

## Appendix 5. Review of Rakaia-Selwyn Decision

### INTRODUCTION

1. The decision has particular significance for the applications before the Commissioners for this hearing, given it was also for the taking of a substantial volume of groundwater from a zone considered fully allocated.
2. A total of 69 resource consents were sought by 59 applicants, for a combined volume of 35.1 million cubic metres of water per annum<sup>1</sup>.
3. With two exceptions Commissioners declined to grant applications to take water from Aquifer 1, given their conclusion in paragraph 53 that Aquifer 1 is clearly over-allocated at least some of the time<sup>2</sup>.
4. In paragraph 65 Commissioners conclude that:

**... takes from Aquifer 1 in conjunction with climatic conditions are the primary cause of effects on Aquifer 1 levels and, therefore, on the frequency, duration, extent and degree of low flows in the spring fed streams.**

5. In the following paragraph they record:

**As a result we have concluded that we should not grant any further consents to take water from the aquifer ... To do so would inevitably exacerbate an already unsatisfactory situation.**

6. Commissioners granted the remaining applications on the basis that any takes with a direct effect on Aquifer 1 levels would be required to go deeper.
7. Paragraph 53 records the Commissioners' conclusion regarding the other aquifers:

**"... the other aquifers appear to still have capacity for further sustainable abstraction at least up to the volumes in these applications."**

8. Commissioners described the hearing as "somewhat unusual" for reasons set out in paragraph 21:

**"In essence it largely became a two way debate between the Council officers and the applicants' experts and counsel. Notwithstanding that there were no submissions in opposition to many of the applications and little evidence from submitters, the officers remained adamant, that with some very minor exceptions we should not grant any of the applications."**

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<sup>1</sup> Refer paragraph 59.

<sup>2</sup> However in paragraphs 127 and 129 they note that it does not automatically follow that a decrease in Aquifer 1 levels results in more than minor adverse effects on ecology and amenity

9. Commissioners caution<sup>3</sup> against seeing the decision in black and white terms, recording that they have not rejected the evidence advanced by Council officers<sup>4</sup>, nor fully accepted the expert evidence for the applicants.
10. They accept that there is an element of “suck and see<sup>5</sup>” so the Council and community will be able to assess whether their approach has been sufficiently precautionary.
11. They also make it clear that, in relation to leakage between Aquifers 1 and 2, they have put considerable reliance on the evidence from the applicant’s experts and state at paragraph 438:

**“If, contrary to their evidence and notwithstanding adaptive management, the leakage is sufficient to have a more than minor effect on Aquifer 1 users, and/or to have more than minor effects on stream flows, then the consents can and should be reviewed. The applicants need to appreciate this risk”.**

12. In paragraphs 198 to 200 Commissioners set out the critical factual issues in terms of whether to grant or decline consent. In relation to effects on Aquifer 1 levels from further takes from aquifers 2 to 6, they set out the issue in the following way:

***“How likely is it that further takes from Aquifers 2 to 6 will significantly affect levels in Aquifer 1, to the extent that there will be a significant effect on the frequency duration or intensity of low flows in the stream fed streams and/or interference with the availability of water to existing Aquifer 1 users, beyond what would occur without those new takes?”***

13. Their conclusion follows in paragraph 199:

**“We have concluded that it is unlikely that any additional effects (including additional cumulative effects) in terms of Aquifer 1 levels and stream flows and interference with existing users, will be any more than minor and that effects on stream flows will be minor”.**

14. Commissioners note in paragraph 201 that this first point is critical and contentious hence they explain their reasoning for their conclusion in some detail in the paragraphs that follow.

15. At paragraph 279 Commissioners summarise the differing opinions between the Council officers and applicants’ consultants as follows:

**As we have stated earlier, there was considerable difference of opinion between the Council officers and the applicants’ consultants as to the nature of the groundwater system. The officers considered the groundwater system to be interlinked and used a “bathtub” analogy. The applicants’ consultants argued for more discrete zonation of the groundwater system. Both groups relied on reports provided by Davey in 2006.**

16. Commissioners then refer at paragraph 290 to a report 06/10 prepared by Davey, noting that he refers in several places to “distinct aquifers” and later in his conclusion he refers to six of these “distinct aquifers”.

17. Commissioners note in paragraph 282 that it would have been helpful if Mr Davey had been able to present his reports to them and answer their questions, but irrespective they record at paragraph 295 that:

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<sup>3</sup> Paragraph 190.

<sup>4</sup> Commissioners go on to record that “... rather we have come to different conclusions based on the data they presented”.

<sup>5</sup> Paragraph 192.

It is clear to us that Davey recognised that aquifers occurred at similar stratigraphic positions and that these were separated by aquitards.

18. And at paragraph 296<sup>6</sup>:

Given the detailed descriptions provided by Davey, it does not appear to us that inter aquifer linkages were considered significant by him.

## DISCUSSION

19. Following the release of the decision a meeting was held with Mr Davey. After the meeting he wrote to the Council setting out the background to his reports and the purpose for which they were written. The following is an extract from his letter (the part underlined was bolded by him):

**I did not consider that this report to have much relevance to groundwater allocation issues or for determination of cumulative effects of groundwater abstraction. Unfortunately it has been used for such issues in the Rakaia – Selwyn hearing decision.** In Point 296, the commissioners state that “.. it does not appear to us that inter aquifer linkages were considered significant by him (Davey).” This is quite incorrect, and can be best illustrated by some work I did on aquifer recharge from border dyke irrigation at the Valetta scheme. This work is briefly mentioned on page 10 of Report U06/10 and more fully covered in ECan Report U06/11 (referenced in U06/10).

20. Mr Davey has prepared an Addendum to both his 2006 reports. Of particular relevance to what the Commissioners identify as the “most contentious” of the critical factual issues is the following extract from this Addendum:

**Drill logs throughout the plains (excluding the confined aquifer system) are conspicuously lacking in any strata which would conventionally be described as aquitards. There is no evidence of laterally continuous layers of sand, silt, peat or clay which could constitute highly impermeable aquitards.**

21. Later he writes:

**My view is that the aquitards represent interglacial surfaces that are likely to be more permeable than the current land surface. This is because the current land surface has thin deposits of soil and loess. There is no evidence in drill logs for the preservation of such deposits on interglacial surfaces. In contrast, there is abundant evidence of the current land surface allowing rapid rainfall recharge to underlying aquifers, and even more rapid recharge from border dyke irrigation.**

**The aquitards beneath the plains are considerably less transmissive than the aquifers. As a result they commonly display quite different water levels in different aquifers. In addition, lack of drawdown in one aquifer during a brief pumping test from a well in another aquifer is commonly observed.**

**In my view aquitards will allow quite ready vertical movement of water through them. They are leaky aquitards, not aquicludes.**

22. Commissioners acknowledged the uncertainty about aquifer structure and interlinkages throughout their decision. For example early in their decision<sup>7</sup> they state:

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<sup>6</sup> See also paragraph 308.

<sup>7</sup> Paragraph 50

**The Rakaia Selwyn ground water zone is a system comprising at least 6 inter connected aquifers. The degree of interaction between the deeper aquifers and between them and Aquifer 1 is not well understood. In particular the effects of taking from the deeper aquifers on downwards percolation from Aquifer 1 and on upward recharge to the coastwards end of Aquifer 1 and, hence, to the spring-fed streams is largely speculative.**

23. Later in paragraph 194 they record:

**One of the few certainties in this hearing, is that the current understanding of how the aquifers in the zone inter-relate and how takes from the deeper aquifers affect Aquifer 1 and therefore, the spring fed streams, is not well developed.**

24. The possibility of being wrong in their conclusions about aquifer structure is discussed in paragraph 385:

**If we (and the applicants' experts) are proven wrong in terms of secondary relationships between the deeper aquifers and Aquifer 1, that possibility is primarily addressed by the short term of the consents and the monitoring and review conditions. However, the adaptive management will also have some mitigating effect. That is because if levels in the deeper aquifers trigger restrictions, and if there is a significant linkage to shallow ground water, then those restrictions will also mitigate effects on streams. Furthermore, as we stated previously, in our view, any effects which may develop from overpumping for a period are reversible once pumping is reduced as a result of a review of conditions or at the time of renewal.**

25. Given the reliance placed by the Commissioners on Davey's report and his comments on their interpretation, there is a significant risk that their expectation of "status quo" during dry periods will not be met and a situation acknowledged to be "already unsatisfactory" will be "exacerbated".

26. Commissioners suggest the adaptive management condition will have "some mitigating effect", however the Environmental Flow Safeguard is set at a level that allows significant volumes of new water to be taken from deeper aquifers<sup>8</sup>.

27. A separate but related matter regarding the extent to which water in Aquifer 1 leaks into Aquifer 2 is dealt with at some length in a Minute dated 7 September 2007 (which forms part of the decision<sup>9</sup>).

28. While the Minute records a number of areas of disagreement, it also records two important areas of agreement, namely:

- (a) Agreement that a model referred to as the Hunt-Scott model is appropriate<sup>10</sup> for calculating (leakage) effects over short times and distances; and
- (b) Agreement that for the example<sup>11</sup> provided by the applicants' consultant<sup>12</sup>, the pumping induced flow from the shallower aquifer over a 3 day period was equivalent to 82.7% of the total pumped volume.

29. This agreement is significant, given there is generally no dispute that leakage increases over time. So while there may be dispute about accuracy of the model over long times and distances, there is every reason to believe that, for the above example, the pumping

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<sup>8</sup> Paragraph 391 – the Environmental Flow Safeguard for A3-A5 is set at 50% of the 05/06 recession below the level at 30<sup>th</sup> April 2006.

<sup>9</sup> See paragraph 1 of the Minute.

<sup>10</sup> Paragraph 70

<sup>11</sup> Using typical aquifer parameters from outside the coastal confined zone

<sup>12</sup> Refer first column of Table in Memorandum of 2 August 2007, referenced in paragraphs 21, 58, 71, 77 and 80 of the Minute.

induced flow from the shallower aquifer will exceed the 82.7% of the total pumped volume that occurs after 3 days.

30. Commissioners were aware of the significance of this when they sought confirmation from the applicants' expert, at paragraph 84 of their Minute, that:

**Nevertheless, in order for us to be sure that we have not misunderstood what [applicants' expert] is saying, we do ask for a brief statement from him indicating whether we have correctly interpreted his comments. We would also like confirmation from him, whether he is still of the view that that leakage from aquifer 1 to aquifer 2 is unlikely to be significant. As an arbitrary rule of thumb we would regard it as significant in terms of a particular well if anything more than a quarter of the annual volume from that well was derived from aquifer 1 during the course of the season. That would be contrary to the basis on which the A2 applicants have put their case to us.**

31. The response to this from the applicants' expert was as follows:

**With reference to paragraph 84 of the above Minute, I can confirm that the Commissioners have correctly interpreted my comments.**

**I can also confirm that I remain of the opinion that in general the effect of leakage from aquifer 1 to aquifer 2 as a result of aquifer 2 applicants pumping is unlikely to be significant. Aquifer testing and ongoing monitoring as proposed in the conditions will be extremely helpful in resolving this issue for specific locations (my underlining)**

32. The second part of the response does not answer the question posed, by virtue of adding in the two words "the effect". Consequently the Commissioners have not received confirmation that less than a quarter of the annual volume from an aquifer 2 well is derived from aquifer 1 during the course of the season.
33. The Commissioners have formulated conditions requiring testing for leakage before consents may be exercised. Council experts advise these conditions cannot be relied on, even when significant leakage occurs.
34. This is clearly a significant matter and together with the comments by Mr Davey suggests the key premises underpinning the decision to grant consent are not valid.

## **CLARIFICATIONS**

35. The decision suggests there may be several areas of disagreement where there may not be. These relate to the use of the bathtub analogy; effect of climate; and how the PNRRP sets levels of sustainable groundwater abstraction.

### **Bathtub Analogy**

36. The decision records at paragraph 52<sup>13</sup>:

**With respect, we do not think that the officers' approach of treating the system as one bath tub (one resource) is of much assistance when assessing effects. It is an interconnected system but different parts of the system react differently and different parts are subject to different demands. The hydrogeological relationships are different in different aquifers and different parts of aquifers.**

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<sup>13</sup> Repeat of paragraph 44a of the interim decision.

37. Council experts agree with this description of the groundwater system and it is unfortunate that the bathtub analogy is seen to be in conflict with this description. One of the risks in using analogies to help explain complicated concepts is that the analogy can itself create further complications.
38. There was never any suggestion that abstraction from anywhere within the groundwater system would have identical effects. Time is a significant factor, with some abstractions taking literally years to affect surface flows while others may have effects within days or even hours.
39. The differences in hydrogeological relationships are codified in the PNRRP where Policy WQN8 refers to varying degrees of connection between an abstraction and a surface waterway. The Policy categorizes abstractions according to whether they have a “high”, “moderate”, “low” or “less than low” degree of connection and each attracts a different management approach.
40. The bathtub analogy was used to reinforce the interconnectedness of the groundwater system which is entirely consistent with the Commissioners description of the system.
41. The fact that some abstractions will take years to affect surface flows is the reason why Council experts advocated restrictions based on rainfall recharge.<sup>14</sup> If all users are to be treated equitably, some will need to face restrictions even though surface flows at the time may be very healthy, given that low rainfall recharge will affect flows in future years and it would be inequitable to restrict only near-stream users at such times.

### **Effect of Climate**

42. The decision records at paragraph 215:

**The applicants' experts advanced a rather different position from the officers. Firstly, they made the point that rainfall is a significant part of recharge. They suggested that variability of rainfall recharge is the key reason why water levels fluctuate in aquifers. They suggested that climate is the main cause of groundwater level fluctuations.**

43. Council experts do not dispute this. They agree that climate is the main cause of groundwater level fluctuations. The effects of abstraction are additive.

### **Sustainable Abstraction**

44. Paragraph 60 of the interim decision states:

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**At least if the methodology in the plan has been correctly applied, the Rakaia Selwyn zone is fully allocated (according to the plan) because the estimated effective allocation exceeds the average recharge to the zone.**

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<sup>14</sup> This is consistent with the approach set out in Policy WQN19(4) which looks remarkably similar to the adaptive management conditions formulated for this decision, but has an entirely different purpose.

**This debate as to whether the resource has already reached the point where it is in decline, or whether these consents if granted will take it to that point, is in our view the most critical issue before us (the stream flow issue being the other key issue).**

45. Paragraph 209 of the final decision states:

**... if the total annual estimated abstractions from the zone as a whole, exceed average estimated rainfall and river recharge to the zone, then the resource is regarded as fully allocated because the "bath tub" as a whole will, in theory, be progressively depleted (net outflows will exceed net inflows over a period of years). This is the approach which has been adopted in the NRRP.**

46. This is not the approach adopted in the PNRRP. Policy WQN14(8)(a) sets out how the size of the allocation block is set and Schedule 4 (as amended by Variation 4) sets out the volume for each block. These are set at considerably less than the "average estimated rainfall and river recharge to the zone" – to exceed those estimates would be unsustainable by definition.

47. Council experts agree that increasing the level of abstraction will result in the establishment of a new groundwater equilibrium. While that may deny access to groundwater by some owners of shallow bores, physical access will continue for the vast majority and is not the issue – the issue is the effect of that new equilibrium on surface flows and existing users.

## **CONCLUSION**

48. Key points emerging from the above review are summarized as follows:

- Any further abstraction from Aquifer 1 in the Rakaia-Selwyn Groundwater Allocation Zone will exacerbate an already unsatisfactory situation;
- The decision authorises abstraction of up to a further 35.1 million cubic metres a year of groundwater, on the premise that deeper aquifers have little or no connection to Aquifer 1.
- This premise is based primarily on work carried out by Mr Grant Davey who did not appear before the hearing.
- Mr Davey considers the premise to be incorrect.
- Commissioners point to the potential for review of consents, in the event they are wrong about degree of connection between aquifers.
- Applicant experts and Council officers agree that in an example using typical aquifer parameters, most of the water pumped from Aquifer 2 over a 3 day period drains from Aquifer 1.
- Conditions formulated to test for leakage may not be adequate to identify even significant amounts of leakage.
- Experts agree that taking water at different locations and depth will have different effects and climate is the main source of fluctuating groundwater levels.

- The limits to sustainable abstraction set out in the PNRRP are based on effects on other users and surface flows and do not exceed estimates of average recharge.

49. For the reason set out above I cannot recommend this decision as an appropriate precedent for the decision on applications within the Valetta and Ashburton River Groundwater Allocation Zones.