

IN THE MATTER OF the Resource Management Act 1991
AND
IN THE MATTER OF Variation 1, Canterbury Proposed
Land and Water Regional Plan.

Evidence of Dr Anthony Davoren, HydroServices Ltd

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Background and Qualifications

1. My full name is Anthony Davoren. I hold the qualifications of Bachelor and Master (First Class) of Science in Earth Sciences from University of Waikato and Doctor of Philosophy in Engineering Science from Washington State University. I am a self-employed consultant, and owner and director of HydroServices Ltd.
2. I have 30 years experience in soil moisture, irrigation management, groundwater and surface water research and other related consulting. After graduating from University of Waikato, I spent two years surveying the peat resources of New Zealand, followed by three years studying for a PhD on a National Advisory Council Fellowship. Water and Soil Division (Ministry of Works and Development) then employed me as a research scientist in the Hydrology Centre in Christchurch (now part of NIWA).
3. Since 1987, I have been involved as a specialist in soil moisture measurement and irrigation management. HydroServices provides irrigation management advice to more than 350 clients in Canterbury. I have had a large involvement in preparing or supervising the preparation of technical assessments for resource consent applications irrigation.
4. In 2007 I founded HydroTrader Ltd with two other persons, Warwick Pascoe and Gus Walkden. In the five years trading and transferring water permits we have gained invaluable experience and expertise with regard to the transfer, transferee, their reasons to or for transfer, the volume of water transferred and where it is transferred
5. With respect to irrigation and groundwater, I have specialised in crop water requirements for irrigation, irrigation efficiency and irrigation design.
6. I was instrumental in developing Adaptive Management for applicants at the Rakaia-Selwyn, Selwyn-Waimakariri and Valetta-Ashburton River Groundwater Zone Hearings.
7. I am a past board member of Irrigation New Zealand and managed a Sustainable Farming Fund project Irrigation System Design Standards and Code of Practice for INZ (Irrigation New Zealand).
8. I acknowledge that I have read the code of conduct for expert witnesses contained in the Environment Court's Practice Note dated 31 March 2005. I have complied with it when preparing my written statement of evidence and agree to comply with it when giving oral evidence.

Information Sources Relied Upon

9. In preparing my evidence, I have drawn on the following relevant information sources:
 - The Proposed Canterbury Land and Water Regional Plan (pLWRP);
 - The Proposed Variation 1 to the Proposed Canterbury Land and Water Regional Plan; and

- The expertise and experience of, and knowledge gathered by HydroServices Ltd with regard to Canterbury soils, irrigation systems and management, and Canterbury groundwater since 1982.

Key Issues Addressed in this Evidence

10. I have prepared this evidence in consultation with other submitters and where possible have avoided repetition.
11. The fundamental issues addressed in this evidence are:
 - a) Inclusion of Kaitorete Spit in the Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zone;
 - b) Establishment and size of the Kaituna Groundwater Allocation Zone (KGAZ); and
 - c) Nature of second-order allocation limit calculation Groundwater Allocation Zones.

Overall Summary

12. In relation to the key issues outlined in Paragraph 11 of this submission to Proposed Variation 1 of the pLWRP I have concluded:
 - a) Support for the overall intent of the proposed Variation 1 with regard to water quantity and water quality policies and rules;
 - b) There is no justification to include all of Kaitorete Spit in the SWGAZ. To the contrary there is sound technical evidence to exclude eastern areas of the spit from the SWGAZ;
 - c) Support for the establishment of the KGAZ, but concern that allocation zones for other valleys and associated aquifer systems on Banks Peninsula have not been considered;
 - d) The size of the KGAZ has been grossly underestimated; and
 - e) Oppose Rule 11.5.36 and its intent.

Sustainable Use of Water and Improved Flows, Kaitorete Spit

13. The pLWRP did not include Kaitorete Spit in an allocation zone. Variation 1 includes the entire spit within the SWGAZ.
14. The rationale of Policy 11.4.21 to manage groundwater and surface water (between the Waimakariri and Rakaia Rivers) as single resource, to ensure and the allocation limits in Table 11(e) are met is supported in part.
15. To include all of Kaitorete Spit within the SWGAZ is not supported because:
 - a) The generally accepted groundwater flow direction is southeast which would place much of the Kaitorete Spit in the Rakaia Selwyn Groundwater Allocation Zone.

- b) Technical Report R14/9 (Elemental Geoconsulting, 2014) and the Section 32 Evaluation Report (February 2014) note the groundwater resources on Kaitorete Spit were not recognised in the pLWRP.
- c) No technical justification (geology, bore log stratigraphy, water chemistry or the like) is given to include the beach gravels of Kaitorete Spit in the proposed Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zone. Both Technical Report R14/9 and the Section 32 report mention hydro-geological differences between the areas but are then ignored in the final recommendations.
- d) Rule 11.5.32 does not allow new groundwater takes from Kaitorete Spit because any take would result in exceedance of the allocation limit in Table 11(e).
16. Water chemistry, geology, bore log stratigraphy, water temperature and lack of direct connection evidence exists to show that at least groundwater at the north eastern end of Kaitorete Spit is sourced from the basalt aquifer system of Kaituna, Prices, Greylees and other Banks Peninsula valleys. This area is hydro-geologically distinct and evidence of this has been available since prior to the decision to include Kaitorete Spit in the Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zone. This has not been considered in the final recommendations.
17. The volume of groundwater recharge in the KGAZ (approximately 22.5Mm³/year) and hydraulic head (up to 680m in Kaituna and Prices Valleys) will push groundwater into the eastern end of Kaitorete Spit (Figure 1).
18. The policy and rule for groundwater takes from the Kaitorete Spit area should allow for applications to be considered on their merits or the area where water is clearly sourced from the basalt aquifers be incorporated in the KGAZ (Figure 1).

Sustainable Use of Water and Improved Flows, Kaituna Combined Water Allocation Zone

19. Rule 11.5.32 is supported in part. The rule as it affects new groundwater takes from the Kaitorete Spit is discussed above and is opposed. I support the establishment of a separate KGAZ but oppose the proposed allocation limit.
20. I am unable to confirm the 1.89 million m³/year (Table 11(f)) allocation limit; the allocation limit of 2.1 million m³/year less 10%. The resource consents to take and use groundwater KGAZ are:
- CRC103935 (Wongan Hills) with a seasonal allocation of 1,107,975m³/year;
 - CRC080283 (P R & M I Kidd) with a seasonal allocation of 532,400m³/year; and
 - CRC992699 (GA Gray) with no seasonal allocation listed on the ECan GIS, simply the comment "EAV 100% as per pLWRP - volume checked and revised for Kaituna allocation of DTJö. In the absence of an allocation, I assume the nominal volume for this consent is 1,890,000 - 1,107,975 - 532,400 or **249,625m³/year**. This probably about right to irrigate 68ha (367mm/year)
21. The allocation limit of 2.1 million m³/year (Table 11(f)) has been crudely and arbitrarily estimated. To establish an allocation limit as a sum of the annual volumes

currently allocated on consents plus 10 percent to allow for a small amount of additional abstraction is at best arbitrary and lacks credibility. At a resource consent hearing in 2011¹, scientific evidence demonstrating the volume of groundwater in the Kaituna Valley basalt aquifer was presented and agreed. This scientific evidence has been ignored in setting the allocation limit.

22. Water balance calculation has demonstrated there is on average, recharge of about 380L/s to the basalt groundwater system in Kaituna Valley. When annualised this equates to 11.98Mm³/year of recharge from rainfall. The adjacent 20km² Prices Valley (about half the size of Kaituna Valley) and Greylees Valley (14.94km²) could contribute a further 6Mm³/year and 4.5Mm³/year respectively. Potentially there is a total from the three valleys comprising the KGAZ of nearly 22.5Mm³/year. Allocation based on 50% of land-surface recharge (excluding any contribution from irrigated land) suggests the allocation limit should be approximately 11Mm³/year.
23. The Prices and Greylees catchments have a strong precipitation gradient (2-3 ×), similar geology to Kaituna Valley, and are likely to have recharge similar to Kaituna Valley.
24. The size of the KGAZ allocation has been poorly calculated and is a significant underestimate of the likely allocation limit based on land surface recharge.

Allocation Limits

25. I oppose in full Rule 11.5.36 and in part Section 11.7 and Table 11(e). In particular, the allocation zone limits are opposed because:
 - The groundwater component has been calculated using second order methodology;
 - Adaptive management consents are included in the allocation limit; and
 - Adaptive management of groundwater is considered too difficult and complex.
26. Rule 11.5.36 is opposed because the second order methodology is too coarse to be used in conjunction with prohibited activity status for new takes. The limits in sub-regional chapters (such as Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zone) should be robust, based on detailed investigations and, be capable of simple and transparent revision as better data becomes available. This rule does not allow for new groundwater takes to be considered on their merits as new information becomes available and/or the environment changes due to climatic or recharge factor and/or there are changes in water use. Prohibited activity status might be justified if robust third order allocation limits had been set for the water allocation zones, as envisaged under the NRRP. Instead, second order groundwater limits that fail to include any adaptive management provisions have been incorporated in the new combined surface and groundwater limits. Furthermore, private plan changes are touted as a means of providing new information in support of changing allocation limits. This notion fails to recognise the significant hurdle that a notified process for a non-complying activity already imposes, and instead introduces a well-nigh impossible hurdle for would-be new groundwater users.

¹ Dr Anthony Davoren, 2011. Wangan Hills Resource Consent Application CRC103935 Hearing Evidence

27. Adaptive management consents in the Rakaia-Selwyn and Selwyn-Waimakariri Groundwater Allocation Zones have been counted into the allocations. This ignores the basis on which these consents were granted following the exhaustive testing of expert evidence at two protracted consent hearings. These consents were granted so that the volume of water abstracted **would not** impact on the allocation limit; i.e. the allocation limit and the existing users accommodated within the limit would be safeguarded. Environment Canterbury staff would appear unable to accept the findings to this effect by independent commissioners, as evidenced by their inclusion in the allocation limit.
28. Adding the annual volumes of these consents into the allocation lacks technical credibility. What volume should be added? Should it be the total volume or should it be the volume when the use is restricted to 50% or the use when the seasonal use is 0%? Adding the Adaptive Management volumes is not credible and is meaningless. The technical evidence has already been debated and the most appropriate planning response is to leave Adaptive Management consents out of the limit.

Summary

29. I support the overall intent of the proposed Variation 1 with regard to water quantity and water quality.
30. I oppose the inclusion of the entire Kaitorete Spit beach gravel system in the Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zone.
31. I support the proposed Kaituna Groundwater Allocation Zone.
32. I oppose the allocation limit for the Kaituna Groundwater Allocation Zone and spatial definition of the zone.
33. I oppose the inclusion of the adaptive management consent seasonal allocations in the allocation for Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zone.
34. I oppose the use of prohibited activity status in Rule 11.5.36.



Dr Anthony Davoren

14 August 2014

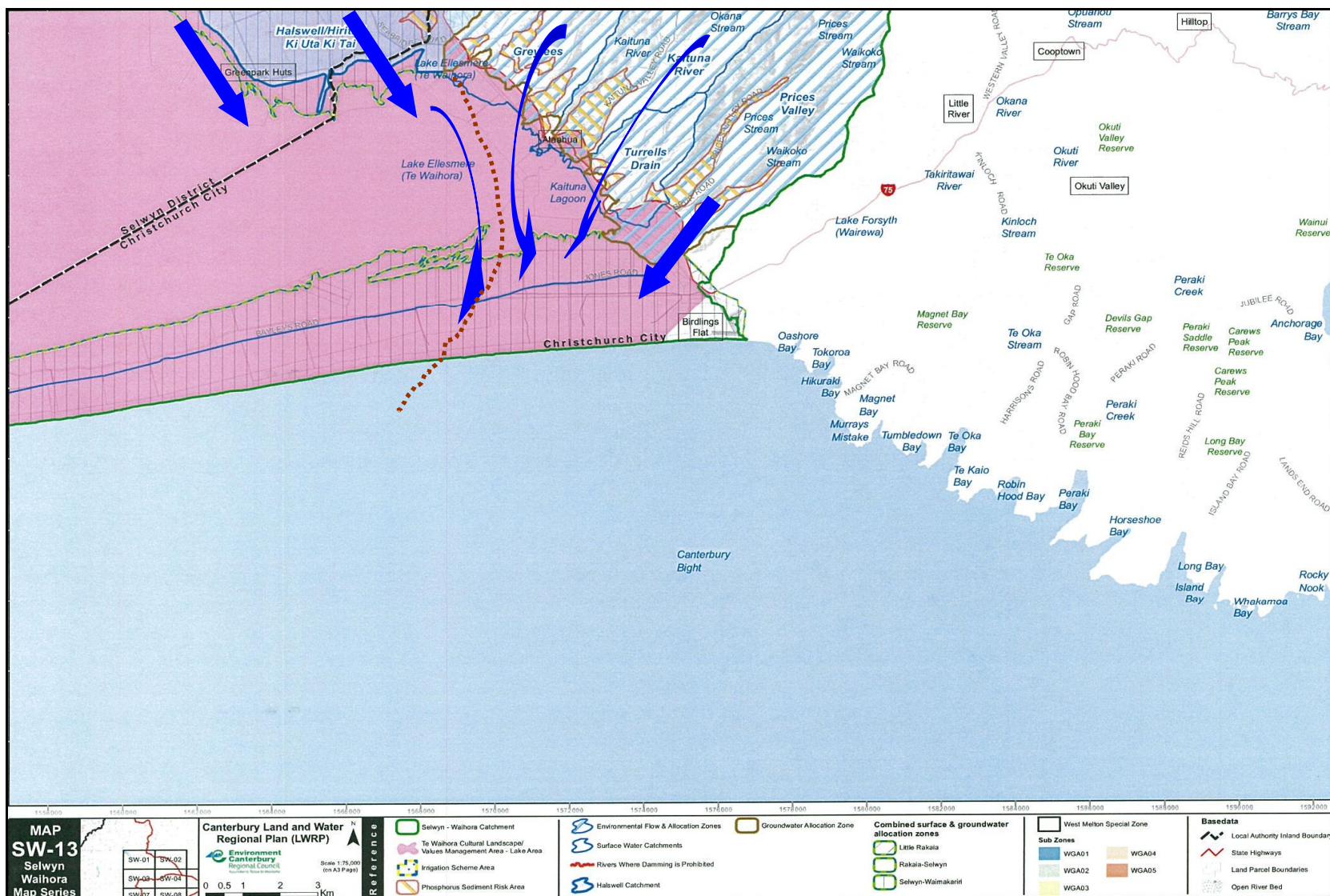


Figure 1. Groundwater flow from the proposed Selwyn-Waimakariri Combined and Kaituna Surface and Groundwater Zones, and western boundary of the KGAZ ().