

**IN THE MATTER OF** the Resource Management Act 1991

and a Notice of Requirement to Selwyn District Council and Applications to Canterbury Regional Council for resource consents.

**BY** Central Plains Water Trust

**AND** Central Plains Water Ltd

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**STATEMENT OF EVIDENCE OF PETER FRANCIS CALLANDER  
ON BEHALF OF THE CHRISTCHURCH CITY COUNCIL**

**2 OCTOBER 2009**

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**1. INTRODUCTION**

- 1.1. My name is Peter Francis Callander.
- 1.2. My qualifications and experience have been set out in my previous statement of evidence to this hearing panel.
- 1.3. I confirm that I have read the Environment Courts Code of Conduct for expert witnesses and this evidence is prepared in accordance with that code. I agree to comply with the code's terms. In that regard, I confirm that the statements made in this evidence are within my area of expertise and I confirm that I have not omitted to consider material facts which might alter the opinions stated in this evidence.
- 1.4. This brief of evidence relates to the concerns raised by Christchurch City Council in light of the revised proposal by Central Plains Water (CPW) to operate an irrigation scheme on a run-of-river basis without the Waianiwaniwa reservoir.

**2. ISSUES OF CONCERN TO CHRISTCHURCH CITY COUNCIL**

- 2.1. As stated in my original evidence, Christchurch City Council has a particular concern about any affects on the quantity and quality of groundwater wells within the City boundary. This includes the following key components, which are shown in Figure 5a:

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- a. the Christchurch City urban supply wells;
  - b. separate community water supplies outside of the urban supply area;
  - c. private water supply wells outside of the urban supply area;
  - d. possible future urban water supply sources:
    - deep aquifers to the south of the City;
    - shallow groundwater or surface water from the Waimakariri River.
- 2.2. CCC is concerned about potential problems arising from raised groundwater levels which could cause increased groundwater contamination due to inundation of septic tank disposal systems and solid waste buried in old landfills. Raised groundwater levels could also cause a loss of gravel resource for the City due to restrictions on the allowable excavation depth for existing quarries west of the City.
- 2.3. CCC has an increased level of concern regarding the health of Lake Ellesmere/Te Waihora. With the amalgamation of Christchurch City Council and Banks Peninsula District Council in 2006, the eastern edge of Lake Ellesmere now falls within the CCC boundary. In June 2009, Lake Ellesmere was included in the CCC's Draft Surface Water Strategy, which includes the following statements:

The Council's surface water management vision is that:

*The surface water resources of Christchurch and Banks Peninsula support the social, cultural, economic and environmental health of the City's citizens, and are managed wisely for future generations.*

The Council's goals are to:

1. *Improve the water quality of our surface water resources.*
2. *Reduce the adverse effects of flooding.*
3. *Improve the ecosystem health of surface water resources.*
4. *Protect and resource Ngai Tahu values associated with surface water resources.*
5. *Support a range of recreation activities on and around waterways.*
6. *Protect heritage values associated with surface water.*
7. *Protect and enhance the landscape values of surface water.*
8. *Support community involvement in surface water management.*

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- 2.4. Finally, CCC has a more general interest in water management issues and is of the view that schemes such as CPW should only proceed if they utilise water in a manner that creates a positive benefit for the City and the region and provided that they operate in a way that minimises the potential for any adverse environmental effects.
- 2.5. The key aspects of the CPW scheme that could impact on the issues of concern to Christchurch City Council are:
- the reduced flow in the Waimakariri River caused by the CPW abstraction;
  - the increased area of irrigated land on the inland plains and its impact on:
    - groundwater levels and
    - groundwater quality.
- 2.6. The remainder of my evidence focuses on these three key issues and provides an update of my assessment in light of the revised CPW proposal. When considering my assessment, CCC have asked that I emphasise that the assessment of groundwater effects is not a precise science, therefore a precautionary approach must be adopted. If any consents are granted to CPW, they must have sufficient safeguards through conditions and review clauses to minimise the risk of adverse effects.

### **3. ABSTRACTION FROM THE WAIMAKARIRI RIVER**

- 3.1. For their presentation to this reconvened hearing, CPW have modified their consent application by removing their upper Waimakariri River intake, reducing their peak abstraction from the Waimakariri River from 40 m<sup>3</sup>/s to 25 m<sup>3</sup>/s and adopting a 1:1 sharing regime at flows above 63 m<sup>3</sup>/s at the Old Highway Bridge. CPW have also indicated they will utilise the Rakaia River water as their first source of supply and only utilise the Waimakariri River when the Rakaia River cannot meet the scheme requirements.
- 3.2. CCC's primary concern about the Waimakariri River abstraction relates to preserving the recharge of Waimakariri River seepage into the Christchurch City aquifers. The changes that CPW have made to their consent application will see more water retained within the Waimakariri River. The available quantification of recharge from the Waimakariri River indicates that it occurs at a relatively steady rate within the current range of river flows. Therefore, I would expect that with the low flow cutoff and the 1:1

sharing regime currently proposed by CPW, that the Waimakariri River recharge of the Christchurch City aquifers is protected.

3.3. Whilst that is my assessment of this issue, in recognition of the uncertainty that is always associated with quantifying these groundwater recharge effects, CCC would like to see conditions placed on any consents that are granted that achieve the following outcomes:

- CPW will only abstract water from the Waimakariri River when the demand from CPW cannot be met by the Rakaia River water. Such a condition would minimise the amount of abstraction from the Waimakariri River and would confirm the commitment given in paragraph 25 of Mr Tipler's brief of evidence dated 7 September 2009;
- monitoring of recharge into the City aquifers should be assessed regularly and any change should result in a review of the CPW allocation of water from the Waimakariri River. Such a condition recognises that the CPW abstraction is a new and large abstraction from the river.

#### **4. LAND USE IMPACTS ON GROUNDWATER LEVELS**

4.1. The revised CPW scheme provides a smaller amount of surface water into the scheme area and requires more groundwater pumping by its shareholders than was previously the case. These changes will lessen the rise in groundwater levels that would occur, relative to the original proposal, although the changes do not remove the issues of concern regarding groundwater level rise.

4.2. CPW's assessment of groundwater level changes arising from their proposed scheme is presented in the evidence of Mr Julian Weir. He presents two types of calculations, one based on his original numerical modelling approach and the other using an alternative calculation method referred to as Eigen modelling.

4.3. Both results show that an increase in groundwater levels will still occur, although of smaller magnitude than under the original proposal. The Eigen model tends to predict larger increases than the numerical model. Mr Weir is of the view that the Eigen model is less accurate because it is a simpler model that does not allow for all the variability of the groundwater system that can be incorporated into the numerical model. However, the greater detail that can be incorporated into a numerical model does not necessarily

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result in a more accurate output because of limitations in our ability to accurately characterise the natural variability of an aquifer system.

- 4.4. The differences in the output of the two models is apparent in Appendices F and G of Mr Weir's evidence, which indicate that the Eigen value output provides a much more accurate reproduction of groundwater level patterns (Appendix F), compared to the numerical model output (Appendix G).
- 4.5. I agree with Mr Weir that the Eigen model predictions of water level rise that go outside the historical range of measurements may over-estimate the magnitude of the rise due to the lack of surface interaction controls in that model. Despite that, the Eigen model exercise has been useful in providing a comparison with the numerical model, and based on its findings, I am of the view that the numerical model output is unlikely to be particularly accurate and not necessarily conservative. It should be viewed as giving no more than a generalised indication of the type of water level changes that might arise from the CPW scheme.
- 4.6. Therefore, even with the revised scheme, the concern about raised groundwater level issues still remain. I expect that any groundwater level rise in the urban Christchurch City area will be less than minor, due to its large separation distance from the scheme and the controlling effect of spring-fed streams. However, more significant adverse effects related to water level rise could occur in the rural area of western Christchurch, including the gravel extraction pits, and in high water table areas around Lake Ellesmere.
- 4.7. Whilst the rise in groundwater levels in the quarry areas represents an adverse effect on the operators of those particular quarry pits, CCC's concern is due to the reduction in good quality gravel volumes in close proximity to the city and loss of available volume at potential future quarry sites.
- 4.8. Therefore, as noted in my earlier evidence, a commitment by the Applicant to the implementation of appropriate mitigation measures is considered to be a necessary requirement if this scheme is to go ahead. These measures should include:
  - a default assumption that any new drainage issues are contributed to by CPW, so that the onus is on CPW to provide mitigation or to demonstrate that they are not contributing to the problem;

- a strong commitment to real and effective mitigation to address all issues related to:
  - land drainage;
  - groundwater contamination caused by raised groundwater levels;
  - loss of gravel resource from quarry pits.

## 5. LAND USE IMPACTS OF GROUNDWATER QUALITY

- 5.1. The effects of nutrients draining into groundwater may be lessened by the changes to the scheme, although that depends on the intensity of land development that occurs and the management of clean water infiltration. For 30,000 ha of land with groundwater consents, there may be no change from the original proposal. For the other 30,000 ha, it is expected that less intensive land use will occur, because on-farm storage will provide a lower level of water supply than the original CPW proposal.
- 5.2. The changes in estimated nitrate concentrations from the revised CPW scheme are reported in the evidence of Mr Tipler. His assessment indicates that the increases in nitrate concentrations will be small, with an average increase from 4.16 g/m<sup>3</sup> to 4.70 g/m<sup>3</sup>. I am not sure whether all the numbers in Mr Tipler's calculations are consistent with the changes that have occurred with the revised scheme, particularly in his allowance for clean water dilution. Also, his average calculations do not allow for the significant variations in space and time throughout the central plains area.
- 5.3. Once again, my view is that the predictions in nitrate nitrogen concentrations should be viewed as a general indication of what might happen, but allowances must be made for the possibility that larger increases may occur at some locations.
- 5.4. In my view, there will likely be a variety of changes in nitrate concentrations in shallow groundwater, as a result of an increase in irrigation area. Deeper groundwater is less likely to be adversely affected.
- 5.5. Regarding the CCC water supply, I do not expect that CPW activities will cause groundwater quality effects that are more than minor on wells in the urban area due to the separation distance from the CPW irrigation area and the recharge effect of low nutrient water from the Waimakariri River. Similarly, I expect there will be deep groundwater available that will enable future bores to achieve a reliable potable supply even if the option to site those bores south of the city and closer to Lake Ellesmere is

chosen. As a result, I do not expect adverse effects will occur for the CCC water supply that could be considered to be more than minor.

- 5.6. The issue of potential concern is the effect of elevated nitrate concentrations in shallow bores more directly downgradient of the scheme area and the effects of shallow groundwater discharges into surface waterways.
- 5.7. It is important to recognise that there will be a time lag of several years before the full effects of irrigation show up in the groundwater system, and therefore an adaptive management approach to this issue is unlikely to be effective.
- 5.8. Instead, there is a requirement for a high standard of nutrient management systems to minimise drainage of nutrients to groundwater. This is particularly so for those areas which receive a severely restricted irrigation supply, because the reduced pasture or crop growth during times of low or no water availability will correspond to a reduced uptake of nutrients from the soil.
- 5.9. CPW plan to address the shallow well issue by offering to provide replacement water supplies to affected parties. That is an appropriate mitigation measure, however, as with the land drainage issue, CPW's mitigation offer comes with the proviso that the replacement well is only provided if the wells fail to meet the drinking water standards ~~as~~ a direct consequence of this (the CPW) consent. In my opinion, placing the burden of proof on the affected party is unreasonable given the variability that occurs in the assessment of groundwater effects. Given that the potential for this adverse effect has been identified by the Applicant, I am of the view that the mitigation should be provided unless CPW can demonstrate that the adverse effect was in existence before the commencement of their scheme, or has an explicit cause that is not related to CPW activities.
- 5.10. In addition to the potential effects on water supply wells, increased nitrate concentrations in the groundwater can also be expected to impact on groundwater fed streams. Mr Burrell's evidence for CPW also raises the issue of phosphorous migration in groundwater. The occurrence of phosphorous in the Central Plains groundwater and its possible derivation from agricultural activities is not well defined. Phosphorous does not cause an issue for drinking water supply wells, but is an important nutrient affecting the spring-fed streams and Lake Ellesmere. In light of this uncertainty, it would be prudent to consider that the increase in irrigation area that

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comes with the CPW proposal could increase nutrient concentrations in groundwater, which will eventually reach the spring-fed streams in the lower plains.

- 5.11. A carefully controlled and monitored management of clean water recharge, coupled with nutrient budgeting on shareholders' properties could help to manage groundwater nitrate concentrations arising from irrigation, although such controlled aquifer recharge may be outside the scope of the current consents.
- 5.12. It would be desirable for CPW to develop a more robust strategy that would quantify and manage nutrient loss across the whole scheme so as to minimise nutrient inputs to groundwater.
- 5.13. CPW have also proposed an Environmental Management Fund that could be used, in part, to enhance the spring-fed streams and the Lake Ellesmere environment.

## **6. CONCLUSION**

- 6.1. The revised CPW proposed leaves more water in the Waimakariri River and reduces the amount of irrigation water that will be applied to their 60,000 ha supply area.
- 6.2. Based on these proposed changes to their scheme, I expect that:
- the Waimakariri River recharge to the Christchurch City aquifers is protected;
  - the effects on raised groundwater levels will be less than previously estimated and should not cause problems for urban Christchurch, but are still a potential concern in the rural areas due to land drainage, possible failure of wastewater disposal systems and loss of gravel extraction from quarries;
  - the effects on nutrients in groundwater are not precisely defined, however they are not expected to adversely affect deep groundwater abstraction wells or the CCC urban water supply. They may affect spring-fed streams or shallow wells away from the alpine river recharge areas.
- 6.3. For consents to be granted, adequate monitoring and mitigation measures need to be put in place for raised water level issues, nitrate effects on shallow wells and scheme-wide nutrient management in relation to spring-fed streams.
- 6.4. If the Commissioners are satisfied that the scheme can mitigate all the potential adverse effects, then stringent conditions are required. A proposed set of modifications

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to the CPW proposed conditions are appended to Mr Prebble's legal submissions. This is an updated set of conditions from those that were presented in the original CCC evidence for this hearing.