

*in the matter of* The Resource Management Act 1991

*and*

*in the matter of* Application CRC040870 by IM & CC  
Donaldson to divert, take and use water  
from the Waipara River

## STATEMENT OF EVIDENCE OF IAN LLOYD

### INTRODUCTION

- 1 My name is Ian Lloyd. I hold Bachelor degrees in Civil Engineering and Geology and a Masters degree in Environmental Science, all from the University of Canterbury. I have 9 years work experience in resource planning and water resource engineering.
- 2 In February 2002 I completed my MSc thesis on "The Water Resources of the Waipara Catchment and their management". Subsequently I have been involved in numerous groundwater and surface water consent applications in the Waipara area as well as surface water investigations in the Omihi Valley.

### SCOPE OF EVIDENCE AND MATTERS TO BE CONSIDERED

- 3 Within this evidence I will address the following matters:
  - The hydrology of the Waipara River including existing flow data and
  - Minimum flows

### HYDROLOGY OF THE WAIPARA RIVER

- 4 The surface water resources of the Waipara catchment are extremely seasonal and flow in the Waipara River is strongly related to precipitation. Runoff is very limited during summer (due to high evapo-transpiration rates) resulting in low flows. Many of the tributaries of the Waipara River are ephemeral and regularly go dry. Similarly the main river has been known to go dry in a number of locations. Flow in the Waipara River is dominated by long periods of low flow and large, infrequent, short duration flood events.
- 5 The Waipara catchment can be separated into two distinct parts the upper catchment which drains the Okuku Ranges, the Cavendish Hills and the foothills around Mount Grey and the lower catchment which drains the Waipara Alluvial basin. For this application we are principally concerned with the lower part of the catchment.
- 6 Current understanding of flow in the Waipara River is based on records from continuous flow recorders situated at White Gorge and Teviotdale and from numerous instantaneous gauging which have been undertaken at various sites along the river.
- 7 The White Gorge recorder site is situated mid catchment (31 km from the coast) and was established in February 1988. The Teviotdale recorder is situated in the lower catchment

(7 km from the coast) and was established in April 2000. Analysis of the flow records indicates that there is an approximately 6 hour lag between flows at the two sites

- 8 Analysis of the average daily flow data from the two sites is summarised in Table 1 (flow data supplied by Environment Canterbury on 22 September 2003, from their flow data archive).

Table 1: Flow Statistics for the Waipara River

	White Gorge		Teviotdale
Length of record	26 February 1988 - present		8 April 2000 - present
Period analysed	26 Feb 1988 – 31 July 2004	8 Apr 2000 – 30 June 2004	8 Apr 2000 – 30 June 2004
Minimum	26	47	175
Average	2911	2721	3914
Median	930	939	1403
Maximum	279694	279694	404931
Flow exceeded 90% of the time	119	102	298
MAFL	85	113 <sup>(1)</sup>	247 <sup>(1)</sup>
7 day MAFL	99	128 <sup>(1)</sup>	262 <sup>(1)</sup>
Notes:			
1) Only 2001-2004 considered, 2000 excluded as only part of the year			

- 9 Comparing the mean daily flow from both sites allows a regression relationship to be established between the two sites Figure 1. The relationship is slightly different at high flow than it is at low flow which is consistent with the findings of Charter 2002 and 2003 and Lloyd 2002. This difference is attributed to the influence of Omihi Stream and particularly the numerous large springs that are situated in the lower sections of Omihi Stream. During periods of low flow, Omihi Stream contributes approximately 50% of the flow that passes the Teviotdale recorder site, while during periods of high flow, runoff from the upper catchment becomes dominant.



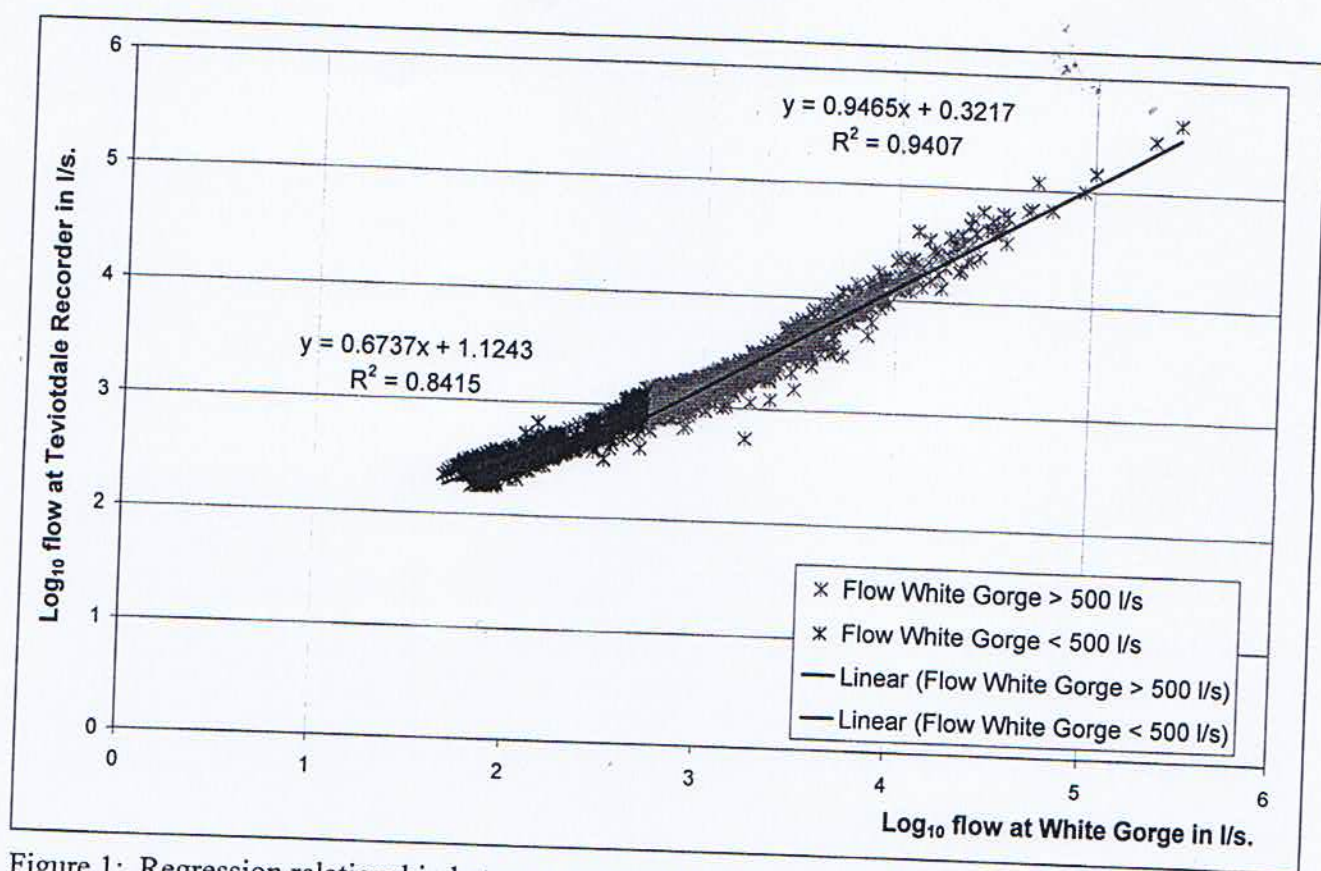


Figure 1: Regression relationship between average daily flow in the Waipara River at the Teviotdale and White Gorge recorder sites based on flow data from 8 April 2000 to 30 June 2004 (data supplied by Environment Canterbury on 22 September 2003, from their flow data archive)

- 10 Using the regression relationships outlined above the flow record for the Teviotdale Recorder site was extended. Analysis of the average daily flow data from the extended record is summarised in Table 2.

Table 2: Flow Statistics for the extended record at the Teviotdale Recorder

	Teviotdale Recorder
Period analysed	26 Feb 88 – 31 Jul 04
Minimum	46
Average	2665
Median	1347
Maximum	404931
Flow exceeded 90% of the time	228
MALF	154
7 day MALF	174
Number of days flow less than 80 $\text{l/s}$	86
Number of days flow less than 110 $\text{l/s}$	133
Number of days flow less than 146 $\text{l/s}$	253



## MINIMUM FLOWS

- 11 In establishing minimum flows there are three principal issues that need to be outlined. Firstly the site at which the minimum flows will be measured, secondly the level of the minimum flow and thirdly the section of the river over which the minimum flow will apply. Environment Canterbury is currently reviewing the minimum flows for the Waipara catchment. Mosley 2003 following a thorough review of existing information suggested that the minimum flow for the Waipara River below White Gorge be 110 l/s. For abstractors below the Omihi Stream confluence Mosley suggested that the minimum flow monitoring site should either be Greenwoods Bridge or the Teviotdale recorder site.
- 12 Historically all the consents (namely the Donaldson's and the Crofts) that draw water from the Waipara river below the confluence of Omihi Stream have been subject to a minimum flow of 80 l/s as measured at Greenwoods Bridge.
- 13 Greenwoods Bridge has long been a flow monitoring site with instantaneous flow gauging being undertaken since 1971. Greenwoods Bridge is situated approximately 4 km from the coast downstream of the lower gorge in an area where the river is braded and where surface flow is lost to groundwater. The Teviotdale Recorder site was established in 2000 within the lower gorge approximately 7 km from the coast. While the river is still braded through the lower gorge tertiary bedrock is close to the surface restricting the volume of underflow. Given this the Teviotdale Recorder site is expected to provide a better indication of the full flow in the Waipara River than the Greenwoods Bridge site. Similarly, the continuous flow records which are available from the Teviotdale recorder site provide a more complete understanding of flow than the spot measurements available from Greenwoods Bridge.
- 14 Based on the above it is suggested that the Teviotdale recorder should be used as the minimum flow monitoring site. It is noted that this is consistent with both the recommendations of the officers report and the conditions of the Crofts consent CRC040492 which was renewed in May 2004.
- 15 Minimum flows have a direct effect on the reliability of water supply for abstractors. Increasing the minimum flow will reduce the reliability of water supply which can significantly affect the effectiveness of irrigation. Table 3 outlines the change in water supply reliability (i.e. the number of days of restrictions) from the current minimum flow measured at Greenwoods Bridge to various minimum flows measured at the Teviotdale Recorder.



Table 3: Changes in water supply reliability for different minimum flows

Year	Number of days of restrictions for various minimum flows			
	80 l/s at Greenwoods Bridge <sup>(1)</sup>	80 l/s at the Teviotdale Recorder <sup>(2)</sup>	110 l/s at the Teviotdale Recorder <sup>(2)</sup>	146 l/s at the Teviotdale Recorder <sup>(2)</sup>
1988 <sup>(3)</sup>	0	0	7	19
1989	0	0	8	31
1990	0	0	3	23
1991	0	0	4	11
1992	0	0	0	0
1993	0	0	0	0
1994	0	0	0	0
1995	0	0	0	0
1996	0	0	2	5
1997	0	0	0	1
1998	0	47	56	95
1999	0	39	53	56
2000	0	0	0	12
2001	0	0	0	0
2002	0	0	0	0
2003	0	0	0	0
2004 <sup>(4)</sup>	0	0	0	0
<b>Total</b>	<b>0</b>	<b>86</b>	<b>133</b>	<b>253</b>
<b>Average</b>	<b>0</b>	<b>5</b>	<b>8</b>	<b>15</b>
<b>Years with &gt;14 days of restrictions</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>5</b>
<b>Number of occasions of 7 consecutive days of restrictions</b>	<b>0</b>	<b>9</b>	<b>15</b>	<b>23</b>
<b>Number of occasions of 14 consecutive days of restrictions</b>	<b>0</b>	<b>3</b>	<b>7</b>	<b>8</b>
<b>Longest consecutive period of restrictions</b>	<b>0</b>	<b>45</b>	<b>47</b>	<b>60</b>
<b>Notes:</b> 1) Based on the relationship determined by Charter 2003 Average daily flow @ Greenwoods l/s = 1.6521 x average daily flow @ White Gorge l/s +50 2) Based on the relationship determined in Figure 1 For Average daily flows at White Gorge of < 500 l/s Average daily flow at Teviotdale Rec (l/s) = $10^{(0.6737 \times \text{average daily flow at White Gorge (l/s)} + 1.1243)}$ For Average daily flows at White Gorge of > 500 l/s Average daily flow at Teviotdale Rec (l/s) = $10^{(0.9465 \times \text{average daily flow at White Gorge (l/s)} + 0.3217)}$ 3) Incomplete year White Gorge flow records start on 26 February 1988 4) Incomplete year White Gorge flow records only to 31 July 2004				

- 16 Increasing the minimum flow to the 110 l/s suggested by Mosley's will significantly reduce water supply reliability to the Donaldson's which will significantly affect the effectiveness of their irrigation system. As previously outlined by Mr Donaldson water restrictions of longer than 14 consecutive days cause the vines significant water stress with die back of leaves and crop damage. If restriction remain in force for longer than 14 continuous days actual die back of the vines may occur.



- 17 In regard to the abstraction for irrigation the officers report suggests two minimum flows:
- A minimum flow of 110 l/s at the Teviotdale recorder site is suggested for the first 12 l/s (605 m<sup>3</sup>/day) of the take and
  - A minimum flow of 146 l/s at the Teviotdale recorder site is suggested for the other 2.16 l/s (605 m<sup>3</sup>/day) of the take.

The officer states that the suggested minimum flows are aimed at ensuring that the adverse effects on ecosystems within the Waipara River will be minor and adverse effects on other users of the water resource will be de minimis. The suggested minimum flows are based on the findings of Mosley (2003). In setting the second minimum flow at 146 l/s the officer has taken the minimum flow suggested by Mosley (110 l/s) and has added the existing consented downstream abstractions namely CRC040492 held by WH and R Croft which authorise the abstraction of 36 l/s. By doing this the officer is giving priority to consent CRC040492.

- 18 As previously outlined most of this application relates to the continuation of an ongoing activity which was initially consented in 1988. Similarly the initial consent NCY870127 held by the Donaldson's was actually for a greater instantaneous take (60 l/s) and a greater daily volume (2,600 m<sup>3</sup>) than that currently proposed. It has always been the intention of the Donaldson's to fully develop their vineyard and hence use all the water they initially applied for in 1988, a fact that was highlighted in both the initial application in 1988 and again when the consent was renewed in 1992. Similarly it is noted that the Donaldson's intake site was used to abstract water for irrigation by the previous owners of the property both JM and MA Pugh and prior to the Pugh's, JM and LS Shearer. The intake site represents one of the earliest irrigation intake sites on the main Waipara River and has been in operation since at least 1983.
- 19 Consent CRC040492 held by WH and R Croft was granted in May 2004 and represents a renewal and change to consent CRC920476 which was initially granted in 1992 and which authorized the abstraction of 36 l/s and 1318 m<sup>3</sup>/day. Consent CRC920476 itself represents the renewal of consents originally held by GCG and HA Brown which were granted in 1983 and 1984. As such both the Crofts and the Donaldsons consents represent some of the earliest abstractions of irrigation water from the Waipara River. Local information indicates that Shearers were irrigating prior to the Browns and as such the Donaldson's consents predate those held by WH and R Croft and hence I find it surprising that the officer has given priority to the Croft consent. Similarly the Donaldsons have continually exercised their consent since 1988 while it is understood that the Croft consent has not been fully exercised for a number of years and since at least 2000 as not been exercised at all. Again I find it surprising that the officer has given greater priority to the Crofts consent which has not been exercised recently than to the Donaldson's consent which has been continually exercised since 1988.
- 20 As the Donaldsons consent both predates the Crofts and has been exercised far more regularly, the Donaldsons consent should be given priority, or at the very least both consents should be subject to the same minimum flows. In fact given the similarities between the two abstractions I suggest that both consents should have similar conditions and expiry dates.