In the matter Resource consent application-Central Plains Water Trust
Resource Management Act 1991

To Canterbury Regional Council and Selwyn District Council

Evidence Tim Wardell

1. My name is Timothy John Wardell. I am a layperson and an equal shareholder in the Commons of Water of the Nation.

2. While smaller in scale than the original application, the new scheme has some fundamental differences in design and usage and therefore differing effects and impacts than the original proposal.

3. Previously, reliability of supply was proposed through a combination of run of river and storage, which is no longer an option. Aquifer enhancement was also promoted even though this raised issues of potential mounding downstream.

4. This new proposal is a marriage of run of river surface water and currently consented groundwater, with reduced reliability over half of the command area.

5. Whatever the final form it takes, it needs to be noted that the water applied for is at the outer bounds of what is available from the Rakaia and Waimakariri and any abstractions will have an effect on environmental and recreational values.

6. It is also worth noting that the groundwaters (Rakaia-Selwyn & Selwyn-Rakaia zones) are over allocated according to the limits set by the Canterbury Regional Council (CRC).

7. My main areas of concern are-

- Current hydrological imbalances
- Scheme reliance on over allocated groundwater
- Lack of consideration of IPCC implications
- Impact on river flows
- Cumulative effects of nitrogen

Current groundwater hydrological imbalance-

8. The catchment between the Rakaia and Waimakariri consists of 2 groundwater zones - the Rakaia-Selwyn and the Selwyn-Waimakariri. In a natural state the aquifers are replenished by the rivers and rainfall recharge.

9. The current allocation limits for these two zones are set by the following methodology outlined in Table 1-

Selwyn-Waimakariri	50% land-based recharge less lowland stream (mean flow) requirements
Rakaia-Selwyn	50% of land surface recharge

Table 1: Allocation methodology (CRC website)

10. Allocation limits, current allocation and zone status are outlined in Table 2.

	Rakaia-Selwyn	Selwyn-Waimakariri
Allocation limit (MCM/yr)	215	121.3
Current allocation	246.33	138.81
Decided	0.31	19.5
In process	3.48	3.93
Total (MCM/yr)	250.11	161.34
Zone status-Current allocation	Red-114%	Red-115%
-Current & decided	Red-115%	Red-131%

Table 2: Allocation limits and current allocation (CRC website)

11. Using current allocation figures, on an averaged, volume weighted basis, the total available groundwaters are 15% over allocated above the combined allocation limit for the 2 zones.

I.e. $\frac{\text{Current allocation}}{\text{Allocation limit}} = \frac{385}{336} = 1.15$

It is worth noting that 20 MCM/yr that has been recently decided will not have had much contributive effect to the current malaise at this stage, but is effectively a further 5% over the allocation limit. The 7 MCM/yr in process, if granted, would add another 2.5% above the limit.

12. Of the allocated water, it is generally accepted that not all is fully utilized on a seasonal basis. Table 3 summarises accepted varied seasonal usage and volumes utilized of the combined allocation limit and the current allocation.

Season	**% utilised**	**Combined alloc. limit (MCM)**	**Volume utilised (MCM)**	**Combined current allocation (MCM)**	**Volume current utilised (MCM)**
Dry	85	336	285	385	327
Normal	70	336	235	385	270
Wet	50	336	168	385	193

Table 3: Seasonal variation of utilization (CRC-per comm.)

13. Previously in the hearing, it was outlined by various parties the state of the lowland spring fed stream, with probably no more telling words than those spoken by Messer's Chamberlain and Lay describing the recent changes they have noted during their lifetimes, i.e. the seasonal reduced flow and drying up of Harts Creek and the Irwell river respectively within the last 3-5 years.

14. Mr Donkers related the loss of reliability of bores in the Te Perita area within the same timeframe.

15. While some argue that the main causal effect has been lower than average rainfall over the last decade, I believe this impact has been mainly caused by the general draw down of the aquifers for productive purposes and that these effects are most obvious but not limited to the lowland spring fed streams.

16. Note Appendix 1 illustrating the divergence between the upper and lower Selwyn and Appendix 2 (well L36/1226) showing a similar decadal trend.

17. Considering the above observations and the implications outlined in table 3, the impact of full utilization of the current allocation on the aquifer

systems and related surface water would be concerning to say the least, resulting in lower aquifer levels, slower response time to rainfall events etc.

18. Further consideration would suggest that the present allocation limits could well be at least 24% too high in a normal year if 270MCM/yr represents the volume utilized of current allocation and downstream values are still going backwards. Note that the drier the season the potentially less reliable the unutilized groundwater becomes and it is important that we do not under estimate the buffer role this unutilized water has played until now.

Scheme reliance on over allocated groundwater-

19. Para. 7 of Mr Tipler's brief outline how the lower half of the scheme will be supported by groundwater to increase reliability.

20. Further, in para.12, he notes that-

"*Groundwater already allocated within the scheme area amounts to approximately 145 MCM/yr. It has been assumed that this water will be available for use across 30,000 ha. The mechanisms by which this will occur have not been resolved; it may involve the transfer of unused groundwater to other land or farms...*"

21. The concern I hold is that on a catchment basis the groundwater is already over allocated by 15% on average as discussed above, and we are observing effects downstream of the scheme area even though what is currently allocated is not fully utilized. As decided and in process consents come on line this situation will worsen.

22. Based on the above concern, and, if there is a wider acceptance of the need to mitigate the cumulative effect of past decisions, effectively there is only 123 MCM/yr available within the scheme area of the 145 MCM/yr referred to by Mr Tipler, which may actually be a generous figure considering the further reasoning of less than full utilization of current allocation on a seasonal basis.

23. Any exchange of surface water for groundwater, while potentially impacting on current consent holders, is pertinent in that these consents are

upstream within the catchment and could go part way to righting mistakes of the past and rebalancing a disrupted hydrological system.

24. In principal I have no problems of combining surface and ground water, yet the priority I would prefer to see, and believe is a long term imperative, is a rebalancing of the hydrological system taking priority over further expansion of intensity.

25. Priority needs to be given to using available surface water further up the catchment to relieve the stress being observed downstream.

26. Further societal benefit would be reduced energy consumption due to less pumping of deep wells.

Lack of consideration of IPCC implications-

27. The RMA asks us to have particular regard to Climate change. A recent address to the CRC by the Ministry of the Environment (MfE) highlighted some interesting points for Canterbury:

- Reduced frost therefore longer growing season
- Increased evapo-transpiration (E-T)
- Increased westerly rainfall
- Decreased rainfall in eastern areas
- Potentially increased rainfall in western areas

28. On the basis that irrigation is the management of the deficit between rainfall and E-T to maintain productive output, here are my basic workings on climate change impact outlined-

- An increase of 20 growing days is an extension of 12% on a 150 day irrigation season. Considering this at the shoulders call it a 5% increase in demand to water the status quo due to increased overall aridity.
- 20% increase in E-T correlates to 20% increase in water demand to irrigate the status quo
- 15% decrease in east coast rainfall equates to a 7.5% increase in demand to water (dependant on whether it is a loss of summer or winter rainfall) the status quo and reduces aquifer recharge by 7.5%

29. In example call it a 40% increase in water demand to continue to water the status quo.

30. Countering this is efficiency gains to be made from less leaky systems, timing of application, return time and the piping of distribution. Most recently the Lyndhurst scheme claim 15% gains through piping. CPW is modeled on 10% loss from distribution races and discharge. Piping would give a 20% increase in efficiency as well as reduced energy requirement benefits.

31. The cost of some of these gains is reduced recharge to the aquifers and hence reduced dilution of nitrates and potentially higher concentrations in groundwater. This was discussed in CPW with headrace leakage benefits versus piping for perceived efficiency gains.

32. So, given an overall efficiency gain of 20% (generous to say the least), with predicted climate change impacts there is still a requirement of 20% increase in water demand to irrigate the status quo.

33. The counter to this is the predicted increase in westerly rain potentially giving increased flow and therefore reliability.

34. "Some major eastern rivers whose catchments reach back into the main divide could maintain or even increase flows, because of projected rainfall increases in these areas. However, a change in phase of the IPO relative to 1978-1998 may mean this does not eventuate over the next 20-30 years. Regardless it is prudent to acknowledge that overall Canterbury will become drier in the foreseeable future." O'Donnell (page 28)

35. The use of historic river flow data in the proposal is influenced by a positive IPO (wetter) cycle. To what extent this influences the mean flows is uncertain, yet it seems it would be important to take into account the potential of lower river flows in the future

36. NIWA reported the loss of 2 billon tons of permanent ice from the Southern Alps in 2007. This ice melt has given dry year resilience in our Alpine rivers, maintaining flows in low nor-west years. The demise of this future water in the hydrographs of our rivers should not be under estimated.

37. Future River flows will therefore be based on rainfall and snow melt without this moderating influence.

Impact on river flows-

38. My main concern here is the potential changing of weighting from the Rakaia to the Waimakariri over time.

39. In para. 11 of his brief Mr Tipler lists 2 cumecs of water from 2 & 3 plus 7 cumecs courtesy of Barhill Chertsey.

40. Mr Fietje notes the priority issues with Synlait on the former (para. 17)

41. Similarly, without knowing the commercial arrangement with BCIL, there is an issue of reduced reliability if that water is not available in the future. The effects of this could ultimately lead to more pressure being put on the Waimakariri, not modeled or indicated at the moment.

42. Continued over abstraction of groundwaters under drier conditions could well lead to a reduction of under pinning hydrological pressure and see our main rivers recede into their own gravels, turning historically reasonable surface takes into environmentally stressful outtakes.

Cumulative effects of nitrogen-

43. Para. 68-71 of Mr Tiplers brief describes the different methodology between himself and the Ecan model for modeling nitrate discharge, particularly around spatial representation.

44. I concur that the final outcome may be similar on average. I disagree that there is no extra benefit from the Ecan model.

45. To be able to potentially predict future hot spots e.g. areas away from the more direct effect of river recharge dilution, allows the ability to manage land practice/mix above stream flow path.

46. This allows us to take best practice from on farm to a wider scheme/landscape perspective than currently mooted and/or practiced.

47. The work of Bidwell et al (2009) via the IRAP program and for the Mayoral Forum is a huge step forwards in our understanding around the cumulative effect of side by side intensity. Averaging negates that.

48. We have moved forward with historically little regard to issues such as assimilation capacities of ground or surface water within catchments. The costs will be bourne by a future generation.

49. I admit to having difficulty in comparing the original initial mass balance (1,998 T) and concentration figure (~3.7g/m3) - P.24, para 81, CPW round 1 – with the revised modeling of 2,590 T and ~4.2g/m3 – P.28, para 79, CPW round 2.

50. Taking into account the 25% increase in irrigated land (para 72) I achieve a total of 2,498 T and need to assume that in the initial modeling this 6,000 ha had no nitrate leaching.

51. My difficulty is compounded in para 74 with the mention of slightly lower areal leaching rates which should lead to a further decrease in the pre scheme median nitrate leaching.

52. Happy to be advised.

53. It is worth noting that a piped distribution system in the name of efficiency of both water and energy would raise the nitrate concentration to 5g/m3, a 0.8g/m3 rise or 20% overall.

54. One of the confusions we are dealing with is concentration of nitrogen within ground and surface water (drinking water and aquatic species issues) versus total mass load of nitrogen to the wider receiving environment. I.e. It ends up somewhere.

55. The increase of mass nitrate leached from 2,590 T to 3,350 T represents a 30% increase within the scheme area and a ~10% increase within the catchment as a whole.

56. In principal, it is an upstream effect and is part of an accumulating mass. As the Central Canterbury catchment is configured, the majority will move via the Ellesmere area and ultimately into the Marine environment. This is dependent on where various aquifers and their volumes discharge.

57. Paul White, TRONT previously put some figures around this cumulative effect and the impact on Lake Ellesmere. Yet, due to the dilution effect of aquifer discharge many well readings in this area can be quite low, similar to those values seen beside the rivers (Hanson P.12).

58. In simple terms, the dilution is an illusion and hides the mass cumulative effect.

59. I am yet to be convinced that we fully understand the implications of lag times of nitrogen in vadose zones and the final cumulative effect that is already in process.

60. We have a tendency to look at concentration measurements and see them as indicators of the fullness of our current actions, giving us plenty of room to move into the future. MAV has become a figure to work up to rather than be wary of.

61. The cost will be reduced flexibility for future generations.

Summary-

62. My main areas of concerns are-

- The proposed schemes reliance on over allocated groundwater and the compounding effect this would have on current hydrological imbalances as proposed

- Lack of consideration of the long term implications of climate change in further developing fully water reliant production systems with little thought towards negating dependency

- The further cumulative effect of nitrogen within the catchment and the continued socialization of that cost

Further to that, the claimed trickle down benefit is an inequitable exchange for the privilege of use of the Commons, particularly when the Common is being returned in poorer condition than when the privilege of use was granted. This amounts to a failure of Stewardship.

Thank you.

References- References:

Bidwell V, Lilburne L, Thorley M & Scott D. Nitrate discharge to groundwater from agricultural land use: an initial assessment. 2009.

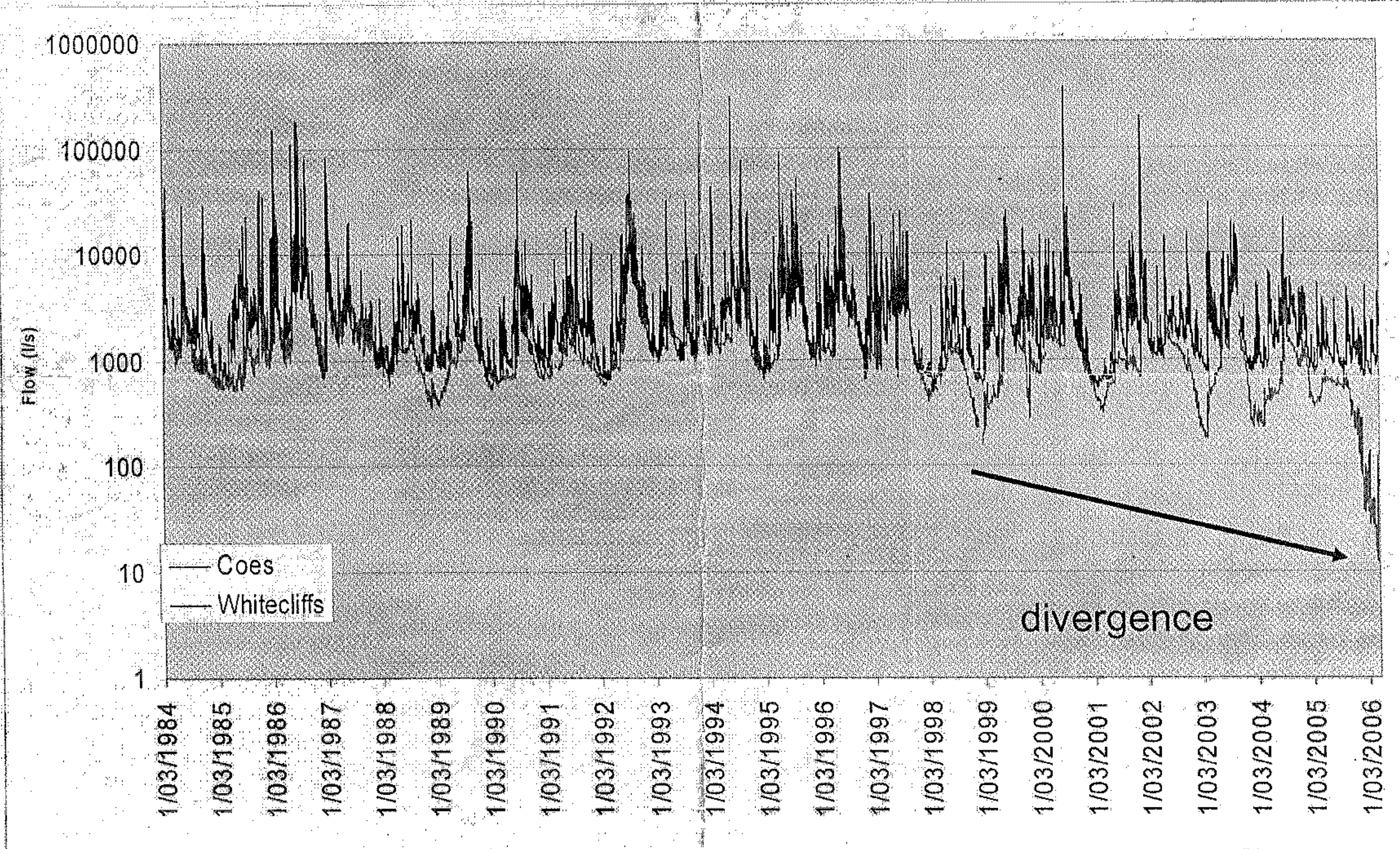
Hanson C. Nitrate concentration in Canterbury Groundwater - a review of existing data.2002. Report R02/17, CRC.

O'Donnell L. Climate change-an analysis of the policy considerations for climate change review for the Canterbury RPS. 2007. Report R07/4, CRC.

Appendix 1

RECENT TRENDS

Climate, abstraction, and / or another factor?



RECORDED RIVER FLOWS AT WHITECLIFFS (RECHARGE) AND COES FORD (DISCHARGE) 1984-2006

APPENDIX 2-

Groundwater chart

Groundwater level plots for well l36/1226

Grid Reference L36:23827-36207 Well Depth 109.3 m

View well details