Three year rolling mean of annual measurements is less than …..
pH: The 95th percentile of monthly measurements shall be less than…..
Clarity: The monthly black disc clarity measurements taken at flows less than the median flow shall be greater than…..

For DIN and DRP experts had a difference of opinion. Ass Professor Death recommends:

DIN: The 95th percentile of monthly measurements shall be less than…..
DRP: The 95th percentile of monthly measurements shall be less than…..

Dr Young recommends

DIN: Annual median of monthly measurements taken at flows less than the median flow is less than….
DRP: Annual median of monthly measurements taken at flows less than the median flow is less than….