IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of submissions and further submissions made by **RANGITATA DIVERSION RACE MANAGEMENT LIMITED** to the **CANTERBURY REGIONAL COUNCIL** on the Proposed Canterbury Land and Water Regional Plan

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STATEMENT OF EVIDENCE BY GREGORY IAN RYDER

ON BEHALF OF RANGITATA DIVERSION RACE MANAGEMENT LIMITED (Hearing 3)

MAY 2013

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1. INTRODUCTION

1.1 My full name is Gregory Ian Ryder.

1.2 I am a Director of Ryder Consulting Limited ("Ryder Consulting"), an environmental consulting business with offices in Tauranga, Christchurch and Dunedin. Prior to this, I held positions at the Otago Regional Council and the University of Otago.

1.3 I am a water quality scientist and aquatic ecologist and hold BSc. (First Class Honours) (1984) and PhD. (1989) degrees in Zoology from the University of Otago.

1.4 For approximately 25 years I have conducted a wide variety of studies on freshwater ecology and water quality throughout New Zealand. I have been project manager for major studies on New Zealand river ecosystems and have had a lead role in a number of multidisciplinary studies involving aquatic and terrestrial ecosystems. Regional councils and government departments have engaged me to peer review environmental studies and resource consent applications, and I have held the position of an independent commissioner on a number of major resource consent hearings associated with marine farms, ski-field development, water abstractions and wastewater discharges.

1.5 In 1995 I set up Environment Southland's State of the Environment Freshwater Monitoring Programme and have since been involved in various aspects of its implementation and data analysis. I have assisted both Environment Southland and Otago Regional Council in developing their respective regional water plans, and was the principal author in developing water quality standards for Southland's Draft Regional Water Plan (Ryder 2004). I am currently assisting Environment Southland with developing water quality management zones for Southland.

1.6 I am familiar with surface waters of the Canterbury region and have undertaken assessments in the Ashburton, Hakataramea, Rakaia, Rangitata, Waimakariri and Waitaki catchments. This work has included assessments of water quality and surveys of benthic ecology (e.g., macroinvertebrates and periphyton) and fish habitat in relation to abstractions and discharges.

1.7 I have undertaken a number of assessments and reviews of the ecological and water quality effects of the RDR's abstractions and discharges. I also presented evidence on behalf of RDRML at the Natural Resources Regional Plan (NRRP) Variation 1 hearing in March 2009.

1.8 I am familiar with braided rivers having been associated with instream surveys and reviews of the Oreti (Southland), Rakaia (Canterbury), Rangitata (Canterbury), Taramakau (West Coast), Wairau (Marlborough), Waimakariri (Canterbury) and Waitaki (Canterbury) rivers.

1.9 I have read the Code of Conduct for Expert Witnesses (Rule 330A, High Court Rules and Environment Court Practice Note) and I agree to comply with it. I have complied with it in the preparation of this statement of evidence.

2. SCOPE OF EVIDENCE

2.1 I have been asked by Rangitata Diversion Race Management Limited (RDRML) to provide ecological advice and evidence for Hearing 3 of the proposed Canterbury Land and Water Regional Plan (hereafter "**the Plan**" or **dLWRP**).

2.2 My evidence addresses Section 13 of the Plan in relation to the Hakatere/Ashburton River, in particular the proposed minimum flow regime on the South Branch Ashburton River immediately downstream of the RDRML intake.

3. RAISING THE MINIMUM FLOW FOR INSTREAM VALUES

3.1 The Ashburton Zone Committee has identified four sustainable water management priority outcomes for the Ashburton sub-regional area:

- Improved and protected natural character and mauri of the Hakatere/Ashburton River.
- Ecosystem health and biodiversity are protected and improved.
- Protected and improved water quality.
- Efficiently used, secure and reliable supply of water.

3.2 To achieve these outcomes higher minimum flows in the Ashburton River catchment than those currently required have been proposed in Section 13.6.1, Table 12 of the Plan. In the South Branch Ashburton River, immediately

downstream of the RDRML intake, the Plan provides for minimum flows of 3,200 L/s from October to April and 2,300 L/s from May to September (A permits, from August 2012 to August 2022). Existing consented minimum flows in the river are 2,300 L/s year round and the RDRML (submitter number 0197) has submitted that the proposed increase to the minimum flow from October to April is excessive, if based on the requirement to provide for salmon passage, and that there appears to be limited ecological justification to increasing the minimum flow over this period. RDRML instead seek that the period of increased flow be decreased to extend only from February to April (i.e., 3,200 L/s from February to April and 2,300 L/s from May to January).

3.3 RDRML asked me to consider whether the higher minimum flow requirement in the South Branch Ashburton River during October to April is necessary to provide for salmon passage. I have previously assessed salmon passage requirements in the Ashburton River and presented my findings at the proposed Natural Resources Regional Plan Variation 1 hearing in March 2009. This evidence has been referred to by RDRML in their current submission and I repeat the relevant points below.

3.4 The Ashburton River salmon run typically peaks within the months of February-April (Mosley 2001). Duncan (2009), in his review science supporting the proposed minimum flow regime for the Ashburton River, prepared on behalf of Environment Canterbury, states that ease of passage, especially for salmon, is particularly crucial from November to March. I do not consider that passage is "crucial" over this entire period. Records from the Glenariffe salmon hatchery show that peak spawning movement in Canterbury tributary streams is in April and May, but that some movement also occurs in the months before and after this (M. Unwin, *pers. comm.* cited in Jowett 1999). Based on this information, Jowett (1999) considered a flow period appropriate for salmon passage might be mid-March to mid-June and that flows less than those required for adult passage would provide for juvenile salmon rearing and downstream passage to the sea.

3.5 I also note that upstream adult salmon passage is stimulated by freshes and floods (Unwin and Glova 2000, Unwin *et al*. 2003) and that minimum flows may be less critical. In their review of the Rakaia Water Conservation Order minimum flows, Unwin *et al*. (2003) noted: "*… salmon are known to swim through shallow riffle areas with their backs partly out of the water. Thus it could*

be argued that the NWCO minimum flows are in excess of those required for salmon passage, and hence that minimum flows as low as 70 m^3s^{-1} would be adequate for salmon passage in the Rakaia River. We are also unclear as to the importance of less than minimum passage depths on the overall effects of salmon migration, given their option to remain in pools, and the fact that upstream movement appears to be readily stimulated by changes in temperature, turbidity, and flow. As the latter two are associated, and are likely to relieve any restriction to passage, it does not necessarily follow that lack of adequate depths for passage during transient low flow periods will significantly restrict upstream migration in the longer term, or extend the mean time for fish to reach their spawning grounds.".

3.6 An analysis of the effects of various abstraction scenarios on mean annual frequency of large floods (>3 x median flow) and small disturbance events or freshes (>1.5 x median flow) found an insignificant change in the frequency of these disturbance events (Kingett Mitchell 2005). These flow events act as a stimulus for upstream migration by adult salmon.

3.7 I am therefore in agreement with the RDRML submission that an increased minimum flow from October through to April (inclusive) is unnecessary to provide for salmon passage and support their suggested alternative increased minimum flow period of February to April.

3.8 It is implied that increasing minimum flows will protect and improve the trout and salmon fisheries of the Ashburton River. While I agree that adequate flows at the right time of year are essential for sustaining these fisheries, there are additional reasons why improvements to these fisheries may not be forthcoming:

- A major decline in Ashburton River fish populations in the 1970s and 1980s to present coincided with an increase in channelisation and habitat loss Hudson (undated);
- There has shown to be no relationship between stream flow and salmon spawning;
- The South Island salmon run has declined across all rivers and river low flows cannot be singled out as the cause of this decline. More important salmon rivers such as the Clutha, Rakaia and Waitaki have experienced no decline in flows yet salmon runs in these rivers have also declined

dramatically, suggesting the South Island salmon run is affected more by 'global' factors (e.g., changes in the marine environment, Unwin 1997);

- Based on his IFIM analysis, Jowett (1995) found that 3,000 – 4,500 L/s in the lower reach of the river would be optimum (given the river morphology) for brown trout, but he could find no significant low flow effects down to a flow of 1,500 L/s;

- Hudson (undated) demonstrated using aerial photography that there was no significant flow related changes in channel patterns or numbers of channel braids over the minimum flow ranges recommended by various workers, including MALF and higher flows.

3.9 The Plan proposes to raise the minimum flow at the State Highway 1 Bridge to 10,000 L/s from August 2022. I can find no ecological basis for this increase apart from that broad guidelines contained in the MfE's "Proposed National Environmental Standard on Ecological Flows and Water Levels". This national environmental standard is currently on hold pending consideration of further advice from the Land and Water Forum. Notwithstanding this situation, I note that matters that this document recommends be investigated for large scale abstractions in large rivers, such as instream habitat and changes to flow variability, have been assessed for the Ashburton River and the findings do not support the need for a higher minimum flow at SH1.

3.10 Of the seven separate minimum flow assessments for the Ashburton River reviewed by Duncan (2007), none recommended a minimum flow of this magnitude at this site. The highest recommended minimum for this site is 5,000 – 6,000 L/s (Mosley 2001). Duncan (2007) did cite a concern expressed by Dr D. Hart that there could be losses or abstractions occurring between SH1 and the Ashburton Lagoon such that 6,000 L/s at SH1 may result in a significantly smaller flow at the mouth, but I do not know whether this concern has been verified through field studies. I understand that historic gaugings of the river indicate there is little or no loss between SH1 and the coast (Mr R. de Joux, pers. comm.). Based on my assessment of the technical literature, I support a minimum flow of 5,000 - 6,000 L/s at SH1 in order to maintain an adequate frequency of mouth opening.

3.11 I note that Appendix 2 (page 189-190) of the Environment Canterbury Section 32 report for the Hakatere/Ashburton River sets out recommended minimum

flows for the river. A flow of 6,000 L/s is recommended for the SH1 site "*… based on need to keep mouth open…*". It also states on page 172 of the Section 32 report that "*More importantly, the hydrological model predicts that a minimum flow of 6,000 L/s is expected to maintain the open river mouth for an extended period of time. It is important to note that in the long term the minimum flow is expected to reach 10,000 L/s at SH1. There is no modelling work carried out to understand the contributing tributary specific minimum flow requirements to achieve a minimum flow 10,000 L/s at SH1. It is envisaged that the increase of SH1 minimum flow from 6,000 L/s to 10,000 L/s is likely to safeguard most ecological values in the Hakatere/Ashburton catchment.*" In my opinion, this statement is too simplistic and does not account for the assessments that indicate a minimum flow in the order of 6,000 L/s will achieve the same outcome.

4. ALTERNATIVE MINIMUM FLOWS SOUGHT BY OTHERS

4.1 Fish and Game and Forest and Bird – South Branch Ashburton River

4.2 Fish and Game (submitter number 0347) submitted that the short term (until August 2022) minimum flows in Table 12 are not sufficient to protect the fisheries values in the Ashburton River catchment and should be amended to require a minimum flow (for A permits) of 4,000 L/s year round in the South Branch of the Ashburton River downstream of the RDRML intake. The Royal Forest and Bird Protection Society of New Zealand Incorporated, Ashburton Branch (hereafter "Forest and Bird") (submitter number 0031) also submitted that Table 12 should be amended to require a minimum flow of 3,200 L/s all year round in the South Branch of the Ashburton River downstream of the RDRML intake. These flow submissions differ from the proposed flow under the Plan and also the RDRML submission (Table 1).

Table 1 *Proposed flows (L/s) in the South Branch Ashburton River (August 2012 to August 2022) immediately downstream of the RDRML intake under the Plan (Table 12), and Fish and Game, Forest and Bird and RDRML submissions.*

Table 12	Fish and Game	Forest and Bird	RDRML
3,200 (October – April) 2,300 (May – September)	4,000 (year round)	3,200 (year round)	3,200 (February – April) 2,300 (May – January)

4.3 Fish and Game state that "*We have consistently presented information showing the minimum flows required to sustain fisheries values within the system*". However, they do not provide with their submission any references for this information, which makes it hard to evaluate their statement. Similarly Forest and Bird provide no information to support their submission.

4.4 Duncan (2009) prepared a review of the science supporting the South Branch Ashburton River minimum flow regime as was proposed under the NRRP (3,200 L/s year round immediately downstream of the RDRML intake). In his critical review of previous instream habitat studies (Jowett 1992, Sagar 1992, Jowett 1995, Jowett 1999, Mosley 2001), Duncan (2009) concluded that a minimum flow of 2,500 to 3,000 L/s at Valetta Bridge (approximately 10 km downstream of the RDRML intake) would provide peak adult trout drift-feeding habitat and was at or within 10% of peak food producing habitat. A flow of 2,800 L/s was recommended by Duncan (2009) (based on Jowett 1999) to provide salmonid passage at Valetta Bridge. Duncan (2009) noted that the proposed (under the NRRP) minimum flow of 3,200 L/s immediately downstream of the RDRML intake was higher than required to provide for salmonid habitat, however it was necessary to ensure sufficient flow for salmon passage further downstream in the river at Ollivers (3,000 L/s).

4.5 Based on Duncan's (2009) review of salmonid instream habitat studies, and my own reading of these, and the fact that salmon passage is not required year round (as discussed in paragraph 3.4 above), I consider there is no requirement for a year round flow of 4,000 L/s immediately downstream of the RDRML intake, as submitted by Fish and Game, to sustain fisheries values nor for a year round flow of 3,200 L/s as submitted by Forest and Bird. Additionally several studies have identified that the fishery values of the Ashburton River are not related to flow. Jowett (1995) states: "*Based on the morphology of the river, I would be surprised if the Ashburton River could ever become a high quality fishery, no matter what the flow*". Mosley (2001) also quotes Hayes (1997) regarding the IFIM approach used for the Ashburton River and its status in respect of trout habitat and angling. Hayes is reported as concluding that "*trout habitat is of poor quality, as a result of the river's morphology, and is insensitive to flow variations. In particular, large pools that are favoured habitat for adult trout are lacking*".

4.6 Save the Rivers Mid Canterbury Inc. – Ashburton River

4.7 Save the Rivers Mid Canterbury Incorporated (submitter number 0018) submitted that the longer term minimum flow of 10,000 L/s in the Ashburton River at State Highway 1 should be required to be achieved in a shorter time frame (than August 2022) (Table 2). Forest and Bird have also suggested that the long term minimum flow (from August 2020) should be 10,800 L/s. I have already discussed the proposal to raise the minimum flow at this site to 10,000 L/s in paragraph 3.8, but add the additional comments below.

4.8 Mosley (2001) recommended a minimum flow in the Ashburton River of 6,000 L/s from November to April and 5,000 L/s from May to October (these flows were proposed in the NRRP). The November to April 6,000 L/s flow was considered necessary to ensure the Ashburton River mouth was kept open[1] for unhindered upstream migration of sea-run salmonids and to maintain the quality of salmon and trout angling, and the May to October 5,000 L/s flow was necessary to maintain habitat for native fish and sufficient depth for salmonid passage (Mosley 2001). Duncan (2009) agreed with these recommendations, although he noted that this was based on the assumption that flows at State Highway 1 result in similar flows into the lagoon. Therefore, based on instream habitat requirements, there is no justification for the higher minimum flow of 10,000 L/s in the Ashburton River at SH1.

Table 2 *Proposed flows (L/s) in the Ashburton River at State Highway 1 River (August 2012 to August 2022) under the Plan (Table 12), and the Save the Rivers submission.*

Table 12	Save the Rivers
6,000	10,000

4.9 Forest and Bird – Ashburton River mouth

4.10 Forest and Bird submitted that Table 12 of the Plan should be amended, as a flow at the Ashburton River mouth of 7,000 L/s from October to April and 5,000 L/s from May to September is needed in order to keep the river mouth open most of the time (i.e., 90% of the time). No information is provided to support

[1] Mosley (2001) noted that the year round minimum flow for fish habtiat of 5,000 L/s was sufficient to maintain the river mouth open when it is flowing directly to the sea, but an increase in flow is necessary when the mouth is offset.

this submission, aside from the comment that it is based on seven years of observations with a *pers. comm.* reference to Mark Webb dated 02.05.2011.

4.11 McDowall (1995) states: "*Overall, more species/lifestages are migrating during spring than at any other time. There is no consistent period of absence of migration*." He goes on to say "*Exclusion from a river mouth by closure at a time critical for migration can be naturally remedied in subsequent seasons by invasion from the sea, of stock originating in other river systems. Although this should not be seen as an excuse for tolerating negligent river flow management that allows or encourages river mouth closure, the natural ability of fish species to repopulate rivers provides an insurance against long-term local extirpation when river mouth closures do occur*."

4.12 The New Zealand freshwater fish database provides records (accessed April 2012) of 13 migratory fish species in the Ashburton River catchment (Table 3). Table 4 shows upstream and downstream migratory periods of nine of these species.

4.13 These tables show that passage to or from the sea for at least one species is required every month of the year. So, notwithstanding the comments of McDowall (1995) about the ability of our fish species to repopulate rivers, it would seem that an open mouth is more preferable than a closed one, particularly over the summer months. However, as I have already noted above, a minimum flow of between 5,000 and 6,000 L/s appears sufficient to achieve this objective. Consequently, I do not consider the request for a 7,000 L/s minimum flow from October to April at the SH1 bridge to be justified.

Table 3 *New Zealand freshwater fish database records for the Ashburton River catchment. * indicates migratory species.*

Common name	Scientific name	Number of records
Upland bully	*Gobiomorphus breviceps*	115
Brown trout*	*Salmo trutta*	75
Canterbury galaxias	*Galaxias vulgaris*	55
No species recorded	-	37
Longfin eel*	*Anguilla dieffenbachii*	17
Common bully*	*Gobiomorphus cotidianus*	17
Canterbury mudfish	*Neochanna burrowsius*	16
Alpine galaxias	*Galaxias paucispondylus*	13
Perch	*Perca fluviatilis*	12
Shortfin eel*	*Anguilla australis*	12
Torrentfish*	*Cheimarrichthys fosteri*	11
Bluegill bully*	*Gobiomorphus hubbsi*	10
Chinook salmon*	*Oncorhynchus tshawytscha*	6
Galaxiid	*Galaxias*	6
Inanga*	*Galaxias maculatus*	5

Koaro*	*Galaxias brevipinnis*	4
Trout	*Salmo*	4
Rainbow trout*	*Oncorhynchus mykiss*	4
Giant bully*	*Gobiomorphus gobioides*	3
Brook char	*Salvelinus fontinalis*	3
Goldfish	*Carassius auratus*	1
Black flounder*	*Rhombosolea retiaria*	1
Bullies	*Gobiomorphus*	1
Common smelt*	*Retropinna retropinna*	1
Unidentified eel	*Anguilla*	1

Table 4 *Upstream and downstream migration periods of the 10 migratory native fish species found in the Ashburton River catchment. Adapted from Environment Waikato (2007) and McDowall (1995). ++ indicates peak periods for migration activity and + the range.*

Species	Summer			Autumn			Winter			Spring		
	D	J	F	M	A	M	J	J	A	S	O	N
Upstream									++	++	++	++
Black flounder (juvenile)												
Bluegill bully (juvenile)	++											++
Common bully (juvenile)	++	++	++								+	+
Common smelt (juvenile)									+	++	++	+
Giant bully (juvenile)	+	+	+									+
Inanga (juvenile)						+	+	+	++	++	++	+
Koaro (juvenile)										++	++	+
Longfin eels (glass eel to estuary)								+	++	++	++	+
Longfin eels (juvenile)	++	++	++	++	++						+	++
Shortfin eels (glass eel to estuary)	+								+	++	++	++
Shortfin eels (juvenile)	++	++	++	++	++							+
Torrentfish (juvenile)	++	++	++									++
Downstream												
Black flounder (adult)							++	++				
Bluegill bully (larvae)	+	+	+							+	+	+
Common bully (larvae)											+	+
Common smelt (larvae)				+	+	+	+					
Giant bully (larvae)	+											+
Inanga (larvae)	+	+	++	++	++	+	+			+	+	+
Koaro (larvae)					+	++	++					
Longfin eel (adult)					+	+						
Shortfin eel (adult)			+	+	+							
Torrentfish (larvae)			+	+	+	+						

5. SECTION 42A REPORT

5.1 I have reviewed Section 9 (“Ashburton (Section 13)”) of the Section 42A report volume 3, in particular Section 9.4 relating to environmental flow and allocation limits in the Ashburton River. The Section 42A report recommends that Table 12 be retained without amendment.

5.2 The Section 42A report comments on the submissions of Fish and Game and Forest and Bird that relate to minimum flows in the South Branch Ashburton River immediately downstream of the RDRML intake, which I have discussed in section 3 above. The officer notes that Forest and Bird has not provided information to support their requested minimum flows and may wish to provide further information at the hearing. The Fish and Game submission, which seeks the higher minimum flow of 4,000 L/s (prior to August 2022) in order to better protect the fisheries of the river, is dismissed in the Section 42A report by noting that a key outcome prior to 2022 is to achieve improved flows in the river while maintaining sufficient reliability of supply for existing irrigators and the proposed regime reflects both sustainable management of the resource and the priority outcomes identified by the community.

5.3 The Section 42A report comments on the RDRML submission that the October to April period of increased minimum flows in the South Branch Ashburton River is not justified based on the requirement to provide for salmon passage. The Section 42A report states: "*It is noted that the flow regime discussed at the NRRP hearings in 2010 is not identical to the regime set out in Section 13 of the LWRP. As set out in Section 8.1* [9.1] *of this report, the flow and allocation regime is to be considered as a package. The hydrological modelling undertaken by Graeme Horrell demonstrates that the residual flow, alongside the other components of the package, will assist with the attainment of the key outcomes prioritised by the community*.". While this statement is acknowledged, I still am of the opinion that the higher minimum flow period expressed in the Plan for the South Ashburton (3,200 L/s October - April) is unnecessary to maintain adequate adult salmon passage and that a period of February to April is adequate provided the frequency of floods and freshes is not significantly reduced.

5.4 I also note the reservations expressed by Mr de Joux of Mr Horrell's hydrological modelling.

6. CONCLUSION

6.1 The Ashburton Zone Committee identified the protection and improvement of ecosystem health, biodiversity and water quality as sustainable water management priority outcomes for the Ashburton sub-regional area. In my opinion, the pLWRP minimum flows for the Ashburton River will protect existing

attributes, but I am less certain that they will result in measurable improvements particularly for Ashburton River fisheries. This is because low flows are not the critical environmental variable influencing the existing ecosystem. Other factors such as channel morphology, channelisation, gravel extraction and riparian encroachment appear to have had a more dominant or overriding effect on ecology.

6.2 In my opinion, a higher minimum flow period expressed in the Plan for the South Ashburton (3,200 L/s October - April) is unnecessary to maintain the Ashburton salmonid fishery. A period of higher flow from February to April is adequate provided the frequency of floods and freshes is not significantly reduced.

6.3 It is generally accepted that a flow of about 6,000 L/s at SH1 is sufficient to maintain an opening at the mouth as well as provide good habitat for instream biota and river feeding birds in the lower reaches. I can find no quantitative information to indicate that a 10,000 L/s minimum flow at this site will provide additional protection or improvement to ecosystem health and biodiversity.

Greg Ryder

May 2013

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