

EDITORIAL

It is my pleasure to be the editor of this special issue of the *Journal of Hydrology (New Zealand)* on the Christchurch Artesian System (CAS). It is 100 years since Professor F W Hilgendorf presented his seminal paper, which was then published in the *Transactions of the Royal Society of New Zealand*, that described the hydrological function of the CAS, and which concluded the scientific and investigatory works of the Artesian Wells Committee of the Canterbury Philosophical Society (Hilgendorf, 1926).

The CAS is one of New Zealand's most important water resources despite being underground and out of sight. Approximately 500,000 people depend on the CAS for their water supply. Environment Canterbury estimates that 375 million cubic metres per year flows under the city of Christchurch. The Christchurch city water supply is allocated about 85 million cubic metres per year (from 163 wells across 53 pumping stations), and industrial and other uses account for another 67 million cubic metres per year (Environment Canterbury, 2025). The rest of the water discharges to the spring-fed streams or flows offshore underground. Similarly large volumes are estimated to flow under the Waimakariri and Selwyn portions of the CAS (Dodson *et al.*, 2012; Hanson, 2014).

The idea for this special issue began in the lead-up to the Society's 60th Anniversary in 2021. At that time, Len Brown had collated a large amount of material on the CAS, following work he had published earlier (Brown, 2001), and the idea was that it could be included in the Society's 60th Anniversary publication. However, it was not possible to prepare the material in time for publishing. After the Society's 2022 conference Helen Rutter and Lee Burberry looked at the material and floated the idea of a special Christchurch groundwater issue of the *Journal*.

Len's material was split into two and a number of other people were asked if they wanted to contribute to the special issue. Lee prepared the opening paper, *Christchurch Groundwater Exposed*, which gives an almost 'fieldtrip guide' introduction to the CAS.

After the fieldtrip guide introduction there are the two pivotal papers, for which this special issue was first proposed. First there is Brown & Hanson's paper on the late-Quaternary stratigraphy of the Christchurch Artesian System. The focus of this paper is on improving our stratigraphic knowledge of the CAS, which sets the scene. One thing that this paper brought to the forefront was the historical inconsistent and idiosyncrasies in naming of the formations within the CAS. We have tried to be consistent across the special issue by:

- Noting that "Formation" is a defined geological term to name a distinct geological unit.
- Noting that everyone has had their own idiosyncrasies and preferences in the way they name the formations of the CAS.
- Noting that, in the case of the CAS, the gravel units have historically been named "x Gravel" (even if they could have been labelled, as a distinct geologic unit, as "x Gravel Formation").

- Noting that, the aquifers now recognised within these gravel units, have been named "x Gravel".
- And so, for the sake of simplicity, we are using "x Gravel" (for aquifers) or "y Formation" (for aquitards) as far as possible throughout the special edition.

Following the stratigraphy is the paper by Brown *et al.* that provides the 'historical treatise' of the CAS. This treatise provides a concise history of investigation, data curation and hydrogeological research of the CAS. It reviews the role government organisations, researchers and well-drillers have played over the years in developing our understanding of its form and function. Having examined the past and present, ideas are provided for topics of future scientific study on the CAS. Suggestions are also made for how public awareness of the CAS might be raised to ensure its recognition as a key asset on which Christchurch depends and thrives.

The following two papers (by Rutter *et al.* and Etheridge *et al.*) are about ground source heat pumps (GSHPs). This is a topic that I do not think was mentioned in Rosen and White (2001), but ground source heat pump (GSHP) technology has expanded in Christchurch, largely driven by post-earthquake rebuild and enabling policies. Rutter *et al.* outlines the GSHP systems that have been installed in Christchurch and describes some of the issues associated with GSHP system installation. Etheridge *et al.* examines groundwater level monitoring data to test whether the rise in groundwater levels in the central city is likely to be connected to ground source heat pump development.

Finally, the issue has two shorter papers. Rutter *et al.* highlights the shallow groundwater monitoring network in Christchurch, describes investigations that have been carried out using its data, and outlines the future needs for shallow groundwater monitoring and modelling. Rutter and Fourie reiterate some of the earlier groundwater nitrate-nitrogen results presented by Rutter and Rutter (2019) and highlight some of the changes that can be observed with the addition of the newly available historical groundwater quality data reported by Aitchison-Earl and Knottenbelt (2024).

Overall, the *Journal* continues to contain papers on issues that are at the forefront of hydrological science in New Zealand, and more generally. After more than 60 years of publication it is extremely encouraging to see papers in the *Journal* that push the research boundaries and contribute more broadly to water management.

As editor of the *Journal*, I would like to express my appreciation to all those who have supported it by reviewing manuscripts. While not always pleasant or easy for authors, this high standard of reviews does benefit both the author and the reader.

I would also like to thank Laura Keenan for her wise counsel and copyediting; Jo Dickson for her layout and production work; and the staff at Caxton for their fine job of producing the *Journal* on a tight schedule. Finally, I thank all authors for their continued willingness to put in the effort to maintain the flow of manuscripts to the *Journal* and for their willingness to respond to my demands. I look forward to the flow of manuscripts continuing.

Dr Richard Hawke

Editor, Journal of Hydrology (NZ)

- Aitchison-Earl, P. & Knottenbelt, M. 2024: Insights from the past: a new source of historical groundwater quality data in Canterbury. *Journal of Hydrology (New Zealand)* 63 (1): 15–33.
- Brown, L.J. 2001: Canterbury. In, Groundwaters of New Zealand. M. R. Rosen and P.A. White (eds). New Zealand Hydrological Society Inc., Wellington. p441–359.
- Dodson, M., Aitchison-Earl, P., and Scott, L. 2012: Ashley-Waimakariri groundwater resources investigation. Environment Canterbury Report No. R12/69
- Environment Canterbury, 2025: Christchurch's water – what's the story? <https://www.ecan.govt.nz/get-involved/news-and-events/2019/christchurchs-water-whats-the-story>
- Hanson, C., 2014. Technical report to support water quality and water quantity limit setting process in Selwyn Waihora catchment. Predicting consequences of future scenarios. Groundwater quality, Environment Canterbury.
- Hilgendorf, F. 1926: Artesian Wells of the Christchurch Area. Transactions and Proceedings of the Royal Society of New Zealand, Volume 56, 1926, p369–382.
- Rosen, M. and White, P. (eds) 2001: Groundwaters of New Zealand. New Zealand Hydrological Society Inc.
- Rutter, K. and Rutter, H. 2019: An assessment of nitrate trends in groundwater across Canterbury: results from a Science Fair project. *Journal of Hydrology (New Zealand)* 58(2): 65–80.

