

BEFORE THE COMMISSIONERS APPOINTED BY THE CANTERBURY REGIONAL

COUNCIL

IN THE MATTER OF

The Resource Management Act 1991

AND

IN THE MATTER OF the proposed Waipara

Catchment Environmental Flow and Water

Allocation Plan 2010.

EVIDENCE

Ivan Donaldson

OF

INTRODUCTION

- 1.** My name is Ivan MacGregor Donaldson. I am presenting this **evidence on behalf of my family**, ie. my wife, 3 sons, 2 daughter-in-laws and myself. We all work together at our vineyard and winery. Although I am a neurologist and was Associate Professor of Neurology at the Christchurch School of Medicine, I have been **actively involved in the wine industry for over 35 years**. I am a national and international wine judge, a wine columnist and the holder of the London Diploma of Wine, a 2 year trade examination. In 1976 I helped establish the first vineyard of modern times in Canterbury and I made the wine for this for a number of years. Because we believed Waipara had a special microclimate favourable for vineyards, my wife and I decided to shift the focus of our activities to that area at a time when viticulture there was in its infancy. We purchased land there and **25 years ago started to plant** what is now the

Pegasus Bay Vineyard. This **evidence** and that which my son Paul Donaldson will present later, is **supported by the Waipara Valley Wine Growers**, who feel they have not been given sufficient opportunity to present for themselves. **We have two vineyard sites**, both on the Waipara River. **One** vineyard takes water from the **Lower Waipara**, from which it **abstracts** water at a site **above the Teviotdale** recorder. The **other** is on the **Upper Waipara** below the **White Gorge** recorder. We thus have a direct interest in both the Upper and Lower Waipara.

2. The **process** which has lead to this hearing on the proposed plan **started very many years ago** because the **Waipara catchment fell outside the parameters of the proposed NRRP**. It is 9 years since ECAN engaged with the community to formulate this plan and since then there have been many public meetings, much work by sub-committees and visits to the area by ECAN. ECAN staff and former councillors came to this area and discussed the problem with the local community, abstractors and other interested parties. ECAN held a workshop on the topic at which all interested parties were invited to give a presentation. All this huge amount of consultation and work resulted in the proposed Waipara Catchment Environment Flow and Water Allocation Regional Plan and it was notified in April 2010. We believe that, by in large, this is a **good plan**, which was **reached by working in good faith** with ECAN staff and with the previous council. It is not perfect, but is good with only a small number of areas of concern, which we have covered in our earlier submissions on the plan. Some of these suggestions have now been adopted in the subsequent reports under Section 42A.

3. We strongly **support all the objectives** in that plan and in the Waipara catchment and the section on the Summary of Water Management which immediately proceeds them, but have **concerns regarding some of the policies** proposed to help meet those objectives. While they are not the main thrust of our presentation today we wish to document them again. They particularly involve Policy 1.10b – to **increase the minimum flows** for takes from the A block for storage or frost fighting, Policy 1.1 and 2 – the **failure to allow for ground water** abstraction with a calculated stream depleting effect of **3 litres/s or less**.

4. The **section 42A reports**, however, have mooted very **significant changes** to the Proposed Plan. Some of these had been **suggested earlier by ECAN staff and were rejected by the**

ECAN council in formulating the notified plan. As they have now resurfaced in the 42A ECAN staff reports we would like to spend most of our time addressing these.

- 5.** The formulation of any regional plan, such as this one, requires the careful evaluation of the advantages and disadvantages of making a change to existing regulations and, in this case, weighing up the economic and social well-being of the local community on the one hand, along with the possible ecological benefits on the other. In fact, it is stated in the objectives of the proposed plan that the **economic and social benefits of abstraction** from the Waipara River catchment need to be **balanced against ecological, cultural, recreational and amenity values** of the river and its tributaries.

The important **issues** really are:

- a) to **what extent is the current abstraction causing a problem or aggravating the situation?**
- b) what would be the **gains from altering the present regimen of abstraction?** and
- c) what **damage would be done by such alterations?**

TO WHAT EXTENT WOULD THE CURRENT ABSTRACTION CAUSING A PROBLEM OR AGGRAVATING THE SITUATION?

Surface and Subsurface Flows

- 6.** To what extent is the current abstraction altering the natural state of the river? Although the ECAN documents show that there is subsurface flow in the bed of the river, all of the predictions and calculations produced by **ECAN treat surface flow** as though it is in a sealed pipe and it **suggests that any abstraction automatically results in a decrease in surface flow** by an equivalent amount below that point. All of Mr Leftey's predictions on the effects of abstraction on flow are based on this premise and in response to a question at this hearing he reconfirmed that he believed any abstraction from the river or river bed in the Upper Waipara would be followed by reduction in surface flow of the same amount at Teviotdale. We believe that the huge subsurface flows of water in the gravel bed, with ongoing gains and losses

between this and the surface flow ensures that this is not the case and provides a **huge buffering reservoir** in comparison with the **relatively small abstraction**. The surface flow can be viewed as only a very small tip in a massive iceberg. In the process leading up to the formulation of this Waipara catchment Plan **ECAN** staff, including Bryan Jenkins, **met with the Waipara River Group in 2006** and discussed the **lack of direct scientific evidence that abstraction** was significantly **impacting on the surface flows**. **Bryan Jenkins** subsequently wrote to the group **proposing a plan of gauging runs** throughout the length of the river covering a full range of flows spread over a series of months. He suggested gauging above and below each direct surface abstraction. Such a study **was never undertaken**. What **measurements** that have been carried out have **not shown such a one to one connection** and have usually been unable to show any significant diminution of surface flow. Thus, while abstraction will have an effect on the total amount of water, both surface and subsurface, any effect on diminishing surface flow and causing or enlarging drying reaches remains to be clearly established. **Other presenters** will give **further evidence on this matter**.

The River's appearance

- 7.** The **Donaldsons** are a **Ngai Tahu family** who were brought up close to the land. We are acutely aware of our environment and respect its ecological needs. Such is our interest that one of my **sons, Paul**, who will present later, opted to do a **zoology degree specialising in aquatic zoology**. Our family has been privileged to **live and work by the Waipara River** for the last **quarter of a century** and we know it intimately. **We** have, and still do **use the river**, its tributaries and lagoon as a **source of mahinga kai** and we value their health. There seems to be a general impression that abstraction has "degraded" the main-stem of the Waipara River. We disagree with this. We believe that the **main way the river has been degraded** over this time is by continued and **unrestricted growth of vegetation, particularly willows**. We agree with Mr. **Jowett** (in his 42A report) when he states that he has "**not seen any evidence that the current flow regime affects recreation, cultural and amenity values of the Waipara**

River". There is a possible effect on native fish and, as mentioned, Paul Donaldson will present on this later.

8. There has only been **one study** which has involved a **direct physical assessment of the river from the Maori perspective** and this was carried out by Rebecca Larking using observers from **the Ngai Tuahuriri Runanga** (Report 01/61), although another report (RO4/01) reviewed tangata whenua values without directly evaluating the river. The Larking and Ngai Tuahuriri report involved **observers looking at the river at multiple sites on almost monthly occasions over the course of a year**. These observers assessed the **quality of the water to be between good and excellent at all sites**. The general health of the river or **mauri** was **assessed at:**

- a) **White Gorge**, prior to any abstraction
- b) at State Highway 1, a little above the **Omihi confluence** after abstraction from the Upper Waipara River and
- c) at **Teviotdale** after abstraction from the Lower Waipara River

At **Teviotdale** the mauri was regarded as **good or better** for the **whole of the year and at periods of normal flow** it was similarly assessed as **good or better at the other 2 sites**. At the times of **lowest flows (January and February)** the mauri was assessed at being **low or poor at** the other 2 sites. The important thing to note, however, is that the **ratings** for the mauri of the river given **prior to any abstraction** (White Gorge) and **after abstraction** (State Highway 1) **were the same**; ie they had not been changed by abstraction. However, "the overall impression from the Runanga representatives was that the Waipara **River was in good health** during the period of study". An observer commented "If all rivers were like the Waipara!"

This study showed that the evaluators' concept of mauri was closely linked to the amount of surface flow present in a particular section of the river and this would be in keeping with my own feelings and evaluations. **I do not disagree** with the Runanga observers. My personal

assessments have been similar (ie when the flow in the **river is low it looks unhealthy**). I have looked at it at these times both at White Gorge and above the Omihi confluence and I agree that at both points its appearance is essentially the same. Unfortunately, however, the hydrology clearly shows that the Waipara River is naturally subject to periods of low flow in the summer and autumn and the fact that **its mauri was assessed as being the same both above and below abstraction on the Upper Waipara River** confirms that at **certain points the river will not appear healthy from our, Ngai Tahu, perspective even without abstraction**. The section of the river most commonly seen by people is between State Highway 1 and the Omihi confluence and it is **unusual for the public to visit White Gorge**. **Most thus attribute the appearance** in this section of the **river to the effect of abstraction** without being aware of the real situation.

The Effect on Animal Life

9. Mr. Jowett in his 42A report (para 4.23) concluded that **native fish are not limited** by the **amount of food available during low flows and that the main effect of abstraction would be on the size of in-stream physical habitat**, with no significant effects on water quality, temperature or water morphology (paragraph 5.2), as concluded by Moseley (2003). Mr Jowett (para 7.6) also states that **“with the minimum flows of 50l/s at White Gorge and 110l/s at the Teviodale recorder, I would expect abstraction to have some effect on torrentfish and bluegill bullies, but not Canterbury galaxias or upland bullies. Torrentfish and bullies are common in South Island east coast gravel rivers and our study showed these diadromous species are resilient with good recruitment in spring, even when the river mouth is open for only a short time”**. As he said in his report to ECAN (30 June 2006), **“it is a value judgement whether abstraction should be limited in order to prevent a potential reduction in bluegill bully and torrentfish numbers. I believe that the objective of a flow management is to maintain fish population at a sustainable level”**. The fact that these fish populations exist in reasonable numbers under the present abstraction, would seem to be good evidence that the fish population is currently maintained at a sustainable level. Paul Donaldson will further expand on fish and their requirements, but it should be noted that **Mr Jowett’s**

recommendations on the minimum flows are based on the same premise that ECAN uses; ie that abstraction is decreasing the flow downstream by the same amount (para 6.15), which we dispute.

- 10.** Mr. Jowett in his 42A report, says that the food supply for wading birds at the river mouth is probably affected when the flow at White Gorge is below 40 L/second, but this level is natural and abstraction has already ceased above this flow. Moseley (2003) concluded that current abstraction from the Waipara River was **unlikely to be having adverse effects on birds** and that disturbance from **off-road vehicles and predators were more likely to be harmful.**

THE GAINS FROM ALTERING THE PRESENT REGIME OF ABSTRACTION

- 11.** The benefits from altering the present flow regime of the river seem to be **modest**, as **recognised by the Notified Plan**, which changed neither the minimum flows nor introduced partial restrictions. Policy 3.5 of that **plan allows for investigation of the costs and benefits of imposing partial restrictions on the A block**, while the section 42A Reports recommend raising the minimum flow and introducing partial restrictions (page 56 Mr McCallum-Clark and Ms Whitmore), both of which were considered and rejected by the former ECAN council in its meeting of 15 July 2009. The section **42A Addendum** has now modified this stance to recommend **“that the future introduction of partial restrictions be clearly signalled within this planning document”**. Mr McCallum-Clark (page 8 Addendum) states that in his view “the hydrological and ecological evidence is quite strongly in support of partial restrictions”. The **presumed justification** for this recommendation in the section 42A Reports is that the **costs and benefits had been sufficiently** investigated to justify these. We don't believe that this is the case. The information with regard to the possible **effect on fish** is indeed **well known**. Mr Jowett makes it clear (para 6.10) “there is **more information on the response of fish to low flows** (in the Waipara River) **than in any other catchment in New Zealand**” It is unlikely further significant information will become available and further ECAN-funded studies of this might be viewed as being obsessive.

- 12.** In summary, the **benefits** of raising the minimum flows and introducing partial restrictions are mainly in terms of a **possible gain in the volume of habitat for 2 common species of native**

fish during periods of very low flow. These perceived benefits are **based on the assumption** that **water lost to abstractors will automatically be reflected in increased surface flows**. Such **gains have never been able to be measured**, even at periods of low flow, no doubt due to the huge sub-surface volume of flow which continues even at these times. Evaluating real benefit would require actual measurement in the river, such as proposed by Bryan Jenkins in 2006 and never carried out. It can not be established by desk-top calculations. Such estimations, however, can hypothesise that some 0.9 million cubic metres could be left in the river bed annually by introducing partial restrictions at White Gorge, but **how much of this would actually be surface flow? For how long and by how much would drying reaches be reduced? How many fish might be saved?** The **answers** to such vital questions are quite **uncertain**.

THE COSTS OF THE SECTION 42A CHANGES

A. The cost of Storage.

13. The Lower Waipara. As Pegasus Bay take on the lower Waipara is above the Teviotdale recorder there is no justification for it being included in the suggested partial restrictions. Nowhere, however, does it say in the 42A reports that it has been excluded from them. If it is removed then the extra amount of water left in the river by partial restrictions would be less. However, even with this take being included the introduction of **partial restrictions on the Lower Waipara** have been theoretically calculated to **save an absolute maximum of 900 litres of water per year, ie 8 seconds worth of the minimum flow per season**. Surely making such a change would be unjustified?

14. The 42A reports suggests **raising the minimum flow on the Lower Waipara**, again on the basis that water not taken will exactly be reflected in augmented flows downstream. It has been **suggested that this would provide a greater degree of consistency and ecological protection throughout the length of the river**, but what does this mean? It seems to be in terms of **satisfying a mathematical relationship between extraction and the 7 day MALF, rather than actually looking at the volumes of water available to fish**. The reason for this hearing is that the Waipara catchment does not fit into such formulations. Figures of **120, 170,**

190 and even **350l/s** at the Teviotdale recorder have been raised. Where is the justification for these figures? As far as I can establish, the basis for the 350l/s is based on a single observation that at a flow of 300l/s on one occasions it was noted there was a dry reach above the lagoon. **No consistent observations have been made or gaugings** have been taken. Our observations have been that a **continuous flow** through these regions does not so much **depend on** the flow in the river but what it has been in the **preceding weeks or months**. Preceding heavy flow will wash this area clear of gravel and then when flows less that 300l/s will easily flow into the lagoon, whereas at other times shingle build-up will prevent flows substantially greater than this level from entering it. The **river bed is continually changing** and I believe that whatever is done **this will persist**. Raising the minimum flow, however, will have a very significant impact on abstractors. There has been an impression given that at **110l/s** at the Teviotdale recorder, restrictions are virtually non-existent. Figures provided by Ian Lloyd (attached) show that this is not the case and that there **can be quite prolonged periods of restriction**. We believe that the minimum flow should be kept as in the Notified Plan and that the hydrological benefits of the theoretical flows are not justified.

15. The Upper Waipara This Waipara catchment Plan has been proposed because Waipara is a water short region and the plan recognises that irrigation related to the river is unreliable. A few abstractors on the Upper Waipara River **have modest amounts of storage** to help them through periods of restriction, but the **situation is already difficult**. Mr Ford's economic report suggests that should partial restrictions be introduced it would require **5.2 million dollars** to be spent just to **maintain the status quo**. His calculations are based on the theoretical possibility of building a single, large storage facility. We **believe** that these **figures underestimate** the actual cost, but even if these are realistic there is **no suggestion that ECAN or any other agency would pay** the cost and it would be enormously expensive to pipe this to current abstractors. Should the abstractors be forced to build **individual storage ponds** to protect their current level of reliability of supply, the **total cost** would undoubtedly be **much greater**. These estimates are based on maintaining the reliability of supply to current abstractors along the main-stem of the Waipara River. Should, however, the

concept of the “Waipara River zone”, as suggested in the 42A Reports (Appendix 1 – Tracked changes Rule 6.1C, part 9 – “Hydrologically connected ground water”), ever be adopted, then the amount of storage and costs required to compensate all of the other people whose ground water abstractions would be subject to river flows would be significantly increased. In addition, the costs are based on the current minimum flows and not on the higher ones now recommended in the section 42A reports. Mr McCallum-Clark in the addendum to his Section 42A report notes that the **costs and volumes** mentioned by Mr Ford are similar to those previously estimated by ECAN (Mr Herb Familton). In other words, these were **known to ECAN staff and to the previous ECAN Council when they approved the Notified Plan, which neither raised the minimum flows nor introduced partial restrictions.**

B The Real Cost of Raising the Minimum Flows and Introducing Partial Restrictions.

- 16.** If an **economic report** is to have significance it surely **should take into account the effect of its impact on the wider community.** We would like to talk about its effect on **the grape growing and winemaking community** in the Waipara area, although we appreciate similar stories could be told by people growing olives, farming and the like. As mentioned, the **Waipara Wine Growers has asked us to represent them** in this hearing, although much of what we will say relates to our own businesses.

Background to the Wine Industry.

- 17.** New Zealand exports over a billion litres of wine annually, in addition to domestic sales. The **Waipara Valley** viticultural area (1422.3 hectares – NZ Winegrowers Statistics) is almost as large as that of **Central Otago.** Roger Lough, an **agricultural economist, has estimated** that the Waipara Valley wine region pays **\$35.5 million in wages** from an **ex-winery value of wine of \$96 million.** This is estimated to **generate \$17-18 million in excise tax and GST.** Viticulture and wine-making are different from some other industries which depend on water, in that the wine industry **spreads its economic benefit widely through communities** because it is **very labour intensive.** As an example of this we would cite Pegasus Bay Vineyards and Winery statistics, not because they are in any way exceptional, but because we have an intimate knowledge of them.

18. Pegasus Bay Vineyards and Winery are entirely **family owned and operated**. We grow grapes and make and sell wine under 2 labels, Pegasus Bay and Main Divide. In order to support our wine sales we run a winery tasting room and restaurant. The **wines are sold locally and throughout New Zealand, as well as being exported to over 30 different markets**, including Australia, USA, Canada, UK, Ireland, Belgium, Holland, Denmark, Germany, Norway, Italy, Spain, Brazil, Japan, China, Singapore, Hong Kong, Thailand, Cambodia and Malaysia. We **employ 75 people**, some of whom are part-time, but it amounts to an equivalent of **45 full-time employees**. Many of our part-timers would like to be full time but they are people with other commitments, such as mothers with children at school. Over **80%** of our staff **lives in the local Amberley/Waipara community**. We are thus a significant employer in the area. **Our producing vineyard**, however, represents only **3% of the area currently planted in vineyard in the Waipara Valley**. As such it is apparent that **grape growing and winemaking industry have a huge potential to benefit the local economy**.

The **employment** of our staff and the other people involved in the viticulture and wine industry in Waipara is **entirely dependant on** growing grapes and making wine. This in turn, relies on vine health for which a **reliable and regular supply of water is essential**.

19. We have **planted on freely draining, stony soil** as we believe this is the type of land which is suited to produce the varieties of grapes and quality of wine that we need. The **“classic” vineyard areas** of Marlborough, Central Otago and Hawkes Bay are planted on **similar freely draining soils**. In this type of soil grape vines require irrigation to survive and thrive. When we started our vineyard adjacent to the lower Waipara River we did **not have access to water**. In those years up to **90% of plants died from dehydration**. They had to be replanted at considerable expense.

20. Because of the low water retaining capacity of the soil, even mature plants can become stressed if they go for too long without water in hot weather during the summer. It **takes approximately 4-6 years after planting, for vines to start producing a commercially**

significant crop. Forward planning in the manufacture and sale of wine thus has to be taken very many years in advance. During these early years when **young vines** are starting to make a contribution to the cash flow of the vineyard, they are **particularly vulnerable to stress**, but **even old vines** growing in freely draining soil can be affected if they go for too long without water in the summer. Within **a week mature plants may show sign of stress and after 10-14 days leaves will start to turn yellow and fall off.** This prevents the proper development and ripening of the fruit and hence **affects the quality of the wine.** Such vines can not produce adequate carbohydrate stores and thus become stunted and weak, affecting their ability to carry an adequate crop the following season and **potentially causing ill-effects in subsequent years.** If left too long without water in this type of soil vines will **eventually die.**

21. Wines made from what the French term *vieille vigne* or **old vines**, generally fetch **higher prices** and it is widely felt that plants need to be **over 20-30 years before** they reach their full potential and are regarded as **“old vines”.** Vines are **not like pasture**, which can come away again after a prolonged period without water. In this respect they are more like live-stock and they need regular access to water for health and life. **Losing vines can be equated to losing livestock**, but established vines, particularly old vines, **can not be simply replaced by buying in more**, as might occur with animals. For these reasons **long term security of water supply is essential** to this type of development, which will probably not reach full potential for 20-30 or more years after planting. Thus, when **storing for viticulture it is necessary** to not just **store** enough water for what might be required in an average year, but **what would be needed in the worst year.**

22. Although **water** is essential for vine health and grape growing it is **used sparingly** by the wine industry. **Vines do not like excess water**, which tends to produce excessive growth of foliage, big berries and inferior wine. Grape growers thus **keep their vines relatively dry**, although they need regular small amounts of water to keep them healthy. As such they have **little reserve to go for long without water.** This technique of **“deficit irrigation”** is used widely by the NZ wine industry. Grape growers regularly **measure soil moisture** content and

only use irrigation should this be strictly necessary. Irrigation in vineyards is by means of **drippers.** A **commissioner,** who heard the application for Pegasus Bay's consent to take water for their Stockgrove Road vineyard, stated "the use of water by the Donaldsons is **highly efficient and there is certainly no waste of the water resource in the trickle irrigation of their vineyards**". The use of water in vineyards is thus **effective and efficient.**

23. While **water harvesting** during periods of high flow with storage, might be thought to be an option for vineyards with a take deemed to be hydraulically connected to the Waipara River, the **economic implications are frightening.** **Small amounts of storage** have been built on the Upper Waipara for vineyard use, but these can tide the properties over **relatively short periods of no take** in the summer, and they would not be sufficient to cope with the periods of restricted flow which would result from the adoption of ECAN's section 42A report with its proposed raised minimum flows and partial restrictions. It should be noted that while some vineyards in the Waipara Valley are supplied by a large water storage facility, the **Weka irrigation scheme,** this was built as part of a Government project and the **costs were completely covered by the state.** It was originally intended to be used for farm irrigation. The irrigation of vineyards only came later and made use of a scheme which was already in place.

24. **Mr Ford's** 42A report makes it clear that in a **prior survey** which he carried out, **partial restrictions** had the potential to cause "**severe losses**" to the **viticultural industry** and that he **doubted that it would be economic** for them to develop sufficiently large storage buffers. This was **carried out in 2005** when the viticultural industry in New Zealand in general was booming. Since 2008 **conditions have substantially deteriorated** throughout the country. It is general knowledge that the **wine industry is in a perilous state** with a number of vineyards and wineries having gone into receivership and many more waiting in the wings. Waipara Valley has not been spared such problems and in fact they have been greatly increased in the last month or so. For many **Waipara vineyards and wineries Christchurch, particularly the central business district, was their main market.** Now this has gone, they are **even more threatened.** Waipara Valley is **now the most vulnerable grape growing region** in the

country. This has recently lead the CEO and Chair of **New Zealand Winegrowers** to hold an **emergency meeting in Waipara** to see what assistance can be given to vineyards, wineries and their employees. We have absolutely no doubt that **should the proposed plan be altered** with the raising of minimum flows and/or the introduction of partial restrictions, as suggested in the Section 42A Reports, it will be the **last straw for many grape growers and wineries** with inevitable **repercussions on their employees and the wider community**. The recommendation in the 42A report Addendum "that the future introduction of partial restrictions be clearly signalled within this planning document" is cold comfort to abstractors. We know the proposed benefits and real costs. We have lived with uncertainty over the past decade and have already spent large amounts of time, effort and finance on this issue. We would all **ask that the commissioners remove the subject of partial restrictions from this plan** as requested by many submitters.

25. The notified proposed plan talks about the possibility of **water being introduced into the Waipara catchment through augmentation**. We have spoken to the **chair of the Waiau-Hurunui zone committee and the Mayor of Hurunui**, who is on that committee, and we are lead to believe there is a **likelihood** within the foreseeable future, possibly within the next 5-10 years. **If this occurs**, then the **need for partial restrictions should disappear**. We believe that if the raised minimum flows and partial restrictions that are mooted in the Section 42A Reports are introduced in the meantime, any such augmentation of the river will **come too late to** save many Waipara vineyards and wineries as they will have ceased to exist and that the Waipara wine industry, which has been developing a national and international reputation, will be dealt a crippling blow. There are many **other wine regions in New Zealand** who would **be happy to take up any slack** in the market place caused by such a happening while **our local community would miss out**.

26. Finally, the suggestion in rule 9 in the Addendum to the section 42A report states that "takes with a high or medium stream depletion effects over 5L/s" should not only be monitored, but should have telemetering to ECAN. We believe this is yet another unnecessary expense to current holders. Our takes are continually recorded and are available to ECAN on request.

They are not compatible with telemetering of data and we feel it is unreasonable to demand this additional cost simply for ECAN's convenience.

Ivan Donaldson

PROF IVAN AND CHRIS DONALDSON

From: "Ian Lloyd" <i.lloyd@aqualinc.co.nz>
 To: "PROF IVAN AND CHRIS DONALDSON" <IVAN&CHRIS@XTRA.CO.NZ>
 Sent: 18 August 2005 2:44 PM
 Subject: Wapiara flows

Hi Ivan,

I have run the numbers for a minimum flow of 250L/s and adjusted the two tables that appeared in my evidence (see below). I hope they are useful in your discussions with Stuart Ford. Based on the numbers below I suggest 1997-1998 would have been devastating! Plus the following irrigation seasons 1987-88, 1988-89, 1989-90, 1998-99, 2000-01 and 2002-2003 would have all had at least 4 weeks of continuous water restrictions.

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 l/s	86
Number of days flow less than 110 l/s	133
Number of days flow less than 146 l/s	253
Number of days flow less than 250 l/s	696

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

Irrigation Year 1 July to 30 June	Number of days of restrictions for various minimum flows					Maximum length of consecutive restrictions
	80 l/s at Greenwoods Bridge ⁽¹⁾	80 l/s at the Teviotdale Recorder ⁽²⁾	110 l/s at the Teviotdale Recorder ⁽²⁾	146 l/s at the Teviotdale Recorder ⁽²⁾	250 l/s at the Teviotdale Recorder ⁽²⁾	250 l/s at the Teviotdale Recorder ⁽²⁾
1987-88 ⁽³⁾	0	0	7	19	31	26
1988-89	0	0	8	31	98	51
1989-90	0	0	3	23	82	28
1990-91	0	0	4	11	48	8
1991-92	0	0	0	0	26	16
1992-93	0	0	0	0	0	0
1993-94	0	0	0	0	0	0
1994-95	0	0	0	0	35	15
1995-96	0	0	2	5	24	17
1996-97	0	0	0	1	15	8
1997-98	0	47	56	95	164	143
1998-99	0	39	53	56	68	64
1999-2000	0	0	0	12	24	14
2000-01	0	0	0	0	39	32

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2001-02	0	0	0	0	0	0
2002-03	0	0	0	0	34	29
2003-04 ⁽⁴⁾	0	0	0	0	8	8
Total	0	86	133	253	696	
Average	0	5	8	15	39	
Years with >14 days of restrictions	0	2	2	5	13	
Number of occasions of 7 consecutive days of restrictions	0	9	15	23	78	
Number of occasions of 14 consecutive days of restrictions	0	3	7	8	32	
Longest consecutive period of restrictions	0	45	47	60	143	

Notes:

- 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

Cheers Ian

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